ELISHA HANSON

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ENTRANCE TO THE STIKINE RIVER FROM POINT HIGHFIELD — POINT ROTHSAY AT THE RIGHT

THE

National Geographic Magazine

Vol. X JANUARY, 1899 No. 1

THE STIKINE RIVER IN 1898

By Eliza Ruhamah Scidmore

The Klondike excitement of 1897 turned attention to the Stikine river as affording an easy route through the Coast range of mountains to the interior of the Northwest Territory, since it was known that Indians, Hudson's Bay Company traders, and surveyors of the Western Union Telegraph Company had long ago used a trail from the upper Stikine across to the lakes and waterways leading to the upper Yukon.

The Stikine was not an unknown or undiscovered country, but only an abandoned one, as the discovery of gold in its river bars in 1861 and richer placers in the Cassiar country beyond in 1873 drew thousands of miners to summer camps, until the exhaustion of the richer placers, the need of machinery, and the discoveries elsewhere drew that fickle and floating population away. Steamers were withdrawn from the river ten years ago, the old camps disappeared in underbrush, and Ft Wrangell, the post of transshipment for all this trade and travel, fell away to a mere Indian village again.

The Klondikers appeared in numbers last January, and continued in an unending procession over the Stikine's frozen surface until the river opened in April, when a dozen light draft sternwheel steamers, fitted with powerful engines, ran, crowded to the guards, for a few weeks. The Hudson's Bay Company put on some fine boats, and the Canadian Pacific Railway Company sent up a dozen steamers, all named for eminent Canadians, the two swiftest river boats on the Stikine appropriately bearing the names *Ogilvie* and *McConnell*, in honor of those two members of the Dominion Geological Survey. Glenora, the head of navigation, 125 miles from Ft Wrangell, and Telegraph Creek, 12 miles beyond Glenora, are starting points on the trail that leads through an open, hilly, and grassy country for 145 miles to Lake Teslin, whence there are no interruptions to boat navigation to Dawson City, a distance of 526 miles. Bills were introduced in the Canadian Parliament giving rights to convert the trail into a wagon road, and a great land grant was to be conferred on the builders of a railway. The railway to Lake Teslin was to be completed by September, and this "all-Canadian route" appealed to many, and especially to British fortune-seekers. A trail from Ashcroft, on the Fraser river, reaches the Stikine at Telegraph Creek, and many who ventured on this longest of all the land routes toward the Klondike district met with disastrous adventures in the great woods.

Ft Wrangell, Alaska, where the ocean steamers landed the all-Canadian army of gold-seekers, was crowded all winter and revived its prosperity of thirty years before. A "boom" of extravagant proportions was well on in March and collapsed by the end of May with distressing results, when the failure of the railway land grant measure resulted from the many political entanglements and jealousies at the Canadian capital. Ft Wrangell real estate took on absurd values while the boom lasted. The tide line was edged for a quarter of a mile with flimsy pine buildings and fragmentary footwalks on stilts; tents crowded upon every vacant spot and whitened the hillside. A score of saloons ran wide open, despite Alaska's severe prohibition laws; the most barefaced gambling games and swindling schemes were conducted on every side without concealment, and this "boom-town" of 6,000 inhabitants displayed all the worst features of such lapses in civilization. Without water supply, drainage, or sanitary measures of any kind, with all refuse dumped into the space before the first row of water-fronting buildings, and with the butcher slaughtering in the open before his shop, Ft Wrangell, in July, was more offensive, parading more filth and smells to the ground space, than any Chinese city I have visited. Great wharves and warehouses were built to accommodate the ocean and river travel, and the restrictions and complications of Canadian and American customs regulations in the bonding, transshipment, and interport carrying trade were endless. The declaration of war between the United States and Spain, even the certainty of it for some weeks beforehand, brought the Klondike rush to an abrupt end, the adventurous and restless Americans seeing an easier vent to their eager spirits in enlistment, and investors and investigators prudently holding back to watch the fate of war. To one remembering how quickly and entirely the Klondike retreated from general view and interest in the eastern states, after the blowing up of the *Maine* even, it was not surprising to find that the expected summer rush to the Klondike had failed; even Alaska tourists failed to come, and the fleet of steamers brought around Cape Horn for the busy summer expected would have entailed great losses upon transportation companies but for the sudden necessity of transports for the Philippine expeditions. About the same time that the stream of gold-seekers ceased coming the Teslin railway seemed doomed never to be built, and certainly not before the railway from Skagway over the White pass. The Teslin trail proved too long and too hard for many who had undertaken it, and the river boats that went up the Stikine empty returned crowded with angry and discouraged Klondikers. The angry ones went on to try the shorter routes to the Yukon from Lynn canal; the discouraged ones sacrificed their outfits recklessly in their one wish to return to civilization. A dozen of the useless river steamers were boarded over at the bows and attempts made to tow them across that roughest part of the Pacific ocean to the Yukon river's mouth, but disaster attended nearly every one of these perilous tows in the open ocean, the seams parting under the strain of waves and hawsers, and the flimsy river boats going entirely to pieces or drifting ashore in hopeless condition.

While the Stikine boom lasted a first opportunity was afforded for pleasure travelers to comfortably view the magnificent scenery of that river, whose valley was aptly called by Dr John Muir "a Yosemite one hundred miles long," but only three tourists or actual pleasure travelers availed themselves of the chance, as far as the most diligent inquiries could establish the fact. Although so powerfully engined, the fleetest of the river boats could only average seven miles an hour against the furious current, making the average trip up to Glenora in eighteen hours, and returning in seven or nine hours, the boats always timing their departures so as to cross the flats at the mouth of the river at high tide, and navigating only during clear daylight. There were no old river captains or pilots surviving from Cassiar times to command this hastily constructed fleet, and the best "swift-water captains" came from the Kootenai, the Snake, and the upper Columbia and learned the Stikine route for themselves, "reading the water" as they went along.

From Pt Highfield, at the end of Etolin island, a few miles around shore from Ft Wrangell, one has a fine view of the imposing entrance to the Stikine splendors, snow-capped mountains towering above the evergreen headlands, and prolonged to westward in that magnificent range that fronts the Alaska tourist when he emerges from Wrangell narrows. Vancouver's men reached and named Pt Highfield; yet those admirable explorers, sent to the northwest coast expressly to find an unknown river, failed to discover the Stikine when their boats were in its muddy outflow, as they before failed to discover the Columbia and the Fraser, and it was left for the American Captain Cleveland to discover the Stikine in 1799.

Crossing the flats at the broad river's mouth, where fishing boats from the neighboring canneries were tending nets, and skirting close to the forested slopes at the right, our steamer followed along so near the banks that we breathed all the fresh, earthy smells, the fragrance of wet wood, mosses, and cedar plumes. Two miles within Pt Rothsay a little flat of intensely green grass at a creek's mouth is landing place for the canoes of those who go to visit the garnet ledge high up on the steep cliff front and blast off fragments of the dark gray mica slate dotted with big almandite garnets for the tourist market at Ft Wrangell.

Although the Stikine is such a swift river, its bed falling 540 feet between Glenora and Pt Rothsay, it is not deep save where compressed in its cañons. It wanders between its steep mountain walls, cutting out islands from one densely forested bank and the other, heaping driftwood on bars in midstream until they form islands and their thickets change to cottonwood forests. These islands are inundated each season and sometimes washed away in unusual freshets, and then the debris accumulates in other places and new islands divert the stream. Cottonwood island, a first such forested bar, was a busy place last winter, when steamers, canoes, and small boats, pushing through the loose river ice of the flats, landed the Klondikers at the lower end of the island, to begin their march over the solid ice that extended unbroken from the further point of Cottonwood's shores. Stikine City grew upon the snow; there was wild speculation in town lots, and tents crowded in lines between the trees and bushes, where sky-scraping business blocks were soon to stand; but the boom had burst by the time the frost was out of the ground, and the vegetation of one Alaskan summer effaced nearly all the traces of Stikine City's ground plan. Tales are told of the Klondikers trembling and becoming breathless as they landed on Cottonwood's shores, as frantic and crazed as if Dawson City and the gold nuggets were in sight.

All along the Stikine there is such a panorama and sky line of snow peaks on either hand as would be enough to make the fame of a whole territory, save in Alaska, where scenery continues on such a scale and with such unusual features that one takes snow peaks and glaciers almost for granted, as obligatory, conventional backgrounds for every scene. The first object of special distinction along these river walls is the Popoff or Little Glacier, ten miles above Pt Rothsay, a narrow blue tongue thrust from great snow-fields and showing in profile beyond forested slopes, whose greens intensify the exquisite pale pure blue of this star-sapphire mass—this slender, steeply-plunging cataract of ice seemingly arrested on the mountain's side. It shows a dirty terminal moraine and a grimy forefoot to those who land and approach it, but from the river this blue ribbon, unrolled from the clouds and the snow-fields, is most exquisite of Stikine glaciers, the color of its hard clear ice divinely blue in the early morning, fading at midday, and intensifying again as the shadows stretch across it. With the windings of the river, one has the Popoff in view from many points as the boat progresses toward, faces, and manœuvres within range. None of the Stikine glaciers have been explored to their sources, mapped, measured, or studied in any sense, and they are virtually unknown glaciers, the region a paradise and happy hunting ground for the glacial geologist. Prof. W. P. Blake, the geologist, who chanced to be in Japan in 1863, was asked to accompany the corvette *Rynda*, which Admiral Popoff despatched to the American coast by order of the Czar to learn if Stikine miners were working within the thirty-mile strip of Russian soil, which had so long been leased to the Hudson's Bay Company. Professor Blake examined the bars and rock formations and made a running survey of the river, naming the glaciers and principal landmarks, and his map was published with his report on the Stikine as a congressional document at the time of the purchase of Russian America by the United States. Dr John Muir made a canoe trip up the river in 1879, "prospecting for glaciers" in a general way, and making notes and thumbnail sketches for his own entertainment. Canadian surveyors have made general maps of the river, and Messrs Tittmann and Ogden, of the U. S. Coast and Geodetic Survey, have surveyed and mapped the lower end of the Stikine in connection with the surveys for determining the international boundary line; and to Mr O. H. Tittmann I am very greatly indebted for several of these accompanying illustrations, reproduced from photographs taken during the boundary survey.

The international boundary line has moved up and down stream on the charts for these thirty-odd years, and Canadian custom-houses and Hudson's Bay Company posts wandered with it, five different places having been accepted as the temporary boundary until a commission can determine it. The place last settled upon for the passing of the imaginary line is a few miles above the Popoff glacier, near the Great bend. In this past summer of 1898 the United States was temporarily and economically represented by a custom-house in a tent on the river bank, to whose canvas sides a small and faded flag was pinned, like an outworn towel. Two men and a dog constituted the American force, both men looking very weary, bored, and homesick, as one lounged down for his mail and fresh beef, and the other whistled in his doorway. There is a station of Canadian mounted police on the river bank a few rods beyond, an officer and twenty men occupying a group of hewn-log buildings on a knoll, with the red flag of the Dominion flying from a tall pole. Their storehouses were on the bank, and men in canvas working-clothes were putting company gardens in order and giving an appearance of permanency, trimness, and order to the edges of British domain.

The Iskoot river, which enters by a long, deep valley from southward, is said to present greater scenic spectacles along its way than even the Stikine river. The Stikine region is the best "bear country" on the northwest coast, and the finest grizzly, cinnamon, and black bears hold the Iskoot wildernesses almost undisturbed, since few sportsmen come this way. Mountain sheep, mountain goat, deer, and elk tempt the big-game stalker, to whom the Stikine and Iskoot would be perfect paradise were it not for the plagues of mosquitoes and gnats. The sharp needle-peaks of the lofty Glacier range are aligned along the Iskoot's course, and there are unnamed and untrodden peaks, passes, glaciers, and snow-fields to occupy Alpine club climbers for many years along the Iskoot's course.

The Orlebar or Great glacier of the Stikine shows first in distant profile as a grayish white mass pressing out between two mountain slopes and spreading in a great curving, fan-shaped front of boulders and dirty ice for fully two miles along the river bank, the crest of one terminal moraine towering in cliffs of debris far above the tree tops of the river bank. Beyond this first forested edge of the river, there is a lake or backwater cut, on which moraines and ice slopes front, and the steamers pass more than a mile away from the ice itself. When directly abreast of the Orlebar, one can see its grayish surface, striped with the fine lines of medial moraines and cross-hatched with the seams of crevasses, sloping up and disappearing through further gaps toward great snow-fields half seen on the shoulders of distant peaks. This glacier has been visited by several geologists, but none have had time to explore it back to the source of its main stream, to follow its tributary branches, to note its rapid motion, or arrive at any idea of its recent retreat and shrinkage. Two young Russian officers once came down from Sitka to explore it, but never returned from their expedition, and prospectors are said to have been lost in its crevasses. Miners who knew it in early Cassiar days, when there was a busy trading station at the hot springs on the opposite side of the river, claim that the front has receded and the whole glacial mass shrunk surprisingly, and Dr John Muir's visit in 1879, although but a reconnaissance, proved to him a very rapid recession within recent times.

A small glacier descends through a gap on the opposite shore directly facing the Orlebar, fed by the snow-fields of Mt Laura, which is so perfectly framed in the opening, and Indian traditions tell that this little glacier once joined with the Orlebar and the river ran through a tunnel in the ice. The Indians, who had come down stream from the interior, were convinced by the annual runs of strange fish that the river must reach the sea, and chose the two oldest members to test the theory—since these aged ones must soon die anyhow. The veterans ran the tunnel safely, and, returning in due time, were held in great veneration for the rest of their lives.

From Orlebar glacier on to the Little cañon, the Stikine presents its most splendid panorama on either hand. The scenery is on such a scale and of such magnificence, with hardly an interval of ordinary or commonplace mountain scenery, that one loses all measure of comparison and hardly appreciates to the full the unusual grandeur of his surroundings. There are glaciers everywhere and of every type—hanging on the mountain side, plunging down ravines and through gaps, curving around spurs, fretting and pricking through the surface of vast snow-fields, and everywhere debouching toward the river's edge in

LITTLE CANON OF THE STIKINE RIVER — SAWBACK RANGE IN BACKGROUND spreading fans of boulders and muddy ice. One can count a dozen great glaciers at once from a certain point of view, and easily accepts Dr John Muir's count of 100 glaciers seen from his canoe, and of 300 glaciers seen by climbs and tramps ashore, all draining directly into the Stikine. There is a feast and almost a surfeit of glaciers in the next fifty miles, the Dirt or Mud glacier, greatest of all, being almost the replica of the Orlebar glacier, save that it is a dirt covered, dark-brown mass instead of a dirty white one. The Dirt glacier remains longer in view, by the serpentine windings of the river, than any one object save the Eagle crag, a great, detached, snow-striped peak with a triple, sharply dentated crown, that one sees ahead, to right and left, in foreground, background, full front, and profile all day long; this peak and the earth-covered glacier omnipresent appearing and reappearing from new points of view, to the utter confusion of one's compass and topographical ideas. There was a superb view, too, of Kate's Needle, over forested points and river foregrounds, as its dark summit pricked sharply through snow-fields to the very sky. There is one superb glacier, just above the Dirt glacier, whose névé is held in a broad amphitheater, whose retaining walls are buttressed on the further side by the finest arrangement of peaks and palisades seen anywhere along the Stikine; and in some far recess near there hides that mysterious Flood glacier, which several times each season breaks away a natural dam and sends a torrent of muddy water roaring out to the river, sensibly raising its level for a time.

We had met signs of the recent rush of Klondike travel all along the Stikine banks, rows of cordwood neatly piled showing as melancholy reminders of abandoned camps and hopes and ventures. Shrewd Klondikers who went up on the snow cut wood diligently, counting upon quick returns for their labor when the fleet of river steamers and the campers in small boats should come in the spring. All the Canadian Pacific boats burned coal and kept their extra supplies on anchored boats along the river. The Hudson's Bay Company had gangs of Chinese cutting cordwood for their boats long before the ice moved, and the independent prospectors in canoes were few. Signs of "Wood and water," "Wood for sale," and the laconic "$4.50 per cord," or only "$4," met one along the banks—monuments of wasted energy, with pitiful epitaphs.

Wherever the valley broadened and the river ran its most serpentine course there were acres of bleached logs and tree roots stranded on bars and banks—enough fuel gone to waste to supply all the river boats and the people of a great city ; and each day the remorseless current cut further into some wooded bank and sent other tall cottonwoods to snags and driftwood. One longed to make a grand bonfire of these unsightly skeletons strewing every bar ; but the two snag-boats at work on the river had too much real and necessary work to do. In some stretches the banks seemed to be upholding groves of elms, where the river had washed away the front ranks of cottonwoods and brought to view the tall elm trees that had had to struggle upward in the crowded forest without lower branches, spreading out in great arching crowns that had all the grace of New England elms.

There were novelties in navigation on board the *Ogilvie* that gave great interest to the Stikine trip, as the " swift-water captain " sought channels and fought the stiff currents that charged around bends and combed against the bows of the river boat as if she were at sea. He " read the water " by a dozen signs, even the different wheezes, groans, and panting of the engine declaring the depth of water to his trained ear, and the swell rolling away at either side another sign telling the depth as certainly as a lead plummet. At each riffle he steered into the midst of the foam where the current ran strongest, and in some of these places, where the river raced in a narrow channel, the water stood higher in midstream than at either bank, and the boat rode high on the turtle-backed flood.

Just below the dreaded Little cañon the *Ogilvie* crept up beside the anchored coal-boat and took on more fuel. We could look straight up the quarter-mile rock flume, whose sides rise perpendicularly for less than 100 feet and then slope away into wooded foothills, far above which towers the great sky-line of the Sawback range, the continental divide. A white disk shot out from a tree branch overhanging the cañon's mouth as signal to our boat that the way was clear to ascend, the reverse of the disk showing a black warning to any boat at the upper end that it must not enter, since two boats cannot pass in that narrow cut, where the broad river is compressed and turned on edge. The incline of foaming water between jagged rock walls that approach within 60 and 100 feet of each other was running with a mild current—only a little over 10 miles an hour that day—and with full steam and forced draught our boat was able to climb the hill of running water in thirteen minutes. In flood times steamers were forced to wait for the fury to subside and to "line up" by reeling in on the capstan wire cables fastened to the largest trees ashore. There was a deafening roar from the boilers and the boat shook as if all its upper works would be loosened, while it worked its way upward, dipping, careening, quivering in all its solid frame, and shipping waves at the bows, and there was more personal excitement and tension in this struggle with the Stikine's fury than we had any idea of until we came out to wider and slower reaches and tied up for the night.

GLENORA FROM THE LANDING

We were then "over the range," "east of the mountains," "across the divide," and there was a great difference in the character of the country. There were grassy benches and hills, stretches of burned forests, and every sign of a scorching, dry, interior climate. The Kloochman's cañon, named because the Indian canoeman, exhausted with his day of frantic tracking and paddling through the Little cañon, leaves this bit of navigation to his *kloochman*, or squaw, was only a stiff millrace of water running for one or two hundred yards between green banks. We easily surmounted its slope, and turning sharply where a bald cliff met the flood, speedily climbed the Big riffle of the Stikine—only a stretch of dashing rapids over a stony bed. Green benches or terraces along the river bank, open and grassy stretches, with towering peaks in the background, gave one the idea of approaching civilization again and the group of log-houses and buildings at Hudson's Bay Flats, or Shakesville, seemed quite in keeping. A great sign on the banks of "Cassiar Central Railway" marked the terminal or initial point of that enterprise, the great trunk road whose fortunes were then balancing—whether to be or not to be. Two miles beyond, Glenora showed a row of log-houses along the river bank, with innumerable tents beyond, and a most discouraged, homesick-looking company of men straggled to the mud bank to watch the tying-up, every man with both hands pocketed. The postmaster carried his mail-bags ashore, the mounted police watched the landing and stowing far above the water line of the dressed lumber and fittings for the gold commissioner's ready-made house, and Glenora subsided into the stagnation of a rainy Sunday in a mining camp whence the boom had twice fled.

Glenora, "the lively camp" of so long ago, had been galvanized to a far livelier condition in the spring of 1898, to fall away again as the difficulties of the long, boggy Teslin trail became known, and as the chances for wagon road and railway building lessened, the army of the disappointed, the faint-hearted, and also the sturdy ones bent on trying the other trails from points further up the coast, had all gone from Glenora, and there remained only those who could not get away and those who felt themselves fixtures there. Everything on the bank was for sale, apparently—tents, blankets, provisions, horses, mules, dogs, sleds, snowshoes, aluminum boats, harness, pick-axes, shovels, pans, forges, quicksilver, and scales—so rough notices at every door-sill and tent-flap told. Great tents served as hotels, stores, and storage warehouses, a charge of five dollars a ton each month leaving these storage depositories banked full of overdue trunks and valises containing the civilized clothes of those gone on into the wilderness, and of "outfits" for which there were no means to have carried over the trail with the owners at the time of the rush, and no claimants later. The reckless extravagance of the mad Klondikers surpasses anything told of them, even their cruelty to animals, and outfits that cost hundreds of dollars were thrown away and left behind at Glenora in the mad race for Dawson, or in the discomfited return toward civilization, while thousands of dollars went to the bottom of the Stikine through breaking ice, overturned canoes, flooded camps, and caches. There were at least four dogs to each inhabitant of Glenora—splendid, shaggy animals that sported in the swift, cold river and breasted its six-mile current in pursuit of sticks in sheer excess of strength and spirits. Nearly all of them had been over the Teslin trail, each one carrying a fifty-pound sack of flour on his back or dragging a three-hundred-pound sled-load over ice and snow, worn to skin and bones by such long-continued exertions and hardships on scant food. These dogs were then living in plenty at Glenora, and were evidently well cared for by kind owners, to judge from the way they capered and jumped and barked around certain men who lounged along the one river bank road; but the tales one hears of the inhuman cruelties to animals inflicted along all the Klondike trails would put a stain upon any gold that is ever brought out of the district. "It was a trail of blood from Stikine City to Glenora, and I never want to see such sickening sights again," one rough frontiersman summed it up. Ignorance, greed, and callousness were evenly combined in this inhuman work. Every kind of a dog was bought or stolen in the States and brought up in midwinter on the open steamer decks, where the half-fed creatures were crowded together in sleet, snow, rain, and bitter winds without shelter or drink. Tied in strings to the fences, they were left to howl the nights out at Ft Wrangell, and were in poor condition to pull the cruel loads when driven off over ice and snow to be beaten, clubbed, and kicked as long as they could stand in harness. All animals were treated as cruelly—horses and oxen brought to Ft Wrangell without food or drink on the way, and left as uncared for on the river steamers, until certain humane captains took the matter in hand, broke into the bales of fodder that the owners were saving for use on the trail, and under threats made those owners give water to the animals crying with thirst as the river ran beside them. The owner of a flock of goats tied them to the Ft Wrangell wharf stringers at low tide and returned to find them all drowned by the usual eighteen-foot rise of water, the crowds of wharf loafers having enjoyed the spectacle as their idea of a joke on the poor distracted goat herder, who had put his every dollar into this Klondike venture.

There was no movement of pack-trains out over or in from the trail for the two days the *Ogilvie* waited at Glenora, and a few incoming packers reported that the corduroying of the bogs between the succession of stony hills had been completed for some 30 miles, nearly to the Hudson's Bay Company's post, and that the detachment of mounted police at Lake Teslin were rapidly putting up their buildings and laying out a permanent post.

The current is very swift between Glenora and Telegraph Creek, twelve miles above, where the Teslin trail strikes away to northward, and as there was no freight to carry and no passengers to be called for, we did not see that last outpost reached by the Western Union Telegraph Company's wires in 1866, when their

THE STEAMER AT GLENORA

surveys for a land line across Siberia to Europe were brought to an end by the success of the Atlantic cable. A distracted packer, however, visited the steamer to know for how much less than one dollar each mule the *Ogilvie* would go to Telegraph Creek and ferry across 75 mules that he had successfully driven up from Ashcroft, on the Fraser river, but the purser could not figure out any profit for the steamer to undercut the local canoe ferry prices, and the mule owner was the picture of despair. Above Telegraph Creek the Great cañon of the Stikine extends for 50 miles, a deep gorge, with terrific rapids and bends, which cannot be traversed save on snowshoes, and which by its inaccessibility is safe in the reputation it has of holding the wildest scenery of the Stikine region.

The river rose five feet the second night, in consequence of rains in the Dease Lake country, floated the steamer across the little wharf to which it was tied, and nearly carried away the lumber for the gold commissioner's house before the boat's watchman could arouse a salvage corps. When we left Glenora that morning, it was a new sensation to fly past the banks so rapidly, the engine only making play of the downstream journey. We shot the Little cañon in less than three minutes, where we had struggled thirteen minutes on the way up, the *Ogilvie* drawn in with the sweep of the current under half steam, and then, with snorts, roars, and wheezes of full steam under forced draught, steering a mid-course through the eddies and dashing waves of that narrow chute, the most exciting and dangerous piece of navigation in Alaska. The peaks and glaciers whirl past in their different rearrangements, and in the earliest afternoon, seven hours after leaving Glenora, we had accomplished the serpentine 125 miles and were fast at the Ft Wrangell wharf, the *Ogilvie* and all the boats of the line then receiving orders to abandon the Stikine and Alaska route. The "all-Canadian" and the Klondike incident closed abruptly, and this river of rivers, this culmination and epitome of Alaskan scenery, this most magnificent stretch of peaks and glaciers along any watercourse of the continent may not again be accessible to easy pleasure travel as in the fitful season of 1898.

In his annual report to the Department of State, Consul Merrill, of Jerusalem, says that ten years ago there were very few carriages in Jerusalem, but now that the Yafa (Jaffa) road is in good condition and the road to Jericho, the Dead sea, and the Jordan is opened up—also that to Bethlehem and Hebron—there are scores of carriages, and the number is constantly increasing. A carriage road has recently been constructed from Jerusalem to the top of the Mount of Olives, and one is to be built from Jerusalem to Nablus, a manufacturing city of 20,000 inhabitants on the site of the ancient Shechem, 32 miles north.

THE U. S. BOARD ON GEOGRAPHIC NAMES AND ITS FOREIGN CRITICS

In the November number of The National Geographic Magazine, under the title "Geographic Aspects of the Monroe Doctrine," is quoted a passage from Petermann's Mittheilungen, 44 vol., 1898, wherein exception is taken to the action of the U. S. Board on Geographic Names in deciding certain cases of disputed nomenclature in Canada. Concluding, the writer says:

> "Even admitting the correctness of these changes, exception must be taken to such action in regions which do not belong to the United States. The greater part of these names belong to Canadian territory, where American officials, in spite of the Monroe doctrine, have nothing to say, and where undoubtedly the Canadians have the exclusive right to give the names."

The United States Board on Geographic Names assumes to control usage only so far as concerns the publications of the United States government. Canada will doubtless continue to spell these names as she chooses, and when she settles upon their spelling the United States Board will probably accept her decisions, in accordance with its general policy. But at the time these decisions were made there was no uniform usage in regard to these names, even in Canada, and it was necessary, to meet our own needs, to clear up this confusion in nomenclature.

While we are on the subject, it may be pertinent to ask why Petermann's Mittheilungen persists in attaching to geographic features in the United States names different from those by which these features are universally known to the people of this country. For instance, it calls the country itself, not United States, but Vereinigte Staaten; the Rocky mountains, Felsen Gebirge, etc. It is no defense to say that these are translations, for proper names are not susceptible of translation. Mr Baker would very properly object to being addressed by a Frenchman as M. Boulanger.

This practice is not confined to the Mittheilungen, or to Germany; every people does the same thing. Most of the principal countries, cities, rivers, etc., of Europe are known to the people of other countries by names different from those by which they are called by the inhabitants themselves.

H. G.

THE WEST INDIAN HURRICANE OF SEPTEMBER 10–11, 1898

By Prof. E. B. Garriott,

U. S. Weather Bureau

That Providence favored the American arms in the recent war with Spain appears from the fact that during the entire period of hostilities our fleets in West Indian and Southern waters were not endangered by tropical storms.

During the investment of Santiago, when a hurricane visitation would have resulted in damage and perhaps disaster to the American fleet and consequent appalling losses to our land forces in subsequent blockading operations along the coasts of Cuba and Puerto Rico, and finally during the dispersion of the naval forces and the transportation to our shores of a large portion of the army of invasion, no serious storm interfered with the fulfillment of American designs; and it was not until an attempt was made to naturalize the *Maria Teresa* that the weather failed to coöperate with the plans of the United States Navy. As a matter of fact, and in a seeming safe extension of the favor bestowed, the hurricane season has passed without the occurrence in or about Cuba or Puerto Rico of a violent atmospheric disturbance.

The single West Indian hurricane which did occur during the season of 1898 confined its ravages to Barbados, St Vincent, and St Lucia, islands of the Windward group. Like many other disturbances of this type, this hurricane had its origin in the region of equatorial rains far to the eastward of the Windward islands. Reports at hand show that it was first encountered at midday, September 9, in latitude north 12° 2′, longitude west 54° 2′, by the French barque *Tourny*, Captain Mortois commanding. This vessel experienced strong northeast winds with heavy sea swells during the afternoon of the ninth, and from 4 p. m. the barometer fell one-tenth inch an hour and reached a minimum of 29.35 at 7 p. m. This hour marked the time of the passage of the storm's vortex. The wind went to southwest blowing exceedingly strong, and by 11 p. m. the air had become relatively calm, although tremendous seas continued. The vessel lost all sail, and her cargo of rice was almost a total loss.

At Barbados the premonitory signs of a hurricane became manifest during the morning of September 10. Cirrus clouds which had been moving rapidly from the south changed formation to strato-cumulus and nimbus from the northeast early in the forenoon. The wind backed from northeast to north, and a heavy sea swell ran from the southeast. The usual rise in the barometer was followed after 11 a. m. by slowly decreasing pressure. From 6 to 9.20 p. m. the barometer fell rapidly to a minimum of 29.462 inches, and the wind increased in force in frequent violent squalls until 10.18 p. m., when the anemometer was blown down during a gust which had a registered velocity of 75 miles an hour. At 11 p. m. the wind changed to north, and, in the opinion of the Weather Bureau observer at Bridgetown, much higher velocities were attained between 11 p. m. and midnight than at any other time. After 11 p. m. the gale abated, but continued strong until the morning of the eleventh. The report of the observer shows that a very remarkable electric display, without thunder, continued during the storm, and that in the southwest, at an apparent great distance, a brilliant, permanent light appeared. The rainfall was very heavy, a depth of 11.42 inches having been measured from 6 p. m. of the tenth to 10.30 a. m. of the twelfth.

From Barbados the hurricane center moved westward and reached St Vincent and St Lucia late in the forenoon of the eleventh. A report made by Mr H. Powell, Curator, Botanical Gardens, St Vincent, shows that during the morning of the eleventh the barometer fell very rapidly to a minimum of 28.509 inches at 11.40 a. m., at which point it remained nearly stationary until 12.30 p. m., and then rose rapidly to 29.533 inches by 3 p. m. Between 11 and 11.40 a. m. the velocity of the wind was 50 to 60 miles an hour from points between north and west, and between 1 and 2 p. m. the wind velocity was estimated at 90 to 100 miles an hour, from the south and south-southwest. From from 9 a. m. to noon 4.94 inches of rain fell. The rain continued in torrents until 3 p. m., but an accident to the gauge prevented further measurements.

After having crossed the Windward islands the storm diminished rapidly in intensity, and its effects were not severely felt in neighboring and more northern islands except in the form of heavy sea swells and torrential rains.

Figures furnished by the observer at Barbados show that the hurricane of 1898 did not compare in point of severity with a hurricane which visited that island August 10–11, 1831. During the storm of 1831 1,477 persons were killed outright, 310 were injured, of which number 114 died, and property to the value of $7,397,532 was destroyed. During the storm of 1898 83 lives were lost, about 150 persons were injured, and the estimated value of property destroyed was $2,500,000. At St Vincent the storm of the present year was pronounced in every way far more destructive than the hurricane of 1831. Accounts agree that these storms stand as the record hurricanes of the Windward islands, compared with which all others experienced in those islands have been comparatively unimportant. A notable feature of the storm of the present year was the period occupied by the center, or vortex, in crossing the island of St Vincent; it appeared to poise, or hover, over that locality about three-quarters of an hour. This fact indicates that the center made, or attempted to make, a recurve at that point; and one of the known characteristics of cyclonic storms is that they develop their greatest strength during recurves.

In all descriptions of hurricanes particular mention is made of the premonitory signs of their approach. These signs are found in the sea, in the wind, and in the clouds. The sea, rendered tumultuous by the terrific, confused winds about the storm's vortex, becomes disturbed and runs in swells far in advance of the body of the storm; the winds increase in gusts, and as a rule converge toward the vortex; and high cirrus clouds, carried forward by the upper air currents, are observed many hours in advance of the storm's arrival. The most important indication is, however, found in the action of the barometer. In that portion of the storm's vortex which may be termed its periphery the air is, as it were, piled up by the centrifugal force exerted about the cyclone's core. This action causes a slight but well-marked rise in the barometer, which in hurricanes of average diameter and speed precedes the arrival of the center by several hours. This rise is quickly followed by a rapid fall in the barometer, with increasing seas coming from the location of the storm center, and cirrus clouds change quickly to heavy, rapidly moving, lower clouds, which usually move in a direction almost perpendicular to a trajectory of the storm's path. In many instances the lower clouds precede the arrival of the vortex one to two days, rendering upper cloud observation after the first signs of cirrus impossible.

In this brief review it may be of interest to note the relative frequency of hurricanes in the several islands of the West Indies.

Available records show that, considered singly, the islands of the Lesser Antilles are comparatively free from hurricane visitations, and that the occurrence of destructive storms increases westward over the Greater Antilles to central and western Cuba, not for entire islands, but for corresponding areas. The cause of the varying frequency of hurricanes in different parts of the West Indies is found in a consideration of their average paths. Practically all the storms of the Lesser Antilles move westward in very narrow paths, and the proportion of storms that recurve northward is increased with increasing longitude until central and western Cuba is reached, where a fairly well-marked region of maximum frequency and recurve is found. Again, many of the storms that reach the Greater Antilles, and more especially Cuba, have their origin over the Caribbean Sea, and move thence northwestward toward Cuba or the Gulf of Mexico.

As regards the relative likelihood of hurricanes for the several months of the stormy season, it is shown that the tracks of West Indian cyclones shift further to the northward and westward as the season advances, and that while August and September are more likely to produce hurricanes in the Lesser Antilles and the more eastern of the Greater Antilles, the chance for hurricanes in Cuba is greater in September and October. In referring to this general law, the late Rev. Benito Vines, S. J., remarked as follows: "This fact is of such ancient belief that the ecclesiastical authority from time immemorial wisely ordained that priests in Puerto Rico should recite in the mass the prayer 'Ad repellendat tempestes' during the months of August and September, but not in October, and that in Cuba it should be recited in September and October, but not in August, all of which proves that the ecclesiastical authority knew by experience that the cyclones of October are much more to be feared in Cuba, but not those of August, and that in Puerto Rico, on the contrary, the hurricanes of August are disastrous, while those of October are very rare."

The limits of this article will not permit a discussion of theories regarding the origin of tropical storms or the laws and conditions which govern their movements. The regions in which they have their origin and the paths which they commonly follow have been referred to, and in conclusion it may be stated that all their movements, considered normally, are apparently influenced or governed by the trade winds and the position of the Atlantic anti-cyclonic area.

COLONIAL SYSTEMS OF THE WORLD

By O. P. Austin,

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Recent discussion in this and other countries renders timely any convenient summary of the colonies, colonial policies, and results of colonization throughout the world. As a first attempt to meet current needs, the following facts and figures have been compiled from the best available sources: *

The colonies, protectorates, and dependencies of the world number 125. They occupy two-fifths of the land surface of the globe, and their population is one-third of the entire people of the earth. Of the 500,000,000 people thus governed, over three-fourths live between the tropics of Cancer and Capricorn, or within what is known as the Torrid Zone, and all of the governing countries lie in the North Temperate Zone. Throughout the globe-encircling area known as the Torrid Zone no important republic or independent form of government exists save upon the continent of America.

The total imports of the colonies and protectorates average more than $1,500,000,000 worth of goods annually, and of this vast sum more than 40 per cent is purchased from the mother countries. Of their exports, which considerably exceed their imports, 40 per cent goes to the mother countries. Large sums are annually expended in the construction of roads, canals, railways, telegraphs, postal service, schools, etc., but in most cases the present annual expenditures are derived from local revenues or are represented by local obligations. The revenues of the British colonies in 1897 were £151,000,000 and their expenditures £149,000,000. While the public debt in the more important and active of these communities aggregates a large sum, it is represented by canals, railways, public highways, harbors, irrigation, and other public improvements intended to stimulate commerce and production, the railroads in operation in the British colonies alone aggregating 55,000 miles.

The most acceptable and therefore most successful of the colonial systems are those in which the largest liberty of self-govern-

* The subject is treated at greater length in the "Summary of Commerce and Finance" for December, 1898 (issued by the Bureau of Statistics, Treasury Department).

ment is given to the people. The British colonial system, which has by far outgrown that of any other nation, gives, wherever practicable, a large degree of self-government to the colonies; the governors are in all cases appointed by the Crown, but the law making and enforcing power being left to legislative bodies which are elected by the people where practicable, in minor cases a portion being elected and a portion appointed, and in still others the appointments divided between the British government and local municipal or trade organizations, the veto power being in all cases, however, retained by the home government. The enforcement of the laws is intrusted to courts and subordinate organizations, whose members are in many cases residents or natives of the communities under their jurisdiction. In the French colonies less attention is given to law-making and administration by local legislative bodies, the more important of the colonies being given members in the legislative bodies of the home government. In the Netherlands colonies and in the less advanced communities under British control the laws and regulations are administered in conjunction with native functionaries.

Of the 125 colonies, protectorates, dependencies, and "spheres of influence" which make up the total list, two-fifths belong to Great Britain, their area being one-half of the grand total and their population considerably more than one-half of the grand total. France is next in order in number, area, and population of colonies, etc., though the area controlled by France is but about one-third that belonging to Great Britain and the population of her colonies less than one-sixth of those of Great Britain.

Commerce between the successful colonies and their mother countries is in nearly all cases placed upon practically the same basis as that with other countries, goods from the home countries receiving in the vast majority of cases no advantages over those from other countries in import duties or other exactions of this character affecting commerce. In the more prosperous and progressive colonies the percentage of importations from the mother countries grows somewhat less as the business and prosperity increase. The chief British colonies in North America (Canada and Newfoundland), which in 1871 took 50 per cent of their importations from the home country, took in 1896 less than 30 per cent from the United Kingdom; those of South Africa (Cape Colony and Natal), which in 1871 took 83 per cent from the home country, took but 71 per cent in 1896; those of

Australia and the adjacent islands, which in 1876 took 48 per cent from the home country, in 1896 took but 40 per cent. The French colonies now take from the home country about 42 per cent of their total imports, while the British colonies obtain about 43 per cent of their total imports from the home country.

Regarding the effect of a well-administered colonial system upon the commerce of the mother country, the following facts seem to be just now interesting and suggestive:

The non-British world buys 15 per cent of its total foreign merchandise from the United Kingdom; the British colonial world buys 43 per cent of its foreign merchandise from the United Kingdom. The total imports of the British colonies amount to 215 million pounds sterling annually. Great Britain, by supplying 43 per cent of this instead of 15 per cent, which she averages in the commerce of other countries, makes an additional market for 60 million pounds sterling annually of her products. Her total exports to foreign countries (omitting the colonies) are 206 million pounds sterling, or 15 per cent of their total imports, and if to this were added a like percentage of the imports of the colonies her total sales would be 238 million pounds sterling instead of the grand total of 296 million pounds sterling which she enjoyed in 1896, the year to which these figures relate. It is thus apparent that her sales are enlarged through her colonial system in the sum of about 60 million pounds sterling in round figures, or 300 million dollars per annum, thus increasing by 25 per cent her total exports, and creating by her colonial system a market for 300 million dollars' worth of her products and manufactures.

Not only has Great Britain added to her market by bringing the 350 million people of her colonies into the colonial relationship, but there has evidently been, through the material development which has followed this relationship, a great increase in the purchasing power. The construction of highways, harbors, railways, and telegraphs has evidently quickened the general business conditions, and with the increased activity and prosperity enlarged the consuming power. The railways now in the British colonies alone are more than 55,000 miles in length, the telegraph lines nearly 150,000 miles, and the highways far in excess of that. A large proportion of the railway lines is under the control and in many cases operated by the government, and it is an interesting fact that the lines operated by the government expend a smaller proportion of their total receipts in running expenses than those operated by private corpora tions. In nearly all the colonies there are savings banks in conjunction with the post-offices, and the deposits in the savings banks of the colonies amount to more than $300,000,000.

In the import trade of Great Britain the colonies also prove advantageous from the British standpoint. Over one-fifth of the more than two billion dollars which Great Britain sends outside of her immediate limits in purchase of supplies is spent among the people of her colonies and thus largely contributes to the prosperity of either British colonists or British capital. That the industries of the colonies are to a considerable extent controlled by British capital goes without saying, and that the expenditure of nearly 500 million dollars of British money in British colonies each year for the products of those colonies must benefit the capital thus employed and so reflect to the business advantage of the home country, whence that capital is drawn, is equally apparent. The total imports into Great Britain from the colonies in 1896 were over 93 million pounds sterling, and in 1891 were over 99 million pounds sterling, or, in round terms, 500 million dollars, forming more than one-fifth of the total imports into the United Kingdom.

Considering the commercial side of the recent developments in the relations of the United States with Cuba, Puerto Rico, Hawaii, and the Philippines, three questions arise:

1. Will these islands in the new relations furnish an increased market for our surplus products?

2. Will any of them prove a door through which a still larger market may be found for our surplus products?

3. Will they supply any considerable share of the products for which we have been accustomed to expend money in foreign countries and thus permit its expenditure among our own people or in support of industries represented by the capital of our own people?

The imports into Cuba, Puerto Rico, Hawaii, and the Philippines under normal conditions have reached nearly or quite 100 million dollars annually, and with the developments consequent upon new methods and the inflow of American capital seeking investment would naturally materially increase. This, however, is but a small sum compared with the markets offered by the countries commercially adjacent to the Philippine islands and to which the port and city of Manila might prove an entrepot for the distribution of American products. The population of the countries commercially adjacent to the port of Manila is more than 800 millions of people, and their annual imports more than $1,200,000,000. Of this vast sum a large proportion is composed of articles and classes of articles produced or manufactured in the United States, especially cotton and cotton goods, manufactures of iron and steel, machinery, mineral oils, provisions, breadstuffs, and other articles of this class for which our people are seeking a market. Up to this time imports into those countries from the United States formed less than 6 per cent of the total importations, despite the fact that the articles desired by the people are largely of the class which our own people desire to sell. With a Nicaraguan canal through which the manufacturers and producers of the United States could ship their products by water without breaking bulk from the door of the farm or factory to a distributing center at Manila, which lies as near to many of the great commercial centers of these countries as Habana does to the city of New York, there seems no good reason why the people of the United States desiring to extend their commerce should not obtain a much larger share of the business of that great consuming territory thus accessible from that point than they now have.

Regarding the third point, as to our present expenditure for the class of articles which may be produced in those islands: the importation of articles of this class into the United States, including sugar, coffee, tobacco, hemp, tropical fruits, etc., has averaged during the past few years nearly or quite 250 million dollars annually, and if this sum, now sent each year to foreign countries, can be expended among people having closer relations with the United States, and among whom citizens of the United States will be represented, either in person or by the capital which they will furnish for business enterprises, the result will be advantageous to the business interests of the country and her people.

If the United States should by the proposed new relationship with these islands open them as a market to our producers and make them a doorway to a much larger market, and at the same time enable us to expend among our own people the large sum which we have been accustomed to send to other countries and to other peoples, the suggestion seems at least worthy of serious consideration.

Colonies, Dependencies, and Protectorates of Nations of the World, Showing Area and Population of the Colonial Possessions, Protectorates, Dependencies, and "Spheres of Influence" of each Country.

[Compiled from the Statesman's Year-Book, 1898.]

Countries.	Number of colonies.	Area (square miles).		Population.	
		Mother country.	Colonies.	Mother country.	Colonies.
United Kingdom (*a*)...	48	120,979	11,250,412	39,824,563	344,059,122
France	32	204,092	3,617,327	38,517,975	52,642,930
Germany	8	208,830	1,020,070	52,279,915	10,600,000
Netherlands	3	12,648	802,863	4,928,658	33,911,744
Portugal	9	36,038	801,060	5,049,729	9,216,707
Spain..........................	3	197,670	245,877	17,565,632	256,000
Italy	2	110,646	104,000	31,290,490	650,000
Austria-Hungary.........	2	240,922	23,262	41,231,342	1,568,092
Denmark......................	3	15,289	86,614	2,185,235	114,229
Russia	3	8,516,139	255,550	126,683,312	5,684,000
Turkey.........................	4	1,115,067	564,500	24,128,690	17,489,000
China...........................	5	1,336,841	2,884,560	386,000,000	16,680,000
United States (*b*).........	4	3,557,000	168,287	75,194,000	10,177,000
Total..................	126	15,672,161	21,824,382	844,879,541	503,048,824

(*a*) Includes feudatory native states of India, whose area is 731,944 square miles; population in 1891, 66,060,479.

(*b*) Subject to ratification of pending treaty.

Note.—The above statements of area and population of British territory include the native feudatory states of India, of which Whitaker's Almanack, published in London for 1899, says that they "are subject to the control of the supreme (British) government, which is exercised in varying degree, being, generally speaking, governed by native princes, ministers, or councils, with the help and under the advice of a political officer of the supreme government." The Statesman's Year-Book, published in London, also includes them in its table of area and population of the British Empire, giving their area at 731,944 square miles; population, 66,060,479.

LLOYD'S JOURNEY ACROSS THE GREAT PYGMY FOREST

Mr Albert B. Lloyd, an intrepid young Englishman, recently performed a remarkable journey across the great pygmy forest of Central Africa, which he traversed by a more southerly route than that taken by Stanley. After many interesting adventures with the pygmies, he descended the entire length of the Aruwimi, passing through immense tracts of forest inhabited only by cannibals. He afterward descended the main Kongo river to the terminus of the railway, whence he traveled to Matadi by train. Although much of the route had never before been explored, Mr Lloyd performed his hazardous journey without any companions save a couple of Baganda servants and a few native carriers. He, however, met with no serious difficulty from the natives and had not to fire a shot in self-defense.

Interviewed at Lisbon by a representative of Reuter's news agency, Mr Lloyd said:

"I left Bamutenda in Toru on September 19, striking due south to Fort Katwe, the British military station on the northern shore of Lake Albert. Thence I followed the Semliki river to M'beni, the frontier fort of the Kongo State. There I crossed the Semliki into Belgian territory. From this point I crossed through the heart of the great pygmy forest, the northern part of which was traversed by Stanley. After passing through the forest I traveled right down the Aruwimi to the junction of that river with the Kongo. Although a portion of the journey, especially along the Aruwimi and through the dark forest, was somewhat risky, I met with no serious opposition. I never had to resort to the use of arms. I was entirely unaccompanied by Europeans until I reached the Belgian State station at Basoko on the Kongo. My caravan consisted of two Baganda boys as personal servants and a few native carriers. Guides I obtained at the various villages en route."

As to the situation in Toru, Mr Lloyd said:

"Since the administration of Captain Sitwell in that province marvelous progress and improvement have been made. When I first went there two years ago there was constant trouble with the chiefs and the natives, but now matters go on very smoothly. The chiefs recognize the King who was placed there by Captain Lugard and loyally obey him. It is very significant that, owing to the loyalty of the Watoro, Mwanga's people, despite repeated efforts, have never crossed Toru, but have met with continual repulses. It is a matter of great congratulation that the force of 120 Sudanese in Toru under Captain Sitwell has remained absolutely loyal during the whole of the rebellion. This is the only province of Uganda which has not been disorganized, owing to the late mutiny. Just after I left, Captain Sitwell and Captain Meldon started on an expedition to check the rebels under Gabrieli, Mwanga's commander-in-chief, who was attempting to proceed to the north to join the ex-King of Uganda in Unyoro. King Kasagama, of Toru, is a thoroughly reliable and indeed exemplary man. Baptized by Bishop Tucker in 1896, he has since lived a thoroughly consistent Christian life."

Describing his journey and his experiences with the pygmies, Mr Lloyd continued:

"During the first ten days' traveling through Toru nothing of a specially noteworthy character occurred. I reached the Belgian frontier post of M'beni on October 1, and then entered the great dark forest. Altogether I was twenty days walking through its gloomy shades. I saw a great many of the little pygmies, but, generally speaking, they kept out of the way as much as possible. At one little place in the middle of the forest, called Holenga, I stayed at a village of a few huts occupied by so-called Arabs. There I came upon a great number of pygmies, who came to see me. They told me that, unknown to myself, they had been watching me for five days, peering through the growth of the primeval forest at our caravan. They appeared to be very frightened, and even when speaking covered their faces. I slept at this village, and in the morning I asked the chief to allow me to photograph the dwarfs. He brought ten or fifteen of them together, and I was enabled to secure a snapshot. I could not give a time exposure, as the pygmies would not stand still. Then with great difficulty I tried to measure them, and I found not one of them over four feet in height. All were fully developed. The women were somewhat slighter than the men, but were equally well formed. I was amazed at their sturdiness. Their arms and chests were splendidly developed, as much so as in a good specimen of an Englishman. These men have long beards half way down the chest, which imparts to them a strange appearance. They are very timid and cannot look a stranger in the face. Their eyes are constantly shifting as in the case of monkeys. They are fairly intelligent. I had a long talk with the chief, and he conversed intelligently about the extent of the forest and the number of his tribe. I asked him several times about the Belgians, but to these questions he made no reply. Except for a tiny strip of bark cloth, men and women are quite nude. They are armed with bows and arrows—the latter tipped with deadly poison—and carry small spears. They are entirely nomadic, sheltering at night in small huts two to three feet in height. They never go outside the forest. During the whole time I was with them they were perfectly friendly.

"There are no Europeans in any part of the forest, but there are a few villages containing three or four houses, which are known as auxiliary Belgian stations. They are occupied by so-called Arabs, who have been placed there by the Belgians. In parts I found a fairly good track, perhaps a couple of feet wide, overhung and crossed by boughs and enormous creepers, but, generally speaking, it was easier to cut our way right through the tropical growth. In places the darkness was very great. Once I tried to photograph my tent at midday, but even with nearly half an hour's exposure the attempt was a failure. Occasionally I came upon a very small natural clearing, but generally speaking the growth was very dense and it was like advanced twilight. In many places it was impossible to read even at noon. I walked during the three weeks I was going through the forest, as, although I had a donkey with me, if I had ridden him I should have continually been pulled off by the creepers. We had several narrow escapes from falling trees. On one occasion my two boys and myself, who were at the head of the party, had just passed under an enormous tree when it fell with a crash between us and the rest of the carriers. Had we passed two seconds later it would have fallen on us. I measured one tree which had fallen across the track and found it to be 20 feet in circumference. The deathlike stillness of the forest was continually broken by reports like thunder as these giant trees fell crashing to the ground. At night-time these reports were most startling. The forest is literally alive with elephants, leopards, wild pigs, buffalo, and antelope. Fires at night kept off any leopards that might have been prowling round our little encampment. At night I used to fasten my tent to the trunks of trees and surround the camp with a zariba of small trees. We never had a guard at night.

"The first Europeans I met after leaving the forest were two Belgian officers at a place called Mawambi, on the Ituri river. Just after reaching that place I again struck Stanley's route, and marched for ten days along the banks of the Ituri to the village of Avakubi. Traveling here was very difficult, in fact almost as bad as in the great forest. The tracks were all overgrown and the country practically uninhabited. Its only occupants were cannibals. At Avakubi, which place I reached on October 20, I got two large dugout canoes and embarked on the Aruwimi. The natives rigged up a little covering on one of the boats for protection from the sun, and this nearly cost me my life. I was in this boat and we were just starting down a strong rapid when the craft began to sink, and I was unable to get free of the covering. I eventually got to the surface in an exhausted condition, but I lost a large number of photographs. Ten days' journey down the Aruwimi brought us to its junction with the Kongo at Basoko. This was regarded as a very quick journey, but we were, of course, going down-stream. During this section I passed through the country of the cannibal Bangwa tribe, a very warlike people, who are noted for their wonderful workmanship in iron, which they make into spears, knives, etc. They are at present more or less cowed by the Belgians, but I doubt if this condition of affairs will be permanent, and I believe the Belgians will have trouble with them yet.

"There are many Kongo State posts down the Aruwimi with white officers, and apparently they manage to keep on fairly good terms with the cannibals by whom they are surrounded. Personally I was received most kindly by these cannibals. They are, it is true, warlike and fierce, but open and straightforward. I did not find them to be of the usual cringing type, but manly fellows who treated one as an equal. I had no difficulty with them whatever. At one place I put together the bicycle I had with me, and, at the suggestion of these people, rode round their village in the middle of a forest. The scene was remarkable, as thousands of men, women, and children turned out, dancing and yelling, to see what they described as a European riding a snake. At Basoko on the Kongo I embarked in the river steamer Ville de Bruxelles and came down the river, calling at stations en route. After a journey of 600 miles in the boat I reached Leopoldville on November 24. There I joined the railway, which I may say is one of the most wonderful things I have seen in Africa. I traveled in an armchair in an excellent saloon carriage, and finally reached Matadi, whence I proceeded to join the Portuguese mail steamer for Lisbon."

Asked in conclusion for information concerning the many reported military movements on the Kongo, Mr Lloyd replied:

"According to report, Baron Dhanis was on an expedition in the Kasai district, and from what I heard he was experiencing great difficulty, especially in the matter of transport, owing to the swampy character of the country. The only other expeditions I heard of were those of Lieutenant Henry, who was on the way from Stanley Pool to Lado, and of Major Lothaire, who had just left Bangala for the north. I saw large numbers of troops being trained at Bangala. Generally speaking, the whole Kongo was quiet—certainly tranquillity prevailed along the river. An expedition was about to be sent north of Basoko against a very hostile tribe. It was reported that it was not safe for any European to go more than two hours' journey to the north of Basoko. At this place I stayed with Captain Guy Burrows, who is commandant of the Aruwimi district, and who helped me considerably. The influence of such men and of other Englishmen who are now in the Kongo State service is doing a great deal to check excesses which were formerly so common."

During the whole of his journey Mr Lloyd enjoyed good health, having only two very slight attacks of fever.

GROWTH OF MARITIME COMMERCE

In his admirable paper on Maritime Commerce: Past, Present, and Future, which appears in the Proceedings of the American Association for the Advancement of Science, 1898, Dr E. L. Corthell, the eminent engineer, states that during the fifty years that have elapsed since the formation of the American Association the weight of the seaborne commerce of the world has increased from 26,500,000 tons in 1848 to 201,000,000 tons in 1898, and the total number of steamships from 242, with a tonnage of 74,700 and an indicated horse-power of 2,000,000, to 11,271, with a tonnage of 17,889,006 and an indicated horse-power of 60,000,000. The average length of the twenty largest steamships has increased from 230 feet to 541 feet, the average breadth from 36.2 feet to 61 feet, and the average depth from 23 feet to 39 feet. The average speed of the twenty largest steamships has increased from 9.2 knots to 18 knots, and that of the twenty fastest steamships from 10 knots to 22 knots.

Dr Corthell states that draught of water for the steamships of the present and future is the desideratum to which urgent attention should be called by all who desire the continued development of commerce and the still further cheapening of transportation and reduction of prices. Twenty-seven feet is now the extreme limit of depth to which a ship can load on either side of the Atlantic. While the great Atlantic liners are increasing in length and breadth, the draught of water has to be kept the same, and it is only a question of time when an absolute limit of speed will be imposed by this restriction of draught. The remedy is to be found in the deepening of channels and harbors and the improvement of docks. Liverpool is being improved beyond all other ports of the world, widening and deepening its docks to accommodate vessels up to 900 feet in length and to 90 feet beam and 36 feet draught. Improvements upon a smaller scale but still of considerable importance are either in progress or in contemplation at London, Hamburg, Antwerp, New York, Boston, Philadelphia, New Orleans, and Galveston, while the depth of the Suez canal has been increased from 26 feet 28½ feet, and plans have been prepared for a further deepening to 30 feet,

It will be seen from these brief references that Dr Corthell's paper contains a large amount of interesting information not hitherto accessible to the general reader, and in view of the growing recognition of the absolute interdependence of nations its present publication is most timely.

J. H.

NATIONAL GEOGRAPHIC SOCIETY

Prizes for Essays on Norse Discoveries in America

The National Geographic Society offers two prizes for the best essays on Norse discoveries in America; these prizes to be awarded under the following conditions:

1. A first prize of $150 and a second prize of $75 are offered for the best and second best essays, respectively, relating to pre-Columbian discoveries and settlements of the Norsemen on the mainland of North America and the location of the lands mentioned in the Icelandic Sagas.

2. Essays submitted in competition for these prizes should be typewritten in the English language, and should not exceed 6,000 words in length; they may be accompanied by maps and other illustrations used for the explanation of the text, but not for embellishment.

3. Essays submitted in competition for the prizes should be signed by a pseudonym or number, and should bear no other indication of authorship, but each should be accompanied by a sealed envelope, marked with the same pseudonym or number, containing the name and address of the author.

4. The competition will close at 6 p. m., December 31, 1899.

5. The National Geographic Society and the judges on behalf thereof reserve the right to withhold either prize, or both, in case the essays submitted are not sufficiently meritorious to warrant publication with the approval of the Society; but in case of withholding one or both of the prizes on this ground, a new competition will be opened.

6. Immediately after the close of the competition the essays submitted in accordance with the foregoing conditions will be laid before the following board of judges, whose adjudication shall be final:

Henry Gannett, Geographer of the U. S. Geological Survey, etc.
Albert Bushnell Hart, Ph. D., Professor of History in Harvard University.
Anita Newcomb McGee, M. D., Acting Assistant Surgeon, U. S. A.
John Bach McMaster, LL. D., Professor of History in the University of Pennsylvania.
Henry S. Pritchett, Superintendent of the U. S. Coast and Geodetic Survey.

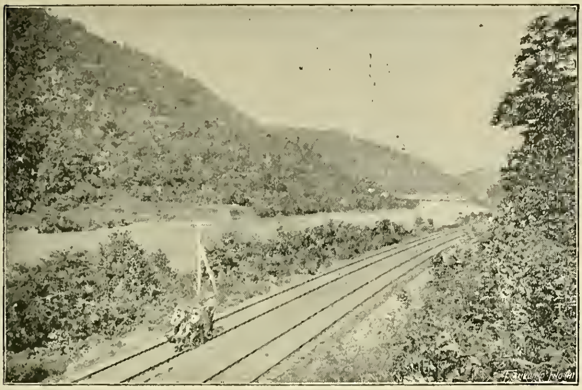
Prof. W. B. Powell, Superintendent of Schools of the District of Columbia, is Chairman of the Prize Committee of the Society's Board of Managers.

SENOR DON MATIAS ROMERO

In the death of Señor Don Matias Romero, Envoy Extraordinary and Minister Plenipotentiary of the Republic of Mexico to the United States, which occurred at his residence in the city of Washington, December 30, 1898, the National Geographic Society has lost one of the most interested and appreciative of its members, and one of the most constant attendants at its meetings. Other scientific and educational institutions of this country likewise have lost a warm friend and liberal contributor.

Señor Romero first came to the United States in 1859, as secretary of the Mexican Legation, and he has remained here, with the exception of about four years, ever since. On account of his superior ability as a diplomatist he has been promoted from time to time, until just before his death—and before his credentials could be presented to the President—he had reached the highest diplomatic position to which his country could assign him, that of Ambassador to the United States.

From his long residence among us and his personal interest in our affairs—in fact in all but his allegiance to his native country—he was one of us. No representative from any foreign country was more respected and beloved by the people of the United States, and the tie that bound him to us was made closer by his marriage to an American lady. In the national capital, where he was a prominent figure for more than a third of a century, his memory will long be cherished.



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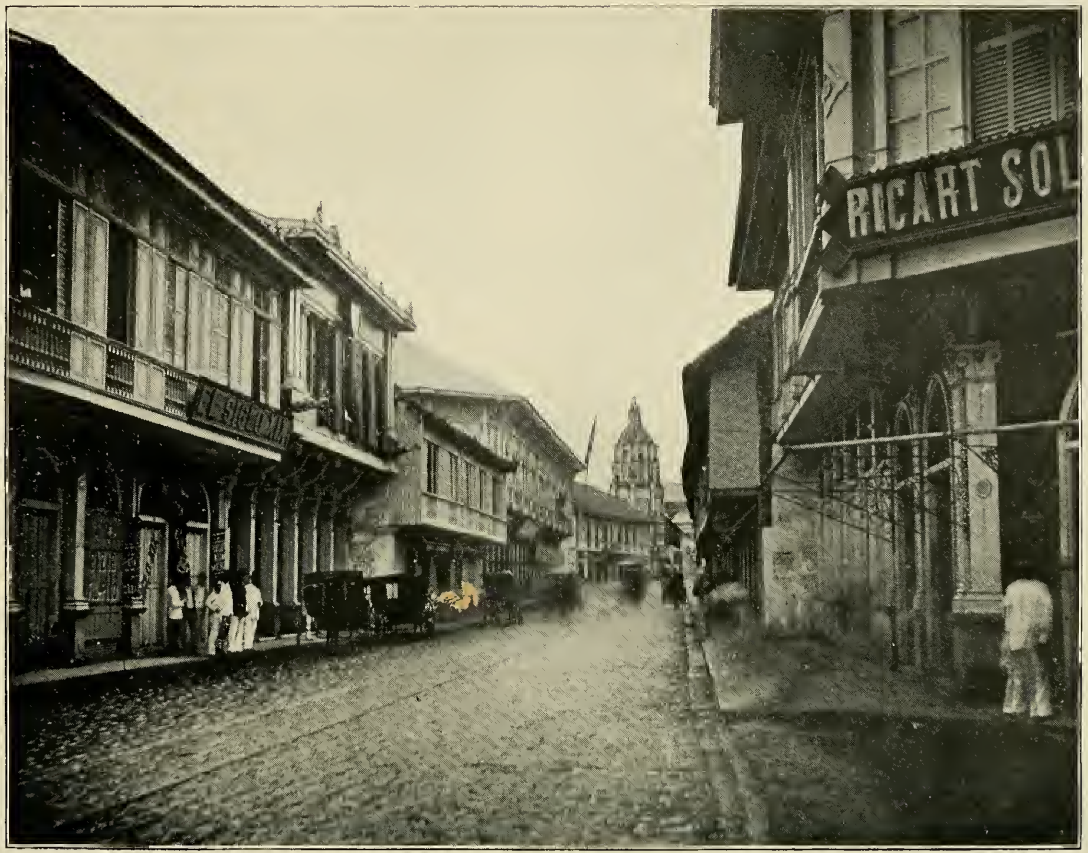


CALLE ESCOLTA PRINCIPAL STREET IN BINONDC

THE
National Geographic Magazine

Vol. X FEBRUARY, 1899 No. 2

THE ECONOMIC CONDITION OF THE PHILIPPINES

By Max L. Tornow,
of Berlin and Manila

General interest in the Philippines, a group of islands long all but forgotten by the rest of the world, has been again thoroughly awakened by the recent cannonade off Cavite. Even with the final settlement of the Philippine question, it is scarcely to be expected that the islands can again fall into forgetfulness. A glance, therefore, at the economic condition of the country, with a few of the more important statistics, will not be out of place, for an exhaustive consideration of the subject would occupy far more space than the present article admits of.

AGRICULTURE

Commencing with the products of the soil, two important points strike us as testifying to the varied and fertile character of the land: the geographical position of the islands, embracing 16 degrees of latitude, and the plentiful supply of water On the other hand, in addition to smaller obstacles raised by the administration, particularly as regards large plantations, the want of labor militates seriously against industrial extension, so that of the arable land only a very small part is today under cultivation. The result is that, notwithstanding the richness of the soil, we find that the total returns are nothing like what they should be.

Not only do all tropical fruits flourish, but also the plants of the temperate zones, such as wheat, barley, and potatoes. Experiments were made some years ago with wheat and barley and met with every success; and there is today a German planter in Benguet cultivating potatoes. I am fully convinced that in certain parts the vine could be grown, and at all events those fruits which demand a mild climate. Attempts have been made with tea to a limited extent, and the results have not been unfavorable; but to all extensive planting—and this is the only way in which it is remunerative—the want of railways, good roads, and laborers presents the greatest difficulty. Not less annoying is the attitude assumed by the Spanish officials and the monks, unless the planter is ready to dance at their command.

The principal agricultural products exported are sugar, hemp, and tobacco, and to a less extent coffee, the cultivation of which, however, has of late greatly decreased. Indigo, sapan-wood, and copra must not be left unmentioned, for they may certainly be expected to take a higher place in the Philippine trade in the future than is the case at present. Rice and maize are grown only for home consumption, and even for this purpose the supply is not large enough. Rice is imported from Saigon and Bangkok and cocoa from Java, although the extremely fertile soil of the Philippines could produce all that is required at home and enough to admit of a large export trade as well. Formerly—from 1850 to 1860, and perhaps later—rice was exported from the islands, but the quantity gradually decreased until exportation ceased altogether, and finally the grain began to be imported. The blame lies with the miserable administration of the country. The planter can no longer compete with Rangoon, Saigon, and Bangkok, where the authorities know how to meet the farmers when necessary, and where ships are not exposed to endless chicanery, such as is practiced by the Manila customhouse officials. For this reason most foreign vessels are careful to steer clear of the latter port. Sugar is chiefly exported from the Visayas islands, and the trade is almost exclusively *via* Iloilo, the largest place after Manila, situate on the island of Panay. Cebu, the third largest port of the archipelago, does now but a small and steadily declining trade in hemp.

The best tobacco grows in the north of Luzon, in the province Isabella, and the south of Cagayan, the most northern province of that island, in the valley of the Rio Grande de Cagayan. The northern provinces of Luzon, from the Gulf of Lingayen, in the west, to the Pacific, are separated from Manila by a range of high mountains, the Caraballo, over which there is, with the exception of a path and the telegraph, no road whatever, much less a railway. The tobacco, therefore, is sent on covered boats, called "barangaijanes," down the Rio Grande to Aparri, and there shipped by steamer to Manila. A flat-bottomed steamboat also runs from Ilagan, when the water allows it; otherwise it goes only as far as Tuguegarao. In this way the transport from the

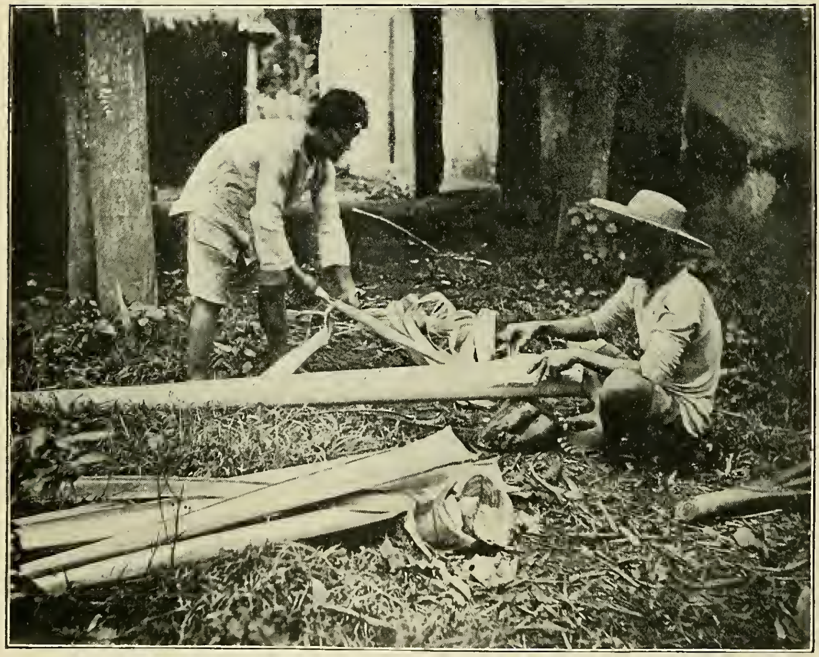
CUTTING THE HEMP TREE, MUSA TEXTILIS

most southern tobacco center, Echague (which as the crow flies is only about 150 miles), often takes as much as three weeks.

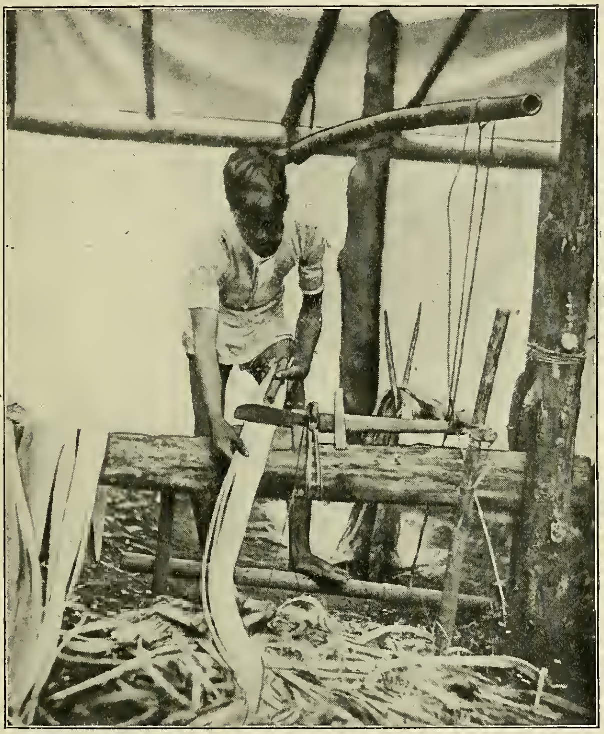
Tobacco has also been planted on the west coast of the northern part of Luzon and on the Visayas islands. This, however, is of inferior quality, and is mostly exported to Spain. In

Manila it is not used, except, perhaps, by the Chinese factories for inferior cigarettes. Regarding the tobacco monopoly, abolished in 1883, I shall have some remarks to make later.

An important and world-famed article is Manila hemp, or abaca, a product of the *Musa textilis.* It is remarkable that, although there are the most various species of the *musa* flourishing all over the tropics and in warm climates generally, the *Musa textilis* appears to thrive to the best advantage only in the Philippines. Attempts to grow the plant in other places have been uniformly unsuccessful. Like its better-known relative, the edible banana (*Musa paradisiaca*), the stem of the plant is formed by the leaf-stalks, in the center of which again is the blossom-stem. The finest growth is obtained in the volcanic and rainy districts of the Philippines, more particularly in Camarines Sur, Albay, Samar, Leite, Marinduque, Cebu, and in some of the small neighboring islands, as well as in Negros and Mindanao. The valuable hemp-fiber is found in the petioles, from which it is taken before the plant has borne fruit, as otherwise the fibers lose in elasticity and luster. In two or



SEPARATING THE PETIOLES OF THE MUSA TEXTILIS three years the plant has usually attained such growth that it can be cut down, the leaves removed, the green epidermis stripped from the stem, and either the bast-strips torn off lengthwise, or the petioles separated singly, and the inner membrane, with the pulpy portion of the plant, removed. The bast-strips thus



THE BAST STRIPS OF THE MUSA TEXTILIS DRAWN FOR THE FIRST TIME UNDER THE KNIFE

obtained are then drawn under a knife in order to scrape away any pulp that may have remained on them. The product, after having been dried in the sun, is then ready for shipment. This process, though simple, involves a great loss of fiber, which might be avoided by the use of more efficient stripping machines. It is difficult to accustom the natives to anything novel, but when once progress has gained a general footing headway will soon be made in particular paths also. Manila hemp has so far been equaled by none, much less excelled.

The principal article is fair current, with its higher and lower grades. Of less importance are quilot and the silk-like lupiz, which, besides their use in the manufacture of fine native fabrics, are also employed for superior toilet articles in Europe, especially in the ladies' hat trade. From the current sorts excellent ships' cables and miners' ropes are made, and in America, where great quantities are consumed, they are used to make grain-binders for harvesting. Hemp comes into the market in bales of two Spanish piculs (280 pounds English). The price varies much, being subject often to great fluctuations, which naturally give rise to speculation. About the middle of

THE BAST STRIPS OF THE MUSA TEXTILIS AFTER BEING DRAWN SEVERAL TIMES UNDER THE KNIFE

the present century the price ranged between \$4.00 and \$5.00 (with high course of exchange), steadily rising. In the sixties we find it from \$7.00 to \$9.00, and in the eighties \$11.00 was the average. In 1890 it was artificially pushed up to \$17.00, an immense crash being the natural result, and all this at a high or even higher course (3 / 3½d–3 / 11d per \$). The course now began to fall steadily, until after the outbreak of the war it stood at 1 / 10½d. Of late the prices for fair current have been between \$6.00 and \$9.00 per picul, at a course of 2 /, and at the end of

April the ton was sold in London at £19. During the blockade of Manila the price was pushed up to nearly £40. At the end of the war it fell again to £28 10.

In 1818, 261 piculs, worth $4.00 per picul, were exported. After that there is no record of the exportation of hemp until 1840. In that year the amount exported is stated to have been 136,034 piculs (8,502 tons). Thirty years later, in 1870, the amount had risen to 488,560 piculs (30,535 tons). The export then increased still more considerably. The following figures show how it has stood during the past six years:

	Piculs.	*Tons English.*
1892	1,581,100	98,818
1893	1,282,942	80,184
1894	1,591,962	99,497
1895	1,664,590	104,038
1896	1,531,810	95,738
1897	1,689,754*	105,610

The chief consumers are England and the United States. The relative consumption by the different countries in 1896 is seen from the following table:

	Piculs.	*Tons English.*
England	815,044	50,940
United States	615,554	38,473
China and Japan	49,494	3,093
Australia	33,892	2,118
Singapore and India	12,166	760
European continent	5,660	354
	1,531,810	95,738

The difference between the large export to England and the small amount which goes to the continent, the very last on the list, is striking. England, however, acts here only as middleman, selling extensively again to the continent, which accordingly buys at second, or rather third, hand.

Various species of the cocoanut palm are found dispersed throughout the whole archipelago, though the exportation has been considerable only during the last few years. Under a more satisfactory state of affairs in the interior of the country, the export trade in copra promises to increase still further in spite of the large consumption of the nuts by the natives themselves. The meat of the cocoanut forms a staple article of food, both raw and prepared.

* From Manila only.

The archipelago is very rich in timber, notwithstanding that the exploitation for building purposes has been going on for over 300 years, and exportation was once very large; nor have new plantations ever been thought of. Sapan-wood for dyeing purposes is also a product of the islands, and there is a regular, though small, export trade done in it.

That the Philippines are among the most fertile colonies on the face of the earth is well known and has been frequently commented upon. It is less generally known that they are also among the most neglected colonies in the world. According to the Spanish authorities themselves, only one-tenth of the available arable land is under cultivation; as a matter of fact the amount is much less. What might not be made of this beautiful country were this mismanagement to be brought to an end.

Cattle-breeding has been carried on by some mestizos for many years, evidently with success or the business would have died out. Of late it has been found more profitable to import the extremely cheap Queensland cattle. But the fact that cattle thrive almost everywhere is a proof that cattle-breeding on an extensive scale is possible. A small number of sheep are imported from China

STREET IN BINONDO, WITH BUFFALO CARTS

for consumption by foreigners. It is by no means improbable, however, that in some provinces, at any rate, they would thrive well. There are but few goats. Of swine and poultry, on the other hand, there is a surplus, the flesh of the former especially forming a favorite article of diet with the natives.

In addition to the small but very tough horses, resembling those of Java, that most useful of domestic animals, the "carabao," or black (gray) buffalo, thrives abundantly. The white species is also occasionally to be found. The buffalo is employed for many purposes—for working the pumps on plantations, for sugar presses, and for draught purposes. In the mountains the buffalo is met with in the wild state. It is, however, undoubtedly only the domestic species that has been neglected. Nevertheless, in the course of years the degeneration has been so great that there now exists a clear distinction between the wild and the domestic buffalo. The wild animal has a more compact head and short horns, while the domestic animal has a long head with long, broad horns. Neither the horse nor the buffalo is indigenous to the Philippines; both have been imported by the Spaniards.

MINERALS

But the arable land does not form the only resource of the country, little regarded as it has unfortunately hitherto been. There is another and doubtless not less valuable property in the mineral riches now slumbering beneath the ground.

The islands yield pit-coal, iron, gold, silver, copper, etc., for the most part of good quality; and recently petroleum has been struck. Careful and expert explorations have several times been undertaken by engineers, yet never to the extent necessary to start lucrative mining, nor yet over a sufficiently extensive area. The former "inspector general de montes," Don José Centeno, and Don Antonio Hernandez are deserving of special mention for their work in this direction.

Coal is probably spread over the whole archipelago. It was first discovered in 1827, in the island of Cebu; then in Negros and Mindanao; on the island of Luzon, in Camarines and Albay, and in many other islands. The wealth thus appears almost inexhaustible. The coal in Cebu is of the best quality, numerous experiments having shown it to be equal to Newcastle coal. Hernandez found four seams running parallel from north to south at a small depth and 95 miles long. In 1874 four further seams were found about 7 miles from the coast, near Compostela, where Don Isaac Con-ui worked the Caridad and Esperanza collieries in a small way. In Albay, one mile southeast of the small harbor of Sugod, is one of the most extensive of the many seams which have been found in Albay. It is 5 or 6 yards deep and runs for a long distance. From this mine, from different places over a distance of a mile or more, 130 tons of coal were dug and practically tested on some steamers. According to the reports of the man-of-war *Berenguela* and the steamships *Butuan* and *Corregidor*, which experimented with the coal, the latter resembles that of Australia, with the advantage of being less bituminous. This is in agreement with the scientific analyses and trials of the coal made in Madrid. Small workings were begun, but exploitation corresponding to the value of the coal fields could not be looked for, as with the fickle government and administrative mismanagement, capitalists feared to finance such undertakings. Especially were foreigners subjected by the government to every possible hindrance, so that a profitable return seemed questionable and the capital invested in danger. The workings were consequently very limited, and up to this day Australia and Japan export coal to Manila—a state of things which, it may be hoped, will soon be changed.

Iron also has been found in many of the islands. The best is that in Luzon, in the provinces of Morong, Laguna, Bulacan, Nueva Ecija, Pampamga, and Camarines, which, according to Centeno, compares most favorably in quality with that of Sweden. The ore contains from 75 to 80 per cent pure iron, and is found in the midst of immense forests, so that there is thus a permanent supply of fuel, if properly used. In addition to this, there is often water-power in the neighborhood which could be profitably utilized. In the above-mentioned provinces Centeno discovered large masses of almost pure magnetic iron oxide (hierro oxidulado magnetico, casi puro). After what has been said above, it is not surprising that here also there has been no thorough exploitation. In the province of Bulacan the natives manufacture a very primitive iron plowshare and pots for cooking (carahays), but even here there has been a gradual decline since the commencement of this century.

Copper exists in the provinces of Tayabas, Camarines Sur, and Antique, and on Masbate; the best quality, however, in the district of Lepanto (Luzon), near Mancayan, Suyuc, Bumuan, and Agbao. Here mines were worked by the Compañia Cantabro-Filipina, but abandoned after about ten years, in spite of the wealth of mineral, on account of the scarcity of labor. The first specimen of black copper was obtained in 1864. In 1867 the output was 2,464 quintals (2,231 cwt. 83 lbs.) of fine copper; in 1870, 4,020 quintals (3,641 cwt. 8 lbs.). The want of workmen then caused the yield to decline, until in 1875 the mines were closed altogether.

It is probable that gold occurs in every part of the archipelago. In a small way it has been extracted by the natives for many years in certain places, particularly in Luzon. It is found instratified and in creeks, from which the natives prefer to wash it. The best known sources are in Camarines Norte, the mountains of Mambulao, Paracale, and Labo and the northern spurs of the Caraballo mountains. Alluvial gold is said to exist largely in Nueva Ecija, near the village of Gapan. In Tayabas the metal is found in the mountains in the neighborhood of the village of Antimonon. In Mindanao, where gold has likewise been discovered, it is believed to be present in particularly profitable quantities. Mindoro, Panay, as well as some other small islands, are also places where the precious metal has been found.

It now remains to inquire into the question whether it would pay to work gold mines at all, for as yet, at all events, no positive proof has been furnished of gold mines being profitable, although during the last few years the subject has been much discussed. In 1893 the Mambulao Gold Mining Syndicate was formed in London, engineers were sent out, and workings were actually commenced in Mambulao. Difficulties, however, arose, the principal one no doubt being that a large part of the shares were not allotted, and the working capital was therefore too small. In general, the participators speculated on the advantageous sale of a part of their concession and the starting of a limited-liability company. Something of a gold fever broke out in Manila, and on all sides concessions were acquired by Englishmen, some Germans, and Swiss. Not one of these concessions, however, seemed the result of a sound *bona fide* project. The object in view was always the promotion of companies and disposal of the concession at a good profit, leaving all the risk to the shareholders. It is not impossible that this would actually in some cases have taken place, and that it would have been followed by a speculation in shares similar to that on a former occasion in Singapore and Hongkong, to the detriment of general trade. The rebellion of 1896 fortunately put an end to speculation. European capital for such purposes was not to be found during the disturbances, and methodical working in some provinces was equally impossible, quite apart from the other difficulties mentioned above.

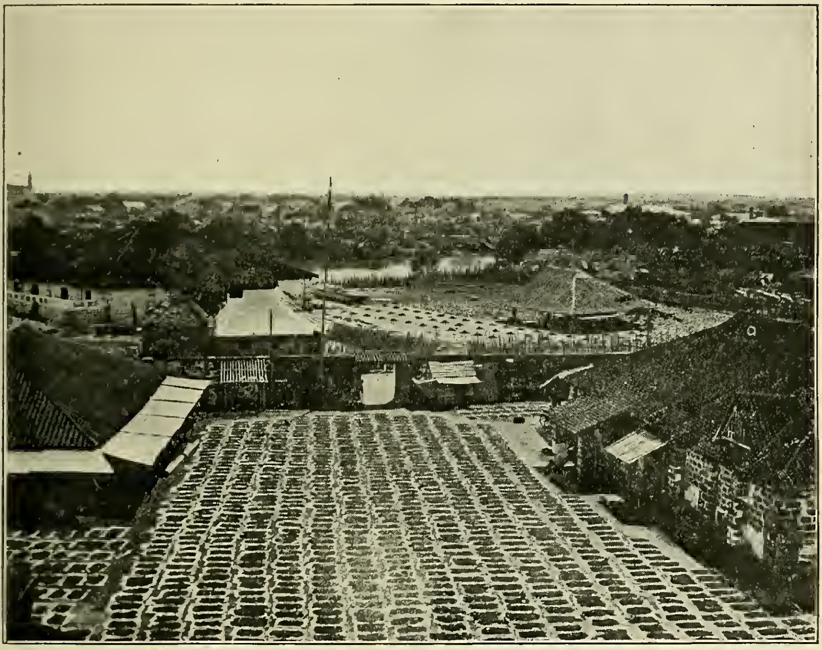
Centeno further states that mercury was formerly found in various places. At the end of the last century a bottle was sent to Manila from Mindanao and a second from Capiz. In 1848 mercury was discovered in Casiguron, in the province of Albay, but the general opinion was that the find was altogether insignificant. At all events, none of these discoveries appears to have been of any importance.

At the beginning of the seventies two beds of galena were discovered in Cebu, in the neighborhood of the village of Consolacion. Specimens were analyzed at the mint at Manila and showed, it is true, only 47 per cent of lead, but also 1 ounce of gold and 2 ounces of silver per hundredweight. Nevertheless, the beds were not of sufficient significance to assure profitable working even on a small scale, so the mines were again abandoned. The department of mines in Manila did certainly recommend further exploration in Cebu, but, so far as I am aware, active steps were never taken. In Mambulao and Paracale the beds of galena and red-lead ore have more than once been got ready for working and are probably very rich. The workings, however, have always been abandoned again—chiefly, it may be surmised, on account of these Spanish undertakings being insufficiently provided with capital from the commencement and because of the lack of the necessary circumspection.

There is naturally an abundance of sulphur in this volcanic archipelago, that which occurs on the Bulusan, in Albay; the Taal, in Batangas, and the Apo, in Mindanao, being of fairly pure quality. Really extensive beds, worthy of exploitation, were found years ago in Leite, in the interior, not far from Dulag, and were worked on a small scale by the natives. In 1818, 3,410 piculs, at $2.50 per picul, were exported, and Dr Jagor states that the price paid in Manila for this sulphur in the fifties was from $1.50 to $4.50. For the last twenty years, however, the sulphur industry has been wholly dead. Alabaster is found in Camarines Sur, and there is a beautiful marble at Bohol and Guimaras, near Iloilo. Granite of excellent quality is quarried at the other side of the Bay of Mariveles, opposite to Manila. Rock oil was found some years ago in Cebu and Paragua and promises to be of importance. I have neither seen samples nor come across any official report on the matter, but I have received direct information from various trustworthy Indians and mestizos.

MANUFACTURES

With the exception of the cigar manufacture, which until January 1, 1883, was monopolized by the government, the islands are not of industrial importance. Manila possesses two large sugar refineries, some distilleries, and rope works. Lately



SUGAR DRYING AT MANILA

rice mills and a flour mill have been set up in Luzon to meet the requirements of the island. The hats made by the natives of strips of reeds in Baliuag also play an important part in the export trade, being shipped largely to America and Paris. The cigar cases (petacas), likewise manufactured in Baliuag, are of less importance. Though of no great significance for the trade, the ilang-ilang essence should be mentioned, the Philippines being the only place where it is produced. The essence is made from the green blossom of the ilang-ilang tree, one of the Anonaceæ (*Anona adoratissima* according to Blanco, *Cananga* *adorata* according to Hook) and finds its way principally to Paris. It forms the basis of all finer quality perfumes and has indeed become an almost indispensable article in the perfumery trade. The distillation of the essence and the business generally connected with it are carried on exclusively by Germans.

Coach-building is of great importance in Manila. The home demand is enormous, as every inhabitant of any standing has his carriage, and the wealthier mestizos excel in the luxury of their vehicles.

That soap and other such articles of popular use are manufactured, it is scarcely necessary to state. There are also three lithographic establishments, owned by Germans.

Besides the Baliuag industry above referred to, the natives manufacture excellent homespun fabrics of cotton, hemp, silk, and piña, the fibers of the pine-apple leaf. Piña-cloth embroidery is also a domestic industry. These articles do not enter at all into the export trade today, but they may certainly be expected to do so before long, the more so if the industry continues to advance as it has done during the past year or so, as regards not only the fabrics themselves, but also the designs and colors. Some coarse hemp textiles have already been exported within the last few years. The finer hemp and hemp and silk fabrics, though much prized by ladies for dressmaking, have not yet entered into the trade, not having so far found favor with the Parisian costumers. A most interesting display of the produce of the Philippines was made at the exhibition (Exposicion Regional de Filipinas) which was held at Manila by the government in 1895.

It is certain that the Philippines, whose future is already assured by their mineral wealth, will play a part in the industry of the coming years equal to, if not surpassing, that of Japan.

COMMERCE

There seems to me to be no doubt that even before the arrival of the Spaniards these islands had relations with the Malay archipelago and China, and to a certain extent carried on barter, particularly with the latter country. Regular trade, however, first began to develop in 1571, when Legaspi established himself in Manila. The inhabitants of Cagayan related to Don Juan de Salcedo in 1572 that their cotton fabrics were brought every year by Chinese and Japanese vessels.

Manila is without doubt the most advantageously situated

MANILA HARBOR

port and trading place in the East, and forms the center of the trade between China, Japan, the Dutch archipelago, and Australia. The position of the Philippines is likewise extremely favorable for the west coast of America, and Manila should be the natural mart of eastern Asia. That it does not already occupy this position is owing to the bad system of administration on the part of the government. Had it been otherwise, I am exceedingly doubtful whether Hongkong could ever have reached its present state of importance in the face of Manila.

During the northeast monsoon most ships going through the straits to China run right across to Luzon to get protection against the strong adverse winds. It would therefore be quite in their course to touch at Manila, but they avoid the port for the reason stated above—the chicanery of the customs officials. For the same reason the regular steamers between Hongkong and Australia steam right past the Bay of Manila without running in. Passengers from Manila to Australia have therefore first to cross to Hongkong, and then take passage from there, returning again directly past Manila and Zamboanga (so close to the latter that the people may almost be recognized on the shore), to the first touching place—Thursday island or Port Darwin.

After 1572 trade commenced also between Manila and New Spain, which for individual Spaniards in Manila proved very profitable. Between 1590 and 1595, however, the citizens of Manila petitioned several times to the King for liberty of trade, but always in vain; the restriction on commerce remained as before. In 1610 the Seville merchants begged that the trade between Manila and New Spain might be closed, as they wanted to do business direct by the Cape with Manila without the intervention of the American colonies. This was, nevertheless, impossible, on account principally, no doubt, of the fact that the Acapulco silk trade gave occupation to over 14,000 persons in Mexico.

Galleons were sent every year from Manila to Navidad, and from 1602 to Acapulco, containing merchandise to the value of $250,000, the maximum permitted by the government, and bringing back double the price. Later this maximum rose to $300,000, and in 1734 to $500,000. Finally the amount reached $600,000, and the home freight double the value. From Manila the galleons, called *naos*, took spices, cotton fabrics, silks, etc., with gold articles and other products of China, India, and the Philippines. Fifty thousand silk stockings are also especially mentioned. (Refer: Lord Anson's "Journey Round the World," 1749, and the description of Spanish commerce by J. C. S., Dresden, 1763.) The home freight consisted chiefly of silver dollars, and there were also passengers—persons going to seek their fortune in the Philippines—and officials and soldiers sent out by the Madrid government as substitutes.

The merchandise yielded twice its value in Manila, and, as is recorded, sometimes even four times, which in certain cases may no doubt have happened. The profit, however, did not all go into one pocket, but was divided among a number. The government issued warrants (boletins) restricting the shipping of cargoes to the monasteries, pensioned officials, and other privileged persons, who then sold them to merchants. In this manner the profits were distributed. The result was that merchandise of very high value was shipped, and the *nao* often so packed with cargo that the guns had to be stowed away. On the home journey there was often over $3,000,000 value on board. As these ships were maintained at the expense of the government, it is natural that a portion of the shipping fees was reserved for the royal exchequer.

Generally the well-laden *nao* sailed from Cavite in July, steering northward to 30°, where, taking advantage of the western winds, it made straight for the shores of California, then coasting southward to Acapulco. The voyage was always most difficult and dangerous and often very long, lasting sometimes six months or more. In later years the ships sailed more commonly through the Straits of San Bernardino, south of Luzon, though this did not shorten the voyage. Arrived at the California coast, they ran into San Lucas, where they took in provisions and received information as to the movements of pirate in the waters—naturally a matter of great concern, considering the value of the cargo. The home voyage to Manila was easier and quicker, seldom occupying more than two months. The ship sailed southward from Acapulco to about 10° N., whence it took the passage to the Marian (Ladrone) islands, and then further, through the Straits of San Bernardino, to Manila. As the time arrived when the *nao* might be expected, nightly fires were lighted on two high rocks, so that the vessel could find her way through the islands. (In old works the islands Guam and Rota are mentioned.)

The *naos* were vessels of 1,200 tons or even more, and were manned as warships and armed with 50 or 60 cannon. Notwithstanding this, they, with their costly cargo, sometimes fell a prey to privateers, pirates, and the warships of hostile powers. In June, 1743, Lord Anson, on board the *Centurion*, captured the *Nuestra Señora de Cabadonga*, a much larger galleon, commanded by Don Jeronimo de Montero, off Cape Espiritu Santo, on the Samar coast.

The captain of a galleon, who bore the title "general," received in the Acapulco trade a percentage amounting to about $40,000 for each voyage. The first officer also was paid a commission.

Toward the end of the last century the profits began to decline, decreasing more and more; sometimes the ships even found the market in Acapulco perfectly flat, without any demand. This was chiefly because of American traders and English merchants supplying all the requirements direct from Europe; but smuggling also played its part. Thus it often happened that the ships were unable to return for long periods of time. The last *nao* which left Manila in 1811 did not return from Acapulco until 1815.

In 1785 the Real Compañia de Filipinas (Royal Company of the Philippines) was started, having its seat in Cadiz and with a capital of $7,000,000. This company more or less monopolized the whole trade until, on August 15, 1789, a decree was issued permitting European vessels to import Asian produce and to export only such Spanish, Philippine, and American produce as the compañia had imported. A second decree, dated October 15, 1803, deprived the compañia of still further privileges and declared the harbor of Manila open to all nations. Certain rights, however, the compañia still retained. In 1814 absolute liberty of trade was allowed to the whole world. As the result of the introduction of the new Codigo de Comercio, July 15, 1833, the privileges of the compañia ceased altogether in 1834. A year later the exportation of manufactured tobacco and cigars was also permitted.

Until the close of the last century (1792) foreigners were not allowed to settle in Manila (although La Perouse, 1787, mentions the French merchant Sebir in connection with that town). As soon as the permission was granted the first foreign houses were established, and the number has continually increased, so that today the external trade is almost exclusively in foreign hands. The year 1851 saw the establishment of the Banco Español Filipino; but by reason of bureaucratic formalities and the strict limits imposed, transactions were much impeded. It is only in recent years that matters have improved, rendering a fair and easy banking business possible. Up to 1860 and still later banking transactions were therefore done almost wholly through two large American houses. Today we find branches of the Chartered Bank of India, Australia and China and of the Hongkong & Shanghai Banking Corporation doing the principal business.

The consulado, established in 1772 and removed on January 1, 1834, and the Junta de Comercio, founded on January 1, 1835, have done practically nothing at all for trade and shipping. The export and import trade, as already remarked, lies almost exclusively in the hands of foreigners, principally English, Germans, and Swiss. The retail and intermediate trade is done by the Chinese. The Spanish, in addition to the Compañia General de Tabacos de Filipinas, which, however, pays but a small dividend, and some inland traders, own a number of provision stores and of millinery shops for town costumes.

How greatly the trade done by foreigners surpasses that of the Spanish is seen from the accompanying tables, giving the external shipping trade and tolls. Since 1896 there has been no American house in Manila.

The traffic between Manila and the provinces is carried on mostly by means of 35 steamers and a large number of smaller sailing vessels. The sole railway runs from Manila to Dagupan, the port of Pangasinan, a rice-growing province on the west coast of Luzon, on the Gulf of Lingayen. The only large line of ships touching at Manila is the Compañia Transatlantica, from Barcelona to Manila, which, however, also has Liverpool as a shipping port, as the steamers would otherwise scarcely be able always to secure a full cargo. The chief profits of the line are no doubt earned from the enormous transport to and fro of officials and soldiers; in nearly every ship all berths are occupied. There is a brisk trade done with Hongkong through four or five steamers under the British flag, for the largest part of the goods goes *via* Hongkong, being transshipped. A steamer runs to Singapore, meeting the French mail steamer, by which the principal European postal traffic is carried on.

Despite the fact that the foreign flag was everywhere at a disadvantage and the Spanish, on the contrary, privileged, the former has always been the one really dominating. Though formerly foreign vessels were obliged to run in in ballast, they nevertheless took outward freight. The privilege allowed to the

Spanish flag remained intact until 1872, and consisted at that time in a reduction of 25 per cent on the custom-house charges. This was gradually diminished every year by 5 per cent, and in the last year by 10 per cent at once.

The following table shows the state of the shipping trade in Manila in earlier years:

	1827.		1828.		1829.	
	Incoming.	Outgoing.	Incoming.	Outgoing.	Incoming.	Outgoing.
Foreign ships.....	96	98	99	89	146	145
Spanish ships	34	29	31	38	41	43
Total........	130	127	130	127	187	188

In 1868, 112 foreign vessels, aggregating 74,054 tons, mostly in ballast, entered to take up cargo, and 93 Spanish vessels entered and sailed with cargo. To show a comparison of the trade during the past two years, I have compiled the following table:

	1896.				1897.			
	Incoming.		Outgoing.		Incoming.		Outgoing.	
	Ships.	Tonnage.	Ships.	Tonnage.	Ships.	Tonnage.	Ships.	Tonnage.
Foreign	181	264,868	175	251,439	204	301,199	197	292,219
Spanish	47	92,541	49	95,802	48	84,326	50	88,649
Total.....	228	357,409	224	347,241	252	385,525	247	380,868

At the commencement of the century the imports were far greater than the exports; then the two became about equal, and finally the exported goods ranked first. In recent years the exports have always exceeded the imports by some 30 per cent, a very promising sign of the productive capacity of the country.

The imports to Aragon in 1818, according to the duties paid, amounted to—

Under foreign flag	$1,680,200 25
Under Spanish flag	616,071 85
	$2,296,272 10

as against an exportation of—

261 piculs hemp, at the average price of	$4.00	$1,044	00
555 quintals cordage, " "	5.00	2,775	00
5 quintals hemp rope, " "	125.00	625	00
84.5 cavans coffee, " "	6.00	507	00
14,405 piculs sugar, " "	7.00	100,835	00
3,200 quintals indigo, " "	60.00	192,000	00
1,105 quintals liquid indigo, " "	3.50	3,867	50
18,825 piculs sapan-wood, " "	1.25	23,531	25
236 piculs shells, " "	8.00	1,888	00
31 piculs tortoise shell, " "	350.00	10,850	00
3,410 piculs sulphur, " "	2.50	8,525	00
2,610 piculs ebony, " "	1.75	4,567	50
1,532 piculs hulled rice, " "	1.50	2,298	00
42 piculs shark fins, " "	16.00	672	00
2,266 piculs bêche-de-mer, " "	24.00	54,384	00
5.68 piculs birds' nests, " "	130.00	738	40
94.24 piculs white birds' nests, "	3,200.00	301,568	00
1,332 piculs dried crabs, " "	6.00	7,992	00
1,176 piculs pure cotton, " "	22.00	25,872	00
310 piculs glue, " "	2.50	775	00
1,192 piculs rattan, " "	4.50	5,364	00
1,280 piculs wax, " "	28.00	35,840	00
230 taels gold, " "	13.00	2,990	00
1,391 trunks timber, " "	1.25	1,738	75
1,066 cavans cowry shells, " "	2.00	2,132	00
1,000 cavans salt, " "	.25	250	00
105 gantas cocoa, " "	1.50	157	50
1,348 gallons rum, " "	.50	674	00
580 pairs plowshares, " "	.50	290	00
420 carpenters' axes, " "	.50	210	00
3,353 buffalo hides, " "	.37½	1,257	37
3,153 cow hides (tanned) " "	.75	2,364	75
684 stag hides, " "	.13	88	92
1,280 mats, " "	.30	384	00
731 buri mats, " "	1.00	731	00
748 hats, " "	.30	224	40
Various		6,333	95
12 riding horses, at the average price of	50.00	600	00
		$806,945	29

There was, therefore, nearly three times as much imported as exported. The list of articles exported, with their prices, is interesting. Of the leading articles of today, sugar was the only one of importance, and even this came after white birds' nests and indigo. Comparing with this the table of Dr F. J. F. Meyen, on board the Prussian merchant ship *Prinzess Louise*, eleven years later, we find a great increase in exports—in the case of sugar tenfold, though with hemp, again, not figuring at all.

He gives the exports as follows :

	1829.	1830.
Sugar	120,274 piculs.	138,387 piculs.
Indigo	11,809 "	13,863 "
Sapan-wood	11,675 "	11,594 "
Hulled rice	114,793 cavans. 104,357 piculs.	197,486 cavans. 179,532 piculs.
Unhulled rice (paddy)	30,830 cavans. 28,027 piculs.	
Rum	19,551 gallons.	
Cigars	4,595 arobas. 52,843 kilograms.	4,257 arobas. 48,955 kgr.

The remaining less important articles are omitted.

Since foreigners have ceased to be handicapped by Spanish discriminations, trade has steadily increased, even if not to the extent it should; the trade of the Philippines should be twenty times what it is today. At the end of the twenties, imports and exports were practically equal.

	Imports.	*Exports.*
1827	$1,048,680	$1,093,690
1828	1,550,933	1,475,034

Up to the seventies both had been increased more than tenfold, the exports considerably exceeding the imports. In round numbers, the trade for the years 1870, 1875, and 1880 may be stated as follows :

	Imports.	*Exports.*
1870	$14,000,000	$16,000,000
1875	13,000,000	19,000,000
1880	17,000,000	22,000,000

The only exception is the year 1872, when the exports stood at 16½ million dollars and the imports at 22 million dollars. In 1892 the exports were 33 million dollars; the imports 25 million dollars.

It is a difficult matter to give statistics of the imported goods, since there are innumerable articles not entered separately at the custom-house, but placed for the purposes of duty in certain classes. Some of the leading goods may, however, be mentioned. From England, Manchester articles figure conspicuously, together with a number of less important wares, such as hardware and leather goods. From Germany come better-class textiles, tricots, hardware, paper, leather, steel and iron, machinery, etc. From Switzerland are imported St Gall laces, muslins and silks. From France come Lyons silks, machinery for cigarette making, and paper. Austria contributes principally Vienna furniture and Bohemian glassware. Belgium sends glass and glassware, iron, paper, cement, etc., while Russia and America furnish kerosene, and the latter country also sends flour and tinned meats. Spain formerly exported little but wines and preserved foods in tins. Within the last few years she has commenced sending to the Philippines other articles to compete with the wares of other countries. The Spanish goods are in every way inferior to those of foreign manufacture, and on account of their being free from import duty the prices are considerably lower.

In the following table the exports during the last five years are given. The minor articles have been omitted:

Principal Exports from the Philippines from January 1 to December 31, 1896

Countries.	Sugar.	Hemp.	Coffee.	Tobacco.	Cigars.	Sapan-wood.	Copra.
	Piculs.	*Piculs.*	*Piculs.*	*Quintals.*	*Thousands.*	*Piculs.*	*Piculs.*
To Great Britain	793,165	815,044	199	47,816	35,010	3,340	33,200
To United States	542,874	615,554	....	132	180	....	....
To Europe	774,852	5,660	928	154,930	32,610	....	548,812
To Australia	....	33,892	....	62	14,850	....	....
To China, Japan, and India	1,379,377	61,660	307	16,076	112,540	50,323	3,895
To Canada	97,920	....	....	....	610	....	....
Total in 1896	3,588,188	1,531,810	1,434	219,016	195,800	53,663	585,907
Total in 1895	3,694,769	1,664,590	3,287	225,677	198,270	38,919	594,469
Total in 1894	3,109,108	1,591,962	9,008	194,500	140,075	75,115	510,633
Total in 1893	4,184,296	1,282,942	5,102	230,572	133,846	76,588	188,404
Total in 1892	3,954,060	1,581,100	21,801	254,063	133,404	52,452	292,536

Values—1894, 1895, and 1896

Articles.	1896.	1895.	1894.
Sugar	$14,000,000	$12,239,000	$12,590,000
Hemp	11,160,000	13,317,000	12,750,000
Coffee	67,500	158,000	412,000
Tobacco	2,630,000	2,707,750	2,310,000
Cigars	1,990,000	1,786,200	1,500,000
Sapan-wood	70,000	58,400	102,000
Copra	2,630,000	2,898,000	2,500,000
Various	224,000	60,800	115,000
Total	$32,771,500	$33,225,150	$32,279,000

The exports from Manila alone, the most important place to be considered, were during the past six years as follows:

Exports from Manila in the Years 1892–1897

Year.	Hemp.	Cordage.	Coffee.	Tobacco.	Cigars.
	Piculs.	*Piculs.*	*Piculs.*	*Quintals.*	*Thousands.*
1892	1,408,444	1,354	21,801	254,063*	133,395
1893	1,154,766	2,200	5,006	230,572*	130,320
1894	1,322,000	1,800	9,000	194,500*	138,000
1895	1,446,990	3,774	3,080	222,510*	198,270
1896	1,333,118	3,619	1,434	212,706*	195,800
1897	1,689,754	3,873	4,947	319,883*	183,735

Year.	Sugar.		Indigo.	Sapan-wood.	Copra.	Shells.
	Dry.	Wet.				
	Piculs.	*Piculs.*	*Quintals.*	*Piculs.*	*Piculs.*	*Piculs.*
1892	921,354	250,369	6,534	29,314	186,519	223
1893	1,359,737	521,980	971	53,767	168,122	254
1894	1,200,000	295,000	1,599	40,000	475,000	350
1895	1,440,000	285,159	26	27,210	226,626	1,367
1896	1,456,549	272,337	5,419	14,234	561,268	1,101
1897	839,994	82,062	4,468	16,631	749,207	1,180

The terms in the produce market in Manila are always cash down. In business with the provinces the Manila house has frequently to make advances, which certainly involves risk, though if one is cautious with whom one deals the business is safe enough. The main thing in the case of transmarine places just springing up is to know the exact state of affairs and to be in a position to form a sound judgment at a moment's notice. The business between the importers and the Chinese retail dealers is done either by means of acceptance (pagare) at six months or, as is now more general, cash within four to six weeks, with 5 per cent discount; but, unfortunately, the four to six weeks are very often exceeded. Insolvencies frequently occur among the Chinese. The creditors usually prefer to come to an arrangement, for if once the matter comes before a Spanish court it is the invariable rule that the creditors get nothing at all.

Fines (multas), particularly in differences with the custom-house, are imposed in a most annoying manner on every possible occasion, the officials receiving a share of the fine imposed. A ship which, for instance, does not deliver precisely the number of bales stated in the manifest is fined for each bale more or less $1,000. In every bill of entry the weight must be stated beforehand, and if it is not correct a fine is inflicted. In this way there are a hundred kinds of chicanery practiced, all costing much unnecessary expenditure of money, the greater part of which goes into the pockets of the officials.

* For the most part to Spain for the monopoly.

The tobacco monopoly, with all its heartless severity and imposts, was introduced in 1781, under the governor Don José Vasco y Vargas, the government, by no means for the first time, finding itself in a critical financial condition. The population guessed at what was coming and opposed the new measure, which was only carried out by force of arms. The law prescribed that every native might plant tobacco, but might only sell it to the government. In the tobacco districts every native had to grow a certain number of plants and devote all his attention to them. The collecting of caterpillars was done by women and children, just as it is today.

This might have been well enough had the people been able to enjoy the fruits of their labor; but the worst has still to be said. The tobacco was sorted, "aforado" as it is technically called, and that unfit for use burned, so as to prevent fraud. The principal matter in sorting was the length.

18 inches and over was primera (first) class.

18–14 inches was secunda (second) class.

14–10 inches was tercera (third) class.

10–7 inches was quarta (fourth) class.

Smaller but good leaves were sometimes classed as 5 and 6. For valuing the tobacco the officials used a scale, according to which the planter received some 20 to 30 per cent of the real value. But he was not paid in cash. He received a certificate, a kind of treasury bond. Had the people had security for the payment of these bonds at an early date the latter would soon, no doubt, have come into currency as paper money. But, far from this being so, no one would have them, knowing that five or six years might pass before they were redeemed. The tobacco planters lived under more miserable conditions than the worst-kept slaves, and were glad if some noble philanthropist would give them half the value of their certificates, for who could say whether the purchaser was not risking his 50 per cent. Frequently the bonds were practically given away. In the cigar manufactories in Manila 30,000 workpeople were employed, and were always paid in cash; so that their lot was more enviable than that of the planters. That under this system, in spite of the enormous army of officials, a profit of four or five million dollars was annually yielded can be easily understood.

The savior of the unfortunate tobacco planter was one of those Spaniards in whom there was still the blood of the hidalgo, the intendant-general Don José Jimeno Agius. In his report in

1871 he relentlessly exposed the condition of affairs under the monopoly and strongly advised its abolition, unless the government wished to destroy tobacco planting altogether and bring about the absolute ruin of the planters, who were living in the greatest misery. Furthermore, he showed that the necessary new buildings and plant in the factories would pretty well absorb all the profit of the ensuing year. This very competent and energetic man could not carry his wishes into effect at the time; but ten years later, in conjunction with the colonial minister, Fernando de Leon y Castillo, he was able to bring about the abolition of the monopoly, and on July 1, 1882, the planters were freed from their chains. On January 1, 1883, the free manufacture of tobacco was also allowed. The rate of duty was, however, raised, tobacco and cigars paying an export duty, while the import duty was raised 50 per cent. In the first place, the treasury bonds had to be redeemed, and this was done by means of auctions, whereby $150,000 was redeemed monthly, precedence being given to those holders who offered their bonds at the lowest rate. The government had even the impudence to declare that demands for more than 80 per cent would not be regarded. The first bondholders were ready to take 45 and 55 per cent, but it was soon found that a number of holders were prepared to take vigorous steps, refusing to accept less than 80 per cent. This caused the government to hasten the redemption, and at the close it had cleared a sum of two and one-half million dollars.

Since January 1, 1883, various cigar factories have been established, of which, however, only a few turn out a really first-class article. The cigars manufactured by many Chinese factories and in the homes of the natives are of very inferior quality.

A new tariff was introduced in 1891, which professed to be based upon a duty of 20 per cent. In reality, however, nearly all articles yielded more, some even yielding over 100 per cent on their value. Then there were various additional fees to pay on imports, and the export fees were also several times changed. Today the practice is as follows: To the import tariff, which in the case of some articles is increased by 20 per cent, are added harbor dues, amounting to 10 per cent and 8 per cent of the value of the goods, which is fixed by law. Spanish goods pay only the harbor dues and the 8 per cent of the value, thus getting upon the market to the disadvantage of other better and originally cheaper produce.

Of the products of the country the principal ones pay export duties as follows:

Hemp	$0 75 per 100 kilo., gross.
Indigo	50 " "
Liquid indigo,	05 " "
Rice	2 00 " "
Sugar	10 " "
Cocoanuts and copra	10 " "
Tobacco from Cagayan and Isabella	3 00 " "
Tobacco from Visayas and Mindanao	2 00 " "
Tobacco from other provinces	1 50 " "
Manufactured tobacco	3 00 " "

and all produce pays $1.50 per 1,000 kilo. harbor dues.

In 1880 the harbor dues on both exports and imports were raised—at first by 20 per cent of the import duty and 1 per cent of the export value—for the purpose of building a new harbor, and this, with some few alterations, remains so to this day. The harbor is a long way from being finished; nor will it ever be finished if the present system continues, even though of late the work has been a little expedited. At a normal rate of work, what has been done could have been finished in one or two years. With the amount received through the increased dues, ten harbors could have been built; but probably the money no longer exists.

The duty returns were, in—

1828	$227,000
1829	229,115
1830	228,061

In the last few years they have stood much higher, this being principally caused by foreign houses.

For the past three years the returns were:

	1895.	1896.	1897.
From foreign houses	$2,818,900	$3,106,100	$3,322,500
From Spanish houses	361,400	425,900	903,000
Total	$3,180,300	$3,532,000	$4,225,500

Thus the foreign houses paid of the indirect duties, in—

1895	87 per cent.
1896	88 "
1897	73 "

During recent years the Spanish figures have risen by reason of the increased export duties on tobacco which the Compañia General shipped for the Spanish monopoly.

NECESSITIES OF THE SITUATION

I now come to the question, "What must be done in order to bring the production and trade of the colony into the condition in which they should be?" The answer follows from what has already been stated. Before all, the system of administration must be changed and commerce and shipping, industry and mining, as also planting, given free play, quite independent of the nationality of the persons concerned. If the natives are not numerous enough to supply sufficient workmen, Chinese coolies should be brought over under government supervision, in the same way as is done in Sumatra. The export duties should be wholly abolished and the import duties put on a suitable basis. The harbor works at Manila should be completed and safe landing places should be provided for larger steamers, and if not a free port, at all events a bonded warehouse is necessary.

I mention first and principally Manilla, which will always remain the center and principal emporium. A beginning must be made by opening up Luzon, by laying down good roads and constructing bridges, of which today there is an absolute lack. The waterways should be controlled, particularly those which can be easily made navigable. The construction of railways should be continued, in order to connect the interior provinces with Manila. The most important line would be one from Manila through Nueva Ecija, the Caraballo mountains, the province of Nueva Vizcaya, into the valley of the Rio Grande de Cagayan. Then a branch of the line already existing from Manilla to Dagupan to the proposed naval port, Subig, which was recently decided upon, but has not yet been constructed. Communication with the Pacific coast and numerous branch lines will also gradually be required. Only a few points can be touched upon here.

A railway from Manila *via* Mariquina to Antipolo would be of great importance to Manila itself. It would pass through an extremely well-populated country, which already supplies Manila with agricultural produce and articles for the native population, and finally, after about 20 miles, ascending with a pretty steep gradient, would reach Antipolo.

Antipolo, a famous place of pilgrimage in the Philippines, lies on the west spurs of the cordillera, in the province of Morong. It enjoys a cool, agreeable climate, and therefore would without doubt form a very suitable health resort for the inhabitants of Manila, and indeed perhaps a climatic health resort in general. For Europeans working under great strain such a place would be invaluable, particularly during the hot season, when the night temperature falls so little that refreshing sleep is often quite out of the question. Nor is it absolutely necessary that Antipolo itself be chosen; a still more suitable spot might perhaps be found in the neighborhood; the chief point is to set about the matter in a practical way and properly carry through the scheme.

Antipolo is frequently visited by foreigners. As far as the Pasig the route lies over what, for the Philippines, are tolerably good roads, though miserably bad ones compared to those of English colonies. After crossing the river, a half day's journey further over roads which are nowhere good and in places are as bad as possible brings us through Cainta and Taitai to Antipolo. The effect of the journey is felt for hours afterward. In April, while the heat in Manila was unbearable, I have had to put on a summer overcoat in the evening in Antipolo.

For such undertakings as I have mentioned, and which can only be carried out by companies, it is absolutely necessary that concessions be granted with promptness and dispatch. Hitherto the custom has been to dally for years, until finally all interest in the matter was lost. Once a concession was actually granted for a railway to Antipolo, but the line was never constructed.

It would take us too long to deal with everything which would aid in bringing the country rapidly into a prosperous condition and lead to lucrative undertakings. What should be done is in general to be gathered from a consideration of the present unsatisfactory state of affairs. If once the first step were taken, others would follow, not only in Luzon, but over the whole archipelago.

I must not omit to give some particulars of Manila itself.

At the place where the river Pasig, the outlet of Lake bay, flows into the Bay of Manila, lies on the left bank the fortified part of Manila, which, being inclosed by walls, is called Intra Muros. It is inhabited by monks, officials, soldiers, and a few shopkeepers. Foreigners do not reside there, nor have they property in it. Running southward along the shore of the bay is the promenade, Luneta, where concerts are held every evening and where there are two suburbs, Ermita and Malate, much frequented by foreigners and containing many fine villas. On the right bank of the Pasig is the wholly unfortified part, called Binondo, where the chief business is done and where the foreigners have their stores and warehouses. The custom-house,

WHARF AT BINONDO

harbor office, and factories are also here. Further north, on the shore of the bay, is Tondo, a suburb consisting of native huts. To the east are Meisig and Trozo. These are the places lying on the beach. Up the river, on the right bank, are the suburbs Sta Cruz, Quiapo, San Miguel, Tanduai, Sampaloc.

The population today is given at 300,000, but, as a proper census has never been taken, this cannot be regarded as exact. Including the population of the suburbs, the number of inhabitants is probably greater.

In the true sense of the word, Manila cannot be said to be unhealthy. On the contrary, it is one of the more healthy of tropical towns, though malignant and intermittent fevers do occur, even if less frequently than elsewhere. Cholera, which formerly was often epidemic, has been completely driven away by the excellent water supply. The water comes from Santolan, about nine miles distant, and is collected in the reservoir at San Juan del Monte and thence conducted to Manila. There has been no outbreak of cholera since 1889.

For the water supply the governors-general Carrriedo and Moriones are to be thanked. Of these the first in his will left a sum of money to the town for the purpose, and the second, some years later, had the work carried out when no one else thought of troubling about it.

Houses have to be erected according to certain rules, laid down in order to guard against the frequent earthquakes. They are for the most part two-storied dwellings, below of stone and above of wood, with galvanized iron roofing. If the roof is tiled, the ceiling must be of planks strong enough to resist the fall of the roof. Since January 23, 1895, the town has been lighted by electricity, and the electric light has also been introduced in a number of houses. The installation was done in part by an American and has been continued by a German company. As yet there is no electric tramway, nor is electricity used industrially. This is principally due, no doubt, to the "Electricista"

CALLE SAN JACINTO, WITH THE AUTHOR'S OFFICE AND TOBACCO GODOWNS

Company, which has not yet been able to make its electric power station yield a good dividend.

There are horse-car lines in the city, and a steam street railway runs to Malabon, a large village situated to the north.

Besides the private vehicles, there are in the city a large number of hackney coaches. These are divided into three classes: the carruajes (landau, with two horses), quiles (two-wheelers, closed, door behind, one horse), and carromatas (two-wheelers, drawn by one horse). The latter are also used in the interior, so far as there are any roads. The transport of goods is carried on by means of two-wheeled carts, drawn each by a buffalo and holding some 1,000 kilos.

Life for foreigners in the Philippines is quite agreeable, and particularly so in Manila, where there are comfortable residences; nor is there lack of company, excursions, and other sources of recreation. In other respects, also, creature comforts are by no means neglected, provided the requirements are not too high. If once the city and its neighborhood were developed in the manner indicated, there would be little lacking to make life there thoroughly agreeable. Manila would then soon surpass all other tropical towns as regards health and comfort.

What the future may bring to the rich and beautiful Philippine islands it is difficult to say. It is, at all events, my sincere hope that this insular domain may soon blossom forth into that degree of importance to which it is by nature entitled.

A RECENT report of the British vice-consul at Hodeida on the Red sea contains some interesting information concerning the province of Yemen. Mocha, once its capital and the queen of the Red sea, has now only ruins to show what its glory was in the fifteenth century. Zabud, also a city of note in ancient times, is now a center of the trade in hides and skins. Except weaving a kind of cloth, dyeing, making mats and ropes, and building sailing vessels, there are no manufacturing industries. All the food grains are cultivated, however, and but for the unsettled state of the province and the want of education, the inhabitants would, it is said, be rich and prosperous. Hodeida is connected with the outer world by a line of mail steamers, and a weekly mail is sent to the chief towns of the interior. It is also connected by telegraph with Mocha and Sana, and with foreign countries through Perim. The population of the province is estimated at 3,000,000.

MANILA AND THE PHILIPPINES

By Major A. Falkner von Sonnenburg,
Imperial German Army, Late Military Attaché at Manila

After Admiral Dewey's splendid victory at Cavite, the neutral powers sent their ships as quickly as possible to Manila bay. It was expected that the quiet waters of the capital of the Philippines would become in the near future the scene of great military and naval activity, and that many still doubtful questions in modern warfare would there find a practical answer.

It was only by chance that Germany had at that time a relatively strong squadron at hand on the eastern station. The territory acquired in China only a few months before had made it necessary to assemble there two cruiser divisions, and as the news of the complete annihilation of the Spanish fleet became known, the admiral of one of these divisions had to go down from the Chinese and Japanese seas to the Philippines. The division was at that time engaged in drill and training in evolutions and target practice, and so it is easily to be understood that the division commander would not wish to divide his squadron, but, on the contrary, would be glad of the opportunity to make use of the trip down to Manila for training and evolutionary purposes. I do not believe that any order of the German government had been given to assemble a strong squadron at Manila. I understand that the leader of the division, who is fully responsible for the training of his men, had in this regard an absolutely free hand, as is usual in our navy and army.

But besides these purely technical reasons, it was to be considered that hundreds of our countrymen, who lived outside of Manila, scattered over the Philippine islands as traders, planters, or engineers, might be in a very dangerous position. The insurrection of the Filipinos against the Spanish rule had become general, and rumors were heard that all the small ports, like Iloilo, in the different islands, each of which contained a few of our countrymen, were besieged by the insurgents, and that their lives and property were in the greatest danger.

Under these circumstances it was to be expected that after the arrival of the squadron in Manila bay ships had to be detached and sent to the small ports to look after the safety of our countrymen and the women and children of other nations.

It was to be expected that of the five ships which were first concentrated in Manila bay two or three would be always at sea, patrolling the islands and visiting the places which were said to be in imminent danger from the Tagals. The two powers at war, America and Spain, could not do that. The former had to remain in front of Manila in her full strength and could not make detachments for purely humanitarian purposes, and the latter was so broken down by the fall of Cavite that she could hardly look after such matters.

But there was still another reason for concentrating the division of Admiral von Diederichs in Manila bay, one worthy of special interest and consideration.

By such concentration on the quiet and well-protected waters of Marwetes bay, near Corregidor, the release from the navy of more than 1.700 trained men from the different ships, the embarking and discharging of necessary cargoes of ammunition and provisions for the men and officers could be easily done in a few days, whereas without concentration it would have taken many weeks. On June 29, 1898, the German naval division of Admiral von Diederichs had finished that work. The admiral had sent home 1,700 of his old, well-trained sailors and gunners. He had sent home two-thirds of his best and most experienced officers and men, who had been with him three years on the Asiatic station. He had replaced them with recruits, with men who had had only three months' land drilling, who had never been on board a man-of-war before, who had never fired a gun, who were to be the sailors and gunners of coming years, but were inexperienced at this critical time. And now may I ask the question whether any responsible flag-officer would or could do that if he had had the slightest idea, or belief, or wish, or intention, or instructions to meet an adversary in the near future?

It was a tropical hot midday of June when I received my first impressions of Manila and Manila bay.

On board the German cruiser *Prinzess Wilhelm* we passed first the high and wonderfully situated island of Corregidor, which commands the two passages into the interior of the wide bay, and on the top of which powerful American fortifications may be erected in later days. Next the peninsula of Cavite, on our right, came nearer and nearer, and soon the tops of the masts of the American fleet behind it became visible; not only these, but also the wrecks of the sunken Spanish ships came into view. The victorious American fleet was anchored on the watery battlefield, and the spoils of her glorious fighting lay between her and the shore.

In front, just before the city of Manila, was a great squadron of neutral ships. There were three German, two French, two British, and one Japanese men-of-war, while between them were anchored chartered steamers full of refugees of the respective nationalities which Admiral Dewey's humanitarian warfare and broad-mindedness had allowed to be brought out of the besieged town, the only condition being that the Spanish vessels had to fly the flags of the respective countries which were responsible for their return to the American authorities after the surrender of the town.

Behind the neutral fleet, whose size was changed almost every day by incoming or outgoing ships, the churches and towers of Manila, still four miles away, rose one by one out of the sea, and then the palm and banana trees and the bamboo jungles became visible, inclosing, like another green ocean, the lower houses and buildings of the old city.

Far away the delicate blue line of high ranges of hills bordered this wonderful tropic picture with its warlike foreground, but peace seemed to rule everywhere on the beach. The steam launches of the neutral men-of-war rushed to and fro, carrying officers in white tropical dress who were making or returning calls. Boat drill was going on, and the yards of the neutral ships were hung with the laundry of their crews.

Small Tagal sailing boats alongside the men-of-war were bargaining with stewards about the price of fruits and vegetables. Sometimes a vessel flying a strange and hitherto unknown triangular flag crossed the waters of the bay from Cavite to Malabon filled with dark men—the Filipinos under their new colors.

When the moon rose in her full tropical grandeur over the darkening sea, when the electric lights shone here and there on the great iron and steel structures which rocked quietly in the phosphorescent waters of the bay like big whales, then flashed out the search-lights of the American fleet over from Cavite, then could you see also the dark red fire balls of exploding shells near Malate and hear the continuous crackling of musketry.

Then you knew that there was war, that another of the Filipino night attacks was going on, and that again men were losing their lives in the bamboo jungles and rice fields round Manila.

From the refugee steamers near by the sound of Spanish guitars swept over the quiet sea, and silvery clear voices of girls could be heard and merry laughter! There they danced their national dances, the Andalusiana and Castillana, on the dirty decks of the vessels, lighted perhaps by only one smoky oil lamp, while officers of the different navies formed the enthusiastic audience of the graceful performers.

Quite a different picture was to be seen in the besieged town, Manila, itself. The deep Pasig river, running down from the large lake (Laguna de Bay) to the sea, divides the town into two parts, differing in their inhabitants, their buildings, their social life, and indeed in almost everything. To the left of the river is the old town Intra Muros. This purely Spanish town is surrounded by the walls of the fortress and covers a space of perhaps three-quarters of a mile square. Here the conquering Spaniards first settled 300 years ago. Massive stone buildings, including the government house, the archbishop's palace, monasteries, and cathedrals, line the narrow, dirty streets and squares, in which you meet scarcely any one but monks, soldiers, and dark, proud officials. There is no modern, quick-running life in that mediæval town; there are no shops, no offices, no trade. One-third of all the buildings are the property of the church or of the different orders of monks, and another third is composed of the government houses and military establishments.

