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AN ILLUSTRATED MONTHLY

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Donations for the founding of Prize Medals and Scholarships are respectfully solicited.

a *b* *c*

VIEW FROM HOYT ISLAND, LOOKING ACROSS HUNTON STRAIT TO HOLM ISLAND

Mounts McGee (*a*), Langley (*b*), and Powell (*c*)

VEGETATION ON SOUTH SLOPE OF HOYT ISLAND, AUGUST 15, 1897

THE

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THREE WEEKS IN HUBBARD BAY, WEST GREENLAND

By Robert Stein,

United States Geological Survey

In 1893 I published a plan of Arctic exploration from a base near Jones sound, proposing first to trace the west coast of Ellesmere land and afterward to explore the triangle between Ellesmere and Grinnell lands on the east and the Parry islands on the south. That field was declared by General Greely to be the one in all the Arctic "that promises the largest results with the least amount of labor and danger." Lieut. Julius von Payer declared that the spot selected for the base was "the most suitable" and the plan "thus far the best imaginable." Numerous weighty authorities concurred in this opinion, especially Lieut. Peary, who called the plan "one of the safest, most promising, and cheapest, avoiding hurry, and permitting the utilization of experience." As now planned, the expedition would cost $5,000.

Failing to secure the requisite funds, I decided, by Lieut. Peary's advice, to undertake a preliminary trip to Greenland in order to gain the experience in Arctic exploration which in his opinion would be of most essential service in securing financial support. Through the kind assistance of the late Hon. Gardiner G. Hubbard, President of the National Geographic Society, as well as of Major J. W. Powell, Director of the Bureau of American Ethnology; Prof. S. P. Langley, Secretary of the Smithsonian Institution, and Mr C. D. Walcott, Director of the U. S. Geological Survey and of the National Museum, I was enabled to take advantage of Lieut. Peary's invitation to accompany him on his seventh Greenland voyage, in the summer of 1897, to spend three weeks in exploration in an interesting field.

Lieut. Ryder, of the Danish navy, explored in 1887 the bay north of Wilcox head (which I have called Hubbard bay), and there found numerous Eskimo remains. The present Eskimos of Upernivik and Tasiusak never until the spring of 1897 ex-

PLAN OF ARCTIC EXPLORATION FROM A BASE NEAR JONES SOUND OR AT CAPE SABINE

tended their hunting trips beyond the great rookery of Cape Shackleton, while the Cape York tribe, according to Lieut. Peary, never go farther south than Melville Monument. This leaves a gap of 140 miles. Inspector Ohlsen, at Upernivik (to whom I am much indebted for valuable assistance) told me that the Eskimos of that colony had a tradition that their ancestors used to go hunting near Wilcox head, but ceased to do so about 200

years ago, so far as he can estimate. How much farther north they had gone he could not tell. Thus the remains found by Ryder were of unusual interest, as representing a stage when the race was unaffected by civilization, except, perhaps, that of the early Norsemen. To collect such remains was my main object. As Lieut. Ryder sent a collection to the Ethnographic Museum at Copenhagen, I feared that nothing of note would be left at the sites he had touched, and therefore asked Mr Peary to land me at Cape Malm, the north end of Hubbard bay.

With three Eskimos from Upernivik, I was landed on August 10 on a headland supposed to be Cape Malm, the dense fog preventing accurate orientation. From the top I perceived next morning that I was on the island next south (which I have called Hoyt island), separated from Cape Malm by a channel five miles wide, filled with icebergs. As soon as the fog had lifted I prepared to row over to Cape Malm, but when we reached the west end of Hoyt island and saw before us the wild chaos of rapidly moving icebergs, the Eskimos, thoroughly frightened, refused to row farther, even for triple pay. Lieut. Peary had urged me to listen to the Eskimos' advice in regard to ice and wind, and I recognized that under no circumstances must I fail to keep my appointment to meet him on September 1, because such failure would subject him to the inconvenience of having to search for me in those unknown and ill-reputed waters of Melville bay. Accordingly, after ten minutes' parley, finding that their apprehensions were real, I turned back.

I now decided to make a thorough exploration of Hoyt island as the type of a group. The island consists of four mountain masses, the highest about 1,000 feet, separated by deep valleys. Except on the storm-beaten western peninsula, which seemed entirely bare, the southern slopes, where not too near the perpendicular or too smoothly glaciated, are covered with the ordinary Arctic vegetation, blueberries, crowberries, grasses, heather, poppy, dwarf willow, dwarf birch, and an abundance of moss, forming carpets into which the foot sank up to the ankle. Everywhere the sod was sliding down in great, black, wavy avalanches, held together by the tough, peaty fiber, so that plants were often seen growing from vertical or even overhanging surfaces. The summits and the north flank, a succession of nearly vertical cliffs, are almost entirely bare of vegetation. In the shadow of many cliffs lay long snow banks (*aput*), hard as ice, offering considerable resistance to the knife, yet evidently not of many years' growth, since a hollow space beneath them bore witness to active melting. The tinkle of little streams could be heard in many places, but only at one point was there a watercourse sufficiently definite to be called a brook. The summits and sides, where not

CREST WITH BOWLDERS, HOYT ISLAND

too steep, were strewn with glacial bowlders, different from the bed-rock, though eruptive, with the exception of three conglomerates. Glacial striæ were seen on the northeast summit. The whole island is seamed by frost fissures. Many of the projecting pinnacles are weathered into fantastic forms and surrounded by a conical talus of glittering rhombic crystals. In many places the talus formation was so active as to overwhelm the vegetation. Nine freshwater lakes, the largest about 30 acres in extent, were seen, some in the valleys, others on the level summits. They were the favorite resort of the red-throated diver, always seen in pairs, but no other life was observed in them. The life in the sea was exceedingly abundant. Seals were seen nearly every day; eider ducks (*mittek*) in long lines, each numbering perhaps five hundred, were paddling over the water with rhythmic cackle; each cove was alive with little auks (*serpak*), handsome in their coat of black, white, and red, their thin, piping voices seeming curiously out of proportion to the size of the bird. The air was alive with gulls and terns. Wherever the depth of water permitted, the bottom could be seen completely covered with vegetation. Long strings of kelp, when drawn out of the water, were found to harbor quite a fauna of crustaceans and mollusks. A piece of bone thrown into the water would be covered with shrimps in a few moments. No reindeer were seen, but shed antlers testified to their occasional visits. The snow bunting and ptarmigan found abundant food in the blueberries and crowberries. The blueberry bushes were fairly alive with little black spiders. Several specimens of a hairy caterpillar and of a large fly were secured. Bears had left records of their visits in numerous seal bones, but were not seen, having gone away with the floe-ice.

The same description applies to most of the land in the vicinity. On Inugsulik, the island next east, I found the cairn marking Ryder's farthest north. Great volcanic fissures, 20 to 100 feet wide, between vertical walls, traverse that island in all directions. Being for the most part level-floored, they afford easy thoroughfares for travel. The level floor is evidently due to glacial action, being formed of débris, sometimes angular, sometimes rolled so as to resemble a collection of cannon balls. Successive terminal moraines have converted several of these avenues into stairways. Though much higher than Hoyt island, Inugsulik's summit also is bowlder-strewn. A brook dashes down its west side, large enough to be impassable near its mouth.

CAIRN BUILT BY LIEUT. RYDER IN 1887 TO MARK HIS FARTHEST NORTH ON INUGSULIK ISLAND. MOUNT OPERTI IN THE DISTANCE ON THE RIGHT

Both from Hoyt island and from Inugsulik I had a full view of the inland ice of Greenland, extending as a white band along the eastern sky and discharging through the magnificent Hearst glacier, with a front of 15 miles, casting off enormous icebergs, which completely blocked Henderson bay and came slowly trooping down in a stately procession to join the great muster of their fellows in Baffin bay. Far above the glacier, a nunatak, Mount Pepper, lifted its black head out of the inland ice. Long crevasses on each side showed that the peak was part of a precipitous wall, over which the ice dropped in a cascade several miles long.

On White island, in the center of Hubbard bay, I found at last the main object of my quest—Eskimo remains. There were two houses beside a little lake on a low rocky spur projecting westward, but the main settlement was on the east side, in a most picturesque site, conspicuous afar by the vivid green of the abundant vegetation. Like the Carthaginians, these ancient Innuits had an outer and an inner harbor, separated by a ledge of rocks, over which the tide flowed in and out. The inner harbor was elliptic in outline and about 50 acres in extent. A long knife-edge of rock protected the bays on the south, and so high were the ridges and so deep the bays that the water must remain unruffled in the fiercest storms, unless they come directly from the east. On a level space between the two bays was the settlement, a dozen houses, with graves scattered in among them and along the foot of the hills. Directly behind was a fresh-water lake, brown with decaying matter, but a second and larger lake, some 30 feet higher, was clear and pure. A few graves were also found on the south side. Stone fox-traps were scattered all over the island. The eyes of my Eskimos beamed with delight, for to them the snug harbor, the easy landing, the low, level plateau, the freshwater lake within a stone's throw, in the midst of such abundance of animal life, must have seemed a paradise. Where the wave beat had exposed a section of the soil it was seen to consist of a black mass, thickly interlarded with bones of whale, walrus, narwhal, and seal. Evidently the garbage question had not begun to vex the minds of these ancients. So far as I could judge, the houses and graves had remained untouched since their builders departed, though Ryder mentions remains on that island. The roofs had fallen in and the rich humus had given rise to a rank vegetation of grass and moss, which had deeply buried the houses, so that some of them could

SOIL CRACK BEHIND ANCIENT ESKIMO IGLOO, RICHARDSON ISLAND, HUBBARD BAY

only be traced by the quadrangular swellings of the sod. To my disappointment, the bones in the graves were all confusedly jumbled together, so that it was impossible to make out a complete skeleton. As each grave contained several skulls, the disorder was doubtless due to the fact that the bones of earlier skeletons had been moved aside to make room for new arrivals. While I was engaged in the task of spoliation the fog turned into rain, converting the mold into a slimy paste, in which fragments of decayed bones or other material could no longer be distinguished. Fearing to spoil the material of a future and better equipped expedition, which the locality richly deserves, I decided to content myself with the spoils of two graves.

On Richardson island, one of the two low islands south of White island, the graves had been opened, probably by whalers, and the bones scattered about. Of two houses at the water's edge, all but the back wall had been washed away. I was at first disposed to attribute this to subsidence, but wide and deep cracks in the soil showed that the whole mass of peat and muck was slowly sliding seaward.

Similar remains were found on Porter island and (sadly plundered) at Wilcox head, and the Eskimos saw others on the

Winter islands. Ryder mentions remains at Cape Kasson and on the north side of Wilcox head, which I did not see. In a house a little farther south Ryder found "a large white glass bead." This would seem to indicate early Norse influences and add to the interest of the region.

My three live Eskimos were interesting "study specimens." One of them was a blond of the purest type, in whom the admixture of aboriginal blood was so slight as to be imperceptible; the others, though dark in hair and eye, were as white-skinned as Europeans. It is the same throughout Danish Greenland. The whole population is being rapidly Aryanized, and within a few generations we shall have the curious spectacle of a race practically Aryan in blood, and of the finest Aryan type at that, the Scandinavian, yet speaking one of the most primitive of "savage" languages, in which so simple a word as *eight* is expressed by the polysyllable *apennepingazhut.* Some of the young women would pass for beauties anywhere, and one is somewhat shocked at seeing them amid their dingy, desolate surroundings. One peculiarity that struck me as soon as I reached Greenland was the exquisitc modulations of the voices of both men and women, constantly reminding one of the French intonations,

ESKIMO FAMILY AT UMANAK

such as you hear them from the lips of cultured Parisians—a soft, almost plaintive, undertone, with no abrupt changes, but merely gentle gliding movements within narrow limits of pitch and volume. Their peculiar "r," *grasseyé* like the Parisian (the word Nursoak is often spelled Nugsoak), completes the illusion.

It affords me pleasure to acknowledge my indebtedness to Lieut. Peary for invaluable assistance and unvarying kindness, and to record my gratification at having been an eye-witness of his management—a model of foresight, readiness, energy, fairness, patience, and consideration. In these qualities one perceives the secret of his magnificent achievement and the guarantee of his crowning success, the conquest of the Pole in 1900.

In naming features which Ryder left unnamed, I have tried to serve a useful purpose by using the names of some of the foremost advocates of a National University at Washington. This may aid in giving to the movement the publicity which, it would seem, is the only thing needed to insure its success.

Washington, Jefferson, and Madison islands, for three Presidents of the United States.

Andrews glacier, for President E. B. Andrews, Brown University.

Carroll glacier, for ex-Governor John Lee Carroll, General President of the Society of Sons of the Revolution, Maryland.

Chamberlin (Mt.), for Prof. T. C. Chamberlin, ex-President of the University of Wisconsin.

Dabney bay, for Hon. Charles W. Dabney, ex-Assistant Secretary of Agriculture, President of the University of Tennessee.

Eaton peninsula, for Gen. John Eaton, ex-U. S. Commissioner of Education.

Edmunds island, for Hon. George F. Edmunds, ex-U. S. Senator.

Frye (Mt.), for Hon. William P. Frye, U. S. Senator.

Fuller (Mt.), for Hon. Melville W. Fuller, Chief Justice of the Supreme Court of the United States.

Garland peninsula, for Hon. A. H. Garland, ex-Attorney General of the United States.

Gilman peninsula, for President D. C. Gilman, Johns Hopkins University.

Harper strait, for President William R. Harper, University of Chicago.

Harris bay, for Hon. W. T. Harris, U. S. Commissioner of Education.

Hawley strait, for Hon. Joseph R. Hawley, U. S. Senator.

Hearst glacier, for Mrs Phœbe A. Hearst.

Henderson bay, for Hon. J. B. Henderson, ex-U. S. Senator.

Hoyt island, for Hon. J. W. Hoyt, ex-Governor of Wyoming, Chairman of the National University Committee.

Hubbard bay, for Hon. Gardiner G. Hubbard, first President of the National Geographic Society.

Hunton strait, for Hon. Eppa Hunton, ex-U. S. Senator.

Jordan island, for President D. S. Jordan, Stanford University.

Kasson (Cape), for Hon. John A. Kasson, ex-U. S. Minister to Austria and Germany.

Kyle island, for Hon. James H. Kyle, U. S. Senator.

Langley (Mt.), for Hon. S. P. Langley, Secretary of the Smithsonian Institution.

McGee (Mt.), for Prof. W J McGee, Ethnologist in Charge, Bureau of American Ethnology.

Newcomb (Cape), for Hon. Simon Newcomb, ex-Director Nautical Almanac

Pepper (Mt.), for Dr William E. Pepper, ex-Provost of the University of Pennsylvania; President of the Museum of Science and Arts, Philadelphia; President of the Pan-American Medical Congress.

Powell (Mt.), for Major J. W. Powell, Director of the Bureau of American Ethnology; ex-Director of the U. S. Geological Survey.

Porter island, for Gen. Horace Porter, U. S. Ambassador to France.

Proctor strait, for Hon. Redfield Proctor, U. S. Senator.

Richardson island, for Mrs Ellen A. Richardson, President of the George Washington Memorial Association.

Ridpath island, for Dr John Clark Ridpath, Editor of the Arena.

Sherman strait, for Hon. John Sherman, Secretary of State; ex-U. S. Senator.

Smith peninsula, for Col. Wilbur R. Smith, Kentucky University.

Strauss glacier, for Hon. Oscar S. Strauss, ex-U. S. Minister to Turkey.

Vilas (Mt.), for Hon. William F. Vilas, ex-Secretary of the Interior; ex-U. S. Senator.

Walcott peninsula, for Hon. C. D. Walcott, Director of the U. S. Geological Survey.

White island, for Hon. Andrew D. White, U. S. Ambassador to Germany; ex-U. S. Minister to Russia.

Wilson strait, for Hon. William L. Wilson, ex-Postmaster General; President of Washington and Lee University.

Wright (Lake), for Hon. Carroll D. Wright, U. S. Commissioner of Labor.

Besides these, the following names were deemed appropriate:

Mounts Björling and Kallstenius, for the two young Swedish explorers who were lost in an attempt to reach Ellesmere land in 1893. The two peaks were ascended by Björling in 1891.

Mount Ryder, for Lieut. Ryder, of the Danish Navy, the first explorer of Hubbard bay. The peak is the highest that he sighted from his farthest north.

Mount Operti, for Mr Albert Operti, the "Arctic artist," who accompanied Lieut. Peary on two expeditions. A cairn erected on the peak by Prof. Gill in 1896 was named after Mr Operti. The peak was erroneously called Devil's Thumb by Ryder. The real Devil's Thumb is in Alison bay.

Gill bay, for Prof. Gill, of the Cornell party of 1896, who ascended Mount Operti, overlooking this bay.

Tarr bay, for Prof. Tarr, the leader of the Cornell party.

THE SAMOAN COCOANUT *

Samoa, the Navigators islands of the old geographies, is a volcanic group, consisting of four principal islands, lying between 13° and 15° S. latitude and 168° and 173° W. longitude. Samoa has an area of about 1,300 square miles, in size between Rhode Island and Delaware. Apia is the single port of entry. Savaii, the most westerly island, is much the largest, 45 miles in length by 25 in breadth. Upolu, 12 miles to the east, is 40 miles in length by 15 in breadth. Tutuila, 38 miles east of Upolu, is 17 miles in length by 5 miles in breadth.

The entire export from Samoa for 1894, excluding bonded goods and other re-exports, was $254,630; of this total, copra (dried cocoanut meat) constituted $248,570. The single exportable staple for which Samoa is eminently adapted, and the one upon which all its business today rests and must for the future be predicated, is the cocoanut (*Cocos nucifera*). It is to Samoa what cotton and corn are to the United States; all that grain, meats, and wool are to the Australasian colonies. The export of the copra (the dried meat of the cocoanut) alone, save with trifling and inappreciable exception, represents the entire agricultural productive capacity of Samoa, and through this source every dollar that trade and commerce bring into these islands finds its way. Were the cocoanut crop an absolute failure for a single year, the entire volume of export of this Kingdom for that year would not amount to more than $6,000. This illustration will adequately represent the prime importance of this single article to the country and its needs.

Like other primitive peoples depending largely on a single resource, the native Samoans have a tradition or myth concerning the origin of their most useful plant—the cocoanut palm; and the myth is peculiarly interesting as an illustration of the inconsequence of ideas in primitive tradition. This myth, with many others, was collected by Mr William Churchill, for some years consul-general to Samoa, who has recently returned to Washington. To understand the myth it is necessary to remember that the

* This article, compiled by Gen. A. W. Greely, is composed mainly of excerpts from the interesting and valuable report on Samoa made to the Department of State by Consul-General James H. Mulligan, and published in Consular Reports, vol. 51, pp. 656–748.

water vessels used by the Samoans consist of cocoanut shells in pairs, connected by cords in such manner as easily to be slung on a stick laid across the shoulders or conveniently carried in the hand, the shells being emptied of their original contents by the simple and effective method of knocking out the "eyes," drinking the milk, and then permitting ants to consume the meat. One of the apertures produced by removing the "eyes" serves as the mouth of this natural jug, which is remarkably light, strong, and durable, and has accordingly relieved the Samoans of the necessity of developing the art of pottery-making. Although so convenient in many ways, this type of water vessel is not easily filled, particularly from a shallow stream or spring; but the Samoans have invented a neat device, by which this difficulty is easily overcome. The maiden who goes to the spring carries with her a cup made from the stem end of a cocoanut shell, with one of the "eyes" removed, so as to transform it into a funnel. This she dips in the water with her finger over the aperture, then, holding it over the neck of the cocoanut jug, removes her finger and directs the stream into the carrying vessel. These utensils—the pair of cocoanut jugs and the cocoanut funnel—have well-established names in the Samoan tongue, and these names apply to no other objects, while the utensils are never made of other material than cocoanut shell. Now, according to the tradition, a village virgin of the long ago went down to the spring for water. While dipping with her cocoanut funnel and directing the stream into the cocoanut vessel she perceived a slender, shadowy eel in the water, and was so entranced by its beauty that she decided to carry it home in the funnel cup and preserve it as a pet, and this she proceeded to do. As time passed the creature grew, and it became necessary to remove it to larger and larger receptacles, until finally it became a terrific monster, threatening to destroy the people. So the people gathered, and, under pretense of placating the monster, supplied it so freely with a Samoan beverage that it became intoxicated and slept. Then they cut off the monster's head, and, to prevent reclamation of this useful organ when the creature should awaken, removed it to a distance and buried it deeply in the earth. Their virtue was duly rewarded when, some time later, the earth swelled and opened, and a strange plant pushed out, delicate in form and graceful in movement as the eel in its infancy. And this magical plant was the first cocoanut tree.

It was the cocoanut and cotton—chiefly the former—which induced a large purchase of lands by a German firm and the planting of some extensive plantations. Twenty to thirty years ago, when the oil of the cocoanut began to be more largely employed in the manufacture of soaps, copra commanded in Europe, where it found its only, and still finds its principal, market, very remunerative prices, which in these times of decreased values in everything are looked back to as phenomenal. These high prices stimulated the planting of these thousands of acres of tossing palms which reach on before the eye in unmatched beauty. But the same stimulus which induced this manifestation of enterprise was felt on every tropic seashore. Millions of trees were planted on the measureless shores of tropic Africa, America, and Asia. All the shores of India, of the contiguous countries, of the unnumbered islands that form the archipelagoes of the vast western Pacific, were transformed into stately groves in the keen search for large profits.

These groves are but a few years past their early maturity. Every year, with favorable season, they yield an increasing crop. The usual reaction has followed. The same result in these latter times of increased output in everything has been reached, and overproduction is steadily bearing prices downward. In addition came the introduction of cotton-seed as an oil-producer. This tells upon Samoa in more than a direct way. No plantations are being laid out. What has been said before in regard to other productions and the great distances of the markets on either side is applicable to the situation of Samoa with reference to its single staple in redoubled force. Distance, to repeat, is synonymous with freight rates. Other copra-making countries are situated nearer to the markets. A lower freight means a lower cost to the purchaser. Again, a small and semi-civilized population, indulging few artificial needs, offers a small market for imported goods; consequently ships to larger countries can carry a cargo out, to return with a cargo of copra. Vessels cannot, save in exceptional, rare cases, find a charter to Samoa. As a result, the Samoan shipper of copra must pay the high rate of steamers regularly calling or pay such a price for transportation as will justify a sailing vessel to come, perhaps partially in ballast, to carry away a cargo of copra.

In this respect the German firm enjoys an advantage, as it does in many other things, for, doing for the country a rather large business and supplying the German men-of-war with coal, it can so adjust its shipments as to offer a vessel a charter both ways, to the great reduction of freight charges. It follows that these advantages of the larger concern tend greatly to continue in a measure the monopoly it once conspicuously enjoyed, to the disadvantage of smaller shippers.

Copra is simply the meat of the cocoanut, dried in the sun, generally by being spread on mats, until the greater part of the watery juice is evaporated. For this purpose the nut is left to thoroughly ripen—that is, until the white flesh, or kernel, which lines the inside of the shell to the thickness of three-fourths of an inch or more, reaches that degree of hardness found in cocoanuts sold at the fruit stands in the United States. At this state all the clear, palatable water which completely filled the interior in the green stage is absorbed.

When a commercial demand for cocoanut oil first sprang up, and shipments were small, it was customary to ship the pure oil in casks, free of the wood or fibrous residuum. It was then bought by the traders direct as oil from the natives, who secured a separation of the oil by allowing the green copra to stand exposed to the sun in canoes—troughs, as it were—until the heat and decay set the oil free to collect at the bottom, to be afterwards strained.

No oil has been so shipped for a great many years, and the one mill set up for extracting the oil mechanically was not a profitable venture. Cooperage could not be had here, and the importation of casks was found too expensive. Then the leakage in a long voyage in wooden packages was found to be very great. For many years the oil cake obtained from cocoanuts met a ready demand from dairymen and small farmers in Europe as a food for cattle, but latterly it has fallen into disfavor, the opinion obtaining that it is productive of derangement, if not of disease. The decline of this use has to some extent affected the price of copra. It was formerly estimated that the sale of the oil cake paid the cost of the freight on the bulk copra.

Marseilles is the principal manufacturing point of cocoanut oil, but large quantities are shipped to Liverpool, to ports on the Baltic, and to San Francisco. The oil is used to some extent by admixture as a lubricant, but its chief use is found in the manufacture of common and medium grade soaps. Its tendency to become rancid—an objection which has not been entirely overcome—is a serious hindrance to its employment in many things, and precludes its use in the manufacture of the better grades of soap, for, free of odor as it may be at first, its pungent rancidity is apt to become soon manifest. The odor of copra, especially when stored in bulk or on shipboard, is of the most disagreeable and nauseating character.

The accepted method of latter years is to plant the cocoanuts in rows 40 feet apart, setting the trees 30 feet in the row. The early planters placed the trees 20 feet apart each way, and many years were required after they came into bearing to show that the planting had been done too closely. The nuts were small and not so abundant as they were on trees scattered widely apart. Taught by this observation, the groves were thinned by cutting away a liberal percentage of the trees, to the considerable improvement of the yield. The cocoanut, of all things, loves the sunshine and free circulation of the air. Indeed, to flourish in perfection it should stand on the outer verge of the shore, its roots striking into the sea water, its branches or palms ever whipped and tossing in the stiff breeze of the trades. It finds its habitat close to the sea, where the salt-impregnated air can reach it freely and in abundance. Like some other members of the vegetable kingdom—for instance, clover—it seems to take a part of the elements of its growth from the air, but that air must be at the high temperature of the tropics and saturated with the salt moisture of the sea. The cocoanut is so much the creature of the sunshine and the sea that it clearly manifests its removal inland in a reduced crop of smaller nuts. The lowlands of the beach on all these islands are more or less covered with the groves, while on the mountains and highlands no tree is found. The smaller size of the trees and the poorer yield are plainly to be noticed on lands at an elevation of from 400 to 600 feet, situated at as short a distance as 2½ and 3 miles from the shore. Standing immediately on the beach, the tree inclines outward over the water; growing inland, it points by its leaning ever in the most direct way to the sea.

The nuts ripen along throughout the year, hanging in pendent clusters close in and around the stems of the palm branches, which spread about on all sides and reach upward from the clustered head forming the top of the tree. The nuts hanging lowest ripen first, the young nuts continually appearing above with the growth of the tree, and so the lower branches wither and dry, falling away as the younger branches push out from above. The body of the tree from the ground to the crown at the top, a distance reaching up from 30 to most frequently 60 and even 80 feet, is smooth and bare like a mere pole supporting a head of nuts and sweeping branches.

The trees come into bearing, in a small way, at the sixth year on suitable soil, and are believed to reach the full limit of production at from 15 to 20 years of age. Many groves known to be 30 and 40 years of age are now bearing in undiminished abundance, and they so continue to do to a great age. Persons who profess to be able to determine the age of trees by the marks left on the bark where the branches have successively fallen estimate in this way that many still vigorous trees are 70 and 80 years of age. Natives who are peculiarly intelligent in so many ways, but who appear to be, for reasons not difficult to understand, peculiarly unable to keep account of time, say that the cocoanut tree will live on beyond a hundred years. In all probability they live to a considerably greater age on the beach lands when the trunk has escaped serious injury.

Springs, while frequently met with, are not abundant, and for fresh water for all purposes reliance is had on the small streams coming down from the mountains. With few exceptions, the natives are not practical or provident enough to provide tanks for the storage of rain water, as is universal among the whites; indeed, the formation and material of the roofs of native houses would make it very difficult to catch rain water from such roofs. As villages are often at considerable distances from natural supplies of fresh water, and as these in the dry months of May, June, and July often become exhausted, recourse is had to a very barbarous method of supplementing the supply of fresh water. Cocoanut trees nearly always incline at an angle more or less oblique. On what may be termed the upper side of the tree, or that opposite to the direction in which it inclines, large cup-shaped notches, similar to those made in the long-leaved pine for turpentine purposes, are cut. With every shower the water trickles down the body of the tree; being caught in these troughs or notches, it serves to fill the cocoanut drinking shells or bottles, the only vessels for holding water they employ; for, except in a few instances, they are slow to adopt buckets or other containing vessels common in civilized life.

The cocoanut tree is capable of surviving a great deal of injury; in fact, it maintains its vigor despite such injuries as would be ruinous to most trees of the temperate climes. Trees are often seen flourishing in undiminished vigor, although notched half through in the way described in two and even three places.

While these unpardonable injuries are sustained without apparent detriment for a long time, they bring about the certain result when the tree becomes old. The surface of the cut becomes decayed, and this, once set in, progresses on into the tree until it can no longer sustain its weight or withstand the high winds of the stormy season. All trees are by no means so injured, but a sufficiently large proportion are thus mutilated in time as to bear manifestly on the total production.

The habit of the cocoanut to reach out over the water seems to be a provision of nature for its propagation and distribution. The nuts, falling into the sea, will float for weeks in the bitterly brackish waters of these tropic seas without injury to the germinating quality. Once thrown upon the warm sands of a beach or tossed by a wave upon the reef above the surface, it soon puts forth its palm from the smaller end, while from the round and larger end the tender roots strike into the soil or decayed coral, as the case may be. Many lagoons which have risen within living memory and which for years remained without sign of vegetation are now covered with the cocoanut, although hundreds of miles from other islands.

The value of the cocoanut is not confined to the single export product, copra. The tree and its products are devoted to many uses. The wood in the green state is very porous and spongy, having consequently a great degree of resistance to rifle shot. In the native wars in the past it was much employed in the building of defensive works. When thoroughly seasoned, it lasts for a long time under ground and is valuable for all purposes for which posts are employed. The oil enters in many forms into the domestic uses of the natives. It forms the basis of all their liniments and emollients in their simple but very rational pharmacopœia. It is used for anointing the body, a practice universally observed and in such a climate by no means so unreasonable as it might appear at the first glance. It has the effect of keeping the skin soft and fine, protecting it from sunburn, which in these latitudes of a vertical sun, without protection, becomes very severe. It serves as well to repel mosquitoes and other small flying insects. Highly perfumed with the odor of the Moso'oi, it is the general dressing for the hair, in the care of which these people are very particular and cleanly, as they are in nearly all matters.

The nut is one of the standard articles of diet. Breadfruit, taro, bananas, and cocoanuts form the staple articles of food, ranking in importance in the order mentioned. The nuts are eaten in the soft, but somewhat tough, gelatinous state, before they reach the woody condition in which they are familiar to the American people, when they are both palatable and exceedingly nutritious. From what has been said, they are, of course, to be had in this state of ripeness at all seasons.

In this condition they enter into the preparation of many cooked dishes, the choicest of which is "palusami," a most delicious preparation. The water of the half-ripened nut, at the state of ripeness mentioned, which so completely fills the cavity that it spurts out on the shell being penetrated at the "eye," forms a pleasant and wholesome drink, ample in quantity and curiously cool. The whole shells, from which all the meat is removed by being left first to decay and then by being shaken a long time half filled with coarse sand, forms the universal water bottle; cut in half, they are made into bowls and drinking cups. The fiber, as has been said, furnishes all the sennet or braided twine and rope for all uses. The leaves of the great branches, which dry rapidly, are used for kindling, for torches in fishing, and a small fire made in a bowl of burned clay set in the floor of every house as a fireplace, when regularly fed with these long and combustible leaves, furnishes the light to the household, of a cheery and attractive kind. Again, the small ends of the long branches are tied together in couples, and, the butts being flat and heavy, they are hung across the combs of the roofs of houses and serve admirably to hold the thatch in place against high winds. These branches by a trick, as it were, are stripped down either side and soon plaited into baskets; treated and plaited much in the same way, they are made into the curtains, or more properly sidings, by which all houses are inclosed and protected.

Were the cocoanut tree by some destructive blight eliminated from Samoa at a stroke, all its export would be at an immediate end, and it would be difficult to see how its domestic life could adjust itself to meet the calamity.

It is generally estimated that an acre of land should yield, when the trees have reached the period of full bearing, about half a ton of commercial copra. As in most other agricultural estimates, in which, it seems, result remains so stubbornly at variance with calculation, this one cannot be reconciled with the crop had from any particular plantation. Still, managers and owners adhere to the estimate and furnish a ready reason when the estimate fails of fulfillment. Green copra—fairly dried and liable to much shrinkage—is worth, and has been for some years past, in spite of a constantly declining foreign market, 1¼ cents a pound when bought from natives. If the estimated production held good, this ought to yield $13.75 per acre; but again the estimate usually places the yield at about $12 per acre, possibly no great difference, as such things go. It will be observed this allows nothing for labor.

Without attempting to reconcile the apparent differences, it is said that a tree is on the average "worth a shilling a year"—that is, yields a profit to that amount. Planting in the manner I have mentioned, an acre would carry about forty-eight trees, and if these yielded the estimated shilling each, or 48 shillings in all, the calculation of $12 per acre profit would be quite well sustained. However the estimates may conflict, however over-drawn they may be, if any—and I am of opinion that, like all similar calculations, they are more encouraging in theory than reliable in practice—they at best do not show a greater profit per acre than with ordinary prices—not those of the past year—may be reasonably anticipated in any of the eastern central States from corn or wheat. As a matter of fact, a very average crop of tobacco, in any of the States growing that staple, would prove more profitable than do the ideal cocoanut groves of the picture islands in the books of travel. True, the trees once planted are producers far beyond the limit of the ordinary lifetime, while the farm crops mentioned are to be laboriously cultivated year after year. On the other hand, many profitless years elapse in waiting for the trees to reach maturity. Even then, in a country where wages are high, because everything else is as well, expense claims a liberal share of the product, for "making copra" is at best a slow and laborious process, although there is but a single planting and no cultivation. Back of all this must be remembered the serious expense of clearing original bush.

Copra is continuously made, as the nuts ripen, from about the middle of April till the middle of October or early part of November—that is, during the dry season—but the making is more active in July, August, and September. Curing could be done, so far as the supply of nuts goes, through the remainder of the year, but the rains, varying from frequent to almost constant, do not permit of drying.

A boy or man, generally the former, with a piece of sennet about 18 inches in length, looped on either foot, will climb the slender, swaying tree with as much ease and rapidity as if it were a ladder. The notched or corrugated surface of the bark, left where branches have in time grown, from the ground up, catches the bit of sennet between the feet, while the weight of the body pressing downward clamps, as it were, the hollow of the ample feet firmly on either side of the trunk. By this means the tree is ascended by a series of jumps, as it were.

In some of the South Sea islands, where onerous taxes are levied in return for the supposed protection afforded by European nations which have annexed them, a boy is accounted as having become a man, liable to the payment of capitation tax, when he is able to climb a tree.

The climber, with a large knife, cuts away the matured nuts which cluster close about the butts of the branches. As they fall they are gathered into piles about the base of the tree. On the plantations they are gathered into panniers slung on donkeys, or into baskets swung on poles borne by two men—after the style in which the tea boxes were carried with ease over the perpendicular mountains by the two little Chinamen on the old blue china of our grandmothers—to be finally piled into great heaps near the copra shed. The nuts are not husked, the thick outer husk having become hard and brown like wood. They are dexterously split in two by an axe and the hard white flesh is more dexterously cut out with a large knife. Nothing remains but to spread it on mats or boards in the sun. When cured it is thrown into a heap in the shed, where it remains until sacked, to be laboriously carried, sack by sack, by wading out to the small boat, which in turn transfers it to the small schooner or cutter lying in deeper water, and from this in turn it is again taken to be stored elsewhere or transferred to the deep-sea vessel for its final voyage.

Copra yields perhaps a greater percentage of oil than any other of the great oil-producing staples, under the modern process, whereby it is mixed with water, heated, and subjected to two pressings, giving as high as 62 and 64 per cent of pure oil.

The cocoanut crop of last year (1894) was by far the largest ever known in the islands; for this, like all other crops, has its unaccountable years of great abundance and those of small production, as little understood. The yield of last year is all the more remarkable when it is borne in mind that the war of 1893, which ended in the deportation of Mataafa, worked a great and barbarous destruction of trees in the western district of this island, known as Aana. The extent of this increase, despite the unfortunate destruction referred to, is illustrated by the fact that while the export of copra in 1891 amounted to 4,842 tons, in 1892 to 4,871 tons, and in 1893 to 4,602 tons, it rose last year to 6,214 tons, an increase of 1,612 tons over the year before—an increase of about 33 per cent over the years 1891 and 1892; yet under the reduced price of late years the larger crops fail to bring into the country as much money as did the far smaller crops of former years.

Copra is bought from the natives, who make and sell it in small quantities, selling as it is made almost entirely for trade—canned meats, biscuits, prints, boat lumber. and other articles suited to their few needs. Cash is rarely paid, but part cash is often paid, and sometimes the price is required in money. In the trading stations in other islands and in outlying districts enormous profits are made; but frequently, the business being small at best, the trader could not subsist or make a profit for his principal, as he is generally an agent, unless such an advance on cost price was made as would be regarded in a town in the United States as prohibitory. In Apia, with its competition of several stores and small dealers, prices are far more reasonable, although they are far from being such as to threaten the dealers with bankruptcy. From the political situation now existing, and which, with mere intervals, has endured for the greater part of three years, the natives of many of the most productive districts dare not come to do their trading in Apia, and hence are thrown back in buying and selling upon the country trader. Of course, in the end all the goods sold and all the copra made comes from or finds its way to Apia, so that from this cause its business is not diminished; yet this condition is distressing for such business men as confine their transactions to Apia. With such houses as are sufficiently extensive to have stations in the hostile districts, which they keep supplied from central stores here, the prevailing situation of affairs is very satisfactory, and it is not unlikely that some of them are well satisfied with it and will not fail, in a quiet way, aided by many advantages, to contribute to its continuance.

Copra buyers pay now, as they have done for a few years past, $1.25 to natives and $1.50 to white men, who sometimes make, but generally buy from natives. The traders insist that the natives bring the copra too green or conveniently overturn the boat that the weight may be greater. To protect themselves against such imposition, as they term it, they have their scales set to keep watchful guard over their interests or are provided with a set of false weights—generally the latter—for the natives watch the weighing with keen eyes, sharpened by sad experience. I have heard this practice warmly defended; but it should be said there are some honorable exceptions.

Recently in a trial had in the supreme court between a firm of this place and one of their agents it was shown that the firm had furnished the agent, along with the scales, a set of correct and a set of false weights. This did not seem to excite surprise or unfavorable comment, while the revelation of the fact was regarded as amusing.

The increase in the American consumption of copra is very gratifying. None was shipped to the United States in 1891 or 1892. In 1893 the value of copra shipped to San Francisco amounted to $1,259; in 1894 to $30,400, and the declared value of that shipped to the same port for the year ended June 30, 1895, was $45,486. Every steamer for the last-named port now takes a shipment. Consignments by this steam transportation are made at a high freight rate. But one sailing vessel has cleared from this port for any American port in a year. By far the greater importations into these islands come from the Australasian colonies, many reasons combining to produce this result. Were there sufficient outward traffic from San Francisco to employ sailing craft, such vessels could afford to carry copra on the return voyage at such a rate as would largely increase the shipments of Samoa's only export to America; for steam rates on so bulky an article over so long a distance approach the prohibitory.

The latest advices (1895) from Liverpool quote copra at $52.50 per ton. This is thought to be too low commercially, and a recovery is expected to $58 or $60 per ton, and these latter figures are thought to fairly represent the present real value. The price has never before reached so low a figure. During 1870–'71 the price was about $115; as late as 1880 it was from $75 to $85; since which time, with occasional recoveries, it has continued to decline until it reached the figures stated.

The freight to England is about $12.64½ per ton; to San Francisco, to which shipments are beginning to be made, $10 by steam and from $6 to $8 by sail, when the few opportunities occur. From Ceylon and places similarly situated charters can be had for at least half these rates. In the era of high prices

$25 and $30 per ton carriage was freely paid, and the price paid by traders in Apia was 2½ to 2¾ cents per pound in buying.

But since 1878 seventeen years have elapsed. During all these years thousands of trees then not planted have come to maturity and are bearing, and thousands of those then in early bearing have greatly increased their yield. As has been said, the crop of last year (1894) was the largest in the history of the islands, amounting in all, as stated, to 6,214 tons, and yet an official report made to the United States Government in 1878 gives the export for that year as 6.775 tons, when in fact it could have been not greatly in excess of half that quantity. The same report estimates the cotton crop at 2,300 bales. Such is a sample of the unreliability of the statistics which have so misinformed the world as to this group; upon such unstable foundations rest so many of the roseate theories as to their future.

THE MODERN MISSISSIPPI PROBLEM

By W J McGee

The great river of the continent has been the object of intelligent inquiry for a century, and of scientific investigation for half as long. The earlier inquiries related chiefly to the river as a medium for inland navigation, and the problem of interior water transportation in America has wrought itself out largely on this river with its principal tributaries. The history of the solution of the problem is significant in its bearings on future industry and commerce.

The canoe of the Indian and the pirogue of the pioneer were followed by the scows or "flatboats" which marked the introduction of real commerce by means of the river; and before the introduction of steam the custom grew up of building "flatboats" along the upper waters, lading them with coal, grain, and other produce, floating them with the current to New Orleans, and there abandoning them, while the shippers returned overland. About the end of 1811 the first practical steamboat on the waters embouching through the Mississippi suffered disaster during its first voyage in consequence of the New Madrid earthquake; but the utilization of steam power proceeded rapidly, and within a few years steam navigation was established and the river became a route for numberless craft carrying freight and passengers against the current nearly as rapidly as with it. Thus began the palmy period of the Mississippi as a line of commercial activity; towns were planted on the upper river and along the Ohio, and especially below the confluence; Columbus, Hickman, Vicksburg, Grand Gulf, Natchez, Bayou Sara, Port Hudson, and a dozen other towns whose names are half forgotten, sprang up along the riverside and promised to become metropoles, while the passenger packets became floating palaces, representing the acme of luxury in American travel. Knowing nothing better, merchants and shippers were content to endure the interruption of traffic by floods, and were too dazzled by glowing anticipations to note the building of bars between their warehouses and the main channel or the undermining of their town-sites by the ever-shifting stream. Then came the locomotive and railway, affording the means of swifter and surer transportation, and the river commerce began to wane, relatively if not absolutely; a third of the river towns were deserted by the stream, a quarter were invaded by the current, and only a third or a quarter were reached by the railways and permitted to thrive under the new conditions. For a time the river held the balance of power between rival lines and modes of transportation, and thus controlled tariffs (indeed this is in some measure true today), but successively larger and larger shares of the traffic were diverted. Recent statistics show that there is still a considerable transportation of coal, grain, and other bulky and indestructible commodities by the river, though the ratio of river carriage to rail carriage is steadily decreasing; today the flourishing river towns are also railway towns, and depend primarily on land transportation for their commercial supremacy; today the old-time floating palace is but a memory, and today only two, or five, or possibly ten packets pass the point where twenty passed a quarter-century ago.

Meantime the inquiries concerningthe great river have changed. Today the practical importance of the lower Mississippi lies in its fertile bottom-lands and in the agricultural and commercial industries which they support; and since these are affected by floods and other fluctuations of the river, the water stages have become paramount as subjects of investigation. The researches concerning the regimen of the river began while it yet retained prime importance as a navigable waterway, and yielded one of the earlier scientific classics of America in the monograph by Humphreys and Abbot, issued in 1861. These hydrologists were concerned chiefly with normal conditions rather than abnormalities, with means rather than extremes; and their masterly treatise remains the guide of students throughout the world. The principles developed by them were subsequently discussed and applied by an important federal commission; while the problem of maintaining an open passage from the river to the gulf for vessels of deep draft was solved experimentally by Eads in a manner eminently satisfactory to long-distance commerce. As the vast and fertile bottom-lands attracted the planter they were gradually reclaimed, the plantations extending quite to the river banks; and to meet local and temporary needs (at least in part in every case) the natural levees built by the river were raised artificially to protect plantations and towns. These levees interfered with the natural regimen of the stream in some measure; they checked the annual flooding of the bottoms, such as has enriched the valley of the Nile, and at the same time prevented the river from shifting to the lower grounds as its bed was built above the level of stability; in short, they initiated the transformation of the waterway from a natural river to an artificial canal. A direct and evident consequence of the change was to render the floods more disastrous when the stream burst its partly artificial barriers, and this led to a demand for building the levees higher and higher and extending them further and further along its banks; it also led to recognition of the importance of floods as agencies affecting the material development of an extensive and rich section of the country. So the burning problem of the Mississippi today is not that of navigation, not even that of normal regimen as a great river, but that of the floods to which the stream is subject.

Accordingly certain recent researches of the Weather Bureau are most apposite and timely.* The report in which they are made public is a straightforward and largely statistical presentation of the facts pertaining to the floods of the Mississippi, especially the notable flood of 1897. The material is arranged in four sections. The first relates to "The River and Basin," and sets forth the physical characteristics of the entire watershed as ascertained from various sources. The second section treats of "Normal Precipitation and Drainage" throughout the basin as determined from the records of the Weather Bureau, which comprise practically all the meteorologic observations extant. Then

* Floods of the Mississippi River. Prepared under direction of Willis L. Moore, Chief of Weather Bureau. By Park Morrill, Forecast Official in Charge of River and Flood Service (U. S. Department of Agriculture, Weather Bureau. Bulletin E). Washington, 1897. 4°, pp. i–vi + 1–79, pls. (i, ii unnumbered +) 1–58.

follows "The River in Flood," in which the relation between precipitation (including the fall and melting of snow) in every part of the basin and the ensuing floods is discussed quantitatively. The fourth section deals with the "Spring Flood of 1897," and applies the principles and relations developed in the more general discussion. The text is amply illustrated by means of charts and diagrams. The discussions are brief, deductive in character, and limited to exposition of the facts recorded; they do not (perhaps unfortunately) extend to the consideration of the levee problem, or to that gradual increase in the frequency and height of floods indicated by the figures—especially those of table xviii, pages 34–37—and undoubtedly attending the heightening of the levees, whether as cause, as effect, or fortuitously—indeed hardly a word appears in the report concerning that association of levees and floods which constitutes one of the important American problems of the day.

The carefully drawn flood-map (plate 2) is especially interesting in view of the disasters still in the minds of patrons of the press; and it is interesting to geographers as giving a bird's-eye view of features recording stages in the development of the region. Among these may be noted the linear arrangement of alluvial belts, especially in the upper third of the embayment, an arrangement strongly suggesting the initiation of mountain corrugation; also the lifted area about New Madrid, which was heaved some twenty feet above the general level of the bottom during the earthquake of 1811–'13; and, too, the diversion of the flood from the course of the river in large districts.

OUR FOREIGN TRADE

Every nation, just as every individual, finds it necessary to sell some of its own products and to purchase others from foreign nations. Some nations find it necessary to purchase more than others, since some produce only a few articles, while others produce almost everything they require. Thus Australia produces mainly mutton and wool, and finds it necessary therefore to exchange these for other necessities of life. On the other hand, the United States, which has a wide range of climate, produces most of the commodities which her people require, and her foreign trade is therefore by no means as great in proportion to her population as that of many other countries.

During the fiscal year 1896–'97, the sum of her exports and imports had a value of 1,816 million dollars. Large as this sum is, it is small compared with the foreign trade of the United Kingdom, France, or Germany. Of this great sum, 765 millions, or about two-fifths, were imports. The difference between them, the "balance of trade," was in our favor to the extent of not less than 286 million dollars. In other words, we sold 286 million dollars' worth more than we bought. The principal articles which were sold were cotton, wheat, meat, petroleum, tobacco, and manufactured goods. Those purchased were mainly sugar, coffee, and manufactured goods.

In carrying on this enormous traffic the port of New York plays by far the most important part. Just about one-half of our foreign traffic passes under the shadow of the Goddess of Liberty on Bedloes island. Two-thirds of our imports and more than one-third of our exports pass through New York. That city is probably the most important seaport in the world, for to this foreign trade is to be added a much larger amount of domestic trade by sea.

Next to New York in foreign trade is Boston, which receives one-eighth of the imports and sends out one-tenth of the exports of the country. New Orleans holds the next place. Although she receives but two per cent of the imports, she sends out ten per cent of the exports, which consist mainly of cotton. Philadelphia is fourth in rank, with six per cent of the imports and four per cent of the exports. Then comes Baltimore, which, though she receives but one per cent of the country's imports, sends out eight per cent of her exports. On the Pacific coast San Francisco is the only port which as yet has any prominence in foreign trade, and her share in it is but four per cent of the exports and imports. The Atlantic and Gulf coasts take about seven-eighths of the entire trade, and the Pacific coast only about one-sixteenth, an amount equal to that of the Great Lakes.

H. G.

THE PRESIDENCY OF THE NATIONAL GEOGRAPHIC SOCIETY

At a meeting of the Council of the National Geographic Society, held December 31, Prof. Alexander Graham Bell, LL. D., etc., was elected President of the Society.

GEOGRAPHIC LITERATURE*

Eleventh Annual Report of the Interstate Commerce Commission. Advance copy without appendices. Pp. 150. Washington: Government Printing Office. 1897.

It was to be expected that the first report of the Interstate Commerce Commission issued after the rendering of the recent far-reaching decisions of the Supreme Court would be an interesting one, and such it proves.