Having passed the dark fortress doors and the sleepy sentries before them, you feel in a foreign, long-past world. Here is the residence of that administration which believed that it could still be possible in our time to separate a gifted native population of more than seven millions from all that modern culture had produced. From this place issued those ominous decrees which prohibited the importation of any books or papers for the natives which had not the sanction of the church, and did not allow the poor man to raise more than one crop of rice a year for his own sustenance, even to prevent his coming to want. Here was settled that division of the whole island of Luzon between the four enormously wealthy and powerful orders of Augustinians, Dominicans, Franciscans, and Des Récollets, and the government could only silently approve such an arrangement, knowing well that in that country it could rule only by and through the omnipotent monks. Like that of mediæval lords, their rule was autocratic and absolute—an iron regime not only for the natives but for every government official who might have dared to cross the ways of the priestly lords.

Since the days when the pious Spanish discoverer, holding in one hand the sword and in the other the cross, took possession of these islands, 300 long years ago, has lasted this terrible misrule over this unfortunate people. But at last the reaction against that incredibly anachronistic administration took place. A highly gifted young Tagale, educated in Europe and having great poetical talent, was able by his songs and poems to excite his countrymen against the Spanish rule, and when some years ago that man was arrested by the government and shot, without trial, on the Luneta in Manila, the Filipinos began their first insurrection against the hated priest-government.

Terrible atrocities were committed at that time on both sides, and there was hard fighting, too; but at last the Spanish government succeeded in overcoming the more open resistance. But the fire was not extinguished. A secret society, the "Katipuna," spread its membership over the whole island of Luzon, preparing another surprise! The murdered poet had acquired the fame of a national hero and martyr, and mysterious tales were told in all the Tagale villages that he lived still in the mountains in the interior, to come down at the right moment to take the leadership of his people in the great fight for independence. And then the second insurrection began. The terrible scenes of cruelty were repeated, but again without any decisive result. A sort of armistice was arranged at the end of 1897 between the young Tagale leader, Aguinaldo, and the Spaniards, and this continued until the beginning of the recent American-Spanish war and the glorious battle of Cavite.

Strange tales, indeed, these time-blackened government buildings in Intra Muros can tell. They know many things about a flourishing Japanese colony that existed two hundred years ago in Manila town. Thirty thousand industrious Japanese once filled the streets of the old city, and the best regiments of the Spanish government in those olden times were composed of Japanese warriors, but the narrow-mindedness and intolerance of the Spanish rulers drove out the followers of Buddha. The Japanese warriors, the Samurais, and the industrious and able workmen left this unfriendly and inhospitable country at the same time, and that long sleep began which was to end at last with the thunder of Admiral Dewey's guns.

But we will leave the old haunted town. It is an unwholesome place, full of evil spirits and horrible memories. We will pass the Pasig river, with its resting blockaded ships, and enter the modern city of Binondo, full of life and traffic and of the great business houses of the white man.

The streets are crowded with Spanish voluntarios, who are very conspicuous in their swell uniforms, filling all the cafés and beer-houses. The Spanish volunteers seemed to me to have quite a different opinion about their military duties from that held by the Americans. The former refused with indignation to do duty in the trenches outside the town. They declared to the captain-general that they were not willing to do such poor, plain, private-soldiers' work, and that they preferred only to make the "guard routine" in the interior of the city, and with old Castilian pride they have done that tiresome, but rather safe work. I found the public buildings in Binondo occupied by strong detachments of well-dressed, well-nourished, and well-armed young men, who helped themselves through the hardships of the war by playing cards and smoking innumerable cigarettes. We will leave them to their innocent doings inside the town and walk to the circle of the widely extended suburbs of Ermita and Malate.

The more we advance, the more the character of the streets changes. No more the crowd of people playing at soldiering; no more the symptoms of untroubled safety. The streets become absolutely empty; all the shutters of the houses are hermetically sealed and the whistling of passing Mauser bullets can be heard; sometimes they strike the walls of the brick country houses of the wealthy Manila people with a short, dry noise, or perforate the miserable bamboo huts of the natives. The only living beings you can see are small bodies of Spanish regulars, marching carelessly in the middle of the enfiladed road to the ill-famed trenches. They look haggard and worn out, but they are brave men, and do not care for whistling bullets. Silent, dull, and hopeless as are these poor unfortunate privates and their subaltern officers of the front, they do their duty scrupulously. For three months they have lived in the trenches; they sleep there, they eat there, they fight there, and they are buried there.

The Spanish forces are widely extended around the suburbs of the town in a circle of sixteen miles; no carefully regulated relief service is in operation, and all military preparations give the impression of improvisations. In the trenches it is still worse; the low ground has prevented the making of deep ditches, as water appears at a depth of from two to three feet, and so it was found necessary to bring out sand-bags and by other artificial means get the necessary height for the covering breastwork. Careless of the danger from whistling bullets are the Spanish soldiers lying in those miserable intrenchments; apathetic everywhere; no activity, not even the wish or the will to improve the very imperfect shelter; such was the general impression upon a military expert; and the tropical sun sends down its fiery arrows to the marshy land, with its numberless small creeks and water ditches, and brews there the worst enemy of the soldier—sickness.

A marshy ground, tropical vegetation, jungles of bamboo, and swampy rice fields are the condition of the land that the Spanish military leaders had to deal with. Thus modern long-range firearms can be used to their full effect only under very rare circumstances. The view is nearly always limited to a hundred yards or less, and is never so extended as to make the full use of such arms possible. The artillery is, practically speaking, absolutely dependent upon the very bad roads; driving across the fields, as in European or American battlefields, is almost impossible. For the same reasons which do not allow the use of the higher sights of the rifles, the artillery fire can never develop that overpowering strength which we attribute to it in modern warfare. The batteries must therefore unlimber within the best range of the rifle shots, so that casualties in the artillery may be considered as disproportioned to its real effect. That cavalry in such a country had to remain nearly always in the rear, and that even reconnaissances are in most cases better performed by infantry, is easily to be understood. In brief, the character of the country seems to be almost ideal for the kind of warfare which military men call "guerrilla fighting."

Only a very methodical and slow warfare gives reliable and *enduring* results. Block-houses must be built from one line to the next, fortified points must be constructed on all river passages and strategical points, if the inhabitants of a large country make a serious and continued resistance.

Spain had never taken such absolutely necessary military measures. and only in view of this can it be understood that with every Tagal insurrection the whole interior of the country was in the hands of the insurgents and Spanish rule was reduced to the maintenance of the seaports round the islands.

The chronic want of money and perhaps also of energy, the influence of the monks and friars, who may have been jealous of seeing another influence than their own established in the interior of all these islands, gives explanation enough of the fact that the Spanish rule has never been powerful in that country; but a stronger, more energetic, and more gifted race, with unlimited financial resources, may do in the future all that the former masters failed to do in *three centuries.*

If the Spanish government was weak from the military point of view, it was not less so from the standpoint of *diplomacy*, in the conciliation and real pacification of the Filipino natives.

Only *one* religious order succeeded, with its incomparable knowledge of the human heart, with its fine psychological and diplomatic means, in being loved and esteemed by native and government alike. If the friars and the various orders of monks were hated with all the energy of a long-oppressed race, the refined padres and monsignores of the famous society of the Jesuits, remained immune from all these savage feelings. They had understood that it was not the priest in his religious capacity, but the priestly lord, the priestly landowner, who excited the Filipinos, and so the Jesuits never tried to accumulate property in the interior. They built up a magnificent scientific observatory, with the most valuable instruments of astronomy, seismology, magnetism, and meteorology. They connected their observatory with all the other meteorological stations in the far east, and saved by their prompt warnings hundreds of lives and millions of dollars. When war times came over the country thousands of poor, homeless, and sick Tagale men, women, and children found a home in the wide courts and arcades of the Jesuits' colleges. They had formed a safeguard of miserables for their own safety with this praiseworthy mercy. They could be sure that they would remain undisturbed in their scientific work, although between the fighting lines. The same men that lived in the refined atmosphere of the highest intellectuality understood the necessity of mercy. The same scrutinizing eyes that read every morning the tales of the self-registering instruments understood also human nature and human hearts, and they have given to the former rulers of the islands a noble lesson. They have taught them that there are things in the world other than guns; they have taught them the eternal truth that science, knowledge, is and shall be power.

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THE

National Geographic Magazine

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THE ORIGINAL TERRITORY OF THE UNITED STATES

By Hon. David J. Hill, LL. D.,

Assistant Secretary of State

In retracing the development of our country we are led back to its infancy—to the cradle around which were already grouped the forces which have determined the destiny of the nation. We cannot too often be recalled to the rude simplicity of that earlier time or too often reminded of the elemental sources of our national life—so near to nature, so little affected by the art or thought of man.

A great continent, an unknown wilderness, rich with every gift of nature, lies waiting for the men who are to awake it from its sleep of ages, to come across the sea. Strange ships enter its bays and harbors and penetrate its broad and navigable rivers, but it still sleeps on; for the strangers come only to gather gold among its sands, not to make it theirs by pledges of honest toil. But at last are united the two essentials of a nation—a land and a people; for while the land lies waste and men are in ceaseless migration, a nation cannot exist. When land and people are wedded by permanent settlement, when man by toil evokes from nature her power to satisfy his domestic needs, and nature responds by kindling within him the flame of local affections, the wheels of society are set in motion, the economic and political forces begin their operation, and the process of national evolution has commenced.

I. THE STRUGGLE FOR THE CONTINENT

The discovery of this continent was destined to deflect all the currents of human history and to offer a home to new nations;

yet for more than a century after the voyages of Columbus there were but two settlements within the present limits of the United States, and both of Spanish origin. The Atlantic slope, whose streams flow eastward from the Alleghany mountains, abounds in safe harbors and land-locked bays, in whose restful waters the ships of the early French and English navigators found shelter after their long and perilous voyages; but the dense forest frowned beyond the coast-line, the shore seemed unattractive, and the ships sailed southward to the fabled land of gold and precious stones. It was with surprise that the early mariners skirted these somber shores barring the way to India, for they believed that north of Florida, supposed to be an island, the open sea led on to the Indian ocean.[1] A waterway across the continent was diligently sought in the belief that America, if not an island, was but a projection of Asia, and John Smith expected by ascending the James, the Potomac, or the Hudson, to emerge upon the South sea. Among his commissions was one to seek a new route to China by ascending the Chickahominy.

With the opening of the seventeenth century were planted the first English colonies in America. Humble merchants and pilgrims, wanderers going forth in frail ships to find uncertain lands, holding as their titles vague charters from King James, landed at Jamestown and on Plymouth Rock.[2] With a world to divide, monarchs were generous in those days, and did their rude surveying on the council table, using parallels of latitude and unknown seas for boundaries. It mattered little that the London and Plymouth companies were granted lands overlapping by three degrees of latitude, for as neither was allowed to settle within a hundred miles of the other, there was no danger of bad neighbors. When, to rectify all errors, the London Company received new boundaries,[3] they were described as extending two hundred miles from Old Point Comfort along the Atlantic coast in each direction, north and south, and "up into the land from sea to sea, west and northwest"—a line which was afterward held to give to Virginia the greater part of North America.

There was no contest for possession of the continent in those early days. Hudson leisurely sailed up the river which now bears his name and claimed it for the Dutch. Gustavus Adolphus, the "Snow King" of the North, without opposition, sent

[1] See Da Vinci's map of 1512–1516. This and the other maps referred to in the notes may be found in McCoun's Historical Geography of the United States.

[2] See map of King James' Patent of 1606.

[3] See map of Reorganization of the Plymouth Company in 1620.

his hardy Swedes to the Delaware peninsula. The French went fishing off the foggy coasts of Newfoundland, claimed the gulf and river of St Lawrence for their King, and built their rude huts amid the snows of Acadia. The English settlements were small and feeble communities, trembling between the sea and the wilderness. There is something sublime in the spectacle of this great unexplored continent, guarding the rich treasures of its vast interior by grim sentinels of gloomy forest, confronting with a frown that narrow, halting strip of civilization, whose frail forces, in spite of early poverty and weakness, were destined to become its imperious master. For a hundred years it seemed a most unequal contest. A handful of log-houses clustered about the fortified church, a few acres of cultivated land not far away, little groups of coarsely clad human figures laboring in the fields with rifles near at hand, the infrequent arrival of a storm-beaten ship—these were the only signs of the coming transformation which for generations met the sharp glance of the stealthy savage as he crept to the edge of the forest to observe the course of the white man's life.

The map of the Atlantic slope in 1640[4] reveals the cramped and perilous condition of the English colonies. Considered as a group, they were wholly inclosed between French territory on the one side and the sea on the other. Beginning with Acadia on the north, the French pressed upon the western limits of New England until their frontiers met those of the Dutch; then sweeping around the home of the powerful Iroquois Indians, who occupied the greater part of what is now the State of New York, New France, following the line of the Alleghanies, hemmed in all the seaboard settlements, cutting them off from the West, and stretching along the whole western boundary of Virginia until it ended in French Florida, covering the present states of South Carolina and Georgia, beyond which lay Spanish Florida and the Gulf of Mexico. While France thus stood as a barrier to the further penetration of the continent by the English, leaving them only a slender strip of coast, the Dutch and the Swedes effectually separated the northern and southern colonies from each other. To crown all, the Indians, affiliated with the French, who fraternized and mingled freely with them, were a constant menace to the safety of the English settlements, and furnished a savage band of mercenaries for advancing the ambitious schemes of France.

[4] See map of National Claims to the Atlantic Slope in 1640.

Considering the map alone, it would seem as if the French power was so intrenched upon this continent as to possess the keys of its destiny. But there are many factors which enter into the problem of nation-building, and the first of these is the temper and quality of men. The French colonies were a nursery, presided over by paternalism. The English threw their offspring out into the wilderness to fight their way for themselves, with no other heritage than liberty. In Canada the French colonist could not build his own house or sow his own seed or reap his own grain or raise his own cattle without the supervision of public officers receiving minute instructions from the home government. No farmer could visit the towns without permission or leave the colony without royal authorization. Public meetings were prohibited, initiative of every kind was forbidden, and the expression of opinion was repressed. Petted, pampered, and protected by royal authority, the French colonies were stricken with paralysis, and instead of looking to themselves became wholly helpless and dependent. When, at last, the death-struggle came in the battle for empire, the result was inevitable. Self-government, self-reliance, and freedom were foredoomed to win.

The map of 1763,[5] before the Peace of Paris, is the record of a hundred and twenty years of struggle and development, in which, with heroism, persistence, and patience the English-speaking colonists fought for and conquered space. The Dutch, tenacious of their speech and manners, having themselves absorbed the Swedes, were in turn engulfed in the English expansion, but not without leaving a deep and lasting impress upon the communities that overbore them. Brave little Holland, the first exchange in Europe for the commerce of the world, a cradle of art and science, a power upon the ocean, and an asylum and school of liberty when England sent her great thinkers across the North sea to sit at the feet of her worthy masters, has always lived, and still lives, in the Empire State and the nation. Her influence, even upon New England, is confessed by John Adams, when he says, "of all the countries of Europe, Holland seems to me the most like home."

New York, New Jersey, Pennsylvania, and Delaware completed the unbroken chain of English colonies from the lawless fishing villages of Maine to the broad plantations of Georgia. Between the sea and the mountains had grown up a solid phalanx of self-governing colonies as jealous of the French and as

[5] See map of English Colonies, 1763.

hostile to their pretensions as the mother country. The colonies of England, which in 1640 were threatened with being pushed into the sea, had become a continuous chain of eager contestants for supremacy, destined to sweep westward and drive the French dominion from the continent forever.

The French had formed a bold and magnificent design for the possession of the vast interior west of the mountains.[6] Near the close of the seventeenth century a brave and brilliant explorer, La Salle, continuing the career of Champlain, who had carried the trade and dominion of France westward to Wisconsin, descended the valley of the Mississippi, after traversing the Great Lakes, and planted a French settlement in Louisiana. The St Lawrence, the Great Lakes, the Mississippi, these furnished the natural highway for the genius of the great Frenchman in his progress toward the fulfillment of his splendid dream of empire; but the chief necessity for its realization was men, and these were wanting. At the close of the seventeenth century the French in all the wide region claimed by them numbered only twelve thousand souls, while the English had grown to a hundred thousand in New England and New York alone. "The paternal providence of Versailles," says Parkman, "mindful of their needs, sent to the colonists of Louisiana, in 1704, a gift of twenty marriageable girls, described as 'nurtured in virtue and piety and accustomed to work.'" But it required more than a cargo of girls to save New France. The forces of true colonization were wanting to the French, whose adventurers were described by an officer as "beggars sent out to enrich themselves," and who expected the government to feed them while they hunted for pearls and gold mines.

A weak chain of forts and trading posts, occupied chiefly by priests and friendly Indians, was the only bond that held together the long interval of wilderness between the St Lawrence and the Gulf of Mexico. The governor of New France, La Jonquière, perceived that the connecting link between these outposts was the rich valley of the Ohio, and demanded of his King the shipment of ten thousand French peasants to populate this intermediate region. But the thought had occurred too late; Louis was indifferent, preoccupied with the pleasures of his court; the inevitable conflict came at last and New France was erased from the map of North America.

France resisted nobly in Europe, but left the defense of her

[6] See map of the territory of the present United States during the French and Indian wars.

American empire to a handful of forces under the gallant Montcalm, while England sent 9,000 men in ships to Quebec, and the sturdy Americans, amidst great sacrifices, pushed their way through the forest to the St Lawrence to join in the attack. Upon the plains of Abraham, whose heights were scaled by superhuman daring, was fought the battle that decided the fate of Canada, and the dying Wolfe wrung from the hand of the dying Montcalm the keys of the great West and the dominion of a continent.

The destiny of America was involved in the issue of that death struggle between the paternalism of France and the forces of self-government. "The town meeting pitted against bureaucracy," says Fiske, "was like a titan overthrowing a cripple. . . . This ruin of the French scheme of colonial empire was due to no accidental circumstance, but was involved in the very nature of the French political system. Obviously it is impossible for a people to plant beyond sea a colony which shall be self-supporting unless it has retained intact the power of self-government at home. It is to the self-government of England, and to no less cause, that we are to look for the secret of that boundless vitality which has given to men of English speech the uttermost parts of the earth for an inheritance."

But it was not political causes alone that effected the annihilation of French influence on this continent. The French, the Dutch, and the Spaniards all surpassed the English in the adventurous spirit that leads to wide exploration and brilliant discovery; but the English had come with their wives and children, and they had come to stay. They loved agriculture and industry and knew the meaning of that potential word "home." They were in the best sense a sedentary people, forming attachments to the soil, and by honest labor with their own hands making it respond to their necessities. With plenty of food and boundless acres awaiting the culture of the toiler, the conditions of a great population were fulfilled. They religiously obeyed the scriptural injunction to "multiply, and replenish the earth," and brought up their numerous children to lead frugal and well-regulated lives, earning their bread in the sweat of their faces. A little later Franklin estimated that the population of the colonies doubled every twenty-five years without counting the immigrants. But it was not so with the French or the Spanish, who left behind them in the wilderness their half-breed offspring to be nurtured by Indian mothers and encounter the hazards of a rude existence, while they themselves moved on in the path of adventure. It was the compactness of the English colonies, their industry, their frugality, and their prolific rate of increase, under the influence of home, which decided the fate of North America and made the triumph of Wolfe "the greatest turning point as yet discernible in modern history."

France emerged from the Seven Years' War defeated, humbled, and overwhelmed, her armies beaten, her navies shattered, her possessions overrun throughout the world. The purpose of the war was colonial supremacy, and it left the map of Europe practically unaltered, but the map of America was totally changed by the Treaty of Paris.[7] France was driven from the continent, and there remained to her, of all her vast possessions in America, only a few scattered islands. Spain relinquished Florida and retired behind the Mississippi. The whole area east of that great waterway, and the entire territory north of the fiftieth parallel, were united under the dominion of the British Crown. By the Peace of Paris the American continent was thus divided between England and Spain, the work of territorial consolidation under a single power between the Atlantic and the Mississippi was completed, the conditions for the development of one great nation in this vast area were supplied, and there was required to effect its formation only those measures of political reorganization which the genius of the people could not fail to accomplish.

But the chief result of the war was the birth of an American people, a distinct nationality, brought to a consciousness of itself by common interests and common sufferings. It was already a composite fabric, whose warp was of English origin, but whose woof was borrowed from every European country. The industrious German, the thrifty Swede, the sturdy Hollander, the virtuous Huguenot, the frugal Scotchman, and the generous but turbulent Irishman were already here, and all had acquired the qualities of a new and independent race. It has been said that "God sifted three kingdoms to send forth choice grain into the wilderness," but the statement is inadequate. The true motherland of America is not England, it is the whole of Europe.

II. THE TERRITORIAL CLAIMS AND CESSIONS OF THE STATES

It is an interesting fact that the year 1763, the date of the Treaty of Paris, marks also the beginning of that movement

[7] See map of the territory of the present United States after February 10, 1763. Result of the French and Indian wars.

toward independence which culminated in the Declaration of 1776. The King and the Parliament, unmindful of the great services of the colonies in the destruction of the power of France, chose to regard them as mere sources of revenue for extinguishing the enormous debt which Great Britain had incurred in extending her colonial empire. The British theory was that the colonies should pay the cost of the war. The latter, on the other hand, had made great sacrifices for the public good. The war had involved them in a large expenditure of life and money. Thirty thousand men had been killed in battle, and many of the colonies had incurred considerable debts. The imposition of special taxes upon them they considered not only unjust in principle but unwarranted by their conduct toward the British Crown, for whose glory they had bravely fought. When, in 1774, the estrangement of the colonies toward England had reached a crisis, they were thirteen separate communities, with different laws and political organizations, possessing little in common except the general use of the English language, allegiance to the same King, and the memories of fellowship in the French and Indian wars. Twenty years earlier Franklin had proposed a union for the common defense, and his telling figure of the snake severed into thirteen parts, representing the colonies, over the legend, "Join or die," in the days of the Albany convention, made an indelible impression on the popular mind. The Union, however, had never been consummated, for it was rejected by the colonial assemblies, who feared they might create a new master, and not acceptable to the English Board of Trade, because the idea was too democratic. But Franklin, who was then in England as the agent of several colonies, had written an official letter to the Massachusetts Assembly, in which he said: "The strength of an empire depends not only on the union of its parts, but on their readiness for the united exertion of their common force;" and, to secure this end, he proposed that a general congress be assembled to make a solemn assertion of the rights of the colonies and to engage them with each other never to grant aid to the Crown in any general war till those rights were recognized by the King and both houses of Parliament.

Accordingly a Congress, styling itself "*the delegates appointed by the good people of these colonies*," assembled at Philadelphia on the 5th of September, 1774. There was no law or precedent for such a union, and it was not even pretended that the colonial assemblies had the legal right to unite without the consent of

Parliament, and as if in some measure to break the force of this illegality, the delegates had assembled in the name of "the people." It was, in effect, the declaration of a new sovereignty. Patrick Henry justified it on the ground that the "colonial governments were at an end;" that "all America was thrown into one mass and was in a state of nature." "Where are your landmarks, your boundaries of colonies?" said he. . . . The distinctions between Virginians, Pennsylvanians, New Yorkers, and New Englanders are no more. I am not a Virginian; I am an American." His theory was premature, however, for Congress had not been appointed as direct representatives of the people, but as committees of organized colonies which had not yet thrown off allegiance to the British Crown; but his words were prophetic and forecast the philosophy which the Declaration of Independence was soon to assert as the expressed conviction of the nation. The tendency of public thought, however, outstripped the progress of events; and, believing the delegates to represent the whole territory claimed by the British Crown in America, the people spontaneously named the assembly the "Continental Congress." To the popular mind the revolution had become the revolt of a continent against the oppression of an island. When Colonel Ethan Allen demanded the surrender of Fort Ticonderoga "in the name of the Great Jehovah and the Continental Congress," he uttered the whole philosophy of the American Revolution.

It soon became apparent that the colonists, to whom their King and Parliament denied the rights of Englishmen, were in fact reduced to "a state of nature," and the idea of Patrick Henry gained ascendancy. The logical result was the abandonment of all allegiance to the British Crown by the Declaration of Independence.

Ten days before the adoption of the Declaration, Congress had resolved that "all persons abiding within any of the united colonies, and deriving protection from the laws of the same, owed allegiance to the said laws and were members of said colony." Thus the same power which declared independence gave to the colonial governments all the authority which they possessed. The colonies owed their existence as independent commonwealths, not to their own separate acts and achievements, but to the united action of all combined. Whatever sovereignty they subsequently claimed was wholly derived from the union between them. Alone each colony was but an empty name;

together they were a sovereign power. It was as a continental force that the people won their independence, and the Nation is in reality older than the States.

All this was felt even at the moment, and on the day the committee for drafting the Declaration of Independence was appointed another committee was directed to prepare the form of a confederation. The power which declared independence and thereby created new sovereignties knew itself to be a mere illusion, except as its acts were ratified by the force of the united nation.

But when the Declaration had in effect brought into being thirteen sovereigns in place of one, new problems burst into view. Each of these new states claimed all the rights granted by its own fundamental laws, and in addition its share of the power hitherto accorded to the Crown. What, then, was to be the disposition of those "Crown lands" which were not within the actual bounds of any colony, although originally included in their charters—that vast territory lying between the Alleghany mountains and the Mississippi, which had been won in battle from the rule of France? [8]

Six states—Massachusetts, Connecticut, New York, Virginia, North Carolina, and Georgia—by reason of their original charters or subsequent treaties, claimed the ownership of all the lands west of their actual boundaries as far as the Mississippi river. It is true that a royal proclamation had been issued in 1763 prohibiting colonial governors from granting patents of land beyond the sources of the rivers flowing into the Atlantic, and that in 1774 the "Crown lands," as they were called, northwest of the Ohio were annexed to the royal province of Quebec; but these were considered by the colonies unjust encroachments, for had they not freely sacrificed lives and money to conquer this same country from New France? The other colonies, however, hemmed in by inelastic boundaries, protested against these large pretensions, maintaining that possessions which had been acquired by the force and sacrifice of all should not be appropriated for the aggrandizement of a part. New Hampshire, Rhode Island, New Jersey, Delaware, Pennsylvania, and Maryland, denied a share of this great territory, saw in the claims of the "land states" not only an evident injustice in refusing them a part in the fruits of a common victory, but a menace to the equilibrium of the states by the arrested development of some

[8] See map of Land Claims of the Thirteen Original States.

and the unlimited expansion of others. It was indeed no imaginary danger, for by offering free lands to settlers the larger states could easily depopulate the smaller. Silas Deane, who had been sent as commissioner to France, had suggested that the Northwest Territory was "a resource amply adequate, under proper regulations, for defraying the whole expense of the war." When, therefore, in September, 1776, a resolution of Congress offered a bounty of land to soldiers enlisting for the war, Maryland, seeing that Congress had no land to give and she herself none to contribute, perceived that the states without land would be compelled to buy it of those whose stock was unbounded and at their own price, thus impoverishing themselves and enriching their rivals.

Virginia in her constitution maintained her charter claims, which if allowed would have made her a mighty empire, greater when developed than all the other states combined. On the 30th of October, 1776, Maryland passed a resolution asserting that Virginia's title had "no foundation in justice, and that if the same or any like claim is admitted, the freedom of the smaller states and the liberties of America may be thereby greatly endangered," and expressed the conviction that, the dominion over those lands having been established by the blood and treasure of the United States, "such lands ought to be considered a common stock, to be parceled out at proper times into convenient, free, and independent governments."

Thus by the foresight of Maryland, to which all honor will be forever due, was first posed the momentous question upon whose decision hung the whole harmonious system of government which we now enjoy. A year later, and a month before the Articles of Confederation were proposed for ratification, it was moved in Congress "that the United States in Congress assembled shall have the sole and exclusive right and power to ascertain and fix the western boundary of such states as claim to the Mississippi or South Sea (meaning the Pacific), and shall lay out the land beyond the boundary so ascertained into separate and independent states from time to time as the numbers and circumstances of the people may require." Only Maryland, battling for this great and fruitful idea and appealing to the wisdom of the people as against the ambition and avarice of the states, voted in the affirmative; but a principle had been laid down whose wisdom was eventually to be perceived by all—a principle which has proved the keystone of the Union, supporting the splendid arch upon which our local liberties and national power now rest.

In 1780 New York authorized the limitation of her western boundaries and the cession of her vacant lands to the United States. "She ceased to use the language of royal grants and discarded the principle of succession. She came forth from among her parchments into the forum of conscience in presence of the whole American people, and recognizing the justice of their claim to territories gained by their common efforts, to secure the inestimable blessing of union, for their good and for her own, she submitted to the national will the determination of her western boundaries, and devoted to the national benefit her vast claims to unoccupied territories."

Nor can we deny to all the states a share in the honor of a wise and noble compromise. For the consummation of the Union the smaller states intrusted their liberties to the keeping of the greater, and the greater, in a spirit of generosity, finally bequeathed their large inheritance to the common good, and shared the luster of a brilliant destiny with new stars yet to rise in the firmament of liberty. Special praise should be accorded to Virginia, for "in her great cession of the territory northwest of the Ohio, the greatest cession of territory in the history of the world ever voluntarily made by a powerful state able to defend it, she invited the other states to follow her example, and thus made possible the local governments and magical development of the West, while she averted the jealousy, and possibly the anarchy and bloodshed, that might have followed the assertion of her claims."

III. THE NEGOTIATIONS WITH GREAT BRITAIN

When the long struggle for independence was concluded, it was not to be doubted that the young Republic would hold out with stubborn insistence for the recognition of its sovereignty over the territory east of the Mississippi. After the battles of the war, which ended with Yorktown, came the battles of diplomacy, which were to be fought with an equal skill and daring. All the glory and pride of colonial supremacy which had animated Great Britain when the Treaty of Paris was made with the French were now to be disputed by the colonies themselves.

Instructed to claim the whole of the territory south of the St Lawrence and east of the Mississippi, Franklin proposed, in addition, that England should voluntarily cede Canada, in order that its lands might be sold to raise a fund for the compensation of Americans whose property had been destroyed; to which Lord

Grenville wittily rejoined that he could not perceive what motive England had for giving away a fourteenth province because she had already lost thirteen.

Although the commissioners had been directed to observe the most perfect loyalty to France, and to rely implicitly upon her counsels, we now know that the most moderate territorial pretensions of the United States had not one friend in Europe. Spain was represented at the French court by the Count d'Aranda, a subtle diplomatist who bore no love to the young Republic of the West. Fearing alike future encroachment upon the territory of Spain and the dangerous contagion of republican principles, with which her American colonies had already become infected, he made preposterous claims for his country and pretended that the West was the territory of free and independent nations of Indians, whose sovereignty over their soil should be considered inviolable. Sustained by such flimsy reasons, he proposed to shut the United States between the mountains and the sea, interposing a vast Indian territory between them and the Mississippi and permitting Canada to extend south to the Ohio river.[9]

Bound to Spain by an ancient family alliance and a secret treaty which made the cession of Gibraltar back to Spain the price of peace with England, France proved the mere advocate of her ally and client. The Count de Vergennes, the able but evasive Minister of Foreign Affairs, had secretly instructed the envoys of France to the United States to oppose by every wile known to the art of diplomacy the American acquisition of Canada, while yet pretending to favor American expansion. Rayneval reports, in great glee, as we now read in his dispatches, how successfully he hoodwinked the President and certain members of Congress, beguiled by his craft and the sweet influence of their tobacco pipes, and won rapturous expressions of gratitude from the Spanish agent Miralès. "It is a part of the system of Spain, as it is also of France," writes Vergennes, "to maintain the English in the possession of Nova Scotia and Canada." During the negotiations he says the same to Luzerne, and adds that, of course, "this fashion of thinking should be an impenetrable secret for the Americans."

We are not surprised, therefore, that the French court sustained the idea of Aranda,[10] and desired to crush the United

[9] See map of boundary lines discussed at Paris, 1782.

[10] See map of Boundaries of the United States, Canada, and the Spanish Possessions, according to the Proposal of the Court of France, 1782.

States by massing to the westward the Spanish, the Indians, and the English, leaving the territory of the colonies only a narrow fringe pendant to the broad snowy mantle of the Dominion of Canada, torn from its own shoulders in 1763, and perhaps with the dim hope of its ultimate recovery amidst the strange international vicissitudes that attend defeat and victory. Regarding the fisheries as "a great nursery for seamen," and seeing in them a school for ultimate supremacy on the ocean, France joined England in seeking to deprive the colonies of their hereditary rights on the banks of Newfoundland and in the Gulf of St Lawrence. The keen vision of Vergennes foreknew the future struggle for the Mississippi valley and the possession of the Far West, and, faithful to Spain, he ridiculed "the extravagance of the American views and pretentions," and called the demands of John Jay "a delirium not to be seriously refuted."

Happily for their country, the American commissioners saw a way to peace without sacrificing the interests of their people, and although threatened with a vote of censure in Congress for their independent action and disregard of French counsel, they were brave and wise enough to maintain every just demand. The Treaty of Versailles not only acknowledged the independence of the United States, secured the rights of the fisheries, and opened the free navigation of the Mississippi, but it confirmed substantially the American claims in the matter of boundaries and won a vast territorial empire for the United States.[11] It was one of the greatest victories in the history of diplomacy and laid the foundation of the nation's greatness. The Great Lakes and the Mississippi became American highways, and the path to the Gulf of Mexico and the Pacific was opened to American enterprise. The peace was received "with a burst of approbation" in the United States, and the refrain was taken up—

> "No pent-up Utica confines our powers,
> The whole unbounded continent is ours."

The completeness of the victory was resented by Spain, compelled to take Florida in place of Gibraltar, and regretted by France, which got nothing at all. The baffled Aranda wrote to his King: "This Federal Republic is born a pigmy. A day will come when it will be a giant—even a colossus—formidable to these countries. Liberty of conscience, the facility of establishing a new population on immense lands, as well as the ad-

[11] See map of the Original Public Domain, 1787.

vantage of the new government, will draw thither farmers and artisans from all nations." Montmorin, the successor of Vergennes, wrote to his envoy: "It is not advisable for France to give to America all the stability of which she is capable; she will acquire a degree of power which she will be too well disposed to abuse." But that was written before the French revolution and from the shadow of a tottering throne. From our great sister republic of today we would receive a different greeting, and among its words of amity would be expressions of gratitude for the principles and example of the United States, which have done so much toward the establishment of the French Republic.

IV. THE INFLUENCE OF THE NATIONAL DOMAIN

A cool and temperate Englishman, "a far-sighted man in many things," wrote of the prospects of the Confederation soon after the peace: "As to the grandeur of America and its being a rising empire under one head, whether republican or monarchical, it is one of the idlest and most visionary notions that ever was conceived, even by writers of romance. The Americans can never be united into one compact empire under any species of government whatever; a disunited people till the end of time, suspicious and distrustful of each other, they will be divided and subdivided into little commonwealths or principalities, according to natural boundaries, by great bays of the sea and by vast rivers, lakes, and ridges of mountains."

The events of the time seemed to justify this dismal prophecy, and the fear of its fulfillment agitated the best minds among the American patriots. The vast Northwest Territory having been ceded to the United States by Great Britain, the question was, How was it to be held? Congress instructed General Washington to garrison the frontier posts, when surrendered, with the continental troops; but after long and elaborate debates the danger of confiding so much power to the federal government was made the excuse for disbanding the troops and leaving the frontiers to the protection of a few state militia. To the ambitious and jealous leaders in the states, anxious to rise to power in their narrow sovereignties, the utility of the Union seemed already passed, and the destiny of America appeared to be wrapped up in the fate of thirteen rival republics, each too feeble to protect itself against foreign aggression and all too suspicious to trust one another. The impotent bond of the Confederation became the laughing-stock of Europe. To many it seemed that a return to the protection of England was the only way of salvation, for the paper money had become worthless, the fires of local insurrection burst forth from the ashes of discontent, interstate commerce was destroyed by petty frontier exactions, and the great experiment of independence seemed doomed to end in anarchy.

We cannot here review the disquiet and anxiety of that troubled time, and can only briefly indicate the unexpected cure. The possession of a national domain, composed of territory ceded by the states to the Confederation, proved to be the anchor of the Union. Over this area Congress had assumed a certain degree of power, and it was the only sphere in which the sovereignty of the Confederation could assert itself. In the vast unpopulated stretches of the great Northwest, Congress, by the ordinance of 1784 and the later ordinance of 1787, exercised the right of eminent domain, ruled by its laws, and sold the land to obtain an income. The future states were bound to make their laws in harmony with the great principles of freedom, education, and suffrage laid down by Congress, and under no circumstances could they ever be separated from the Union. "I doubt," says Daniel Webster, "whether one single law of any law-giver, ancient or modern, has produced effects of more distinct, marked, and lasting character than the ordinance of 1787."

Thus grew up silently, almost unobserved, yet, as Madison remarked, "without the least color of constitutional authority," a national sovereignty which justified recognition at last by the formation of the Constitution. The Articles of Confederation had contemplated no such exercise of power, and the ordinance was never submitted for ratification by the States; but the necessity of governing that vast territory had forced upon Congress a course as wise as it was illegal, until, as by a sudden turn in a mountain path a splendid landscape bursts into view, the great and impressive fact that a nation had been created commanded attention; and, seeing its sublime significance, confessing its rightful claims, the whole people felt their kinship and unity, and could express their conviction in the potent phrase, "We, the people of the United States."

The treaty of 1783 stipulated that the navigation of the Mississippi from its source to the ocean should be forever free and open to the citizens of the United States. Spain, however, who was not a party to this agreement, asserted an exclusive control over the river and denied the right of free navigation. This situation gave rise to one of the most thrilling controversies in the history of our country, now almost forgotten, but fraught with momentous consequences to the future of the American people. Franklin had foreseen the issue when he said to Jay, "Poor as we are, yet, as I know we shall be rich, I would rather buy at a great price their right on the Mississippi than sell a drop of its waters. A neighbor might as well ask me to sell my street door."

Soon after his retirement from the army, Washington made a tour into the western country, which he had known so well in his early days and whose wealth and value he justly appreciated. His purpose was to ascertain by what means it could be most effectually bound to the Union. The population of that rich and fertile region, a bold and adventurous class, separated by the remoteness of their position from connection with the eastern states, with little respect for the feeble rule of Congress, in which they had no representation, already showed signs of estrangement and independence. So rich a soil, such luxuriant vegetation, had never belonged hitherto to any branch of the English-speaking race. Plains capable without cultivation of supporting millions of cattle, fields golden with heavy harvests in response to the minimum expenditure of toil, rivers affording great natural highways for the movement of their agricultural productions needed only an adequate market to render the great Northwest the richest portion of the globe. The Atlantic states knew little of this vast region or its untold resources. They looked upon it chiefly as a means for paying the federal debts by the sale of public lands, and did not realize its political significance until their indifference and the inefficiency of the government had almost lost it to the Union.

Washington, whose large practical intelligence was so quick to discern great issues, saw the impending danger. Returning from his western journey, he recommended the appointment of a commission to make a survey ascertaining the means of natural water communication between Lake Erie and the tidewaters of Virginia. His project was to open all the possible avenues between the western territory and the Atlantic, thinking thus to identify the interests of the two sections, to offer to the West participation in the advantages of the sea and to enrich the East by making it the emporium of the western productions. But the shrewd frontiersmen who had taken up the western lands saw another avenue to the sea and another way to market. It was the Mississippi and the tributaries flowing into it which seemed Nature's great highway ready for their use. Only one barrier opposed them, the obstinate refusal of Spain, who held the mouth of the great river and its western bank, to permit its free navigation. An interposition so autocratic, so unjust, and so injurious roused the resentment of the strong men of the West and they resolved not to submit to this limitation of their rights. The East, fearing that the West would be lost if not held to its eastern connections, opposed the opening of the Mississippi, preferring a commercial treaty with Spain to free navigation. Congress met the problem with the feebleness that characterized its action after the Revolution. Diplomacy was bartering away the rights of the young West, when suddenly a trader, whose shipment had been seized by the Spanish authorities, returned to tell the story of his wrong just at the moment when news arrived that Congress intended to surrender the present use of the Mississippi. The whole population of the western settlements rose in wrath and indignation to protest against the folly by which they were being sacrificed. Looking out over their magnificent domain, whose soil they were redeeming from the idleness of its natural state, they felt that their abundance was turned to poverty if the mighty rivers which swept past their fields waving with harvests abundant to sustain the populations of Europe, were closed to them, and they themselves shut up in their fertile valleys, unable to exchange their wealth of cereals for the merchandise they could not create. But there at the outlet of their noble river stood the obstinate Spaniard, sword in hand, refusing them egress to the open sea and excluding them from the commerce of the world. They must despoil their luxuriant valleys to pour their tribute at his feet, and share with an alien and an enemy, "the largest return which American labor had yet reaped under the industry of its own free hands." No; they would not. They had fought the savage and the wild beast. They had come here to accept their heritage from the hand of nature and to find justice without relying on the power of kings. They must go to the sea. If Congress opposed, it was to be defied, as the Crown of England had been in the Revolution. If the Spaniard opposed, they would drive him off the continent and rid the land of an incumbrance. They set their faces like flint for the empire of the West. Twenty thousand men, trained in the field and the forest, turned their backs to the

Alleghanies and their faces toward the great river, resolved to march to its mouth and drive the Spaniards into the sea.

Congress could not deny their plea, and yet was not strong enough to espouse their cause. The need of a closer union in place of "the rope of sand" which bound the states together became evident. The great Northwest must be saved. A new vision burst upon the American people. "A great and independent fund of revenue," said Madison, "is passing into the hands of a single body of men who can raise troops to an indefinite number and appropriate money to their support for an indefinite period of time. . . . Yet no blame has been whispered, no alarm has been sounded." Since, then, there already existed in the Union a form of sovereign power, why not give it substance? Why not provide the nation with an adequate constitutional basis? Under these circumstances was convoked the Constitutional Convention of 1787.

The lands between the Alleghanies and the Mississippi were seen to be the key to the continent. They were the old vantage ground of France. Emigration was setting toward them and in a few years they would constitute a mighty empire. They belonged to the people, not to the states, and the common possession bound the whole population together in a corporate interest. The discernment of this momentous fact created a new patriotism and flooded the intelligence of the people with a new light. Henceforth there were to be two kinds of government to correspond to the two kinds of interest that existed—that of the States, preserving their memories, their traditions, and their organizations, and giving perpetuity to their laws and liberties, and that of the Nation, binding them all together in indissoluble union, preserving the common heritage of their people, giving them fraternity at home and prestige abroad, sweeping away the local barriers to trade and intercourse, gathering the whole people under the folds of one glorious flag, and sheltering the sister states under the spacious dome of a common nationality whose protection should extend over all alike.

No wonder that the Constitution has been called "the finest specimen of constructive statesmanship that the world has ever seen." It has a character of universality about it like the great laws of nature. It was compacted of historic liberties won in a thousand battles and rendered sacred by colonial memories and revolutionary struggles, yet was made for indefinite growth and future expansion, in view of vast stretches of unoccupied wilderness threaded by mighty rivers destined to bear upon their bosoms the commerce of untold millions when these trackless wilds should be peopled by the makers of the Great West. The history of the United States is the story of its continued benedictions. Ampler vision has broadened the interpretation of its meaning, and enlarged experience has widened the application of its principles; and today, as hitherto, the Constitution is flexible enough to admit of adaptation to all the changing conditions of our national development, yet strong enough to hold in one harmonious system forty-five great states, spanning the continent and including within their limits every diversity of nature and every variety of man. Designed for a population of three millions, it has become the fundamental law of more than seventy; ratified by a little fringe of people scattered along the Atlantic seaboard, it is accepted by a great continental nation; written in a period of legalized slavery, it has laid the foundations of universal liberty; expressing the final goal toward which political evolution is tending—local government for local affairs and a general government for general affairs—it presents a model for the final organization of the entire human race, when some far-distant dawn shall usher in

"The parliament of man, the federation of the world."

In a recent report to the Department of State, Consul-General De Leon deals at some length with the proposed railway from Guayaquil to Quito. The track is laid for the first 60 miles, but the broadening of the gauge and the laying of new ties and rails will almost amount to a new construction. The present terminus is at the foot of the western cordillera of the Andes, at an elevation of 1,130 feet above sea-level. Between this point and Sibambe, a distance of 60 miles, there will be a gradual rise to an altitude of 8,138 feet. This is considered to be the most difficult part of the entire line, as not only does it lie for the most part on the thickly forested mountain side, but the geological formation will add greatly to the difficulty of construction. Between Sibambe and Quito the line will have to surmount three spurs of the cordilleras, ranging from 10,000 to 12,000 feet. The road, as a whole, will be a triumph of railway construction and will open up a region of wonderful productivity, the mountain valleys that will be rendered accessible possessing a fine climate and an exceedingly fertile soil.

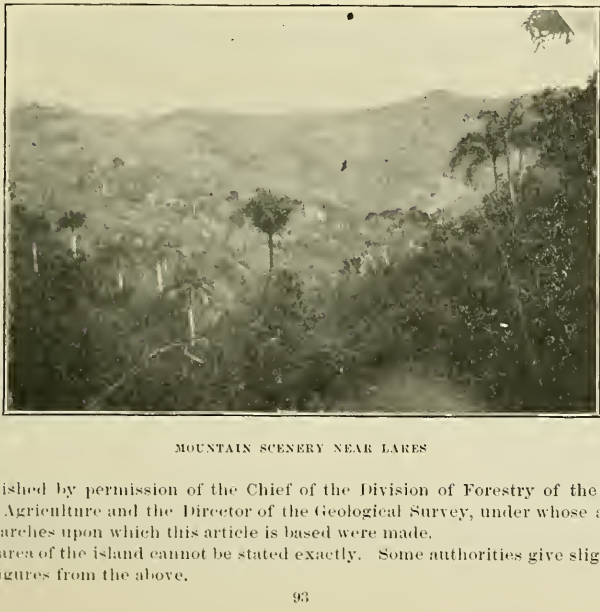
PORTO RICO*

By Robert T. Hill,

United States Geological Survey

CONFIGURATION AND GEOLOGY

Porto Rico is the most eastern and the smallest of the Great Antilles, being 500 square miles less in area than Jamaica. It is 95 miles long, 35 miles wide, and has an area of 3,668 square miles.† The coast-line is about 360 miles in length. Its area is 300 square miles greater than that of Delaware, Rhode Island, and the District of Columbia combined, and 300 square miles less than that of Connecticut. At the same time, it is the most productive in proportion to area, the most densely settled, and the most established in its customs and institutions. It is also notable among the West Indian group for the reason that its preponderant population is of the white race, and that it produces foodstuffs almost sufficient to supply its inhabitants as well as some of the neighboring islands.



MOUNTAIN SCENERY NEAR LARES

* Published by permission of the Chief of the Division of Forestry of the Department of Agriculture and the Director of the Geological Survey, under whose auspices the researches upon which this article is based were made.

† The area of the island cannot be stated exactly. Some authorities give slightly different figures from the above.

Although it nowhere attains the great altitudes of the other Antilles, the island is practically the eastward continuation of the Antillean chain of uplifts. It rises from the shallow submerged bank which borders it for a few miles and is a continuation of the other Antilles. This bank is the upward extension of a remarkable submerged mountain slope, which, at least on the north side, descends nearly 30,000 feet to the bottom of the Brownson Deep, until recently supposed to be the deepest hole in the world.

Its outline presents the appearance of an almost geometrically regular parallelogram nearly three times as long as broad, with its four sides following the four cardinal directions. The sea-line, unlike that of Cuba, is almost straight, and the coast is usually low, especially on the southern side, although there are a few headlands. It is also void of fringing keys and deep indentations of its coast, such as border the island of Cuba.

Porto Rico, like all the Antilles, in comparison with the United States, has a configuration ancient in aspect, although comparatively new in geologic age, the material all being of late Cretaceous and younger periods. Of the four chief topographic features of the Great Antilles—central mountains, coast-border topography, interior plains, and inclosed mountain basins—only the central mountains and coast-border topography are represented upon this island.

The central mountains, which are the largest conspicuous eastern member of the partially submerged chain of the Great Antilles

COFFEE ESTATE IN MAYAGUEZ DISTRICT

A MOUNTAIN STREAM, SIERRA LUQUILLO

and Virgin islands, are largely of one general physiographic type, while the coast-border topography is more complex and diversified, consisting of three subtypes, which may be called coast hills, parting valleys, and playa plains.

The mountains constitute the major surface of the island, approximately nine-tenths of the whole. The other features collectively make an irregular and lower lying belt around the coastal margin comparable to the narrow rim of a high-crowned alpine hat. In fact, the whole island is practically an elongated elevated sierra, made up mostly of volcanic rock, surrounded by a narrow collar or dado of limestone hills, formerly marginal marine incrustations which have been elevated. Viewed from the sea these mountains have a rugged and serrated aspect, consisting of numerous peaks and summits void of a definite crest line, rising from a general mass whose steeply sloping sides are deeply corrugated by drainageways, so that they have the aspect of a wrinkled handkerchief—a figure of description ascribed to Columbus in telling Queen Isabella of the Antilles. Their superfice has been etched by erosion into innumerable gabled lateral ridges (cuchillas) separated by deep V-shaped gorges. This type of mountainous configuration has been described by Davis as a dissected range, while the angular lateral ribs or salients are known in Cuba as cuchillas (knives).

This sculpture is so peculiar to the central mountains of the island that it forms a ready means of differentiating them from the foothills. The mountain region has a long and relatively gentler inclination toward the north coast and falls off more ab-

STREAM AND VOLCANIC ROCKS, MAYAGUEZ

ruptly toward the south. While the general axis of uplift extends east and west, the mountains do not now present a well-defined and continuous summit crest, although various terms are popularly used indicating a feature such as the "central backbone range," etc. The chief approach to such an axial feature is an irregular line of summits which can be drawn about two-thirds the distance across the island from east to west between the headwaters of the streams flowing to the north and south coasts. This feature, however, which follows more nearly the southern than the northern coast, is a line of separated peaks and passes. High peaks exceeding in altitude this so-called divide project at various places from the lateral ridges which extend between the parallel streams flowing from this drainage divide.

The main crest line extends from Mayaguez on the west through Aibonito and Adjuntas to Humacoa on the east. This is called the central Cordillera west of Aibonito and the Sierra de Cayey to the east of that town. Another crest line bifurcates from this main ridge near the center of the island like a letter ≺, so that there are practically two crest lines in the eastern half of the island. This northern branch is the Sierra Luquillo, which practically extends from westward of the San Juan-Ponce military road to the northeast cape. This range, which decreases in altitude to the westward, contains the highest island summit, El Yunque, and is nearly separated from that of the Sierra Cayey by the valleys of the Rio Guarabo, which flows west into the

Loiza, and the Rio Naguabo, which flows east into the Anegada passage. The summit lines of the two sierras merge near Barranquitas, near the geographic center of the island.

More accurately speaking, these mountains as a whole, when looked down upon from the highest points, present the aspect of a sea of conical peaks and beaded ridges, rather than a dividing ridge, from which angular laterals extend between the drainageways. They rise abruptly from the sea, especially at the east and west ends of the island, or from the narrow marginal plain which separates them from it.

The highest eminences of this billowy sea of summits nowhere exceed 4,000 feet, and this altitude is reached by only one peak, that of El Yunque at the extreme northeast. The height of this is given on the Spanish maps at 4,087 feet, but it is reported much lower by other authorities, with a minimum estimate of 3,200 feet. The summits of the remainder of the island, although numerous, nowhere attain much over 2,800 feet, as shown in the following table:

ALTITUDES OF TYPICAL MOUNTAIN STATIONS IN PORTO RICO[1]

Altitudes of the Sierra Luquillo

	Feet
El Yunque,[1] eastern summit	3,752
El Yunque,[1] western summit	3,790
Divide north of Juncos (about)	2,400
The hill of the Guaraguo (Rio-piedras to Caguas), military road[2]	685
Las Calabazas (culminating point from Rio Pedro to Caguas)[2]	866

Altitudes of Points in the Sierra Cayey (that portion of the main Cordillera east of the San Juan-Ponce road)

	Feet
Caguas, plaza, in the Caguas basin, separating the Yunque and Cayey sierras and draining into the Loiza[2]	246
House of Vicente Pico (from Caguas to Cayey)[2]	1,525
Culminating point between Caguas and Cayey (watershed)[2]	1,682
El Torito, south of Cayey[4]	2,735
Torito, culmination of Sierra Cayey, south of Cayey[1]	2,819
Sierra de Cayey, level of the calcareous platform of Cayey[2]	2,223
Hacienda la Julia de Loris[2]	1,400
Summit which overlooks Cayey and from which the city can be seen to the south-southeast[2]	2,542

[1] Compiled by U. S. Coast and Geodet c Survey, as published on its map.

[2] Chart of Saint Claire-Deville, published in Historia Civil Natural de la Isla de Puerto Rico, edition of 1866, pp. 427, 428.

[3] Aneroid measurements, by Mr H. M. Wilson and the author.

[4] Map of Don J. M. Lago, Mayaguez, 1898.

	Feet
Culminating point between Cayey and La Cidra[2]	1,781
La Cidra (Presbiterio)[2]	1,423
Cayey, level of the plaza[2]	1,351
Sierra de Cayey, culminating point of the route from Cayey to Guayama[2]	2,810

Altitudes of Points in the Cordillera Central (*the extension of the main Cordillera west of the San Juan-Ponce road*)

	Feet
La Torre, between Aibonito and Barranquitas[1]	1,130
La Torre (The Tower) pass between Barranquitas and Aibonito to the west-northwest of the latter.[2] According to Saint Claire-Deville, the summit of this mountain is next highest after Yunque, and attains at least 1,000 meters (3,280 feet)	2,456
Summit west of Aibonito (1 mile)[1]	3,280
Aibonito, house of Domingo Torre[2]	2,066
Adjuntas[3]	1,440
Adjuntas, house of D. José Bosch[2]	1,640
Divide south of Adjuntas[3]	2,350
Culminating point between Ponce and Adjuntas, summit of this district[2]	2,617
Plain at the summit of Adjuntas on road to Peñuelas[2]	2,810
Culminating summit of district of Peñuelas[2]	2,812
Mata de Platano, northwest of Ponce[4]	2,812
Cumbre Guilarte, southwest of Adjuntas[4]	2,625
Guilarte[1]	3,608
Barranquitas, home of Bonocio Ferrer[2]	2,082
Culminating point between Sabana del Palmar and Barranquitas[2]	2,260
Sabana de Palmar (Presbiterio)[2]	757
Cumbre de Asomante[2]	2,089
Tetos de Cerro Gordo (due north of Sabana Grande)[1]	2,625
Tetos de Cerro Gordo[4]	2,235
Summit of the hill situated to the east of Mayaguez[2]	708

Through this mountainous mass the numerous and copious streams of the island, ramifying in every direction, have cut deep valleys, singularly free from cliffs, but of the V-shaped type, and etching the surface into many Λ-shaped lateral ridges and points. Of these streams the largest and longest drain into the north coast, the next largest flow to the west, while the streams of the south and east sides, although copious, are comparatively short. The headwaters of the three principal rivers of the north coast, with upper ramifications, have nearly reached across the island in a southward direction. The easternmost of these is the Loiza, which rises only eight miles north of Arroyo on the south coast; the Rio de la Plata, which rises the same distance north of Guayama and reaches the north coast near the central meridian of the island, and the Rio Grande, which rises twelve miles north of Ponce, near Adjuntas, and empties into the sea near Arecibo.

Besides the wide alluvial plains near their mouths, to be described later, the lower stretches of these northeast streams present somewhat large areas of bottom land extending for considerable distances within the margin of the mountain area, rarely broadening out into local circular mountain valleys, but their upper portions are steep angular V-shaped gorges (quebradas), where habitations are confined to the slopes and not the valleys. There are other streams of the island which also present small areas of bottom land indenting the mountainous area for a very short distance from their coastal borders, notably the Portugues near Ponce on the south and the Añasco on the west.

The demarcation between the rugose-angular topography, the soils, and the geologic features of the coastal belt of the central mountain regions is well defined, and the most unobservant traveler can but remark the radical natural differences which take place upon passing from it into the lower-lying coastal plains and foothills, especially upon the south side.

On the west side of the north coast there are some exceptionally high hills which extend back as far as Lares and San Sebastian, and which might be considered truly mountainous, owing

MOUNTAIN CULTIVATION NEAR MAYAGUEZ

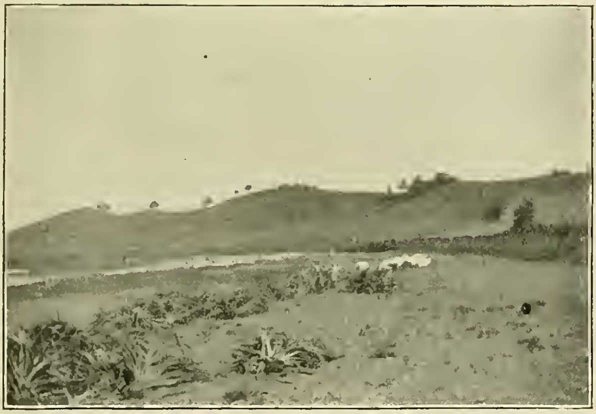
to their high elevation (1,200 feet) along their interior border and the fact that they are a part of the general mountain uplift. Along their inner border these are of remarkable pointed character, known in Jamaica as "cock-pits" ("Farallones" in Spanish nomenclature), and are appropriately termed by the natives "Pepinos" or cucumbers. These are numerous sharp-pointed

CULTIVATION OF MOUNTAIN SUMMITS

A SUMMIT IN THE SIERRA LUQUILLO

conical or flattened limestone hills, the remnants of a dissected cuesta or sloping plateau. When viewed from the mountains above they look like thousands of large white Sibley tents below. The interior hills of this group, which are most pointed, rise to 1,200 feet above sea-level, although they stand only 300 to 500 feet above the intervening valleys. The extent of this country north of Lares and San Sebastian we were unable to determine from personal study, but it apparently stretched below us to the northern seacoast. By the courtesy of Captain A. C. Macomb, 5th United States cavalry, we present the following interesting sketch of this region from his pen:

"As you look out to the north and northeast from Las Marias the eye sweeps over the valley of the Rio Guacio (Prieto, also Añasco), and the horizon is a hill formation made from the breaking down of a limestone plateau. This is the range of mountains that one strikes north of Lares. The range shows very strongly one mile north of San Sebastian, passes to the northwest, and juts out just north of Aguadilla. The railroad from Mayaguez runs into it at Aguadilla, and its very steep rugged hills of "worm-eaten" limestone are seen to the eastward from the car window.



BANK OF RIO LOIZA, COASTAL PLAIN

The railroad ends at Aguadilla on account of the hill region mentioned. The wagon road from Aguadilla on to San Juan rises rapidly on to the limestone plateau, over a rocky stiff grade; then the country carries the mind back to Texas—the surface gently rolling, sandy, and rocky, no mud, fine pasture sloping seaward (northerly), but reaching the sea in a bold bluff notwithstanding. When my troop struck this new country, free from the everlasting red mud, and were even able to raise a slight dust, a murmur of content rose from the column. The Guajataca cuts a great gash through the plateau, and its west bank is a rocky limestone bluff of 175 feet. By the winding road just east of the river we rise once more to the plateau and soon reach Quebradillas; thence to Camuy over a rocky and sandy road. The road falls gently into Camuy, which is just at the foot of the north face of the plateau, about one-half mile from the north coast. This coast is *generally rocky*, but here its surface is sand over limestone rock. At the sea itself is a range of sand hills 50 feet high—just drifted sand—and then a sandy beach, with the sea constantly breaking over the jagged teeth of broken and sunken reefs, here and there close into shore—a rocky rugged island, small and generally verdureless."

The coast-border topography may be broadly conceived as a narrow belt of low hills and plains encircling the main or mountainous mass of the island, and broken in continuity upon the northeast, southeast, and west by spurs of the central mountains which run across it into the sea. This border region of itself is an exceedingly diversified area, presenting two conspicuous major types of relief, coast hills, playa plains, and generally a third type which may be called parting valleys.

Seen from the sea the coast-border topography at the southwest end presents the aspect of a low tilted bench or plain, bluffing rather abruptly at the water's edge, and its summit gently arching toward the foot of the ribbed and corrugated front of the mountains. Here and there a stream from the mountains cuts across this coast bench and severs it into blocks of hills. These stream valleys are wide alluvial plains, frequently of a much greater area than the hills. The hills resulting from the dissection of this bench may be either round or oblong, according to the amount of erosion; but of whatever shape their slopes are always regular and void of the strong vertical corrugations and knife-edged salients which characterize the mountains. They are also distinguished from the interior mountains by their entirely different geologic composition, and on the south coast by their vegetation.

For want of a better word, the term "playa plains" may be used for the wide alluvial plains which sever the coast bench into

HILLS OF COAST BORDER, CAROLINA

A CERRO, SOUTH OF SABANA GRANDE

hills and are found at more or less frequent intervals along the entire coast, the borders of which delimit them. I have used the word playa plains for this feature merely as a convenient designation. The word " playa " means literally the shore or strand. Many of the cities of Porto Rico are situated upon the interior border of such plains, where they meet the foothills several miles from the port of entry at the immediate seashore, which is usually designated "playa," in order to distinguish it from the city proper. These plains are fan-shaped in area, with their broader base next to the sea, where they are often many miles in width, and stand only a few feet above the ocean. They are bordered by escarpments composed of the sharp rise of the coast hills, and extend backward up the stream valleys toward the central mountains with gently rising altitude until they pass into a mountain gorge or quebrada. These plains are composed of rich alluvial soil, principally reddish sandy loams, and constitute the sugar lands of the island. These are now what were formerly old alluvial river estuaries, which in late geologic time constituted bays indenting the land, and which have been reclaimed by the general elevation of the island.

These plains are in many cases so extensive that they now far exceed the area of the limestone bench out of which they were originally carved, and in places the surviving hills of the bench are almost entirely removed.

On the north coast the coast hills stand as steeply sloping solitary mounds or domes, rising singly or in chains above wider extents of plain lying between them and the mountain front. The citadels of San Juan are built upon a hill of this character, others of which rise to the east and west of the city as far as Rio Grande and toward Arecibo. They probably do not exceed 500 feet in height at their interior side toward the mountains, but exact measurements were not made.

On the southwest end of the island there are two parallel rows of hills separated from each other and the interior mountains by long and fertile valleys. The interior chain, which extends from north Cabo Rojo to within three miles of Yauco, passing west of San German, is of a peculiar type not seen elsewhere upon the

COAST HILLS NEAR CABO ROJO

island. It is a single chain of high rounded wooded hills of the type called knobs in this country and cerros by the Spaniards, which owe their configuration to a thick cap stratum of hard mountain limestone of Cretaceous age, the lower portion being composed of the softer tuffs and decomposing rocks of the interior mountains. Where this cap has been removed erosion has widened the valleys into great elongated plains or vegas.

From the southwest cape of Porto Rico to within three or four miles of Ponce, except where occasionally broken by playas, coast hills are finely developed along the shore. These hills, like those of the northwest coast, may be termed a dissected cuesta—that is, hills which are the remnants of what was once a steeply slanting summit plain. In this particular case the slant is from the central mountains toward the sea, where the hills are in some places terminated by a steep scarp or sea bluff 100 feet in height. The interior scarp of these hills faces the parting valley lying between them and the cerros and central mountains and is occupied by the lake of Guanica.

The playa plains are in places very extensive and in others are exceptional features. They are notably wide along the entire north coast from Arecibo *via* San Juan to the northeast cape; on the west at the mouth of the Añasco north of Mayaguez and south of the same city (the plain of Hormigueras), and along the south coast east of Ponce. Ponce is situated upon a typical playa plain extending for a short distance back of the city up the valley of the Rio Portugues and widening out to the coast. West of Ponce they are exceptional features, but well defined at the mouths of the principal rivers, the limestone bench being more continuous and less broken in this direction.

Similar plains occur at intervals to the eastward of Ponce at Salinas, Guayama, Arroyo, and Jacaboa. Extensive playa plains of this character are also met with on the east coast near Naguabo, Ceiba, and Fajardo, and on the north coast reaching up the valley of the Loiza as far as Carolina.

From San Juan to Camuy, according to Captain Macomb, "the railroad follows the south edge of the coast plain, here and there cutting through a little shoulder. The plain is but a narrow strip until close to Arecibo, when we strike a cane country, the sea to the left one-half mile or more and the mountains some four miles to the south. At Camuy, the railroad terminus from San Juan, the north coast plain is terminated by striking the rising ground of the Pepino hills."

The name "parting valley" I have given to certain long and narrow valleys which sometimes occur where foothills of the limestone bench abut against the front of an elongated mountain range. Certain streams which come from the mountains and cross the lower country tend either to bend along the mountain front as they pass from it or to send out laterals parallel to the same. The erosion attendant upon such phenomena tends to produce long valleys at the junction of the mountains and foothills running parallel to them. Parting valleys of this character are especially well developed on the south side of Porto Rico, such as the plain of Saba Grande and the depression of Guanica lagoon. The former is a long valley extending east and west between the Cerro Gordo hills and the interior mountains, threaded by the Rio Grande of Mayaguez. Continuous erosion in the future would soon reduce this valley to sea-level and cut off from Porto Rico as an island a long strip of country between the River Susua and Rio Grande. This particular valley is given up almost entirely to the extensive culture of Indian corn.

South of this valley and separated from it by the Cerros is the parting valley of the Laguna de Guanica, extending from near Guayanilla to the port of Cabo Rojo. This is a narrow east-and-west valley nearly at sea-level, lying between the Cerro hills and the narrow rim of coast hills, the latter separating it from the sea. The Laguna de Guanica occupies the east end of this valley, and has outlet to the sea by a narrow passage cut through the limestone hills. Parting valleys of a similar character are developed in many places around the remainder of the island, although perhaps not quite so extensive in area.

The following data will give an idea of the relief of the coast-border topography:

Altitudes of Points along the Southern Coast Border Region

	Feet
Guayanilla, level of the plaza[2]	36
Guayanilla, highest level of the hill of modern limestone surmounting the bay[2]	278
Garganta de la Torre (Pass of the Tower) route from Yauco to Sabana Grande[2]	616
Limestone hills between Ponce and Guayanilla[2]	331
San German, house of Don Ramon[2]	229
Level of the modern shells to the north of the Hacienda de Delgado, north of Cabo Rojo	98
Cabo Rojo, casa de Cabaza[2]	278
Hacienda de Delgado, Cabo Rojo[2]	46
Sabana Grande[2]	305
Level of the superficial deposits of modern shells on the hill situated to the south of the hacienda[2]	314
Mayaguez, level of the plaza[2]	68
Ponce, Hotel de Girl, in the heights of the city[2]	75
Ponce, Moreno Hotel[2]	33
Hacienda la Carlota (Guayama)[2]	141
Coamo-arriba plaza[2]	413
Hot spring of Coamo[2]	190
Coamo-abajo, hotel[2]	29

For references, see footnote on p. 97.

There are several minor and exceptional features in the configuration of Porto Rico which are more developed upon the other Great Antilles, notably a few interior mountain valleys, the bordering benches of elevated coral reef, the coast lagoons or lakes, and the mangrove swamps.

The interior mountain valleys are not conspicuous or abundant features, nor are they completely closed (without drainage outlets) like those of Jamaica, but are local widenings of the stream-valleys which formerly reached slack water a considerable distance within the marginal area of the mountain mass, when the present coast bench was submerged beneath the sea. The valley of Caguas is the most conspicuous example of this type. This is a wide amphitheater, a considerable distance within the mountain area, and its bottom is filled with old alluvium. It stands at present about 250 feet above the sea.

WEATHERED MOUNTAIN ROCK

Elevated reef benches or soborucco, so abundant in Cuba and forming the narrow coast rim of hard rock protecting a softer interior, thereby producing the excellent pouch-shaped harbors of that island, are but faintly developed in Porto Rico. I saw this material only at the entrance of San Juan harbor, but my studies of the littoral were not extensive. San Juan, Jabos, and Guanica, however, are the only pouch-shaped harbors of Porto Rico, and I believe that their general absence is largely due to the lack of the elevated reef formation.

The coast lagoons or lakes are collections of water in swales of the coastal plain on the north and in parting valleys of the type of that of Guanica, previously described.

Mangrove swamps are extensively developed around the interior margin of San Juan harbor.

It is not my intention to burden this paper with geological detail, but inasmuch as all the cultural and natural aspects are intimately associated with the geologic structure, a few words upon this subject are absolutely essential—in fact, I have seen no region where these phenomena were so intimately related.

The chemical and physical composition of the soils are two of the chief factors producing vegetal differences in the southern United States and tropical America, altitude being next, and rainfall, owing to its general abundance, the least appreciable one. Inasmuch as the soils of Porto Rico, with the exception of that of the playa plains, are all residual—the surface decay of the underlying rock—it is impossible to make a clear presentation of the forestry conditions without presenting a few elementary geological descriptions. The chief and most radical differences in flora (excepting altitude, which is relatively a less important factor in Porto Rico) are those occurring between clay and calcareous soils, especially in the tropics, where the latter is of an open-textured white limestone which abounds from Florida southward, but is not common in the United States.

The mountains are composed largely of black or other dark-colored basic igneous rocks, occurring as tuffs, conglomerates and sills of hornblende-andesite, cut by dikes of diorite. While these rocks are of volcanic origin, there are nowhere any signs of recent or late geologic volcanism, such as craters, unburied lava flows, cinder cones, etc., all original volcanic forms of topography having been destroyed by erosion, to which are due the present features of configuration. Besides, much of this volcanic material has been worked over into sediments in prehistoric ages and now occurs in well defined strata.

Included in this mass of volcanic rocks are two limestone formations, interbedded with them and relatively inconspicuous in area. One of these, found on the crest of the island near Cayey and Aibonito, is a black bituminous shaly limestone interbedded with the volcanic conglomerate. This calcareous horizon is fully 1,000 feet thick, apparently upholds the crest of the Sierra, and weathers into soils noted as the best tobacco lands on the island. The other is a light gray crystalline limestone with Cretaceous fossils (Rudistes). It is seen outcropping on an east and west line from near Cabo Rojo to fifteen kilometers north of Ponce on the Adjuntas road, and has no special agricultural value, but the natural vegetation is always noticeably different where these rocks occur.

VOLCANIC TUFF FORMATION OF THE MOUNTAINS

The upper part of the Pepino hills is made up at their surface of a rather hard lime marl full of coral heads, with occasional indurated strata of firm white porous limestones. These rocks (the Pepino formation) are of Miocene age, as determined by Mr T. Wayland Vaughan from the corals collected by me, similar to certain rocks of Antigua hitherto not known in the geologic sequence of the Great Antilles. Their tilted position, standing at 1,200 feet where they meet the older volcanic mass, testifies to the great geologic movements which have taken place in the West Indies in late geologic time.

Below this limestone, which is at least 100 feet thick, are fossiliferous greensand marls of undetermined age (Eocene or Oligocene), which in turn rest upon a great thickness of thinly stratified reddish lignitic clays and sands of Eocene age (the Richmond formation) which outcrops near San Sebastian, Guatemala, and Mocha on the western end of the island, and near Carolina on the northeast coast.

The south coast hills are composed entirely of chalky or other loose-textured glaring white limestone of a very porous character, often chalky, which was deposited around the margin of the mountainous island mass when it was submerged about 600 feet lower than it stands at present. These are largely of Pleistocene age, although some of the lower strata may be as old as the Oligocene. Their surface is often covered by the peculiar efflorescent calcareous precipitate known in Mexico as tepetate, which forms a shallow subsoil or pan.

The playa plains are composed entirely of alluvium, derived mostly from the mountain formations, but also mixed with the débris of the adjacent white limestone hills, generally reddish in color, except that which is derived from the Pepino hills, which is a black calcareous soil. These extensive alluvial deposits are of a loamy nature, combining essentially the qualities of the residual soils, both of the clay mountains and the calcareous foothills, with the additional advantage of a more loamy physical structure adapted for better drainage and root penetration and general cultivation.

The geologic history of the island may be briefly summarized as follows :

The earliest positive chronology that can be fixed at present is Cretaceous time, when the island, in common with the other Great Antilles, was the site of active volcanism, which resulted in the piling up of vast heaps of igneous rocks now constituting its mass.

At the close of Cretaceous time and during the beginning of the Tertiary this volcanic material was water-sorted and converted into marginal sea sediments, as represented in the stratified tuffs, conglomerates, and fossiliferous Cretaceous and Eocene rocks. The history of Porto Rico during Oligocene time is obscure, the vast thicknesses of white limestone of that age which occur in Cuba, Jamaica, and Santo Domingo not having as yet been detected upon the island. It is supposed, however, that the island, together with the other Great Antilles, suffered great subsidence during this epoch.

In late Tertiary time all the aforesaid rocks were uplifted and deformed into their present mountainous aspect, in common with the general Antillean uplift of that epoch. The exact period of this uplift in the later half of the Tertiary has not as yet been fixed, but it was largely accomplished before the close of the Miocene epoch. The tilted Pinones strata of Miocene age, at the northwest corner of Porto Rico, clearly show that the movement was not completed until after the close of the Miocene. In Pleistocene time the island suffered minor oscillations of elevation and subsidence, resulting in the present erosion and configuration of the coast-border topography.*

*The complicated geologic history of the Great Antilles is set forth in detail by the author in the Bulletin of the Museum of Comparative Zoölogy of Harvard College, which is now in type and will probably be published before this article appears.

The mountain areas present but little, if any, barren indurated rock surface, but are covered with a deep red arenaceous clay soil, to which vegetation clings tenaciously. Decay is so rapid under perpetual warmth and moisture that the volcanic rocks constituting the major area quickly rot and weather. This mountain soil is one of the most marked features of the island, and to it are largely due many of its agricultural and forestal conditions. Were it less tenacious and sticky than it is (and language can hardly convey an idea of the unctuousness of this stickiness, which is especially disagreeable as a road material), the mountain slopes of Porto Rico would now be washed and dreary wastes of barren rock.

Owing to this soil, which clings to its framework, the mountains are cultivated to their very summits, verticality of slope presenting no obstacle to cultivation in the minds of the natives. I have seen the steepest possible slopes cultivated to the highest degree in coffee and tobacco—in fact, the most productive crops of this character are grown upon declivities upon which the American farmer would not risk the danger to life and limb.

As a result of long cultivation, much of the soil of Porto Rico is now abandoned and in the condition known throughout the English-speaking West Indies as "ruinate." This has resulted from overcultivation, from the failure to apply fertilizers, and in some cases from erosion. Land of this character was observed by the writer in many parts of the island. On the north coast, in the vicinity of Rio Grande and Carolina, ruins were seen of what were once houses of extensive sugar estates, the former fields being grown up in grass. In the western part of the island, in the high summit region seen in passing from Adjuntas to Lares, many abandoned fields were observed, which are now entirely denuded of trees and cultivated crops. Considerable areas of ruinate were also observed on the south coast, between Juana Dias and Ponce. The reclamation of these lands by forestization or other methods of scientific agriculture is one of the problems which Porto Rico presents to the civilization of its new owners.

The climate of Porto Rico is being well studied upon the ground by Professor Mark W. Harrington, of the U. S. Weather Bureau, and I shall not attempt to describe it other than to state a few facts concerning its bearing upon the distribution of life and culture. Professor Harrington has already published many new and interesting facts concerning the climate and its local variation, which will be mentioned in a future article.

The whole island may be divided into a wet and a dry belt, on the north and south sides of the central Cordillera, respectively. The greatest rainfall, which sometimes attains 120 inches a year on the slopes of El Yunque, is at the northeast end. On the south side, from Guayama to Cabo Rojo, the region is dryer, but the whole island is wet in comparison with the standard of the United States. The higher mountains are slightly cooler than the coast belt, but the temperature is so uniformly warm that altitude has but little bearing upon distribution of vegetation. The mountains are constantly bathed in moisture, either by daily rainfalls or dense mists which collect upon them at night, except upon the lower portion of their southern slopes; hence it may be said that the superfice is never dry and the subsoil is constantly saturated in the mountain region.

On the southern coast, however, owing both to the porosity of the limestone, which quickly drains off the moisture, and the generally dryer climate, the surface above has a parched and arid look, especially in the long dry season. Some portions of this south belt are very arid, and great complaint was heard upon the island in places that the rainfall for the past two years had been insufficient for domestic supply. In fact, in order to cultivate the staple crops of the lowlands of the south coast, irrigation is necessary and is practiced with great skill and at considerable cost along the whole southern border from Guayama to Cabo Rojo.

In a subsequent article I shall set forth the economic geography of the island, and show the intimate relation which exists between the configuration and geology, which I have described, and the vegetal conditions—the agricultural, hygienic, and commercial capacities.

Note.—In order to meet the wishes of the author, the name of the island treated of in the foregoing article is spelled in the form commonly in use in England and the United States. The form "Puerto Rico" is that commonly used by the people of the island itself and by those of other Spanish-speaking countries, and is good Spanish. It is the form adopted by the U. S. Board on Geographic Names, in accordance with its logical principle of adopting for other countries the names by which they are known to their own inhabitants. The Editors wish it to be understood that in acceding to Mr Hill's request in this trifling matter they are not establishing a precedent.

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SOURCE OF THE LITTLE FORK OF THE SASKATCHEWAN

THE

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Vol. X APRIL, 1899 No. 4

SOURCES OF THE SASKATCHEWAN

By Walter D. Wilcox

The Saskatchewan, one of the larger rivers of North America, takes its source in the rugged fastnesses of the Rocky mountains, and flows eastward over the sparsely inhabited plains of southern Canada till it reaches Lake Winnipeg. Save for a rapid at its mouth, the river is navigable for steamboats for about 1,000 miles. Strangely enough its two chief branches come from the same ice-fields in the high Rockies, and after diverging several hundred miles unite far out on the rolling plains about 900 miles from their source.

From the Canadian Pacific railway the easiest way to reach the headwater tributaries of the Saskatchewan is by ascending the Bow river to its source. My friend, Mr R. L. Barrett, and I left the station of Laggan on July 12, 1896, bound northward, in the hope of reaching the Athabasca pass and measuring the height of Mt Brown and Mt Hooker. For such an extensive journey, which would require two months to accomplish, we had five saddle-horses and ten pack-horses to carry our provisions and camp necessaries. To manage the horses and arrange our camps we engaged two skilled packers, Tom Lusk and Fred Stephens (the latter an expert axman) and also a cook.

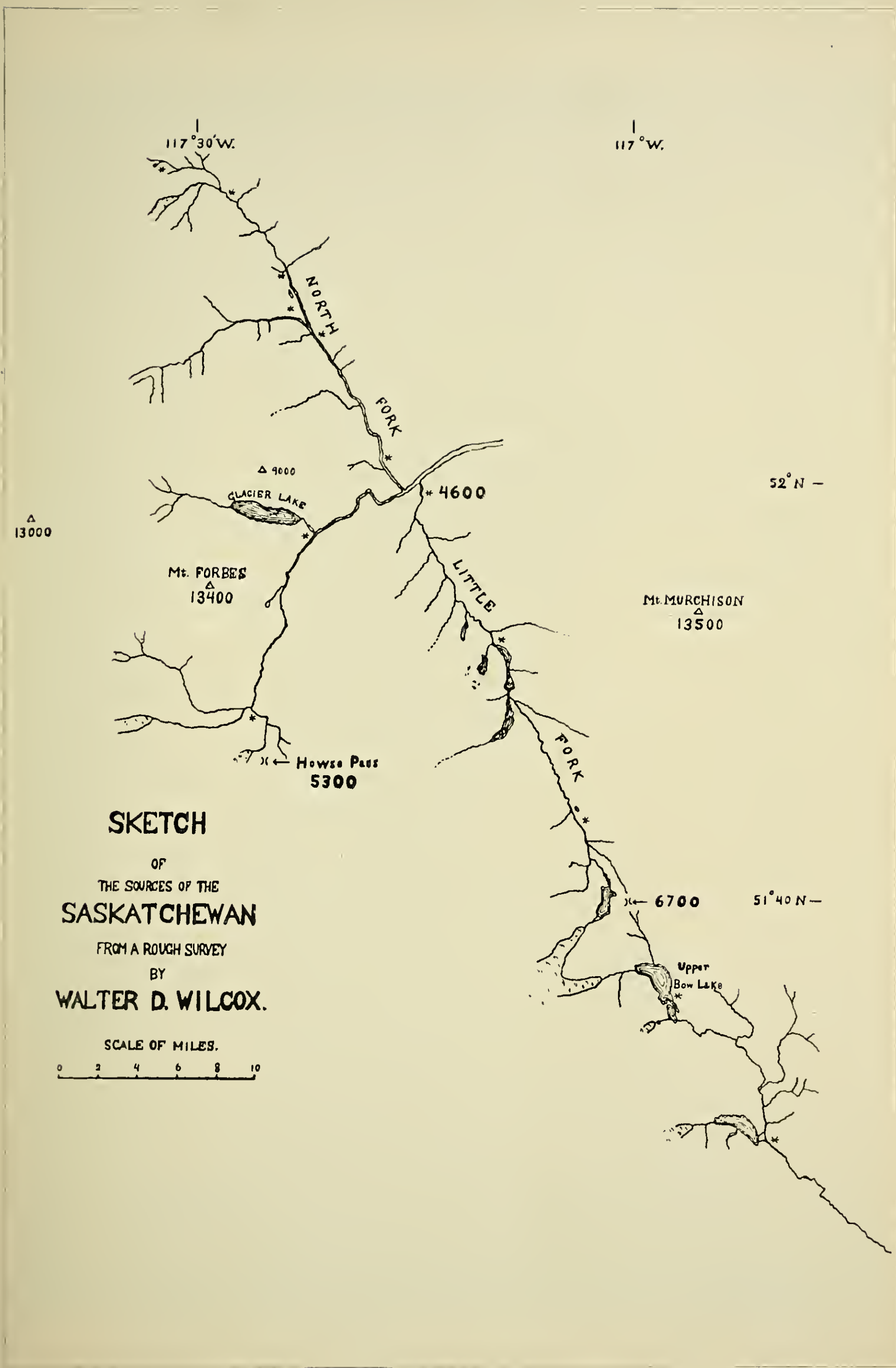
On the third march from civilization we came to the upper Bow lake, which is about 20 miles from the railroad. This lake, though only four miles long, has fine surroundings, being closely pressed by grand precipices hung with ice and frequently echoing to the thunder of avalanches, while its indented shores and green forests make it one of the most attractive spots in the

Rockies. A muddy stream descends from a glacier beyond the head of the lake and pollutes its clear waters, while a trout brook comes from an upland valley lying to the northwest, and this latter stream is perhaps the true source of the Bow. Up the valley countless springs and melting snowbanks, with large tracts of swampy land, contribute their waters from every side. The level of the valley rises into a gently sloping plain, the last rivulet is passed, and one stands on the divide overlooking the Little Fork of Saskatchewan river.

Those who have reached this region have had an opportunity of seeing one of the grandest views that the mountains offer. Far to the west are the lofty peaks of the highest range of the Canadian Rockies, buried in perpetual snow and discharging their surplus ice by glaciers in every lateral valley. Deep set amid dark precipices, such a glacier is to be seen west of the pass. From two cavernous ice-tunnels a large stream issues and sweeps in a devious course over a barren gravel-wash for a mile or more, till it enters a lake. Then, as the clear stream leaves the lake and winds away to the northwest, it is lost to view, hidden amid deep forests, and only reveals its course here and there where it expands into one or another of the many lakes which this valley contains. Between the spurs of the summit range on the west and a parallel range on the east, the great trough or valley which carries the Little Fork and the North Fork of the Saskatchewan draws away in a nearly straight line for more than 60 miles, till it is lost in the blue haze of distance.

The summit of the pass is a delightful region, situated at an altitude of 6,700 feet, or only 300 feet below tree-line. The woodland is consequently rather open and abounds in meadows, while the spruce trees, many of which must be four or five centuries old, have that symmetrical beauty of form rarely seen where there is less space and light in the crowded forests of the deep valleys.

It seemed best to camp on the summit, as a forest fire had broken out in the Little Fork valley some miles distant and was sweeping furiously up the mountains to the east. Mr Barrett and one of the packers spent the next day in making a horseback excursion to investigate the extent of the fire and see if there was a way through. They returned in the evening, after a hard day's travel, without having reached the fire. It was evident that the distance had been much underestimated, perhaps owing to the great extent of view from the pass; but it was


117°30′W.
117°W.
NORTH
FORK
△ 9000
GLACIER LAKE
4600
52° N
△ 13000
Mt. FORBES
△ 13400
LITTLE
Mt. MURCHISON
△ 13500
FORK
Howse Pass
5300
SKETCH
OF
THE SOURCES OF THE
SASKATCHEWAN
FROM A ROUGH SURVEY
BY
WALTER D. WILCOX.
6700
51°40 N
Upper
Bow Lake
SCALE OF MILES.
0 2 4 6 8 10

SCENE ON THE LITTLE FORK OF THE SASKATCHEWAN small comfort to know that the fire was farther off than had been supposed, as we had to change our idea of its magnitude. As there was nothing to be gained by waiting, we moved a short march into the valley the next day.

The descent into the Little Fork valley is much steeper than on the other side of the pass, and in the first three miles the trail drops about 1,000 feet. These mountain trails were used by the Indians long before the whites came into the country. In every important valley, especially where game abounds, there are trails which prove of great value to the traveler.

As our horses were winding through a deep forest, a bird appeared which resembled a pine bullfinch, flitting from tree to tree and following us closely. Somewhat later it gave the most remarkable instance of tameness that I have ever seen. Having followed us for about two miles, it waited in a tree during the bustle and confusion of making camp, but in the afternoon, when all was quiet and some of our men were asleep, the bird became exceedingly familiar, walking on the ground near us and finally perching on our extended hands. It was soon evident that the object of our visitor was to catch mosquitoes, which were hovering in swarms around our heads. It pecked at a ring on my hand, at our needles, and in fact any metal article, but the climax was reached when by accident the bird saw its own image in a small looking-glass which lay on the ground. Then, with extended wings and open bill, it uttered cries of rage and pecked madly at the glass in which an enemy appeared. Among the solitudes of mountain forests squirrels, finches, and whiskey-jacks often show unusual confidence in man, but this particular instance is remarkable, because the bird would alight on our persons even after it had been momentarily though gently detained several times as a prisoner in my hand.

Further investigation showed that it was possible to get our horses through the fire, which had spent its energy on a large extent of green timber, so after three hours' travel from camp we came to the burning trees, where the fire was advancing slowly, as there was a calm. Then came several miles of the recently burned area, now changed to a forest of blackened sticks, some of which were already fallen, with here and there a column of smoke rising from smouldering moss, and everything half concealed in a snowy covering of ashes. At the other edge of the fire there was more danger, and frequently some tree would flash up and send a scorching heat toward us. We were chiefly anxious that the packs should not take fire and cause a stampede among the horses, so for a considerable distance we drove our animals along the edge of a lake and frequently waded deep in the water to avoid the heat of blazing trees.

After an exhausting march of six hours we made our camp in a muskeg, or swamp, about half a mile from the fire. The wind, however, which had been increasing for a time, began to carry the fire toward us, and our situation soon became alarming when some heavy timber began to blaze and the columns of flame, shooting hundreds of feet into the air, made a terrifying roar, which caused our horses to stop feeding. At one time a funnel-shaped whirlwind about 200 feet high formed over the heated area and remained there a few moments.

At the rate of progress the fire was making, we should soon have been surrounded had we not packed up and moved a mile further down the valley. The second camp was made by the side of a considerable stream, wide enough to stop the fire; but toward evening cloud banners began to form at the peaks of the mountains, and next day, after many weeks of drought, rain fell steadily for ten hours and fortunately extinguished for a time the fires that were destroying this beautiful valley.

We were now two days' journey down the Little Fork valley, a distance of about 18 miles in a straight line. We remained in camp the next day to do a little survey work from a mountain to the east. From this point, at an altitude of 8,000 feet, the Little Fork valley appears straight, deep, and comparatively narrow, with a number of lateral valleys coming in from the west side and cutting the mountain masses into projecting spurs. The strata of the mountains are for the most part nearly horizontal, and the cliffs are frequently almost vertical. There were six lakes in view from our survey point, of which two, each about a mile long, were merely expansions of the river, three were in lateral valleys, and one lay far up the valley where the river takes its source. The lateral valleys head in the summit range to the west and probably have never been visited.

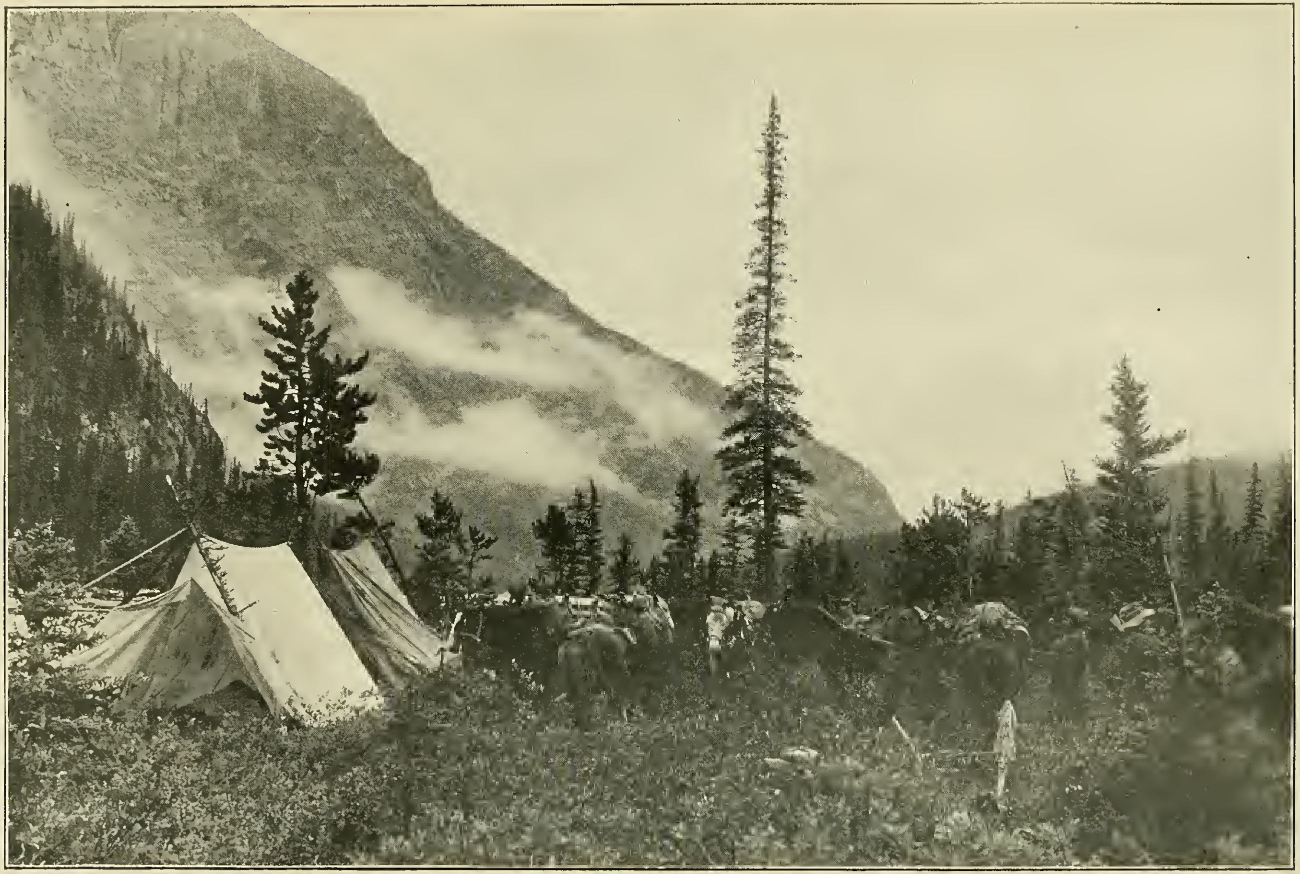
The scenery is very grand near the lakes. A striking peak about 10,000 feet in height, with a precipitous rock face and wedge-shaped summit, stands guardian, and, together with the jagged mountains near it, helps to give a gloomy, fiord-like appearance to the region. Mt Murchison is supposed to lie in a group of mountains to the east of this place, and, as seen from the Pipestone pass by Dr Hector, was estimated to be 13,600 feet high. It has never been seen from the Little Fork valley, though it cannot be more than 10 miles distant.

On July 22 we marched six hours, and reached Saskatchewan river. The trail is very good, and runs for many miles through forests of splendid timber, especially in the great valley of the Saskatchewan. At the forks or junction the Saskatchewan is a rapid stream about 150 yards wide and apparently quite deep, and the pure blue waters of the Little Fork are soon lost to view in the muddy volume of the main river. The Saskatchewan valley is about four miles wide at this point, the river itself flowing between bluffs of glacial drift, and while the massive mountains on every side are between 10,000 and 12,000 feet high, they are less imposing than usual because of their distance. The main river runs about northeast, cutting through the mountain ranges, and taking its source to the southwest among the highest glacier-bearing peaks of the summit range.

A very large tributary, which we called the "North Fork," comes in from the northwest and joins the main river about one mile above the Little Fork. This river is not correctly placed on Palliser's map, nor was there any available information about the region whence it comes. Even Stony Indians who travel through these mountains know little of this river, because, it is said, many years ago one of their tribe was lost while hunting in that region, and they think he was destroyed by an evil spirit dwelling there. At all events, they will take no chances in visiting that part of the country now.

Our route to the Athabasca, however, lay up this river, and our first duty was to find a ford across the Saskatchewan. A day was spent in finding a safe place, as the river was in summer flood, though not at its highest stage. Mr Barrett, with characteristic energy, discovered a ford about one mile upstream, where the river spreads out among low sand islands to the width of nearly half a mile.

A sense of relief came when, the next day, after fording the turbulent Little Fork, we had crossed the main river, which is of great size at this point, only 30 miles from its most distant source, and were safely on its north side. Turning northward along a high bluff, we came in a short time to the North Fork, which appears to equal the so-called Middle Fork or main river. About one mile above its mouth the North Fork flows between rocky banks, and there is a fall or rapid in a constricted channel blocked by immense masses of fallen cliff, where the water surges



CAMP SCENE ON THE NORTH FORK OF THE SASKATCHEWAN in foaming breakers and dark whirlpools. For a mile or so above this fall there is a fine trail through a light pine forest, and then comes a burnt area with trees crossed in such confusion that it required two hours to make half a mile, and we were so much delayed here that our progress for the day could not have been more than three miles in nearly six hours.

On the following two days we advanced about 10 miles up the valley, having a trail wherever there were green forests, but suffering much delay from burnt timber and muskegs. On one occasion when marching along a steep bank of the river a pack-horse stumbled among loose logs and rolled over into a deep pool. The horse was carrying over 200 pounds of flour, a burden that kept it for a short time at the bottom of the river, but after some violent struggles it came right side up and climbed out. No damage was done, however, as flour absorbs water only to a slight depth and very soon makes an impervious layer on the outside.

Ten miles up the river a stream from the west unites with the North Fork. As the two streams are about equal in size we were at a loss which one to follow in order to reach the Athabasca. In order to get a more extended view of the country, an ascent was made of a mountain which lies between the two rivers. On the summit, at an altitude of 8,400 feet, it was seen that the western stream takes its source in a large glacier about 12 miles distant. A fair idea of the branch streams was given by the valley openings, but it must be confessed that less is known about this river than of any other source of the Saskatchewan under discussion. As a result of this ascent we were firm in the belief that our route did not lie up the western branch. The other valley, however, seemed exceedingly deep, canyon-like, in the very short distance that it was visible at all. Though the air was smoky from forest fires, in spite of considerable rainy weather of late, I tried some photographic work, and during a brief but fatal moment, when I was reaching for a plate-holder, the strong wind blew my camera over and broke it badly on the rough limestone rocks. The most fragile parts, the ground glass and lens, fortunately escaped, while the wood and brass work were in pieces. With a tool-box carried for such emergencies the camera was reconstructed after a few hours' labor and did excellent work later in the trip. Our men returned in the evening and reported that there was a trail in the deep valley to the northwest.

The next two days we advanced only about ten miles because of the uncertainty of the trails, the rough nature of the forests, and repeated crossings of the river. Our progress was slow in spite of our custom of having one or two men explore and cut out the trail for the next day as far as possible each afternoon. In this place the river is at the bottom of a narrow valley, the sides of which are smooth precipices adorned here and there by clumps of trees clinging to the ledges. Streams and springs from far above come down in delicate curtains of spray or graceful waterfalls wafted from side to side by every breeze. The flood of glacial waters sweeps over a gravel-wash in a network of channels, with the main body of water swinging from one side to another of the valley and washing against steep or inaccessible banks. This condition of things caused us to cross and recross the stream almost constantly, and, though the fords were in general not more than three feet deep, the icy waters ran with such force that our crossings were not without excitement. In spite of the best judgment and care of our packers horses got beyond their depth several times and had to swim across. As the saddle-horses are guided by riders, they rarely lose their footing, but the pack-animals, coming along in a bunch, confused by the shouting of the men and the roar of the rapids, hesitate and often enter the river a little above or below the best ford, and so get into deep water. Dangerous rapids or a log jam below make such occasions critical, not alone for the safety of the horses, but even for the success of an expedition in case a large quantity of provisions is lost. Pack-horses cannot swim very far with their tight cinches, and moreover the icy waters of these mountain streams paralyze their muscles very quickly.

The trail at length leaves the river and makes a rapid ascent through forests on the east side of the valley, so that in an hour we had gained 1,000 feet. Through the trees we caught glimpses of magnificent scenery, the uniting streams in the canyon bottom, the mountain sides heavily timbered or rising into snow summits, and to the west an immense glacier, which was the source of the largest stream. The North Fork was rapidly dividing into its ultimate tributaries. The sound of mountain streams falling in cascades, the picturesque train of horses, each animal cautiously picking a safe passage along the rocky pathway; the splendid trees around us, our great height, and the tremendous grandeur of the mountain scenery, all helped to make our surroundings most enjoyable. Above the sound of

FALLS ON THE NORTH FORK OF THE SASKATCHEWAN wind in the forest there was presently heard the roar of a waterfall, and half a mile beyond we saw a large stream apparently bursting from the top of a fine precipice and falling in one magnificent leap down a great height. Through a notch in the mountains there was another fall visible some miles distant fully twice as high as the one near us. It was learned later that every stream descended into the canyon by a fall and a succession of cascades.

We camped in a beautiful wooded valley with much open country at an altitude of 6,300 feet above the sea. Near our tents was the river, which at this place is a comparatively small stream of crystal clear water. In the afternoon I ascended, with one of the men, a small mountain which lay to the west of our camp. From this summit two passes were visible, one five miles to the north and the other more distant and toward the northwest. The view to the west was more extended. There was a large straight glacier, directly before us, the one we had seen earlier in the day, which supplies the greater part of the water of the North Fork. At least six or seven miles of this glacier is visible, and it may extend much further behind the intervening mountains. The glacier has no terminal moraine, and slopes by a very even grade to a thin knife-like edge, in which it terminates.

The next day Mr Barrett went off to climb, if possible, a mountain over 11,000 feet in altitude, north of our camp, while one of the packers and I started to explore the pass to the northwest. The other packer spent part of the day investigating the other pass. This division of labor was a great saving of time. At our conference that evening, which did not occur till midnight, when the last member came into camp, it was decided that the pass to the north seemed unfavorable as a route to the Athabasca. Mr Barrett failed in his ascent because the mountain was more distant than it appeared. The pass to the northwest was more favorable, and on the next day we moved our camp so as to be almost on the summit. The last and longest branch of the North Fork comes from a small glacial lake on one side of a meadow-like summit and at the base of a splendid mountain, a complex mass of rocky arêtes and hanging glaciers.

Upon further inquiry we learned that the valley as it descended to the northwest was blocked by a glacier that came into it, and beyond that a canyon, which made this route altogether out of the question. A high valley on the right, however, offered the last and only escape for us, and after reaching an altitude of

8,000 feet our descent began into a valley that we knew must be either the Athabasca or the Whirlpool river, which flows into the Athabasca. Thus the most critical part of our expedition, the discovery of a pass from the Saskatchewan to the Athabasca, was safely accomplished. It is highly probable that ours is the first party to go over this route. Though now twenty-six days out from Laggan, we were only a little more than half way to the Athabasca pass, but a description of that country would carry us beyond the subject in hand.

It was not until late in the season of 1898 that I had an opportunity to visit the source of the Middle Fork of the Saskatchewan. For this trip I engaged as packer William Peyto, a man who had proved very efficient on previous expeditions; also a cook and an outfit of nine horses.

It seemed almost foolhardy, when on October 12, against driving snow showers and a cold wind, we set out from Laggan and once more resumed our toilsome march through the many miles of burnt timber northward, as it were, into the very teeth of winter. Through constant snowstorms—for the headwaters of the Bow are a breeding place for bad weather—we passed the upper Bow lake, the divide beyond, and got six miles down the Little Fork on the third day, as a result of forced marches. During the following night there was a curious creaking sound of the tent ropes and a sagging of the canvas, and in the morning our prospects for a successful trip were very gloomy indeed, with ten inches of new snow on the ground. Not wishing under these circumstances to get further away from civilization, we remained in camp all day. By afternoon the snow ceased, and the next day we were again on the march. The snow was fifteen inches deep in the Little Fork valley, but only half that depth near the Saskatchewan, which we reached on the sixth day.

On October 18 we crossed the Little Fork and turned westward into a region that promised to be full of interest. The weather, which had been cloudy and threatening for some days, now gave signs of improvement by the appearance of blue sky in the west, and soon after the high mountains up the Middle Fork were bathed in sunlight, the dazzling light on the snow-covered landscape being very cheering after the days of gloom and storm. The trail penetrates a forest on the south bank and, frequently coming out on the river, allows views of the wide, log-strewn gravel-wash, the work of summer floods.

About five miles up the river a valley comes in from Glacier lake, and our camp was placed on a point of land between the confluent streams. The Saskatchewan at this cold season is clear as a mountain spring and shallow enough to be fordable on foot. In summer, however, it is a raging flood that makes the region of Glacier lake very difficult to reach. From our camp I set out in the afternoon to see the lake, and found it in an hour, though not without a hard scramble through deep snow and fallen timber. The view was well worth the labor expended. The lake, which is three or four miles long, is beautifully set among high peaks, and at the farther end a snow mountain sends down a glacier nearly to its level. The setting sun sinking into a notch of the distant mountains poured shafts of light through gray, misty clouds and tinged their edges with a pale golden illumination. The lake was nearly calm and reflected the beautiful picture of mountain and sky from a tremulously moving surface. The water, by retreating from its summer level, had exposed a wide margin of mud-covered boulders and slippery logs—the trunks of trees carried into the lake by snow slides—but in the distance the forested banks seemed to press close upon the water. There was something wonderfully impressive in the awful solitude of such a scene under the spell of evening calm.

From what had been seen of the country I decided that it was important to reach, if possible, the summit of a high mountain that lay to the east of the lake, which from its position would command a comprehensive view of the whole region and also surely reveal Mt Forbes, which was somewhere west of the lake, according to Palliser's map.

Accordingly I was afoot the next morning at nine o'clock, with a camera on my shoulders, ready for the ascent. The mountain appeared to be about 7,800 feet in altitude, or in round numbers 3,000 feet above our camp. The weather was bright and cold, nor was there a cloud in the sky, and it proved by far the best day of the trip. It appeared that the walking would be better on the other side of the Glacier Lake stream, and after some ineffectual attempts to bridge the river by felling trees, Peyto carried me across on his back in a shallow place, and so the climb was commenced with dry boots. In less than five minutes a fine trail appeared, which saved a great deal of labor and considerable time in getting to the lake. The trail at length diverged to the east toward the mountain and went in the right direction until the altitude was 600 feet above the lake, effecting a great saving of energy in forcing our way through the underbrush. The sunlight was painfully brilliant on the snow, which was fully a foot in depth at 7,000 feet. At this altitude, in a last clump of spruce trees, I hung my camera to a branch and took a short rest, as the climb so far had been very exhausting.

After a pause of ten minutes the sharp air urged a recommencement of the ascent. The brilliant glare of an hour previous had given place to a somewhat cloudy sky, as a belt of heavy cirrus was drifting along over the mountains in a great line running north and south. The sun shone through it feebly, and was surrounded by a halo. I soon began to have doubts of my ability to succeed in the ascent, as my strength began to fail under so much exertion in the deep snow. The bushes, rocks, and other inequalities of the ground were buried, so that I frequently stumbled and fell. Moreover, it now became apparent that the size of the mountain had been much underestimated, for the heights on the right rose tremendously even after an altitude of 7,500 feet had been reached. The inclination was very steep, and the glare of the now returned sun on the vast expanse of snow and the absence of anything to fasten the eyes upon for relief produced a curious sensation of dizziness, due perhaps in part to exhaustion. I felt, however, the importance of reaching the summit, as it meant practically the success of the entire trip. Moreover, the extraordinarily fine weather on this critical day of the trip seemed too providential to be lost from any lack of exertion or ambition.

Summoning, then, all my resolution, I made reasonable progress for a time, but soon, in spite of every eager desire for success and ambition to reach the summit, the contest between will-power and tired muscles became doubtful, as the snow grew deeper with higher altitude, the slope steeper, and the far-off summit seemed no nearer. Every few yards of progress was invariably terminated by a fall in the snow, and it seemed better to rest for a moment in whatever position chance had it than to get up at once.

A little later a view appeared that in itself well repaid the labor of the climb. On the right was an expanse of spotless snow, exceedingly steep, vast in extent, and dazzling in brilliancy. Its rounded contours were sharply outlined against the sky, but there was no interruption of stone or cliff in the monotonous covering of snow, nor any scale by which to judge of size or distance. The chief object of interest in the view was a

VIEW OF MOUNT FORBES FROM AN ELEVATION OF ABOUT 9,000 FEET snowy, triangular peak covered with ice, which now began to appear in the west. The colors of rocks and cliffs in the distant peaks and precipices seemed absolutely black in contrast with the remarkable whiteness of the snow surface on all sides. Overhead the sky was intensely blue, but marked by distinct wisps of white cirrus cloud, spun out like tufts of cotton into shreds and curving lines.

At an altitude of 8,800 feet, or more than 4,000 feet above our camp, I at length reached the summit of the mountain crest. It was necessary to walk along the crest a quarter of a mile to reach a somewhat higher point, which was the true summit. The snow along this mountain ridge was in many places three or four feet deep, and, mindful of the terrible alpine accidents caused by cornices, I kept well away from the edge, below which it seemed to drop sheer several thousand feet. The snow was sparkling in the sun, and of the myriads of bright points about one-half were merely white light, like diamonds; the other half were either green, blue, or amber-colored, like emeralds, sapphires, and topazes. From intense frost my gloves were frozen so stiff that notes and sketches had to be done with bare hands.

The most conspicuous and interesting part of the whole vast panorama was the lofty summit of Mt Forbes, beyond the valley of Glacier lake. This mountain and another about 10 miles to the west were the two highest peaks in sight, and each is probably between 13,000 and 14,000 feet in altitude. Glaciers of very large size come from these mountains and terminate a few miles above the lake. The whole valley of the Saskatchewan to its upper end and in the opposite direction for many miles below the mouths of the North and Little forks was clearly visible. There was a very high rocky peak in a group of mountains east of the Little Fork that occupies the position of Hector's Mt Murchison, which he calculated to be 13,600 feet high. This mountain is hidden away in a group that must be 75 miles in circumference, and so it is rarely seen. There was a fine view to the north, where a wild and desolate valley, thousands of feet below, was dominated by a castle-like mountain over 11,000 feet high, probably Mt Lyell, cut in ruins like ancient towers and battlements. Of four plates exposed on this mountain only one was successful, so I had a narrow escape from failing altogether in getting a view of Mt Forbes, which, because of its great height, is veiled from view by clouds and is frequently invisible for weeks at a time.

On Thursday, October 20, the day broke gray and unsettled, with the highest mountains touched by clouds. We continued our march up the Saskatchewan valley, and urged the horses rapidly over a level gravel plain at such speed as to make in all ten miles. On the west side of the valley there is a stupendous wall of rock between 11,000 and 12,000 feet high, which terminates in the giant peak of Mt Forbes, a little to the north. About four miles from our camping place there is a group of curious rounded hills rising like forested islands from the sea of gravel.

There was a strong raw wind against us, and because of our water-soaked boots, half frozen by contact with snow, it was altogether too cold to keep in the saddle long, and every one walked most of the time. We made camp in a miserable place of stunted timber half killed by gravel which had been washed over the place by some change of the river's course not many years before. The river here divides into three streams. The smallest, near our camp, comes from the Howse pass, less than three miles distant; the other two come from a valley to the southeast, all, curiously enough, flowing on different sides of a flat valley. In the afternoon I walked some three miles up the valley to where the lesser stream comes in from the west, and as it heads at the base of Mt Forbes, I followed it a mile or so farther, till presently the current became rapid, the valley narrow, and the water closely hemmed in by rocky banks, so that walking was very difficult. The snow was a foot deep in this little valley, where the sun and wind could not exert their influence as in the open. The stream on the other side of the valley is larger and comes from a glacier several miles distant. This whole region was very thoroughly examined last summer by Messrs Baker, Collie, and Stutfield, who not only explored the large glacier, which is supposed to be 10 or 15 miles long, but went up the other stream several miles to the base of Mt Forbes, in the hope of ascending it. The flood of waters that sweeps down here in summer from the long glacier has cut channels three or four feet deep, lined with immense boulders, across the whole bottom of the valley. This is the chief stream or source of the Saskatchewan.

During the night the wind came up in fitful gusts; the stars were no longer bright points, but foggy spots seen through a thin mist; bands of cloud swept along the mountain sides almost as low as our camp, and at length the whole sky was overcast. The barometer was much lower at midnight. By 1 a. m. snow began to fall, which was a cause for no little apprehension, as we were far from the railroad.

On Friday, October 21, the sky was still threatening, though very little snow had fallen. We were on the march soon after ten o'clock, and reached the summit of the Howse pass in an hour. This pass was made known to the traders of the Northwest Fur Company about 1810 by a man of the name of Howse or Hawes, and was at one time much used by the Kootenai Indians, who came over the mountains and bartered with the fur-traders at a place about three days' journey down the Saskatchewan, now known from this circumstance as the Kootenai plain. This route is now impassable, as fire has run through the forests in the lower part of the Blaeberry valley, and the timber has fallen for many miles. The pass itself is about 18 miles from the Little Fork and 5,300 feet in altitude.

At this point we were seven days' journey from the railroad by either of two routes, the one by which we had come, or another, which, by going down the Blaeberry one day's march and then over a pass to the southeast, would bring us to the Kicking Horse river, and so to Field, in British Columbia. The latter route seemed preferable, as it would be through a new region.

The descent into the Blaeberry is one of the most trying exploits that the mountains offer. We commenced to descend rapidly the channel of a brawling mountain torrent, crossing from side to side constantly, so that our horses were compelled to climb up and down steep banks, to scramble over immense logs, or sometimes to force a way down the boulder-strewn bed of the stream. As there was no trail, Peyto had to lead the way by whatever route appeared best, and in several places our horses had to slide on their haunches down steep banks forty or fifty feet high, jump into the torrent, cross it, and then ascend a similar bank on the other side at the greatest risk of accident and to the no little trial of our own nerves. A trail appeared after three hours of such labor, and we camped about ten miles down the valley. It rained hard all night, turning to snow in the morning.

On Saturday, October 22, we followed a branch stream which comes in from the southeast for a mile or so, and then ascended 2,600 feet without a trail through a heavy forest. The snow, which was hardly apparent in the Blaeberry valley, became eighteen inches deep near the tree-line. Snow also fell at frequent intervals throughout the day and shut out the landscape, so that our bearings were mostly by compass. Almost at night-fall and in desperation we camped in the depths of a heavy forest on the mountain side. The snow was very deep and the temperature low, so that it was all the harder for our horses, which had to be turned loose in the timber with no chance to feed. The heavily laden spruce trees sent down avalanches of snow at every stroke of the ax, so it was very difficult to keep our camp-fire going, which was the more important as we had no water except by melting snow.

On Sunday, October 23, the weather was still cold and threatening. It was very hard work packing up, as all the ropes, canvas covers, tents, and blankets were frozen stiff and covered with granular ice. Our horses looked very thin after their recent hard marches and little or no feed. They were hungry enough to bite off twigs and woody branches from the bushes which had a few buds on them. We did not get off till nearly noon, and then continued a traverse of the forested mountain side with a constant gradual descent in the hope of reaching a valley bottom that leads to the pass. We had no sooner started than a heavy snowstorm set in, shutting out everything from view. There was no trail, as the pass had never been used before this summer. In about two hours we reached a valley bottom that we supposed to be the right one, though Peyto, who had taken the only other party through that ever crossed this pass, did not recognize it for some time. The deep snow and the constant ascent were very trying to our famished horses. One or two of us went ahead all the time and broke trail for them, but in spite of this some of our pack-animals lay down in the snow exhausted and groaned pitifully. We at length reached the summit and camped half a mile beyond. The snow was 24 inches deep on the level, and in depressions of the ground it was between three and four feet. Here our horses got a little grass by pawing away the snow, a trick that they learn during the hard winters on the plains.

We were now at the head of the North branch of the Kicking Horse river, and it was practically a constant descent to Field, where we arrived in three days, after having been out seventeen days. On this excursion every camp but the first was made on snow-covered ground, and there were only three days on which some snow did not fall. No small measure of our success was due to the splendid outfit of horses supplied by Mr T. E. Wilson, of Banff, who gave me the pick of his pack-animals. Very much depends on the training and strength of the horses in a rough country, where countless obstacles have to be overcome,

WINTER SCENE ON PASS BETWEEN THE BLAEBERRY AND THE NORTH BRANCH OF THE KICKING HORSE RIVER fallen trees passed over, swamps and rivers crossed, the close-set mazes of deep forests penetrated, and a pathway carefully selected over the treacherous holes of loose rock-slides. To seize the exact hour or day, amid the changes of fickle weather, the veiling smoke of forest fires, and blinding snowstorms, that a particular journey or mountain ascent may be accomplished rests in no small measure on the experience of the pack-horse, and it is a cause for little wonder that the traveler soon learns to take a certain pride in the faithful beasts which often do service at the sacrifice of their lives.

Speaking generally of the headwaters of the Saskatchewan, the valleys are well wooded, the mountains very high for this part of the Rockies, and large areas are covered by snow-fields or glaciers. The general character of the scenery is remarkably grand and unfailing in variety of mountain forms, so long as the valleys are the point of view. When viewed, however, from high summits it is somewhat monotonous, due to the fact that thousands of mountains are visible in the grand panorama, all quite uniform in height, among which the higher peaks that are 11,000 or 12,000 feet above sea-level are apparently lost.

All the larger streams come from glaciers, and consequently reach their highest stage during the hottest weather. Their waters are turbid with glacial mud, and they undergo a rise by day, when the sun melts the ice, and a fall at night, when freezing commences. The region of the Middle Fork, especially near Glacier lake and the base of Mt Forbes, is one of the grandest and most imposing, not only in the Rockies, but possibly in any mountain region of the world, even under gloomy skies and in the desolate garb of winter. In this region are some of the highest mountains between Montana and the Athabasca pass.

The forests which clothe all the mountains up to a height of 7,000 feet above sea-level are chiefly of Engelmann's spruce and balsam fir, with occasional areas of jack pine. The beautiful Lyall's larch, characteristic of the mountains farther south, was never seen in these valleys.

The summer season, which usually begins in June and lasts till September, is too short for extensive geographical work, so that much remains to be done in the way of exact measurement of mountains and glaciers. However, the very fact that travel among these mountains is still for the most part purely exploratory adds not a little to the pleasure of visiting a region of such exceptional grandeur.

EXPLORATION IN THE CANADIAN ROCKIES

At a meeting of the Royal Geographical Society, held at the University of London on February 13, Professor Norman Collie read a paper entitled "Exploration in the Canadian Rockies: a Search for Mount Hooker and Mount Brown." Professor Collie's paper dealt with two journeys taken during 1897 and 1898 through that part of the Canadian Rockies which lies between the Kicking Horse pass on the south and the source of the Athabasca river on the north. The most interesting problem connected with the first journey which presented itself to Professor Collie and his party was whether a lofty mountain—probably 14,000 to 15,000 feet high—seen from the slopes of Mount Freshfield, from which it lay distant about 30 miles in a northwesterly direction, might be Mount Brown or Mount Hooker, which were supposed to be 16,000 feet and 15,000 feet respectively. Professor Coleman, in 1893, starting from Morley, had arrived at the true Athabasca pass, found the historic Committee's Punch-bowl, and his brother had climbed the highest peak on the north, presumably Mount Brown. This peak he found to be only 9,000 feet. The question presented itself,Could he have been mistaken or was it possible that there existed two Athabasca passes? Professor Collie and his companion returned to their camp on the Saskatchewan pass without having solved the question of either Mounts Brown and Hooker or the Committee's Punch-bowl. It was finally settled on the return to England by reference to the journal of David Douglas, the naturalist, dealing with his journey over the Athabasca pass. From the authentic account of the two mountains there given, it was seen that the credit of having settled with accuracy the real height of the peaks belonged to Professor Coleman. For nearly 70 years they had been masquerading in every map as the highest peaks in the Rocky mountains. No doubt now remained as to where Brown and Hooker and the Punch-bowl were. That Douglas climbed a peak 17,000 feet high in an afternoon (as narrated in his account) was impossible; the Mount Brown of Professor Coleman, 9,000 feet, was much more likely. There was only one Athabasca pass, and on each side of its summit might be found a peak—Mount Brown, 9,000 feet, on the north—the higher of the two—and Mount Hooker on the south. Between them lay a small tarn, 20 feet in diameter—the Committee's Punch-bowl. The peaks to the south, among which the party wandered last August, were therefore new, and they probably constituted the highest point of the Canadian Rocky Mountain system.

HOW LONG A WHALE MAY CARRY A HARPOON

In a lecture before the National Geographic Society on February 21, 1895, the Hon. George C. Perkins, U. S. Senator from California, mentioned the fact that a "toggle" harpoon head which he exhibited, and afterward generously donated to the Society, had been obtained from a whale in Bering sea. The harpoon bears the following inscription:

M O N T O O O O O

The first four letters are the mark of the American whaler *Montezuma*, which was engaged in whaling in Bering sea and the North Pacific about 1850–'54. The five circles represent the number of the boat to which this particular iron was assigned. Taking the latest date (1854) as the date when the whale was struck, it appears that the whale must have carried it thirty-six years. The following abstract of Senator Perkins' remarks gives some of the circumstances:

"The harpoon was perfect, as you see it, and in a splendid state of preservation, but the shank had been eaten away close up to the skin of the animal by the action of the salt water. A little rubbing revealed the name.

"During the war of the rebellion, in 1861, Charleston was blockaded by the federal fleet. The blockade-runners again and again successfully eluded the fleet and carried supplies to the beleaguered city. To stop this the federal government bought a number of old whalers that were lying in the harbor of New Bedford, patched them up and sent them to Charleston filled with stones, and sank them across the entrance to the harbor. The vessels have been known ever since as the 'stone fleet,' and the *Montezuma* was one of them. This was thirty years ago, and the *Montezuma* was built sixty years prior to that. She was at one time a British man-of-war, and was bought by New Bedford people and turned into a whaler. It will thus be seen that it is safe to say that the harpoon head found by the *Beluga* had been carried by the whale fully thirty-six years. Ever since whaling became an industry it has been the custom for each whaling firm to have the name of the vessel stamped on each harpoon. This is done in case two or more boats from different vessels should be surrounding one of the animals, in order to show which of the vessels has struck it, if the animal gets away and is afterward found dead."

The following note from Captain Knowles, of the Pacific Steam Whaling Company, was attached to the harpoon when presented to Senator Perkins:

"Harpoon head found in a whale taken in Bering sea in August, 1890, by steam whaling bark *Beluga*, Captain R. D. Wicks, of the Pacific Steam Whaling Company's fleet. This iron was from the whaling bark *Montezuma*, as you will see by the mark. The *Montezuma* was sunk in Charleston harbor during the war of the rebellion. She was in Bering sea some ten years previous to being sold to the government, so this iron must have been in the whale forty years. J. N. KNOWLES."

I was discussing the matter recently with Capt. E. P. Herendeen, of the U. S. National Museum, and mentioning cases reported where whales struck in Greenland waters had got away and afterward been taken in Bering strait with the first iron in them, or *vice versa*, when Captain Herendeen observed:

"In regard to the whale iron or harpoon found in a whale with the name of a ship on it which had never been in the Greenland fisheries and had always been employed in this industry in the region of Bering strait, I can only say that while it is most likely that the whale does make the passage from the vicinity of Point Barrow to the waters around Greenland and Hudson bay, still I do not think the evidence of the irons conclusive, for the following reasons: Ships were often changing ownership and being withdrawn from the service and their inventory of whaling implements sold and put on board other ships, and while it is true that the ship receiving such weapons would erase the marks of the former ship *if put in use*, there remains the possibility of such irons being given or traded to the Eskimo, and such a whale may have been struck by an Eskimo in the vicinity of its final capture with a second-hand iron from which the name had not been erased.

"We know that the ships of the Franklin search expedition approached very near each other to the east of Banks land, and we know the whale is able to make long journeys beneath the summer ice floes, for they easily see any places where the light shows through the ice, which denotes a possible breathing place.

"I have often heard whales blowing among the ice when I could not see any sign of water anywhere."

These notes appear to have a certain interest on account of the stories current from time to time of whales supposed to have made the northwest or northeast passage, and also throw light on the possible age which may be attained by these animals.

WM. H. DALL.

SHIPBUILDING IN THE UNITED KINGDOM IN 1898

Lloyd's returns of shipbuilding show that, exclusive of warships, 761 vessels of 1,367,570 tons gross (viz., 744 steamers of 1,363,318 tons and 17 sailing vessels of 4,252 tons) were launched in the United Kingdom in 1898. The warships launched at both government and private yards amounted to 41 of 191,555 tons displacement. The total output of the United Kingdom for the year was, therefore, 802 vessels of 1,559,125 tons.

The total output of the world during 1898 (exclusive of warships) appears to have been about 1,893,000 tons (1,779,000 steam, 114,000 sail). Lloyd's Register Wreck Returns show that the tonnage of all nationalities totally lost, broken up, etc., in the course of 12 months amounts to about 733,000 tons (328,000 steam, 405,000 sail). It will thus be seen that, while the sailing tonnage of the world has been reduced by about 290,000 tons during 1898, the steam tonnage has increased by about 1,450,000 tons. The net increase of the world's mercantile tonnage is, therefore, 1,160,000 tons.

The output of the year in the United Kingdom has surpassed all earlier records. In some previous returns of this kind the figures for 1889 have been taken for comparative purposes as a rough approximation to the maximum productive capacity of the shipbuilding yards of the United Kingdom. The fact that the output of that year has now been exceeded by 158,000 tons as regards merchant vessels, and by upward of 150,000 tons as regards war vessels, indicates alike the remarkable character of the year's work and the great resources of British shipbuilders.

Comparing the present returns with those for the past two years it will be seen that the tonnage launched in 1896 and 1897 was less by 208,000 tons and 415,000 tons respectively than that launched in 1898. Concurrently with this increased output of mercantile tonnage during 1898 the 1897 figures for war vessels have been doubled, and those for 1896 have been exceeded by 28,000 tons.

It is noteworthy, moreover, that the output of 1898 is, with inconsiderable exceptions, entirely composed of steam tonnage. . . . Of the total output 1,057,775 steam tons and 3,867 sailing tons, or 1,061,642 tons in all (nearly 78 per cent), belong to ports in the United Kingdom. In this connection it may be noted that the losses, etc., of United Kingdom vessels during 12 months are shown by Lloyd's Register Wreck Returns to average 276,000 tons (194,000 steam, 82,000 sail). Sales to foreign and colonial owners for the 12 months ended October, 1898, reached the large total of 563,000 tons (426,000 steam, 137,000 sail). On the other hand, purchases from foreign and colonial owners during the same period amounted to 104,000 tons (100,000 steam, 4,000 sail). The sailing tonnage of the United Kingdom would thus appear to have decreased by about 211,000 tons, while the steam tonnage has increased by 538,000 tons. The net increase of United Kingdom tonnage during 1898 is therefore about 327,000 tons. This figure exceeds the similar estimates for 1895, 1896, and 1897 by 198,000 tons, 110,000 tons, and 279,000 tons respectively. Of the vessels launched in the United Kingdom 654 of 1,131,237 tons have been built under the society's inspection with a view to classification in Lloyd's Register Book.