The Interstate Commerce Commission has never claimed rate-making authority, but from its organization until early in 1897 it acted in accordance with the belief that when the legality of a rate, established in the first instance by a carrier subject to the act to regulate commerce, had been questioned by those interested, and the issue determined adversely to the carrier upon facts and arguments brought out during a formal investigation and hearing, of which both parties had had suitable notice and at which they had had opportunity to introduce testimony and cross-examine witnesses, it then became its duty, not merely to declare the particular rate excessive or unreasonable, and consequently unlawful, but, in addition, to decide what rate would be right, and subsequently to enforce, in the manner provided in the law, the latter rate. Congress, it was supposed by the Commission, had by implication granted this power as a necessary incident of express authority to execute and enforce an act requiring that all rates shall be reasonable and just. In a decision rendered during May, 1897, the United States Supreme Court declared this to be a misconception of the purpose and meaning of the act, and that Congress did not confer upon the Commission the limited authority to prescribe future charges which it had supposed itself to possess. Accepting this interpretation, the Commission believes that the same rule will be found, when occasion arises, to leave that body without authority, in the absence of amendatory legislation, to enforce any order to prevent unjust discrimination or undue preference in the future. The result is thus stated in the report:

> "The other sections and provisions of the law are in aid of and were intended to make effective the first three sections, which relate to and were intended to make unlawful and to prohibit unreasonable charges, unjust discriminations, and undue preferences; and without authority to make these three sections effective in the future practically all the Commission can do toward executing and enforcing the vital provisions of the act is to inquire into wrongs done in the past and report the result of its investigation to itself."

The inadequacy of so restricted a remedy for the evils incident to current methods of railway rate-making is obvious. The farmers who produce grain, cotton, live stock, and other commodities entering largely into interstate commerce are not as a rule shippers. They sell to dealers upon the basis of current rates, whether reasonable or the reverse, and the latter are the actual shippers. If the reasonableness of previous charges only may be investigated, the remedy is necessarily limited to the collection of damages representing the difference between the rate actually charged and that which would have been reasonable and just. The only person in a position to collect these damages would be the one who had made the actual shipment, and to whom, having bought upon the basis of the rate paid, the amount collected would constitute an additional and unreasonable profit.

In the "Louisville and Nashville case," one of the earliest decided by the Commission, it was declared that the dissimilar circumstances justifying a higher charge for the short than for the long haul, under the fourth section of the law, might exist, (*a*) as a result of the competition of carriers by water; (*b*) as a result of competition by carriers not subject to the interstate commerce law; and (*c*), in rare and peculiar cases, as a result of competition of carriers subject to the law. Subsequently it was laid down that if the rate for the longer haul was controlled by unregulated competition, the carrier might make a lower charge, to meet such competition, without application to the Commission; but where the justifying competition alleged to exist was that of carriers subject to the law, application must be made to the Commission for permission to promulgate the lower rate, under the proviso permitting the Commission in special cases to make exemption from the general rule of the long and short haul clause. During November, 1897, the Supreme Court of the United States decided that competition of railway carriers subject to the act must be considered in cases arising under the fourth section, and that where it exists sufficiently to constitute a controlling force the circumstances are dissimilar. If therefore the Commission find the existence of such competition to a controlling degree, the rule of the fourth section is inapplicable. The Commission is apparently of the opinion that this construction practically eliminates the long and short haul clause from the law.

The Commission frankly acknowledges that its members are unable to agree as to the wisdom of authorizing pooling contracts. "A majority," says the report, "think it must occasion some improvement in the rate situation at almost all points, and that it might altogether amend it at many points." Though reminding the public that whatever beneficial results pooling may accomplish must be secured through the restriction of competition, a majority of the Commission are inclined to recommend that the experiment, surrounded by suitable safeguards, be tried. Something, it is admitted, must be done, and the insistence of the railways, whose officers are in a situation wisely to judge, that this is the proper remedy is entitled to careful attention. Protest is entered against the practice, akin to special pleading, of quoting a single sentence from some report of the Commission as evidence of an opinion favorable to pooling. The Commission is unanimous that to reverse the effect of the "Trans-Missouri decision," to repeal the anti-pooling clause and enact in its place a pooling bill, would be little better than a crime against the people, unless at the same time the Commission or some other tribunal was invested with adequate powers of supervision and control. The following paragraphs are important enough to be given in full:

> "It should be further said that, while a majority of the Commission have felt that it would be wise to adopt the remedy suggested by the carriers in the present emergency, we do not admit that Congress is altogether powerless to correct this evil without the adoption of that means. The difficulty with enforcing the present law is not in its criminal features, which, with some slight changes, are well enough and strong enough, but in obtaining evidence of violations of that law. When those who have knowledge of what is actually done are put upon the witness stand, they refuse to disclose the truth."
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> "Since these witnesses will not state the fact as it exists, some means must be provided of otherwise ascertaining that fact. So long as these gentlemen refuse to tell, it is necessary to provide a way by which the Government can find out for itself. If the interstate carriers of this country were compelled to keep their accounts in some prescribed form, and if the agents of the United States had the right at any time to inspect those accounts, or to take charge of one or more of the stations of a carrier when so advised, the effect must be to greatly diminish these practices. This kind of supervision would be no more rigorous than that under which national banks now exist."

The report also discusses the work of the Commission during the current year, uniform classification of freight, through routes and through rates, procedure in the courts on applications for the enforcement of the orders of the Commission, railway statistics, and other matters of importance. Previous recommendations in regard to legislation on these subjects are renewed. Attention is called to the recommendation of the Statistician in regard to the establishment of a bureau of railway statistics and accounts, and to the endorsement of the plan by the latest convention of state railroad commissioners. H. T. Newcomb.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1897–'98

Special Meeting, November 12, 1897.—Vice-President Greely in the chair. Dr Sheldon Jackson gave an illustrated lecture on Alaska: a Trip to the Yukon and Klondike Gold Fields.

Excursion to the Naval Observatory, November 13, 1897.—Saturday evening excursion to the Naval Observatory by invitation of Commander Charles H. Davis, U. S. N.; attendance, about 400. Reception by the Superintendent and officers in the library. Parties were formed, in charge of officers and assistants, to visit the various departments and inspect the instruments and the magnetic observatory. On the return, the members and their guests called at "Twin Oaks" to pay their respects to President Hubbard, who had been prevented from attending the meeting by indisposition.

Regular Meeting, November 19, 1897.—Mr Henry F. Blount in the chair. The report of the committee appointed to audit the accounts of the

Treasurer was read and accepted. Papers were read, with lantern illustrations, by Mr Arthur P. Davis on The Pollution of Potomac Water, its Sources and Extent, and on The Effects and Remedies, by Passed Assistant Surgeon E. K. Sprague, of the Marine Hospital Service.

Special Meeting, November 26, 1897.—Mr W J McGee in the chair. Mr W. H. Holmes, of the National Museum, gave an illustrated lecture on The Ruined Cities of Yucatan.

Regular Meeting, December 3, 1897.—Mr W J McGee in the chair. Papers were read by Mr F. W. Hodge, of the Bureau of American Ethnology, on Acoma and the Enchanted Mesa, and by Dr Walter Hough on Indian Medicinal Plants of the Southwest. The first paper was illustrated by lantern slides.

Special Meeting, December 10, 1897.—Vice-President Greely in the chair. Professor E. A. Grosvenor, of Amherst College, gave an illustrated lecture on The Greek and the Turk: the Product of Geographic Environment.

Elections.—New members have been elected as follows:

November 13.—C. F. Frederick Adam, S. M. Becker, R. G. Campbell, Dr O. F. Cook, Miss Amelia R. Charles, L. A. Coolidge, R. B. Dashiell, U. S. N., Assistant Naval Constructor David G. Fairchild, Edward M. Fowler, George R. Ide, Miss Mary E. O'Connor, Lieut. J. G. Ord, U. S. A., Hon. Ellis H. Roberts, Alfred G. Safford, John Sherman, Dr Andrew H. Smith, Mrs Sterling H. Smith, Walter T. Swingle, Mrs Horatio N. Taplin, Miss Marion Thatcher, Mrs Julia C. Townsend, Rev. D. C. Weston, D.D., J. W. Witten, J. E. Woodman.

November 24.—Mrs E. F. Adams, Albert Carry, Dr J. B. Gregg Custis, Hon. J. L. Davenport, Miss Adelaide Fuller, Mrs E. C. Hobson, Miss Annie E. Johnston, Rev. R. H. McKim, D.D., John Meigs, Jr., Gen. J. K. Mizner, U. S. A., Mrs W. H. Osborn, Mrs M. C. Peabody, J. A. Pitman, George W. Rouzer, Dr E. K. Sprague, S. Sugenheimer, Mrs Adelia L. S. Thombs, Miss Ellen A. Vinton, Sanford N. Whitwell.

Portuguese East Africa. A concession has been granted for the construction of a railway from Beira to Tete, with the object of developing the Tete coal-fields.

British Central Africa. The trade of Chinde, the port of British Central Africa, at the mouth of the Zambesi, is said to be increasing rapidly. Chinde is now in direct telegraphic communication with Zomba and Blantyre.

Transvaal. The Industrial Commission reports that during 1896 out of the 183 gold mines in the Transvaal 79 produced gold to the value of £8,603,821. The remaining 104 produced no gold, most of them being merely in process of development. Only 25 companies declared dividends, the aggregate amount thus paid being £1,718,781.

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FEBRUARY, 1898 No. 2

The National Geographic Magazine

AN ILLUSTRATED MONTHLY

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THE

National Geographic Society

ORGANIZED, JANUARY, 1888

SECRETARY'S OFFICE

Room 55, Ohio Bank Building, Twelfth and G Sts. N.W., Washington

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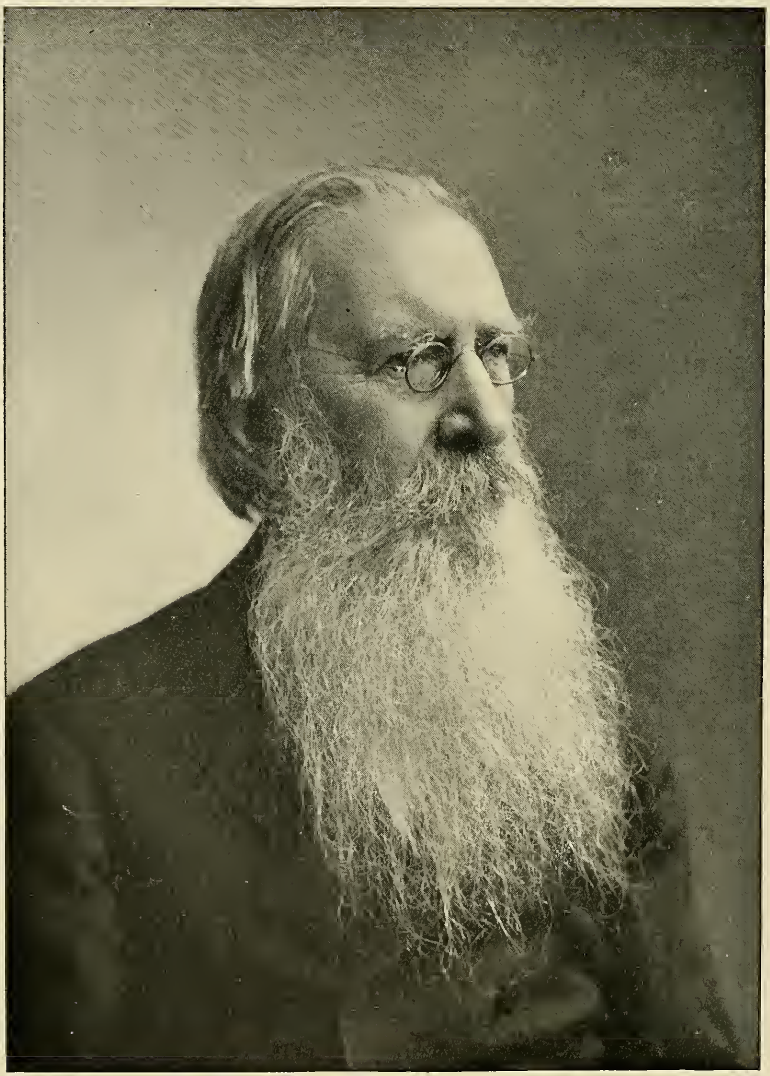
The National Geographic Society, the object of which is the increase and diffusion of geographic knowledge, has a paying membership of 1,500. Its membership is not restricted to practical geographers, but is open to any person in good standing who may be sufficiently interested in its work to seek admission. The annual subscription is: for active members, $5.00 per annum; for corresponding members, $2.00 per annum. Active members pay also an entrance fee of $2.00 on election. The National Geographic Magazine is sent regularly to all members, both active and corresponding.

Donations for the founding of Prize Medals and Scholarships are respectfully solicited.



Gardiner Greene Hubbard

THE
National Geographic Magazine

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GARDINER GREENE HUBBARD

An Address delivered at the Memorial Services held at the Church of the Covenant, Washington, D. C., December 13, 1897,

By Rev. Teunis S. Hamlin, D. D.

Our Capital city has lost its first citizen in civil life. The country and the world have lost a benefactor. Science, art, invention, discovery, the legal profession, philanthropy, broad-minded and generous culture, intelligent and refined hospitality are distinctly impoverished. Friendship of a pure, unselfish, persistent sort will miss a noble exemplar. Family life of the ideal type will have one less illustration among us. We are all personally bereaved today, and feel it our right to mingle our sorrows even with the more intimate grief of kindred, as we gather here to pay our last tribute of respect, reverence, and love.

Gardiner Greene Hubbard was descended from an educated and gentle ancestry on both sides for many generations. Physically, mentally, and morally his heredity, and so his personal nature, were of the best. He was born in Boston August 25, 1822. His father, Samuel, an alumnus of Yale and a doctor of laws from Yale, Dartmouth, and Harvard, was an accomplished lawyer, and during his last years a member of the Supreme Court of Massachusetts. His grandfather, William, was a successful merchant. Back of this the family is English, its first representative in America being William Hubbard, a graduate of Harvard in 1642; pastor for 38 years at Ipswich, Mass., and historian of New England. His mother, Mary, was the daughter of Gardiner Greene, of Boston, one of the most prosperous and eminent men of his day.

After careful preparation at the then, as now, excellent Boston schools, Mr Hubbard took a full course at Dartmouth in the class of 1841, and at once entered upon the study of law at Cambridge.

Admitted to the bar in 1843, he entered the office of Benjamin R. Curtis and remained with that eminent firm until its head came to this city to take his seat upon the Supreme Bench of the United States. For twenty years he practiced his profession in Boston and for five years longer in this capital, to which he was drawn by considerations of health and by our salubrious climate. It is so long since Mr Hubbard laid down his profession (almost twenty years) and he has since become so eminent in so many other activities that his real greatness as a lawyer has become obscured; but he was thorough in this as in all else. He was associated with Webster and other great men in many notable cases. Both Dartmouth College and Columbian University gave him a doctorate of laws. Had he devoted himself till life's close to his first pursuit he would have made and held a place among the leaders of the American bar.

Mr Hubbard very early evinced the far-sighted enterprise and the broad and active public spirit that characterized him to the last. Fixing his residence in Cambridge, he threw himself at once into all its municipal interests. He became president of the company that built the first street railroad in this country outside of New York city—that, namely, between Cambridge and Boston. He was for some ten years a member of the State Board of Education of Massachusetts. In 1860 he was led by the result of serious sickness in one of his own children to carefully investigate the possibility of teaching deaf mutes to speak. The idea had originated in Germany and been successfully applied in a few cases; but it remained for Mr Hubbard to make this, like several other things lying dormant or inefficient, widely or universally available. Convinced by personal study of what might be accomplished, and with an object-lesson before him in his own household, he gathered a half dozen pupils, employed a teacher, and opened a school in Chelmsford, near Boston, to which he was a most generous contributor for several years. Meanwhile he applied to the legislature for a charter only to be met with doubts, and discouraged as a visionary. But he persevered; took the pupils of his school, and even his own little daughter, before a legislative committee to demonstrate his success; and finally secured the founding of the Clarke school at Northampton, the best of its kind in the world, which he organized, of whose board of trustees he was the first president and a member till his death, and which, in telegraphing its condolence, says it "recognizes an immeasurable loss." In this great achievement Mr Hubbard opened the benefits and delights of language and of association, on practically equal terms with their fellowmen to a multitude that had hitherto been doomed to live apart and to miss many of life's sweetest joys. His keen interest in this work never lagged, and he has for many years been first vice-president of the American Association to Promote the Teaching of Speech to the Deaf. This alone would entitle him to be called a benefactor of mankind.

These services, together with his high standing as a lawyer, and his very efficient labors as a commissioner from Massachusetts to the Centennial Exposition at Philadelphia, had given Mr Hubbard a national reputation; and in 1876 President Grant appointed him chairman of a special commission to investigate the entire question of railway mail transportation. His work here was characteristically thorough, and is to be chiefly credited with the present excellent condition of that important branch of the public service. From that time distinguished political preferments have been repeatedly offered him; but though the compliment was fully appreciated, the offer was always declined, since he believed independence of action to be best, both for himself and for the causes that he loved, and aimed to promote. During his residence of nearly a quarter of a century at this Capital he has been the trusted friend and counsellor of Presidents and statesmen, and has exercised a strong, if indirect, influence upon national and international affairs. He was a wise and staunch friend of arbitration. He believed that the Government should use its post-offices as telegraph stations. He was vitally interested in the free library of this city. He had long urged what is just now happily coming anew to the front, the establishment here of a true national university upon the lines drawn by Washington. He was an active and efficient trustee of the Columbian University. He cherished the keenest interest in his Alma Mater; was president of her Alumni Association in this city, and provided a lectureship at the college which is filled by his close and cherished friend, ex-Senator Dawes. President Tucker says: "The college honors the memory which has become a part of its lasting possessions." He was a regent of the Smithsonian Institution, and eminently fitted to be, for he was committed mind and heart and soul to "the increase and diffusion of knowledge among men."

And so, while not himself a specialist in science, Mr Hubbard became a promoter of science, and in a remarkable degree a friend of scientists. He felt a hearty and honest pride in our city's leading position as a scientific center in this country. Every earnest student of science was sure of his sympathy and encouragement. Nowhere outside of his own household will he be more missed than in the goodly scientific fellowship here, as nowhere has he been more honored and beloved. It was this fondness, probably, that led him to cast such a wealth of thought and labor into the National Geographic Society, the beloved child of his old age. He carried it daily upon his heart. He planned for it constantly. He was never too busy or too weary to consult and act for its welfare. He had willing and efficient helpers; but no one will be more quick than they to say that the President made it what it was, easily the leading organization of its kind in the United States. The estimation in which he was held among the scientific men of the National Capital is shown by the fact that he was thrice elected President of the Joint Commission of the Scientific Societies of Washington, and held that honorable position from the formal organization of the Commission in 1895 until his death.

But, if not a technical scientist, Mr Hubbard's intense sympathy with science was supplemented by a wide and far from inaccurate knowledge. He was a close student of the electric, or magnetic, telegraph, and the late president of the Western Union Company said he had done more than any other man to make the service of that great corporation popularly available. His capacities in such directions were widely recognized, and for many years he was first vice-president of the American Association of Inventors and Manufacturers. One of his last labors was filling the semi-scientific position of Commissioner of Awards at the Tennessee Exposition. At the cost of immense care and very wide and protracted correspondence he formed his jury of fifty experts, and then spent three busy weeks in Nashville in directing and supervising their labors. So highly was his work appreciated that when death came there lay upon his desk an invitation to do the same thing next year at Omaha.

It was this scientific leaning, combined with a fine commercial talent and matured business judgment, that enabled him to render to the telephone that inestimable service by which, perhaps, he will be most widely known and longest remembered. In no sense its inventor, Mr Hubbard's unfaltering faith in its possibilities fitted him to take this product of the splendid genius of his son-in-law, Professor Bell, and make it practicably available and commercially profitable. When the invention—one of the greatest of the century—was to all intents and purposes complete, it had brought with it an enormous task. "A new art was to be taught to the world, a new industry created, business and social methods revolutionized." Mr Hubbard was the man for the hour. "It does speak," cried Sir William Thomson; and Mr Hubbard added, "I will make the world hear it." He did. What men thought a toy he showed to be a machine of price-less value. He brought it into hourly use in this country, in England, on the continent of Europe, organizing the International, Oriental, and other companies, until, in less than a quarter of a century, it is conveying thought in every civilized language, and has become, more quickly than any other invention of history, a necessity of daily life and an untold blessing to mankind.

But this man of tireless energy and exhaustless capacity for varied enterprises does not diminish upon a closer view. He recognized his obligations as a citizen of this Capital, and met them promptly and well. He was governor of the Society of Colonial Wars in the District of Columbia. It was represented to him that the city should be made interesting and attractive by preserving some of its most notable historic houses, and suitably marking its historic sites. Instantly his mind assented and his heart was enlisted. He gave himself with ardor to the forming of the "Memorial Association of the District of Columbia," and it is largely through his efforts and influence that the Congress has purchased the house in which Mr Lincoln died and set it apart as a perpetual shrine of patriotic pilgrimage. He dispensed a generous and refined hospitality, not only or chiefly for his own pleasure—though he keenly enjoyed good society—but also because he recognized the duty of a suitable welcome to the city's and the nation's guests. It is many years since any man of distinction for real merits or valuable services has come to Washington without finding himself seated at Mr Hubbard's table, and among guests whom it was a pleasure and an honor to meet. He read the best books; and, while evincing no special talent as a writer, he had a fine literary taste and was a judicious and kindly critic. He had a passion for art, especially for etchings and engravings, in knowledge and appreciation of which he was a rare expert, and his collection is one of the finest in this country. Seldom was he seen to better advantage than when showing these treasures to some appreciative friend, when his fine face would beam with pleasure and his deep eye scan afresh every detail of beauty that he knew and loved so well.

Mr Hubbard was a man of marked purity of life, to whom a stain of any sort seemed utterly foreign. No one would have ventured upon coarseness of word or act in his presence. He was intensely conscientious. He was unselfish, willing to accept the efficient result of his labors, and let others get the praise. He could not be roused to resentment, and was often silent when friends thought he should speak and claim his rights. He served his fellowmen not only in the great ways already noted, but with unstinted gifts of thought and sympathy, and, if need be, of money, in quiet, unmentioned ministries; and he served them also with what is by no means easiest to give—steadfast friendship. The number is very large of young men, and men not so young, whom Mr Hubbard drew to him and who regarded him as more than friend—as almost father. This single fact is one of the finest tributes possible to the beauty and strength of his character. His family life may hardly be mentioned here; but it is no intrusion to name what all who entered his beautiful home witnessed—a chivalrous, conjugal devotion and a tender love for children and grandchildren, most delightful to see, and that have now become sacred and blessed memories.

Mr Hubbard's love for this church was intense and unfailing. During the second year of its existence he succeeded Mr Justice Strong as president of its board of trustees and still held the office at his death. He served upon its building committee and builded his best thought and devotion into its walls. He planned and labored to have it minister to all that is high and pure and elevating for the community; and one of his latest wishes was that this fine organ should be used freely to give pleasure to the music-lovers of the city. Of his inmost religious experiences we may not speak too freely, for he himself was reticent about them. He confessed Christ in his early manhood in Boston under the ministry of the celebrated and godly Dr Edward N. Kirk, and later removed his church membership to Cambridge, whence he never brought it to this city. He was not clear about some points of metaphysical theology, and was too conscientious to do what would seem to commit him to anything that he did not fully believe. He was reverent, devout, sincere, aiming each day to shape his life on the plan of fidelity to his noblest ideals, to man and to God.

It is a unique life that has thus been led among us and that has now, amid universal grief, though as one has said with "exultation" in what it has been and has accomplished, sunk peacefully and gently to its close. One of the most competent judges writes: "When I say that I regarded him as the most useful citizen of Washington, I cannot say more of any man." What high and noble phase of the life of our city is not the poorer for his going, but also the richer for his having lived among us? What that is purest, truest, sweetest, most broad-minded, most generous-hearted, did he not illustrate and adorn? Man of faith and of action, scholar, lover of art, patriot, cosmopolitan, true friend, tender husband and father, who didst always live with thy face to the sun-rising! "Good night; and flights of angels sing thee to thy rest."

GARDINER GREENE HUBBARD

Memorial Meeting, held in the City of Washington, January 21, 1898,
Prof. Alexander Graham Bell, LL. D., President of the
National Geographic Society, presiding

ADDRESSES

President Bell: A familiar face has departed from among us, and the place left vacant we cannot fill. The President of the National Geographic Society, the Honorable Gardiner Greene Hubbard, died December 11, at his home, Twin Oaks. He himself arranged for this meeting to commemorate the tenth anniversary of the founding of the National Geographic Society, and it has seemed peculiarly appropriate to the Board of Managers that it should be made also a memorial meeting to himself.

On behalf of the National Geographic Society, I desire to extend a very cordial welcome to the representatives of other scientific societies who are present with us on this occasion, and to the many personal friends of Mr Hubbard who have honored us with their presence.

Of the many letters of regret that have been received from gentlemen unable to attend, I will read but one. This letter is from the Executive Mansion, dated January 21, 1898. It is as follows:

"My Dear Sir: I beg leave to acknowledge the courteous invitation to attend the memorial meeting in honor of the late Gardiner G. Hubbard, to be held under the auspices of the National Geographic Society, at the First Congregational Church this evening.

"The President wishes me to express his sincere regret at his inability to be present at this meeting, as he would have been very glad to join with Mr Hubbard's friends in paying tribute to his high character and the commanding influence of his noble life.

(Signed) John Addison Porter,
Secretary to the President."

A large number of telegrams have also been received, but I shall read only the following cablegram from the Honorable Andrew D. White, Ambassador to Germany, who sends this message:

"I unite in very affectionate tribute to Mr Hubbard, a faithful friend, patriotic citizen, devoted public servant, and true man.

(Signed) Andrew D. White."

It will not be my place to speak to this assemblage of the interest and the work of Mr Hubbard in connection with the National Geographic Society, as that will be done by one far more competent, Gen. A. W. Greely. Mr Hubbard's heart has for many years been especially devoted to the Geographic Society. His last thoughts were of this Society and of this meeting, the tenth anniversary of its foundation. So peculiarly wrapt up in this Society was he that his family entrusted his remains to its

Board of Managers, the members of which personally carried his body to the grave.

Mr Hubbard was a man of large views. I know of no man who could take so broad a view of things as he could or who was so well fitted to occupy the position to which he was elected in this city, and which he esteemed above every other honor of his life, the position of President of the Joint Commission of the Scientific Societies of Washington. His views were not confined to narrow horizons. Without making any claim to be a specialist in science himself, he had an exceedingly clear conception of the relations of the sciences one to another, and he was therefore admirably fitted to be the president of such an organization as the Joint Commission. We who are more especially identified with the National Geographic Society feel that our friend and leader has been taken from us, and I know that in the Joint Commission a similar feeling is expressed. I will call upon Gen. George M. Sternberg, Surgeon-General of the United States Army, who is Acting-President of the Joint Commission of the Scientific Societies of Washington, to speak to us on behalf of that body.

Surgeon-General STERNBERG: It is my privilege to pay a brief tribute to the memory of my departed friend and late associate upon the Joint Commission of the Scientific Societies of Washington, Mr Gardiner G. Hubbard.

Mr Hubbard was elected President of the Joint Commission at a time when this organization was in a state of unstable equilibrium, due to differences of opinion as to the nature and extent of the powers which should be conferred upon it by the several societies whose governing boards constituted its membership. He looked upon it as an organization which, properly directed, might accomplish useful results in the diffusion of scientific information and which would prove a bond of union between the scientific societies of Washington and enable them to act together in matters of common interest. These objects commanded his sympathy and active coöperation, and from the time of its reorganization with increased membership and extended powers, in January, 1895, to the day of his death Mr Hubbard was the president of this body. We owe much to his experience and skill as a presiding officer, to his practical methods of dealing with business matters coming before the Executive Committee, and to his cordial sympathy with the objects in view. If, as we now hope, the Joint Commission, by a natural process of evolution, shall become the nucleus of a Washington Academy of Sciences, Mr Hubbard will always occupy an honorable place in the history of this Academy of Sciences. He was in the habit of disclaiming any pretensions to be considered a "scientific man." If only those who are engaged in scientific research work are properly so called, his modest disclaimer may be admitted; but it would be well for many of the scientific men of the country if they could take as broad a view and as intelligent an interest in the general progress of scientific knowledge and of applied science in all departments of human industry and art as that manifested by the late President of the Joint Commission.

His interest in science was catholic, and no doubt found its inspiration to a large extent in that genial and generous humanity which was so characteristic of him. Anything calculated to promote the comfort and happiness of those about him and of mankind in general was to him a matter of interest, and this kindly feeling led to the generous hospitality and cordiality of manner which all have experienced who enjoyed the privilege of his acquaintance. He quickly recognized merit and earnest effort in any department of human endeavor, and his ready sympathy and practical advice were always at command for the advancement of any good cause. With him acquaintance quickly ripened into friendship when he was brought into contact with one whose work and character commanded his respect.

Although his age and extensive personal interests might have excused him from active participation in the management of the affairs of the Joint Commission, he was too conscientious to neglect any of the duties pertaining to the office which he had accepted, and at meetings of the Executive Committee his kindly presence was seldom missed. Prompt in his attendance and expecting others to be equally punctual in keeping their appointments, he had a happy method of dispatching business and of checking unnecessary discussion and dilatory proceedings. He manifested no intention or desire to overrule the wishes of the majority in anything relating to the organization and interests of the Joint Commission, but as presiding officer did his best to promote harmony and to carry into effect the measures which were evidently favored by a majority of the members of the organization. So far as his relation to the Joint Commission and the scientific societies of Washington is concerned I have nothing to add, but I cannot close without expressing my personal sense of loss and bereavement. Although my acquaintance with

Mr Hubbard dated back only to the year 1893, I had learned to look upon him as a friend and to appreciate his cordial greeting when we met as one of the pleasant things in life.

He was so young at heart and in appearance that I scarcely realized that he was much my senior in years, and the announcement of his death after so brief an illness came to me as an unexpected shock. Those of us who knew him well will continue to cherish his memory as that of a public-spirited citizen, a lover of truth, a promoter of good works, and a trusted friend.

President Bell: Mr Hubbard was a Regent of the Smithsonian Institution and took great interest in its progress. I shall ask Professor Langley and the Hon. William L. Wilson, President of the Washington and Lee University and ex-Postmaster-General of the United States, to say a few words on behalf of the Smithsonian Institution.

Professor Langley: I knew Mr Gardiner Hubbard for many years, and I owe some of the very pleasantest hours of my Washington life to the kindness and hospitality I received in his home. Among the many occupations of his own varied life there were few in which he took more interest or was more zealous than in his duties as Regent of the Smithsonian Institution. It might seem as if I, as Secretary of that Institution, could with propriety give an account of his relations to it. That, however, can be better given by another, and since we have here tonight the gentleman whose name has just been mentioned, the late Postmaster-General, who, as a resident of Washington, became not only a Regent but a member of the executive committee and a colleague of Mr Hubbard, and who comes here in spite of the engrossing duties of the University to speak to us tonight, I feel that I cannot do better than to give place to him and ask him to speak of one whom he knew so well in this connection, and whose relations as a colleague have been more intimate than mine.

Mr Wilson: To those who were permitted to enjoy the personal friendship of Mr Gardiner Hubbard and to garner up gracious memories of intimate association with him, the first and strongest impulse tonight naturally is to speak of him as a man, to recall and commemorate the qualities and virtues that lay at the foundation of all that he was and all that he did. The world outside the circle of his acquaintances may sometimes have regarded him merely as a man of large possessions; his occasional fellow-workers in the varied fields of his activity and interests doubtless regarded him as a man of great achievements. Those who were privileged to enter the closer circle of personal friendship knew that however ample those possessions, however varied and admirable those achievements, they were much less than the man himself. They were the natural, almost the necessary, fruit of a clear intellect, a strong will, and, above all, a moral force that instinctively arrayed itself with generous sympathy on the side of the true, the beautiful, and the good.

The good causes of which Mr Hubbard was ever the discriminating and liberal, though modest, patron; the good work in which he was, to the very close of his life, an active participant, were not external to him; they were, one and all, part of his own nature. He was too self-respecting a man to court notoriety, either as a philanthropist or as a patron of education or science, by ostentatious benevolence.

Now that Mr Hubbard has gone from us forever, we begin to realize how large, how unique, and how beautiful a part he bore in the social, charitable, and intellectual life of his adopted city. Washington is doubtless destined to become more and more the residence of men who have won fame or fortune in other parts of the country, and come here to make their homes amid congenial surroundings, homes of hospitality, and not seldom homes of refinement and culture. Mr Hubbard did this and he did more than this. No home in Washington has dispensed a more charming and constant hospitality than his. He came to Washington with an acknowledged social position, with well known and honorable lineage, with liberal education and refined tastes, with large and successful experience in the business world, with a mind stored and broadened and liberalized by much reading and much contact with men and things in his own and other countries. For such a man it was inevitable that he should become associated with every form of charitable, educational, and scientific work in this country that appealed to a man of public and patriotic spirit, and if he became connected with them, it was as inevitable that he should become a leader in them.

His election, as Professor Bell has told us, to the presidency of the Joint Commission of the seven scientific societies of Washington is but one illustration of this. The Congress of the United States chose him a Regent of the Smithsonian Institution. His associates on the board made him a member of its executive committee, charged with a personal supervision of this institution and of the scientific department which Congress had placed under its administration.

Professor Langley has said that I would speak of him in this connection tonight, and yet what can I say of him here that would not be true of him in everything and in every duty that he assumed? It was not in the nature of Mr Hubbard—it was not the habit of his life—to be a mere ornamental holder of positions, to be a mere routine worker. High as was his personal regard and unstinted his admiration for the ability and scientific attainments of the Secretary of that institution and the heads of its bureaus, he wished, if possible, to press still forward; and at the last meeting of the Board of Regents, on his motion a committee was appointed, of which he was made chairman, to consider and report how the value and usefulness of these bureaus could be promoted.

So many sided was Mr Hubbard's character, so many sided were the activities of his life, that it is fitting that the tributes paid to him tonight should come from many friends and from many points of view; but, start from wherever they may, they will inevitably meet and blend in the common tribute to the man himself.

I have tried to speak of him with that studied moderation which I know would be most in accordance with his wishes. I have spoken of him as a man of public spirit, as a patron of education and science, and as a benefactor of his fellowmen.

I will draw aside the curtain of his home life only so far as to say that in all the relations of husband and father and grandfather he was the embodiment of courtesy, affection, and gentleness, the inbred traits of a born gentleman.

President Bell: Mr Wilson has referred to the philanthropic spirit of Mr Hubbard, and I will now invite your attention to a philanthropic work of his that was unique. In March, 1864, Mr Hubbard brought into the Massachusetts legislature a bill for the establishment of an oral school for deaf children. The schools of this country were taught by means of spelling on the fingers and by means of the French sign language. Many persons had suggested that oral schools like those in Germany, where the deaf had been taught to speak and to learn to read from the lips, should be established in America; but none had been established, until in March, 1864, Mr Hubbard made the first attempt to establish a school where deaf children could be taught to speak and to understand speech by the motions of the mouth without resort to signs or manual spelling on the fingers.

It is not my purpose to fully set forth his efforts in this direction, but simply to direct attention to the magnitude of the work that has resulted from those efforts. Last year there were more than 5,000 deaf children in the schools of the United States learning to speak and to read from the lips. There were over 3,600 pupils who were taught by the oral method alone, without resort to alphabets or the sign language. The percentage of pupils taught by speech since these early efforts of Mr Hubbard's has gone on increasing, increasing, increasing, until we know now with absolute certainty that the time will come when there will no longer be any deaf or dumb in this country, for all shall be taught to speak without resort to spelling or the French sign language. The instrumentalities through which this wonderful change has been effected are largely the Clarke school at Northampton, Mass., and the organization of a society to promote the teaching of speech to the deaf, known as the American Society. There are three great results that were originated by the movement of 1864: First, the teaching of speech to the deaf; second, lowering the age of instruction to the deaf (at that time no attempt was made to teach deaf children under 12 years of age), and last, but not least in importance, the employment of women as teachers of the deaf. Before that time the instructors were largely men; but the necessity of teaching speech to the very little child led to the employment of women. This fact and the improvement in the methods have been the secret of success in teaching speech to the deaf, and the work is now largely in the hands of women.

The American Association to Promote the Teaching of Speech to the Deaf is represented here tonight by its Vice-President, Miss Caroline A. Yale, LL. D., who is also the Principal of the Clarke School at Northampton, which sprang from Mr Hubbard's movement of 1864. Mr Hubbard has passed away, but he has breathed his spirit into us. In this work of teaching speech to the deaf there are hundreds of Mr Hubbard's friends. They are organized into a society, and they are working and accomplishing the result at which he aimed. The leader of this movement is with us tonight and will tell us something of the work. I introduce to you Dr Caroline A. Yale.

Miss Yale: Among all the interests of Mr Hubbard's life, possibly none extended over a longer period or was more deeply rooted in his rich nature than his interest in the education of the deaf. In this, as in many other departments of his activity, he seemed possessed of prophetic vision. In his own little child's voice he heard the prophecy that deaf children might speak, and to him is due, probably more than to any other one man, the fact that all America has realized the fulfillment of that prophecy.

The results of the teaching of his own little child, made deaf by illness in early childhood, by means of lip-reading and speech, without the use of signs or the manual alphabet, were so satisfactory that Mr and Mrs Hubbard were confirmed in their opinion of the importance of very early instruction for deaf children and of the superiority of the oral method of instruction. They were most anxious that this method should be fairly tried and felt strongly that such trial could not be made satisfactorily in any of the already established schools, which employed the sign method and to which pupils were seldom admitted under ten or twelve years of age.

The story of Mr Hubbard's efforts to establish a school in Massachusetts, in which instruction should be given through lip-reading and speech alone, may most fittingly be told in his own words. He writes that previous to that time "the sign language was believed in this country to be the best and only efficient method of instruction for the deaf. The reports of the Hon. Horace Mann in favor of the German system of articulation had attracted attention, and gentlemen from our oldest institutions had been sent abroad to examine into the subject. Their reports were only partially favorable, and the efforts to engraft the German system of articulation upon the French system of signs then in use in our country proved a failure." So when in 1864 Mr Hubbard presented a petition to the legislature asking for a charter for a school, it was the first attempt to establish a school under the oral method in a country where for fifty years the sign method had been firmly established.

He says: "This application was opposed by the friends of the American Asylum, on the ground that it was a visionary project and attempting the impossible. Dr Samuel G. Howe, of South Boston, earnestly seconded the petition and appeared with me before the legislature. Our efforts were unsuccessful and our proposition was rejected. I determined to show that it was not a visionary project, and meeting Miss Rogers, who was then teaching a deaf girl by articulation, we determined to organize a small school, so that when we again appealed to the legislature we could show the results of our new system. A small fund was raised. Our plan was advertised in the papers and after six or eight months we found six pupils, with whom we opened a school at Chelmsford, under the care of Miss Rogers."

Miss Rogers began teaching her first pupil a few months after the failure of the first attempt to establish a school. Mr Hubbard watched the work of this little school with most intense interest, for from the first the full import of the experiment seemed clear to his mind. If it was successful it meant speech for the deaf and the English language through speech ; if it failed it meant a deeper silence and a strange language of signs used in place of the language of home and country. The success of the school exceeded their expectations, and in 1867 an effort was made to secure its incorporation. Mr Hubbard wrote: "Mr Talbot and myself called on Governor Bullock and asked him in his message to the legislature to refer to our school and favor an application we intended to make for a charter for it. To our great surprise, he told us that he had that morning received a letter from a gentleman in Northampton offering $50,000 if a school for the deaf could be established in Northampton."

Governor Bullock did refer at considerable length to the offer of Mr Clarke and recommended the establishment of a school for the deaf in the Commonwealth of Massachusetts. That portion of his message was referred to a special committee of the Senate and the House, of which the Honorable Lewis J. Dudley, of Northampton, was chairman on the part of the House. Long, earnest, and sharp were the debates held before the committee. The advocates of the sign method still felt that a fearful mistake was being made. The Massachusetts State Board of Charities, of which the Honorable F. B. Sanborn was secretary, heartily endorsed the movement toward the establishment of the new school. Mr Dudley had become a convert to the oral method and used his utmost influence to forward the movement. The act of incorporation was secured, and Mr Clarke expressed his purpose to give the school the bulk of his remaining property.

The little experimental school of Miss Rogers was closed. Its zealous and devoted teacher and her pupils became the nucleus of the Clarke school in Northampton, which opened in October, 1867. Mr Hubbard was made president of its corporation and for the first ten years of its existence gave the school much personal attention.

Then followed years when he lived much abroad and when his life was overcrowded with other interests; but wherever he was and however busied with other matters, he always found time to visit schools for the deaf and write of their methods and results.

When later he was more at home and less abroad, the old-time enthusiastic interest in the school seemed to be roused anew. He rejoiced in the growth and expansion of its work, its adaptation of kindergarten methods, its establishment of a training class for teachers, and most of all he rejoiced in the higher intellectual work accomplished, which made it possible for a steadily increasing number of pupils to leave the school, fitted to enter higher schools for hearing young men and women, and to pursue their studies as students simply, in a world of ordinary students, becoming a part of the great world of speaking people.

In 1890 the American Association to Promote the Teaching of Speech to the Deaf was founded by Dr Alexander Graham Bell, the husband of the little child whose need of special instruction first led Mr Hubbard to take an interest in the instruction of the deaf. The specific objects of its organization were to aid schools for the deaf in their efforts to teach speech by training teachers and by disseminating information in regard to methods of speech-teaching. Into Dr Bell's plans for this new organization Mr Hubbard entered with all the enthusiasm which he gave to his early work. He was its first vice-president, and the wisdom of his counsel and the strength of his purpose have done much to guide the association through the difficulties of its first years of work and to give it the position which it now holds as the most influential and effective organization connected with the education of the deaf in this country—probably in the world—its membership including, in addition to a large number of teachers, many other persons like Mr Hubbard and Dr Bell, who are most effective promoters of the work of the association.

The influence of these two institutions, in the founding of which Mr Hubbard bore so active a part—the Clarke school and the American Association to Promote the Teaching of Speech to the Deaf—has been most widespread, both in this country and in Europe. Today one-half of all the teachers in the schools for the deaf in America are teachers of articulation, and over one-half the pupils in those schools are taught speech.

Beyond these definite results the effect of the growth of oral teaching in this country has been most stimulating to the general work of the education of the deaf, and "at every turn and on every marked occasion the influence of Mr Hubbard has been felt in this expanding and liberalizing movement." Surely the work and the workers must sadly mourn the loss of a leader and a friend, one clear of vision, strong of will, and kind of heart.

President BELL: Mr Hubbard, as a Trustee of the Columbian University, took, as we all know, a great interest in that institution, and I shall ask Dr Whitman, its President, to speak to us on its behalf.

President WHITMAN: Dr Hubbard was exceptionally happy in educational work. The Columbian University does not speak for itself alone when it emphasizes this phase of his influence, but it is able to speak with unusual emphasis from the fact that Dr Hubbard was an active member of its board of trustees. His name had an honored place on other boards of like character, but Columbian has been so situated that it has been able at all times to take advantage of his time and strength and influence. This makes it peculiarly proper that Dr Hubbard's educational work should be represented in a tribute from this particular institution.

The preparation of Dr Hubbard to serve educational interests was large and varied. His own academic and professional training made him familiar with general educational principles, and continuous service through a long and busy life kept him in touch with the progress of educational enterprise. His well-known intimacy with prominent educators both at home and abroad, his recognized standing as a patron of art and science and literature, his well-known leadership in the business world, gave him peculiar fitness for dealing with educational problems. This fitness it was the good fortune of the Columbian University to enlist directly in its service.

Two sets of ideas indicate clearly the services of Dr Hubbard to the University.

On the one hand there is a group of ideas—thoroughness, prudence, progressiveness. Dr Hubbard always insisted upon the obligation to go to the bottom of things, whether the matter under consideration was a course of study or a purchase of real estate. He always urged the importance of knowing just what the facts were; this, however, was simply part of his great habit of prudence. He was never an obstructionist, but he was never willing to go faster than conditions warranted. It was thoroughly characteristic of him that when a few days before his death he sent for a representative of the University that he might be acquainted with the progress of a movement looking to the radical betterment of part of the University's property. The enterprise itself he heartily commended, but at the same time he insisted that it should not be undertaken until it was known where the means would come from to carry the enterprise to completion. This incident illustrates, perhaps, as clearly as a trait can be illustrated the general attitude of Dr Hubbard's mind toward work to be undertaken; in it thoroughness and prudence both speak. Happily, however, the habits of thoroughness and prudence did not make him unduly conservative; rather he was one of the most progressive of men. His mind was so well balanced that so far from suggesting obstruction, prudence with him was simply the basis of wise undertaking. He never cut loose from the base of supplies, but the base of supplies was for him also the base of vigorous operations leading to ever larger movement and ever larger conquest. Dr Hubbard had in marked degree the great gift of far-sightedness; his vision was large; his plans for an institution could no more be confined to the limits of a single city than his own life and influence could be. There were always fields beyond to be taken into account, and there was in his heart largeness of hope answering to the largeness of his vision; he was no pessimist. It was a sad, dark day for university work in Washington and everywhere when his large vision of things was clouded by death.

On the other hand, we have his life as manifested in the great virtues of integrity, trustfulness, sympathy. Integrity he possessed in large degree; it is simply the truth to say that his life was a life of integrity. Falsehood, deceit, double speaking, unfaithfulness of every kind was hateful to him. Clouding of issues he could not tolerate. A line of thought he developed with great clearness and power when engaged three years ago in committee work with reference to filling the office of president, then vacant, was simply the speaking out of his own sense of the importance of a clear conception of the purpose of the institution. Conversation had turned upon certain obligations of the University toward those who had founded it in prayer and sacrifice. Dr Hubbard insisted that these prayers and offerings should be held in remembrance, and that while the institution ought not to be regarded as an agency for the glorification of any body of Christians of any name, it ought beyond all question and beyond all doubt to be an agency for the furtherance of Christian education. When at the close of the last academic year, after long and painstaking canvass of the whole question, it was thought well to revise the charter of the institution, Dr Hubbard worked indefatigably toward clearing up all doubtful questions, and heartily coincided with the Committee of Revision, on which he was serving, in their recommendation to the corporation that such changes should be made in the governing boards of the University as should clearly define all general issues and secure the most efficient oversight possible. It was not first a question of policy with him, but a question of right. Is it right that this should be done? And when he himself answered yes, he could add, and he did add, "If it is right, then it is wise." And when during the past year the University had to face the painful task of dealing with dishonesty in a trusted official, it was the sense of violated obligation that filled the soul of Mr Hubbard most with righteous indignation. His horror and contempt for theft and falsehood were the natural language of a soul which kept itself unsullied by insisting that the supreme rule of life is the rule of right. Naturally enough Dr Hubbard's integrity made him trustful of others; the presumption of honesty in the other man was always emphasized by him. Clear proof had to be given that his confidence was misplaced before that confidence was withdrawn. His own word meant his honor pledged, and he assumed that the word of the other man meant the other man's honor, too.

Withal, Dr Hubbard exhibited in marked degree the beautiful trait of sympathy. Many were not aware of this. They saw the man who had achieved success in his business and professional career and who gathered up unto himself lines of influence that made him a man of mark in the community; but those who were permitted to know him as a man were impressed by his kindliness of spirit, his willingness to sacrifice self for others, and his wonderful ability to enter into the joys and sorrows and ambitions of others. His life was a life of infinite detail along the most varied lines of interest; but all these details and interests did not make him forgetful of those who needed encouragement and help. It was a revelation to the man in question, but it was in every way characteristic of Dr Hubbard's kindly thought, that from his sick chamber he sent for a representative of the University, who did not dream that certain of his activities had been noticed, only to say to him these words, "You are working too hard." A thousand illustrations of this trait could be enumerated, but the one experience tells the whole story as clearly as a thousand could; and when one had once learned that the brusqueness which sometimes marked his speech had no connection with his heart, but was rather to be interpreted by the twinkle in the eye that looked so kindly on the world, one had found the way to a rich store of sympathy and help. He admonished only when admonition was necessary; he warned and admonished and rebuked, but all was done with a kindliness that took away the sting. In all his life he never intentionally wounded a friend. He was no croaker; he was no faultfinder; he never scolded; he never complained. He shared his gifts without grudging. The most precious of all his gifts he gave most freely of all, and that was himself.

It is no wonder, then, that the Columbian University holds his name in grateful remembrance, for in that institution, as in the world outside, all respected him, and those who knew him loved him. His best monument is a community enriched and a world made better by his influence. All else decays; this abides forever, and in this the Columbian University gratefully records its part.

> "What is excellent
> As God lives is permanent. Hearts are dust.
> Hearts' loves remain."