As regards the movements of the shipbuilding industry during the course of 1898, Lloyd's Register Returns show that, irrespective of warships, the total tonnage under construction in the United Kingdom on December 31, 1898, exceeded by about 387,000 tons, or over 38 per cent, that under construction 12 months previously.

GEOGRAPHIC LITERATURE

The Educational Series of Rock Specimens Collected and Distributed by the United States Geological Survey. By Joseph Silas Diller. Pp. 400, with 65 illustrations. Bulletin No. 150. U. S. Geological Survey, Charles D. Walcott, Director. Washington, 1898. 25 cents.

A good many years ago Major J. W. Powell, then Director of the Geological Survey, conceived the happy idea of distributing among the leading educational institutions of the country collections of specimens of typical rocks for use in the study of certain branches of geology. The collection, classification, and distribution of the material was an undertaking of no small magnitude, and it is only recently that it has been completed. Concurrently with such completion there has been published a treatise on the study of rocks, in which the educational specimens are minutely described—69 of them by Mr J. S. Diller, who has been almost wholly responsible for their selection and arrangement, and 87 by other well-known geologists. While fulfilling in a way that leaves nothing to be desired its primary function as a handbook to the mineral collections, this work has an educational value that is entirely its own, as an attractively written and handsomely and instructively illustrated manual to the study of lithology and petrography. With a courage and good sense worthy of general emulation, Mr Diller, although dealing with an exceedingly technical subject, has not disdained to make himself intelligible to the non-scientific reader, some of his definitions even recalling Huxley's famous Norwich lecture "On a Piece of Chalk," that marvelous example of lucid exposition which every scientific writer reaching out to a popular audience may with so much advantage make his model.

J. H.

The Mechanical Composition of Wind Deposits. By Johan August Udden. Pp. 69. Rock Island, Illinois. 1898.

A few years ago, Dr Johannes Walther, a distinguished German geographer and traveler in many lands, visited this country, and became interested in the efficiency of our western winds in geographic development. He was especially impressed with the work of the winds in erosion; and, in a widely-quoted article in The National Geographic Magazine, he described this agency appreciatively, designating it deflation. Now comes Professor Udden, of Augustana College, with a still more elaborate memoir dealing with the work of the wind as an agent of transportation and deposition. His inquiry was suggested, and indeed started, by a question of the eolic origin of the loess of the Mississippi valley; afterward it extended to dunes and other deposits of drifted sand; still later he turned his attention to the air itself, devised ingenious appliances for collecting atmospheric dust, and proceeded to examine and sort the material with infinite patience. The various materials from dunes and lee-slopes and air were classified into groups or grades of eleven diameters, and the quantities (including, of course, the relative proportions of each) were carefully determined, and are represented graphically in the memoir. The determinations indicate that the wind is an assorting agent of great delicacy; for the range in magnitude of particles in any particular deposit is slight and consistent. The general result of the study is to establish criteria for discriminating wind deposits and ascertaining the conditions under which they were laid down. The bearing of the inquiry on the origin of the much-discussed loess of the Mississippi valley is noted, though Professor Udden judiciously refrains from final expression; it may be hoped that his excellent work will stimulate corresponding investigation of the mechanical composition of glacier mud and river silt. Professor Udden's memoir is bound to become a standard.

W J M.

Twelfth Annual Report of the Interstate Commerce Commission. Advance copy without appendices. Pp. 91. Washington, January 11, 1899.

Tenth Annual Report on the Statistics of Railways in the United States for the year ending June 30, 1897. Prepared by the Statistician to the Commission. Advance copy without tables. Pp. 114 and map.

The announcement of the practical failure of the interstate commerce law contained in the Eleventh Annual Report of the Commission was so distinct and unequivocal that it has been difficult to anticipate what would be added after another twelve months of legislative inaction. In the language of the present report, "to state that the law in its present condition cannot be enforced is only to repeat what has already been said," and the commission, after a brief though emphatic characterization and a few pertinent illustrations of the situation as it was at the close of 1898, passes to the discussion of practicable remedies. Comparing the rather definite intimations in this connection with the significant omissions in that of last year, one feels warranted in describing the later emission as a record of the progress of the commission toward a fuller appreciation and fairer expression of the necessities of the railway situation and of the fact that railway corporations and investors have rights to protect as well as duties to perform. It is not that the recommendations of last year's report were in themselves objectionable, or that they reappear substantially altered in form or substance; it is rather the change in the order in which they are presented and the transference of emphasis that is remarkable and significant. Last year there was a great deal in regard to the power to correct rates, the imperfections of the long and short haul clause, the lack of finality accorded the proceedings before the commission, but very little concerning the desirability and means of restraining competition, and that little expressed in exceedingly indefinite and general terms. The following extracts from the present report are expressed in terms neither indefinite nor unnecessarily general.

"A railroad is essentially a monopoly. This is literally true as to all local points upon its line which are reached by it alone. It is only at competitive points—that is, at points where traffic can be carried by two or more lines—that the railroads become actual competitors. It results from this fact that, as a rule, competitive points gain at the expense of non-competitive points. . . . The natural result of railway competition, it may be fairly said, is to create preferences between localities. . . .

"The same thing is true of preferences between individuals. . . . Considered *a priori*, therefore, we should expect that railway competition would produce preferences and discriminations between communities and between persons. What might to a large extent be expected has actually occurred beyond all legitimate excuse.

"One of the outcomes of these railway abuses was the act to regulate commerce. The purpose of that act was largely to do away with preferences and discriminations. It also aimed to keep alive competition between railways by prohibiting pooling arrangements. In other words, it endeavored to eradicate the results and to perpetuate the cause. . . . To one familiar with actual conditions it seems practically out of the question to establish rates that are relatively just without conference and agreement; but when rates have once been established the act itself requires that they shall be observed until changes are announced in the manner provided. Certainly it ought not to be unlawful for carriers to confer and agree for the purpose of doing what the law enjoins. . . . The logical way to remove these evils would be to remove their cause. If unrestricted competition produces discrimination, one obvious way to prevent such discrimination is to restrict competition. . . . We are inclined to think . . . that time has demonstrated the futility of attempting by criminal enactments to secure absence of discrimination in railway rates so long as independent ownership and unrestrained competition exists. We are inclined to think that competition should be restricted; but if the railroads are allowed to agree for that purpose, such conditions should be imposed as will fully protect the public interest."

While the ideas of the commission have developed they have not vacillated. The conditions which must be imposed in the interest of the public are those that were advocated a year ago, though it is now easier to discover the broad and intelligent spirit of compromise which no one doubts will lead the commission, whenever amendatory legislation can be secured, and would have led it at any time in the past, to make every reasonable concession which will not endanger the rights of the public.

The report contains the usual review of the year's work in railway regulation and a brief historical sketch of traffic associations.

It is rather curious that the attention of the commission does not appear to have been directed to the very remarkable and unusually successful Chicago-Omaha pool, which antedated by four years the "Saratoga conference," and, unlike the latter, produced substantial results. It was an investigation of the operations of this pool that led the Railroad Commission of Iowa to declare that pools constitute "the only agency that can compel the through traffic to bear, as it should, its proportion of the interest on the cost of maintaining and operating the roads."

One turns with relief from the report of the commission, with its disheartening record of legislative inefficiency and inertia, to the report of its statistician. The formal excellence of the latter leaves nothing to be desired, and the most critical statistician might well prefer to expend whatever space can be given for review in praise rather than to call attention to its few shortcomings. It is no fault of Professor Adams that this report affords so incomplete a presentation of the transportation business, that the accounts upon which it is based are by no means uniform, that important agencies of railway transportation are excluded, that it appears eighteen months after the close of the year to which it relates, or that many of its averages are based upon such widely divergent facts as to be much less representative of actual conditions than is both practicable and desirable. These imperfections and inadequacies also are results of legislative inertia. Until the frequently repeated recommendations of the statistician on these points receive the attention they merit, he will be powerless to secure better results in either of these particulars.

The statement that less work was done during 1896–'97 "by both passenger and freight locomotives than during any previous year of which this office has record," on page 24, is not supported by the summary to which it refers on page 23. The latter shows the work of passenger locomotives to have been greater than during 1895, and that of freight locomotives greater than during 1894 or 1895. It is difficult to believe that Professor Adams would claim that any considerable value attaches to the figure alleged to represent capitalization of new mileage given on page 49, or to the average derived therefrom. The foot-note on the same page is also of questionable accuracy, as it very materially understates the probable effect of changes in capitalization due to reorganizations.

Exception must be taken also to the statement on page 61 that there has been no reduction in railway passenger charges corresponding with that in freight rates. While verbally accurate, this is not unlikely to mislead those who are not students of transportation. The movement of an article of freight between any two points is part of a commercial transaction that cannot be very materially varied. There are differences in safety and speed; but common carriers have always been insurers of the goods they move, while the acceleration of the speed of freight trains, even within the past fifty years, is a matter of more importance to the railways in enabling them to handle increased traffic than to ordinary shippers. The service of moving an individual by rail does, on the other hand, admit of changes of great importance. Safety is a primary consideration which no insurance can eliminate, while time and general comfort en route are elements of scarcely secondary importance. American travelers have demanded and obtained improved facilities, superior signaling apparatus and other safeguards, more comfortable cars and more rapid trains, rather than actual decreases in rates; but the purchasing power of their dollars, in connection with passenger transportation, has none the less increased. One can illustrate this by comparing the charges for such services with those for hotel accommodations during former and recent years. When in 1848 the novel luxury and unprecedented splendor of the Astor House were greater marvels to the transient visitor to New York than is the Waldorf-Astoria to his least sophisticated successor, the rate per diem for meals and room at the former was but two dollars. The railway rate at that time from New York to Boston was just what it is today, though it is undeniable that the inferiority of the railway accommodations to those of the present time was much greater than that of the Astor House to the finest hotel of the present. At the same time the journey by rail from New York to Philadelphia required five hours and cost four dollars, while the rate is now $2.50 and the trip can be accomplished in two hours.

H. T. NEWCOMB.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1898–'99

Special Meeting, December 9, 1898.—Acting-President McGee in the chair. The chairman announced the election to honorary membership of the President of the United States, and stated that the committee—consisting of the Acting-President, the Secretary, Col. H. F. Blount, Mr C. J. Bell, and Prof. Willis L. Moore—appointed to notify President McKinley of the action of the Society, called at the Executive Mansion on December 8 and tendered to the President the certificate of election, at the same time explaining to him that it was the design of the Society to signalize the beneficent changes of the year in the modification of the civil geography of the world, and that the action was to be understood as an indorsement by one of the leading scientific organizations of the country of the course of the President as a great national leader. The President, the chairman continued, accepted the election and expressed his high appreciation of it, especially as coming from the most conservative class of citizens. Characteristically disclaiming credit for the recent extension of enlightenment by means of changes in civil geography, he observed that the results flowed from the efforts of an entire people, among whom he was but a single individual; he added that the full extent of the changes could not be stated pending the completion of the Treaty of Paris, remarking, however, that the last direct advices were favorable. He also explained that only the pressure of public business would prevent him from attending the ensuing meeting of the Society. The announcement of the election of the President was received with applause.
Hon. Robert Adams, Jr., M. C., U. S. Minister to Brazil, 1889–'90, gave a lecture on Brazil and its Revolution, illustrating his remarks by numerous colored lantern slides.

Regular Meeting, December 16, 1898.—Acting-President McGee in the chair. Col. F. F. Hilder gave an illustrated lecture on Fashoda and the Valley of the Nile.

Special Meeting, December 23, 1898.—Acting-President McGee in the chair. Mr H. W. Turner, U. S. Geological Survey, delivered an address on the Yosemite and the High Sierra, and discussed the origin of their topographical features. The lecture was illustrated by lantern slides.

Special Meeting, January 6, 1899.—Acting-President McGee in the chair. Mr Willard D. Johnson, U. S. Geological Survey, gave an illustrated lecture on Glaciers and their Work in High Mountains.

Regular Meeting, January 13, 1899.—President Bell in the chair. The Rev. David Macrae, of Scotland, gave an illustrated lecture on the National Characteristics of the English, Scotch, and Irish.

Special Meeting, January 20, 1899.—President Bell in the chair. Mr Gifford Pinchot gave a lecture on the Protection and Administration of our Public Forests, illustrating his remarks by lantern slides showing the various forest reserves of the United States.

Regular Meeting, January 27, 1899.—President Bell in the chair. Mr Arthur P. Davis, U. S. Geological Survey, gave an illustrated lecture on the Hydrography of Nicaragua.

Elections.—New members have been elected as follows:

December 16, 1898.—Amos Reed Buck, Miss Virginia Butler, General James A. Dumont, R. H. Duncan, E. W. Gould, Hon. J. L. Slayden, M C., Alonzo H. Stewart, Miss M. B. Warren.

December 23, 1898.—Rev. Wilbur F. Crafts, Dr Basil H. Dutcher, Louis H. Perley, Prof. Frank J. Polley, Dr William L. Ralph, George T. Roberts, Miss Lewanna Wilkins.

January 3, 1899.—Dr C. Evelyn Gilbert, Henry Cleveland Perkins, Miss Margaret P. Smith.

January 13, 1899.—Albert H. Bumstead, Miss M. R. Hays, A. J. Henry, Gust. Moser, Mr Tam Ye.

January 27, 1899.—E. Eckfeld, Mrs Emily J. Harris, Mrs W. Keiller, Miss Estell Reel, Henry E. Sawyer, Mrs Fanny Bullock Workman.

MAJOR JED HOTCHKISS

Major Hotchkiss died at his residence in Staunton, Virginia, on January 17. He was prominent as a topographer and mining geologist, his researches being mainly devoted to the development of the resources of the Virginias, in which work he has borne a very prominent part. During the Civil war he served as topographer upon the staffs of Generals Robert E. Lee and "Stonewall" Jackson, and prepared most of the maps with which these officers conducted their campaigns.

The maps of Virginia, between the time of the Civil war and the recent work of the United States Geological Survey in that state, were due almost entirely to Major Hotchkiss' work. On the death of William B. Rogers, leaving much of his work as State Geologist of Virginia unpublished, Major Hotchkiss was selected by Mrs Rogers to prepare the results of her husband's work for publication.

Major Hotchkiss has been a member of the National Geographic Society from its organization and has contributed largely to the success of its lecture courses and excursions. Many members will recall the delightful trip to Shendon, Virginia, on which occasion Major Hotchkiss was the host, and entertained the Society with true Virginia hospitality. The Society owes much to him. Personally and socially he was one of the most genial and lovable of men.

His health had been failing for some time when he was attacked by meningitis, resulting in his sudden death. H. G.

For the most complete, authoritative, and attractive publication on the KLONDIKE, send for the April, 1898, number of THE NATIONAL GEOGRAPHIC MAGAZINE, containing large official map and numerous illustrations. By mail for 25 cents.

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National Geographic Magazine—Back Numbers

The Society is prepared to purchase Vols. I, II, III, and IV, or Nos. 2 and 4 of Vol. I, 2 and 4 of Vol. II, 1, 3, 5, and 6 of Vol. IV, and 6 of Vol. VII. Members or subscribers having these volumes or single numbers to dispose of are requested to communicate with the Secretary.

MAP SHOWING THE GEOGRAPHICAL DISTRIBUTION OF REDWOOD ON THE PACIFIC COAST

Area covered by forest indicated in black ward through northern California, nearly to the bay of San Francisco. Indeed, a few scattering groves are found south of the bay, in Santa Cruz county and other localities, and there are evidences that not many centuries ago it extended over the Coast ranges as far south as Los Angeles; but in all this region it is now practically extinct. The densest forests are found in Humboldt county. In Del Norte county, on the north, the area is comparatively small and the forests somewhat less dense; while in Mendocino county, on the south, where the redwood area is even greater than in Humboldt, the forests are not as dense, and in Sonoma county, still farther south, the timber becomes more scattering, thinning out into groves. Its habitat is a region of heavy rainfall, which comes in the winter, and of fogs which sweep in from the Pacific at all times of the year. It is a very moist, temperate region, both of which conditions appear to be essential to the growth of the species. On the north its range is probably limited by temperature, since the humidity is even greater in Oregon and Washington than in California. On the south it is probably limited by the diminishing amount of hu-

REDWOOD FOREST SCENE, ILLUSTRATING DENSITY OF GROWTH midity. The species seems to require for its development a rather nice adjustment of temperature and moisture conditions, which are not found elsewhere, and, as will be seen later, do not at present fully meet the needs of the species, even in its present habitat.

This is probably the densest forest on earth, as measured by the amount of merchantable timber—that is, of timber suitable for the saw-mill—contained per acre. It is not the size of the trees alone which produces this, although they are exceptionally large, even in this state of large things, but it is the great number of trees on each acre, the closeness of their stand. In a redwood forest the sun never shines—it is always twilight. You are, as it were, under the roof of a vast temple, a roof of foliage, supported by great tree columns.

In order to obtain a conception of the enormous stand of timber in the redwood strip, let me commence with some familiar examples for comparison.

The great pineries of the southern states contain, on an average, about 5,000 feet, board measure, of standing timber per acre. Of white pine the heaviest county in Minnesota is estimated to contain an average of 5,000 feet, while others, regarded as forested, contain 1,000 to 2,000 feet; and a tract containing 10,000 feet per acre is regarded as heavily forested. Contrast these figures with the following: The average stand of redwood upon 173,000 acres in Mendocino county is 44,000 feet per acre. There is here nearly nine times as much timber on an acre as in the southern pineries; yet even this is exceeded in Humboldt county. Upon 96,443 acres in this county the average stand is 84,000 feet per acre, nearly seventeen times as great as in the southern states. The lumber companies around Eureka, California, the principal center of the redwood industry, have realized, since they commenced operations, an average of between 75,000 and 100,000 feet per acre, and one of these companies has for ten years cut an average of 84,000 feet per acre of redwood alone, besides fir and spruce, which would increase the amount to nearly 100,000 feet. These last figures are not in any way estimates, but the actual products of the mills. The disproportion is even greater than appears here, for the standard for lumber used in the redwood country is much higher than in the east, and consequently the estimates of the amount of timber are correspondingly less. For instance, whereas in the east logs eight inches in diameter are cut and sent to the mill, and knotty stuff is sawed, on the Pacific coast nothing less than 16 inches in diameter is sawed, and clear lumber only. If the redwood were used as economically as the southern pine, these estimates of its stand might easily be 50 per cent greater. The forests of Washington and Oregon are very heavy, but they by no means equal the redwoods in density. The most heavily forested county in Washington, Skagit, contains an average on its forest land of but 28,000 feet per acre, and in Oregon the stand is no greater. Of course, there are in these states individual acres, and even square miles, which are vastly more heavily forested; but so, also, are there in the redwood strip. On Mad river, near Eureka, a lumber company is at work in a tract of several square miles which actually cuts 150,000 feet per acre.

There is on record a single acre, near Garberville, which yielded in the mill 1,431,530 feet in lumber. There was sufficient lumber on this acre to have covered it with a solid block of frame dwellings ten stories high. A redwood tree of average size, say five feet in diameter at the butt, furnishes enough lumber to build an ordinary cottage, and many trees have been cut each of which would suffice for half a dozen such houses. One tree is on record as having scaled 66,500 feet. A tree was felled in a lumber camp near Eureka in 1898 which was 16 feet in diameter inside the bark, and which scaled over 100,000 feet, and there is standing in the same neighborhood a tree 22 feet in diameter which scales nearly twice as much. Such examples of wonderful yield might be multiplied to any extent, but this would merely involve repetition.

The redwood strip is composed of the westernmost of the Coast ranges, with the valleys between them. It is narrow at the north, in Del Norte county, where it is not over five to six miles in breadth. It widens in Humboldt county to an average of 10 to 12 miles; then south of Eel river, in the southern part of the county, its continuity is broken for a few miles. At the north edge of Mendocino county it commences again, and in the central part of that county attains it greatest breadth, of perhaps 20 miles. Farther south, especially in Sonoma county, the redwoods scatter, being found in detached clumps and groves, which become more and more scattering southward. The trees, however, remain as large as elsewhere.

The closest and finest growth is in Humboldt county, near the northern end. That portion in Mendocino and Sonoma counties

SPROUTED REDWOOD ON CUT AREAS

is not as heavy or continuous, nor are the trees as valuable for lumber, as they branch lower down. The wood is, however, of slower growth, is denser and harder. and perhaps more durable. The best lumber and the heaviest growth is everywhere in the valleys and on the flats. On the hillsides the trees are smaller and not so close. Nowhere is there any young growth. The youngest trees, which are found only in the northern portion of the belt, are several hundred years of age.

When the timber has been cut there is no sign of reproduction from seed. In many localities sprouts are growing from stumps in the cut areas, but even this form of reproduction is limited. Indeed, everything appears to indicate that for some reason, probably a progressive drying of the climate, the present environment is not favorable to the growth of redwood, and that with the clearing away of the present forests the end of the species as a source of lumber will be at hand.

The area of the redwood belt has been carefully mapped, and is, as nearly as can be estimated, 2,000 square miles, or 1,280,000 acres. The stand of timber on this area is not so easy to ascertain. The figures given above in this article are the best that have been obtained. I will recapitulate them with additions. In Del Norte county, out of 67,000 acres of redwood land. 11,000 acres are estimated to contain an average stand of 60,000 feet. In Humboldt county, out of an area of 500,000 acres, 96,443 acres have an average stand of 84,000 feet, with a range in different tracts from 25,000 to 200,000 feet. These figures are corroborated by the result of all the cutting done in the neighborhood of Eureka, where nearly all the lumbering of the county is done. The companies report an average yield of between 75,000 and 100,000 feet per acre. In Mendocino county, out of a redwood area of 640,000 acres, 173,000 acres are reported to contain an average of 44,000 feet, with a range from 12,000 to 75,000 feet. In Sonoma county the timber is so scattering that the total amount, which is spread over an area of some 75,000 acres, is comparatively slight.

Using the above figures, we obtain as the amount of standing redwood the following:

	Feet
Del Norte county	4,000,000,000
Humboldt county,	42,000,000,000
Mendocino county	28,160,000,000
Sonoma county, say	1,000,000,000
	75,160,000,000

To appreciate the magnitude of these figures, it may be said that the annual cut of lumber in all the mills of the United States is about one-third of this amount. The redwood strip alone would therefore supply the entire country with mill timber for three years.

Many estimates of the amount of standing redwood have been made, with results widely at variance with one another. The area of the belt has long been pretty well known, and the discrepancies among the estimates seem to be due mainly to differences in the estimated stand per acre. The first estimate that I find was made in 1881 by John Dolbeer, of Eureka, who gave 23,650 million feet. At about the same time Mr E. L Allen, secretary of the Redwood Manufacturers' Association of San Francisco, made the estimate published in the report of the tenth census, which was 25,825 millions. In 1885 Mr Hubert Vischer published, in the report of the California State Board of Forestry, an estimate of 30,500 millions, and in 1890 Capt. A. C. Tibbetts, secretary of the Humboldt Lumber Manufacturers' Association of Eureka, estimated it at 97,500 million feet.

The area seems to be generally agreed upon as being from 1,000,000 to 1,280,000 acres. The measurements from the best map available, that of the State Board of Forestry, give the latter figures. It is out of the question that the redwood lands yield, on an average, so little as 20,000 to 30,000 feet per acre. All estimates of stand and all records of cut show yields far in excess of these figures; and it cannot be contended successfully that these estimates and records relate only to selected areas far above the average. There is, as yet, very little selection of timber lands taking place. The whole territory is so heavily forested that it is no advantage to select those most thickly clothed with timber, but rather a disadvantage. The only selection yet made has been on the score of accessibility by stream in earlier times and by rail route at present. I consider, therefore, that the figures quoted above, which represent 280,000 acres out of 1,280,000, or nearly one-fourth of the entire area, together with the records of the entire amount cut in Humboldt county, furnish a fair sample of the stand in the belt. Captain Tibbetts' estimate seems to me, under present logging conditions, much too high, but I have no reasonable doubt that his amount will eventually be cut from the belt, owing to the economies to be effected in the future.

The annual cut by the mills, excluding other uses to which the wood is put, such as firewood, shingles, ties, posts, and poles—

TYPICAL REDWOOD FOREST SCENE

for such uses are not considered in the estimate of the stand—is 250,000,000 feet. At the present rate of cutting, therefore, the supply will probably last for three hundred years.

The rate of cutting will, however, increase and, as transportation is cheapened, may increase many hundred per cent. For instance, the completion of an isthmian canal will open up the entire market of the eastern states, where redwood will inevitably replace white pine, causing an immense demand. On the other hand, with the increased demand will come increased economy in the utilization of the wood. At present only about one-third of the tree emerges from the mill as sawn lumber. Nothing but clear lumber is sawed. One may go through miles of lumber yards at Eureka and examine millions of feet of lumber without finding a knot or, indeed, an imperfection of any kind. The upper branched third of the tree is left in the woods.

In felling the tree there is much damage done. Although great care and skill are exercised, the fall of one of these giants, weighing scores of tons, not infrequently splinters them; occasionally, too, a tree falls across its fallen fellows and thus produces great destruction.

In the mill the amount of lumber is diminished, first, by the slabs cut from the outside of the log, and, second, by the sawdust. This last is an item of great importance, especially where circular saws are used. The great saws used in the first cutting of the logs make a cut five-eighths of an inch in thickness. This means that if the log were cut directly into inch boards, more than one-third of the wood would be converted into sawdust; but this is not often done. The log is commonly first cut into thick planks and beams, and these are subsequently cut into smaller dimensions by smaller, thinner saws. Moreover, in most of the great mills today the first cutting is done by band saws, which are much thinner, and consequently convert less of the log into sawdust.

There is one cause of destruction from which this tree is entirely exempt—that is, fire. Containing no pitch, but, on the other hand, a large amount of water, it will not burn when green. No fire can run in a redwood forest. We shall, beyond reasonable question, have the use of our supply of redwood; shall not have the pain of seeing it go up in smoke. It is the only one of our coniferous lumber trees which is thus exempt.

The redwood is entirely in private hands, having long ago passed from government ownership. It is mainly held in small tracts by a great number of persons, but a few of the lumber companies have large holdings. Classifying the 280,000 acres above spoken of by holdings, it appears that—

Of a quarter section, 160 acres or less, there were...	6	holdings
From ¼ section to a section (640 acres)	7	"
From 1 section to 4 sections....................	8	"
From 4 sections to 18 sections....................	11	"
From 18 sections to a township....................	7	"
Over a township..................................	3	"

The last were tracts of 30,000, 30,000, and 27,000 acres. The above are the holdings of lumber and mill companies. Whether this classification properly represents the character of the holdings of the entire belt is doubtful. It is probable that the holdings of those not owners of mills or logging camps are smaller.

The forest is nearly pure redwood. Occasionally spruce and Oregon pine—that is, red fir—are found, forming perhaps 10 per cent of the forest only. The southern part of the strip is, on the whole, composed of older trees than the northern part, and the wood is denser and of less rapid growth. In the north are some tracts covered with trees not more than 200 or 300 years old, while the age of the mature trees reaches several hundred, perhaps a thousand years. The annual rings show that in the north, especially in damp valleys, the growth is several times as rapid as in the southern part of the strip.

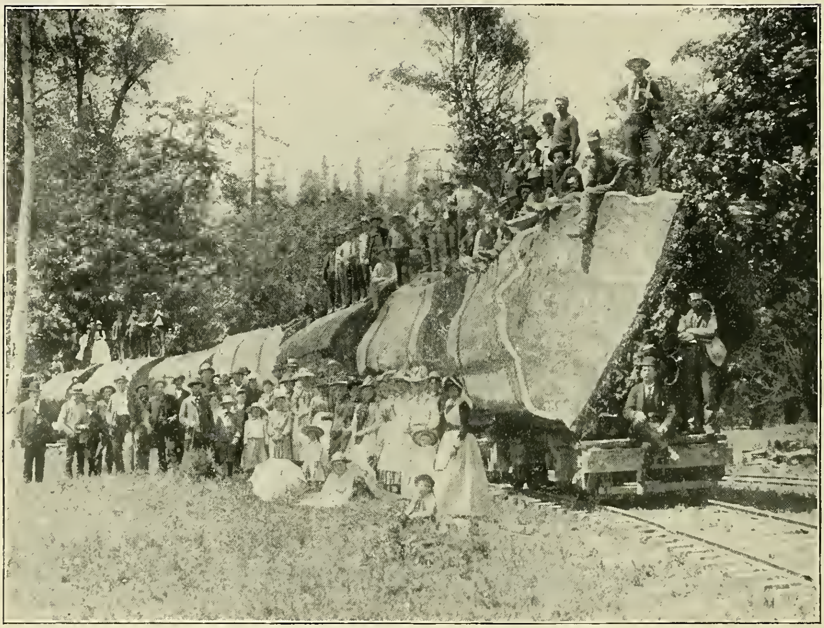
The methods used in logging are, in the main, similar to those employed in the great fir forests of Washington, but with slight modifications to fit different conditions. The use of animals, such as oxen and mules, for dragging the logs from the woods is over; so are the days for driving logs in streams. More modern methods are universally employed. Indeed, the most modern methods of labor saving are here in use. In every respect a redwood logging camp and a redwood lumber mill are thoroughly up to date—nay, more, they are the pioneers in labor-saving devices. The trees are felled in this wise: They are chopped half-way through on the side on which they are to fall, and then the other half is cut with the saw. Two days' work of two men is required to fell a tree five feet in diameter. The felling must be done with the utmost accuracy, as the trees stand so thickly that when felled they cover the ground completely, and yet they must not be allowed to fall on one another, as that would involve great loss by breakage.

The felling is done in the winter, the season of rains, when the ground is soft, and the trees are left lying on the ground until late spring, when things have become drier, when the whole thing is set on fire. This fire burns the brush and branches and much of the bark, but does not injure the trees themselves, which are still too wet to burn. Then the work of cutting up the trees and getting the logs out begins. The trees are sawed by hand, with whipsaws, into logs, generally 16 feet in length, although greater lengths are not infrequently cut for special needs. The big logs are split into halves and quarters for convenience in handling and sawing. From the end of the railroad, for railroads have taken the place of streams in the transportation of logs, a road is built to the logged area. This may be merely a dirt road, of hard, compact clay, kept wet and muddy by liberal applications of water, packed in bags on horses, or it may be a skid road, paved with small logs, laid crosswise at short intervals, and likewise kept slippery. A force of 50 to 75 men is employed, and two donkey engines. The latter do all the work, taking the place of oxen and mules, and to a great extent of men, in the labor of moving logs about in the woods and dragging them down to the railroad.

The donkey engine in the woods is anchored by wire cables to stumps, at a strategic point, so that in subsequent operations it will move the log and not itself. Then a wire cable, attached to a drum on the engine, is carried through pulleys to the log to be moved, and is attached by hooks, so that by winding up the cable on the drum the log is moved to the desired position. Often much ingenuity is required for the proper placing of pulleys in order to produce the desired result, but in all cases the machine, directed by experienced heads, does its work quickly and effectively. It is extremely interesting to watch the varied operations of a donkey engine in handling the logs and clearing away the waste lumber and not the least interesting part of it is the quickness and clear comprehension of the men. There is no fuss or noise; everything in the varied operations goes on quietly and smoothly. If the foreman gives instructions they are general ones, and in detail each man knows his part, recognizes what he has to do, and when to do it. Soon a train of logs, 10 to 12 in number, is on the road chained together tandem; then the cable-donkey is called upon. This is a stationary engine, located at the end of the railroad. From its drum goes a wire cable along the road up to the slashings, just like the cable

HAULING LOGS BY CABLE

of a street-car line, except that the cable is on the surface instead of below it. This cable is fastened to the leading log of the train, the engine is started, and the train moves railroadward. Just in advance of the train walks a man with a bucket with which he dips water from tubs along the road and wets the track. Arrived at the end of the railroad, a third engine is put to use in loading the logs on the railroad trucks by the use of wire cables. Here the logs are scaled and measurements re-



A TRAIN LOAD OF LOGS

corded. When the train is loaded it is hauled down to the mill and the logs dumped into the water, there to lie until their turn comes for conversion into lumber.

The work in the woods is hard. Although every device is used to reduce manual labor, there remains sufficient to make this one of the most wearing of physical occupations, and it is said that few men can stand the strain for any great period. The work is also extremely dirty, owing to the burning, so that the men look like stokers. Naturally, this work commands high pay, and with high pay a superior class of men, both physically and mentally, are obtained. I took dinner one day in a camp with about 75 men, all splendid specimens of manhood and all black as negroes—faces, hands, and clothing—from the charcoal in which they work, but well read, intelligent, and interested in the doings of the outside world.

The mills of the redwood strip are as progressive and up to date as are the logging operations. The logs and the lumber are moved and handled everywhere by machinery in the most complete and ingenious manner. They are drawn from the pond up into the mills and are rolled on to the carriage and moved into place for the saw by ingenious devices operated by steam. The logs are sawed by band saws—a continuous band of steel, with teeth cut on one edge, running over drums above and below. This is preferable to the circular saw for two reasons: it can saw a log of almost any size, which the buzz saw or any combination of buzz saws cannot do; and, second, since it can be made much thinner than the buzz saw, there is less waste of wood in sawdust. In some mills the band saws have teeth cut on each edge, so that a cut may be made both as the log moves forward and backward. The boards, beams, joists, plank, etc., as they come from the band saw, are distributed by rollers, steam-worked, to the proper parts of the mill for future cutting, while the slabs and other waste are similarly carried off to waste-heaps. The lumber, as it comes from the band saw, is edged, cut to smaller dimensions, etc., by small circular saws, in some cases harnessed in gangs, so that several cuts are made at once. To watch the wheels go round in one of these big mills is a most entrancing occupation.

Redwood is in almost universal use on the California coast. In the construction of houses little other timber is used, even as far south as Los Angeles and San Diego. It is exported as far south as Valparaiso, Chili, and westward to Japan and Australia. Indeed, considering its cheapness, $14 per thousand feet in Eureka for the best, it seems strange that it has not found its way in quantity to the Atlantic coast. Certain it is that before many years redwood will supplant the now vanishing white pine in eastern markets.

IS CLIMATIC ARIDITY IMPENDING ON THE PACIFIC SLOPE? THE TESTIMONY OF THE FOREST

By J. B. Leiberg

The extension of explorations and observations in the region of country west of the Rocky mountains tends in many ways to develop and confirm the proposition that a steadily progressive aridity is slowly replacing former more humid climatic conditions. This change is manifest in various ways—most conspicuously in the decreasing volume of water in many of the lakes and streams throughout the region, as shown by the existence of former beach lines at higher levels, and in the profound disturbances and modifications taking place in the native flora. The phenomena which follow the advance of aridity are not limited by altitude; for, while the desert conditions at low elevations exhibit them in their most intense aspect, they are also clearly traceable to the highest summits, where gradually dwindling glaciers and abnormally high extensions of certain lowland types of forest show the general trend of the climatic change.

In the general exhibition of increasing aridity there are to be noted two important distinctions. One is dependent upon climatic effects, the other upon the relief of a region as affecting the drainage, and is termed soil aridity. Excellent examples of the latter occur on the plains of the Columbia, where the great coulées or sunken water channels, which traverse the plains in all directions, are separated by comparatively narrow blocks of plateau-like country. The drainage from these elevated tracts is extremely rapid. As a consequence, their summits and slopes are left without sufficient soil moisture during the growing season to maintain a forest stand, although the annual precipitation is high enough to make tree growth possible, were the drainage conditions different. Similar examples occur in the forested subhumid and humid regions, where any large area on which temperature and precipitation are practically the same throughout often shows a growth of species belonging to the drier areas in the midst of the humid groups of trees, merely because the angle of slope in some localities favors a more rapid drainage than upon the contiguous areas. Similar effects are sometimes produced by excessive porosity of soil. Loose sand and gravel or volcanic ashes are poor conservators of moisture, and part with it readily, both through evaporation and percolation. Soils of these sorts are not common, however, in these regions, where, as a rule, moisture-retentive qualities are the predominant characteristics. In the following discussion the question of soil aridity is eliminated and the effects of climatic aridity alone are considered.

The variations of plant life which accompany the encroachments of aridity are diverse and often very complex. Innumerable general modifications and adaptations occur, mostly tending toward a more or less successful resistance to the stress imposed by drier climatic conditions. Local peculiarities, depending on adjacent heights or depressions, specialize—that is to say, they lessen or increase the general degree of aridity prevalent over any large area, thereby favoring minute adaptations or gradual transitions to more extensive and pronounced modifications.

In the region west of the Rocky mountains, the forest as a unit is the type of vegetation which, aside from the purely aquatic element of the flora, suffers a more profound disturbance of its equilibrium and is more quickly and thoroughly driven out by the advancing aridity than any other. In the herbaceous and to a lesser extent in the suffrutescent flora there is a gradual evolution of new forms, or of entire groups of certain types, to meet the changing environments. It is doubtless true that many herbaceous and shrubby species have gone under in this struggle within recent geologic times, while others are so rare and scattered as to warrant the assumption that they, too, are rapidly approaching extinction; but, on the other hand, there are many groups possessing the power of adaptation in a high degree, and through the slow development of modifications or by evolution of what we term species, they are enabled for a time to withstand successfully very adverse conditions.

It is different with the forest growth in this region. Overwhelmingly composed of cone-bearing trees, representing comparatively few species, it has an extremely narrow margin for the evolution of new forms or species. The fact stands out clear and distinct that most of the types and species of the order of coniferæ west of the Rocky mountains possess the power of adaptation only in a very limited degree. Their outlying forms are few and only vaguely definable. It is true that we can recognize differences such as that of texture and color of wood, variations in bark characteristics, or in the general port of the various individuals of a species upon any given area, but the differences are not such as to indicate that they constitute a definite and sharply determined trend in adaptability. They rather convey the impression that they are a series of expiring gasps of a type of vegetation which reached its culminating point of development immensely far back in time, and is now on the road toward complete extinction.

The forest areas in this region which have been more closely examined than any other in relation to the effects of increasing aridity are the tracts adjacent to and encircling the Columbia watershed in Idaho, eastern Oregon, and eastern Washington. We shall first examine the tracts lying within these limits, thence passing to others elsewhere, not so well known.

When the coniferous flora of the region is investigated it is found that certain species have a far higher ratio of endurance to conditions of aridity than have others. This might be taken to indicate a certain degree of adaptability, but the strongly marked characters which separate the species were acquired ages ago, and, with the exception of one or two species, do not in our region in the present age show any marked evolutionary tendencies.

The minor effects of the encroachment of aridity upon the forested areas are many, but comparatively unimportant.

The greater effects are contained in one general phase, which strikes at the very foundation of the species' existence. It consists in a gradual loss of reproductive power in the individual trees, and hence in the species as a unit, and is marked by two periods. In the first we have a gradual crowding back to more humid tracts of such species as require a considerable degree of soil and atmospheric moisture for their growth. They are replaced by others capable of enduring subhumid or distinctly semi-arid environments. In the second period we have a gradual crowding out or a complete extinction of the species of replacement, hastened or caused in the latter, as in the former, case by a loss of reproductive vigor, and a final complete deforestation of the particular area and the creation of a treeless region.

There are three general types of climatic conditions to which the term arid will apply. They are semi-arid, arid, and desert. As here employed, the semi-arid are regions not necessarily deforested, but which support a tree growth of peculiar species in other localities than in proximity to streams and lakes; the arid are regions completely deforested, away from streams and lakes, natural or artificial, but which bear an often rich and varied flora of herbaceous and suffrutescent vegetation; the desert are tracts without vegetation. The two former are abundantly represented in this region by very large areas, as we shall see. The third, or the desert, does not exist here. It is common to speak of "the desert regions of eastern Oregon," for example, but the fact is that in no place has aridity reached its third and last stage. When herbaceous vegetation is absent, as on certain alkali flats east of Steins mountains, or on drifting sand-dunes along the Columbia and on the plains of eastern Washington and northeastern Oregon, it is due to local soil conditions, not to absence of sufficient precipitation.

To facilitate a more detailed examination of the various forest conditions, as modified by increasing aridity, the region under consideration will be divided into certain classes or zones. These zonal distinctions have reference solely to the amount of precipitation which each class receives without regard to altitudinal limitations, and will be designated arid, semi-arid, subhumid, and humid areas.

THE REGIONS OF ARIDITY

The regions of greatest aridity north of the 42d parallel of latitude between the Rocky mountains and the Cascades are found: in Idaho, on the Snake River plains; in eastern Oregon, on the plateau areas between the Snake and the Owyhee rivers on the one hand and the Steins mountains on the other; in the region bounded by Crooked river and Malheur lakes and river on the north, Steins mountains on the east and the northern boundary of Nevada on the south, and in the Deschutes depression between the Blue mountains and the Cascades; in eastern Washington, north of the Snake and east and south of the Columbia river.

The aridity which prevails upon these areas is of various degrees of intensity, depending more or less upon local conditions and the proximity or distance of humid, snowy mountain ranges. In eastern Washington the driest section is situated at the eastern base of the Cascades, and extends eastward some 60 or 70 miles, gradually merging into uniform semi-arid and subhumid conditions as the moisture-condensing Bitter Root ranges are approached. In eastern Oregon the most arid tracts are found to the west of the Owyhee, extending in a westerly and northerly direction 100 to 120 miles. In eastern Washington the Cascade range evidently contributes largely to the aridity which exists on its east slope, and is therefore a local factor; but in eastern Oregon the most arid tracts lie at a distance of 200 miles or more east from the Cascades, and owe their origin to the interception of the moisture-laden westerly and southwesterly winds by the Sierra Nevada, and in a lesser degree by other intermediate ranges. Irrespective of local conditions, however, it can be stated as a general proposition, borne out by observed facts, that the crest of the advancing wave of aridity in the intermontane region of southern Idaho, eastern Oregon, and eastern Washington is traveling from the southeast toward the north and northwest. The tracts termed arid bear no forests. It is true that narrow fringes of trees skirt many of the rivers or creeks which meander through these areas, but the growth is made possible only by the humid or subhumid soil conditions due to proximity of streams, and cease at short distances from their banks.

Looking backward in time, there are abundant proofs that many of the now treeless tracts once bore a forest covering. Silicified wood is found in thousands of localities in the region where no tree growth is now possible, owing to insufficient precipitation, and its occurrence on the surface of these plains, not as transported material, but in place, argues in favor of the hypothesis that the extinction of this forest growth does not date back so very many centuries. The fossil wood, where it occurs on the treeless areas, is found resting directly on the volcanic rocks, indicating that sufficient time has not passed since the forest grew there to change the surface in any perceptible degree. The fossil woods referred to consist of remains of oak and probably of pines and junipers, and if not wholly identical with species that now exist in the adjacent regions are very closely related. There are also many localities on these arid tracts where are found fossil plants of Tertiary age imbedded in rock, deeply covered with basalt, but they belong to a period when specifically distinct climatic conditions, as compared with those of our age, prevailed in the region, and are not here considered. The areas classed as arid exist in many localities in this intermontane region. The most extensive have already been noticed; but, favored by local conditions, many small lobes from the main body of aridity stretch out on all sides. That they should penetrate into the areas we term semi-arid is to be expected, as they are but a step removed, but it is rather surprising to find them in the midst of subhumid conditions; yet such is exactly the case. Along the eastern base of the Cascades many of the south and east-facing slopes are distinctly arid, though surrounded by and adjoining decidedly subhumid regions. Similar conditions are encountered on the east, south, and west slopes of the Powder River mountains, on the plateau areas between the Clearwater and the Salmon rivers, in Idaho, and even in scattered localities north of the Snake, among the terminations of the western spurs of the Bitter Roots. Crossing the Bitter Roots and entering the basins and plateaus on the west slope of the main range of the Rocky mountains, we once more meet these extensions of arid conditions projecting into the subhumid regions. They are very well marked in the region of the Blackfoot basins, where they cross the main range and connect with the arid upper Missouri plains through the comparatively low passes at the head of the Blackfoot tributaries; thence stretching westward, they cover large areas of the Clark fork of the Columbia basin, and following the valley of this stream approach to within 60 or 70 miles of the eastern Washington plains. In the Clark fork watershed these arid extensions are usually bordered by a margin of semiaridity—their penumbra, as it were—but in many places they join and exist in the midst of the subhumid timbered tracts without any semi-arid transitions. The causes which operate to bring about these apparently erratic and sporadic advances of arid conditions are not very clear. Where they occur in proximity to the general body of aridity their presence is easily explained, but we find such tracts covered with herbaceous and shrubby vegetation peculiar to very arid regions in the midst of a forest of yellow pine, or even higher, where the elevation borders on the subalpine. These isolated spots might be compared to sparks wafted far in advance of a coming conflagration, each one constituting a nucleus for the further spread of its own peculiar conditions.

The altitude of the arid tracts varies considerably. At the junction of Snake and Columbia rivers it amounts to less than 150 feet above sea-level. On the southeastern Oregon plateau it rises to fully 6,000 feet on the slopes of various ranges, such as Steins mountains, the ranges to the east of Warner lake, and on unnamed heights between the Paulinas and Malheur lake. Farther north we find the arid tracts at elevations varying from

600 feet to 3,000 feet on the eastern Washington plains and from 4,000 feet to 5,000 feet in the regions between the Bitter Roots and the main crest of the Rocky mountains.

THE REGIONS OF SEMI-ARIDITY

From the arid regions we enter those termed semi-arid. We meet here a forest growth. It is one which throughout these regions is strictly typical of semi-arid environments. As it comes most closely in contact with the highest degree of aridity and has to bear the full force of the ultimate and permanent deforesting processes, its condition and aspect become doubly interesting. This forest growth is wholly composed of junipers belonging to the following species:

Juniperus monosperma, One-seeded juniper.
Juniperus occidentalis, Western juniper.
Juniperus scopulorum, Mountain juniper.

They occur in the various semi-arid districts as follows: Western juniper, in eastern Oregon and probably on the Snake River plains; mountain juniper, on the areas between the Rocky and Bitter Root mountains, thence extending into the eastern Washington plains; one-seeded juniper, on the Snake River plains and along the hills bordering this river valley nearly to its confluence with the Clearwater.

The western juniper is the most abundant of these species and forms true forests. It occurs as close and absolutely pure stands in many localities. The most extensive are found in Crook and Wasco counties, in Oregon, where it covers areas of over 100 square miles, with a stand twice as heavy as the ordinary stand of yellow pine in Oregon and Washington. Outside of these large tracts the species occurs in small groves or aggregates, or as scattered individuals, throughout most of the plains region of eastern Oregon. These juniper forests exhibit clearly the second period of the general phase of progressive extinction, that of deficient reproductive capacity.

The western juniper reaches large dimensions on the eastern Oregon plains. Individuals occur with basal diameters up to six feet. It is a species of slow growth, centuries being required to produce such large trees as just noted. In examining the stand, one is struck by the great preponderance of old trees, the comparatively small percentage of young, and the marked deficiency of seedling or sapling growth. It is noticeable that the older trees produce enormous quantities of galbuls—juniper berries—

but on examination one finds that most of them contain only aborted seeds. Round about the trees the ground is thickly strewn with berries, but the lack of seedlings proves how few of the seeds possess germinating power and indicates that the general climatic conditions are not favorable to seed germination. In many localities extensive burns are found. They have ravaged the edges of the forests or plowed wide swaths through what once were very dense and uniform stands. Some of these burns are very old, the stumps indicating that perhaps a century or more has passed since the fires. Others are comparatively recent. Reforestation does not take place on the burned-over areas. They become a part of the adjacent, arid, treeless tracts. Places occur in the midst of heavy stands entirely devoid of trees and stumps. It is probable that they represent extremely ancient burns, showing that reforestation in the juniper growth has practically ceased on areas contiguous to the main body of aridity. It is not alone when fire has swept the juniper forest out of existence that one notices a lack of reforestation. It is also to be seen adjacent to settlements where the growth has been cut clean for domestic uses, and the great number of detached groves and scattered individuals dispersed over the plains are arguments in the same general line. It is, of course, impossible to say with absolute certainty that all these outlying groups are parts of a uniform juniper forest, which once extended over the entire plains regions of eastern Oregon, yet from analogy we are justified in concluding that such is the fact. The fires and direct human agencies which are cutting into the larger bodies of forest at the present time produce just such detached groves and scattered individuals, and the gaps give every promise of remaining permanently deforested.

The forest of western juniper extends up to the subhumid areas, where it meets the western yellow pine. It even goes beyond a strict line of demarcation and penetrates several miles into the yellow-pine areas. It has been noticed that in many places the juniper produces an abundance of fully developed seeds and a plentiful supply of seedlings where it comes in contact with the subhumid regions. Such would be a natural result of the more favorable moisture conditions prevalent there.

Accompanying the front of the semi-arid wave, comes a tree which, in these regions, can endure neither the same high degree of aridity as the juniper nor so great a humidity as the yellow pine. This is the mountain mahogany, *Cercocarpus ledifolius*, which therefore furnishes an excellent indication of the limits of the *quasi* semi-arid and lower subhumid conditions which mark the front of the semi-arid advance and the rear of the subhumid retreat. The mountain mahogany occurs, therefore, in numerous localities all along the edge of this debatable ground and mingles not alone with the yellow pine, but in many instances also with the lodgepole pine, ascending to elevations of 7,000 feet.

Crossing from the eastern Oregon plains to those of the Snake, in southern Idaho, we find a growth of the one-seeded juniper, *Juniperus monosperma*. Comparatively little is known of the growth and distribution of the junipers on the Snake River plains, but this species is one which prevails largely on the arid regions in Utah, and should, perhaps, be regarded as being pushed toward the north through the stress of increasing aridity farther south. Coming into the interior Rocky Mountain region, we meet a juniper much resembling the Virginian juniper or red cedar of the east. It is the species named mountain juniper, *Juniperus scopulorum*, a small tree or shrub. It occupies more or less closely the semi-arid regions on the west slope of the range, doubtless extending across to the eastern declivities along the lines of semi-aridity. This juniper can endure a greater degree of humidity than the other two species mentioned. So far as it has come under my observation, it reproduces itself freely. It has not yet encountered a stress of arid conditions excessive enough to lower its seed-producing capacity beyond the balance point. It extends along various of the mountain streams into the plains of eastern Washington, usually keeping close to the streams. It does not spread into the open plateau region of this state to any noticeable extent, indicating that the semi-aridity of the interior Rocky Mountain basins, where the tree grows on hillsides and in valleys alike, is not so intensive as on the open plains of eastern Washington.

THE SUBHUMID REGIONS

Adjoining the region of semi-aridity lie the subhumid belts. Four species of conifers are of common occurrence here. They are: Western yellow pine, *Pinus ponderosa;* red fir, *Pseudotsuga mucronata;* lodgepole pine, *Pinus murrayana*, and great silver fir, *Abies grandis*. Their endurance of dry soil and climatic conditions is in the order named, the yellow pine ranking highest and the great silver fir lowest in the scale.

The western yellow pine occurs generally throughout the entire subhumid area in this region. In course of time it has succeeded in establishing a high degree of adaptability to the desiccating climatic changes, and it therefore forms the extreme rear of the coniferous growth in the subhumid belt, receiving the full force of the oncoming semi-aridity. While the tree thus shows its drought-resisting power, it is erroneous to suppose that it has reached a stage of adaptation where it absolutely requires dry regions for its development. The heaviest stands of western yellow pine that have come under my notice, varying from 30,000 to 50,000 feet B. M. per acre, occur in small patches in the Selway basin of the Bitter Root forest reserve, where the precipitation probably is not less than 70 or 80 inches per annum. Where the species is found under such conditions, it is fair to assume that it represents the more ancient form, capable of enduring more humid environments than the forms which now make up the bulk of the species in these regions. As a rule, however, the tree occupies the lower areas of the subhumid regions, and is mostly of open or scattered growth.

Coming now to the effects of semi-aridity upon the growth of this species, we may observe that as a rule it has not progressed far enough to seriously affect its reproductive capacity over any very large area. We find, however, where the species borders the semi-arid tracts of greatest intensity or where here and there long narrow tongues, lobes, or thin lines of it project several miles from the main body of growth into them, that in such localities the reproductive capacity of the tree is exceedingly limited or altogether wanting. In other places, especially in eastern Oregon, where a few small groves or single trees are found crowning some isolated eminence entirely cut off from all direct connection with the species elsewhere, the same condition is noticeable; and, precisely as is the case with the western juniper, the ovules are generally unfertilized, or, if fertilized, most of them abort, and those that are fertile and develop into perfect seeds fail to germinate. In consequence, seedlings are rare or altogether lacking in such localities. One of the phenomena noticeable in this species, when much exposed to the desiccating influences proceeding from contiguous arid tracts, is a remarkable dwindling in its cone dimensions. Normally, in these regions, the mature cones are from three to four inches in length; but where the species occurs in proximity to the deforested areas on the eastern Oregon plains, the cones are frequently not more than one and a half to two inches in length. A most conspicuous example of this phenomenon are the yellow-pine forests on the northern slopes of the Paulina mountains, where thousands of individuals bear cones but a trifle longer than those of the lodgepole pine, and the cone dimensions of the entire growth are far below the normal. As this tract of forest is separated only by a narrow strip of semi-aridity from areas of intense aridity, it is naturally under a high stress of the latter condition of climate, and the inference is fully warranted that the decrease in cone dimensions is a forerunner to general sterility in the species upon these particular areas.

Going farther northward there are seen thousands of localities throughout the yellow-pine areas which are absolutely deforested or contain a few, very old, lone individuals. Some of these tracts consist of south-facing hillsides, which receive the full force of the desiccating rays of the sun. If they, in addition, possess a high angle of slope, causing too rapid drainage, soil aridity is likely to result, with consequent deforestation. But many bare tracts exist when soil aridity is not a factor, and the influence which prevents the spread of the adjacent forest into such areas must be climatic, so far as can be determined.

The middle and upper portions of the subhumid belts carry, in addition to the yellow pine, the other species enumerated. Two of them exhibit clear traces of yielding to the effects of semi-aridity. They are the great silver fir and the red fir. The former is exceedingly deficient in cone production, but yields a high percentage of seeds with germinating power; the latter is a free cone producer, but matures an insignificant proportion of its ovules. In this respect it acts exactly similarly to the western juniper. The great silver fir possesses small powers of adaptability. On the western spurs of the Bitter Roots it has developed a type of tree low, small in diameter, soft and sappy in its wood, short-lived, and with extremely scanty cone production. This form takes a lower place in the subhumid zone—that is to say, nearer to the line of semi-aridity—than does the larger and more fruitful type. The adaptability of the red fir is of a much higher type than the foregoing. Notwithstanding its deficient seed production, there is no evidence that it is not maintaining the integrity of its stands throughout our region. It is not confined to subhumid areas exclusively, thriving and developing its largest dimensions in extremely humid situations on the west slope of the Cascades; but in the region under consideration it belongs to the subhumid areas, and, as before remarked, it is here deficient in seed production. A factor enters here to be considered later. This is temperature conditions. It is evident that unless a certain ratio of increase in the mean annual temperature accompanies the aridity, there is a limit of tolerance beyond which certain species cannot be forced. When this limit is reached the species must succumb, and this is probably the reason why the red fir does not push far into the humid areas in these regions.

The lodgepole pine possesses the highest power of adaptability among the subhumid group of trees. It ranges from the humid down through the subhumid and well into the lower edge of the semi-arid belts. While not a plentiful producer of perfected seeds, most of the ovules aborting, it amply makes up for this deficiency by its multitude of cones and the early age at which it begins to produce them. If the present vigor of the species continues, it promises to become the dominant one on all subhumid and humid areas in our region. In the subhumid forests of eastern Oregon, along the lower slopes of the Cascades, three species enter which are lacking farther north. They are:

Abies concolor, White fir;
Libocedrus decurrens, Incense cedar;
Pinus lambertiana, Sugar pine.

The white fir, perhaps not specifically distinct from the great silver fir, occupies the same general place in the subhumid group of trees on the more southern areas that the latter does on the northern. We might even suppose that the great silver fir is a modification of the white fir evolved to meet changing temperature and humidity conditions. It is evident from the relative position which the white fir occupies that its limits of endurance to increased temperatures and lower humidity are far higher than those of the great silver fir.

The incense cedar and sugar pine come into the middle areas of the subhumid belts. Their distribution or retreat northward, or into the humid areas, is limited by temperature considerations. As they show no adaptability to meet them, their extension northward is precluded and their extinction will be rapid, compared with other species in this region. The sugar pine is a free cone and seed producer, while the incense cedar appears to be deficient in this respect.

THE HUMID REGIONS

From the subhumid tracts we come to the humid ones. These are chiefly limited to the mountain regions. When they extend into the plains or into areas of lower humidity, they do so only in the bottoms or on the northern slopes of deep canyons or the northern slopes of ridges. On the other hand, it is everywhere noticeable that the subhumid areas send long, strong lobes and extensions into the humid tracts, carrying their characteristic trees with them and indicating the coming ascendancy of drier climatic conditions.

The trees which compose the forests in this zone group themselves into three divisions, according to their altitudinal range. The first group, occupying the higher elevations, contains the following species:

Larix lyallii, Lyall larch;
Pinus albicaulis, White-bark pine;
Tsuga pattonii, Mountain hemlock.

The second group contains species which most generally occupy areas at the lowest elevations in the zone. They are:

Thuja plicata, Pacific arbor-vitæ;
Larix occidentalis, Western larch;
Tsuga mertensiana, Western hemlock;
Pinus monticola, Mountain white pine.

The third group contains species which range indiscriminately from the upper to the lower areas of the humid zone and are as follows:

Abies lasiocarpa, Alpine fir;
Picea engelmanni, Engelmann spruce;
Pinus murrayana, Lodgepole pine.

Of the species included in this group, the Alpine fir possesses the least power of adaptability, the lodgepole pine the highest.

In addition to the species enumerated, there are the following whose behavior as to altitudinal extensions and limitations are not very thoroughly known. They are:

Libocedrus decurrens, Incense cedar;
Chamæcyparis nootkatensis, Yellow cedar;
Abies amabilis, Amabilis fir;
Abies nobilis, Noble fir;
Abies shastensis, Shasta fir;
Pinus flexilis, Limber pine;
Pinus lambertiana, Sugar pine.

With the exception of the limber pine, most of these species are, in these regions, confined to the Cascades, and do not extend very far from the high, upper slopes of the range. Only the sugar pine and incense cedar come into contact with regions of subhumidity.

I have already noted that strong and broad projections from the subhumid areas push far into the humid belts. This is most marked along deeply eroded valleys, where high summer temperatures prevail. Not only do the subhumid conditions become conspicuous in the humid belts along such lines, but one meets occasionally spots of true aridity in their midst. Such localities present the anomalous spectacle of permanently deforested areas supporting species of grasses and other herbaceous plants peculiar to the arid plains at subalpine altitudes, and in regions where the situation seemingly should insure an abundance of precipitation. Excellent examples of these phases are seen in the Bitter Root forest reserve in Idaho. This region lies within an area of sufficiently heavy precipitation to be generally classed as humid above the 5,000-feet level; but arid and subhumid conditions have extended up the Clearwater and Salmon river valleys, in places reaching the main range, and overleaping this barrier have joined the arid regions of the interior Rocky mountain basins. The subhumid and semi-arid conditions have spread upward from the valley bottoms along the mountain slopes to elevations of 6,000 feet to 7,000 feet, carrying their peculiar shrubs and trees with them. We cannot account for the permanency of these arid and semi-arid extensions, except by adopting the proposition that a progressive diminution of the annual precipitation is now an established and general climatic feature in this region.

Coexistent with the advance of drier climatic conditions into the humid areas, we find, as already noted, many of the trees and shrubs of the semi-arid and subhumid tracts, while the entire forest has been profoundly disturbed in its equilibrium. Among the shrubs of the arid and semi-arid regions which have thus penetrated into the humid areas may be mentioned *Cercocarpus ledifolius*, *Kunzia tridentata*, *Artemisia tridentata*, *Artemisia arbuscula*, and one or two species of Forsellesia. These shrubs abound on the arid regions of the plains, to which they properly belong. They are found following the subhumid areas into the humid ones in the Bitter Roots, in the Rocky mountains, and in the Cascades. Their presence and distribution here proves unmistakably progressive semi-aridity into the subhumid tracts, subhumid extensions into the humid areas.

In the semi-arid belt we noted the occurrence of detached aggregates and scattered individuals of its forest growth separated from the main body by deforested lanes and wide stretches. They were taken to represent the effects of a gradual invasion of the adjacent arid conditions, creating a sort of fringe or frayed edge of timber growth along the edge of the forest. If our ideas of progressively drier conditions extending throughout the different belts of humidity are in accordance with facts, we have a right to expect analogous phenomena in the humid and subhumid areas. That is exactly what we find, but they differ from those which exist in the arid and semi-arid region in this way: that the edge of the advancing semi-aridity into the subhumid tracts and the front of the subhumidity where it penetrates into the humid areas are not typically marked by deforested openings. Instead, they present detached groups of the species, which belong to the upper and more humid tracts of each of the zones, entirely surrounded by heavy bodies of the kinds which belong to the lower zones and which are capable of withstanding greater dryness.

In examining the phenomena of forest growth in the humid areas, as changed or in process of modification by the shifting climatic conditions, we can find no localities within these regions that present the various phases so clearly and indisputably as does the west slope of the Bitter Root mountains. This area is truly a debatable ground. Its forest growth is subject to great and extensive stress—on the east from the arid conditions of the Rocky Mountain regions, on the west from those which prevail on the treeless plains of the Columbia River plateau. It is seamed, furrowed, and crossed in various places by extensions from those two great tracts. At the same time it contains very large areas of extremely humid slopes, where the drying effects of the changing climate are as yet scarcely felt, if at all. These conditions provide numerous transition grounds for the study of the forest modifications.

Beginning with the group of summit trees, as they might be called, we have three species which are in the Pacific northwest true timber-line trees. Nowhere, however, in the Bitter Roots do these species form a timber-line zone, for no peak in the range is high enough to reach it. As summits exist 10,150 feet in height above sea-level, it follows that the absolute timber-line is here phenomenally high—a significant fact in connection with the wide extensions of subhumid and semi-arid conditions into the interior of this range, and a possible consequent rise of the mean annual temperature. The absence of a timber-line even at the highest peaks was noted and commented upon by the various parties engaged in the first surveys for a northern transcontinental railroad route, but was generally ascribed to the effects produced by a current of warm air supposed to move eastward from the plains of the Columbia in this latitude.

None of the three species contained in the summit group of trees possesses any marked power of adaptation. The Lyall larch is wholly deficient in this respect. The white-bark pine ranks slightly higher, and the mountain hemlock somewhat above the latter, as shown by its occurrence within undoubted subhumid conditions in some localities, as in the middle portion of the Deschutes basin in Oregon. In the Bitter Roots we find the Lyall larch along the high crests of the main range from a point just north of Nez Perce pass to an as yet undetermined northern point. However, it does not go very far beyond the ridges which bound the north fork of Clearwater basin. It is found on both the east and west slopes of the range, extending three to four miles away from the crest on either side. The western spurs of the range present one or two outlying small groves of the species on the divide between the Lochsa and Selway forks. Its habitats in the Bitter Root range are absolutely cut off from all connection with others elsewhere by gaps of low altitudes a hundred miles or more in width, which now cannot possibly be spanned by the species. In these regions this larch is clearly approaching extinction. Its cone and seed production are extremely scanty. Its growth is excessively slow. Most of the individuals which make up the stands are far advanced in age. Seedlings or saplings are rare and scattered. No farther back than three centuries there must have been abundant seed production, as a majority of the trees are approximately of this age. Three centuries hence the stands, if existing at all, will show great diversity of age, unless the cone-bearing periods run in cycles, long intervals of barrenness being followed by periods of fertility. Whatever rotation may exist in this respect (and that some does occur admits of no doubt) it operates only within narrow limits of time, producing what are called "off years," and does not impress itself very strongly upon the stand of the species as a whole.

Passing to the white-bark pine, we find it extending over all the ridges and spurs of the Bitter Roots having elevations above 6,000 feet. On the north the range of the tree is intercepted by the valleys of the Clark fork and the Bitter Root river. On the south it follows the crest of the ridges into the Rocky mountains. The species is lacking in vigor and is not maintaining its former stands. It is a conspicuously shy cone producer throughout all this region. The staminate blossoms or aments are borne in the greatest profusion, but the pistillate are very rare. In consequence, but few cones are seen, and the seedlings, while not wholly absent, are very sparse and scattered.

The mountain hemlock occurs on the ridges above 5,500 feet elevation throughout the central areas of the Bitter Root system. It is cut off on all sides from connection with the species elsewhere by wide stretches where it is wholly lacking. In the northern portion of its range it is an abundant cone and seed producer, and is maintaining the average densities of its stands. Its southern boundary in this region lies along the crest which separates the north and middle forks of Clearwater. All along this southern edge it abuts upon the subhumid tracts which spread upward along the slopes of the low-lying valley of the middle or Lochsa fork of the Clearwater. A low ratio of cone and seed-bearing capacity marks the southern edge of its range, and its seedlings are far from sufficient in number to keep the stands at their maximum density. Throughout the entire Bitter Root region the declining vitality of the species is indicated by its small cones, which do not average one-half of the normal size for the more vigorous type of the species. The habit of the three summit species is inimical to survival under very great stress of subhumidity. Their place of growth is invariably on drained slopes. If through adaptation they should acquire the power to grow in wet or saturated soil, they would stand a far better chance of survival, but no evidence exists of any such modifications.

Below the summit group of trees are the species of the second group. Among these the western larch possesses the greatest power of adaptation, next the mountain white pine, then the Pacific arbor-vitæ, and last the western hemlock. The western larch is able to endure subhumid conditions which, in places, almost border on semi-aridity. Of the trees distinctly belonging to the humid areas, it is the last to retreat before the advancing line of climatic siccation. All these species are at home in wet or swampy localities, and are therefore better fitted for a lengthy resistance than would otherwise be the case. Their northward range extends indefinitely to the limits where the mean temperature becomes too low for their growth. Their southward boundary in the Bitter Root region lies a few miles north of a line drawn east and west through the crest of the divide which separates the Salmon river from the Clearwater drainage. Northeastward they cross the Bitter Roots into the Rocky Mountain ranges, while in the northwest they extend through the mountains between the Fraser river and the Columbia into the Cascades. Owing to the circumstance already mentioned—that the species can exist in swampy ground—they hold their own against the subhumid encroachments everywhere but along their southern edge. Their retreat is here marked, exactly as in the case of other species, by deficient cone and seed production and by the occurrence of detached bodies of the species along the line of retreat.

The third group of the humid series of trees contains species whose adaptability to varying altitude and moisture conditions is of the highest. This is owing to their capacity for enduring very diverse habitats. They are equally at home on dry, well-drained slopes, or in wet places, where their roots are continually immersed in circulating water. Among the three, the lodgepole pine has the greatest endurance, and all appearances indicate that it is the species which eventually will supplant the other species in the humid regions.

The Alpine fir ranges throughout the entire extent of the Bitter Root mountains, and extends indefinitely north and south, east and west, along the crests of connecting ridges. It is a fair producer of cones and seeds, and is maintaining its stands in most localities. Its susceptibility to adverse subhumid conditions is found in the occurrence of large deforested tracts occupied by the tree within comparatively recent times, but which now show no evidence of a return to forest cover. Such tracts are frequent everywhere throughout its range in these regions. Generally they front on some broad valley, along whose slopes the subhumid or semi-arid changes are advancing into the mountains.

The Engelmann spruce and the lodgepole pine have a universal range throughout the mountains in this region. Both have developed forms to meet drier conditions. Engelmann spruce never reaches its greatest development except in swampy localities, where it grows to be a large, well-formed tree. On dry ridges it exists as a small, knotty, branchy, undersized tree. The lodgepole pine follows the same general rule. The reproduction of these two species is excellent, and they are constantly occupying new ground to the exclusion of the other species.

The forest fires which ravage the mountains show how closely balanced are the majority of the humid species and how slim a hold they possess on existence along the front line of the spreading subhumidity. It is a fact patent to every one who studies the after-effect of a forest fire in this region that the increased evaporation from the denuded surfaces causes intense soil aridity. This condition is not alike in all places. Some localities, by reason of local topography or exposure, suffer more severely than others. There are thus on south-facing hillsides, near the larger valleys, numerous places where centuries ago the subalpine forest was destroyed by fire, and arid conditions set in to the extent of absolutely preventing reforestation to this day; but in the majority of cases the first burning of the forest destroys only the more tender species and favors the growth of those which possess greater power of adaptability. This in the humid areas means a preponderance of the lodgepole pine, because of its wide limit of tolerance to different climatic conditions. Fires in the humid growths hardly ever destroy the forest completely over any very large area. Small patches are left untouched, though surrounded by wide lanes of burned forest. The growth of lodgepole pine which comes in after the fires, because better fitted than any other species to endure soil aridity, follows the denuded areas and often covers them with dense stands. In so doing it cuts off these slices of unburned forest from all chance of regaining their former connection with the main body of their own type of growth, and gives rise to conditions which are somewhat analogous to those in the semi-arid belts, where deforested areas, supporting types of vegetation peculiar to arid regions, separate the outlying groves of forest.

It is not alone in the region of the Columbia river watershed that the increasing climatic aridity is modifying or disturbing the forest types and their ancient balance. The same phenomena are repeated in California, and are doubtless general throughout the Rocky mountains and the areas collectively termed "The Pacific Coast." A conspicuous example occurs in southern California, in the behavior of the big cone fir, *Pseudotsuga macrocarpa*, and the redwood, *Sequoia sempervirens*. The big cone fir is a common species on the slopes of the mountain ranges in southern California. On the west slopes of the San Bernardino and San Jacinto ranges, its main body of growth is above the 4,000-feet contour line. Below this the tree thins out rapidly, and at elevations of 3,000 feet practically ceases. In the San Gabriel mountains it begins to grow at elevations of 1,000 feet above sea-level; at 3,000 feet it forms very numerous groves in the midst of the chaparral. Now, there are the clearest evidences that not very far back in time a nearly uniform forest of this species covered many of the slopes of the San Gabriel mountains between the 2,000-feet and 3,000 feet contour levels. The numerous single trees and old stumps in the chaparral are the remnants of this growth. Moreover, when the big cone fir is burned out on the slopes below the 4,000-feet level, neither it nor any other species of conifers reforest the denuded areas, showing that conditions exist which are inimical to forest growth. In the San Bernardino and San Jacinto ranges the lower edge of the big cone fir forest is tolerably compact and well defined. The outlying patches on the slopes that one sees so frequently in the San Gabriel are lacking. The extensions from the main body of growth are along the streams and gorges where abundant moisture exists. The San Bernardino and San Jacinto mountains are farther from the ocean than the San Gabriel; hence for same elevations they do not receive so heavy a precipitation, and have in consequence a higher limit for the lower edge of the range of the big cone fir. The San Gabriel mountains, being nearer the ocean, receive a greater precipitation; hence have an ulterior limit for the inferior edge of the big cone fir at a considerably lower elevation than the other two ranges; but the lack of reforestation on areas where the growth is destroyed and the many detached patches below the main body of growth prove that the species is retreating toward regions of greater humidity. As the process is aided and accelerated by forest fires of modern date, another generation will not pass before the lower limit for the growth of the tree in the San Gabriel mountains will be at quite as high altitude as it is in the San Bernardino and San Jacinto ranges. In comparison with the allied northern *Pseudotsuga mucronata*, or red fir, the species is more definite in cone and seed production.

The redwood is a tree of extreme susceptibility to temperature and humidity conditions, and apparently possesses a very low ratio of adaptability. It ranges along the California coast from Los Angeles county to the northern boundary of the state and across into Oregon. At its extreme southern end it is represented by small scattered groups of trees—a few hundred individuals only are reported—and a long gap intervenes before its appearance farther north. The heaviest stands of the species are found in Mendocino and Humboldt counties, in California. It thins out toward the Oregon line and finally disappears a few miles north of the boundary. The northward extension of the species is evidently limited by a mean annual temperature lower than its ultimate point of endurance. Southern extensions are impossible, owing to an insufficiency of rainfall in that section of California, and its spread into the interior, away from the proximity of the ocean, is precluded by adverse conditions of both temperature and humidity. The reproduction of the species is said to be very low. Cut-over areas show no evidences of reforestation with the same species. Thus hemmed in by inimical climatic conditions and unable to maintain its stands, its extinction seems assured at no very remote period.

SUMMARY

The salient points brought out by a study of the forest conditions in these regions, so far as they relate to the effects of climatic aridity, can be stated concisely as follows:

The arid, non-forested plains regions of eastern Oregon yield silicified remains of arborescent vegetation identical or nearly so with existing species on adjacent areas, proving the presence of forest growth on these timberless lands at no very remote period.

The forests on the semi-arid tracts, although consisting of species capable of enduring dry climatic conditions, show everywhere a persistent and gradual dwindling in extent and density. Their stands, consisting mostly of old trees, show a conspicuous deficiency in seed production, an enormous percentage of the ovules aborting, and a notable scarcity of seedlings. When, from any cause, a tract of the old stands is deforested, reforestation does not occur, as a rule; this results in the formation of detached groves and individuals whose reproductive powers become even more limited and weakened and the extinction of which is merely a matter depending on the age limit of the individual trees.

In the subhumid forest there is a slow and apparently ineffectual adaptative evolution of smaller forms of the various species to replace the larger ones, which require more moisture for their growth. There is also a conspicuous shortage of cone and seed production in the group of trees which form the upper subhumid types, and a pushing of the lower subhumid types which grow in drier atmospheric and soil conditions into the areas of the upper types, and frequently a complete and permanent replacement of the upper subhumid types with those belonging to the lower groups when such upper types have been destroyed by fire or other means.

In the humid forest are found the same phenomena as noted for the subhumid tracts, with areas in the upper humid belts, where certain species occupy tracts separated by long distances (sometimes a hundred miles or more) from the next appearance of the species elsewhere. These intervals, which break the continuity of the range of such species, are held to indicate more humid conditions in the part favoring extensions across these gaps, which are now precluded and cut off by adverse climatic changes in the direction of aridity.

PROFESSOR O. C. MARSH

Othniel Charles Marsh, LL.D., Ph.D., Professor of Paleontology in Yale University, Vertebrate Paleontologist of the U. S. Geological Survey, and a member of the National Geographic Society, died in New Haven, Connecticut, March 18, 1899. His death removes an eminent contributor to American science.

Born in Lockport, New York, October 29, 1831, Marsh grew up an athlete and sportsman, rather than student, until his observations on nature directed his attention to the natural sciences. In 1852 he went to the Phillips-Exeter academy at Andover, whence he graduated as the valedictorian of his class. In 1856 he matriculated at Yale, graduating with honors in 1860. Subsequently he retained almost constant connection with his alma mater, to whose prestige he contributed much, the longest interruption occurring in the early sixties when he was engaged in special work in European universities. In 1866 he was made Professor of Paleontology, a position retained until his death. The nephew and heir of George Peabody, he was the possessor of means enabling him to exercise his strong individuality freely in the prosecution of scientific researches. His best-known work was that of explorer in the western territories and collector of vertebrate fossils, by which the museum of Yale and U. S. National Museum were enriched; yet his most enduring monument takes the form of original contributions to vertebrate paleontology. His researches were conducted with remarkable vigor, notable acumen, and exceptionally clear recognition of the principles of biology. To the general surveyor of the field of organic life, past and present, several of Professor Marsh's contributions seem to be of the first magnitude: The modern method of seeking and quarrying for complete skeletons to be used as material for study, in lieu of resting content with fragments, was largely due to his broad views and pertinacious industry, and his liberal expenditure of private means; partly by reason of this method, he was able to classify extinct forms, and trace their relations to living organisms in a superior manner; while his improved methods in field and laboratory enabled him to give unprecedented vitality and living interest to the animals of ages past and the life history of the earth primeval. Among his special contributions, the tracing of the phylogeny of the horse attracted world-wide attention, while his development of the principle of cephalization is of exceeding service to biologists and anthropologists, as well as to specialists in his own domain. During the last decade he turned attention to geology, and his researches in the Atlantic Coastal plain have received much attention and yielded results of permanent value.

Professor Marsh's scientific work brought recognition from various institutions. He held honorary connection with several European academies of science, and was the recipient of the Cuvier prize of the Institute of France and of the Bigsby medal of the Geological Society of London; he was President of the American Association for the Advancement of Science in 1878, and President of the National Academy of Sciences for twelve years, 1883–1895. A bachelor and the last of his line, he bequeathed practically the whole of his considerable property to Yale University.

W J M.

THE AREA OF THE PHILIPPINES

In a recent communication to the Geographical Society of the Pacific, of which he is President, Prof. George Davidson writes as follows:

In several government documents the statement is made that the area of the Philippine islands is something over 114,000 square miles. In the latest one just received it is given as 114,326. This error has doubtless arisen from a hurried examination of the Spanish documents. We find in the "Guia Oficial de las Islas Filipinas, para 1898; Publicada por la Secretaria del Gobierno General; Manila, 1898," the statement that the archipelago comprises an area of 355,000 square kilometers, without including the Jolo (Sulu) group. It then specifies about thirty of the principal islands, and their areas aggregate 298,485 square kilometers. That, of course, leaves a multitude of the smaller islands not specified in the guide, but covered by the larger area. As the number of square kilometers multiplied by .386052 will give the number of square miles, the area of the islands specified amounts to 115,238 square miles, and the area of all the islands, less the Jolo group, amounts to 137,057 square miles. Further, the statement is generally made that the Archipelago of the Philippines contains from 1,000 to 2,000 islands, and the "Guia Oficial" says the number is more than 1,200. But in examining the "Derrotero del Archipielago Filipino, Madrid, 1879"—that is, the Coast Pilot of the Philippines, covering more than 1,200 pages—we find that the Islas, Islitas, Isletas, Islotes, Islotillas, and Farallones therein described amount to 583. Of course, this does not include reefs, rocks, or hidden dangers. I submit that these figures of the areas and of the number of islands and islets be accepted until replaced by government surveys.

THE RECENT ASCENT OF ITAMBÉ

In his letter referring to the ascent of Itambé, Lieutenant Shipton states (this magazine, November, 1898, p. 476) that "we are supposed to have been the first men ever on the summit of this peak." Itambé was ascended and measured by Spix and Martius in 1818. Those authors say of it: "The peak of Itambé, the highest one ascended and measured by us in all our travels through Brazil, has an elevation of 5,590 Parisian feet."* This measurement was made with a mercurial barometer, and, so far as I know, it has never been repeated.

The fact that Itambé has not been ascended is due to its being in a thinly populated, untraveled country, rather than to any particular difficulty in getting up the peak itself. It dominates almost the entire diamond district of Minas, and in my own travels through that region I was constantly reminded of what Dr Santos says—that this peak served the old gold and diamond hunters instead of a compass, for they never got lost so long as it was in sight. "It was a granite light-house to travelers—the center of a circle, seventy leagues in diameter, in which they could revolve without fear of getting lost."†

J. C. Branner.

Stanford University.

*Reise in Brasilien von Dr J. B. von Spix und Dr C. F. P. von Martius, ii, 456, München, 1828; also Beiträge zur Gebirgskunde Brasiliens von W. L. von Eschwege, 334, Berlin, 1832.

†Memorias do Districto Diamantino, por J. F. dos Santos, p. 8, Rio de Janeiro, 1868.

MISCELLANEA

The total imports of the Samoan islands amounted in 1895 to $418,840 and the total exports to $256,758. The share of the United States was but $60,624 in the imports and $33,050 in the exports.

The government of Haiti has imposed a surplus tax of 25 per cent on all importations, in effect from March 14, 1899. The proceeds are to be applied to the withdrawal of the paper money now in circulation.

The Austrian Lloyds have recently established a direct service between Trieste and Calcutta. Austria is becoming an important factor in the rivalry of the greater European powers for the markets of the far East.

The Simplon tunnel, when completed, will be 21,580 yards long. It will contain only a single track, but a second tunnel is to be constructed parallel to it, at a distance of 19 yards. The northern entrance to the tunnel is about a mile and a half from the station at Brieg, at an elevation of 2,254 feet. The exit on the Italian side will be 800 yards from Isella.

To prevent the extinction of india-rubber trees in the Congo Free State, the government has decreed that for every ton of rubber yielded annually there must be planted not less than 150 trees. The law which prohibits gathering rubber except through incisions in the bark is to be more strictly enforced, and violations will be punished by a fine up to $2,000, or by imprisonment.

An English syndicate has begun the construction of additional quays and magazines at Genoa. In 1897, 5,000,000 tons of merchandise passed through the warehouses of this port, and it is calculated that with the completion of the Simplon tunnel and the consequent improvement in railway communication, the annual tonnage will rise as high as 10,000,000. Genoa will then be the most important port of the Mediterranean.

In a recent report to the Department of State, Mr Thomas E. Moore, U. S. Commercial Agent at Weimar, gives some valuable statistics concerning the balance of trade and the increase of population in Germany. The rapidly increasing population has caused a corresponding increase in the imports of provisions and raw materials, the home products not being sufficient to meet home demands. The population of the German Customs Union has risen from 50,960,000 in 1893 to 54,530,000 on July 1, 1898, an increase of 3,570,000, or 7 per cent within five years. The value of imports has increased by 29.5 per cent, and that of exports by 27 per cent. With the increase of population has also come a very apparent expansion of the productive capacity of the manufacturing industries. This is especially well shown by the steady output of steam-engines. The total horse-power of the steam-engines built in 1888 was 1,683,000, while in 1898 the total was 3,422,000. The most significant figures, however, are those of the manufacture of stationary engines during the last three years. In 1896 the total horse-power was 2,534,000; in 1897, 2,714,000; in 1898, 2,947,000. Agriculture does not show a corresponding development, as the limits of the grain-growing area can be extended but slowly.

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NATIONAL GROWTH AND NATIONAL CHARACTER*

By W J McGee,

Vice-President of the National Geographic Society

On July 4, 1776, the dawn of a new era brightened humanity's horizon. The harbinger of enlightenment, the American Declaration of Independence was itself the product of antecedent forces and conditions of great significance. Some of these forces and conditions demand special attention from those who would trace aright the growth of modern nations.

For more than a century, the world's most vigorous attempt at colonization had been in progress along the Atlantic coast of North America. Viewed in the light of later knowledge, the stirring conquests of Alexander and Cæsar were little more than predatory forays in which the conquered gradually absorbed their conquerors; the epoch-marking expeditions of the Spaniards three centuries before and of the Norsemen four centuries earlier

*An address delivered before the National Geographic Society, March 28, 1899, as a summary of a series of lectures on "The Territorial Growth of the United States." These lectures, forming the "Lenten Course" for the year, delivered in Columbia Theater, Washington, D. C., during February and March, were as follows: "The Original Territory of the United States," by Honorable David J. Hill, LL. D., Assistant Secretary of State (printed in the March number of the National Geographic Magazine vol. x, 1899, pp. 73-92); "The Louisiana Purchase, Oregon, and Florida," by Professor Albert Bushnell Hart, of Harvard University; "Texas and the Mexican Accessions," by Professor John Bach McMaster, of the University of Pennsylvania; "Alaska," by J. Stanley-Brown; "Hawaii," by Professor Edwin V. Morgan. A preliminary outline of the general subject, entitled "The Growth of the United States," was presented at a meeting held in Boston on August 25, 1898, and printed in the National Geographic Magazine for September (vol. ix, 1898, pp. 377-386). The data relating to the territorial growth of the country were set forth in detail in the successive lectures; the summary was designed to indicate the causes and conditions affecting the progress of the nation as described by the eminent authorities who conducted the course.

still were as guerrilla sorties, producing little permanent effect save by frequent repetition; but the British colonial movement in North America was as that of a well-ordered army. Throughout this era more than ever before the Briton tested his own mettle; he came prepared to meet and overcome obstacles insurmountable by his contemporaries; when the ranks were thinned by starvation, as at pitiful Plymouth and fated Jamestown, by the Red Man's arrow or by strange disease, as at many other outposts, or by occasional desertion all along the line, the vacant places were filled with fresh recruits; and the vigorous army rested only after victory over an inhospitable land beset by forbidding forests and flanked by miasmatic marshes where warring aborigines and strange ills lurked in cruel waiting for the unwary. Other countries added their forces in some measure, with great ultimate benefit to the nation yet unborn; but the character of the movement was shaped by the inherent power and pertinacity of Britain's sons.

The stock represented by the colonists was a notable one. During the prehistoric ages, as the relics of caves and moorlands tell, Europe was overrun by primitive tribes which slowly attained the plane of pastoral and maritime culture; and the remains and trappings of their domestic animals and the ruins of their sea-going craft, which today enrich the museums of Europe, bear testimony to their prowess by land and sea. The shadowy history of two millenniums supplements the prehistoric record, and shows that the European tribes gained gradually in strength and culture, partly by normal growth, partly by the absorption of invading—and sometimes conquering—peoples from the east and south; the written record indicates, too, that blood was mixed and culture interchanged in such manner as to weld the tribes into larger groups, the germs of later nations. Now, in some way blood enriches blood and culture fortifies culture so effectively that, in all ages, it has been the people of blended blood and commingled culture who have dominated the continents and the world; and Europe was the first great theater (as America is the second) for these obscure but potent factors in human development. Most of the interactions were naturally confined to the continent; but, under a peculiar combination of geographic conditions, all the stronger streams of blood and all the higher waves of culture ultimately impinged on the adjacent isles of Great Britain and Little Britain—and with such marvelous effect that this areally insignificant spot on the map grew apace into the greatest national power the world has seen.

Britain's supremacy, although commonplace to the educated, is the marvel of history; and there is no worthier theme for the thinker than analysis of the factors of that supremacy. The factors are far too many for present consideration; the blending of blood and the commingling of culture derived from an unprecedented number of notably vigorous tribes and peoples gathered from all Europe and hither Asia, have been mentioned; but a seldom-recognized factor is worthy of special note: After long puzzling over the Aryan problem, philologists have begun to realize that Aryan speech, with its numerous patois and dialects and languages, is a product of combination rather than differentiation; and some knowledge has been gained as to the modes in which the combination was effected. As tribe met tribe and as nation met nation (whether amicably or inimically), ideas and their linguistic symbols were interchanged, one of the modes of interchange being indicated in the well-known generalization that the conqueror takes the language of the conquered; so that a struggle for existence arose among the linguistic elements, in which the worse were gradually eliminated while the better survived. Through this survival of the fit, the originally multifarious tongues were gradually combined into a limited number of groups, the combination receiving great impetus with the development of writing and still more with printing; and the recorded modifications in the groups of tongues suggest what appears to be the ultimate tendency of linguistic development—*i. e.*, the development of the *word* as a discrete oral and graphic symbol for a discrete idea. Most of the Aryan tongues approach those of still more primitive character in the utterance of ideas in associative terms (or holophrasms), the association being expressed by verbal combinations and inflections; apparently the associative languages are the more economical of thought when the number of ideas is small, but the experience of mankind, as expressed in linguistic growth, clearly indicates that such languages are not adapted to the expression of the numberless ideas of abundant knowledge; and it is easy to observe that the associative languages of the Aryan stock are gradually losing their verbal mutations, or else becoming extinct because no longer adapted to living needs. Now, measured by the standards of linguistic development, there is one European tongue which towers above its neighbors, like Saul among his brethren—it is the English, a language of simple vocables and simpler phonetic and simplest syntax, with little formal grammar save that borrowed from decadent or dead dialects, with an indefinitely extensible series of oral and graphic symbols for discrete ideas, with a vocabulary enriched by contributions from all other tongues, with a most economical orthoepy, and with a perfected lexicon save for the barbarous orthography inherited from lower culture. Language is a mechanism for shaping and expressing thought, just as the locomotive is a mechanism for transporting men and merchandise, and relative efficiency is beneficial in one case as in the other; throughout the world the proficiency of peoples may be measured (other things equal) by the efficiency of their languages; and the most efficient of all, as indicated by the laws of linguistic development, is that produced by the concentration and integration of the tongues of Europe and western Asia on the British isles. The Briton of three centuries past was strong in many ways; yet no small part of his strength must be ascribed to that efficient mechanism of expression which left him larger balance of brain energy for other duties.

The linguistic factor combined with others in giving strength to the Briton, and Britain began colonization with an unparalleled heritage of human excellence. The vigor of the Viking, the courage of the Celt, the nobility of the Norman, the energy of the Angle, the incisiveness of the Saxon, the dauntlessness of the Dane, the gallantry of the Gaul, the freedom of the Frank, the rovingness of the early Roman, even the stoicism of the Spartan, had come down to him through the blood of sires and dames of a hundred generations, or had grown up in him through centuries of intellectual commerce. The Briton of that day stood forth preeminent in perfection of body and brain, the paragon of human excellence; for his superb stock (made Anglo-Saxon by a figure of speech only) summed the excellencies of a thousand tribes and a hundred nations, concentrated through uncounted centuries. It was from this singularly prepotent stock that the American colonists sprang.

The British and Dutch and other north-European pioneers in the New World were something more than mere representatives of the strongest stock of humanity extant; they were picked men and women, impelled to adventure of body and mind through hereditary aptitude for vigorous activity. Many of them had made preliminary essays in adventure by land and sea before fixing eyes finally on Atlantic's shore of promise; some of them, like the early Puritans, served an apprenticeship in settlement in other lands—and all were strengthened by the earlier experience to cope with the difficulties surrounding the land of their ultimate hopes. The migratory bird gains strength of wing by exercise, and acuteness of instinct by varied experiences ; so the migrant people gain strength of limbs and lungs by the exercise of journeying, acquire culture through contact, and achieve strength of mind by exercise of faculty ; and thus the average comers to American shores were not merely the select of their stock, but workers specially trained and developed during their earlier life. Then came the hard task of pioneering, under which the weakest fall out of the race while all others are strengthened ; and in this way the stock still further improved with the generations grown up on America's soil. Meantime the same blending of blood and commingling of culture which gave prepotency to the parent stock went forward more rapidly than ever before : The British colonists were from different shires and provinces ; they associated and finally consorted with one another, with representatives of the Low Country and other lands of northern Europe, and to some extent with the sons of France and the scions of Spain, while a trace of the strong blood of the aborigines was absorbed. Thus by the middle of the eighteenth century at latest, the American branch had outpassed the parent stock in its complexity of both blood and culture.

So it came about that all the factors of the fatherland were intensified in the character of the American colonists. Sorted out by the sieve of adventurous pioneering, invigorated by earlier experience, strengthened by contact with a rigorous environment, and revivified by admixture of blood and culture, the American pioneers were, even before the Revolution, the strongest people of the world in body and brain. This great fact, often ignored because so commonplace, cannot be too strongly emphasized ; for the wonderful birth and marvelous growth of the American nation were nothing less than a miracle unless illumined by this fundamental fact.

A special factor contributed materially to that strengthening of the American colonies which matured in independence : A considerable part of the pioneers came for conscience's sake, in full confidence that, in this new land, they might think as they would and believe according to their bent, without bar of church or state ; many others came because of instinctive desire for relief from irksome laws and customs—indeed not a few came in durance because of infraction of often odious laws, fit for lowly serfs rather than loyal subjects. Northwestern Europe had become, indeed, a great reservoir of pent-up thought, of intellectual individuality seeking natural outlet; a part of the tense originality held to conventional bounds through which it wrought the intellectual renaissance marked by the immortal contemporaries, Shakspeare and Bacon; but the more aberrant thought merely seethed and bubbled and fomented discord throughout its reservoir. A flood-gate opened with the colonizing of America; and thinkers instinctively athirst for new motives gave character to the human stream flowing toward the sunset. Thus the American colonists were preëminent in that intellectual activity which is the germ of intellectual freedom. Others might lie supine in stocks and shackles of intellectual subjection, but not this intellectually prepotent people; and it was but natural that they should be the first to finally rend the fetters of mental serfdom.

Such was the stock, and such were the characteristics, of the American colonists who gathered from meager settlements scattered over a thousand miles of Atlantic coast to sign the American Declaration of Independence. They were not representatives of a nation, for there was no nation; they were simply strong men forced together by a common impulse toward freedom and equality. No other men bound to fatherland by blood and bone were ever put to so severe a test of moral strength; no weaker men would have risked the fatal chance; no earlier men in the history of the world possessed the profound physical and moral confidence required to consciously cast aside the lessons of history, to deliberately overthrow established conventions, and to calmly face the necessity of erecting a new national theory on a new plane of thought. The step was not one to be taken by weaklings; it could have been taken by no other living men than those chosen representatives of colonists whose veins carried the blood of the strongest peoples of the earth for uncounted generations, and whose brains throbbed with a heritage of vigor summing the intellectual progress of the world.

The issue of the Declaration introduced a new factor into the lives of the colonists—a factor equally efficient in war and in peace, a factor that no subject of kings can comprehend, a factor indeed that some free citizens have half forgotten: The ancestral tribes of the Briton in Europe and America were led and guided by personally-beloved patriarchs and priests, half-worshipped heroes of land and sea; as the tribes grew into feuds and principalities and at length into kingdoms, the ties of loyal affection gradually hardened into the chains of royal subjection—and thenceforth the spontaneous individuality which of yore gave strength to the tribesmen was confined and in part curtailed by artificial class distinctions, most galling always to those of strongest faculty. The Declaration removed this instinct-felt burden from the minds of the colonists; at the last pen-stroke they became freemen, the peers of princes, ready to strive individually and collectively in their own interests and the interests of their loved ones; the yoke of the ruler was gone, his behest was less than the passing breeze, and each man was a monarch bound by no law save that of equal right to all men. The inspiration of freedom spread with the slow means of communication, and infused new life in the ill-fed, poorly-armed, and worse-clad soldiery, and in the wives and babes and aged ones by the lonely hearthstones—and thenceforth American arms were invincible. Since the Declaration the tide of battle has sometimes turned temporarily against the American; but every fair experience has shown that the self-inspired freeman stands on a higher plane than his king-inspired adversary, and cannot be conquered.

As the new factor of complete civil freedom inspired the soldier, it found lodgment in the mind of the statesman and gave new dignity to the strife for independence; and when the struggle ended the colonists combined on the boldest essay in territorial expansion in the history of the world. Russia, acting as a great nation inspired by belief in the divinity of kings, annexed Siberia after a long process of education of statesmen and soldiers; England, actuated in like fashion, acquired India through easy stages during which the minds of Briton and Hindoo were slowly conjusted to the changing condition; Spain, also under kingly control, captured continents through expeditions which slaughtered some natives and married others, yet never undertook complete conquest of any land; while George Washington and his handful of compatriots, only three million strong and scattered over three hundred thousand square miles of coast-plains and adjacent mountains, making no nation but only the loosest of confederacies, with lifelong experience of the practical difficulties before them, deterred by deeper appreciation of vested human rights than any predecessors possessed, were not content with the title to their coastwise zone alone: they looked to dim future as well as hardly brilliant present, weighed the needs of their children and children's children, and solemnly undertook the duty of conquest over half a million square miles of little-known woodland haunts for warlike tribes stretching from the mountains to the Mississippi. Today this transmontane territory may seem small; to present geographic knowledge it may seem but a natural appendage of the Atlantic plains and mountains; in the light of the history of the nineteenth century, with its marvelous territorial growth of many nations, the expansion may seem trivial; but, so far as the light of 1779 can now be measured, the undertaking was one of singular boldness—of a boldness exceeding even that displayed in the Declaration of Independence. This first essay in territorial growth was worthy the well-grown progeny of humanity's finest stock; it could not have been made by any weaker people—indeed it would seem impossible that it could have been made even by the cumulatively prepotent colonial stock save through that inspiring self-reliance which is the boon of freedom.

Having undertaken the conquest of their outlying territory, the colonists set themselves to their task with serious persistence. True, the territory was for a time a bone of contention among the colonies; true, strong young lives were lost in numbers through disease and savage ambuscade, as the outposts of settlement were pushed forward; true, it became necessary to erect a part of the territory into a federal colony (an action contributing much to subsequent union); true, the hardest pioneering the world has seen was required to subdue the forests and lay the ways of traffic over and beyond the mountains; yet few among the founders appear to have regretted, or even to have fully recognized, the boldness of their essay. As the years grew into decades, the wisdom of the colonists became manifest; inspired in peace as in war by freedom, the pioneers pushed into the forests, acquired lands, built mills, laid out trails and stage lines, and above all inaugurated an era of public education the most noteworthy in any country; invention was fostered by a patent system, industries grew apace, race troubles began to settle themselves (albeit slowly), and the hard-working settlers developed that physical and moral strength which is the best fruit of voluntary labor. Meantime the blending of blood and culture, aided by the immigration of thinkers and workers, continued to raise the vigorous pioneers even above the plane on which the Declaration of Independence was conceived.

So began and ended the first great episode in American development; it comprised an epoch-marking departure from a decadent national theory, the boldest essay in territorial extension recorded in the annals of nations, the partial subjugation of a vast wilderness, the inception of road-building, the erection of a public-school system on an unprecedented scale, and (directly through the initial expansion) the binding of the colonies into closer federation.

Enlightenment dawned with the Declaration of Independence in 1776; it broke into full day with the adoption of the American Constitution thirteen years later. It is needless now to review the masterly analysis of events leading up to the Constitution presented in the initial address of this course; the opinion of Britain's brilliant statesman that the supreme originality and beneficence of this document suggest divine inspiration, needs no more than passing mention; yet it is worth while to define in some detail the era in world-history marked jointly by colonial Declaration and federal Constitution.

The scientific student of mankind notes certain races distinguished by physical features; he also notes, as of much greater importance, certain phases of intellectual character which have been found to represent stages in development. The phases may be outlined in different ways, all agreeing in import; the most convenient definition is made in terms of law or social organization. The simplest phase and lowest developmental stage is commonly called Savagery; it is characterized by a social organization based on kinship traced in the maternal line. The second stage, commonly called Barbarism, develops into patriarchy and finally into allodialism, the forerunner of feudalism; its law is based on kinship reckoned in the paternal line. The third stage, conveniently called Civilization, rises in feudalism and grows into that monarchism whose last term is imperialism; the source of law and organization in this stage is traceable to recognition of property right, especially in land. The fourth stage of development may be called Enlightenment; its fundamental laws are based on recognition of intellectual right, especially freedom of opinion, with its necessary concomitant, a voice in public affairs.

The records of history and of observation among various peoples show that these stages arise in a certain order which may be traced to intellectual development. Savagery persists until definite recognition of paternity arises, when the next stage is spontaneously entered; and once the transition is effected, through the enlarged knowledge, there is no retrogression save by extinction of entire groups. Barbarism in turn persists until population is so increased that personal contact between patriarch or priest and the people is necessarily replaced by arbitrary conventions, which arise spontaneously in such manner as to reflect both general knowledge and local conditions, so that the transition is effected, or partly effected, in various ways; in Europe it was partly brought about through the passage from allodialism to feudalism, which (although but a small part of the entire change) involved the development of a new order of law, according to Sir Henry Maine; with the aid of a beneficent cult, it was wholly effected in the arid land of Palestine, whence the leaven spread throughout much of the world in the form of more altruistic law than is known to lower culture. Civilization evinces no tendency toward retrogression into the lower order of law, yet there is a constant tendency toward a higher order marked by the limitation of hereditary monarchies, by revolutions at first bloody but gradually growing bloodless, by the separation of church and state, by the abrogation of odious laws, and in many other ways; in certain instances the form of governmental organization known as military despotism seems to bridge the chasm between civilization and enlightenment, much as feudalism connected barbarism and civilization in Europe during the last millennium. Enlightenment reveals no retrogression, save through senile surrender of self-reliance or hereditary debility which lead some to seek the support of stronger fellows; certainly no nation that has once tasted intellectual freedom in its fullness ever turned back toward mental bondage. Accordingly, the order of the developmental stages is definite, invariable as the movement of the planet in its orbit, as the flow of the river in its channel, or as the growth of the insect from egg to larva, from larva to pupa, and from pupa to imago; and the normal law of human progress is from savagery through barbarism to civilization, and then in due course to that enlightenment in which the mind is released from trammels and the physical being inspired by the boundless possibilities of free action.

So the student of the social stages sees four great milestones along the course of human development; the first marks dimly the origin of man on earth as the lord over lower creation; the second, seen vaguely in many lands, marks the passage from the most primitive condition to a higher stage through normal growth of knowledge; the third marks clearly the birth of nations, chiefly through the most beneficent belief the world has known; the fourth marks the passage of humanity into its best estate, in which individual strength of body and brain is the seal of nobility.

After half-imaginary glimmering, as in the "Republic" of Plato, the morning star of enlightenment rose first on the Alps of Switzerland. The early Swiss were a hardy stock, sifted by their own strength from the mid-European assemblage of tribes and nascent nations; their vigor was increased by adventurous life, while they learned the lesson of mutual helpfulness in ceaseless strife against rocks and ice; and thus they acquired, earlier than other strains of the European stock, that deep respect for self and regard for neighbor which bears fruit in altruistic government. The strong Swiss character is displayed in many ways; they are types at once of individual independence and of unselfish devotion; though clannish as Scotsmen, they have sown the seeds of science and other learning in every cultured land; they love their hard fatherland beyond all other men save the Arab and Bedou and Papago adorers of their native deserts; and it is not surprising that their combined individuality and solidarity forced the fruit of humanity even before the bud burst into flower in softer lands. Such was the character of the people that, when the yoke of the oppressor galled, a liberator stood ready to cast it off. Inspired by relief from her fetters, Switzerland sprang into national being; she stands today a distinct and peculiarly significant type of nationhood.

The sun of enlightenment tinged a broad horizon with the Declaration of American Independence, and rose in its fullness when the colonies were united as states. The time was fully come, for the intellectual quickening would not be stilled. America had her idolized Washington, as Switzerland her idealized Tell, and, through the singular capacity of the First President and his fellows, the transition from one culture plane to another was made at once and for all time with a facility and completeness which are a constant marvel to the student of the commonly devious and dilatory ways of human progress.

The examples of Switzerland and America have been widely followed. The soil of the western hemisphere has proved peculiarly fertile for free institutions; our neighboring republic of Mexico is a brilliant instance; a score of Central American and

South American republics have taken shape or are still coming up through successive essays in which grinding despotism constantly diminishes, while the bloodshed of the revolutions as constantly decreases; even the somber isle of the Antilles, Haiti, is essaying republican law and order. Beyond the Atlantic, France has seized and still clings to republicanism, despite the disposition toward despotism in which two-thirds of her sons more easily rest; while progressive Britain has grasped the substance of altruistic government through a thin shadow of conservatism brightened by personal affection for the most gracious sovereign the world has seen. Other nations are treading the path surveyed by Britain's eldest-born—that path along which, under nature's law of progress, the parent must follow the child.

The earlier episodes in the building of the American nation marked an era in the making of the human world; they are accordingly of the most profound and far-reaching significance. Other episodes followed in turn; but these (unless the events of this year 1899 be otherwise adjudged) have been episodes in national history merely.

The second full chapter in American history records the acquisition of the vast territory of Louisiana and Oregon, an acquisition through which the national area was more than doubled, while dominion was extended to the Pacific coast of the continent. This extension was not an easy one—indeed it was our boldest essay in areal growth, with the sole exception of that original stroke through which the transmontane and cis-Mississippi territory was taken. The difficulties encountered by the nation in making this essay were enhanced by a certain conservatism on the part of the Chief Executive of the time. True, President Jefferson was scholar and scientist as well as statesman, and had projected an exploring expedition through the Louisiana territory even before its acquisition; true, this expedition was dispatched in accordance with his plans even before the purchase was consummated, and resulted in fixing title to Oregon as gained through earlier discovery and later settlement; yet the President and his advisers held back from the bargain of a million square miles of adjacent territory for a bagatelle until they were forced to the mark by many conditions, including an incipient revolution on the part of the people. This popular movement, more significant than any presidential policy, was an expression of growing national character, itself the product of those forces and conditions to which the birth of the nation was due. With the close of the Revolution, the coastwise colonists forged their weapons into implements of peace or turned them against savage tribes; ambitious sons of hardy sires forced the forests, made conquest of the wilderness, and began the development of a riparian commerce which required the freedom of the rivers, especially the Mississippi; year by year the material of commerce increased with the extension of agriculture and the development of new industries to which the hard-handed and strong-headed settlers instinctively turned; and, under the ceaseless stimulus of individual freedom, each generation grew stronger than the last and sprang more readily toward conquest over lower nature—or over alien nation that might stand in the way. The sons of the sires who had broken Britain's rule were not to be balked by the feeble claims of Spain, or the diplomatic demands of once-allied France; the land for which their fathers bled, with all the privileges thereunto appertaining, were theirs by treaty right in clear conscience and common sense; and twenty thousand of them rose in arms to defend this right with lives enriched by the blood of all the best of mankind and the ripened knowledge of generations. The popular movement of the time proves that the strong character inherited by the colonists and strengthened through their stirring activities had gained still further strength through the sublime exercise of subjugating a vast wilderness. History will always credit to Thomas Jefferson and Robert R. Livingston the noble national achievement consummated in the acquisition of the fertile plains and priceless rivers of Louisiana territory; but the student of moral forces can never forget the agency of those American citizens, heirs to the divine right of kings, who exercised their prerogatives so efficiently and so wisely in 1803. Oregon territory, with the rich states into which it has grown, must always stand as a monument to Jefferson's sagacity and foresight; but the splendid states into which Louisiana was reconstructed form a still nobler monument to American citizenship—they were acquired by the people themselves for the use of the people forever.

The acquisition of Louisiana and Oregon reflected a national character made up of individual characters shaped during a hundred generations; at the same time it proved a power in further shapement of both personal and national character. Confronted by new problems and enlarged fields of activity, the pioneers turned toward fresh conquest of nature: They pushed over the plains, replacing buffalo and deer and antelope with kine and sheep and swine; they felled forests, and began the development of the world's greatest lumbering industry; they broke the virgin soil, converting the profitless acres into fertile fields and inaugurating a world-epoch of agriculture. As the produce multiplied they cut canals more energetically than any other people has ever done, and developed a large and luxurious steamboat traffic, long the wonder of the nineteenth century. The hunter and trapper led the lumberman and farmer in a long chase ending at the foothills of the Rockies; then Whitman and others crossed the mountains and completed by settlement the task begun by the explorations of Lewis and Clarke. The Indian warfare served to keep alive the sense of eternal vigilance, while a brush with the British proved anew the invincibility of freemen; yet withal the noblest conquest was that over the subtle powers of darkness which have trammeled mankind from the beginning—for knowledge was diffused more freely than ever before through the public school system, genius was fostered through the patent system, and the citizens were enabled to look down on lower nature from ever-new and ever higher points of vantage. The forces of dull nature move mechanically, but humanity's powers are multiplied by inspiration and stimulated by shock, and that quick outpushing of the bounds of American enterprise which came with the doubling of territory stimulated American faculty, set the personal and national pulse athrob, and nerved the freemen to even swifter and nobler conquests than those of their eventful earlier history. The acquisitions of 1803–1805 changed the map of a continent; they wrought far deeper change in the minds and characters of Americans.

The acquisition of Florida, albeit significant in many ways, formed but a ripple in the stream of national progress; not so the self-sought admission of Texas at the end of the most dramatic chapter in the history of the struggle for freedom—a chapter not yet properly signalized in the world's literature. When the Austins, father and son, migrated from Connecticut to Virginia, thence to Missouri, and finally to Texas, they became the nucleus of a group of adventurous spirits to whom the growing conventionality of eastern and southern sections was irksome, and in the free air of the Lone Star region they developed exultant strength of body and mind. At first hunters and prospectors and pioneer plowmen—"brier-breakers" in their own vernacular—they soon planted a stock-raising industry by which other enterprises were supported later, and so began conquest of the southern plains. The semi-lawless but unprecedentedly strong character of young Texas grew with the growth of ranger and brier-breaker; and, whether the character be admired or not, it played an essential part in the later growth of the nation. Without the ranger, the plains and mountains would have been far slower in subjugation; without the brier-breaker, the Mexican accessions would not have been made, and California's gold would have enriched another country; and without the Texan, history's most tragic episode in human strife would not have been. Savagery must have reeked with unwritten tragedies; doubtless tragedies dotted the unrecorded path of barbarism in its early gropings; but the world's writing cannot parallel the tragedy of the Alamo, when a hundred and forty Texans stayed for days an army of forty times as many Mexicans, of whom they slew four times their own number. The charge of the Light Brigade, immortalized in song and story—when

> "Into the jaws of Death,
> Into the mouth of Hell
> Rode the six hundred"—

has stirred the souls of millions and shaped the lives of thousands; yet the brilliance of Balaklava pales beside the glory of the Alamo. Even storied Greece, despite her tinge of heroic myth, held lower place: "Thermopylæ had its messenger of defeat; the Alamo had none." Travis and Bowie and Crockett were buoyed by freedom's benison into typical Americanhood; they could and did sell their lives to the last throb of their hearts, but they could not surrender; they could and did erect a living tomb and there bathe themselves in the blood and bury themselves neath the bodies of slaughtered foemen—for every blow was struck for freedom. The strong pulse of America beats fuller forever because of the mortal tragedy enacted in the shadow of the Cottonwood by these immortal actors.

It is the law of war that the strongest and bravest fall; it is the paradox of war that each such sacrifice is seed of richer strength and spirit. So the tomb of freedom within Alamo's walls became the cradle of liberty for the Lone Star empire and state. The exultant death-cry resounded over Texas' plains; it transformed a renegade into a hero and roistering rangers into invincible avengers; "Remember the Alamo" became the direst slogan of history; and Sam Houston led his little band with such deep skill and mysterious swiftness and dogged disregard of death that the great army of Santa Aña was first terrorized and then defeated ignominiously—and Texas rose into republican freedom.

The hard-fought liberation of Texas was an expression of personal and national character, yet the events were reflected in a million minds with such inspiring effect as to raise Americans to a new vantage-point in their struggle for conquest over the material and the moral. Without the Declaration there would have been no trans-Appalachian acquisition of territory; without this conquest there would have been no Union, no Constitution, no Louisiana; without Louisiana and Oregon there would have been no great nation; without Texas there would have been no America, in the sense in which we and others employ the term; and the admission of Texas into the Union, albeit dilatory, was but an expression of that manifest destiny which attends the spread of enlightenment wheresoever liberty's luminary shines.

The next large chapter in American history was opened by an echo from the preceding chapter; for international feeling engendered by the admission of Texas rankled until removed by the treaty of Guadalupe Hidalgo with its acquisition of half a million square miles of territory (including California), an acquisition supplemented five years later through the much-derided Gadsden purchase. These accessions marked growing self-reliance on the part of the nation, itself the expression of individual strength; yet the first was barely consummated before it began to react on character with unexpected and unprecedented vigor. The golden gleam of Yuba's placers shot athwart the mountains and plains and caught the eyes of the hardiest sons of a vigorous ancestry; and a voluntary industrial army laid overland trails, or devised sea routes, of six months' journey toward the sunset. Like the British colonists and the Texan rangers, they were picked men and chosen women; like their fathers and mothers, they were strengthened by the test to which they were subjected; and in good time they were followed by progeny of the finest physical and mental constitution the ages have produced. Taught by a beneficent school system, educated by a judicious patent system, and inspired (like all of their fellows) by freedom's boon, the "Forty-niners" and their followers carried creative faculty with them, and invention kept pace with their travel and their later labors in placer and shaft. A consequence was unprecedented development of mining, not merely in material production but in the construction of appliances and the discovery of new applications; a further consequence, following duly as the brightened intelligence of California spread over the land under the cumulative law of mental growth, was the opening of a new era in the development of devices for transportation, so that California quickly made America the foremost railway nation, and later the leading telegraph and telephone nation of the world. Curiously combined with the material growth of the Pacific coast was a significant moral growth, at first apparently aberrant, though soon falling in line with the great principles established by human experience, and bringing some benefit to the law of the land. Beyond the reach of courts and processes, the pioneers were forced to become a law unto themselves; this they did by aid of Judge Lynch, who attained his greatest eminence in the chaotic courts about the Golden Gate; yet it is a meaningful commentary on American morality that, with few exceptions, justice was wrought by the miners and freighters and pioneer farmers—justice of a quality not exceeded by that of the highest tribunals of civilization and enlightenment. Perhaps the severest test to which American character has been put was that of pioneer California; yet it was found not wanting.

The influence of the Mexican accessions on the nation has been profound: Gold beyond that of the Indies, fruits more luscious than those of Mediterranean shores, wool-products finer than those of the vale of Kashmir, have been showered over the land; returning pioneers have brought back the breath of a stimulating clime; our minds have expanded to encompass a home of El Dorado, a region of giant trees and proportionately big enterprises, a province of canyons and mountains sublime beyond compare; we have no large industry unaffected by conquest of once-scorned California, no national characteristic uninfluenced by the spirit of the Pacific coast; and throughout all America there is no personal character that has not been in some way touched—and always for the better—through the influence of this national possession. America has become a nation of established characteristics; without the Mexican accessions she would be another country.

A slender affluent entered the stream of national progress with the Alaska purchase twenty years later. For a quarter of a century its contributions to material prosperity and national character were limited; but within five years the problems presented by its frigid valleys and fruitful fishing-grounds have come into prominence, while its gold has become a bait for settlers, as did that of California a half-century past. Within a year Hawaii has come to us, like Texas, of her own volition; Puerto Rico has come through fortune of war for humanity's sake; Cuba and the Philippines have been liberated in such manner as to demand policing yet to promise early entry into the sphere of enlightenment. The ultimate effect of this series of additions to the nation—past, present, and prospective—may not be foretold fully, though it may be prevised in terms of past history: The trans-Appalachian acquisition by Washington and his compatriots united the colonies in a nation, opened an era of education and invention, and raised a race of pioneers; the acquisition of Louisiana and Oregon by Jefferson and the people brought an era of canal-building and steamboating, revolutionized agriculture, and diffused intelligence beyond previous imagining; the admission of Texas ushered history's most heroic struggle for liberty, lifted industries connected with horses and kine to a new plane, and introduced a type of manhood required for further conquest; the Mexican accessions brought wealth and national power, made America the foremost railway and telegraph nation, enlarged intelligence, strengthened character, and produced the world's highest type of humanity. In the light of these pregnant facts, it seems safe to presage important physical and industrial and moral advances through the influence of the later acquisitions; and if Cuba and Puerto Rico, Alaska and Hawaii, and Luzon and her neighbors do not make America the foremost naval and shipping nation of the earth within a quarter-century, then experience stands for naught, history is a delusion, civilization a failure, and enlightenment a farce.

In reviewing the territorial growth of the nation, it is needful to remember that the forces and conditions which led first to the predominance of Britain and then to the independence of the American colonies are still in effect. The blood-blending and culture-commingling have continued increasingly until the American has come to represent the world's most complex ethnic strain, and his culture to comprehend that of all other ages and lands in addition to his own rich product. The selection of the strong by pioneering has been repeated over and over again, and the prepotent progeny have gone back to vitalize the weaker vessels with little loss of their own vigor, and each generation has enjoyed that stirring exercise required to raise it above the ancestral level. More than all else, the generations have been lighted on their way by Freedom's torch : they have been not only permitted but constantly encouraged in the development of latent power; they have been educated better than any contemporaries; their hands and brains have been developed by the most varied activities of any nation; they are better fed, better clothed, better housed than peoples of other lands and climes; their self-respect has been built into a structure so strong (as shown by Texas and California) as to withstand every shock; and through the combination of all these factors they have become fit representatives of humanity, invincible in war yet generous to fallen foes, subjugators of lower nature, and conquerors of the powers of primal darkness—in every way easy bearers of the world's highest culture.

Such are America and the Americans at this end of the nineteenth century.

The progress of the American people has not been effected without opposition from some of their own number. A few of the original colonists deserted and fell back into bondage; the Revolution produced some tories and traitors and more mere doubters; the trans-Appalachian territory was a bone of contention in the Continental Congress; the epoch-marking Declaration and Constitution were opposed by a minority of the nation-makers. Despite the popular approval, the acquisition of Louisiana aroused some sentiments and words of antagonism, which were repeated when Texas sought admission, again when the Mexican accessions were under consideration, and once more—with the same lugubrious intonation—during the present year 1899; yet in every emergency the stronger have carried the weaker, and progress has gone forward.

At every stage even unto today the voice of the prophet of evil has been heard. Stolid representatives of Britain's virile stock, from Herbert Spencer to Sir Edwin Arnold, rail against the unseeming celerity of movement of the typical American, and predict hospital or mad-house as his goal; they forget that the American but moves at a normal pace shaped through his more varied ancestry and richer heritage of successful exercise than his contemporaries, that there is less overwork in America than in any other progressive nation, that in average expectation of life as in stature the American leads the world, and that even in this active land ten men rust out where one wears out. The faint-hearted shudder at the figment of Wall street and the phantom of the monopoly; they forget that the multi-millionaire's daughter becomes an angel of mercy whose beneficence softens hundreds of sick-beds and lengthens scores of lives, and that the best organized American monopoly founds a university whence a thousand students go forth annually to diffuse higher knowledge and better capacity for self-support among a hundred thousand countrymen. Pessimists cower before the formless monster of political corruption which they conceive to gnaw at the vitals of our national institutions; they forget that the executive of the state containing our so-called corrupt metropolis was elected on the sole platform of honest manhood, and that our present Chief Executive is one to whom, more than any predecessor, the will of the people is law. Today the trembling ones shrink shrieking at the self-conjured ghost of imperialism, as if empire could grow in freedom's soil, as if the bright-winged papilio of constitutional law might, forsooth, creep back to the chrysalis where the monarchical pupa grew in centuries past; these do more than forget—they never knew that the culture-plane of constitutional control is so far above that of imperial rule that the subject of empires can never see its inspiring expanse; they ignore the Law of Human Progress (seen through the coördination of other sciences in the Science of Man) under which humanity moves, in ways orderly as planetary orbits or vital stages, from savagery into barbarism, thence into civilization, and finally into enlightenment, never dropping backward save by extinction; they comprehend not the full significance of humanity's law, vaguely expressed as "manifest destiny," which proves that imperialism is impossible on the plane of enlightenment, and that the peoples of the earth are steadily rising from plane to plane with the certainty of ultimate union on the highest of the series. Would that the ever-present prophet of evil might always fail of honor in his own country!

"Take up the White Man's burden," chants the bard of his generation in the ballad of the century:

> "Take up the White Man's burden—
> The savage wars of peace—
> Fill full the mouth of Famine,
> And bid the sickness cease."

The white-skinned man indeed leads the world today; but he is not the only burden-bearer. In savagery the strong man leads his fellows, while the weaker fall; in barbarism the strong man leads his family, turning perchance in pity to the weakling; in civilization the strong man supports subjects and feeds their families, and reaches out in helpfulness toward other subjects; but in enlightenment the strong man not only carries the weak until cured or coaxed into strength, but seeks ever to lift to his own plane the world's weaklings, whether white or yellow, red or black. Civilization indeed makes noble subjects of Oriental princes, but enlightenment makes leaders of nations in Indian Juarez and half-Indian Diaz, and leaders of minds in African Douglass and Booker Washington; the dark-skinned man is no less human than his lighter brother, and on the plane of highest intelligence it is the self-taxed task of the white giant to lift darker fellows to liberty's plane rapidly as the duller eyes can be trained to bear the stronger light. Nor is this the whole burden; for in enlightenment, much more than in civilization, it is the duty of the strong man to subjugate lower nature, to extirpate the bad and cultivate the good among living things, to delve in earth below and cleave the air above in search of fresh resources, to transform the seas into paths for ships and pastures for food-fishes, to yoke fire and lightning in chariots of subtly-wrought adamant, to halter thin vapors and harness turbulent waters unto servile subjection, and in all ways to enslave the world for the support of humanity and the increase of human intelligence.

Of such are the tasks in which the strong exult and glory, whether their skins be light or dark.

Would that poesy's living fire and science's finéd gold might meet to gild the noble fane of all humanity; would that Parnassian light might shine on the whole long path of man's advance as it shines today on the kindliest step of kingly progress; would that the Strong Man of the ages might lodge in a thousand million hearts, as the White Man of the century lives on a hundred million tongues, through genius' touch! For it is the Strong Man of the races and eons who has borne the burden of the world and made humanity.

The American people, offspring of the strongest stock the world has seen, gained early strength by exercise, and raised human law to a new plane a century and a quarter ago; with half a dozen great leaps they have sprung forward, at once in territorial growth and strength of character and breadth of intelligence, outpassing their fellows of older nations; at every step they have borne the Strong Man's burden—and few among them today would willingly cast it off.

JOBOS HARBOR

Mr Robert T. Hill's allusion to the rediscovery of Puerto Rico by the Americans is a witty characterization of our ignorance of that lovely island. Among other rediscoveries made there, is that of the harbor of Jobos, for as long as 30 years ago Wappäns, in Stein's "Handbuch der Geographie," said that "especially Jobos might be made a seaport of great importance." The Spaniards, however, never charted it. Perhaps that is why the American troops did not land there. Be that as it may, it did not escape the keen observation of Captain Whitney, the young army officer who risked his neck in traveling through the length and breadth of Puerto Rico at the outbreak of the war in humble disguise, and who reported on the possibilities of the place. Later on General Roy Stone brought to Washington a sketch of the harbor, showing a few soundings, and finally the U. S. Coast and Geodetic Survey undertook the mapping and charting of the locality, and the preliminary survey at this date has probably been completed by Mr Hodgkins, commanding the *Blake*.

The western entrance to the harbor is about 25 miles east of Ponce. The harbor itself is formed by a line of low wooded coral reefs, between which and the mainland there is a perfectly sheltered narrow sound with ample depth for vessels of moderate draft. Vessels of the deepest draft can enter through the western entrance, but our present knowledge leaves us in doubt as to the width of the channel inside, and not until the *Blake's* work has been received will the actual value of the harbor be known. A second entrance, four miles to the eastward, bears the suggestive name of Boca de Infierno, and carries but 12 feet of water. From this entrance the sound runs about two miles north and then two or three miles to the eastward, forming a bight in which the water is decidedly shoaler than in the western part.

O. H. Tittmann.

SAMOA: NAVIGATORS ISLANDS

By Commander H. Webster, U. S. N.

The Samoan islands, some 4,200 miles southwest of San Francisco and 420 miles northeast of the Fiji islands, were discovered by the French navigator Bougainville in the year 1768, and with the single exception of the Hawaiian group are the largest and most populous in the Pacific.

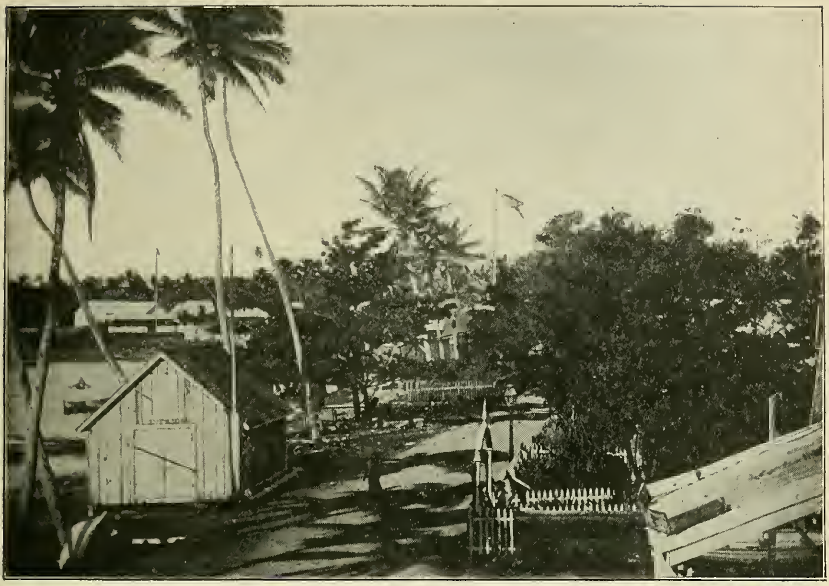
Geographically, the Samoan group lies between 13° 30′ and 14° 20′ south latitude, and between 169° and 173° west longitude. There are thirteen islands in the group, but a large proportion are little more than barren volcanic rocks. Three only are inhabited, for three alone possess the wherewithal to support a population. These three islands, which have come into such prominence within very recent years, are Savaii, with an area of 700 square miles, Upolu, with 550 square miles, and Tutuila, possessing but 55 square miles. On Tutuila is situated the landlocked harbor of Pago-Pago. The population of the group is variously given at from 30,000 to 50,000, but the first-named figure is probably nearer the truth.

NATIVE ROAD IN SAMOA

The highest peak in the islands is on Savaii, a fine specimen of volcanic mountain 4,000 feet high and, in common with others of the archipelago, clothed to its top with a thick growth of cocoa and other palms, bread-fruit, guava, and numberless specimens of tropical vegetable life. Upolu is almost entirely surrounded by those singular coral growths called barrier reefs, wonderful submarine walls or breakwaters built up to the level of the sea and forming fine lagoons by means of which communication from point to point is facilitated in all kinds of weather. The distance from the reef to the shore varies from a few feet to three miles.

The climate of the Samoan archipelago is distinctly tropical, the temperature seldom rising above 100 on the Fahrenheit scale or falling below 70. During a large part of the year the winds are moderate and from diverse directions, so that on the elevated plateaus near the ocean the climate is not disagreeable or unhealthy. Beginning in February, however, and extending through the entire month of March, the islands are subject to violent hurricanes which often do immense damage to plantations and dwellings. The historic tornado of March 15 and 16, 1889, will be recalled as an example of the cyclonic fury of the winds which visit these latitudes at long and irregular intervals. Throughout the year frequent thunder-showers temper the atmosphere and supply

GERMAN PLANTATION IN SAMOA



STREET IN APIA

the necessary irrigation for the rank vegetation growing on every available spot, from the beach to the highest pinnacles of the mountains that rise from every island of the group.

The Samoan language bears a strong family likeness to those of many of the other Pacific islands, but its resemblance to the Hawaiian tongue is so remarkable as to induce the belief that the two were derived from a common parent stock. It has been observed, however, that any attempt to ascertain which of the Polynesian dialects can be considered the mother tongue must prove fruitless, as the absence of a record of any sort, beyond the transmission of crude history through tradition, effectually blocks the road to investigation. By some writers the insular language is regarded as original, in the usual acceptation of the word, implying no more than such a degree of obscurity as would render useless all attempt to trace the line to its derivation. The Hawaiian and Samoan natives are able to converse understandingly on the subjects involved in their simple life, but each claims that the differences from his own existing in the other are merely corruptions of his own speech. In this respect, however, these islanders are not unique.

The food of the islanders is mainly vegetable; bread-fruit, taro,

INTERIOR OF SAMOAN NATIVE HOUSE

yams, bananas, and cocoanuts are the staple articles, but the lagoons and reefs abound in fish and shell-fish, among the latter being a fine variety of shrimp, of which the natives are very fond. Following the discovery of the islands by Bougainville and the celebrated Captain Cook, pigs and fowls found a lodgment here, until of late years a wider variety in the native dietary has gained foothold. Fishing is carried on solely with spears and nets, as the inhabitants of the waters surrounding Samoa decline to use the hook, be it baited ever so alluringly.

The cooking among the natives is done by the men, and if a woman is seen cooking it is regarded as just cause for jeering at the men of her family. No spices or seasoning are used, but salt water is sparingly employed to give additional flavor to food. From taro and bread-fruit is made *poi*, which is extensively eaten in all the Polynesian islands, the process of manufacture being everywhere the same. The native meal hours are not very different from those usual in more civilized parts of the world. The principal meal comes in the evening, when the whole family meets—men, women, and children eating together. They have no tables or other furniture, but seat themselves cross-legged on mats round about the circular house. Each person has his portion set before him on a bread-fruit leaf. After the meal, water to wash the hands and lips is passed around, and a rub on the nearest post is the table napkin.

Hospitality is a leading virtue, though often in many parts of the group its application involves sacrifices of everything held in highest esteem by the simple islander. Traveling parties can go from end to end of the group without expense for food or lodging, and the official "Large House," maintained by each village, is seldom vacant. This peculiar institution is provided by

SAMOAN GIRLS MAKING KAVA

contributions from every family in the place. One of the results of this type of hospitality is that the Samoan has become a great traveler. Large parties, resembling our "tourists," band together and go from town to town and from island to island.

The native drink, or *kava*, is prepared from the root of the *Piper methysticum* and is but mildly intoxicating. In fact, my own experience with this liquor is that it does not sensibly affect the head, but makes the knees tremulous. The head of a family when taking his cup of *kava* at the beginning of the evening meal pours a little of it on the ground as a sort of drink-offering to the gods. Formerly *kava* was prepared by the girls of the family. The root, after being carefully washed and cut into thin slices, was chewed into a fine mass and thrown into a large wooden bowl of water. After quite a prolonged stirring, the mixture was strained of its solid constituents by passing through it a bunch of cocoanut fiber, leaving a grayish, pungent fluid, with a pleasant taste of peppermint. As soon as made it is ready for use, and is passed around in cups made of shells of the cocoanut. In more recent times the root is grated or pounded instead of being masticated; but, while this is undoubtedly a cleaner process, it is said by connoisseurs to impair the flavor of the *kava*.

A favorite amusement for old and young is the *siva*, the word meaning to dance. It is not, properly speaking, dancing, but is more like an acting charade, for, although accompanied with music, singing, and slapping of hands, the *siva* has no steps or regular figures, its motions consisting of slow pacings, bodily and facial contortions, and what may be called descriptive acting. The actual *siva* is performed by girls. The dancers are prepared for the *siva* by copious smearings of cocoanut oil applied by some female relative, followed by a careful adorning of the glistening body with the *lava-lava*, or loin cloth, and flowers for the hair and neck. The subjects represented all relate to the life of the islands, and are frequently given with a verisimilitude which leaves nothing to the imagination. Courtship, marriage, and the care of children find a leading place in the representation, while making *poi*, spearing fish, paddling the canoe, gathering fruit, and also some of the "living pictures," are not omitted. As the pace grows livelier frequent draughts of *kava* incite the dancers to renewed activities, and often, as the excitement grows, subjects of a grosser nature are given, and frequently before the conclusion of a first-class *siva* the girls will divest themselves of even the pretense of clothing, the *lava-lavas* following the flower garlands until the space in the hut devoted to the performers is filled with a swaying mass of glistening bodies, and the odor of the cocoanut oil becomes simply overpowering to the few civilized onlookers who are permitted to witness a genuine *siva*.

The Samoan has a great liking for games of skill. The favorite sport throughout the islands is a sort of quoits, only, instead of being played with disks of stone or metal, the implements are long, slender rods, which are cast with a peculiar turn of the wrist that causes them to go through the air with a certain humming or singing noise. These rods are marked or numbered, and the thrower casts the same rod each time. The distance to which a skillful player will throw his rod is astonishing, the one making the longest throw a certain number of times in succession being the winner. One of the results of contact with the white man has been the introduction of card-playing, especially of casino, or "Sweepy," as the natives call it. Cricket has taken a strong hold upon the pleasure-loving native, and so all-pervading was the influence of this game during the reign of Malietoa that it was no uncommon experience for us to come upon a native village utterly deserted by its inhabitants, for the entire population would be in a neighboring clearing, watching or taking part in the favorite game of the British, from whom, of course, they had learned it.

In the construction of his simple water craft the native follows the time-honored practice described so graphically by De Foe in "Robinson Crusoe." It is a dugout, made partly with fire and partly with the rude chopping implements his skill has enabled him to manufacture. This frail craft can be navigated with safety through heavy weather which would swamp more pretentious boats, and is to be found on far-distant voyages among the islands of Polynesia.

Considerable romance has always attached to that singular material called by the natives *tapa*. Though called a cloth,

SAMOAN NATIVE CANOE — DUGOUT

tapa is in no sense a woven fabric, but in the material employed, as well as in the processes of its manufacture, is more a paper than a cloth. *Tapa* is the inner bark of *Broussonetia papyrifera*, a member of the mulberry family. It is beaten out on a board and the narrow strips are joined together with a paste of arrowroot, so as to form any width or length required. The juice of berries, red clay, and the soot of the burned candle-nut furnish the coloring

SAMOAN BRIDE

matter with which to form the figures and designs generally seen on the native cloth. The fabric can be beaten out as thin as the most delicate tissue paper, and in this form is soft and smooth in texture. Fine mats are skillfully woven by women from the leaf fibers of a species of *pandanus*, which are scraped as thin as tissue paper. They are regarded as heirlooms and are carefully preserved.

Among the men of these islands the practice of tattooing is quite general. This is a dangerous as well as painful operation, and many deaths have ensued from it, blood-poisoning frequently occurring as a result of the methods practiced. A sharp piece of human bone, secured to the end of a long spear-shaped piece of wood, is the instrument employed, and, as the same one is used indiscriminately, disease is very easily transmitted. The tattooed area extends from just above the knee to a point approximately on a horizontal line with the navel, the effect being that of a tight-fitting suit of light-blue undercloth-ing. The tattooing is only applied when the youth attains his majority, and usually takes several weeks to complete. Many women are also tattooed, but not so elaborately as the men. Sometimes there is only a line or two on the arms or across the breasts. In other cases the girl's name will be seen indelibly fixed on the right arm.

Unlike many other nations and tribes of tropical origin, the Samoans do not marry until they have reached the age of maturity. The marriage ceremony is of the simplest, the main point being that the mutual consent of the man and woman shall be witnessed by as many members of their respective families as possible. The dowry, consisting of mats, *tapa*, personal adornments, and the few household utensils employed, is supplied by the bride, and becomes the property of the groom as soon as the formal meal following the wedding ceremony is eaten. There are many marriages, however, without any ceremony whatever, a simple expression of willingness to live together filling the requirements. Divorce is not uncommon, and immemorial custom provides that all young children shall go with the mother. Polygamy was at one time practiced, but of recent years this has almost ceased. An old Samoan tradition has it that in the beginning their fathers had no houses, but were "housed by the heavens."

A native house resembles a gigantic beehive thirty or forty feet in diameter, and raised from the ground on a number of short posts placed at regular intervals. The thatching is laid with great care, and consists of the long dry leaves of the sugar cane, which here grows wild, secured in place by the picturesque branches of the cocoa palm. The thatching, if well done, is rain-tight, and lasts a number of years. In the center of the house, as shown in the illustration, there are two, and sometimes three, posts, twenty feet long, sunk into the ground three feet or more.

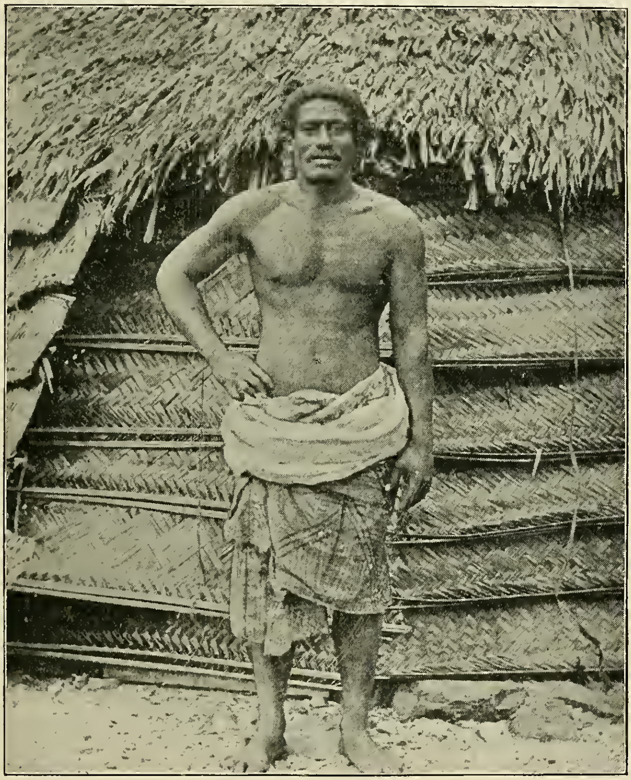
These pillars support the ridge-pole of the building, and are made from the trunk of the bread-fruit tree.

Their great circular roofs are so constructed that they can be lifted bodily from the supports and removed anywhere. No metal of any sort is used in the construction of these houses, all fastenings being made with a thin cord plaited from a cocoanut fiber. The arrangement of the houses has no regard to order, each man putting his house on his little plot of ground according to his fancy. Due regard, however, is paid to the shade

SAMOAN NATIVE HOUSE

of neighboring trees, the direction of prevailing winds, height of ground, etc. A house contains but a single room, and this apartment is by turns the common sitting-room, dining-room, and bed-room. Four or five mats make the bed, while the pillow is a piece of bamboo three or four inches in diameter, three or four feet long, and raised from the ground on short legs. The fireplace is a circular hole several feet in diameter by six or eight inches deep, and the fuel commonly employed is dried cocoanut shells, which give neither smell nor smoke. Cooking, however, is not carried on at these fireplaces, but, save in the worst of weather, is always performed at some distance from the dwelling-house. An entire village often lends a hand in the erection of a house for a newly married couple.

The Samoans are physically well formed; they have straight hair and regular features, and are very much like Europeans in



SAMOAN CHIEF

expression. Their natural disposition is open and amiable, and the absence of a thieving propensity is a most marked characteristic. In war they have proved themselves brave and hardy, and in victory disposed to lean toward mercy. They possess great mental ability, and are capable under favorable circumstances of great improvement.

THE COMMERCIAL IMPORTANCE OF SAMOA

Commercially the Samoan islands are more important as an aid to the merchant marine of the world than as any addition which they can ever make to the world's commerce. With an area but about equal to that of Rhode Island, and much of it comparatively unproductive, little can be expected as to their producing capacity, and consequently little as to their consuming capacity. Upolu and Tutuila, however, are very fertile, and with their tropical climate could increase their products to a very considerable sum in value if properly cultivated. The natives, however, are averse to labor, and those who have attempted agricultural pursuits in the islands have been compelled to import laborers from other islands, chiefly from the New Hebrides, New Britain, New Ireland, Ellice, and the Gilbert islands, rates of wages being $1 per day for laborers, or $10 per month with food; mechanics from $3 to $5 per day; clerks, $50 per month and board, and book-keepers, $100 per month and board. There are now constantly from 1,000 to 1,500 foreign laborers in the islands, and about 300 Europeans and Americans.

The agricultural productions are chiefly copra (the dried kernel of the cocoanut), sea-island cotton, bread-fruit, sugar, and coffee. The exports of copra in 1896 amounted to $230,000, the average annual quantity being about 5,000 tons, with a present value of about $40 per ton, against $60 to $75 per ton in former years. The supply of copra has been considerably reduced by the wars between the natives, who devote their attention to raids upon the cocoanut plantations of their enemies, a man with a sharp knife being able in a few moments to destroy a tree which requires seven years to reach a producing stage by simply cutting out the crown of the tree. The copra is used for making cocoanut oil, and finds a market in the United States and Europe, about one-fifth of the crop coming to the United States, though the general market for cocoanut oil has been materially injured by the increased supply of cotton-seed oil. Experiments have been made in the production of sea-island cotton, cacao, sugar, tobacco, and coffee, and while the result has not been altogether satisfactory, it is probable that with a settled condition politically and industrious habits among the population they might be grown satisfactorily and the exports of the islands increased from their present figure of $260,000 to $300,000 to more than double that sum.

The imports consist chiefly of cotton goods, clothing, hardware, iron manufactures, arms, ammunition, provisions, coal, mineral oil, malt and spirituous liquors. The proximity of Australasia renders it the chief purchasing market, $260,000 of the $418,000 worth of imports in the latest year's reports having come from New South Wales and New Zealand, while Germany comes next with $64,500, the United States with $60,600, Tonga, $12,000, New Britain, $8,600, other South Sea islands, $5,600, and the United Kingdom, $1,500, though doubtless a large share of the imports from Australasia is of British production. The total imports amount to from $350,000 to $400,000 annually. Both the import and export trade are in the hands of the Germans, who have large plantations and the chief trading establishments of the islands. The latest reports from the American consuls, however, indicate a gradual decline of German trade, accruing in about equal proportions to the Australian and American trade.

Transportation is by steamer lines between Sydney, Auckland, and San Francisco, their vessels calling at Apia each way every four weeks, and by the Union Steamship Company of New Zealand, which sends two steamers monthly, one from Sydney and one from Auckland. The steamers usually spend from two to five hours at Apia at each trip, dependent upon the amount of freight to be handled and the state of the weather. New Zealand is reached in five, Sydney in eight, and San Francisco in fifteen, days. Freight rates to and from the Australian colonies are much less than those to and from San Francisco, the rates on flour per ton being $7.50, against $12 from San Francisco, though rates from the islands to San Francisco are recently quoted as very low as compared with those to other purchasing markets for copra.

The currency of the islands was established by the Berlin treaty as American coinage, but the only coins current are of the mintage of Great Britain. All accounts, however, are kept in terms of United States currency, the English sovereign ($4.86) being in current business transactions accepted as equivalent to the American half eagle, the English florin (2 shillings, 48 cents) to half a dollar, a shilling to the quarter of a dollar, and the sixpence to a dime. The only case in which values are more rigidly computed is in foreign exchange, in which the rate is almost practically uniform at $4.86 to the pound sterling or sovereign. The money in circulation is said to be about $35,000, or equivalent to about one dollar per capita, though in the absence of banks or other facilities for determining this with accuracy, these figures are necessarily merely estimates.

As already indicated, the Samoan islands are vastly more important from their strategic advantages, both commercial and political, than from the sum they can ever contribute to the trade of the world. Lying directly in the route between the Isthmus of Panama and Australia, the Philippines and the Orient, and also in the trade routes between the western coast of the United States and Australia, they are of great importance as ports of call for repairs, supplies, coaling and cable stations, etc., either for merchantmen or war vessels. The harbor at Apia is good under ordinary conditions, though the sad events of 1889, when all the German and American war vessels in that harbor were destroyed, show its unsatisfactory qualities in a severe storm. The harbor of Pago Pago, in the island of Tutuila, which is owned by the United States, is, however, pronounced by experts the best in the South Pacific.

O. P. Austin.

THE NATIONAL GEOGRAPHIC SOCIETY

The comprehensive work of the United States Government, in connection with the scientific exploration and survey of its vast territory, brings together each winter in the National Capital a larger number of specialists in those several departments of science which are more or less closely related to geography than is to be found in any other city in the world, with possibly one exception. All these workers have traveled far and wide in the prosecution of their researches, and most of them continue to devote all but the winter season of each year to further investigations in the field. Without depreciating in the slightest degree the contributions to geographic science of other explorers and investigators, it may be said that our knowledge of the geographic features, physical conditions, and natural resources of the United States and Alaska is almost wholly the outcome of the scientific work of the Government. The first explorers of the Grand Cañon of the Colorado and of the marvelous region of the Yellowstone; the men who for so many years had the distinction of having carried the flag of their country to a more northerly point than the bravest adventurers of any other nation; those who have measured the altitude of our most famous mountains, have traced the windings of our coasts and the meanderings of our rivers, have determined the geographical distribution of our fauna and flora, have enlightened us as to the manners and customs of the aboriginal inhabitants of our country, and marked out, even in advance of their coming, the pathway of the storm and the course of the devastating flood—all of them have their homes in the National Capital and are pursuing their investigations in the service of the Government.

It was this assemblage in Washington of so many of the most active contributors to geographic science that led to the formation, on January 20, 1888, of the National Geographic Society, which, in pursuance of its constitutional object—the increase and diffusion of geographic knowledge—has performed from the first the double function of promptly presenting to the American people the principal results of geographic exploration and research and affording to the geographic workers of the National Capital opportunity for the publication, through an agency popular and yet authoritative, of information that might otherwise have lain buried in voluminous reports, more or less delayed in publication, and perhaps too technical for popular reading. The National Geographic Society began with 167 members, and so steady and uninterrupted has been the increase in its membership that, without the exertion of any special or systematic effort to excite interest in its work, it now has 1,100 active or resident, and 500 corresponding or non-resident, members. In Washington its annual course of lectures has come to be so important a feature of the intellectual life of the city that the capacity of the largest available auditorium is inadequate to its accommodation, and the erection of a building specially adapted to its requirements is in contemplation. Its official journal, The National Geographic Magazine, published for the first eight years at irregular intervals and as the transactions of a scientific society rather than as a magazine of general geographic information, has, since January, 1896, been issued monthly, and its increasing circulation among teachers and the general public, independent of the Society's active and corresponding membership, has done much to encourage its editors in their efforts to keep it in the front rank of the geographic magazines of the world, and to maintain its position as the acknowledged exponent of the geography of the western hemisphere, and particularly of the United States and its possessions. The Society has furthermore sought to promote the "increase" of geographic knowledge by the encouragement and assistance of various scientific expeditions and the "diffusion" of such knowledge by the offer of prizes for the best essays on designated subjects of geographic interest.

In not one of these several directions, however, does the Society's most substantial and conspicuous success afford more than a faint foreshadowing of the possibilities of usefulness that are open to it, and of which it stands ready to take advantage as rapidly as its financial resources will permit. It is doubtful if the study of any branch of human knowledge ever before received so sudden and powerful a stimulus as the events of the past year have given to the study of geography, and the National Geographic Society should be in a position to extend to the residents of every large city and of every important educational center in the country the same opportunities for the acquisition of geographic knowledge that are now so much appreciated by the people of Washington. There is not one of the new territorial possessions of the United States the geographic conditions and economic possibilities of which have not already been discussed, under the auspices of the Society, by distinguished men who are thoroughly familiar with them from personal observation and research, and it would be almost impossible to devise a means of more effectually promoting the Society's objects than by the delivery of these and other entertaining and instructive lectures in all the large centers of population. It is also desired to increase the size, and in corresponding measure the attractiveness and value, of the Magazine, and to this end a strong and influential addition has been made to the Editorial Committee, and an Assistant Editor, who will devote his entire time to the work, has been appointed.

While the Society will welcome any special donations that can be devoted to the promotion of geographic research, to the foundation of scholarships, or as awards for competitive essays, its main reliance must continue to be those annual dues of members for which it renders a full equivalent in its lectures and publications. Its past and present presidents, the late Hon. Gardiner G. Hubbard and Dr Alexander Graham Bell, have been generous contributors both to the ordinary and the special agencies by which it has sought to attain its objects, and together with the Editors of the Magazine, the Secretaries, and the Board of Managers in general, have given freely of their time and best energies to the furtherance of the interests for which it stands. For the first time in its history a systematic effort is about to be made to increase its membership, as the first step toward the enlargement of its work, and if each member will recognize his obligation—if not to the Society as an organization, at least to the cause with which it is identified, the closing year of the century will see the National Geographic Society enter upon a career of usefulness unexceeded in its far-reaching importance by that of any other scientific society in the world.

JOHN HYDE.

GEOGRAPHY FOR TEACHERS

There have been evident of late two simultaneous tendencies, one in scientific. the other in pedagogic, circles, whose combined result bids fair to exercise a great and far-reaching effect on the literature and life of the future. The idea was long prevalent among teachers that pupils in the common schools ought to learn only such well-established facts as could never be disputed, thus laying a firm foundation for all later knowledge; that in the college course modern theory might be profitably discussed, but that only the post-graduate student should be intrusted with original investigations. The pendulum has now swung so far the other way that some modern educators refuse to allow the multiplication table to be taken on faith, and inductive arithmetics, grammars, and physics, inductive methods even in Latin and Greek, flood the market. On the other hand, the specialist is everywhere read—through interviews in the daily papers, through articles in the magazines, through popular publications—retailing in untechnical English the fruits of his discoveries, and, where necessary, introducing and explaining those technical terms which are untranslatable, to the enrichment of the popular vocabulary.

One phase of the interrelations between the learned and the learning world is found in the text-books of the day. The writing of these books is no longer intrusted to professional bookmakers as middlemen, but such names as Fiske and McMaster in history, as Davis, Russell, and Gilbert in geography, show the desire of the public for the voice speaking with authority. A second phase is represented in a class of popular works such as Stanford's Compendium of Geography, each volume of which, though intended for laymen, is written by an authority on the region covered; the work on the United States published by Appleton and Company five years ago, the editor a Harvard professor, and each chapter contributed by a specialist of note; the National Geographic Monographs, published three years ago by the American Book Company for distribution among teachers, each a contribution from a geologist of note on some special region of our country.

The National Geographic Society represents a third phase, including, as it does, in its membership geographers and discoverers of world-wide fame and private citizens with no claims on any science but that of interest. In order properly to index this feature of the Society and to further cement the relations between the upper and lower orders of the educational structure, the Society purposes to publish in The National Geographic Magazine such information as may best aid the progressive teachers among its membership to procure both knowledge of geographic facts and skill in their presentation.

During the summer months most teachers strengthen their minds, exhausted by too much giving, by a little getting; hence the summer schools are crowded. In some of these good work is done along several geographic lines. Those teachers who remain at home need to study in this direction not the productions of the middleman, but the best authorities, for none can tell a fact either so tersely or so graphically as its discoverer.

The two lines of work most emphasized of late in geographic teaching are physiography and economic geography—the processes of the earth's preparation for man and of man's exploitation of the earth. Two, at least, of the lately published school geographies treat well, though briefly, of the first. Shaler's First Steps in Geology, followed by the reading of Le Conte's Geology, which, though not of highest scientific value, is very easy reading, will prepare for the comprehension and enjoyment of Geikie's large book. Directly following such a course may be studied the economic side of the subject as represented by King's The Soil, one of the Rural Science series, edited by L. H. Bailey, of Cornell; The Fertility of the Land, by Roberts; The First Principles of Agriculture, by Voorhees, or Vegetable Mould, by Darwin. All these involve processes related to agriculture. The Report on Iron and Steel in the Census of 1880; Economic

Mining, by C. G. Warnford Lock; The Genesis of Ore Deposits, by Poseping, or Stones for Building and Decoration, by G. P. Merrill, cover another economic field as closely related; and American Highways, by N. S. Shaler, treats of a third branch of industry based on the same study. None of these books is too difficult for such comprehension as may broaden the knowledge of any intelligent reader, though none of them is free from difficult passages or terms.

C. L. Garrison.

THE HARRIMAN ALASKA EXPEDITION IN COOPERATION WITH THE WASHINGTON ACADEMY OF SCIENCES

Through the generosity and interest in science of Mr Edward H. Harriman, of New York City, the most comprehensive and well-equipped scientific expedition that has ever left this country has just started for Alaska. The especial object of the expedition is to collect information and material relating to the fauna and flora, geology, glaciers, and other features of Alaska. As almost every branch of scientific research is represented by specialists of national reputation, from mutual coöperation and the consequent economy of time and labor, a vast fund of knowledge about the geographic features of this little-known area will be gained. The equipment throughout is as complete and generous as the plan is comprehensive, for everything that can contribute to the comfort and assistance of the members Mr Harriman has unstintedly provided. The details of the expedition are in charge of Dr C. Hart Merriam and Dr Lewis R. Morris. The plan of itinerary has been left elastic in order to take advantage of information gained on the way. The eastern members of the party left New York on May 23, expecting to be joined by the others at Chicago and Seattle, and to sail from Seattle by the steamship *George W. Elder* on or before June 1. This vessel, recently overhauled by the Union Iron Works of San Francisco, is 250 feet long, 38.5 feet beam, draws 18 feet of water when loaded, and registers 1,709 tons. She has been specially provided with new triple-expansion engines and new boilers, and equipped throughout with modern conveniences and every appliance that will contribute to scientific work on board. The first stop after leaving Seattle will probably be at the well-known Metlakatla mission of Rev. William Duncan on Annette island; the next at Wrangell, opposite the mouth of the Stikine; but lack of time will probably make it impracticable to ascend very far up the river. Thence, after stopping at Juneau to inspect the Treadwell gold mines, which operate the largest stamp mills in the world, they will proceed to Lynn canal and visit Skagway and Dyea. A railroad is at present being built over the White pass by an enterprising American company, and if completed in time the party will cross over to Lakes Bennett and Lindeman, on the headwaters of the Yukon. Returning to Skagway, they expect to proceed to Muir glacier, named after one of the party, and to explore it and the neighboring glaciers; and thence to Yakutat bay and the Mt St Elias range, the grandest mountains in the world. The course now changes westward to Prince William sound and Copper river, then around Kenai peninsula into Cook inlet and Kamishak bay. Here some days will be passed exploring Iliamna, a smoking volcano rising 12,000 feet directly from the water's edge, and hunting for perfect specimens of the white Dall's sheep and the black Alaskan moose, the largest of the deer tribe. After crossing Shelikof strait to Kadiak, the party will probably separate, some members remaining on the island to hunt and explore, while the ship continues on to Unalaska and Iliuliuk, a region of smoking volcanoes. On Kadiak island lives the Kadiak bear, the biggest bear and largest carnivore in the world—an animal twice the size of the largest grizzly. No perfect specimen of this huge beast is at present owned by any museum in Europe or America. The ship expects to return from Unalaska to Kadiak in time to bring the entire party back to Seattle about August 1.

The character of the men who make up the party is the best index of what is likely to be accomplished. The different branches of scientific research are in charge of the following: Biology, Dr C. Hart Merriam, Chief of the Biological Survey, U. S. Department of Agriculture, assisted by Dr A. K. Fisher, Assistant Biologist, and Edwin C. Starks, and with Prof. W. E. Ritter, University of California, as associate; botany, F. V. Coville, Botanist of the U. S. Department of Agriculture, assisted by Thomas H. Kearney, Assistant Botanist, with D. W. Trelease, Director of Shaw Botanical Gardens, St Louis, Mo., assisted by De Alton Saunders, of South Dakota, as associate; geology, G. K. Gilbert, and Prof. B. K. Emerson of Amherst College, assisted by Dr C. Palache, of Harvard University. The other scientists of the party who will direct special lines of investigation include Henry Gannett, Chief Geographer of the U. S. Geological Survey; Dr Wm. H. Dall, U. S. National Museum; Chas. A. Keeler, Director of Museum of California Academy of Sciences; Prof. B. E. Fernow, Cornell University; D. G. Elliot, Field Columbian Museum, Chicago; Prof. Wm. H. Brewer and Prof. W. R. Coe, Yale University; Robert Ridgway, Curator of Birds, National Museum, and John Muir, the authority on glaciers. Edward S. Curtis, of Seattle, the photographer of several expeditions to Alaska; Louis A. Fuertes and R. Swain Gifford, artists; W. D. Devereux, of Glenwood Springs, Colorado, mining engineer; John Burroughs, the popular writer on birds; Dr Lewis R. Morris, physician and sportsman; Dr George Bird Grinnell, editor of *Forest and Stream*, and Capt. Luther S. Kelly, the well known scout, also accompany Mr Harriman. G. H. G.

THE CAROLINE ISLANDS

In the April number of *The Scottish Geographical Magazine* Mr F. W. Christian gives a valuable and timely description of the Caroline islands. Their total population is about 50,000, a combination of the Black, Brown, and Yellow races, and is scattered over a chain of islands extending for some 1,000 miles east and west. The massive ruins existing on Yap and Ponape indicate that the islanders formerly possessed a high degree of civilization. On Yap, toward the west end of the group, there are embankments and terraces, solid roads neatly paved with regular stone blocks, ancient stone platforms and graves, and enormous council lodges of quaint design, with high gables and lofty, carved pillars. On Ponape, at the east end of the group, are still more remarkable remains of a former civilization. Here are distinctly seen the ruins of an island city, a Micronesian Venice. The ruins consist of sixty walled islets of rectangular form, built up in the waters of a shallow lagoon, while an immense, double breakwater, three miles in length, shuts out the deep waters of the outer lagoon. The walls, islets, and great breakwater are built of massive blocks of black basalt, upon which no marks of iron tools are to be found.

PROPOSED METEOROLOGICAL STATION IN ICELAND

The Meteorological Institute of Copenhagen is seeking to establish a station in Iceland whence daily weather reports can be cabled to Europe. The Grande Compagnie des Télégraphes du Nord has generously offered to lay the cable to Iceland and the necessary overland lines and to operate them free of charge, if guaranteed merely the annual expenses of operating the line and 4 per cent interest on the capital invested, with its liquidation at the end of 28 years. The cost of laying the cable and overland lines, as estimated by the Danish government, is $600,000. Allowing 4 per cent interest on the capital and 28 years for its liquidation, the lines would require about $36,000 annually for 28 years. To this must be added the cost of maintenance, estimated at $32,000, making about $68,000 to be paid each year. The company will build and maintain the line if guaranteed this amount for 20 years, after which time it offers its free use.

The Danish government has promised $19,000, or nearly one-third the total amount required; also, it has undertaken to carry out the necessary hydrographic work in connection with the laying of the cable and to establish and maintain the necessary meteorological stations in the Faroë islands and Iceland. There thus remains an annual sum of $49,000 to be guaranteed before the plan can be put into execution, and in order to make up the amount the Meteorological Institute of Copenhagen has invited the different weather bureaus in Europe and America each to contribute a share. As Iceland is in the direct path of the majority of the storms which ravage the coasts of northern Europe, the great advantage of weather forecasts from that region for the northern countries of Europe is most apparent. By an annual expenditure of $1,000,000 the United States, through its weather forecasts, saves its shipping interests at least $20,000,000 annually, and the improved meteorological information consequent upon the establishment of a station in Iceland would undoubtedly bring a like proportionate return to Europe. The U. S. Weather Bureau, while realizing the importance of such a station, believes that the expense should devolve upon the countries immediately interested, as France, Germany, Russia, etc. Hence it has decided that it can with more propriety and profit to Europe spend its money in seeking more extended telegraphic facilities toward the north and west, covering Bering sea and Alaska, especially as for many years past it has sent daily and free of cost to Prof. Mascart, at Paris, an international cablegram, giving a synopsis of the general distribution of pressure and storms over the United States and the neighboring portions of the Atlantic.

For the map of the Theater of Military Operations in Luzon, which accompanies the present number, The National Geographic Magazine is indebted to Major Simpson, Chief of the Military Information Division, War Department, under whose direction it was prepared. It is the first official map of Manila and vicinity published by the U. S. Government.

THE BELGIAN ANTARCTIC EXPEDITION

The Societé Royale Belge de Geographie, of Brussels, through whose efforts the *Belgica* was equipped and dispatched in search of the South Pole, has published the preliminary report of Captain De Gerlache on the results of the expedition. After leaving Punta Arenas, December 14, 1897, the *Belgica* kept on southward, and without any incident except the loss of a few days, caused by grounding on a submerged rock near Lapataïa, reached Hughes bay January 24. Three weeks were then passed in exploring this bay in every direction, and also in investigating a strait discovered between the lands toward the east and a large peninsula, which they temporarily called Palmer archipelago.

They entered the Pacific February 12 and soon made out in the distance Alexander I Land, but as an impenetrable ice-floe prevented an approach, changed their course to the west. Two weeks later, when at 70° 20′ south by 85° west, a violent northeast wind opened up deep channels in the pack, so that, although the season was very far advanced, the occasion seemed favorable to continue on toward the south. The dangers of a winter in the Antarctic zone were evident, but, on the other hand, if caught in the ice and unable to regain the open sea, they might drift to a high latitude and perhaps winter near new lands. On March 3, seeing the absolute impossibility of continuing farther, they put the helm about, and during the few following days drifted seven or eight miles in the midst of a compact mass of ice. By March 10 the *Belgica* was completely blocked, as the cakes of ice which surrounded her had welded together and formed an impenetrable field.

Beginning with the latter half of the month of March the cold became very sharp because of the winds from the south. The temperature, however, was dependent upon the direction of the wind, for winds from the south brought clear, sharp weather, while those from the north—that is, from the ocean—almost always meant clouds and mist and a temperature about zero C., and sometimes even higher. The drift also was a direct function of the wind. The aspect of the pack changed continually; though for the most part very compact, at times great gaps and channels would open and extend for miles, but the ship, imprisoned in a wall of ice, could not gain them. By May 30 they had drifted to latitude 71° 36′ by 87° 39′, apparently the farthest point south gained by the expedition. During the winter snowstorms frequently made all work out of doors impossible; also the treacherous character of the ice-floe and the violence of the gusts of wind prevented any long excursion upon the ice. The sun set on May 17 and did not rise again until July 24. The seals and penguins, without ever being very numerous in the immediate neighborhood of the vessel, constituted the main part of the crew's fare during the last months of winter, and this fresh food not a little contributed to maintain their good health, which, except during the polar night, was excellent.

In October, 1898, an outlet opened about 600 meters distant, but immediately around the ship the floe continued unbroken. As summer was passing very quickly and a second winter seemed imminent, at the beginning of January, 1899, De Gerlache determined to dig a canal to this outlet. The measurements made by the sounding line indicated an average thickness of ice of one meter, but around the vessel it exceeded two meters. Something like 2,500 to 3,000 cubic meters of ice were excavated, and this work, in which every one took part, lasted for three weeks. By February there only remained the blocks immediately adjacent to the *Belgica*, but the pressure increased; the canal just completed contracted, and at the same time the outlet in which it ended closed up. Eleven days later, however, the pack opened sufficiently for them to advance fifteen or sixteen miles toward the north, when they were again blocked. But the dark sky in the north and the perceptible swelling of the sea were a sure sign that in this direction there was a grand expanse of water, and perhaps the open sea. During the winter the *Belgica* had only once suffered dangerous pressure; only for a few moments had she ever been in danger, but now continually battered by the great blocks of ice wedged against her by the swelling sea, the little vessel was in a very dangerous situation. Fortunately, the pack opened again March 14, and this time they were able to gain the open sea and return to Punta Arenas.

Captain De Gerlache concludes his report as follows: "Upon our escape from the pack, we were about 103° west longitude, so that the general drift was found to be 18° toward the west by about 70° 31′ average latitude. We had seen no signs of the land given in the charts at 70° south and 100° west. It is furthermore worthy of remark that our drifting, which was almost as rapid toward the south before the north wind as it had been toward the north before the south wind, as well as the soundings which we made whenever the weather permitted, carries several degrees toward the south the hypothetical contours of the austral continent in this part of the Antarctic zone. During this winter, the first that has been passed in the midst of austral ice, we were able to conduct satisfactory magnetic operations, to form an important series of meteorological polar observations, and to make a good collection of specimens of pelagic and abyssal fauna, as well as of specimens of submarine deposit."

CORRECTION

An error in the obituary sketch of Professor O. C. Marsh in the May number of the Magazine (page 181), regrettable in itself and unjust to an educational institution whence several distinguished geographers have been sent forth, requires correction. "The Phillips-Exeter Academy at Andover" should read *the Phillips Academy at Andover*. The error was unthinkingly transcribed from the usually accurate *Scientific American*, vol. lxxx, page 201.

W J M.

GEOGRAPHIC LITERATURE

Explorations in the Far North. By Frank Russell. Report of an expedition under the auspices of the University of Iowa during the years 1892, '93, and '94. Published by the University. 1898. 8°, pp. i–ix + 1–290. Illustrated with portrait, route map, and numerous plates.

The record of one of the most difficult and exciting (albeit easily the most modest of all) explorations of the Arctic interior of North America, this book is attractive reading. The author, an assistant in the University of Iowa, conceived the idea of making natural history collections in the practically unknown country toward the Arctic circle; with a little help from the University, he entered the wilderness, "lived Indian" for a couple of years, acquired the native methods of hunting the musk ox, and amassed for the University the best collection of musk ox material in the country, if not in the world. Incidentally, he made valuable observations on the natural history and ethnology of the country north of the Great Slave lake and east of Great Bear lake, winding up his work with a nearly solitary canoe voyage down Mackenzie river, and thence, through open ocean to Herschel island, where he just made connection with a whaling fleet on the eve of departure. This final juncture ended the chapter of fortunate accidents of which the book is a simple and unpretentious recital; for the survivals from starvation and storm, from wounded animals and treacherous natives, from desperate exhaustion and insidious freezing, from engulfment in muskeg pools and hidden ice crevasses, from wrecking in rapids and capsizing in surf, form a succession of surprises. There is not a boastful sentence in the book; yet between lines the author writes himself down one of the most successful explorers of frigid barrens, able to live and write and photograph and collect natural history material where earlier explorers starved and froze, and thus to demonstrate the physical as well as the intellectual superiority of the white man over Eskimo and Athapaskan even under their own special environment. Eight chapters, or half the book, are devoted chiefly to somewhat desultory itinerary; then follow four ethnologic chapters, and a sixty-page monograph on the natural history of the region, with a full index to the entire work. W J M.

The Adirondack Spruce. A Study of the Forest in Ne ha-sa-ne Park, with Tables of Volume and Yield and a Working-plan for conservative Lumbering. By Gifford Pinchot. New York: The Critic Company. 1898. 18mo, pp. i–v, 1–157, 27 pls.

This neat booklet of 165 pages and two dozen handsome plates is addressed especially to the owners and operators of spruce lands in eastern United States; so it abounds in eminently practical facts, figures, and forest pictures. At the same time, it is a sign of the times—it is a tangible evidence of growing interest in our forest resources, and a promise of increasingly intelligent effort to maintain and utilize these resources through wisely directed action, both individual and collective. The thoroughness, comprehensiveness, and evident accuracy of the work give a gratifying earnest for the future; for, since its preparation, its author has been placed in charge of the Division of Forestry in the federal Department of Agriculture, and so has entered on a forest administration for the entire country. W J M.

MISCELLANEA

In May a Russian expedition started for Spitzbergen, where it will pass two summers and a winter in exploration and scientific research.

The steam whaler *Capella*, chartered by Mr Arthur Wellman, brother of Walter Wellman, will sail from Tromsö within a short time to bring back the members of the Wellman polar expedition.

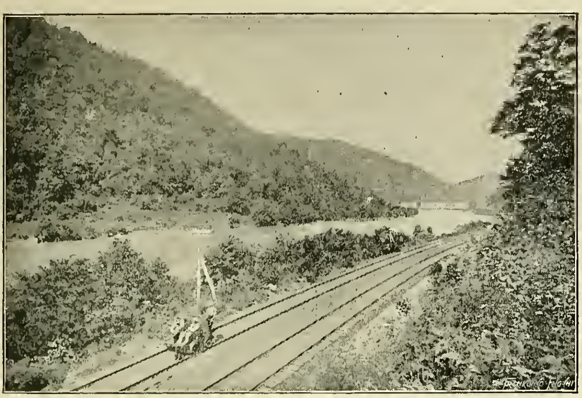
Mr L. N. Jesundofsky, in a recent report to the Weather Bureau relative to the floods in South Carolina during February, states that the volume of water that passed seaward through the state that month was almost as great as the entire flow of the past two winters.

Since March 1, 1899, the Republic of Mexico has issued a daily weather map which makes immediate connection with the daily weather map of the United States and Canada. The observations are made simultaneously at 8 a. m. on the seventy-fifth meridian, or 6.23 a. m. local mean time of the City of Mexico.

The Duke of the Abruzzi, Prince Luigi Amadeo, expects to start early in June on an expedition to the North Pole. He has purchased and altered a Norwegian steam whaler and named her the *Stella Polare*. He purposes to winter in northern Franz Josef Land, and thence make an advance toward the Pole during the spring of next year.

The *Monthly Weather Review* states that the greatest thickness of ice in the harbors and rivers of the country during the past winter was during the week March 20–27 at Moorhead, Minnesota, when ice 44 inches was measured. The greatest average thickness throughout the United States occurred on February 13, when there was a thickness of 38 inches at Moorhead, Minnesota; of 8 inches at New Brunswick, New Jersey, and of 2 inches at Columbia, South Carolina.

The Biological Survey of the U. S. Department of Agriculture has sent out a special expedition to Alaska, in charge of Mr William H. Osgood, accompanied by Dr L. B. Bishop, of New Haven, to determine the geographical distribution and life zones of animals in Alaska. The party will start from Lynn canal, at Skagway, cross the White pass, and from Lake Bennett work right down the Yukon, making the complete sweep of 3,000 miles to St Michael. This is the first biological party to explore the Yukon by starting from its sources. Other expeditions of the Biological Survey during the summer include a party in charge of Mr Vernon Bailey to be engaged in biological surveying and field-work in Texas, and two parties in California, in Humboldt bay and Hoopa valley, to determine the life zones and distinctive forms of flora of that region.



THE NATIONAL GEOGRAPHIC MAGAZINE.

The National Geographic Magazine is a journal of geography, physical, commercial, and political. It aims to convey new information and current opinion on geographic matters, and to be a medium of communication between geographers in America and Europe.

Its editorial staff includes officers and experts of the different scientific bureaus of the Government, each representing a field teeming with facts of geographic interest. Its corps of contributors comprises nearly every United States citizen whose name has become identified with Arctic exploration, with the Bering Sea controversy, with the Alaska and Venezuela boundary disputes, or with the new commercial and political questions arising from the acquisition of the Philippines. Through the cordial coöperation of the different diplomatic representatives of the foreign nations at Washington, it is able to present the latest and most authentic geographic intelligence from other countries.

The National Geographic Magazine numbers among its contributors the following well-known writers on the different branches of geographic science:

Prof. Cleveland Abbe
Cyrus C. Adams
Cyrus C. Babb
Capt. J. R. Bartlett, U. S. N.
Dr George F. Becker
Alexander Graham Bell, LL.D., etc.
Hon. Emory F. Best
Prof. F. H. Bigelow
James H. Blodgett
Hon. J. B. Browne
Lieut. J. C. Cantwell, U. S. A.
Frank M. Chapman
Robert H. Chapman
Dr E. L. Corthell
Dr Elliott Coues
F. V. Coville
Hon. William E. Curtis
Frank H. Cushing
Hon. Charles W. Dabney
Dr William H. Dall
Prof. George Davidson
Arthur P. Davis
William M. Davis
Dr David T. Day
W. A. Dickey
J. S. Diller
Lieut. C. P. Elliott, U. S. A.
S. F. Emmons
Dr Walter H. Evans
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MAP OF
THE REGION ADJACENT TO
THE
NicaraguaCanalRoute
BY
C. Willard Hayes
1899.
CARIBBEAN SEA
PACIFIC OCEAN
LAKE NICARAGUA
Matagalpa
Rio Grande
Corinto
León
Managua
Granada
Jinotepe
Rivas
Brito
San Juan del Sur
Ft. San Carlos
Castillo
Greytown
Bluefields
CONTINENTAL DIVIDE
FORMER CONTINENTAL DIVIDE
BOUNDARY LINE
NICARAGUA
COSTA RICA
Miravalles
Tenorio
Rincon
Turialba
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Gulf of Nicoya
Rio San Carlos
Rio Frio
San Juan
Viejo
Telica
Santa Clara
Momotombo
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THE

National Geographic Magazine

Vol. X JULY, 1899 No. 7

PHYSIOGRAPHY OF THE NICARAGUA CANAL ROUTE

By C. Willard Hayes,

United States Geological Survey

The region whose topography and geology have a most intimate bearing upon the problems connected with the proposed Nicaragua canal embraces northern Costa Rica and southern Nicaragua. It is sharply limited on the south by the high volcanic range of Costa Rica, which rears its massive form diagonally across the isthmus. It is limited to the north somewhat less definitely by the increasing height of a deeply dissected plateau, which merges with the mountains of northern Nicaragua. Between these limits lies a broad irregular depression, which extends very nearly across the isthmus in a diagonal direction parallel with the Costa Rican range. This depression is now occupied chiefly by Atlantic drainage, the continental divide lying within a short distance of the Pacific. It contains the basins of Lakes Nicaragua and Managua and their outlet, the San Juan river. It is important to note that the Nicaraguan depression is not a simple river valley. The portion with which we are chiefly concerned, that lying between the lake and the Caribbean, embraces two distinct drainage basins, whose streams formerly flowed in opposite directions, although by a geologically recent reversal of the drainage they now have a single outlet to the sea.

When examined in detail the surface of the Nicaraguan depression presents considerable relief, and its topographic features naturally group themselves into three classes.

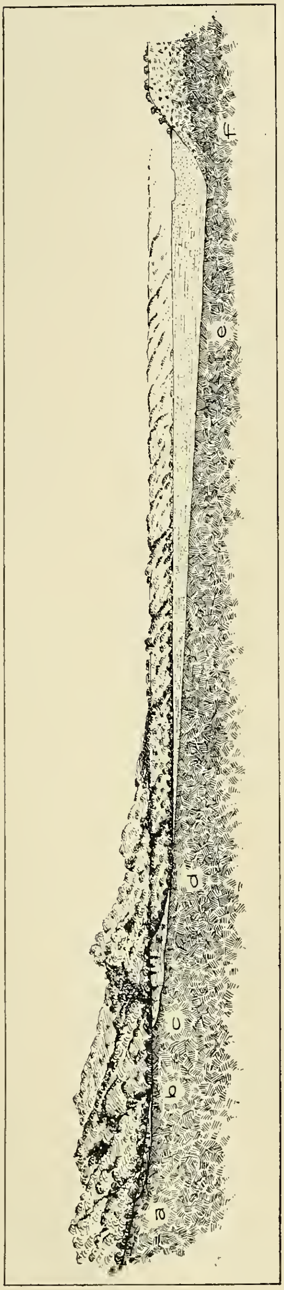
Extending from the base of the Costa Rican volcanoes northward to the San Juan river and beyond are many hills whose summits reach a tolerably uniform elevation on north and south lines, but increase in height from either side of the isthmus toward its axis. In the vicinity of the San Juan these hills have steep slopes and rounded summits. Some distance back from the San Juan the valleys which separate them are narrower, and there are considerable areas of level or undulating surface at an altitude corresponding with the summits of the hills nearer the center of the depression. It is evident that if the valleys were filled even with the summits of these hills, there would be formed a broad undulating plain, sloping gradually up from either side toward the axis of the isthmus. It is entirely probable that such a plain once existed, and that it has been converted into a series of even-topped hills and ridges by the subsequent cutting of stream channels below its surface. The manner in which this plain was originally formed is manifestly by the long-continued action of streams when the land stood considerably lower than now—that is, by the process of stream degradation or baseleveling. It was therefore a gradational, not a constructional, plain. If it were reconstructed by the filling of the stream valleys, its present altitude would vary between 100 and 200 feet.

As indicated above, numerous valleys now intersect the surface of this old plain. Except in the case of the San Juan they vary with the size of the stream which they carry. The reasons for this exception will be pointed out later. The valleys are broad in proportion to the extent to which the old plain has been destroyed, and they grow narrower with increasing distance from the axis of the depression. The smaller streams generally head in narrow gorges. In some cases they have not completely dissected the old plain, but flow upon its surface in shallow valleys which, lower down, give way to narrow gorges, and these in turn to the rather wide alluvial valleys near the trunk stream. The greater part of the erosion which has dissected the surface of the old plain was accomplished when the land stood somewhat higher than at present. The valleys were then much deeper and none had extensive floodplains, except perhaps the largest streams near the sea. The recent change in the altitude to the land has brought the valleys below sea-level, changing the rivers from corrading to aggrading streams. They have since silted up the estuaries which were thus formed, producing the wide alluvial plains through which they now meander.

Corresponding in some degree to the valleys incised within the old plain are eminences rising distinctly above its surface.

These are residual hills which, by reason of the harder rocks of which they are composed or their position on the divide away from the main drainage lines, were never reduced to the level of the plain. Where the plain was best developed, that is, near the sea margin on either side, these residual hills are infrequent and inconspicuous. To the southward of the San Juan, in the region lying between the Sarapiqui and the San Carlos, there is also an extensive area in which the hills are almost wholly remnants of the dissected plain, their summits in general presenting but little variation in altitude. To the northward of the San Juan the residual hills occur with increasing frequency and greater altitude, and finally merge with the mountains of northern Nicaragua. They also increase in number and height from either side of the isthmus toward its center, being most abundant along a line which crosses the San Juan valley in the vicinity of Castillo. If the old plain were reconstructed by the filling of the present valleys, it would not be continuous across the isthmus, but its eastern and western portions would be separated by an irregular line of these residual hills, the low gaps between them being slightly above the level of the plain.

The relations of these three classes of topographic forms will perhaps be made somewhat clearer by a reference to the accompanying idealized sketch and section on page 236. The surface of the peneplain is indicated by the even summits of the hills to the right. Residual hills are represented to the left, rising abruptly and distinctly above the surface of the peneplain. The profile shows a transverse section of the San Juan valley and a longitudinal section of the valley of a tributary stream. The latter is represented as rising in the residual hills to the left and flowing for some distance in the narrow gorge *a b*. From *b* to *c* the stream flows in a broad shallow valley at about the level of the peneplain. From *c* to *d* it is in a narrow gorge recently cut and still being actively deepened within the peneplain. It emerges from this gorge at *d* and thence to the margin of the main river valley at *e* it meanders through an alluvial plain continuous with the San Juan floodplain *e f*. The bottom of the valleys which the tributary and the trunk stream occupied before the recent depression of the region is represented in the profile by the solid line between the alluvium and the underlying rock. When these valleys were formed they were considerably above sea-level and the streams had a much more rapid fall than at present, but they are now somewhat below sea-level.



IDEALIZED DIAGRAM TO ILLUSTRATE THE DEVELOPMENT OF THE PRESENT TOPOGRAPHY IN PORTIONS OF THE SAN JUAN VALLEY

Summing up the foregoing statements very briefly, it appears that the surface of the Nicaraguan depression consists of a broadly undulating plain formed by the erosion of streams flowing to the Pacific and to the Atlantic from low gaps at the divide. Above this plain are residual hills, most abundant at the axis of the isthmus, where the continental divide was formerly located, but increasing in height along the axis toward the north, where they merge with the mountains of northern Nicaragua, and finally, there are many valleys which have been cut in the surface of the plain by the erosion of streams after the region had been elevated to a higher altitude. The lower portions of these valleys have subsequently been drowned and silted up with the formation of broad alluvial floodplains.

During most of the time in which these topographic features were being developed the Pacific coast had an outline very different from that which it has at present. Lakes Nicaragua and Managua then had no existence, and the region which they now occupy was in part the basins of streams flowing to the Pacific, in part open ocean, and in part a bay which then indented the Pacific coast and whose southern point was near the present island of Madera. The relations of the present and former coast lines are shown on the accompanying map, plate 6.

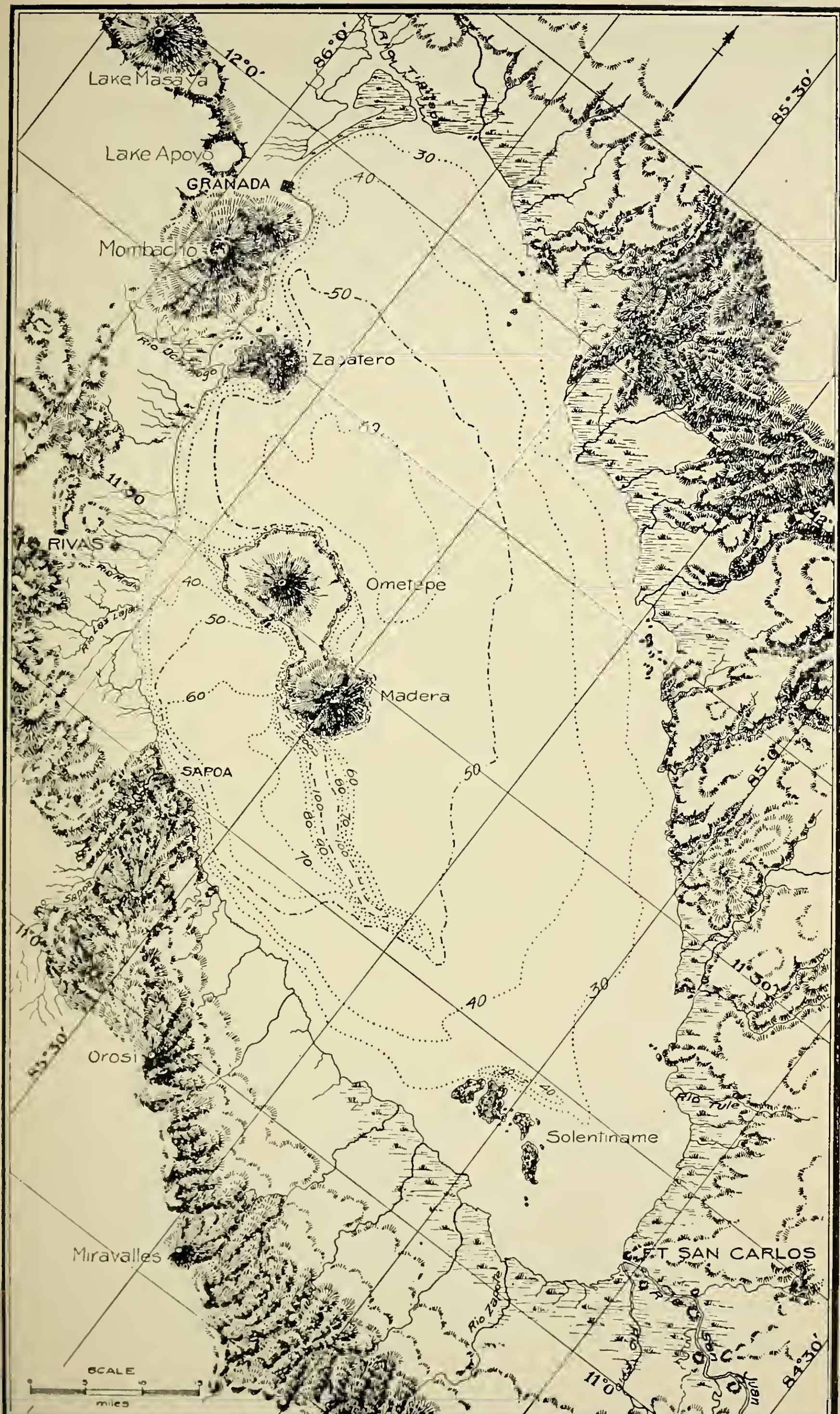
Lake Nicaragua has a regular oval outline, its longer axis extending about northwest-southeast. Its area is very nearly 3,000 square miles, and the mean elevation of its surface is about 104 feet above tide. Its shores present considerable diversity, depending chiefly on the character of the rocks which form them and the direction of the prevailing winds. The trade winds blow with great persistency throughout a large part of the year. They are deflected from their normal course by the high volcanic range of northern Costa Rica, so that instead of being northeast winds they vary from east to east-southeast. As a result of this constant wind direction the southeastern end and northeastern side of the lake rarely experience any surf, and hence those portions of the lake shore have no beach, but are bordered by swamps, with vegetation constantly encroaching upon the lake. Along the southwestern side and western end of the lake, on the other hand, there is a constant heavy surf and as a result a broad sand beach, generally backed by a wave-cut cliff. The accompanying map (page 239), based upon surveys made by the U. S. Nicaragua Canal Commission, shows the configuration of the lake basin. The most interesting feature shown is the old channel, evidently a drowned river channel formed when the southern half of the lake basin was dry land. This channel marks the course of a river formed by the union of the several streams now entering the lower end of the lake with the one which occupies the upper portion of the San Juan valley. It is first detected in the vicinity of the Solentiname islands, and if it was ever excavated between this point and the mouth of the Frio this portion has subsequently been filled by sediment brought into the lower end of the lake. From the Solentiname islands for about 10 miles northwestward there is only a slight indication of the channel. Thence to the base of Madera it is continuous and distinct. The greatest depth in the lake, over 200 feet, is near the western end of this channel.

To the west of the bay, which, as shown on the map, plate 6, formerly indented the Pacific coast, was a long cape or peninsula. This now forms a part of the narrow strip of land occupied by the continental divide between Lake Nicaragua and the Pacific. This part of the isthmus, although intimately connected with the Nicaraguan depression, is not properly a part of it. Its topography is particularly interesting in connection with the proposed canal, since it contains the lowest gap in the continental divide between the straits of Magellan and the Arctic ocean.

The manner in which this gap was developed is worthy of consideration.

Bordering the lake along its southwestern side is a very perfectly baseleveled plain from five to eight miles in width, which I have called the Rivas plain (see map, page 242). This is probably a portion of the same peneplain which forms the fundamental topographic feature of the Nicaraguan depression, and was at one time doubtless continuous with it. From the lake shore where the waves have cut a narrow terrace backed by a low cliff, the plain ascends toward the southwest at the rate of about 8 feet per mile. Its even surface is interrupted by occasional low residual knobs, which increase toward its inner margin, passing into the continuous ridges and high hills of the main continental divide. The Tola hills which border the Rivas plain on the southwest here extend to the Pacific, although further toward the northwest a narrow coastal plain is developed similar to the Rivas plain on the opposite side of the range.

The Tola hills doubtless correspond to the residual hills which rise above the peneplain of the Nicaraguan depression. They have a serrate outline, the altitude of their summits varying between 800 and 1,800 feet. While this range of hills still formed a long, narrow point of land between the *bay of Nicaragua* and the Pacific, the effect of deformations and wave erosion was such as to make the position of the divide unsymmetrical. As shown on the map, it was for a time located very much nearer to the Pacific than to the head of the bay. Hence the streams which headed upon the divide and flowed in opposite directions were of very unequal length. Those flowing east to the bay must have been five or six times longer than those flowing west to the ocean. Such conditions rendered the divide unstable and the familiar process of shifting toward a position of stable equilibrium took place. A stream occupying the position of the lower portion of the Rio Grande, by reason of the advantage which it possessed in having its fall concentrated within a short distance, cut back into the divide and diverted to its own basin successive portions of the opposing stream. At the beginning of the process an eastward-flowing stream occupied the valleys of the present Tola, upper Rio Grande, Guiscoyol, and lower Las Lajas. A small tributary headed against the Pacific stream on the divide in the vicinity of La Flor. This tributary was first reversed and then the upper portion of the original stream, the present Tola, was diverted toward the southwest. The same process was continued



MAP OF LAKE NICARAGUA

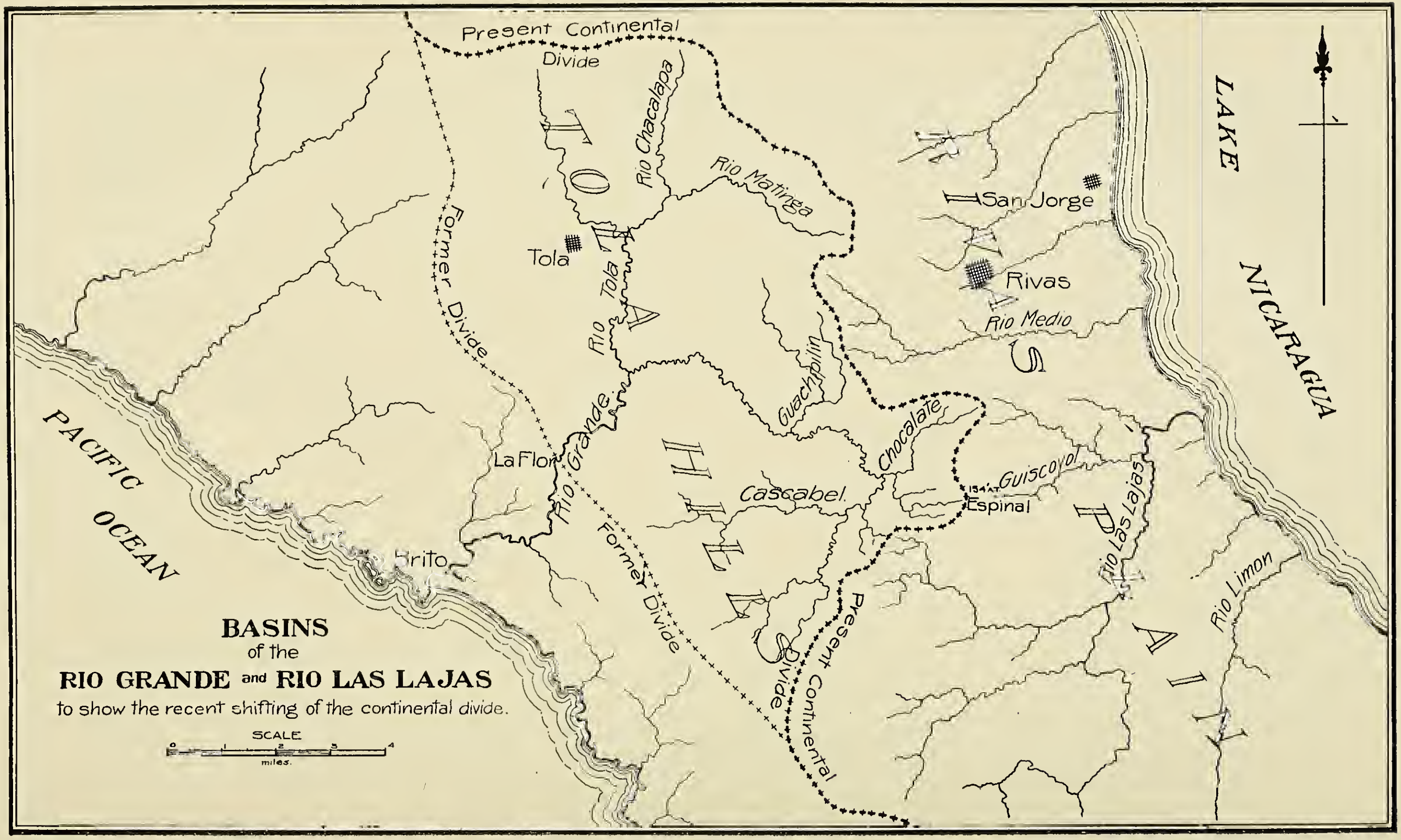
From surveys made by the U. S. Nicaragua Canal Commission, 1898 '99 until the divide was pushed back to its present position at Espinal. Streams to the northward also suffered some loss of territory. Thus upper tributaries of the Medio and Gonzales were diverted, forming portions of the present Guachipilin, Matinga, and Chacalapa. The deserted river valley formerly occupied by the eastward-flowing Tola and Cascabel, and from which the beheaded Guiscoyol now flows, forms the lowest gap in the continental divide. Its summit is 154 feet above sea-level, and the ascent is so gradual from either side that accurate instrumental work is required to locate the divide. During the wet season the gap is occupied by a swamp from which the water appears to flow both to the Atlantic and Pacific.

The map (plate 6), on which the present and former coast lines are represented, shows that a large land area has recently been added to this portion of the isthmus. The topography of this region differs totally from that of the Nicaraguan depression above described. The latter is an oldland, and its surface forms are those developed by the processes of subaërial degradation. The former, on the other hand, is composed of materials recently ejected from volcanic vents, and it retains to a large extent its original constructional forms.

Extending through the center of the area in question is a line of volcanoes, all of which are geologically very recent, while some are still active. From these numerous vents, which were at first submarine, a vast amount of material has been erupted, building up broad, gently sloping plateaus, from which rise more or less isolated volcanic cones. The southernmost of these volcanoes are the twin peaks of Madera and Ometepe, which occupy an island in Lake Nicaragua. Toward the northwest are Zapatero, also on an island, Mombacho, Masaya, Chiltepe, Momotombo, the clustered peaks forming the Maribios range, and finally Coseguina, on the Gulf of Fonseca. Most of these volcanoes have erupted both molten lavas and fragmental material, the latter varying from coarse blocks of solid lava to the finest dust. It is this fragmental material which gives to these volcanoes their beautifully symmetrical forms. Those which have been recently active, as Ometepe and Momotombo, are almost perfect cones. The effects of erosion, however, are seen almost before the volcanic activity ceases, and the symmetry of the cones is quickly destroyed. The details of outline in the ash cones vary from year to year. When the loose material has been removed or modified by erosion the summits assume the irregularly rounded form seen in Madera and Zapatero. In some cases the conical summit is destroyed, not by the slower process of erosion, but by an explosive eruption. The result is an irregular, jagged truncation of the cone, usually with a depression in the center occupied by a lake. This form is seen in Mombacho and Coseguina. There is a tradition that the former was once a conical peak, and, as is well known, the summit of Coseguina was blown off by an explosive eruption in 1843, the most violent recorded eruption until surpassed by that of Krakatoa in 1883.

These volcanoes rise from a level plain which stretches from the head of Lake Nicaragua northwestward to the Gulf of Fonseca. It is composed wholly of fragmental volcanic materials, which reached their present position probably in the form of mud flows. The materials are not sorted, though successive layers are separated by distinct planes. In a quarry near Managua human tracks have been found in this material, showing that it is very recent, and also affording some indication of the physical conditions under which it was deposited. To the southwest of this plain and separated from it by a rather steep escarpment is a plateau which slopes somewhat gradually from an altitude of about 1,200 feet along its inner margin southwestward to the Pacific coast. This plateau is composed of exactly the same materials as the lower plain to the east, and it appears probable that the two surfaces were once continuous, but have recently been separated by a fault.

From all the evidence thus far obtained, it appears probable that during early Tertiary time the waters of the Atlantic and Pacific had free intercommunication across this portion of the isthmus. During that time sedimentary rocks were accumulated over a considerable portion of the isthmus and great masses of volcanic rocks were poured out upon them. In middle Tertiary time the region was elevated above sea-level, and there is no evidence that it has at any time since been depressed so as to give free communication between the two oceans. The elevation of the region was followed by a long period of erosion, during which its surface was reduced to a broadly undulating plain. The main divide was then near the axis of the isthmus, and from this divide streams flowed in opposite directions—eastward to the Caribbean and westward to the bay which indented the Pacific coast. After the surface of the country had been considerably reduced across this narrowest portion of the isthmus the region



BASINS
of the
RIO GRANDE and RIO LAS LAJAS
to show the recent shifting of the continental divide.

suffered another elevation. The streams were thereby stimulated and began to trench the surface of the baseleveled valleys which they had previously formed. Shortly after this elevation there was a renewal of the volcanic activity, which had been quiescent for a long time. This second distinct period of activity has continued down to the present time. It was manifested along two nearly parallel lines of vents. One of these lines gave rise to the Costa Rican volcanic range, and the other to the Nicaraguan range. The vents forming the latter were submarine. They occupied a line nearly parallel with the Pacific coast, terminating to the southward near the southern end of the bay which then indented the Pacific coast. Vast quantities of lava and ashes were thrown out from these vents, and their position was such that the ejected materials formed a dam, cutting off the bay from the ocean. Since the precipitation was greater than the evaporation, the waters collected behind this barrier, and, as their surface was gradually raised, encroached upon the basins of the streams which had been tributary to the bay. The water doubtless continued to escape westward for a long time after the volcanic activity began, but successive eruptions finally raised the dam to such a height that the impounded waters found a gap in the continental divide, which was lower than the dam to the westward. They then escaped eastward to the Atlantic. The continental divide, which had previously occupied a position near the axis of the isthmus, was thus abruptly shifted to its present position near the Pacific coast west of the lakes. When the waters of the lake first overtopped the continental divide they were doubtless considerably higher than at present. The material forming the divide, however, was residual clay and deeply weathered rock, and the outlet was quickly lowered to the solid rock, where it has been held practically unchanged to the present time.

The latest episode in its geologic history has been the depression of this portion of the isthmus to the extent probably of one hundred or two hundred feet. By this depression the lower portions of the river valleys were drowned, forming long tidal estuaries. The streams flowing to the Pacific have in most cases entirely filled these estuaries with sediment. Thus the Rio Grande valley, which is followed by the western portion of the canal route, is a flat alluvial plain about a mile in width between the abrupt margins of the older valley. This plain extends out nearly even with the headlands, which are connected by a long curving beach.

A few of these Pacific streams have not yet completely filled their old valleys with sediment, and the unfilled portion of one now forms the harbor of San Juan del Sur. The San Juan river, flowing eastward to the Caribbean, has not only filled the estuary which once occupied its valley, but has pushed the coast line eastward by a broad delta plain.

The San Juan river and its valley bear such an intimate relation to any canal scheme that a somewhat more detailed account of its peculiarities should be given. Considered from any point of view, either with reference to the history of its development, the present character of its channel and banks, or the possibility of using it for a canal route, the San Juan valley is naturally divided into three sections. Starting from the point where the river leaves lake Nicaragua, the first extends to the head of the Toro rapids; the second from the head of the Toro rapids to the mouth of the San Carlos river, and the third from the mouth of the San Carlos to the sea.

In the upper section the river has a moderate current and a considerable depth. Its banks are low and swampy, except where it swings against the foot of one of the numerous hills rising above the alluvial plain through which it meanders. It is evident that the lake formerly extended down to and beyond this point, and that a large amount of territory has been reclaimed from its waters. It is well recognized that lakes are ephemeral features, and the ordinary ways in which they are obliterated are by the filling from their upper ends and by the cutting down of their outlets. In this case, however, the first of these processes has been exactly reversed. The area of the lake is being contracted chiefly by filling at its lower end. The filling is being accomplished not by the water which comes from the lake, since this is practically clear, but by the tributaries which entered this lower portion, many of which have been converted into tributaries of the San Juan. The present river channel does not coincide with the position of the river which formerly occupied this basin before it was drowned by the waters of the lake. Its position is dependent upon the relative amounts of sediment delivered by the tributaries on either side, and it has been pushed toward the northern edge of the old basin by the larger tributaries from the south—the Frio and Poco Sol. This may best be described as a *residual river channel;* that is, a broad arm of the lake has been gradually constricted by the deposition of sediment on its margin, and all that remains is the narrow river channel, kept open by the current of water flowing from the lake.

The second section of the San Juan extends from the head of the Toro rapids to the mouth of the San Carlos. Its essential characteristics are the rapid fall of the river and the narrow valley in which it flows. The Toro rapids which retain the lake at its present level are not formed by a solid ledge of rocks crossing the valley, but by boulders, sand, and clay. It appears that when this arm of the lake extended down to the continental divide it received a rather large and swift tributary, the Rio Sabalos, near its head. The sediment carried by the Sabalos, consisting of clay, sand, and boulders, was deposited on reaching the quiet water. A delta was thus formed extending as a shoal across the arm of the lake at this point. As the river channel sank in the gap across the divide the latter became lower than the surface of the Sabalos delta, and the crest of the barrier which maintains the level of Lake Nicaragua moved westward from its original position at the former divide to the present position of the Toro rapids.

From the head of the Toro rapids to Machuca the river channel consists of rather long, quiet reaches separated by rapids. The total fall in this section is about 40 feet, or an average of two feet to the mile. Of this fall, however, all but about six feet is accomplished by the numerous rapids. These appear to be due to the unequal hardness of the underlying rocks. The intervening quiet stretches are located upon softer rocks, which are worn down by the moderate current more rapidly than the harder rocks by the swift current of the rapids. Between Machuca and the mouth of the San Carlos the river is deep and narrow and the current is generally moderate. In some places at low stages of the river it is almost imperceptible, and when the San Carlos is in flood the current may even set upstream for a time. The water has a depth varying between 15 and 60 feet, the bottom of the channel being at some points below sea-level. It is evident that the present river is here flowing in a channel which was cut when the land stood higher than now, and which has not yet been filled by sediment. This portion is called the Agua Muertas, or dead water.

The third section of the river extends from the mouth of the San Carlos to the Caribbean sea. With the entrance of the San Carlos the character of the San Juan is entirely changed. Above the junction it is a comparatively clear stream, and except at the rapids has only a moderate current. Below the entrance of the San Carlos it is usually muddy; it is shallow, with a shifting, sandy bed and has a uniformly strong current. Its slope is nearly a foot to the mile in this section. The Sarapiqui is similar to the San Carlos, although somewhat smaller. Both of these streams have their sources on the slopes of the Costa Rican mountains to the south. The recent volcanic eruptions of this region have furnished an abundant supply of unconsolidated sand to these streams and they are heavily loaded with this material. Below the entrance of the San Carlos the floodplain immediately adjacent to the San Juan has been built up more rapidly than the floodplains of its smaller tributaries; hence the latter are ponded in their upper courses and many lagoons are thus formed. From the mouth of the San Carlos eastward the San Juan occupies the northern margin of its valley. This is doubtless due to the more abundant supply of material furnished by the southern tributaries and also to the northward drift of the littoral current in the Caribbean sea. As the river extended its course eastward by the filling of the estuary, and later by the formation of the deltaplain, it was continually crowded to the northward by the direction of the sand-drift along the coast. This tendency became more pronounced the farther out the delta was built, and the sharp northward bend of the lower San Juan is its direct consequence.

As the river channel was carried northward this northern portion of the valley would be filled first and to a higher level than the southern portion. The river would thus at times find itself in a position of unstable equilibrium and would seek a new channel on the lower part of the deltaplain to the southward. Thus it is probable that the river originally occupied the present position of the San Juanillo. When this position became unstable it gradually deserted its northern channel for the present position of the lower San Juan. Subsequently the latter became unstable, and a more favorable course to the sea was found still farther south. The recent channel of the Colorado was then developed at the expense of the lower San Juan. This process is still going on, and the relative amounts of water carried by the two channels has very materially changed within a generation. Unless artificially modified, the lower San Juan will continue to dwindle, and probably all the water will find its way to the sea by the Colorado or by some more favorably located channel still farther south.

MOMBACHO IN CLOUDS

NICARAGUA AND THE ISTHMIAN ROUTES

By A. P. Davis,

Hydrographer, U. S. Geological Survey

The state of Nicaragua is the largest of the Central American republics. It lies entirely within the torrid zone, and contains about 49,000 square miles, or about one-fourth more than the state of Ohio, and is on the same meridian of longitude. It is bounded on the east by the Caribbean sea, on the west by the Pacific ocean, and lies between the republics of Honduras and Costa Rica to the north and south. The northern part is largely occupied by rugged mountains belonging to the main axis of the Cordillera. A little farther south this range divides into two main spurs, one following a southeasterly course, nearly parallel to the Caribbean coast, almost to the south boundary of Nicaragua, where it is cut through by the San Juan river. The west branch closely follows the Pacific ocean, and is peculiar in its low altitude and the narrow strip of land it occupies.

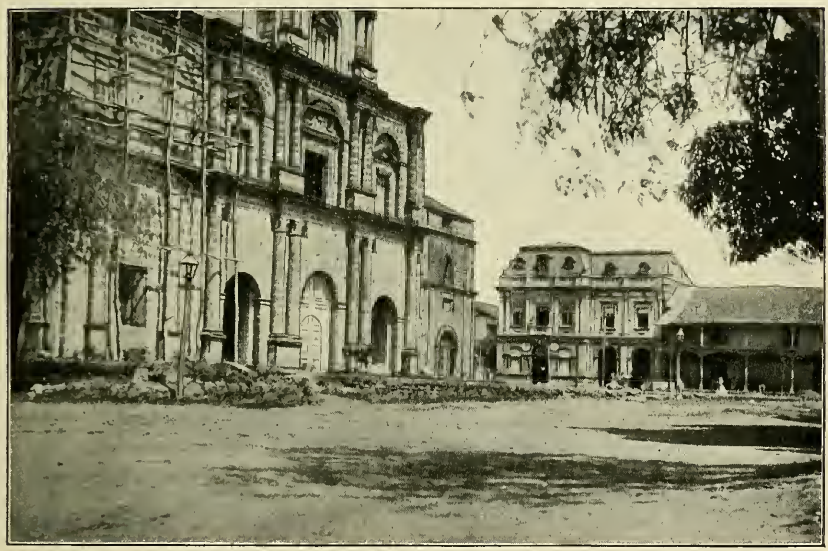
The east coast for a distance of 20 to 30 miles inland is mostly of a swampy nature. High rolling country approaches the coast at Monkey Point and near Greytown, but with these exceptions the coastal region is low, flat, and during the rainy season largely covered with water.

Reliable information regarding rainfall in Nicaragua is extremely meager. There is a record of 19 years at Rivas, which began in January, 1880, and is still continued. This record has been voluntarily kept by Dr Earl Flint, an American resident of Rivas. A rainfall record was kept at Masaya from July, 1886, to December, 1896, by Mr William Climie. The observations were then transferred to Granada and have been continued ever since, although results are at hand only to the end of 1897. Observations of rainfall were also made in Granada in 1876 by Ramon Espinola, and in 1877 by Dr Flint; also in 1883 and 1884 by the National Institute at Granada. At Bluefields observations were made by Hon. W. H. Jackson and others from September, 1883, throughout 1884 and 1885, and a portion of 1886. The Nicaragua Canal Company kept a record of rainfall at

Greytown for the years 1890, 1891, 1892, and a portion of 1893. The Nicaragua Canal Commission took observations at a number of points during the year 1898, in connection with other meteorologic and hydrographic measurements. An examination of the records and diagrams shows in a striking manner the fact that along the east coast there is no definite dry season. The maximum rainfall yet measured was that for the year 1890, when nearly 300 inches of rain fell at Greytown, and the year 1892 showed nearly as much. In the region of Lake Nicaragua and on the west coast there is a distinct dry season from about December 1 to the middle of May, when rain seldom falls, and never in large quantities. The total rainfall on the east coast is much greater than on the west, both from the absence of any dry season and from the heavier monthly rainfall, the mean so far observed at Rivas being under 70 inches, while that at Greytown is about 250. This fact is easily explained by the direction of the trade winds, which, blowing with remarkable persistency and uniformity from the Caribbean sea, are robbed of the greater part of their moisture in passing over the mountains east of Lake Nicaragua. The gap formed in these mountains by the San Juan, however, allows a portion of the moisture to be carried past, even during the dry season, so that at Fort San Carlos, where the San Juan river leaves Lake Nicaragua, rain is liable to fall any month in the year, though in quantities far less than on the Atlantic coast, while on the east and south shores of Lake Nicaragua, a few miles north or south of Fort San Carlos, no rain falls in the dry season.

Although Nicaragua is almost entirely covered with dense forest growth, the really useful timber is not abundant. A district on the Atlantic slope near Bluefields affords large quantities of yellow pine of fair quality, which, however, is not yet easily accessible. The only timber yet used to any extent for lumber is the cedar, which is soft, straight-grained, easily worked, and durable. The trees are scattered and not plentiful. The lumber is mostly sawed by hand. The timber of greatest value is the mahogany, which is cut for export to be used as an ornamental wood and in cabinet making. The monopoly of its export is conceded to an American firm. The wild cotton tree is sometimes used in making canoes. A number of the forest woods found in Nicaragua are heavy and so hard that it is impossible to drive nails or spikes into them, but they are exceedingly durable. A variety of dye-woods is found in various parts.

The present population of Nicaragua is estimated at about 400,000, or only about eight to the square mile. Of each hundred inhabitants there are 50 Indians, 1 negro, 45 of mixed blood, and 4 whites. They are sharply divided into classes, the Caballeros, or "*gentlemen*," and the peons, or laborers, who can be distinguished by their costume as far as they can be seen. This classification is punctiliously observed on all occasions, and is particularly noticeable on railroad trains and steamboats. The upper classes dress very much as we do in summer, that season being perpetual in Nicaragua. Among the lower classes the men's costume usually consists of a straw hat, a short cotton



PRESIDENT'S PALACE — CHURCH ON LEFT INJURED BY EARTHQUAKE

shirt, and trousers of darker material. No shoes are worn, but sometimes a pair of light sandals are used as a protection against hot or thorny ground. The dress of the women is even more scant, being minus the hat and sandals, a skirt substituted for the trousers, and the arms and upper part of the bust entirely bare.

The country people and the poor of the cities live in thatched huts, with walls rudely constructed of upright poles, or with no walls at all. The better buildings in the cities are of stone, brick, or adobe, stuccoed with cement, and covered with tiles. They are cool and comfortable and almost fireproof, but sadly lacking in light. The president's palace in Managua has glass windows, and a few Americans in Greytown enjoy the same luxury; but in Leon, Granada, Rivas, or any other city of Nicaragua there is hardly a pane of glass. By far the finest buildings are the churches and cathedrals. The sidewalks are often only three or four feet wide, and change their grade with nearly every house they pass, so it is necessary to climb up or down three or four steps every fifty feet or so. The streets are narrow and usually unpaved; but most of the towns are built on sandy or rocky ground, so that mud is not much encountered.

The peculiar interest attaching to Nicaragua from the American point of view is the promise held out by the remarkable hydrographic and topographic conditions of a practicable route for a large ship-canal.

These conditions consist of a large, deep lake 100 feet above sea-level, separated from the Pacific ocean by a narrow strip of land, containing the lowest depression in the continental divide between the Arctic ocean and the Straits of Magellan, and a large navigable stream carrying the surplus waters from the lake to the Caribbean sea. This route is especially fortunate in having at its summit level a magnificent natural reservoir in Lake Nicaragua, fed by an ample drainage basin. This reservoir is useful not only for storing water for operating the locks of the canal, but also for regulating the control of great floods that could hardly be provided for at practicable cost without its aid. No other route enjoys advantages of this kind.

The San Juan river is the sole outlet of Lake Nicaragua and its tributary drainage basin. Its total length from the lake to the sea is 124 miles, and it is usually navigable for light-draft river steamers. It leaves the lake at Fort San Carlos at an altitude varying from about 97 feet to about 111. Its course for a distance of 26 miles is through a low, swampy country, relieved by occasional hills. Through this course the river is sluggish and receives several tributaries of small discharge, which, in the dry season, are practically still water. The principal of these are the Melchora, Media Queso, Palo de Arco, and Rio Negro. The first tributary of importance to the San Juan river is the Rio Sabalos, which enters from the north and empties 26 miles east of Fort San Carlos. About half a mile below the mouth of the Sabalos are the first rapids, called Torro rapids. These rapids are caused by boulders and gravel, probably brought into the river by Rio Sabalos in former times, but do

CASTILLO RAPIDS — TOWN AND FORT

not seriously obstruct navigation except in times of extremely low water. Below this point the San Juan receives the waters of a few streams, the principal of which are the Rio Poco Sol and Rio Santa Cruz. Ten miles below Torro rapids are the largest rapids on the river, at Castillo Viejo. As the river here falls about five feet in a few hundred feet, steamers are seldom taken over except in high water. A railroad about 2,000 feet long is provided for the portage of freight and passengers on the right bank of the river.

Below Castillo are the Diamond, Balas, and Machuca rapids, the last-named being 13 miles from Castillo. All these rapids admit the passage of river steamers, except at extreme low water. Below Machuca there are no more rapids. The river is now deep and sluggish for a distance of about 17 miles, until it receives the waters and sediment of the Rio San Carlos. This river is the largest tributary of the San Juan, rising far to the southward, in the mountains of Costa Rica, and bearing such a volume of sediment that a delta has been built up at its mouth. From this point to the sea the San Juan is a shallow stream with sandy shifting bed; 25 miles farther down the Serapiqui empties into the San Juan from Costa Rica. Of the tributaries to the San Juan it is second in size to the San Carlos, and, like the latter, bears large quantities of sediment in times of flood. Eight miles below the mouth of the Serapiqui the San Juan assumes decidedly the character of a deltaic stream, and sends out a small distributary known as the San Juanillo, which meanders through the swamps to the northward and, after receiving the drainage of the Deseado, reënters the San Juan four miles above its mouth. Six miles below the exit of the San Juanillo, or about 105 miles from Lake Nicaragua, the main stream of the San Juan separates into two large distributaries, the larger, called the Rio Colorado, flowing eastward directly to the Caribbean, and the smaller, or Lower San Juan, meandering to the northeast and finding its exit into the ocean at Greytown. Between the mouth of the Colorado and the Lower San Juan another distributary, called the Rio Tauro, finds its way from the Lower San Juan to the sea.

The principal obstructions to free navigation of light-draft river craft from Greytown to Fort San Carlos consist of the shoal character of the Lower San Juan, especially in times of low water, and of the rapids lying between Machuca and the mouth of the Sabalos. For purposes of a ship-canal the river also requires deepening below the mouth of the San Carlos and between the Sabalos and Fort San Carlos.

When the three little caravels of Christopher Columbus sailed from Palos, Spain, in 1492, it was with the object of reaching the south and east shores of Asia by a shorter and easier route than any yet known. This was the first systematic effort ever organized with this object, but it marked the beginning of a series of similar attempts which have increased in magnitude and frequency irregularly to the present day. For nearly half a century these efforts took the form of a search for a supposed strait through the American isthmus. When at last the numberless fruitless efforts convinced the world that such a strait did not exist, the dream was changed to one of a canal to be cut through the isthmus, and later it was proposed to construct a railway capable of transferring loaded vessels across.

The project of a ship railway was promoted by the state of Honduras with reference to a line across its own territory, connecting the harbors of Puerto Caballos on the Atlantic and La Union on the Pacific. This route was examined by the British-Honduras Interoceanic Railway Company, and is said to offer many attractions as a route for railway transit.

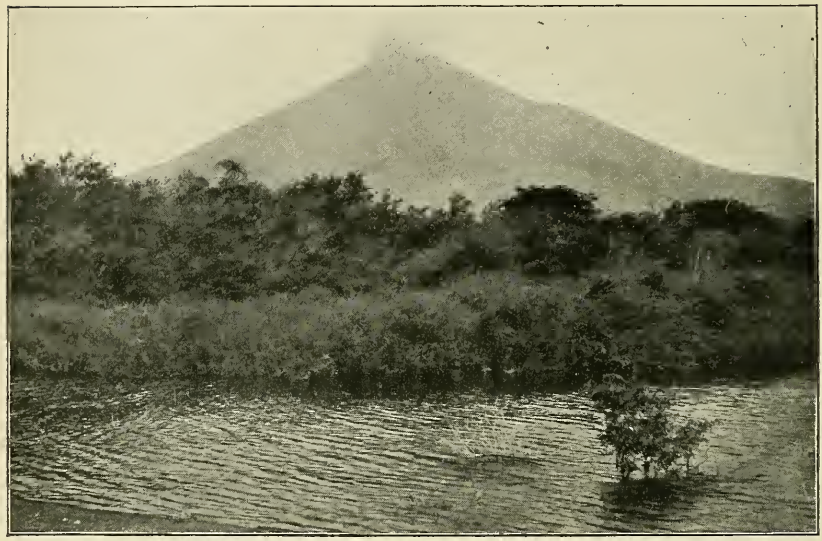
The ship-railway route that has received the most attention, however, is that across the isthmus of Tehuantepec in Mexico. This route was first explored about 1520 and its advantages utilized by the Spaniards in the transportation of shipbuilding materials. It was later abandoned and almost forgotten, until, in 1771, an expedition was fitted out to examine and report upon the topography of the isthmus and the practicability of a canal by that route. This examination was very superficial, and it was reported that a tide-level canal was feasible. Another examination was made thirty years later, but without result. After the independence of Mexico was established an examination was made by General Juan Orbegozo, who reported the canal project as "problematical and gigantic."

In 1842 Don José de Garay obtained from the Mexican government a charter for a canal or railway across the isthmus of Tehuantepec and appointed a commission to make a survey of the route. They reported the summit of the route to be 684 feet, and recommended the employment of the Chicapa and the Ostuta rivers as parts of a canal line. The length of the canal in excavation was to be about 50 miles, and 161 locks were to be constructed. A further examination and partial resurvey was made under the same concession, in 1851–'52, and more detailed information obtained.

Many years after this Capt. James B. Eads turned his attention to this route. After some investigation and discussion the project for a canal was abandoned on account of the large number of locks and great cost. Captain Eads adopted the idea of a ship railway over this route, and worked out elaborate plans, which have since been perfected and advocated by Mr Elmer L. Corthell, C. E. This project proposes 12 parallel rails, upon which is to run a huge carriage, supporting the entire ship and cargo as in a dry dock. Bends will be provided for when necessary by means of turn-tables. The motive power is to be two huge locomotives, which rest upon 6 rails. To provide for the passage of ships going in opposite directions and for repairs, turnouts are to be conveniently placed, the change of direction from the main track being effected by a turn-table.

The ship-railway project, however, has never succeeded in attaining the degree of popular approval that has been bestowed upon canal propositions. The general sentiment appears to be summed up in the epigrammatic expression, "A ship is never so well borne as when water-borne." The canal routes which have attained the greatest degrees of public favor are the Atrato, San Blas, Panama, and Nicaragua.

Atrato Routes.—The gulf of Darien, an arm of the Caribbean sea, at the point where the isthmus joins the main continent of South America, receives the waters of the Rio Atrato, a navigable stream which rises and flows due north about 200 miles into the gulf. Its watershed is bounded on the west by the continental divide, which here hugs the Pacific coast very closely, and has several passes of moderate altitude. Various projects have been proposed to utilize this river and its tributaries to ap-



MOMOTOMBO

proach the Pacific coast as near as possible and then cut through the range to the sea. Of these projects the two that have received the most favor and attention are the two which utilize the Napipi and Truando rivers, tributaries of the Atrato. But neither has been regarded with as much favor as the more northerly routes.

The Napipi-Atrato route provides for making use of the Atrato river for a distance of about 140 miles and the construction of about 30 miles of canal, of which 3½ miles would be in tunnel. The estimated cost of this canal is about $98,000,000. The chief objections to this route are the long stretch of river navigation before the canal proper is reached, the uncertainty of tunnel construction and maintenance, the aggregation of a number of locks close together near the Pacific coast, and the uncertainty of a sufficient water supply for the summit level.

The Truando-Atrato route is a modification of the Napipi-Atrato route, the project being to leave the Atrato river about 80 miles from its mouth and then to cut a sea-level canal through a tunnel under the continental divide into the Pacific, the flow of the Atrato river being diverted into the Pacific ocean. The length of the cut from the Atrato to the Pacific would be 43.2 miles. The cost of the work has been variously estimated from $135,000,000 to $156,000,000. The chief difficulties of this route are the considerable tunnel excavation and the control of the flood waters of the Atrato river.

San Blas Route.—This route lies between the gulf of San Blas in the Caribbean sea and the mouth of the Bayano river on the Pacific. It is the narrowest part of the entire isthmus, being only 30 miles from ocean to ocean. It is proposed that the level of the water in this canal be that of ordinary high tide in the Pacific ocean. The tides in the Caribbean sea being inconsiderable, no provision need be made to accommodate them; but on the Pacific coast the tides are from 16 to 20 feet, and a lock would have to be provided for maintaining the canal at any desired level. At high tide the lock can be left open, while at low tide there would be a considerable descent by means of the lock. This route requires the construction of a tunnel seven miles long, which it is proposed shall be 80 feet wide at the surface of the water and 140 feet high from the canal bottom. Much disagreement has arisen regarding the practicability and cost of the proposed tunnel. No work of any such magnitude or under such conditions has yet been attempted, and it is claimed that the gloom of a tunnel, the constant shower of chilled water from its roofs and sides, and its deoxygenated condition would rapidly undermine the health of the workmen, who would be unable to combat successfully the malaria and other enemies to health which abound on the isthmus. The long tunnel required, with the accompanying uncertainty of cost and practicability, is the chief objection to the San Blas route, though unquestionably this route has obtained a higher degree of public favor than any other excepting the Panama and Nicaragua routes.

Panama Route.—This route lies between Colon or Aspinwall, on the coast of the Caribbean, and Panama, on the bay of Panama. The existence of fairly good harbors at each end is one of the reasons for the advocacy of this route, and in 1851 a railroad was built between these points to accommodate the sudden growth of travel between the eastern states and California, due to the gold excitement. The total length of this canal from ocean to ocean is 42 miles. Two distinct propositions have been advocated regarding this canal. The first, for a sea-level canal, was M. De Lesseps' scheme. The canal proposed by this project has a length of 45.5 miles, a depth of 28 feet, and a bottom width of 72 feet. It was estimated that 75,000,000 cubic meters of material would have to be moved, at an estimated cost of about $170,000,000. The only object in excavating a sea-level canal in preference to one with locks is to avoid the use of locks, but this cannot be avoided on the American isthmus, owing to the great range of tides in the Pacific. A sea-level canal, if constructed, would require the use of a lock on the Pacific side to control the tides, so that the advantage of such a canal is small when compared to the increased cost of construction which it involves. For many years this project was actively promoted in France and vast sums of money were subscribed for its construction. A large amount of work was actually done, the canal being practically complete for seven miles on its eastern end, and large quantities of heavy excavation made in the upper and

CALABRA CUT — PANAMA CANAL

western portions of the route. The work accomplished, however, represented only a small fraction of the funds subscribed, the balance being squandered in corruption and reckless extravagance. The scandals occasioned thereby led to the bankruptcy of the company and the suspension of the work. The sums actually subscribed and put into this work are variously stated as more or less than $260,000,000, not more than one-fifth of which is represented by actual construction.

On the reorganization of the company a balance of about twenty million dollars remained available for surveys and construction. The sea-level plan was abandoned, more complete surveys were made, and plans drawn up for a lock-canal, which is to be supplied with water from reservoirs to be constructed on the Chagres river. A small force is and has been for several years at work on construction, and the project is not by any means abandoned, though it is admitted that it will cost over $100,000,000 to complete the canal under any possible plan.

Nicaragua Route.—The advantages offered by this route for interoceanic communication were recognized at a very early period, and surveys were ordered by the crown of Spain as early as 1524, but were not executed. In later years several superficial examinations were made and many conflicting statements rendered, but all the really useful knowledge of this isthmus is of recent date. Nothing reliable and definite as to distances and elevations was obtained until 1850, when Col. O. W. Childs was sent there by the Atlantic and Pacific Ship-Canal Company. He made a reconnaissance of the entire strip of land between the Pacific and Lake Nicaragua, and made surveys of several routes to connect them. That from Salinas bay to Sapoa river he examined and condemned on account of the great elevation to be overcome. The favorite route of Louis Napoleon, by way of Lake Managua, he also condemned on account of its elevation and great length. His examination led him to the conclusion "that the line leading from the mouth of Las Lajas to the Pacific at Brito presented more favorable conditions for the construction of a canal than any other." The correctness of this conclusion is now universally acknowledged.

Colonel Childs estimated for the construction of a canal with a continuous depth of 17 feet. He proposed to hold the lake permanently at 108 feet above sea-level, and to overcome this elevation by 14 locks on each side, with a maximum lift of eight feet; the summit was to be controlled by dams at Castillo on the east and Buen Retiro on the west. The total length of his proposed line was 194.4 miles, and the cost was estimated at $31,538,000. This included the cost of an artificial harbor at Brito; but at that time there was a good harbor at Greytown. The object of this survey was primarily to establish a means of communication with California to accommodate the heavy traffic induced by the discovery of gold.

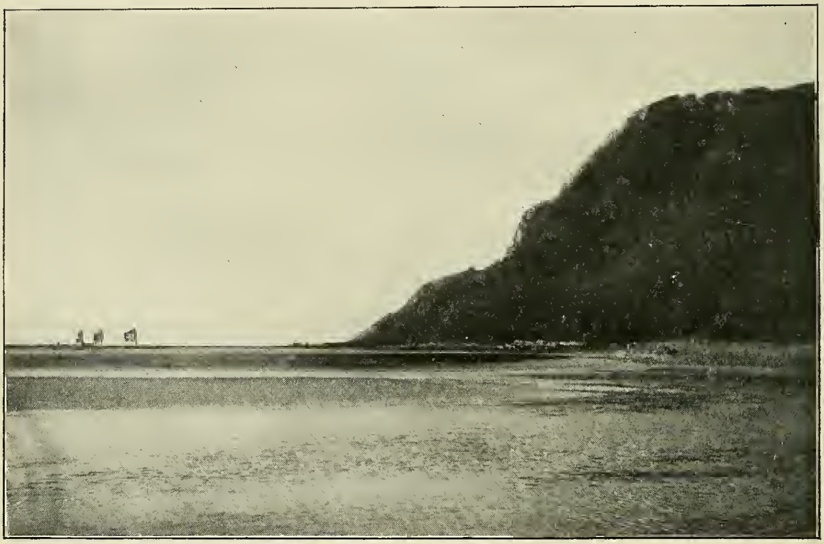
President Grant took a deep interest in the canal problem, and in 1872 appointed a commission consisting of General A. A. Humphreys, Chief of Engineers; C. P. Patterson, Superintendent of the Coast Survey, and Commodore Daniel Ammen, of the U. S. Navy, to examine the information at hand and determine the most feasible route for an interoceanic canal. The routes considered were the Tehuantepec, Nicaragua, Panama, and Atrato-Napipi. The commission unanimously reported in favor of Nicaragua, and this has ever since been regarded as the favorite canal route from the American point of view.

In 1873 an expedition was fitted out by the United States Government for the confirmation and continuation of the Childs survey. It was placed under the charge of Commander E. P. Lull, U. S. N., who surveyed the route with reference to the construction of a canal 26 feet deep. He confirmed the surveys of Colonel Childs, but fearing difficulty with the waters of the upper Rio Grande, he recommended that the canal leave Lake Nicaragua by way of the Medio instead of Las Lajas. This was shorter by a mile and a half, and avoided the Rio Grande, but involved a ninety feet deeper cut through the divide. The western half of the routes coincide, and reach the Pacific at Brito. Commander Lull also caused a reconnaissance to be made of a portion of Lake Nicaragua and of the San Juan river. It was thought that the river could be improved at the rapids by means of locks, and that by this means and by dredging, could be converted into a canal to a point near the mouth of Rio San Carlos. Here it was proposed to construct a dam, and the canal was to leave the river and follow near it until the swamp region was reached below the Serapiqui, and then to cut across to Greytown. Eleven locks were proposed west of Lake Nicaragua, and ten on the east side. The estimate included $2,500,000 for the restoration of Greytown harbor, and was in all $65,700,000.

Associated with Commander Lull in this survey was Mr A. G. Menocal, a civil engineer of the navy, who has since become famous as the chief engineer of the Maritime Canal Company,

STREET IN PANAMA

and to whom is largely due the public interest in the Nicaragua canal. In 1885 Mr Menocal was sent by the Government to continue the examination, and the plans adopted by Lull were completely revolutionized. On the west side he adopted the Childs route—by way of Las Lajas—the Rio Grande to be diverted from its course and turned eastward into Lake Nicaragua. The summit level of Lake Nicaragua was to be maintained at 110 feet by a dam across the San Juan at Ochoa, three miles below the mouth of Rio San Carlos, where the sailing line was to



MOUTH OF RIO GRANDE: PROPOSED SITE OF BRITO HARBOR

leave the river and follow nearly a straight line to Greytown, the summit level being maintained until the east divide had been passed, and the descent to the Caribbean made by three locks with a maximum lift of 40 feet. This necessitated the construction of a series of high embankments between Ochoa and the east divide, a distance of 12½ miles. About half of this distance consists of steep clay hills, which were to be connected by the embankments, 67 in all, ranging from 6,000 feet long downward. The cut through the east divide was to be over three miles long and to have a maximum depth of 324 feet. This project was the one adopted with some modifications by the Maritime Canal Company. Two short basins were added by the construction of dams on the Deseado and the Rio Grande up to the summit level. All these plans were elaborated in great detail, and the total cost was estimated at $65,084,176.

In 1895 Congress provided for a board of engineers to ascertain the feasibility, permanence, and cost of the canal, and appropriated the sum of $20,000 for the purpose. Col. William Ludlow, of the army, Civil Engineer M. T. Endicott, of the navy, and Mr Alfred Noble were appointed by President Cleveland to constitute it. Considering the time and funds at their disposal, this board made a very thorough examination of the route, the data, and the estimates, all of which were freely discussed and criticised. They reported that while the canal was undoubtedly feasible, the information collected was entirely inadequate for a basis on which to make final estimates of cost or even to determine the practicability of certain peculiar features involved in the company's plan. They recommended, therefore, that an appropriation of $350,000 be made for further surveys and investigation. A provisional estimate made the cost just about double that estimated by the company. Accordingly, a commission was appointed by President McKinley, consisting of Rear Admiral J. G. Walker, Col. P. C. Hains, and Lewis M. Haupt, for the further survey and examination of the canal route.

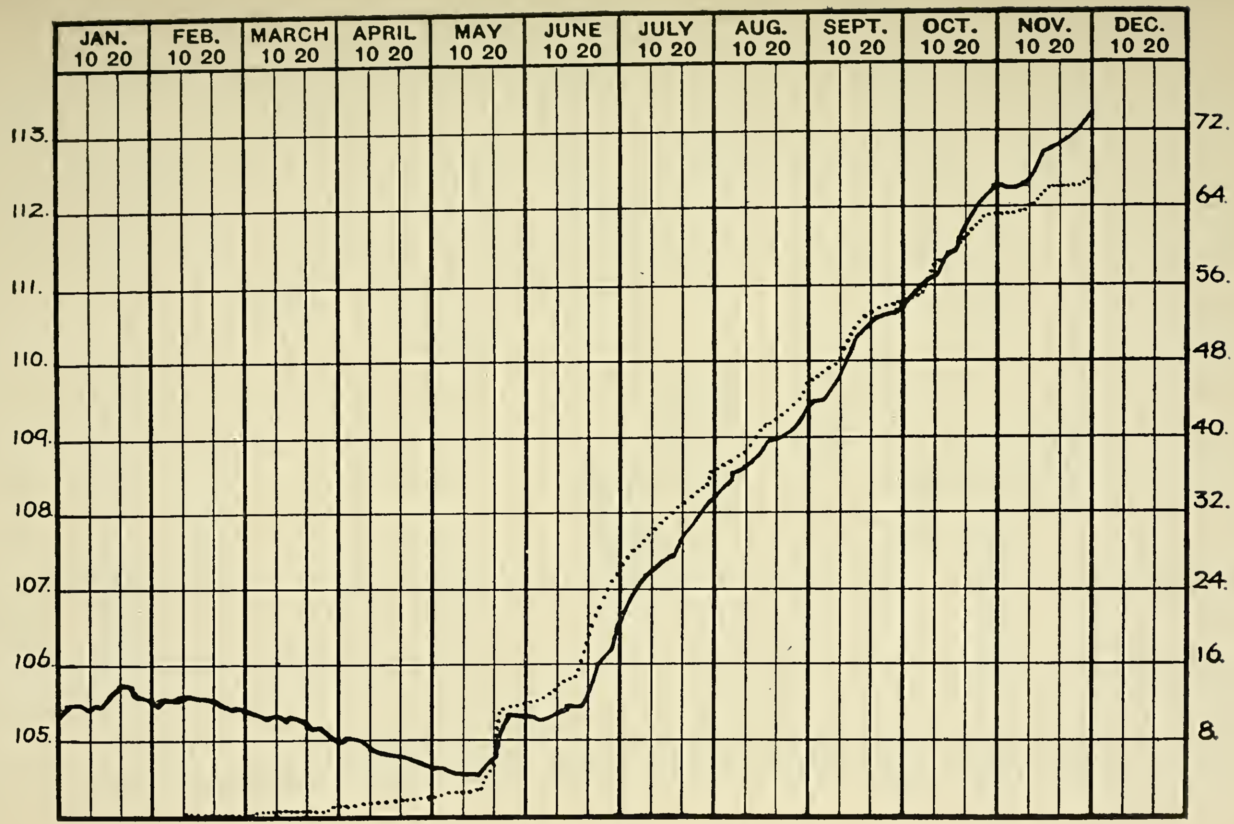
The points of weakness in the company's data were numerous and some of them serious. The borings on some parts of the line were meager, and in many cases the results had been confused and the cores taken had been lost. The Ochoa dam was to be constructed of large rocks loosely dumped into the stream and left to find their own foundation. This style of dam involved the use of rocks of very large size and of hard and permanent structure. The intention was to obtain this material from the deep cut through the east divide. Investigation, however, aroused serious doubt as to the existence of a sufficient quantity of hard, permanent rock in the divide for this purpose. No satisfactory information existed as to the foundations for the Ochoa dam and the San Francisco embankments. The large amount of material to be dredged in the San Juan river had not been investigated at all. But little was known regarding the foundations of the proposed dam at La Flor and the material to be dredged at Brito.

The greatest lack of information, however, was with reference to the hydrography. Though it was proposed to deal with the floods of the San Juan, San Carlos, San Francisco, and other streams, no attempt had ever been made to measure their flood discharge or even to make an approximate estimate on this point. It was designed to hold the lake at an elevation of 110 feet above sea-level, any rise above that mark being injurious to property and any fall below reducing the navigable depth of the canal throughout the summit level; yet no attempt whatever had been made to determine the maximum or minimum inflow or the rate of outflow or evaporation from the lake. There was also some discrepancy in the levels and in distances on San Juan river and Lake Nicaragua.

The Walker commission directed its efforts to supplying these deficiencies and to the investigation of alternate routes with reference to comparative permanence, utility, and cost, and also to checking the results of surveys already made. Sufficient information has been obtained to fix plans and quantities within narrow limits, so that disagreements as to cost relate almost entirely to the relative efficiency of labor in a warm, wet climate as compared with temperate regions, where we have more data.

The hydrographic investigations included the measurement of all the principal streams encountered by the possible canal routes, the rainfall all along the line, the evaporation from Lake Nicaragua, and the sediment carried by the San Carlos and Serapiqui rivers with reference to its influence on the maintenance of the canal. The twelve camps which were established measured twenty streams and took the other observations required.

On the San Juan one station was maintained at Ochoa, where it is proposed to build the big dam. Another, just above Sabalos, was maintained as being the highest point on the river where a dam might be built and as giving essentially the outflow from the lake, there being no important tributaries between this point and the lake. During the latter part of the dry season a tour around the margin of Lake Nicaragua was made to determine the inflow during the dry season, and, though the preceding rainy season had been the wettest on record, the inflow was found to be practically negligible. Observations show that the average evaporation here in the dry season is about two-tenths of an inch per day. The length of the dry season and the rate of evaporation indicate that in ordinary years the surface of the lake would decline about two feet during the dry season, and this will, of course, decrease the navigable depth of the canal by



MEAN INFLOW TO LAKE NICARAGUA COMPARED WITH THE MEAN RAINFALL IN ITS BASIN

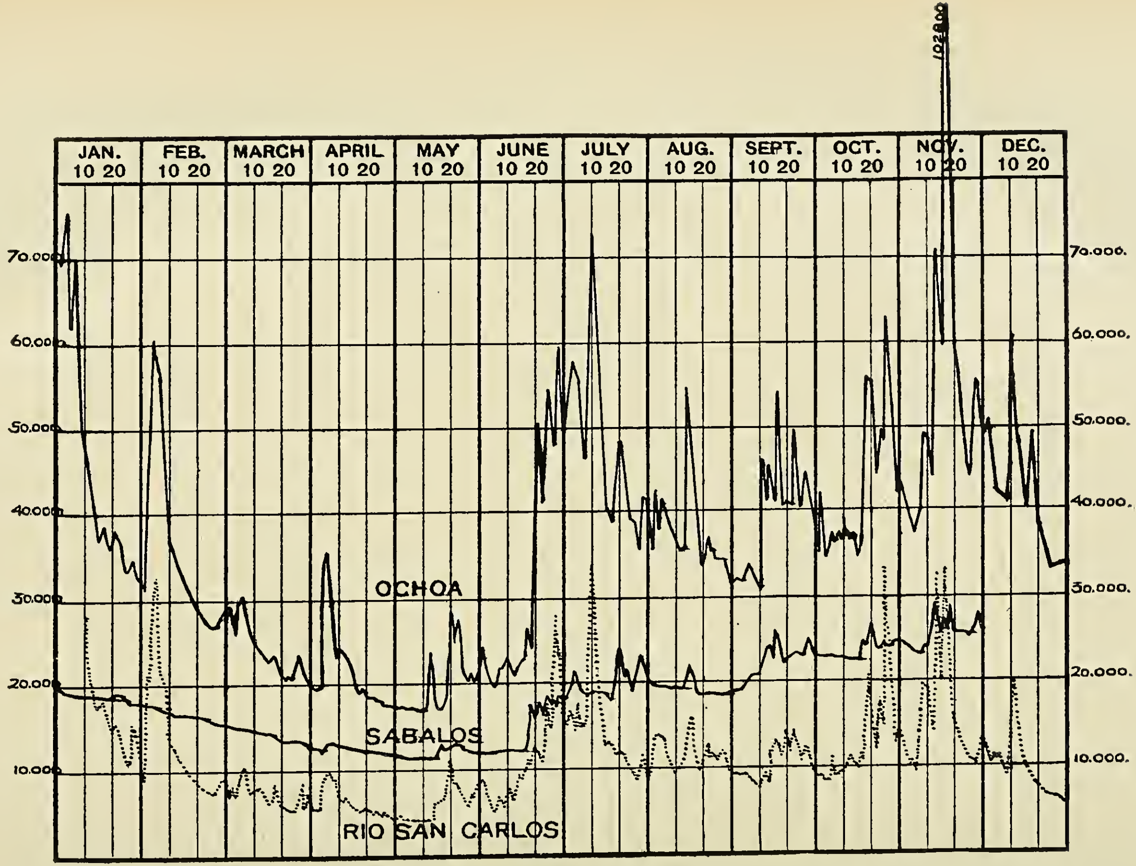


DIAGRAM OF THE DAILY MEAN DISCHARGE IN CUBIC FEET PER SECOND OF THE RIO SAN JUAN ABOVE MOUTH OF SABALOS AND AT OCHOA, ALSO OF THE SAN CARLOS THREE MILES ABOVE ITS MOUTH, 1898 that amount throughout the summit level. Hence to maintain a depth of 30 feet it will be necessary to secure and hold a depth of 32 feet at the beginning of every dry season. There are very strong indications, however, that whole years sometimes occur in which the evaporation exceeds the rainfall by two feet, so that amount should be stored against the exceptionally dry years, and a depth of 34 feet secured at the opening of each dry season to secure a permanent depth of 30.

Only two streams carried any considerable quantity of water into the lake last April. These were Rio Frio, which empties at Fort San Carlos, and Rio Zapote, coming in at the extreme south end. A few springs and brooks also flow the year round, but most of the tributaries are, during the dry season, stagnant estuaries, from 10 to 25 feet deep. Aquatic vegetation grows in great profusion in these streams, choking the channel, unless a passage for navigation is kept open by canoes. This vegetation is not rooted to the soil, but floats freely and shows no disposition to flow out toward the lake. The water is dark-colored, foul, and stagnant. When the rainy season sets in in earnest, however, these wide, deep channels are filled with a rushing current so swift that it is very difficult to paddle a canoe against it. The floating vegetation is carried out in great quantities, forming floating islands several hundred feet across. As the current of the stream often extends far out into the lake, the floating vegetation forms a large crescent around the mouth, and in some cases constitutes quite an annoyance to navigation. Some of these islands find their way to Fort San Carlos, and pass down the San Juan river. The inflow to the lake is sometimes as great as 300,000 cubic feet per second, and to prevent injurious submergence of adjoining property it is necessary to provide a spillway of large capacity, and to control the discharge so as to waste the surplus and yet to store the large amount of water necessary to provide for the evaporation from this immense lake surface.

As illustrating the problems solved by this survey, the extreme flood discharge of Rio San Juan at Ochoa was estimated by the company at 63,000 cubic feet per second. A discharge of about 105,000 cubic feet per second has been already observed, and a study of the floodplain in connection with the observations at the same point shows that the maximum discharge cannot be less than 200,000 cubic feet per second, or more than three times the estimated maximum. The San Carlos and Serapiqui rivers have been shown to carry such quantities of sediment, sand, and gravel that practically all plans for canalizing the river below the mouth of Rio San Carlos are prohibited. The section of the river between San Carlos and Sabalos, which requires such a large amount of dredging, has been shown by the borings to contain no solid rock, and these results have been confirmed most signally by Dr Hayes' development of the geological history of this river. A line of precise levels has been run from tide water on each side to the lake, thus settling all uncertainties of elevation. A careful survey was also made of Lake Nicaragua, locating the shoreline and fixing its depth at all points.

The route that now seems to be the best is in general similar to the one selected by Commander Lull in 1873.

It is now definitely settled, as stated by the commission, that the Nicaragua canal is a practicable proposition, all the serious difficulties being either eliminated or a method of solution pointed out. The cost, with a depth of 30 feet or more throughout, with locks large enough to receive the largest war vessels afloat, safe harbors at each end, and all constructions of the safest and most permanent character, will probably be about $125,000,000. Whether or not it will be worth that amount to the American people is another question.

SCENE IN RIVAS — READY TO START

THE WELLMAN POLAR EXPEDITION

With the news that arrangements have been made for the return of Mr Wellman and his party, speculations arise as to the probability of his having reached a point further north than has been yet attained. Up to the last word received all his plans had been carried out, and unless the unexpected has happened, there is reason to believe that success will be his reward. The story of the equipping and starting of the expedition has been told by Mr Wellman (*Century Magazine*, Feb., 1899)—told modestly and absolutely free from the exaggeration that such enthusiasm as his might well prompt. It was my good fortune to assist in the final preparations for the trip, and from an experience of travel under all sorts of conditions I could form an opinion as to how well he was prepared to meet any conceivable emergency. He had profited by the trials of all who had gone before, and had devised a number of expedients that gave promise of making his task easier. Unless the problem contains unheard-of factors, I feel sure that he will reach the ultimate north.

He sailed unusually early from Tromsö, intending to take advantage of any breaking up of the ice; but unfortunately the prevailing winds banked the ice up instead of driving it southward, so he was compelled to put back to Norway for coal and then make a second attempt. This time he pushed through to Franz Josef Land, and established his first camp on Hall island. The plan was to send northward a reconnaissance party to locate a favorable site for winter headquarters, and spend the remaining days of summer hunting, to lay in supplies for the men and dogs. The rest of the party would follow by slower marches, and bring up the heavier equipment for the winter and for the flying column that would start as early as possible this spring.

The strongest feature of Mr Wellman's plan is the way in which this advance is to be made. For this he secured devices that give the minimum of waste in motive power and material. He has sought to avoid the discouraging retraveling of the route by taking plenty of dogs and having light loads. One of the best proofs of the wisdom with which every detail has been looked after was the readiness of experienced men to accompany him. Of the five Norwegians in the party three have repeatedly endured all the vicissitudes of Arctic work. After having assisted in the final preparations and seen each thread upon which their lives may depend, they embarked as though the goal were plainly in sight.

The past winter was to be spent in such rude huts of snow and walrus skin as they could erect. When the weather permitted they would train the dogs and practise on their *skis*, so that when the final start was made no time would be lost in breaking-in their forces. It was the intention to start from this winter camp as soon as the twilight was bright enough for them to see, and move northward to the Pole, returning in season to reach Franz Josef Land by the time the relief ship arrived there. They have sufficient supplies for another winter, and in case there should be failure this year in any part of the scheme they will remain until next summer. Every one is asking, "Will they succeed?" They will if they reached a high latitude last fall; if sickness did not weaken their forces during the long winter night; if the unprepared-for was not met. But each *if* must be written large.

J. Howard Gore.

THE COAST AND GEODETIC SURVEY: ITS PRESENT WORK

The wide scope embraced in the operations of the Coast and Geodetic Survey demands correspondingly wide limits in the character of the work and in the geographical distribution of its activity. Parties are now engaged on the Atlantic, Pacific, and Alaskan coasts, and in Puerto Rico. The coming season will witness great additions to our very incomplete knowledge of the mouth of the Yukon and of its approaches. The southern shore of Puerto Rico, contrary to the general belief, contains one or more good harbors, and the hydrography necessary to develop their commercial capabilities is now being rapidly executed. The great arc measurement on the 98th meridian is being pushed vigorously. This work is the worthy counterpart of the transcontinental arc on the 39th parallel, and will eventually become the backbone of the Mississippi Valley triangulation. The present year marks a notable era in Coast and Geodetic Survey work bearing on the figure of the earth, inasmuch as it will witness the publication of the definitive results of one of these arcs and the comprehensive prosecution of work on the other. This season is the first in which several classes of work are carried on simultaneously and systematically on the 98th meridian.

A Coast Pilot party has been organized for the purpose of keeping the present publication up to date by additions and corrections. The information sought will be in the following lines :

I. General description of the coast line.
II. Detailed directions for avoiding dangers and obstructions.
III. General sailing directions.
IV. Geographical positions of lighthouses and beacons.
V. Practical information in regard to fog signals, tides, variations of the compass, etc.
VI. Views of the coast and principal harbors.

Additional work has been planned by the Coast and Geodetic Survey, but the parties have neither been assigned nor selected. A line of precise levels is proposed from the Great Lakes southward, crossing and checking our work on the 39th parallel, and continuing to Tennessee, there touching the lines from the seaboard by the Geological Survey, thence onward to the work of the U. S. Engineers in Mississippi, and finally connecting with our own levels brought north from the Gulf. Such a line would form a connecting link between the determinations of the three great government organizations.

E. D. Preston.

EXPLORATIONS IN ALASKA

During the past winter the members of the exploring parties that visited Alaska last year have carefully canvassed geographic knowledge of that country with special reference to determining in what localities exploration might be most advantageously carried on this summer. The large unexplored area lying south of the Yukon and west of the Alaskan mountain range, about the headwaters of the Kuskokwim and including the towering peaks of Mt McKinley and its neighbors, is a district of special interest toward which future exploration may probably be directed. But careful study has shown that, because of its inaccessibility except by river, no adequate returns could be expected from an expedition to that region this year. The experience of last season, when the exploring party could advance against the current of the stream but from one to three miles a day, and hence consumed all the time in getting there, has proved that the streams must be ascended while they are still frozen; but to do this the expedition would have to leave Washington, D. C., in February.

Another district carefully considered in the preparation of plans is the general region of northwestern Alaska tributary to Kotzebue sound. It is well known that many prospectors have penetrated into the interior from the eastern shore of Bering sea, and that geologic investigation would probably reveal the western extension of the Alaskan gold belt. But all information available as to modes of travel and native routes prove to be of so vague a character as to render it advisable to obtain more definite information through exploration this summer before planning for the development of that region.

Still other plans were proposed and considered, but the final selection determined that two parties should be sent out by the U. S. Geological Survey, one into the region north of the St Elias range, and to proceed westward between the Tanana and Yukon rivers; the other to the headwaters of the Koyukuk river, within the Arctic circle. The object of both of these expeditions is the exploration of little known areas for the purpose of adding to geographic knowledge, but they differ in the scope of the work proposed, as our present knowledge of the two districts is very unequal.

The first mentioned party under Mr W. T. Peters, topographer, accompanied by Mr Alfred H. Brooks, geologist, provided with a pack-train of horses, will cross Chilkoot pass and pursue the Dalton trail for some distance. At a convenient point they will diverge to the west along the northern flanks of the St Elias range. It is expected that in their westward route they will determine the northern limits of ancient and modern glaciation from the range; that they will ascertain the position of the headwaters of the White and Tanana and Copper rivers and bring out a fairly accurate recognizance map of this unknown region. On striking the divide between the Tanana and White rivers, at the point where these same explorers last year crossed from one to the other, they will proceed northwestward into a comparatively well-known area, lying between the Tanana and Yukon. In this locality gold-bearing rocks are extensively developed and have been generally prospected. Maps of the area are, however, lacking, and it is the purpose of this expedition to prepare as thorough a map as the limits of the season will permit. Throughout the route careful geologic as well as topographic observations will be made, and it is expected that our knowledge of Alaskan geology will be greatly extended.

The second party, in charge of Mr F. C. Schrader, geologist, and Mr T. G. Gerdine, topographer, will proceed by the now well established route down the Yukon to Fort Yukon, or some point in that vicinity whence a convenient route northward can be found. The equipment will be the same as that used last summer, consisting of canoes and outfit that can be easily packed and carried. Beyond this starting point the route is left to the discretion of the chief of the party, but his general instructions are to penetrate the basin of the upper Koyukuk as far as possible. The main purpose of this expedition is necessarily geographic, but geologic information will be gathered so far as practicable. It is expected that valuable information will be gathered to determine future plans for the exploration of the region between Bering sea and Arctic ocean. This party will continue its work until forced to retreat before the advent of winter, and will then float down on the swift current of the Koyukuk river. Neither party will winter in Alaska. Although the advantages of such a course have been recognized, careful consideration shows that it is not expedient with present knowledge and available means.

METEOROLOGY IN THE PHILIPPINES

In view of a public presentation and criticism, through the medium of a printed circular issued by the director of the Manila Central observatory, of action taken by the United States government in suspending all telegraphic typhoon warnings made by the Manila observatory for points outside of the Philippines, it seems proper to present for the information of all persons and interests concerned a statement of the facts and circumstances which led up to the action taken by the United States authorities.

In a communication dated November 5, 1898, Dr W. Doberck, Director of the Hongkong observatory, informed the Chief of the United States Weather Bureau that the Manila observatory was continually communicating sensational typhoon warnings to the newspapers in Hongkong, and that as this action was against international regulations laid down for the guidance of meteorological authorities, which prohibit an authority in one country to issue storm warnings for another country, he desired and recommended that the American government of the Philippines put a stop to this irregularity, which interfered so materially with the work of the Hongkong observatory.

Acting upon the recommendation made by Dr Doberck, and approved by the Chief of the United States Weather Bureau, the Secretary of Agriculture requested the Secretary of War to provide for discontinuing telegraphic typhoon warnings from the Manila observatory to points outside of the Philippine islands. The position taken by the United States authorities was that the Manila observatory was improperly interfering with the British observatory by sending warnings into the territory covered by the observatory at Hongkong, and that warnings of this character should not be sent except upon the request of the British government. They held that as Director of the British meteorological observatory, having supervision over meteorological matters for the British government in China, Dr Doberck would not be justified in sending weather forecasts to Manila, and that such action on his part would, with propriety, be resented by the officials of the Manila observatory. In this position they were strengthened by the relations which have for many years existed between the prominent meteorological services of the world. The United States and Canadian meteorological services never presume to issue forecasts or storm warnings for any part of the territory under the sovereignty of the other, notwithstanding that they have in their possession daily meteorological observations from observatories both in the United States and Canada.