President Bell: Mr Hubbard was President of the Society of Colonial Wars. I will ask Dr Marcus Benjamin, Historian of that Society, to speak on its behalf.

Dr Benjamin: Gardiner Greene Hubbard was twice Governor of the Society of Colonial Wars in the District of Columbia, and at the time of his death his name had been selected by the committee on nominations to head the list of the society's officers for a third time.

The society, which it is my privilege to represent on this occasion, is composed of descendants in the male line of those men who in a military or naval capacity or in high civil office rendered service in the wars of the American colonies from the time of the settlement of Jamestown, in 1607, to that of the battle of Lexington, on April 19, 1775. It has for its object the preservation of the memory of those forefathers whose public services made our freedom and unity possible.

It is not for me to attempt an account of the achievements that made Mr Hubbard so valuable a citizen to the world, for that has already been done by those who knew him more intimately; indeed, my acquaintance with him only began with his admission to the Society of Colonial Wars, in the winter of 1895; but if you will permit me, I will, in the short time at my disposal, say a few words concerning those ancestors whose records Mr Hubbard filed with our society and of whose memory he was so justly proud.

The first of his forefathers to settle in the New World was William Hubbard, who sailed from London on the ship *Defence* and landed in Boston on October 6, 1635. He is believed to have been a gentleman of easy circumstances and the owner of much landed estate, but left his home because of a sense of irritation to his religious views, caused by the interference and restrictions then placed upon freedom of worship in England. Two years previous John Winthrop, the younger, had founded the settlement of Ipswich in the young colony, and here William Hubbard, who had come from the older Ipswich in Suffolk, made his new home. That he was a man of means is shown by the numerous purchases of large tracts of land that are recorded in the "Old Norfolk County Deeds." He was also a lover of learning, for in 1636 he became the founder and principal of the Ipswich Grammar School, giving one acre of ground for its site. The spot is still preserved, for the Cogswell school occupies today the acre consecrated to education more than two hundred and fifty years ago by the first of the Hubbards. This early pioneer was highly appreciated by his neighbors, for he was a deputy to the general court during 1638 and 1646, and held other public appointments. About 1652 he removed to Boston, and there he died in the summer of 1670, at the ripe age of seventy-six. He was regarded as "a very learned man, being well read in state matters, of a very affable and humble behavior, who hath expended much of his estate to helpe on this worke." Such was the ancestor through whom Mr Hubbard sought admission to our society.

Of greater fame, perhaps, was the second William Hubbard, the fourth child and second son of his parents. He was born in Essex county, England, and came to this country with his parents. While a resident of Ipswich he entered Harvard and received from that university the master's degree in 1642, in the first class that ever graduated from an American college. While in Harvard he studied medicine, but the church claimed him and he was ordained in 1658, becoming the pastor of the Congregational church in Ipswich, over which charge he continued until advancing years compelled his retirement in 1703. He was recognized as a scholar, a historian, and a divine, and was active in many concerns of public interest. His historical works are painstaking records of the condition of New England between 1620 and 1630. They include a "Narrative of Troubles with the Indians," published in Boston in 1677, and a "History of New England," finished in 1680.

For the last-named work he received £50 as a "manifestation of thankfulness" from the general court, and the manuscript is still preserved in the library of the Massachusetts Historical Society. Cotton Mather in his "Magnalia" acknowledges his indebtedness to Mr Hubbard. He died in 1704, and of that event the record is still preserved in the following words: "He goes to ye lecture, after to Col. Apletons, goes home, sups, and dyes that night." The Reverend John Eliot refers to him as "equal to any in the province for learning and candour, and superior to all his contemporaries as a writer."

The line of descent continues through John Hubbard, who was born in Ipswich in 1648 and who in early manhood settled in Boston, where he became a leading merchant. In 1671 he married Ann Leverett, second daughter of Sir John Leverett.

To the career of this distinguished military leader a few words must be given. Born in England in 1616, he came with his father to Boston in 1632 and became a successful merchant. Early in life he was chosen captain of a militia company, and in 1644 he went to England to fight against the King under Cromwell. Later he returned to Boston and was chosen a delegate to the general court, also becoming a member of the governor's council. In 1671 he was appointed deputy governor, and two years later governor of the colony. Meanwhile his knowledge of military matters was recognized, and from 1663 to 1673 he was major general of the Massachusetts soldiers. It was during his administration as governor that King Philip's war occurred, and it was largely owing to his skill and energy that the war was brought to a fortunate issue. For his services in this direction Charles II conferred upon him the honor of knighthood.

Returning to the Hubbard ancestry, John, previously mentioned, had a son, born in 1677, to whom he gave the name of John. This second John was graduated from Harvard in 1695 and became pastor of the church in Jamaica, Long island, in 1698. He died in 1705, and is described as a man "of gentle disposition and greatly beloved by his flock, who deplored his early death." In 1701 he married Mabel Russell, granddaughter of Richard Russell and, on her mother's side, of Samuel Wyllis.

The Honorable Richard Russell was a man of much importance and most of his life was devoted to public service. He was born in Hertfordshire, England, in 1612, and came to Massachusetts in 1640. Four years later he was made treasurer of the colony, and held that place until his death, in 1674. Besides filling that important office, he was a member of the general court for many years, serving as its speaker in 1648–'9, 1654–'6, and 1659, and he was assistant during the years 1659 to 1674.

Mr Hubbard was sixth in descent from Samuel Wyllis in consequence of the marriage of his great-great-grandfather with Mabel Russell, and we pass from the records of Massachusetts to those of Connecticut.

Samuel Wyllis was a native of Warwick, England, and accompanied his father to the New World, settling in Hartford. He was graduated from Harvard in 1653, and a year later was elected one of the magistrates of Connecticut. In this office and the corresponding one of assistant under the charter of Charles II he was retained by annual election until 1685. It was on his estate, directly in front of his house, that the famous oak stood in which the charter of Connecticut was concealed in 1687. His death occurred in Hartford on May 30, 1709. Samuel Wyllis married Ruth, daughter of Governor John Haynes, and of whom a few words are necessary.

John Haynes was born in Hertford, England, in 1654. He was a man of wealth and culture and lived on his estate of Capford Hall in Essex before emigrating. In company with Thomas Hooker he sailed in the *Griffin* and arrived in Massachusetts in 1633. In the year following he was made a freeman and also an assistant, becoming governor of Massachusetts in 1635. Removing to Connecticut a year later, he settled in Hartford, and in 1639 was made first governor of Connecticut. Thereafter, until his death, in 1654, he was chosen governor every alternate year. Governor Haynes was one of the five authors of the first constitution of Connecticut in 1638, which embodies the main points of all subsequent state constitutions and of the Federal Constitution. He was a man of great uprightness and refinement of character, and of strong religious convictions. He tempered justice with mercy and had the power of making himself greatly beloved. His life was spotless and his character without reproach.

Of the six ancestors whose records were filed by Mr Hubbard in the archives of our society there still remains one to be mentioned, namely, the father of Samuel Wyllis.

George Wyllis was descended from an old and honored family, and was born in Warwick, England, about 1570. He received a liberal education and settled on a valuable estate in Knapton; but, espousing the cause of the Puritans, he sent his steward, William Gibbons, with twenty men to purchase an estate in Hartford, and on which to erect a suitable house for himself and family. Two years later he sailed for America, and at once on his arrival became an important member of the colony. He was one of the framers of the constitution in 1639, and at the first election that was held under it was chosen one of the six magistrates of Connecticut, holding that office until his death. In 1641 he was chosen deputy governor, and a year later was elevated to the higher office. Governor Wyllis was famed for his social and domestic virtues, his simplicity of manner, and his love of civil and religious liberty. He died in Hartford in 1645.

It would be a pleasant task to mention other ancestors of Mr Hubbard, and even to continue his genealogical line down to himself. Moreover, it would be of interest to point out those traits of character that were inherited from his forefathers; but time will not permit.

It is axiomatic that "pride of ancestry is a natural and ennobling sentiment." Well might Mr Hubbard be proud of his ancestors. As educators, ministers, governors, and generals, their names stand out conspicuous in the annals of our American colonies; they were leaders of men. And of their descendant what shall we say? Equally was he a leader among men, and law, education, literature, and science have been advanced because of his life.

President Bell: Dr Daniel C. Gilman, President of Johns Hopkins University, was very dear to Mr Hubbard's heart, and he will speak upon him as a helper.

President Gilman: I come forward tonight not as a neighbor, not as a colleague, not as a fellow-citizen, but as a friend, and I speak to you as friends. It is natural that we should regard the benefactors of society in groups, by the various services they render to their fellowmen. The gifts of genius are dramatists, poets, sculptures, pictures, buildings, and inventions; the gifts of wealth are hospitals, libraries, churches, colleges, and institutions; the gifts of wisdom are education, science, law, philosophy; but the gift that is best of all, the gift that smells sweet and blossoms in the dust, is the gift of one's self for the benefit of others.

Our departed friend, as every speaker has reminded you, gave himself almost without reserve during his residence in Washington and, as I have been told, throughout his long life to the advancement of good works. This title of remembrance is as comprehensive as it is honorable; he was a helper of his fellow-men. Time, money, effort, thought, suggestion, influence, the acquisitions of a long life and the experience of a versatile career, were at the service of any one who needed them. All classes and conditions of men were his clients; the writer, the editor, the preacher, the artist, the inventor, the investigator, the arbitrator, and the statesman turned to him for counsel, and never went empty away. Men of science trusted his good sense, men of affairs knew his sagacity, men of education depended upon his advice, philanthropists and men of religion were sure of his support. At home everything was for others; his books, engravings, etchings, and, in summer, his grounds, with their shrubbery, shade trees, and flowers, were given to hospitality. Nothing for display, but everything that strangers might be friends and that neighbors might become more friendly through the amenities of social intercourse.

In the city of his choice it was natural that a man of such breadth, of such varied observations in other lands, and of such eagerness for information should be best known as the founder of a society whose field is the world, and which believes that nothing human is alien, nothing in nature barren or dry. What plans he suggested, what persuasiveness he employed, what successes he won in bringing to the front the makers of geography, the interpreters of the earth, air, and sea, are all well known to one who has spent a winter in this capital, and best of all to you who are here assembled.

In the world at large he was regarded as an original promoter of that epoch-making invention which in twenty years has not only revolutionized the processes by which speech can be heard at a distance, but has completely changed the business usages of every country where civilization is found. To those who knew our friend only as a business man or only at a distance, this gives him fame. But there are others, like the speaker, who came near to him during the latter years of his life, and never heard him speak of business or allude to his successes, who never met him when his mind was not alert to promote a cause, to render a service, to encourage merit, to remove perplexities, or to find the right man. These seemed to be the occupations not of leisure, but of life. Most noteworthy has been his devotion, as you have already been told, from an early period of his life, to the welfare of the deaf. He was one of the first to believe that they could be taught to speak with their lips, and he lived to see this belief transferred from the domain of faith to that of fact.

As I recall the manifold subjects I have heard him discuss, I know not which is the more remarkable, the range of his sympathy or the depth of his goodwill. The possible relief of Helen Kellar; now a rare print that he had acquired or an attractive book he was reading; now the Garfield hospital; now the memory of Abraham Lincoln, or the story of Napoleon Bonaparte, of Greely, Melville, or Nansen; now the promotion of international intercourse and the prevention of war; now the relief of the Armenians; the possible establishment of a National University; now the awards to be bestowed upon exhibitors at Atlanta and at Nashville; now and always the support of the Smithsonian Institution, the Geological Survey, and every scientific bureau supported by the Government.

The graces of a good ancestry, of a liberal education, and of wide intercourse with his fellowmen, and of a home where the refinement and affection of a devoted wife and children were supreme, enriched his life and adorned his character. His heart craved sympathy; he must keep in touch with those whom he trusted—by speech, by print, by mail, by wire. Few men valued friendship as he valued it, and the much that he required he returned with ample usury.

Public station would not have increased his influence nor added to his happiness; it would have fettered his spontaneity and his impulses. It is as dear friend; considerate, helpful, and strong, versatile and suggestive, that we who have known him well now call him venerable and beloved because he was the helper of his fellowmen.

President Bell: Mr Hubbard's great interest in the advancement of science in America led to the foundation of an independent scientific journal for the use of scientific men on this continent, and I shall call upon Major J. W. Powell, Director of the Bureau of American Ethnology, Associate Editor of *Science*, and ex-Director of the United States Geological Survey, to speak on behalf of the journal *Science*.

Major Powell: This is an age of specialized literature. The daily papers serve a daily purpose; but when the day is gone the paper is gone. A flame is kindled twenty-four hours after the issue of the daily paper in every home in America, and the yesterday's news is the origin of this household fire, but it comes to us freighted with power with the same regularity that longitudes wheel to the matinal light. Weekly, biweekly, monthly, and quarterly journals have a longer life. Within the last quarter of a century the magazine has become a forum in which public men find expression for their best thoughts to a large public, who wish to consider with care the current questions of the day and preserve the material thus utilized for future reference. For this reason it has come about that magazines have multiplied. All thoughtful people are now magazine readers. The daily press has become the mighty organ of current news, business life, and political affairs, while the magazine is the organ of current thought as literature and science. The daily paper, reviewing the daily affairs of life, makes comment on public men, public measures in the nation, the state, and the city. It pours out wit and humor, sometimes good, sometimes far-fetched, with a story for the idle and a syndicate letter for the inquisitive, which are read and forgotten, all going to the morning crematory.

Neglecting the magazine as the organ of literature and considering it as the organ of science, by a careful review of the subject it will be seen that the correlation of scientific research and the organization of scientific opinion is now largely dependent upon magazine literature.

In late years this new organ for the correlation of scientific research has sprung up. The heat, light, electricity, magnetism, and gravity of which the ether is the medium between celestial orb and celestial orb, the orbs themselves, of which the earth is a modest member, stealing its way through the universe by an unseen path, content with reflecting the light of others—the earth itself, with its moving atmosphere, hydrosphere, lithosphere, and centrosphere—all coöperate with the chemical agencies that are forever reconstituting the rocks of the earth, and these through their mantle of soil coöperate with living vegetal forms, and these again coöperate with the hosts of animate things. This vast system of coöperation between the hierarchy of bodies which constitute our solar system allies every man engaged in scientific research to every other man who studies the ways of nature. For the solution of the problems connected with every crystal, every plant, and every animal cannot reach their final solution without considering the whole world of bodies. One human mind cannot solve them all. Inductive research must consider all of the multitude of particulars in every body, and those observed by one must be added to those observed by others before the induction is complete. Then deduction may enter the field for the final reconstruction of the external universe in a hierarchy of valid concepts representing the hierarchy of the universe until the universe itself shall be reproduced in every human mind.

Many men must work together to operate a railroad across the continent; but when coöperating, what feats of transportation they can accomplish. All the men of the world could not carry the freight from San Francisco to New York which could be transported by one railroad. Coöperation in scientific work is equally economic. The problems of the universe are to be solved, and they cannot be without the organized labor of research. To expect men to accomplish this labor without coöperation is like expecting men to gather the wheat of the prairie and carry it on their shoulders to the seaside mart; but a selected few of those laborers may easily perform the task when they are organized as railroad transporters.

By what agency can the men engaged in scientific research coöperate in the solution of the problems of the universe? Scientific men will solve these problems when they coöperate, for all problems can be solved after they are stated. One man may be an agnostic, but all men are not agnostic for all time; while much of the universe is unknown, the universe is not unknowable. The universe is unknowable only to the fool who would try to carry it in a sack on his own shoulder.

There is an army of men engaged in research in America which is but an integral part of the world's scientific men. In 1883 two men, Gardiner Greene Hubbard and Alexander Graham Bell, sought to more thoroughly organize the American army and put it in coöperation with the world's scientific host; for this purpose they essayed to organize a magazine or journal of science. They called to their aid President Gilman, of the Johns Hopkins University; Professor Marsh, of Yale College, and Professor Scudder, of Harvard. Mr Scudder was made the editor and the journal was launched on the sea of publication.

This journal was specialized in five departments: First, there was editorial comment on public affairs relating to the institutions of research in America; second, its columns were open to the discussion of scientific subjects by the leaders of thought; third, it was a medium for the announcement of discoveries;

fourth, it contained announcements of what men and institutions were doing in America; and, fifth, it contained a summary of the scientific progress of the world. In these five departments the two volumes of the first year contained a well-digested summary of the current scientific thought and accomplishment in America and throughout the world. This journal was called *Science*; and it had engaged in the labor of its preparation many men in the different departments of research employed in the preparation of materials for publication relating to all branches of work. It inaugurated the new era in America. Hitherto men had worked largely in isolation, without the sympathy and assistance of their fellowmen; few of them meeting once or twice a year for conference as the American Association for the Advancement of Science and the National Academy; but in the general isolation diversities of opinion sprang up and grew to unnecessary proportions, so that the infrequent meetings of scientific bodies were characterized by bitter discussion which often led to lifelong antagonism. Under the ægis of this journal there sprang into existence many more organizations, and the meetings of scientific men were multiplied and the differences of scientific men were harmonized; ultimate differences of opinion were modified and mollified and the whole spirit of research as exhibited on this continent was transformed; jealousies and antagonisms melted in the sunlight of publication. In the host of scientific workers there has always been a few men exploiting on the verge of research whose chief delight is in controversy and who consider that eminence can best be acquired by attacking their fellowmen. This modicum of malcontents were speedily relegated to the purlieus of disputation and the real workers remain to coöperate, encourage, and assist.

Since 1883 the journal has passed through many vicissitudes, and many experiments have been made with it in order that it might become self-supporting, and many efforts have been made to secure an enlarged clientage, but the first three volumes established the high-water mark of scientific journalism and are ideals for all future enterprises in this field. In this manner the founders of the journal, led by Mr Hubbard, contributed to the organiz ıtion of scientific research. In later years I had the honor to be called into their councils, and I know how earnestly they labored to make a magazine worthy of the scientific public, and wherein there was failure and wherein there was success. Mr Hubbard was the leading spirit in all this work and to it he gave much time and profound thought. It was designed, not as a business enterprise, but as a contribution to science; not for the purpose of accumulating a property from which a revenue could be derived, but of establishing a means of communication for scientific men, to be presented to them as their journal.

In the library on Connecticut avenue and under the shadow of Twin Oaks Mr Hubbard was wont to assemble his friends in conference on scientific subjects; often the magazine was the theme under consideration; other interests of science were also considered. The hours which he spent with his friends in consultation from day to day, month to month, year to year, endeared him to an ever-enlarging circle of public men, for his sympathies were wide, his plans large, and the resources of his genius great, and, though he has gone, the works of his heart and mind will remain to bless mankind.

I could talk with a full heart of Mr Hubbard as a friend. Through many years at his home in the city and at his home in the country and in far-away lands and in long journeys across the continent I spent many hours with him, and while I honored him as a public man, and think what he has accomplished, these days and years have more than led me to learn to love him as a friend.

President Bell: Mr Hubbard was Vice-President of the Columbia Historical Society. I will call upon the Honorable A. R. Spofford to say a few words on behalf of that Society.

Mr Spofford: The talents and energies of him whom we commemorate tonight embraced a wide and varied field. His active mind took in many subjects of inquiry, and his sympathy and aid were hospitably given to so many causes and objects of public interest that it is perhaps difficult to name any of the more important in which, at some time or other, his name and influence were not invoked. One of the more recently organized of the societies devoted to objects of research to which he belonged was the Columbia Historical Society. This association was formed March 7, 1894, at a meeting held at Columbian University, adding another to the historical societies, now numbering nearly three hundred, which have been organized with a view to preserve and perpetuate historical knowledge in the United States.

To this meeting, not being able to be present on account of absence from the city, Mr Hubbard sent a note through a friend who was a leading promoter of the movement, suggesting the possibility of some encroachment, in the new society to be organized, upon the sphere of the Memorial Association of the District of Columbia, of which he was himself an active and earnest member. But, upon discussion of this suggestion by gentlemen present who were affiliated with both societies, it was the concurrent judgment of the meeting that the objects proposed for the Historical Society were of a much more comprehensive scope, embracing the wide field of investigation of the annals of Washington and the District of Columbia, its foundation, history (civil, literary, political, and ecclesiastical), biography, statistics, public works, education, and development generally. The special aim of the Memorial Association, on the other hand, was to preserve and commemorate historic buildings, marking by tablets or otherwise ancient landmarks, and endeavoring to perpetuate an interest in the past of Washington city by fitting memorials.

At the meeting following the preliminary conference referred to, namely, on the 12th of April, 1894, the Historical Society was fully organized. Gardiner G. Hubbard was one of the original charter members, signed the constitution, and was elected first vice-president of the society. His great preoccupation, however, with the work of other societies, and especially that of the National Geographic Society, over which he presided with such signal ability, prevented his attendance at the monthly meetings of the Historical Society, and for this he frequently expressed his regret. On May 29, 1894, feeling his inability longer to hold himself ready to discharge the duties of vice-president, he tendered his resignation of that office in a letter, assigning as a ground for his action that he was unable to give to its duties his personal attention. The resignation was accepted, and Hon. John A. Kasson was chosen vice-president in place of Mr Hubbard, and succeeded to the presidency, by election, after the death of Dr Joseph M. Toner, the first president of the society.

At a later day Mr Hubbard, continuing his membership, recommended to the society, in a letter of November 29, 1895, through the secretary, a lecture by Professor Lewis on "Lafayette and the Historians," which, however, was not delivered.

Regarding Mr Hubbard's life-long interest in historical subjects, those who knew him the best can best testify. An earnest student and a wide reader from early years, he was also a busy and intelligent collector of books. Upon the history of countries he read much and was unusually well informed. His many addresses and articles contributed to the Geographic Society evinced the breadth of his culture and the wealth of his knowledge upon the history and resources, as well as the topography, of the regions treated by him.

It is pertinent for me to mention here, as an example of the thorough method of Mr Hubbard in treating the history of any subject, the elaborate article furnished by him to the *Atlantic Monthly* for January, 1875, entitled "Our Post-office." This historical article contains an admirable condensation of the facts regarding the postal system of the United States and its predecessors, the colonial and British post-office establishments. It draws many instructive parallels and points out the departures from the true objects of a governmental postal system, the quick and cheap diffusion of the people's correspondence and periodicals, through the carriage of mere merchandise in the mails, leading to large annual deficits. The article, although appearing in the pages of a periodical, is of great and permanent value.

The same may be said of another of Mr Hubbard's studies, upon a subject of greatest practical interest to the people, namely, his article on "Proposed Changes in the Telegraphic System," published in the *North American Review* for July, 1873. This presents a history of the various American lines of telegraph up to its date, and is a close and careful analysis of the whole system, with comparative statistics of the telegraph as managed by governments in foreign countries and by corporations in the United States.

Of Mr Hubbard as book-collector, art lover, and connoisseur others will doubtless make fitting record. His library was large and select, and his refined taste led him to make choice always of the best editions. Like most bibliophiles, he read many sale catalogues of books, imported liberally from many of the best book-houses in London and on the continent, and had a marked liking for fine bindings. In the graphic arts his knowledge and taste were of the first order, and his large collection of early and late engravings, etchings, etc., was one of the finest gathered by a private individual. These were the recreations of a busy man of affairs, and the collection, study, and illustration for the benefit of others (which he sometimes consented to offer in the form of an art lecture) were a source of constant gratification to his generous spirit.

President Bell: The Honorable John W. Ross, Chairman of the Board of Commissioners of the District of Columbia, will speak on behalf of the city of Washington and the District of Columbia.

Mr. Ross: The honorable part has been assigned to me of speaking of the late President of our society with regard to his business activities and as a citizen of the District of Columbia.

My last meeting with him was on an occasion when he was serving this people in a most effective manner. In the month of September, 1897, a committee of the National Educational Association came to Washington to consider its availability as the city in which to hold their next annual gathering. Through the courtesy of the proprietor of the Riggs house a banquet was given to the visiting delegates and to the local committees, in order that our citizens might confer with the representatives of the National Association and explain to them the exceptional advantages offered here in comparison with the other cities under consideration. Mr Hubbard was one of Washington's most influential champions at that meeting. As I recall the enthusiasm and earnestness with which he portrayed the great educational features of the capital, it is difficult to realize the truth that he was then about 75 years of age. To him and to the other resourceful promoters of our cause is due the gratifying result that Washington will, in July next, welcome the largest convention of educators ever assembled in the United States.

Amid all the cares and responsibilities which attended his useful life, Mr Hubbard never evaded any municipal duty. While he never sought preferment by the appointment of the executive officers of the District, yet his practical ability and his zeal were so generally recognized that successive boards of District Commissioners appreciated the fact that they served and promoted District interests by appointing him to positions of trust and responsibility. In May, 1896, he was selected as a member of the Tennessee Centennial Exposition Commission. In June, 1896, he was chosen a member of the board of trustees of the Free Public Library. In March, 1897, he was appointed one of the commission for the Omaha Exposition of 1898. He was also an active member of the board of directors of the Central Dispensary and Emergency Hospital. The duties pertaining to these positions were willingly assumed by him, notwithstanding his exacting engagements to the scientific societies of the District; and in so far as any work could be done, it was performed by him with fidelity and ability.

Next to the great cause of scientific research, he loved his adopted home. There was not a movement made having for its end the prestige, the adornment, or the development of the National Capital which did not have his strong and sturdy support. From his beautiful home on the heights beyond Rock creek he had within his view that ideal site bounded by the Potomac, the Anacostia, and the commanding hills which border those streams whereon the wise foresight of Washington founded the chief capital city of the new world.

Every surrounding appealed to his keen sense of the beautiful and strengthened his conviction that Washington was destined to be the most superb of the world's capitals. He believed that as the one and only city belonging to all the people of the United States, as the official home of the President, of the Congress, and of the 15,000 Government employés from the States of the Union, it of right should, as to its facilities for the education of its youth, as to its healthful conditions and surroundings, as to its means of protection of life and property, and as to its promotion of the comfort and well-being of the public servants residing here, be the first and foremost of American cities; and that the members of the enlightened Congress of the United States, as its immediate custodians, should regard any impairment or lowering of that standard a slight and an insult to their own constituents. His high character and strong personality helped to impress these, his views, upon the national representatives with whom he was associated.

In the decease of Gardiner Greene Hubbard, therefore, the people of this municipality have suffered a grievous loss and bereavement. It may not be unfair to the living to state that there is no one quite so well fitted by temperament, by training, and by practical tact and ability to perform all the several rôles on the stage of human activity which he enacted so well. His tall and commanding form and the kindly tones of his voice will be missed wherever Washingtonians may assemble to foster and protect the best interests of the District of Columbia.

His name should and doubtless will, in time, be borne by some appropriate municipal building. We cannot hope even by all these tokens of respect and affection to give adequate expression to our sorrow or to our appreciation of his public service. The most eloquent tribute to his memory on the part of his surviving associates would be an emulation of his civic virtues and an effort to be as zealous, as sincere, and as patriotic as he was in the performance of every public duty.

President Bell: The last address of the evening will be made by General A. W. Greely, Chief Signal Officer of the United

States Army and Senior Vice-President of the National Geographic Society, on behalf of that Society.

Gen. A. W. Greely: When I first came to know Mr Hubbard his years were such as had well won a right to rest, but with noble discontent he held the creed, "Old age hath yet his honor and his toil." How great that toil it has been for few to know; how great that honor in some way we felt before death touched him, but its full extent has only been revealed by this notable memorial meeting in the capital city of the Nation, of which he was so proud. The school, the library, the university, the Smithsonian Institution, the church—in short, all the varied elements of a Christian civilization, in which he was not only an actor but an inspirer—are distinct losers by his death. It is, however, the National Geographic Society that has a right to feel itself especially bereft, for this Society was the child of his old age, which had won his heart, for which he toiled at all seasons, and toward which, last of all, turned his thought and affection. His last months were filled with plans for the fit celebration of our tenth anniversary, which now lacks so much by his absence, but which also seeks inspiration for the future by a brief review of the past. Mr Hubbard was not only our President for these ten years, but he was also an initiator and an incorporator of the Society. At the original meeting, on January 13, 1888, there were present thirty-three individuals, who have increased to an aggregate membership of 2,421, of whom remain with us 1,572, the loss by death and resignation being 849.

In his introductory address of February 17, 1888, Mr Hubbard set forth the aims and objects of the Society on broad and generous lines, thus insuring growth and success. He said, "I am one of those who desire to further the prosecution of geographical research. We hope to bring together, first, the scattered workers of our country; second, the persons who desire to promote their researches."

The work was to be patriotic, educational, and scientific. How far it succeeded is rather a record of facts than an expression of opinion. It appealed to the spirit of patriotism by the establishment of two departments, the Geography of the Air and the Geography of the Sea, representing the two allied branches of meteorology and oceanography that owe their initial formation to the genius and activity of Americans. To this Society is due the credit that America was fittingly associated through the means of a Geographical Conference at the Columbian Exposition at Chicago, an exposition that celebrated contemporaneously the discovery of America and the birth of modern geography. Again, at the meeting of the British Association for the Advancement of Science, at Toronto, this Society upheld the dignity of our country by a series of geographic papers that won the generous praise of European scientists. Conjointly with other American societies, it played a conspicuous part in the proceedings of the International Geographic Congress in London in 1895. On this last occasion, it may be added, it excited attention by the presence of women as delegates, thus emphasizing our broad spirit of indiscrimination in advancing science by the coöperation of all willing workers and promoters. The Lenten lectures of 1898, Mr Hubbard's last plan of work, will do patriotic service by bringing to our members an appreciation of the advantages and a pride in the evolution of the great and varied sections that constitute the American Union.

On educational lines the Society has striven, not with the greatest success, it must be said, to stimulate proper geographic instruction in schools and universities. It has also added to geographic literature a series of monographs, written by eminent specialists, which have elicited praise from foreign scientists that must bear good fruit in their use by American teachers. Our regular winter course of lectures, by eminent specialists and on timely topics, exceed in number, variety, and utility those furnished by any other geographic society in the world.

In science this Society has done important work, if only in forming under governmental auspices a Board on Geographic Names. In our technical meetings have been presented and discussed papers of great value, and the influence of many of these papers has been extended by their publication in The National Geographic Magazine.

Among other important work should be noted the encouragement of exploration in Alaska, the establishment of The National Geographic Magazine, now in its ninth year, and the instituting of geographic field days.

Finally, we have a right to ask, Could any organization in the first ten years of its existence more fully carry out its initial plan than has this Society? In deserving and winning this success no other member did so much as did Mr Hubbard. Dealing with a Board of Managers composed of able but positive men, it was Mr Hubbard's strength that he was receptive, conciliatory, and practical. Many a seemingly hopeless idea he changed into practical form, and often from conflicting opinions he evolved an acceptable plan.

It would be placing Mr Hubbard's labors on a low plane to say that this Society throve only by them. He had the higher aim to interweave his labors with others, and so to plan and build that he might exert an enduring influence. This higher work he accomplished. We feel that the future of this Society is not doubtful; that it will continue to maintain its high ideals of public usefulness by fostering patriotism, by stimulating education, and by advancing science. Thus it will best show its active appreciation of the labors of Gardiner Greene Hubbard, and in thus doing justify the poet's words:

> "So when a great man dies,
> For years beyond our ken
> The light he leaves behind him lies
> Upon the paths of men."

President Bell: The meeting is now adjourned.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1897–'98

Regular Meeting, December 17, 1897.—Vice-President Greely in the chair. The Chairman spoke of the recent death of President Hubbard and announced that a committee had been appointed to make arrangements for a memorial meeting. He also stated that Mr Everett Hayden had resigned the office of Recording Secretary, and that Mr F. H. Newell had been designated to fill the vacancy. Professor D. G. Elliot, of the Field Columbian Museum, gave an illustrated lecture entitled "A Naturalist's Expedition to East Africa."

Special Meeting, January 7, 1898.—Mr W J McGee introduced with appropriate remarks the new President, Dr Alexander Graham Bell, who took the chair. Mr H. Snowden Ward gave an illustrated lecture entitled "Shakespeare at Home."

Regular Meeting, January 14, 1898.—President A. Graham Bell in the chair. Surgeon-General George M. Sternberg gave an illustrated lecture on the Geographical Distribution of Yellow Fever.

Special Meeting, January 21, 1898.—President A. Graham Bell in the chair. This was a memorial meeting in honor of the services and character of the late President Gardiner G. Hubbard. About 1,000 members and guests were present. Addresses were made by Surgeon-General Sternberg, U. S. A.; President Wilson, of Washington and Lee University; Président Whitman, of Columbian University; President Gilman, of

Johns Hopkins University; Dr Marcus Benjamin, Hon. A. R. Spofford, Dr Caroline A. Yale, Professor S. P. Langley, Hon. John W. Ross, Major J. W. Powell, and General A. W. Greely.

Regular Meeting, January 28, 1898.—President A. Graham Bell in the chair. Mr N. H. Darton gave an illustrated lecture on the Bad Lands of South Dakota and Nebraska.

Elections.—New members have been elected as follows:

December 14.—Miss Mary O. Dean, Mrs Annis H. Enochs, Lieut. C. D. Galloway, U. S. N., Alexander Grant, Mrs Gardiner G. Hubbard, E. G. Kimball, Gerard H. Matthes, E. W. Nelson, Professor Henry S. Pritchett, Charles H. Stevenson, Miss Mary A. Taylor.

December 27.—Elmer I. Applegate, Major E. S. Godfrey, U. S. A., William Ogilvie, W. H. Wiley.

December 31.—Dr Arthur M. Edwards, F. F. Hilder, Professor W. H. Norton.

January 7, 1898.—Miss Rachel C. Brown, Cyrus L. Hall, Dr F. C. Kenyon, Miss A. M. Lakeman, Heber J. May.

January 14.—William Churchill, S. F. Emmons, Miss Margaret French.

January 24.—Miss Mabelle Biggart, Miss Mira Lloyd Dock, Levi Maish, Daniel P. Mumbrue, August Piepho.

GEOGRAPHIC LITERATURE

Stanford's Compendium of Geography and Travel. North America, Vol. I; Canada and Newfoundland. By Samuel Edward Dawson. Pp. 719, with 18 maps and 90 illustrations. London: Edward Stanford. 1897.

This work forms part of a revision of Stanford's Compendium, the first edition of which was published in 1883. In that edition Canada and the United States occupied one volume. In the present the Dominion occupies, with Newfoundland, one large volume, being more than doubled in size. The book is simply a geographical description of the British possessions in North America. Its first chapter, after the introduction, describes the American side of the north Atlantic. Then the Dominion of Canada is taken up as a whole—its extent, area, boundaries, relief, drainage system, climate, fauna, Indian tribes, political organization, population, means of communication, government, history, and industries. Each of the provinces is then described under much the same plan, but in greater detail, in succeeding chapters. This method of description involves much repetition, greatly and unnecessarily extending the book. An interesting chapter is included in the history of Acadia. The illustrations and maps are excellent and the type and paper all that could be desired. Altogether, the work, as a description of our northern neighbor, is easily the best yet published. It is curious to find, however, at this late date any one gravely contending for the preposterous claims of Great

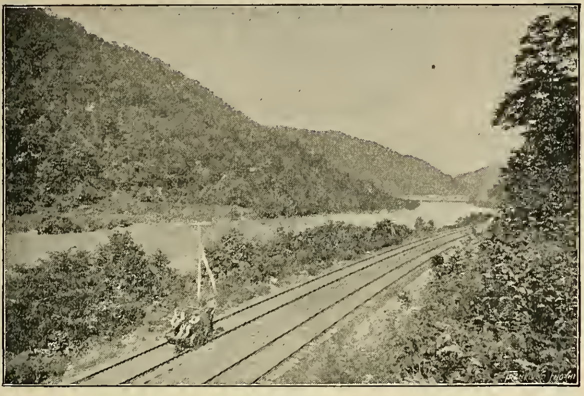
Britain in regard to the international boundary on the north of Maine, as is done by the author of this book. The story may be briefly told: By the treaty of peace at the close of the revolution that boundary was placed, in terms, on the divide between the Atlantic and the St Lawrence. No sane, disinterested person could interpret this otherwise than as meaning the divide north of St Johns river; but Great Britain, with her accustomed modesty, claimed that the divide referred to was that between the Penobscot and the St Johns. The matter was finally referred to the King of Holland, who split the difference between the conflicting claims and placed the boundary on the St Johns river. And now our author pleads that Great Britain fared hardly under this decision. H. G.

A pamphlet recently issued by Dr E. L. Corthell, C. E., entitled "Remarks Before the Committee on Rivers and Harbors," contains a history of the jetties at the mouth of the Mississippi and a statement of the dangers to which navigation is now subjected at that point. Twenty-five years ago New Orleans was well-nigh cut off from the sea by reason of bars which had been deposited at the mouth of the passage. Southwest Pass, then the broadest and deepest, had a depth of water at its mouth of barely 18 feet. To remedy this it was proposed by the Board of Army Engineers to canalize the Southwest Pass, at a cost of eleven and a half million dollars. In opposition to this Mr James B. Eads proposed, at his own risk, to build jetties and maintain a channel 30 feet deep. After a long struggle Mr Eads' proposition was accepted, with certain modifications, the principal of which was that South Pass, a much narrower and shallower outlet, should be taken, and that a depth of 26 feet, or a breadth of not less than 200 feet, should be opened and maintained. Every one knows the triumphant success of Mr Eads' project, that the river has cut away its bar at the mouth of South Pass, and a depth of 34 feet has been maintained through South Pass for a score of years. Now, however, these improvements are seriously threatened. In 1891 a crevasse was cut through the low bank just above the head of South Pass, and through this crevasse a large proportion of the river's water is pouring to the Gulf, so large a proportion that a sufficient flow cannot be obtained through South Pass to keep the channel clear, and it is rapidly silting up. The Eads executors have spent, in attempts to close this crevasse, $145,000.

H. G.

Madagascar. A steamship line has been organized between Havre and Madagascar. The telegraphic system of the island is being rapidly extended.

Switzerland. The total value of importations into Switzerland in 1896 was $191,814,822, or $58,980,443 in excess of the exports. Germany furnished 30.7 per cent of the imports and took 25 per cent of the exports, France following with 17.9 and 11.8 per cent, Italy with 13.8 and 5.7 per cent, Great Britain with 5.2 and 21.4 per cent, the United States with 4 and 10.3 per cent, and Austria-Hungary with 7.2 and 5.9 per cent respectively.



THE MARCH NUMBER

OF

THE NATIONAL GEOGRAPHIC MAGAZINE

—TO BE PUBLISHED MARCH 1—

will contain, among other interesting features, the following illustrated articles:

Iceland, Greenland, and Vineland in Saga Times,

By MISS CORNELIA HORSFORD;

Two Hundred Miles up the Kuskokwim River,

By CHARLES HALLOCK;

ALSO A PORTRAIT OF

Prof. Alexander Graham Bell, LL. D., etc.,

President of the National Geographic Society.

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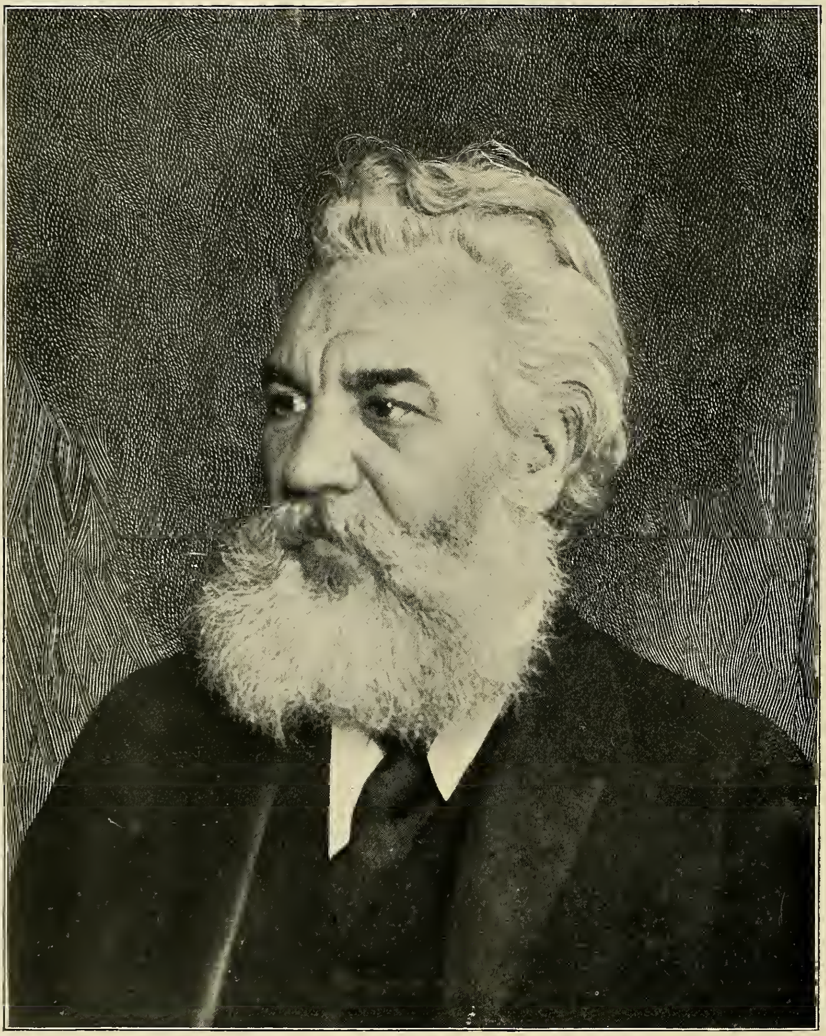
The National Geographic Society, the object of which is the increase and diffusion of geographic knowledge, has a paying membership of 1,500. Its membership is not restricted to practical geographers, but is open to any person in good standing who may be sufficiently interested in its work to seek admission. The annual subscription is: for active members, $5.00 per annum; for corresponding members, $2.00 per annum. Active members pay also an entrance fee of $2.00 on election. The National Geographic Magazine is sent regularly to all members, both active and corresponding.

Donations for the founding of Prize Medals and Scholarships are respectfully solicited.



Alexander Graham Bell

THE

National Geographic Magazine

Vol. IX MARCH, 1898 No. 3

DWELLINGS OF THE SAGA-TIME IN ICELAND, GREENLAND, AND VINELAND

By Cornelia Horsford

The Saga-time began with the colonization of Iceland in 875 and lasted for about 150 years. During this time the oft-repeated accounts of the discovery, colonization, and early history of Iceland, as well as that of all Scandinavia, acquired the form of Sagas or narrations. Ari Thorgilsson, the historian, who was born in Iceland in 1067 and died in 1148, was the first to write down these events in chronological order. In each of the four books attributed to this writer Greenland and Vineland are briefly mentioned.* Other Sagas relate the adventures, tragedies, and family histories of the colonists, and among these are the Sagas which tell about Greenland and Vineland.†

We know that Scandinavia has been a rich field for collecting relics of the stone, bronze, and early iron ages, but no ruin of a dwelling dating from the Saga-time has yet been identified in Denmark, Sweden, or Norway. This may be due to the lack of durability in the way of building the houses and to the custom of using over and over again in new buildings all the suitable material from the old walls.

In 1888 a young Icelander named Valtýr Gudmundsson, who was studying for the degree of Doctor of Philosophy at the Uni-

* Islendingabók, Landnamabók, Kristni-Saga, and Konungabók.

† Hauksbók, Eiríks Saga Rauthi, and Flateyjarbók. Greenland and Vineland are also briefly mentioned in the Fornmanna Sögur, Eyrbyggja Saga, and in three vellum manuscripts in the Arna-Magnæan Library at Copenhagen. An account of these will be found in the first chapter of "The Finding of Wineland the Good," by Arthur Middleton Reeves. London, 1890, Henry Frowde.

versity of Copenhagen, chose for the subject of his thesis "Private Dwellings in Iceland in the Saga-time."* In preparing for this he read every saga of his native literature, comparing each description, sentence, and word relating to his subject, until in imagination he had reconstructed every form of dwelling and outhouse of the Saga-days. These buildings differed considerably from the design given by Finsen in his edition of Gunnlaug's Saga, printed in 1775, which was the accepted model until the publication of Dr Gudmundsson's work.

In 1894 Lieutenant Daniel Brunn, of the Danish navy, was sent by the Danish government to make extended researches among the Norse ruins in Greenland. These researches went far toward confirming the results of Dr Gudmundsson's studies.

It was therefore with much gratification that Dr Gudmundsson (who was by that time professor of Old Norse literature and history at the University of Copenhagen) accepted my commission to direct archeological researches for me among the ruined dwellings and other works of man in Iceland during the summer season of 1895.† He took with him from Copenhagen another Icelander named Thorsteinn Erlingsson, and to him the greater part of the work is to be accredited, for Dr Gudmundsson was in attendance at the Icelandic Parliament and could not be present in the field himself.

ICELAND

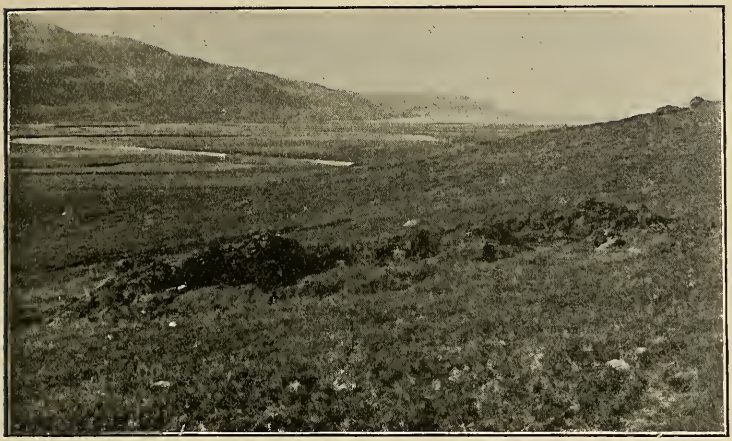
The Icelandic Antiquarian Society has done some good work in the field. They have identified and roughly measured the ruins of many historical farms and of several hundred booths at some of the old open-air law courts called "things." One or two pagan temples have been dug out and carefully described, and many burial mounds, which also belonged to the pagan days. The ancient dwellings were situated on sloping ground, near rivers or fjords.

From the early days this has been believed to be the ruin of the house built by Erik the Red in the Hawk River valley soon after his marriage with Thorhild, and here his eldest son Leif was probably born. Erik lived in four different places in Ice-

* "Privatboligen paa Island i Saga-Tiden" af Valtýr Gudmundsson. Copenhagen, 1889. Andr. Fred. Host & Sons, Forlag.

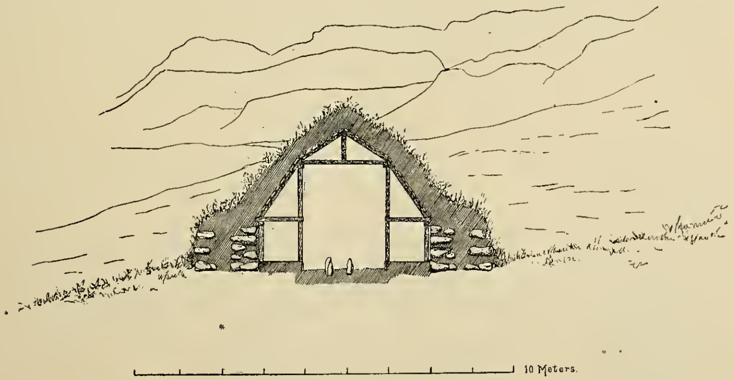
† The report of this expedition will soon be published by the Viking Club of London under the title of "Ruins of the Saga-Time."

‡ The researches of this society are published yearly at Reykjavík, Iceland, in the "Árbók hins Islenzka Fornleifafélags."



SUPPOSED BIRTHPLACE OF LEIF ERIKSON

land before he finally settled in Greenland. The supposed ruins of his houses on Öxney and Sudrey can still be seen also,* but I do not know that any ruins have been identified at Drangar. The ruins of these dwellings, when undisturbed, are low, grass-grown ridges and hollows often difficult to detect, except when stones protrude through the turf. A dwelling usually consisted



VERTICAL SECTION OF AN APARTMENT

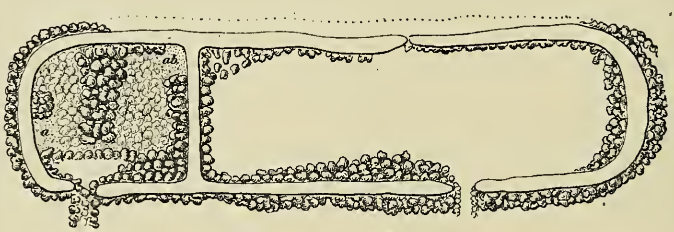
of three apartments: a hall or principal room, in which there was always a fireplace; a sitting-room for the women, and a store-room or pantry.† These apartments were like small houses,

* "Finding of Wineland the Good," by A. M. Reeves, p. 165.

† "Fortidsminder og Nutidshjem paa Island" of Daniel Brunn. Copenhagen, Ernst Bojesen, p. 161.

each with a separate roof, but attached to each other, with passages through the thick walls. Near by were usually one or more small outhouses. These dwellings were built on the surface of the ground, which was probably levelled when necessary. The floor was of firmly beaten earth.