The British government has a chief observatory at Hongkong and possesses a chain of meteorological observatories extending 1,500 miles northeastward and 800 to 1,000 miles southward, and in addition receives reports from Bolinao, on the island of Luzon. In fact, the director at Hongkong possesses a system of observations which is necessary to the issue of forecasts that are worthy the serious attention of mariners. The habit of the Manila observatory of issuing storm warnings for Hongkong and the China coast was not only contrary to international usage, but was not justified by the possession of superior facilities for making the forecasts. The relative accuracy or value of the warnings issued by the Hongkong and Manila observatories and the comparative scientific attainments of the directors of these observatories had, under the conditions presented, no bearing upon the subject. Dr Doberck has by years of well-directed work and study established an excellent service and gained an enviable standing as a meteorologist, and is unquestionably entitled to the consideration and courtesy which usage has accorded to directors of meteorological services.

THE MISSION OF THE "DIANA"

The Peary Arctic Club, under whose patronage Civil Engineer Peary, U. S. N., is now engaged in an expedition to the North Pole, will dispatch the steamship *Diana* about the middle of July on the second of a series of annual reinforcements proposed by Mr Peary in his original plan of action. The *Diana*, a 427-ton steam barkentine-rigged sealer, built in Greenock in 1871, and thoroughly rebuilt, reëngined, and reclassed in Dundee in 1891, was engaged by the Canadian government during 1897 in the exploration of the water route for commercial purposes between Hudson bay and Liverpool. She is a fast, stanch, and commodious vessel, and the best which has yet been employed in the northern work.

The *Diana* is to be commanded by Capt. Samuel W. Bartlett, of Brigus, Newfoundland, and will be manned by a select crew of Newfoundlanders, familiar with the conditions prevailing in high latitudes. Captain Bartlett is a brother of Capt. John Bartlett, of the *Windward*, and of the late Capt. Harry Bartlett, of the *Falcon*, who were engaged in Peary expeditions. The former has not returned from the expedition of last summer, and the latter was lost with his ship and all on board while returning from Philadelphia to St Johns in the fall of 1894. The *Diana* will carry a scientific party headed by Prof. William Libbey, of Princeton University, for biological and oceanographic work, and a hunting party of four, led by Mr Russell W. Porter, of Boston. Robert Stein, of the U. S. Geological Survey, of Washington, with two companions, will also sail on the *Diana*, to be landed, if practicable, on Ellesmere land, where he expects to remain for one or two years. Prof. William Libbey, with a complete deep-sea dredging equipment, intends to work at the southern entrance of Smith sound, determining the course and direction of the southward currents, while the Porter party will be taken to the deer and walrus habitats on the Greenland side of the straits.

The *Diana* will take one year's supplies for the *Windward* party, which has not returned, and for her own party, so that in case of any unforeseen accident there will be no danger of lack of food. She will also carry mail and small packages from Norway for Sverdrup, in the *Fram*, who has not been heard from since his departure from Upernavik, July 30, 1898. The itinerary of the *Diana* is that planned by Mr Peary before leaving for the north last summer. The hope of meeting Peary or his representatives and of obtaining information concerning the winter experiences of the *Windward* and *Fram* parties will make the voyage of this summer one of more than popular scientific interest.

It is reported that to a deputation of the Royal Geographical Society which waited upon him a few days since, Right Hon. Arthur J. Balfour, First Lord of the Treasury, promised that the government would render substantial aid in furthering the work of an Antarctic expedition.

GEOGRAPHIC LITERATURE

A Thousand Days in the Arctic. By Frederick G. Jackson, Knight, etc. With Preface by Admiral Sir F. Leopold M'Clintock. 8mo, pp. i–xxiii + 1-940, with many illustrations, including five original maps. New York and London: Harper & Brothers. 1899. $6.

"This is an unvarnished tale of a thousand consecutive days spent in the Arctic, printed almost word for word as it was written . . . in our hut, or tent, when on sledging and boating journeys in Franz Josef Land. It is a simple, true account and statement of facts incident to our life and work there—plain facts, penned by a plain man." Such is the deprecatory note modestly prefixed by one of the foremost explorers of the decade to the published record of his work. Frederick G. Jackson, a Briton of characteristic physique and intelligence, is one of the legion lured by the ignis fatuus of the northern Pole; at the same time he is one of that division of the legion whose dreams are sane and whose strivings are sensible. On studying the conditions it seemed to him probable that Franz Josef Land (discovered and named by Weyprecht and Payer in 1873) might afford an overland route to the Pole; and, after much unsuccessful search for means, he at last effected a conjunction with Mr Alfred C. Harmsworth, who equipped an expedition for geographic work in the little-known land. Fortunately the patron was not more dazzled by the purely polar gleams than his explorer; it was his chief desire that Jackson and his companions should "add to our knowledge of the geography and the fauna and flora of Franz Josef Land and the area lying immediately north of it" (p. 774). Thus it was on a practical basis that the *Windward*, with the Jackson party on board, weighed anchor on July 12, 1894. A southerly point on Franz Josef Land was reached without great delay, and a landing was effected; but before the transfer of goods was completed the vessel was caught in the ice, and remained until the break-up of 1895, when she returned to England, leaving Jackson and his six companions on one of the most desolate spots ever touched by explorers. Nearly a year later the solitude was broken by that most marvelous accident of Arctic exploration, the meeting with Nansen and Johansen, who remained a month before embarking on the *Windward* on her return trip of 1896, while the British party remained another year, to be brought out by the same vessel in the summer of 1897. During the three years of their arctic sojourn Jackson and his experts were seldom idle. In the spring of 1895 a long sledge journey was made northward, resulting in the discovery that the supposed continuous land is but an archipelago. Later in the season a perilous, not to say foolhardy, sea-trip was made in a half-seaworthy whale-boat, which resulted in a map of the southern coast and the location of the southwesternmost point of Franz Josef Land. Another sledge journey northeastward, with further surveys, followed in the spring of 1896; but by far the most noteworthy sledge trip was that of the spring of 1897, when Jackson, with one companion (Albert B. Armitage), traversed the entire latitude of the more continuous portion of the archipelago, skirted its northern coast, approached its western headlands, and resurveyed the southern shore. The sledging trips were unique in Arctic exploration in that horses (Russian ponies) were used, up to the middle of the long trip of 1897, when the last of the original four succumbed on the great glacier covering the western portion of the westernmost island. The experience seems to establish the explorer's opinion that the use of properly selected horses is essential to the best results in polar work; certainly Jackson's longest trips were made possible only by this form of motive power, and it seems evident that if a fresh supply of suitable ponies had been brought in by the *Windward* in 1896, in lieu of the utterly useless reindeer, the work of the expedition might have been materially facilitated and enhanced in extent. True, a special strain of horse-flesh is required; docility to the degree of taking kindly to snow-shoes or assistance over ice-cracks and crevasses, hardiness enough to permit survival of snow-laden gales down to temperatures of —50°, and omnivorousness extending at least to dog biscuit and bread, and even to bear meat and bacon, are among the requisites; yet all these requisites are met by the Russian ponies, as Jackson's experience demonstrates. In the absence of the leader the naturalists at the home station, and at all other times except in the dead night of polar darkness, the whole party were occupied with studies and collections of the fauna and meager flora, the fossils and rocks, and the other natural features of the region; while the leader and others made maps, numberless photographs, and admirable meteorologic records. The mode of life was largely conventional—for Arctic regions; but the leader was a sportsman, possessed of strong convictions concerning modes of maintaining health, and kept the larder supplied by shooting bears, walruses, and (during the short summer) loons and other fowl nesting in the cliffs. The itinerary abounds in episodes, often approaching the tragic, and is of unsurpassed interest throughout. The monotony of the boat trip in 1895 was relieved by a three days' gale, by which the party in their shaky craft were blown out to sea, and so hardly and constantly beset that they were unable even to reach the food on board or to protect themselves from frost-bite, and were finally blown back to land by mere chance of wind and weather; the sledges crossed ice-cracks and soft sludge at sea and crevasses on the glaciers over frail snow-bridges, and dogs and ponies were again and again hauled out of jeopardy by their necks; in one case a sledge-load of food for a considerable trip was lost through rotten ice, and the return trip was a cold and hungry one. The interviews with fearless and hungry bears in the polar dark were often thrilling—as when one over-curious bear took twenty-three inches of rifle barrel and a hand above the wrist in his mouth before voting the contest a draw. Throughout, the explorer reveals himself the typical Englishman in character, in everyday custom, in mode of speech, and in habit of thought; he is monarch over his small domain, ruling his yeomanry with rod of iron, yet always charging himself with their safety and comfort; he concentrates in his own person the energy and ambition and nearly all the individuality of the party, and inevitably dwarfs, in some measure, the abilities of the others; he alone, or nearly so, responds to the signal "Bear" sounded by dog or man, and leads the van on all occasions; and when ponies and dogs are broken down, it is he who takes the harness as leader of the team. Throughout it all he glories in his "tub;" even when but a gill of water can be painfully obtained by snow-melting, and when the blizzard howls far below zero, he creeps out on hummock or glacier to gloat over a sponge bath to the waist! And his philosophy is as characteristic as his language when, on summarizing the nasty boat trip, he says, "We have had an exceedingly near squeak for it, and it was very nearly ta-ta on many occasions" (p. 299). Though monarch of his domain, he is always Briton and mindful of Britain's Queen; and one of his mainsprings is the desire to extend Her Majesty's dominion even unto the futile shadow of the poles, and he rejoices in the opportunity to replace the imaginary portion of "Franz Josef Land" by a far-stretching "Queen Victoria sea." The geographic results of Jackson's work are notably valuable; he surveyed a large part of the little-known Franz Josef Land, showing it to be an inconsiderable archipelago rather than a great land mass extending to the Pole; he shows "Gillis Land" to be non-existent; and he gives an admirable record of the natural history and meteorology of a little-known portion of the globe. The "land" consists of a congeries of basaltic mesas rising a few hundred feet above sea, with the intervening valleys submerged; and nearly all the surface is mantled with perpetual snow, forming extensive névé-fields and glaciers whence bergs are constantly fed to the surrounding ocean. Apparently the region is one of peculiarly unstable climate; gales keep water and ice astir, so that the effect of summer is hastened despite the irregularity of the seasons, and this doubtless accounts for the incomplete glacial covering and hence for the considerable fauna, especially of bear and walrus and seal—which was, however, greatly reduced by Jackson's hunting. The bulk of the book is well illustrated itinerary; but 140 pages are devoted to appendices on the natural history of the region, and there is an important chapter on scurvy, containing the results not only of Arctic experience, but of experiments on monkeys in England. The publishers have done their work admirably; so that, on the whole, the book is one of the most instructive and attractive products of Arctic work thus far issued.

W J M.

Shoreline Topography. By F. P. Gulliver. (Proceedings of the American Academy of Arts and Sciences, Vol. xxxiv, No. 8, January, 1899.) Pp. 151–258.

As an able representative of the school of modern geographers fostered especially by the U. S. Geological Survey and Harvard University, Dr Gulliver is already favorably known; and this little monograph will add materially to his prestige and to the beneficial influence of his school. Throughout he employs and applies the genetic method, dealing with the shore features as products of recognized agency; dynamic agencies are indeed conceived to be conditioned by static factors of volume, structure, hardness, etc., while the descriptive terms connote forms; yet the classification is in accord with latest phase of earth science, in that it is primarily genetic, only secondarily structural. Proceeding on this basis, the author naturally adopts as his thesis the postulate that "the forms of any coastal belt may be grouped in the appropriate stages of a cycle" (page 155)—*i. e.*, he passes easily from the dynamic to the sequential. The features discussed are adequately illustrated, chiefly by maps. W J M.

GEOGRAPHIC MISCELLANEA

The exports of gold from the ports of South Africa at present average about $2,000,000 each week.

On account of the withdrawal by the government of its annual subsidy the Jamaica Weather Service has been discontinued.

The Budget Committee of the Reichstag has voted the first installment of $47,600 for the German Antarctic expedition of 1902.

In the *Monthly Weather Review* for March is an article by the editor, Prof. Cleveland Abbe, outlining the history of meteorology in Russia.

A recent *Independent* (June 8) contains a history of "The Alaskan Boundary," by Marcus Baker, secretary of the U. S. Board on Geographic Names.

For the first time in the history of the Weather Bureau, forecasts for forty-eight hours in advance, for all states east of the Rocky mountains, were regularly issued from Washington each night during April, 1899.

Reports from Odessa and southern Russia represent the winter grain crop of that region as almost destroyed by drought. As the spring grain crop is likewise seriously threatened, it is feared that the crop may not exceed that of 1897.

Reports from Vancouver, B. C., announce the ascent for the first time of Mt Morrison, the highest mountain in Formosa, by Stoepel, the explorer of the Pic of Orizaba in Mexico. It is stated that Mt Morrison is inhabited by a wild tribe of cannibals, evidently of Malayan origin and distinct from any known race.

The next meeting of the International Meteorological Committee will be held at St Petersburg August 25. Willis L. Moore, Chief of the Weather Bureau, is the representative of the United States. Among other members of the committee are E. Mascart, France; R. H. Scott, Great Britain; W. V. Bezold, Germany, and M. Rykatcheff, Russia.

The Nation states that Mr Charles F. Lummis is about to print in his *Land of Sunshine* (Los Angeles, Cal.) an accurate translation of the Viceroy Revilla Gigedo's report on California, the clearest and closest summary of Pacific Coast affairs and explorations from San Blas to Nutka, 1767–1793, that we possess. It has not been printed heretofore in English.

The Union Pacific Company has invited three hundred prominent geologists to join in a free excursion of sixty days to study the recent fossil finds in the Wyoming wonderland. The professors of the various large colleges throughout the country are especially invited, and transportation is to be furnished for at least one assistant free. The excursionists are expected to gather at Laramie, Wyo., on July 19.

Col. W. S. Brackett, of Peoria, Ill., a corresponding member of the National Geographic Society, has organized and equipped an expedition to determine the geologic and mineralogic features of the almost unknown region lying between Buffalo hump, in Idaho county, Idaho, and the Nez Perce pass, in the Bitter Root range. The party numbers twelve men, all experienced mountaineers, some of whom have been in that country since 1862.

The successful navigation of the vast and comparatively unknown interior of South America by the U. S. gunboat *Wilmington*, which ascended over 2,100 miles up the Amazon and its tributaries and reached Yquitos, in Peru, within 400 miles of the Pacific ocean, is another instance of the power of "the navy as a motor in geographical and commercial progress," so ably described by G. W. Littlehales in the *Bulletin of the American Geographical Society*, No. 2, 1899.

At the anniversary meeting of the Royal Geographical Society held in London, June 4, the Founders' medal was conferred on Captain Binger for his explorations in 1887-1889 in the region included in the bend of the Niger, while another Frenchman, M. Foureau, received the Patrons' medal for his extensive travels in the Sahara during the past twelve years. Ambassador Joseph H. Choate presented to Sir John Murray the medal awarded him by the American Geographical Society.

Dr C. Willard Hayes and Mr A. P. Davis, the respective authors of "Physiography of the Nicaragua Canal Route" and "Nicaragua and the Isthmian Routes," which appear in this number of The National Geographic Magazine, were detailed from the U. S. Geological Survey by the Secretary of the Interior for special duty on the Nicaragua Commission. They accompanied the Commission in its investigations on the isthmus, Dr Hayes as the geologist and Mr Davis as the hydrographer of the party.

Attention should be drawn to the valuable series of reports prepared by the Bureau of Statistics of the Treasury Department and given free to any one asking for them. Recent reports include *Commercial China in 1899*, with a map (13 by 14 inches) showing treaty ports, ports of foreign control, railways, telegraphs, waterways, etc.; *Submarine and Land Telegraph Systems of the World*, with map (14 by 21); *Colonial Systems of the World*, with map (13 by 21), and *Foreign Commerce of Cuba, Porto Rico, Hawaii, the Philippines, and Samoan Islands.*

The Duke of the Abruzzi, nephew of the King of Italy and an honorary member of the National Geographic Society, sailed from Christiania June 12, *en route* for the north polar regions. The outfit of the party has been divided into four sections, arranged in boxes of different colors, so that in an extremity the most important can be easily saved. The expedition consists of twenty-one persons, the second in command being Captain Cogni, who accompanied the Duke on his expedition to Mt St Elias in 1897, when that famous peak was ascended for the first time.

The members of the new commission appointed by President McKinley to determine the best route for an interoceanic canal are as follows: Rear Admiral John G. Walker, Col. P. C. Hains, U. S. A., and Lewis M. Haupt, C. E., of the University of Pennsylvania (members of the commission which has just handed in its report); ex-Senator Samuel Pasco, of Florida; Alfred Noble, C. E., who was also on the Ludlow Canal Commission; George S. Morrison, C. E., of New York; Prof. Wm. H. Burr, of Columbia University; Lieut. Col. Oswald H. Ernst, U. S. A., and Prof. Emory R. Johnson, of Pennsylvania.

From a chart which the division of mines and mining of the U. S. Geological Survey will publish in a few weeks to show the total value of mineral productions in the United States for the years 1889–1898, it appears that the total value of mineral products in 1898 was nearly $700,000,000, as compared to $632,000,000 in 1897. This total represents simply the value of the material in its first marketable condition, and does not include coke, white lead, and other manufactured minerals. There was a general increase all along the line, especially in the production of bituminous coal, which increased from 147,600,000 short tons in 1897 to 166,500,000 short tons in 1898. The value of the gold production rose from $57,363,000 to $64,463,000, while the production of petroleum decreased 5,000,000 barrels in quantity, but increased $3,200,000 in value.

In view of the recent developments in the industrial and transportation facilities of Russia, by which the products of her fields and forests may be increased and brought into closer competition with those of the United States, a recent report of O. P. Austin, Chief of the Bureau of Statistics of the Treasury Department, "*The Russian Empire and the Trans-Siberian Railway*," is timely. An examination of the map (21 by 15 inches) which accompanies the report shows that the trans-Siberian road is now completed for nearly two-thirds of the distance toward the Pacific, and that the construction of 600 miles of track eastward from Lake Baikal (the deepest lake in the world) will bring trans-Siberian trains to the navigable waters of the Shilka and Amoor rivers, which flow into the Pacific. Probably within two years a complete rail and water system across Russia and Siberia will be in operation.

According to a recent publication of the Weather Bureau, *Lightning and the Electricity of the Air*, Bulletin No. 26, Part II, 312 persons on the average are killed annually by lightning in the United States. The author, Prof. A. J. Henry, believes that this number is below rather than above the true figure; in other words, that more comprehensive methods of reporting deaths by lightning would show a greater number than has thus far been recorded. The death-rate from lightning in the United States is apparently higher than in England, Norway and Sweden, France, and possibly the greater portion of the Russian Empire. It is about equal to that of the German Empire and probably a little less than that of Austria-Hungary. The danger of lightning stroke seems to be greatest in Wyoming, Colorado, Montana, and other portions of the Rocky Mountain country. In the South Atlantic states also it is above the average for the country at large. The regions of least danger are the Pacific coast and the Great Basin.

The Johns Hopkins University has sent a medical expedition to Manila for the purpose of studying the characteristics of tropical diseases as they may be observed in the Philippine islands. Two of the professors in the Johns Hopkins Medical School, Dr Simon Flexner and Dr L. F. Barker, both of them highly trained pathologists of wide professional repute, volunteered for this service. They go well equipped with the best apparatus for pathological and clinical observations. They carry letters of introduction from officers of the government at Washington. Two medical students well advanced in their studies, Joseph M. Flint, of Chicago, and Frederick P. Gay, of Boston, are members of the party, and Mr J. W. Garrett, of Baltimore, is also a member. The expenses are defrayed by generous contributions from five Baltimore merchants. The party sailed from Vancouver for Manila, by way of Yokohama and Hongkong. Several days were passed in Japan, where Professor Aoyama, in Tokyo, gave them special opportunities for observing certain cases of disease in the hospitals of that city. Upon reaching Manila, Drs Flexner and Barker commenced work at once, their inquiries being facilitated by the coöperation of Colonel Woodhull, M. D., U. S. A. In Manila there are two large army hospitals, the first and second reserve, the civil hospital under Dr Bournes (who accompanied Prof. Dean C. Worcester in his travels through the islands), the prison hospital at Cavite, and a convalescent hospital at Corregidor.

In "The Race for the North Pole," which appears in the June *Munsey*, Gen. A. W. Greely reviews the work of the three explorers, Peary and Wellman, Americans, and Sverdrup, Norwegian, who are trying to reach the Pole. Of the three explorers, Peary and Sverdrup have followed what is known as the American polar route by the channels leading from Baffin bay northward along the west coast of Greenland to the polar ocean. As to the probability of their success, General Greely states: "There are two phases of the question—first, whether the waterways to the west of Greenland are so ice-free as to justify the belief that either the *Windward* or the *Fram* can round the northwestern point of Greenland and enter St George's fiord; and, second, the possibility of the *Fram* circumnavigating Greenland, and that of either Peary or Sverdrup reaching the Pole by sledge journeys." Even should an open ice season permit either ship to reach St George's fiord, of which judging from past history there is little probability, it would never be able to leave the fiord. From St George's fiord the explorers could easily reach Cape Washington, the most northerly known land, 83° 24′ (gained by the Greely expedition), whence they would have a journey of 300 miles each way over the ice pack, or a distance three times greater than that covered by Nansen after leaving his ship. General Greely believes that Wellman, who has chosen the Franz Josef Land route, has the most difficult task before him. "The difficulties of ice travel are very much greater in the case of Wellman than of either Peary or Sverdrup. The distance over the frozen sea from the northernmost point of Franz Josef Land to the Pole and back again cannot be much less than 1,000 miles, and no reader who has studied the narrative of Markham or Nansen can believe that such a journey is within human power in a single season."

THE NATIONAL GEOGRAPHIC MAGAZINE.

The National Geographic Magazine is a journal of geography, physical, commercial, and political. It aims to convey new information and current opinion on geographic matters, and to be a medium of communication between geographers in America and Europe. Its editorial staff includes officers and experts of the different scientific bureaus of the Government, each representing a field teeming with facts of geographic interest. Its corps of contributors comprises nearly every United States citizen whose name has become identified with Arctic exploration, the Bering Sea controversy, the Alaska and Venezuela boundary disputes, or the new commercial and political questions arising from the acquisition of the Philippines. Through the cordial coöperation of the different diplomatic representatives of foreign nations at Washington, it is able to present the latest and most authentic geographic intelligence from other countries.

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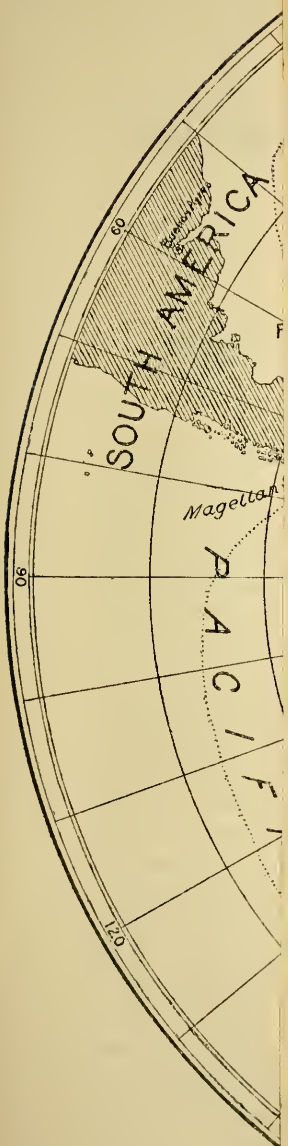
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THE

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SHISHALDIN AS A FIELD FOR EXPLORATION

By Joseph Stanley-Brown

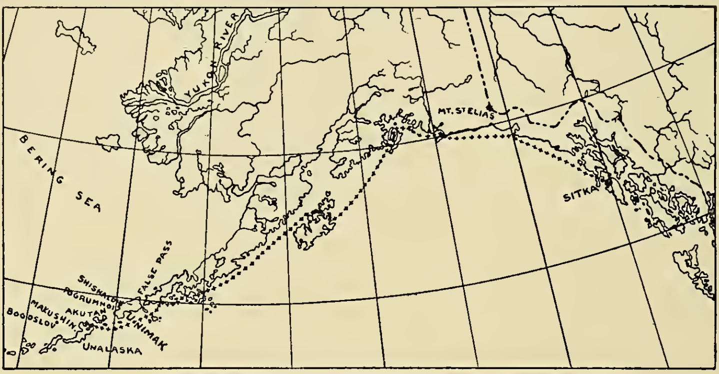
The areas within the boundaries of the United States yet untrod by the geologist or explorer are rapidly becoming fewer and fewer, while fields offering *unique* features of interest to either class of investigators are indeed rare. Even Alaska, formerly shunned, is now much in evidence, and is being traversed by private and governmental exploring parties to an extent which promises soon to gridiron that northern wilderness with mail routes and traveled trails, while from the systematic work being carried on by means of river, land, and sea we may expect at no distant day far more satisfactory geologic and topographic maps of the territory's vast and previously little known interior than have heretofore existed. Leaving these broader areas to those having special reasons and ample financial resources for surmounting the great obstacles they offer, attention is asked to a limited field of exploration which for compactness, accessibility, economy of effort and expense, and probable richness of returns stands unrivaled today within our borders.

The route from Sitka to Unalaska has been one of continuous travel by sea-going vessels for many years. While making this journey hundreds of voyagers have looked on and exclaimed over the majestic beauty of Mt Shishaldin, but so far as known no white man's foot has yet trod the higher slopes of this splendid cone, which rears its snow-clad crest nearly 9,000 feet above the adjacent sea.* The eastern half of Unimak island is occu-

* Professor Pinart's claim that he ascended Shishaldin is untenable, being evidently based on a misunderstanding of the name of the mountain he climbed. The ascent could not have been made in the limited time in which he states it was done.

pied by it and the associated peaks. This island, some 70 miles long, with an average width of 15 or 20 miles, crowded with extinct volcanoes and separated only by a shallow pass from the Alaskan peninsula, is the first member of the Aleutian archipelago—that chain of submerged mountains which with its prolongation, the Commander islands, sweeps from continent to continent, describing across the North Pacific ocean an arc of more than a thousand miles.

Shishaldin is undoubtedly still an active volcano, but how active cannot be accurately known until some explorer stands on its summit. There are recent stories by some who claim to have seen flame-colored vapors rising from it, and by others who assert they saw columns of smoke ascending. In 1897 I saw



SKETCH MAP OF ALASKA

Showing mail route and suggested field for exploration

what appeared to be banners of steam issuing from it; but fogs are frequent here and snow carried by the winds about the peaks of mountains of high altitudes play deceitful pranks. There are two very intelligent and well-to-do traders (Charles Rosenberg and Charles Swanson) who live with their families at Morshovia village, near the base of the mountain. While on a trip in their schooner to Dutch Harbor, Unalaska bay, last summer for supplies they told me that the volcano is now in a state of eruption, and that at night they had seen, high on the slopes, tongues of molten lava creeping slowly down the mountain side and branching around obstacles lying in their course, thus leaving islands between the fiery streams. They asserted also that ashes are ejected from the crater, and that on hunting trips they had ascended far enough to detect the heat and recognize the sulphurous fumes.

SHISHALDIN AND ASSOCIATED PEAKS

AKUTAN ISLAND — ALEUTIAN ARCHIPELAGO

The determination of the real conditions is an inviting task. It will probably be found that Shishaldin is a gigantic cinder cone, one of the largest in the world, and of a symmetry equaling, if not surpassing, that of Fuji-yama. The accompanying reproduced photographs show not only the wonderful regularity and beauty of this cone, but also that it has a neighbor apparently its equal in magnitude and probably the true volcano as well as the elder of the two. The relationship may be similar to that existing between Lassen peak and the Black Butte cinder cone. As seen from a distance there appears to have been a lava discharge from the side of Shishaldin which cut a huge gash, while the castellated character of the adjacent peak suggests a well-formed crater with rock walls. The view of this most interesting mountain mass as given in the illustration must be interpreted with caution, for the apparent uniformity in the size of the two peaks may be due to varying distances from the camera. which was on the deck of a vessel at least 10 miles from the shore,

Unimak island alone, with the story of volcanism it has to tell, is well worth a summer's work, but near by within a circle of a hundred miles' radius there are other volcanoes with more or less residual life, which, with Shishaldin, form a group so favorably situated for exploration that its systematic study could be accomplished without great expense and in a short field season. Pogrumnoi, on the western end of Unimak, is extinct, but on Akutan, the next island, there is an active volcano of the same name. One unusually favorable day in August, 1892, Mr Charles H. Townsend, of the United States Fish Commission, and I climbed one of the peaks of Unalaska bay, which brought Akutan in full view. To our great surprise, we saw gigantic rings of smoke, such as sometimes come in miniature from the smokestacks of locomotives, issuing from the crater at regular intervals of about twenty minutes. As each succeeding ring appeared, its predecessor was slowly breaking up and fading away in the air. Four such rings were seen, but how long the display lasted it was not possible to determine, as the peak became obscured in drifting banners of fog.

On Unalaska island is the huge volcanic mass of Makushin, between 5,000 and 6,000 feet high. From the reports of those who have ascended Makushin, it would seem that fumarole action is all that is left of its plutonic fires; but earthquakes, some of decided vigor, are annually felt in the locality, while the many adjacent cinder cones and craters testify to the activity of other days.

Some 40 or 50 miles from Unalaska in a north of west direction are the two tiny dots of rock which compose Bogoslov (Joánna Bogoslóva), whose origin was within historic time and whose form has undergone changes quite recently. Columns of steam steadily rise from one of the mounds, and here the warm earth temperature is now utilized, as some one has playfully suggested, to assist in the hatching of the eggs of the myriads of guillemots which, in company with a colony of sea-lions, occupy these volcanic remnants. The other member of the group, connected with its neighbor by a low-lying strip of sand, is without heat.

Suggestions concerning the exploration of these areas would be incomplete without reference to methods of reaching them. A mail boat now makes a monthly trip from Sitka to Unalaska. This boat is under the control of the Pacific Steam Whaling Company, a corporation which would willingly extend a helping hand to such work. It would not be difficult to get this vessel to stop at the village of Morshovia, past which it goes, where could be readily secured the services of such men as Rosenberg and Swanson, who own a hunting cabin at the base of Shishaldin and have boats and suitable equipments for transportation. They could also obtain from among their Indian friends the necessary packers. The approach would have to be made from the Pacific side, as here the ground is high, barren, and rolling, while on the Bering Sea side there are lakes and swamps which would make travel difficult if not impossible.

From Morshovia the mail steamer on its next monthly trip could move the party to Unalaska bay, where are located the comfortable stations of the North American Commercial Company and the Alaska Commercial Company, both of which corporations would doubtless render all possible assistance to such an expedition. Here also the aid of a revenue cutter or that of a small schooner could be secured to make the short trips to Akutan and Bogoslov. The Revenue Cutter Service has won a high place for itself in the field of travel and of exploration, and is always in sympathy with such matters. At Akutan, some twenty or thirty miles from Unalaska, there is an Indian village within a beautiful land-locked harbor. Here the party could be left for ten days or two weeks, guides and packers secured from the Indian village, and the ascent and exploration of the volcano of Akutan readily accomplished. Bogoslov could be explored in a round trip of two days or possibly less from Unalaska, if the conditions for landing were favorable. Using the commer-

BOGOSLOV ISLANDS — ALEUTIAN ARCHIPELAGO

cial company's stations as a base of supplies and assistance, the ascent of Makushin could be made direct from Unalaska, and that volcano fully investigated in about three or four days.

Dr Dall,* in his work on Alaska, has presented a very interesting and instructive chronological tabulation of the activities of the volcanoes of Alaska, from which it would appear that there has been great diminution of energy with the passage of time. The systematic exploration and study of these volcanoes, as well as the associated volcanic areas, are well worth the attention of geographic societies in America, or those who can command leisure and a little money; but perhaps we shall have to wait, as in the case of Mt St Elias, for another Prince Luigi to come and tell us the facts concerning Shishaldin and Akutan.

MAGNETIC WORK OF THE COAST AND GEODETIC SURVEY

By L. A. Bauer,

Chief of Division of Terrestrial Magnetism

From the date of the organization of the Coast Survey the supplying of magnetic data to the land surveyor and the mariner has formed one of the chief functions of its work. With every year the demand for such data has become more and more pressing, so that the present superintendent, Dr Henry S. Pritchett, has found it necessary to form a distinct division for magnetic work. The work that it is proposed to carry out with the enlarged opportunities may be briefly classified as follows:

1. *Magnetic Survey of Land Areas under the Jurisdiction of the United States.* The three elements, magnetic declination or "variation of compass," magnetic inclination or dip, and the intensity of the magnetic force, will be determined at stations on the average 25 to 30 miles apart. As the endeavor will be to observe at about 500 stations per annum, it is estimated that the complete survey of the country will take about ten years. The short-period variations, as the diurnal variation of the magnetic declination, will be eliminated with the aid of the continuous observations at the magnetic observatories, while the

* Dall (W. H.): Alaska and its Resources, pp. 467–470.

corrections for secular variation will be made with the aid of observations repeated at certain intervals at so-called "repeat" or "secular variation" stations. The Survey likewise is coöperating with the various state geologists in the carrying out of detailed state magnetic surveys. This work consists in the establishment, at the county-seats, of true meridian lines for the use of the surveyor and in the detection and mapping out of regional magnetic disturbances and the correlation of the latter with geologic formations.

2. *Magnetic Survey of Ocean Areas.* When the great rôle which the compass plays in the art of navigation is recalled, it seems remarkable that our country has done so little systematic work in the determination of magnetic elements at sea. In supplying compass directions on its charts the Survey is feeling keenly the need of more accurate data. It is a well-known fact that at the very places—near coast lines and over submerged land areas—where danger from shipwrecks is greatest the compass directions, taken from present charts of the lines of "equal magnetic variation," are weakest. At these places these lines will present the same peculiar curvatures and interlacings that we find over the land areas. The Survey therefore proposes to contribute its adequate share toward remedying these defects and is making ample provision for carrying on such work systematically in the future. This work will be of a twofold character:

a. Determination of magnetic elements at shore stations.

b. Determination of magnetic elements at sea, the dip and relative intensity being obtained with the Fox dip circles.

3. *Continuous Observations at Magnetic Observatories.* To make possible the rapid and economical execution of the plans just set forth, three well-equipped magnetic observatories will be established, viz., one near Washington city (this to be the central or standard observatory, at which the constants of all magnetic instruments will be determined). one on the Pacific coast, and another on the Hawaiian islands. These observatories, with the coöperation of those at Toronto, Habana, Mexico, and Manila, and some temporarily established observatories for recording the variations of the declination, will suffice for the practical needs of the magnetic survey work. Their function will be to record and to fix the countless variations and fluctuations of the earth's magnetism and thus make possible the reduction of all magnetic observations to a common epoch.

THE ALBATROSS

DEEP-SEA EXPLORING EXPEDITION OF THE STEAMER "ALBATROSS"

By Hugh M. Smith,

U. S. Commission of Fish and Fisheries

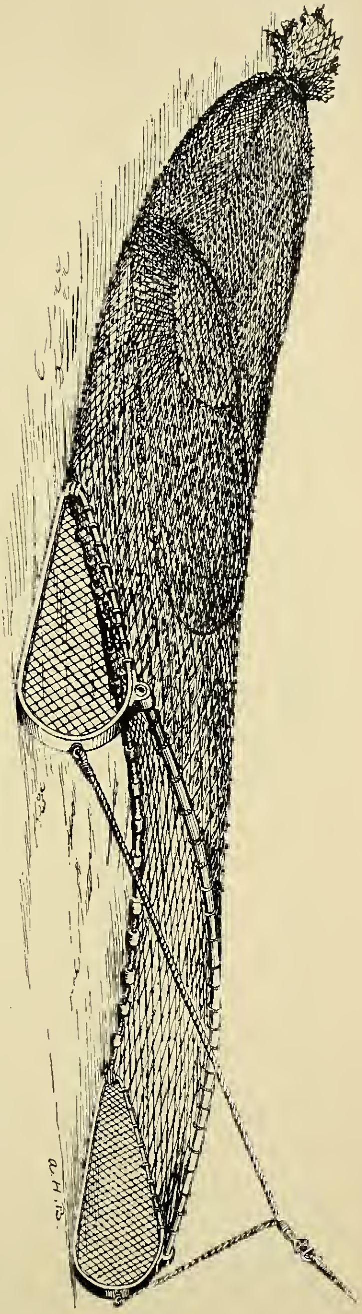
Unusual public interest has been manifested in the recent announcement of Hon. George M. Bowers, United States Commissioner of Fish and Fisheries, that the steamer *Albatross*, belonging to the Commission, would soon be dispatched on an exploring expedition to the Pacific ocean, the President having approved the detail of the vessel for that purpose. With the main objects of the expedition fully determined on, the arrangements for the cruise about completed, and the itinerary mapped out, it is now possible to give an outline of the leading features of the voyage.

The *Albatross* is the best-equipped vessel afloat for deep-sea investigation, for which work she was especially constructed for the Fish Commission in 1882, at a cost of nearly $200,000. She is a twin-screw steamer of 384 tons burden, 234 feet long and 27½ feet beam. The coal capacity is about 240 tons, and the steaming radius with that supply, in good weather, is over 4,500 miles, allowing a speed of eight knots an hour and a daily coal consumption of 10 tons. A full account of the construction of the *Albatross* and her appliances for marine investigation has been given in the admirable work on "Deep-sea Exploration," by Commander Z. L. Tanner, U. S. N., under whose direction the vessel was built and who was in command from the date of her launching until 1894. The reputation long enjoyed by the *Albatross* of being unequaled in effectiveness for marine research will be more than ever deserved on the approaching cruise because of the extensive improvements and repairs she has recently undergone, including the installation of new boilers, ice-making machine, cold-storage plant, etc., together with the thorough replenishing of the scientific outfit.

The *Albatross* will pass through the Golden Gate on August 21 and begin her long voyage to certain groups of islands in the middle of the Pacific ocean, both north and south of the equator, whose local fauna is almost unknown, while in the adjacent waters little or no scientific investigation has been carried on. The Society islands will be first visited, although the vessel will touch at the Marquesas islands for coal. Between San Francisco and Tahiti, a distance of 3,500 miles, dredging and sounding will be carried on at regular intervals on a section of the sea-bottom almost wholly unexplored. Tahiti will be the headquarters while the Society islands and the Paumota islands are being explored. In the latter archipelago, which is about 600 miles long, six or eight weeks will be spent and important scientific discoveries should be made. In the Tonga or Friendly islands, distant about 1,500 miles from the Society group, a week or ten days will be passed. The vessel will then proceed to the Fiji islands, where a short stay will be made, and thence 1,700 miles to the Marshall islands, in which interesting archipelago, of whose natural history almost nothing is known, six or seven weeks will be devoted to exploration. The Ellice and Gilbert islands, lying between the Fiji and Marshall islands, will also be visited. It was originally the intention to have the *Albatross* proceed from the Marshall islands to the Hawaiian islands and thence to San Francisco, running a line of deep-sea dredgings along the entire route; but, owing to the prevalence of head winds at the time when the vessel will be ready to leave the Marshall islands, this plan has been abandoned, and instead the vessel will sail for Japan, making frequent use of the dredge and the deep-sea tow-net and setting the trawl in the moderately deep water off the Japan coast, where the fishermen are continually bringing up curious forms. The voyage of nearly 20,000 miles will come to an end at Yokohama, where the *Albatross* will arrive in April, 1900, and refit for a summer cruise to Alaska to resume the systematic examination of the salmon streams begun several years ago.

The leading features of the expedition will be deep-sea dredging, trawling, and sounding, and some special appliances for such work have been constructed. A wire dredge-rope 6,000 fathoms long has been made to order, and to accommodate this enormous quantity a special drum has had to be prepared. It is expected that both the dredge and the beam-trawl will be hauled in deeper water than heretofore. One of the novel pieces of collecting apparatus is a beam-trawl of unprecedentedly large size, especially designed for the capture of larger animals than can be taken with the usual apparatus. What results may attend its use can only be conjectured. The iron framework consists of two runners 6 feet long and 4 feet high, connected by a 20-foot beam, which has an upward curve of 2 feet from the horizontal in order to increase the size of the entrance of the net. Fitted to this frame is a bag 30 feet long, made of $\frac{3}{16}$-inch twine, with an 8-inch mesh; a funnel-shaped throat is attached 7 feet back from the lead-line. The mouth of this trawl is twice the size of that of the largest trawl heretofore constructed. The wide mesh permits the escape of the mud and finer bottom material which contribute so much to the weight when the ordinary small-mesh trawls are lifted.

While the deep-sea investigations will receive the most attention, surface and intermediate towing, shore-seining, and fishing trials with lines, gill-nets, and other appliances will be regularly carried on and will undoubtedly yield rich collections. This is a region abounding in atolls and elevated reefs, many of which will be visited and studied for the purpose of obtaining data bearing on the disputed question of the origin of coral reefs.



BEAM-TRAWL — DESIGNED BY C. H. TOWNSEND

The *Albatross* is manned by about 10 officers and 70 petty officers and enlisted men of the United States Navy. The commanding officer is Lieutenant Commander Jefferson F. Moser, U. S. N. The civilian staff on

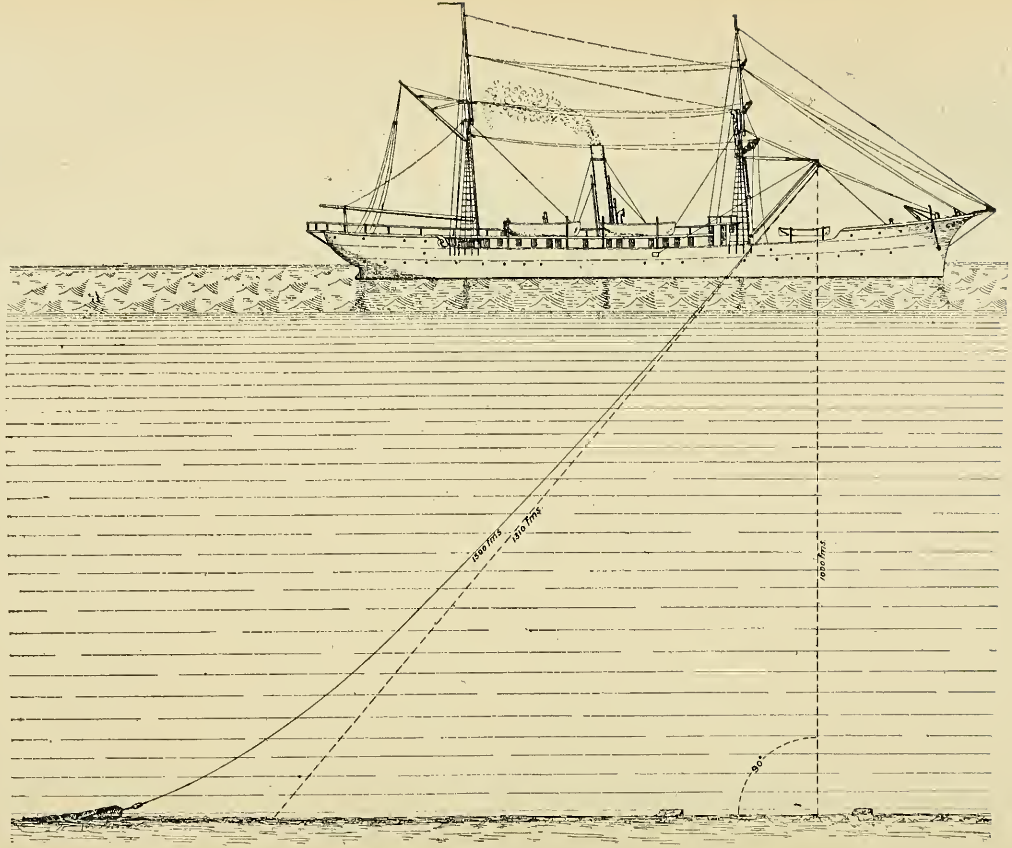


DIAGRAM SHOWING DEVIATION OF DREDGE-ROPE FROM A PERPENDICULAR LINE OF 1,000 FATHOMS this expedition consists of Professor Alexander Agassiz, in charge of the scientific work. who will be accompanied by his son and his personal assistants, Dr W. McM. Woodworth and Dr A. G. Mayer, of the Museum of Comparative Zoölogy, Cambridge, Mass.; Dr H. F. Moore, chief naturalist of the *Albatross;* Mr Charles H. Townsend, former naturalist, now chief of the fisheries division of the U. S. Fish Commission; Mr A. B. Alexander, fishery expert, and Mr H. G. Fassett, photographer, both of the U. S. Fish Commission.

Opportunity will undoubtedly be afforded for conducting a number of important collateral inquiries without detriment to the regular scientific work. Advantage will be taken of every chance to obtain for the National Museum specimens of the mammals, birds, insects, and other land animals of the various islands visited. A study of the aboriginal fishing methods, apparatus, and boats, and the collection of specimens of the native fishing appliances will be in charge of the fishery expert.

The Smithsonian Institution has specially requested that the Fish Commission make an effort to trace the origin of some of the ethnological specimens brought back from the Pacific islands by the Wilkes Exploring Expedition. Owing to the indifferent care which the collection received during early years, many of the labels were lost and the articles thus rendered practically worthless. Photographs and descriptions of such specimens will be furnished by the Smithsonian Institution in the hope that the *Albatross* may ascertain something about them. Inasmuch as such an opportunity may never again arise to secure for the National Museum articles illustrating the arts and customs of the natives of these isolated islands, which are rapidly yielding to the influences of civilization, Commissioner Bowers has notified the Smithsonian Institution that the naval and civil attachés of the vessel will be given special instructions to be on the lookout for desirable ethnological material.

In order that the movements of the vessel in the islands to be visited may be facilitated, the Department of State has, through our ambassadors, notified the British, French, and German authorities of the approaching cruise, and asked that tariff and other regulations be waived.

There is every reason to believe that this expedition will yield valuable scientific results and will be creditable to the country. It promises to be by far the most important marine expedition on which the Fish Commission has embarked and one of the most pretentious scientific enterprises in which the government has ever engaged. It is a matter for congratulation that, in the activity in exploration of the seas now being exhibited by the British, German, French, Dutch, and Norwegian governments, the United States will participate under such favorable auspices and be represented by a scientist of such wide experience in deep-sea investigation as Professor Agassiz.

GEOGRAPHICAL CONGRESS AT BERLIN

The delegates of the National Geographic Society to the Seventh International Geographical Congress, which will be held at Berlin from Thursday, September 28, to Wednesday, October 4, under the auspices of "die Gesellschaft fur Erdkunde zu Berlin," are as follows: Dr Alexander Graham Bell, President of the Society; Gen. A. W. Greely, U. S. A., also designated by President McKinley to represent the United States government; Hon. Andrew D. White, U. S. Ambassador to Germany; Prof. Willis L. Moore, Chief of the Weather Bureau; Miss Eliza Ruhamah Scidmore, Foreign Secretary of the Society; Mr Marcus Baker, of the U. S. Geological Survey; Dr L. A. Bauer, of the U. S. Coast and Geodetic Survey, and Prof. Wm M. Davis, of Harvard University.

Antarctic exploration will occupy the most prominent place in the deliberations, for Captain Drygalski and Dr Neumayer and Sir Clements Markham will earnestly strive for the definite coöperation of the German and British expeditions that are to be sent out in the autumn of 1901. Prof. Penck, of Vienna, will reopen the discussion of his proposed map of the world on a scale of 1 : 1,000,000, which at the last Congress, in London, 1896, was referred to a committee for report at this meeting. In the section of physical geography Prof. Wm. M. Davis will contribute a paper on The Geographical Cycle, and also one on Land Forms due to Glacial Erosion, while Poultney Bigelow, under the head of political geography, will discuss Colonial Government in different parts of the World. Other papers will be contributed by Prof. Supan, Sir John Murray, Prof. Wagner, Dr Oscar Lenz, the Prince of Monaco, Dr Futterer, and Miss L. A. Owen, of St Joseph, Mo. The committee in charge of the Congress have arranged for a delightful series of excursions to places of geographic interest within a day's reach of Berlin.

THE PROPOSED AMERICAN INTEROCEANIC CANAL IN ITS COMMERCIAL ASPECTS

By Joseph Nimmo, Jr, LL. D.

The question as to the practicability of either the Nicaragua or the Panama Canal project depends upon three classes of considerations, viz., those relating to its engineering aspects, involving questions as to cost; those relating to its commercial possibilities, and those relating to its military importance.

The government of the United States has thus far confined its inquiries almost exclusively to the engineering features of the project. During the last four years three engineering commissions have been appointed, viz., the "Ludlow Commission," authorized by act of January 28, 1895; the "Walker Commission," authorized by act of June 4, 1897, and a commission of nine persons, authorized by act of March 3, 1899, and appointed by the President June 9, 1899. Rear-Admiral Walker is also chairman of this commission. There was appropriated by Congress for the Ludlow Commission $26,176; for the commission of 1897 the sum of $300,000, and for the commission of 1899 the sum of $1,000,000. So it appears that the total sum of $1,326,176 has been appropriated within four years for the purpose of ascertaining the engineering features and the cost of constructing an American interoceanic canal, but up to the present time not one cent has been appropriated by Congress for the purpose of ascertaining the probable commercial value of the project—*i. e.*, the amount of shipping which would pass through it. The proponents of the Nicaragua Canal scheme have from the beginning opposed any governmental investigation whatsoever as to the practicability of their project. Such objections have been overruled by Congress as to the engineering aspects of the enterprise, but, singularly enough, have prevailed with respect to the commercial, the economic, and the military aspects of the scheme. The advocates of the canal declare that the commercial necessity for its construction is so clear that it needs no investigation. That is monstrous. It goes in the face of common sense and of every dictate of prudence. Section 231 of the Revised Statutes of the United States provides that "there shall be prepared and submitted to Congress, in connection with the reports of examinations and surveys of rivers and harbors hereafter made to Congress, full statements of all existing facts tending to show to what extent the general commerce of the country will be promoted by the several works of improvement contemplated by such examinations and surveys." But, in the face of this provision of law touching the ascertainment of the commercial value of improvements of navigation within our own borders, the proponents of the Nicaragua Canal in Congress and out of Congress have for years been urging the government to lend them one hundred million dollars for the construction of a canal in a foreign country, more than one thousand miles from our shores, without any official inquiry whatsoever as to its probable commercial value.

In his book entitled "The Nicaragua Canal and the Monroe Doctrine," Professor Keasbey says: "What we need is another board of experts to study the commercial effects of the canal." The Hon. Thomas B. Reed, in his article in the *North American Review* for May, 1899, in referring to "the possible tonnage which would pass through the Nicaragua Canal," says: "It would seem, therefore, that after the question of cost is determined, or perhaps while it is being determined, a commission of competent persons, unprejudiced, should be invited to study this part of the subject. We shall then be equipped with the necessary facts to enable us to judge of the commercial success of the undertaking."

Near the close of the last Congress the fact seemed to have dawned upon the minds of certain leading Senators and members of Congress that the commercial inquiry should have preceded any appropriation for the construction of the canal; but the act of March 3, 1899, appropriating one million dollars for the examination of both the Nicaragua and the Panama routes, refers only to the engineering, the proprietary, and the financial features of those schemes, and contains not a word as to their commercial, economic, or military aspects. Action has, however, been taken whereby a committee of three of the commission of nine has been assigned to the duty of inquiring into these particular aspects of the subject. This is not in terms authorized by law, but it appears to be the beginning of an inquiry of deepest interest to the people of the United States.

It is the object of this paper to present some of the more important geographic, commercial, and economic conditions which determine the commercial possibilities of any American isthmian canal, and to show the importance of their thorough investigation by specific provision of law before committing the government to any financial obligations for construction.

Neither the Nicaragua Canal nor the Panama Canal would afford the shortest or the most practicable route for the trade of the Atlantic seaports of the United States or for the trade of the countries of Europe with Asia or Australasia. This is placed beyond all question by the following statement of distances furnished to me, under date of June 10, 1898, by the Superintendent of the United States Coast and Geodetic Survey:

	Nautical miles.
From Manila to New York:	
Via Suez Canal	11,565
Via Nicaragua Canal	11,746
From Manila to London:	
Via Suez Canal	9,600
Via Nicaragua Canal	14,680

This indicates that the Suez route has an advantage of 181 miles over the Nicaragua route for the trade of New York with Manila, and an advantage of 5,080 miles over the Nicaragua route for the trade of London with Manila. The Suez Canal is, however, a sea-level canal, whereas the Nicaragua Canal involves 220 feet of lockage. In respect to the important consideration of coaling facilities, having regard both to location of coaling stations and the price of coal, the Suez Canal route is also greatly superior to either the Nicaragua or the Panama route. Taking all these facts into consideration, it is evident that the Suez Canal possesses an equivalent advantage of fully 1,500 miles over the Nicaragua or the Panama Canal route with respect to the commerce of the Atlantic seaports of the United States with Asia and Australasia, and of fully 6,000 miles with respect to the commerce of the various countries of Europe with Asia and Australasia.

The rainfall at the eastern end of the Nicaragua Canal has amounted to 25 feet in a single year, whereas the average annual rainfall at Suez is only about two inches. The enormous precipitation at Nicaragua not only vitally affects the question as to the permanence of earthworks but has a material bearing upon the question of navigation. A careful observer of engineering works on the American isthmus and contiguous territory declares that all maximum estimates of cost of construction in the United States should be multiplied by 2½ in order to obtain the cost of similar earthworks on the American isthmus on account of the enormous precipitation in that part of the globe.

It is claimed by the proponents of the two American interoceanic canal projects that the commerce of the Pacific Coast states of the United States with that portion of the country which lies east of the Rocky mountains will afford a large amount of traffic for either of the proposed canals. This has little support in commercial, geographic, or economic conditions. About two-thirds of the people of the United States reside west of the Appalachian range. The principal commerce of our Pacific Coast states is with that portion of the country which lies west of this line and east of the Rocky Mountain range. The average distance from all points of production and consumption in the Pacific Coast states to all points of production and consumption in the area between the Rocky Mountain range and the Appalachian range by direct rail lines is only about one-third the average distance between such points by the Nicaragua or Panama route. Besides, the direct rail route is greatly superior to the water route with respect to speed, facilities for the collection and distribution of freights, and the avoidance of those transshipments of cargo which would be necessary in the case of goods shipped by the canal route. The same is true as to merchandise of all sorts shipped from points east of the Rocky mountains to both interior points and to seaports of the Pacific Coast states. It is also beyond all question that the transcontinental rail lines will for all time secure the entire carriage of passengers, the mails, bullion, express goods, perishable goods, and fast freights generally, and that by an inevitable law of the economics of transportation they will also secure the carriage of nearly all the rest of the traffic in general merchandise between the Atlantic and the Pacific coasts. This is matter of common experience throughout the country. The transcontinental railroads are now extensively engaged in the transportation of raw material and gross products for long distances. Among these commodities may be mentioned coal, lumber, ores, and agricultural products of every description. It is manifestly absurd to assume that Chicago, St Louis, Cincinnati, and hundreds of other centers of trade will ever engage in trade with the Pacific Coast states by the way of the Nicaragua or Panama Canal; such traffic will for all time be carried on over direct rail lines. This is an inevitable result of the wonderful reduction which has been made in the cost of transportation by rail. The average rail rate in the United States is now only about one-third the average of the rates which prevailed thirty years ago. A report, prepared in 1898, under the direction of the Statistician of the Department of Agriculture, on Changes in the Rates of Charge for Railway and other Transportation Services, shows (p. 49) that rail rates per 100 pounds on carload lots from Pacific Coast terminals to the port of New York were in the years 1870 and 1897 as follows:

Rate on canned goods, $3.66 in 1870 and 75 cents in 1897; on dried fruit, $3.66 in 1870 and $1.00 in 1897; on raisins, $3.66 in 1870 and $1.00 in 1897; on wine in wood, $4.79 in 1870 and 75 cents in 1897, and on hops, $3.66 in 1870 and $1.50 in 1897.

A corresponding table on page 50 of the report just mentioned shows that rates per 100 pounds from New York to Pacific Coast terminals in carloads were reduced as follows: On stoves, from $3.66 in 1870 to $1.10 in 1897; on glassware, from $5.66 in 1870 to 85 cents in 1897, and on agricultural implements, from $3.48 in 1870 to $1.15 in 1897.

The foregoing characteristic data indicate that the present rail rates between the Atlantic and Pacific coasts of the United States are only about one-fourth the rates which prevailed during the year 1870. There is a pressing need that these important commercial facts shall be brought to the attention of Congress and of the country by a competent and impartial commission charged with that duty.

The assumption that large quantities of cotton would be shipped from New Orleans and other Gulf ports to Asia *via* the Nicaragua or Panama Canal is negatived by the fact that at current rates cotton can be shipped more quickly and at less expense from points of production in our southern states to San Francisco by rail and thence by ship to Asia. There is a difference of more than 2,000 miles in favor of the overland route.

The assumption that coal can be profitably transported from the mines of Virginia and West Virginia to San Francisco is also absolutely negatived by current prices of coal at Atlantic and at Pacific ports, the cost of transportation and the canal toll, assuming it to be $1.80, the present Suez Canal rate. Nevertheless, through false representations, the assumptions as to cotton and coal have to some extent taken possession of the public mind, and therefore should become the subject of careful investigation by a properly organized governmental commission.

In this connection there arises an important question as to markets. The value of the products of all industries in the states of the Pacific coast and in the so-called arid region is fully \$700,000,000 annually. This gives rise to an enormous commerce with the states east of the Missouri river. Chicago, St Louis, St Paul, Minneapolis, Cincinnati, and other interior cities are now the centers of that commerce over direct lines. Hence arises the important question as to whether the people of those cities and of the entire western and northwestern states are or are not in favor of the payment of a capital subvention probably amounting to at least \$200,000,000 and an additional subvention on account of interest and maintenance of works amounting annually to at least \$9,000,000 for the purpose of diverting this great trade to rival commercial centers.

The utter absurdity of the proposition that the Nicaragua Canal would be of any possible benefit to the great interior cities or to the entire western and northwestern section of this country is also indicated by the following statement of distances:

San Francisco to Chicago:	Miles.
By direct rail line	2,356
By Nicaragua route and rail	5,803

The seaport cities of the Pacific Coast have also to face the question as to whether they are or are not in favor of such Panama or Nicaragua Canal subventions having in view the object of diverting our commerce with Asia and Australasia from Pacific Coast ports. This inquiry is accentuated by the fact that Honolulu, the intermediate coaling station of the Pacific Ocean, is 1,142 statute miles south of San Francisco. I have no faith in the potentiality of such subventions upon the course of commerce for reasons of an economic and commercial nature herein set forth, but merely allude to the obvious purpose and tendency of such subventions and to the necessity for honest and thorough official inquiry into the matter.

Neither the Panama nor the Nicaragua Canal will ever be available for sailing vessels on account of lack of wind and towage charges. This constitutes one of the most important conditions affecting the practicability of any American interoceanic canal. It would be necessary not only to tow sailing vessels through any American canal, but also, as a rule, to tow them to and from the canal through the Doldrums. For the same reasons no sailing vessel ever passes through the Suez Canal. The enormous precipitation at Nicaragua and at Panama increases the difficulty at the American isthmus.

Proponents of the American canals imagine, however, that upon the completion of their projects sailing vessels will give place to steamships. That is highly problematical. Sailing tonnage is fairly holding its own in the ports of the globe, especially for long voyages. The following was the composition of the American merchant marine for the year 1898:

	Tons.
Tonnage of sailing vessels	2,377,815
Tonnage of steam vessels	2,371,923

This shows the tonnage of sailing vessels to be somewhat in excess of that of steam vessels. Besides the carrying capacity of sailing vessels considerably exceeds that of steam vessels on account of space occupied on the latter by boilers, engines, and coal. The total tonnage of vessels entered at and cleared from ports of the Pacific coast of the United States in trade with Europe during the year 1898 amounted to 821,010 tons, of which only 1,199 was steam tonnage, the rest being composed of large sailing vessels. Sailing vessels pursuing the Cape Horn route require much more time than would steamers by the canal route, but are much more cheaply operated and afford the important advantage of storage at sea. Besides, steam vessels would incur the expense of tolls on the canal, which at the rate lately current on the Suez Canal—$1.80 per ton—would amount to $7,200 on a 4,000-ton steamer for each passage. Sailing vessels are still largely employed in the trade of Great Britain with Australia and with China and Japan. Such vessels pursue the route *via* the Cape of Good Hope and never take the Suez Canal route. This is a subject which should be carefully investigated and reported upon by a competent and impartial commission duly authorized by order of Congress. There is now a large number of sailing vessels in course of construction in this country and the owners of these vessels face the future with confidence in the success of their ventures.

The commerce of the western coast of South America, including Chile, Peru, Ecuador, and the United States of Colombia on the Pacific, is sharply conditioned by that broken and irregular mountain range which extends from Alaska to Cape Horn—the most striking orological feature of the western continent. That part of this range known as the Andes skirts the western shore of South America and practically limits the foreign commerce of this coast to the narrow strip of country embraced within its western slope. This commerce centers at Valparaiso, the chief seaport of Chile, and is carried on mainly by means of steamer lines which pursue the Straits of Magellan route and ply between Valparaiso and New York and between Valparaiso and ports in Europe. The commercial success of the vessels of these lines depends very largely upon the fact that they touch and trade at ports on the eastern coast of South America. The principal of these ports are Buenos Ayres, Montevideo, Rio de Janeiro, Bahia, Pernambuco, and Para; also ports in the West Indies. It is certain that for the reason just stated no considerable part of this commerce would be diverted to any American isthmian canal.

Besides, the exportable products of the west coast of South America are essentially sailing-vessel cargoes, consisting mainly of the nitrates, copper, wheat, coal, manganese ore, barley, copper ore, and wheat flour. A considerable part of the import cargoes into the countries of this coast are also sailing-vessel cargoes; but, as before shown, it will be entirely impracticable to navigate sailing vessels through any American isthmian canal.

There is a comparatively small amount of commerce which moves northward to Panama. According to the best available data, it amounts to about 230,000 tons of shipping annually. The possibility of its development is confined mainly to a narrow strip of country comprising the west slope of the Andes, north of Callao.

The attempt has many times been made to prove inferentially that an American isthmian canal must succeed because the Suez Canal has proved to be a success. This is not argument; it is idle vaporing. Inferences may be projected from similar but not from dissimilar circumstances and conditions. It would be quite as logical to infer the failure of the Nicaragua or Panama Canal from the failure of canals in various parts of the world as the result of railroad competition as to infer the success of such canal from the success of the Suez Canal or of the Sault Ste Marie Canal of the United States. The commercial failure of the Manchester Canal, the Kiel Canal, and the Corinth Canal are examples in point; so is the abandonment of canals in all parts of this country, notably the recent abandonment of the Delaware and Hudson Canal. The President of the Delaware and Hudson Canal Company, which is now exclusively a railroad company, states in his last annual report that the canal belonging to that company was abandoned because "the cost of transportation by that route was too great as compared with other methods." In a letter dated July 8, 1899, the secretary of the company informs me that the views expressed in the report just mentioned "have been more than vindicated by subsequent results in the company's operations."

The enormous falling-off in the tonnage of the Erie and Welland Canals, and the changes and astounding reductions in the traffic of rivers in all sections of this country as a result of the competition of rival railroads point in the same direction. During the 16 years from 1876 to 1892 the tonnage of freights transported on the lower Mississippi fell 41½ per cent, the tonnage on competing railroads increased 350 per cent, and the sea traffic of New Orleans increased 70 per cent. This deflection of commerce from the Mississippi to competing railroads is still going on.

The Sault Ste Marie Canal has no parallel in the world as to the commodities which pass through it or the conditions under which its commerce exists. Any attempt, therefore, to predict the success of the Nicaragua or Panama Canal from the success of the Sault Ste Marie Canal is glaringly absurd.

The Suez Canal connects great commercial and industrial nations, whereas the most striking physical aspect of any American isthmian canal is that it would connect two vast unproductive oceans. The Suez Canal has no competing railroad, but the wonderful progress of railroad building in Asia and the grand schemes of railroad construction now being agitated in Europe and in Persia, India, and China seem to forecast an era of railroad construction which in time will seriously affect the traffic of the Suez Canal. A single competing railroad as effective as any one of the transcontinental lines which connect the Atlantic and Pacific coasts of the United States would at once take from the Suez Canal the entire carriage of passengers, the mails, express goods, perishable goods, and fast freights generally, leaving to it only the lower class of freights, for which sailing vessels, by the old Cape of Good Hope route, would be, as they are today, sharp competitors. This is an economic fact beyond all question.

Let the government of the United States institute a thorough and impartial investigation of all these conditions, and no longer leave them to be determined by the speculations of canal proponents, who not only fail to make known the facts upon which their own estimates of tonnage are based, but vigorously oppose any governmental attempt to institute practical inquiries into the subject, at the same time being ardent applicants for enormous subventions from the national treasury in aid of their particular undertakings.

The idea that the Nicaragua or Panama Canal route, even at the present rate of tolls charged on the Suez Canal, about $1.80 per net ton of shipping, will secure the traffic in wheat and lumber from the Pacific coast to the countries of Europe or to other countries and islands on the eastern side of the American continent is subject to serious question. Wheat, lumber, and coal transported on long voyages are essentially sailing-vessel cargoes; but, as before shown, it will for all time be impracticable to navigate sailing vessels through any American interoceanic canal, for the same reason that no sailing vessel ever passes through the Suez Canal.

The records of commerce across the Isthmus of Panama during the last fifty years serve to throw light upon the question as to the practicability of an American interoceanic canal. The construction of the Panama Railroad was begun in the month of May, 1850, and it was opened for traffic January 28, 1855. The length of the road is 47½ miles. The cost of its construction was $8,000,000. It continued to be the principal avenue for commerce between the Atlantic and Pacific coasts of the United States until the completion of the first transcontinental railroad, the Union and Central Pacific, on May 10, 1869. During the year ended June 30, 1869, the total value of merchandise shipped from New York to San Francisco and from San Francisco to New York *via* Panama amounted to $70,202,029. As the result of transcontinental railroad competition, it fell in the following year, to $18,594,255. During the year ended June 30, 1898, it amounted to only $4,887,289. Upon the completion of the Union and Central Pacific railroad line in 1869, the carriage of passengers, the mails, coin and bullion, express goods, perishable goods, and all the more valuable "fast freights" was at once deflected to the transcontinental railroad, nevermore to be transferred to any possible trans-isthmian rail or water route. Since the year 1869 eight other transcontinental lines and parts of lines have been constructed, and direct connections have been formed with lines reaching to every center of trade and of production in this country from the Atlantic to the Pacific and from Canada to the Gulf.

Thus an enormous internal and transcontinental traffic has sprung up. The total freight traffic of the Panama Railroad, through and local, embracing freights to and from the entire western coast of North America, Central America, and South America, amounted during the year 1897 to only 290,651 tons, whereas the tonnage carried across the continental divide by rail, according to the best means of information, amounted to over 3,000,000 tons, and included freights of every class, from the highest to the lowest. Besides, an enormous local traffic has sprung up along the transcontinental lines and their branches. A vast area has thus been reclaimed to the arts of civilization. The seventy-ton steel locomotive and the eighty-pound steel rail have become the chief instrumentalities of the grandest and most efficient system of transportation ever seen on this globe, and the demand for still larger achievements is imperative. The one-hundred-ton steel locomotive has been built, the one-hundred-pound steel rail has been laid, and the practicability of the one-hundred-and-ten-pound steel rail is affirmed. The determining economic factor in the case is not railroad grades or mountain summits or continental slopes, but *coal, the price of coal.* It is a mere question of fuel, and nature has granted to our country superabundant supplies of that invaluable source of power. The result is that the quest of the early navigators for a natural waterway through the western world and the vagaries of American interoceanic canal propagandists have become or are fast becoming things of the past—the mouldy past.

The commerce of Colon at the eastern terminus of the Panama Canal is very largely incidental to other and more important traffic. Steamers embark from ports in Europe for ports in South America, Central America, and the West India islands, touching at Colon, as they do at other ports *en route.* The same is to a considerable extent true as to the commerce of Panama at the Pacific terminus of the Panama Railroad. In a word, neither the Panama Canal nor the Nicaragua Canal is on the line of any great independent commercial movement, but if completed would occupy the position of lateral lines to comparatively small commercial movements, the terminus of either canal being merely points at which certain ocean steamer lines would touch and trade.

In December, 1898, the American interoceanic canal question assumed a new aspect. The "New Panama Canal Company," a French enterprise (as was its predecessor, the Panama Canal

Company, of which the late Count de Lesseps was president), presented to Congress and to the President of the United States certain picturesque and elaborately prepared documents with the object in view of proving that it would be much better for the government of the United States to grant large financial aid for the completion of that enterprise than to construct the Nicaragua canal. Under the title "The Traffic of the Panama Canal," the report presented by this company merely states that it has adopted a new method of computing the probable tonnage of the proposed canal and that the results obtained are most exact. But, strangely enough, like all the deliverances of the Nicaragua Canal proponents, it fails to state what those results are, from what particular commercial movements the expected tonnage is to come, or of what products its traffic is expected to be composed. The amount of shipping which would probably pass through either of the proposed canals is the vital point upon which the practicability of any American isthmian canal must turn. Failure to state it, at this time, must therefore stand as a confession of the commercial unworthiness of any trans-isthmian scheme until the question as to its commercial possibilities has been placed beyond all doubt. Nevertheless the proponents of the Panama Canal were able to lead Congress to order a new American interoceanic canal commission, at the enormous outlay of one million dollars, for the purpose of ascertaining the cost of the two rival projects and the practicability of placing either one of them "under the control, management, and ownership of the United States." Unfortunately, in this statutory enactment, no provision was made for the investigation of the many and difficult economic and commercial problems upon the proper solution of which depends the vitally important question as to the commercial value of any American interoceanic canal.

The important question as to the military value of an American interoceanic canal has never yet been determined by any thorough and impartial governmental inquiry. Thus far proponents of canal schemes have been able to prevent such inquiry by order of Congress. The governmental reports touching upon this feature of the proposed canals are, on the whole, unfavorable. It is now seen that if the Nicaragua Canal had been completed before the outbreak of the late war with Spain the U. S. battleship *Oregon* would not have passed through it, for the reason that the warships which would have been required for the defense of its eastern entrance and the troops which would have been required for the defense of the entire line were then needed for other service. The whole question as to the military value of the Nicaragua Canal to the United States in time of war is, however, fatally compromised by the blundering Clayton-Bulwer treaty of 1850. That treaty secures to Great Britain and other foreign nations equal rights for the passage of ships both of commerce and war. Such neutralization of the Nicaragua Canal was clear to Mr Blaine and was stated by him, as Secretary of State, to Mr Lowell, our Minister to England, in a letter dated November 19, 1881. There is no feature of the American interoceanic canal scheme which demands more patient and thorough governmental investigation than does that as to its military aspects.

As the shipping of Great Britain and other nations engaged in international commerce greatly exceeds that of American vessels thus employed, either the Nicaragua Canal or the Panama Canal, if completed, would be much more subservient of foreign than of American shipping interests. This is indicated by the following facts: During the six months ended June 30, 1898, the total tonnage which passed through the Suez Canal amounted to 4,842,078 tons, of which 3,252,634 tons, or 67 per cent, was British; 471,571 tons, or nearly 10 per cent, was German; 439,001 tons, or 9 per cent, was French, and only 1,531 tons, or three one-hundredths of one per cent, was American. Again, during the year ended June 30, 1898, the tonnage entered at ports of the United States from foreign countries amounted to 21,700,311 tons, of which 18,337,836 tons, or 84 per cent, was foreign and only 3,362,475 tons, or 16 per cent, was American. Surely it would be better for the country to adopt an efficient policy for the restoration of the American merchant marine before entering upon the construction of a canal, at least 90 per cent of the benefits of which, if any, would inure to the ships of other nations, under the provisions of the Clayton-Bulwer treaty.

The fact that the proponents of the canal companies who now seek governmental aid have been unable to float their securities in the money markets of the globe constitutes overwhelming presumptive evidence of the unworthiness of their project from the commercial point of view. It is idle to assume that the scheme is too large for private enterprise, when hundreds and even thousands of millions of dollars are continually being secured for commercial and industrial enterprises of merit.

When M. de Lesseps visited this country in the year 1880 I was invited by the American Society of Civil Engineers in my then official capacity as Chief of the Bureau of Statistics in the Treasury Department to compute the amount of tonnage which would probably pass through an American interoceanic canal. This I did, under an order of the Secretary of the Treasury, investigating the available sources of geographic, economic, and commercial information. The work was one of considerable magnitude. It was begun in the month of February and completed in the month of August, 1880. I reported a possible tonnage of 1,625,000 tons per annum for any one of the proposed canals. Since the year 1880 seven transcontinental lines and parts of lines have been completed, the facilities for transportation by rail have been greatly increased, there has been an enormous development of transcontinental traffic, and, as already shown, rates have greatly fallen. In a word, the general trend of the evolution of transportation facilities during the last twenty years has been in the direction of reducing the possible tonnage of any American interoceanic canal. From a computation based upon all the controlling conditions of the present day, I conclude that not more than 400,000 tons of shipping annually can be confidently expected to pass through any such canal. The receipts of any American interoceanic canal from tolls would therefore be insufficient to meet the expenses of its maintenance and administration, with nothing for interest on cost of construction, amounting probably to eight million dollars a year.

During the last ten years I have from time to time plead for a thorough and impartial investigation of the economic and commercial aspects of the proposed American interoceanic canal project by a commission upon which there should be placed no advocate or opponent of any one of the proposed schemes, and now through The National Geographic Magazine I submit to the criticism and impartial judgment of geographers, economists, and students of commercial problems throughout the world my conception of the nature and scope of a proper governmental inquiry, and the main facts and conditions upon which such inquiry should be based.

THE INTEROCEANIC CANAL *

By Emory R. Johnson,

Assistant Professor of Transportation and Commerce in the University of Pennsylvania

The nature and scope of the influences which a canal across the American isthmus will exert have not been so thoroughly studied as have been the engineering and political questions connected with the enterprise. Congress has established several boards of engineers to survey the canal routes and to report upon the technical problems and to estimate the probable cost of the work; but as yet there has been no official report upon the industrial and commercial effects that will follow from the construction of the waterway. It is not altogether obvious what economic changes will be brought about by the canal, and it would seem desirable that we should understand more clearly than we now do why this waterway is essential, if it be so, to the welfare of the American people and the American nation.

The construction of an isthmian canal is proposed for the general purpose of shortening distances between the Atlantic and Pacific. The route for sailing vessels between San Francisco and New Orleans, the route now being by way of Cape Horn, will be shortened 11,000 miles, that from San Francisco to New York 10,000 miles, and to Liverpool 7,200 miles. For steamers the distances saved will be about 2,000 miles less, because they pass through the Straits of Magellan instead of rounding the Horn, and also follow a more direct course than sailers can. The canal will make Valparaiso 1,000 miles nearer to our

*As a writer on the industrial and commercial aspects of the Isthmian Canal problem, known to regard favorably the proposed construction of a waterway across the Republic of Nicaragua, Professor Emory R. Johnson was invited to contribute an article on the subject to this number of The National Geographic Magazine. His engagements being such as entirely to preclude him from accepting the invitation, he has, at the special request of the Editor, kindly revised for this issue the article which he wrote a few months ago for the *Independent*, in which the benefits which he considers likely to accrue to American commerce from the construction of an Isthmian Canal are very clearly and forcibly set forth. If any justification were needed for the virtual reproduction in this Magazine of an article that has recently appeared in so widely-read a journal as the *Independent*, it should be sought in the desire of the Editor to present both sides of that most important question, whether the benefit to be derived by the United States from the construction of an Isthmian Canal would be such as to justify a large Congressional subvention.—Ed.

Atlantic ports than to Europe, and will bring our Atlantic and Gulf cities nearer than Liverpool and other European cities (their route being through the Suez Canal) to Australia, Japan, and China from Shanghai north.

How will these modifications in distances affect our navy, our industries, and our commerce? We have had some recent illustrations of the way in which an isthmian canal would affect the efficiency of our navy. The battleship *Oregon* left San Francisco March 19 and arrived at Jupiter inlet, Florida, May 25, having been 67 days *en route*. If there had been a canal across the isthmus, the *Oregon* could have reached Florida in 15 days. She would have saved 52 days' sailing and made the trip in one-fourth the time. We are now sending two men-of-war from the Atlantic to the Philippines. It takes these vessels about 50 days longer to reach their destination by rounding South America than it would by way of an isthmian canal. With the canal constructed we shall be able to accomplish much more with the war ships in our possession, and will need to construct and maintain fewer ships than will otherwise be necessary. If we do not construct the canal, we shall need to put a third of what the waterway would have cost into additional naval vessels. The expense of maintaining these ships would cover more than one third the cost of operating and maintaining the waterway.

The effects which the canal will have upon our economic interests will be, in general, those which will result from lengthening the radius of the circle within which the industries of our country may exchange commodities. Shorter and cheaper transportation, such as an isthmian canal will afford, stimulates existing industries by giving them more and larger markets and enabling them to secure more advantageously the raw materials which they require. Improved transportation also leads to the establishment of new business enterprises and develops domestic and foreign trade. That the isthmian waterway will affect these general results in the United States may be shown by considering how it will change our relation to the lines of the world's commerce and by noting the way in which the canal will affect the industries in the eastern, southern, central, and western sections of our country.

The leading industrial nations of the world are adjacent to the North Atlantic These countries originate the larger part of the world's commerce; the main streams of international trade are those which connect these countries with each other and with those regions of the earth less highly developed industrially. Inasmuch as the land masses of the earth lie mainly in the northern hemisphere, and, indeed, very largely north of the Tropic of Cancer, the primary routes of commerce are those which follow the parallels of latitude proceeding from the North Atlantic as a center east and west to reach developing regions in America, Asia, and the Orient generally. The routes of traffic of secondary but increasing importance run with the lines of longitude connecting the lands of the north temperate zone with the tropical regions and the countries which occupy the relatively restricted land areas of the south temperate belt.

The Isthmus of Suez, just north of the Tropic of Cancer, and the Isthmus of Panama, a short distance south of that line, were the only barriers which nature placed across an otherwise continuous water route around the earth in the northern hemisphere. These barriers diverted the lines which the world's largest volume of traffic tends to follow far to the south around Africa and South America, or did so until 1879, when Europe overcame the barrier of most consequence to her by the construction of the Suez Canal. Since the opening of that waterway Europe has enjoyed trade advantages far superior to those enjoyed by our country. Our regions most highly developed industrially are tributary to the Atlantic and Gulf of Mexico. To the east of us lies Europe, a region of great industrial advancement, demanding little more than our surplus food products and raw materials; to the south are the countries of the South Atlantic lying along the line of the world's secondary commercial routes; countries, moreover, whose trade we can secure only in direct competition with Europe, which has already forestalled us at many points. In pushing their trade westward the industrial states of the United States—and they are found in the eastern half of our country—find that the possibilities of a traffic by land are restricted within narrow bounds by the heavy costs of a long haul over the elevated Cordilleran Mountain ranges, while shipments by water have to take the circuitous and expensive route around South America. Until an isthmian canal is constructed the United States will be very seriously handicapped in its competition with Europe for the trade of all countries bordering the Pacific ocean.

Such being the general relation which the canal will bear to the commercial development of the eastern half of the United

States, how will it affect the leading industries of the different sections of the country? The northeastern section is one of varied manufactures and corresponds roughly with western Europe in industrial development. The manufacturers of this part of our country can hardly hope to build up a large trade with Europe, but can unquestionably develop large markets for their wares in the western third of the United States and in the markets of the Orient when the time and expenses of transportation have been reduced by an isthmian waterway. A trade of some importance, though not large, can be established in western South America.

Our southern states are now producing much more cotton than the mills of Europe and our own country can use, and are anxious to increase their sales both of the raw staple and of cotton manufactures in the Pacific countries. Besides developing the cotton textile industry the South is opening up her rich coal and iron mines and manufacturing iron and steel, and these industries must also look to the West for their chief markets.

The states north of the Ohio and Missouri rivers include our richest agricultural resources, our most productive iron mines, our chief stores of bituminous coal, and also have forests of large extent. The industries of these states, though still mainly extractive, are to a large and rapidly growing extent composed of manufactures. Their mills and factories turn out large quantities of iron and steel, machinery, ships, furniture, wooden wares, and flour. That these states in the central part of our large country are enjoying such a phenomenal industrial development is due mainly to the transportation facilities which have been provided by the railroad trunk lines to the Atlantic and the Gulf, the Mississippi and Ohio rivers, the Great Lakes, and the Erie Canal. Whatever cheapens transportation accomplishes surprising economic results in this section of our country. The canal across the American isthmus will give the central West a chance to increase its traffic with the trans-Cordilleran states and with the foreign countries that border the Pacific. What the Great Lakes and the Erie Canal have done for the eastern trade of these states, the interoceanic canal will do for its western trade.

The section of our country tributary to the Pacific is devoted mainly to agriculture, stock-raising, farming, lumbering, and the mining of the precious metals. Most of the products of these industries are bulky, and only the precious metals, fruits, and a few forest products of high value can bear the costs of transportation by rail over the mountains to the eastern states. The people of the Pacific states are eager to increase their trade with Europe and the eastern half of the United States, and are clamoring for an isthmian canal. The waterway will do for the eastern trade of the Pacific section what it will do for the western trade of the eastern, southern, and central states.

In considering the general commercial and industrial changes which an interoceanic canal will effect, attention may well be directed to three things which the waterway will not accomplish:

First. It is possible that the traffic through the canal will not grow more rapidly than did the commerce through the Suez route. British India, the East Indies, and other countries with which Great Britain and the continental nations trade by way of the Suez Canal had, when the Suez route was opened, more extensive industries and a larger and longer established commerce than have many of the Pacific countries whose commerce is to cross the American isthmus. In the case of the Suez Canal it was largely a question of increasing an existing trade. The American isthmian canal traffic will consist mainly of a newly created trade and only to a small extent of an existing traffic diverted from present routes. The American canal, however, will have the advantage of connecting the two coasts of the United States, and the commerce between these sections will increase rapidly.

In the second place, it must not be expected that the canal will give us control of the Pacific trade unless we accompany the construction of the canal with the establishment of other agencies that give our European competitors greater trade advantages than we now possess. There must be international banking facilities provided; we must have cable connections with the South American and Pacific countries, and, most important of all, we must bring about the establishment of more lines of vessels plying regularly between American and foreign ports. These auxiliaries of commerce, as well as the canal, are essential to commercial expansion.

Thirdly. The canal is not going to be a detriment to the transcontinental railroads. Some people suppose that it will, but the history of the competition of waterways and railroads does not warrant such a conclusion. The railways to the Pacific will find that their traffic will increase more than *pari passu* with the growth of the business done through the canal. Some of the freight now carried by rail will be diverted, but the amount will be small, and will be more than made good by the increased traffic that will result from the industrial and commercial development produced by the canal. The railroads having the heaviest traffic in the United States are those which serve the territory adjacent to our Great Lakes, upon which there is an enormous freight business done. In Germany the railroads carrying the largest volumes of traffic are in Westphalia, through which flows the Rhine. the busiest waterway on the continent of Europe. The interoceanic canal will not only increase the total volume of business done by the transcontinental railroads, but it will also increase the ratio which the local freight will bear to the total traffic. The canal can only carry its traffic between the seaports; the railroads must collect and distribute the commodities it transports, and that means a larger amount of local freight, the business from which the roads derive their best profits.

The policy of territorial expansion which we have apparently decided to adopt is fraught with many duties and not a few dangers. Some public leaders are opposing the acquisition of colonies, but no one is opposed to the acquisition of trade and the expansion of our commerce. The necessity for promoting our foreign trade is recognized by all parties and sections, and our attention is being directed more and more to securing our full share of the prospectively large trade of the countries of the Pacific. In order to compete successfully with Europe in the Pacific we need the canal across the American isthmus.

PLANS FOR REACHING THE SOUTH POLE

By Gilbert H. Grosvenor

The return of the *Belgica* in early spring, with the splendid record of being the first vessel to pass a winter within the Antarctic circle, and the bold landing of Captain Borchgrevink and his scientific staff on Victoria Land, where they are now making the first attempt ever made by man to winter on Antarctic land, have given great impetus to the projected Antarctic expeditions from England and Germany. Announcement is made that the British government is ready to grant a subsidy of $200,000 for the Antarctic expedition that is to set out in the summer of 1901 under the joint patronage of the Royal Society and of the Royal

Geographical Society, and unless the promoters of the German expedition are being misled in their expectations, the Reichstag will soon guarantee substantial aid to the German National expedition. As one of the main subjects to be dealt with at the approaching International Geographical Congress at Berlin will be the mutual coöperation of these two expeditions, it may not be inopportune to review briefly the plan and route of each.

It was originally intended by the Antarctic Committee, representing the Royal Society and the Royal Geographical Society, that the English expedition should consist of two ships, and that it should be under naval discipline and led by naval officers. In consequence, however, of the unwillingness of the government to consider such a plan with favor, the committee finally determined to equip but one vessel and to make an appeal for funds to the general public. The appeal has met with so generous a response that, including the splendid gift of $125,000 by Colonel Longstaff, $200,000 has been obtained. The plans of the expedition have not yet been finally determined in all their details, but it has been decided that the ship shall follow what is known as the South American route, sailing from the South Shetland islands southward to Alexandria Land. Here, at about 70° south by 90° west, a landing will be made, if practicable, and the first station established. Continuing onward, their course being dependent, as shown in the map (plate 8), upon the amount of ice encountered, the party expect to establish on Cape Adare, Victoria Land, a second station, from which the great dash for the South Pole will be attempted, and in the vicinity of which the principal scientific work will be accomplished.

The movement for a distinctly German expedition to the South Pole may be said to date back to the early seventies, when Dr Neumayer, the originator and organizer of the entire undertaking, began his agitation to that end. But his untiring advocacy of Antarctic research gained no practical recognition until 1895, when the Bremen meeting of the German Geographentage acknowledged its importance. Finally, somewhat over a year ago, plans took such definite shape that Dr Erich von Drygalski, professor at the Imperial University of Berlin, was chosen as the leader of the expedition. Since then the route to be followed has been carefully determined, and nearly all the details for a two years' exploration have been arranged.

The principal danger to navigation in the Antarctic region is not ice pressure, for the currents radiate outward and not in-ward, but rather the stormy nature of the sea. Captain Drygalski proposes, therefore, to construct his ship on lines that will insure seaworthiness. This he believes can be secured by a vessel stanchly built of wood, with strong internal supports, which will at the same time afford protection against powerful magnetic influences.

The Kerguelen islands, lying in the Indian ocean at 70° east by 50° south and open to navigation at all seasons of the year, are to be the starting point. From these islands the route follows a line southwestward to some point on Wilkes Land, where a winter station will be built upon the edge of the ice-sheet and systematic observations taken. In the early spring an advance will be attempted on sleds across the ice in the direction of the magnetic pole, and in the fall a return will be made in a westerly direction along the little-known coast of Wilkes Land. Perhaps the party will be able to reach the most southerly known land, Victoria Land, discovered by Ross in 1842. As the English explorers are to build a station on the edge of this same Victoria Land and thence proceed southward as well as along Wilkes Land, Victoria Land will be the objective meeting ground of both expeditions. But naturally no geographic limits can be set in a region about which scarcely a single conclusion can be formed.

Captain Drygalski has repeatedly emphasized a condition now prevailing in southern waters which is especially noteworthy in view of the statement of Dr Supan that we are now passing through an unusually warm-temperature period. This condition, as stated by him, is as follows: "The unusual quantity of drift-ice which first appeared in the South Atlantic ocean in 1891 and 1894, and then in the Indian ocean from 1894 to 1897, has each year advanced further toward the east and has now reached the Kerguelen islands, which are for the most part beyond the northern limit of drift-ice. From its nature we are able to determine that it is land-ice which has at last broken away after years of confinement to the mainland, a phenomenon well known as happening at long intervals in the northern parts of Greenland. Similar unusual variations in the conditions of the ice in the Antarctic region have been previously remarked. Though Captain Weddell, in 1823, from the South Orkney islands was able to advance unchecked as far as 74 degrees of latitude, and thence reported a sea free of ice as far as the eye could reach, all subsequent explorers have found an impenetrable barrier in front of them long before reaching that point." Inasmuch as a less obstructed advance than hitherto will be possible after the disappearance of this remarkable quantity of drift-ice, the next few years will be especially favorable for the resumption of Antarctic exploration.

Apart from purely scientific reasons, an ambition to advance German navál prestige is a prominent motive in the advocacy of a national expedition. The following paragraph, quoted from the *Kölnische Zeitung*, tends to show that the same logic that prompted the purchase of the Caroline and Mariana islands will be the most convincing argument for any vote by the Reichstag in favor of a large subsidy for the expedition : " For naval supremacy are necessary not only men-of-war and a merchant marine, but also an active participation in those scientific undertakings which lead to man's conquest of the sea. Such enterprises we Germans formerly left to others. Then we not only considered strategic points in distant seas unnecessary for ourselves, but actually surrendered to foreign hands, one after another, the approaches to our own harbors. Each course was equally inglorious ; but about 1860 a desire arose for a personal share in the exploration of the North Polar regions, and from this feeling has grown the demand for a German fleet and the renewal of the plan for a canal to the North sea and of other similar projects. The honest conviction has come that all these enterprises are mutually dependent and but parts of one whole. To be strong at sea in the knowledge of readiness to fight, to be strong at sea in the consciousness of a peaceful commerce that carries our flag into every port, to be strong because of a scientific and intellectual conquest of the sea, are the rights of a great people working for one end—national development. Therefore let us hope that the German Antarctic expedition will not only add great honor to our scientists, but also bring new glory to German valor at sea."

The advantages, both from a geographic and general scientific point of view, of a further exploration of the South Polar regions have been so repeatedly set forth that it is hardly necessary to enlarge upon them here. Briefly they may be stated as: the verification or disproof of the existence of a vast Antarctic continent; the determination of the origin of the cold ocean currents which have their rise in the south ; the study of the nature of ice itself, of the differences between land-ice, sea-ice, river-ice, etc ; and the investigation of the conditions of atmospheric pressure and temperature, of volcanic action, and of terrestrial magnetism within the Antarctic circle.

GEOGRAPHIC LITERATURE

The United States, with an Excursion into Mexico. Handbook for Travellers. Edited by Karl Baedeker. Pp. c + 579, with 19 maps and 24 plans. Second revised edition. Leipsic: Karl Baedeker. 1899. Sole agents for the United States: Charles Scribner's Sons, New York. $3.60 net.

To those who are not already familiar with Baedeker's famous guide books no brief review of this, his latest and perhaps his most successful volume, will convey any adequate idea of the prodigious amount of information that has been compressed into it or of the judgment and skill with which the attractions of the country for the traveler are set forth. Opening the volume at random, one is at once struck by the clearness and beauty of the maps and plans which accompany the descriptions of the principal cities, mountains, and other places of interest, even to battlefields and public buildings. The minuteness of the information concerning routes of travel, hotels, restaurants, and theaters creates almost as instantaneous and favorable an impression, while upon closer examination the wealth of information brought together and the remarkable discriminating intelligence displayed in the enumeration of the different objects of interest come as the crowning surprise to those who have no previous knowledge of the thoroughness which is characteristic of a Baedeker guide book. No other publication, great or small, can compare with this little volume as a compendium of information concerning the United States, and, guide book though it is, there is no school library in the country too well equipped to find it a useful acquisition. J. H.

The Races of Europe. By William Z. Ripley, Ph. D., Assistant Professor of Sociology, Massachusetts Institute of Technology, Lecturer on Anthropology at Columbia University. New York: D. Appleton & Company. 1899. $6.

This book is a monument of careful and profound scholarship. There is nothing about it superficial. Whether the reader agrees with or dissents from its arguments and conclusions, he will carry throughout its perusal a sympathetic and never-abating admiration for its honesty of purpose and for the wide learning of its author.

In the preface Professor Ripley states that his aim has been "to co-ordinate, illustrate, and interpret the vast mass of original material" concerning race or physical relationship which has been accumulated by investigators and observers in all parts of Europe. In the oriental tale the Persian khan imposes upon his librarian the task of reducing to a single volume the many hundred manuscripts of his library, and at the same time of omitting nothing which those many manuscripts contain. A task as immense this author imposes upon himself. Too high tribute cannot be paid to the conscientious faithfulness with which he has performed his task. It is manifest on every page and in every line. The writings of each authority accessible, and none seem to have escaped a tireless vigilance, have been scrupulously studied, their contents mastered, and their opinions presented without bias or distortion. Collignon, Beddoe, Virchow, La Pouge, even Deniker, can complain of no misrepresentation on these pages.

But the author attempts not merely to condense and put together whatever the collaborators in his chosen field have observed and noted down; he endeavors to present a digest of all that has been achieved in the domain of anthropology and ethnology. From what he considers demonstrated facts he seeks to deduce principles and construct a system. For years anthropologists have enjoyed many advantages; governments have assisted in their researches; tape-lines and calipers have been worn out in experiments; thousands of measurements have been taken; interminable tables of figures have been built up. But how many definite results have been gained by all the toil? How much can be discerned distinct in the bewildering maze? If anything, what? These and similar questions Professor Ripley endeavors to answer.

His subject-matter he treats in twenty-one chapters. Chapter III is strongly written and contains the main proposition, the text and test of all, in the cephalic index. Chapter VI, on The Three European Races, is the application of chapter III and is no less ably and forcibly constructed. The other chapters, except the twenty-first, on Acclimatization, are subsidiary to or extension of chapter III. Introduced at frequent intervals are 85 maps with which the author fortifies or from which he develops many of his deductions. These are generally approximative rather than demonstrative, inasmuch as based on a limited number of data. For example, observations on 800 skulls in the Netherlands, where there are more than 5,000,000 living persons and a vastly greater host of dead, or on 1,200 heads in the British islands, where the population exceeds 40,000,000, may point to probabilities but cannot be accepted as proofs. The 235 "portrait types" are of interest and importance, yet often they seem selected by the deductive rather than the inductive method. Apparently the conception is first formed as to what a national type should be, and then from the pictures of that nationality one is picked out conformable.

Like all the rest of us, Professor Ripley has his pet theories. These theories are never mere preconceptions, but are always based on examination and reflection, and are therefore entitled to respect. A theory he has once adopted he regards as a truth and clings to it firmly. Whatever militates against that truth must be argued away. If obstinately it refuses to vanish, he takes refuge in the comfortable adage, "the exception proves the rule," and passes on. He almost carries us captive in the sweep of his logic and learning. But what do his 650 close-packed pages reveal? Instead of a consensus of authorities, we find constant absence of agreement and contradiction of one another. Nor does this dissonance limit itself to matters of detail; the investigators press along on divergent paths to different goals. The reason of this is not hard to seek. Anthropology is a science of recent, almost contemporaneous, birth. It moves with the uncertain feet of a child beginning to walk. Its disciples are pushing out upon an unknown sea, for which they have themselves improvised discordant charts. So it becomes them to be humble or, at least, if not humble, tolerant of philology and history. Yet even Professor Ripley, judicial and courteous as he usually is, descends to ejaculations like this, "May the day come when philologists shall have an eye to the common decencies," p. 437, and discants on "the current mouthings about Aryans and pre-Aryans," p. 104, and annihilates an inference of Motley with the assertion, "Nothing could be more erroneous," p. 293, 294. Chapters XIV, XV, and XVI form the least valuable portion of the book. Here sometimes the author's punctilious carefulness seems to fail him. He refers to the Jews in a manner satisfactory to the ardent anti-Semite and chips at Polish history in accommodation of a theory. He hardly appreciates the meaning of the historic term "Osmanli." For no conceivable purpose he even states, "The only name recognized by the Osmanli themselves is that of Turk," p. 415, oblivious of the fact that this name they never use, but consider an insult. Most astounding is his eulogium of the Circassians, "In character the Circassians are preëminent," p. 442.

His style is in general clear, often graphic, sometimes eloquent. The unique ethnical conditions of the Caucasus have never been better portrayed than in these words, "Up against such a mountain system . . . have swept great currents of human life from every quarter of the Eastern hemisphere. They have not blended. There has been continuous isolation, to coin a phrase, ample in supply for all." In a splendid sentence, referring to the tenacious Celts of Brittany, he speaks of that "ethnic struggle, unsuspected by the statesmen who were building a nation on the shifting sands of race." The concluding paragraph of chapter XVIII is specially fine. Such limpid, transparent English is rare in scientific treatises. Doubtless the "remorseless criticism," to which we owe the delightful and chivalric reference in his preface, is in part responsible for this admirable result.

Bound separately from the major volume is a comprehensive Bibliography of the Anthropology and Ethnology of Europe, containing nearly two thousand titles. To remark the exceeding value of this supplement of 160 pages would be superfluous.

Edwin A. Grosvenor.

Amherst College.

Through Asia. By Sven Hedin. With nearly Three Hundred Illustrations from Sketches and Photographs by the Author. Two vols. Royal 8vo, vol. 1, pp. i–xviii + 1–649; vol. 2, i–xii + 650–1255 and maps. New York: Harper and Bros., 1899. $10.

As the itinerary of one of the noteworthy explorations of recent years, this sumptuous two volume work is a book of the decade. It was prepared for the press during an interval of rest from exploration; and it is reported that, before his recent redeparture for Thibet, the author presented to some royal dignitary (all of whom he delights to honor) half a dozen copies of the book, printed in as many different languages. The demand attested by this extensive reprinting gives little occasion for surprise; for Sven Hedin—newly graduated under the influence of Europe's famous geographer Baron vón Richthofen, and with one interesting Asian trip already to his credit—conceived and successfully carried out a plan for exploration so strikingly novel and ambitious that his name and fame had spread throughout the thinking world even before his book was put on the press. Whatever his future, Hedin has already earned a place among the great explorers of history; and "Through Asia" is the popular account of exploratory work hardly surpassable in interest. Dr Hedin's journeys began with his departure from Stockholm, October 16, 1893; they practically ended with his arrival at Peking in the middle of February, 1897—for the return by post across Siberia was over trodden paths, and gave no opportunity for new observation. The serious work began with a winter journey over the Pamir—the Roof of the World,—where weeks of wintry weather were spent in tedious mapping at altitudes averaging about that of the highest crests of Rockies and Sierra; thence it extended eastward, attaining especial value in the desert of Gobi (Takla-makan), and on the bleak and cloud-swept heights of northern Thibet; the original work ended with the passage through the country of the Tangut robbers (whose heads bear the blood of earlier explorers), near the headwaters of the great Hwang-ho and west of myth-shrouded Koko-nor, the great saline lake of western China. Route-maps were carried forward constantly; most were drawn on the scale of 1 : 95,000; on the flat deserts the scale was reduced to 1 : 200,000, and in regions of complex morphology it was increased to 1 : 50,000. The length of the route covered by the mapping was 6,520 miles, of which 2,020 were previously untrodden by Europeans; and there were over 8,000 miles of incidental travel to and from the field of work. Most of the geographic details are necessarily omitted from the itinerary, though two main and several minor maps elucidate the text satisfactorily; the more technical results, geographic, anthropologic, geologic, phytologic, and meteorologic, are reserved for special publications. Ample illustrative material was collected, photographs in the earlier part of the work, pencil or ink sketches after the photographic outfit was lost in the desert; and an abundance of these, with a few artistic pictures, executed in Sweden under the author's direction, enliven and embellish the itinerary. The first winter's work in the Pamir derives interest from the great altitude at which it was conducted, with the attendant climatic peculiarities. There are five principal passes from the Siberian plains over the northernmost range of this stupendous protuberance of the earthcrust, averaging 13,250 feet in altitude; then comes Alaï valley, a singular trough 75 miles long and from 8,200 to 10,500 feet (*i. e.*, from a mile and a half to two miles) in altitude; next begins the Pamir proper in the Trans-Alaï mountains, culminating in Kaufmann peak, 23,000 feet high. Thence southward toward the Himalayan front stretches a plateau, corrugated in east-west ranges and divided by a labyrinth of valleys among which gather the waters of several of the great rivers of the earth, flowing northward to the Arctic, southward to the Indian ocean, and westward to inland seas. The air is wrung dry in ascending the mighty slopes, so that the summer rainfall is limited and the winter snowfall meager; but the light atmosphere is capricious and unstable, so that storms, sudden and severe, lurk always about the passes and harass the valleys. The more tolerable part of the region is sparsely inhabited by patriarchal and often migratory Kirghiz tribes of pastoral habit; travel is possible for horses and for camels, but the higher districts and snowier stretches repel all burden-beasts save the mountain-born yak, whose peculiar capacities made possible some valuable work. Save for a single earlier Asian journey, the Pamir survey was the author's apprenticeship in exploration, and this part of his itinerary is rich in detail and plentifully seasoned with adjectives; yet it is a surprise, in view of the altitude and latitude (no less than the adjectives), to find the "inconceivable" cold of Hedin's lowest thermometric record —36.8° Fahrenheit, and the "incredible" depth of soil-frost three and a half feet—in many ways a striking contrast to the congealed mercury and six feet of soil-frost in the upper Mississippi valley last winter. Dr Hedin's most minute surveys were those of glacier-clothed Mustaghata (Father of the Ice Mountains), "the loftiest mountain of the Pamirs, and one of the loftiest mountains in the world, [which] towers up to the height of 25,600 feet, and like a mighty bastion overlooks the barren wastes of central Asia" (p. 217). More than once did he circumscribe it; dwelling long on its flanks and about its base at the height of world-famed mountains, he learned the legends to which its majesty has given birth in the simple minds of the natives, surveyed its glaciers, and studied their behavior at different seasons, and strove repeatedly but vainly to reach the culminating dome. The slopes are not inaccessible, but a barrier—half deified by the Kirghiz as the Soroche of the Andes is deified by the Peruvians—exists in the rarity and chill of the air; horses lose their powers little above the plateau level, and men yield to the strain of climbing ere half way up the slopes; the big-lunged and phlegmatic yak might indeed be forced within climbing distance of the crest, but Hedin found that he and his Kirghiz were incapacitated by camping at the 20,000-foot level. So the icy crest, standing guard over bleak Pamir and sun-parched Takla-makan, and looking down on all but the lightest of clouds, remains unhonored by human tread. Of no less geographic interest were the more general surveys in the desert of Gobi (Takla-makan) and the studies of long-mysterious Lob-nor—the shifting lake in which the waters gathering from the eastern Pamir and northern Thibet are lost through evaporation and absorption. The desert work involved several trips, including an ill-starred (and ill-started) journey in which two men, half a dozen camels and some other livestock, as well as much of the instrumental outfit, were sacrificed, the author and his Asian mentor, Islam Bai, escaping with their lives through a succession of accidents with which ordinary foresight had little to do. Partly because of its stress, even this desert experience is a contribution to knowledge; probably no better record of the effects of hunger and thirst on men and animals has been written—though the trip was made with a thermometric range from about 90° downward (*i. e.*, at a temperature considerably lower than that of the blood), so that the march of physiologic events by no means kept pace with that observed in our own Death valley and Mojave desert and Papagueria, where the midday thermometer reaches 130° in the shade and 160° in the sun, or far above normal blood-heat. The later desert trips were productive in other ways; at least two sand-buried cities of considerable antiquity were brought to light; the camel was found wild, under such conditions as to suggest to the author a domesticated ancestry; and the shiftings of Lob-nor, which, with so slender observational basis, have given rise to so voluminous literary discussion in the last lustrum, were analyzed with no little acumen. One of the most fruitful trips was the final journey eastward from Khotan through northern Thibet to Tsaidam desert and the Koko-nor; a full half of the route traversing a desolate. plateau, uninhabitable by reason of aerial rarity and consequent sterility. The plateau, fronted on the north by the Kuen-lun mountains, is corrugated in east-west ridges like the Pamir; but they rise so far above the zone of vapor-weighted clouds that the precipitation is insufficient to produce waterways opening to the sea, and the intervening valleys are lined with wind-blown as well as water-borne detritus and dotted with saline lakes, while the slopes are mantled with frost-fractured debris well toward the crests. Here the classic khulan (wild ass) and the wild yak live, enjoying a seclusion so perfect that the passing caravans awaken curiosity rather than fear. The plains over which they skurry, and even the lakes whose shores they haunt, are amid the higher clouds, 15,000 to 18,000 feet above tide; the low pass in the second range (Arka-tagh) stands 18,180 feet; and even in midsummer the mountain chill is below freezing, always by night and often by day. The trip was not made without effort; all suffered from mountain sickness, Islam Bai narrowly surviving, while the Chinese interpreter was sent back; and of the six camels, twenty-one horses, and twenty-nine donkeys of which the caravan consisted at the outset, but three camels, three horses, and one donkey crawled feebly down to the settlements on the borders of Tsaidam. Yet the observations, geographic and geologic, with studies of yak and khulan and smaller life, well repaid the cost. As the party pushed eastward through Tsaidam, the to-be-expected brush with Tangut robbers—who slew Dutreuil de Rhins and assailed Przhevalsky and Roborovsky—was realized; yet by some chance (or trick of Tangut superstition) the explorers, with three rifles, five revolvers, and two marksmen (not including the leader) escaped actual assault. The exploration was conducted under patronage of King Oscar of Sweden, the Nobel family, and other donors of the $8,000 or $10,000 expended; the support finding its warrant in the admirable outline of past and prospective Asian exploration incorporated in the introductory chapters, and finding justification in the important results attained by Dr Hedin. The narrative is naive, and reveals the personality of the author in attractive fashion. By the vigorous and self-reliant explorers and surveyors who have pushed geographic knowledge over the North American continent, this quiet, spectacled student, chronically homesick and frequently helpless, would be voted a tenderfoot; yet the fact remains that good chance and persistence carried him through stress of weather, hunger and thirst, tricky theft and threatened robbery, with all other explorers' ills, and enabled him to consummate a memorable task in making known the previously unknown world.

W J M.

MISCELLANEA

Dr Sven Hedin is on his way to Central Asia for a two and a half years' further exploration of that region.

The heaviest rainfall in the world, sometimes over 180 inches in a single month, occurs at Cherapungee, in India, on a hillside about 4,000 feet above sea-level.

The address of Mr F. H. Newell, Chief Hydrographer of the U. S. Geological Survey, before the Trans-Mississippi Commercial Congress at Wichita, Kansas, is published in the June number of *Irrigation Age*.

"What Glaciers Have Done for Iowa," the subject of an article by Prof. Samuel Calvin in the July number of *Annals of Iowa* (Des Moines, Iowa), demonstrates that glaciers and glacial action have contributed in a very large degree to the making of that magnificent state.

The scientific staff dispatched by the government of France, in charge of Captain Maurain, of the Engineers, and Captain Lacombe, of the Artillery, for the remeasurement of the Arc of Peru and its extension, so as to include five to six degrees of latitude, reached Quito in July.

The "shrinkage" in the distance between Point Viento and Ponce, Puerto Rico, previously given on Spanish charts as 50 miles, but on remeasurement by the U. S. Coast and Geodetic Survey the past winter found to be only 43 miles, is a convincing proof of the necessity of a careful resurvey of the new possessions of the United States.

The *Monthly Weather Review* for May contained an exhaustive article on the "Climatology of the Isthmus of Panama," by H. T. Abbot, Brigadier General, U. S. A. (retired), with a valuable appendix by Prof. A. J. Henry, containing data of the precipitation at different points on the isthmus. Mr A. P. Davis contributes a paper on "Rainfall and Temperature in Nicaragua."

Precisely at 4 p. m. on the 10th day of every month in the year except December, the Bureau of Statistics of the Department of Agriculture is directly connected by wire with every large stock and produce exchange in the country, and a summary of the monthly crop report is simultaneously flashed to every commercial center.

It is a pleasure to announce that the systematic effort begun in June by the National Geographic Society toward the enlargement of its work by increasing its membership throughout the country is proving most successful. Within the last 60 days considerably over 250 non-resident members have been enrolled, representing every state of the Union and different sections of Canada and North America.

Petermann's Mittheilungen states that in the autumn a party under the leadership of A. Paulsen, the Director of the Danish Meteorological Institute, will set out for Iceland, where, from a station to be established on the north coast, they intend to study the magnetic properties, height, etc., of the northern lights. Similar researches will be conducted by the Swede-Russian expedition in Spitzbergen and northern Norway.

The *Diana*, under the command of Mr H. L. Bridgeman, of the *Standard Union* and Secretary of the Peary Arctic Club, sailed from Sidney July 20 on the second of the series of annual reënforcements for Lieutenant Peary. As announced in the July number of The National Geographic Magazine, the vessel carries stores of provisions for her own party, for Peary's, and for the *Windward's*, enough for 50 men for one year.

In an article on the Erie and Welland Canals, Bradstreet's of July 15 says that the phenomenal lowering of railway transportation rates in recent years has tended toward the crippling of all but the most favorably situated of the interior water routes, and adds that it is questionable whether the purely artificial waterways can be so improved as to get back a fair share of the immense traffic which formerly sought these channels on the way to market.

Dr F. A. Cook, the surgeon and anthropologist of the *Belgica*, in a paper appearing in the *New York Herald* (July 2, 1899), gives the following summary of the results of the Belgian expedition: "The discovery of a new strait nearly as large as the Straits of Magellan; the discovery of about five hundred miles of new coast; the discovery of a submarine plateau west of Graham Land; a complete series of meteorological and magnetic observations throughout one year." The strait, to be called Belgica strait, is said to begin about five hundred miles southwest of Cape Horn, on the sixty-fourth degree of south latitude, and between the sixty-first and sixty-second degrees of west longitude. Its general direction is southwesterly, with an average width of twenty-five miles and a length of two hundred miles.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1898–'99

Special Meeting, February 3, 1899.—President Bell in the chair. Prof. Alfred P. Dennis gave an illustrated lecture on Life on a Yukon Trail.

Regular Meeting, February 10, 1899.—President Bell in the chair. Major A. Falkner von Sonnenberg, of the German Imperial Army, gave an illustrated lecture on Manila and the Philippines.

Special Meeting, February 17, 1899.—President Bell in the chair. Prof. John L. Ewell, of Howard University, gave an illustrated lecture on Germany in the Reformation Period, with its Geographic Relations.

Lenten Course, February 21, 1899.—President Bell in the chair. Hon. David J. Hill, Assistant Secretary of State, gave an illustrated lecture on The Original Thirteen States.

Regular Meeting, February 24, 1899.—President Bell in the chair. Prof. H. S. Pritchett, Superintendent of the U. S. Coast and Geodetic Survey, gave an illustrated lecture on The Results of Recent Alaskan Surveys.

Lenten Course, February 27, 1899.—President Bell in the chair. Prof. Albert Bushnell Hart, of Harvard University, gave an illustrated lecture on The Louisiana Purchase.

Special Meeting, March 3, 1899.—President Bell in the chair. Capt. Edwin F. Glenn, U. S. A., gave an illustrated lecture on his Experiences on a Military Exploring Expedition into Alaska.

Lenten Course, March 8, 1899.—President Bell in the chair. Prof. John Bach McMaster, of the University of Pennsylvania, gave an illustrated lecture on Texas and the Mexican Accessions.

Regular Meeting, March 10, 1899.—President Bell in the chair. Messrs Robert T. Hill and H. M. Wilson gave an illustrated lecture on A Recent Trip to Puerto Rico.

Lenten Course, March 14, 1899.—President Bell in the chair. Mr J. Stanley-Brown gave an illustrated lecture on The Alaskan Purchase.

Special Meeting, March 17, 1899.—President Bell in the chair. Mr Snowden Ward, of England, gave an illustrated lecture on The Land of Dickens.

Lenten Course, March 21, 1899.—President Bell in the chair. Mr Edwin Morgan gave an illustrated lecture on The Annexation of Hawaii.

Annual Reception, March 22, 1899.—The Annual Reception of the Society was held at the Arlington Hotel, from 8 to 10 o'clock p. m. Prof. Willis L. Moore, Chief of the Weather Bureau, explained the workings of meteorological instruments, and Prof. Charles E. Tripler, of New York, gave a demonstration of the properties of liquid air.

Regular Meeting, March 24, 1899.—Vice-President W J McGee in the chair. Mr Henry Gannett, Geographer of the U. S. Geological Survey, gave an illustrated lecture on Redwood.

Lenten Course, March 28, 1899.—Mr F. H. Newell in the chair. Prof. W J McGee gave an illustrated lecture on The Effect of National Growth on National Character.

Special Meeting, March 31, 1899.—President Bell in the chair. Commander Harrie Webster, U. S. N., gave an illustrated lecture on China, the Flowery Kingdom; the Country and its People.

Regular Meeting, April 7, 1899.—Vice-President W J McGee in the chair. Mr F. H. Newell, Chief Hydrographer of the U. S. Geological Survey, gave an illustrated lecture on The Annexation of the West.

Special Meeting, April 14, 1899.—President Bell in the chair. Hon. F. H. Wines gave an illustrated lecture on How the Census is Taken.

Regular Meeting, April 21, 1899.—President Bell in the chair. Dr Mitchel Carroll, of Johns Hopkins University, gave an illustrated lecture on The Acropolis of Athens.

Special Meeting, April 28, 1899.—Vice-President W J McGee in the chair. Dr Alexander Graham Bell, President of the Society, gave an illustrated lecture on Japan, under the auspices of the affiliated scientific societies of Washington.

THE NATIONAL GEOGRAPHIC SOCIETY

SECRETARY'S OFFICE

Rooms 117, 118, Corcoran Building, Fifteenth and F Streets N. W., Washington, D. C.

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....*189*

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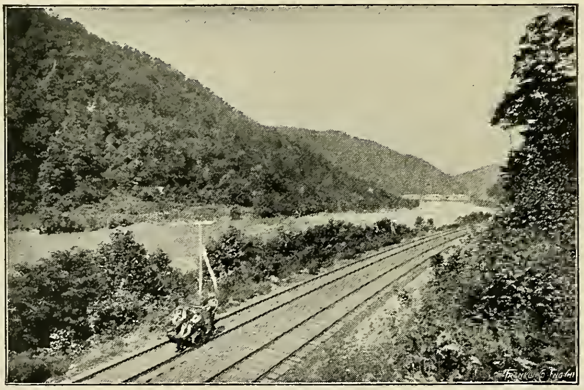

THE NATIONAL GEOGRAPHIC MAGAZINE.

The National Geographic Magazine is a journal of geography, physical, commercial, and political. It aims to convey new information and current opinion on geographic matters, and to be a medium of communication between geographers in America and Europe. Its editorial staff includes officers and experts of the different scientific bureaus of the Government, each representing a field teeming with facts of geographic interest. Its corps of contributors comprises nearly every United States citizen whose name has become identified with Arctic exploration, the Bering Sea controversy, the Alaska and Venezuela boundary disputes, or the new commercial and political questions arising from the acquisition of the Philippines. Through the cordial coöperation of the different diplomatic representatives of foreign nations at Washington, it is able to present the latest and most authentic geographic intelligence from other countries.

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AN ILLUSTRATED MONTHLY

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THE

National Geographic Magazine

VOL. X SEPTEMBER, 1899 No. 9

THE COMMERCIAL DEVELOPMENT OF JAPAN

By O. P. AUSTIN,

Chief of the Bureau of Statistics, Treasury Department

With new currency, a new tariff, new relations to her foreign population, and new treaty relations with the commercial world, Japan's commercial future is a subject which naturally arrests attention and also arouses much conjecture; and when it is considered that the trade relations of that country with the United States are growing more rapidly than those with any other nation, the subject becomes one of especial interest to the people of the United States. Our exports of merchandise to Japan, which 20 years ago were but a couple of millions of dollars annually, had reached five millions by 1890, nearly eight millions in 1896, over 13 millions in 1897, 20 millions in 1898, and between 17 and 18 millions in 1899. Our purchases from Japan of articles which we must have, such as raw silk and fibers for our manufacturers, tea, rice, and other articles which we cannot produce at home, have constantly grown, even while our purchases from other parts of the world were being reduced, and are now from 25 to 26 millions a year, against one-half that sum fifteen years ago. Over a thousand citizens of the United States are now residing in Japan, many of them actively participating in her foreign commerce, two-thirds of which is still conducted by foreigners, while over seven thousand citizens of Japan are residing in the United States, many of them as students, and over twenty-seven thousand of her people are residents of the Hawaiian islands, which are now under the United States flag. No European nation except Great Britain has so many citizens residing in Japan as has the United States, and no country has as many Japanese citizens under her flag as has our own, while no nation is so closely associated with the growth of her commerce or has greater reason to expect an active participation in it.

Japan has during the past few years assumed an important rank in the list of commercial nations, and in doing so has vastly increased her commerce with the United States, the nation instrumental in first opening the doors of that country to commerce with the world. Within the last two years new treaties have been made with the principal countries of the world, by which their citizens are given equal privileges with the citizens of Japan in all parts of the empire and made subject to its laws, which have been recently revised. Also new commercial codes have been established, new currency adopted, new tariffs created, and new ports opened for commercial intercourse with the world. Lastly, Japan and the United States have become near neighbors physically, Japan's northern territory, the Kurile islands, lying within 500 miles of the Aleutian islands, while her southern extreme, Formosa, is within 200 miles of the Philippines, thus making a complete chain along the Pacific front of Asia. From Yokohama, her most important port of entry, the distance to Manila as a trade center is practically the same as that to Hongkong, which has proved so important a distributing point for British trade. From Yokohama to Honolulu, a distance of 3,400 miles, Japanese steamships now regularly ply, and from Yokohama to the Pacific coast ports of the United States the distance is far less than to the ports of any other great commercial nation, while the opening of an isthmian canal would greatly lessen the water route between Japan and the Gulf and Atlantic ports of the United States, from which she draws so large and constantly increasing a proportion of her supplies.

To the readers of The National Geographic Magazine the earlier commercial relations of Japan to the world and the part which the United States has had in developing them are so well known that they need not be recounted in detail. Portuguese adventurers, who were the first to establish commercial relations in China, soon extended their trade to Japan, where sailors landed in 1542, and within a few years established an active commerce. Encouraged by that success, the Dutch East India Company in 1598 dispatched five merchant vessels to Japan. In 1609 other Dutch ships arrived and were well received by the Japanese, who conceded them a port on the island of Hirado and the privilege of establishing a "factory" or trading post and settlement. The hostilities between the Portuguese and Dutch, however, and the extreme demands of the Portuguese, who considered themselves already established in the commerce of Japan, coupled with dissatisfaction with the attitude of foreign missionaries toward the popular religion of Japan, led to the exclusion of all traders except the Dutch, who were permitted to take up their residence on a small island, Deshima. Here they remained for more than two centuries in undisturbed monopoly of the entire European trade of Japan. In 1852 serious complaints of mistreatment of American sailors wrecked on the coast of Japan having been made, Commodore M. C. Perry, with a fleet of American vessels, was sent by the United States government to demand from Japan a treaty by which American vessels should be allowed to enter one or more of its ports to obtain supplies, and, if practicable, that Americans should also be given general trading privileges in these ports. This undertaking was peacefully carried to a successful termination, a treaty being signed March 31, 1854, by which the ports of Shimoda and Hakodate were opened as harbors of refuge, supply, trade, and consular residence to the United States. This action was quickly followed by a successful demand for similar privileges by the British, Russian, and Dutch governments, and by 1860 the ports of Hakodate, Kanagawa, Nagasaki, and Niigata were opened to the commerce of the leading nations of the world.

From this time forward the commercial relations of Japan with the world made rapid progress. In 1860 and 1861 a Japanese embassy visited the United States and Europe. The decade 1860–'70, while largely occupied by dissensions, and in some cases hostilities, between the elements favoring commercial relations with the world and those preferring former methods, saw marked developments within Japan, the beginning of the adoption of the customs and methods of western nations, and laid the foundation of the progress which has since been made. In 1871 another embassy, consisting of the ambassador and junior prime minister, Iwakura, the vice-ambassador, Kido, Count Ito Hirobumi, the three ministers of the cabinet, and several officers, sailed from Japan to visit all the nations having treaties with that country.

The development of Japan which followed these tours of observation and intercourse with other nations of the world was very rapid. Schools were increased, students were sent abroad to obtain a higher education and study foreign methods, internal highways made, steamships built and communication with foreign countries increased, manufacturing industries encouraged and multiplied, and business men from other countries welcomed to participate in the commercial and business development of the country. As a consequence, the foreign commerce of Japan, which in 1878 amounted to less than $30,000,000, in 1898 was over $218,000,000, while the development of railroads, manufactures, and internal industries had been equally great.

The United States, which has been constantly and actively associated with the development of Japan, has participated largely in the growth of her commerce. Thousands of young men from Japan have visited the United States as students, and thousands of merchants and business men from the United States have gone to Japan as instructors both in educational and commercial lines. As teachers and professors in schools and colleges, as editors and publishers, as merchants who engage in both importing and exporting, as manufacturers, as constructors of railways and telegraphs and in establishing modern electrical aids to commerce, citizens of the United States have been active in Japan. As a consequence, the trade relations between the two countries have grown with greater rapidity than between Japan and any other nation. In 1881 the imports from the United States formed less than 6 per cent of the total importations into Japan, while in 1898 they formed 15 per cent of the total importations. Meantime Great Britain's share in the imports of Japan fell from 52 per cent in 1881 to 23 per cent in 1898. The United States is also Japan's largest customer by reason of the fact that the chief export products of Japan are articles required by the manufacturers of the United States and cannot be produced in this country.

Of the $23,560,000 total exportations to the United States in 1898, the value of $12,620,000 consisted of raw silk, $3,286,000 of tea, $1,847,000 of mats for floors, $347,000 of rice, $336,000 of chemicals, drugs, etc., and $3,109,000 of manufactures of silk, while Japanese foot-mats, manufactures of bamboo, lacquered ware, and other products peculiar to the Japanese are prominent in the list. Exports from Japan to the United States have steadily grown, especially since the development of the silk manufacturing industry in this country. The United States is the largest purchaser of raw silk from Japan, whose total exportations of raw silk exceed $28,000,000. France is the next largest customer in this line, her purchases of raw silk from Japan in 1897 amounting to $10,000,000 in value against $16,000,000 by the United States. The exports from Japan to the United States in 1881 were $5,500,000 in value, being 36.5 per cent of the total exports of that year, and in 1898 were $23,600,000, or 29.06 per cent of the total exports of that year.

Japan's imports from the United States have grown with even greater rapidity than her exports to the United States. In 1881 they amounted to but $890,000, and in 1898 had reached $20,000,000 in value. They have increased even more rapidly than the total importations of Japan, our share of her import trade having risen from 5.72 per cent in 1881 to 14.57 per cent in 1898, while the United Kingdon, our principal competitor in that market, which furnished in 1881 52.51 per cent of the total imports of Japan, supplied in 1898 22.84 per cent. In the fiscal year 1892 our total exports of domestic merchandise to Japan amounted to $3,288,282, and in 1899 to $17,158,970. Of this total of $17,158,970 exported to Japan in the fiscal year just ended, the largest item was raw cotton, which amounted to $5,775,784 in value; the next largest was tobacco and manufactures thereof, amounting to $2,927,700; then followed iron and steel and manufactures thereof, $2,578,616; illuminating oil, $2,341,922; breadstuffs, $744,562; wood and manufactures thereof, $530,693; distilled spirits, $414,404; paper and manufactures of, $350,118; instruments for scientific purposes, $232,000; provisions, $212,408; leather and manufactures of, $209,611; clocks and watches, $133,307; paraffine wax, $132,273; lubricating oil, $119,553; chemicals, drugs, and dyes, $80,498; condensed milk, $76,701, and india-rubber manufactures, $57,579.

Taking up the great class of iron and steel and examining it in detail, we find that the exports of locomotive engines in 1899 amounted to $529,514; builders' hardware, $26,498; sewing machines, $5,270; car wheels, $3,624; firearms, $38,306; machinery not separately specified, $569,641, and iron and steel not separately specified, $1,405,715.

A detailed study of the exports from the United States to Japan with the purpose of determining the articles mostly in demand in that country during the decade, and in which the export trade has most rapidly grown, shows that the largest item is raw cotton, the value of which exported in 1890 amounted to but $85,211, had grown to $7,435,526 by 1898, and was $5,775,784 in 1899, the imports of 1898 having been somewhat excessive. Leaf tobacco, which was exported in such small quantities prior to 1894 that it found no separate statement in the official accounts, amounted in 1894 to $820, in 1897 to $55,124, and in 1899 to $2,414,482. Cigarettes amounted in 1890 to $76,556, in 1894 to $137,895, and in 1899 to $445,263. Illuminating oil, which in 1890 amounted to $3,559,395 in value, was in 1899 $2,341,922. This reduction is due in part to the active competition by Russian and Sumatran petroleum and in a small degree to the fact that Japan is now producing some petroleum from her own wells, though a recently published statement indicates that the product is small and the cost of producing practically as great as importing from other countries. It is proper to add, however, that the reduction indicated by the figures quoted is more apparent than real, and is partially due to a reduction in price per gallon, the total exports of illuminating oil to Japan in the fiscal year 1899 being 32,705,180 gallons, against 37,892,930 gallons in 1890. Flour has increased from $127,120 in 1890 to $722,710 in 1899. This increase is evidently due to a growing disposition among the Japanese to consume more of this class of food rather than rely as largely upon rice as in former years, since the number of foreigners in Japan, other than Chinese and Coreans, amounts to but about 5,000, and has not materially increased during the period in which our exports of flour to that country have more than quadrupled.

The growth of the importations of tobacco into Japan has been phenomenal. In 1892 the total importation of tobacco, leaf and cut, was valued at $40,000; in 1896 it was $74,000; in 1897, $212,000, and in 1898, $2,350,000, this extraordinary importation of 1898 being due in part to the increased rate of duty provided by the new tariff; but the fact that in 1897 it was three times as much as in the preceding year would indicate a rapid growth in the demand for tobacco. An examination of the table of exports of tobacco from the United States shows that the markets of this country benefit by practically all of this increase, the exportations of tobacco from the United States to Japan in the fiscal year 1899 being $2,927,700 in value, as against $671,272 in the preceding year, prior to which time there had been a steady growth in the exports of tobacco from the United States to Japan.

In paper and its manufactures the export trade to Japan has grown very rapidly, the total exports of this class being, in 1890, $1,606; in 1896, $10,126, and in 1899, $350,118. Instruments for scientific purposes increased from $9,441 in 1890 to $34,600 in 1894, $148,271 in 1897, and $232,892 in 1899. Paraffine wax, of which the exports only began to be separately stated in 1891, amounted in that year to $255, and in 1894 to $73,315, in 1896 to $127,001, and in 1899 to $132,273. Chemicals, drugs, and dyes increased from $23,030 in 1890 to $80,498 in 1899; manufactures of india-rubber increased from $22,871 in 1890 to $57,579 in 1899. In the same period canned beef increased from $11,212 in 1890 to $40,750 in 1899, and beef, salted or pickled, from $628 to $42,893. Leather and its manufactures find a steady demand in Japan, owing to the fact that the number of cattle and other animals whose skins are used for this purpose is comparatively few. The total number of cattle in Japan is given in the last census as 1,148,761, or 26.92 for each 1,000 inhabitants, while in the United States, according to the latest reports of the Department of Agriculture, the number of cattle is 44,000,000, or about 600 for each 1,000 inhabitants.

Exportations of cotton cloths to Japan have fallen by reason of the rapid increase in the manufacture of cotton cloth in that country, the total for 1899 being but $33,828, against $141,264 in 1897. Meantime, however, exportations of raw cotton to Japan have rapidly increased, being, as already indicated, $5,775,784 in 1899, against $85,211 in 1890. This is largely due to the increase in the manufacture of cotton goods in Japan, though American cotton has grown in popularity with the manufacturers there within the past few years. Experience has shown them that cotton from the United States is more satisfactory for use in manufacturing than that which they had been accustomed to obtain from India and China, the staple in American cotton being longer, thus giving better results. As a consequence, imports of American cotton now form a much larger percentage of the total importation into Japan than in earlier years, although the cottons of China and India have largely the advantage both in the matter of proximity and cheapness of labor utilized in their production. Japan also produces a considerable amount of cotton of her own, though it can scarcely be expected that the production will increase sufficiently to keep pace with the growth of her cotton manufacturing industry.

The entire area of Japan is but 169,140 square miles, or less than the State of California, while but about 10 per cent of her land is under cultivation and but a comparatively small proportion cultivable, since mountain ranges and rocky islets and shores form a large proportion of her area. It must be remembered that Japan, with a small cultivable area, has a population of about 45,000,000, and must therefore devote most of her arable land to the production of foodstuffs, while her natural products of silk and tea are so much in demand the world over that they are not likely to be displaced for cotton, which can be so readily brought from other and comparatively adjacent countries. Cotton manufacturing in Japan has, however, grown very rapidly, the total number of spindles in 1899 being 4,358,702, against 5,468 in 1863 and 43,700 in 1883. It is thus apparent that Japan will continue to purchase from other parts of the world a large proportion of the raw cotton which her rapidly growing cotton mills will consume, and as the cotton from the United States has already made rapid headway against that from the nearer countries of China and India, it is reasonable to assume that the market for American cotton will continue to grow, especially if an isthmian canal gives opportunity for direct water shipments from the cotton-growing section of the United States.

In iron and steel there seems no reason to doubt that the demand upon the United States will continue. The importations of manufactures of iron and steel into Japan have grown very rapidly. It is apparent that the demand for manufactures of this class will continue to increase with perhaps greater rapidity. The various manufacturing and mechanical industries are being encouraged by the government and by Japanese capitalists, as are also the construction of railroads, the building of ships, and other enterprises of this kind, which will require great quantities of iron and steel and their manufactures. While considerable quantities of iron ore are known to exist in various parts of Japan, it is not believed that they will prove sufficient to seriously interfere with or take the place of the supplies now being furnished from other countries, especially since there are few places where iron and coal are found in conjunction. In addition to this, it may be said that while the coal supply is now such as to have become quite an article of export, rivaling that of Australia and other localities in that part of the world, I do not believe that it will be sufficient to meet the great demand upon it for all classes of manufactures for any considerable term. Besides, the large capital required for the construction of establishments for the manufacture of iron and steel, coupled with the extreme cheapness of production in the United States through proximity of coal and iron mines, makes it improbable that the market in Japan for manufactures of this class will be seriously impaired by local production and manufacture.

One important factor entering into the question of local manufactures in Japan, making her a competitor with other countries which have formerly held this market, is that of labor. All recent] writers agree that rates of wages in Japan have very much increased in the last few years and are likely to continue to increase, and that the fear formerly expressed that a combination of modern manufacturing developments with the cheap labor of the Orient would result in driving the manufacturers of other parts of the world out of the markets thus far does not seem to have been justified by the experiment. An interesting illustration of this statement is seen in the importations of clocks and watches. The opinion was expressed a few years ago that the cleverness of Japanese workmen in reproducing articles of delicate workmanship brought to their attention would soon reduce to a minimum the importation of clocks and watches and other articles of this character. Experience, however, has not justified this belief. The importation of clocks and watches into Japan, according to the official figures of the Japanese government, has increased from $320,000 in 1892 to $1,400,000 in 1898.

That the effect of the new treaties upon the business relations of foreigners in Japan will be extremely important, not alone to foreigners, but to Japanese commerce in general, is shown by the fact that in 1898 foreign merchants exported $53,650,000 in value of the total exports of $81,075,000, and imported $91,800,000 of the total imports, which amounted in that year to $136,720,000, or, in other words, of the total foreign commerce of Japan in 1898, which amounted to $217,800,000, $145,450,000, or about 67 per cent, was conducted by foreigners. While the foreign residents of Japan generally look with some anxiety upon the effect of the new relations, which will subject them to Japanese laws and customs, it is believed that their anxiety is more the dread of a change from a system to which they have always been accustomed than to any real hardships or disadvantages which the new order is likely to develop.

BIG BAD LANDS — SANDSTONE CAPS ON CLAY COLUMNS — LOOKING NORTHWEST FROM HEAD OF INDIAN DRAW, WASHINGTON COUNTY, SOUTH DAKOTA

THE BAD LANDS OF SOUTH DAKOTA

By N. H. Darton,

U. S. Geological Survey

There are Bad Lands of greater or less area in various portions of the arid and semi-arid districts of the west. The most extensive tract is in the southwestern part of South Dakota, on White river, a short distance east of the Black hills. They begin near the 101st meridian and extend for about 120 miles up the White River valley, nearly to the Nebraska line. Their width varies from 30 to 50 miles and their total area is about 4 000 square miles. They attain their finest development on the north side of the valley, along the divide between White river and the south fork of the Cheyenne river. This divide is high and narrow, and is composed of the light colored clays—of the White River formation—and is a region of slight rainfall.

The principal factors in bad-land development here are massive structure of the moderately hard clay and the steep declivities which, together, afford exceedingly favorable conditions for rapid erosion. Somewhat similar conditions prevail on the south side of the White River valley. The region was originally a relatively smooth plain. It was uplifted in a recent geologic time, and as the White river and the south fork of the Cheyenne river deepened their valleys during the progress of this uplift, they and their branch streams cut deeply into the surface of the plains. As erosion progressed, portions of this surface have been sculptured into narrow ridges, steep-sided buttes, rounded domes, pinnacles, and castellated forms in endless variety. Portions of the plains remain as grass-covered table-lands, usually bounded by high, rugged cliffs of clay, and deeply channeled by intricate winding cañons. As erosion is more rapid than soil formation, the slopes are bare and their prevailing tints are flesh, cream, ashy gray, pale green, and buff. The material is fairly homogeneous in its texture, but owing to slight differences in texture, it is carved and channeled into great variety of forms. Occasionally thin beds of sandstone and beds of slightly harder clays add to the complexity of erosion products. The lower beds of the formation are filled with thin vertical veins of chalcedony, a very hard material, which stands out in innumerable minute ridges and accumulates on the surface in fragmentary condition as the clay is washed away.

To one standing on a high point in the midst of the Bad Lands, a unique view is presented. The bare surfaces are dazzlingly bright in the sunlight. Mesas and buttes, pinnacles and spires of every variety of form rise to varying heights in intricate confusion. Small areas of original plains surface stand as mesas presenting steep walls, deeply notched by cañons and with projecting ridges cut into spires and pinnacles, often of considerable altitude. Many of the pinnacles are capped by masses of sandstone which have protected the underlying clay and left a column standing. A typical general view in the Bad Lands is given on page 338, which also shows some representative pinnacles. The highest features in the region rise from 150 to 300 feet above the valleys. These valleys penetrate far into the Bad Lands, and often contain sufficient soil to sustain a sparse growth of grass. They contain water holes at long intervals, in which limited supplies of water are occasionally preserved far into the autumn, often covered by a thin pellicle of mud which diminishes evaporation. One of the most prominent features in the Bad Lands is the "Great Wall," which extends along the north side of the White River valley for many miles. It is a bare escarpment descending from a ridge of grass-covered table-land, deeply invaded from the northwest by wide bad-land valleys extending toward the Cheyenne river.

Near the center of the bad-land area rises a prominent remnant of the original plain, known as Sheep mountain, named from the mountain sheep, some of which still remain there. Its table-like surface is covered with grass, but its slopes are marked by a wide zone of bad lands, consisting of high, bare cliffs intricately cañoned and buttressed as shown on page 341.

Very few roads cross the Bad Lands, but there are a few lines of travel through them, which have served for communication. The greater part of the area lies within the Pine Ridge Indian Reservation.

The Bad Lands are famous for the large amount of fossil animal remains which they contain. They have produced hundreds of tons of fossils of Tertiary animals, and every season the region receives visits from one or more parties of "bone-hunters," as they are called, from some of the colleges. A trip to the Big Bad Lands is an interesting experience. They may be easily reached

NEAR SOUTHERN END OF SHEEP MOUNTAIN, WASHINGTON COUNTY, SOUTH DAKOTA

TOADSTOOL PARK, NEAR ADELIA, SIOUX COUNTY, NEBRASKA from several points along the line of the Chicago and North-Western railway, Black Hills division. Hot Springs, on both the North-Western and the Burlington railway lines, is within two days' drive from Sheep mountain, but Hermosa, on the North-Western railway, is somewhat nearer. At this station conveyance may be had, and a fairly large area of the Bad Lands may be seen in a three-days' trip, including a climb to the top of Sheep mountain and the top of the divide between the head-waters of Indian creek and Cottonwood draw.

The White River clay formation extends into Nebraska, and at a number of localities exhibits characteristic bad lands. Near Adelia, on the Burlington and Missouri River railroad, in the extreme northwestern corner of Nebraska, there is a small but exceedingly interesting area of these bad lands, presenting the usual characteristics. One particularly unique locality in this vicinity is shown on page 342. On the North Platte river the same formation presents many striking topographic features, notably Jail Rock, in Cheyenne county, an admirable illustration of which appears as the frontispiece.

THE WEST INDIAN HURRICANE OF AUGUST 7–14, 1899

By E. B. Garriott,

Professor of Meteorology, U. S. Weather Bureau

The American public has manifested a peculiar interest in the West Indian hurricane of August 7–14, 1899. This interest may be partially attributed to the fact that for the first time in her history the United States possessed territory in the tropics which was devastated and made temporarily dependent by a hurricane. And aside from this consideration the storm afforded an opportunity for demonstrating the utility of the newly organized West Indian branch of the United States Weather Bureau. The experience of Puerto Rico in this hurricane is of special interest and importance for the reason that she possessed the advantage of a full-reporting station of the Weather Bureau from which warnings of the approach of the hurricane were disseminated the day before its arrival and where accurate data near the path of the center of the disturbance were recorded.

Extending nearly four hundred miles east and southeast from Puerto Rico are the Leeward islands of the Lesser Antilles. To the west of Puerto Rico is the island of Santo Domingo. North and distant about one hundred miles from the Santo Domingo coast are the easternmost islands of the Bahama group, which extend from the Turks islands on the east about six hundred and fifty miles in a northwesterly direction to the west end of Great Bahama island, which is seventy-five miles from the Florida coast. These islands border a line drawn northwest by west from Guadeloupe, one of the southernmost islands of the Leeward group, over the Bahamas, a distance of 1,400 to 1,500 miles, and this line represents the approximate path of the hurricane from August 7 to 12.

Puerto Rico records show that the usual path of hurricanes is somewhat to the south of that island, and that during the last four hundred years the island has been visited by eight hurricanes which were attended by a marked loss of life or property. The first of these occurred in July, 1515; the second in 1527, when the executive building in San Juan was destroyed, and the third on August 21, 1615, when the cathedral was demolished. The *San Juan News* of August 8, 1899, which contains this record, states that the most violent hurricane in the history of Puerto Rico occurred on the night of August 22, 1772. It continued from eleven at night until three in the morning, in alternating violent gusts and squalls. Trees were torn up by the roots, fields were inundated, plantations disappeared, and a large number of people were killed and buried under the ruins of their houses. On September 4, 1806, a hurricane caused great damage at Ponce. On September 21, 1819, crops were damaged to such an extent that a famine followed. A violent hurricane, which is remembered by many present residents of the island, occurred October 29, 1867. On August 14, 1886, a hurricane passed to the south of Puerto Rico, doing considerable damage along the south coast and destroying crops in the interior.

Incubated in the warm and exceedingly moist region of equatorial rains, the hurricane of August 7–14, 1899, advanced toward the outlying islands of the Leeward group during the night of August 6, its approach being first indicated by the 8 a. m. reports of August 7 from the Weather Bureau stations at Roseau, Dominica, and Basse Terre, St Christopher. Moving northwestward during the afternoon and night of the 7th, the hurricane center apparently passed almost directly over Guadeloupe and Montserrat and to the south of the Virgin islands, which are the extreme western islands of the Leeward group. The island of

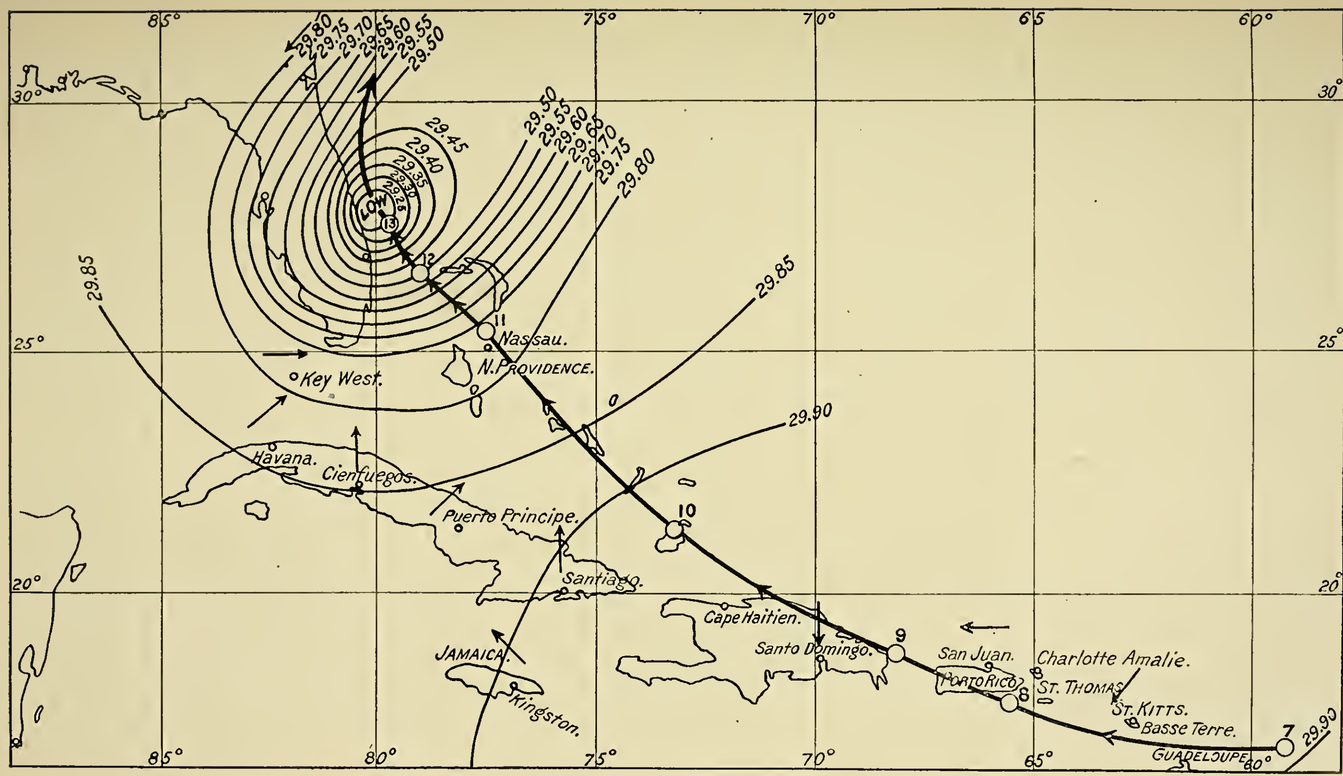

DIAGRAM SHOWING TRACK OF WEST INDIAN HURRICANE OF AUGUST 7–14, 1899

Guadeloupe suffered severely, and on the island of Montserrat nearly 100 persons were reported killed and villages and estates were destroyed. On the islands of Nevis, St Christopher, and Antigua the storm was less severe, while the Danish island of St Croix was the only one of the Virgin islands which suffered to any great extent.

Between 8 and 9 a. m. of August 8 the hurricane center passed over or very near the south coast of Puerto Rico, attended by an appalling loss of life and property, and by the morning of the 9th had reached a position near the north coast of Santo Domingo. Following a west–northwest track, the hurricane center arrived at the eastern Bahamas and evidently passed near Grand Turk island during the night of the 9th. The position and course of the storm during the succeeding twenty-four hours were approximately determined by the distant Weather Bureau stations of observation at Santiago and Puerto Principe, Cuba, and by regular and special reports received through the coöperation of the colonial government at Nassau, Bahamas. By the morning of the 11th there was evidence at Nassau of the approach of the storm-center. During the day the barometer fell rapidly, with increasing northeast winds and heavy rain, and during the evening cable communication between Nassau and Jupiter, Fla., was lost. On the following day, August 12, the barometer fell rapidly at Jupiter, with wind increasing to a gale from the northeast, and by the morning of the 13th the barometer at that station had fallen to 29.22 inches and the wind had reached a velocity of 52 miles an hour. From the 14th to the 19th the storm-center drifted slowly northward and northeastward along the Atlantic coast, attended by severe gales and high seas from Florida to Virginia, after which it apparently passed eastward over the ocean beyond the region of land observation.

With data now available it is not possible to determine the intensity of this hurricane at various points along its course. During August 7 and 8 the character and extent of the destruction it caused will give it rank among the historical hurricanes of the Leeward islands, Puerto Rico, and Santo Domingo. During the period it occupied in advancing from Santo Domingo over the Bahama islands and thence northward off the Atlantic coast of the United States, no observations have been received which show the exact strength of the storm as measured by instrumental observations. Observations of this character, made by shipmasters who encountered the hurricane, will furnish data for a later and more exhaustive report. In the meantime reports of disasters at sea are being multiplied, and when the history of this hurricane is completed the casualties it caused on land and sea will aggregate hundreds of human lives and millions of dollars' worth of property.

Owing to the special interest taken in Puerto Rico by the people of the United States, and to the fact that this island possessed the only fully equipped and regular reporting station of the Weather Bureau which occupied a position in the path of the hurricane, and near its center, an account in detail of the storm's characteristics will at this time be confined to data contained in instrumental records and reports rendered by the official in charge of the Weather Bureau office at San Juan. At San Juan the barometer began to fall at 10 p. m. of the 7th, and the lowest recorded reading, 29.23 inches, was reached at 8.30 a. m. of the 8th. The wind was variable, with occasional gusts during the night of the 7th–8th, and gradually settled into a gale from the northeast toward the morning of the 8th. The hurricane was at its height at San Juan between 7 and 9 a. m. of the 8th, when the wind velocity was calculated by the Weather Bureau observer at 85 to 90 miles an hour. The observer reports that practically no thunder and lightning attended the storm, only two flashes of lightning, and they were not severe, being observed by him. The rainfall was very heavy, a total of 6.37 inches falling, of which 4.18 inches fell from noon to 8 p. m. of the 8th. Ponce and the port of Ponce on the south coast were wrecked, with a loss of about two hundred lives and an aggregate property loss of at least $500,000. The estimated damage to property throughout the island is in the millions of dollars. Dwellings were destroyed and crops were ruined and the main body of the working population will be for a time dependent on the United States, their home government, for the necessities of life.

In conclusion, it seems proper to refer to the action taken by the United States Weather Bureau in giving warning along the line of its advance of the approach of the hurricane center. Immediately upon the receipt of the morning reports of August 7, when the storm was central east of Dominica, the central office of the Weather Bureau at Washington ordered, through Habana, Cuba, hurricane signals from Dominica to Puerto Rico, and the signals were carried to Santo Domingo the afternoon of the 7th. Messages containing information regarding the position and probable course of the hurricane were sent to all Weather Bureau stations in the West Indies from Barbados to Cuba; and as the hurricane moved westward signals were ordered and advices were telegraphed to all Weather Bureau stations in the threatened districts and to Atlantic coast and Gulf ports and there given the widest possible dissemination. In fact, the warnings foreran the storm by a period which varied from a few hours at the easternmost Leeward islands to 36 and 48 hours at points along the South Atlantic coast and Gulf ports of the United States. That the warnings were prompt, accurate, and of almost incalculable value is universally acknowledged by owners and masters of vessels who by holding their vessels in port avoided a hurricane which, by the evidence of disasters and reports of disasters, was one of exceptional violence.

THE RETURN OF WELLMAN

By J. Howard Gore,

Professor of Mathematics and Geodesy in the Columbian University

In the short article that appeared in The National Geographic Magazine for July, I mentioned three obstacles that might stand in the way of Mr Wellman's success in his attempt to reach the ultimate north. From the meager accounts that have reached us it appears that all three of these hindrances were encountered: a high latitude was not reached last year, the greater part of the expedition spending the winter at or near the point of debarkation and only two members of the party advancing northward; death carried away one of the best and strongest men and the leader himself was incapacitated by a serious accident; and, finally, a breaking up of the ice on which they were encamped caused a loss of a considerable part of the equipment.

Fortunately we are assured that some important discoveries were made in the neighborhood of Freedom island; possibly this means that the four or five islands already known were more accurately located and perhaps better delineated. It is to be hoped that magnetic observations were made during their winter sojourn, and that aurora displays were carefully noted. Such a series of observations might yield an adequate return for the outlay of capital, labor, and suffering.

WALTER WELLMAN

CAPE TEGETTHOFF — THE HEADQUARTERS OF THE WELLMAN EXPEDITION

The most pathetic incident that has reached us is the account of the lonely vigil of Bjoervig. We are told that he and Bentzen were spending the winter night alone in the outpost camp, nearly a hundred miles north of the main camp. Here Bentzen died—surely not from the scurvy, as anti-scorbutic food in abundance had been taken from Norway—and, with the inherent dread the Norwegians have of having bears feed upon their bodies, he evidently exacted from his companion a promise to preserve his corpse until the summer sun could loosen enough stones to form at least the semblance of a grave. Such a promise was made to be kept, and for two months the little tent-like hut sheltered the living and the dead. These two men during the days of preparation were always together. Both knew much of the dangers and labor that would soon confront them, and they worked with the common purpose to prepare to meet them. In the discussions and conjectures as to who would form the advance guard, all wished to be included, but all knew that these two would surely go; their fitness picked them out. And now Bentzen, the jolly, robust, energetic, noble-hearted man, has taken another and still longer step into the unknown, and Bjoervig has returned with the last messages of his companion and the memories of that long night of waiting. Such an example of fidelity almost merits the hardships of the Arctic for its procuring.

Now that Mr Wellman will soon be with us, it is better to await his story of what was accomplished, and content ourselves at this point with saying that if it speaks of failure in any form it will give positive proof that, under the circumstances, herculean efforts could not have yielded better results.

THE INTERNATIONAL CLOUD WORK OF THE WEATHER BUREAU

By Frank H. Bigelow,

Professor of Meteorology, U. S. Weather Bureau

In the month of May, 1896, several national meteorological services began in coöperation to take a series of simultaneous observations on the height and the motion of the ten standard types of clouds which have been defined by the International Committee. The object of this survey of the movements of the atmosphere, continued for at least one year, was to gather material that could be used to determine the action of the higher strata with reference to the formation and the progressive motion of storms. Our observations are generally so exclusively made in the lowest level of the ocean of air that comparatively imperfect information exists regarding the higher currents upon which to found intelligent theories, and it is with the purpose of supplying this deficiency that the series of international observations was undertaken. By the liberal policy of the United States government the Weather Bureau was able to do its part of this work. The discussion of the data is now nearly finished for the report which it is expected to issue before the end of the present year. While it is not practicable to give any detailed account of the results, it may be interesting to have presented in THE NATIONAL GEOGRAPHIC MAGAZINE a brief synopsis of the scope of the report now being prepared by the writer.

The observations are divided into two classes: (1) The *primary*, which are made by means of two theodolites placed at the end of a long base line adapted to triangulations in the vertical direction. These give the *absolute* heights, velocities, and direction of motion of individual clouds; between 6,000 and 7,000 of such observations were made at Washington, D. C. (2) The *secondary*, executed with nephoscopes at fourteen stations distributed at nearly equal distances from each other over the districts east of the Rocky mountains, give the *relative* velocities and direction of motion, and with the help of the results obtained by the primary system can be translated into absolute values; there were 25,000 to 30,000 of these observations made in the United States.

The discussion of these data has been divided into a number of parts, of which the following may be mentioned in this connection: (1) The distribution of the cirrus, cirro-stratus, cirro-cumulus, alto-cumulus, alto-stratus, strato-cumulus, cumulo-nimbus, nimbus, cumulus, stratus, was so determined that we now know the average height of each type for every month in the year and the depth of the zone or horizontal belt in which they may severally occur. Thus the upper types are found in layers as much as six miles thick, though they form most frequently near the middle of their respective belts; the lower are thinner, and have some peculiar characteristics besides. When we consider that the height and shape of these belts, changing from month to month, indicates some very delicate physical process going on in the aqueous vapor of the atmosphere, it is easy to see that they become the best means for studying the state of the pressure, temperature, and vapor tension—that is, the physics of the air itself. (2) A very important subject has been the determination of the direction and velocities of the horizontal motions of the air in each of the eight principal levels, on all sides of the anti-cyclones and cyclones, high and low areas of pressure, as they move over this country. These movements have been separated into two components, the first belonging to the general or undisturbed motion of the atmosphere, which is about eastward in this latitude, and the second to the local motions, which are gyratory and especially concerned with descending and ascending vortices or storms. These data give us for the first time definite information regarding storm components, and these enable us to look into the theories much more closely than heretofore. (3) This analysis has been supplemented by a compilation of cloud motions taking place in the cumulus or the cirrus levels, as derived from the Weather Bureau cloud charts collected during the past twenty years, the object of which is to show how the average anti-cyclone and cyclone are affected by the circulation of the air over different parts of the United States—that is, by the Rocky mountains, the Lake region, the Gulf of Mexico, and the Atlantic States—the results being exhibited on a series of colored charts.

These practical facts lead to the necessity of definite theoretical studies in order to account for them, and this again to several other lines of research: (1) The first thing was to prepare a system of standard constants and formulæ by a comparative study of the papers of several authors, and by the addition of such new demonstrations as seemed desirable, so that the work of many men in their several branches may be read as one consistent meteorological scheme. This standard system represents the outcome of several years' study of the subject. These formulæ include most of the thermodynamic or hydrodynamic conditions likely to arise on a rotating body surrounded by an atmosphere, like the earth. (2) Next, a completely new set of working tables, based upon these formulæ, has been prepared for the barometric reductions from one level to another; for studying with the greatest accuracy the exact conditions of pressure, temperature, and vapor tension at the level where a cumulus cloud base forms by the vertical convection, at the place where the hail forms, and at the level where the snow is produced, and finally for computing the dynamic forces and the gradients of motion according to the observed velocities. These tables are permanently useful to meteorology, and that they are needed is seen from the following considerations: The Smithsonian tables and the International tables are adapted for the reduction from elevations 2,000 meters or less to the sea-level; but in cloud-work it is necessary to reduce at will throughout a region up to 15,000 meters in height and with ranges of temperature from + 30° to — 60° centigrade, which is far beyond the limits of any existing tables. The Hertz diagram for adiabatic expansion leaves out the vapor contents of the air in parts of the formulæ, introducing errors as much as 0.30 inch in pressure. Besides, it is desirable to be able to start with surface conditions and compute upward in exact figures all the elements existing in the cloud, and also the gradients connecting one level with another.

Since the atmosphere differs very widely from the adiabatic laws, one of our problems is to discuss how much this departure is for all seasons of the year, and from these data we expect to study carefully the laws of solar insolation and terrestrial radiation—that is, the actinometry of the atmosphere—by means of this new and improved material. Finally, there are no tables published which are available for computing the dynamic forces indicated by the equations, and this is necessary if meteorology is to be made an exact science. (3) The possession of all this new matter enables us to analyze closely the Ferrel theory of the local cyclone and the German theory of the same, which differ from each other, and to show that they are both only ideal solutions of vortices and do not conform to the stream lines given by the observations. An attempt has been made to interpret the analytical equations of motion, so that they shall match the observed facts, and this leads to a different idea of the circulation in storms from that commonly taught by meteorologists. The application of the theory to tornadoes is certainly satisfactory, and in the case of hurricanes and cyclones it is on the whole very promising.

The new treaty between the United States and Japan went into effect on July 17. The main feature of the treaty is the abolition of the jurisdiction of the United States consular courts in Japan. Henceforth all the exceptional privileges, exemptions, and immunities formerly enjoyed by citizens of the United States, as a part of or appurtenant to such jurisdiction, will absolutely cease and all such jurisdiction will be assumed and exercised by Japanese courts.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The forty-eighth annual meeting of the American Association for the Advancement of Science was held in Columbus, August 19–26. While naturally not attended by as large numbers as was the jubilee meeting in Boston the preceding year, the work accomplished yielded even better results, as the more effectual organization and the limited number of papers read permitted the free discussion of nearly every subject presented. The purpose and work of the Association, and at the same time the achievements of modern science, are admirably reviewed in the following paragraphs from the opening address of the distinguished President, Dr Edward Orton:

"Alfred R. Wallace has recently made a careful inventory of the discoveries and inventions to which the progress of the race is mainly due, and he divides them into two groups, the first embracing all the epoch-making advances achieved by man previous to the present century, and the second taking in the discoveries and advances of equal value that have had their origin in the nineteenth century. In the first list he finds but fifteen items of the highest rank, and the claims of some even of this number to a separate place are not beyond question. They may not really be of epoch-making character. But he puts into the list the following, *viz.:* Alphabetical writing and Arabic notation, which have always been the two great engines of knowledge and discovery. Their inventors are unknown, lost in the dim twilight of prehistoric times.

"Coming, after a vast interval, to the fourteenth century, A. D., we find the mariners' compass, and in the fifteenth century the printing-press, both of which, beyond question, are of the same character and rank as alphabetic writing. From the sixteenth century we get no physical invention or discovery, but it witnessed an amazing movement of the human mind, which in good time gave rise to the great catalogue of advances of the seventeenth century, the most prolific of all the centuries antecedent to our own. To it we credit the invention of the telescope and, though not of equal rank, the barometer and thermometer, and in still another field the invention of differential calculus, the all-important discovery of the attraction of gravitation, of the laws of planetary motion, of the circulation of the blood, of the measurement of the velocity of light. To the eighteenth century we refer the more important of the early steps in the evolution of the steam-engine and the foundation of both modern chemistry and electrical science. This completes the list. Counting all these inventions and discoveries as separate, we get sixteen. Wallace places the barometer and thermometer under one number, and makes a total of fifteen.

"In making such a list it is evident that the personal equation of the author undoubtedly needs to be recognized, and different orders of arrangement, even if the elements were the same, would be assigned by different students. At any rate, something like this is the list of what the race has gained in science since it first came to itself up to the year 1800. The greatest steps have certainly all been counted.

"And now what has the record been since 1800? How does the nineteenth century compare with its predecessors? A brief examination will show us that in scientific discovery and progress it is not to be compared with any single century, but rather with all past time. In fact, it far outweighs the entire progress of the race from the beginning up to 1800. Counting on the same basis as that which he had previously adopted, Wallace finds twenty-four discoveries and inventions of the first class that have had their origin in the nineteenth century against the fifteen or sixteen already enumerated of all the past. This is not the proper occasion to review, compare, and set in order the several elements of this glorious list, but let me simply recall to your minds a few of them.

"Of the same rank with Newton's theory of gravitation, which comes from the seventeenth century, stands out the doctrine of the correlation and conservation of forces of our own century, certainly one of the widest and most far-reaching generalizations that the mind of man has yet reached. Against Kepler's laws from the seventeenth century we can set the nebular theory of the nineteenth. The telescope of the seventeenth is overbalanced by the spectroscope of the nineteenth. If the first reveals to us myriads of suns, scattered through the illimitable fields of space, the second tells what substances compose these suns and maintain their distant fires, and, most wonderful of all, the direction and the rate in which each is moving. Harvey's immortal discovery of the seventeenth century finds a full equivalent in the germ theory of diseases of the nineteenth. The mariners' compass of the fourteenth century easily yields first place to the electric telegraph of the nineteenth, while the barometer and thermometer of the seventeenth century are certainly less wonderful, though perhaps not less serviceable, than the telephone and phonograph of our own day.

"I need not pursue the comparison exhaustively, but in addition to the advances now enumerated the great doctrine of organic evolution, supported especially by the recapitulation theory in embryology, finds nothing to match with it in broadening and inspiring power in all the past history of the race. The same can be said of the periodic law of Mendeléeff in chemistry, of the molecular theory of gases, of Lord Kelvin's vortex theory of matter, of the glacial period in geology, and of the establishment of the origin and antiquity of man—all of our own century. Nothing can be brought from all the past to compare for one moment in direct application to 'the relief of man's estate' with the discovery of anæsthetics, while by his discovery of antiseptic surgery the name and fame of Sir Joseph Lister will grow to the last syllable of recorded time. In the mobilization of man and the giving to him of the freedom of the globe, the railways and steamships of our century are absolutely without any element for comparison in all that the past has left us.

"There are, however, three inventions and discoveries that we have inherited from the past, and that have been already named, two of them from some distant but unrecorded century and one from the darkness of the middle ages, which have proved so indispensable to all subsequent advances that it is impossible for even the nineteenth century to present anything that can be properly compared with them. I refer to the alphabet, Arabic numerals, and the printing-press. To this list might be added, perhaps, language and the use of fire. The factors I have named are presupposed in all modern progress. By the very necessities of the case they must have preceded the progress at which we have glanced.

"As I have before said, the nineteenth century is the century of science, and it is science, mainly physical science, that constitutes the proper object of this association. Our geographical name is wide, but the scope of our association is wider still. It deals with and is devoted to science, which is the best product of the best powers of the human mind—the human mind, created in the image of God and divinely inspired to interpret this wonderful universe. This association marks the stage already reached in this interpretation, but in its very title it indicates that the work is incomplete; that it is still in progress.

"Its founders, fifty years ago, clearly saw that they were in the early morning of a growing day. The most unexpected and marvelous progress has been made since that date, but as yet there is no occasion and no prospect of an occasion to modify the title. We are still laboring for the advancement of science, for the discovery of new truth. The field, which is the universe, was never so white to the harvest as now, but it is still early morning on the dial of science. It is possible that we could make ourselves more interesting to the general public if we occasionally foreswore our loyalty to our name and spent a portion of our time in restating established truths. Our contributions to the advancement of science are often fragmentary and devoid of special interest to the outside world; but every one of them has a place in the temple of knowledge, and the wise master builders, some of whom appear in every generation, will find them all and use them all at last, and then only will their true value come to light."

The papers of geographic interest were principally read before the sections of Geology and Geography, Social and Economic Science, and Anthropology. Among such a large number of important and original contributions it is impossible to more than indicate the titles of the following:

Before the section of Geology and Geography: "The Pre-Lafayette (Tennesseean) Baselevel," by W J McGee; "The Geology of Columbus and Vicinity," by Edward Orton; "The Cape Fear Section in the Coastal Plain" and "Some Geological Conditions Favoring Water-power Developments in the South Atlantic Region," by J. A. Holmes; "A Consideration of the Interpretation of Unusual Events in Geological Records," by Frederick W. Simonds. Before the section of Social and Economic Science: "Corn as a Factor in the Wheat Problem," by John Hyde; "The Increase in the Median Age of the Population of the United States since 1850," by Mansfield Merriman; "Trusts: A Study in Industrial Evolution," by H. T. Newcomb; "Moral Tendencies of Existing Social Conditions," by Dr Washington Gladden. Before the section of Anthropology: "A Comparative Study of the Physical Structure of the Labrador Eskimos and the New England Indians," by Frank Russell;

"Regarding the Evidences of Ancient Prehistoric Man in the Maumee River Basin," by Charles E. Slocum; "The Latest Discoveries of Traces of Glacial Man at Trenton, N. J., and the Light Thrown upon Them by a Comparative Study of the Gravels of the Delaware and Susquehanna Valleys," by G. Frederick Wright; "Report of Committee on White Race in America," by J. McKeen Cattell; "The Beginnings of Mathematics," by W J McGee. Among other papers of especial note may be mentioned: "Some Experimental Illustrations of the Electrolytic Dissociation Theory," by A. A. Noyes; "Some New Products of Maize Stalks," by H. W. Wiley and W. H. Krug; "On Some Piratine Bugs, which may be Responsible for So-called 'Spider-bite' Cases," by L. O. Howard.

A gratifying feature of the meeting was the generous gift of $1,000 by Mr Emerson McMillin, of New York City, who thus becomes a patron of the Association. The Association was extremely fortunate in its entertainment, for the local committee that had the arrangements in charge did everything in their power to contribute to the success and pleasure of the delegates.

G. H. G.

THE REDISCOVERY OF PUERTO RICO

The acquisition of the island of Puerto Rico as one of the consequences of the recent war with Spain threw at once upon the government the duty of providing for the safe navigation of the waters which wash its shores by supplying to the seafaring community reliable charts of its almost unknown coast. It was a reproach to the Spanish administration that this plain duty was so long neglected, although it is only fair to say that a resurvey of the islands was in progress at the outbreak of hostilities, which of course put an end to the work. Whether the new survey would have been entirely satisfactory may be doubted, but it would probably have been an improvement on the previously available information. The war, however, made the results of this work unavailable, as the records were carried to Spain. Since the task of furnishing at an early date trustworthy information in regard to the approaches to this one of our possessions devolved upon the U. S. Coast and Geodetic Survey, the superintendent of that service, Dr Henry S. Pritchett, took immediate steps to meet these new demands upon the resources of the organization.

The south coast of Puerto Rico, being the least known and having a larger number of ports than any other part of the island, was selected for the beginning of the work. The steamer *George S. Blake*, so well known to the scientific world from association with the researches of Professor Agassiz and from results achieved by Captain Sigsbee and others, was fitted out for this duty and sailed from Baltimore December 27, Mr Hodgekins commanding. She arrived off Ponce early in January, and began work in that vicinity by the measurement of a base line and the development of a scheme of triangulation along the south coast, to serve as a basis for the topographic and hydrographic surveys which were simultaneously in progress. An astronomical azimuth was also measured near Ponce, to insure the correct orientation of the work. In the beginning of the survey, the western point of the bay, which forms the port of Ponce, was taken as the western limit of the detailed work, which was thence carried to the eastward toward Jobos and Arroyo. At the end of March the work on the south coast was temporarily suspended in order to comply with a request from the Navy Department for a detailed survey of the important harbor of San Juan. The survey of the entrance and the principal part of the harbor was completed before the end of April, and the results are shown on a large-scale chart which is about to be issued to the public, blue-print copies having been furnished to the naval authorities at San Juan. This survey verified the important fact that the depth of water on San Juan bar is thirty-five feet, instead of twenty-four, as previously reported. Returning to the south coast, the *Blake's* company spent the month of May in completing the survey of Port Jobos and approaches of Arroyo bay. Point Viento was the most eastern point reached by the triangulation and topography, and here the season's work was closed.

Perhaps the most interesting feature of the information obtained during the season is the careful development of the haven known variously as Port Aguirre, Port Jobos, or Boca del Infierno, previously described by Mr O. H. Tittmann in The National Geographic Magazine (vol. X, p. 206). The *Blake* found here a good harbor of refuge with a wide and deep entrance and anchorage of sufficient depth for any vessel. The upper portion is somewhat difficult of access and not so deep as the lower anchorage, but is still of considerable value and may in time, under the stimulus of American energy and capital, develop into an important port. Of the south coast of Puerto Rico in general it may be said that though there are real dangers to be avoided, they are less to be dreaded than the uncertainty engendered by the old and inaccurate maps. Knowing the true location of the shore line and of the few outlying reefs, navigation along this coast becomes very easy and perfectly safe.

A curious circumstance developed by this survey is the fact that the island seems to be considerably smaller than has been supposed, at least if one can safely generalize from the experience of one season. According to previous information, Point Viento is about fifty miles east of Ponce, but the actual distance was found to be about seven miles less. If this "shrinkage" should be found to extend to other portions of the island, it would make a considerable decrease in the area of the island from the figures usually stated.

The Harriman Alaska expedition returned to Seattle July 31, after having traveled 1,600 miles in 78 days. The expedition proved most successful, discovering a new bay, several new glaciers, and bringing back an immense treasure of specimens of birds, plants, animals, etc.

THE WELLMAN POLAR EXPEDITION

Mr Walter Wellman on his arrival in England has issued a brief statement of the experiences of his party in Franz Josef Land during the past twelve months. The expedition, it will be remembered, left Tromsö June 26, 1898, but, owing to the large amount of ice barring the way, was unable to gain Cape Tegetthoff, its headquarters, before July 30. Mr Wellman is reported to have said:

"Desiring to push further north with the greatest speed, I dispatched Mr Baldwin August 5 with the Norwegians, sledges, dogs and boats, myself and others intending to follow in a few days. Shortly after Baldwin's departure I discovered that, owing to a sudden break-up of the ice, I was unable to proceed, but I sent two Norwegians to inform Baldwin to build his outpost, leave two men in charge of it, and return to my headquarters." Meanwhile Mr Baldwin had pushed on to latitude 81, where he built the outpost, and, leaving the two Norwegians, Bentzen and Bjoervig, in charge, rejoined Mr Wellman at Cape Tegetthoff late in October. Here they all passed the winter in the Harmsworth House, which was completely buried with snow. On February 18, 1899, Wellman, with the Norwegians, started north, but on reaching the outpost found Bentzen dead. Mr Wellman continues:

"After a delay of ten days the party, including Bjoervig, pressed north in sledges, and by March 20 reached 82 degrees, east of Rudolf island. The prospects were most reassuring. We had three months of the best season before us and we were confident of reaching 87 degrees. Though, of course, we had suffered from cold, we were all in fine form.

"Then a seemingly trivial accident turned the satisfactory advance into a precipitate retreat. While struggling with the sledges in rough ice, my right leg was bruised and sprained by my falling into a snow-hidden crevice. For two days I went on and, had other circumstances not occurred, I should have pressed onward so far that I should never have been able to return alive. At midnight on March 22 we were awakened by the crashing of the ice under our feet. It swayed and deep crevices yawned about us. Several dogs and sledges were crushed. In the darkness and storm it was impossible to see a path of safety. Expecting to be overwhelmed at any moment by the ice, we scrambled over the field of ice and saved most of our equipment except the dog food, reaching a place of safety in half an hour. Our brave Norwegian comrades did not express the slightest fear. While it was possible to go on for a time, my leg now demanded a retreat. For two or three days I stumbled along until I fell. There was nothing to do then but get on a sledge and be dragged back to headquarters by the men and dogs. Forced marches by my devoted comrades saved my life.

"The point at which we turned back was twenty-five miles northwest of the Freedom islands, where Dr Nansen landed in 1895. North of these islands we photographed three islands and some large land, unseen either by Payer or Nansen. We also found that Payer's so-called Dove Glacier does not exist. I still believe it is possible to reach the Pole by Franz Josef Land, but I cannot say if I shall make another effort.''

After Mr Wellman's return to the Harmsworth House, on April 9, Lieutenant Baldwin and four Norwegians went out to Wilczek Land, charting the unexplored east coast and discovering a new ice-covered island, extending to 64 degrees east, almost as large as Wilczek Land. They named it Graham-Bell Land in honor of the President of the National Geographic Society.

THROUGH FRANZ JOSEF LAND

The Duke of the Abruzzi, whose departure from Christiania on the *Stella Polare* has been announced, reached Archangel in July, where he was accorded a magnificent reception by the Russian garrison. Unlike Nansen, who sought to approach the Pole as near as possible upon his ship, either by sailing through an open sea or by drifting when bound in the ice, the Duke of the Abruzzi will watch for a favorable moment to gain a creek or port suitable for wintering and for serving as a base. The intention of the prince is to advance across Franz Josef Land and from his base, at intervals of two or three days' march, to establish a series of depots or caches of provisions extending toward the Pole. *Le Tour du Monde* contains the following interesting account of his plans and equipment: ''The baggage of the expedition has been distributed among 1,500 boxes, each weighing about 55 pounds, and thus in case of need easily portable upon a man's back. The boxes are divided into four classes: provisions; clothing and equipment; tools and scientific instruments; and, lastly, articles that are useful but not indispensable. Each class has its own special color and each box is numbered according to the class and the nature of its contents. The provisions—rice, sea biscuit, preserved or salted beef, etc.—have been so divided that each box contains five different kinds of food, in order that the fare may in no extremity be reduced to one article of food. Each chest is lined on the inside with tin and soldered to keep out water and dampness. The boxes containing the clothes are of a bright green, those containing the scientific apparatus red, while the boxes containing the useful but not indispensable articles are yellow. Among the latter are playing-cards, dominoes, a guitar, a graphophone, a phonograph, and an æolian with a generous and varied repertory, including *Cavalleria Rusticana*, *Lohengrin*, *Tannhauser*, *Don Juan*, and dance music. The party expect to return in eighteen months. Of the total expenses, estimated at about $575,000, the King of Italy has contributed one-fourth.'' The main purpose of the Duke of the Abruzzi is the thorough exploration of Franz Josef Land. If the conditions are favorable, however, he hopes to reach a point further north than any previous explorer, and perhaps gain the Pole itself. The *Capella* reports meeting the *Stella Polare* August 9, headed for northwestern Franz Josef Land.

THE ISTHMIAN CANAL PROBLEM

A careful reading of Mr Nimmo's article on "The Proposed Interoceanic Canal in its Commercial Aspects," in the August number of The National Geographic Magazine, brings to light various errors in statement which seem to require early attention. Two of these seemed to me of such importance as to warrant careful inquiry with a view to early correction:

1. On page 299 the distances from Manila to New York and London are tabulated as follows:

	Nautical miles.
From Manila to New York:	
Via Suez Canal	11,565
Via Nicaragua Canal	11,746
From Manila to London:	
Via Suez Canal	9,600
Via Nicaragua Canal	14,680

In reply to specific inquiry, the Acting Superintendent of the U. S. Coast and Geodetic Survey writes, under date of August 15, 1899, that these figures were given Mr Nimmo on June 10, 1898, but adds:

"The distances then furnished . . . are in error, the measurements having simply been taken from charts.

The true distances are:

	Nautical miles.
Manila to New York:	
Via Suez Canal	11,596
Via Nicaragua Canal	11,078
Manila to London:	
Via Suez Canal	9,583
Via Nicaragua Canal	13,798

I regret that the error was not discovered before the publication of the article by Mr Nimmo."

2. Still more seriously misleading is the tabulation on page 303 designed to prove that "Sailing tonnage is fairly holding its own in the ports of the globe," despite the fact that the figures are ostensibly correct. This is indicated by the paragraph in the "Report of the Commissioner of Navigation" for 1898, page 11, in which the figures quoted by Mr Nimmo are published; this paragraph is as follows:

"The increase in steam tonnage is both real and apparent. In the last annual report of the Bureau the statement was ventured that on June 30, 1898, "steam tonnage, for the first time in our history, will exceed the combined tonnage of sailing vessels, barges, and canal-boats." The actual figures are: Steam vessels, 2,371,923 tons; all others, 2,377,815 tons. The removal of 62,000 tons of steam vessels from the merchant list by purchase for the government could not have been foreseen."

Moreover, although the figures are ostensibly correct, they are really incorrect, in that Mr Nimmo's "tonnage of sailing vessels" corresponds to Commissioner Chamberlain's "all others," which includes a tonnage of 541,988 in canal-boats and barges; so that the figures should read, steam tonnage 2,371,923, sailing tonnage 1,835,827.

It is especially deplorable that the several errors should lie in a single direction—a direction supporting argument against the Nicaragua Canal.

W J McGee.

GEOGRAPHIC LITERATURE

The Tides and Kindred Phenomena in the Solar System. By George Howard Darwin. Boston and New York: Houghton, Mifflin & Co. 1898. Pp. xviii + 378.

Professor Darwin is the son of the great naturalist and himself a distinguished mathematician. In the present volume he appears as the mathematician explaining in every-day speech a subject that has elsewhere no such treatment in our language. In this rôle he is as successful as he seems to be diffident. Despite the disadvantage of the lecture form, the book is extremely readable and interesting. Any one who has looked through the non-mathematical literature of tides is familiar with the crude explanations found in encyclopedias and hand-books of astronomy and geography, where the moon is made to lift the ocean on the side of the earth next her away from the earth, while also lifting the earth away from the ocean on the further side—a statement true in a way, but quite unintelligible until amplified. To such the present volume will prove most welcome.

Professor Darwin gives admirably lucid accounts of the equilibrium and dynamic theories, besides pointing out clearly the failure of mathematics to grasp the whole problem of the actual tides. The book contains certain general tidal information, an exposition of the mathematical theory, analysis and prediction of oceanic tides, and an excellent account of tidal friction as an element in cosmogony. Forel's unique unmathematical work on the seiches of Lake Geneva receives a merited tribute and its first presentation in English.

Tides in rivers is the somewhat broad title to the account of bores. A gem of simple comprehensive statement is one of the several views of tide-raising forces: "If every particle of the earth and of the ocean were acted on by equal and parallel forces, the whole system would move together and the ocean would not be displaced relatively to the earth; we should say that the ocean was at rest. If the forces were not quite equal and not quite parallel, there would be a slight residual effect tending to make the ocean move relatively to the solid earth. In other words, any defect from equality and parallelism in the forces would cause the ocean to move on the earth's surface" (p. 104). The whole treatment of the tide-raising forces in both theories is very successful. Use is made of W. M. Davis' suggestion of absolute equality of centrifugal forces in every part of the earth. As gravitation varies with the square of the distance, residuals of excess and defect appear which are the tide-raising forces. This presentation Professor Darwin illustrates with an arrow diagram, which is surely the simplest possible method of showing the equality of the centrifugal forces. The diagram and explanation of horizontal components of the tide-raising forces is equally simple and lucid. For the dynamic theory motion in the masses subjected to periodic impulses is the feature of actuality not contemplated in the equilibrium theory.

In a continuous equatorial canal of some 13 miles' depth we should have free oscillations that would pass around the earth with the moon. In less depths, and our oceans are much shallower, the wave would go slower. Thus the moon's periodic impulse is quicker than the free oscillation, and the resultant oscillation is inverted with low water always under the moon. About such a state of affairs occurs in the Pacific, and it is completely opposed to the equilibrium view. The fact that the Pacific is not an equatorial canal, however, forbids us to account this theorem as more than a suggestion. For regions where the tide follows the moon by irregular intervals Professor Darwin seems to fall back on Whewell's abandoned cotidals. Here we are beyond the grasp of mathematical treatment. Tides in canals or on a uniform ocean-covered globe admit of analysis, but the actual geographic problem has not been solved; even a large lake is of doubtful solution (p. 185). Ferrel declares his conviction that an equatorial dike across the Atlantic, though barring out all waves from the southern ocean, would not alter the actual tides of the North Atlantic. Darwin seems to consider the wave from the south as more significant than the local tide. "It may be conjectured that on the coast of Europe the latter is of less importance than the former" (p. 188). The whole subject is full of conjectures at this point. "The problem is one of insuperable complexity" (p. 188). Dr Whewell was obliged to abandon his famous chart of cotidals in 1836 on two grounds: (1) the excessive contouring of well-determined cotidals, and (2) the great difference of epoch of the diurnal wave in Europe and America, together with the identical epoch in Spain and at the Cape of Good Hope, supposed to be separated by a long journey up the Atlantic. No answer has ever been made to this objection, yet Professor Darwin again appeals to this cotidal chart abandoned by its author in the second year of its age, since copied in innumerable hand-books, and made responsible for the mythic birth of the tide in the Pacific.

One fancies that the author found the closing chapters, dealing with the rôle of tidal friction in the universe, most pleasant to write. Here Professor Darwin is peculiarly in his own domain, and his exposition is of the happiest. Looking back to days when the earth was still a glowing, fluid mass, we are made to see its molten tides rising toward the moon and struggling against the friction of particle on particle. In this way somewhat delayed, flood height is only reached when the earth's rotation has carried it somewhat forward past the moon. This high-tide protuberance pulls the moon forward in its orbit, which is thus enlarged and the month lengthened. At the same time the moon, striving to keep the tide crest under her, resists the earth's rotation and prolongs our day. Longer and longer grow both day and month, though at unequal rates, and must do so, even under the slighter impulse of the present purely oceanic tides, until in the distant future both shall come to an equality, with a length of 55 of our present days. An important point in the proof that oceanic tides would affect the day and month in the same sense as the tide in the plastic mass is given us as a "fact" (p. 269). The author's success in putting mathematical argument into plain English compels one to regret that he did not attempt this point also. To look back is to see that day and month must once have been shorter than now. Indeed, an early date sees them again equal and but four or five of our hours long. The moon then swung in so small an orbit as almost to graze the earth, suggesting its origin by rupture of a parent body under the indefinitely growing amplitude imposed on the solar tide wave by that rotation period. Confirmation is found in the present elements of the lunar orbit.

If such a history is not inferred for the satellites of other planets, we at least see the influence of solar tides in checking or delaying birth of satellites for the nearer planets and in their coincidence of month and day. Saturn's stony meteor rings lie just within the distance where the planet's tide-raising force would shatter a small satellite to fragments. Nebulæ and binary stars are scanned and illuminated with the light of this tide-raising force, which is seen to produce far-reaching results throughout the universe. M. S. W. J.

From Sea to Sea. Letters of Travel. By Rudyard Kipling. Two volumes. New York: Doubleday & McClure Company. 1899. Pp. 880. $2.00.

These two volumes, containing the letters of travel in India, Burma, Japan, and the United States, together with sketches of Calcutta and Lahore life, are published under the author's private seal of the sacred *Swastika* as a defense and protest against unauthorized editions which had appeared in this country. Mr Kipling has edited and revised the matter, and, as he has revisited Japan and resided for several years in the United States since the letters of travel from those countries were written, it may be presumed that there have been modifications.

Although written from the Anglo-Indian standpoint for Anglo-Indian readers, nothing could be more enjoyed by the globe-trotter, whom he so openly despises and ridicules, than Mr Kipling's accounts of his visits to out of-the-way places in the native states of India. These letters are plainly the note and sketch book from which came many scenes of "*the Naulahka.*" The *dak bungla* at Joohpur, with its trusting commercial travelers, is easily recognized; also the deserted ruins of Chitor and the dreadful "dull, blue tank sunk between walls of timeless masonry," and yet Boondi's intricate, rock-wrought palace, with the hanging gardens, its courts and gates, and everywhere the unseen eye of the zenana women. "The howling globe-trotters," who infest India in the cold weather to Mr Kipling's discomfort, will not be inclined to follow him to these places of strong local color and acute discomfort; surely not that globe-trotter who pronounced "Jeypore" with an "accent on the first syllable, if you please," to the derision of Mr Kipling.

Yet, when turned an "insolent globe-trotter himself," Mr Kipling glibly drops whole syllables from Japanese geographic names, and refers to Kobé—accent on the last syllable, if you please—which puts him worse than level with the poor couple, who may have since revisited Jeypore, and put the accent where it does not offend the Anglo-Indian ear. But this, and even the moving of Stampede tunnel a few hundred miles across country, from the Cascade range to the Rocky mountains, we could forgive him ten times over if he would not employ the low and offensive sailors'-boarding-house term "Jap" for Japanese. There are people, "masses," in fact, who habitually use the abbreviations Brit and Yank and Jap, gent and pants and bike, but surely Mr Kipling, certainly in his serious, his editing and revising moods, is not of these. That pigeon-English abomination of "Chinaman" for Chinese is lapse enough. His guardian, Ganesh, whom he freely invokes, should prevent him from ever writing "Jap" again.

All trifles aside, nothing could be more brilliant, more clearly, cleverly photographic than these letters of travel, and no one has ever in such brief chapters gone to the spirit and the genius of the new countries and new people he found in his travels. His description of dank, chilly, fog-pressed Hongkong in April is the perfect thing, and also that inevitable amazement, that hesitating confession of chagrin of the Anglo Indian when he discovers and admits the superiority of the Chinese to the Hindu, when the Anglo-Indian has always considered that India, mere middle Asia, was all Asia, the real East, the Far East an unconsidered incident. "They will overwhelm the world. . . . Neither at Penang, Singapur, nor this place have I seen a single Chinaman asleep while daylight lasted; nor have I seen twenty men who were obviously loafing. All were going to some definite end—if it were only like the Coolie on the wharf, to steal wood from the scaffolding of a half-built house. . . . Where he hides his love of art the heaven that made him out of the yellow earth that holds so much iron only knows. . . . It grieves me that I cannot account for the ideas of a few hundred million men in a few hours. This much, however, seems certain: If we had control over as many Chinamen as we have natives of India, and had given them one tithe of the cosseting, the painful pushing forward, and studious, even nervous regard of their interests and aspirations that we have given to India, we should long ago have been expelled from or have reaped the reward of the richest land on the face of the earth. . . . The great big lazy land that we nurse and wrap in cotton-wool and ask every morning whether it is strong enough to get out of bed seems like a heavy, soft cloud on the far-away horizon, and the babble that we were wont to raise about its precious future and its possibilities no more than the talk of children in the streets, who have made a horse out of a pea pod and match-sticks and wonder if it will ever walk. . . .

"And you think, as you go to office and orderly room, that you are helping forward England's mission in the East. 'Tis a pretty delusion, and I am sorry to destroy it, but you have conquered the wrong country. Let us annex China."

Never was there truer description of Canton than this: "Do you know those horrible sponges, full of worms, that grow in warm seas? You break off a piece of it, and the worms break too. Canton was that sponge. . . . Hongkong showed me how the Chinaman could work. Canton explained why he set no value on life. The article was cheaper than in India. I hated the Chinaman before; I hated him doubly as I choked for breath in his seething streets, where nothing short of the pestilence could clear a way. . . . The Hindu is a sanitating saint compared to the Chinaman. . . .

"The march of the Mongol is a pretty thing to write about in magazines. Hear it once in the gloom of an ancient curio shop; hear the tramp of the feet on the granite blocks of the road, and the breaking wave of speech that is not human! Watch the yellow faces that glare at you between the bars, and you will be afraid, as I was afraid."

After five days' study Mr Kipling gave up that "oilskin mystery, the Chinaman," and sought the secrets of Hongkong's wealth and splendor, that magnificent city of truly palaces by the sea, to which "Calcutta is but a hamlet;" and then he took ship to Japan, where all of his finer and poetic susceptibilities were aroused, and everything—the landscapes, houses, men, women, little children, and works of art—is exquisitely transmuted into phrases by the magic of his mind. "I was satisfied. . . . Fujiyama was exactly as I had seen it. . . . I would not have sold my sight of it for the crest of Kinchunjunga, flushed with the morning. Fujiyama is the keynote of Japan. When you understand the one you are in a position to learn something about the other."

His praises fall justly and discriminatingly, and his description of old Hari Shin's remarkable conglomeration of a curio shop in Kobe and of that "blackwood cabinet" in Kioto, where Nammikawa creates his wonderful cloisonné enamels, are not better in their way than his summing up of Osaka castle: "Castles in India I know, and the forts of great emperors I had seen, but neither Akbar in the north nor Scindia in the south had built after this fashion—without ornament, without color, but with a single eye to savage strength and the utmost purity of line."

"The Chinaman's a native; that's the look on a native's face; but the Jap isn't a native, and he isn't a sahib, either." There Mr Kipling met the greatest puzzle of the Far East, and, like scores of the globe-trotting and all other kind, left before he had solved the racial enigma. "Japan is a great people," he finally says. "Her masons play with stone, her carpenters with wood, her smiths with iron, and her artists with life, death, and all the eye can take in. Mercifully, she has been denied the last touch of firmness in her character which would enable her to play with the whole round world. We possess that—we, the nation of the glass flower shade, the pink worsted mat, the red and green china puppy dog, and the poisonous Brussels carpet. It is our compensation."

Before he reaches California Mr Kipling found that "the American is objectionable; and *yet* how pleasant in every way is a nice American whose tongue is cleansed of 'right there,' 'all the time,' 'noos,' 'revoo,' 'raound,' and the Falling Cadence."

In slight, unconscious reprisal Hon. T. B. Reed, interviewed but this same month in London, avers that England would be a nice place if all Englishmen did not all the time use the Rising Inflection.

Of all letters of American travel Mr Kipling's are distinctly the most entertaining, and with the same "cocksureness" of which he accuses "the hideously versatile American" he settles conclusions as to our police and politics, commercial morality, social customs, railroads, and army. Regarding the latter, some of the visitor's comments are most truthful and the more cutting and hurtful to American vanity. The citizen's scorn and contempt for the soldier he had instance of daily in Yellowstone Park, where he saw good examples of "that Regular Army, which is a dear little army. . . . It's too tiny to be a political power," etc., etc.

His sketches of the headquarters settlement of the East India railway, of its coal fields and shops, of the Ghazipur opium factory, and of the sample sitting of the Calcutta municipal council are such perfect bits of his own best vein that one only complains that the volumes are so small. One must wish that he would write more letters of travel, more letters from Burma, from China, from Japan, from America, since these few are but foretaste and aggravation to the admirers of the greatest genius ever cradled by the *Allahabad Pioneer*, that nursery of talent in whose columns Swinett and Marion Crawford and others in an earlier day first tried their wings. E. R. S.

Porto Rico and the West Indies. By Margherita A. Hamm. New York: F. Tennyson Neely. Pp. 230, with half-tone illustrations. $1.25.

Among the many hastily published books on Porto Rico this excels all others in its descriptions of the social and domestic life of the people of the island. If one will overlook the cheap press-work and inferior illustrations and close his eyes to a few glaring misstatements, he will find this to be a charming and readable work. Miss Hamm possesses strong literary and descriptive ability and the feminine art of seeing those little traits of domestic life and human nature which have escaped the observation of the scientist, soldier, and newspaper correspondent in Porto Rico. Furthermore, her tone is sympathetic and appreciative. She has made an excellent compilation of the natural features of the island, but this is unfortunately marred by many mistakes which careful editing would have avoided. She adds some 2,000 feet to the height of the mountain summits, tells us that the island has been uplifted 25 feet in 25 years, talks about "mineral guano of the Tertiary period" and "the granite rocks of the island," which do not exist; described the aborigines as Caribs, and reintroduces us to our quondam friend, "the coral insect." These defects are fully compensated for, however, by her most entertaining and charming descriptions of the habits and customs of the Borinquenians.

Robert T. Hill.

Hawaii: Our New Possessions. By John R. Musick. With Fifty-six Full-page Plates. New York and London: Funk and Wagnalls Company. Pp. v + 534. $2.75.

This addition to the growing literature on Hawaii is a sumptuous specimen of the bookmakers' art, being well printed, fully illustrated, and tastefully bound. The volume is largely a record of personal experiences on the part of the author, and is written in an agreeable vein by one possessed of a ready appreciation of the picturesque. The descriptions of scenery are accurate in most particulars, so that a good idea of this "Paradise of the Pacific" can be gleaned from the pages of Mr Musick's book. The much mooted "missionary" question receives considerate treatment by the author, and, as intimately connected with the same subject, the lepers of Molokai are described and illustrated more fully, perhaps, than has been done by any other recent writer on the subject. The customs, habits, and manners of the native Hawaiian are portrayed with a delicate pen, the opinion being expressed that "though the Hawaiian is a failure at the head of business, lacking the power to direct and control, he makes a trusty and faithful clerk." Of course the famous volcano of Kilauea receives a due share of attention, and the description of a visit to the celebrated extinct crater of Haleakala, "House of the Sun," is well written. Much space is taken up with a full and fairly unbiased account of the political events which precipitated and accompanied the overthrow of the monarchy, and a clear idea of those incidents is here given for the first time to the American reader. The illustrations are well chosen and artistically executed, and a careful index adds to the intrinsic value of an interesting book. The reading world is to be congratulated on the appearance of a volume pleasantly written and devoid of many of the blemishes to which the subject seems especially liable. While the actual and valuable geographic and scientific knowledge of Hawaii is not materially increased by the author, a fairly accurate description of the islands is presented.

HARRIE WEBSTER, U. S. N.

Ruins of the Saga Time: Being an Account of Travels and Explorations in Iceland in the Summer of 1895. By Thorsteinn Erlingsson, on behalf of Miss Cornelia Horsford, Cambridge, U. S. A. With an Introduction by F. T. Norris and Jón Stefánsson, Ph. D., and a Résumé in French by E. D. Grand. London, 1899. 8vo, pp. 1–112 and map.

As known through various publications, Miss Cornelia Horsford has undertaken researches relating to the early Norse discoveries in America. The inquiries have been taken up and pursued with great vigor and in a notably comprehensive manner, and the work has differentiated into several lines. Among these are (1) studies of the Sagas, (2) investigation of pre-Columbian and early post-Columbian cartography, (3) critical examination of artificial structures and other relics in eastern Massachusetts, and (4) comparison of these relics with the known products of the Norsemen in Iceland, Scandinavia, and elsewhere. Considerable portions of the work are conducted by Miss Horsford in person, frequently with the aid of expert archeologists; other portions are performed by experts under her directions and auspices. Certain summary results appeared in her article in THE NATIONAL GEOGRAPHIC MAGAZINE for March, 1898, while some of the details were derived from the work in Iceland, which is described at length in the recently issued memoir. The publication bears the stamp of the Viking Club of London. W J M.

THE Instituto Geologico de Mexico in its eleventh bulletin publishes a detailed list of the minerals and mines in the Republic.

GEOGRAPHIC MISCELLANEA

An institution for the study of tropical diseases will shortly be erected in Hamburg by the German government.

The Japanese government has decided that all children must be vaccinated before the age of ten months; the first revaccination is to take place at six and the second at twelve years of age.

The *Scientific American* announces that the ground on the shore of Botany bay, New South Wales, where Captain Cook landed 129 years ago, was recently formally opened as the "Captain Cook Reserve."

Prof. J. B. Hatcher, of Princeton University, has returned from a successful expedition to Patagonia, where he has been making extensive researches in geology and palæontology during the past eight months.

"A Fossil Egg from South Dakota," by Dr O. C. Farrington, vol. I, No. 5, Geological Series, Field Columbian Museum, describes what is believed to be the petrified egg of an Anatine bird of the early Miocene age.

The *Independent* states that Lieut. Hjalmar Johansen, Nansen's only companion on his sledge journey, has written a narrative of the fifteen-month trip after leaving the *Fram*, entitled "With Nansen in the North."

The American Geologist for August contains two articles of special note: "Glacial History of the New England Islands, Cape Cod, and Long Island," by Warren Upham, and "The Evolution of Climates," by Marsden Manson.

The expedition equipped by the Liverpool School of Tropical Diseases for the study of malaria in Sierra Leone sailed recently from the Mersey. Freetown will be the center of experiments with special regard to Major Ross's theory that malaria is propagated by mosquitoes.

A cablegram from Valparaiso, Chile, early in August described a tidal wave of unusual violence at that place. It is quite possible that the wave arrived at Valparaiso from Mauna Loa, in which case it would also be felt at some other points on the Pacific coast, as far north as Alaska.

Mount Dawson, a peak of the Selkirks hitherto unclimbed, has been ascended by Professor Charles E. Fay, of Tufts College, and H. C. Parker, of Columbia University, members of the Appalachian Club. Mt Dawson is the highest of the Selkirks thus far ascended, being about 10,000 feet above sea-level.

Nature states that the magnetic observatory at Vienna has had to be discontinued in consequence of the electric tramways and electric light wires. The Austrian government is now considering plans for a new observatory, to be situated at some distance from Vienna and to be provided with instruments of the latest construction.

It is stated on the authority of a Finnish official that the Czar's desire to connect the Finnish and Russian railways and at the same time effect economy necessitates the abandonment of the project for a railway connecting with Sweden and Norway, which was approved by the Finnish senate. The Finnish railway will be connected with the Russian system by bridging the Neva.

The projected ship canal from Georgian bay to Montreal would mean a saving of 725 miles in the transportation of grain from Chicago to Liverpool. The canal would run from Georgian bay eastward through the French river to Lake Nipissing, thence through a small tributary to the Ottawa river, and on to Ottawa and the St Lawrence. All but 29 miles is open river and lake waters.

The schooner *Julia E. Whalen* has returned to San Francisco from a cruise to the Galapagos islands, west of Ecuador. The vessel carried the scientific expedition sent out last autumn by Leland Stanford University, under the patronage of Timothy Hopkins, of San Francisco. It is reported that a splendid collection of specimens of live land tortoises, birds, fish, etc., has been brought back.

Twenty six-wheel connected side-tank locomotives were built recently at the Richmond Locomotive and Machine Works for the Swedish state railways for use north of the Arctic circle. While they have a foreign appearance, they are built strictly in accordance with American practice, with a few exceptions, the most notable of which are the copper fire-box and copper hollow water-space stays.

A party from the U. S. Coast and Geodetic Survey is now engaged in gathering information on Long Island sound for a new supplement that is soon to be issued of the Coast Pilot Chart. Four topographic and three hydrographic parties are also at work near the head of the Chesapeake bay, and, at the request of the Navy Department, special examinations are being made near Governors Island, New York harbor, and at Pollock Rip, off Cape Cod.

Andrée and His Balloon, by H. Lachambre and A. Machuron, who accompanied the expedition to Spitzbergen, recently published by Archibald Constable, Westminster, England (crown octavo, $1.50), describes the inception and preparation of Andrée's hazardous enterprise. The book also contains a brief biography of Andrée, about whom comparatively little is known in this country, and is beautifully illustrated by 40 full-page cuts from photographs taken by the authors.

Ten maps recently issued for gratuitous distribution by the U. S Geological Survey embody the results of the explorations and surveys made by the parties sent to Alaska in 1898 by the War Department and by the Survey. The maps are a convenient compilation of recent Alaskan surveys, and also a summary of our present geographic knowledge of the country. Application for them can be made either to Senators or Representatives or to the Director of the U. S. Geological Survey.

During the past ten years a fuller recognition of the place of the great circle route in the problem of accelerating ocean transit has stimulated an advance to methods by which great circle courses can be taken from the Solar Azimuth Tables or measured from the chart compass with very great facility. These new developments have been recently incorporated in a second edition of *The Development of Great Circle Sailing* by G. W. Littlehales, issued from the U. S. Hydrographic Office as Bulletin No. 90.

"The Geographic Board of Canada," which was created December, 1897, to bring about uniform usage and spelling of geographic names in Canada along the lines followed by the "U. S. Board on Geographic Names," has recently published its first annual report, covering the calendar year of 1898. The report, which is mainly a history of the organization of the Board and a statement of the rules of nomenclature that will be followed, contains a list of some 600 names approved by the Board.

While recognizing that forecasts based upon legitimate data cannot be regularly made for a period greater than forty-eight hours in advance, the Chief of the Weather Bureau is encouraging the forecast officials to give to the public all information regarding unusual and severe types of weather permitted by their reports and experience. During periods of intense heat or cold or in the presence of drought or continued rains, information bearing upon the indicated duration of existing conditions is at times of incalculable value to the agricultural and commercial interests and also to the public at large.

The Alaskan parties that have been in active operation since July 1 have made material progress on the hydrography of the Yukon River bar and on the topography of the Copper River country. Detachments are also operating in the vicinity of Stuart island and Scammon bay, the former developing the 3-fathom curve around the island and through the passage between it and the mainland, and the latter making an examination with special reference to a harbor in the vicinity of Cape Dyer. Some of the Alaskan work is reconnaissance and of a preliminary nature. Most of it bears on the important question of shortening the sea route to the Klondike.

The War Department has in contemplation a general improvement of the roads and highways in Cuba, and orders will be issued shortly to General Brooke at Habana, directing him to secure reports from the different department commanders on the condition of the roads in their departments and the probable cost of improving the same. In several of the departments roads are already in existence, but they have become almost impassable because of neglect and lack of use. Within the past six months several improvement companies have started the cultivation of farms in Cuba, but as they have been handicapped by the condition of the roads, the work has been carried on at a great disadvantage.

The Grand Duke Vladimir of Russia recently opened on the Lapland coast a new port, Catherine harbor, which will probably prove of great commercial importance as a depot for the hide trade with Siberia. It is situated at the extreme north of the Russian possessions, where by a strange freak of nature the Gulf stream keeps the water open during the winter, while the more southern ports remain closed by ice. The plan contemplates the development of the immense timber area adjacent to this region. The famous ice-breaker *Yermak* and other vessels of the same type are expected to ply between Catherine harbor and the mouths of the Obi and Yenisei rivers, 1,500 miles to the east, and keep the sea route open during the summer.

The Hydrographic Office of the Navy Department has published, under the direction of Capt. J. E. Craig, a new chart of the world showing the ocean tracks for full-powered steam vessels, with distances given in nautical miles. The most valuable as well as interesting feature of the chart is the statement of the distances of the new American possessions from the different cities of the Pacific and Atlantic coasts. The chart shows in the Atlantic ocean the tracks used by steamers connecting New York, Boston, and Philadelphia with Liverpool, Southampton, and Gibraltar, showing the northern routes used between August and January and the southern routes, followed between January and August. The longest steamer route given on the map is that connecting New York and Esquimault by way of Cape Horn, 16,290 miles. This is exceeded by the track used by sailing vessels connecting New York and Yokohama *via* the Cape of Good Hope, which is 16,900 miles in length.

International measurement of the variation of latitude will soon be under way. As related in *Science* (vol. 8, p. 841), the International Geodetic Association decided last year to establish six permanent stations for this purpose at convenient intervals along the 39th parallel. The U. S. Coast and Geodetic Survey, representing the Association in this matter, has made an examination of the localities for the two stations falling within the boundaries of the United States. For the east American station it has secured a tract of land at Gaithersburg, Md., 21 miles north of Washington, and for the west American station one at Ukiah, Cal., about 75 miles north of San Francisco. At these two points neat observatories are soon to be erected from plans provided by the Association. Each observatory will be completely equipped with instruments needed in work of this precision. The other localities at which observations will be made are Midsusawa, Japan; Tscharjui, Turkestan; Calabria, Italy, and Cincinnati, Ohio.

The Statistician of the Department of Agriculture has issued a special report, prepared by E. S. Holmes, Jr., on the agricultural situation in the recently submerged district in Texas. There were in the flooded district 339,000 acres in cotton, of which it is estimated that 86.2 per cent was entirely destroyed, and that there has been a decrease of 16 per cent in the condition of the cotton remaining. There were 124,400 acres in corn and 39,400 acres in other crops. It is estimated that 87.7 per cent of the corn and 86.1 per cent of the other crops were entirely destroyed. A conservative estimate of the actual destruction includes about 227,000 bales of cotton, representing, at an average price of four and a half cents per pound, about $5,100,000; 4,400,000 bushels of corn, worth, at 20 cents per bushel, $880,000; sugar cane to the value of $335,000, and the other crops $235,000, a total loss to the standing crops of $6,570,000. The addition of the loss to farm property raises the total to $7,414,000, or about $74 per capita of the population of the district, which is estimated at 100,000, negroes largely predominating.

In an address before the Washington Academy of Sciences and Affiliated Societies last winter, W J McGee, President of the Anthropological Society of Washington and Vice-President of the National Geographic

Society, asserted that the human cranium has shown a marked increase in capacity and change of form during the past century. The address, which has aroused much interested discussion among scientific men, is printed in full in the July number of the *American Anthropologist*, under the title of "The Trend of Human Progress." Prof. McGee states: "The average capacity of recent European crania is much above the average among the cave men of Europe; the skulls of modern dissecting-rooms are decidedly better developed than those of ancient ossuaries; even in the history of America, to judge from the best portraits extant, the cranial conformation has changed from the retreating type of Washington and his contemporaries to the full-forehead type of the living statesman. The data are less complete than might be desired, but wheresoever there are measurements for comparison their testimony is consistent; they tell of progressive increase in cranial capacity among all peoples, with decrease among none. The process of cephalization is manifested hardly less strikingly in the reduction of prognathism, in the shortening of the forelimbs, in the tendency toward diminution in number of teeth which dentists note, and in other characters of both skeleton and soft tissues."

THE new steamer of the U. S. Coast and Geodetic Survey, the *Pathfinder*, after receiving her scientific outfit at Washington, recently started on a voyage to San Francisco *via* Cape Horn, her destination being Alaska and subsequently the Hawaiian islands. An examination made by Superintendent Pritchett in Hawaii last year developed the necessity of continuing the geodetic and hydrographic surveys of those islands by the U. S. government. The land operations, however, have been successfully organized and carried on for the last 25 years by the Hawaiian Government Survey. The steamer carries the necessary instruments for observations of terrestrial magnetism, densities of sea water, current velocities, and sea bottoms, as well as for the regular hydrographic and topographic survey of the coasts. A record will also be kept of the phenomena observed while *en route* along the coasts of South America. During the summer seasons the *Pathfinder* will reënforce the ships and parties of the Survey operating in Alaskan waters, retreating during the winter months to the milder Hawaiian shores. The *Pathfinder* is under the command of Frank Walley Perkins, of the Survey staff, with J. C. Dow, a well-known Transatlantic master, as executive officer. She is the largest of the Survey's vessels, and is peculiarly well fitted for the long-distance work of the character she undertakes, her coal endurance being about 6,000 miles. She carries a complement of about 75 officers and men. Including the *Pathfinder*, the Survey will now have four steam vessels on the Pacific station and three along the Atlantic and Gulf coasts, besides a number of schooners and smaller craft at various points.

The Geographical Journal for July publishes in full the address of the president of the Royal Geographical Society, Sir Clements Markham, read at the anniversary meeting, June 5, 1899. The address is a clear and concise summary of the geographic work of the past year, particularly of what has been accomplished and planned in the exploration of the Arctic and Antarctic regions. Sir Clements Markham announced that an arrangement had been arrived at between the University of Oxford and the Royal Geographical Society for the creation of a School of Geography at Oxford. The Society agrees to pay $2,000 a year and the University promises a like sum. The school will be under the superintendence of Mr Mackinder, subject to the supervision of a joint committee consisting, in addition to the Vice-Chancellor, of four members of the University and three members of the Council of the Society. Mr Mackinder, as University Reader, will lecture twice a week during the three terms, and will also have special classes for advanced students. There will be an assistant who will lecture on physical geography, will hold classes five times a week, and will teach surveying and cartography; and there will be two lecturers, one on certain branches of physical geography and one on ancient geography. It is intended that a diploma shall be granted to students who complete the course, and there will be one or two scholarships of $300. These will be inducements to graduates to spend a year in mastering the principles of geography and the knowledge required for teaching the science and for making it practically useful. The upper floor of the old Ashmolean building at Oxford has been set apart for the purposes of the school, and an annual sum will be devoted to the supply of books and appliances.

Miss E. R. Scidmore, the Foreign Secretary of the National Geographic Society, who has recently returned to America from extended travels in China, Japan, and the Philippine islands, in an article in the August *Century*, entitled "The River of Tea," presents some forcible facts regarding the rapid development of Russian power in China: "At Hankow, the great tea market of the world and until within a few years the chief source of supply of British tea-drinkers, the Russian has come, and to stay, and the shadow of the Muscovite is over it all. The Russian is not only established at the gates of China, but also at its very heart, the invasion and absorption being as remarkable in this British settlement at Hankow as anywhere in Korea or Manchuria. Hankow is fast becoming a Russian city or outpost, a foothold soon to be a stronghold in the valley of the Yangtsze, which China has given her word shall never be alienated to any power but England. Although the Russians have their own concession at Hankow, they do not care to build upon it and live there, amenable then to Russian laws and consular jurisdiction, to Russian restrictions and espionage. The Russians prefer the laws and the order of the British concession, crowding in upon it at every opportunity, competing for any house that comes into the market, and building closely over former lawns and garden spaces. They compete with and outbid the few British tea merchants who remain in these days of active Russian trade aggression. Only one tea steamer took a cargo to London in 1896, two more British firms closed out and left Hankow that year, and, still more significant, only one pony showed the colors of the one British racing stable at the autumn races. In the retail shops prices are quoted and bills made out as often in rubles as in taels or dollars, and the Russians have gradually assumed an air of ownership, of seignorial rights, as complete as if they held the lease or diplomatic deeds to the place for ninety-nine years."

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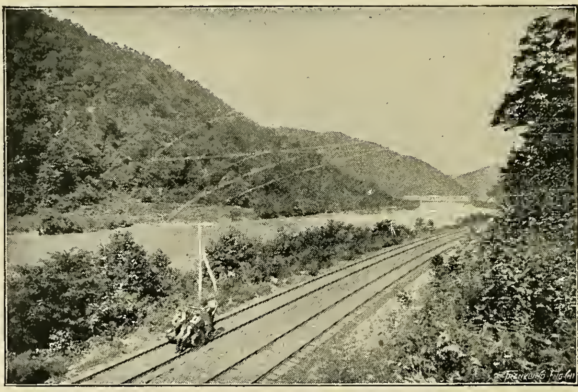

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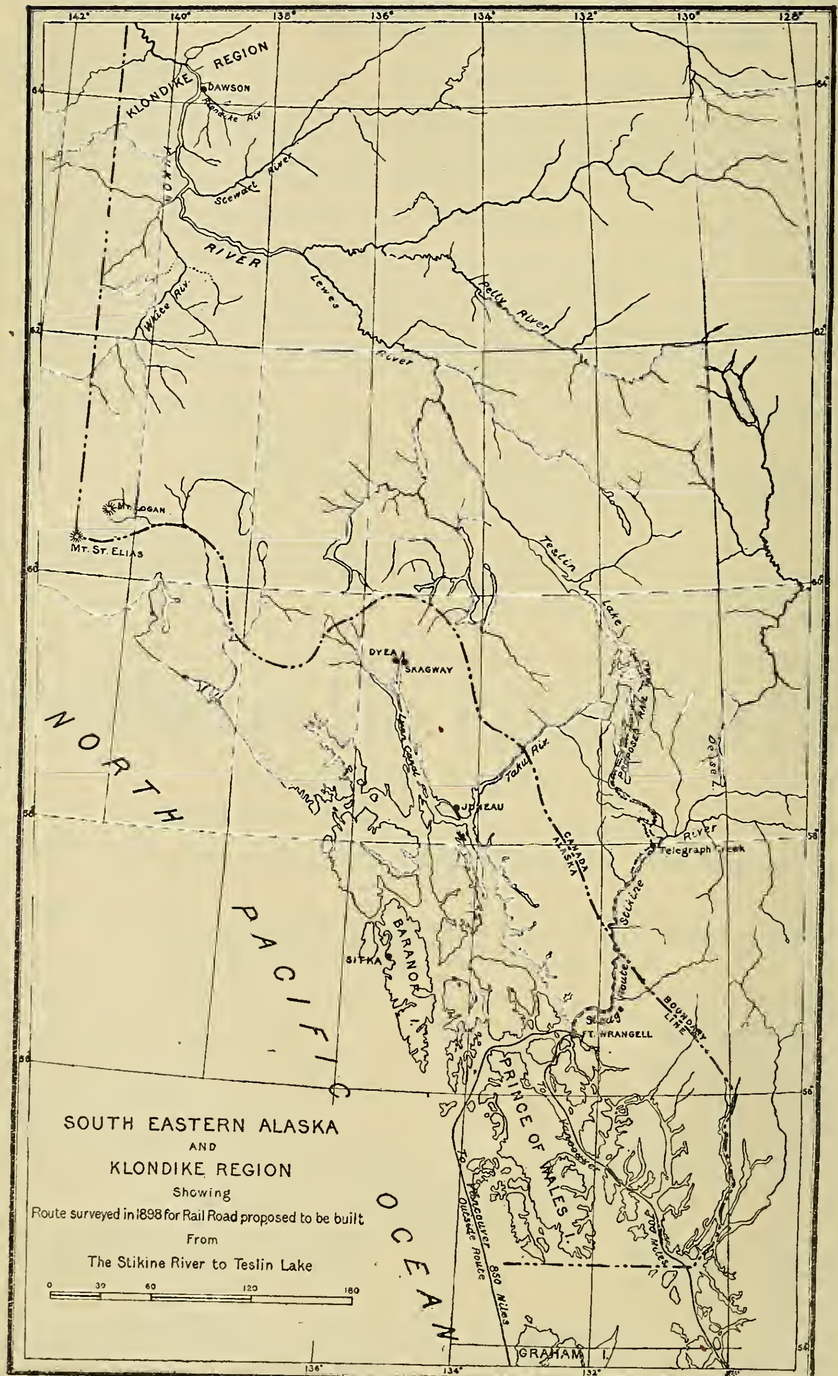
KLONDIKE REGION
DAWSON
Stewart River
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Lewes
River
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Lake
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BOUNDARY LINE
PRINCE OF WALES I.
GRAHAM I.
SOUTH EASTERN ALASKA
AND
KLONDIKE REGION
Showing
Route surveyed in 1898 for Rail Road proposed to be built
From
The Stikine River to Teslin Lake

THE

National Geographic Magazine

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LIFE ON A YUKON TRAIL

By Alfred Pearce Dennis, Ph. D.

The Stikine river is the chief feature of the hydrography of northern British Columbia. The waters of this stream mingle with the Pacific near Fort Wrangell, Alaska. About 2,000 miles further around the big Alaskan peninsula the waters of the majestic Yukon pour into Bering sea. These rivers, 2,000 miles apart at their mouths, are less than 200 miles apart at the nearest point of their headwaters.

As the Stikine is open to free navigation by treaty with the United States, it was proposed by the Canadian authorities when the Klondike excitement was at its height to build a narrow-gauge railway from Glenora, the head of navigation on the Stikine, to Teslin lake, one of the principal sources and feeders of the Yukon. It was claimed that with the completion of the railway a passenger could go through from Vancouver to Dawson in fifteen days, with no greater inconvenience than the labor involved in stepping from the river steamer to the train. It was hopefully predicted that with the opening of the route the bulk of Klondike travel would be diverted from the American ports of Dyea, Skagway, and St Michael, and the volume of outfitting trade transferred from Seattle to Vancouver and Victoria. After four months of preliminary survey work for the proposed railway the project was in June, 1898, abandoned. A number of causes contributed to the collapse of the enterprise: First, the waning of the Klondike excitement; second, the failure of the Dominion senate to ratify a heavy subsidy granted the road by the Canadian assembly; and, third, the energy in execution displayed by American capitalists in pushing the enterprise of a road to Lake Bennett *via* the White pass. Scarcely too much could be said for the All-Canadian route as a potentiality, but as an actuality, in the undeveloped graces of early infancy, it justly earned the reputation of being the most arduous and difficult of all the so-called practicable trails to the Yukon goldfields.

Compelled by ill-health to suspend for two years all work requiring mental stress, the writer became tolerably familiar in the mountains of southern British Columbia with the actual requirements of various rough manual employments and the actual characters of various rough folk of the mines and logging camps. It was a desire to add to these experiences with rough jobs and rough people that led him to apply for a subordinate position on the exploration and survey party dispatched in the winter of 1898 to the northern wilderness in the interests of the All-Canadian route to the Yukon.

Our party of 13 men took steerage passage in February from Vancouver, B. C., to Fort Wrangell, Alaska, in a battered old Chinese freighter, the *Amur*. From this point we crossed on open water to Cottonwood island, at the mouth of the Stikine river. It was the purpose of the party to move up the river for 150 miles over the ice to Telegraph creek. From this point we were to strike northward into the interior, for the purpose of running preliminary surveys 140 miles to Teslin lake, one of the principal sources and the head of navigation of the Yukon.

Camped on the ice and dirty snow at the mouth of the Stikine was a motley crowd of not less than 1,000 men who had been diverted from the accustomed routes to the Klondike by false reports about the opening of this new route. They had been informed that a serviceable trail connected Telegraph creek with Teslin lake. Many, too, had visions of town sites along the proposed railway, and hoped to "get in on the ground floor." They were sadly misled. The information was false, and the major portion of the wayfarers, after months of struggle, were utterly baffled in the attempt to thread their way through a remorseless wilderness of mountain and swamp to Teslin lake.

We were better equipped for making an expeditious journey up the river and soon the bulk of these fortune-seekers were left far in our rear. Our outfit consisted of a four-months' supply of bacon, beans, flour, baking powder, provender for the horses, and the usual camp impedimenta of tents and blankets. The entire outfit weighed about four tons. We camped on four feet of soft snow and waited for the rain to cease in order to get out of the mild coast belt and proceed over the snow up the river. The few days of waiting on the island were enlivened by sights and incidents of some contemporaneous human interest. The place seemed to be a reservation for the exhibition of many amusing features of human crankery. All sorts of business ventures, more or less quixotic, were in evidence, from the saloon-keeper who intended to haul a barrel of whisky up the river on a hand-

STEAM LOCOMOTIVE ON RUNNERS — DESIGNED TO DRAW LOADED VANS OVER THE SNOW

sled to the man who was taking along a 60-foot steamboat in sections for launching on Teslin lake. One of the most extraordinary manifestations of genius for impracticabilities was Captain Armstrong's snow train. This was nothing less than a steam locomotive on runners, designed to draw heavily loaded vans of freight for 300 miles over the surface of the snow by means of a windlass and steel-wire cable carried ahead to anchorage. The snow train was hauled after incredible exertion eight miles up the river and there abandoned.

PLODDING UP THE STIKINE ON SLEDGES

During the early stages of the river journey we ordinarily made the morning start between midnight and two o'clock a. m., in order to get the advantage of an unbroken crust. It was dreary work plodding on by the creaking sledges several hours before daylight, the heavy snow of the broad river stretching out uninvitingly in the gloom before us like some gray morass. It was pleasant to think at these times that the whirling earth was bringing the genial sun flying across the continent; pleasant to think of Washington fully awake, of Chicago stirring uneasily in the sunrise of a new day. As our turn comes the forms of the giant peaks to the east gain detail and color in the gray pallor of the dawn. Soon the crests stand forth rosy against a pale pink sky-line, and tidings of coming day are flashed to the dark-green spruce forests that lie in shadow on the river's brink. With the sun fully above the mountain crests the glare in the valley becomes painful. The snowy expanse of the river and its mountain walls glitters and scintillates with cruel brilliancy. Every one becomes more or less affected with snow-blindness, and complexions deepen into the hue and finish of red earthenware crockery. The writer's sleeping companion, John, the cook, introduced the device of daily blackening his face with soot from a charred fagot. It helped, he said, to soften the intolerable glare. Traces of these applications were visible upon a more or less wrinkled and pachydermatous face many weeks later.

About the middle of March we crossed the Alaskan boundary, 40 miles up the river, and two miles beyond passed the dead body of a man wrapped in canvas and strapped to a tree near the river's brink. Hard-by stood a hand sled and its empty harness. The gaunt stark figure and the motionless sled in the silent white desert told the brief story of the hope that had braved the wilderness and of the quest that had failed. We bivouacked nightly under the stars on the ice of the river. There was no unpacking of tents or removal of clothing. The tired men stretched themselves in couples upon a layer of blankets, over which were drawn more blankets and a tarpaulin, and were soon sunk in stertorous slumber. There were those in the party who could not sleep more than half the night while "lying out" on account of the cold. To crawl forth in the dead of the night from a heap of blankets in a semi-torpid condition for the purpose of thawing out by a painfully kindled fire was austerely somber work.

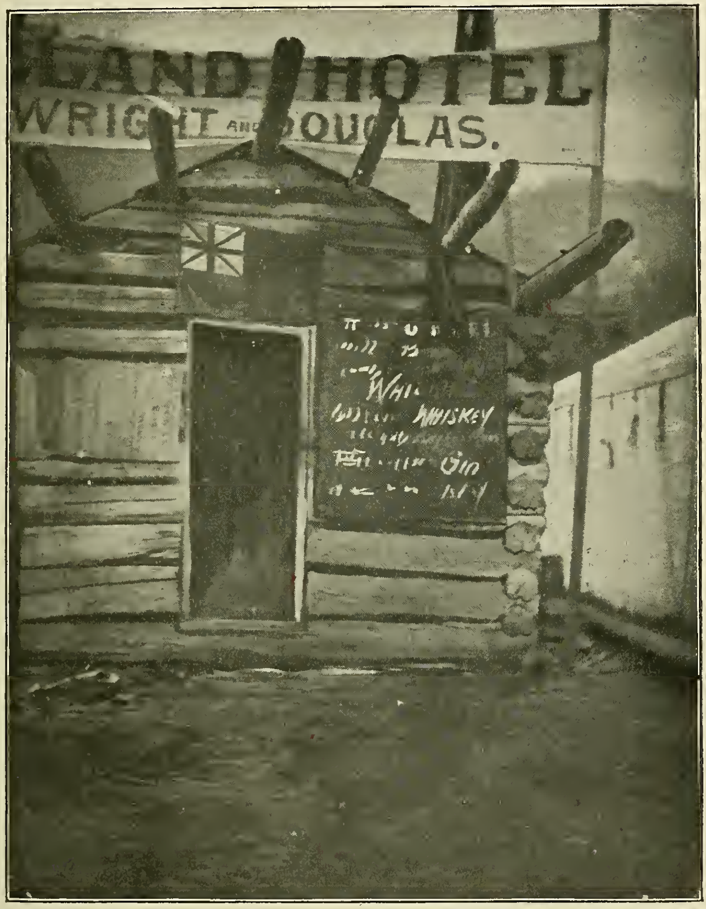
About 50 miles up the river the base of a great glacier was skirted, whose jagged billows of bluish ice silhouetted against a cloudless sky-line had been a sort of pillar of cloud by day for many weary miles of travel. The bunching of the boulders on the beaches and the plainly defined scratchings on the grim faces of the deeply serrated ridges testify to the sliding of a great ice-sheet in the remote ages of the past. The present-day glaciers, the lineal scions of this ice-mantle, lie anchored in splendid isolation upon the flanks of the lofty mountains that hem in the river. The course of the river through 200 miles of cross-ranges, that might not be inaptly termed the Cordilleras of North America, is contentious and turbulent, circumventing barriers by abrupt bends. About 95 miles upstream the pent-up current boils through a gloomy cañon not 100 feet in width, but ordinarily the stream flows composedly to the sea between banks that are anywhere from 300 to 3,000 feet apart.

The heaviest snow encountered on the river was in the Fortymile stretch between Fifty-five mile camp and the cañon. The snow lay in great wind-driven dunes from bank to bank, often concealing thin ice. The ice varied from a few inches to four feet in thickness. At short intervals steel-pointed picket rods were thrust through the snow in advance of our heavy sledges, and the distance was covered in safety. Many outfits were lost through the ice in this stretch and six cases of death by drowning came to our notice.

Our outfit was well in advance of the bulk of the movement up the Stikine. Some light dog-teams had passed up the river a few days before, and the snow compacted by these sleds would ordinarily sustain the weight of our horses. The trail was a succession of heavy ruts and furrows; it was impossible for the horses to step to the snow on either side of the beaten track. The crust yielded even to the light cayuses or Indian ponies, and they floundered helplessly until lifted bodily back again to the trail. We struggled toilsomely through morasses of soft snow, tugging and heaving on the heavy sledges, while the teamsters urged on the discouraged horses. One Sunday, after making derricks of ourselves for half the day in our efforts to get the horses through heavy drifts, we hit upon the plan of drawing the beasts to a place of security on the sledges. The horses were accordingly detached, the loaded sledge drawn ahead, and the baggage removed. We then returned, and binding a worn-out horse securely to the top of the sledge, every man in the party laid hold of the tow-rope and tugged the beast up the river to where the stores had been deposited. Most of the men who had come thus far with horses had gone into camp on the river's bank in order to save the lives of their beasts. Little pools of blood along the trail marked the points where tired animals, cut by the crust, had been halted for a rest. The gaunt and wasted carcasses of dead horses and dogs by the wayside told the story of overwork and of exhausted food supplies.

On Tuesday, March 28, after three weeks of travel on the river, we rounded a bend of the stream and beheld Glenora. From Fort Wrangell to this point no settled human habitation had met the eye. Now we perceived that Callbreath's log-trading cabin and a dozen Indian shacks perched squat-like on a low margin of river bank formed the settlement that made so brave a showing upon the maps of that region. Two months later the Indian shacks had been turned into hotels and 15 saloons were doing a lively business. A local weekly newspaper was being hawked through the streets at 25 cents a copy. Outfits were piled 20 feet high along the river front, and 2,000 white men lay camped behind this rampart of provisions.

It was dark when we reached Telegraph creek, our destination, 12 miles further up stream. Great hills rose sheer in rocky escarpments from the river, and there was no spot for a camping



LELAND HOTEL — GLENORA, B. C.

place on the small segment of soil at their base. There were no poles on which to raise our tents, no boughs on which to spread our blankets, no fuel for cooking the evening meal. We had labored unceasingly for 18 hours that day. Every one was tired and ill-humored. Blankets were unrolled in the dirty snow and all sought repose—all but Dan, the axman, and John, the cook. They visited an improvised saloon that night, purchased Hudson's Bay Company rum, made acquaintances freely, and by morning had a considerable *clientèle* among the Indians.

Telegraph creek is an old trading center of the Hudson's Bay Company with the Tahltan Indians. A small creek pours through the rocky defiles of the mountains into the Stikine at this point. There is not a telegraph line in 1,000 miles. The name, however, recalls the enterprise of connecting the Old World with the New by a cable across the Bering sea. Work was actually begun on stringing the overland wire through this region, and great coils of rust-eaten wire still lie on the banks of the Stikine, precisely where they were dropped when the successful laying of the Atlantic cable killed the western project.

The Tahltan Indians about Telegraph creek speak Chinook and understand some of the most ordinary English words or speech of "Boston men." The rich and aristocratic, whose fortunes were laid in the packing industry twenty years before, in

TELEGRAPH CREEK — 150 MILES UP THE RIVER FROM WRANGELL, ALASKA the days of the old Cassiar gold excitement, live in comfortable log rancheries near the water's edge. The unthrifty, owning neither cabins nor ponies, live back in the brush in wickiups or hovels of poverty.

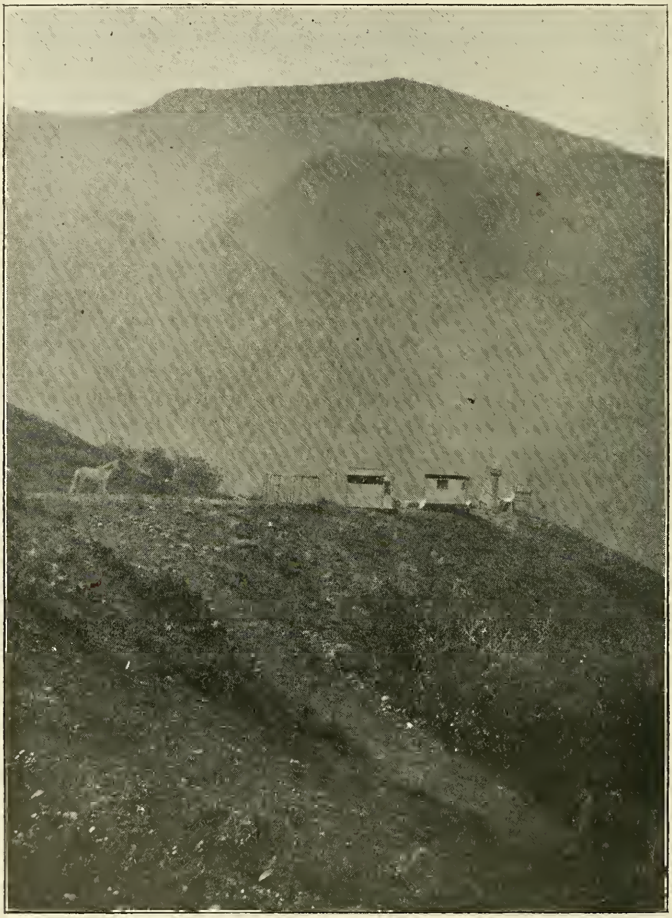
Social lines are strictly drawn. The ownership of a log cabin marks class divisions. Another badge of distinction lay in the possession of gaily beribboned straw hats. These hats had been taken into the country the previous autumn by the Hudson's Bay Company. Any young buck who aspired to be anything at all contrived to wear a straw hat last winter. Preference ran to Princeton colors. The Klooches, or women of the tribe, had a passion for gay-colored dress and were especially fond of dancing.

The family life of the Tahltans is of a low order. These people have not emerged from a state of polyandry. Paternity being a matter of doubt and maternity a matter of fact, the tracing of relationship among them is confined rather closely to the female line. Of course this has a direct influence upon property rights. Among Indians of the same tribe of the Tahltan river the institution of *mutter recht* or mother-law is clearly defined. The children of a marriage belong to the mother's family. It is said that in rare cases a child is transferred to the father's side of the house through formal adoption for a brief period by the father's sister. In the matter of inheritance it is the sister's son who takes precedence over the wife as a man's natural heir, though when a man dies his friends take over pretty much all his portable property. The wife, however, receives some compensation in the distribution of presents at the next *potlatch* or memorial festival, at which the deceased is honored. A trace of exogamy and of marriage by capture still exists in the feigned pursuit of a bride by the intended husband. The hostile demonstrations against the captor made by the friends of the bride are significant only of mock anger, being a relic of the archaic usage of hurling real weapons in actual wrath at the retreating bridegroom. Our own civilization has advanced a step farther. Rice and old slippers are thrown at bridal couples without even the affectation of wrath.

One would expect from their crude ideas of marriage to find a condition of club law or of lawlessness among the Tahltans. This is not true. They have scrupulous respect for rights of person and property. Of the many tons of food supply left unguarded along the trail we did not hear of a single case of theft by hungry

Indians. Prices, too, were high in the region of Telegraph creek before the break-up of the ice and arrival of river steamboats. Flour and bacon sold for 50 cents per pound, and one ton of hay could have been sold for $500.

There is some novelty in the method by which the Tahltans



INDIAN CABINS FOR THE DEAD — TELEGRAPH CREEK

dispose of their dead. After the flesh has been burned from the bones on a funeral pyre, with the favorite weapons and ornaments of the deceased, they are packed in small tin-covered trunks furnished by American traders. The trunks are then placed in neatly constructed cabins with glass windows. The cabins of the dead perched upon Mameloose hill, 200 feet above the river, can be seen for three miles down the stream. One little trunk, scarcely larger than a physician's medicine chest, was housed under a diminutive canvas tent. Few of the living Tahltans possess glass windows in their cabins, but these luxurious accessories are furnished the dead, whose spirits, with proverbial Indian curiosity, are supposed to be on the lookout for interesting phenomena in the village below. And since the world began was there ever so much to thrill the imagination of those simple folk of the forest as the phenomena provided by the gold-seekers last spring!

Gold hunting has no fascination for the natives of these regions, and they have never worked the old placer grounds in the vicinity in search of it. It must have seemed to them that all white men had suddenly gone mad. The sudden irruption into the solitudes of a far country of hundreds of swarthy men with horses, bullocks, goats, dogs, and impedimenta by the ton, amused the simple natives in much the same way as children are pleased at the antics of a menagerie of performing animals. All day long the bucks, wrapped in Hudson's Bay Company blankets, sat stolidly upon piles of lodge-poles on the bank, absorbed in the contemplation of the busy scenes on the river. They were amazed at the prodigious quantity of supplies; they marveled at the energy which had braved the snows of the river, but all shook their heads discouragingly at the project of taking the heavy outfits over the mountain trail into the interior. From being objects for the satisfaction of curiosity merely, the strangers became objects for the gratification of avarice. These untutored savages are shrewd and Shylockish in their keenness after a bargain. The prices the noble red men put upon their wares or their services were perfectly ridiculous. Ten dollars for a pair of moccasins and $20 for a day's labor at packing were gravely demanded of the strangers. Prices were finally scaled down to a basis of $150 per ton for packing to the first summit of nine miles. At this rate an Indian with his pony could earn from $15 to $18 per day. The Indians suffered economically as well as morally through their fondness for strong drink. Much bad whisky was quietly exchanged for their services. Our cook fixed up a decoction of lemon extract and dark water in which tea leaves had been steeped. Brown sugar and a dash of pepper were added to the mixture. The stuff was put up in old bottles

PACK TRAIN ASCENDING TO FIRST SUMMIT—TESLIN TRAIL

and slyly traded to the Klooches in exchange for moccasins and leggins as a highly prized brand of American wine.

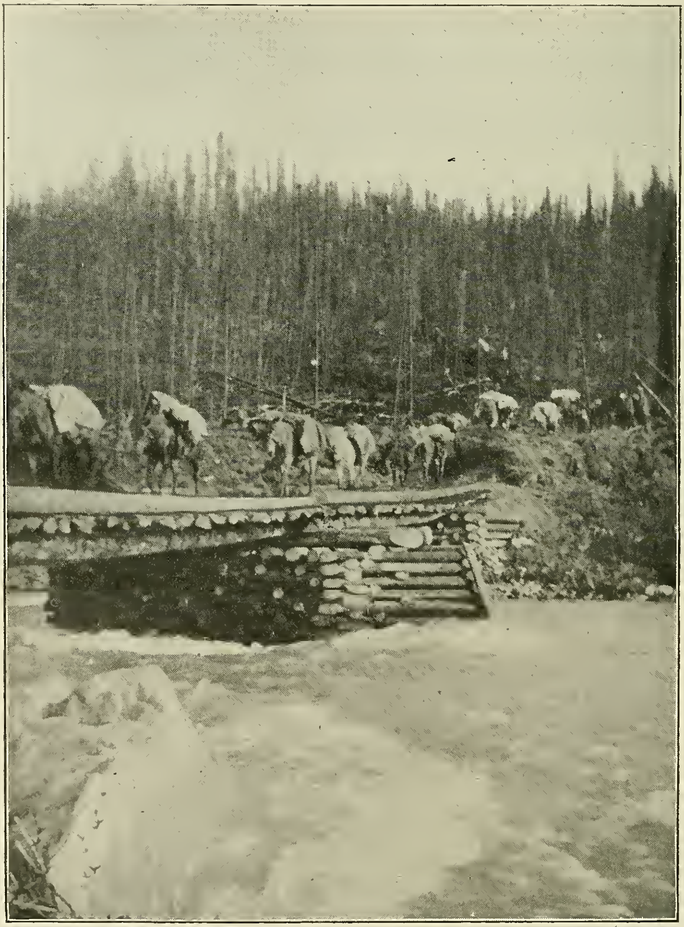
As we broke camp to begin the nine-mile climb to the first summit, three of our men rolled their blankets and bade us farewell. Their secession was due to unpleasantness over the duties of flunky to the cook, for which seven of us had been detailed. "We did not come into this country to act the part of scullion to a sheep-herder," said they. So they left the party to become professional packers, which is harder on one's back, but not so trying to one's pride. Soon after this John, our ingenious cook, left the party as a result of a little unpleasantness with Dan, the axman. John had made soup of some moose bones purchased from the Indians, in an old lard can that "Calgary," the teamster, had used the day before as a wash-boiler for his month's laundry. Dan would eat no soup, remarking that "when a man became too dirty to drive sheep he still had a chance of going in to cook on a survey corps." This sinister reference to John's former occupation broke the *entente cordiale*. John secretly disposed of about $200 worth of our provisions to some gold-seekers and departed for Glenora to start in business as a professional poker player. His place was taken by a stranded gold-seeker

CAMPING ON THE FIRST SUMMIT — ABOVE TELEGRAPH CREEK

called Ben, who approached the subject of cooking without any preconceived opinions or errors in experience.

On quitting the rivers we followed the roaring mountain torrent that threads its way from the first summit nine miles to the northward. By noon of the second day we stood upon the first divide, at an elevation of about 2,700 feet above Telegraph Creek village. In this distance we had lifted and tugged the sledges over a succession of benches that rose *échelle*-wise in formidable declivities from the river. A bitterly cold, searching wind was encountered on the summit, and we could not halt for lunch or rest. Over the divide the country gently falls off toward the valley of the Little Tahltan, about 16 miles to the northeast, from which low level another summit of 2,600 feet is to be surmounted in the ensuing 12 miles of trail to the Coketsie lakes.

Just beyond the first summit we were caught in a heavy snowstorm, thick with fine, driving snow. The men who worked at the sledges to keep them on the narrow, tortuous trail could scarcely distinguish the driver who led the horse. The horses repeatedly lost footing on the beaten path, and fell plunging and snorting over their withers in the dry, powdery snow to one side. As we could not push on to a suitable camping place and the



IMPROVISED BRIDGE OVER LITTLE TAHLTAN RIVER — TESLIN TRAIL horses could not remain on the narrow trail through the stormy night, the sledges were detached and the beasts sent back to the south slope of the divide.

The snow lay seven feet deep over the stunted willows that grew about the little mountain stream we were following to the Tahltan. This stream was located and a shaft was sunk through the snow and ice to the running water. Pails of water were thrown upon the dry granulated snow in order to get a substantial flooring for a single tent. After four hours of work, seven men managed to find shelter from the storm. The draughtsman who had begun to doubt the wisdom of continuing with the party recovered his confidence; but in this auspicious hour our little sheet-iron stove becoming hot keeled over on its foundation and settled two feet in the snow. This separated the stove pipe at one of its joints, and a dense cloud of smoke filled the once happy home. It was a case of *sauve qui peut.* Every one fled to the open air; but above the howling of the storm an over-sensitive ear might now have caught certain lurid epithets and objurgations that only an extraordinary exigency serves to invoke from the vocabulary of the habitually profane.

[*To be concluded in the November number.*]

TIDES OF CHESAPEAKE BAY

By E. D. Preston,

U. S. Coast and Geodetic Survey

A successful attempt to fix a permanent tidal plane for the Chesapeake bay has recently been made by the U. S. Coast and Geodetic Survey. During the last fiscal year nearly 40 stations were occupied, at 13 of which we are in possession of simultaneous tidal observations extending over one complete lunation.

The application of harmonic analysis to this unique series along our seaboard will open the way for correct predictions from the capes to Havre de Grace, and will also result in the establishment for the whole bay of a plane of reference of unequaled permanence and undoubted accuracy. The establishment of an invariable datum plane is one of the first requisites of inshore hydrography. The accuracy with which such reference level should be determined depends, of course, on the nature of the work based upon it. In foreign surveys vast sums have been expended in maintaining tide-measuring instruments in the North sea, along the coasts of France, and in the Mediterranean sea. These have been connected, wherever possible, in efforts to compare the sea-level at different ports around Europe. France and Spain occupy favorable positions in work of this kind, since by comparatively short lines, without leaving their own territory, they may connect the mean sea-levels of the Atlantic and the inland waters east of Gibraltar. How important the determination of heights is regarded abroad may be judged from the fact that up to 1895, the date of the last published report of the International Geodetic Association, more than 122,000 kilometers of precise leveling had been done in continental Europe, and nearly 99,000 permanent bench-marks had been established. This work has had its greatest development in Germany, Austria, and France, in the order named.

The average tide for the entire bay is about one foot; possibly less. For Old Point Comfort we have two and one-half feet; for the mouth of the Potomac, one foot; for Washington, three feet; Richmond, three feet; Elk river, at the head of the bay, two feet, and Annapolis less than one foot. The wind effect, however, is sometimes more than the total tide. For example, at Baltimore the wind effect may amount to three feet, while the tide proper, uninfluenced by local disturbances, is only one-third as much. This diminution in the height of the tides as we come northward from the entrance and the subsequent increase as we continue on in the same direction is one of the peculiar features of the tidal phenomena of the bay.

The small range at Annapolis is due partly to the change in width of the bay, but principally to the fact that there is an interference at this point between the incoming and outgoing tidal waves. When the crest of the southbound movement reaches the mouth of the Severn river it meets the northbound wave from the capes, and a partial neutralization of the vertical motion of the water takes place. Another interesting point in connection with the subject is that the rate of progress of the tidal wave from the mouth of the Potomac to Washington is somewhat less than that of an ordinary steamer, so that a vessel requiring the greatest depth possible would be able to enjoy the condition of high water during its entire passage up the river. The fact was first brought out by Mr C. A. Schott many years ago, when the *Great Eastern*, of transatlantic cable fame, availed itself of this favorable circumstance and came to anchor within a few miles of the Capitol.

THE RELATION OF FORESTS AND FOREST FIRES

By Gifford Pinchot,

Forester of the U. S. Department of Agriculture

The study of forest fires as modifiers of the composition and mode of life of the forest is as yet in its earliest stages. Remarkably little attention, in view of the importance of the subject, has hitherto been accorded to it. A few observers who have lived much with the forest, such as John Muir of California, have grouped fire with temperature and moisture as one of the great factors which govern the distribution and character of forest growth; but so little has been said or written upon the subject that the opinion of each man seems to have been reached independently and upon the single basis of personal observation. The documents upon the subject still reside, with very few exceptions, in the forest itself. It is unfortunate that our acquaintance with what might almost be called the creative action of forest fires should be so meager, for only through a knowledge of this relation and through the insight which such knowledge brings can there be gained a clear and full conception of how and why fires do harm, and how best they may be prevented or extinguished.

The records of past fires, written in the forest now on the ground, are often decipherable for more than a hundred years back, and in many cases for more than twice that length of time. Such records throw light on the relations of forests and fires as nothing else can, and are consequently the most valuable of all documents upon the somewhat intricate but most important question of the final effect of fire upon the forest; for we must clearly realize, before the present subject can fall into its proper sequence, that we have not stated everything when we say that "a given forest is destroyed by fire." The forests which the first white explorers saw as they landed on this continent and gradually overran it were themselves the successors of others, which, through thousands of years, were burned down at intervals that we can no longer trace. There is but little of all the vast forest area of this country which does not bear, either in actual scars and charcoal or in the manner and composition of its growth, the marks of fire, and indeed it is more than probable that further investigation will greatly narrow the limits of those portions which may now seem to have been exempt.

That fires do vast harm we know already, although just what the destruction of its forests will cost the nation is still unknown.

FALLEN AND STANDING FIRE-KILLED TIMBER READY FOR THE NEXT FIRE — PRIEST RIVER FOREST RESERVE, IDAHO

From "A Primer of Forestry"

Records compiled by the Division of Forestry indicate that the average direct recorded loss from this source is not less than $20,000,000 a year. To this figure must be added the vast direct loss unrecorded, together with a great but indefinite damage from the effect of forest destruction on water supply, and other losses of immense importance, the deterioration of the soil, the destruction of the young growth, and the loss of the increment which a healthy young forest would have been laying on year by year. The latter may commonly amount in a pure forest to several hundred board feet per acre each year. With further study a more exact statement of the grand total of the loss will be possible; but even now it is safe to assume that for the nation as a whole the loss is represented yearly by a sum much in ex-

A SLASHING BEFORE THE FIRE — THE MASS OF DEBRIS IS TOO THICK TO PERMIT REPRODUCTION — WESTERN WASHINGTON

cess of $50,000,000. That figure sufficiently proves that the destructive action of fire on the forest in its relation to human needs is a subject of the first interest and importance; but in the present paper this brief reference must suffice. The regulative action of fire on the forest is here more directly in question.

Fires determine the presence or absence of forest in a given region far more generally than is often supposed. A very large part of the prairie regions of the United States is treeless probably because of fire. Such evidence as we have points strongly

FIRE GLADES SURROUNDED BY FIRE-SCARRED TIMBER ON HIGHER GROUND — BLACK HILLS, SOUTH DAKOTA

in this direction, and in addition the behavior of the border forest lands along the eastern edge of the prairies powerfully confirms this view. Where such forest lands have been protected from fire, as they have very largely through the progress of settlement, young trees have usually sprung up in great numbers under or between the scattered veterans which had survived the fires, and a dense and vigorous young growth stands ready to replace by a heavy forest the open park-like condition which the fire had created and maintained. The well-known "oak openings" furnish an excellent case in point. In a similar way and for similar reasons trees are spreading from the borders of streams in the prairies to the grass lands near by. Such indications as these, joined to the occasional discovery of evidences of former tree growth out on the prairie, where trees no longer grow, go far to prove that trees once grew and may grow again much beyond the limits they occupied when the white men first entered the country. That fire was a restraining cause admits of no doubt whatever, and that it was the principal cause over vast areas is altogether probable. One set of facts which may ultimately be used to establish this latter contention is found in the positions chiefly or exclusively occupied by trees in semi-arid regions, which positions are either along water-courses, and so shielded from fire by moisture, or on rough and stony ground, and so protected by the absence of enough grass or other vegetable ground-cover to carry a destructive flame.

The same course of reasoning applies to certain kinds of open glades or prairie, well named "fire-glades" by Mr Frederick V. Coville, Botanist of the U. S. Department of Agriculture. In the Black Hills of South Dakota, for example, these glades, surrounded by forest-bearing land, are almost exclusively confined to ground rich enough to support a crop of grass sufficiently dense to burn fiercely, while the timber is restricted to rough rocky or stony land, almost always higher than the glades and comparatively safe from fire because of the scantiness of the minor vegetation it is able to support.

In semi-arid regions where fire-glades of this kind occur, there is an interesting alternation, by years or series of years, of the presence and absence of the moisture which makes forest reproduction possible. In the same way the occurrence or absence of burning gives or denies an opportunity for young seedlings to reach a size at which they are reasonably safe from the attacks of ordinary surface fires. It must be clearly borne in mind that it is only the average effect of the class of causes of which fire and rain are the chief with which we are concerned. Young trees sometimes succeed through combinations of temporary immunities in establishing themselves in the midst of fire-glades of old date, and the rocky refuges where some seedlings usually escape the fire are not uncommonly burned over, as the fire-scarred trunks abundantly testify. But these facts do not obscure the effective working of the averages, although they do tend powerfully to lengthen the time required for the average to work itself out. Thus reproduction around the fire-glades of the Black Hills is extremely slow.

Perhaps the most remarkable of the regulative effects of forest fires relates to the composition of the forest—the kinds of trees of which it is composed and the proportion of each. This effect depends upon the action of fire in combination with the various qualities of resistance which trees possess. These qualities are of two chief kinds; one, adapted to secure the safety of the individual tree directly through its own powers of defense, the other to assure the continuance of the species, with little regard for the single tree. An example of the first kind is the western larch, whose enormously thick bark is almost fireproof, and so good a non-conductor that it protects the living tissue beneath it even against fires hot enough to scorch the trunk 50 or 75 feet above the ground. It is to this quality of their bark, as well as to their marvelous vitality, that the big trees of California owe their power to reach an age of 3,000 or 4,000 years. The eastern pitch pine protects itself in the same way. So do many other trees, including the longleaf pine, which adds to this quality of its bark another method of protection that places it at the head of all the trees of my acquaintance in its capacity to resist fire.

Almost all trees yield readily to slight surface fires during the first ten or fifteen years of their life. To this statement the longleaf pine is a conspicuous and rare exception. Not only do the young trees protect themselves in early youth by bark which is not uncommonly as thick as the wood (the whole diameter being thus two-thirds bark and one-third wood), but they add to this unusual armor a device specially adapted for their safety when growing amid long grass, usually a most fatal neighbor to young trees in case of fire. It is to be noted that the vast majority of longleaf pines are associated with grass from the beginning to the end of their lives. During the first four or five years the longleaf seedling reaches a height of but four or five inches above the ground. It has generally been erroneously assumed that this slow growth made it specially susceptible to injury from fire; but while the stem during these early years makes little progress, the long needles shoot up and bend over in a green cascade which falls to the ground in a circle about the seedling. Not only does this barrier of green needles itself burn only with difficulty, but it shades out the grass around the young stem, and so prepares a double fire-resisting shield about the vitals of the young tree. Such facts explain why the fire which has restricted the spread of evergreen oaks in parts of Florida, for example, has made a pure forest of pines in a region where the reproduction of the oaks is phenomenally rapid wherever the annual fires cannot run.

The second method of protection against fire is that which sacrifices the individual but secures the safety of the species. Perhaps the most striking example of this method is furnished by the lodgepole pine, which is being distributed over hundreds of square miles in the Rocky Mountain region by the action of fire. It is a fact that this thin-barked tree, which succumbs with the utmost readiness to fire, is gaining ground by the action of its enemy, replacing over great areas thick-barked species like

FIRE-SCARRED SEEDLING OF LONGLEAF PINE — SHOWING PROTECTING NATURAL GROWTH OF ITS NEEDLES

the red fir and the western larch. The device to which this curious result is due is similar to that of *Pinus attenuata*, to which John Muir long since called attention.* It consists in the hoarding for several years of the ripe seeds in the cones. Fire rarely

* See The Mountains of California, p. 151.

TWO GENERATIONS OF LODGEPOLE PINE IN EVEN-AGED GROWTH AFTER FIRE — THE GROUPS ARE TWELVE AND FIFTY YEARS OLD RESPECTIVELY burns down the lodgepole pine, but in nearly every case simply kills the standing tree and leaves it to be blown down years after, when decay shall have weakened the roots. In the meantime the hoarded winged seeds are set free by the opening of the cones, are distributed and germinate, and the new crop contains a larger proportion of lodgepole than the old. By the repetition of this process great stretches of burned land are finally covered with a pure even-aged young growth where formerly the forest was composed of other and usually much more valuable species. The details of the return process by which the more valuable species will undoubtedly in the end regain possession of the soil I do not yet know.