The walls were one and a half meters thick and from one to one and a half meters high. The inner side was built of unhewn stones and the interstices were filled with earth. The outer side was of alternate layers of turf and stones, and the space between the two sides was filled in with earth kneaded hard. When these walls fall, the stones necessarily slip down on either side, and the bottom row with the space between remains almost intact, unless



Blóthúsið í túninu á Þyrli, 57 fet á lengd, og 17 fet á breidd Gólfið í afhýsinu er steinlagt og lægra en í aðalhúsinu. a. fannst aska. ab. fannst aska og hrosstönnur.

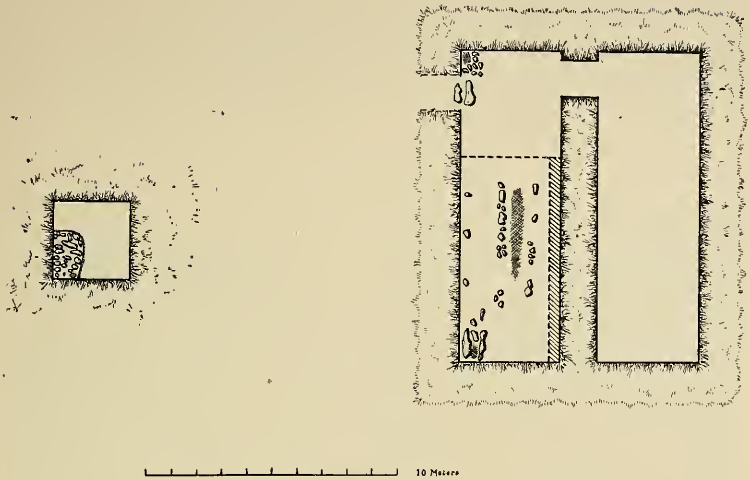
RUIN OF PAGAN TEMPLE AT THYRLI

Árbók Hins Íslenzka Fornleifafelags, 1880–1881

unnaturally disturbed. Often, however, the walls were built entirely of layers of turf or with only disconnected rows of stones at the base.

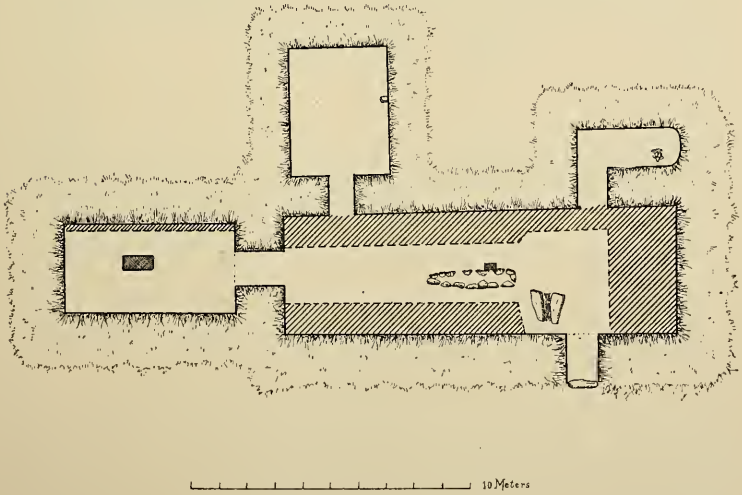
The drawing of the pagan temple at Thyrli shows the manner of laying the inner and outer sides of a wall with the earth between the two. A large stone, of course, extends farther back into this earth between than a small one does.

The inside measurement of a hall varied from 3 to 7 meters in width and from 10 to 17 meters in length. The plan is of the ruin of Erik the Red's house, shown above from a photograph. A long narrow fire-place usually extended through the middle of the room. This was either paved or surrounded with stones standing on edge, and was about 3 meters long and from 60 to 80 centimeters broad. Besides the long fire which served to warm and light the hall, there was a small cooking fire made in the same way, about 1 meter square and raised a few centimeters



PLAN OF THE HOUSE OF ERIK THE RED IN HAUKADALE

above the level of the floor. Other non-essential forms of fire-place I need not describe here. A separate apartment was often formed by erecting a thin partition across a room, as is shown in this plan by the dotted line. Pavements, but more often thresholds made of one or more long stone slabs, were sometimes in the doorways and also in the passages through the thick walls between the apartments. The outhouse shown at the



RUIN OF SÁMSSTADIR IN HIGÓRSÁRDALR

left was about 13 meters from the door of the house, on the steep mountain side. It was 4 meters square, built of turf only, and partially underground. There was a large square platform of stones in one corner which had served for a fire-place.

Narrow platforms of earth faced along the outer edge with upright stones, on which the inhabitants both sat and slept, extended along one or both sides of the hall. In the large halls these platforms were about 23 centimeters high and 1¼ meters broad. Sometimes there was also a broader platform at one end of the hall. Sámsstadir is one of the farmsteads in the Thor's River valley which was buried during an eruption of Mount Hecla in the fourteenth century. This valley is called the Pompeii of Iceland. The farm was probably abandoned about 1300. It shows the first change in the evolution toward thicker walls.

With the exception of some spinning-stones, which were found in the sitting-room of a house not shown here, no relics were found during these researches. It is also an interesting fact that no runic inscription belonging to the Saga-time or for two centuries later has yet been found in Iceland.

The evolution which has taken place in house-building since the Saga-time has been in the steady increase in the thickness of the walls until their breadth is nearly doubled, a slight increase in height, not admitting a second story under the roof, and the addition of many apartments, so that from a distance the many roofs of a farmstead look almost like a little village.

GREENLAND

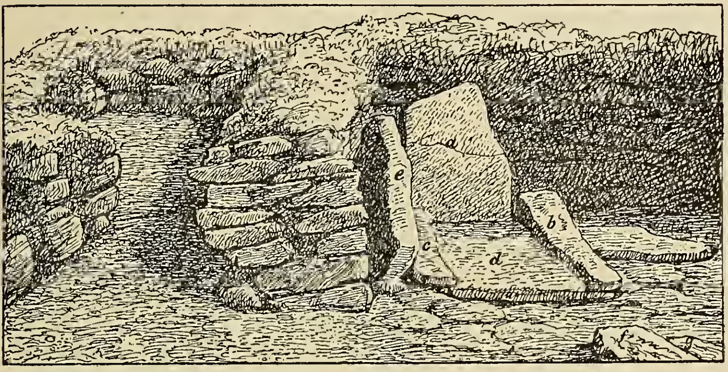
Greenland was discovered and colonized by Erik Thorvaldsson toward the end of the tenth century, and from that time two Norse colonies, called respectively the eastern and the western settlements, prospered for about three hundred years. The ruins of these two settlements have been studied with more or less care by the Danish government. In the eastern settlement a hundred and fifty farms, with all their outbuildings, have been surveyed and measured. A few dwelling-houses have been thoroughly dug out and examined.*

* Beskrivelse af Ruiner i Julianehaabs Distrikt i Aaret 1880, af G. F. Holm. Meddelelser om Grönland, udgivne af Commissionen for Ledelsen af de geologiske og geographiske Undersögelser i Grönland. Copenhagen, 1883, vol. vi.

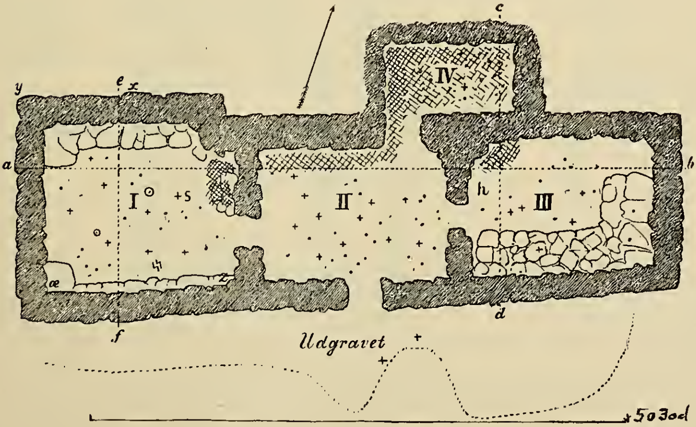
Undersogelse af Grönlands Vestkyst fra 64° til 67° N. B. af J. A. D. Jensen, 1884 og 1885. Meddelelser om Grönland. Copenhagen, 1889, vol. viii.

Arkæologiske Undersögelser i Julianehaabs Distrikt af Daniel Bruun, 1895. Meddelelser om Grönland. Copenhagen, 1896, vol. xvi.

As in Iceland, these farmsteads were situated on the shores of rivers and fjords. Although in the main they resemble those of Iceland, one is impressed at once with certain striking differences. Even the undisturbed ruins suggest narrower, straighter, and stronger walls.



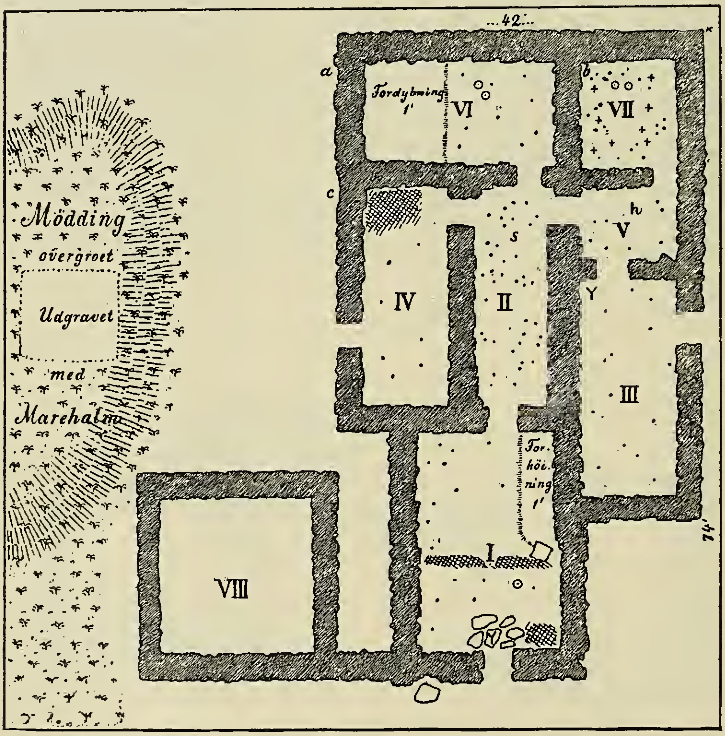
WALLS OF A NORSE RUIN IN GREENLAND
Meddelelser om Grönland, vol. xvi. Daniel Brunn



PLAN OF A NORSE RUIN IN GREENLAND
Meddelelser om Grönland, vol. xvi. Daniel Brunn

The dwellings were usually long and narrow, consisting of from three to eight rooms, and were surrounded by numerous outhouses and stables for cattle, sheep, and goats. Close to the houses are found enormous midden heaps, often larger than the ruins of the houses themselves. The walls were narrower than the Icelandic walls, and, although they were built of layers of turf and stone or sometimes of turf on a foundation of stone, the middle space, filled in with earth, had almost disappeared, as may be seen in the sketch. The long platforms of stone along the walls, the pavements, thresholds, and scattered fireplaces recall similar constructions in Iceland.

In 1261 Greenland became subject to the Crown of Norway, and to this influence the Danes attribute certain differences be-



SUPPOSED SITE OF THE HOUSE OF ERIK THE RED IN GREENLAND
Meddelelser om Grönland, vol. xvi. Daniel Brunn

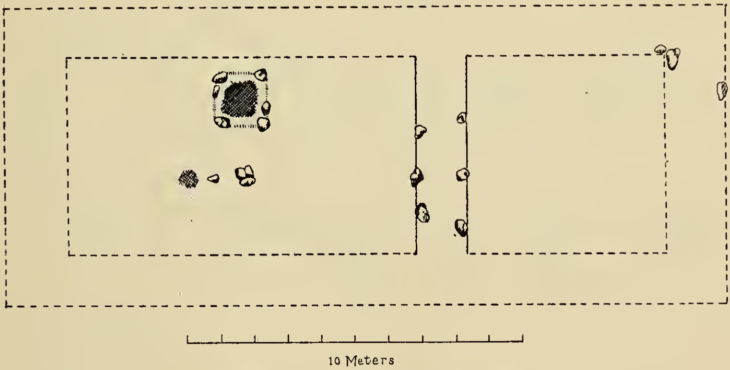
tween the customs of the Norsemen in Iceland and in Greenland, which I need not describe here.* Perhaps the difference in architecture is due to the same cause. The ruin of the house found on the supposed site of Brattahlid, the abode of Erik the Red, looks as if it might have been remodeled several times since that fearless Norseman first settled in the land.

* Meddelelser om Grönland, vol. xvi, p. 490.

Numerous relics have been found in these ruins—iron nails and knives, pieces of stone vessels, spinning stones, bone combs, and stone pendants bored with holes and incised with rune-like but illegible characters. These, like all the ruins in Greenland which have been thoroughly dug out, are attributed by the Danes to a period later than the Saga time.

VINELAND

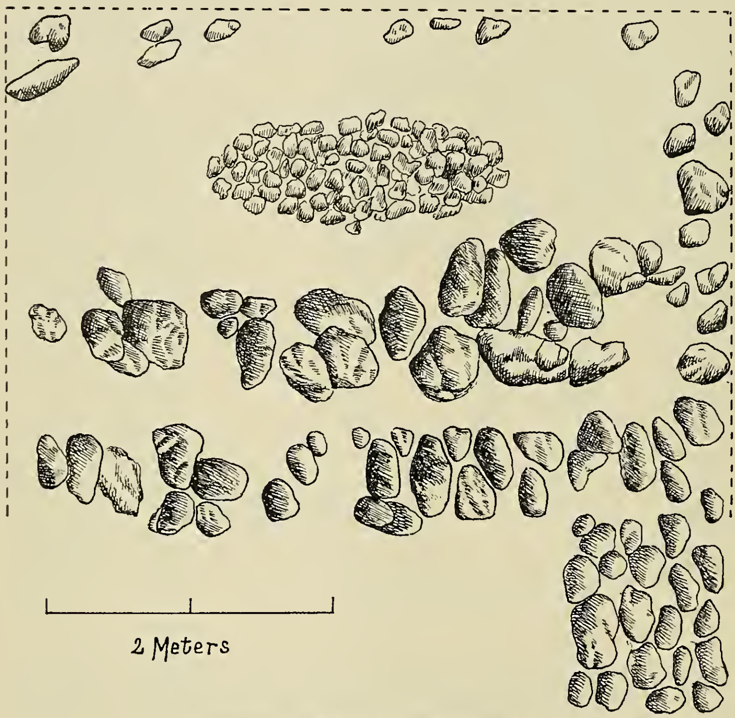
The ruins, found where one had every reason to hope to find traces of the houses built in Vineland by Leif Erikson and his followers, did not differ in their essential features from those of Iceland in the Saga-time. The situations were similar. The walls were laid in the same way and were of the same thickness, and the fireplaces were constructed as they were in the habit of constructing them at home.



SUPPOSED NORSE RUIN IN MASSACHUSETTS

The walls of this house can be little more than suggested. They were probably built almost entirely of turf, and they looked as if they might have been intentionally destroyed. I show it for its fireplace. Three or four fireplaces were on the site, one of them being the familiar Indian clam-bake, with its neatly paved, saucer-shaped hearth piled with ashes and unopened clam shells, for this temptingly prepared feast had never been eaten. One of these fireplaces, however, was very different from the others, and of the Icelandic type, with its surrounding upright stones at the four corners and a mass of charcoal and stones inside. This house is one of those on the place pointed out in Cambridge by my father, Eben Norton Horsford, as the site of the group of houses built by the party of Thorfinn Karlsefni in Vineland.

The second house I show for the construction of the walls and the little pavement, presumably at the door, which resembles that in the temple at Thyrli shown before. The outer side of the wall contained only one layer of stones, the inner, according to custom, containing more and larger stones, some of which had fallen in. The oblong platform of small stones occupied the place of



SUPPOSED NORSE RUIN IN MASSACHUSETTS

and resembled a fireplace, but showed no trace of such use, unless in the dark sticky earth between and under the stones, which I have since been told may have been ashes absorbed in the soil. This house, with the other ruins near it, are about ten or more miles from the settlement at Cambridge, and so far from the river that it must be attributed to later visitors from the North than those told about in the Vineland Sagas.

No relics have been found at either of these sites which I attribute to the Northmen. I have, however, one stone implement, which was found imbedded in the yellow sand and seemed to have been lost before the advent of the Northmen, and presumably belonged to the savages they found here.

Probably the reader will contrast these different dwellings of the Northmen with those of the native tribes of North America, from the magnificent ruins of Copan to the long, narrow houses of the Iroquois, and will detect the similarities and differences between these and the habitations of the Greenland Eskimos.

The Spanish, Dutch, French, and English explorers visited and might have built houses on these shores, but in Europe no houses of this type are found outside of Iceland, except in the Faroes, and, although ruins of Norse dwellings are probably awaiting detection in England, Scotland, Orkney, and Shetland, they have not yet been brought to the notice of archeologists.*

The earliest examples of architecture on our shores, as well as the present knowledge of the evolution of European architecture, as far as I have been able to find out, show that the walls of the inferior houses in post-Columbian times were unlike those of Iceland. Our oldest French house is the Sillery manor house near Quebec, built by the Jesuits in 1637. The walls of this house are built of stone, and are three feet thick, laid in mortar which is now nearly as hard as the stone itself. I have been unable to find anything more primitive of French workmanship here. I have found nothing in English work which is not familiar to you all, although I have followed up several mistaken reports. The Dutch buildings show an equally advanced though different type of development, and also the Spanish.

I am glad to have an opportunity to express publicly my sincere thanks and deep indebtedness to the American archeologists, both here and in Canada, who have come most kindly to my assistance and taught me in the field the knowledge they had acquired by their own experience, without which I could not have learned how to gather many facts, a few of which I have here presented.

Mr Gerard Fowke: Seven weeks of field work in and near Cambridge. Two weeks of field work in Ohio, Pennsylvania, West Virginia, and Maryland, 1894. Five weeks in Cambridge, 1896.

Dr Franz Boas: Two days in and near Cambridge, 1894.

Mr David Boyle, *Curator of the Canadian Institute at Toronto:* One week in and near Cambridge. One week in Ontario, Canada, 1894. One week in Cambridge, 1896.

* Since writing this I have been notified that ancient Norse ruins have been found in the Hebrides.

Mr F. W. Norris, *Hon. Editor of the Viking Club, London:* One week in Cornwall, 1895. Three weeks in Scotland, Orkney, and Shetland, 1896. Two weeks in England, 1897.

Dr phil. Valtyr Gudmundsson, *Professor of Old Norse History and Literature at the University of Copenhagen:* Direction of explorations in Iceland for four months, 1895. Five weeks in and near Cambridge, 1896.

Mr Thorsteinn Erlingsson, *Iceland:* Four months in Iceland, 1895.

Rev. Henry Otis Thayer, *Maine Historical Society:* Two weeks among old English ruins in Maine, 1896.

Sir James Lemoine, *Past President of the Royal Society of Canada:* Direction of researches near Quebec, 1896.

Mr C. C. Willoughby, *Peabody Museum, Cambridge:* Two days on Cape Cod, 1897.

Mr W J McGee: Advice, criticism, and encouragement, both in Washington and Cambridge for over four years.

COMPLETION OF THE LA BOCA DOCK

In a recent report to the Department of State, Consular Clerk Murphy of Colon announces the completion of the La Boca dock, the Pacific terminus of the Panama canal. The real importance of the work at La Boca, says Mr Murphy, remains to be demonstrated. The tide fluctuation at Panama amounts to over 25 feet, and at the lowest ebb the bottom of the sea is exposed for a mile or more from the shore. As to whether or not vessels will venture to use the La Boca dock, time alone will prove. Mr Murphy says he has heard the opinion expressed that the dock will prove to be a complete success. On the other hand, he has heard it even more confidently stated that this is only another example of the waste which has characterized the management of this apparently simple undertaking. To one traveling across the isthmus, he says, it appears that there can be no obstacle to the completion of the canal which money, honestly used, engineering skill, and common sense cannot easily overcome. The land is mostly level, the highest point being little over 300 feet above the sea. The distance is only about 45 miles. The freshets of the river Chagres seem to be the only difficulty, and it appears that provision for the storage or escape of such water can be made. The work, if it were in American hands and under American control, could, Mr Murphy believes, be completed in a few years at moderate cost. About one-half of the work—14 miles at the north end and 6 miles at the south—has been completed or partially completed, though the freshets of the Chagres river have caused great damage during years of neglect.

TWO HUNDRED MILES UP THE KUSKOKWIM

By Charles Hallock

Many mighty rivers besides the Yukon flow out of Alaska into Bering sea, of which the largest and most notable is the Kuskokwim. It is 800 miles long. From its source in the geographical center of the province, it flows with many a majestic sweep and sinuous curve out from granite walls, through rounded foothills and level plains, into the bosom of the sea some two degrees north of the Aleutian peninsula, and with the great bay of the same name, into which it empties, constitutes the phenomenal counterpart on the Pacific of the bay of Fundy and the river Peticodiac on the Atlantic, though the Kuskokwim is beyond comparison the larger river of the two. It is so wide at its mouth that its shores are invisible from mid-channel, and it is navigable for barges for a distance of 500 miles up. The tide rises *fifty feet*, and when it runs out it exposes a vast area of oozy mud flats

KUSKOKWIM RIVER FROM KOLMAKOVSKY

(sixty miles wide at the entrance of the river), which are seamed with countless shallow, dirty rivulets flowing seaward. Very different is its physical aspect when it is bank-full at flood. "It shimmers then like an inland ocean studded with myriads of mossy islands." The head of the tide is 100 miles upstream, at a trading post called Mumtrekhlagamute. Boats ascending the river must wait for the tide, whose flow is irresistible even by steam-power, for it rises vertically over eight feet an hour, filling up the vast chasm which forms its bed in the brief space of six hours, though there is an entire absence of anything like a tidal "bore" rolling in and overwhelming everything in its impetuous career. This phenomenal procedure is an old fable which used to be current regarding the bay of Fundy, until people learned differently, and graphic recitals were told of pigs which had been foraging on the flats, scampering before the advancing wave and being presently overtaken and engulfed.

On the Kuskokwim there are no less than sixteen trading posts and villages within the first 400 miles of its mouth. Messrs Hartmann and Weinland, Moravian missionaries from Bethlehem, Pennsylvania, who are men of marked ability, located a school and mission at Kolmakovsky, 200 miles up, as long ago as 1885; and the description of the river which here follows, with the accompanying illustrations, is from observations made by them on their initial trip. They afford a very realistic picture of summer life in the interior of Alaska and will serve to counteract the popular impression that the country is wholly frigid and barren.

When these gentlemen first arrived at the mouth of the river, in June, the salmon fishing was at its height, varying little, if any, from the running season on the St Lawrence tributaries. The eastern bank of the estuary was swarming with native fishermen (Eskimos), whose huts were strung along the top of a narrow dike at high-water mark in close continuity for miles, crowding each other so closely that there was hardly room for more. This dike was fringed with alders, willow, birch, and poplar saplings interspersed, flanked by a vigorous growth of coarse sedges and bulrushes. Back of the dike (or levee, as it would be called in the southern states) the country is a flat waste, covered with a spongy bed of moss or "tundra" from six inches to a foot deep and destitute even of shrubs. Great deposits of driftwood from above line the shore and afford fuel for the resident inhabitants, who number several thousands, but whose ranks are

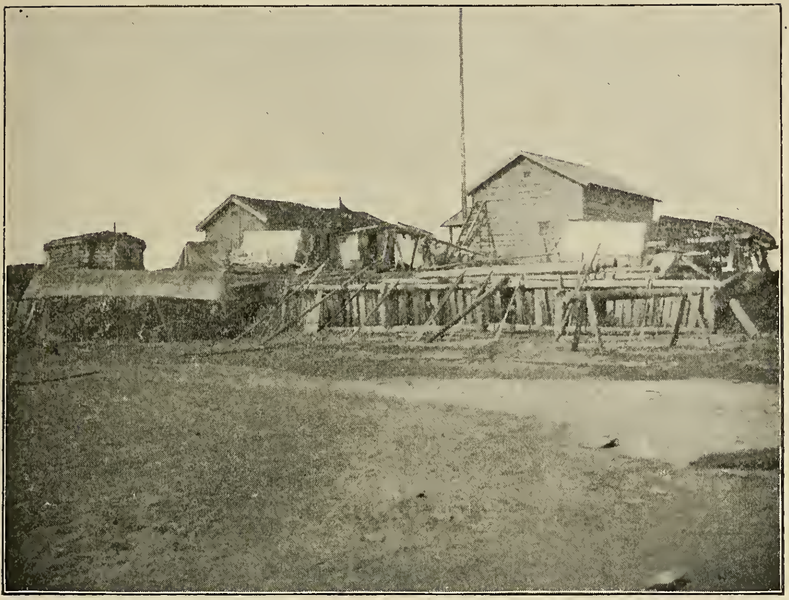
FRAMES FOR DRYING FISH

swelled in the fishing season by accessions from the Yukon to a total of perhaps seven or eight thousand. There is a portage of sixty miles from the Yukon to the Kuskokwim, which has been traveled for a century by employés of the Russian Fur Company and others since. The salmon are taken chiefly in dip-nets along the banks, and our travelers measured a specimen which weighed 41 pounds and measured three feet in girth and nearly four feet in length.

Though the Yukon is the great arterial drainage conduit for the summer meltings from the snow-capped mountain ranges which traverse the interior and are consequently filled with glacial mud, big salmon are found in it, and in some of its clear-water tributaries there is an abundance of large grayling and so-called salmon trout.

Leaving the steamer (in which they had taken passage from San Francisco) at the mouth of the river landing stores, the missionaries proceeded up the stream in company with four freighting barges destined for upper posts. Their own private conveyances were native bidarkas, or sealskin canoes decked over, each with three manholes, the passenger occupying the central hole and the paddlers the end ones. A three hours' sail brought them to one of the storehouses above mentioned, located near the outlet of a small, deep river, it being 11 o'clock at night and still daylight. The weather was clear, but head winds detained them for the next five days. Starting on June 18, at 2 a. m., just before sunrise, they made an eight-mile pull to a village of about ten barabarahs or native houses, named Kuskokwagamute (it is well to remember these names), and, lying by until 1 o'clock, attempted to snooze, but were distressed by ravenous mosquitoes. Then a two-hours' paddle found them, at 3 o'clock, at the village of Apokachamute, numbering about 150 inhabitants, located on a small tributary of the Kuskokwim, where large numbers of beautiful salmon were lying on the bank waiting to be dressed. All the people were dressed in sealskin coats and wore beads and ivory ornaments. Lying by twelve hours, starting again at 3 o'clock in the morning—always waiting for the tide to serve—they arrived at Togiarhazorimute at 8, and after breakfast made a 60-mile run to Lomavigamute (*mute* means village). Traveling was delightful. A fine breeze kept the mosquitoes off. Point after point was reached and left behind. The skin boats seemed to glide through the water. "As we went on, the river grew narrower, so that the opposite bank became distinctly visible. The

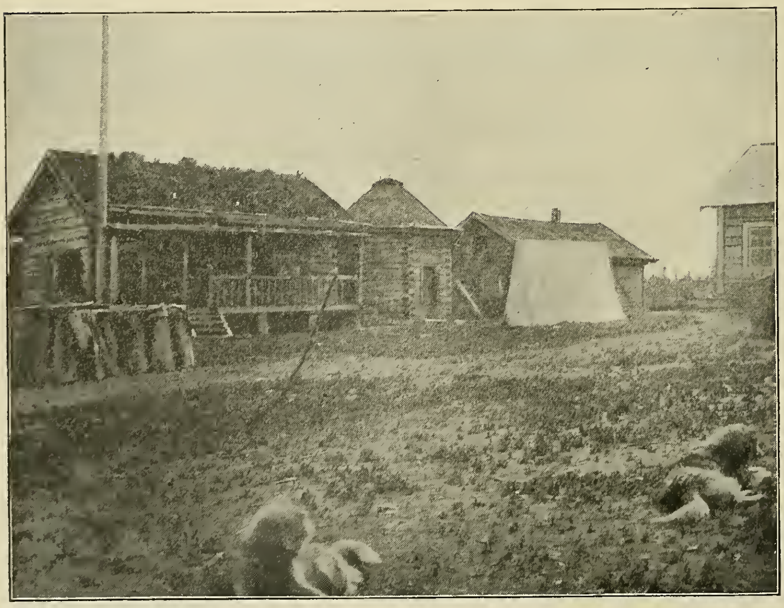
BIDARKAS (SKIN CANOES) ON THE LOWER KUSKOKWIM



MUMTREKHLAGAMUTE

river, which hitherto had been an unbroken stream, was now divided by numerous islands into many channels. The shores were lined with a higher growth of underwood, and thickets of small birch trees alternated with grassy or mossy banks. The tide was also sluggish."

The next day, sailing still among enchanting wooded islands, they came to Napahaiagamute, where a lot of Eskimos were in their kayaks or sealskin boats with a single hole—fishing for salmon with gill nets. Soon they passed Napahaiagamute and, rounding an island, came in view of the important trading station of Mumtrekhlagamute, situated on a high bank, with a background of pine trees and a hill range in the distance. The tide here rises about 4 feet. The station comprises two large, well-built log-houses and several smaller ones, and a Russian bath-house or kashima, besides the usual annex of native barabarahs. Here the boatmen struck for higher wages, as they always do, but were finally conciliated by the factor of the trading post. The dogs here were numerous, and howled so as to disturb the missionary when he was reading the 116th Psalm by daylight at 1 o'clock a. m. The cause proved to be a wrestling match between two rivals for the permanent possession of a woman. The following day they proceeded up a winding channel whose banks were clad with pine trees forty feet high, and finally reached Kikkhlagamute, where they counted fifty birch-bark canoes, which here begin to replace skin ones. The village contained 216 people and was situated in a low, marshy ground, with an abundance of mosquitoes. On the 27th of June they stopped at a small Eskimo fishing station, where they met a white mining prospector coming down. The villages of Akiagamute, Iulukiak, and Kivigalogamute were afterward successively passed, and the following day found them at the fishing station of an enterprising half-breed, when rain began falling, the first of any consequence since they left Unalaska on the 16th of May. Still proceeding up river, more villages—Ugavik, Kalkhagamute, Ookhogamute—were passed, all under the influence and civilization of the Greek church, and at last, after a journey of 9 days, the great focal trade center of this district, Kolmakovsky, was reached. Ranges of snow-covered mountains were visible the day previous, with foothills clad with pine, up whose somber glens favorable glimpses were had at times. Kolmakovsky consists of 7 log buildings, built in the form of a square, including a church and a hexagonal block-house built 50 years ago. It stands on



KOLMAKOVSKY

a bluff. The country seems much more populous than Alaska had been credited with being. All the white traders whom the missionaries met had adopted native women as partners, who were very decorous in manner and behavior. Their children are of prepossessing appearance, dressed in European fashion, and trained in the ways of their white fathers. There are some 50 children at Napaimute, a village 10 miles higher up the stream. These people know nothing about intoxicating liquors.

Kolmakovsky is 200 miles above the mouth of the Kuskokwim. There is another trading post, called Venizali, twenty days' journey still farther up. The missionaries retraced their voyage from this point, reaching the mouth of the Kuskokwim on July 17, in nine days' time, while the journey upstream occupied twenty-one. The weather for the previous fortnight had been fickle—sometimes bright and often rainy, warm and cold by turns, and frequently too hot for comfort. Thence they cruised along the seacoast, following its indentations to Good News bay, a large and beautiful basin surrounded by lofty mountains, and, passing safely through its narrow entrance on the surf of an incoming tide, came to anchor at the head of the bay in front of a village of 150 people of mixed complexion, and some of them almost white. By taking a canoe route from there across the neck of a mountainous headland or cape, it was possible to reach their place of destination at Togiak bay, and thus avoid a perilous coastwise journey outside, and so poling up a winding mountain stream, beautifully clear and very rapid, which finally cut a deep crooked rut through a mossy swamp, with high grass lining the banks, they came to a portage, and, crossing the divide, entered a chain of lakes which formed the headwaters of the stream which they had to descend. The lakes, of which there are four, are small, the largest scarcely a mile in length, with water beautifully clear and sweet, and full of "red salmon," some of which their native guides speared. This fish is probably *Salvelinus malma*, or Dolly Varden. One characteristic of these fish was "a big swelling on the back close to the neck." (Can these be the same as the redfish of Idaho described by Captain Bendire?) Their flavor was not highly esteemed. The outlet of this chain of lakes which the canoe followed was at first so narrow and crooked as to be scarcely passable, but it soon developed into "a winding mountain torrent, alive with trout, some of which we saw shooting through the water with incredible velocity." The paddlers had little to do except to let her run and keep her off the banks at the bends. The scenery was very beautiful, the view bounded on either side by well-shaped mountains, green with sphagnum, rising from the plain below, with snow still resting on them in patches. The region was "one vast solitude, over which bears and birds hold undivided sway." On July 26 the voyagers took dinner at the deserted village of Aziavigamute, and then made their way in a short time to Togiak bay, having occupied three days in crossing the divide. "Brother Weinland shot some ducks and four geese, and the natives speared a large salmon."

ESKIMO MONUMENTS

Subsequently the missionaries made a trip up the Togiak river, which occupied two days, and after visiting several villages with polysyllabic names they returned to the coast, where they found a hamper from their friends of the Alaska Commercial Company (bless them!) which "contained thirty good cigars (it seems the brethren smoke), four large cakes of tobacco, two tins of boiled oysters, two of corned beef, one of fresh boiled beef, three tins of sardines, one of peaches, one of corn, and one of peas."

So the record runs.

THE MT ST ELIAS EXPEDITION OF PRINCE LUIGI AMADEO OF SAVOY, 1897

A lecture of Dr Filippo de Filippi, who accompanied Prince Luigi of Savoy on his expedition to Mt St Elias, was delivered before the Turin Alpine Club and has been published in the *Rivista Mensile del Club Alpino Italiano*, the first authentic account given of that remarkably successful ascent of one of the greatest snow peaks of the world. A translation of this article appears in the latest Sierra Club Bulletin, January, 1898, by Dr Paolo de Vecchi, of San Francisco, member of the Sierra Club and the Turin Alpine Club, who assisted Prince Luigi by making the advance preparations on the Pacific coast.

Dr Filippo de Filippi tells how Prince Luigi determined upon the expedition in February, 1897, and at once began correspondence with those in the United States who could best inform and advise him. He associated with him Lieutenant Cagui, Sr Gonella, Sr Vittorio Sella, the Alpine photographer, and Dr Filippo. Four guides or huntsmen from the royal Italian estates and the special guide of Sr Sella accompanied them, leaving Turin May 17 and reaching New York from Liverpool May 28. They proceeded to San Francisco, where part of the equipment was procured, and sailed from Seattle on the regular mail steamer for Alaska June 13, Major E. S. Ingraham, of Seattle, with ten American packers, their equipment and provisions, having sailed a few days before on the schooner *Aggie*. The expedition left Sitka June 20, the mail steamer towing the *Aggie*, for Yakutat bay, where a landing was made on the coast of the Malaspina glacier June 23.

Prince Luigi was thoroughly informed of all the work of the expeditions of Schwatka and Topham and of the two expeditions sent to Mt St Elias by the National Geographic Society, Prof. I. C. Russell commanding, and before leaving Italy had planned every detail and mapped out his route. Professor Russell, Professor George Davidson, the senior scientist of the Pacific coast, Professor Fay, of the Appalachian Club, Boston, and Major Ingraham, of Seattle, who has climbed Mt Rainier again and again, gave advice and assistance without stint. It was the most thoroughly planned and well managed expedition that we have known of on American peaks, and was carried out like a military maneuver. Perfect discipline and harmony prevailed, the ten Italians leading the way, while Major Ingraham and his ten packers conducted a transport service that never failed in promptly passing on, by the chain of camps extending to the foot of the Newton glacier, the ample store of provisions landed at the seashore. There was not the slightest delay nor hitch in any of the arrangements, and from the time Prince Luigi left Turin until he returned to London everything moved like military maneuvers at an annual review. It was indeed but a promenade to the top of Mt St Elias and back again—a promenade over the ice and snow that had daunted and defeated four expeditions before that year and a fifth expedition but a fortnight before Prince Luigi landed on the forest-covered edge of the Malaspina glacier.

Starting from the seacoast on the morning of June 24 and always preceding the party to choose the way and determine the places for halts and camps, Prince Luigi led his men across Malaspina's forest, and on the sixth day reached the edge of clear ice, where the four extra Indian packers were sent back to Yakutat and the sleds made ready for use. They were then 492 feet above the sea, the real climb began, and for all the rest of the way their route lay over snow and ice—Mt St Elias presenting the longest snow climb anywhere in the world.

Beginning their alpine work on the 1st of July, allowing one day's rest on the Fourth that the Americans might celebrate Independence Day, Prince Luigi piloted them across the Malaspina and Seward glaciers to the point near Pinnacle pass where he found the cairn and tent fragments left by Prof. Russell in 1890. At that point Major Ingraham and the American packers were left behind to carry on independently the work of passing provisions up from the coast and victualling the route as far as the upper Newton glacier, where the Italian guides then took charge of the packs. The Prince proceeded across the Seward and on up the Agassiz and Newton glaciers toward that same ridge on the north side of St Elias from which Prof. Russell essayed the summit in 1891. They encountered rain, fog, mist, and snow for all the early part of the climb, dragging the sleds over slush and soft snow in which they often sank to their hips. Of the thirteen days spent in toilsomely ascending the Newton glacier only three were tolerably clear, and Dr Filippo says: "During these the panorama was really enchanting, with its different colors changing at every instant, and with a characteristic indigo blue very different from the coloring of the Italian alps. These glaciers differ from those of the Alps in that the stormy weather in Alaska is not dangerous and the thunder is not heard mingled with the noises of the avalanches."

On the morning of July 30 Prince Luigi left the camp at the head of the Newton glacier, 8,958 feet above the sea, and camped that night on a ridge 12,248 feet above the sea. "The atmosphere is so clear that the far-away sea and all the peaks around * * * can be seen. From St Elias and from the rocks of Newton continual avalanches of snow and ice and stone fall with a tremendous noise. The sun-setting is beautiful. The sky is steel blue, the rest of the horizon orange-red, and Augusta (Mt) looks like a volcano in eruption," Dr Filippo observes, from which it may be inferred what photographs Prof. Sella was able to make with his two large cameras. Starting at midnight with perfectly clear sky and climbing to a point 16,400 feet, they halted for breakfast, and then continued the dizzying, exhausting climb, resting every ten minutes to breathe.

"One hundred and sixty feet from the top, Petigax, who is at the head, stops to give way to the Prince, telling him, 'It is for you to touch the top first, as you deserve it by your perseverance.' His Highness steps to the top of St Elias, and all the others run, anxious and exhausted, to join him in the hurrah. The victory is complete, and it is all Italian. All ten have accomplished the purpose for which they left their own country. * * * It was 11.45 of the 31st of July, 'and the Italian flag was waving, hanging to a post, while the little crowd stood cheering Italy and the King.'

"The temperature is —12° centigrade. The mercurial barometer points to 385 mm. and, with the correction, shows an altitude of 18,086 feet above the sea level, closely approximate to that of 18,080 feet, calculated in 1891 by Russell with triangulation."

The descent was as perfect a military maneuver as the ascent, the party making three of the previous camps in each day; the food supplies were all in waiting at the chain of camps, and in ten days they had retraced the route it had taken them thirty days to ascend. The Prince had ordered the *Aggie* to meet them between the 10th and 11th of August. On the evening of the 10th they camped on the shore, embarked on the 11th, sailed on the 12th, reached Sitka the 17th of August, fifty-seven days after leaving it. Sailing from New York by the *Lucania* September 4, the party broke up in London September 11, the Prince in good time to take part in some yacht races for which he had promised to reach England by the middle of September—the most modest and unassuming as the most intrepid and successful of all the explorers who have essayed Mt St Elias. E. R. S.

THE ORIGIN OF FRENCH-CANADIANS*

Acadia was peopled without any kind of organization between 1636 and 1670. No one has yet satisfactorily demonstrated where the French of that colony came from, though their dialect would indicate their place of origin to be near the mouth of the river Loire. They were distinct from the French-Canadians in some particulars, and not allied by marriage with the settlers of the St Lawrence. It is ascertained from Champlain's writings that no "habitant" tilled the soil of Canada during the first quarter of the seventeenth century.

From an examination of family and other archives, involving over thirty years' labor, the following conclusions are arrived at: Perche, Normandy, Beauce, Picardy, and Anjou contributed about 200 families from 1633 to 1663, the period of the Hundred Partners' regime. By natural growth these reached the figure of 2,200 souls in 1663. In 1662–1663 there came about 100 men from Perche and 150 from Poitou, Rochelle, and Gascony, with a small number of women. This opens a new phase in the history of our immigration by introducing Poitou and Rochelle among the people of the northern and western provinces of France, already counting two generations in the three districts of Quebec, Three Rivers, and Montreal.

After 1665 the city of Paris, or rather the small territory encircling it, contributed a good share. No part of the south or east of France had any connection with Canada at any time. Normandy, Perche, Mainc, Anjou, Touraine, Poitou, Saint Ongc, Angoumois, Guienne, and Gascony—on a straight line from north to south—furnished the whole of the families now composing the French-Canadian people.

From 1667 to 1672 a committec was active in Paris, Rouen, Rochelle, and Quebec to recruit men, women, and young girls for

*Abstract of paper, by B. Sulte, read before the Anthropological Section of the British Association for the Advancement of Science, at the Toronto meeting.

Canada. This committee succeeded in effecting the immigration into Canada of about 4,000 souls. Half of the girls were from country places in Normandy, and the other half were well educated persons who did not go into the rural districts, but married in Quebec, Three Rivers, and Montreal.

In 1673 the King stopped all immigration, and this was the end of French attempts to colonize Canada. The settlers, of course, remained as they were, and in 1680 the whole population amounted only to 9,700 souls. Double the number every thirty years and we have the present French population of the Provinces of Quebec and Ontario, and of the groups established now in the United States.

On the subject of uniformity of language, which is so remarkable among the French-Canadians, we may observe that it is the best language spoken from Rochelle to Paris and Tours, and from there to Rouen. Writers of the seventeenth century have expressed the opinion that French-Canadians could understand a dramatic play as well as the élite of Paris. No wonder to us, since we know that theatricals were common occurrences in Canada, and that the "Cid of Corneille" was played in Quebec in 1645; the "Tartuffe of Molière" in 1677, and so on. The taste for music and love for song are characteristics of the French-Canadian race. The facility with which they learn foreign languages is well known in America, where they speak Indian, Spanish, and English as well as their own tongue.

THE HEIGHT OF MT RAINIER

By Richard U. Goode,

United States Geological Survey

Four separate determinations of the height of Mt Rainier, Washington, have been made, and, while no single one of them independently would be considered conclusive, the close correspondence between the results warrants an acceptance of the mean as being very close to the true altitude. Two of these determinations were by cistern barometer and two by angulation.

During the summer of 1897 Professor Edgar McClure carried a cistern barometer to the summit of Rainier, at the time the Mazamas had their annual outing, and obtained one set of observations, including readings of attached and detached thermometers.* The barometer had been especially prepared and was supposed to be in the very best condition. These observations were carefully computed by Professor E. H. McAllister, of the University of Oregon, in connection with synchronous barometric readings at Seattle, Portland, Fort Canby, and Walla Walla, these points occupying positions approximately north, south, west, and east of Rainier. The result was 14,528 feet above sea-level. Major E. S. Ingraham, of Seattle, had previously determined and published the altitude of Rainier, as a result of readings of mercurial barometers, as 14,524 feet.

In 1895 Mr S. S. Gannett, of the U. S. Geological Survey, determined the height by angulation, in connection with triangulation in the Cascades, to be 14,532 feet.† In 1896 Mr G. E. Hyde, also of the U. S. Geological Survey, while making a topographic map of the country to the northeast of Rainier, secured about forty angles of elevation to the highest point of the mountain from various points, the distances averaging about 25 miles, the mean of all these results being 14,519 feet.

Recapitulation:

	Feet.
Barometric determination, McClure and McAllister	14,528
Barometric determination, Ingraham	14,524
Angulation determination, U. S. Geological Survey, Gannett	14,532
Angulation determination, U. S. Geological Survey, Hyde	14,519
Mean	14,526

In addition to the above, the U. S. Coast and Geodetic Survey determined the height of Rainier by angulation to be 14,440, but the distances used were so great that the result was considered merely approximate.

GEOGRAPHIC WORK BY THE BUREAU OF AMERICAN ETHNOLOGY‡

The germ of the Bureau of American Ethnology was an exploration of the canyons of Colorado river, begun in 1867 by Major J. W. Powell. At first an amateur exploration, the work was gradually refined into a survey fostered and afterward sup-

* In descending the mountain Professor McClure lost his life by falling over a precipice on July 27.

† Nat. Geog. Mag., vol. vii, p. 150, April, 1896.

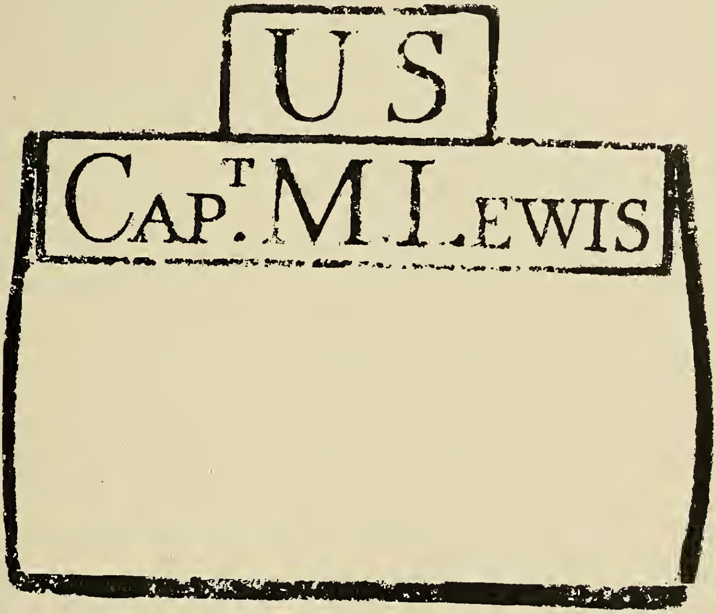
‡ Extract from one of the replies (signed by W J McGee, Ethnologist in Charge, Bureau of American Ethnology) to letters of inquiry for information to be incorporated in a paper on geographic research in the United States for presentation before the British Association for the Advancement of Science at the Toronto meeting.

ported by the Smithsonian Institution and the Federal Government. The bureau thus built up was known as the "U. S. Geographical and Geological Survey of the Rocky Mountain Region" until 1879, when the work was divided, a moiety being transferred to the newly instituted U. S. Geological Survey, the other moiety (including the ethnologic researches, which constituted an important part of the work of the Rocky Mountain survey) being continued in the ethnologic bureau at the cost of the Government and under the supervision of the Smithsonian Institution; so the geographic work of the Bureau may be considered to have begun with the exploration and survey of Colorado canyon and the neighboring country through the boldest and most perilous among the scientific expeditions recorded in the annals of the nation. Subsequently it was found inexpedient to make extended geographic surveys, and the work was generally carried forward by means of the surveys and maps of other instrumentalities, notably the U. S. Geological Survey. Yet from time to time special explorations and surveys have been made, the latest (and the most extended during recent years) being that of western Sonora (Mexico) and contiguous parts of Arizona, by W J McGee, with W. D. Johnson as topographer, who traversed a considerable territory of which portions were never before trodden by white men. Although the surveys have thus been limited, the researches, viewed broadly and in clear light, are largely geographic. It is a primary function of the Bureau to trace the geographic distribution of tribes and larger groups of aborigines; and this has been done throughout the territory of the United States, and, to some extent, in contiguous countries, and the resulting ethno-geographic maps are recognized as standards throughout the world. At the same time, effort has constantly been made to trace the migrations of the native tribes, as observed by the pioneers and as indicated by the surprisingly rich legends and traditions of the tribesmen, and also as recorded in the distribution of prehistoric relics; and thus it has been found feasible to prepare ethno-geographic maps of various portions of the continent representing different periods in the development of the primitive race, and a number of maps showing the migrations and less regular wanderings of the native tribes have been published. Through observations on the tribes and studies of their wanderings it has been found that primitive peoples are, in large measure, creatures of environment, and thus reflect the geographic conditions by which they are surrounded; and the researches concerning the relations between man and geographic condition have been found suggestive and fruitful. The various studies have served to correct early impressions concerning the aborigines; it has been shown that the Indians were more or less definitely organized in tribes and confederacies, belonging to some sixty distinct stocks or families, each characterized by distinct languages, institutions, and beliefs, and each occupying a definite though perhaps slowly shifting habitat. Some of the groups were large, some small, the greater number being confined to a narrow belt along the Pacific coast, while a few large groups occupied the eastern two-thirds of the continent. Study of the movements of the natives constituting each group indicates that they expanded or contracted, and shifted or persisted, much as do the definitely organized nations of civilization, under the influence of both external and internal forces, the former being essentially geographic and the latter essentially human. It is only when the groups are defined and when their movements are investigated and compared that the principles of ethno-geography are brought to light. These principles are set forth in a score of the publications of the Bureau.