A somewhat less obvious, although not a less interesting, instance of distribution controlled by fire is that of the red fir in those portions of Washington (and presumably of Oregon also) where it reaches its best dimensions and greatest commercial importance. Here the young seedlings are found in remarkable abundance on unshaded spots wherever the vegetable covering of the mineral soil has been burned away. An actual count

UNSCARRED EVEN-AGED YOUNG GROWTH OF RED FIR — SHOWING FIRE-SCARRED ROTTING STUBS OF THE PREVIOUS GENERATION — OLYMPIC FOREST RESERVE and measurement of every tree on many hundred acres of fir timber in various parts of the Puget Sound region, and a study in the Olympics, combine to show them practically absent in the shade of their elders. In the latter region, as I had occasion to say in a report (dated January 26, 1898) to the Secretary of the Interior on the condition and proper management of the national forest reserves, " Continuous stretches of miles without a break were covered with a uniform growth of Douglas fir (red fir) from two to three feet in diameter, interspersed with numerous rotting stumps of much larger trees bearing the marks of

REDFIR FOREST ON LAND ONCE RAVAGED BY FIRE

fire. The young firs were entirely unscarred, but charcoal was found at the roots of some specimens which had been thrown by the wind. . . . Charcoal was found directly beneath a growing cedar tree four feet in diameter, under which a hole had been excavated in the course of lumbering operations. This mass of evidence acquires a crucial importance with relation to the forest from the fact that in my ten days' visit to this region I did not see a single young seedling of Douglas fir (red fir) under the forest cover, nor a single opening made by fire which did not contain them." In a word, the distribution of the red fir in western Washington, where it is by all odds the most valuable commercial tree, is governed, first of all, so far as we know at present, by fire. Had fires been kept out of these forests in the last thousand years the fir which gives them their distinctive character would not be in existence, but would be replaced in all probability by the hemlock, which fills even the densest of the Puget Sound forests with its innumerable seedlings. I hasten to add that these facts do not imply any desirability in the fires which are now devastating the West.

These examples of the relations of fire and the forest are cited because they are conspicuous among the few which have already been worked out. Without question a number of relations of vastly greater importance remain to attract and reward the student of this branch, one of the most fruitful and fascinating of all the fascinating and fruitful branches, of forestry in the United States.

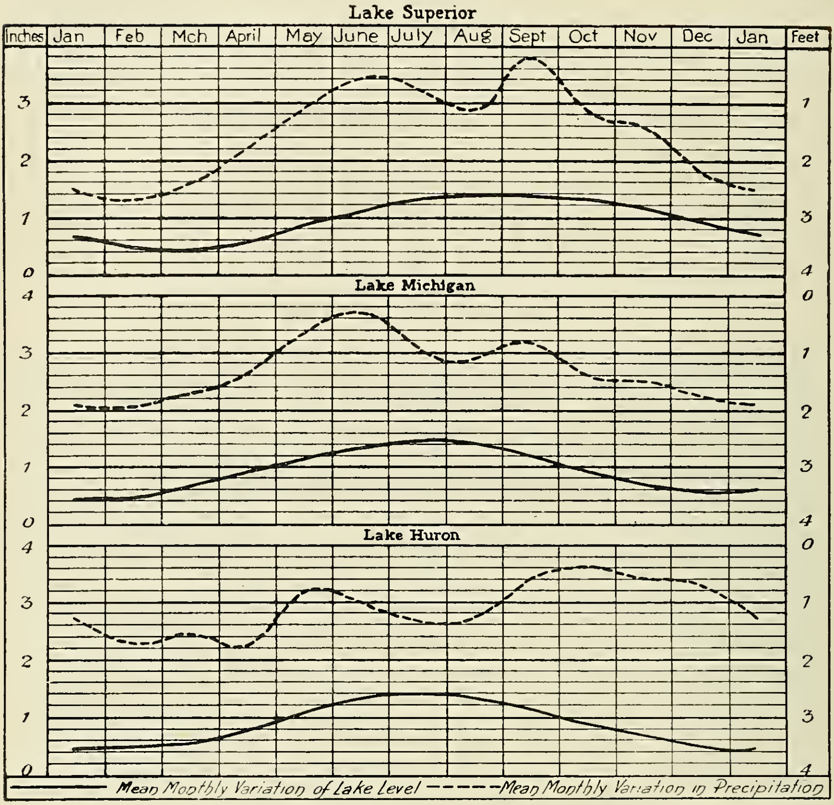
VARIATIONS IN LAKE LEVELS AND ATMOSPHERIC PRECIPITATION

By Alfred J. Henry,

Chief of Division of Records, U. S. Weather Bureau

A study of the fluctuations in the surface level of the Great Lakes is always an interesting problem. It is especially so at the present time, owing to the near completion of the Chicago drainage canal and the projection of various industrial enterprises, which, when completed, will divert large quantities of water from present channels. The physical problems involved in an adjustment of the situation are manifold and intricate, as are also the commercial interests seeking recognition. The writer desires at this time, however, merely to direct attention to the possibility of determining the probable level of the lakes by accurately gauging the precipitation over the various watersheds.

The stage of water in a river or natural reservoir system, such as the Great Lakes, is dependent primarily upon supply, discharge, and evaporation. In small streams the correspondence between precipitation and water stages is easily observed. The drainage basins themselves are small, and when precipitation has once begun but a short time lapses before all portions of the basin are contributing to the stream-flow. In a small basin of uniform surface and slope it is possible to calculate the exact



MEAN MONTHLY VARIATION IN LAKE LEVELS AND PRECIPITATION

time of maximum stage providing the amount and intensity of precipitation are known. As the drainage basin increases, however, the problem becomes one of greater complexity and the correspondence between precipitation and water stages is not so definitely marked.

The important oscillations in the surface level of the Great Lakes may be conveniently divided into two classes, *viz.*, annual or periodic, and irregular or non-periodic. The first of these consist of a rise from low water of winter to high water of midsummer, followed by a return to low water, the entire range from low to high water rarely exceeding a foot. The irregular or non-periodic variations also consist of oscillations up and down about a general mean level; but, unlike those first named, they may range through several feet and persist in a single direction for a number of years. Lakes Michigan and Huron, it may be remembered, fell continuously from 1886 to 1892, the total fall being about two and a half feet.

The mean monthly variation, both in lake levels and monthly precipitation over the respective watersheds, is shown in the diagram on page 404. The full curve shows the average level in feet of the surface of Lakes Superior, Michigan, and Huron below the plane of reference of the U. S. Lake Survey (high water of 1838). The dotted curve shows the average distribution of precipitation, in inches, throughout the year. The agreement between the two sets of curves is as close as could be expected, considering the nature of the data on which they are based and the natural climatic differences between the regions under discussion.

The climate of the Lake Superior watershed differs in several respects from that of the region to the southward, partly by reason of its geographic position and partly on account of the lake itself. The precipitation of winter is generally in the form of snow, and is derived for the most part from storms advancing from the North Pacific or the Canadian Northwest. The snowfall is greatest on the south shore of the lake and is particularly heavy from the Keweenaw peninsula eastward to and beyond Wetmore, on the Duluth, South Shore and Atlantic railway.

If the two curves showing the monthly rise in the level of Lake Superior and the distribution of precipitation in its watershed respectively be compared, it will be seen that the annual rise in the lake begins coincidently with an increase of precipitation. We should not be too hasty in placing these phenomena in the relation of cause and effect. The rise in the waters of the lake in the spring is doubtless due to the breaking up of the ice in the rivers and the melting of the snow. Water from these sources is fed into the lake during April and May more rapidly than it is discharged through the St Marys river; hence the surface level rises. The rains of June, July, and August, on the average, equal about nine inches in linear depth, which amount, plus the run-off from the watershed, should be set against the loss by evaporation. The latter is, to a certain extent, an unknown quantity, varying somewhat from year to year. Under the most favorable conditions the loss by evaporation will not greatly exceed the rainfall. The height to which the water of the lake will probably rise, therefore, must depend greatly upon the amount of water carried by the tributaries of the lake after the breaking up of the ice, plus the amount conserved during the spring and early summer in the swamps and forested areas within the watershed, and this in turn is largely dependent upon the amount of snowfall during the previous winter and the manner of its disappearance.

The present season has been one of abundant rainfall on both sides of the international boundary, north of a line drawn through Alpena and Parry sound. South of that line the rainfall has been deficient. The water of Lake Superior has been higher than usual, and there has been an increase in water levels of Lakes Michigan and Huron also, although rainfall over a large portion of the watersheds of the lakes last named has been deficient.

This is an important fact, since it suggests at once the probability that the stage of water in Lakes Michigan and Huron is controlled in great measure by precipitation in the Superior basin. The number of rainfall stations reporting to the Weather Bureau from the lake region is about 300. It should be possible in the course of a few years to define in at least approximate terms the relations which subsist between atmospheric precipitation and fluctuations in the level of the lakes.

CALCULATIONS OF POPULATION IN JUNE, 1900*

By Henry Farquhar,

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The problem to be discussed in this paper may be stated as follows: Given the population of the United States (not including recent territorial extensions) for the first of June in each tenth year; given also the total immigration to the country for the several decades beginning with 1821 and ending with 1900; to conclude from those data the population probably to be returned for the same territory for the first of June next year. In using the decennial population figures, those for 1870, confessed by General Walker himself to be several hundred thousand short of the truth, are omitted. The immigration for the fiscal year just begun has necessarily to be estimated in calculating the increase from 1890 to 1900; otherwise the official returns constitute the data of the problem.

Immigration.—The annual figures are given by fiscal years ending with September from 1820 to 1849, with the exception of

* Read before Section I of The American Association for the Advancement of Science, Columbus, August 22, 1899.

the years 1832 to 1842; then from 1850 to 1865 the year of the immigration report closes with December; from 1866 to date the fiscal year ending with June is adopted. To make the figures homogeneous, the earlier returns are approximately reduced to years ending with June by adding and subtracting, for the fiscal year of each decade, a proportion of the immigration equal to the proportional part of the year between the end of June and the end of the immigration year adopted; that is, one-fourth if the latter ends with September, one-half if with December. This approximate reduction would be exact if immigration during the year so divided were precisely uniform. The assumed immigration for the present fiscal year, 354,000, is larger than that reported for any year since 1893, though considerably less than for the first three years of the decade. The last decade, however, shows but one year, that ending June, 1886, when the immigration was less than 354,000.

Immigration by Decades, and Reduction to Years Ending with June.

Decade begins.	Reduction to July.	Decade ends.	Reduction to June.	Total immigration.	Reduced immigration.
Oct., 1820	+ 2,100	Sept., 1830	— 5,800	143,439	139,700
Oct., 1830	+ 5,800	Dec., 1840	— 42,000	599,125	562,900
Jan., 1841	+ 42,000	Dec., 1850	— 148,000	1,713,251	1,607,300
Jan., 1851	+ 148,000	Dec., 1860	— 75,100	2,579,520	2,652,400
Jan., 1861	+ 75,100	June, 1870	0	2,298,596	2,373,700
July, 1870	0	June, 1880	0	2,812,191	2,812,200
July, 1880	0	June, 1890	0	5,246,613	5,246,600
July, 1890	0	June, 1899	+ 354,000	3,396,011	3,750,000

Natural Increase.—It need hardly be confessed that to take the difference between the population at the beginning of June for years ten apart, to diminish that difference by the immigration for a ten-year interval reaching forward to the end of the same month, and to treat this diminished difference as the natural increase for the decade of the population reported at the beginning, is not a procedure that should be employed in a calculation where any great refinement is admissible. Unfortunately, in this case our data do not admit of delicate handling. The most important error involved in this treatment is probably that of neglecting the increase in the immigrant population itself from the time of landing to the end of the decade. If allowance were made for such increase, it would result in a slightly smaller estimated population for the first day of June next. The correction is here neglected for four reasons: (1) its uncertainty—for the assumption that an immigrant population, immediately after arrival, will increase at the same rate as natives is only approximately true, and there is no trustworthy way of tracing this element of the population from census to census; (2) the smallness of the amount involved—no reasonable estimate of the increase in question for any decade, even that beginning with 1880, would reach half a million, by but a very small fraction of which amount the final result for 1900 could be affected, a fraction insignificant when compared with errors unavoidably entering; (3) the desirability of simplicity in the calculation, as well as definiteness; (4) the probability that the discordance between the 1880 and 1890 census figures, brought out by the application in the formulæ herewith to be shown, is due more to deficiency of the latter rather than to excess of the former, so that any treatment which, using the figures as they stand, leads to a lower final result for 1900 is to be avoided. The "natural increase," therefore, as here understood, is the total increase during the decade by census record, diminished only by the accession from immigration in that time.

Law of Natural Increase.—In a newly occupied territory the tendency of a population is to grow in a geometrical progression; the percentage of increase is in that case constant for a constant interval, and the total population equal to some fixed quantity raised to a power represented by the time. After a period, longer or shorter, according to the capacity of the population to support itself on the land, the percentage of increase falls off and grows lower as the population grows greater. The law of this falling off in the ratio is one which, in the present state of our knowledge, has to be decided empirically. The following formula is used, with some modifications to be explained, in these calculations:

$$\Delta p = \frac{p}{e + fp + gp^2},$$

where p denotes the population, Δp its natural increase in ten years, and e, f, g positive constants to be found by calculation. It will be seen that this formula would give a geometrical progression if f and g were zero; that it gives a near approach to such a progression for small values of p; that Δp would continually increase (thus showing always larger additions per decade) and approximate to an arithmetical progression with common difference equal to $\frac{1}{f}$ for very large values of p if g were zero; that without any such supposition Δp increases in value as long as p is less than $\sqrt{\frac{e}{g}}$, but decreases when p exceeds $\sqrt{\frac{e}{g}}$; and that the effect of the constant g is to make the population, when it becomes very large, nearly proportional to the square root of the time elapsed. If Δp is taken as a differential coefficient, it is easy to deduce a value of the time in terms of the population, involving the logarithm of p as well as its first and second powers; but a statement of p in terms of the time seems to require a series to express it. To treat Δp as a difference instead of a differential only introduces further complexities, so that it will not be worth while to go further into the mathematical discussion of the formula.

For convenience the constants f and g are made to apply to a population in millions, a million inhabitants being taken as a unit in the calculation. The table to be shown is constructed accordingly. To apply to natural units, f would have to have six ciphers prefixed, while g would require twelve.

Table of Results.—The results of four calculations will appear in the table. In the first all the coefficients—e, f, and g—are determined. The census figure for 1870 is rejected, but the law of natural increase is supposed to operate undisturbed from 1860 to 1870, as in the decades before and after. This gives the results headed A.

In the second calculation g is taken as zero, and, as before, no break is supposed between 1860 and 1870. This calculation is denoted B.

The third calculation, C, differs from B by supposing that the law of increase, which applies from 1820 to 1860 and after 1870, is not true for the decade of the civil war, and that a new start must be made from the latter date, the difference between the new value and that calculated from the 1860 figure denoting the effect of the extraordinary losses by wounds, disease, etc., during that decade.

The fourth calculation, D, agrees with C in recognizing a break after 1860, but it takes $f = 0$, and so determines e and g. Two lines are given in the table for the date 1870, where the calculation assumes a break, the first showing a normal increase from

1860, and the second making allowance for extraordinary losses (marked l in the table). All differences, ratios, etc., in which the census population for 1870 enters are put in parentheses.

In forming the four columns of calculated population the formula is applied to the figure found for the beginning of the decade to obtain the natural increase. To this is added the ascertained immigration for the decade. The result is the total increase, and hence is derived the calculated figure for the end of the decade.

The second column of the table shows the census population in millions and decimals of a million for the dates in the first. The third column gives successive differences of the second. The fourth shows the immigration, and the fifth the difference between the two preceding, here called "natural increase." The percentage formed by that increase, compared with the population at the beginning, next appears. This shows a general falling off in value, as noted above, while its reciprocal, denoted $\frac{p}{\Delta p}$ in the seventh column, is the number represented by $e + fp + gp^2$ in our formula. The remaining columns give the four calculations of population, as already explained. Each calculated value is followed by the correction reducing it to the value actually found.

Another word as to the meaning of the coefficient e, the number of people that increased by a unit (as 2.862 to 3.862, 2.279 to 3.279, and so on) in ten years, when the population was very scanty. The length of time in which the population would double itself under those circumstances, by natural increase, is found by ascertaining what power 2 is of $1 + \frac{1}{e}$. The four calculations give 23, 19, 21, and 26½ years respectively. The time of doubling lengthens without limit as the population increases, and the effect of coefficients other than e appears.

Comparison of Four Calculations.—All calculations agree in indicating a large deficiency for the census population in 1870, which was 898,000 by the last and nearly double as much by the first. The 1890 census was also short by a less amount, while that of 1880 gave an excess according to all four. The census figures from 1820 to 1860 are much more easily reconcilable. None of these is more than a hundred thousand in error by more than one of the four calculations, and only one census, that for 1830, errs in the same direction according to all

Population by Census and by Formula

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
							A		B		C		D	
Year.	Population.	Increase next 10 years.	Immigration.	Natural increase.	Per cent.	$\frac{p}{\Delta p}$	Calc.	Cor.	Calc.	Cor.	Calc.	Cor.	Calc.	Cor.
1820.........	9.634	3.232	.140	3.092	32.10	3.116	9.696	— .062	9.576	+ .058	9.659	— .025	9.802	— .168
1830.........	12.866	4.203	.563	3.640	28.29	3.535	12.786	+ .080	12.803	+ .063	12.803	+ .063	12.770	+ .096
1840	17.069	6.123	1.607	4.516	26.45	3.780	17.047	+ .022	17.154	— .085	17.085	— .016	16.935	+ .134
1850.........	23.192	8.251	2.652	5.599	24.14	4.142	23.233	— .041	23.331	— .139	23.240	— .048	23.126	+ .066
1860.........	31.443	(7.115)	2.374	(4.741)	(15.08)	(6.632)	31.461	— .018	31.427	+ .016	31.417	+ .026	31.571	— .128
1870.........	(38.558)	(11.598)	2.812	(8.786)	(22.79)	(4.389)	40.303	(—1.745)	40.110	(—1.552)	40.331 39.571	(l .760) (—1.013)	40.890 39.456	(l 1.434) (— .898)
1880.........	50.156	12.466	5.247	7.219	14.40	6.948	50.124	+ .032	49.924	+ .232	49.714	+ .442	49.829	+ .327
1890.........	62.622	....	3.750	....	....	....	62.635	— .013	62.767	— .145	63.064	— .442	62.949	— .327
1900.........	....	....	....	....	....	....	73.648	....	74 693	....	75.679	....	74.466	....

In calculation A, $e = 2.862, f = .035, g = .00091$
" B, 2.279 .086 .0
" C, 2.57 .073 .0
" D, 3.35 .0 .0012

four. Perhaps this may be taken as an indication that the 1830 census gave a somewhat excessive total, while the others were fairly close to the truth. Calculation C gives a near agreement with all these ante-bellum results, while B and D show systematic divergences. To those since the war, on the contrary, B and D are both nearer than C. The agreement of A for every census but 1870 is strikingly close.

No attempt has been made to compare these results by aggregating the residual corrections and so computing a probable error of quantities found, because this work could only be misleading. It is plain that the results of calculation A would come out best and C worst by such test, residuals in parentheses being omitted; and yet it is the belief of the writer that the result under C for 1900 is nearer the truth than that under A. He does not believe that the rate of natural increase has really reached a maximum and is now diminishing, as both A and D require (for $\sqrt{\frac{e}{g}} = 56$ by A and 53 by D). He does not believe that the discordance of the 1870 census is altogether due to omissions in taking it, or that it can really be a million and three-quarters short. A calculation in the preface to the population volumes for 1890 made the deficiency a little over a million and a quarter, and even that figure is probably too high, because it depends upon a supposition that the southern section of the country, which had suffered most in the war, yet increased during that decade correspondingly with other sections. The writer believes that three-quarters of a million is a fair estimate for war losses in the 1870 census, and that the official figures were little, if any, over a million too small—about as calculation C makes them. It is more probable that the eleventh census, or both the tenth and eleventh, were largely in error, than that such a theory of the ninth census as is shown under calculation A is true.

Final Result for 1900.—The final figures under the four calculations have a range of two million and indicate a corresponding uncertainty in the prediction. The highest of them is two million less than the Treasury Department's calculation would give: the estimates of population which accompany the monthly financial reports point to a value of 77,676,000 for June, 1900. Those estimates show substantially uniform third differences, and therefore appear to connect population with time by an algebraic equation of the third degree. There is no evidence of an attempt to take separate account of immigration in the

Treasury estimates. A conclusion inconsistent with them requires therefore little apology.

Reasons have been given for preferring calculation C, which gives the largest result of the four, to the others. The writer can only present his own views for what they are worth. According to them the population to be shown by the twelfth census will be more probably above than below 75,000,000, but is altogether unlikely to reach 76,000,000. If it should be anything like so high, it will indicate a deficiency in the last census total sufficiently marked to invalidate any computation for the future in which the figures of that census are adopted, without correction or criticism. In fact, while it is necessary to take the whole series of results, so far as that can be done, as a foundation for any law which is applied to further calculations, it is necessary also to correct one set of figures by others, that the result may be as little as possible tainted by errors belonging to one or a few previous results. If it be supposed, on the other hand, that all discrepancies between census figures and calculation are indications of real irregularities of which the calculation takes no account, it need hardly be added that such a supposition negatives the validity of any possible prediction from the data at command.

THE DEFINITE LOCATION OF BOUVET ISLAND

The last number of the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* is entirely devoted to the recent German deep-sea expedition of the *Valdivia*. The navigating officer of the ship gives an interesting account of the rediscovery of Bouvet island. It appears that in the year 1738 a French company in search of the Terra-Australis, supposed to be a fruitful and populous country, sent out two ships, one of them, *L'Aigle*, being commanded by Captain Lozier Bouvet. On January 1, 1739, Bouvet discovered land which he supposed to be a mere promontory, and which he called Cape Circumcision. During nine days, however, Bouvet found it impossible to effect a landing and was forced to continue his journey. In 1775 Cook searched for Bouvet's discovery, but, finding nothing, concluded that Bouvet had been deceived by large masses of ice. In October, 1808, Captain Lindsay, commanding the whaler *Swan*, belonging to Messrs Enderby, and who had been commissioned by them to search for Bouvet land, sighted an island, which he called Lindsay island, in the locality in which he was directing his search for Bouvet land. Lindsay found it impossible to land, and gave a brief description of the estimated dimensions and general contour of the island. In 1825 Captain Norris, of the whaler *Sprightly*, sighted an island and assigned a certain position to it, calling it Liverpool island. In 1843 Sir John Ross, commanding the *Erebus*, searched for Bouvet land and came to the same conclusion that Cook did because he failed to find it.

Thus our knowledge of the facts remained until the *Valdivia*, after a careful search, sighted the island on November 25, 1898. The position of the island, which is given as latitude S. 54° 26.4′, longitude E. 3° 24.2′, does not correspond with that assigned by Bouvet to his discovery, or to the positions given by Lindsay or Norris, but a thorough and careful discussion of the subject warrants the belief that Liverpool, Lindsay, and Bouvet islands are identical, and therefore the discoverers adhered to the latter name. The island is about four nautical miles in diameter and rises to a height of 935 meters. The shores are abrupt and inaccessible and glaciers come down to the water's edge, while the summits of the mountains are covered with ice and snow. A few birds, notably *Daption capensis* and *Pagadroma nivea*, were seen on the island, but otherwise there were no signs of life.

O. H. TITTMANN.

U. S. Coast and Geodetic Survey.

PEARY'S WORK AND PROSPECTS

Peary's latest year in the Arctic, after all allowance has been made, stands as a record of magnificent achievement, and a foundation upon which still greater results are to be attained. The entire country north and west of Cape Sabine, reaching beyond Greely fiord and the eightieth parallel, has been definitely outlined and the confused and utterly inaccurate coastline, sinuous and perplexing to the last degree, of the western side of Smith sound, between Capes Sabine and D'Urville, has been definitely measured and charted. The striking change in the character of the western slope of Grinnell Land is in itself enough to justify and reward the expedition, and will stimulate workers in that most inviting and heretofore neglected field. The hand-to-hand battle against the opposing forces of darkness, frost, and distance which Peary waged during the entire winter makes a chapter daring and effective as any recorded in Arctic history. Where other explorers have waited in more or less impatience, sometimes in comfort and many times in suffering, Peary has been continuously in the field, daunted by no obstacle, and breaking the route along an almost impassable ice-foot for 250 miles. This, too, was not as a mere exploit, but as a practical step in the greater work to be determined next spring. Peary rounded up his year's work with a further personal reconnaissance to the westward, and practically completes twelve months of active work in the open field.

The American people, learning as they will shortly from Peary's own pen the story of the year, cannot fail to feel a sense of pride in their countryman and an excitement of hope that ultimate success may crown his effort to attain the goal of the ages and place his country's flag at the very farthest north. Those who read between the lines and who follow matters practically, find in Peary the mental as well as physical traits, making a combination as rare as the work he has undertaken, coupled with a clear head, and a practical, definite correlation of means to ends, which go far to secure the results desired. Peary will take the field next year, barring unforeseen accidents, a thoroughly sound, rested, and well man, in the very prime of condition, and can be counted on to make a record, even if he does not fully attain his desire. If beaten in 1900, he will try it again in 1901, and maybe again a year later. The very latest word is the very gratifying one that the old *Windward*, battered and scarred from her winter in the ice and stormy passage home, is still sound and seaworthy; that the ship will be repaired, rebuilt, and refitted, and, under an American flag and American master, will return to her contest with the forces of the north, from which she will not come back unless victorious.

H. L. Bridgman.

Brooklyn, N. Y.

PEARY'S EXPLORATIONS IN 1898–1899

"The Mission of the Diana," outlined in The National Geographic Magazine for July (see p. 273), has been successfully carried out in every detail under the able management of Mr H. L. Bridgman, Secretary of the Peary Arctic Club. More than a year's supplies have been added to the reserve stores of Peary and full accounts obtained of his important explorations during the past twelve months. Thus far merely an outline of his discoveries has been published, but, as Mr Bridgman has stated in the preceding article, a more detailed account will soon follow.

Instead of reaching Sherard Osborn fiord, on the north coast of Greenland, beyond the narrow channel which all sailing craft must take to reach that part of the globe, Peary was obliged to winter in Kane basin, about 50 miles north of Cape Sabine. His ship stayed in latitude 79°, and not 82°, as he had hoped might be possible. Not having been able to establish his base of sledging operations near Sherard Osborn fiord, he nevertheless ventured northward during the winter four times to Fort Conger, the headquarters of the Greely expedition, a point equally near the Pole, but on the west side of the channel. These long trips were made both for exploration and also to establish caches of supplies along the west side of the channel leading to the north, so that they may be available next spring and during the time the party is engaged in its explorations next summer. These supplies and others that will be added to them will enable Peary to begin his researches on the north coast of Greenland whether or not the *Windward* is able to land her stores at the proposed base in Sherard Osborn fiord.

In the south Peary discovered that the so-called Hayes sound, northwest of Cape Sabine, is only an inlet or bay. It was supposed by many that it extended through to the Arctic ocean west of Ellesmere Land and separated that country from Grinnell Land on the north. Peary's discovery proves that these regions are one and the same land, and he has thus been able to settle one of the most important geographical problems that awaited solution in that region. He also traveled west across the northern part of Ellesmere Land, which has never before been penetrated for any distance, and visited its west coast, joining his survey of the shoreline with the short bit of the coast further north, which Lockwood, of the Greely expedition, discovered in May, 1883. This is the first time that any part of this coast has been seen south of the inlet visited by Lockwood. In his various sledge journeys up the channel from the *Windward's* position, Peary skirted the east coasts of Grinnell Land and Grant Land for a distance of about 250 miles, rectifying the mapping of this shoreline in some respects, and particularly the surveys of a number of indentations. Fort Conger was the headquarters of the Greely expedition, and Peary was the first to visit the place since Greely left it, in 1883. The most northern point reached by Peary was Cape Beechey, about 82° north latitude. No effort to push northward has been made this summer, and Peary's winter camp has been established on the Greenland side of Smith sound, several miles further south than his quarters of a year ago. Here he has landed all the remaining provisions of the *Windward* and all that the *Diana* brought him.

The *Diana* reports landing the Stein party at Cape Sabine and leaving them in good spirits for a winter in Ellesmere Land. The hunting party led by Russell W. Porter, of Boston, left the ship at various points on the Greenland coast and secured a number of walrus, reindeer, and other game, most of which was added to Peary's stores. Sverdrup in the *Fram* was frozen in near Cocked Hat island, ten miles west of Cape Sabine, where he wintered about 50 miles south of the point reached by Peary. Sverdrup planned this summer to work his ship up Kennedy channel, leaving the *Fram* at some point along the coast for a sledge trip across or around the northern end of Greenland.

THE CALIFORNIA AND NEVADA BOUNDARY

The oblique boundary between California and Nevada, which lies between the intersections of the 39th parallel of latitude with the 120th meridian and the 35th parallel of latitude with the Colorado river, a distance of about 400 miles, was retraced and temporarily marked by the U. S. Coast and Geodetic Survey between the years 1893 and 1899, the work being advanced from time to time as money was available for that purpose.

The line passes over very rough country, varying in altitude from 750 feet at the Colorado river to 13,000 feet at the White mountains. The lofty elevations made it possible to obtain some very long sights, the maximum being 68.8 miles, between the Sweetwater mountains (10,500 feet) and the White mountains. There were two other sights over 60 miles in length. The line was ranged out with a theodolite, beginning at Lake Tahoe and running to the southeast. In order to put points in the line at long distances, heliotropes, with a suitable code of signals, were used. The termini, both at Lake Tahoe and on the Colorado river, were established by telegraphic longitude, and latitude determined by observations with the zenith telescope. A scheme of triangulation was carried along the entire line, so that each distance was checked. Four base lines were in the scheme, three of them measured with steel tape and the other derived from the Yolo, a primary base nearly 11 miles in length.

An azimuth was measured at Lake Tahoe to get the direction of the line, and no change was made in the entire distance. After ranging out the random line, it was corrected back to the starting point.

The random line passed southwest of the Colorado terminal post, 400 miles from the beginning....................	150.5 meters.
A line 3,180.3 meters long on the Colorado river, depending on the Needles base (steel tape), was found to differ when determined by triangulation brought through from Lake Tahoe..	0.2 meters.
Difference of azimuth of the same line, brought through from Lake Tahoe..................................	10.2″

It may be stated that the uncertainty in azimuth, or direction of the line, amounted to one minute of arc. The local deflection in latitude at the Lake Tahoe end is nearly 300 meters, and almost as much at the Colorado terminus.

C. H. Sinclair.

U. S. Coast and Geodetic Survey.

GEOGRAPHIC LITERATURE

A Primer of Forestry. Part I.—The Forest. Bulletin No. 24, Division of Forestry, U. S. Department of Agriculture. By Gifford Pinchot. Pp. 88, pls. 47, with 83 cuts in text.

This beautiful booklet, tasteful in typography, artistic in illustration, neat in binding, and attractive in *ensemble*, marks an innovation both in the Department of Agriculture and in the Government Printing Office; and it is far removed from the conventional government publication in content as in dress. The four chapters summarize the science and epitomize "the art and mystery" of modern forestry in simple, comprehensive, yet withal vivid language, adapted alike to busy layman and anxious learner; the style is that of the highest magazine order—*i. e.*, that of the vanguard of literary progress. So the book affords attractive, not to say alluring, reading. A sub-title, "Part I—The Forest," gives gratifying promise that the innovation will be pursued and the style maintained. In the first chapter "The Life of the Tree" is outlined and illustrated by sun pictures in effective fashion, and in such terms as to picture clearly the structure and functions, or the anatomy and physiology, of the arborean organism; the second chapter treats of trees in their collective aspect, both as forests and as successive generations of arborean species; the third chapter deals with "The Life of the Forest" in such manner as to bring out the relations between the arborean collectives and their environment, both physical and vital; while the final chapter is devoted to the "Enemies of the Forest" (which are chiefly traceable to the human factor in the arborean environment), and to the means of counteracting these enemies. So the treatment is notably broad and comprehensive; yet the grasp displayed in each chapter, and indeed each paragraph, is strong and close. The book may be commended, no less to teachers and pupils than to general readers, as an example of scientific method applied to an important practical subject; it may be commended to makers of scientific books as a model, and to laymen as a worthy bit of literature of the objective sort. The author and the Agricultural Department are alike to be congratulated on its appearance.

W J M.

The Break-up of China. By Lord Charles Beresford. 8vo, pp xxii + 491, with portraits and maps. New York and London: Harper and Brothers. 1899. $3.00.

Sir Stafford Northcote was sagacious when, in behalf of the Associated Chambers of Commerce of Great Britain, he selected Lord Charles Beresford as the man to visit China and report upon British interests in that empire. Rarely, if ever, has one uniting so high rank, recognized ability, and wide experience been sent as an envoy of commerce on a tour of inspection. All doors would open before him. He would observe carefully, make no blunders, and afterward narrate just what he had seen.

Reaching Hongkong September 30, 1898, he did not leave China until January 9, 1899. During that time the Chinese government did all in its power to further his mission. Though invested with no diplomatic functions, he found everywhere the highest authorities—Tsung-li Yamen, viceroys, mandarins, governors, admirals—accessible and sympathetic. He "inspected the whole military force of China, and by permission of the generals put the troops through the various movements, in order to test their efficiency." He "visited every fort, every arsenal, with one exception, and all the naval and military schools; also the ships of both the Chinese fleets, viz., the Peyang and Nanyang squadrons, and one dockyard." He "visited those places where British communities reside and wherever there was a chamber of commerce convened meetings" and "obtained the opinions of the members;" nor did he lose an opportunity "of seeking interviews with representatives of all foreign nations holding trading interests in China." On leaving that country he returned home through Japan and the United States, "hoping to be able to obtain from the chambers of commerce some definite opinions for the Associated Chambers of Great Britain."

The results of his faithful observation and investigation are set forth in this somewhat ponderous book. Lord Beresford terms it "a plain statement of valuable facts for immediate use." A large part of this information is accessible nowhere else. Because of the known reputation of the author, its statements, as far as they are statements of facts and not personal inferences and opinions, are entitled to full credit.

The title, "The Break-up of China," expresses what the author realizes is becoming a fact. This catastrophe he deplores, believing it injurious to Great Britain. A patriotic British subject, his outspoken and only concern is the advancement of British interests. There is no hypocrisy or cant about him. Knowing that his country retains the commercial scepter of the world with a failing hand, he would keep China alive so as not to lose a purchaser. His position does not differ from that of any other commercial traveler, except that the commercial house he represents is the British empire, and that the wares which he would press into the market are whatever that empire produces. For the fall of China, now perhaps inevitable, but which once might have been avoided, he holds the inefficient foreign policy of the British government responsible. Meanwhile he forgets or ignores the fact that to China's territorial integrity, to the physical welfare of its people, and to the authority of its government more staggering blows have been dealt by Great Britain than by any other country. An ardent advocate of an Anglo-American alliance, he insists that "the interests of the United States and Great Britain are absolutely identical." He does not fear Russia, but he reveals an awesome consciousness of Russia's existence. He suggests in his first interview with Chinese authorities "that the British government would allow an officer to help the Chinese to put their army in order." When shortly afterward asked "whether, if China put the whole of her armies under British officers, Great Britain would assist China in any quarrel that might arise between her and any other power," he remarked that he "would not enter into any political questions, but that the last thing Great Britain wanted to do was to mix herself up in quarrels which might arise between other countries." It is not strange that "the idea is gaining ground all over China that Great Britain is afraid of Rnssia."

The disintegration of an empire containing 400,000,000 people, and yet powerless to protect itself, is an astounding spectacle, unparalleled in history. Yet such impotence is an argument against its political continuance. It is difficult to doubt that the break-up of China will advance civilization and even benefit the fragments into which the empire breaks.

EDWIN A. GROSVENOR.

Amherst College.

Les Lacs Français. By André Delebecque, etc. With portfolio atlas containing plates i-xi. 4°, pp. xii + 436, pls. xxii. Paris: Typographie Chamerot et Renouard. 1898.

This is an imposing and exceedingly rich repository of information concerning the lakes of France in their principal aspects. Beginning with a lively preface, in which he emphasizes the declaration that there *are* lakes in France, the author proceeds in the first chapter to classify the water bodies by the natural provinces in which they occur, including the Alps, the Jura, the Vosges, the Central plateau, the Pyrenees, and the Atlantic and Mediterranean littorals. The second chapter recounts the processes of sounding with the apparatus employed, and sets forth the results which are shown in greater detail in the accompanying atlas, while the third chapter is a detailed description of the more noteworthy lakes. Then follows a chapter on the lacustrine topography, including shores, bottoms, islands, talnses, fans and deltas, submerged ravines, etc., and another on the lacustral sediments and other constituents of the lake basins. The next chapter is devoted to supply, discharge, evaporation, and changes in level of the lakes, and still another to temperature, which is discussed in some detail with relation to climate, depth, temperature of affluents, etc. In chapter VIII the colors are described and the principal causes of coloration analyzed, while the mirage receives attention; and the succeeding chapter is devoted to extended consideration of the solid and gaseous materials held in solution in the lacustral waters. The portion of the work of widest interest is the tenth chapter (pages 242–343), in which the geologic relations of the region and the lakes are discussed at length, and which ends with a classification of the water bodies by known or supposed origin. The historical and social aspects of the lakes are indicated in the eleventh chapter, which is followed by an extended descriptive table of the principal lakes of France, with reference to the provinces in which they occur, and to the sheets of the official maps on which they are represented. The work is fully indexed and well supplied with lists of contents and illustrations. There is little reference to the accompanying portfolio, which is really a distinct publication; its sheets are variable in size and form and show little more than the shores and subaqueous contours of the principal lakes; and their convenience is somewhat diminished by inconstancy in contour-intervals and bathymetric tints. The monograph forms a highly useful compendium of facts arranged in accordance with well-established scientific principles.

W J M.

RAILROADS AND CANALS

The important bearing which the great reduction in rates for railway transportation has on the question of canal construction and maintenance is attracting widespread attention. In a recent letter to the committee on canals of the state of New York, the Hon. Abram S. Hewitt, until now one of the staunchest friends and advocates of the state canals, and one who has done more to promote the cause of the New York state waterways than any other living man, writes as follows:

I was brought up in a school of politics which taught that the prosperity of the state of New York was created by the canals and could not be maintained unless they were kept in a state of perfect efficiency.

But a new condition has appeared in the great reduction of the cost of transportation by the railways which compete with the canals for business. This reduction is due to several causes: notably, the greater durability and the lower cost of steel rails, the increase in the train-load, and the economy of fuel in hauling a train. . . . My knowledge of the subject inclines me to believe that we have reached a permanent era of low cost of transportation by rail. . . . Hence the question is presented in altogether a new light, and although I am reluctant to come to the conclusion that the canals have lost their usefulness, I confess freely that the argument for their continued maintenance is greatly weakened if not altogether destroyed.

GEOGRAPHIC MISCELLANEA

The British Association for the Advancement of Science has granted $5,000 toward the expenses of the English Antarctic expedition of 1901.

There passed through the American and Canadian ship canals at Sault Ste Marie during July 4,024,789 tons of freight, or 778,000 tons more than in the corresponding month last year.

The medical expedition sent to the Philippines in early spring by the Johns Hopkins University for the purpose of studying the characteristics of tropical diseases in those islands left Manila some weeks since and will probably reach Baltimore early in October.

"Guarding the Highways of the Sea," contributed by Theodore Waters to *McClure's Magazine* for September, is very readable and from a popular point of view is an excellent description of the work and records of the Hydrographic Office of the Navy Department.

The *Railroad Gazette* estimates the railroad building in the United States during the six months ending June 30 as aggregating 1,181 miles. The longest line completed by any one company was 64 miles, and the five leading lines aggregated only 244 miles, or an average of less than 50 miles each.

The magnetic survey of Maryland has now been practically completed, the distribution of the stations being such that on the average there is one station for every 100 square miles. The expenses of the work, with the exception of this year, have been entirely borne by the Maryland Geological Survey.

The excursion of geologists last summer to the fossil fields of Wyoming, under the patronage of the Union Pacific Company, will add some rare specimens to the collections of different universities throughout the country. It is believed that several fossils of a new species have been obtained. Though the excursion was originally planned for 30 days, many of the geologists are still at work in the field.

A telegram from Tacoma, Washington, announces the return of A. J. Stone, corresponding member of the Zoölogical and Ethnological Museum of Natural History and New York Zoölogical Society, who for the past two years has been traveling about the Arctic circle studying the geographical distribution of animals in that section. It is reported that during five months of travel last winter he covered 3,000 miles of Arctic coast and mountain entirely above the Arctic circle.

Reports from Alaska *via* Seattle, Washington, describe two distinct earthquakes felt from Lynn canal to the Aleutian archipelago. The first, on Sunday, September 3, did but little damage, but it was followed by a very severe shock on September 10. Several islands are said to have settled from 20 to 25 feet. A report received by the U. S. Coast and Geodetic Survey shows that an earthquake was also felt in Prince William sound on September 3, but that no damage was done at this point.

Charles Patrick Daly, LL. D., for 35 years president of the American Geographical Society of New York City and former chief justice of the court of common pleas of New York, died at his home, in Sag Harbor, Long Island, September 19, 1899. While preëminently a lawyer and a jurist, his long connection with the society of which he was the president and his honorary membership in the National Geographic Society, the Royal Geographical Society of London, the Berlin Geographical Society, and the Imperial Geographical Society of Russia will make his death especially felt in geographic circles.

The Geographical Journal for September opens with the first of a series of articles by Dr Francisco P. Moreno on his "Explorations in Patagonia" at different times between 1873 and 1897. Capt. G. E. Smith, R. E., contributes a description of "Road-making and Surveying in British East Africa." Robert T. Turley describes a "Tour in 'No Man's Land,' Manchuria." Other articles of interest are "The Cambridge Anthropological Expedition to Torres Straits and Sarawak," "From Njemps to Marich, Save, and Mumia's (British East Africa)," by Major H. H. Austin, R. E., and "Dr Passarge's Journeys in South Africa."

An interesting feature of the "Pilot Chart of the North Atlantic Ocean" for September is a diagram prepared from investigations made by Prof. George Davidson, of the University of California, showing the line separating the lands of the Pacific where American date is kept from those where Asiatic date is kept. The line passes through Bering straits, skirts the Aleutian islands on the west extremity, and then follows the 180th meridian southward as far as the Fiji islands, where it diverges slightly to the east. Thus the Aleutian, Hawaiian, and Samoan islands keep American time, while the Marshall and Fiji islands and New Zealand follow Asiatic time, or are one day ahead.

A recent number of *Science* states that the American Museum of Natural History at New York City has now 23 representatives in the field, engaged as follows: "The Jesup expedition to the North Pacific, making archæological and ethnological researches in British Columbia and northeastern Siberia; the Jesup zoological expedition to the United States of Colombia; the Constable expedition to the Northwest for large mammals; an expedition to New Mexico to study the cliff dwellings and the Pueblos; an expedition for the study of North American Indians in California and Arizona; a paleontological expedition to Wyoming; an expedition to Peru and Bolivia under Dr Bandelier, and local archæological work."

An anchor and a buoy marked "Andrée Polar Expedition" are reported to have been found by a Norwegian cutter on the north coast of King Charles islands, east of Spitzbergen. Neither the Wellman nor the Peary parties in their explorations of the past year discovered any trace of the missing aeronaut; also the steamer *Antarctic*, which left Helsingborg, Sweden, May 25, with an expedition under Prof. A. G. Northorst to look for Andrée along the northeast coast of Greenland, on her return in September reported a fruitless search. The report received at the beginning of this year that the bodies of Andrée and his two companions had been found on the coast of Siberia has not been confirmed by later advices.

On August 26 General Lord Kitchener formally opened for traffic the bridge, built by American engineers, across the Atbara near its confluence with the Nile. Trains can now be run to within 75 miles of Khartum, and before the end of the present year the whistle of the locomotive will be heard at the capital of the Sudan itself. Mr Cecil J. Rhodes has the utmost confidence in the completion of the proposed railway from the Cape to Cairo within ten years, and, in view of the energy displayed in the construction of the 700 miles that have been built since the project began to be seriously considered, there is little doubt that the completion of a line of railway across the Dark Continent will be one of the early achievements of the coming century.

Various sites within a radius of 25 miles of Washington are being examined by parties under Dr Bauer's direction for the determination of the best location for the Coast and Geodetic Survey Observatory. The examinations thus far made have disclosed some interesting regional disturbances, especially in the vicinity of Gaithersburg. In order to determine what influence such regional disturbances have upon the variations of the earth's magnetism, such as, for example, the diurnal variation or the secular variation, it is proposed to mount a sensitive Eschenhagen dedinetograph at Gaithersburg, with the aid of which the variations of the most sensitive of the magnetic elements—the declination—will be continuously and automatically recorded.

The election of Hon. John Gifford, of Princeton, N. J., to a Chair of Forestry in Cornell University, a department recently established at that institution, is in line with the growing realization throughout the United States of the necessity of the study and solution of the forest problems of the country. Mr Gifford was the founder and the first editor of *The Forester* (then the *New Jersey Forester*), the official organ of the American Forestry Association, which is doing so much to promote the protection and care of the American forests. Last year Cornell University acquired 30,000 acres of woodland in the Adirondacks for the exclusive use of her forestry department. Over a million small trees, it is stated, have been planted in different sections of this tract, and several seed beds have also been laid out.

The Division of Forestry of the U. S. Department of Agriculture has recently issued a handsome little bulletin (No. 26), entitled "Notes on the Forest Conditions of Porto Rico," by Robert T. Hill, of the U. S. Geological Survey. The bulletin embraces the results of observations made during a rapid reconnaissance through the military department of Puerto Rico by Mr Hill in January, 1899, and contains not only a clear statement of the forest resources of Puerto Rico, but also such succinct descriptions of the physical features of the island as are necessary to an understanding of its forest problems. In the study and description of the native woods Mr Hill was assisted by G. B. Sudworth, Dendrologist of the Division of Forestry. Fifteen of the woods are reproduced by a process by which the impressions are made directly from the woods themselves, a process designed by S. J. Kübel and here used, it is believed, for the first time. An excellent feature of the bulletin is an admirable relief map of the island compiled by Mr Hill.

In *The Scottish Geographical Magazine* for September Francis H. Skrine presents a strong article, "From London to Karachi (India) in a Week," urging the construction of a branch connecting the English railway system in India with the Russian system in Turkestan. At present the British line ends at Chaman, on the southern border of Afghanistan, only 430 miles distant from the terminus of an offshoot from the main Russian line through Afghanistan. Mr Skrine asserts that the connecting link, including the necessary rolling stock, can be constructed for $15,000,000, as the route presents no great engineering difficulties. In the same issue of the magazine Alexander Begg describes "Vancouver Island, B. C.;" R. Blake White publishes some "Brief Notes on the Glacial Phenomena of Columbia (S. A.)," and A. D. Milne contributes a few "Notes from the Equatorial Province."

Major Ronald Ross, the leader of the expedition sent to Sierra Leone by the Liverpool School of Tropical Diseases to investigate the possibility of exterminating the malaria-bearing mosquito, has sent to Liverpool the following cablegram: "Malarial mosquito found. Ask government to send at once men." *Nature* states: "Major Ross' observations in India indicated that the malaria parasite is borne by the spotted-winged mosquitoes, and not by the common brindled or gray mosquitoes; and his message announces that he has found that malaria on the west coast of Africa is produced under the same conditions as in India. There is evidence that the malaria-bearing species only breeds in small isolated collections of water which can be easily dissipated, but the expedition has not yet had time to verify this point." In response to the request of Major Ross asking that workers should be sent out to join him at Sierra Leone, the school has dispatched, as an assistant to him, Dr R. Fielding Ould, of the Liverpool School of Pathology, who has had special experience in private bacteriological research.

A preliminary prospectus has been issued of the "Physical Atlas," in course of preparation by J. G. Bartholomew, F. R. S. E., F. R. G. S., under the patronage of the Royal Geographical Society. The Atlas, comprising seven volumes, consists of a series of maps illustrating the natural phenomena of the earth, being based to some extent upon the Berghaus Atlas, but comprehending much new and original material. Explanatory text accompanies the maps, and for each section of the work there is also a general introductory article, a critical bibliography, and an index. The work, which has been in progress for over ten years and is now approaching completion, is revised and edited by: Sir Archibald Geikie, geology; Sir John Murray, oceanography; James Geikie, orography; Alexander Buchan, meteorology, and a number of other distinguished scientists. The publishers, Messrs Archibald Constable & Co., of London, claim apparently with justice that the atlas is the most comprehensive publication of its kind ever attempted. The cost of production alone will, it is estimated, exceed $100,000. The meteorology section, with over 400 maps, will be issued during the autumn of 1899, the zoölogy, ethnography and demography, geology, botany, and other sections following in rapid succession. The price of each volume or section is $13.

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2. Essays submitted in competition for these prizes should be typewritten in the English language, and should not exceed 6,000 words in length ; they may be accompanied by maps and other illustrations used for the explanation of the text, but not for embellishment.

3. Essays submitted in competition for the prizes should be signed by a pseudonym or number, and should bear no other indication of authorship, but each should be accompanied by a sealed envelope, marked with the same pseudonym or number, containing the name and address of the author.

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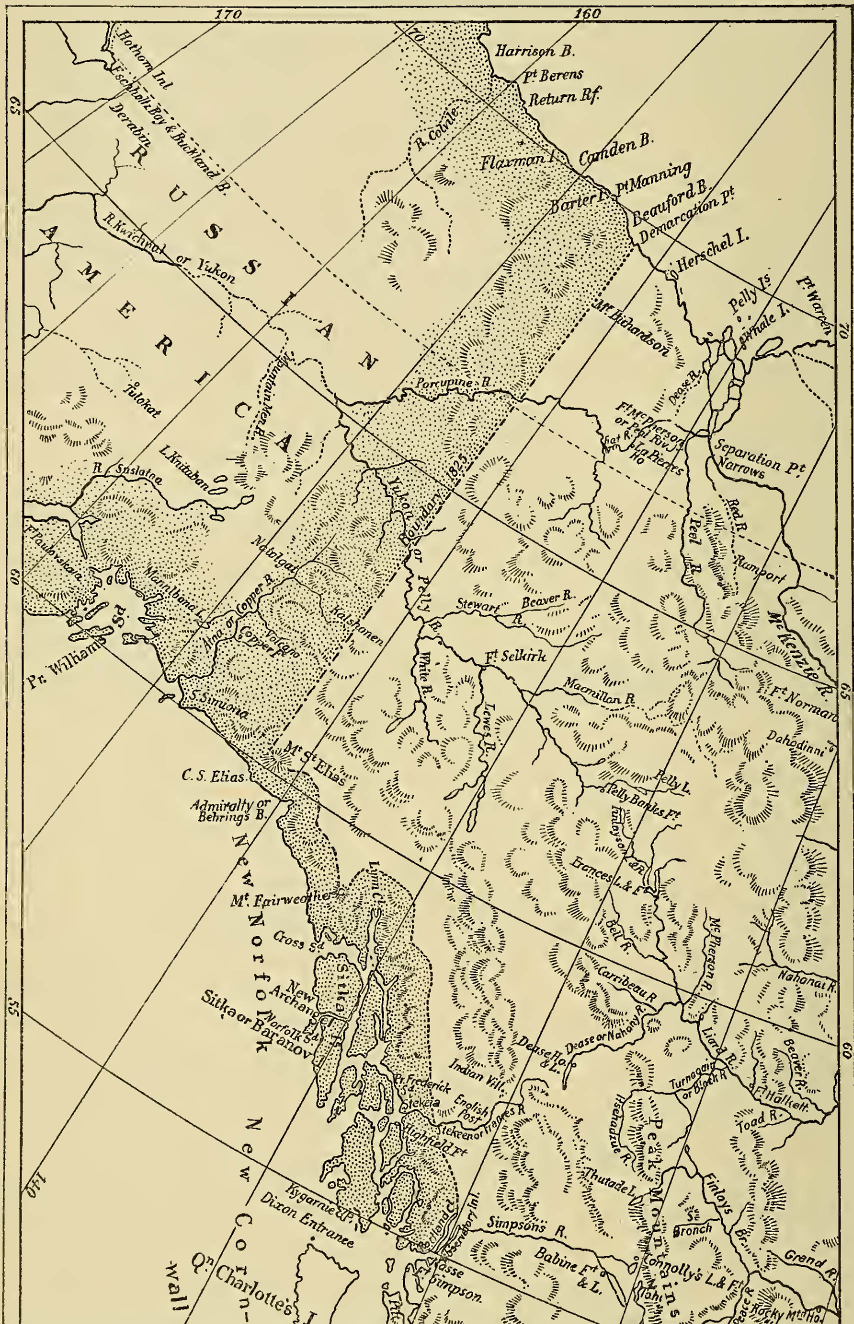


MAP No. 11

HUDSON'S BAY COMPANY MAP

"Ordered by the House of Commons to be printed, 31st July and 11th August, 1857"

NOTE—The Russian territory, colored yellow on original map, is indicated by dotted portion

THE

National Geographic Magazine

Vol. X NOVEMBER, 1899 No. 11

THE ALASKAN BOUNDARY

By Hon. John W. Foster,

Ex-Secretary of State

In the letter of the President of the Geographic Society inviting me to prepare a paper for The National Geographic Magazine, he expressed a desire that I should discuss the Alaskan boundary, because it was a subject that most deeply concerns our people and the paper would be a timely contribution toward its proper consideration. In accepting the invitation, I feel that I must confine my presentation of the topic to the facts accessible to any student of the events of the period and avoid all reference to pending negotiations.

Happily, however, the material at hand for an accurate understanding of the subject is abundant and within reach of the inquirer. Its history had its inception three-quarters of a century ago; yet few negotiations among nations of such a date are accompanied by so great a mass of concurrent documents and facts to explain the motives and objects had in view by the interested parties, and to make apparent the understanding of these parties as to the effect of the negotiations after their conclusion. The Alaskan boundary is fixed by the treaty of 1825 between Russia and Great Britain, and every step of the anterior negotiations was carefully recorded at the time, and the seventy or more years following the celebration of the treaty are marked by repeated acts of the contracting parties and those claiming under them, explaining their interpretation of that instrument.

The treaty of 1825 grew out of the issuance by the Emperor of Russia of an imperial ukase in 1821, the purport of which, briefly stated, was (1) a claim by Russia to exclusive jurisdiction on the high sea extending 100 miles from the coast of Asia above latitude 45° 50′ north and from the northwest coast of America above latitude 51° north; and (2) a prohibition to all foreign vessels to land upon or trade with the natives on any part of the coasts indicated.* This ukase brought forth a prompt and vigorous protest from both the United States and Great Britain, which was soon followed by negotiations between Russia and the two latter governments. It was early made known that Russia was prepared to withdraw its claim to exclusive jurisdiction in the Pacific ocean and would not insist upon its territorial claim to the coast of America below latitude 55°.† As the United States was advancing no serious claim to the territory north of that line, it found little difficulty in reaching an accord, and a treaty between Russia and the United States was signed April 17. 1824, nearly a year before an agreement was reached with Great Britain.

The chief object had in view by Great Britain in its protest and subsequent negotiations was to secure the withdrawal by Russia of her claim to exclusive jurisdiction in the Pacific ocean. At that period Great Britain was the rising power of the world in maritime commerce, the United States being its next competitor, and it made good use of the latter to aid in bringing about this withdrawal. At that day the vast territory of North America lying between the Rocky mountains and the Pacific ocean above latitude 55° was almost a *terra incognita*, and, with the immense areas to the east of the mountains still unoccupied except by a few trading posts, the country was held in little estimation by Great Britain. A few navigators had skirted the coast and enterprising American traders had held some intercourse with the Indians living immediately on tidewater, but none but the Russians had penetrated any distance inland. Only one British trading post was established in this region west of the Rocky mountains, on the line of 55°, and that 120 miles from the ocean, and there was not one above that line.‡

But we are not left to infer from these historical facts what was the ruling motive and object of Great Britain in opening and prosecuting negotiations with Russia, for these are explicitly stated in the instructions given by the Secretary for Foreign

* Fur Seal Arbitration Papers, 1893, vol. iv, p. 370, for full text of Russian ukase.
† Ib., p. 390. ‡ Ib., p. 383.

Affairs, George Canning, to the British negotiators. At the very inception of the negotiations he directed the attention of the first negotiator, Sir Charles Bagot, to "the extravagant assumption of maritime jurisdiction" as the essential point to be adjusted, and as Russia was prepared to waive her pretensions, the mode and degree of disavowal was to be so made as to least offend the national dignity of Russia.* It was therefore determined that it would be made more easy for Russia to retire from its maritime claim under cover of a treaty of limits. This is made clear in the instruction given by the British Secretary for Foreign Affairs, December 8, 1824, to Sir Stratford Canning, who had succeeded Mr Bagot in the negotiations. He says: †

"The whole negotiation grows out of the ukase of 1821. So entirely and absolutely true is this proposition that the settlement of the limits of the respective possessions of Great Britain and Russia on the northwest coast of America was proposed by us as a mode of facilitating the adjustment of the differences arising from the ukase by enabling the court of Russia, under cover of the more comprehensive arrangement, to withdraw, with less appearance of concession, the offensive pretensions of that edict.

"It is comparatively indifferent to us whether we hasten or postpone all questions respecting the limits of territorial possession on the continent of America, but the pretensions of the Russian ukase of 1821 to exclusive dominion over the Pacific could not continue longer unrepealed without compelling us to take some measure of public and effectual remonstrance against it.

"You will . . . declare without reserve that 'the point to which alone the solicitude of the British government and the jealousy of the British nation attach any importance is the doing away (in a manner as little disagreeable to Russia as possible) of the effect of the ukase of 1821.'"

Near the close of this instruction, which was quite lengthy, Secretary Canning, impressed with the importance of the main object, repeats himself in these words:

"It remains only in recapitulation to remind you of the origin and principles of this whole negotiation.

"It is *not* ‡ on our part essentially a negotiation about limits.

"It is a demand of the repeal of an offensive and unjustifiable arrogation of exclusive jurisdiction over an ocean of unmeasured extent. . . .

"We negotiate about territory to cover the remonstrance upon principle." §

With this object in view and under these instructions, the negotiations were initiated at St Petersburg. It will not be possible to follow them in all their details, which are set forth in

* Ib., 405. † Ib., 446. ‡ The italics appear in the original. § Ib., 448.

Prepared in the Office of the U. S. Coast and Geodetic Survey, Treasury Department.

MAP No. 1

SIR C. BAGOT'S PROPOSALS, 1824

the published correspondence of the British negotiators with the foreign office and of the Russian negotiators with their ambassador in London. I can only give the leading features. It having been determined that the treaty of limits should be agreed upon as a cover to the more essential stipulation to be contained in it, to wit, the disavowal of the maritime jurisdiction, the negotiators, in the first instance, addressed themselves to a fixation of the east-and-west line, or, more particularly, to the point on the northwest coast of America which should limit the possessions of the two governments. From the first moment the boundary was broached Russia had indicated that it would rest its claim to territory on the line of latitude 55°, being the limit fixed by the Emperor Paul in the charter of 1799 to the Russian American Company, and which had never been objected to by Great Britain.*

Sir Charles Bagot, however, in the first instance, proposed "a line drawn through Chatham strait to the head of Lynn canal, thence northwest to the 140° of longitude" † (see map No. 1). This line was rejected by the Russian negotiators, and, at the request of Mr Bagot, they submitted a counter-proposal, which was in effect the same as that suggested in the first instance above mentioned, the line of latitude 55°; but "as the parallel of 55° would divide Prince of Wales island," they proposed to start the boundary line at the southern extremity of that island, and thence "follow Portland channel up to the mountains which border the coast." ‡ The Russian proposal was met by a second proposition from Sir Charles Bagot, to wit, "a line traced from the west toward the east along the middle of the channel which separates Prince of Wales and Duke of York islands from all the islands situated to the north of the said islands until it touches the mainland." § This was likewise rejected, and he then made a third and final proposal of "a line drawn from the southern extremity of the strait called 'Duke of Clarence sound' through the middle of this strait to the middle of the strait which separates Prince of Wales and Duke of York islands from all the islands lying north of those islands, thence toward the east through the middle of the same strait to the mainland." ‖

This last British proposition was rejected by the Russian negotiators in a paper of some length, in which they set forth the situation of the parties in interest, and why it was impossible for Russia to modify its proposal. They show that the parties whose

* Ib., 390, 412. † Ib., 424. ‡ Ib., 427. § Ib., 428. ‖ Ib., 430.

interests were involved were, on the British side, the Hudson's Bay Company, which was pushing its posts across the Rocky mountains towards the coast, and the Russian American Company, which was in possession of the islands and maintaining a profitable trade with the natives on the mainland, and that unless the latter was protected by a strip of the coast on the mainland, that company would be without a support [*point d'appui*], and would be exposed to the competition of establishments on the mainland which it was their purpose to exclude.* The motive of the Russian negotiators in insisting upon a strip of the coast is also shown in the report of M. Poletica, one of the Russian plenipotentiaries, to the ministry for foreign affairs of the earliest conferences with Mr Bagot, in which he said the Russian American Company "had mainly in view the establishment of a barrier at which would be stopped, once for all, to the north and to the west of the coast allotted to our American company, the encroachments of the English agents of the . . . Hudson's Bay Company" (M. Poletica to Count Nesselrode, November 3, 1823).

On the other hand, the main purpose of the British plenipotentiary in the particular negotiation above referred to was to secure for British traders a foothold on the Pacific ocean as far above the latitude of 54° 40′ as possible. In reporting the result of his conferences to the British foreign office, he says: "Our chief objects were to secure . . . the embouchures of such rivers as might afford an outlet for our fur trade into the Pacific."† He further states that his object in presenting the line of Clarence strait was to "preserve uninterrupted our access to the Pacific ocean," and he adds that the line of the Portland channel "would deprive His Britannic Majesty of sovereignty over all the inlets and small bays lying between latitude 56° and 54° 45′, . . . of essential importance to its [Hudson Bay's] commerce."‡

The negotiators were brought face to face with their conflicting claims, the one side insisting that it must have a strip of territory on the mainland in order to keep the Hudson's Bay Company from the ocean opposite their islands, and the other insisting that the Hudson's Bay Company must have possession of such part of that territory and the inlets as would afford it access to the ocean. Mr Bagot informed the Russian negotiators that he had made his "ultimate proposition," and, being told by them

* Ib., 428, 430. † Ib., 424. ‡ Ib., 425, 429.

that the Emperor's final decision was "that they must continue to insist upon the demarcation as described by them," he announced that he should "consider the negotiations as necessarily suspended," and they were accordingly broken off.*

Count Nesselrode sent to the Russian ambassador in London an account of the negotiations and their abrupt termination, a copy of which was handed to Secretary Canning. In this report he insists that Russia had gone to the extreme of liberality in its concessions to Great Britain. These were, first, an agreement to disavow the maritime jurisdiction; second, to yield its claim to territory from latitude 51° to 54° 40′; third, to grant free access to the British posts in the interior by the rivers which may cross the Russian strip on the mainland; and, fourth, to open Sitka to British trade. The count, after showing that his country was only seeking to hold what its enterprise had gained, and, contrasting the spirit of the two nations, "we wish to keep and the English company wish to obtain," referred to the point upon which the negotiations were broken off—the strip of territory on the mainland—and impressed upon the ambassador the necessity which impelled the Emperor to insist upon it, and then made the following emphatic declaration: "Russia cannot stretch her concessions further. She will make no others, and she is authorized to expect some concessions on the part of England." †

The expectations of Russia were not to be disappointed, for in the month following Secretary Canning informed the Russian ambassador in London that Sir Charles Bagot would be instructed "to admit, with certain qualifications, the terms last proposed by the Russian government." The qualifications related to the width "of the strip of land required by Russia on the continent," to the boundary in the vicinity of Mt St Elias, and the free use of the rivers, seas, straits, and waters which the limits assigned to Russia would comprehend.‡ In his instructions to Sir Charles Bagot, Secretary Canning said: "There are two points which are left to be settled by Your Excellency:" the first, "the eastern boundary of the strip of land to be occupied by Russia on the coast," and, second, the right of resorting to the territory and waters conceded to Russia.§

The second negotiations were mainly confined to the second point. In the interval a treaty had been signed between Russia and the United States, whereby the latter had secured the right

* Ib., 425. † Ib., 401. ‡ Ib., 432. § Ib., 433.

for ten years to frequent "the interior seas, gulphs, harbours, and creeks upon the coast [north of 54° 40′] for the purpose of trading with the natives of the country." Bagot was instructed to obtain a like privilege for Great Britain, but to secure a longer term than ten years if possible.* He thereupon made a demand for the privilege, not for a term of ten years, but *forever* as to the coast along the strip of land (*lisiére*) up to latitude 60° and as to Sitka, and for ten years as to all the other Russian territory to the north. Russia refused the demand on the ground that such a perpetual concession was repugnant to all national feeling and was inconsistent with the very idea of sovereignty, and the negotiations were again broken off.†

Thereupon Sir Charles Bagot was recalled and Sir Stratford Canning, one of the ablest British diplomatists of the present century, was transferred from Washington to St Petersburg, and the negotiations were again renewed. Sir Stratford Canning was instructed to recede from the demand made by his predecessor, and to accept the language of the Russo-American treaty as to the use of the territorial waters of the strip of land (*lisiére*). This left only the eastern boundary of this strip to be definitely fixed. It was from these instructions to Canning that I have quoted the liberal language in which occur the expressions: "It is *not* on our part essentially a negotiation about limits," and "We negotiate about territory to cover the remonstrance upon principle." In this connection it is proper to note that in the early stage of the negotiations, when Sir Charles Bagot reported that Russia had indicated latitude 55° as the line of division, Secretary Canning replied: "It does not appear . . . how far the line proposed . . . was intended to run to the eastward. If to the Rocky mountains, it obviously would be wholly inadmissible by us;" and later in the instruction he says:

"It would . . . be expedient to assign, with respect to the mainland southward of that point [the head of Lynn harbor], a limit, say, of 50 or 100 miles from the coast, beyond which the Russian posts should not be extended to the eastward. We must not on any account admit the Russian territory to extend at any point to the Rocky mountains."‡

* Ib., 434. † Ib., 439.

‡ Ib., 419, 420. Attached to Secretary Canning's instruction, from which the above quotation is taken, is a letter to him from the deputy governor of the Hudson's Bay Company (Ib., 421), showing that the suggestion of a strip 50 to 100 miles in width originated with that company. He says: "From a want of accurate knowledge of the courses of the rivers or ranges of mountains, it is difficult to suggest any satisfactory boundary in the interior of the country in question, and (if consistent with your

With this instruction in his possession Sir Charles Bagot, at the outset of the negotiations, in response to the Russian demand "for a strip of territory (*lisière*) upon the mainland" which would be "parallel to the sinuosities of the coast,"* proposed that the eastern line of this strip should run "always at a distance of 10 marine leagues from the shore as far as the 140° of longitude."† Russia suggested that the line should "run along the mountains which follow the sinuosities of the coast."‡ When the second negotiations were resumed Secretary Canning sent Mr Bagot a draft of a treaty in which it was provided that this line should "be carried along the coast in a direction parallel to the sinuosities and *at and within the seaward base* of the mountains by which it is bounded."§ In explanation the Secretary said, if pressed by Russia Mr Bagot might substitute the summit of the mountains if a limit to the east was fixed beyond which the line should not go. The British draft proposal of "the seaward base of the mountains" was rejected by Russia, and its counter-draft was that the line "shall not be wider on the continent than 10 marine leagues."‖

But Sir Charles Bagot's attention was so occupied with the other points of the treaty that the matter of the width of the strip did not receive serious consideration until the final stage of the negotiations was undertaken by Sir Stratford Canning, and as Great Britain had by that time receded from all the other contentions, it only remained for him to adjust the eastern line of the strip of the mainland which was to be held by Russia. In his draft of treaty it was proposed that the line should follow the crest of the mountains, provided that if the crest of the mountains should be more than ten marine leagues from the ocean the line should follow the sinuosities of the coast, so that it should at no point be more than ten leagues from the coast. This was in accordance with his instructions.¶ The Russian negotiators objected to the proviso and insisted that the crest of the mountains should be the invariable line, arguing that the natural frontier was the mountains following the coast.

Much of the difficulty in reaching an agreement on this point grew out of the imperfect geographic knowledge of the period.

views) it might, perhaps, be sufficient at present to settle a boundary on the coast only and the country 50 or 100 miles inland, leaving the rest of the country to the north of that point and to the west of the range of the mountains, which separate the waters which flow into the Pacific from those which flow to the east and north, open to the traders of both nations."

* Ib., 427. † Ib., 428. ‡ Ib., 399. § Ib., 435. ‖ Ib., 441. ¶ Ib., 447.

In 1792–'95 George Vancouver, under the direction of the British admiralty, made the first accurate and scientific survey of the northwest coast of North America, and his charts were published in 1798. These charts were for more than a generation the basis and source of information of all maps of that region. His survey was confined to the coast, as he made no exploration of the interior of the mainland beyond what was visible from his vessels. From these he saw at all points in the region under consideration a continuous array of mountains, and upon his charts there appears delineated a regular mountain chain following the sinuosities of the coast line around all the inlets (see maps Nos. 2 and 3). We know that the negotiators of the treaty of 1825 had before them Vancouver's charts and two other maps, one issued by the quartermaster-general's department, St Petersburg, 1802,* which reproduces the mountains as laid down by Vancouver, the other Arrowsmith's latest map, being the one published in London in 1822, with additions of 1823, and this map omits all mountain features in the region, being entirely blank. The published correspondence frequently shows that as to the interior of the mainland the negotiators were in great ignorance of its topography, and we have seen that even the deputy-governor of the Hudson's Bay Company was no better informed (*supra*, p. 431). Secretary Canning referred to "the mountains which run parallel to the coast and which appear, according to the map, to follow all its sinuosities," but he asks the British plenipotentiary to explain to his Russian colleagues the difficulty had with the United States arising out of the maps of the eastern side of the continent, on which mountains were laid down and which were found afterwards to be quite differently situated, and he adds: "Should the maps be no more accurate as to the western than as to the eastern mountains, we might be assigning to Russia immense tracts of inland territory where we only intended to give, and they only intended to ask, a strip of seacoast." † The British minister's fear was, as we have seen, lest an invariable line of "the summit of the mountains" might carry the Russian line even to the Rocky mountains, and it was to avoid such a contingency that he insisted on a specific limit to the Russian strip of the mainland. The Russian negotiators reluctantly yielded to the British view and the treaty was concluded.

The correspondence and documents thus reviewed by me

* Found in Fur Seal Papers, 1893, vol. V, appendix to British case.
† Ib., vol. IV, 447.

clearly establish three facts as the result of the negotiations: first, that Russia was to have a continuous strip of territory on the mainland around all the inlets or arms of the sea. Sir Charles Bagot fully understood this, and hence his repeated efforts to push the southern boundary of Russia as far north as possible, so that the Hudson's Bay Company might come down to tidewater with its trading posts, recognizing that this could not be done in front of the Russian line. The purpose for which the strip was established would be defeated if it was to be broken in any part of its course by inlets or arms of the sea extending into British territory. Second, with the strip of territory so established, all the interior waters of the ocean above its southern limit became Russian, and would be inaccessible to British ships and traders except by express license. It was because the Russian negotiators refused to make this license perpetual that the negotiations were a second time broken off, and only renewed when Great Britain yielded on this point. Third, the strip of territory was to be 10 marine leagues wide in all its extent, unless inside of that limit a chain of mountains existed which constituted a natural boundary or watershed between the two countries. The "seaward base" proposed by Great Britain was rejected, and there is no indication that isolated peaks were to constitute the line.

A fourth fact, not material to explain the treaty, is apparent from the record of the negotiations, and especially Secretary Canning's instructions of January 15, 1824, already cited,* to wit, that while the British government sought to restrict the limits of Russian territory as much as possible, it was prepared in return for the revocation of the ukase of 1821, if Russia was persistent, to accept an east line of the strip distant from the ocean 100 miles, and to have the line to the Arctic ocean drawn along the 135° of longitude, thus giving to Russia a strip more than three times as wide as she obtained and the whole of the Yukon gold districts.

We come now to the provisions of the treaty, and I confine my examination to those respecting which there are existing differences. Article III, in delineating the first section of the boundary, provides that "commencing from the southernmost point of the island called *Prince of Wales Island*, which lies in the parallel of 54° 40′ north latitude, . . . the said [boundary] line shall ascend to the north along the channel called

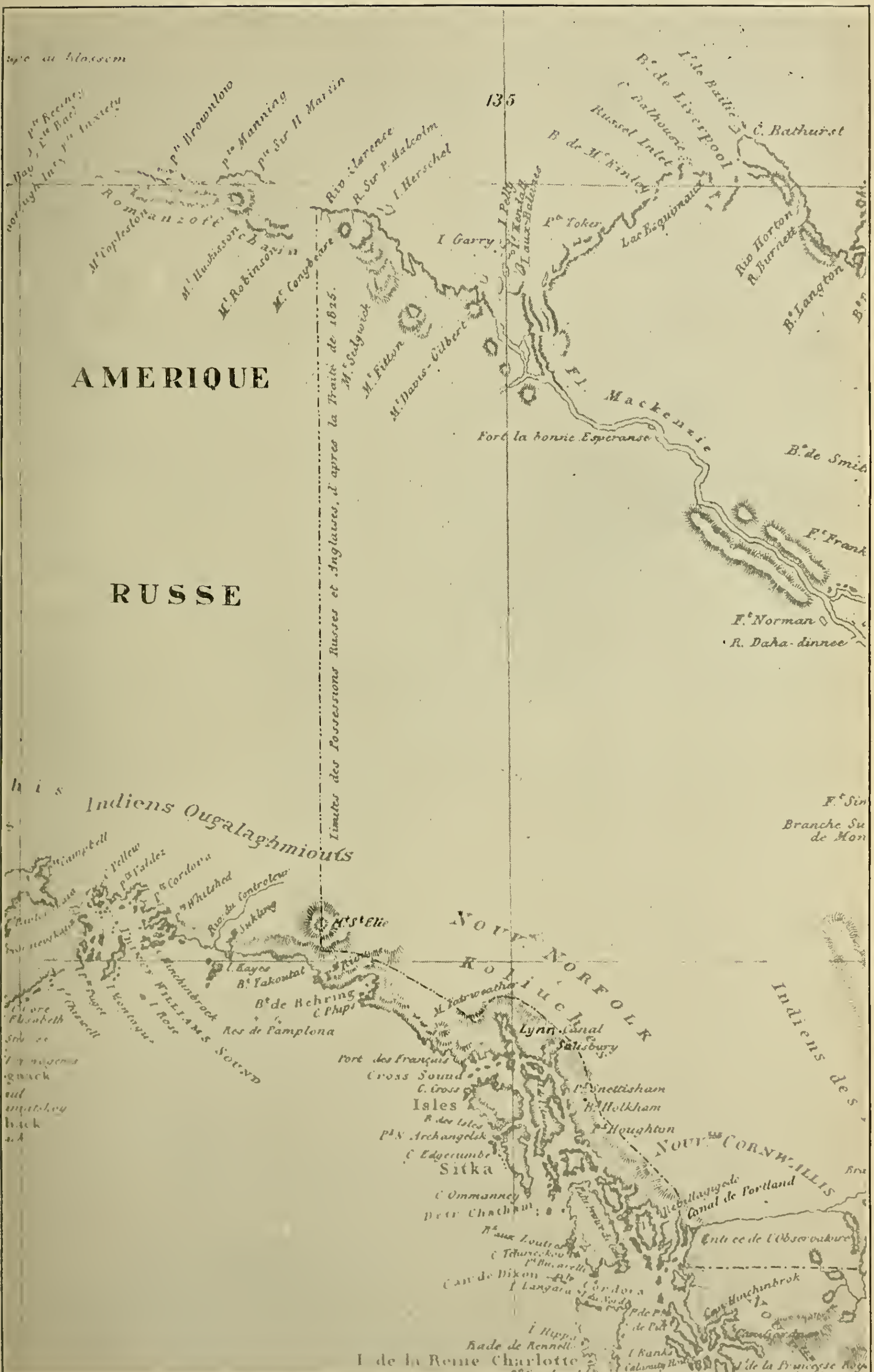
* Ib., 415–420.

Portland Channel as far as the point of the continent where it strikes the 56° of north latitude." The United States holds that under this provision the line starting from the extremity of Prince of Wales island shall enter the broad, deep, and usually navigated opening of Portland canal or channel and pass up to its head, and thence on the continent to the 56° of latitude. The present contention of Great Britain is understood to be that the line from the extremity of Prince of Wales island should enter the tortuous and narrow channel now known on the British admiralty and American charts as Pearse canal, and thence up Portland canal to the 56° of latitude, thus placing Wales, Pearse, and a few small islands in British territory.

The second portion of the line in dispute is described in the treaty as follows:

> "From this last-mentioned point [the 56° above the head of Portland canal] the line of demarcation shall follow the summit of the mountains situated parallel to the coast as far as the point of intersection of the 141° of west longitude. . . . Whenever the summit of the mountains which extend in a direction parallel to the coast . . . shall prove to be at the distance of more than 10 marine leagues from the ocean, the limit between the British possessions and the strip of coast which is to belong to Russia, as above mentioned, shall be formed by a line parallel to the sinuosities of the coast, and which shall never exceed the distance of 10 marine leagues therefrom."

This language of the treaty presupposes that there existed a defined mountain chain, to repeat its terms, "situated parallel to the coast" or "which extend in a direction parallel to the coast;" but the surveys of the region made since the territory of Alaska was ceded to the United States have established the fact that there is no such defined chain or watershed within 10 marine leagues of the sinuosities of the coast except at two points, namely, White and Chilkoot passes; hence the United States claims that the boundary of the strip is placed 10 marine leagues from the coast at all points except at White and Chilkoot passes, and that the strip is an unbroken belt of territory on the mainland, following the sinuosities of the coast around the inlets of the sea. On the other hand, the British claim is that the line from the 56° runs directly to the coast and follows the mountains nearest to the outer shore line and crosses not less than ten or twelve arms of the sea or inlets, thus breaking the strip of mainland into as many different sections, and transferring all the water of the bays and inlets to the British possessions (see map No. 12.)



MAP No. 4

RUSSIAN IMPERIAL MAP

"Dressé par M. de Krusenstern, Coutre-Amiral . . . publié par ordre de Sa Majesté Imperial. St Petersbourg, 1827"

MAP No. 5

BRITISH MAP, 1832

"By permission dedicated to the Hon'ble Hudson's Bay Company. Containing the latest information which their documents furnish, by their obedient servant, J. Arrowsmith." London, 1832

The remaining article to be noted is the seventh, which provides "that for the space of ten years . . . the vessels of the two powers, or those belonging to their respective subjects, shall mutually be at liberty to frequent, without any hindrance whatever, all the inland seas, the gulfs, havens, and creeks on the coast mentioned in article 3 for the purposes of fishing and of trading with the natives." I have already referred to the fact that the negotiations were broken off because the British plenipotentiary insisted that the liberty to frequent those "inland seas, gulfs, havens, and creeks" should be made perpetual, and that the negotiations were renewed upon the basis of the privilege granted in the Russo-American treaty of 1824, the language of article IV of which, as Secretary Canning informed Sir Charles Bagot,* was copied into the British treaty. This ten years' privilege is inconsistent with any other interpretation of the treaty than the complete sovereignty of Russia over, not only a strip of territory on the mainland which follows around the sinuosities of the sea, but also of the waters of all bays or inlets extending from the ocean into the mainland. This is the more manifest when the subsequent history respecting the provision of article IV of the American and article VII of the British treaty is recalled. At the expiration of the term of ten years the Russian minister in Washington gave notice to the Government of the United States that the privilege had expired, and a notification to that effect was made in the public press of the United States.† Persistent efforts were made by the United States to have the privilege extended for another period of ten years, but it was firmly refused by Russia.‡ The British privilege was likewise terminated upon the expiration of the ten years mentioned, and this article of the treaty was never again revived.

Having reviewed the negotiations preceding the treaty of 1825 and examined the provisions of that instrument now in dispute, I pass to a statement of facts since the celebration of the treaty, showing the views of the high contracting parties and those claiming under them as to the stipulations of that convention. As soon after the treaty as the data could be compiled, to wit, in 1827, a map was published in St Petersburg, "by order

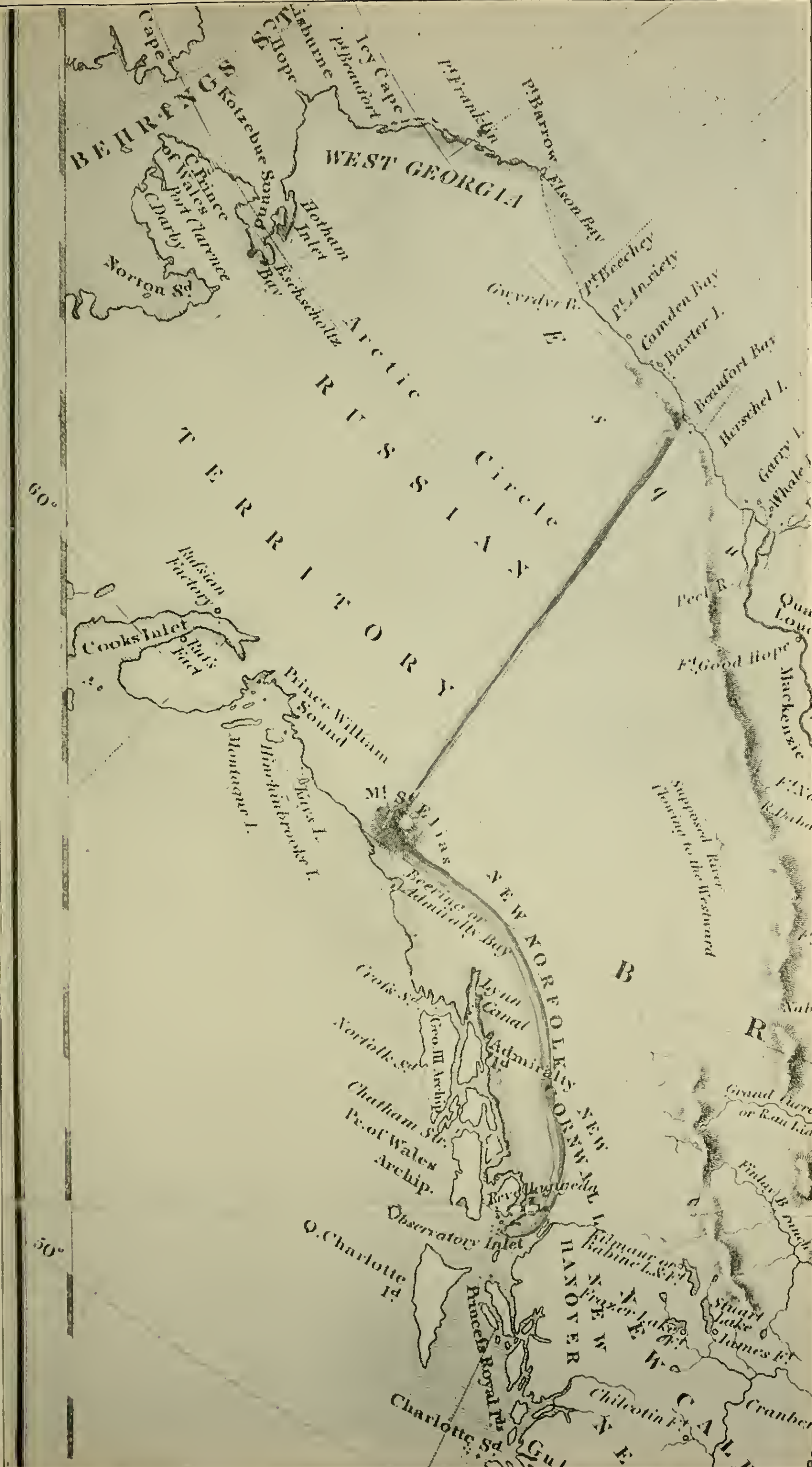
* Ib., 434. Secretary Canning, in his instruction to Sir Stratford Canning, used this language: "Russia cannot mean to give to the United States of America what she withholds from us, nor to withhold from us anything that she has consented to give to the United States."

† Senate Ex. Doc. No. 1, Twenty-fifth Congress, third session, p. 24. ‡ Ib., 69.

of His Imperial Majesty," on which the boundary line of the Russian possessions on the continent of North America was drawn from the head of Portland channel, at a distance of ten marine leagues from tidewater, around the head of all the inlets to the 141° of longitude, and thence following that longitude to the Arctic ocean. Along this line on the map is inscribed the legend: "*Limites des Possessions Russes et Anglaises, d'apres la Traité de 1825*" (see map No. 4). So far from this map exciting any protest or criticism its delineation was adopted and followed by the cartographers of His Britannic Majesty, of the government of Canada, and by all the map-makers of the world. John Arrowsmith, the most authoritative cartographer of London, whose map was used by the British negotiators of the treaty of 1825, published a map of the northwest coast in 1832, which states that it contains the latest information which the documents of the Hudson's Bay Company furnish. It will be seen that it exactly follows the line laid down by the Russian imperial map of 1827 (see map No. 5).

Arrowsmith's map was preceded, in 1831, by a map of the northern part of North America, prepared by Joseph Bouchette, deputy surveyor-general of the province of Lower Canada, and "published, as the act directs, by James Wyld, geographer to the King, London, May 2d, 1831." It is "with His Majesty's most gracious and special permission most humbly and gratefully dedicated . . . to His Most Excellent Majesty King William IVth, . . . compiled from the latest and most approved astronomical observations, authorities, and recent surveys." This map traces the Russian boundary on the continent in conformity to the Russian imperial map of 1827 (see map No. 6). And all later publications, either official or unofficial, of Canada followed the same course, as illustrative of which I reproduce the map which bears the following title: "Map of the northwest part of Canada, Indian territories, and Hudson's Bay. Compiled and drawn by Thomas Devine, provincial land surveyor and draftsman. By order of the Hon. Joseph Cauchon, commissioner of Crown lands, Crown department, Toronto, March, 1857" (see map No. 7).

So far as I have been able to examine, the map-makers of all foreign countries followed the boundary line drawn by Russia in 1827. This was notably the case with the French cartographers, who have held a high place in the profession for accuracy and authenticity. From the great number of publications, I have



MAP No. 6

CANADIAN MAP OF 1831

"Compiled from the latest and most approved astronomical observations, authorities, and recent surveys . . . by Joseph Bouchette. Junr., Deputy Surveyor General of the Province of Lower Canada." May 2, 1831.

MAP No. 7

CANADIAN MAP OF 1857

"Compiled and drawn by Thos. Devine, Provincial Land Surveyor and Draftsman. By order of Hon. Joseph Cauchon, Commissioner of Crown Lands, Crown Department, Toronto, March, 1857" selected one which appeared in 1844, first, because it was based upon the actual observations of a voyage of exploration made by a French official, and, second, because it was "published by order of the King, under the auspices of . . . the president of the council of ministers and of the minister of foreign affairs." It will be seen that on this map is inscribed the line of the "*Traité entre la Russie et l'Angleterre du 28 Fevrier, 1825*," as indicated on the Russian imperial map (see map No. 8).

No map accompanied the treaty of 1867 between Russia and the United States for the cession of Alaska, but immediately after it was signed the Secretary of State caused a map to be compiled and published to indicate the territory acquired by that convention, and it delineates the strip of territory on the mainland just as it had been claimed by Russia forty years before (see map No. 9).

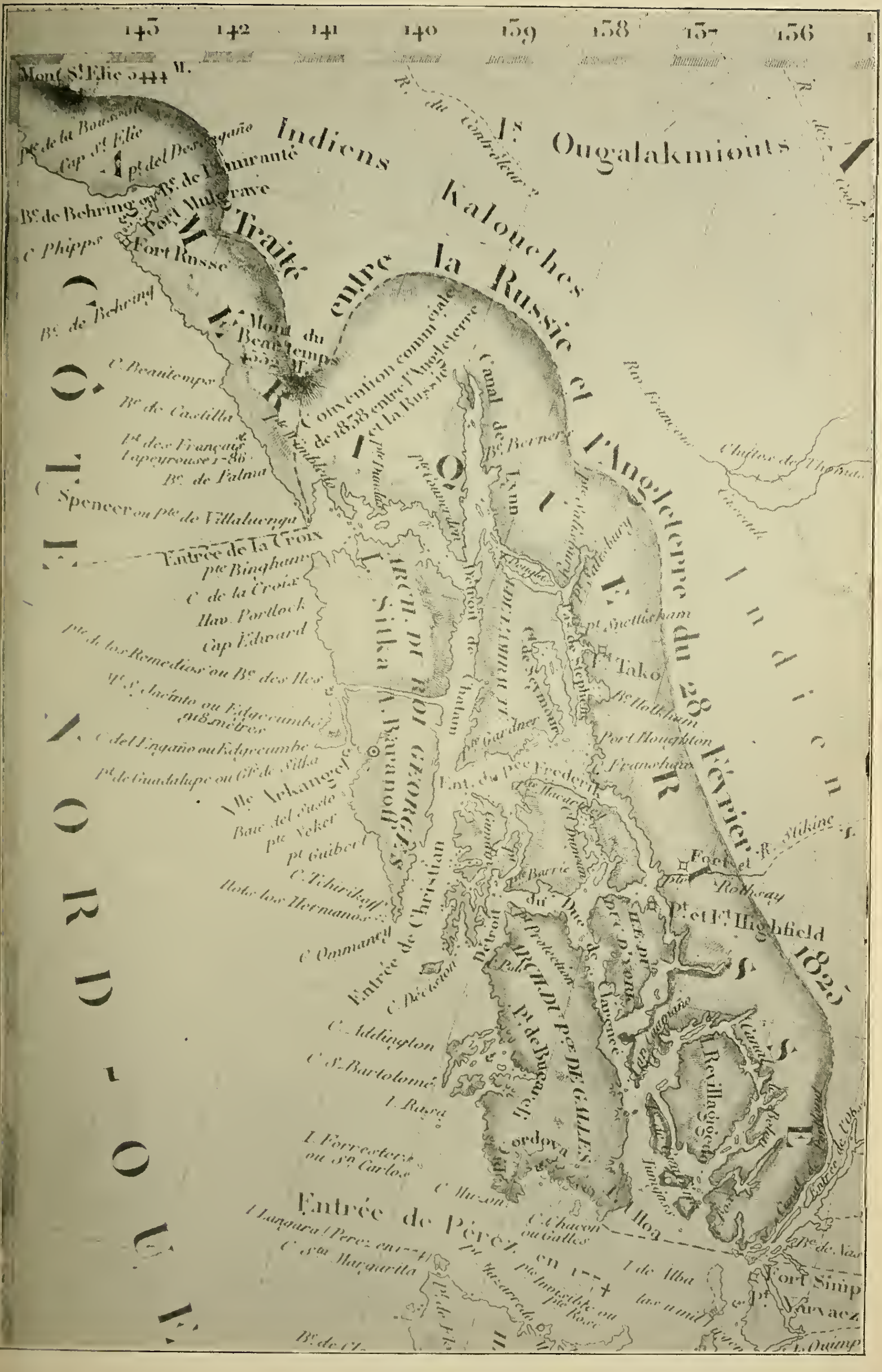
A multitude of maps might be reproduced to show that, with the exception of certain maps published in British Columbia in and after 1884, all such publications, whether emanating from British and Canadian or from disinterested foreign sources, from the time the treaty of 1825 became known up to the meeting of the Joint High Commission in 1898, were of the same character as those already described and reproduced; but I will limit myself to one of the most recent. This was published in the *Scottish Geographical Magazine*, Edinburgh, the July number, 1898, to accompany an article entitled "The Yukon District, by Wm. Ogilvie, astronomer and land surveyor." This map, it will be seen, lays down the line according to the American claim (see map No. 10). It is not cited to establish any authoritative fact, but simply to show that even after the Joint High Commission had been agreed upon the best informed British cartographers had not become aware of any conflicting claim.

Soon after the expiration of the ten years' privilege enjoyed by British vessels and traders to visit "the inland seas, the gulfs, havens, and creeks" enclosed by the Russian strip on the mainland, an important event occurred which is decisive of the interpretation of the treaty given to it by the two nations who were the contracting parties. I have referred to the two competing trading companies in whose interest the negotiations were carried on and for whose benefit, mainly, the treaty was made. The Russian American Company, which was the virtual government of the territory of Russian America, is described by Bancroft in his "History of Alaska" as a "powerful monopoly, firmly established in the favor of the imperial government, many nobles of high rank and several members of the royal family being among its shareholders." The correspondence shows that the Russian negotiators were chiefly concerned to so frame the treaty as to meet the wishes of the representatives of this company, which was in intimate conference with them at St Petersburg.

The Hudson's Bay Company is so conspicuous a part of the history of British North America that I need hardly refer to its part in the government and development of that vast region of our continent. At the date of the negotiations it had recently absorbed its rival, the Northwest Company, and it was at the height of its power and influence. It was the only representative of British authority in all the region west and north of the province of Ontario at that date and for several years after the middle of the present century. The British negotiators of the treaty of 1825 were influenced almost entirely in their negotiations by the views and interests of this company. Its representatives were in constant communication with Secretary Canning by personal interviews and by letters; the boundary line which they recommended was accepted and urged by the British government; and when negotiations were broken off they were not resumed till this company was heard from, and its views were again adopted and pressed.* It is safe to assert that no one understood so well as the officials of these two companies the territorial rights of their respective governments and subjects secured by the treaty.

A British vessel in the service of the Hudson's Bay Company, the *Dryad*, reached the Russian post of Fort Wrangell, destined, as it was alleged, for the British territory in the interior, at the headwaters of the Stikine river. The vessel was detained and not allowed to proceed on its voyage. The British government protested to the Russian government and presented to it a large claim for damages. The Russian government, being hard pressed by the British minister, urged the Russian American Company to come to some settlement with the Hudson's Bay Company, and thereupon the governor of the latter, and one of the directors of the former company, with the express authorization of the two governments, met at Hamburg in 1839. As a result of their conferences the Russian American Company agreed to lease

* Fur Seal Arbitration Papers, vol. iv, pp. 380, 383, 387, 417, 419, 421, 431.



MAP No. 8

FRENCH MAP, 1844

"Publié par ordre du Roi, sous les Auspices de M. le President de Conseil des Ministres et de M. le Ministre des Affaires Etrangères, Paris, 1844"

MAP No. 9

STATE DEPARTMENT MAP, 1867

"Showing the territory ceded by Russia to the United States. Compiled for the Department of State at the U. S. Coast Survey Office, second edition, May, 1867" to the Hudson's Bay Company the strip of territory on the mainland and "all the bays, inlets, estuaries, rivers, or lakes in that line of coast" secured to Russia under the treaty, in consideration of the abandonment or satisfaction of the claim for damages on account of the *Dryad*, and also of an annual payment by the Hudson's Bay Company.* This lease was approved by both the Russian and British governments, and in accordance with its terms the Hudson's Bay Company entered upon and occupied the strip of territory, and at the expiration of the term of years stated the lease was, with the approval of the two governments, extended for another like term, and afterwards prolonged to about 1865.

The plenipotentiary on behalf of Great Britain and the Hudson's Bay Company who negotiated and signed this lease was Sir George Simpson, governor of the Hudson's Bay Company, who had assumed that office five years before the treaty of 1825. He was fully conversant with the negotiations, and, as he testified before the Parliamentary committee, was familiar with the leased strip of territory, having traveled over it in the course of his duties as governor. The language of the lease is sufficiently explicit as to the particular territory and waters to which it applied, but we have in addition an authoritative ocular proof of what land and water this lease embraced.

In 1857 a select committee of the House of Commons of the British Parliament was appointed "to consider the state of those British possessions in North America which are under the administration of the Hudson's Bay Company, or over which they possess a license to trade."† Among the members of this com-

* The following is a copy of article I of the lease:

"Article I. It is agreed that the Russian American Company, having the sanction of the Russian government to that effect, shall cede or lease to the Hudson's Bay Company for a term of ten years, commencing from the 1st of June, 1840, for commercial purposes, the coast (exclusive of the islands) and the interior country belonging to His Majesty the Emperor of Russia, situated between Cape Spencer, forming the northwest headland of the entrance of Cross sound and latitude 54° 40′ or thereabouts, say the whole mainland coast and interior country belonging to Russia, together with the free navigation and trade of the waters of that coast and interior country situated to the southward and eastward of a supposed line to be drawn from the said Cape Spencer to Mount Fairweather, with the sole and entire trade or commerce thereof, and that the Russian American Company shall abandon all and every station and trading establishment they now occupy on that coast, and in the interior country already described, and shall not form any station or trading establishment during the said term of ten years, nor send their officers, servants, vessels, or craft of any description for the purposes of trade into any of the bays, inlets, estuaries, rivers, or lakes in that line of coast and in that interior country." (Russian archives, Department of State.)

† Report from the Select Committee on the Hudson's Bay Company, etc. Ordered by the House of Commons to be printed 31 July and 11 August, 1857, p. 2.

MAP No. 10

SCOTTISH GEOGRAPHICAL MAGAZINE MAP, 1898

"Map of western part of the Dominion of Canada, to accompany a paper by Wm. Ogilvie. *Scottish Geographical Magazine*, 1898" mittee are found the names of Lord John Russell, Lord Stanley, Mr Roebuck, and Mr Gladstone. Another member was Mr Ellice, a native of Canada and a director of the Hudson's Bay Company. There was also in attendance on the sessions of the committee, as a representative of the government of Canada, Chief Justice Draper, of Canada. Sir George Simpson was examined before this committee and was questioned in detail respecting the lease, and his testimony confirms the foregoing statement. To explain and accompany his testimony, he exhibited to the committee a map of the territory in question, and said: "There is a margin of coast, marked yellow on the map, from 54° 40′ up to Cross sound which we have rented from the Russian American Company for a term of years";* and he proceeded at some length to explain the territory and the reasons for the lease.

No question was raised by any member of the committee, or by the representative of Canada, as to the validity of the lease or to the correctness of the map, which was printed as a part of the report submitted to Parliament. An examination of this map will show that the leased strip of territory is continuous, and is carried around all the inlets and interior waters, in conformity with the present claim of the United States (see map No. 11). This lease was followed by another act on the part of the two governments confirming their approval of the transaction. During the Crimean war, at the request of the two companies, the territory embraced in the lease was, by order of both the British and Russian governments, exempt from the opera-

*Report, etc., p. 1391. Extract from Simpson's testimony:

"1026. Besides your own territory, I think you administer a portion of the territory which belongs to Russia, under some arrangement with the Russian Company? There is a margin of coast, marked yellow on the map, from 54° 40′ up to Cross sound which we have rented from the Russian American Company for a term of years.

"1027. Is that the whole of that strip? The strip goes to Mount St. Elias.

"1028. Where does it begin? Near Fort Simpson, in latitude 54; it runs up to Mount St. Elias, which is farther north.

"1029. Is it the whole of that strip which is included between the British territory and the sea? We have only rented the part between Fort Simpson and Cross sound.

"1030. What is the date of that arrangement? That arrangement, I think, was entered into about 1839.

"1031. What are the terms upon which it was made? Do you pay a rent for that land? The British territory runs along inland from the coast about 30 miles; the Russian territory runs along the coast; we have the right of navigation through the rivers to hunt the interior country. A misunderstanding existed upon that point in the first instance; we were about to establish a post upon one of the rivers, which led to very serious difficulties between the Russian American Company and ourselves. We had a long correspondence, and to guard against the recurrence of these difficulties it was agreed that we should lease this margin of coast and pay them a rent. The rent was, in the first instance, in otters. I think we gave 2,000 otters a year; it is now converted into money. We give, I think, 1,500 a year."

tions of the war. This fact is shown by the Alaska archives and by the testimony of Sir George Simpson before the Parliamentary committee.*

About the time of the cession of Alaska to the United States gold was discovered in the Cassiar region of British Columbia, reached through the Stikine river, and the passage of miners made it desirable to have the eastern boundary of the strip where it crosses that river more accurately marked, and this led to a movement, in 1873–'4, on the part of the British and United States governments, for a joint survey of the boundary. In a conference at Washington, February 15, 1873, between Secretary Fish and the British minister, Sir Edward Thornton, it was stated by Mr Fish that a survey of the entire boundary, as estimated by the engineers, would cost, for the United States alone about $1,500,000, and it was suggested that it would be found sufficient to fix the boundary at certain determined points, and there were named the head of Portland canal. "the point where the boundary line crosses the Rivers Skoot, Stakine, Taku, Iselcat, and Chilkaht, Mount St. Elias," etc. The legislative assembly of British Columbia, in petitioning the Canadian government for a survey, refers to it as "the boundary of the 30-mile belt of American territory." Sir Edward Thornton communicated to the Foreign Office the result of his conference with Secretary Fish, and it was then submitted through the Colonial Office to the Canadian government, by whom it was referred to the surveyor general, Dennis, who reported favorably upon the plan. He restated the points to be determined and enumerates the rivers "Skoot, Stakine, Taku, Iselcat, and Chilkaht," and says that in his opinion "it is unnecessary at present (and it may be for all time) to incur the expense" of any other survey than that named. It was thereupon determined that such a joint survey should be made, the total cost of which the British boundary commissioner, Major Cameron, estimated might reach $2,230.000. The plan was not at that time carried into execution because of

* Report, etc,, p. 140:

"1738. During the late war which existed between Russia and England, I believe that some arrangement was made between you and the Russians by which you agreed not to molest one another? Yes; such an arrangement was made.

"1739. By the two companies? Yes; and government confirmed the arrangement.

"1740. You agreed that on neither side should there be any molestation or interference with the trade of the different parties? Yes.

"1741. And I believe that that was strictly observed during the whole war? Yes.

"1742. Mr. Bell, which government confirmed the arrangement, the Russian or the English, or both? Both governments."

the failure of the United States Congress to vote the appropriation.* This fact is cited to show that in 1872–'3 the British and Canadian officials understood that the eastern boundary of the strip crossed the rivers named at some point above their mouths, which are at the head of inlets, including Lynn canal, and that the boundary could not, therefore, cross any of these inlets.

In 1876 a Canadian official was conducting one Peter Martin, charged with some offense, from Canadian territory across the strip of American territory traversed by the Stikine river. Having camped for the night at a point 13 miles above the mouth of the river, Martin, in an attempt to escape, committed an assault on the officer, for which, on his arrival at Victoria, B. C., he was tried and condemned to imprisonment. Martin complained to the consul that he was an American citizen, and the Secretary of State presented the case to the British government. A surveyor was dispatched by the Canadian government to the Stikine river to locate the exact spot of the assault, which he reported to be in United States territory under the treaty of 1825. Thereupon the Canadian Privy Council, following the indication of the British Foreign Office, decided that as the offense for which Martin was convicted was committed in American territory, he must be released, and he was accordingly set at liberty.†

A further indication of the views of the British government respecting the boundary line of the strip is found in the action of the two governments in agreeing upon a provisional line on the Stikine river in 1878. The Canadian and American customs outposts on that river came in conflict in the vicinity of a point approximately 30 miles in a straight line from its mouth, and caused considerable friction. The Canadian government dispatched a surveyor on its own account to survey the river and fix a boundary line, he having been supplied with the text of articles 3 and 4 of the treaty of 1825. He made his report, and claimed to have found a range of mountains filling the requirements of the treaty at a point which crossed the river about 25 miles above its mouth, or about 20 miles in a straight line from the coast. A copy of this report and accompanying map were sent through the British Foreign Office to the minister at Washington, by whom it was submitted to the Secretary of State, with a view to securing his acceptance of this boundary, and Secretary

* Canadian Sessional Papers No. 125, vol. xi, pp. 11, 21, 28, 36.

† Canadian Sessional Papers cited, pp. 57, 59, 143, 152, 155. U. S. Diplomatic Correspondence, 1877, pp. 268, 271.

Evarts consented to accept it as a provisional line, without prejudice to the rights of the parties when the permanent boundary came to be fixed.*

The foregoing citations show that whenever the British government or those holding interests under it have had occasion to express their views as to the strip of territory secured to Russia under the treaty of 1825 they have made it plain that they regarded it as an unbroken strip on the mainland following around the inlets of the sea, and that the interior waters enclosed in such strip were Russian or American territorial waters.

When, in 1822, the Duke of Wellington was about to depart as the British plenipotentiary to the International Congress of Verona, he carried with him an instruction from Secretary Canning to bring the protest of his government against the ukase of 1821 to the attention of the Russian plenipotentiaries at that congress. After obtaining the opinion of the great English lawyer, Lord Stowell, he wrote:

"Enlightened statesmen and jurists have long held as insignificant all titles of territory that are not founded on actual occupation, and that title is, in the opinion of the most esteemed writers on public law, to be established by practical use." †

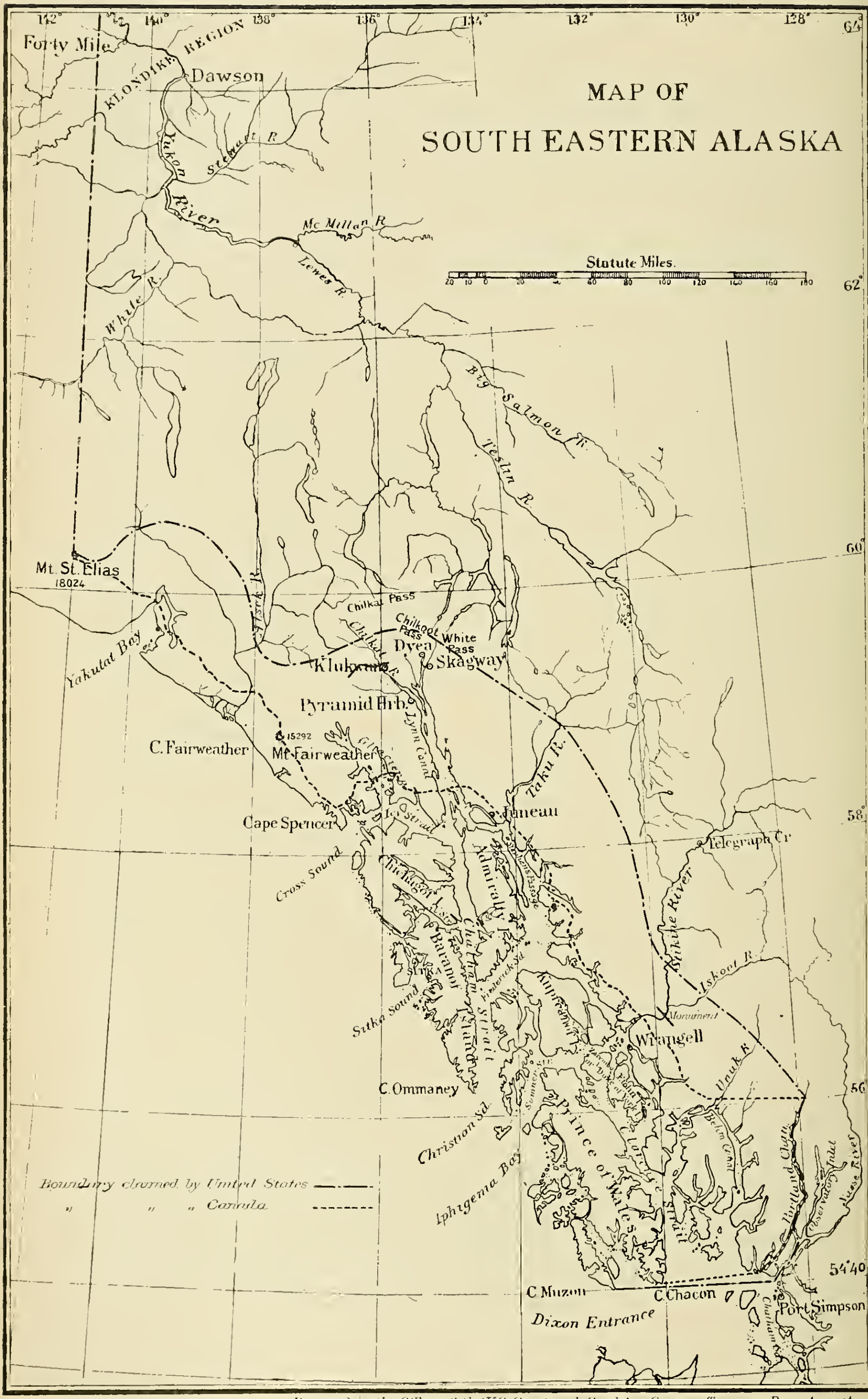
There is no claim or pretense that the British authorities or subjects ever occupied any of the territory now in dispute except under the lease cited, or ever exercised or attempted to exercise any acts of sovereignty over the strip or waters enclosed by it. On the other hand, let us examine the acts of occupation and sovereignty exercised by Russia and the United States. First, we have seen that very soon after the treaty of 1825 the Russian government published a map claiming the strip of territory and all the interior waters of the sea enclosed by it. Second, the Russian American Company established forts and trading posts within the strip. Third, by virtue of the lease cited, which was a recognized assertion of its sovereignty, it temporarily transferred these forts and posts to the British company. Fourth, at the termination of the extended lease it reentered and took possession and remained in possession till the cession of Alaska to the United States. Fifth, it received the allegiance of the native Indians inhabiting the strip, and exercised control and supervision over them. Sixth, immediately after the cession in 1867 the Department of State of the United

* U. S. Foreign Relations, 1878, pp. 339, 346.

† Fur Seal Papers, etc., vol. 4, p. 388.

States likewise caused a map to be published, setting forth the bounds of Alaska in accordance with the treaty of 1825, and the same claim as to the strip was thereon made as by Russia in its map of 1827. Seventh, upon the transfer of Alaska a portion of the United States army was dispatched to occupy the territory and a detachment was stationed for some time on this strip of the mainland. Eighth, since the cession post-offices and post-routes have been established and maintained at various points on the strip. Ninth, custom-houses have likewise been established and duties collected therein. Tenth, government and mission schools have been maintained, and notably so, for near twenty years, at the head of Lynn canal. Eleventh, the revenue vessels of the United States have continuously since the date of the cession patrolled the interior waters surrounded by the strip to enforce the revenue and other laws of the United States. Twelfth, the naval and revenue vessels of the United States have for the same period exercised acts of sovereignty over the Indian tribes inhabiting the strip, especially about the head of Lynn canal, and the latter have yielded unquestioned allegiance to the United States. Thirteenth, in the Census of 1880 and 1890 all the Indian tribes inhabiting the strip were included in the population of the United States and so published in the official reports. Fourteenth, the territorial government of Alaska has exercised various and repeated acts of sovereignty over the strip and interior waters enclosed by it, and the writs of the United States courts have run throughout its whole extent. Fifteenth, under the territorial claim of the United States and the protection of the government, citizens of the United States have entered and occupied the strip, built cities and towns, and established industrial enterprises thereon.

All the foregoing acts have taken place without a single protest or complaint on the part of the British or Canadian governments, except that some friction has occurred between the customs outposts as to the exact demarcation of the eastern line of the strip. For the first time a statement was presented by the British government to the Government of the United States on the 1st of August, 1898, developing the fact that a difference of views existed respecting the provisions of the treaty of 1825 relating to the strip of territory and the waters embraced by it. Two months previous an agreement had been reached between the two governments for the appointment of a joint commission for the adjustment of pending questions of difference between the United



Prepared in the Office of the U.S. Coast and Geodetic Survey, Treasury Department

MAP No. 12

BOUNDARY LINES OF AMERICAN AND BRITISH CLAIMS

States and Canada. Soon after the commission met at Quebec on August 23, 1898, it was made known for the first time that the British government would claim that the boundary line should run from the extremity of Prince of Wales island, along the passage known on modern maps as Pearse canal, to the head of Portland canal, thence directly to the coast, and follow the nearest mountains to the coast, crossing all the inlets of the sea, up to Mount St Elias. Such a line would give the United States a strip of an average width of less than five miles, broken at short intervals by the arms of the sea, and would transfer the greater portion of all the inlets to British territory (see map No. 12). As the Canadian government, with the consent of the British Foreign Office, has made public the protocol or official journal of the Joint High Commission, showing the result of its deliberations on the boundary,* I violate no diplomatic propriety in referring to these facts. The protocol shows that, after sessions of several months, the commissioners were unable to agree. In a failure of concurrence as to the language of the treaty of 1825, one of the two methods of adjustment was proposed by the British commissioners. The first was a conventional boundary, by which Canada should receive, by cession or perpetual grant, Pyramid harbor, on Lynn canal, and a strip of land connecting it with Canadian territory to the northwest, and the remaining boundary line to be drawn in the main conformable to the contention of the United States. The American commissioners, not being prepared to accept this proposition, the alternative was submitted by the British commissioners of an arbitration of the whole territory in dispute, in conformity with the terms of the Venezuelan arbitration, and in response to an inquiry from their American colleagues whether the selection of an umpire from the American continent would be considered, the British commissioners replied that they would regard such a selection as most objectionable.

The American commissioners declined the British plan of arbitration, and stated that there was no analogy between the present controversy and the Venezuelan dispute; that in the latter case the occupation of the territory in question had from the beginning been followed by the constant and repeated protests and objections of Venezuela, and the controversy was one of long standing; but that in the case of the Alaskan territory

* Fourth session, 8th Parliament, 62 Victoria, 1899. Protocol No. LXIII of the Joint High Commission, Washington, respecting the boundary between Alaska and Canada. Printed by order of Parliament, Ottawa, 1899.

there had been a peaceful and undisputed occupation and exercise of sovereignty for more than seventy years, and that no question respecting this occupation and sovereignty had been raised by the British government until the present commission had been created. They challenged their British colleagues to cite a single instance in history where a subject attended with such circumstances had been submitted to arbitration, and in declining the British proposition they proposed the plan of settlement which had been framed by Secretary Olney and Sir Julian Pauncefote in 1897. The treaty which these two distinguished statesmen framed so carefully marked the most advanced stage yet attained for the peaceful settlement of international questions not susceptible of adjustment by diplomatic negotiation. In that convention, drafted with a view to "consecrating by treaty the principle of international arbitration," they provided that all such questions should be submitted to arbitrators and an umpire, except territorial claims. They recognized that territorial questions affected so vitally the sovereignty and honor of nations that as to them a different method was necessary, and they provided that these should be submitted to a tribunal of three judges of the highest standing in each country, and that a binding decision could only be rendered by a vote of five of the six judges.* The American commissioners embodied this plan in their proposition for the settlement of the Alaskan boundary dispute, with the modification that a binding decision might be rendered by four of the six judges.

This proposition was rejected by the British commissioners, and, no other plan being brought forward, the Joint High Commission adjourned with the understanding that the boundary question should be referred back to the two governments for further diplomatic negotiations.

* U. S. Diplomatic Correspondence, 1896, art. vi of treaty, p. 239.

LIFE ON A YUKON TRAIL

By Alfred Pearce Dennis, Ph. D.

(Continued from the October number)

On Saturday, April 9, 42 days after our departure from southern British Columbia, actual work was begun on the railway survey. The experience of snow-shoeing 10 or 12 miles, with a day's work thrown in between, was trying at first. Any one who has worked on snow-shoes can estimate the labor of moving that distance over "rotten" snow. The crust yields at every plunge, and many pounds of snow pour in upon the shoes like loose gravel. The dead weight must be lifted when the shoe is withdrawn above the crust for the next step. The strain tells severely upon the back and the adductor muscles of the lower limbs. About 5 p. m. actual work on the line ordinarily ceased, but the return to camp would not infrequently require as much

HALT FOR FORAGE

as three hours. On one of these outings it happened that the line lay along a sunny slope of the mountain. Every one's moccasined feet got thoroughly soaked. After leaving this genial spot the wet moccasins became frozen. The back-chainman and the rodman were the first to exhibit signs of human weakness. They halted, sat down on a log, and wept with pain and vexation. A fire was kindled and the tearful rodman and weeping back-chainman were thawed out. This circumstance was regarded as a singularly felicitous one during the remainder of our stay in the wilderness from the standpoint of such men as Dan the axman, whose sense of humor, it seems, had been exquisitely developed.

There was always a period of reviving spirits after the midday lunches of bacon and beans which "Calgary" carried on the line in his old lard can; but after four or five hours more of work the men would drag into camp about dark, one at a time, tired and bedraggled. So the days went by, one much like another. Toward the first of May it was possible to leave the cumbersome snow-shoes in camp. Plunging through the rapidly sinking snow with low rubber shoes and "Dutch socks" was much less fatiguing, although it involved wet garments to the knees. Our survey line was completed to the Big Tahltan. We ascended this valley to the source of the stream in the second divide. Here, at an altitude of about 2,600 feet, we crossed the frozen surface of two beautiful lakes—Upper and Lower Coketsie. Crossing the summit, the general direction of the watercourses lay to the northwest. Launching on the Doo-de-don-Tooya one might float to the Inklin, and thence down the Taku to its mouth near Juneau, Alaska. Indians who professed to be familiar with the voyage down the Taku to the coast lived in forlorn hovels near the Shesley river. They were not of the Tahltan tribe and had no dealings with them. All the young bucks of the settlement were off on a caribou chase. A withered old man, who was crouching over some dying embers in his wickiup with some grimy Klooches, gave us to understand that the winter had been a hard one, and that salmon were expected soon in the Shesley.

These Shesley Indians are anthropologically of a Mongolian type, with low foreheads, flat noses, and brachycephalic skulls. The principal occupation of the born-to-drudgery women is to collect fuel for the fires which smoulder in the wretchedly damp and chilly wickiups. No one could complain that laundry work was a burden in such a settlement. Like the inhabitants of a Thlingit rancheria, these people seem to have turned the old Greek and Roman religion of external cleanliness into a sin. But if the outward and visible signs of sanctity can ever take the form of uncleanness, certainly the "odor of sanctity" can never again be considered a mere figure of speech. Three out of five of these miserable creatures seemed to suffer from lung or throat diseases.

The Stikine opened on May 7, two weeks earlier than usual, and a week later our mail, which had arrived in Glenora by steamboat, was sent in to us by a special messenger of the company.

CAMP ON TESLIN TRAIL

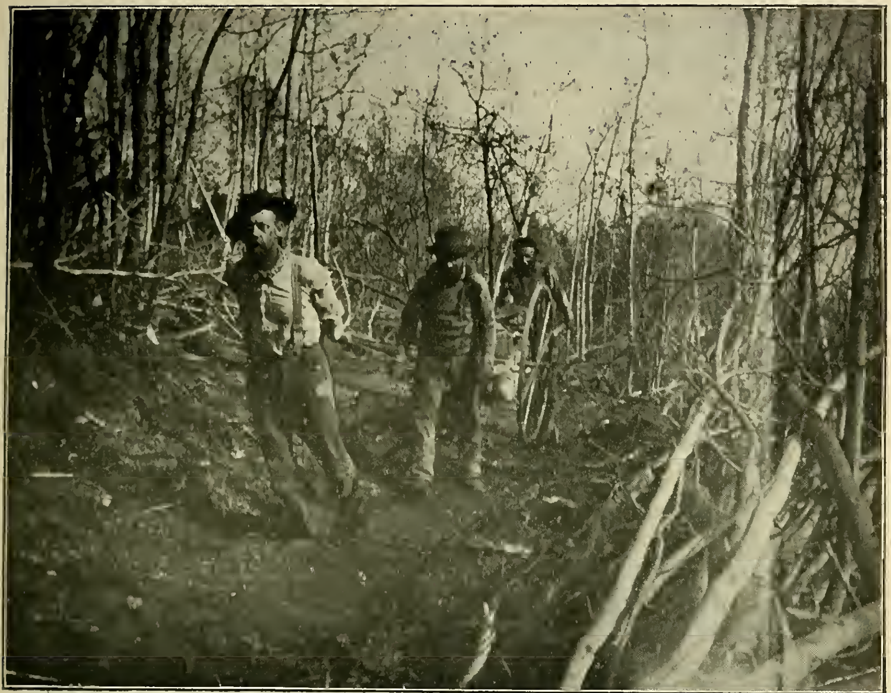
Most of the letters and papers were two months old. It was noticeable that few of the men received any letters or evinced any interest in the arrival of the mail. One man in the party admitted that he had not written to any of his home people in the East for nine years, and others had allowed several years to pass without writing.

By May 20, small, light-laden parties were slowly pushing along the trail toward Teslin lake, with their entire outfits stowed upon their dogs' backs and upon their own. They reported the daily arrival of steamers at Glenora, and told of the vast accumulation of freight, and of the congestion of Klondikers at that point. Many of these men, it seemed, had failed in their attempt to reach Glenora over the ice. They had been forced to camp on the river bank until the ice broke up. In this situation, their horses, on which they had relied on packing their outfits to Teslin, had perished. On arrival in Glenora by steamer the men had either sacrificed their provisions and were pushing into the Yukon with

WHEELBARROW WITH LOAD OF 300 POUNDS

only a few months' stores, or else were sitting idly by their outfits on the banks of the Stikine.

One swarthy frontiersman was taking in 350 pounds, distributed on the backs of himself, his partner, his dog, and his squaw. Others, with rude wheelbarrows, were making five or six miles per day with a load of 250 pounds. Usually a well-trained dog tugged indefatigably in the traces ahead. The narrowness of the pathway absolutely excluded any ordinary two-wheeled vehicle from the trail. The exigencies of the situation brought out some remarkable one-wheeled concerns. The "go-devils,"



ONLY TWO-WHEELED VEHICLE SEEN ON TESLIN TRAIL

to use the technical name of these vehicles, were fashioned in the wilderness, with only an ax and whipsaw as instruments of construction. Thongs of buckskin bound the parts together, nails being reserved for future use in boat-building. Where the center of gravity of these "go-devils" was low, two men could balance a load of 500 or 600 pounds in the roughest places.

Men now appeared whose faces were familiar. They were men whom we had passed on the river more than three months before. These belated wayfarers had an exceedingly rough appearance. The venture seemed to have particularly attracted the "bronze beards" and "barbarossas." A tangle of long hair, worn in portières over the ears, and an unkempt, bushy beard, commonly of a reddish hue, half concealed, but also strongly revealed in all their stern aspects, faces which bore the sad traces of hardships, of deprivations, of bitter disappointments. Nearly all had tales of losses of provisions through the ice, of losses of animals from starvation, of exorbitant transportation rates over distances which they had hoped to traverse without financial loss. Failure was not more clearly written on the ranks of the Grand Army in its retreat through the snows of Moscow. These pilgrims to the shrines of Mammon no longer expressed the feverish, fanatical hopes of the inexperienced gold-seeker. Confidence had waned, and they spoke of their mission apologetically and not with enthusiasm. All regretted that they had chosen this route, and they told of men who, unable to take steamer passage, were descending the Stikine in small boats to make an attempt to reach the Yukon valley by other routes.

One naturally asks why these stranded Klondikers did not have their outfits packed in to Teslin lake on horses. The condition of the trail precluded this means. The minimum rates for transportation over the 150-mile stretch of mountain forest and swamp was $800 per ton. Horses were expensive and rarely lasted through the journey. The sixty miles of high level trail to a point beyond the Shesley river was easily passable for a pack-train when we left the country, but the region beyond was a wild chaos of willow swamps and muskeg morasses, permeated with streams of all sizes, from tiny rivulets to the unfordable Nahlin.

GO-DEVIL FLAT CAR DRAWN BY A HORSE — 600 POUNDS LOAD

In some places in the lowlands the ice still lay intact beneath a heavy carpet of moss and heather as late as the middle of June. But for this moss the swamps would have rapidly dried out under the 18 hours of sunlight.

As to the class of men met on the trail to the Yukon, they were, as a rule, rough and common-place, as might have been expected. Nearly all had the outward appearance of desperadoes. Their dress contributed to their savage appearance. Wolf-skin caps, red mackinaws with penitentiary stripes, and yellow, blanket-

ENGLISH ACTORS STRANDED ON TESLIN TRAIL

lined, canvas jackets were most in vogue. The award for the most ingeniously bizarre costume rightfully belongs to a man from the Palouse country, in Washington, attired in a cowl and toga of striped bed-tick lined with muskrat skins, the wearer impartially distributing novelty to the eye and malodors to the nose at every stage of his progress.

Two English actors were encountered who were depending upon their voices for means of transportation in making a tour of the world. They were stranded on Teslin trail. One soon grows familiar with the type of old knock-about like Dan, the axman. In the heart of such a man a good dog supplies much of the place of family, church, and state. Such men are not so much immoral as unmoral. They are not introspective and harbor no unavailing regrets for the past nor morbid anticipations for the future. "Have pleasure while you live," say they, "for you will be a long time dead." During the drudgery of work in the wilderness the mind dwells in complacent reminiscence on some wild bit of revelry when last in town or fondly anticipates the next opportunity of squandering a month's wages in one night of boisterous bedevilment. The generosity of these men is something larger than any formal rule of moral obligation. It extends to the last crust and freely puts life in pawn. After the day's work on the line, the men would usually gather in the largest of our tents for conversation. The talk generally ran to such subjects as gains and losses at poker or faro, the grievances of the Cœur d'Alene miners, the scale of wages at Butte, or personal vicissitudes when "dead broke." Occasionally talk drifted to higher themes, as when Charlie Collins, who had played a bass horn in a fireman's band, ventured on musical discussion, or Jim Coyle on literary criticism. Collins remarked one evening that he had not been to church since he had picked up his knowledge of music. "When a man gets to know music right," he observed, "he can't sit under the bum alto singing of a church choir." "The sweetest music I ever heard," added "Calgary," the teamster, "was the bell on the neck of my old lead mare on the Edmonton trail."