A RELIC OF THE LEWIS AND CLARKE EXPEDITION

The print of which the accompanying illustration is a reproduction, slightly reduced, was made from an iron believed to be an original branding-iron used by Captain Meriwether Lewis on the Lewis and Clarke Expedition of 1804–'06. It was found by Mr Winans, of The Dalles, Oregon, about three years ago, clasped in the hands of an Indian skeleton, in one of the old Indian burial places on an island in the Columbia river, near The Dalles.

Quite a number of Indian burial places are located along the Columbia, and several were described by Lewis and Clarke. It was the Indian custom to bury with deceased members of the tribe any articles especially prized by them. Lewis and Clarke passed down the Columbia in November, 1805, and wintered at Fort Clatsop, near Astoria, Oregon, at the mouth of the river. In the spring of 1806 they started eastward, homeward bound, advancing slowly up the Columbia. Their diary makes frequent mention of the fact that they exchanged trinkets of all descriptions for food and at times wood. As they approached the mouth of Snake or Lewis river, they were delayed several days in the effort to obtain horses for their overland trip across the continental divide. They found a difficulty in this, owing to their greatly reduced supplies, and everything not of absolute necessity was used in their barterings.



The above-described relic is now deposited in the land office at The Dalles. It was seen by the writer during the summer of 1897 in a fairly well preserved but, of course, rusty condition. It is one solid, welded piece of iron, with the box under the name formed by a raised rim. A pivoted handle, which was not found, was evidently used with the brand, as a short, cylindrical projection on the back of the iron could hardly have been used for any other purpose. This brand was not used for stock, but probably for stamping boxes, leather, or notices of locations or discoveries on near-by trees. It is the intention to deposit this relic with the Oregon Historical Society.

Cyrus C. Babb.

AN INTERESTING RUMOR CONCERNING ANDREE

The recent publication in the daily newspapers of a dispatch from Stockholm to the effect that Professor Nordenskjold had informed the Swedish Academy of Science that he regarded as of sufficient importance to call for a closer investigation the intelligence received by the Swedish Foreign Office that several persons worthy of credence saw Herr Andrée's balloon in the Caribou District of British Columbia in August last led President Bell, of the National Geographic Society, to immediately ask the American Minister at Stockholm, by cable, what news of Herr Andrée the Swedish Foreign Office was really in possession of. The following day a reply was received referring President Bell to the Swedish Consul at San Francisco, who, in answer to a telegram that was forthwith sent him, replied to President Bell, by telegraph, as follows:

"Statement of a balloon passing over the Horse-Fly Hydraulic Mining Camp in Caribou, British Columbia, in latitude fifty-two degrees twenty minutes and longitude one hundred and twenty-one degrees thirty minutes.—From letters of J. B. Hobson, manager Caribou Hydraulic Mining Company, and of Mrs William Sullivan, the blacksmith's wife there, and statement of Mr John J. Newsom, San Francisco, then at the camp, about two or three o'clock in afternoon, between fourth and seventh August last, weather calm and cloudless, Mrs Sullivan, while looking over the Hydraulic bank, noticed a round, gray-looking object in the sky to the right of the sun. As she watched, it grew larger and was descending. She saw the larger mass of the balloon above and the small mass apparently suspended to the larger. It continued to descend until she plainly recognized it as a balloon and a large basket hanging thereto. It finally commenced to swing violently back and forth and move very fast toward the eastward and southward. She then called her daughter, eighteen years old, and after pointing the balloon out to her they both watched it rise rapidly until it disappeared in an easterly direction. Mr Hobson writes that Mrs Sullivan and daughter are intelligent, and he is disposed to believe their statement. Mrs Hobson had at about time stated noticed Mrs Sullivan looking into the sky at something, and that she called her daughter, who went to her side, looked in the direction indicated, and both watched some object for several minutes, turning their faces from southerly to easterly direction. Mr Newsom reports that something was thrown out from the balloon when lowest, and subsequently people thought it might have been some message, but the country is too wooded to warrant any search. When Mr Newsom returned to San Francisco he was ill and did not immediately report the matter. Mrs Sullivan has since examined the picture of Andrée's balloon and says it represents the object seen. The president Geographical Society of the Pacific here instituted inquiries that have resulted as above."

The locality described is very near Quesnelle lake. While British Columbia is in the opposite direction to that in which Herr Andrée's balloon is believed by Arctic explorers to have been borne, it is by no means an impossibility that it was carried in that direction, and the approximate date, August 4–7, at which a balloon is alleged to have been seen in that region would be just about the expiration of the time that it is believed Herr Andrée's balloon would remain in the air. The physical features and conditions of British Columbia are such as to render it absolutely impossible to prosecute any search for traces of the alleged aerial visitant at this season of the year. Meanwhile the consensus of opinion is that Andrée, if alive, is much more likely to be in Franz Josef Land, north Siberia, north or east Greenland, or Spitzbergen, and his safe return seems to depend largely on some fortunate accident that would lead to his being picked up by a whaler.

J. H.

GEOGRAPHIC NAMES IN WEST GREENLAND

In his article in this magazine (vol. ix, pp. 1–11) Mr Robert Stein gives 46 new names to capes, bays, mountains, glaciers, etc., chiefly in honor of the "advocates of a National University at Washington." Most of these points were merely seen from a distance and most of them have already been explored and mapped, and some of them have been visited by at least two parties, each of which applied as few names as possible. The plan adopted by Mr Stein is not uncommon in "geographic exploration," though it is difficult to understand the importance of such work. Doubtless the Danes will feel fully justified in ignoring the nomenclature, which is burdensome, needless, and meaningless.

My chief object in this note is to call attention to the fact that in the promiscuous naming of things, the Wyckoff glacier,* one of the five names that I applied to this region, is ignored and replaced by the name Hearst. My belief is that names of places

* Bull. Geol. Soc. America, Vol. viii, 1897, p. 257.

are valuable only when needed in description, and I have scrupulously avoided applying new names excepting where necessary for this purpose; but when once applied in this way they should not be put aside without a valid reason. But while I protest against this, I wish also to protest against geographic work which consists mainly in scattering names broadcast. Explorers often do little else than this.

RALPH S. TARR.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1897–'98

Special Meeting, February 7, 1898.—President A. Graham Bell in the chair. Mr G. K. Gilbert lectured on the Origin of the Physical Features of the United States.

Regular Meeting, February 11, 1898.—President A. Graham Bell in the chair. Mr Richard U. Goode gave an illustrated lecture on the Bitter Root Forest Reserve. At the conclusion of the lecture Hon. James Gunn, M. C., of Idaho, gave a description of that state, its topography, products, agriculture, irrigation, minerals, and mining.

Special Meeting, February 14, 1898.—President A. Graham Bell in the chair. Hon. J. Phinney Baxter lectured on New England: the Home of the Pilgrims and Puritans.

Special Meeting, February 18, 1898.—President A. Graham Bell in the chair. Mr John M. Robertson gave an illustrated lecture on the Influence of Climate and Land Formation on Early Civilization and Politics.

Special Meeting, February 21, 1898.—President A. Graham Bell in the chair. Professor Richard E. Dodge gave an illustrated lecture entitled "New York State: its Physical Geography."

Regular Meeting, February 25, 1898.—President A. Graham Bell in the chair. Mr Henry Gannett gave an illustrated lecture on Lake Chelan.

The fine portrait of Prof. Alexander Graham Bell, LL. D., the distinguished president of the National Geographic Society and inventor of the Bell telephone, which forms the frontispiece to this number, constitutes a notable addition to the series of portraits of eminent men of science which have appeared in the NATIONAL GEOGRAPHIC MAGAZINE during the past two years.

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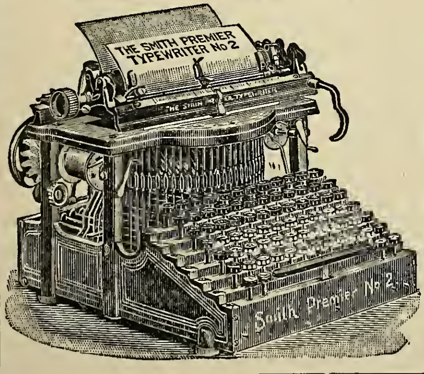

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The National Geographic Society, the object of which is the increase and diffusion of geographic knowledge, has a paying membership of 1,500. Its membership is not restricted to practical geographers, but is open to any person in good standing who may be sufficiently interested in its work to seek admission. The annual subscription is: for active members, $5.00 per annum; for corresponding members, $2.00 per annum. Active members pay also an entrance fee of $2.00 on election. THE NATIONAL GEOGRAPHIC MAGAZINE is sent regularly to all members, both active and corresponding.

Donations for the founding of Prize Medals and Scholarships are respectfully solicited.

THE

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THE NORTHWEST PASSES TO THE YUKON

By Eliza Ruhamah Scidmore

While Vancouver's ships lay at anchor in July, 1794, in his Port Frederick, the Komtokton of the natives and the Hoonah post-office of today, at the northwest end of Chichagof island, Messrs Whidby and Lemesurier, in a small boat, followed the north shore of Icy straits and penetrated the long Lynn canal, bringing back reports that ended Vancouver's hope and search for a northwest passage through from the Atlantic—De Fuca's straits and Del Fonte's river myths and dreams of "hypothetical projectors" and "closet navigators," as this greatest of surveyors and explorers bitterly termed them.

Whidby's men rowed up that finest fiord of all that landscape coast to Point Seduction, so named because of the "exceedingly artful character" of the natives, who met them at that point and lured them further on up the western arm (Chilkat inlet) to the mouth of the river, just beyond the modern Pyramid Harbor.

These artful natives had then enjoyed trade with white men, and the Chilkats and Chilkoots, really one tribe and closely related, were not only the greatest warriors and boldest buccaneers of the coast, but were great "grease-traders" and middlemen as well. Two "grease trails" led away from the two inlets across the range to the game country beyond, where the milder plains people, the "Stick" or Tinneh tribes of Athabascan stock, were content to trap and trade at great disadvantage, exchanging their pelts and horns for the fish oil and sea products of the coast tribes and the goods which the latter obtained from white traders. Russian, 'Boston,' and Hudson's Bay Company traders realized

CHILKOOT PASS — YUKONERS APPROACHING SUMMIT, OCTOBER, 1897

From a Photograph by E. S. Curtis

more than one hundred per cent profit on the goods they gave the Chilkats in exchange for furs, and the Chilkats realized a still greater profit when they dealt with the Tinnehs.

For the half century that the H. B. Co.'s ships regularly visited Chilkat inlet the traders never dealt directly with the Tinnehs. The Chilkats were relentless monopolists, meeting the Tinnehs at established camping grounds, at Tagish houses, and other points beyond the range each year, and packing the furs back over the Chilkat or the Shaseki (Chilkoot) pass. Occasionally they brought a Tinneh chief down under escort as a great reward and honor, to allow him to look at the fire-ship of the white traders. Mr Robert Campbell, of the H. B. Co., who crossed from the Mackenzie river to the Pelly in 1842–'43, wrote: "The rascally Chilkat Indians from the Pacific coast were in the habit of making trading excursions to Pelly. They ascended by Lynn canal, thence crossed over the mountains to the head of Lewes river. Descending this river they came to the Pelly, where oftentimes, when strong enough, they pillaged and massacred the Pelly Indians, than whom there could be no more honest men."

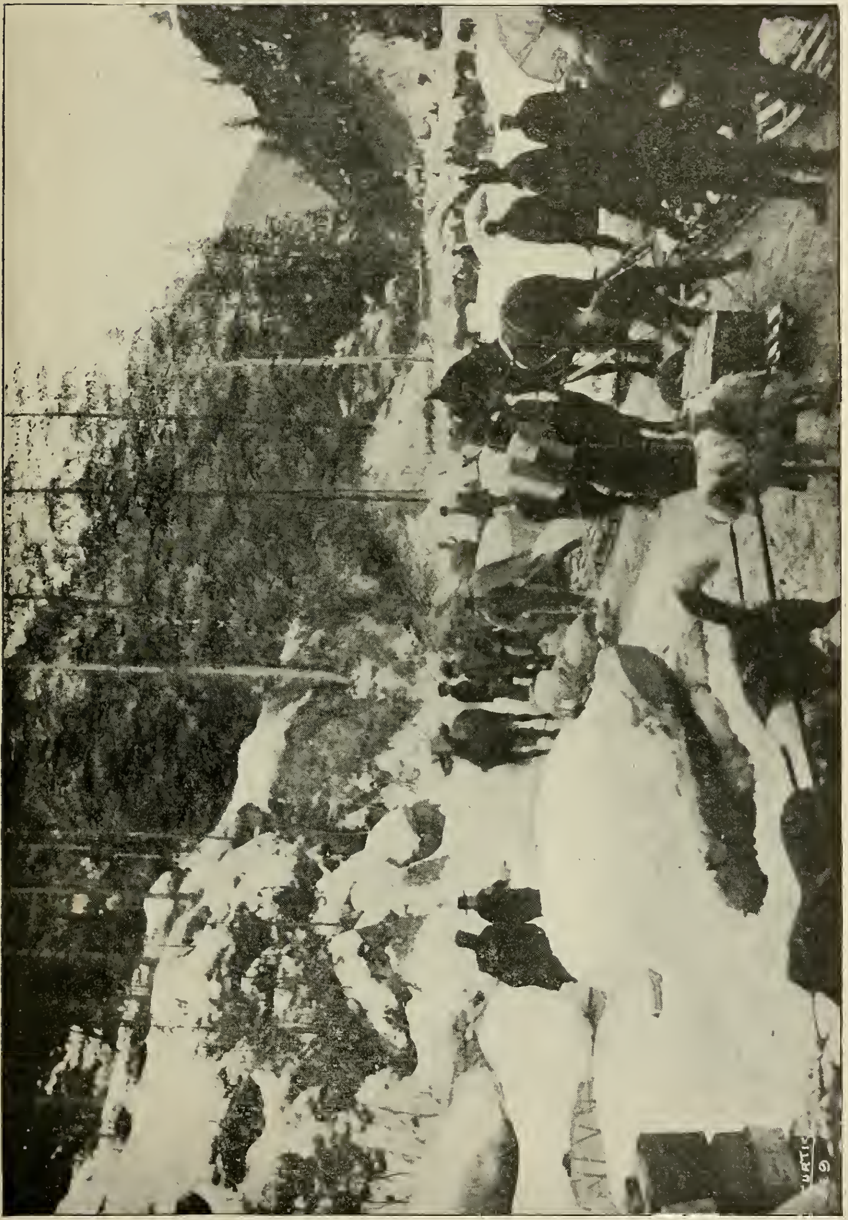
In 1849 the H. B. Co. built Fort Selkirk, at the junction of the Lewes river and the Pelly, buying furs directly from the Tinnehs and sending them out by the chain of H. B. Co. forts connecting with the Mackenzie river and Hudson bay. The difficulty of getting supplies into Fort Selkirk had induced the H. B. Co. to consider abandoning it, when the Chilkat chief, incensed at this interference with his fur trade, led a war party across the mountains and plundered and burned the fort. The blockade of the passes was more strictly maintained than ever against Tinnehs and whites.

The first white man to cross the range, according to local Chilkat and common Alaskan tradition, is said to have been a red-headed Scotchman in the employ of the H. B. Co., who, reaching the ruins of Fort Selkirk in 1864, started alone over the old "grease-trail" to the sea. He hid from Indians all the way, but was captured near the coast and held until ransomed by Capt. Swanson, of the H. B. Co.'s *Labouchere*, on its regular visit to Pyramid Harbor. Because of his red hair he was regarded as a shaman and treated with distinction during his stay. Dr Dawson discredits this story of the Scotch pioneer, as Fort Selkirk was in ruins at that time, and he believes the whole story arose from the fact that certain articles belonging to the traders at Fort Selkirk were brought to the trading ship on the coast.

Prof. George C. Davidson, who had visited the Chilkat country in 1867, when making a scientific reconnaissance of Russian America for Secretary Seward, returned in 1869 to observe the eclipse of the sun, August 7, establishing his station and observatory at the upper Chilkat village, where he was the guest of the great chief Chartrich, Kloh-Kutz, or Hole-in-the-Cheek, as that head of the Cinnamon Bear clan was variously known. Secretary Seward and his party were escorted up the Chilkat river in Kloh-Kutz's war canoe on eclipse day, and, joining Prof. Davidson for another day, carried away the astronomer and his instruments before there was time for him to make an intended trip toward the pass. During his stay Prof. Davidson had induced Kloh-Kutz and his wife to draw a very intelligible map of the route up the river to the Chilkat pass and across to Fort Selkirk, a route Kloh-Kutz had traversed since childhood, and which his father had traversed as one of the war party which burned Fort Selkirk. Lying face downward, the old chief and his wife discussed and laboriously drew on the back of an old chart the lines of all the water-courses and lakes, with the profile of the mountains as they appear on either hand from the trail. The great glacier is indicated by snow-shoe tracks to show the mode of progress, and the limit of each of the fourteen days' journey across to Fort Selkirk is marked by cross-lines on this original Chilkat map, which is still in the possession of Prof. Davidson, at San Francisco. There is a copy (Topographical Sheet No. 2268) at the U. S. Coast and Geodetic Survey office at Washington, and this Kloh-Kutz map was the basis of the first charts.

George Holt, a miner, claimed to have crossed the eastern, the Chilkoot, or Shaseki pass in 1872, and descending as far as Lake Marsh, returned by way of the Teslin to the headwaters of the Stikine, following in reverse a part of the route of Michael Byrnes, of the W. U. T. Co. survey, who came up from the Stikine region to the Teslin and Tagish lake in 1867. Holt crossed the pass again in 1874, and descended the Yukon to the portage connecting with the Kuskokwim.

In 1877 Lieut. C. E. S. Wood, U. S. A., undertook independent explorations in Alaska. Mutiny of his canoemen prevented his reaching Mt St Elias, which he wished to climb, but he visited Taylor and Glacier bays on Cross sound, camped and hunted mountain goats around Geikie and Muir inlets, and crossed from the Muir glacier to Lynn canal. He spent some time with the Chilkats and Chilkoots, but neither Kloh-Kutz nor Doniwak,



SKAGWAY CAÑON — YUKONERS EN ROUTE, MARCH 3, 1898

From a Photograph by E. S. Curtis

the one-eyed tyrant of the Chilkoot village, would let him cross the mountains, which they pictured as full of dangers, although Lieut. Wood was fortified with messages, gifts, and tokens from Doniwak's sister, the wife of Sitka Jack. An account of his stay, "Among the Thlinkets in Alaska," was published in *The Century* magazine July, 1882.

In 1878 Doniwak peremptorily refused entrance to the prospectors Rath and Bean, but is said to have permitted George Holt to go as far as Fort Selkirk and return under guard.

In 1880 the same Edmund Bean, with a party of nineteen miners, were placed under the special protection of Kloh-Kutz, through the active interest and clever diplomacy of Capt. L. A. Beardslee, U. S. N., and guided across the passes, after giving assurances that they would not interfere with the fur trade. A trader did slip in in the wake of the prospectors, but being detected, was brought back and his life saved by Capt. Beardslee's earnest interference. As these miners went in, they met James Wynn (now of Juneau) coming out, and from him received warning of the dangerous rapids in the river beyond the lakes. Wynn has assured me that he had previously crossed the pass in 1879.

Forty-five miners crossed the pass in the spring of 1882 and returned in the autumn, and the Indians, finding that the packing of miners' supplies was more remunerative than the diminishing fur-trade, virtually raised the blockade and established an exorbitant tariff for transportation.

The Doctors Krause, of the Geographical Societies of Berlin and Bremen, spent the year 1882 and the succeeding winter at Pyramid Harbor and in the Chilkat villages, making the ethnographic studies published in the volume *Die Thlinket Indianer* and in collecting for their museum. Kloh-Kutz was, as usual, the patron and protector of scientists, and assisted in their exploration and survey of the Chilkat river and its branches, the Chilkat pass, and the country beyond as far as the great lake named Lake Arkell in 1890. The Drs Krause's maps of this region were published by the Berlin and Bremen Geographical Societies in 1883.

In 1883 Lieut. Frederick Schwatka, U. S. A., crossed by the miners' usual trail the eastern, Chilkoot, or Shaseki pass, renamed it the Perrier pass, and rafted his way down the Yukon to the sea. The miners who went in in 1883 sent back for provisions and spent the winter on the upper Yukon.

VIEW FROM DALTON TRAIL, BETWEEN DALTON'S POST AND HOOTCHI LAKE

By courtesy of McClure's Magazine

In 1884 Dr Everette, U. S. A., crossed the Chilkat pass along the Krause route, intending to explore westward and descend the Copper river, coöperating with Lieut. Abercrombie, who attempted the exploration of Copper river from its mouth; but neither plan was followed to completion. When Lieut. H. T. Allen explored the Copper river in 1885, his party ascended to the headwaters, crossed the divide to the Tanana, and descended that stream to the Yukon.

In 1890 Mr E. J. Glave, leading an expedition sent out by the *Frank Leslie's Weekly* newspaper, followed the Doctors Krause's routeto the Alsek basin, went northward and returning descended the Alsek to the ocean at Dry bay. In 1891 Mr Glave proved his claim that pack horses could be taken over the range and could find sufficient pasturage in the bush country beyond. His "Pioneer Pack-horses in Alaska," published in *The Century* magazine, September and October, 1892, describes his route across to Lake Arkell, a route now known as the Dalton trail—Jack Dalton having been his assistant in the experiment with pack-horses.

The existence of a lower pass still further east, to be reached by an easy trail from Skagway creek, was reported to Mr William Ogilvie during his survey of 1887, and Capt. Moore of his party was detailed to explore it. He determined the altitude of the pass as 2,400 feet above sea-level, and named it in honor of Hon. Thomas White, Canadian Minister of the Interior. It was at once seen that White pass most easily allowed a wagon road to be constructed across to Lake Bennett—a distance of 47 miles and a rise of 2,400 feet, in contrast to the distance of 27 miles and a rise of 3,500 feet on the Chilkoot, Shaseki, or Perrier pass, again named as the Dyea pass by Mr Ogilvie.

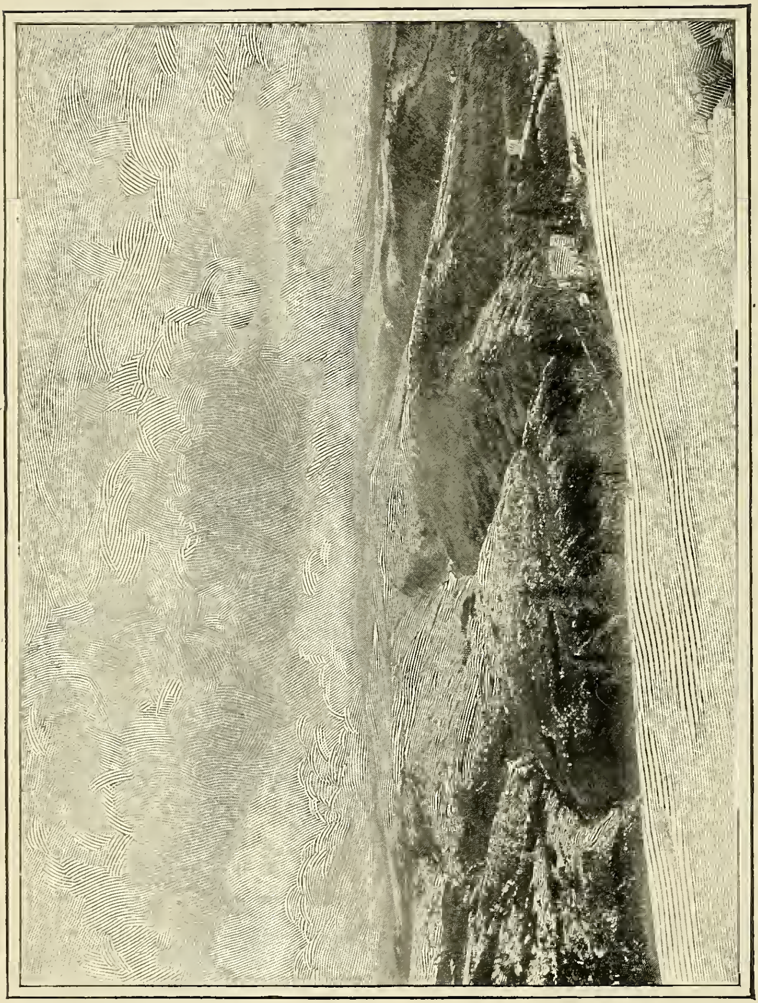
The passes to the Yukon basin from Taku inlet and river were known to H. B. Co. traders and the W. U. T. Co. surveyors, but were first definitely exploited as a route to the Yukon mining regions by the expedition of Lieut. Schwatka, U. S. A., and Dr C. Willard Hayes, of the U S. Geological Survey, in 1891. They followed the north fork of the Taku river and crossed to Lake Teslin, where they launched canvas boats and proceeded without interruption to Fort Selkirk. The river connecting Lake Teslin with the Lewes—known to the Indians as Teslintoo, and as the Hootalinqua or "Hoody-Link" to the miners—was marked on the Coast Survey chart at the time as the Nas-a-thane, or "no salmon," and was renamed the Newberry river by Lieut. Schwatka.

OVERLAND ROUTES TO THE KLONDIKE

By Hamlin Garland

By all accounts the Yukon valley is a grim country—a country of extremes. In winter the sun hardly makes itself felt, rising pale and white only for a few hours above the horizon, while in summer it shines all day and, as an Irishman might say, "part of the night." Moss covers the high ground like a thick wet sponge throughout vast areas, and the soil is in effect perpetually frozen. There is little vegetable mould and plant life is sparse. Steam arises under the hot sun from the cold rain-soaked moss, and the nights are foggy and damp even in June and July. Gnats and mosquitoes move to and fro in dense clouds during midsummer, and add to the many discomforts and discouragements of the region. Life is a warfare. Fuel is scarce. There is little game, and not many fish. There never were many Indians in the district—the valley is too inhospitable for life of any kind to greatly abound. Agriculture is practically impossible. It is likely to freeze any night of the year. The climate, in short, is subarctic in character, and in and about Dawson City nearly all the features of the Arctic zone are realized. The ice does not go out of the river, even at Dawson, till late in May or June, and the river closes early in September.

Having decided that he wishes to take the risk involved in entering this grim country, the miner must decide on his route. The routes may be divided into two groups—the overland and the seaport. Of the overland, there are at present three—the Edmonton and Peace River route, the "Old Telegraph Trail," and the Kamloops inland route. The Edmonton route begins at Edmonton, a small town at the end of a northern spur of the Canadian Pacific Railway, and proceeds by way of Little Slave lake to Peace river, thence across the divide into the valley of the Stikine river to Telegraph creek and Teslin lake, which is the headwaters of the Yukon. This route is a very long one, and little information is obtainable concerning it. It is undoubtedly practicable, and will be largely traveled by those not in breathless haste to get to Dawson City. It offers abundant fields for prospecting and is a pleasant summer route. It will take about



VIEW FROM NEAR DAWSON CITY, LOOKING ACROSS THE YUKON VALLEY

By courtesy of McClure's Magazine

sixty days to go from Edmonton to Teslin lake. The citizens of Edmonton are using all means to make this route easy and safe. It cannot be safely used before the middle of May. Pack horses are plentiful, and feed is good from May 15 to November.

The second overland route, the "Old Telegraph Trail," begins at Ashcroft, a small village on the Canadian Pacific Railway, and follows the Fraser river over an excellent stage road constructed by the Canadian government to the little town of Quesnelle, 223 miles north. Good stopping-places abound along the road. Here the road ends, and the trail turns to the west, and, passing over a nearly level country with good grass, reaches Fort Fraser, on Fraser lake, 125 miles from Quesnelle. Fort Fraser is a Hudson Bay post and trading store, with two white men and several families of Indians, quite well civilized, settled near. A limited amount of supplies will be obtainable here. Up to this point the trail is quite level, and though there are hundreds of creeks none are deep or hard to pass. The three rivers, the Blackwater, the Mud, and the Nechaco, can be forded except in high water, when rafts will have to be used and poled or paddled across. Neither of them is very wide. Many trails cross the route, and it will be necessary to have a native guide, unless some means should be taken to mark the main trail. In this 125 miles there are over 300 good hay swamps and many Indian villages where feed for the horses can be found in abundance.

Beyond Fort Fraser the next supply point is Stuart, a Hudson Bay post, with three or four whites and eighty or one hundred Indians, who live in cabins and make their living by hunting, fishing, and trapping. From Fort Fraser to Hazelton is probably 325 miles. The trip from Quesnelle to Hazelton can be made by pack animals, and will require from sixteen to twenty days. Hazelton has a small population of prospectors who winter in the neighborhood. A Hudson Bay post, a few cabins, and a couple of stores are all that are to be found here, although about 15,000 Indians trade at this point. The goods are brought up by a Hudson Bay boat on the Skeena river during high water.

"From here it is about 200 miles to Telegraph creek. The trail has been traveled for thirty-five years, and the government has spent thousands of dollars to keep it in first-class condition. It will probably take about ten days to cover this distance, as it is a little harder than before reaching Hazelton." There are two large stores at Telegraph creek at present, and undoubtedly a small town will immediately spring up there. From Telegraph creek over to Teslin lake the trail will be opened and operated by the Canadian government. A wagon road will be constructed and a bill has already passed the House of Commons granting subsidies for a railway. The road at present is estimated to be about 150 miles long and can be traversed in ten days or less. The way is wooded and has no dangerous features. At Teslin lake is a saw-mill and lumber for rafts or boats can be purchased and the rest of the journey made by water.

The Ashcroft trail and the Kamloops route, which is practically the same in character, is alluring. It begins in a genial climate between the coast range and a spur of the Rocky mountains, and is therefore somewhat like eastern Washington in temperature and rainfall. After leaving Quesnelle the trail plunges at once into the wild country, and to those who are fond of sport and adventure it will offer a special charm. There are frequent stopping-places, and the Indians are friendly and if properly treated will be a source of aid in case of necessity.

The advantages of this route are offset, however, by obvious disadvantages. It is very long. According to the most liberal estimates, it will take forty days from Quesnelle to Telegraph creek, though it can probably be done in less time, provided there are no delays for bridge-building. It will be possible to go in light, sending part of the outfit by way of Victoria to Telegraph creek, and by leaving an advance order for supplies with the Hudson's Bay Company to be delivered on a certain date from their stores at Hazelton.

It will not do to leave Quesnelle until the grass comes, say by the 10th of May. Before that time, even though it might afford a fairly good "nip," it would still be watery and without sufficient nutriment. After the 10th of May the Ashcroft trail will be a comparatively cheap and easy route to the Cassiar and Teslin Lake mines, with no duties and very little toll to pay.

In the matter of outfitting it is probable that Kamloops, Ashcroft, and Quesnelle will be able to furnish complete outfits for a limited number of pack-trains, and being upon the Canadian Pacific Railway, supplies in case of need could be hurried forward by telegraph from Victoria, Vancouver, or Winnipeg.

It is safe to count on about fifty days' time from Ashcroft, and while the expense will be light, probably not exceeding three hundred dollars for transportation and a year's provisions, it would not be well to start with less than five hundred dollars in hand or within reach at Teslin lake.

THE FUTURE OF THE YUKON GOLDFIELDS

By William H. Dall,

Smithsonian Institution

The conditions likely to prevail in the near future at the Yukon goldfields have received but little attention in the public prints. Some discussion of them may, therefore, be useful.

It is well understood among those who have had experience in that region that the most important question for the welfare of gold-seekers and others visiting the Yukon is that of transportation. Men and, to some extent, domestic animals may reach the Yukon by their own efforts; but their food, tools, tents or other portable shelter, and the heavy clothing necessary for protection against exceptional conditions of temperature and weather must be carried. No man can carry his own provisions and outfit without assistance. Even for dogs, the most economical draught animals, the necessary food will take up an exorbitant proportion of their load. It is hopeless to attempt to transport the necessaries of life for thousands of people by the means hitherto in use.

A conservative estimate places the number of people at present on the Yukon at 5,000. Few have estimated the number desirous of going in during the present season as low as 50,000. Should anything like that number succeed in reaching the Yukon during the next six months, it means that the transportation over that of the past season must be increased tenfold. A certain proportion must be allowed for waste, losses in transportation before reaching the destination, and the excess of need beyond the ordinary ration in more temperate climes.

The number of trips to Dawson, from the seacoast, made in 1897 by the steamers now on the river was seven in all. While, with all conditions favorable, two trips per season can be made by a capable vessel, it is unsafe to reckon on more than one. For 50,000 people seventy trips would have to be made in order to eliminate the possibility of starvation which has stared so many in the face under present conditions. This provides not for comforts, not for necessary furniture, tools, and machinery adequate to improve conditions as they exist, but merely to prevent things from getting worse. Does any reasonable person familiar with the region believe that seventy trips are possible?

Quite a number of flat-bottomed stern-wheelers for the Yukon are believed to be in process of construction at Unalaska, the intention being to tow them to St Michael on the opening of navigation. Suppose that the fleet succeeds in reaching that port by the 27th of June, the average date when the ice goes out of Norton sound. Allow a week for getting them loaded in working order and ready to start for the river with a few days' fuel on board. If they take much fuel they cannot take goods. Once well within the delta, feeling their way cautiously over the sand bars of the river, unknown to most of their navigators, they must depend for fuel on wood cut from the banks. The wood of the country is spruce, with a little poplar and willow. These will not burn when green. When the river ice breaks up, about June 1, an enormous quantity of driftwood is carried down by the water, which runs bank full, owing to the obstruction caused by the broken ice. When the ice is fairly out the river falls a little, and all along the bars, low banks, and level beaches this wood is stranded, to remain until the freshet of next spring. It is mainly upon this driftwood that the steamers depend for fuel. The two old companies have landings scattered along the river and Indians employed during the winter cutting up the wood and sledding it to places where the steamer can reach the bank.

The population of the Yukon is small in proportion to the area. The reliable Indians are few and already engaged. When the first rush of the melting snows is over the river falls rapidly into its normal channel and for the most part remains there during July and August. Later the mountain springs begin to give out, or freeze at night, and the river continues to fall. Wide flats appear on either side, so that the spring drift, stranded on the shores, is separated from the channel by a wide space of sand and mud, over which wood must be carried after being found and cut into suitable lengths for use. The dry spruce burns rapidly, and 12 cords a day seems a not unreasonable estimate of the amount required to run a good-sized boat well loaded. How much of each day will be used up in procuring wood by the steamers not belonging to the two old companies any one may estimate for himself.

Taking this delay into consideration, it is evident the independent steamers are very unlikely to be able to make more than one trip up the river as far as Dawson during the season.

Let us allow two trips for each of the old companies' steamers, or, say, twenty-four loads, and one trip each for ten independent steamers. The total amounts to thirty-four loads, or less than half the number required to keep the assumed influx of people on a next-to starvation basis through the winter of 1898–'99. I cannot emphasize too strongly that no dependence is to be placed on the rare beds of inferior lignite which occur on the upper river, even were any attempt being made to work them, which is not the case. The lower river affords plenty of food in the shape of salmon ; but this must be caught, dressed, and dried or salted in the height of the season, July and August, when the very men who may need it are straining every nerve to reach the upper river, where there is very little fish. Once the ice sets in, transportation over it of any large body of food, such as would be required by the assumed population, is impossible.

Enough has been said to show the impossibility of feeding 50,000 people by means of supplies carried up the river under present conditions.

We may now turn our attention to other routes of supply. We are told that the Canadian government proposes to give a monopoly of transportation over the old trail from Glenora, on the Stikine river, to Lake Teslin. No reasonable person familiar with the conditions of the region will believe that a railway 150 miles long can be built and equipped for traffic over this route in four months. No such person in his senses will claim that provisions could be taken from Lake Teslin to Dawson for a population of thousands, in the winter season, over the frozen river. It is wholly impracticable. There is, therefore, no hope of adequate relief by this route.

By the short route over the passes, if an immediate start is made, it is just possible that provisions might be rushed through before the close of navigation; but that this will be accomplished there is little reason to hope. While legislators are wrangling about special privileges, precious time is being wasted, and many lives will pay the penalty. Unless the rush of incomers is checked and the influx of people rigidly restrained, I see no escape from the conclusion that the winter of 1898–'99 will see starvation on the Yukon on an unparalleled scale. Every instinct of humanity calls aloud for the promotion of every possible transportation facility at once. Nothing but the fullest freedom in putting through every possible means of transport while there is yet time, regardless of private greed and the not unnatural desire to retain national control of the means of transit, can be justified for a moment. The true interest of Canada, as well as of the United States, lies in the fullest development of the resources of the region, and without accepting all possible means of transportation this is impossible. Those who may be able from their own resources to push through a year's supply of provisions for themselves will in the long run be as much interested as any others in the welfare of the whole mass of immigrants, for a starving man will respect no property rights in food, and no man in the face of starving people may hope to keep his own store intact.

Leaving out of account the impending crisis on the Yukon, it is the writer's belief that it is imperatively necessary for the development of the goldfields that transportation for coal should be provided from the seacoast to the Yukon, avoiding the interrupted navigation of the Lewes river. Here, again, the change from the sea-going vessel to a river steamer on the Stikine, from that steamer to the railway, and then to another steamer on the Teslin marks the Stikine route as impracticable. One transshipment to the railway at Pyramid Harbor and from the cars to barges on the Yukon is so much simpler and cheaper as to put an end to argument.

The present method of using wood of so poor a quality as spruce on the Yukon steamers cannot last if the country is to be permanently developed. With coal floated downstream on barges from the headwaters the steamers might be abundantly supplied with suitable fuel, and two or even more trips a season might be reckoned on as a certainty. British Columbia has coal in abundance, and here would be a means of its indefinite utilization, by which a far greater profit would inure to the people of that province than is possible through any short-sighted monopoly of transportation, which would infallibly strangle the development of their Yukon goldfield in a very short time.

A broad and generous coöperation of both countries is essential to a satisfactory outcome of the projects now in contemplation. Let us hope that it may be realized before it is too late.

The length of the coast-line of Alaska is estimated at 18,211 miles, which is greater than that of the entire coast-line of the United States.

NOTES ON THE WILD FOWL AND GAME ANIMALS OF ALASKA

By E. W. Nelson,

Biological Survey, U. S. Department of Agriculture

Among the many interesting features to be seen by visitors to Alaska, the animal life is noteworthy for several reasons. During the brief summer, the otherwise desolate tundras are animated by swarms of water-fowl, which arrive from the south in spring as soon as the bare ground begins to appear, and after a short delay set about their summer housekeeping. The water-fowl on the rivers and lakes of the interior are the familiar species which winter among the ponds and marshes of the western United States. The Canada, Hutchin's, white-fronted, and snowy geese are there with swans and fresh-water ducks of many species. Besides these, sand-hill cranes and numerous waders abound. One of the most strikingly colored species along the small tributaries of the Yukon is the harlequin duck. The most interesting part of the bird-life of this region, however, is found along the coast of Bering sea. Four species of eider ducks occur there, some of which are very handsome. Among these the king, Steller's, and spectacled eiders are shown in the accompanying illustrations.*

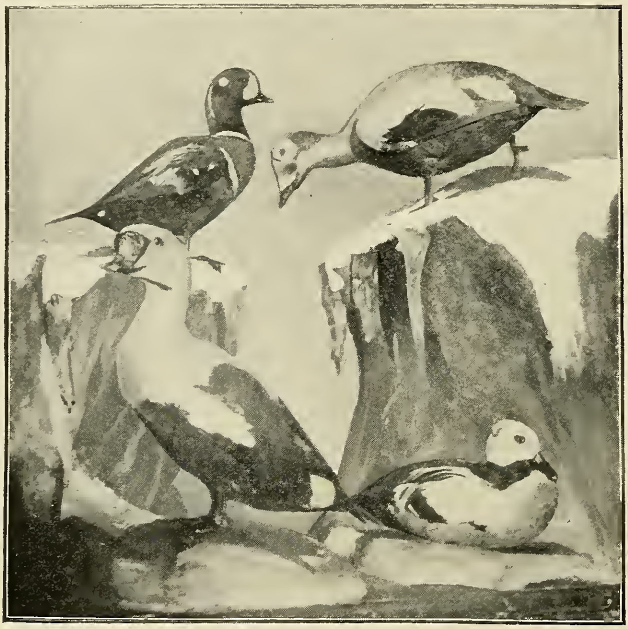
The emperor goose is another fine bird peculiar to this country; it has its home in the marshy region between the mouths of the Yukon and Kuskokwim rivers. It is the most elegantly dressed of its kind in America. The top and sides of the head and neck are snowy white, the chin, throat, and under side of the neck blackish, and the feathers of the back a soft, silky, gray color, bordered by a black crescent near the end and tipped with white. The under surface is similar, but duller, and the feet are vivid orange.

The black brant pass along the coast of Bering sea in great numbers every spring, and afford royal sport to persons fortunate enough to choose good stands while the flight lasts.

During the four years the writer lived at St Michael water-fowl was a very important item in the bill of fare, and when the

*I am indebted to Mr F. W. True, Executive Curator, U. S. National Museum, for the photographs of bird and mammal groups in the Museum which illustrate this article.

frosty autumn days approached he sallied out with his companions into the marshes to lay in a supply of ducks and geese for winter. The question of cold storage cut no figure, for the two or three hundred birds brought in were drawn and hung up in an old warehouse and the climate did the rest, enabling us to have roast duck or goose during the entire winter.

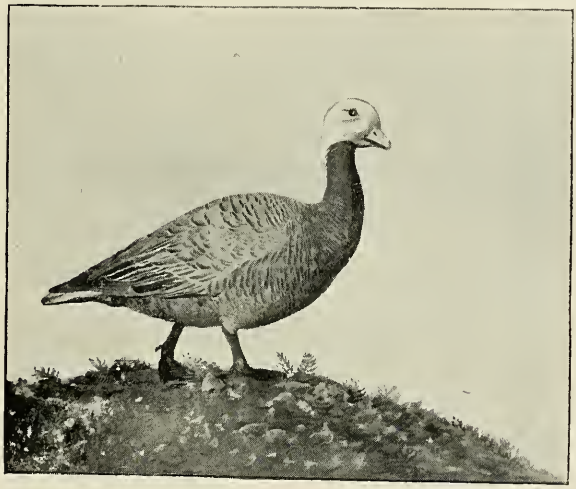


HARLEQUIN DUCK — SPECTACLED EIDER
KING EIDER — STELLER'S EIDER

Among the numerous berries growing wild on the treeless hills of this coast, a kind of blueberry is very abundant in September, and the young ducks feed upon it until they become excessively fat and so delicately flavored that they are delicious morsels. We became tired of hung duck, however, before the winter ended, and when the first solitary goose came flying over in spring, on a reconnoitering trip, there was general rejoicing. I still remember the hearty zest with which we put an extra edge on our knives and attacked the pioneer old gander that fell to our guns. He was lean and tough after his long flight, but was thoroughly enjoyed as an earnest of the coming season of plenty.

Two kinds of ptarmigan are common on the mainland, and will be considered dainty birds by many a hungry prospector, although, to tell the truth, they are about the poorest flavored of the American grouse. Their handsome summer plumage of mottled brown gives way in winter to one of snowy white. In winter, in the valley of the Kuskokwim the ptarmigan called willow grouse gather in large flocks. During my sledge journeys I sometimes encountered flocks of hundreds among the patches of scrubby willows, and when flushed it seemed as if the snowy surface of the ground had suddenly burst up and taken wing.

When the first mossy knolls appear in spring the willow grouse begins to lose its snowy winter dress. At first a few brown feathers show about the base of the bill and gradually increase in



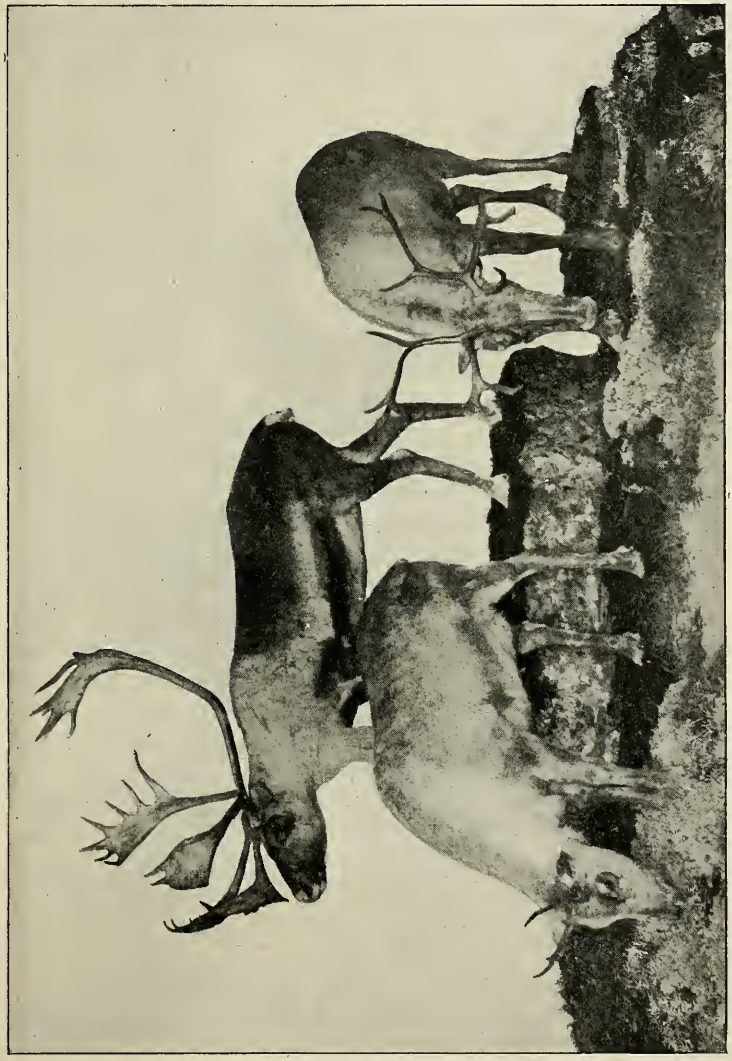
EMPEROR GOOSE

number until the entire head becomes brown while the body is still white. This progressive change keeps pace with the melting snow, and with the disappearance of the last drifts the last white feather has been dropped and the bird is in full summer garb. The willow grouse begins its courtship in May, with the appearance of the first brown feathers, and it is vigorously carried on with loud challenging notes of defiance, accompanied by many fierce rough-and-tumble fights. When the ground is mostly bare, the snow remaining only in scattered drifts, the males choose these white patches as the stage upon which to strut and ruffle for the admiration of their female friends. In the tundras they may be seen and heard on all sides as they fly up with stiffened wings a few yards above the snowbanks and then glide down, uttering loud harsh notes. Every now and then the efforts of some gallant cock become too obnoxious for his neighbor, who starts full tilt for his detested rival. The latter likes nothing better and meets the enemy in mid-air. They clinch and fall to the ground, apparently using beak, wings, and claws in the encounter. During such times the moult of white feathers is profuse and the combatants are the center of a perfect blur of whirling plumage. Directly one of the birds gets enough and starts off in hasty flight, pursued for thirty or forty yards by the victor, who then gives up the chase and fairly splits his throat with exultant notes. The Eskimos take advantage of this belligerency and snare many ptarmigan by means of fine sinew nets placed on small stakes set on the snow around stuffed skins of male birds. The hunter conceals himself and imitates the challenge cries until a neighboring grouse dashes blindly at his supposed rival and becomes enmeshed in the net.

Aside from the birds which have a definite value as food are numerous smaller species, among which the "whisky jack" will become a familiar character to the miners. He is a kind of jay with a dull, smoky-brown coat and bright inquisitive eyes, and is withal an intelligent and companionable little chap, who has no hesitation in sharing your camp for the gratification of a frank curiosity and sound appetite. His impish ways were always highly entertaining to me and I do not doubt will furnish amusement to many a gold-hunter in his lonely camp.

Although I have dwelt upon the birds because they are more numerous and more generally distributed than most other kinds

SEA OTTER



BARREN GROUND CARIBOU

of game, the man who loves the rifle will find his opportunity among the mountains and valleys of the interior. Formerly large mammals were much more numerous in Alaska than at present, and the decrease has come about almost entirely since our ownership of the country. The history of the fur-seal is well known. The sea otter is another animal that is passing away. Its doom is even more certain than that of the fur-seal, for it is a dangerous thing for an animal to wear a coat worth from five hundred to a thousand dollars. All that has kept the sea otter from extinction is its shyness and the fact that the stormy parts of the sea it frequents render its pursuit hazardous and uncertain. Upon the mainland are several fine mammals, among which native reindeer are the most generally distributed. There are two kinds of these deer—a large, dark-colored one, called the woodland caribou, which lives in the wooded district of the upper Yukon, and a smaller, paler kind, called the barren ground caribou, which lives in the open tundras or treeless country. Barren ground caribou were once exceedingly numerous, and the coast hills along the shores of Norton sound are still scored with their trails, leading diagonally up to the cool summits, where the animals used to go in summer to avoid the mosquitoes that swarm on the tundras. But even so far back as 1877 the caribou was very rare along most of the coast of Bering sea. When Alaska passed under American control it became possible for the natives to secure breech-loading rifles, especially where whalers and trading schooners called, and the result was a rapid slaughter of the large game.

Since the barren ground caribou usually live in the open tundras where there is no cover, it is extremely difficult for the hunter to approach unseen. Like the antelope of our western plains, they are inquisitive animals, and before starting away often make a circuit about anything which excites their interest. Before they became sophisticated by the common use of guns, the Eskimos had an ingenious method of stalking them in open ground, which the old hunters told me was very successful. The Eskimos hunted in pairs, and when they found a bunch of caribou on an open plain they would start directly for the animals, one hunter walking immediately behind the other, keeping step, with their bodies touching, so that from the front they appeared like one man. When they were still some distance away, the caribou would throw up their heads and start off to circle around the intruders. The hunters kept on in their original course, apparently paying no attention to them, and when the men passed the first little bush, knoll, or other cover the one in the rear sank down behind it while his companion kept on. The caribou continued to circle as the single hunter advanced, and were almost certain to pass close to the concealed man and thus afford a deadly shot at short range. The sudden appearance of the concealed hunter drew the attention of the game from the man who had gone on, enabling him to drop flat upon the ground without being noticed. The caribou, in starting off wildly from the new danger, often ran within shot of the man who had last concealed himself Hunters told me that in this way they often got several shots before the animals finally gathered their wits and left the vicinity.

The large woodland caribou of the upper Yukon lives in the forest with the moose. The latter ranges over much of the interior, and during my residence in the country a single individual was killed in the Yukon delta close to the sea—a very rare occurrence. In summer they are rarely hunted by the Indians in the dense forests of the upper Yukon, but are killed every now and then on the banks of streams or while swimming across them. In winter they wander from place to place, browsing on the tender twigs of cottonwoods, white birches, and willows, until the increasing depth of snow forces them to unite in "yards." When caught in deep snow or with a heavy crust they are easily killed by the Indians who follow them on snow-shoes.

On the upper Yukon the old method of moose hunting in early winter was for the Indians to go out on snow-shoes after a heavy snowfall and search for fresh trails. When one was found the swiftest runner, stripped to a shirt and breeches and carrying a light shotgun loaded with ball, started off after the moose, while the women and slower runners followed. Sometimes a moose would run eight or ten miles before being overtaken. At this season the cold is generally very intense, and the hunter would quickly freeze if he stopped while heated from his long run and with so little clothing. For this reason, after killing the moose, he returned to camp at a run, leaving the followers to cut up and drag the carcass home. When there was a light crust, small dogs were used to bring the moose to bay and enable the hunter to kill it with less exertion. Before the snow fell in autumn the moose were stalked in the dense spruce thickets, but they were very wary animals, and usually became alarmed and started off at a swift trot, with a great clatter of hoofs, before the hunter caught sight of them. At such times the Indian, knowing the country and the habits of the game, would run at his best speed to the opposite side of the small basin or valley and take a position where he could see for some distance on all sides, for when started in this manner the moose often made a wide circuit and returned within gunshot.

DALL'S MOUNTAIN SHEEP

Two species of mountain sheep, quite different from one another and from the Rocky Mountain bighorn, are known in northwestern America. The first of these, a superb, snow-white animal, was described by the writer some years ago as *Ovis dalli*, in honor of Prof. Wm. H. Dall, the pioneer scientific explorer on the Yukon. The specimens upon which my description was based were obtained from the Fort Reliance country by Mr L. N. McQuesten, now President of the Order of Yukon Pioneers. Dall's mountain sheep is found over a wide area, from the low hills beyond the tree limit near the Arctic coast south across the Yukon and Kuskokwim to the Alaskan range. Last year Dr J. A. Allen described another species from the headwaters of the Stikine river and named it *Ovis stonei*. But little is known of this handsome animal, which has a dark, almost iron-gray, coat, very different from the white of Dall's sheep. The discovery of these two sheep in northwestern America indicates that we may expect other interesting, if less striking, new forms of animal life in the mountains of that region.

In the high mountains bordering the Pacific coast, north of Sitka, mountain goats occur, but we have little definite information concerning their range and abundance. Owing to the white color of Dall's sheep, it is quite probable that in many cases they may have been mistaken for goats.

Bears also are very numerous in some places, and several kinds are known to occur. The huge bear of Kadiak and the Alaskan peninsula is the largest species in the world, and the skull of an old male looks as if he belonged to the animal life of a former geologic age, when beasts of gigantic size roamed the earth. Black bears are generally distributed over the mainland, except on the barren tundras bordering the Arctic coast. About the last of October or first of November they find a sheltered cleft or cavern in the rocks, where they make a bed of leaves and grasses and hibernate until the warm days of April bring them out again. On the upper Yukon the Indians kill them with arrows, guns, or spears. Some of the bravest and most powerful of the hunters will attack them armed only with a long-bladed knife. In such cases the hunter wraps a blanket about his left hand and arm, and with it thus protected thrusts it out for the bear to seize as it rises upon its haunches, giving him an opportunity to make a fatal thrust under the guard thus formed. Both Eskimos and Indians give these animals credit for supernatural knowledge and cunning. The Eskimo hunters are very careful not to speak in a disrespectful manner of bears, and are especially guarded

POLAR BEAR

against letting any one know of their plan to go on a bear hunt. They believe firmly that if they should speak of such intention these animals would know it at once and would lie in ambush to attack them. Bears figure largely in the folk-lore and ceremonial dances of the Eskimos on the lower Kuskokwim and Yukon rivers.

About the Arctic coast the polar bear is a regular winter visitor, and a half-grown individual was killed near St Michael in August, 1880. They are common on the pack-ice of the Arctic ocean north of Bering strait, and many were seen during the cruise of the *Corwin* in 1881. The accompanying illustration represents a female killed by the writer near Wrangel island, while with the *Corwin*. In summer these animals are usually well fed and avoid encountering men whenever possible. In winter, when hunger presses, they become dangerous, and I have heard of several Eskimos who were killed and have seen others who were badly scarred from encounters with them.

In the fall, as the pack-ice comes south through Bering strait, it brings great herds of walruses and many white bears. The latter sometimes reach the Fur-Seal islands, but only at rare intervals. Some years many of the bears fail to retreat beyond the strait early enough in spring and are left stranded on St Matthew and St Lawrence islands. During the summer of 1874 Mr Elliott and Lieut Maynard found them on St Matthew island to the number of several hundred. When these gentlemen landed on the neighboring Hall island the same season sixteen white bears were in sight as the boat approached the shore, ten of which were together on the beach. Quite a number were killed and none showed fight. They were fat and when asleep were easily approached. When aroused they stood up and sniffed at the party as if to learn whether they were friends or foes, and when the men were scented the bears ran back into the hills. At this time they were seen feeding on grass and roots, with motions like those of a grazing hog.

Aside from the whales, the walrus is the largest Alaskan mammal. Formerly it was very numerous around the islands and along the American coast of Bering sea and the Arctic ocean. During the cruise of the *Corwin* we saw thousands of them on the border of the pack-ice. The Eskimos report the female walruses to be very dangerous in April and May, when they have young. At that time they say an old female will attack a man in a kyak on sight, and becomes as fierce and dangerous as an old bear. An Eskimo living at Cape Vancouver once told me of an encounter he had had with a walrus while seal hunting in the drift-ice off the cape, in which he and a companion had a narrow escape. They met and killed a young walrus without having seen the female. A moment later she arose in the water and, catching sight of the hunters, uttered a hoarse bellowing cry and dashed at them. The men paddled for their lives and reached a cake of ice just in time to escape. Here they were kept prisoners for nearly a day. Several times, supposing she had gone, they launched their kyaks, but the moment they did so she appeared and drove them back on the ice. During our cruise in the Arctic we saw many females with young, and the watchfulness of the old ones was very noticeable. The young nearly always swam directly in front of its mother, and the latter, in diving, always carried the little one under with her by resting the points of her tusks on its shoulders and forcing it down.

In the old days, when caribou were abundant, wolves were common and ran in large packs. With the growing scarcity of caribou the wolves decreased, until, during my residence at St Michael, they were uncommon along the coast of Bering sea and the adjacent interior. The white and blue arctic or stone foxes are common on the barrens, and red foxes are also common and much more widely distributed. The region about Dawson City was formerly noted for the number and quality of the black fox skins taken there every winter. Canada lynxes, wolverines, land otter, American sable and mink are among the fur-bearing animals which helped make up the main wealth of Alaska until recent developments.

Among the "rats and mice and such small deer" are many animals of more or less interest. The whistling marmots live in the mountains about the upper Yukon and Tanana rivers, and the bob-tailed little conies are also found in that region. The last-named animal makes its home in broken masses of rock and has an amusing way of barking at strange visitors with a squeaking voice like that of a toy dog.

The great increase in the population of Alaska which is now taking place cannot but have a decided effect upon the large game. Most of the prospecting parties will be provided with rifles and will take every opportunity of securing an addition to their scanty camp fare. With this going on in thousands of localities in the hitherto unvisited areas, the effect will necessarily be disastrous to such animals as bears, mountain sheep, caribou, and moose. Unfortunately not a museum in the world has even a passable representation from Alaska of any of these animals.

The threatened early extermination of such fine species is to be greatly deplored, but cannot well be avoided, and it is altogether probable that within two or three years it will be extremely difficult, if not impossible, to secure specimens for scientific purposes. The U. S. National Museum in Washington is the proper repository for a full representation of the animals indigenous to our territory, for exhibition purposes as well as scientific study, and it will be a great loss to science if any of the large Alaskan mammals become extinct before a proper series of skins and skulls is in the possession of this institution. I wish to impress this upon settlers and others going to Alaska the present season, in the hope that, having their attention called to the importance of saving specimens, they may take a patriotic interest in placing them in the National Capital.

CLIMATIC CONDITIONS OF ALASKA

By General A. W. Greely, U. S. Army

The most obvious elements of climate are those of temperature, humidity, precipitation (rain, snow, fog, etc.), and winds, and of these temperature and precipitation affect most potently the comfort and prosperity of man.

It is about 25 years since the writer was one of several consulted by the late General A. J. Myer as to the establishment of stations of observation in Alaska, and in 1881 he was consulted by the late General W. B. Hazen regarding the extension of the system of such observations in the same remote and almost unknown region. A certain class of persons—those who plume themselves on being strictly utilitarian—then sneered at a policy that would expend a few hundred dollars annually for the purchase of instruments and for the cost of recording meteorological observations by volunteer observers on this outer edge of this civilized world. "Who knows or cares," said they, "whether the Yukon river flows into Bering sea or the Arctic ocean, and of what use is a knowledge as to the summer and winter conditions under which the animals of this river valley live and thrive?"

Today the question answers itself, and tens of thousands of men eagerly search for reliable and satisfactory data on which to base their plans and outfits for their search for fortunes in the gold regions of the upper Yukon. It therefore seems timely to bring together such observations of the climatic conditions of the different parts of Alaska as may give at least a general idea as to the weather to be encountered.

Most extensive countries have two kinds of climate: first, the continental type, where far from the sea we find hot summers, cold winters, light rainfalls, and much sunshine; second, the littoral or shore type, where the heat of summer and the cold of winter are modified by moist winds from the ocean bringing copious or heavy rains. To these Alaska adds a third kind, the marine or island type, where the winters are, comparatively speaking, unduly warm and the summers unduly cool, while rains, fogs, and cloudiness are prevalent through the greater part of the year.

Considering first the marine climate, it is to be said that it prevails on all the outlying islands of Alaska in the Aleutian archipelago and in parts of the Alaskan peninsula. Naturally the extremes of temperature become more marked to the north.

The littoral or coast climate of Alaska is materially tempered by the oceanic current usually known as the Japan stream, which keeps at an abnormally high temperature the moisture-laden winds that, blowing landward, deposit large quantities of rain or snow, thus setting free large quantities of latent heat to warm the land. The enormous quantity of such heat and its influence on the temperature of the air may be imagined from Haughton's calculations, which show that "one gallon of rainfall gives out latent heat sufficient to melt seventy-five pounds of ice or to melt 4.5 pounds of cast iron."

The settlers and miners of Alaska will find that the coast conditions change rapidly as one goes inland to a continental climate of the most pronounced type. Cool, cloudy, and rainy summers, and raw, damp, foggy, and not very cold winters are to be anticipated along the immediate main coast or the inlets. Wherever rapidly rising shores are found the hills or mountains are subject to heavy precipitation, with resulting deep snows and low temperatures for a considerable part of the year.

Almost everywhere in Alaska the climate changes decidedly within one hundred miles of the mainland coast and becomes continental in its characteristics. Rain and snow are less frequent, the summers are longer and warmer, the skies less cloudy, and the winters marked with excessive cold, though the winds are much lighter and storms are infrequent. Continuous freezing weather, usually below zero, continues for months, and even in July, with midday temperatures of 70° to 80°, it is an almost daily occurrence for the temperature to fall during the night to the neighborhood of the freezing point.

Let us now turn from general statements to specific data from such selected stations as are acknowledged as climatically typical of various parts of Alaska. In so doing one turns naturally to Dall's admirable article and tables on the meteorology of Alaska, published in the *Pacific Coast Pilot*, 1879. Although his work and charts are 21 years old, yet they are the only discussion and data that have ever been published on the general meteorological conditions of Alaska.

St Paul island, Bering sea, has a typical marine climate; its lowest recorded temperature is —12° and its maximum 62°. The temperature rarely exceeds 50°, and in 1875 it only reached 48°. February is the coldest month, with an average temperature of 26.1°, and August the warmest, with a mean of 48.4°.

Sitka is a typical coast station for extreme southern Alaska and Point Barrow for the northern. In 45 years Sitka had extreme temperatures of 88° and —4°. The coldest month is January, 31.4°, and the warmest August, 54.9°. Every year it is either rainy or snowy 200 days on an average. In 1856 rain and snow fell on no less than 286 days, but in 1883 there were only 114 such days. The annual rainfall is very great, being 81 inches, of which about one-half falls from September to December.

Point Barrow, the extreme northern point of Alaska, is in 71° 23′ N., 156° 40′ W., and its climate is important as indicating closely that of the coast-line of the whole tundra or moorland region situated along the Arctic ocean. It should be remembered that as one goes inland the winter becomes colder and clearer; the summers, warmer and drier. The observations of Capt. P. H. Ray, 1881–'83, and of H. M. S. *Plover*, 1852–'54, are the base of the following notes: The winter is long, as freezing weather obtains from early September to early June, when summer comes in full force. The mean winter temperatures are: December, —15.4°; January, —17.5°; and February, —18.6°, with occasional periods when the cold is from 40 to 52 degrees below zero. The average heat of July is 38.1°, and of August 37.9°; but the temperature often rises above 50° and has touched

65.5°. The snowfalls are light, amounting (melted) to 8.25 inches, the greater part falling from July to October. The severity of the cold is indicated by the fact that the ground was found frozen, as far as excavations were made, to the depth of 38 feet. Winds and gales are most frequent from August to November and the lightest winds are from February to May. The natives quit their snow huts for tents about May 1. The tundra is snow-free late in June.

The watershed of the Yukon includes the regions whose climatic factors are at present of the greatest interest and prospective value. Fortunately, there are sufficient data to justify clear-cut statements that must closely approximate the truth.

St Michael, 68° 28′ N., 162° 04′ W., although an island, immediately borders the mainland near the mouth of the Yukon. Its climatic characteristics have been fully set forth by Mr E. W. Nelson. The winter is very long, the average temperature being below the freezing point from October to April, inclusive. The coldest month, February, averages from twelve years' observations, −2.3°, but in 1877 it was −23.7°. A temperature as low as −55° has been observed. The warmest month, July, has a mean temperature of 53.6°. It should be said that one summer month of any year closely resembles the same month of any other year, but there are great variations between the same winter months of various years. Spring bursts into summer about the middle of May, but it reverts more slowly to winter through a partial autumn. Summer is very depressing, from its frequent spells of misty rain and the prolonged presence for many days of unbroken, low clouds. Winter is marked by long periods of beautifully clear days, which are usually of intense cold. Strong gales occur irregularly through the year. While most frequent in autumn, yet fierce winter storms are not uncommon, which, with their terrible accompaniments of blinding clouds of snow and temperatures considerably below zero, are wisely dreaded, as even the hardy natives sometimes perish therein. The harbor closes as a rule by October 15, and rarely opens before June 10. The breaking up of the Yukon ice about the 1st of June is usually followed by several foggy days. Very light rains or snow are frequent and continued. The precipitations scarcely reach 18 inches annually, of which the greater part falls from July to September. Snow falls often in summer, sometimes in notable amounts. Rain or snow falls three days out of five from August to October, but only one out of four from January to March.

At Nulato, 60° 40′ N., 158° 13′ W., the summer consists largely of warm, hazy days, free from high winds or much rain. The Yukon closes about October 20 and opens late in May. At Ikogmut mission, 61° 47′ N., 161° W., the river closes about November 4 and breaks up about May 23, but in 1849 it remained closed until June 5.

Mr A. J. Henry gives in the *Monthly Weather Review*, August, 1897, other temperature means for short periods. The lowest monthly means are as follows: Anvik, 62° 37′ N., 160° W., December, −2.1°; Tuklukyet, 65° 10′ N., 152° 45′ W., January, —11.1°; Belle Isle (a short distance up the Yukon from Circle City), 65° 30′ N., 142° 38′ W., January, −15.8°; Camp Colonna, about 64° 45′ N., 141° W., February, −15.3°; Camp Davidson, about 67° 30′ N., 141° W., January, −17.4°; Fort Reliance, 64° 10′ N., 139° 25′ W., January, −28.7°.

The most important temperature observations in the Klondike regions are those made at Dawson from August, 1895, to November, 1896, by Mr William Ogilvie, whose scientific standing and ability are guarantees of their worth. While they do not give all the mean temperatures, yet they record the minimum and much information of value. In July only the temperature did not sink below freezing. During June, July, and August, 1896, the temperature rose on 29 days above 70° and thrice above 80°. The extreme severity of the winter is indicated by the fact that from December 1, 1895, to February 1, 1896, the temperature fell below zero every day. On 28 days it fell lower than —40°; on 14 days, lower than −50°, and on nine days lower than −60°. The mean temperature for January, 1896, was —40.7°, and for February, —35.4°. Bright weather is the rule. From October 1, 1895, to the 1st of May following, snow fell only on one day in seven. In June, 1896, however, it rained on 12 days and the temperature rose above 80°. The Yukon broke up on May 17 and ran thickly with ice until the 23d, when the first boat came down the river. Except for two weeks, the Yukon was free from ice until October 29; it was frozen solid November 5.

The temperature observations at Fort Reliance, adjacent to Dawson, in 1880–'81, communicated to The National Geographic Magazine of November, 1897, by Mr E. W. Nelson, confirm the severity of the winter climate. The Yukon was frozen from November 2 to May 14. The mean temperatures for December, January, and February were −31°, −7°, and −29° respectively, and on 35 days the thermometer registered between

−40° and −66°. Snow fell but one day in February and 25 days were perfectly clear.

With the middle of May summer comes at once, the Yukon breaks up, the snow vanishes as if by magic, and vegetation develops with astonishing rapidity until opening September brings sharp frosts almost daily.

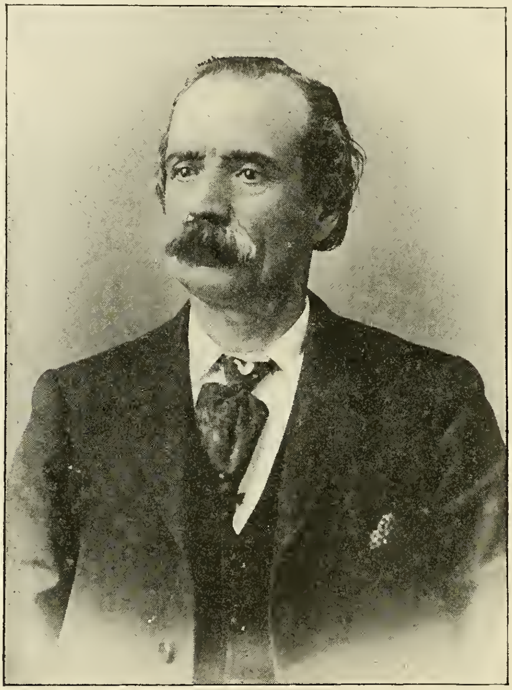
By methods familiar to meteorologists the temperature means for the three coldest months—December, January, and February—have been calculated for all the points hereafter named, except for St Michael, which is definitely known. St Michael, mouth of Yukon, 3.3°; Anvik, 62° 37′ N., 160° W., −1.2°; Circle City, −10.2°, and Dawson, 64° 05′ N.′ 138° W., −24°. Any single winter may be considerably warmer or colder than is here calculated, but the means are practically correct and afford a good idea of all intervening points in the valley of the Yukon, and therefore have a definite value for all who seek to wrest from rugged and inhospitable Nature the golden hoards of Alaska.

A YUKON PIONEER, MIKE LEBARGE

The first white men to explore the Yukon between the Russian settlements and the Hudson Bay post called Fort Yukon were Frank Ketchum, of St Johns, New Brunswick, and Michel Lebarge, of Chateauguay, Quebec. After the death of the lamented Kennicott, at Nulato, in May, 1866, the expedition which he had planned and which was only waiting for the ice to pass out of the river to make a start, was loyally and successfully carried out by his chosen and faithful companions. They ascended the river from Nulato to Fort Yukon, and then returned, crossing the portage to St Michael to make their report to the commander-in-chief of the Telegraph expedition, Col. Chas. S. Bulkeley, at that port. The following year the party was augmented by Wm. H. Dall and Frederick Whymper, who wintered at Nulato. Ketchum and Lebarge undertook a remarkable journey over the frozen river to Fort Yukon in March, accompanied by two Indians. They arrived safely at their destination just as the ice was breaking up, and after the freshet was over took birch canoes at Fort Yukon and continued their explorations to the junction of the Lewes and the Pelly at the site of old Fort Selkirk. Returning, they joined Dall and Whymper at Fort Yukon, the second half of the party having made the journey to that point in canoes.

The united party then descended the river to the sea and reached St Michael in safety, thus making the first continuous trip from the headwaters to the sea.

Michel Lebarge was born in Chateauguay in 1837, of Canadian parents of French origin. In May, 1865, he started for California, on the steamer *Golden Rule*, by the Nicaragua route. On the same vessel were Kennicott and his companions on their way



to join the expedition of the Western Union Telegraph Company for the exploration of Russian America. The crossing of Nicaragua was accompanied by a number of lively incidents, including the loss of a steamer on the San Juan river; and the excellent qualities displayed by Lebarge in trying circumstances attracted the attention of Kennicott and led to the engagement of the young Canadian in the corps of northern explorers. After the disbanding of the Telegraph expedition, in which the courage, ingenuity, and companionable characteristics of Lebarge had made him a universal favorite and cemented an enduring friendship with his American comrades, in 1868 he engaged in the fur trade in the Yukon region with a number of associates, under the name of the Pioneer American Fur Co., and in 1871 entered the service of the Alaska Commercial Company, from which he retired, with a modest competency, in 1875. He is now living in his native town in the Province of Quebec. An indefatigable traveler, a delightful companion *en route* or by the camp fire, full of expedients whatever befell, tactful and adroit in his dealing with the natives, generous and helpful to the inexperienced—in short, a capital voyageur of the best type—no one who knew him in those days but thinks of him always with admiration and affection. His services to geography are commemorated by Lake Lebarge, on the direct route to the Klondike, and Lebarge river, an affluent of the Yukon from the north below Fort Yukon. The name Lebarge has been variously spelled; the form in use during the expedition has been adopted as here written by the U. S. Board on Geographic Names. Frank Ketchum lies under the green turf of an Unalaska hillside. May his faithful companion and our good friend survive for many happy years.

WM. H. DALL.

ALASKA AND ITS MINERAL RESOURCES*

By SAMUEL FRANKLIN EMMONS,

U. S. Geological Survey

INTRODUCTION

Alaska was first visited by a Russian expedition under Bering in 1741. In 1799 the territory was granted to a Russo-American fur company by the Emperor Paul VIII, and in 1839 the charter was renewed for twenty-four years. In 1867 it was ceded to the United States for a money payment of $7,200,000. The first mining excitement in the interior was in the Cassiar mining district in British Columbia around Dease lake, near the head of the Stikine river, from 1871 to 1887. Later, prospectors found their way into the more northern regions and down the valley of the Yukon into American territory, where they discovered valuable placers on Birch creek, Mission creek, and Fortymile creek, small southern tributaries of the Yukon. In the autumn

*This paper, published with the permission of the Director of the U. S. Geological Survey, is an abstract of a pamphlet prepared by his direction to accompany a map of Alaska, and giving such information, compiled from data in the possession of the Survey, as it was thought would prove useful to the traveler or prospector who might visit that region.

of 1896 still richer discoveries were made a short distance east of the boundary, along the Klondike river, and a great rush of miners to these now famous diggings set in the following spring.

Accurate data with regard to the geography of Alaska it is as yet difficult to obtain. The immediate coast-line and the many islands which border it have been mapped by the United States Coast and Geodetic Survey, and the course of the great Yukon river, comparable in size to the Mississippi, was determined by the Western Union Telegraph Company's expedition in 1867 and by an expedition in 1869 under Lieut. C. W. Raymond, of the United States Engineers. What other information has been obtained with regard to the interior is derived from route and sketch maps made by individual explorers, who generally followed the valleys of the larger streams. Vast tracts of mountain land between these streams are yet practically unknown.

Ketchum and Lebarge, of the Western Union Telegraph expedition, were apparently the first white men to traverse the entire length of the Yukon river. They traveled on ice and snow from St Michael to Fort Yukon in the winter of 1866–'67, and in the following summer made their way to Fort Selkirk and back, joining on their return W. H. Dall, who had charge of the scientific work of the expedition, and who, with Frederick Whymper, had ascended to that point by water. In later years scientific explorations of the interior have been made by members of the Canadian and of the United States Geological Surveys. In 1887 Dawson and McConnell, of the Canadian Survey, ascended the Stikine to the Liard, the former going northwestward by the Frances and Pelly to Fort Selkirk, the latter descending the Liard to the Mackenzie and the following season crossing from the Mackenzie to Fort Yukon by the Porcupine river and ascending the Yukon to its southwestern sources. William Ogilvie, of the same corps, entered the Yukon district in 1887 and has been there most of the time since, engaged in route and boundary surveys. In 1889 I. C. Russell, of the United States Geological Survey, in company with a boundary party of the Coast Survey, ascended the Yukon river from its mouth to the head of boat navigation, coming out over the Chilkoot pass. In 1890, under the auspices of the National Geographic Society, Russell explored the Mt St Elias region from Yakutat bay. In 1891 C. W. Hayes, of the United States Geological Survey, accompanied Schwatka's expedition up the White, across Scoloi pass, and down the Copper river. In the summer of 1895 G. F.

Becker and W. H. Dall, under orders of the Director of the United States Geological Survey, made examinations of the coastal regions with reference to gold and coal, and in 1896 J. E. Spurr, assisted by H. B. Goodrich and F. C. Schrader, made a reconnaissance of the gold-bearing rocks of the Yukon district. It is from the reports of these later explorers that the data contained in the following pages have been compiled.

GEOGRAPHICAL SKETCH

Alaska has an area of 580,107 square miles. It is roughly quadrangular in outline, with a panhandle extension in the southeast along the coast and a peninsula stretching out into the ocean on the southwest, which continues in the chain of the Aleutian islands that separate Bering sea from the Pacific ocean. Its eastern boundary is formed by the 141st meridian of longitude west from Greenwich, and the westernmost portion of its mainland, Cape Prince of Wales, is on the 168th meridian, or within 54 miles of the easternmost point of Asia. In latitude it extends from 54° 40′, the southern point of Prince of Wales island, to Point Barrow, in 71° 23′ north latitude, far within the Arctic circle. Its greatest extent in a north-south line is thus 1,100 miles, and from east to west 800 miles.

The coast-line is much broken by arms of the sea, reaching far inland, either as open bays, as sounds or submerged river valleys, or as fiord-like inlets. The coast abounds in islands, which cover an aggregate area of 31,205 square miles and which as a rule are very mountainous. The chain of the Aleutian islands, reaching nearly 1,500 miles into the Pacific ocean, is largely of eruptive origin and contains many volcanic craters, some of which are yet active. They rise very abruptly from the sea, often to an elevation of several thousand feet, one on Unimak island reaching a height of 8,955 feet.

The Alexander archipelago and the adjoining coast strip, the best-known and most frequented part of the Territory, resemble the submerged portion of a narrow and precipitous mountain system. The archipelago consists of 1,100 islands, the largest and most southern of which is Prince of Wales island. It is intersected by deep and relatively narrow waterways, which often run far inland and bear evidence of previous occupation by glaciers. In some cases, as at Glacier bay, enormous living glaciers are found at their head. The islands themselves are steep-sided, and rise to an average elevation of 2,500 feet. On the seaward side of Baranof island, one of the outer tier, on which Sitka is situated, is a volcanic crater, called Mount Edgecumbe, 2,855 feet high. Further northwestward, forming part of the same mountain line, the St Elias range, which follows the immediate coast, contains many high mountains, and culminates to the north in Mount St Elias at an elevation of 18,024 feet. Mount Logan, further inland, is supposed to be still higher, and explorers report that far in the interior, between Copper river and the Lower Yukon, there is a group of mountains, extending in the same general direction, of equal or perhaps even greater elevation, the highest point of which has been designated Mount McKinley. A second line of elevation is supposed to extend southwestward from near the head of Copper river, following the coast-line in the direction of the Alaskan peninsula.

The rivers entering into the waters of the Alexander archipelago are generally short, and only two, the Stikine and the Taku, are known to head beyond the crest of the mountains immediately adjoining the coast. The Chilkat river is a considerable and rapid stream, entering the head of Lynn canal from the northwest; it is probably less than 100 miles in length. The next river northward is the Alsek, about which little is known, but it is supposed to head on the east side of the St Elias range, in the vicinity of Mount Logan.

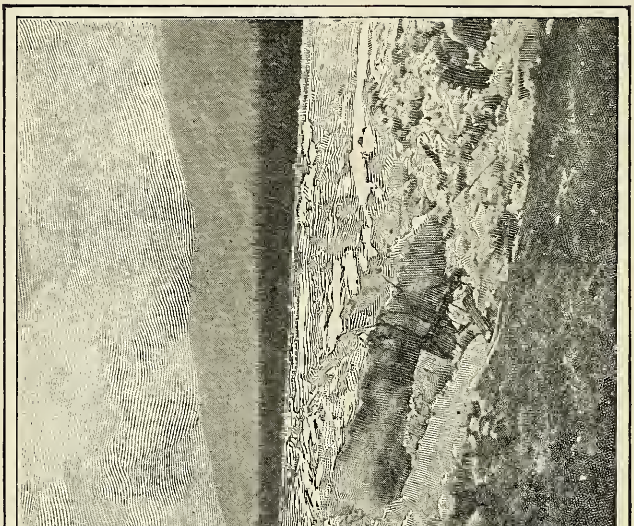
Copper river is a larger stream than any of those thus far mentioned, and heads in a mountainous country, containing several high peaks with an estimated elevation of 12,000 to 18,000 feet, and little known, except by the Indians. Rolled masses of native copper, of which their knives were made, were obtained somewhere in this region. A northwestern branch of this stream is said to head between the Sushitna and the Tanana rivers, possibly in the lake which on the map is represented as being drained by the Sushitna. The Sushitna also is an important stream, emptying into the head of Cook inlet, very wide and difficult of navigation near its mouth owing to the great rise and fall of the tide. Its sources are in a high mountainous region, a main northwestern branch being supposed to head near Mount McKinley.

The next large river, the Kuskokwim, is the second largest in the Territory, its length being estimated at over 600 miles. It drains a mountainous region difficult of access. The Russians ascended it in boats as far as the Redoubt Kolmakof or crossed from the Yukon by a portage near Oknagamut. The currents of the lower stream are rapid. A winter route was also used from Fort Alexander up the Nushagak and down the Chulitna; in summer the morasses along this route may not be passable.

Beyond Norton sound, into which empties the great Yukon, that drains the whole interior region, the principal streams of known importance are the Kowak and the Noatak, which flow into Kotzebue sound. The Colville river, which empties into the Arctic ocean, is supposed to head in the same general region as the two just mentioned.

The Yukon river has an estimated length of 2,000 miles, of which three-fourths is continuously navigable for river steamers. It empties into Norton sound through a wide delta in four principal mouths 50 to 64 miles in length. For about a hundred miles above the delta it has a general northwest course, then bends at right angles and has a southwest direction up to the bend at Fort Yukon, just within the Arctic circle. Here it receives the waters of the Porcupine, a stream having the same general southwest course and heading near the mouth of the Mackenzie river. Fort Yukon is distant in a direct line about 650 miles from the mouth of the river. Above this point the general direction of the river is again northwest, but a short distance east of the international boundary it turns to a north-south course, which it maintains for nearly a hundred miles, through the Upper Ramparts. It is at the bend below this north-running stretch that the Klondike river enters from the east, above which, and more or less parallel, are the Indian and Stewart rivers, all famous as draining a region phenomenally rich in gold. Near the upper end of this north-south course the White river enters in the same direction from the south. Above this the Yukon resumes its northwest course and maintains it to Fort Selkirk, which is near the head of navigation. At Fort Selkirk it splits into two main branches: the Pelly, which drains the Rocky Mountain regions to the northeast, and the Lewes, which in several branches drains the region to the southwest and the many lakes on the eastern side of the Coast ranges.

The principal tributaries of the Yukon from Fort Selkirk to Fort Yukon are, on the south side, in descending order, White, Sixtymile, Fortymile, Mission, Seventymile, and Charlie rivers, and on the north, from Dawson at the mouth of the Klondike downward, the Chandindu, Tatondu, Tahkandit, and Kandik rivers. From Fort Yukon to the open country near the mouth of the river the longer streams coming from the southeast are



VIEW ON ELDORADO CREEK, A BRANCH OF THE KLONDIKE

By courtesy of McClure's Magazine

Birch creek, Beaver, Tanana, and Nowikakat rivers; from the north come the Dall, Tozikakat, Melozikakat, and Koyukuk rivers, the latter one of the largest tributaries and said to be 500 to 600 miles in length.

The Yukon is generally a broad and muddy stream, flowing with a current of 3 to 9 miles an hour. Occasionally it runs in a narrow, rocky canyon cut through lava, or across low mountain ranges, and such stretches are locally called "ramparts." For the most part, however, its valley is wide, and the stream often spreads out into many channels with low wooded islands between, the whole covering a width said to reach 10 miles in places. Dry spruce is practically the only fuel available for steamers along the Yukon, and the supply is limited and difficult to obtain. Although the river is frozen up during eight months of the year, from October to June, its importance as a means of transporting supplies can hardly be overestimated. In the early years, when the connection between the upper and lower portions of the river was not absolutely known, the Hudson bay fur-traders were in the habit of taking their peltry from Fort Selkirk down to the mouth of the Porcupine and up that stream to the Mackenzie, preferring to make this long and circuitous journey rather than encounter the difficulties of a more direct route across the mountains to the eastward.

The international boundary between American and Canadian territory has no relation to the physical structure of the interior region; hence in this description that portion of British Columbia which lies opposite the Alexander archipelago and the coastal strip of American territory southeast of Mount St Elias will be considered as part of the general province of Alaska. The known portions of the interior region, which lie mainly south of the Arctic circle, belong to the drainage system of the Yukon river. This stream, with its various tributaries, drains the northwestern portion of the cordilleran system included between the coast and the Mackenzie river valley, which are about 700 miles apart and approximately parallel. The Mackenzie river flows from Great Slave lake into the Arctic ocean. To one tracing the broader features of physical structure northwestward from the United States through British Columbia, it would seem that the mountainous region between the Yukon and the Mackenzie represents the Rocky mountains proper, and the Alexander archipelago and adjoining coast slopes the Coast ranges. The basin of the Upper Yukon (the river above the great bend) would then be the representative of the Great Basin region in the United States, since north of the 49th parallel the uplift of the Sierra Nevada has merged with that of the Coast ranges into one general system.

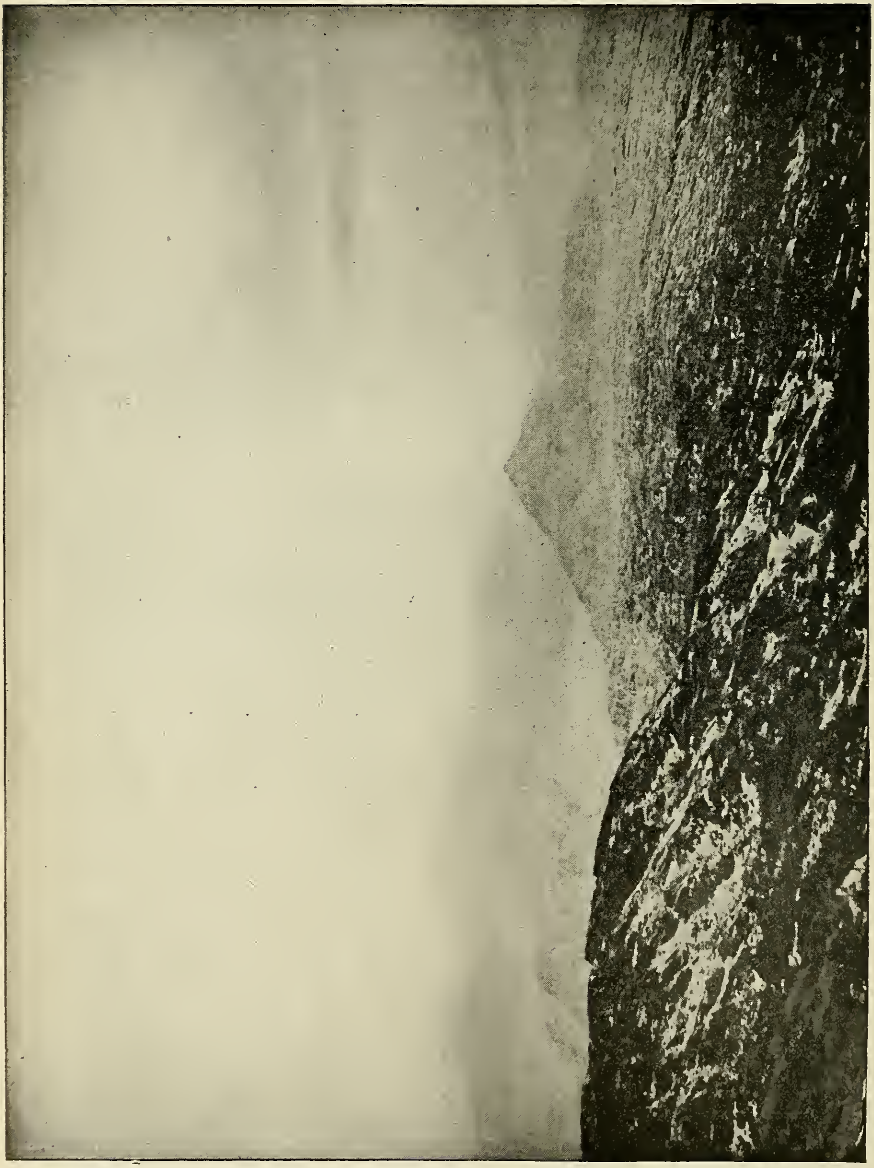
The Coast range proper is a broad elevated belt with many scattered peaks, but not differentiated into continuous ranges. Oceanward it presents an abrupt, rugged front, cut by fiord-like valleys. To the east is a plateau-like region which descends gradually to the north from an elevation of 5,000 feet in the upper lake region to 3,000 feet in the lower Lewes and Pelly river valleys. The river valleys in this stretch often lie 2,000 to 2,500 feet below the general plateau level.

In the interior region the soil is frozen for a large portion of the year, so that there is comparatively little rock decay. Where there is no timber the surface is generally covered with an abundant growth of moss. This, wherever the surface material is sufficiently compact to become impervious to water by freezing, produces large areas of swampy tracts, even on sloping ground, which, except in the glaciated regions or when cut through by large streams, obscure the rock surface and render difficult the work of the prospector.

The northwestern continental ice-sheet, or cordilleran glacier of Dawson, which centered in British Columbia between latitudes 55° and 59° N., did not extend in this interior region north of the 62d parallel, hence the greater part of the Yukon basin has not been glaciated, except by local glaciers. This fact has been readily recognized by the geologists who have visited the region in recent times, and indeed is evident, on inspection of the maps, by the abundance of lakes above this line and their absence below it.

The Yukon or all-water route.—This route is by ocean steamer from Seattle or San Francisco to St Michael, near the mouth of the Yukon; thence by river steamboat up the Yukon to Dawson. The length of this route is about 4,000 miles, it being nearly 2,700 from Seattle to St Michael, and about 1,300 up the Yukon to Dawson. Those taking this route aim to leave St Michael early in July, in order to avoid the delays in upstream progress caused by sand-bars at low stages of water later in the season. The time from Seattle to St Michael is about twenty days, and that from St Michael to Dawson the same, making about forty days for the trip. Under favorable weather and circumstances it may be made in less time. Though this route is the one over which commercial companies operating in the Yukon country transport their goods, it is seldom used by miners who wish to enter in the spring, since at that season it takes several weeks longer to make the trip by this route than it does to make it by some of the trails mentioned below. It is, however, highly advantageous for persons unfitted to rough it on the trails.

The Skagway or White Pass route.—From Seattle to Skagway, a distance of 1.115 miles, the route is by ocean steamer northward along the coast, and finally up Lynn canal. It is practically a still-water route, being protected from the swells of the ocean by an almost continuous barrier of densely wooded islands. The trip requires about three and one-half days. Skagway is located on the east side of Dyea inlet, a branch of Lynn canal. Its population, which is much increased by people who have been unable to get across the trail, is said to be about 8,000. Dyea is situated four miles north of Skagway, west of the mouth of Dyea river and at the head of Dyea inlet. The rise and fall of the tide in this inlet is about 24 feet. At Skagway steamers find good anchorage within half a mile of the beach, to which freight is taken in lighters at high tide, which are unloaded when the tide recedes. Several newly built wharves are said to be now in practical use, and the facilities for landing cargoes are greatly superior to those at Dyea. From Skagway the trail leads northeastward up the valley of the Skagway river. crossing the mountains at White pass and running thence northward to the head of Lake Bennett, whose waters flow into the Yukon. The summit of White pass is 2,400 feet above sea-level, and its distance from Skagway is 18 miles. For the first four or five miles there is a good wagon road, which crosses the river several times by ford. At high stages of water, however, freight must be packed across on foot bridges. Beyond this are long stretches of very miry and rocky ground, where a loaded man will sink knee-deep in the mud. There are also several steep and rough ascents, of which Porcupine hill is the sharpest. The last two miles before reaching the summit is a steady, hard climb, but presents no cliffs or precipices. Many horses have been killed or have died on this trail. Seventy-five to 100 pounds make a good load for the ordinary packer. From the summit to Lake Bennett, 17 miles, the trail improves, although still bad. It is for the most part gradually downhill, over an undulating, rocky surface. The timber-line is reached again at The Meadows, about five miles beyond the pass, which is the ordinary camping-place. The trail passes the two small lakes known as Summit and Middle lakes, on which fer-



SUMMIT OF WHITE PASS — FALL OF 1897

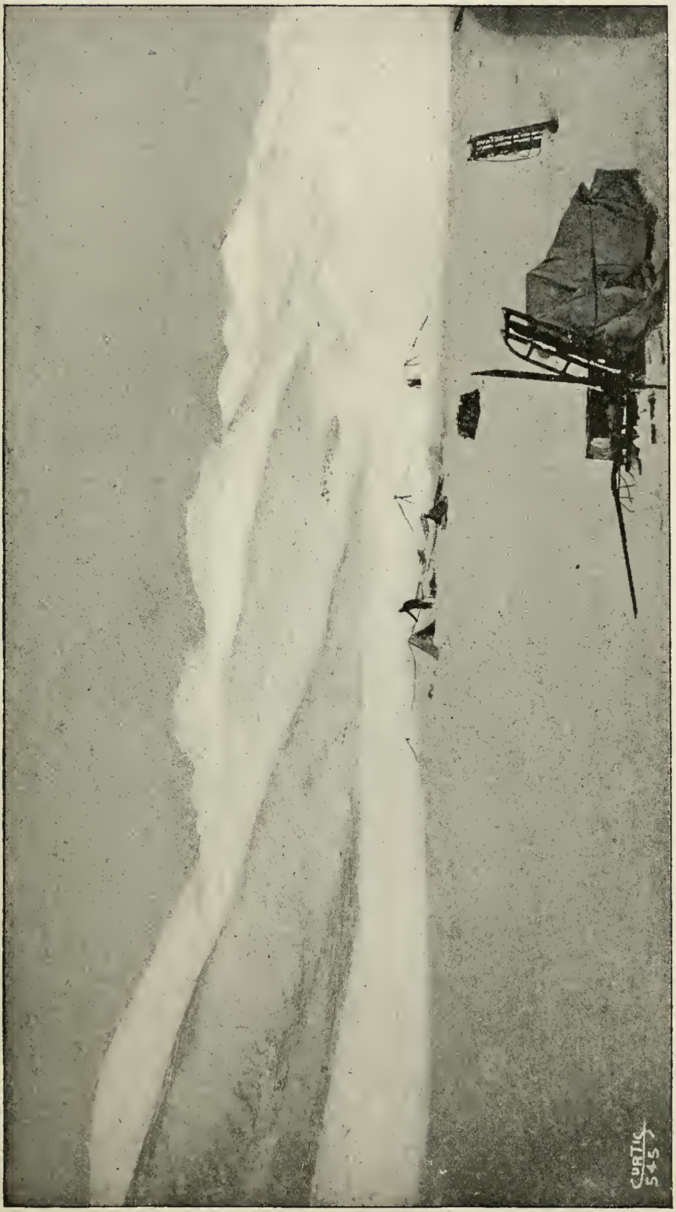
From a Photograph by E. S. Curtis

riage may be secured when the water is not frozen. Midway between the latter and Lake Lindeman, about three miles before reaching Lake Bennett, the Canadian custom-house officials have put up a large log cabin, which is used as a place of shelter by those crossing the trail. At this point a trail branches off to the right down to Tooshhie lake; but as there are seven miles of impassable river between Tooshhie and Tagish lakes, travelers bound for the Yukon are warned from taking this route. At the head of Lake Bennett the Skagway joins the Chilkoot trail. The Skagway trail is somewhat longer than that over the Chilkoot pass, but the pass is much lower. It requires, however, considerable improvement in bad and swampy places. This route has been recently recommended by the United States Quartermaster's Department of Puget sound.

The Dyea or Chilkoot Pass route.—This trail has been used by the Indians for generations, and until a year ago was practically the only route followed by miners and prospectors who entered the interior. It is the shortest route to the headwaters of the Yukon.

Dyea (or Taiya) is the Indian word, meaning *pack* or *load*. Owing to the extensive shoals at the head of Dyea inlet the conditions for anchorage and discharging cargoes from ocean vessels are less favorable than at Skagway. They are either unloaded by means of lighters or put upon a rocky point about a mile from the beach, whence they are hauled off in wagons. Dyea trail runs northeastward up the Dyea river and across the Chilkoot pass, at an elevation of 3,500 feet, to the head of Lake Lindeman, a total distance of 28½ miles. The summit is 13 miles from Dyea, the first 6½ miles following a comparatively open valley, in which there is a good wagon road. Owing to the windings of the stream within the walls of the valley the river must be crossed several times—by fords in summer, by ferries in spring when the water is deep. The trail then enters a narrow canyon with steep, rocky walls, which it follows to Sheep camp, at timber line, 4½ miles further on. Through the canyon the trail is rougher, but horses have been successfully used for several years in packing to Sheep camp. Good camping places are found all along the route from Dyea to Sheep camp, and at several points refreshments may be obtained. Sheep camp is the last camping place on the west side of the range, as from there on there is no timber or fuel until Deep lake, on the other slope, 12 miles distant, is reached. From Sheep camp to Scales, where packs are weighed by the Canadian authorities, a distance of 3¾ miles, the rise is about 1,800 feet. The trail is free from mud, and traveling is not difficult, though in places the ground is covered with bowlders. From Scales to the summit of the pass the ground rises 1,000 feet in a distance of about half a mile, and masses of broken rock or talus make the climb very difficult, and impossible for pack animals. The building of an aerial or wire tramway, with buckets carrying 400 pounds of freight, has been contemplated for this portion of the route. From the summit of Chilkoot pass to Lake Lindeman, a distance of 15½ miles, the trail descends first very steeply to a small lake called Crater lake, and thence more gradually along the drainageway of a chain of lakes known as Long, Canyon, and Deep lakes, which are connected with one another and finally with Lake Lindeman by small streams. Till late in spring the whole of this drainageway is frozen over, and one travels from the summit to Lake Lindeman by sled. On either side of the pass, especially on the south, snow sometimes accumulates to a depth of 50 or 60 feet, forming a sort of névé of limited extent. Late in the season, when the drainage is open, a ferry sometimes plies on Long lake, a distance of four miles. From the foot of Lake Lindeman there is portage past the rapids to the head of Lake Bennett, where the Dyea and Skagway trails meet.