One Sunday evening Coyle, the litterateur, reviewed *Quo Vadis* in the cook tent. He brought out very prominently the decadent institutions of the Eternal City under Nero. At the close of the recital, Collins, who had listened attentively, remarked that Rome under "that tough mayor must have been run as wide open as Wrangell."

We were working one warm June day about four miles from camp on a surface of wet moss and heather in a heavy spruce thicket. The mosquitoes had been active for a week, and that day they were particularly exasperating. We had no mosquito netting, but every one had swathed neck and face in a cheesecloth fabric that had been wound about the bacon. The back flagman and the transitman had just kindled for the twentieth time that day "smudges" to enjoy in the smoke thereof a few minutes' respite from the tormenting insects. At this conjuncture a messenger from Glenora appeared with a proclamation of

CINCHING UP — TESLIN TRAIL

emancipation. He brought the news that the Canadian government had withdrawn its support from the railway project; that the building of the road had consequently collapsed; that the engineer corps had been ordered out of the country. The next day we set out for Glenora, whence, after a wait of three days, during which two of the men expended the earnings of more than three months, we took steamer passage down the river.

It is a pleasant thing to quit this country at any time, but particularly so in summer. The month's toilsome journey up the river over the ice is retraversed in 12 hours by the swift river steamers that must at times outrun a 12-knot current in order to get steering way. Some day an artist will take a summer's outing on the Stikine* and with pencil and palette make its glaciers famous. It is delightful to sit on the upper deck of one of the river steamers in the mellow light of evening and shoot down the swollen stream long after the sun has dipped behind the mountains. By 9 in the evening the untrodden peaks of the giant mountains are still a rosy red; at 10 o'clock, in an arrested riot of jagged ridge and crest, they stand forth distinctly in line and color against the pink sky-line. Here and there long granite claws, picked clean by glaciers of a past age, run down into the lowlands and are lost there. But best to be observed are the glaciers of the present day. High upon the summits the everlasting snow gleams spotless in the fading light; lower down rise the jagged pinnacles and upheaved billows of the glacier itself, a study in blue; while below it and nourished by its waters lies the dark-green spruce forest fringing the banks of the rushing river. By midnight detail and color are lost in dusky shadows, but the rose-colored light still lingers mayhap before the traveler's eyes as he realizes that he is speeding southward to home and to civilization.

THE RATIONAL ELEMENT IN GEOGRAPHY

By W. M. Davis,

Professor of Physical Geography in Harvard University

Abundant conference and correspondence with teachers of all grades in recent years make it evident that the introduction of the "causal notion in geography," as McMurry has phrased it, is warmly welcomed wherever it is well understood. The traditional lists of capes are doubtless still memorized and recited in some schools, to the exclusion of examples involving explanation and correlation as elements of geographical study; but such schools do not rouse the pride of progressive superintendents. Enterprising teachers are constantly striving toward a more rational treatment of geography, and with every advance in their own understanding of its problems empirical statements are replaced by reasonable explanations in their teaching, much to the advantage of the scholars.

*In the January, 1890, number of The National Geographic Magazine is an excellent description of the Stikine river by Miss E. R. Scidmore.

The two chief causes of the change now in rapid progress from an empirical to a rational geography originated outside of the limits of geography proper. One of the causes is the understanding of the evolution of land forms that has been contributed by geology; the other is the belief in the evolution of organic forms contributed by biology. To these must be added the better knowledge of meteorology through the application of physics to the study of the atmosphere, as well as the results of strictly geographical exploration of lands and seas; but all this is of secondary importance alongside of the revolution that has been worked by the acceptance of inorganic and organic evolution. The study of the earth in relation to man, as now illuminated, has become wonderfully more interesting at this end of the century than it was in Ritter's time in the beginning, and we may well believe that the explorations of the twentieth century will profit greatly by the more sympathetic appreciation of nature that geographers will then carry into the field.

It will not be possible to consider in this article any of the organic elements of geography, and among the many inorganic elements of the subject attention can now be given only to the lands; the earth as a globe, the atmosphere, and the ocean cannot be included. Furthermore, only one of the most practical aspects of land study will here be touched upon, namely, the art of giving an accurate and effective verbal description of land forms: a description that shall be at once accurate in representing the essential facts of nature, and effective in being intelligible to its hearers or readers.

It is not a simple matter to frame a good verbal description of geographical forms. The description must not attempt the impossible by undertaking to set forth facts of form and relief with the fidelity of a good model, or by trying to indicate facts of distribution as accurately as they are shown on a good map, or by seeking to present perspective impressions from a single point of view, such as are given in good pictures. The patience of the hearer or reader would be sorely tried if the perseverance of the speaker or writer tempted him to indicate by words the innumerable details that find proper expression by plastic, graphic, or pictorial art. Verbal description has an object of its own. It must be devoted chiefly to summarized facts, whether they are details or generalities, and it must deal with new facts by means of their likeness or contrast with certain previously known types whose forms serve as the standards upon which descriptive terms are based.

Now it is curious that while geographical surveying has a well recognized place as a technical art, and while geographical drawing and modeling are understood to require well-trained skill, there has been comparatively little conscious attention given to training students in the geographical description of land forms. There can be no question that the latter art more generally deserves cultivation than the others, for speech is heard and books are read upon geographical subjects more often than maps, models, and pictures are consulted; yet practical instruction and exercise in the description of land forms are seldom made part of school or college teaching. Perhaps it is for this reason that books of travel so generally fail to give their readers a clear idea of the regions with which they are concerned. As a means of correcting this error of omission, practical exercises should be introduced in connection with recitations or lectures in physical geography—physiography—and serious emphasis should be laid on the translation into words of the facts observed either directly on the face of nature during field excursions or upon models, maps, and pictures in the laboratory.

When the attempt is made to describe geographical forms in spoken or written language three classes of more or less technical terms may be employed, as was shown by Penck in a communication to the Sixth International Geographical Congress in London, 1895. One class is empirical and well rooted in our language, including such nouns as hill and mountain for smaller and larger eminences, ridge and valley for elongated elevations or depressions, as well as many adjectives of geometrical association, such as precipitous, steep, rolling, level, and so on. Another class introduces phrases suggesting a relation between structure and form, and these phrases are all modern, such as monoclinal ridge, anticlinal mountain, synclinal valley, and so on. A third class employs terms that imply an understanding of the evolution of the forms concerned, and this class is the youngest of the three; here we find consequent, antecedent, and superposed rivers, subsequent and obsequent valleys, maturely dissected plateaus, and partly regraded slopes. None of the classes contains as many terms as it needs.

The first or empirical class has the merit of simplicity and safety, and some geographers would therefore hold closely to it, as if forgetting that such a method of description implies the neglect of those mental faculties which have been so successfully employed in investigations that make " scientific use of the imagination," as Tyndall put it. The second or structural class has at least the negative merit of not being dangerous, but it fails to satisfy the student who has left empiricism in search for rationalism in his geographical work. The third or explanatory, rational, and genetic class is stimulating to the investigator, but it is objected to by conservatives as involving grave risk of error, because the explanations on which its terms are based may be incorrect. It is interesting to inquire which of these classes of terms a geographer shall employ in his studies or which a teacher shall use with his scholars.

The practical worker will at first probably employ some terms from all three classes, because he finds no one class complete in itself. According to his temperament, he will feel a preference for one class or another, and he will very likely venture now and then to suggest new terms appropriate to his favorite class, if his attention and interest are directed closely to a special field of research where existing terms are insufficient for his needs; but as soon as he begins to use the genetic class he finds that the success of his work is marked by the freedom and confidence with which he can use explanatory terms, and that just as the greater includes the less, so the genetic include the empirical and the structural. The teacher, as well as the investigator, will then feel an increasing discontent with the blind and dull empirical terms, however safe they may be, and with the structural terms, however essential they may be. He will press forward in the hope that all the land forms with which he is concerned may in due time be vouchsafed as full and certain explanatory description as many of them have already received.

A double reward comes to the teacher who leads his scholars beyond empirical description toward rational explanation: a much greater interest is excited in geography as its meaning is found to be richer, and soon afterward a greater power of observation is developed in response to the discovery of many correlations among the elements of land forms that springs from their explanation. Herein lies the practical value of a method that may thus far seem chiefly theoretical.

A concrete case may be illustrated by the diagrams on pages 470 and 471. Empirical description will see a narrower and a broader canyon: the walls of the first consist of cliffs and slopes; the walls of the second consist of cliffs, slopes, and platforms. No correlation is sought for between structure and form, for empirical description does not concern itself with correlations.

Structural description recognizes a correlation between the horizontal strata of which the canyoned plateau is built and the attitude of the belted cliffs and slopes in the canyon walls, and between the relative resistance of the various layers and their surface expression, for the harder strata determine the cliffs and the weaker ones determine the slopes; yet the consideration of structure alone will not lead to a just comparison of the two diagrams, inasmuch as the structures are alike in both, and the forms represented depend on the less development of one and the greater development of the other canyon; but structural description takes no account of development or of the resulting correlations of form and time.

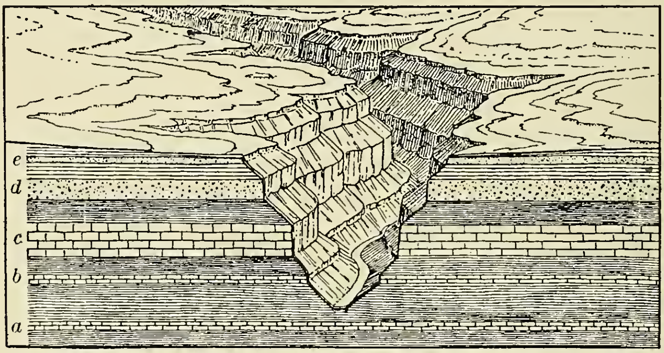


DIAGRAM OF NARROW CANYON

From Davis and Snyder's Physical Geography, by courtesy of Messrs Ginn & Co.

Genetic or explanatory description recognizes and employs all that has gone before, and goes further. The variety of form in the canyon walls is seen to be a necessary consequence of the action of the weather on horizontal layers of unequal hardness. The narrower canyon is soon perceived to be only a younger stage of the wider one, and the platforms of the wider canyon are recognized as characteristic features of an approaching maturity of development. Moreover, the platforms are found to be systematically placed between the slope from a weaker, faster-retreating cliff and a stronger cliff next below it, and not *vice versa.* Structure, process, and time are thus all rationally correlated with form, and all these elements interact most suggestively in framing a verbal description. It cannot be doubted that a student who has gained an understanding of such correlations will give a much better account of forms like those here illustrated than one who trusts to observation without explanation. Sharp-eyed as the student may be, his outer sight is greatly aided by his insight. Actively as he may traverse his field of work, his path will be determined only by a patient endeavor to see everything, unless it is guided by a well-planned search for critical points. Accurate as his notes may be, they run the danger of being abundant rather than intelligible, if they are empirical without being explanatory. And yet, with all the advantages that come from successful explanation, the conservative teacher may still hesitate to advocate this method of description because of its inherent dangers. How, then, can its dangers be reduced to so moderate a measure that they may be

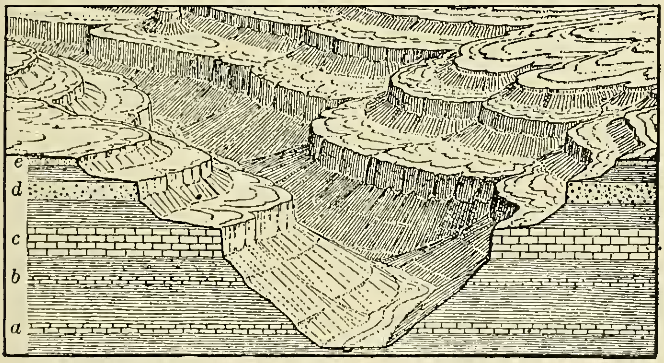


DIAGRAM OF WIDENED CANYON

From Davis and Snyder's Physical Geography, by courtesy of Messrs Ginn & Co.

set aside as of much less import than its advantages? This question opens the whole subject of reform in the teaching of geography.

A reasonable safety in explanatory description can be attained by well-taught students who are first practised on empirical description in their elementary work, and who are gradually and systematically led forward to an explanatory description based on a comprehensive understanding of the evolution of land forms. They must be under the direction of teachers who have had experience enough in field work to recognize if not to discover the geographical evolution of the home district. Field work must be an essential part of instruction in all grades of study, and an equally essential part must be a general scheme of geographical classification to which the student is gradually introduced and through which he may come to appreciate the systematic development of land forms. Some idea of the changes that land forms slowly suffer should be given with the most elementary teaching. Streams should be recognized as not consisting of water alone, but of water that bears along the waste of the land. The slow crumbling of rocks and the formation of soil under the attack of the weather, the slow movement of the soil cap by washing and creeping, and the slow changes of form that result from weathering and wasting should all become familiar in early school years. A child need not wait till he studies chemistry and mineralogy to recognize that iron rusts and rocks weather; but when chemistry and mineralogy are reached he will gain a fuller understanding of these processes. He need not wait for a formal course in geology to learn that rock waste washes and creeps down hill, for this topic is as essentially geographical as the movement of rivers, ocean currents, and winds. He may very early be convinced that the earth has existed through a long period of time, for the changes of form that he soon comes to appreciate must have required ages for their accomplishment: great periods of time thus become as familiarly associated with the earth as great distances through space. An excellent introduction to geology is thus gained through physical geography, but a true geographical flavor is retained by always considering processes of change as a means of explaining existing form rather than an end of study in themselves.

When the student has grasped the idea that existing land forms are the product of changes worked by ordinary processes on earlier forms he should begin the systematic study of land forms. The school grade, the school equipment, the school surroundings, the text book, and, above all, the teacher should determine whether this more advanced branch of geography should be set forth in one way or another. It may be presented inductively, beginning with local examples in the home neighborhood, going on through a chosen series of forms illustrated by models, maps, and pictures, and thus gradually building up broad generalizations that will serve as guides for observation, explanation, and description in all parts of the world. Or the subject may be presented deductively, expanding from simple ideal cases to examples of greater and greater complexity until the systematic scheme embraces a wide variety of types, all of which receive verification when confronted in due order with examples of actual land forms. But in either case the student must go on from the simple correlations observed between the minor elements of local forms in his elementary study and advance toward much broader correlations by which the forms of large areas are brought into harmonious association. Systematic geography will thus come to serve the same important object as systematic zoölogy or botany; it will provide convenient means of assembling a great body of facts in what is believed to be their natural relations, and it will devise an accurate terminology by which rational and effective description can be given to a vast variety of land forms through their likeness to or difference from many standard types.

In my own experience, the dominating principle of systematic geography is that of the geographical cycle, of which some account has been given on an early page of this Magazine (vol. i, 1889, p. 20), and in various later articles, and of which a fuller statement appears in the current number of the (London) *Geographical Journal.* With increasing experience in its application, the more comprehensive, powerful, and practically useful has the principle of the cycle become. It is now an indispensable guide in observation as well as description, because it leads off a whole procession of facts, marshalling them in good order. From its earliest and most general application to consequent streams, it is now extended to streams of many kinds, systematically acting on one another in the rearrangement of their drainage areas during their progressive adjustment to the structures on which they work. The cycle accommodates itself easily to the peculiar conditions of arid or frigid climates, and to the special conditions of the seashore. It stimulates the recognition of real homologies: the rudimentary conception of land drainage as limited to streams of water has thus been expanded so as to include all lines of down-hill movement, whether of water or waste; and the generalized river is thus seen to cover all the surface of its basin. A graded condition or "profile of equilibrium" is first attained by the trunk river on areas of weak rocks and last attained by the creeping waste near the divides on areas of resistant rocks, and the geological theory of evolutionary uniformitarianism receives new support from the correspondence between the generalizations thus reached and the facts of nature. However theoretical all this may seem to be, I do not believe there is any more practical means of land-form study than is found in the application of the principles here referred to. I earnestly urge teachers of whatever grade to make themselves acquainted with the geographical cycle, and to introduce its elements appropriately in their teaching.

EDWARD ORTON, LL. D.

Less than 90 days ago the sessions of the American Association for the Advancement of Science in Columbus were presided over by the distinguished ex-president of the Ohio State University, Dr Edward Orton. On October 16, with only a few hours' warning, Dr Orton passed away. The place which he had won in the scientific world will be hard to fill. Dr Orton graduated from Hamilton College in 1848. Since 1869 he has been state geologist of Ohio, and since 1873 professor of geology and for some years president of the Ohio State University. Many volumes and reports on the geology of Ohio and the natural-gas supply of the United States are the evidence of his original investigations. In 1897 he was president of the Geological Society of America. *Science* in its report of the Columbus meeting has truly described Dr Orton as a man " honored and beloved of all."

NATIONAL GEOGRAPHIC SOCIETY

Owing to the press of his official duties as the Hydrographer of the U. S. Geological Survey, Mr F. H. Newell has been compelled to resign the secretaryship of the National Geographic Society, an office which he has so ably and zealously filled during the past two years. As an evidence of his efficient management, dating from December, 1897, it may be stated that the membership of the Society has increased from 1,300 to more than 2,200, and has received an impetus that promises in the near future to greatly enlarge that number.

Frederick Haynes Newell was born in Bradford, Pennsylvania, March 5, 1862. After a course at the common schools of Needham, Massachusetts, he entered the Massachusetts Institute of Technology at Boston, where he graduated with high honors as a mining engineer and geologist in 1885. Several years were passed in miscellaneous engineering in Pennsylvania, Virginia, and various sections of the United States. In 1888 he was appointed Hydrographer of the U. S. Geological Survey. a department then formed for the first time. Since then Mr Newell has planned and organized the systematic measurement of the flow and capacity of many rivers in arid regions of the West, his object being to ascertain the resources of water available for the gradual reclamation of the vast tracts of desert land. In other words, a great work has been begun and is nearing completion in what Mr Newell has aptly termed "The Annexation of the West." Mr Newell is the author of "Agriculture by Irrigation," "Hydrography of the United States," "The Public Lands of the United States," etc.

As a successor to Mr Newell, the Society has been fortunate in securing the acceptance of the secretaryship by Mr Joseph Stanley-Brown. Mr Stanley-Brown needs no introduction to geographers. His long connection with the U. S. Geological Survey and with the Geological Society of America (of whose publications and proceedings he is the editor) have made him personally acquainted with the many geographers and diverse geographic interests of the country.

G. H. G.

GEOGRAPHIC LITERATURE

Mexico and the United States: A Study of Subjects Affecting Their Political, Commercial, and Social Relations, Made with a View to Their Promotion. By Matias Romero. Large 8vo, pp. xxxv + 759. New York: G. P. Putnam's Sons. 1898.

This is an exceedingly full handbook of Mexico, prepared by the man of all men most competent to do so, the late minister to the United States. It contains accounts of the topography, climate, mining, fauna and flora, peoples and their social condition, industries and trade, government and laws. Chapters are devoted to the Mexican free zone and to the workings of the silver standard in Mexico. The work is invaluable as a reference book concerning our sister republic.

H. G.

Alaska: Its History and Resources, Gold-fields, Routes, and Scenery. By Miner Bruce. 8vo, pp. 237, with 53 illustrations and maps. Second edition, revised and enlarged. New York: G. P. Putnam's Sons. 1899.

This is a popular compendium of information upon Alaska, written in a rather optimistic tone. It includes chapters upon history, topography, climate, agriculture, minerals and timber, fisheries, and other resources; the Eskimo and Indians; the work of the missionaries; the routes to the interior; the gold-fields, and closes with a chapter of suggestions to prospectors and a statement of the boundary dispute. The matter of the book is, for the most part, accurate, although in a region in which history is being made so rapidly it is extremely difficult to keep the printed page abreast of the fact. We might be disposed to take exception to the rather roseate view which the author appears to have regarding this possession of ours, for, so far as can be seen, Alaska has little future after we have reaped the harvest which Nature has produced, after we have collected its furs, its fish, its gold, and its timber.

H. G.

Rivers of North America: A Reading Lesson for Students of Geography and Geology. By Israel C. Russell. 8vo, pp. xv + 237, with 17 full-page illustrations and 23 cuts. New York: G. P. Putnam's Sons; London: John Murray. 1898.

Professor Russell is one of the few scientific men who can put the results of science in popular form. He comes to this work well equipped after a score of years devoted to travel and study. In the present book, which forms one of a science series, he treats of the life and work of rivers. It opens with a chapter on the disintegration and decay of rocks, followed by the laws governing the erosion of streams, the influence of inequalities in the hardness of rocks, the material carried by streams, either in suspension or solution, the deposits of streams, stream terraces, the development of streams, including the adjustment of their drainage basins under stable and unstable conditions of surface and climate. Finally he applies all these principles to the rivers of this country. It is a book which should be read by all students of physiography.

H. G.

Man and His Work. By A. J. and F. D. Herbertson. Black's School Geography Series. London: Adam and Charles Black.

This book is a symptom, if not an exponent, of a widespread and gratifying movement in modern geography teaching. It treats primarily of man's work—chiefly as it is influenced by his physical environment. It is intended to dwell on the *relations* between facts, and holds consistently to its purpose; but the generalizations made are sometimes too sweeping. American sky-scrapers have not yet been proven more durable than the stone castles of mediæval times; not all the soils of temperate lands are inferior. No attempt has been made to write a "pedagogic" book. Concrete examples are used to *illustrate* principles previously stated, not to *lead* to these principles by induction. The paragraph headings are generally good topics, though in some places irrelevant matter is introduced under them, as on page 3, where the effect of elevation on *trade* is treated, under the heading, Elevation and *climate*. The use of original narratives of travel has added much to the interest of the book, but the authors are frequently beguiled into too much detail. An exhaustive comparison of the agricultural methods of the Battaks and the Dyaks is out of place in a text book of this kind. The work needs editing. Guiding feathers were never, surely, *discovered* on arrows, and dead ancestors cannot be commemorated *among* the living. But the book is interesting from cover to cover, and no teacher who has read it will again be willing to confine her work to drilling on dead facts. The authors have plainly shown a better way.

Two Women in the Klondike: The Story of a Journey to the Gold Fields of Alaska. By Mary E. Hitchcock. With a map of Alaska and over 100 illustrations from photographs. 8vo, pp. 485. New York: G. P. Putnam's Sons. 1899.

This minute personal journal of the experiences of two women who went to the Klondike with the rush of gold-hunters in the spring of 1898 is a long story of small discomforts, but not a tale of peril or adventures. The ladies are introduced and described, socially vouched for by Mrs Elisha

Dyer, of New York, and the book is dedicated to Mrs Elisha Dyer. Mrs Hitchcock faithfully narrates all that she saw and heard, and that befell her. Her journey comprised the voyage by steamship to St Michaels, and thence by river boat and barge to Dawson, where she remained a couple of months, and then continued by boat up the Yukon to the foot of White pass, and over that summit to steamship service again. She lived in a great tent on the river side opposite Dawson, save for the three or four days given to a heel-blistering expedition to Eldorado creek and the diggings, and greater discomforts were probably never endured by well-to-do women for so little apparent reason. The reader continually asks *why?* and *what for?* as he follows the intimate record of their daily life and housekeeping, the repeated dish-washings, fire-buildings, and tent-proppings, the strange menus of their feasts of "canned goods," the shivering in heavy clothing and furs, and the frequent dreary rains, while the great Dane, the parrot, and the canary claim one's sympathies. Nothing is withheld; and manicuring, tender passages, land laws, customs regulations, the running of an animatascope, and the descriptions of toilets take their turn at equal length. The two women staked a claim in the Klondike, "grub-staked" a prospector or two, built a cabin on their lot opposite Dawson, and after being fleeced and swindled in most grotesque ways came away none the sadder, apparently.

A Constitutional History of the American People. 1776–1850. By Francis Newton Thorpe. Illustrated with maps. Two vols., 8vo; vol. 1, pp. xxvii + 485; vol. 2, pp. xv + 520. New York and London: Harper & Brothers. 1898. $6.

There is suggestive originality in this title. Constitutional histories of the State abound, but not constitutional histories of a people. Very few among past or still-existent peoples afford the field for a constitutional history of themselves. Usually the term would be a misnomer.

In the preface Mr Thorpe states that this work "is the record of the evolution of government since the Revolution;" that "constitutional history is the history of a constituency which, consciously or unconsciously, is ever striving to promote its own welfare," and that the claim of popular government to authority is "its identification with the great principles of civilization." His first chapter opens with the words: "In the evolution of democracy in America," and the same phrase—"evolution of the democracy"—is emphasized on the second page. On the fifteenth page he strikes his keynote: "My theme is a history of the evolution of democracy in America."

To him "American democracy, like Greek poetry, is the presentation of the whole estate of man." But there is scholarly modesty in his words: "The historian shrinks from attempting to trace the record of democracy in all its phases. He must be satisfied, and indeed thrice happy, if he is able to trace, even imperfectly, the record of a single phase." He defines his own chosen phase as "the history of political and civil adjustments." This meager definition hardly hints at the multifarious nature of the theme or at the research and infinite patience required for its treatment. Intimate acquaintance was necessary with the numerous decisions of the Supreme Court and of the State courts and with the dissenting opinions of the justices in the minority; with countless conflicting interpretations of sentences or words in the national Constitution; with opposite opinions on scores of subjects advocated in scores of constitutional conventions; with the various motions and votes; with the names and training and history of the members of those conventions. Hundreds of State constitutions, formulated, rejected, or approved, repealed or still in vigor, and tens of thousands of State laws, passed, amended, repealed, or still on the statute book, must be scrupulously examined and carefully collated. The data must be scrutinized with toilsome and persistent honesty, but the horizon must be larger than that of an erudite compiler. Broad-minded and philosophic, the writer must be sensitive to every political breeze and keen to appreciate its source and influence and direction. Peering with the microscope into minutiæ, he must, above all, with the telescope sweep the sky.

Believing that the "history of American democracy . . . is a history of political thought rather than of individuals," he lingers little upon the lives or characters of the apostles of that democracy, and still less upon the lives or characters of its opponents. The mass of the army and the direction of its march count more with him than the personality of the chiefs; yet it is curious to note that in his first volume he refers by name to Washington nine times, to Marshall ten times, and to Hamilton eleven times, while to Franklin twenty-five times, and to Jefferson sixty-six times. This is not indeed disproportionate, for the two latter are the real founders of American democracy. With a sympathy which he makes no effort to hide, he traces the course of democratic government in its expanding and magnificent career.

In sagacious contrast to most historians he recognizes the decisive share which geographic conditions have had in determining our national life. Nowhere have they played a more definite part, not even in Russia or Spain. But how commonly in American histories are they absolutely ignored! Well does he say, "Thus the fate of the republic depended on the course of streams and the trend of mountains as well as on Congress and the legislatures;" or again, "Had gold or silver abounded in New England, Pennsylvania, or Virginia, the evolution of democracy on the Atlantic seaboard would have been retarded for centuries." "The sunny, semi-tropical climate of Florida and South Carolina" and the sturdier climate of Massachusetts and Vermont affect the vision and the formation of political creeds. With reason does he exclaim, "Our morality is much a matter of latitude!"

Through more than a thousand pages does the author interpret American history with accuracy and truth. He renders evident the sublime fact that our national strength and glory are found not in what our fathers brought here in the early days or in what has been wafted to us since across the ocean. It is what they and later generations wrought out here on the virgin soil of this untouched continent that constitutes America's contribution to mankind; nor is the mission of the republic yet accomplished. Still is the region in the western hemisphere between the thirtieth and forty-fifth degrees of north latitude the political laboratory of the world. One cannot but regret that Mr Thorpe concludes his work in

1850. Why, having weighed in the balance two periods which the nation has completed, did he halt before the third period, which the nation had likewise completed? The fourth period, which we are now traversing, is unfinished and its earlier events lack perspective; but that cannot be said of the years between 1850 and 1876. It would have been a privilege to be led through that storm of words and swords and readjustment by so intelligent a guide as Mr Thorpe.

Every page of this "Constitutional History of the American People" commands respect and admiration. One may not always agree with its premises and conclusions. Its dicta sometimes arouse dissent bordering upon resentment; but faithfulness of research, honesty of purpose, and ability of treatment are manifest throughout. The whole is a splendid work, honorable to its scholarly author and sure of a permanent place among the most valuable contributions to American history.

Edwin A. Grosvenor.

Amherst College.

GEOGRAPHIC MISCELLANEA

There has been a steadily growing demand in the last few years for better teaching of geography, and as earnest an effort on the part of many teachers to meet that demand. The National Geographic Magazine proposes to aid the work by presenting in its pages a series of articles written by those most fitted to speak: able geographers who are also teachers of renown. Prof. Wm. M. Davis, of Harvard, opens this series with an article which appears elsewhere in this number, and which is soon to be followed by a second from him on field and laboratory methods of teaching geography. Commissioner Harris, of the Bureau of Education, will treat the subject in several of its aspects, and a number of other equally prominent educators have promised articles which are to appear in the Magazine within the next few months.

The Association Review is the title of an educational magazine to be published bimonthly during the school year by the American Association to Promote the Teaching of Speech to the Deaf, and edited by Frank W. Booth, the general secretary and treasurer of the association. The first number of the magazine, that for October, is an exceedingly interesting and instructive number, and includes among its contents: "The Teacher and the State," by John M. Tyler; "Kindergarten Work in Schools for the Deaf," by Edward C. Rider; "Pictures and How to Use Them," by Florence C. MacDowell, and a number of briefer papers. An excellent picture of the late Hon. Gardiner G. Hubbard is accompanied by a brief biographical sketch of his great life-work. The number also contains the proceedings of the sixth summer meeting of the association, held in Northampton, Mass., June 22–28, 1899, and includes addresses by Hon. F. B. Sanborn, L. Clark Seelye, LL. D., and the address of the president, Dr Alexander Graham Bell.

The Scottish Geographical Magazine for October is mainly a report of the proceedings of the sixty-ninth annual meeting of the British Association, which was held at Dover the second week of September. "Oceanography," the title of Sir John Murray's presidential address to the Geographical Section, is published in full and is accompanied by a bathymetrical chart of the ocean showing the "deeps" according to Sir John Murray. From these results it appears that considerably more than half of the sea-floor lies at a depth exceeding 2,000 fathoms. He emphasizes the fact that the recent soundings of the German steamship *Valdivia* in the Atlantic, Indian, and Southern oceans, as well as the many thousands of deep soundings taken within the last decade, have in but few instances caused any very great alteration in the positions of the contour lines on the *Challenger* maps.

The delegates of the National Geographic Society to the International Geographical Congress in Berlin, on their return to the United States, report the meeting a success in every way. Gen. A. W. Greely, U. S. A., and Mr H. G. Bryant, president of the Philadelphia Geographical Society, were elected honorary vice-presidents of the Congress. The next place of meeting was referred to the executive committee for decision. Gen. Greely presented a number of papers, among which the following may be mentioned: "Geographical Work of the American Commission on the Venezuelan Boundary," by Marcus Baker; "Late Researches by the U. S. Weather Bureau," by H. C. Frankenfield; "Geographical Work of the U. S. Coast and Geodetic Survey," by J. M. Hayward; "Geographical Work of the U. S. Department of Agriculture," by John Hyde; "United States Geological Surveys and Geographical Work," by C. D. Walcott; "Geographical Researches of the U. S. Bureau of Ethnology," by W J McGee. Ambassador Andrew D. White, Major H. T. Allen, U. S. A., Prof. Wm. M. Davis, Miss E. R. Scidmore, Dr L. A. Bauer, and Mr Marcus Baker also represented the National Geographic Society. An account of the proceedings of the Congress will appear in a later number of the Magazine.

A recent number of *Nature* contains the following interesting statement: "From the reports in the *Agricultural Journal*, published by the Cape Department of Agriculture, it appears that much success in exterminating locusts by inoculation with the locust disease fungus has been attained in many districts. The fungus is prepared and supplied by the director of the Bacteriological Institute, Graham's Town, at a cost of six pence per tube to all applicants residing in Cape Colony. One of the reports upon its use states that over a hundred locusts which were inoculated with the fungus disease were distributed among a swarm, and on the next morning and the following days large numbers of dead ones were in the sand dunes, being killed by the fungus, as microscopical examination and further experiments with the bodies proved. The growth of fungus from the dead locusts produced a fungus more rapid in growth, but smaller in size, than the government fungus. In another case the fungus was mixed in luke-warm water, and young locusts were released after immersion in the liquid. After three days' rainfall and on the afternoon of the fourth day locusts were found in heaps in the bushes about three miles from where they were immersed. Districts in which no such measures are being taken are much more infested with locusts than those where the fungus treatment is adopted."

THE NATIONAL GEOGRAPHIC SOCIETY

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....*189*

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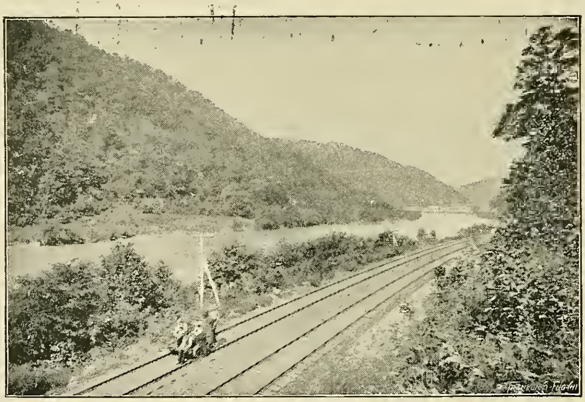

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4. The competition will close at 6 p. m., December 31, 1899.

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AN ILLUSTRATED MONTHLY

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THE

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THE WELLMAN POLAR EXPEDITION

By Walter Wellman

The Wellman Polar Expedition of 1898–'99 had two purposes in view. One of these was to finish the exploration of Franz Josef Land, and the other was to make an approach, by means of what is known as "a dash," near or to the North Pole. Incidentally to both these efforts scientific work of the usual character was to be carried on by a competent corps of observers. The expedition was aided in a financial way by the National Geographic Society, by President Jesup of the American Museum of Natural History, by President McKinley, Secretary of State Hay, J. Pierpont Morgan, W. K. Vanderbilt, William C. Whitney, Richard Olney, and other well-known public men. The cost of the expedition was about \$27,000, of which sum \$12,000 was subscribed by the various contributors.

June 26, 1898, the expedition sailed from Tromsö, Norway, in the ice-steamer *Frithjof*. Aboard were nine members of the expeditionary party—four Americans and five Norwegians. Prof. James H. Gore, of Washington, who had planned to accompany the expedition to Franz Josef Land for a summer's work in geodesy, was unable to go beyond Tromsö on account of the danger that the ship might not get back in time to enable him to meet imperative engagements. Calling at Archangel, Russia, the *Frithjof* took aboard a pack of 83 Siberian dogs which had been brought from the Ob river by Alexander Trontheim, a trustworthy Russian, who has now supplied three Arctic expeditions with draught dogs purchased from the Ostiak tribes. In order to deliver his pack according to contract, Trontheim had to make a 2,000-mile journey over the Ural mountains, across the plains and tundra, fording swollen rivers and wading deep swamps. Material for house-building was also taken on at Archangel, and the *Frithjof* then steamed northward. The pack-ice was met at about the 77th parallel of latitude July 9, and three days later, the supply of coal running short, it was deemed prudent to run back to Norway for more fuel. July 20 the ship was again at the ice edge, and after a week of ramming through loose floes and searching for open leads found a clear waterway, in which such rapid progress was made that the ice-capped mountains of Franz Josef Land were visible from the crow's-nest July 27.

Next day the *Frithjof* was at Cape Flora, which for three years had been the headquarters of the Jackson-Harmsworth (English) expedition, and where Nansen and Jackson had had their memorable meeting in June, 1896, a chance encounter which doubtless saved the lives of the Norwegian explorer and his comrade. It had been the first plan of our expedition to make Cape Flora our winter quarters, and we had secured from Mr Harmsworth the privilege of making such use as we wished of the house and stores there. It appearing that there was a possibility of pushing our winter quarters farther north and east, we took aboard one of the collapsible houses, which had been used at Cape Flora for storage purposes, and steamed away to the eastward.

At Cape Flora we had hoped to find Andrée and the members of his balloon expedition, which had left Danes island, Spitzbergen, a year before; but finding neither Andrée nor any tidings of him, we were forced to the sad conclusion, which time has since confirmed, that the brave Swede and his comrades lost their lives by a descent of their air-ship into the waters of the Barents sea, east of Spitzbergen and south of Franz Josef Land, probably within 10 or 15 days after their ascension.

After making an unsuccessful effort to push our ship north through the ice-clad British channel, which had been explored by Jackson and down which Nansen had come in his retreat from his winter hut, we moved eastward along the south coast as far as Cape Tegetthoff and Salm island. Off the south shore of this island we steamed in open water over the very spot where the Austro-Hungarian ship *Tegetthoff* had been abandoned, fast in the ice, a quarter of a century before. It may be remembered that for more than a year the *Tegetthoff* had been held in the ice, having become beset off the western shores of Nova Zembla, and that she had drifted helplessly to this spot, where her crew, through this fortunate accident, were able to discover a hitherto unknown Arctic land. Vainly endeavoring to find water through which to force the *Frithjof* still farther north along the east coast (then unexplored), and finding nothing but ice in every direction, we were compelled to return to Cape Tegetthoff, and there send our stores ashore for the purpose of establishing winter quarters. By August 3 this work was completed, and the ship sailed away for home, leaving us the only human inhabitants of Franz Josef Land, our nearest neighbors being Samoyedes and a few Russians in Nova Zembla, 500 miles to the south. Neither Franz Josef Land nor Spitzbergen is now inhabited by Eskimo or other northern tribes, and, so far as can be learned, never was occupied by any other men than Europeans there for the purposes of exploring and hunting or fishing. Spitzbergen has been known for 250 years. and is visited every summer by a considerable number of craft, but Franz Josef Land has until recently remained almost a *terra incognita.*

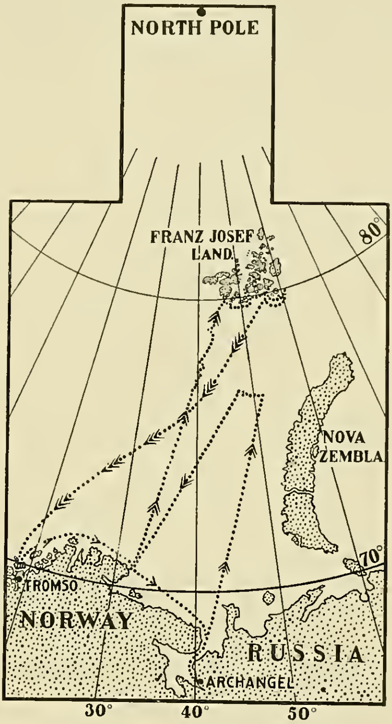

DIAGRAM SHOWING THE ROUTE OF THE FRITHJOF, 1898

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The cosmopolitanism of modern scientific exploration is nowhere better illustrated than in this region. Discovered by chance by Austro-Hungarians, it was next visited by Englishmen under the leadership of B. Leigh Smith. It was in 1882 that Mr Smith, on his second voyage to these coasts, lost his ship, the *Eira*, near Cape Flora, and was compelled to pass the long winter in an improvised hut built but a few rods from Mr Jackson's subsequent headquarters. The ruins of that hut, in which 25 men passed the winter in good health, living chiefly upon bear and walrus meat, still remain, mute witnesses to the fact that Dr Nansen and Lieutenant Johansen were not the first explorers to show that if worst comes to worst the adventurous man, caught out for the long night, may make himself reasonably comfortable with such materials as the country affords, while his rifle keeps him from starvation.

Next came the carefully prepared Jackson-Harmsworth expedition, which explored the western and central parts of the archipelago, but did not succeed in getting farther north than a little beyond the 81st parallel. Mr Jackson, whom I esteem as a painstaking and conscientious explorer, pronounced his judgment that Franz Josef Land was not a good gateway to the Pole, being a mass of small, detached islands, instead of a continental land mass. My own opinion is quite the contrary. It is true the region is one of comparatively small lands and many islands, and in summer the straits and fiords are broken up and filled with drift-ice, which precludes, more or less, active expeditionary work; but at this season of the year not much can be done anywhere in the Arctics, and in the favorable season, to wit, the spring of the year, these fiords and straits afford the best of roadways toward the far north.

The next visitor to these lands was Dr Nansen, and he came down from the north on his return from his memorable sledge journey from the *Fram*, reaching the northeast islands at the end of the summer, and finding it necessary to winter in an improvised hut. Next spring, without knowing where he was, and imagining himself to be nearer Spitzbergen than Franz Josef Land, he renewed his journey, only to meet, by a most rare and happy chance, with the Englishmen at Cape Flora.

After the Norwegians came the Americans, ourselves, with our Norwegian comrades, and as we were coming out this summer we met going in the young Duke of Abruzzi, the Italian prince. This young scion of royalty (he is a son of a former King of Spain, Amadeus) has at great expense outfitted his expedition, and is determined, as he says, to reach the Pole or lose his life in the effort. When we met the Duke his ship, the *Stella Polare*, was in the British channel, in latitude 80° 20′, and with good prospects of pushing 20 or 30 miles farther north before stopping for the winter. Subsequently a pigeon message is reported arriving in Russia with word from the Italian explorer that he is wintering about the 81st parallel of latitude, near the site of the Nansen hut. He has, therefore, an excellent chance for doing good work

BASALT FORMATION — FRANZ JOSEF LAND

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in the way of a northerly advance next spring. He has 120 dogs, procured for him by Trontheim, and every device that ingenuity could suggest or money buy. The real test for him will come, as it comes to all who attempt the arduous road to the Pole, when he leaves his comfortable winter quarters or his ship and takes to the open field in a sledging trip during the extreme cold. Up to this time it is all comparatively easy, but sledging in February, March, and April tries men's endurance and courage to the utmost.

It is not too much to say that of all the men now in the Arctic regions the young Italian prince has the best chance to reach the Pole or to eclipse Dr Nansen's record. In my opinion, neither Peary nor Sverdrup, both of whom are wintering on the west coast of Greenland, about latitude 79°, has much chance. Their base is too far south. True, Lieutenant Peary has supplies at General Greely's house at Fort Conger upon which he may draw during his sledge journey next spring, but he must travel 150 miles to reach that outpost, and then will be but a little nearer his goal than the Italian is at his base. Besides, Mr Peary was unfortunate enough last winter to suffer the loss of seven toes, and though he is known to be a resolute man, it is questioned by all men of Arctic experience if it be possible for him, thus handicapped, to endure the tortures of a severe sledging campaign. As for Captain Sverdrup, who has so far failed in his scheme to circumnavigate Greenland in the *Fram*, it is not known precisely what he is to attempt to do.

With Peary, Sverdrup, and Abruzzi the conditions are the same in one important respect as they were with us. The effort to make the North Pole must be by a dash, and nothing but a dash. The writer admits that he was the author of the phrase, "a dash for the Pole," but he cannot claim credit as the originator of the idea. As far back as 1827, Parry, the Englishman, attempted a dash for the Pole from the shores of northern Spitzbergen, and established one of the northerly records in that constant advance toward the Pole which restless man has persisted in making. Many other dashes have been made since that time.

Why must it be a dash? Why cannot one take his time to the task, making a gradual approach, year after year? These are questions often asked. The answer is very simple. If we had land extending to or near the Pole the old theory of a gradual advance from depot to depot would hold good. Reaching the Pole would in that case be simply a question of persistent effort, of stretching out a base of supplies, of a long campaign, or of one organized on a sufficiently large scale to enable the flying column at the front to be well supported from the rear. But the polar explorer, like the mining engineer, the railway constructor, and the colonist, must take conditions as he finds them and adapt his methods to them. There are two main avenues of approach to the Pole—one by North Greenland and the other by Franz Josef Land. These are the two lands reaching nearest to the Pole from lower latitudes, but neither extends, so far as we now know, nearer than within 450 miles of that mathematical point upon which it is the ambition of man to plant his feet.

The aim of every pole-seeker is to get his base or his outpost established as far north as possible upon the land, and to make a dash beyond that point. Thus Mr Peary planned a depot of supplies at the extreme northerly limits of Greenland, but has not as yet been able to establish it. Abruzzi is wintering at 81°, and we made our headquarters a little north of 80°, and established an outpost about 81°. The explorer may use two or three years in establishing his outposts upon the most northerly land he can employ for this purpose, but when he once leaves the land and takes to the frozen surface of the polar sea his journey must be one of short duration—a dash—for these reasons :

1. It is only in the spring of the year that he can travel advantageously over the ice-sheet, and this is so because the winter is too dark, while in the summer the warmth of the sun makes the snow soft and "sticky," fills the pockets with sludge and water, and aids the winds and currents in breaking up the ice. The favorable, practically the only, season for travel over this drifting, shifting field of ice, is confined to March, April, and May, with what little of February one is resolute enough to use amid the darkness, and a part of June in which he may still do something before the snow becomes too soft. Thus the pole-seeker has at his command from 110 to 125 days, according to the earliness of his start, in which to make his northerly journey and his return to the land.

2. Everything he and his dogs eat, as well as the fuel for melting ice into drinking and cooking water, must be carried from the land or the outmost depot, not only for the advance journey, but for the return. Nothing can be had on the way. There is a limit, of course, to the weight of load that may be carried, and if the sledge party started with supplies for a six months' campaign they would be so heavily burdened they could make no

A PAIR OF WALRUS KILLED FOR DOG FOOD

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progress at all. At the minimum each man must have two pounds of food and each dog one pound per day, and the hauling power of a dog is limited to about 60 pounds and of a man to about 200 pounds. Besides, there is weight of sledges, instruments, bedding, weapons, etc., to be reckoned.

3. It is useless to establish depots upon the sea ice beyond the land, for the sufficient reason that they could never be found again, except by rare good luck. Even in winter the ice-sheet is never at rest. It is constantly drifting to and fro, with a general movement, as was shown by the voyage of the *Fram*, toward the west. If one left a depot upon the ice he could never be sure the ice had not opened there during his absence and destroyed it. On returning from their sledge journey, Nansen and Johansen made no effort to find the *Fram* again, though they were at no time more than 115 miles from the ship, and on their southward march, with a dreadful and doubtful prospect before them, they must have passed within 30 or 35 miles of her at farthest.

Limited in time and limited in weight, the explorer perceives that the best and practically the only thing for him to do is to take advantage of the favorable season of from 100 to 125 days and make all his plans accordingly. The lighter his loads the shorter time he can remain out; the heavier his loads the slower must be his rate of travel. Between the two extremes he endeavors to find the happy mean and to apply to it the utmost of skill and ingenuity in keeping down weights and in utilizing motive power. Thus we see why it is only by the dash method that any one now seriously proposes to reach the Pole. Dr

MOUNTAIN AND GLACIERS AT CAPE TEGETTHOFF

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Nansen made his dash from the *Fram* after she had drifted far within the ocean, giving him the best start and the best chance to reach the Pole any one has had or is likely to have for some time to come. Peary proposes a dash from north Greenland. Andrée made his dash, bravely but recklessly, by balloon. Abruzzi essays a dash from near Nansen's winter hut and our own outpost.

We tried the dash, too, and might have done very much but for an accident which overtook us. In preparation for this effort to reach or approach the Pole, and also to aid the work of exploration, which also formed a part of our plans, we established at Cape Heller, near the 81st parallel, an outpost or depot of supplies. This was done immediately after our arrival in Franz Josef Land. Within two days after the *Frithjof* sailed back to Norway a party set out with small boats and sledges for the north. Their instructions were to establish a depot as far north as possible. When they started the ice-sheet upon the bay and the straits was solid and apparently unbroken. But conditions

PREPARING THE HEADQUARTERS HUT FOR WINTER

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often change with amazing rapidity in the Arctics, and so it was in this case. Within less than 48 hours the party found themselves involved in the greatest difficulty on account of the sudden breaking up of the ice and its rapid drifting out to sea under the influence of strong offshore winds. Nothing but desperate, even heroic, work enabled them to save their lives and the valuable equipment. Finally managing to reach the land, they struggled northward for a month, sometimes upon the ice-sheet, more often upon the rough shore, occasionally crossing glaciers and now and then advancing some of their heavier weights by boats in comparatively ice-free water, and were at length compelled to stop for good on account of drift-ice in the channel and the rapid approach of winter.

At Cape Heller they built a hut of rocks. A few pieces of driftwood served for the ridge-pole. The hides of walrus, killed in the water pools of Austria sound, near by, formed the roof. In this hut were accumulated about a ton of stores for use the following spring—sledges, boats, and other articles needed on sledge journeys. Forty dogs were there also, and for their sustenance during the winter the flesh of fifteen walruses was cut up in small squares and stored in a bin built of snow-blocks. To protect the hut from the winter's storms high walls of snow were built, and these made the premises look so much like an old-fashioned fortification that Mr Baldwin, leader of this party, named the place Fort McKinley. As soon as everything was made snug for the winter Mr Baldwin, pursuant to his instructions, asked for volunteers to remain at the hut through the winter to guard the supplies and care for the dogs. All five of the Norwegian members of the party offered their services, and great was the disappointment of the three who were not chosen. The two men assigned to the task were Paul Bjoervig and Bernt Bentzen, of Tromsö, both sailors, neighbors, and warm friends. Together they had often talked of the pleasure it would be to pass a winter in the Arctics in a little hut well stocked with food and tobacco, and this was to be the realization of their dream.

Their enthusiasm was not due to inexperience. Paul Bjoervig was a veteran Arctic sailor and traveler, and had been with the Wellman Expedition of 1894 to the north of Spitzbergen. Bernt Bentzen was a member of Dr Nansen's crew aboard the *Fram* on that famous drift-voyage through the polar seas. Both men were happy and well when their comrades left them and started for our headquarters at Cape Tegetthoff, just at the beginning of winter. It is a coincidence that but a few miles to the westward of this hut is the spot where Nansen and Johansen passed the winter of 1895–'96 in a similar structure, built out of such materials as could be found upon the ground.

Meanwhile those of us who had remained at Cape Tegetthoff were busy preparing our own house for the long winter. As first erected, the hut was a mere shell, two thicknesses of thin boards with an air-space between, and a roof of two layers of canvas. The house was ten-sided, one of the sections containing a door and two others little windows. With planks converging at the apex of the roof we built another shell around the whole, walled it up with blocks of snow and stretched a third roof over it in the shape of an old discarded mainsail from the *Windward* which we had picked up at Cape Flora. When the winter came on in earnest the snow drifted over the house, fairly burying it, as well as the store-shed which we had built at one side of Russian timber. The little windows were buried under walls of snow six or eight feet in thickness, and about this house there were in the Arctic darkness just two signs that it was actually used as a human habitation—the little stovepipe at the apex of the roof, pouring forth its cherry sparks, and a small, black hole at the entrance to the shed, through which we crawled in making ingress or egress.

We built an observatory of snow-blocks, too, for protecting the meteorological and magnetic instruments from the fury of storms, and within this enclosure (it had no roof) Mr Baldwin, the meteorologist from the U. S. Weather Bureau, and Mr Harlan, the physicist, carried on a series of observations throughout the dark season. Mr Baldwin secured continuous thermograph, barograph, and anemometer records during our entire sojourn in the Arctics, and also made a most painstaking study of the *aurora borealis*, comparing the manifestations here with a similar study which he had made in Greenland some years before. His observations and conclusions in this important field of scientific inquiry, when elaborated and published, as I understand they are to be by the government, will, in my opinion, form a valuable contribution to the literature of that topic. Mr Harlan also studied the aurora, particularly from the point of view of its effect upon the magnetic needle, and his report thereon, as well as his general study of the physical conditions of Franz Josef Land, I intend to publish in proper form and place as soon as possible. Dr Edward Hofma, medical officer and naturalist of the expedition, has a most interesting report concerning the fauna and flora of that region.

Within our hut we passed a very comfortable winter. It is true that at times the thermometer, hanging upon the wall 10 feet from the diminutive stove, had hard work keeping its head above the zero mark, and where we sat upon our packing boxes, each in his own "corner," hoar-frost was constantly hanging upon the wall; but all this was reckoned as nothing; nor did we suffer from the effects of the long night. If there was any melancholia its victim managed to keep his sufferings pretty well concealed.

PLATEAU AT CAPE TEGETTHOFF SHOWING HARMSWORTH HOUSE, THE WELLMAN EXPEDITION HEADQUARTERS

THE HEADQUARTERS HOUSE — FROM A PHOTOGRAPH TAKEN BY MOONLIGHT DURING THE WINTER NIGHT

All three of my American comrades, unfortunately, were ill for short periods during the winter, and this made it impossible for any of them to accompany me upon the sledge journey to the north, for which we were all winter busily preparing. But these ills might have shown themselves at home, and were in no way due to the climate or the surroundings. We had good beds, good food, including plenty of fresh bear meat, and American oatmeal, bacon, and flapjacks were not forgotten.

To the most of us the winter seemed short and not much of a test of patience. True, the absence of the sun for 127 days and nights was somewhat of a deprivation, leading us to the conclusion that if we were going to pass the remainder of our days in those regions sun-worship is the religion which would most strongly appeal to us; but we had work to do, bears to kill, scientific observations to carry on, books to read, exercise in the open air to take when the winds did not blow too severely, and the night was none too long. Almost every day we were out for a walk or a run upon snowshoes, and glorious it was to get about in the crisp air and the bright moonlight. But for the moon this far-northern world would be the very depth of gloom during the winter; but when the skies were clear and the moon was full the Arctic night was almost as bright as a winter day in temperate zones, and some of our best photographs were taken under these conditions.

Bathing was not neglected by any member of our party, even in the coldest weather. A tub of water was taken into the storehouse, one man at a time, and though the temperature there was usually from 5 to 15 below zero, we stripped and bathed in tolerable comfort, and without taking colds. In fact, such a thing as a cold the writer has never suffered from in the Arctic regions, though he has bathed in the open sea, diving from icebergs, and refreshed himself by a naked plunge in a natural tub formed of ice, floor and walls. Wool is now admitted to be better than furs for extreme cold, though some travelers cling to fur garments. In the Arctics one does not suffer from the direct effects of cold, but from its indirect effects in the formation of frost and damp within the clothing due to congelation of the exhalations from the body. It is for this reason that wool possesses superiority to skins, as the former permit the moisture to pass through the fabric, the frost forming outside, while furs retain it within. Upon the sledge journey, in temperatures ranging from 10 to 48 below zero, the writer wore no furs, save a pair of reindeer-skin moccasins upon his feet. Within these moccasins were from three to five pairs of thick woolen stockings, these being surrounded by loose dry grass to absorb the moisture. He never once suffered from cold feet, and even after he had met with an accident and the circulation in one of his legs below the knee was almost wholly stopped, he suffered no frostbites. Upon the hands wool is better than skin. We usually wore two pairs of ordinary woolen mittens. The inner pair was dry and warm, while the outer pair was filled with frost, which could be shaken out at intervals.

February and March were our coldest months, and these were the months of the sledge journey. The lowest temperatures observed by us were a little under 50° Fahrenheit, not as great a degree of cold as is observed every winter in Siberia and in the interior of Alaska; but it must be remembered that all of our observations were taken at the sea-level, where the relative humidity of the atmosphere is greater than upon the elevated table-lands of Siberia or in the mountains of Alaska. Franz Josef Land we found to be a region of storms, due probably to its proximity to the comparatively warm Barents sea to the south, where the influence of the Gulf Stream is quite marked, and to the fact that it lies directly within the track of what might properly be called the Arctic trade winds.

This Arctic trade wind, result of the same causes as the trade winds so well known to navigation in the southern hemisphere, blows from northeast to southwest, as the trades of the region below the equator blow from southeast to northwest. In both cases the chief causes are the rotary motion of the globe and the flow of cooled air toward warmer zones along the surface of the earth. It is this trade wind which produces the set or current of the Arctic seas from the northern coasts of Siberia to the great outlet of the ocean between Greenland and Spitzbergen—the same movement of waters that Dr Nansen relied upon to bring the *Fram* through in safety. In Franz Josef Land we had opportunity to observe not only the effects of this current, pouring down through all the sounds and straits summer and winter, either under the ice or breaking the ice-sheet and carrying the débris with it, but also the meeting of two opposing forces, namely, the Arctic trades and the Gulf Stream. The mighty ocean river that debouches from the Gulf of Mexico, traverses the coast of North America, and crosses the Atlantic to the shores of Great Britain, divides there into two branches.

One flows southward toward the equator, while the other impinges against the coast of Norway, keeping ice-free all winter the fiords and harbors of that picturesque country even farther north than the latitude of Point Barrow, in Alaska, and then flowing on into the Barents sea against the western coast of Nova Zembla and, thus turned northwestward, continuing its course in a westerly direction along the southern coasts of Franz Josef Land. There our investigations and observations enabled us carefully to note the mingling of the two currents. Just as the Gulf Stream is the product of the piling up of masses of water within the Gulf of Mexico by the trade winds of the southern hemisphere, so the Arctic current which brings the icy waters down into the Atlantic from the polar sea is the product of the northern trade winds. We were thus at a most advantageous point for study of this vast circulatory system of the sea. We were at the meeting of the waters from the two Poles of our earth.

Of great importance to explorers is this constant movement of the liquid masses which impinge upon Arctic lands. It frees the coast of Franz Josef Land of ice through the summer months, making navigation all along its shores comparatively easy at that season, even though there may be a thick belt of almost impenetrable pack-ice farther to the south. It brings to Arctic shores, too, from the headwaters of Siberian rivers, masses of driftwood for fuel and building purposes. It seemed to us a remarkable beneficence of nature that we should find timber from the interior of Asia to put into our little hut and to burn with blubber for our fires a thousand miles above the tree limit and within six hundred miles of the North Pole itself.

While wintering at Cape Tegetthoff we burned considerable quantities of this driftwood, and at times we thought it not such a bad country, after all. Perfectly fresh water came pouring down from the glaciers in the summer months and formed limpid pools at our very doors. Building materials we sawed out of frozen snowdrifts, blocks as true and almost as firm as marble. Bears had a comfortable habit of walking into our front yard to be shot, and right nice steaks and stews we contrived to make of them. The surf threw firewood upon the beach right in front of our dwelling, and never at any time did we have need of the iceman.

The sunless winter was long, but not tedious. Best of all, good fellowship abode with us. It is an Arctic axiom that exploring parties should be of but one nationality. It is a pleasure to record that though we were Americans and Norwegians living in one little room, night and day, for five months, not a word of discord between Yankees and Norsemen marred the novel experience. No better or more faithful men ever served under the banner of Norway than those young men who lived with me under the Stars and Stripes at Cape Tegetthoff that winter, in the most northerly inhabited house in the world, and who subsequently accompanied me upon the sledge journey.

"BEARS WALKED UP TO OUR DOORS TO BE SHOT"

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It was on February 18 that we set out upon this trip to the north. The sun had not risen, and the days were short and dark. But well we knew that if we were to make the Pole, or approach nearer to it than any of our predecessors, we should have to start very early in the Arctic morning. We stumbled along in the gloom, through deep snows and rough ice, encountering storms and great cold, sometimes making but two or three miles a day, and at last arrived at our outpost at Fort McKinley. This was near the end of February. Here we found that a remarkable tragedy—one of the most remarkable tragedies known to the history of Arctic exploration—had occurred during the winter. Bentzen had been taken ill in November, shortly after our men had left the two there together, and had never recovered. Lingering till January 2, carefully nursed by Bjoervig, death had then come to Bentzen's relief. All this Bjoervig told me, when, at the head of our little procession, I met him standing in front of the tunnel which led down into the now snow-buried hut. Then we crawled in, and Bjoervig poked up the blubber fire and started to make me some coffee, as I sat looking about at the strange little cave, its walls coated with hoarfrost even within two feet of the brilliant flames.

"Where did you bury Bentzen, Paul?" I asked.

"I have not buried him, sir," was the reply. "He lies in there."

I lit a little lamp—a bicycle lamp; it had been here in Washington—and walked into the darkened portion of the hut, partly partitioned from the remainder of the apartment, to which Paul had pointed. As soon as my eyes had become accustomed to the peculiar light which the frosted walls and roof reflected from the dim lamp, I saw at my feet a one-man sleeping bag, bearing evidences that it had been occupied by a living man the night before. By its side, within arm's reach, lay another bag. This one was occupied, and had been for several months. Bag and contents were now frozen as solid as a rock. For two months Bjoervig had slept by the body of his dead comrade—two months of solitude amid the Arctic darkness when night was not to be distinguished from day—two months alone with the dead in this Arctic tomb.

Bjoervig had not buried Bentzen because he had promised him he would not, and he had promised because of the sick man's fear that if buried in the cold and darkness it would be in such manner that the bears and foxes might get at his remains.

Notwithstanding this dreadful ordeal through which he had passed, Bjoervig was sane, cheerful, almost normal. He was a little nervous, and had difficulty in getting sleep; but next day he helped us drag out the body and carefully bury it in a hole which the wind had hollowed out. It was a bitter day, 45 below zero, and a fierce blast blowing down from the glaciers. But the most industrious man of us all, after the little funeral ceremony was over, was Paul. For hours he was busy chinking up all the openings in the walls around the rude tomb. "I promised him the bears and foxes shouldn't get him," he explained.

We took Bjoervig with us, contrary to our original plan, and continued our journey to the north. Though the weather was still gloomy, the snow deep in places, storms too frequent, the ice rough, and the loads heavy, we made satisfactory progress. By March 20 we were off the east coast of Rudolf Land, near the 82d parallel of latitude. Our prospects were bright. We had traveled one-fifth of the way to the Pole, and had yet at our command for northerly advance six or seven weeks of the most favorable season. We had passed through the worst of the darkness and cold, and had just reached that period when, in those latitudes, we were to have the sun all the time in the heavens. All our men and equipment were in good condition, and we were scenting the victory that lay before us when a seemingly trivial accident occurred to one of our number. All pride goeth before a fall, and this man, glorying in his strength and endurance, slipped while working his sledge through heavy ice with his team of dogs and fell in a little crevice in the path. The hurt which he received would not have been serious had he stopped for ten days or a fortnight for rest; but in that work, with the farthest north, and perhaps even the Pole itself, beckoning him on, one does not stop. He always thinks he will be better the next day and quite well the day after. So he keeps going, dragging himself along, till he drops in the snow and can go no farther.

Then came the bitter retreat. The injured man had to ride upon a sledge and be dragged by his faithful companions and his dogs. He suffered, of course, but quite as much in his pride as in his body, for it is inglorious to be hauled off the field of battle. His Norwegian comrades were as brave as lions and as tender as women. They nursed him and cared for him, unmindful of themselves. They made the ambulance, bounding along over the rough ice, as comfortable as they could; the tent they converted into a hospital, and bandaged the injured limb with hot water in temperatures of 40° below zero. Fearing their broken leader might die upon their hands, they made a gallant race for a man's life back to headquarters at Cape Tegetthoff, arriving there April 9.

If the man riding southward upon the sledge in those first days of April looked longingly to the eastward, where the glint of ice-capped and wholly unexplored lands was seen under the rays of the sun, and planned that in a couple of weeks he would take his sturdy Norwegians out there to explore and

CAPE GREELY — FRANZ JOSEF LAND

Track of Steamer "Capella," 1899, which brought back the Expedition.
Track of Sledge Journeys of the Wellman Expedition, 1898-'99.
★ *The Northernmost Point Reached by the Expedition. (565 Miles from the Pole.)*

MAP OF FRANZ JOSEF LAND ARCHIPELAGO, SHOWING THE NEW LANDS DISCOVERED AND EXPLORED BY THE WELLMAN EXPEDITION

A. Royal Society island
B. Pritchett island
C. Brice island
D. Bliss island
E. Alger island
F. Jackson island
G. Brady island
H. Aagaard island
I. Simon Newcomb islands
K. Willis Moore islands
L. McGee island
M. Payer island
N. Lyman Gage island

c. Cape Elkins
d. Cape Vilas
e. Cape Hanna
f. Cape Foraker
g. Cape Fairbanks
h. Cape Gorman
i. Cape Tyrol
k. Cape Copeland
l. Cape Robert Hitt
m. Cape Frick

map, that was but another evidence that in Arctic exploration it is a good thing to have plenty of optimism, served in daily rations and carried in imperishable packages.

This journey was subsequently made, however, by a party led by Meteorologist Baldwin, and the result of it was that, whereas when the Wellman expedition arrived in Franz Josef Land the eastern limits of that land were unknown and formed a topic of discussion among geographers, they are now carefully marked out upon the map. By means of these two sledge journeys and a voyage in the unexplored parts of Markham sound subsequently made in the steamer *Capella*, which was sent after the expedition at the expense of my brother, Arthur Wellman, some 20 new lands or islands were added to the map of that archipelago. Upon these new lands, their capes and straits, we had the pleasure of placing the names of well-known American scientific and public men who had befriended the expedition, including that of the President of the National Geographic Society.

We bear testimony to the surprising accuracy of the survey of a part of Franz Josef Land which had been made by Payer, the discoverer of that region, 25 years before. His one great error, the location of an enormous glacier, capping a land of continental dimensions, extending northward from Wilczek Land, had been in part demolished by Dr Nansen, who had landed at the Freeden islands and crossed in his journey over the sea ice the spot where Payer had placed his Dove glacier. We completely finished the destruction of that geographic error. The Dove glacier does not exist, nor has Wilczek Land the form or dimensions ascribed to it by the Austro-Hungarian explorer.

Four times did we cross the path of Dr Nansen—twice on our sledge journey to the far north, where we saw, but did not reach, three islands which he had passed without seeing, as they lay a considerable distance to the westward of his course, and twice in our steamers in the British channel and along the coast of Northbrook island at Cape Flora. We regret, of course, the accident which deprived us of our chance to wrest from the gallant Norwegian the honor of the farthest north; but if we have in a modest way been able to contribute something to the world's knowledge of the world, we feel amply repaid for all the hardships and all the sacrifices.

Above all, we are glad to subscribe to that cosmopolitan spirit which knows no frontier lines in the pursuit of knowledge. We honor the Norwegian for what he did, and we expect great things of the young Italian prince, the Duke of Abruzzi. Upon meeting him in Franz Josef Land we went aboard his ship and welcomed him to the region of ice and snow and wished him good luck in a fashion which I feel sure was hearty and sincerely American.

We may have differences of opinion as to the value of reaching the Pole. If we apply the utilitarian test, it is of small moment; but so is a poem. And what is polar exploration but an epic of endeavor, in which all sordidness is left behind, and in which a man, knowing the risks and the chances of failure, ventures his life and his all in a combat against the forces of ignorance? For I deem it beneath the dignity of man, having once set out to reach that mathematical point which marks the northern termination of the axis of our earth, which stands as a sign of his failure to dominate those millions of square miles of unknown country, to give it up because the night is dark and the road is long. He will not give it up. The polar explorer typifies that outdoor spirit of the race which has led conquering man across all seas and through all lands, of that thirst for knowing all that is to be known which has led him to the depths of the ocean, to the tops of mountains, to dig in musty caves, to analyze the rays of light from distant worlds, to delve in the geologic records of past times. It will carry him to the North Pole, too, and that before many years shall have passed. Any one who supposes anything else of man doesn't know man. His acquaintance with human nature—with the nature of the adventurous races of our zone and times—is limited.

The eyes of the scientific world are turning with more and more eagerness to the Antarctic regions. Little now remains—beyond the Pole itself—in the Arctics; but in the far south there is great work to be done in every field of scientific exploration and investigation. I have here the suggestion to make to the National Geographic Society, and I make it after a careful study of the situation in all its bearings. It is that this Society institute a movement whose object shall be to gain from Congress an appropriation for an American Antarctic Expedition, to work in harmony with the expeditions which are to go into that field from England and Germany. The modest sum of $150,000 would equip a creditable expedition bearing our flag, and it is my belief that even in this utilitarian age the American Congress can be induced to devote such a small sum to such a great purpose.

MR WELLMAN READY TO START ON THE SLEDGE JOURNEY — FEBRUARY, 1899

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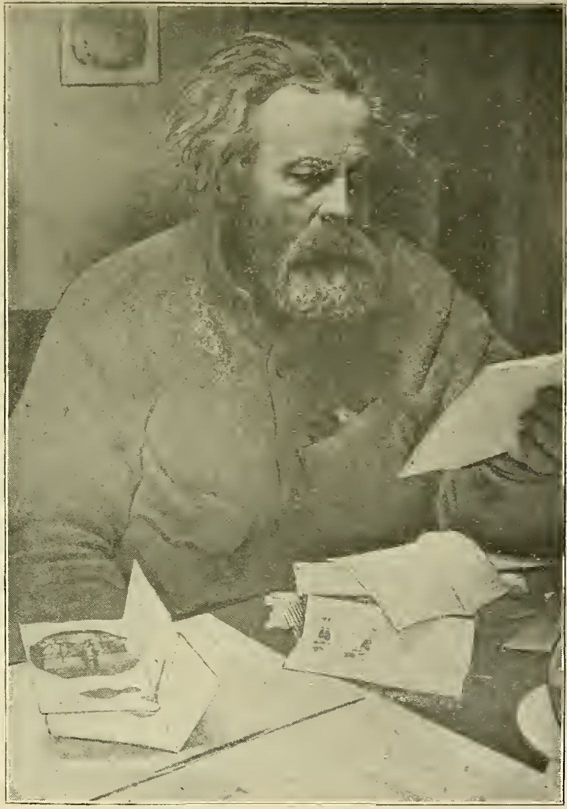

MR WELLMAN IN AUGUST, 1899

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MAP SHOWING ROUTE OF HARRIMAN ALASKA EXPEDITION

THE HARRIMAN ALASKA EXPEDITION

By Henry Gannett,

Chief Geographer, U. S. Geological Survey

This expedition, notices of whose movements have appeared in earlier numbers of The National Geographic Magazine, reached Seattle on its return July 31. It left the same port for the north June 1, and in the intervening 60 days the *George W. Elder*, bearing the expedition, steamed 9,000 miles and visited points along the entire northwest coast from Seattle to Bering strait. Not less than 50 different landings were made. The *Elder's* route is represented in a general way on the accompanying sketch map of Alaska.

The party was composed of Mr Harriman's family and a few of his personal friends, with some 30 scientific men, making a total party of 50. This comprised zoölogists, botanists, geologists, and geographers. Every possible facility for the prosecution of scientific work was made, including outfits for inland travel and accommodations for the preparation of specimens, etc. Indeed, the whole expedition, although projected primarily as a pleasure trip for Mr Harriman's family, was subordinated in all ways to the needs of the scientific party. Even the movements of the ship were arranged day by day by a committee on board in the interest of the scientific work.

The general plan pursued was to follow the coast, making brief stops at numerous points for the purpose of making observations and collections. The steamer followed the inside passages as far as Glacier bay, making numerous stops on the way, but none of much duration until Glacier bay was reached. At this point, which is notable for the immense glaciers which reach the sea-level and discharge icebergs, the ship remained for several days, which were improved by the geologists in mapping the glaciers, paying special attention to the positions of their discharging fronts, for purposes of comparison with earlier measurements and for comparison by future students. A similar stop was made in Yakutat bay, where the steamer was taken not only to the head of Yakutat bay proper, but traversed its extension to its head. From Yakutat bay the expedition went to Prince William sound and spent a week in this interesting and almost unknown region.

Upon its shores are many glaciers, few of which are of record, which extend down to tide and drop bergs into the sea. In this region Mr Gilbert explored and mapped one of the finest glaciers of Alaska, situated upon the north shore, just west of Port Valdez, to which the name of Columbia glacier was given, the fiord into which it enters being called Columbia fiord. Port Wells, an extensive fiord on the northwest coast of Prince William sound, was also explored, and a sketch map of the upper part of this inlet is presented on page 511.

From Prince William sound the boat visited Homer, in Kachemak bay, and thence proceeded to Kadiak island, where parties were landed for hunting and for scientific work. Thence the boat coasted the Alaska peninsula, passing among the Shumagin islands, and thence on to Unalaska, stopping at numerous points on the route. Leaving Unalaska, a short pause was made at Bogoslof, a group of two volcanic islets, one of them a century old and the other but fourteen years of age; thence the course was north to St Paul island, where a short stop was made to visit the fur-seals, and thence to Plover bay, in northeastern Siberia, where the Innuit people were first encountered. The ship then crossed to Port Clarence, passing just south of Bering strait, within sight of the Diomede islands. At Port Clarence was found a fleet of arctic steam whalers which were waiting there for the ice to retreat from the vicinity of the straits. From Port Clarence the boat visited various islands in Bering sea—St Lawrence, St Matthew, and Hall islands—and thence steered a straight course for Unalaska. From that point she returned to Seattle, following much the same course as on the way up and stopping at comparatively few points.

Throughout, the expedition was greatly favored by the weather. It is a common saying that nothing can be certain about Alaskan weather except that it will be unfavorable. Still, during the two months that the expedition was in Alaskan waters there was but one rainstorm, and there were many clear, bright, sunny days. Although fogs and cloudy weather were frequent, they commonly occurred when there was little to see or do, and the work of the expedition was but slightly delayed or hampered by it.

The entire south coast of Alaska, from Portland canal to the Aleutian islands, is composed of a succession of glacial fiords, which continue inland as branching glacial gorges, reaching far up into the coast mountains. Many, if not most, of the gorges are still filled with glaciers near their heads, and in scores of cases these glaciers still extend so far downward as to protrude their fronts into the deep water of the fiords.

A few thousand years ago, perhaps at the time the Egyptian pyramids were rising, the fiords which form the inland passages now traversed by the tourist were filled with great rivers of ice from the sea bottom nearly to the mountain summits. Indeed, the ice was spread in great sheets, covering all but the highest mountains. The retreat of the ice, though apparently slow, has yet been at so rapid a rate that the oldest land, which first emerged, has suffered little from subsequent aqueous erosion. The glacial carving is still strongly in evidence, and this in a region of excessive rainfall and steep slopes, where aqueous erosion is at a maximum. From these oldest regions, densely forest-clad, with the remains of older forests under foot, we may pass, going up the fiords to land continuously younger. As we approach the glacier the older, dead forests disappear. There is now but a single generation of trees, and these become younger and smaller. Soon they are succeeded by alder and willow bushes; then by grasses and annual plants, by mosses, and other low forms of vegetation, and, finally, by bare rock ridges, polished and scoured by ice and by bare glacial gravel a few miles only from the ice-front.

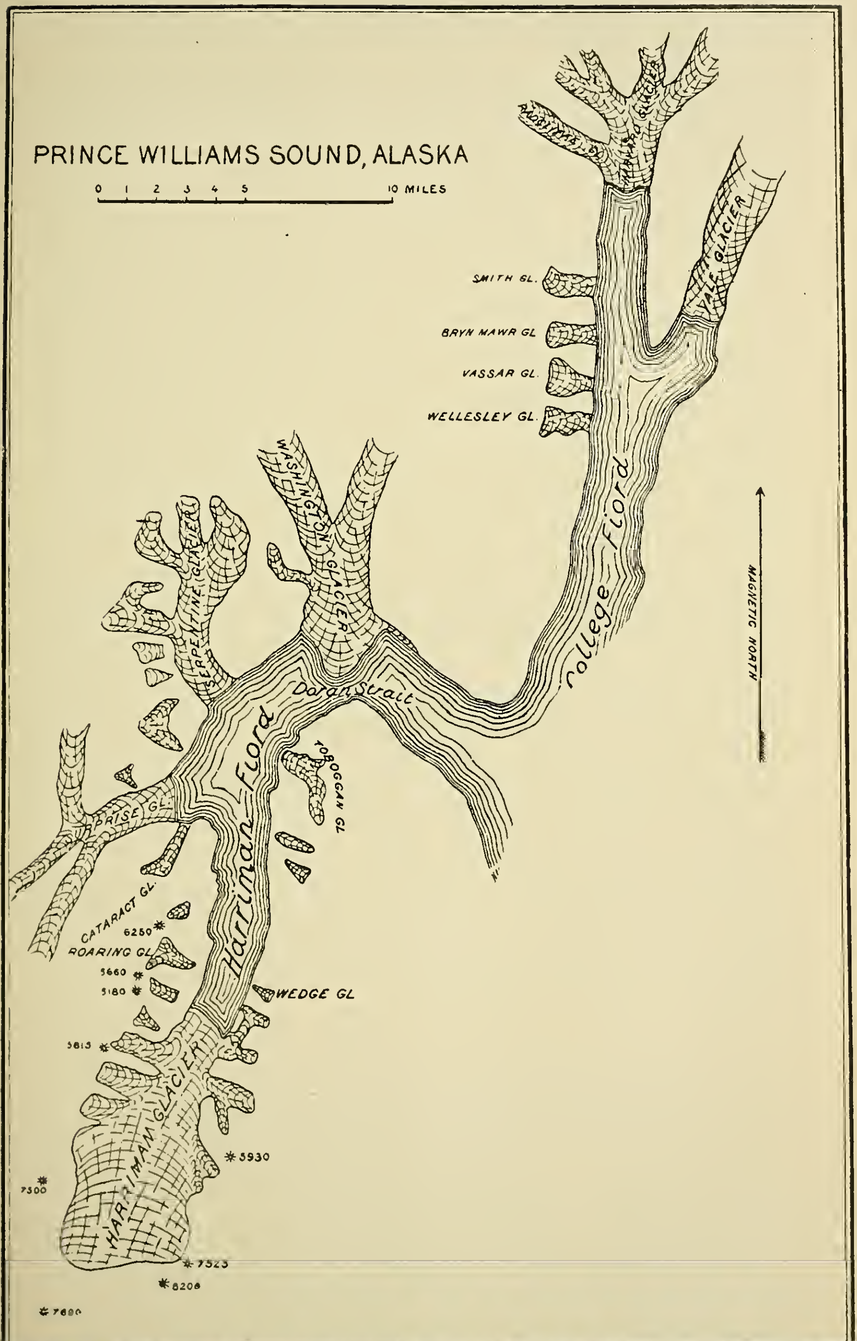
The glaciers are still retreating. The next generation will find few of them with their fronts still in the sea, discharging bergs. The thunder of the glacier, as it breaks off into the sea, will soon be no more heard in the land. A century ago, when Malaspina explored these shores, the ice extended much farther down the fiords than now. They found fiords closed which now are open, and their charts show that the inlets then extended far less deeply into the land. Malaspina sailed up Yakutat bay, passed Haencke island, and for the moment believed that to him it had been given to discover the long-sought northwest passage, but he was soon confronted by a blank wall of ice, which, extending from side to side, barred further passage. Sadly he named this upper portion of Yakutat bay Disenchantment bay, for his dream was over. Now the ice barrier, the front of Hubbard glacier, has retreated, and ships may pass 25 miles farther, away to the head of Russell fiord, as the southward extension of Yakutat bay has been named, in honor of Prof. I. C. Russell, who first explored it. When this fiord was dammed by the ice-front of Hubbard glacier it became a lake, with its level some 200 feet above sea, as shown by lake benches along its walls. Then it overflowed to the south, directly to the Pacific, or westward to the lower part of Yakutat bay. Here, therefore, is a fiord 25 miles in length, opened up within a century.

Port Wells, in Prince William sound (see map, page 511), is a fine example of the retreat of the ice and the opening of navigable waters. The old charts show this fiord to be only some 30 miles in length, whereas the explorations of the Harriman expedition in 1899 show that it now runs northward into the land not less than 40 miles. It terminates at the upper end in two branches, each occupied by a great glacier, Yale and Harvard, whose fronts are in the water, while along the west side of the fiord are four smaller glaciers, tumbling down in ice cascades from "hanging valleys" into the water. These terminal glaciers have retreated 9 miles in a century.

But the finest of the recent accessions to the navigable fiords of Alaska is the Harriman fiord, discovered and mapped by the expedition. This is a western branch of Port Wells and is not indicated on any chart. Five miles above its mouth it turns abruptly from a northwesterly to a southerly direction and runs in this course some 15 miles. At the bend it is nearly closed by the ice-front of Washington glacier. Indeed, although this glacier has been known for some time to the people who navigate these waters, it was supposed that it extended entirely across the fiord, closing it. It was therefore a great surprise, even to the local pilot of the *Elder*, when a close approach to the front of Washington glacier disclosed a passage through and an open fiord, lined with magnificent glaciers and mountains, beyond.

Under the circumstances it required great nerve to take a 1,700-ton steamer through waters so utterly unknown as these. There was no danger from shoals in the open fiord, but a projecting rock which might in earlier days have been a nunatak might have been encountered at any moment; but the ship was run safely to the head of the fiord, unfolding at every bend a wonderful scene of rock and ice.

From all indications, it is certain that within the century the four great glaciers which now drop bergs into the waters of Harriman fiord were united in one, which occupied the fiord from its present head to its mouth. Moreover, but few years have elapsed since Washington glacier bridged or dammed the fiord at its bend, closing it to all access except by land journey. From these, amid thousands of similar instances which might be cited, it is clear that Alaska is "Our Youngest Possession." The coast, at



THE UPPER PART OF PORT WELLS, PRINCE WILLIAMS SOUND, ALASKA least, has but recently emerged—so far as it has emerged as yet—from its mantle of ice. But there are enormous areas still buried beneath ice coverings thousands of feet in thickness. The Muir glacier alone covers an area probably as large as the state of Rhode Island, and there are scores of others comparable with it in magnitude. The region north of Prince William sound is covered in greater part by glacial ice. There is more ice there than dry land.

One broad fact or conclusion, long ago pointed out by Mr John Muir, but persistently overlooked by geologists, is forced daily upon the attention of the traveler on the Alaskan coast. This is that the existence of glacial fiords is no evidence of a subsidence of the coast. The Alaskan fiords were cut and are being cut today by glaciers below sea-level. It may be that the coast is subsiding, but its fiord character is no evidence of this. Glaciers are now protruding their fronts into water a hundred fathoms deep and many miles from where the shoreline would be were the ice removed.

Of the results accomplished by this expedition little can be said at present, since little will be known until the specialists of the expedition have had time and opportunity to investigate the material collected. The movements of the party were arranged in such wise as to be especially favorable to the work of the biologists. The frequent stops made in many different localities afforded them an opportunity for a thorough study of the distribution of plant and animal life throughout a vast stretch of the coast. The comparatively longer stops made in the vicinity of the most important glacier regions enabled them to make quite exhaustive studies of the extension of plant and animal life over newly made land, recently freed from the ice covering, and in this branch of study it may well be that interesting and important results will be obtained.

THE METEOROLOGICAL OBSERVATIONS OF THE SECOND WELLMAN EXPEDITION

By Evelyn B. Baldwin,

U. S. Weather Bureau

In the following article I purpose to give merely an outline of the scope and character of the meteorological work of the second Wellman Expedition. The observations that were secured, together with some account of the meteorology of the year spent in the Arctic regions, will form the subject of a separate paper. Through the courtesy of the Chief of the Weather Bureau, the instrumental equipment of the expedition was made as complete as possible within the short time available. It consisted of standard wet and dry thermometers, self-registering maximum and minimum thermometers, aneroid barometers, a barograph, a thermograph, an anemometer, and a water thermometer.

The observations may be divided into three series, *viz.*, those made on shipboard, in camp, and in the field.

The observations on shipboard began June 27, 1898, the day following our departure from Tromsö. They were made thrice daily, as nearly as possible at 7 a. m., 2 p. m., and 9 p. m., local time, the ship's position being duly noted. Each observation consisted of readings of the dry and wet bulb thermometers, water thermometer, salinometer, aneroid barometers Nos. 1134 and 1135, giving the atmospheric pressure in inches, and of the ship's barometer, indicating the pressure in millimeters, wind velocity, as indicated by an anemometer erected on the ship's bulwark, allowance being made for the speed of the ship, which, however, was very slow. In addition to the foregoing, observations were made as to the direction of the wind, the amount of cloudiness, and the kind and direction of clouds. This series of observations extended in a line from near North Cape to Vardö, Norway, thence to Archangel, which point was reached July 4; thence northward to about latitude 77° 54′ N., longitude 44° 58′ E., at which point the ship turned southward on July 11, returning to Vardö, and from Vardö northward again, July 17, reaching Cape Flora, Franz Josef Land, latitude 77° 56′ 27″ N., longitude 49° 42′ 18″ E., on July 28, and then, finally, eastward to Cape Tegetthoff, latitude 80° 6′ N., longitude 57° 54′ E., reaching the latter point on August 3, on which date the expedition ship began her return voyage to Norway.

During this voyage the southernmost occurrence of ice was noted in the course of the night of June 28, latitude 69° 20′ N., longitude 35° 00′ E. It consisted, however, of but small pieces. The highest temperature was recorded at Archangel, *viz.*, 77° F., July 4. But, in general, the temperature recorded in the southern part of Barents sea varied from 53° to 43° F., gradually sinking to from 37° to 32° F. along the southern coast of Franz Josef Land. The salinometer indicated the salinity of the sea to vary but little from 27 per cent, while in the White sea it gradually diminished to zero at a point six miles below Archangel, in the Dwina river. The temperature of the sea varied from about 45° F. in the southern part to 30° F. at Cape Tegetthoff. Generally cloudy weather, with much fog at times, prevailed during the voyage.

With the departure of the ship, regular meteorological observations were taken on shore for two days, or until 7 a. m., August 5. Thereafter, till the night of October 30, a period of eighty-six days, during which time I was in the field in charge of the expeditionary advance party, the work embraced nearly continuous records of temperature and pressure by means of the barograph and thermograph, checked by means of standard thermometers and two excellent aneroid barometers, besides nearly continuous measurements of the wind movement and velocity by Robinson anemometers, and frequent eye observations of the clouds, general weather conditions, movements of the ice, etc.

The self-registering instruments were carried in a large basket, through which the air circulated freely. The basket rested upon an inflated rubber pillow. The anemometer was mounted on a hickory pole seven feet in length. Whether on the sledge or in the boat, these instruments gave entire satisfaction. Owing to the very slow progress made in advancing the equipment from day to day, the value of these field observations was not materially impaired by change of station, the largest radius of which did not exceed fifty miles in a straight line between Cape Tegetthoff and Fort McKinley.

From August 22 to September 19 a station was maintained at Storm bay, Wilczek Land, 35 miles northeast of Cape Tegetthoff, and we were thus afforded an exceptional opportunity of studying the meteorology of that storm-swept region. Strong southerly winds blew almost incessantly, accompanied at times by fog, snow, rain, and sleet, and on one occasion by hail.

On September 19 we made a forced march across Quereau glacier, Storm bay, to a low point of land near Cape Heller, where we built an outpost and named the same Fort McKinley. During this journey the self-registering instruments continued to record in a most excellent manner, the barograph indicating the height above sea-level (1,100 feet) and the inequalities of the surface wherever ice valleys were crossed.

As illustrating the weather on this journey, I quote from my journal as follows:

September 18: Weather clearer, but the wind from 2 p. m. (17th) to 10 a. m. (18th) averaged 19 miles per hour from the southeast; 5

o'clock p. m., moved the camp to the north side of Storm bay, on the edge of Quereau glacier, to an elevation of 100 feet; very thick snowfall and wind strong from the southeast; 9 p. m., blinding snowfall continues before southeast wind; 10 p. m., wind gentle, but accompanied by a shower of sleet and dense fog; 11 p. m., light fall of hail for three minutes. September 19: 11 a. m., weather cleared; temperature 28.0°; wind gentle, from the west; 3 p. m., station at an elevation of 1,100 feet above sea-level, on Quereau glacier, north from the previous camp; average wind velocity since 11 a. m., 20 miles per hour from the west; considerable fog at times; 8.30 p. m., station advancing northward, the elevation now being 1,130 feet; dense fog generally prevalent, being either "blown up" or formed upon the glacier by the west wind coming from Markham and Austria sounds; frequent glimpses of a golden glow upon the clouds from the fog-hidden sun in the northwest assisted in keeping the course with the compass; 11 p. m., wind continuing strong from the northwest and darkness upon the moving station, but by noting the lines of snowdrift, we continued to advance. September 20: Quereau glacier, 1 a. m., crossing a series of inequalities or broad and gently sloping valleys leading toward the west face of the glacier; 2 a. m., the surface beginning to slope northward as well as westward; 4 a. m., first view of the summit of Cape Schmarda; 6 a. m., "station" at the foot of Quereau glacier, two miles east of Fort McKinley, and at 7.30 a m. at Fort McKinley.

The closing days of September were spent in completing the fort and in cutting up walrus meat for dog food. During the night of September 30 and October 1, young ice formed on the surface of the sea, and it became impossible to use the boats save in open spaces. The temperature of the air had now sunk to 12° F.

Six days later I determined to make an effort to communicate with Mr Wellman, at Cape Tegetthoff, and to ask to be permitted to continue the meteorological work at Fort McKinley in person, and for this reason, as well as to determine the condition of travel southward, I dispatched, on October 8, three of our Norwegian supporters by boat to make the attempt to reach Cape Tegetthoff. They, however, returned in a short time, on the same day, and reported it to be an utter impossibility to force the boat through the "mushy" surface of the sea, and there remained now no other course to pursue except to wait patiently for the forming ice to harden, and then, agreeably to instructions, to return to headquarters, at Cape Tegetthoff. For the first time this season (October 11) the temperature dropped below zero, a half degree Fahrenheit, and on the 13th to 10° below. On the 14th, although the young ice was strong enough to support the weight of a large bear, it was still too unsafe to admit of sledge travel. On the 16th, although the temperature of the sea water at the surface was 28° F., that of the air rose to 25° F.; fell again to —9° F. by the 20th ; the young ice measured from seven to nine inches in thickness, and on the 22d we set out for Cape Tegetthoff, arriving there on the night of October 30. The lowest temperature experienced on this journey was 17° F., on the 27th, and much thick weather prevailed. The young ice was frequently not over two inches thick; it had apparently been broken up a few days prior to our journey, and in the subsequent freezing the surface had become much broken, thus making travel in the gathering darkness of the long Arctic night exceedingly difficult.

On reaching the base station regular observations were made until the arrival of the relief steamer *Capella*, July 27, 1899.

During my absence in the field, as above described, and a second time for a period of 35 days—April 26 to May 30, 1899—in the eastern part of Franz Josef Land, observations were zealously made by Dr Hofma and Mr Harlan. In addition to the data already noted, the occurrence of sunshine, miscellaneous phenomena, and auroral displays were duly recorded and described. Of the last-mentioned, there were obtained at least 140 entries or descriptions of displays occurring on 83 different dates. During my second absence in the field, a series of observations of temperatures, atmospheric pressure, clouds, and estimated wind velocities were obtained for comparison with the regular observations at headquarters.

PORTO RICO OR PUERTO RICO ?

The editorial foot-note to my article on Porto Rico (p. 112) seems to render it desirable for me to state my reasons for spelling the name of the island in accordance with "the form commonly in use in England and the United States." They are as follows:

1. The U. S. Board on Geographic Names is not necessarily a final authority on the orthography of geographic names ; its membership does not embrace lexicographers or linguists, and its chief duty is merely to simplify and unify custom in geographic nomenclature for administrative convenience.

2. The decision of the Board in favor of the spelling "Puerto Rico" was made several years ago, when the island was foreign territory, and when the name was not in frequent use in the official records and literature of the United States, and whatever may have been the merits of the decision at that time, it is now obsolete, as shown by official usage. The

usage includes (*a*) that of the President of the United States (creator of the Board on Geographic Names), who employs the form Porto Rico in all his messages and documents; (*b*) that of the local official government, which, since the American occupation, has been designated "The Military Department of Porto Rico;" (*c*) that of the Treaty of Peace, executed at Paris last year, in which the name of the island is given as Porto Rico; (*d*) that of the Post-Office Department, through which all post offices of the island are officially located in the "island of Porto Rico," and (*e*) the prevailing custom of the U. S. Department of Agriculture, the U. S. Geological Survey, and other governmental departments and bureaus (from which the membership of the Board on Geographic Names is made up), all of which use the form Porto Rico in their official publications.

3. The name Porto Rico is established by 300 years of world-wide usage, as I have shown in detail elsewhere. This form has been adopted by all the best English writers, and by all the world-famous cartographers of England, France, Holland, and Germany almost since modern geography had its beginning in the discovery of America.

4. The term Porto is easily pronounced and is written phonetically, while the word Puerto is practically unpronounceable in English, and hence involves non-phonetic writing; accordingly, the former is so fully in accord with the laws of linguistic evolution, which cannot here be fully set forth, that it could not possibly be supplanted by the latter.

5. If it is the principle of the Board to adopt "for other countries the names by which they are known to their own inhabitants," they have undertaken a needless and impossible task. In my opinion, it will be a long time before the English people will use such names as Kraljeorna Srbyia, España, Deutschland, etc., for Servia, Spain, and Germany, or before we can make the Germans, French, and Spaniards call our own country by any other names than the Vereingten Staaten, Les Etats Unis, and Los Estados Unidos, respectively. In endeavoring to enforce such a revolution upon a world-wide custom of language the Board is transgressing its powers and diminishing its field of usefulness.

R. T. Hill.

Washington, D. C.

THE NATIONAL GEOGRAPHIC MAGAZINE AND THE U. S. BOARD ON GEOGRAPHIC NAMES

On September 4, 1890, the President of the United States issued the following order:

As it is desirable that uniform usage in regard to geographic nomenclature and orthography obtain throughout the Executive Departments of the Government, and particularly upon the maps and charts issued by the various Departments and Bureaus, I hereby constitute a Board on Geographic Names, and designate the following persons, who have heretofore coöperated for a similar purpose under the authority of the several Departments, Bureaus, and Institutions with which they are connected, as members of said Board:

(Here follow names.)

To this Board shall be referred all unsettled questions concerning geographic names which arise in the Departments, and *the decisions of the Board are to be accepted by these Departments as the standard authority in such matters.*

Department officers are instructed to afford such assistance as may be proper to carry on the work of this Board.

The members of this Board shall serve without additional compensation, and its organization shall entail no expense on the Government.

BENJAMIN HARRISON.

EXECUTIVE MANSION, *September 4, 1890.*

The policy of the Board was fully set forth in its first report, pages 6–10, published in 1892; it also formed the subject of an article by Mr Henry Gannett, chairman of the Board, which appeared in THE NATIONAL GEOGRAPHIC MAGAZINE for July, 1896, and dealt at some length, and in an exceedingly interesting manner, with the various difficulties encountered by the Board in the performance of the important duty intrusted to it.

As originally organized, the Board consisted of representatives, ten in number, of the Geological Survey, the Coast and Geodetic Survey, the Hydrographic Office, the Corps of Engineers, U. S. A., the Light-House Board, the Department of State, the Post-Office Department, and the Smithsonian Institution. Nearly all its original members were engaged in geographic work of one sort or another, and their high professional standing undoubtedly lent great weight to their decisions. The rulings of the Board have with unimportant exceptions been fully sustained by public opinion, and the only criticism that has been heard has been called forth by that strict regard for consistency which has characterized the Board in all its decisions. In the various Executive Departments its rulings have had all the force of law.

Among the earliest of its decisions was the one determining the spelling of Puerto Rico, in which the Board adhered to its policy of adopting the orthographic form in local use. For the following six years *Puerto* Rico was the only form recognized in any of the Executive Departments. It was a report from the United States Consul at San Juan, *Puerto* Rico, that was published by the Department of State only a few days before the blowing up of the *Maine;* it was to *Puerto* Rico that United States mails were dispatched up to the breaking out of the war with Spain; it was a map of *Puerto* Rico that was subsequently issued by the Military Information Division of the War Department; it was a bulletin on the Trade of *Puerto* Rico that was published by the Department of Agriculture less than six weeks prior to the acceptance by Spain of the President's terms of peace.

With the outbreak of the war, however, American newspapers, with few exceptions, began to accustom the public to the form *Porto* Rico, and it was only a short time before this spelling made its appearance in the correspondence and publications of two of the departments. When the final Treaty of Peace was made public it was found that, either through ignorance of the fact that the Board on Geographic Names had made a ruling on the subject or by one of those inadvertences on the part of an engrossing clerk that have been known to invalidate entire acts of Congress, the form *Porto* Rico was the one used in that copy of the treaty, *and that only*, which was retained by the representatives of the United States. How far the use of this form in so important a connection, whether by accident or by design, has affected the usage of the Executive Departments, it is impossible to say, but that in several of them the form *Porto* Rico is now in use is undeniable. Such use, however, is not nearly so general as Mr Hill would have us believe. In the three great geographic bureaus, the Coast and Geodetic Survey, the Hydrographic Office, where the charts used in the U. S. Navy are prepared, and the Geological Survey, the form *Puerto* Rico, said by Mr Hill to be obsolete, is the only one used, except that in the last-mentioned bureau the use of *Porto* Rico has been permitted in papers of which Mr Hill is, himself, the author, and in which he has insisted upon this form being used. For Mr Hill to quote Mr Hill may be amusing, but it is hardly convincing. The only notable instance of the use of the form *Porto* Rico in the Department of Agriculture is, similarly, in a recent publication of which Mr Hill is joint author. It is in general use, however, in the Post-Office Department and the Weather Bureau, but in neither of these is its adoption understood to have been the outcome of any very careful consideration, and certainly in the case of the Weather Bureau it can hardly possess much significance, seeing that equally conspicuous with *Porto* Rico in its maps of the West Indies is *Puerto* Principe.

The adoption or non-adoption of the Board's decisions by the Departments is, however, a matter concerning only such Departments and the Board. The object of this article is not so much to justify the Board's decisions as to justify The National Geographic Magazine in regarding the Board as the one and only standard of authority on geographic nomenclature, so far as the government and people of the United States are concerned. If the need of such authority has been felt in the Executive Departments to the extent of calling for presidential action, how much more has it been felt by the editors of a Magazine the object of which is the extension of geographic knowledge, in whose pages appear, from time to time, articles dealing with those less-known regions of the world whose geographic nomenclature is still in its formative stage, and that desires accuracy and consistency in every statement that it contains. The editor's labors have been enormously lightened by the work of the Board on Geographic Names, and there is not the slightest disposition on the part of the present management to aid in the restoration of that condition of confusion and inconsistency wherein every man was a law unto himself by ignoring so much as a single one of the Board's decisions.

J. H.

PLACE NAMES IN CANADA

The first annual report of the Geographic Board of Canada, printed at Ottawa, in 1899, by order of Parliament, has come to hand. This is the first report of the Canadian Board on Geographic Names—a board authorized December 18, 1897, and organized May 11 of the following year. The report gives the origin and history of the board, its by-laws, the rules adopted for governing its decisions, and a list of some 200 decisions. These relate almost entirely to the northwestern part of Canada, in the Yukon region. It appears that as long ago as March, 1888, the question of the establishment of such a board was agitated, and again in 1892, but for some reason the matter was not followed up. The present board, constituted by an order in council approved by the Governor-General, is composed of two representatives of the Department of Marine and Fisheries, and one each of the Department of Railways and Canals, Postoffice Department, and the Geological Survey, and the Queen's Printer.

The by-laws of the board governing its organization and methods of procedure are very similar to those of the United States board. The rules of nomenclature which have been adopted are also quite similar, but we note the absence, except by inference, of the most important of all such principles—*i. e.*, that local usage should prevail. On the other hand, great stress is laid upon priority of publication of names. The first of these rules is as follows: "When the priority of a name has been established by publication, particularly when such publication has occurred in any standard or authoritative work or works, that name should, if possible, be retained."

We do not think that our Canadian neighbors appreciate what the result of the application of this principle will be on their nomenclature. It is safe to say that the majority of Canadian place names, as now used, are not identical with those first applied. From our limited knowledge of the history of the place names of Canada, we could cite scores or hundreds of names which, as now used, are different from those originally applied in maps and books. In biology it may be possible to carry out this principle of priority, although it must be said that its application in this branch of science involves a vast deal of labor and confusion, but in geographic names it is simply impossible.

The organization of the Canadian board will relieve our United States board from the necessity of making decisions on names in Canada, and doubtless our board will accept, without question, all decisions made by the Canadian board.

H. G.

THE ANTARCTIC CLIMATE

Henry Arctowski, the meteorologist of the recent Belgian Antarctic expedition, in *The Geographical Journal* for October gives a preliminary account of the meteorological observations conducted by him during the expedition. Because of their relatively small distance from the open sea and great distance from the pole, the positions ranging from 81° to 95° west longitude and 69° 50′ to 71° 30′ south latitude, two distinct types of climate were experienced, according to the direction of the wind—a continental and an oceanic. July was the coldest month, its mean temperature being —23.5° C. (— 10.3° F.), and the lowest temperature observed during the month, —37.1° C. (—34.8° F.).

The warmest month was February, with a mean temperature of — 1.0° C. (30.2° F.), and a minimum for the month, — 9.6° C. (14.7° F.). If we regard June, July, and August as the antarctic winter months, and December, January, and February as summer, we may take it that the mean winter temperature is — 16.8° C. (1.8° F.), and the mean for summer — 1.5° C. (29.3° F.).

From his observations, Mr Arctowski concludes that between the seventieth and seventy-first parallels of the southern hemisphere and amid the ice of the Antarctic ocean—first, the mean temperature is lower than that of the northern coast of Spitzbergen (Mossel bay, 1872-'73, — 8.9° C. (16.0° F.)); second, the minimum temperature is quite as low as the minima observed on the east side of Greenland (Sabine island and Scoresby sound); and, third, the mean temperature of the three summer months is lower than the corresponding mean in the ice of the Arctic ocean. If we consider that a considerable fraction of the seventieth parallel of south latitude is land, we can suppose that it may have a mean temperature as low as the 70° N., and include a pole of cold with lower temperature as the Asiatic or North American poles of cold.

During the drift in the pack-ice hourly observations were made with a marine barometer and with an aneroid. While Mr Arctowski has not yet been able to apply exact corrections to these observations, the uncorrected values are near enough for present purposes. The lowest pressure observed during the winter was 711.74 mm. (28.022 inches), and the highest 772.14 (30.400 inches). The mean value of the monthly variations of the barometer, amounting to 34.30 mm. (1.350 inches), shows very clearly that the cyclonic belt extends beyond the polar circle. The three months of almost continuous daylight (November, December, and January) are characterized by a very small variation of pressure—only 23.95 mm. (.943 inch). The three corresponding months of winter have also a mean less than those for the intermediate or equinoctial months. The differences between the annual and monthly means show that February, March, and April form a negative group, in which pressure is relatively low; the three months of polar night form another group of maximum barometric pressure; then follow August, September, and October—months of decreasing pressure—a group which, although not exactly negative, forms a distinct secondary minimum; and, lastly, three months of polar day forming a secondary maximum of pressure. The existence of a direct, simple relation between the barometric pressure and the progress of the sun is at once obvious.

The winds blew from northerly and southerly points with almost equal frequency, but easterly winds predominated over westerly. The sky was usually overcast, most frequently with a thick layer of stratus which formed a uniform gray covering and often persisted for days or even weeks together, with only short breaks. The number of days during which the air did not remain saturated —*i. e.*, on which the hygrometer indicated a humidity of less than 90 per cent—was October, 12; November, 18; December, 22; January, 15, and February, 11. If ice deposits from fog and similar precipitation are included, snowfall is recorded on 257 days and rain on 14 days of the year. Speaking generally, it may be said that the weather was extremely cloudy; that fogs were frequent; that snow fell on many days, and that the air was saturated nearly the whole time.

GEOGRAPHIC LITERATURE

Puerto Rico: Its Conditions and Possibilities. By William Dinwiddie. With Illustrations from Photographs by the Author. Pp. 295. New York and London: Harper & Brothers. 1899. $3.00.

Mr Dinwiddie's book excels as a minute description of the industrial conditions and commercial possibilities of the island and in the excellence of the illustrations made from views from his own camera. Those who are merely interested in the utilitarian side of Porto Rico will find this an excellent book of reference. The scientific statement is a little halting, however. For instance, an illustration of one of the white limestone hills between Utuado and Lares is entitled "coral formation," when in fact it is one of the finest examples of the truly sedimentary tropical oceanic white limestones we have ever seen. Mr Dinwiddie is excusable, however, for many geologists have persisted in terming all the tropical white limestones "coral formations." In the long chapter entitled "The Great Caves" the author commits the common but provoking blunder of treating technical scientific publication as no publication. In order to increase the reader's anticipation of his own glowing discoveries which are supposedly to follow, he begins this chapter with the remark that "it is astonishing how little is known about the geology of the island." A few lines further on he says that the owner of the caves "told us that several years ago an Englishman, a member of some British scientific society, had paid a short visit to the caves, . . . and it is quite likely that a report of its wonders has been published in the scientific journals of Great Britain." Perhaps if the "scientific journals" had been examined, in them would have been found at least an intelligible description of the caves, which, so far as Mr Dinwiddie's researches are concerned, only resulted in about 3,500 words of "padding," leaving the reader in as profound a darkness concerning the nature and origin of the caverns as that which must exist in these wonderful depths—at least, he in no manner adds to that knowledge of the geology of the island which he assumes to be so deficient. It is also regrettable that Harper & Brothers permitted the use of the spelling "Puerto Rico," which is no longer excusable, since the island has been officially designated Porto Rico by the United States government. The work is well indexed and on the whole is a credit to its author and publishers.

Robert T. Hill.

Japan in Transition: A comparative study of the progress, policy, and methods of the Japanese since their war with China. By Stafford Ransome. 8vo, pp. xvi+261, with 55 illustrations and 4 maps. Harper & Bros.: New York and London. 1899.

This book, written by a journalist trained in the study of foreign peoples, aims to present a picture of the present life, customs, industries, and politics of the Japanese, especially in their relations to the rest of the world. The author describes the accommodations for travel, the hotels and railways, the attitude of the natives toward foreigners, the condition of education, of Christianity, the Japanese moral standards and business integrity, international relations and politics, the condition of Japan's industries, etc. All these subjects are treated with freedom and fullness and by the pen of a master. Mr Ransome finds theoretical education well advanced among the Japanese, but practical education, the power to apply knowledge in doing things, he finds far behind. He judges the work of Christian missionaries to be largely a failure. In morals his verdict is that the Japanese are not behind the Anglo-Saxon, but different. This is a charitable way of characterizing a moral code which sanctions polygamy and prostitution. In business integrity the Japanese are behind the Anglo-Saxon, as would very naturally be expected from their want of experience. In modern manufacturing these people are making a good beginning, but have a long road to travel before becoming serious competitors of the great nations. H. G.

Through Unexplored Asia. By William Jameson Reid. Illustrated by L. J. Bridgman. 8vo, pp. 499, with 3 maps and 52 cuts. Boston: Dana, Estes & Co.

This is a narrative of a portion of a notable journey through western China, eastern Tibet, and southern Mongolia during the year 1894 by the author in company with the late George Burton. The extreme western point reached was in approximate longitude 95° east, latitude 34° north, and the extreme northern point was just above the 40th parallel. The present volume, which is published independently, carries the narrative forward to the shores of Charing Nor. It is the intention of the publishers to present the remainder of the narrative in a second distinct work. The book is written in the form of a journal, through which is scattered, amid the narrative of adventure, much information regarding the geography of the country traversed and the habits and customs of the people encountered. H. G.

Alaska and the Klondike. By Angelo Heilprin. 8vo, pp. 315, with 35 illustrations and 3 maps. New York: D. Appleton & Co. 1899.

This is a narrative of adventure and observations made by the author during a trip to Dawson *via* Lynn canal and the upper Yukon in the summer of 1898. It is a bright, readable book, and is of value in portraying in vivid colors the life and social conditions in this unique mining camp when in the heyday of its prosperity, as well as the life on the trail and river. The illustrations are strikingly illustrative and are well reproduced. H. G.

The Empire of the South, its Resources, Industries, and Resorts. By Frank Presbrey. 4to, pp. 181. Published by the Southern Railway Company. 1899.

This book is an illustration of the highest art in advertising. The dedication of the book reads as follows: "This volume is dedicated to the people of the South by the Southern Railway Company, whose interests are identical with those of the states traversed by its lines." The economic truth here uttered is the key-note of the book. It is a description of the southland, the "territory" of the Southern railway, its scenery, its soil, its people, its products, presented in so charming a way that it reads like a novel, and profusely illustrated with the finest of modern work. Considered simply as a piece of book-making, it is, in paper, print, and illustration, one of the finest specimens that the century has brought forth. H. G.

Hawaii and Its People. The Land of Rainbow and Palm. By A. S. Twombly. Boston: Silver, Burdett & Company. 1899.

This book, an historical reader for young people, is a very readable account of the Hawaiian people, their legends, beliefs, and characteristics. It is divided into three parts, which deal, first, with the myths and folklore of ancient Hawaii; second, with the transition period, beginning with Captain Cook's discovery of it; and, third, with modern Hawaii. Into it also is woven much of the descriptive and economic geography of the country, and the book has a number of good and attractive illustrations. It is one of a series of supplementary readers published by the same firm, of which are *Australia and the Islands of the Sea* and *Our American Neighbors.* C. L. G.

The Yosemite, Alaska, and the Yellowstone. By William H. Wiley and Sara King Wiley. 4to, pp. xix + 230, with 157 illustrations. London and New York: John Wiley & Sons.

This book is an interesting narrative, somewhat in the form of a journal, of the trip made by the American Society of Mechanical Engineers to the San Francisco convention, in the spring of 1892.

GEOGRAPHIC MISCELLANEA

Vessels drawing 25 feet of water can now enter Galveston harbor, and the foreign commerce of the port is rapidly increasing.

Work on the Simplon tunnel is being prosecuted with great energy, but its completion is not looked for before the summer of 1904.

Professor Wilhelm Joest, who died some time ago during an expedition among the South Sea islands, is reported to have left $75,000 to the Ethnological Museum in Berlin. The interest of the bequest is to be used for purchasing new collections and assisting scientific expeditions.

Dr F. A. Cook, surgeon and ethnologist of the Belgian Antarctic expedition, in an article contributed to *McClure's Magazine* for November, entitled "Two Thousand Miles in the Antarctic Ice," gives an interesting account of the experiences of the party during their winter in the South Polar regions.

The Dismal Swamp canal was officially opened to traffic on October 14. The new waterway, which is 22 miles long, connects Chesapeake bay with Albemarle sound and enables light-draft shipping to avoid the much-dreaded Diamond shoals. It also opens up to improvement thousands of acres of fertile land and a considerable area of good hardwood and pine timber.

The area under wheat in Argentina for 1898–'99, from which the crop was recently gathered, has been officially estimated at 6,150,319 acres. No official estimate of production has been received, but its aggregate amount has been put at 70,000,000 bushels.

Plans are being made for the construction of a tunnel under the Hooghly river at Calcutta. The river at this point is about 36 feet deep, and according to one of the plans the tunnel will pass 12 feet beneath the bed of the river. The length of the tunnel proper will be 6,875 feet.

The construction of the Nicaragua canal would reduce by about two-thirds the distance by water from New York to San Francisco. By the Cape Horn route the distance is 14,870 miles, by the Nicaragua route 4,946 miles; hence there would be a saving of 9,924 miles—about 26 days time.

The construction of the trans-Alaskan military road, with which Capt. W. R. Abercrombie, commanding the Copper River exploring expedition, has been so prominently connected, is now completed through the Coast range of mountains into the Copper River valley. It is entirely free from glaciers, and is believed to be as cheap a piece of work as was ever undertaken by the War Department in opening up a new country.

A Russian author, according to *The Independent*, appears to have proved in a book recently published that Bering strait was not first discovered by Bering, who found the passage in 1728, but by Semen Deschnef, a Cossack, who was in Siberia from 1638 to 1659, and on his return to Moscow reported the existence of the strait, which he had discovered while exploring the country adjoining it on the west.

The Tide Tables for 1900, issued by the U. S. Coast and Geodetic Survey, contain, for the first time, as a part of the annual tables, the predicted tides for St Michaels, Alaska, during the season of navigation. The times of slack current for each day of the year at Sergius narrows, Peril strait, Alaska, are also given. This is the first time full predictions of slack currents have been made and published for the localities.

An interesting article on the subject of Liverpool and its docks appears in a recent number of the *Windsor Magazine*. The docks, the most extensive in the world, occupy the north shore of the Mersey for nearly eight miles. Their total water area is 385 acres, affording over 25 miles of wharfage. The largest dock, the Alexandra, covers upward of 33 acres. The principal graving dock is 950 feet long and is the largest in the world.

The reports circulated in several western newspapers during the past month of the breaking up of a tornado at Hennessey, Okl., by the discharge of a cannon, has recalled to attention a "tornado-breaker" patented by W. S. Blunt, C. E., several years ago. The principle of this machine rested upon the theory that an explosive discharged into the midst of an approaching tornado would immediately dissipate the cloud. The Chief of the Weather Bureau emphatically states, however, that the discharge of the most powerful cannon would be utterly inappreciable in its effect upon a tornado cloud, and that it is impossible for such clouds to be dissipated by any explosive that man may invent.

The Coast Pilot party of the U. S. Coast and Geodetic Survey is now engaged on a revision of the Atlantic Coast Pilot, part IV, Point Judith to New York. The field work, which included all of Long Island sound, was executed in August of this year. It is hoped to have the published volume ready for distribution within two months. There was also prepared and published during the past month a supplement to the last edition of part II, which was published in 1893.

For the excellent map of the scene of the military operations in South Africa, which accompanies the current number, The National Geographic Magazine is indebted to Major W. A. Simpson, U. S. A., Chief of the Military Information Division of the War Department. The map shows in detail the military roads, mountain passes, and other features necessary to a clear understanding of the country in which the present military operations are taking place. It is the only map of its kind on such a scale that has been published in this country, and its official character is a guarantee of its correctness.

The attention of the people of Great Britain has on various occasions been called to the fact that the exhaustion of those wonderful beds of coal which have constituted so important a factor in the industrial supremacy of that country is not so remote an event as to justify the complacency with which it is commonly regarded. Such warnings, however, have usually excited nothing but ridicule. It will be interesting, therefore, to note the effect upon the public mind of a recently published report from one of the official inspectors of mines, in which it is stated that within fifty years, which is but a short time in the life of a nation, scarcity will begin to be felt.

The Russian canal which is now being built from the Baltic to the Black sea, with the expectation of being completed within four years, will be 1,080 miles long. Its width of 217 feet at the top and 117 feet at the bottom and its depth of 28½ feet will permit the largest warship to pass through. Six days will be necessary for a vessel's passage, steaming at the rate of six knots day and night. The whole course is to be lighted by electricity. The total cost is estimated at $116,796,000. The gigantic extent of the work can be partially comprehended when it is remembered that the Suez canal is 92 miles long, while the proposed Nicaragua course is 169.4 miles from ocean to ocean and would require 44 hours for its transit.

The U. S. Coast and Geodetic Survey steamer *Pathfinder*, Capt. F. Walley Perkins commanding, which left Norfolk June 17 for San Francisco *via* the Straits of Magellan, arrived there September 17. The voyage was made under favorable conditions, the time (three months between the terminal points) being remarkably short. Stops for several days were made at Santa Lucia (June 25), Pernambuco (July 6), Rio Janeiro (July 19), Montevideo (July 27), Valparaiso (August 20), Callao (August 26), and San Diego (September 14). After a short stay at San Francisco the vessel will probably go to Hawaii to engage in hydrographic work. The harbor of Hilo will probably be taken up first, and afterwards an examination will be made of a region between Honolulu and Moanalua.

WRITING in the *Pall Mall Magazine*, Arminius Vambery concurs in the general expectation of a large increase in the population of Siberia within the next hundred years as a result of the facilities that will be offered by the Russian government for the exploitation of its enormous wealth in timber, minerals, and arable land. M. Vambery, however, does not look for so large an increase—sixty or eighty millions—as is predicted by many Russian writers. While admitting the migratory propensities of the Russian peasant, he calls attention to the fact that even in the most fertile districts of southwestern European Russia the density of population is far below that of other European countries.

AMONG the many interesting facts brought out by the U. S. Coast and Geodetic Survey parties operating in Alaska are several relating to tidal phenomena. Observations in the Copper River delta by Assistant Ritter show that the tidal curve as registered on the gauge is of a peculiar type, for while the upper portion remains normal the lower part is very nearly a straight line. A possible explanation of the phenomena may be that a great ledge prevents the water from falling below a certain level. The tidal work in western Alaska by Assistant Pratt shows a rapid transition from an almost strictly diurnal tide at St Michaels to a well-marked semidiurnal type at the Kusilvak entrance to the Yukon.

Commercial Africa in 1899 is the title of a recent report issued by O. P. Austin, Chief of the Bureau of Statistics of the Treasury Department. The report is a summary of the physical and ethnical features of the railroads and mining interests, etc., of different sections of British Africa, German Africa, Italian Africa, Abyssinia, the Boer Republics, and of every state of the continent. An excellent chart of Africa (14 by 18 inches) accompanies the report. There are also diagrams showing the languages as well as the religions of the different sections of the continent. The report is an exceedingly valuable and interesting one and should be in the hands of every one interested in the commercial progress of Africa.

AT a meeting of the Board of Managers of the National Geographic Society, November 1, 1899, the following resolutions were passed :

Resolved, That the Board of Managers of the National Geographic Society, having learned with profound regret of the death of the Hon. Charles P. Daly, LL.D., president of the American Geographical Society, place on record its high appreciation of the distinguished services to geographic science rendered by Judge Daly during his long and honorable career, and tender to the officers and members of the American Geographical Society its respectful sympathy with them in their loss.

Resolved, That a copy of these resolutions, signed by the President and the Secretary, be transmitted to the American Geographical Society.

ONE of the most interesting features of railroad travel in the mountain regions of the Far West has hitherto been the steep grades by which the various lines have, with one or two notable exceptions, been made to reach the high elevations at which they have been carried over the different ranges. These, however, are rapidly being done away with, in some cases by the construction of tunnels, in others by the building of new lines over passes of lower altitude. The famous Veta Pass line of the Denver and Rio Grande, with a maximum grade of 4.7 per cent, or

248 feet per mile, will soon be a thing of the past, a new route, with a maximum grade of only 3 per cent, being in course of construction eight miles south of the existing line.

Hydrographic investigations have been extended by the Nicaragua Canal Commission to the Isthmus of Panama, the work being still under the charge of Mr Arthur P. Davis, of the Division of Hydrography, U. S. Geological Survey. The Panama Company has been maintaining on Chagres river three elaborate nilometers or automatic devices for recording the height of water. Two of these records have been kept for a number of years. A third was established in April, 1899, at Alajuela. It is somewhat extraordinary that hitherto no observations of rainfall have been maintained above these river stations and no measurements made of the Rio Grande, the stream on the Pacific slope. Arrangements have been made for obtaining a record of rainfall and for measuring this stream, every facility being afforded by the French company.

The article on "The Relation of Forests and Forest Fires," by Mr Gifford Pinchot, Forester of the U. S. Department of Agriculture, which appeared in the October number of this Magazine, is receiving much favorable comment from students of forestry. A feature of the article is the excellent set of original pictures with which Mr Pinchot has illustrated his text. It is regrettable that, through an error for which Mr Pinchot was not responsible, several mistakes should have crept into the titles. The photograph on page 400, showing most clearly two generations of lodgepole pine, was taken by Prof. C. S. Crandall, of Fort Collins, Colo., a collaborator in the Division of Forestry, and should have been credited to him. Four feet beneath the large cedar tree standing in the background on the right of the cut on page 402, a layer of charcoal was found—a proof that the tree had grown up after a fire. The title of the picture of a seedling longleaf pine on page 399 is misleading, for while the drooping needles still retain their natural downward curve, the young tree is too far advanced for them any longer to afford protection to the lower stem in case of fire.

In a recent communication to the Department of State (see Consular Reports, vol. lxi, No. 230, p. 487) the U. S. consul at Stratford, Ontario, expresses the opinion that the most serious problem that confronts the Canadian people of the future is material for fuel. He states that the gigantic lumber industries and the great annual forest fires have so denuded the timber area of Ontario that the people are thoroughly alarmed about the future fuel supply. So long and severe are the winters that an ordinary residence will consume $100 worth of fuel in a year. It has been well known for years that there were extensive beds of peat bogs in Canada, and particularly in the Province of Ontario, and an effort has been made during the past six months to utilize this product of nature. It has been tested in locomotives with excellent results, 100 pounds of peat having been found to be equal to 95.15 pounds of coal. The heat produced is much greater than that of coal, but it is 8 per cent deficient in lasting power. The recent invention of machinery, by means of which vast areas of hitherto unused bogs can be converted into marketable peat, has opened up a new Canadian industry.

THE NATIONAL GEOGRAPHIC SOCIETY

SECRETARY'S OFFICE

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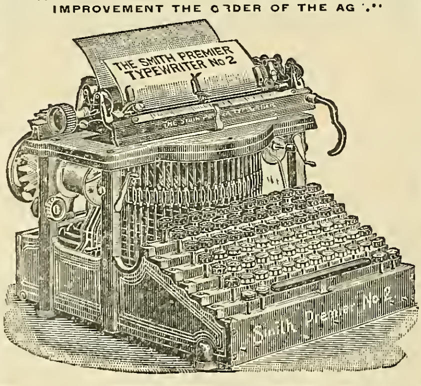

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INDEX

ERRATA

Page 60, lines 19 and 30, for Manilla read Manila.

Page 159, line 31, for Chili read Chile.

Page 184, line 15, for Congo read Kongo.

Page 250, line 39, and page 251, line 4, for Torro read Toro.

Page 238, line 38 ; page 240, line 7, and page 242 (map), for Guiscoyol read Guiscoyal.

Page 251, line 20; page 252, line 2; page 258, line 36; page 262, line 23, and page 265, last line, for Serapiqui read Sarapiqui.

Map facing page 233, for Mombucho read Mombacho, for Zapatera read Zapatero.


A CHART
Shewing part of the
COAST OF N.W. AMERICA
With the Tracks of
HIS MAJESTY's SLOOP
DISCOVERY and Armed Tender CHATHAM
Commanded by GEORGE VANCOUVER Esq.r and prepared
under his immediate inspection by Lieu.t Joseph Baker,
in WHICH the
Continental Shore has been correctly traced and determined from Lat.de 57° 07.½ N. and
Long.de 227° 00. E. to Lat.de 59° 59. N. and Long.de 219° 00. E.
at the periods shewn by the Track
Photo-lithographed from original print in the
Archives of the U.S. Coast and Geodetic Survey
by the Norris Peters Co. Washington, August 1898
CAPE PHIPPS
CAPE FAIRWEATHER
CAPE SPENCER
CROSS SOUND
CAPE CROSS
CAPE EDWARD
BAY of ISLANDS
CAPE EDGECUMBE
NORFOLK
KING GEORGE III
CHATHAM STR
LYNN CANAL
STEPHENS PASSAGE
CAPE FANSHAW
PRINCE FREDERICKS SOUND
60°
59°
58°
57°


A CHART
shewing part of the
COAST OF N.W AMERICA
with the tracks of His Majesty's Sloop
DISCOVERY and Armed Tender CHATHAM
Commanded by GEORGE VANCOUVER Esq. and prepared
under his immediate inspection by Lieut. Joseph Baker in which the
Continental Shore has been correctly traced and determined from
Lat. 51°.45 N. and Long. 232°.08 E. to Lat. 57°.30 N. and Long. 226°.44 E.
at the periods shewn by the Tracks.
The parts not shaded are taken from Spanish Authorities.
denotes the Vessels track Northward their return Southward.
NEW CORNWALL
DUKE OF YORK'S ISLAND
PRINCE OF WALES'S ARCHIPELAGO
CLARENCE'S STRAIT
ISLAND OF REVILLA GIGEDO
CANAL DE REVILLA GIGEDO
CHATHAM'S SOUND
CHRISTIANS SOUND
CAPE OMMANEY
CAPE DECISION
CAPE POLE
CAPE ADDINGTON
CAPE NORTHUMBERLAND
PUERTO DEL BAYLIO BUCARELI
PUERTO CORDOVA
Hazy Isles
Coronation
Warren's I.
Forresters Isle
Isle de Zayas
Brown's Passage
Cº de Sᵗ Bartolome
Cº de Muzon
Cº de Chacon
Pᵗᵃ de Bazan
Pᵗᵃ de Nunez
Pᵗ North
Pᵗ Frederick
Yᵃ de Langara
Pᵗᵃ Ynvisible
Pᵗᵃ de Masavido
Pᵗ Wales
Pᵗ Davison
Pᵗ Percy
Pᵗ Ellis
Pᵗ Baker
Pᵗ Barrie
Pᵗ Bowe
Pᵗ Stewart
Pᵗ Vallenar
Pᵗ Grindall
Pᵗ Nesbitt
Pᵗ Stanhope
Pᵗ Onslow
Wales Rock
Behm's Canal
Port Stewart
Bradfield Canal
Prince Ernest's Sound
Cholmondeley Sound

FOLDOUT WILL BE SCANNED AT A LA