From the head of Lake Bennett to Dawson, 548 miles, there is a continuous waterway through lakes and rivers, which may be followed in summer by boat and in winter on the ice. Long stretches are navigable by light-draught steamers. Boats may be procured or built at the head of the lake, but in some respects the most advantageous method is to start early enough to travel on the ice as far as the foot of Lake Lebarge, where timber for boat-building is abundant, as in this way the dangerous passage of the White Horse rapids is avoided. Lake Bennett is 26 miles in length, narrow and canyon-like in form, and deep at the lower end. Fifteen miles below the bend, where the southwest arm comes in, strong winds often prevail, producing a rough sea that is dangerous for boats, and parties are often storm-bound there for several days. A sluggish stream, 2½ miles long and often not more than three feet deep, known as Caribou crossing, extends from the foot of Lake Bennett to Tagish lake. Thence there is clear sailing 19 miles down Tagish lake and five miles along a river deep enough for ordinary river steamers to Marsh or Mud lake. Marsh lake is 19 miles long and empties into Fiftymile river, whose current averages three to four miles an



SUMMIT OF CHILKOOT PASS — CAMP OF CANADIAN MOUNTED POLICE — FEBRUARY, 1898

From a Photograph by E. S. Curtis

hour. About 25 miles down, the river enters Miles canyon, a chasm about 100 feet wide and five-eighths of a mile long, between perpendicular walls of basalt 80 to 100 feet high. The swift, turbulent current carries a boat through this canyon in about three minutes. For a fair-sized boat, not too heavily loaded, which is kept under steerageway by one or more good oarsmen and follows the middle of the stream, so as not to be dashed against the steep rocks on either side, the passage is quite practicable. At the foot of the canyon one must keep to the left until the heavy swells are passed, then turn sharply to the right and land on the east or right bank. A safer course, which is followed by many, is to portage one's load along the right side of the canyon, over a hill about 200 feet high, and run the boat through empty.

Three-eighths of a mile below this canyon are rapids about half a mile long, which, though very rough, are not dangerous. A half-mile below these are the White Horse rapids, the most dangerous on the whole river. They are about one-third of a mile long and are confined between low basaltic walls. Near their foot the walls close together, forming a chasm only 30 yards wide, while the bed of the stream drops suddenly, so that the river rushes wildly through, leaping and foaming in a cataract. Many boats have passed successfully through, but others have been swamped, with loss of outfits and sometimes of life. The safer plan is to portage around the rapids and let the boat down by line. The portage is on the west shore, but on either side a tramway could be constructed without great difficulty.

Lake Lebarge, which is 60 miles below the White Horse rapids, is 31 miles long and easily navigable by steamers. There is abundant good timber at its foot. The river below Lake Lebarge, as far as Fort Selkirk, is known as the Lewes, and is also navigable for 160 miles, down to the Five Finger rapids. Here a rock of conglomerate rises up from the river bottom, forming several islands and backing up the river a foot or two, so as to produce a strong swell below. Steep cliffs of the same rock on either bank render a portage at this point impracticable. With proper steerageway and care, however, an ordinary boat may run the rapids safely. The right or east side is followed by most Yukon travelers, but Ogilvie, of the Canadian Survey, from actual experience pronounces the channel along the west bank as also passable. For six miles below the Five Finger rapids the current is swift, and then occur the Rink rapids, which extend halfway across the river from the western bank, producing a decided riffle. On the east side, however, the water is comparatively smooth and safe. Below this the river is practically free from rapids and navigation is unimpeded. Fort Selkirk, where the Pelly and Lewes unite to form the Yukon, is 65 miles below. Thence it is about 95 miles to the mouth of White river, 10 miles further to the mouth of the Stewart, thence 22 miles to Sixtymile river, and 45 miles further to Dawson, at the mouth of the Klondike.

Dalton or Chilkat Pass route.—This is an overland route following a direct course, more or less independent of waterways, from the head of Chilkat inlet to Fort Selkirk. It has been used by J. Dalton, a trader, for some time as a pack-train route and for driving in cattle, but little is definitely known of its geography. It ascends first the Chilkat and Klahoela rivers, crossing the pass in 45 miles at an elevation of 3,000 feet and thence descending into the drainage of the Tahkeena river at Lake Arkell. From Lake Arkell the trail is said to pass over an undulating plain, well timbered in the valleys and with grass on the slopes. The distances from the head of the inlet are given as 75 miles to the watershed and 100 miles to Dalton's trading-post; from there to the Pelly the distance is 200 miles, or 300 miles in all to the Pelly, and 350 to 400 to Fort Selkirk.

The Stikine route.—By this route one travels by boat from Fort Wrangell 150 miles up the Stikine river to Telegraph creek, and thence, a little to the west of north, 150 miles to the head of Teslin lake. The ascent of the Stikine river is tedious and sometimes dangerous, the current being swift and rapids numerous. It is, however, the route that was followed in former days by miners going to the Cassiar district. From Telegraph creek to Teslin lake the trail is said to pass through a gently undulating and well-timbered country which presents no obstacles to the building of a railroad. Lake Teslin is said to be about 80 miles long and bounded on both sides by high mountains. From its foot down to the Lewes runs the Teslin river, which is navigable except for two small rapids, one near its head, the other further down. In its lower course the Teslin spreads out into many channels, occupying a total width of two or more miles. This route appears promising, but is as yet only prospective.

The Taku route.—This route ascends the Taku inlet and river and crosses directly to Lake Teslin or Aklen, a distance of 185 miles from Juneau. Thence it is identical with the Stikine route.

By this route one travels by steamer from Juneau 18 miles up the Taku inlet to the foot of a large glacier, which is often very dangerous to boats, even at a distance of several miles, by reason of the ice masses that break off from it; then by boat 60 miles up the Taku river to the head of canoe navigation. The portage which follows is for the first 20 miles through the canyon-like valley of an eastern branch, then for 50 miles in broad valleys of the upper Taku, 3,500 to 5,000 feet above sea-level. For the last 15 miles the route is in the densely wooded valleys of Teslin lake, among many small ponds. This route is said to be not impracticable for a railroad, and a charter for one has already been granted by the Canadian government. Its merits, however, have not yet been thoroughly tested. Both this and the Stikine route have the undoubted advantage of avoiding the dangerous White Horse rapids.

The Copper River route.—This, the only land route within American territory, would strike inland from near the mouth of the Copper river and follow a general northeasterly course toward the Klondike, thus crossing a great mountain range whose rough topography and many glaciers that fill the valleys and passes render general travel difficult. Orca, the only settlement on the coast near by, which is 50 miles beyond the mouth of Copper river and 700 miles from Sitka, had in 1897 a population of 22 whites; it is the first post-office west of Sitka. According to reports of natives, confirmed by Lieutenant Allen, who crossed over to the Tanana in 1885, the better way is to start inland from Valdes inlet, on Prince William sound, and, crossing the Valdes glacier, strike Copper river 180 miles above its mouth, thus avoiding the gorge and the most dangerous rapids. From the Copper River basin an advisable route would seem to be over the Scoloi pass and down White river; but from observations made by Hayes it appears that the pass, which has an elevation of over 5,000 feet, is occupied by a glacier 300 to 400 feet thick, and that White river abounds in rapids too rough for a loaded boat. I. C. Russell, who visited the Mount St Elias region in 1890 and 1891, reports a mountainous region to the northward occupied by huge glaciers. This region is to be explored during the coming summer by parties sent out by the War Department.

GEOLOGICAL SKETCH

Original or Vein Deposits

At present, so far as known, it is only in the coastal region that deep mining is being carried on in gold-bearing veins. Here it has become a well-established industry, and many large quartz mills are running on the ore extracted from these veins. The principal deposits of southeast Alaska are found in a belt somewhat over 100 miles in length on the seaward slope of the mainland, reaching from Sumdum on the southeast past Juneau to Berners bay near Seward on the northwest. This belt may be also considered to include the deposits on Admiralty and other interior islands. A second belt, further west, is represented by the deposits on the western side of Baranof island, not far from Sitka. The ores, though not always exceptionally rich, are worked at a good profit because of the natural facilities of the region for cheap reduction. The most notable instance of this is the great Alaska-Treadwell mine, which has extracted over seven million dollars' worth of gold from an ore carrying $3.20 a ton, which is worked at an average cost of $1.35. Such conditions can not be expected to obtain in the interior.

These deposits occur in metamorphic slates, diabases, and granites, all similar to the rocks of the auriferous belt of California, and probably, like those, they are of post-Jurassic age. Owing to the dense covering of living and fallen forest trees in this region, prospecting is extremely difficult, and it is probable that future exploration will prove the extent of these gold belts to be much greater than at present appears. The gold-bearing beach sands from Lituya bay to Yakutat bay, along the west foot of the St Elias range, and the placers at the head of Cook inlet, around Turnagain arm and on the Kaknu river, may have been derived from the wearing down of rocks of similar age and composition in the St Elias range and on the Kenai peninsula.

At Uyak bay, on Kadiak island, gold deposits in slates are being worked, and the gold-bearing beach sands of the western end of that island and at Portage bay and the Ayakulik river on the neighboring mainland are apparently derived from metamorphic slates associated with granite, so that it is possible that these more recent gold-bearing rocks extend that far westward. On Unga island, of the Shumagin group, still further west, gold occurs in eruptive andesites of Tertiary age, and mines have been opened on these deposits, the most important of which is the Apollo, one of the most successful in the province. As the Alaska peninsula and the Aleutian islands are largely made up of recent eruptive rocks, this is an important indication, showing the possibility of the occurrence of valuable deposits in such rocks.

In the Yukon basin the gold, so far as known at present, is derived from a much older series of rocks, for the gold-bearing slates of the coastal region have not yet been recognized there. While the exact age of these gold-bearing rocks has not yet been determined, they are known to be older than the limestones supposed to represent thc Carboniferous and Devonian formations of the cordilleran system ; hence they are probably pre-Paleozoic, and in part are possibly as old as the Archean. The grounds for assuming this derivation are that these rocks contain abundant auriferous quartz veins, and that the richest placers thus far discovered are so situated that they must have been derived from them. These rocks are classified by Spurr as follows, commencing at the base:

Basal granite-schist.—This, so far as known, is the fundamental rock formation of the region. The granite has characteristically a somewhat schistose or gneissic structure, thus showing evidence of having been subjected to dynamic action or intense compression, and it may pass into a gneiss, or even a mica-schist, where this action has been most energetic. On the other hand, it is sometimes massive, showing no parallel structure planes, and then is with difficulty distinguishable from the massive younger granites, which are also of frequent occurrence in the region in the form of dikes and intrusive masses cutting across older rocks. As distinguished from the granites of the coastal region, which are intrusive, these older granites are generally of reddish color and crumbly nature, while the later ones are dark gray from the abundance of hornblende as a constituent mineral.

Birch Creek series.—Resting upon the fundamental granite is a series of rocks, roughly estimated as possibly 25,000 feet in thickness, named the Birch creek series, from the place of their typical occurrence. They consist mainly of quartzitic rocks, generally thin-bedded or schistose, so that they pass into mica-schists; in some places they contain carbonaceous matter and develop graphitic schists. There are also bands which probably originated as intrusive rocks, but which by compression have become schistose like the other members. These rocks have abundant quartz veins; they are generally parallel to the schistosity or bedding, small and not persistent, but some cross the bedding and arc then wider. They carry gold with abundant pyrites, and sometimes galena. They are often broken and faulted.

Fortymile series.—Younger than the Birch creek series, but in general closely associated therewith, is another thick series of rocks, called the Fortymile series, because of their development on Fortymile creek. They are characterized by alternations of beds of marble, from a few inches up to 50 feet in thickness, with quartzitic and other schists, which may be micaceous, hornblendic, or garnetiferous, and sometimes graphitic. They are traversed by abundant dikes of eruptive rock, mostly granites and diorites. Two sets of quartz veins are developed in these rocks: (1) an older set, which are generally parallel to the schistosity or lamination, like those in the Birch creek series, and like them are broken by later movements and carry pyrite and occasionally galena; (2) a set of larger veins, which form an apparent transition from dikes of aplite, a rock consisting of quartz and feldspar. They cut across the bedding and are not disturbed by later rock movements, hence are younger in age.

Rampart series.—This still later series is primarily distinguished from the preceding by the darker color of its rocks, which are dark green when fresh and become a dark red by weathering. They consist largely of basic eruptive materials, beds of diabase and tuffaceous sediments, with hard green shales and some limestones containing glauconite, or green silicate of iron. They also contain novaculites, or fine-grained quartzitic slates, and jasperoids, or iron-stained quartzose rocks. Serpentine and chlorite, noticeable by their softness and green color, are frequent alteration products. These rocks also contain a few quartz and calcite veins, which are generally developed along shear zones, or places where by rock movement and compression a series of closely appressed parallel fractures are developed. The basic character of these rocks and their large content of pyrite seem favorable to the concentration of ore deposits; they present, moreover, certain analogies, both in composition and in geologic position, with the copper-bearing rocks of Lake Superior. But the observed veins are younger than the joints and shear planes, which were probably produced by the rock movements that crushed the veins of the older series, and assays of their ores have as yet shown but insignificant amounts of gold and silver. These veins, as well as those in the granite, are, moreover, much less abundant than those in the Birch creek and Fortymile series; hence it is thought that the latter are probably the principal source of gold in the placers.

The younger rock series noted are, briefly, the following:

Tahkandit series.—This consists of limestones, sometimes white and crystalline, generally green or black, alternating with shales.

In certain localities, notably on the Tahkandit river, it has conglomerates carrying greenish pebbles supposed to be derived from the rocks of the Rampart series. In the beds of this series have been found fossils of Carboniferous age and plants of Devonian aspect.

Mission Creek series.—Later than the Tahkandit series, but, like it, not very well defined, is the Mission creek series, consisting of shales and thin-bedded limestones with gray sandstones. Locally there are thin beds of impure lignite and at the base a conglomerate ("cement rock" of the miners) containing pebbles not completely rounded derived from older rocks in the neighborhood, which sometimes carries gold. The beds of this series are sometimes altered and sharply upturned and folded, but generally have a rather fresh appearance. In the neighborhood of shear zones they are impregnated with pyrite and carry small quartz veins. The limited exploration of these rocks has developed no important deposits of mineral. The age of the beds is as yet uncertain, but they are in part as late as Cretaceous.

Kenai series.—Next above the Mission creek rocks, and not always readily distinguishable from them, is a great thickness of rather loosely consolidated conglomerates, shales, and sandstones, generally greenish in color, which are the coal-bearing rocks of the region; they everywhere contain plant remains and rest unconformably upon the older rocks. They have, however, been folded to a certain extent, and stand upturned at angles of 20° to 60°. They are supposed to be of Eocene-Tertiary age.

Later Tertiary beds.—Other and more recent Tertiary beds have been observed generally in the more open country of the Lower Yukon, which have little economic importance, though they sometimes contain thin lignitic seams. They are variously known from the localities where they have been observed, as the Nulato sandstones and the Twelvemile and Porcupine beds, the two last named being assumed to belong to the same series.

The more recent formations, silts and gravels, will be considered under the heading "Detrital or placer deposits."

DISTRIBUTION OF GOLD-BEARING ROCK FORMATIONS

The most definite facts with regard to the occurrence of the gold-bearing formations, the Birch creek, Fortymile, and Rampart series described above, were obtained by the reconnaissance made by members of the United States Geological Survey in the summer of 1896, under the charge of J. E. Spurr, in the American portion of the Yukon district, and the exposures of these rocks as shown on the maps of his report have been indicated in colors on the accompanying map. Data gathered by earlier geologists, notably those of the Canadian Survey and of C. W. Hayes and I. C. Russell, of the United States Geological Survey, have provided suggestions as to the extent of these rocks in outside areas, but the reader need only bear in mind the enormous area, the difficulties of exploration, and the want of accurate maps of the region, to realize that generalization must as yet be very tentative and liable to future change.

As shown by the map, the belt in which these rocks have been found extends about 500 miles in a general northwest-southeast direction, but there are indications that the actual extent of these exposures may be twice as great.

The best-known exposures of these rocks occur along the northeastern flanks of a broad belt of fundamental granites and crystalline schists, which apparently form the central nucleus or backbone upon which they rest. This belt is known in a general way to extend up the Tanana river from near its mouth southeastward across the White river below the Donjek. In the latter region C. W. Hayes reports quartzites and limestones resembling the Birch creek and Fortymile series on the southern flanks of the granite, but the width of the belt, and whether there is any considerable extent of the gold-bearing formations along its southern flanks, is as yet unknown. It may not improbably extend into the high range south of Tanana, of which Mount McKinley is the culminating point and in which the Kuskokwim and Sushitna rivers of western Alaska take their rise, for from the reports of Moravian missionaries and of the traveler Dickey it appears that gold occurs in the sands of each of these streams. To the westward the granite backbone appears to pitch gently downward, as its surface area narrows, and no exposures are known west of the Yukon river. It is probably not a continuous mass of granite on the surface, but contains smaller areas of the later rocks folded in with it. East of the international boundary the area in which the granite occurs apparently widens, but its exposures are less continuous, the overlying rocks not yet having been worn away. One granitic axis appears to extend eastward from the Fortymile district through the Klondike region in a nearly east-west direction, which is that of the prevailing strike of the sedimentary rocks. The Canadian geologists report a second granite axis on the Dease river just below Dease lake, which may belong to the older granites, though they do not make the same distinction that Spurr does between the older granites and the later intrusive rocks.

Rocks of the various gold-bearing series above the granite are reported at the following localities: Their first appearance, to one ascending the Yukon from the sea, is near the mouth of the Nowikakat. From here up to the Tanana river, rocks of the Birch creek series outcrop frequently along the river, when not concealed by Tertiary sandstones and conglomerates, and the range of low mountains on the north side and parallel to the river is probably formed of these and Fortymile rocks. About three miles above the mouth of the Tanana, granite is exposed on an island in the Yukon, and 12 miles higher calcareous quartzitic schists of the Fortymile series appear under the Tertiary conglomerates. From the mouth of the Tanana up to Fort Hamlin, at the lower end of the Yukon flats, the river runs in a canyon-like channel, known as the Lower Ramparts, cut through a low range of mountains, which consist principally of the dark greenish and reddish rocks of the Rampart series, except where these are buried under Tertiary conglomerates. The latter rocks occur immediately above the exposures of Fortymile rocks, and again from Mynook creek up beyond the mouth of Hess creek. Higher up on these streams the Rampart rocks come to the surface, and the Fortymile rocks are supposed to be uncovered at their very heads. Between the two areas of Tertiary rocks the Rampart rocks occupy a belt 15 to 20 miles wide along the river, and are cut by great dikes of intrusive granite.

From Fort Hamlin up to near Circle City, a distance, neglecting curves, of about 200 miles, the river flows through a perfectly flat region covered by fine silts and gravels, known as the Yukon flats, in which no outcrops of solid rock have been observed. In the Birch creek district, around the headwaters of Birch creek and southwest of Circle City, the Birch creek series occupy a broad area; their general strike is east and west, curving at either end to the northward, and the prevailing dip is between 5° and 30° to the south. There is, however, evidence of a northern dip as well, and the Fortymile schists and marbles rest upon them along the trail to Circle City. Marbles, probably belonging to the Fortymile series, are also reported in the hills between Birch creek and the Tanana to the southward.

At the crossing of Birch creek by the trail from Circle City and along the Yukon river for 30 or 40 miles above the Yukon flats, rocks with the characteristic dark coloring of the Rampart series are exposed. From these up to the mouth of Mission creek rocks of the Tahkandit, Mission creek, and Kenai series occupy the banks of the river. On Mission creek itself only these later formations are found, but the gold in the gravels is supposed to come from the conglomerates ("cement rock") of the Mission creek series, which contain pebbles of the older rocks. On American creek, the main branch of Mission creek which comes in from the south, the dark rocks, shales, limestones, and tuffaceous beds which form the bed-rock are supposed to belong to the Rampart series, which also occur along the Yukon river from five to ten miles above Mission creek to within 25 miles of the mouth of Fortymile creek. Above this to some distance above Fortymile creek the river runs in beds of the Mission creek series.

It is in the Fortymile district and the adjoining mining district, on tributaries of Sixtymile creek, that the relations of the different gold-bearing series are best seen. Here there is an east-west axis or backbone running parallel to the upper part of Fortymile creek and along the divide between it and Sixtymile creek, with quartzite schists of the Birch creek series resting immediately on it, both to the north and to the south. Above these, on either side, are the marbles and alternating schists of the Fortymile series. Fortymile creek below the forks runs for a considerable part of its course along the junction between these two series, on the northern flank of the anticline. Dikes of various eruptive rocks, including intrusive granite, are very abundant, especially on the South fork. On the upper part of this fork are green tuffs and slates of the Rampart series, overlain unconformably by conglomerates, sandstones, and coaly shales of the Mission creek series. Both the South fork and Sixtymile creek are supposed to head in a backbone of granite around Sixtymile butte, which is surrounded by quartzite schists of the Birch creek series. These regions lie partly in American, partly in Canadian territory.

The Canadian area has not been studied by American geologists, except in wayside observation along such routes of travel as necessarily lay through it. The Canadian geologists, on the other hand, did not in their earlier and published observations recognize any subdivisions in the older rocks such as have been made by Spurr. Hence it is not possible to attempt even a proximate outline of the Canadian gold-bearing rock formations. General geological data and local discoveries of gold-bearing gravels indicate that the gold-bearing area is very large, and may be roughly defined as reaching from Dease river to the boundary, with a width of 200 to 300 miles or more. The recent enormously rich discoveries have, however, been confined to a more limited area around the Klondike and Stewart river districts, over which it has been possible to extend, with a reasonable degree of probability, the colors indicated on the map for adjoining American areas. Thus it is assumed that the east-west uplift of fundamental granite and overlying rocks extends eastward into the Klondike district, and that a second uplift in a southeasterly direction extends from upper Fortymile creek toward the valley of Stewart river.

Spurr noted outcrops of the schistose quartzites of the Birch creek series for a large part of the distance from the mouth of Fortymile creek up to the junction of the Pelly and the Lewes at Fort Selkirk ; also granites at various points, in some cases schistose like the fundamental granite, in others fresh and massive like intrusive granite. There were also occasional belts of marble belonging to the Fortymile series, notably one five or six miles above the mouth of Sixtymile creek, not far from that of Stewart river. These observations afford a rough section across the belt of crystalline schists mentioned by the Canadian geologists as stretching eastward and southeastward along the upper Pelly and adjoining streams and across to the Frances river. Along the eastern edge of the crystalline belt they also recognized rocks of a general greenish color, made up largely of altered volcanic rocks, which would answer to the description of the Rampart series. Similar rocks were also noted at various points on the Lewes above its junction with the Pelly, notably in the Seminow hills near the Big Salmon river, which may represent the development of the Rampart series on the south flanks of the crystalline belt.

PLACER OR DETRITAL DEPOSITS

The extraordinarily rich placer deposits of the gulches tributary to the Klondike river above Dawson, and of similar gulches of the nearby Indian creek and Stewart river, have been so recently opened that no detailed geological description of these localities has yet been received. In his report, however, Spurr had shown that the strike of the gold-bearing rocks in the Fortymile district and the exposures observed along the Yukon indicated that their gold must have been derived from the same gold-bearing formations that had furnished the richest placers in the districts visited by him. A brief statement of the prominent characteristics of these districts as given by him will therefore probably be of value.

The hills surrounding the gulches of the Little Mynook and Hunter creeks, on the Lower Yukon, are formed of rocks of the Rampart series. The bed-rocks are of diabase, tuffs, impure shales, and quartzites, and in the bottoms of the gulches there is from 10 to 20 fect of gravel. The gravel consists in part of angular fragments of rocks that form the walls of the gulch, in part of waterworn pebbles of Birch creek schist, schistose granite, and other rocks. The gold is generally in rounded, bean-shaped grains and nuggets, and less frequently in unworn particles. This points to a two-fold origin of the gold, as derived in part from the rocks immediately about and in part from distant and older rocks, which may have been worn down, possibly along an old seashore, into terrace gravels, and then by subsequent erosion brought into the present stream beds. Further exploration in the hills to the south may disclose the true source of these pebbles and of the gold that accompanies them. On American creek, in the Mission creek district, the gold-bearing placers are also derived from rocks of the Rampart series—quartzitic schists, serpentines, and chloritic rocks—and the gold is said by Spurr to have been derived mainly from the schistose zones in the bed-rock.

The richest gravels have been found in the Birch creek and Fortymile districts. In the entire Birch creek district, which lies south of Circle City, and on Miller, Glacier, Poker, and Davis creeks of the Fortymile district, near the international boundary, the bed-rocks are always the quartzite-schists of the Birch creek series, containing veins of quartz. The gravels rest, as a rule, directly on the schist, though in some cases, as on Harrison and Eagle creeks, in the Birch creek district, there is clay beneath the gravels, and the gold, as a rule, does not extend into the bed-rock, but occurs chiefly at the top of the clay. Generally, however, the schist is rotted and reddened from oxidation for a few inches to several feet below the surface, and in this part the gold has settled into the cracks and joints. The pay gravels lie mostly next the bed-rock, in an average thickness of perhaps two feet, though sometimes up to ten feet, while the overlying gravels average eight or ten feet, with a maximum of 25 feet. In the gravels the schist is in quite large, flat fragments, and the quartz is in bowlders of varying size. The schist fragments lie flat, and are mixed with sand, showing that the sorting action of running water has not been carried far. In the concentrates from the sluice-boxes the heavier minerals associated with the gold—galena, magnetite, limonite, hornblende, and garnet—are in each case such as are found in the neighboring schists, and the nuggets of gold often have pieces of quartz still adhering to them. All these facts are evidence that the gold is derived from rocks in the vicinity and is not brought from a great distance, perhaps by glaciers, as some erroneously suppose.

The rocks of the Fortymile series in the Fortymile district, as already stated, form the west bank of Fortymile creek, and south of the South fork cross the divide between Franklin gulch and Napoleon creek, where they are overlain by green slates of the Rampart series, which in turn are overlain by conglomerates of the Mission creek series. In Franklin creek the bed-rocks are marbles interbedded with mica and hornblende schists; the gravel contains fragments of marble, quartzite, mica-schists, and vein quartz. At one point a quartz vein is found in the bed-rock, and below it native silver has been found in the gravels, which apparently came from this vein. It is the schistose rocks that mostly carry the gold, as the marbles do not show much evidence of veins. In this gulch are two levels; the higher one, at the head of the gulch, had not been worked, while the pay gold had been found mainly at the lower level, near the mouth of the gulch.

Chicken creek, so called because its gold occurs in grains the size of chicken feed, drains a wide area toward the Ketchumstock hills to the southwest, and the actual source of the gold is less readily defined. The gravel contains fragments of granite, quartzite, schist, and marble.

On Napoleon creek conglomerate forms the bed-rock near the mouth. The gravels contain fragments of quartzite, vein quartz, hornblende-granite, and various eruptive rocks, and the source of the gold is assumed to be the conglomerate, which is made up of fragments of the older rocks, for the rocks higher up the gulch above the conglomerates have not been found to carry much gold.

The most trustworthy reports from the Klondike region indicate that the exceptionally rich placer gravels thus far found occur in side valleys entering the main Klondike valley from the south, such as Bonanza, Eldorado, and Hunker creeks, and in some gulches across the divide tributary to Indian or Stewart rivers. No gold in paying quantities had been found on the

Klondike itself. The placer deposit generally consists of 10 to 15 feet of frozen muck and decayed vegetation at the surface, then a gravel bed that rarely pays; below that a clay selvage, under which is pay dirt, from one to five feet in thickness, resting on the upturned edges of the schist, from which it is separated by a clay selvage. The pay streak or bottom of the old channel is usually very regular and straight, not following the bends of the present stream; it is said to average 60 cents to the pan, and may yield $1 to $3. Only very exceptionally rich gravel can be worked at all under present conditions.

Other detrital deposits.—Besides the placer gravels above described, there are other detrital deposits that may carry gold, some of which are known to occur in the Yukon district, but have not as yet been extensively worked. In the larger streams accumulations of gravel and sand are made in places of slackening current, such as the inner side of curves, or at points where considerable coarse material is brought into the main stream by more rapid tributaries; such accumulations are called "*bars*," and often contain much gold. In some cases the entire mass of sand and gravel in a river bed contains enough gold to be worked at a profit by mechanical processes. There must necessarily be a large amount of gold in the bars of the Yukon and its tributaries, but whether they are rich enough to be profitably worked under existing conditions has not yet been proved.

Another common form of detrital deposit is the fine "*silts*," which often cover wide areas. The most notable instance is what is called the Yukon flats, which extend for a hundred miles or more above and below the great bend of the river at Fort Yukon and a considerable distance up the Porcupine, thus covering an area perhaps 100 by 200 miles in extent. Similar flats, but of more moderate dimensions, occur at various points along the lower course of the river, generally in the concave sides of curves. These silts are being deposited at the present day in the annual floods when the river waters cover such wide areas that their movement becomes as sluggish as those of a lake. There are, however, similar beds of silt of like appearance and constitution at altitudes of several hundred feet above the present stream, which are of widespread occurrence not only in the lower Yukon country but in the plateau region of British Columbia. The latter have been designated white silts by Dr Dawson, who considers that they were laid down in fiords connecting with the sea, their material being furnished by the grinding of the retreating cordilleran glacier. These ancient silts and the benches or terraces that fringe the mountains all over the interior of Alaska up to 3,000 feet above the present sea-level point to a comparatively recent submergence of the country to this amount. The American geologists are inclined, however, to attribute a lacustrine origin to part at least of these silts. The absence of marine fossils in them is admitted by Dr Dawson to be negative evidence against their marine origin. From an economic point of view, these silts are of little importance, however, as the gold contained in them would be so finely divided that it probably could not be extracted at a profit.

It is otherwise, however, with the *terrace gravels*, which are also very widespread throughout the interior. When these occur at moderate heights above the present streams and evidently represent earlier stages in the cutting down of their valleys, they may naturally be expected and indeed are often found to contain considerable gold, which it may pay to extract. In the Cassiar mining district quite a large proportion of the gold was derived from terrace gravels. The higher terraces, which are not confined to present valleys, but cross divides and sometimes form plateaus, must have been worn down or redistributed by broader bodies of water, which would be less likely to concentrate the gold than river waters. They have already been observed at 1,500 feet elevation, and if the hypothesis of submergence expressed above is correct, should be found up to 3,000 feet; they are probably of little economic importance.

Ancient river gravels that have been protected from erosion by a covering of recent lava have not yet been noted in the Yukon valley, though recent flows of basaltic lava occur at various points from the lake region of the Lewes river down to St Michael island, 60 miles north of the mouth of the Yukon. In the Upper Stikine valley such an old river channel, in which auriferous gravels had been protected by a recent flow of basalt, is cut through by the modern stream and has caused a notable enrichment of its bars immediately below. It is a question, however, whether modern erosion in the Yukon valley is sufficiently deep and active to expose such channels if they do exist there.

Another source of gold, which occupies an intermediate position between original and detrital deposits, is what is generally known as *fossil placers* or conglomerate beds, within a geological rock formation which is made up of material resulting from the wearing down, generally on an old shore line, of older gold-bearing rocks. Such conglomerates have been observed in both the Mission creek and Kenai series of beds, and if future study shows them to have been formed under favorable conditions they may prove to be an important source of gold. According to Mr Spurr's observation, the modern placers of Napoleon creek in the Fortymile district, have been enriched by gold derived from the basal conglomerate of the Mission creek series, which is made up of materials derived from the Birch creek, Fortymile, and Rampart series.

PROBABLE EXTENT OF GOLD-BEARING DEPOSITS

In a new country gold is first sought in the stream gravels, and thence traced up to its source. Very fine gold may be carried long distances by river waters ; hence it is only when it becomes relatively coarse, or at any rate carries coarse particles, that the source may be considered necessarily near at hand. Fine gold is found in almost all the rivers of Alaska, even the silts of the Yukon yield it in places. Gold has been found along the whole length of the Lewes, the Teslin, the Big Salmon, the Pelly, the Stewart, and the Selwyn, and on the Yukon river almost continuously from the junction of the Lewes and Pelly downward. Still further east, Frances and Dease rivers, the main branches of Liard river, which flows into the Mackenzie, carry gold. In the Cassiar district, on the Dease river, gold was discovered as early as 1861. The district was actively worked as a placer camp from 1873 to 1887, during which time it yielded about five million dollars' worth of gold dust. These upper regions are distant about 1,000 miles in a straight line from the known outcrops of gold-bearing rocks in the Rampart mountains on the Lower Yukon, and are within areas either in which exposures of the gold-bearing rocks as defined above are actually known to exist or in which the similar lithological character of rocks described renders it probable that in some part of the area they may be exposed.

There is also some evidence of the extension of rocks of the gold-bearing series to the northwest of the Lower Yukon, though it is as yet impossible to determine whether the primitive gold-bearing rocks of the Birch creek and Fortymile series there come to the surface, or whether it is simply the fossil placers or gold-bearing conglomerates of later formations, where made up of fragments of these older rocks, that have furnished the gold of modern streams.

In this region gold has been found extensively along the Koyukuk, and most abundantly, as already mentioned, where the valley cuts through conglomerates supposed to belong to the Kenai series. This is at the forks, about 300 miles above the mouth, below which the country is low and swampy; above the forks the mountains close in and the sides of the valleys become precipitous. The gold in the bars is said to be coarse, suggesting nearness to the source, and has yielded as much as $100 per day by use of the rocker. Prospectors are said to have explored to considerable distances above the forks, up to 500 miles from the mouth, and to have recognized rocks similar to those of the Birch creek and Fortymile districts. This, if true, is important as an indication of still further extensions of the area of exposures of the older gold-bearing rocks.

Further east, at the head of Dall river, low, broken hills, apparently composed of schists and quartzose rocks, extend northeastward to the Romanzof mountains. The latter are snow-covered in summer, and form the northern boundary of a low plain that lies to the north of Porcupine river; these mountains are likewise said to be made up of metamorphic schist and quartzites.

Still further northwest, in the country to the northeast of Kotzebue sound, gold has been reported from the Kowak and Noatak rivers. It is possible that the older series of rocks is exposed in the mountains of this region, but more probable that the gold is derived from the conglomerates of the Mission creek series, which, as already shown, afford gold on Napoleon creek and in the Mission creek district.

Gold is also reported by prospectors from a belt of country which is generally parallel to the known gold belt, but set off to the southwest and which corresponds to the supposed southwestern flank of the granite backbone. Such discoveries have been reported from Fish creek, which flows into Norton sound north of St Michael, and from the upper Kuskokwim river, which flows into Bering sea. On the Sushitna river, which flows into Cook inlet, W. A. Dickey reports colors of fine gold in the sands all along the stream, and platinum on the upper river, where veins of white quartz carrying gold, silver, and copper were found in slates associated with granite and porphyry. Gold and copper have been reported by various persons from the region about the sources of the Copper and White rivers. It is thus evident that the elevated region along the heads of these various streams, and between them and the waters of the Tanana, possesses great possibilities in the way of mineral development, but from all accounts it is a region exceptionally difficult of access, and it may well be questioned whether it is advisable to attempt its exploration until facilities for travel and obtaining supplies in the Yukon region have been increased, as they will be in the near future.

More accessible is the region immediately north of the Tanana river known as the Tanana hills and Ketchumstock hills, which from reports appears to be mainly a granite region, but in which it is likely that outliers or patches of the gold-bearing schists will be found inclosed within the granite area.

Late reports by prospectors in the Tanana region state that the river has slack water, navigable for steamers 150 to 200 miles above its mouth; above that the current is swift. Mountains border the river on the north side from the mouth up, on the south they are far distant. Colors are found in all the creeks; those heading toward Fortymile and Seventymile offer best promises, but no important prospects have been found. Toward Circle City the creeks do not freeze up, and a hot spring was found in one of the gulches.

In the mountain region to the northeast of the Yukon river immediately above the bend, such observations as have been made do not offer much promise of exposures of the older gold-bearing schists. Older limestones occur there, but, though important gold deposits are known to occur in limestones, in the Yukon country the general rule appears to prevail that gold is concentrated mainly in the siliceous rocks. It may well be, however, that in the conglomerate or cement deposits of the coal-bearing formations that are known to occur in this northeastern region there are portions sufficiently rich in gold to make paying placers by their wearing down. In searching for such places the prospector should study the character of the pebbles that make up the conglomerate; it is only when these include fragments of the gold-bearing rocks and occasionally of vein quartz that they are likely to be productive.

For the region east of the international boundary, Spurr had already pointed out, as a result of his observations in the summer of 1896, that the Klondike and Indian creek regions were likely to show rich placers, because the schists of the Birch creek series, and to some extent the marbles of the Fortymile series, formed the bed-rock.

George M. Dawson reports bars of fairly coarse gold on the

Pelly all the way up to Hoole river. Just below the mouth of the McMillan the river has cut a canyon through gray granite hills, below which are dark crystalline schists with east-west strike and northerly dip, associated with which are alternating marbles and chloritic schists, probably of the Fortymile series. Granite occurs again near the junction with the Lewes. Of the valley of the McMillan nothing was known. The Pelly above the detour or bend had a similar series of quartzite schists, with interbedded limestones on the north, while the Glenlyon hills to the south were of granites. Above these are sandstones supposed to belong to the coal-bearing series and dipping 45° S. Still higher up in Hoole canyon are marbles again, associated with schists and volcanic rocks, possibly of the Rampart series. Still further northeast, in the middle canyon of the Frances river, Dawson found marbles again, while in the Tootsha range to the east were seen granites and schists with abundant quartz veins.

All along the summit of the Coast range the prevailing rocks are granites, cut by later porphyry dikes. They form a belt 20 to 80 miles wide, and are generally of the hornblende or intrusive type. On the Dyea and Skagway trails they extend down on the northeast side to the mid-length of Lake Bennett. In the range of hills between Miles canyon and the Teslin river are diabasic or dark eruptive rocks and limestones, which may belong to the Rampart series, though Dawson considers the limestones to be probably Carboniferous.

Along the region of Rink and Five Finger rapids, below the Big Salmon, are infolded masses of Cretaceous rocks (Kenai ?) with conglomerate at the base, overlain in places by lavas. Below these are greenish eruptive rocks, and then near the mouth of the Pelly is granite again, succeeded below the Pelly by basalt flows. Twenty-five miles below the Pelly granitic rocks again appear, and are succeeded by crystalline schists of various kinds, which constitute the prevailing rock down nearly to Fortymile.

COAL AND LIGNITE

Coastal Region

The coal of Alaska so far examined, whether in the interior or on the seacoast south of Bering strait, is of Eocene or early Tertiary age and belongs without exception to varieties of lignite, brown coal, or glance coal. North of Bering strait, in the vicinity of Cape Lisburne, is a coal field of considerable extent containing a fuel which is believed to be of greater geological age, perhaps similar to that so extensively mined at Nanaimo and other points in British Columbia. As rocks of Carboniferous age occur in close proximity to this coal, it was long supposed to belong to the Paleozoic coal measures, like that of Pennsylvania, but an examination of the fossil plants actually associated with it has shown this opinion to be erroneous.

The various coals of Alaska occur in beds interstratified with sandstone, shale, conglomerate, and clay, these rocks usually containing numerous fossil plants, leaves, cones, and amber derived from the fossilization of resin from the ancient coniferous forests. The geological formation containing the coal and leaf-bearing shales is called the Kenai formation, and is usually covered by beds of sandstone containing fossil oysters and other shells belonging to the Miocene or middle Tertiary.

Like all Tertiary coals, the Alaska mineral is light in proportion to its bulk, burns rapidly with little smoke, and has a tendency to break up into small pieces under the action of the weather. The glance coal is brilliant and clean to handle, like anthracite, for which it is often mistaken, but which, bulk for bulk, is considerably heavier. The brown coal gives a brown instead of a black streak when scratched, has the appearance of fossil wood, and in drying splits up into chip-like pieces. The coal-bearing strata are comparatively widespread both along the coast and in the interior, but as yet but few beds have been actually worked.

In the Alexander archipelago, on Admiralty island, coal seams and leaf-bearing shales crop out at a number of points along the shores of Kootznahoo inlet, and a mine has been opened from which considerable non-coking coal has been extracted at the head of Davis creek, near Killisnoo village, about 40 miles northeast of Sitka.

Coal or coal-bearing strata are also reported on Prince of Wales island, near Kasahan bay ; on Lindenberg peninsula of Kupreanof island ; on the northeast and also on the west side of Kuiu island ; on the southern point and in Seymour canal, on the western side of Admiralty island ; at Whale bay, on Baranof island, 23 miles southeast of Sitka, and at various points on Chichagof island, northwest of that place. Similar occurrences are reported at Lituya and Yakutat bays, on the southwest flanks of the St Elias range.

The most important known coal field is on the east shore of Cook inlet, on the Kenai peninsula. Here the coal beds cover an area of 70 by 30 miles and rise in high bluffs 2,000 feet above the sea. At Kachemak bay, where is the only good harbor, there are six or seven seams, the thickest of which is four feet thick. Several shiploads of the coal, which is of fair average quality, have been taken out.

Along either shore of the Alaskan peninsula and on islands adjoining them and in the Aleutian chain for some distance beyond Unalaska coal strata are reported, and have been worked or opened at Amalik harbor, Unga island, and Chignik bay, on the south shore, and at Herendeen bay, on the north shore of the peninsula.

North of the Yukon, coal beds are reported at several points along Norton sound, on the Kowak river, which empties into Kotzebue sound, and on the banks of a river entering into Wainwright inlet, on the Arctic ocean. The Cape Lisburne coal field extends in a general way from Cape Lisburne to Cape Beaufort, a distance of 25 miles; this coal has been extensively used by steam whalers.

In the interior, coal strata have been observed at or near Andreafski, Kaltag, Nulato, and Melozikakat, on the Lower Yukon. Three seams have been mined on the right bank of the Yukon in the Lower Ramparts at Coal creek, and coal has been taken from Coal creek, which enters the Yukon from the north. There is some evidence of a considerable development of coal-bearing strata extending in either direction from this point nearly parallel with the Yukon river and not far north of it. Although these coals are rather light, their proximity to the gold fields promises to render them of considerable industrial importance.

THE CIVIL GOVERNMENT OF ALASKA

By Hon. George C. Perkins, U. S. S.

A bill making provision for the civil government of Alaska is now before Congress and may become a law, but pending its passage the political organization of the Territory is as follows:

The executive head of the territorial government is the governor, appointed by the President. The code of laws of the Territory is that which was in force in the State of Oregon on May

17, 1884, so far as the same may be applicable and not in conflict with the provisions of the act providing a civil government for Alaska or with the laws of the United States. There is a difficulty, however, in the machinery to enforce these laws, as there is only one judge, who holds court at Sitka and Wrangell, in the narrow strip along the coast known as the Panhandle. He is, however, authorized and directed to hold such special sessions as may be necessary at such times and places as he may deem expedient. There are nine commissioners for the Territory, who, under the act of May 17, 1884, exercise all the duties and powers, civil and criminal, now conferred on justices of the peace under the general laws of the State of Oregon. Commissioners are stationed at Unalaska, Kadiak, Circle City, Dyea, St Michael, Unga, Sitka, Juneau, and Wrangell. These commissioners have also probate and *habeas corpus* jurisdiction, and are notaries public and recorders of deeds. There are a marshal and ten deputy marshals, the latter residing at the places mentioned above and Douglas City. They have the powers of constables under the laws of the State of Oregon. There is one district attorney for the district court and one assistant.

The salaries of these officials are as follows:

Governor, $3,000; district attorney, $2,500; marshal, $2,500; district judge, $3,000; clerk, $2,500; commissioners, $1,000, with the usual fees of U. S. commissioners and justices of the peace for Oregon and such fees for recording instruments as are allowed by the laws of the same State; deputy marshals, $750, with the usual fees of constables in Oregon.

Under the Interior Department there are twenty-one Indian police. Under the Treasury Department there are four special agents stationed at the Pribilof, or Seal, islands, in Bering sea, whose duty is to protect the seals from poachers and to see that the specified number of skins to be taken each year is not exceeded. They are stationed at the Pribilof islands. There is also an inspector for the protection of the salmon fisheries of Alaska, with one assistant, whose headquarters are at Sitka, but whose duties take them to the various streams along the coast which the salmon frequent, and on which there are canneries. The customs service includes a collector of customs and two deputies at Sitka, and deputies at Juneau, Mary island, Kadiak, Karluk, Cook inlet, Unga, Unalaska, St Michael, Circle City, and Dyea.

Under the Interior Department there is a general agent of education in Alaska, with an assistant general agent and a superintendent for each of the two educational districts. There are twenty-three teachers and an enrollment of 1,267 pupils in 20 day-schools. These schools, with about 20 mission schools and homes conducted by the various missionary organizations of the United States, the most efficient of which is the industrial school at Sitka, with a few schools of the Russo-Greek Church, supported by the Russian government, constitute the educational facilities of Alaska. In Sitka, Juneau, and Douglas separate schools are maintained for white and native children. During 1896 a school-house was erected near the Treadwell gold mine on Douglas island, and in 1897 a new school-house was built at Hoonah, Chichagof island. In September, 1896, a school was opened at Circle City.

The government maintains five herds of reindeer in the territory, namely, one at Cape Prince of Wales, numbering 253, one at Cape Nome, numbering 218, one at the Swedish mission at Golovin bay, and one at the St James' Episcopal station near by, numbering together 206, and the central government herd at the Teller station, numbering 423, making a total of 1,100.

There is a prohibition against bringing liquor into the Territory, but it is evaded by smugglers from Canada and the United States, and at every settlement the numerous saloons seen are evidences of the extent of the smuggling operations.

Annette island, in southeastern Alaska, has been set aside as a reservation for the Metlakatla Indians, who emigrated from British Columbia, and to whom the island was assigned by the act of March 3, 1891. The Secretary of the Interior recommends that citizenship be extended to them.

The great necessity to commerce, in consequence of the rush of gold-seekers to Alaska, of more exact information regarding channels, etc., along the coast, has led the Coast and Geodetic Survey to send out two parties for the purpose of surveying the channels of entrance to the Yukon river and the navigability of the Copper river. The head of Cook's inlet will also be examined. The Geological Survey has also sent men into the Alaska field, for the purpose of examining and reporting upon the mineral resources of the Territory.

A military reservation has been established by the Government at St Michael, in Bering sea, embracing a territory within a hundred miles' radius from the port of St Michael. It takes in a portion of the Alaskan mainland, including the delta of the

Yukon. The policy of the Government is to lease for a nominal sum sufficient area and water frontage for commercial, manufacturing, and shipbuilding purposes. The Government has also a military station near Circle City and another on the Copper river.

Special legislation relating to Alaska has, up to the present time, had reference simply to the narrow strip along the southern coast, known, as stated above, as the Panhandle, and to the Pribilof and Aleutian islands. Its provisions are not sufficiently flexible to permit of its extension to the interior by executive action. There is, however, one exception, wherein the Secretary of the Treasury is authorized to extend the customs laws throughout the Territory.

The laws of the United States relating to mining claims and the rights incident thereto were put in force in Alaska by the act of 1884 and the act of March 3, 1891.

The laws relating to lands and titles are as follows:

The mineral land laws of the United States.

Townsite laws which provide for the incorporation of townsites and acquirement of title thereto from the United States government to the townsite trustees.

The law providing for trade and manufactures, giving each qualified person 160 acres of land in a square and compact form. Applications for townsites and for trade and manufacturing purposes are to be made to the marshal and clerk at Sitka. The coal-land regulations are distinct from the mineral regulations or laws, and the jurisdiction of neither coal laws nor public-land laws extends to Alaska, the territory being expressly excluded by the laws themselves from their operations. The act approved May 17, 1884, providing for civil government in Alaska, has this language as to mines and mining privileges:

"The laws of the United States relating to mining claims and rights incidental thereto shall, on and after the passage of this act, be in full force and effect in said district of Alaska, subject to such regulations as may be made by the Secretary of the Interior and approved by the President, and parties who have located mines or mining privileges there, under the United States laws applicable to the public domain, or have occupied or improved or exercised acts of ownership over such claims, shall not be disturbed therein, but shall be allowed to perfect title by payments provided for."

There is still more general authority.

The act of July 4, 1866, says:

"All valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are hereby declared to be free and open to exploration and purchase, and lands in which they are found to occupation and purchase by citizens of the United States, and by those who have declared an intention to become such, under the rules prescribed by law and according to local customs or rules of miners in the several mining districts, so far as the same are applicable and not inconsistent with the laws of the United States."

The patenting of mineral lands in Alaska is not a new thing, for that work has been going on all the time.

In 1897 a surveyor-general was specifically provided for by the act of June 24 and an additional land office authorized, but the latter could not be opened, as no appropriation was made for salaries.

By the bill now before Congress, and which will undoubtedly become a law, the homestead land laws are extended over Alaska, subject to such regulations as may be made by the Secretary of the Interior.

The bill provides:

That no indemnity, deficiency, or lieu lands pertaining to any land grant outside of Alaska shall be located within that Territory.

That no entry shall be allowed extending more than forty rods along the shore of any navigable water, and along such shore a space of at least forty rods shall be reserved from entry between such claims.

That nothing within the act shall be so construed as to authorize entries to be made or title acquired to the shore of any navigable waters within the Territory.

That no homestead shall exceed forty acres, unless it be located on meadow land or land chiefly valuable for grazing or agricultural purposes, of which 160 acres may be entered as a homestead under the general land laws of the United States.

That any citizen, association, or corporation may purchase, for purposes of trade, manufacture, or other productive industry, not exceeding forty acres, at $2.50 per acre, such tract not to include mineral or coal lands.

That a right of way 100 feet wide may be granted to duly organized railroad companies, which are also given the right to take from unoccupied public lands adjacent such material as may be necessary in construction, and to purchase not to exceed forty acres of land for terminal facilities and twenty acres for stations, at $1.25 per acre, but the act cannot be construed to give such companies the ownership or use of minerals or coal within the right of way or terminal and station grounds.

That all charges for transportation shall be fixed subject to the approval of the Secretary of the Interior.

That rights of way, 100 feet broad, may be granted for wagon roads, wire-rope, aerial, or other tramways on similar terms.

All affidavits, proofs, and other papers in relation to lands which may have been or may hereafter be taken and sworn to anywhere in the United States shall be accepted.

The Secretary of the Interior may cause to be appraised and sold the timber on the public lands, in such quantities as he may prescribe, to be used in the Territory, but not for export purposes.

The President is authorized to divide the Territory into two or more land districts, and to appoint a register and receiver for each district.

A bill making further provision for the civil government of the Territory has been presented to Congress and is now under consideration. It may be amended before final adoption. It makes the following provisions:

The temporary seat of government will be at Sitka, but there will be no legislative assembly and no delegate to Congress.

The governor will be appointed and will have such powers as pertain to the governor of a Territory.

A district court is established, with civil and criminal jurisdiction, and three district judges are provided, one presiding in each of the three divisions into which the district is divided. One will preside in Sitka, one at St Michael, and one at Circle City. At least two terms of court shall be held yearly at Sitka and one in each of the other divisions. Special terms may be held, if necessary. The jurisdiction of each division shall extend over the entire district, but the court may change the place of trial from one division to another in certain cases.

The respective judges shall appoint and at pleasure remove commissioners for the district, who shall have the powers and jurisdiction of commissioners of the United States circuit courts. They shall also have the power and exercise the duties of justices of the peace; shall have jurisdiction in all testamentary and probate matters; shall have power to grant writs of *habeas corpus;* shall have the power of notaries public; and shall have, when acting as justices of the peace, jurisdiction in suits, not affecting titles, where the value involved is not over $1,000.

Three clerks shall be appointed, one for each of the three divisions of the court. There shall also be three district attorneys.

There shall be a marshal, who shall appoint a chief deputy marshal for each division.

The governor, with a salary of $4,000; attorneys, $4,000; judges, $6,000; clerks, $2,500, and marshal, $4,000, shall be appointed by the President, and shall hold office for four years.

The commissioners shall receive double the usual fees of United States commissioners and of justices of the peace in Oregon; the chief deputy and deputy marshals, double the usual fees of constables and deputy marshals in Oregon.

The judges of the district shall divide it into three recording divisions, and each court may establish in its division one or more recording districts, in which a commissioner shall act as recorder, while the clerk of the court shall be *ex officio* recorder in any part of the district not so established.

Notices of location of mining claims shall be filed for record within 90 days from the date of discovery, and shall be recorded in the recording district wherein the claim is situated.

The President is empowered to establish or discontinue land districts, and to appoint a register and receiver for each district so established.

The United States mining laws shall continue applicable to the Territory.

Natives of the Dominion of Canada shall be accorded the same mining rights and privileges as are given to Americans in British Columbia and the Northwest Territory.

Nothing in the act shall be construed to put in force the general land laws of the United States.

The general laws of the State of Oregon in force January 1, 1894, are declared to be the law in the Territory.

SOME OF THE CONDITIONS AND POSSIBILITIES OF AGRICULTURE IN ALASKA

By Walter H. Evans, Ph.D.,

Botanist, Office of Experiment Stations, U. S. Department of Agriculture

During the summer of 1897 the Secretary of Agriculture, acting under authority from Congress, commissioned Dr Sheldon Jackson, of the U. S. Bureau of Education; Mr Benton Killin, one of the regents of the Oregon Agricultural College, and the writer to investigate the agricultural conditions and possibilities of Alaska. The report of this commission has been made to Congress, and it has been issued as Bulletin 48 of the Office of Experiment Stations of the Department of Agriculture. Dr Jackson made a preliminary report on the Yukon valley, while the other commissioners reported their observations along the coast from Dixon entrance to Unalaska. The following account consists in the main of an abstract of the fuller report.

From the information gained it appears that successful attempts have been made at a number of places along the Yukon river to raise hardy vegetables. Potatoes, turnips, cabbage, cauliflower, radishes, lettuce, peas, etc., have been cultivated to considerable extent, some of them having been grown as far north as Circle City and Dawson. Berries abound in the interior, as they do along the coast, and grasses suitable for grazing and hay were met with nearly everywhere. Specimens of good hay grasses more than six feet tall were secured from the vicinity of Circle City.

Mr William Ogilvie, who is connected with the Land Survey of the Dominion of Canada, estimates the agricultural area of the upper Yukon at about 460,000 acres. It is possible that the growing of vegetables could be considerably extended in this region.

As the observations of the writer were confined to the coast region, that portion of Alaska will be considered more in detail.

Considered from an agricultural standpoint, the coast region is divided by a wide stretch of mountains, embracing the St Elias and Fairweather ranges, into two rather characteristic regions, a timbered and a treeless region. The southeast or wooded region embraces the great Alexandrian archipelago, which consists of more than 1,000 islands, and the mainland as far as Juneau. The second or southwestern region, much of which is barren of trees, extends from Cook inlet along the Alaskan peninsula westward, including the Aleutian archipelago, Kadiak, and the neighboring islands, the Shumagin group, and numerous other smaller islands. The northern and northeastern part of this region contains some timber, but in general the region is characterized by its remarkable wealth of grasses. Toward the western portion of this area the arborescent flora disappears entirely or is represented by a few small, stunted shrubs, mostly willows.

Without entering into a general discussion of the meteorology of Alaska, attention may be called to two important facts: First, that the sum of effective temperatures for certain points in the coast region, although somewhat low, surpasses the effective temperatures of several localities in Europe of known agricultural capabilities; and, second, that although the total annual precipitation is large, there is only one point at which as much as one-third of it falls during the summer months. The summer rainfall at Wrangell, Pyramid Harbor, and Killisnoo is less than that at Indianapolis, Ind., Raleigh, N. C., or Washington, D. C.

The soils of Alaska to a great extent are of vegetable origin and to a considerable degree resemble what are called the rice lands of the South or the peat formations of Europe and elsewhere. In some places in southeastern Alaska there are deep deposits of this rich-looking soil overlying slate or conglomerate bed rock, with often a deposit of gravel intervening. Sometimes there is an impervious stratum of clay underlying the black soil. Where the soil lies directly on bed rock or is underlain with clay, the drainage is usually poor and the land more or less marshy.

Samples of what appeared to be average soils were collected at various places and transmitted to the Division of Soils of the Department of Agriculture. In commenting upon the character of the samples analyzed, Professor Milton Whitney says:

The organic content of many of these soils is very much higher than in any of the agricultural lands of the States. They correspond very nearly with the rice lands and peat formations. The black soils of the plains and the famous Red River Valley soils of the Northwest contain from 8 to 10 per cent of organic matter, but seldom more. If these soils are so situated as to be well drained, they should be capable of producing enormous crops, and with an abundant and well-distributed rainfall they would be adapted to almost any kind of crop suited to the general climatic conditions of that portion of the country.

In several places complaints were heard of a decided acidity of the soil, but no definite information could be secured relating to it. In one place the addition of a large amount of lime to a small plat had corrected the evil complained of.

Peat formations are of considerable extent in southeastern Alaska. In the southwestern portion of the country volcanic material adds to the fertility and porosity of the soil in many places. In the Cook Inlet region the drainage is usually good, the soil overlying deep deposits of gravel. Another characteristic soil formation is that which is so conspicuously illustrated by the tide flats of the Copper and Stikine rivers. These places are more or less marshy and are subject to overflow at high tides. Where protected from the encroachment of the sea and sufficiently drained they are generally considered as very productive soils.

In the southeastern portion of Alaska the Sitkan spruce (*Picea sitchensis*) and the hemlock (*Tsuga mertensiana*) abound, now one and then the other predominating. They grow from tidewater to timber line, an elevation varying from 2,000 to 4,000 feet, and in some places the trees attain considerable size. Specimens of the Sitkan spruce were seen that were at least 8 feet in diameter and probably more than 200 feet high. Logs of this species were seen at the Wrangell saw-mill that approximated 100 feet in length, with an average diameter of more than 4 feet. At different places in the southeastern region the so-called red and yellow cedar (*Thuja gigantea* and *Chamæcyparis nootkatensis*) abound, usually at some little elevation from the sea, although trees of considerable size were seen almost at sea level. Seldom do these trees occur in such abundance as to wholly exclude other species. Another spruce (*Tsuga pattoni*) was observed, but not in great abundance. But a single species of pine (*Pinus contorta*) was seen, and that was almost invariably found on the flats or on the edge of bogs. Two species of alder (*Alnus oregona* and *A. viridis*) were common along the streams and on the mountain sides where snowslides have swept away the dense growth of moss and conifers. Willows are common, but seldom were they seen to attain the dignity of trees.

In the north and northeastern portion of what has been designated the southwestern part of the coast region some spruce (*Picea sitchensis*) and cottonwood (*Populus balsamea*) occur, the trees frequently attaining a considerable size. Considerable birch (*Betula papyrifera*) and perhaps another species occur in the upper part of the Cook Inlet region, but elsewhere the forests of the southwestern coast are very insignificant.

Local demands for lumber and fuel are the principal uses to which the timber is put, and with almost entire exemption from forest fires, the supply, if properly regulated, will be sufficient for all needs of Alaskans for a long time to come.

Next to the timber, perhaps the grasses of Alaska are among the most valuable of the plant products. In all parts of the country they flourish to an extraordinary degree. In southeastern Alaska, wherever the timber is cut away and the undergrowth of the shrubs kept down, a dense growth of grass soon takes place, to the exclusion of all other plants. Of the common grasses timothy (*Phleum pratense*), Alaska red top (*Deschampsia cæspitosa* and *D. bottnica*), blue grass (*Poa pratensis*), orchard grass (*Dactylis glomerata*), wild barley (*Hordeum boreale*), *Calamagrostis aleutica*, and wild rye (*Elymus mollis* and other species) are the most widely distributed, and are probably the most valuable for pasture and hay. Timothy, orchard grass, and blue grass have become thoroughly established and grow to great size. One of the most common native grasses is the Alaskan red top. It is a prominent factor in nearly all grass mixtures, and frequently exceeds a man in height. Specimens at Sitka, July 5, were a little more than 4 feet in height and just heading. Orchard grass more than 3 feet high was seen as early as June 20. In the western part of Alaska, valley and hillside as far as 1,000 feet or more elevation were green with grass during the time spent in that region.

The most common hay grasses at Kadiak are *Poa pratensis*, *Deschampsia cæspitosa*, and *Hordeum boreale*, with some wild timothy (*Phleum alpinum*). *Calamagrostis langsdorfii* was the most abundant hay grass observed in Cook inlet. At Unalaska the common pasture and hay grasses appear to be *Trisetum subspicatum* and *Calamagrostis aleutica*.

White clover was seen in many of the small meadows and door-yards, from which places it seems to be rapidly spreading. Some red clover was also seen, but its adaptability to Alaskan conditions can neither be affirmed nor denied, since apparently no thorough attempt has been made to introduce it. In a few places alfalfa was also seen that was beginning to seed in August.

On the tide flats dense growths of sedges are common, and in some places a very common vetch (*Vicia gigantea*) occurs, and if utilized it would add considerable to the feeding value of the marsh hay.

The nutritious character of the Alaskan grasses was not only shown by their analyses, but also by the sleek and fat cattle seen during the summer. Aside from pasturage, but little use is made of the grasses. The amount of hay that is made is wholly inadequate, and much more could undoubtedly be had if more care be given the subject.

The abundance of berries in Alaska has been a subject of remark by every one who has written concerning this country. So far as could be learned, but little attention has been given to their cultivation, but the few attempts that have been made seem to promise favorably. Hardly any berries are cultivated, except a few strawberries, currants, and raspberries, and of these both wild and cultivated forms were seen growing, and the adaptability of the wild plants to domestication was very evident. The wild strawberry was seen under cultivation at Wrangell, and specimens of *Rubus stellatus*, known as dewberry, "Morong" and "Knesheneka," were seen growing in a garden at Sitka, and it seems probable that more could be done in this line.

The flavor of most Alaskan berries was found to be excellent, and some of them might be worthy of introduction into the States.

Of the berries which have widest distribution may be mentioned the salmon berry (*Rubus spectabilis*), two kinds of cranberries, the high-bush (*Viburnum pauciflorum*) and the little cranberry (*Vaccinium vitis-idæa*), the red and black currant (*Ribes rubrum* and *R. laxiflorum*), crowberries (*Empetrum nigrum*), huckleberries (*Vaccinium uliginosum* and its variety *mucronatum*), raspberries (*Rubus strigosus*), elderberries (*Sambucus racemosa*), bunchberries (*Cornus canadensis* and *C. suecica*), and the "Molka" or baked apple berry (*Rubus chamæmorus*). Of less general distribution are strawberries (*Fragaria chiloensis*), dewberries (*Rubus stellatus*), thimbleberries (*R. parviflorus*), salalberries (*Gaultheria shallon*), bog cranberries (*Vaccinium oxycoccus*), wine or bear berries (*Arctostaphylus alpina*), etc. These berries are used in many ways by the native and white population, and in addition to the consumption of fresh berries many are stored up in various ways for winter use. The white population preserve, can, and make jelly of the different kinds, while among the natives the principal method of preserving them is in seal oil, a vessel filled with berries preserved in this way forming a gift that is usually highly prized.

Numerous miscellaneous plants are used for food. Among the more common are the Labrador or Hudson Bay tea (*Ledum grœnlandicum*); wild rice or "koo," the underground bulbs of which are dried, powdered, and made into a sort of cake; wild peas are employed to some extent, and several species of mushrooms are collected for use. Quite a number of plants are used as pot herbs, and the medicinal value of others is recognized.

Cultivated areas in Alaska are, with the exception of one or two notable instances, confined to kitchen gardens, in which are grown many of the hardier vegetables of our own gardens, such as lettuce, radishes, carrots, parsnips, potatoes, onions, peas, snap beans,celery, turnips, cauliflower, cabbage, rhubarb, horse-radish, etc., in most places the local supply of radishes, lettuce, turnips, and carrots being about equal to the demand.

It is a subject of dispute whether or not potatoes mature in Alaska. Under the methods of culture adopted in Alaska it is very probable that a dry starchy potato is not secured, as potato tops seen late in the fall were still quite green. In Cook inlet and on Kadiak island, as well as elsewhere, the natives grow a small round potato, the original stock of which is said to have come from Russia or Siberia, and so far as could be learned it is the same now as it was fifty or one hundred years ago. No trouble was reported in securing sufficiently mature tubers so that the seed could be kept over from one season to another. Among some specimens of vegetables sent to the Department of Agriculture by Mr Frederick Sargent, of Kadiak, were some potatoes, specimens of which weighed a pound each. No doubt these were larger than the average, but it certainly disposes of the stock idea "that potatoes will not grow larger than walnuts in Alaska."

Complaints were heard in some places that cabbage and cauliflower would not head. There occasionally appears to be some ground for this, but 16-pound cabbages from Killisnoo and 24-pound cauliflowers from Wrangell would rather indicate that in some places these plants do well. Local conditions may cause failures of these crops, just as seems to be the case with several others. Localities were visited where it was said that onions would not grow; others where beets could not be raised; but both of these vegetables were seen in flourishing conditions elsewhere. In a few places where attempts have been made to grow peas and snap beans the efforts have been apparently quite successful. When the peas are gathered at frequent intervals, the vines are said to bear for an extra long period. Specimens of a so-called dwarf pea were seen at Wrangell that had grown to a height of 3 feet. Whether this was due to a mistake in the variety or to the climate and soil cannot be determined. During the past summer cucumbers are reported to have been grown at Tyoonock, but none were seen when that place was visited.

But little appears to have been done in attempting to grow cereals throughout the whole country. It is reported that during the Russian régime spasmodic attempts were made to do something in the line of promoting agriculture, but it appears that nothing of a permanent nature was accomplished. At Yakutat, on the site of the old town, an agricultural colony was established, and at various places in Cook inlet the same was attempted. It is claimed that during Russian occupation oats, rye, barley, and buckwheat were grown to a considerable extent, but if this is true there are now no traces of the fields where the grain was formerly cultivated.

The few cereals seen growing were for the most part self-seeded from hay, feed, etc. At Wood island and Kadiak mature oats were seen August 22 that had evidently grown from seed scattered from feed or packing. A few specimens of barley were seen at one of the places that were about 15 inches high, headed but not ripe. Their origin was probably due to the same causes as that of the oats.

At Tyoonock a limited experiment was made during the last summer with spring-sown wheat, rye, and barley, and on the last day of July the barley and rye were about 15 to 18 inches high and fully headed out. The wheat had made a fine growth, but showed no tendency to head. At Sitka, in 1896, a small plat of wheat was ripened in fairly good condition, and in 1897, at the same place, a plat of flax was sown, and on September 4 the plants averaged about 30 inches in height and were in full bloom, the earlier capsules containing almost mature seed.

About the only real farm in the country is on an island between Juneau and Sitka, near the village of Killisnoo. It consists of about 40 acres under cultivation, and has been under cultivation for about three years. The equipment of stock consists of a team of horses, 6 head of cattle, and about 30 hogs. Part of the land was tide land, and dikes have been built to keep out the sea. Turnips, peas, cabbage, potatoes, Swedish turnips, beets, etc., are now grown extensively. The crop for this year consisted of about 7 tons of potatoes, 20 tons of Swedish turnips, several tons each of beets, carrots, parsnips, and a large quantity of peas. Two silos are maintained at this place, and the owner is able to carry his stock through the winter in very good condition. He supplies some milk and meat as well as vegetables to the village of Killisnoo, where there is a fish-oil and guano factory, and also to the steamers touching there during the season.

For the most part the same methods of cultivation are pursued throughout nearly the entire country. The generally neglected appearance of gardens is everywhere apparent. It is not confined to the garden of the native, but too often that of the white man is as poorly cared for. Often a vast amount of labor is expended in planting the crop; but once planted, it is allowed to care for itself. The result is a large and luxuriant crop of weeds.

Bedding up the soil is practiced nearly everywhere. On the lighter and better drained soils it is not as necessary as on the heavy, poorly drained ones. Usually the beds are formed about 3 or 4 feet wide and raised as high above the general level as can be economically done. Most crops are planted in rows across the beds, the distance separating the individual plants varying according to the crop. Close planting seems to be the rule with nearly every crop. The attempt seems to be to secure the largest possible harvest from a limited area by planting a large amount of seed. Potatoes are not infrequently planted 6 inches apart in rows separated not more than a foot. The result of such planting is a thick growth of vines that covers the ground to such an extent that the sun's rays never reach the ground. Such methods can hardly fail to produce a yield of very inferior tubers.

At present stock-raising is carried on to a very limited extent, milch cows being the most common farm animal seen. At nearly every village there were seen some cows, pigs, and poultry, while horses are kept at a few of the larger places. The team at the Killisnoo farm is probably the only team in Alaska employed in agriculture, the other horses being used for teaming around the towns and packing around mining camps. At several places dairies are maintained, supplies of milk and a small quantity of butter being furnished most of the year. At Kadiak some years ago an attempt was made to introduce sheep. Quite a number were placed on a small island, and, as they had come from a much warmer and a drier region, many died during the winter in consequence of being poorly fed and not provided with shelter.

Pigs are reported to thrive exceedingly well in most parts of Alaska, but when allowed to run at large their flesh is liable to acquire a fishy flavor. The same objection is raised against the flesh of fowls, since their diet in winter consists almost entirely of fish refuse.

The prevailing conception of Alaska as a region wholly given up to glaciers and mountains is strikingly at variance with the facts. In 1894 the director of the Geological Survey estimated the tillable land in southeastern and southwestern Alaska as embracing between 4,000 and 5,000 square miles, or from 2,500,000 to 3,200,000 acres, an area about equal to that of the State of Connecticut. If the grazing lands be added to the above estimate, the acreage would be greatly extended.

The agriculturist of Alaska will have some serious problems to consider. The more important are the clearing and draining of the land, lack of markets, and transportation facilities.

In southeastern Alaska, with the exception of the tide flats, land must first be cleared of the dense forest growth, and in some places the deep moss will also have to be removed. The spruce stumps must be dug out, as they are very slow in rotting, and not infrequently produce large second-growth timber. In addition to clearing, the land must be thoroughly drained and protected against seepage from above. This ditching and removal of stumps is very laborious, and estimates of $200 per acre were given as a probable cost of preparing the soil for cultivation. This cost seems well nigh prohibitive for agricultural purposes. However, the same process had to be followed elsewhere. A report issued by the experiment station at Pullman, Washington, states the cost of clearing muck lands of cedar and alder stumps at the Puyallup substation to be $122.80 per acre. No definite information has been obtainable as to the cost of clearing farm land elsewhere, but wherever practiced the process is expensive. In the southwestern portion of the country the expense of clearing away the stumps will not be required, nor is draining necessary to the same extent as in the other region.

The agricultural possibilities of Alaska can be estimated only from the rather meager evidence of limited experiment, and by comparing what has been accomplished in regions having somewhat similar conditions. Agriculture as it exists in Alaska has been described in the previous pages. It is not expected that this country will ever rival the Mississippi valley in its productiveness, but it does seem probable that agriculture and horticulture could be extended so as to supply local demands for many products. When the climatic conditions, topography, soils, etc., of Norway, Iceland, the Orkney islands, as well as Scotland, Sweden, and Finland, are compared with those of Alaska, it seems probable that what has been accomplished in European stations could also be done in this country, if properly undertaken. It is well established that many agricultural products flourish in parts of northern Europe having approximately the same temperature during the growing season as we find to exist in portions of Alaska, and if temperature is the controlling factor in plant distribution there would seem no reason why the same varieties of plants would not succeed in both countries if properly introduced and cultivated. Rye, oats, and barley are grown in sufficient abundance in the north of Europe, not only to supply local demands, but also to some extent for export.

Comparing Alaskan data, secured from agricultural experiments that have not always been conducted in the best manner, with the results secured from other regions having a somewhat comparable climate, it seems safe to say that the coast region of Alaska possesses agricultural possibilities of no little importance, and with an enlightened native population and a permanent white one it seems possible that the demand for many of the agricultural products could be supplied.

THE METLAKATLA MISSION IN DANGER

The history of missions from the earliest epoch has been a struggle, not only against the natural obstacles of the situation, but against the indifference or criticism of opponents in the rear. It is not difficult to criticise, "For John came neither eating nor drinking, and they say, He hath a devil. The Son of Man came eating and drinking, and they say, Behold a man gluttonous, and a winebibber, a friend of publicans and sinners."

There are two modes of mission work among the Indians: one which draws its sinews of war from friends in the churches and sends out salaried missionaries, who devote themselves to teaching and the work of conversion. The teachers often lack in practicality what they make up in devotion to the ideal. Nevertheless it would be folly to deny that these missions have done much good in their way, and will continue to do so. Of them the scoffer says: "The missionaries live at their ease and do nothing for it but teach dogmas which the Indian cannot understand, and train girls to be good housewives, who, when their education is completed, will be sold by their heathen relatives to some miner or trader. When the mission is closed for want of funds or otherwise, the converts relapse into evil ways, and in a little while their last state is worse than their first." That there have been instances justifying to some degree this harsh view, every one familiar with Indian missions will admit.

The other method is to fit the Indians to provide for themselves and for the mission by industrial training, self-denial, and hard work, shielding them in the early stages as we shield our own children from contact with evil men and things until, stimulated both by their own material interests and by the truths of the gospel, in the course of time and growth they shall be able to stand alone, men among men, to fight the battles of life. This is the method of Hampton and Carlisle, whose most conspicuous exponent on the uncivilized frontier is the Rev. William Duncan, of Metlakatla, Annette island, Alaska. This gentleman has given forty years of his life to the work among the Tsimsian Indians, first at Metlakatla, on the British Columbia side of the line. Through a most injudicious exercise of religious narrow-mindedness, well known, but of which there is insufficient space to speak here, the Indians were obliged to abandon their homes, church, and school and much other property and move over into American territory at Annette island to obtain freedom of religious worship. Here, several years later, Congress granted them the use of the island, and, in confidence that they were at last safe from interference, under Duncan's direction they went heartily to work. His plan was, in brief, to keep the colony together and free from undesirable elements, liquor and vice; to teach them to utilize the resources of the region to support themselves and their families by work; to build good houses and maintain family life as known to civilization, and to teach the English branches and manual training to the young people.

In pursuance of this ideal, Mr Duncan put his own means and contributions of friends into the outfit of a salmon cannery which has been worked by the Indians, as well as a saw-mill and other correlated facilities. The success has been complete. The colony has maintained itself, some of the Indians have become shareholders, and the canning business has yielded a good profit. The evidence of this is overwhelming and includes the testimony of almost every disinterested person who has visited the colony. Even the scoffers admit that as a business enterprise the mission is a great success. Its very success has become a source of danger. Business competition is nowhere sharper than in Alaska, because the ordinary safeguards of public opinion and well enforced law are not available in restraint of greed and sharp practice. Most of the canneries are included in a trust, and outsiders have scant consideration and must fight for their interests unceasingly and at great disadvantage. Nothing which might hurt the sensitive feelings of the trust can be found in the published reports of the official salmon inspectors; yet it is the common opinion that the law is violated systematically, except during the visits of the inspectors for a few hours during the whole season.

Like all the Alaskan islands, Annette island contains a few quartz veins. There is good reason to think that none of them is of any great value, and no development work, such as is required by law, has been done on any of them. Under the reservation of Congress the prospectors could not acquire any rights, at any rate. But an attempt is now being made to induce Congress to bolster up a speculation in these undeveloped leads by rescinding the reservation act, so as to cut off from the colony its waterworks, its mill and cannery, and to a large extent its fishery rights, and thus leave the people without resources and open to the vices of the mining camp and rumseller, to the inevitable destruction of all that has been hitherto accomplished.

The bare statement of the facts carries its own commentary. The friends of justice, and of the Indian's right to work out his salvation, and eventually to take his place among the citizens of our common country, should make themselves heard before it is too late.

WM. H. DALL.

AGRICULTURE IN THE YUKON VALLEY

In a brief preliminary report on the agricultural and horticultural conditions in the Yukon valley, Dr Sheldon Jackson mentions having found at the Roman Catholic mission at Koserefski, 338 miles from the mouth of the river, and at the Protestant Episcopal mission at Anvik, 17 miles higher up the stream, gardens producing potatoes (7 or 8 inches long and 3 inches in diameter), turnips weighing 10 pounds, cauliflower, radishes, cabbage, lettuce, carrots, beets, and peas, while strawberries, blackberries, raspberries, and other well-known small fruits were growing wild in the immediate vicinity. At Circle City, 1,322 miles up the river, and at Fort Cudahy, 1,522 miles up, many favorite varieties of garden truck seemed to be thriving. Dr Jackson sums up his statement in the following words: "While Alaska will never be an agricultural state in the same sense in which that term is understood in the Mississippi valley, yet it has agricultural capacities much in advance of the public sentiment of the country."

ON ESKIMO GEOGRAPHIC NAMES ENDING IN MIUT

Mr Charles Hallock, in his article on the Kuskokwim river, in The National Geographic Magazine for March, 1898, enumerates a number of names of Eskimo settlements on the river, all ending in *mute*, and explains (on p. 88) that "*mute* means village." This is not really a translation of the affix, although words with this termination appear to be very generally used as village names in that part of Alaska—at least, by white men. Strictly speaking, such names are not applicable to the village itself, but to the inhabitants of the village, for the termination, which properly should be written *miut*, is simply the plural of the well-known Eskimo enclitic affix *mio*, "he who dwells," or "that which belongs" (in any place), which is found wherever any dialect of the Eskimo language is spoken. In Greenland these names are applied only to the inhabitants of single village sites, as, for example, Nûngmiut, "the people of Godthaab;" but in the central region and in northwestern Alaska they are applied sometimes to more extended regions, and thus serve as a kind of tribal name. For instance, the Point Barrow Eskimos call the people of the Mackenzie delta collectively Kupangmiun, "the people who live on the great river."

This termination should always be written *miut* (or *miun* in the northwestern dialects), but appears in the writings of different explorers in several incorrect forms, such as *mute*, mūt, *meut*, or *meun*.

John Murdoch.

Boston Public Library.

GEOGRAPHIC LITERATURE

Geographical and Statistical Notes on Mexico. By Matias Romero. Pp. xiv + 286. New York: G. P. Putnam's Sons.

The modest title conveys an inadequate idea of the scope of this book, which is a compendium of useful and interesting data as to the resources and commercial progress of our sister Republic. The high official position of Señor Romero has procured for him data inaccessible to most writers, while his long diplomatic service in the United States has enabled him to select wisely the statistical matter herein presented. He treats clearly, from original sources, mining, railways, revenues and expenditures, foreign trade in general, and especially the commercial relations between Mexico and the United States, the data in many cases extending to 1897. The volume closes with an interesting article on "The Drainage of the Valley of Mexico," a problem that for 500 years baffled the local engineers, but which, now finally resolved, will be practically completed in June, 1898.

The subject of railways occupies the most space, as is proper, they constituting the most potent factor in the late astonishing development of Mexico. Señor Romero's account of the mining industries will command attention, not only from the interesting manner in which it is presented, but also from the pr dominating part played by silver in late years. Mexico has coined silver to the value of $3,530,000,000, and has used one-fourth as much more in the arts, etc.

The coinage during the colonial period (1537–1821) averaged annually $7,500,000, during the independence (1822–'73) $15,600,000, and under the republic $24,700,000. It is estimated that the annual output of silver in Mexico will ultimately reach $100,000,000.

The commercial relations between Mexico and the United States are treated fully, and the statistical tables illustrate forcibly the steadily increasing trend of Mexican trade toward this country. In 1872–'73, the first regular report of the Mexican statistical bureau, the imports from the United States were valued at $6,430,000, in 1896–'97 they amounted to $23,535,000, consisting principally of manufactures of metal, wood, and cotton, and raw cotton, although corn figured largely, owing to the failure of the crop in Mexico. In the same years Mexico exported to the United States $16,430,000 (1872–'73), and $30,714,000 (1896–'97). The increase in exports is almost entirely in merchandise, the principal articles being copper, coffee, and fibers.

The excellencies of Mexican climates scarcely appear in the meager meteorological data presented, and the value of the table on page 89 is impaired by the misprint of 1869 for the correct year, 1896. It is much to be regretted that so valuable a publication has no general map.

A. W. G.

Map of Alaska, showing known Gold-bearing Rocks, with Descriptive Text containing Sketches of the Geography, Geology, Gold Deposits and Routes to the Gold Fields. U. S. Geological Survey. Pp. 44. Washington. 1898.

A Report to Congress on Agriculture in Alaska, including Reports by Walter H. Evans, Benton Killin, and Sheldon Jackson. U. S. Department of Agriculture, Office of Experiment Stations. Bulletin No. 48. Pp. iv + 36, with map and illustrations. Washington. 1898.

Rand, McNally & Co.'s New 18 × 24 Map of Alaska, showing also British Columbia, with portions of Northwest Territories, etc. Chicago and New York: Rand, McNally & Company. 1897.

Rand, McNally & Co.'s Official Map of Alaska, including The Klondike District and Adjacent Gold Fields, showing various routes to the mines. 24 × 36, cloth. Chicago and New York: Rand, McNally & Co. 1897.

Golden Alaska. An Up-to-Date Guide. Klondike District. Yukon Valley. By Ernest Ingersoll. Pp. v + 160, with maps and illustrations. Chicago and New York: Rand, McNally & Company. 1897.

The Golden North. By C. R. Tuttle. Pp. *x* + 307, with maps. Chicago and New York: Rand, McNally & Company. 1897.

Nothing could be more timely or, for their purpose, more valuable than the reports on Alaska recently published by the U. S. Geological Survey and the U. S. Department of Agriculture, the one on the mineral resources of the Territory and the other on its agricultural capabilities. While there is still much awaiting demonstration in both these fields of investigation, enough is definitely known to prove of the utmost utility to those who are seeking their fortune in the new Eldorado. The principal authors of both reports have rendered the readers of The National Geographic Magazine the service of summarizing the results of their investigations for this number, but the reports themselves should be carefully studied by all prospective visitors to the region described.

The reputation of the well-known firm of Rand, McNally & Co. is fully maintained in their recent publications on Alaska and the Klondike. Their "18 by 24 map" shows in considerable detail the whole of Alaska and the western portion of the Dominion of Canada, and notwithstanding the small scale on which it is drawn, it is clear and distinct in every particular. The "official map," while twice the size of the foregoing, embraces a much smaller area, with the result that the different geographical features of the attractive region it represents stand out with a distinctness that leaves nothing to be desired. Mr Ernest Ingersoll's "Golden Alaska" contains much useful information for intending settlers, but is hardly up to the author's usual standard in its literary style. Mr Tuttle's "The Golden North" is a somewhat more ambitious and more serious work and not so obviously designed to meet a merely temporary want. While the two publications necessarily cover to some extent the same ground, each has its place, and the two books are really complementary to each other.

J. H.

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THE

National Geographic Magazine

Vol. IX MAY, 1898 No. 5

CUBA

By Robert T. Hill,

United States Geological Survey

SITUATION AND GEOGRAPHIC RELATIONS

Cuba is the westernmost and largest of the four islands known as the Great Antilles. These, with the Virgin islands at their eastern end, stretch east and west for over 1,350 miles, and constitute a distinct geographic province—distinct in relief, geologic formation, and history from the other West India islands and the adjacent mainlands.

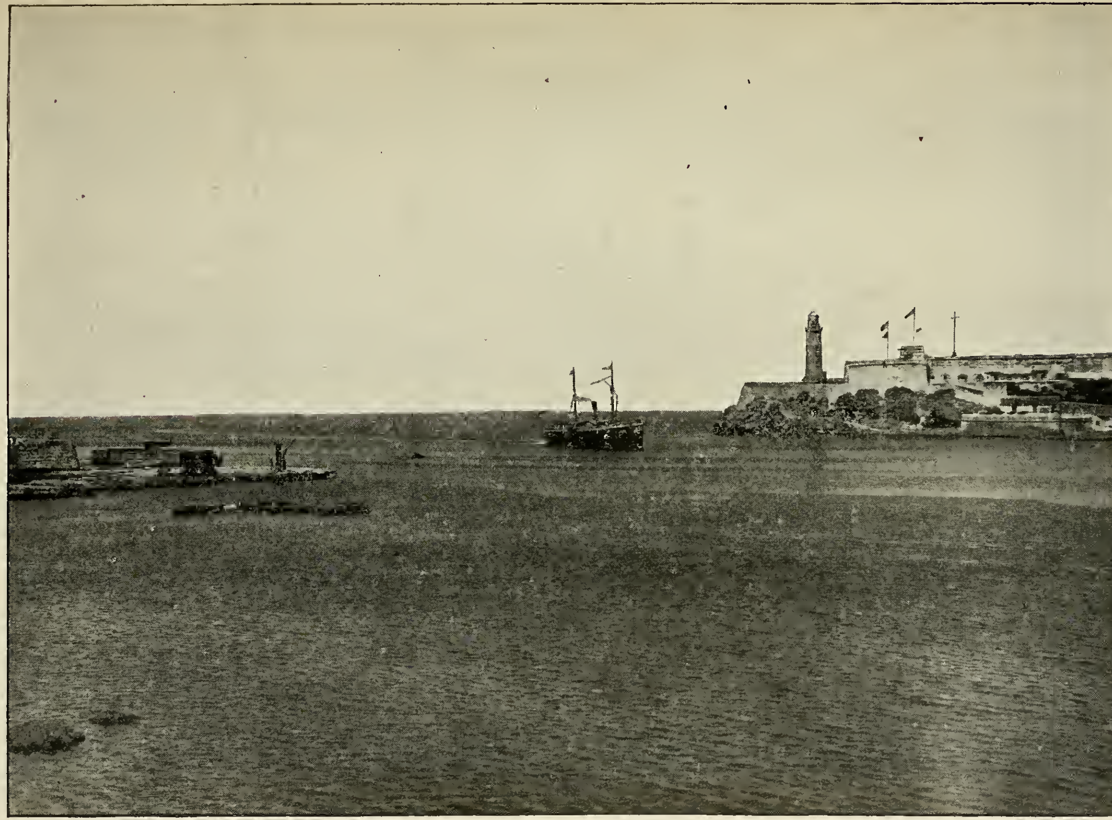
In their climate and vegetation, as in their topographic features or geologic history, the Antilles have no affinities with conditions with which we are familiar in the United States. Their whole aspect is tropical, yet they possess so many unique individual features, differing from those of other tropical lands, that they belong in a class entirely by themselves. The causes of this individuality are involved in a peculiar geologic history, which can be dwelt upon here only to the extent of stating that it has produced certain peculiarities of configuration and given origin to formations which weather into soils of unusual productiveness.

Collectively the Great Antilles consist of a disconnected chain of mountains (the Antillean system) protruding above the sea and having an east-west trend directly transverse to that of the axial continental Cordilleras. The highest peaks of this system in Haiti, Cuba, and Jamaica are 11,000, 9,000, and 7,000 feet respectively. These mountains of deformation are irregularly flanked below 2,000 feet by horizontal benches or terraces, which are the result of regional elevations and base-leveling after the last period of mountain-making in Miocene time. The Antillean uplift may be compared to an inverted, elongated canoe, the highest and central part of which is in the region adjacent to the Windward passage. Thus it is that the higher peaks occur in Haiti, eastern Cuba, and eastern Jamaica, while the arching crest line descends toward the western part of the two latter islands and, on the east, toward Porto Rico. The higher mountains are composed of non-calcareous clay conglomerate and igneous rock, the debris of unknown lands of pre-Tertiary time, which, with the exception of a few restricted points, were buried, during a profound subsidence in early Tertiary time, beneath a vast accumulation of calcareous oceanic sediments now composing the white limestones which constitute the chief formations of the islands, and which were, together with the preceding formations, elevated into their present position at the close of the Tertiary period.* The mountains above 2,000 feet are composed of the older non-calcareous formations and the bordering plateaus of limestone, resulting in two distinct and contrasting types of soil throughout the Antilles.

STRATEGIC AND COMMERCIAL POSITION

In area, in natural resources, in the number and character of its inhabitants, in position as regards proximity to the American and Mexican seaboards, strategically Cuba is by far the most important of the Great Antilles. It is very near the center of the great American Mediterranean, separating the Gulf of Mexico from the Caribbean sea, and in close proximity to our southern

* The general geology of the island, while not discussed in this article, is well shown in many of the illustrations. It may be briefly stated as consisting of an older basement of pre-Tertiary sedimentary rocks, in which Cretaceous and probably Jurassic fossils have been found. Above this there are, first, littoral beds composed of terrigenous material, and then a great thickness of white limestones consisting of organically derived oceanic material, as distinguished from true reef rock of late Eocene and Oligocene age. The island was reclaimed from the sea and assumed its present relief by a great mountain-making movement in late Tertiary time, succeeding the deposition of these limestones. In later epochs, Pliocene and Pleistocene, the island underwent a series of epeirogenic subsidences and elevations which affected the coastal borders, producing the wave-cut cliffs and a margin of elevated reef rock which borders the coast in many places, as can be recognized in the illustrations of the cities of Habana and Baracoa. So far as its history is known, the island has never been connected with the American mainland, although such has frequently been asserted to be the case. These assertions have been based upon the erroneous identification of certain vertebrate animal remains. There are no traces in the animal life of Cuba, past or present, which justify this conclusion. Some of the crystalline rocks may be ancient, but most of them are mid-Tertiary in age.



ENTRANCE TO HABANA HARBOR, LOOKING OUTWARD

A shore battery on the left *Morro Castle on the right* seaboard, the coast of Mexico, the Bahamas, Haiti, Jamaica, Central America, the Isthmus, and the coast of South America.

The island commands three important maritime gateways: the Straits of Florida, leading from the Atlantic ocean into the Gulf of Mexico; the Windward passage, leading from the Atlantic into the Caribbean sea, and the Yucatan channel, connecting the Caribbean sea and the Gulf. The first and last of these completely command the Gulf of Mexico. It is less than 96½ miles from Key West to the north coast of Cuba. From the east end of the island, Haiti and Jamaica are visible, 54 and 85 miles distant respectively. From the western cape (San Antonio) to Yucatan the distance is 130 miles.

OUTLINE, DIMENSIONS, AND AREA

The outline of the island, commonly compared by the Spaniards to that of a bird's tongue, also resembles a great, hammer-headed shark, the head of which forms the straight, south coast of the east end of the island, while the body extends to the westward in a sinuous curve. This analogy is made still more striking by two long, fin-like strings of cays or islets, which extend backward along the opposite coasts, parallel to the main body of the island.

The longer axis of the island extends from the 74th to the 85th meridian, while its latitude, between 19° 40′ and 23° 33′, embraces nearly four degrees. Its length, following an axial line drawn through its center from Cape Mayci to Cape San Antonio, is 730 miles. Its width varies from 90 miles in the east to less than 20 miles in the longitude of Habana. Cape Mayci, on the east, lies directly south of New York, while Cape San Antonio is situated south of Cincinnati.

At the outset the reader should dispossess his mind of any preconceived idea that the island of Cuba is in any sense a physical unit. On the contrary, it presents a diversity of topographic, climatic, and cultural features which, as distributed, divide the island into at least three distinct natural provinces, which for convenience may be termed the Eastern, Central, and Western.

No accurate trigonometric surveys have been made of the island and its bordering islets, including 570 cays adjacent to the north coast and 730 to the south, or of the Isle of Pines, a large and important dependency. Nearly all existing geographic data have been based upon a large map compiled by Pichardo, engraved in Barcelona, which was a compilation of local surveys of various and doubtful degrees of accuracy.

The area of the main island has been estimated at from 40,000 to 43,000 square miles, that of the Isle of Pines at 1,214, and that of the cays at 1,350. Some of the larger cays, like Romano, are 140 square miles in extent. Reclus estimates the total at 45,883 square miles, an area about equal to that of the state of New York and nearly one-fourth the size of Spain.

CONFIGURATION

The distinct types of relief include regions of high mountains, low hills, dissected plateaus, level plains, intermontane valleys, and coastal swamps. In general, however, with the exception of a strip of the south-central coast, the island as a whole stands

CONFIGURATION.—1. Bench of elevated coral reef. 2. Later terraces bordering the island. 3. Cuchilla terraces. 4. Older and higher levels. 5. Mountains of deformation.

well above the sea, is thoroughly drained, and presents a rugged aspect when viewed from the sea. About one-fourth of the total area is mountainous, three-fifths are rolling plain, valleys, and gentle arable slopes, and the remainder is swampy.

THE COAST

The coast line of Cuba is very extensive, measuring, without its meanderings, nearly 2,200 miles. On Pichardo's map the coast line, measured with all its embayments and including the islets, is over 6,800 miles. On all sides except the south-central the coast is abrupt, except where indented by pouch-like harbors, and stands above the sea as if the waters of the latter were rapidly planing away what had once been a more extensive land. In many places the immediate coast line is a narrow bench of elevated reef rock a few yards in width and

ELEVATED NORTH COAST OF CUBA, BETWEEN HABANA AND MATANZAS, NEAR CANAISI RIVER standing about 20 feet above the sea, between the bluffs and the water. The coast border on the north presents a low cliff topography, with a horizontal sky line from Matanzas westward, gradually decreasing from 500 feet at Matanzas to 100 feet in the west. The coast of the east end is abrupt and rugged, presenting both on the north and south sides a series of remarkable terraces, representing successive pauses or stages in the elevation of the island above the sea, and constituting one of the most striking features anywhere to be seen. West of Guantanamo to Cape Cruz the precipitous Sierra Maestra rises immediately back of these terraces. From Cape Cruz to Cape San Antonio, with the exception of a brief stretch between Trinidad and Cienfuegos, the coast is generally low and marshy.

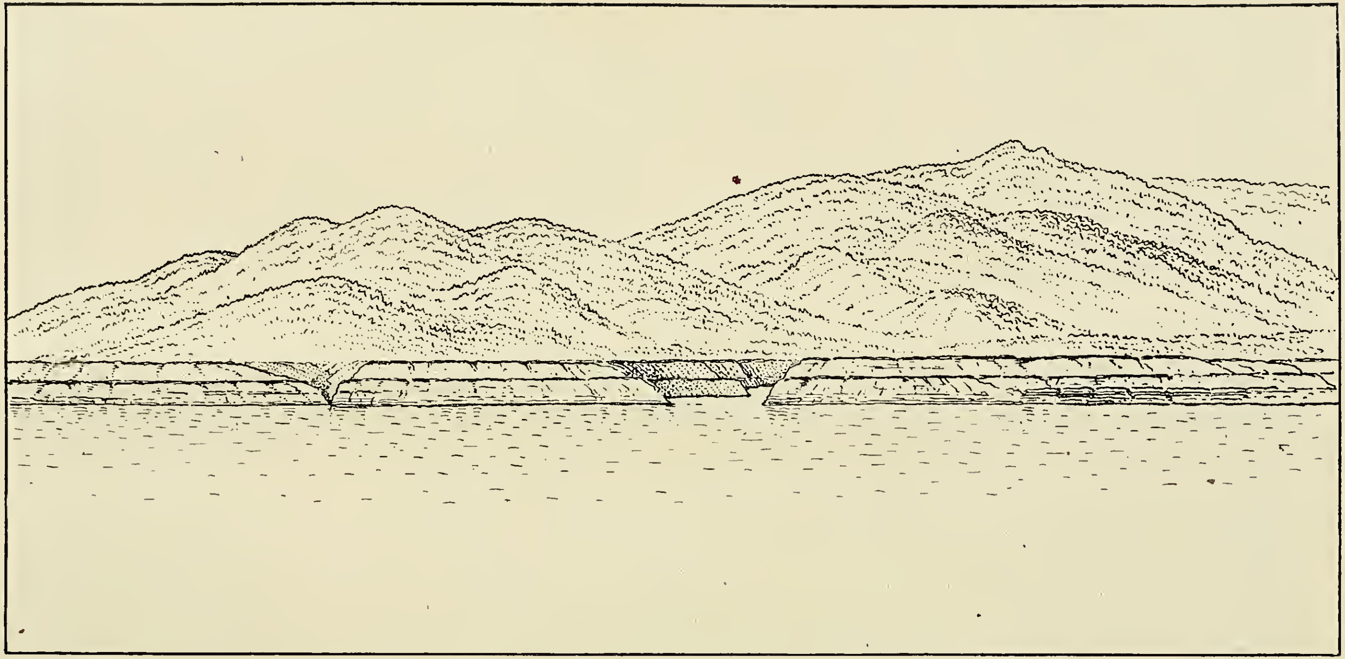
The cays adjacent to the middle third of the island, on both the north and south sides (the famous Jardines of Columbus), are mostly small coral or mangrove islets which have grown up from shallow, submerged platforms surrounding those parts of the island and in places form barriers to the mainland. They are mainly uninhabited, owing to the scarcity of potable waters, but constitute a formidable obstacle to navigation, except when guided by skillful pilotage.

THE INTERIOR

The interior of the island of Cuba has not been sufficiently surveyed to accurately map the nature of the soil or the relief of the surface. The various commissions named in times past by the Captains General to make reconnaissances avow in their reports that the lack of habitation in the greater part of the territory, the impenetrability of the forests, the insurmountable Cordilleras, and the scarcity of means and time have prevented them from carrying out successfully the mapping of the diverse ramifications of the mountains, the tracing out of their salients and valleys, and the determination of their extent, altitude, and geologic structure. It seems that their observations did not extend east of the 70th meridian, where the most interesting part of the island, from a scientific point of view, is found. Furthermore, the results of such investigations as were made were but imperfectly published in fragments.

MOUNTAINS

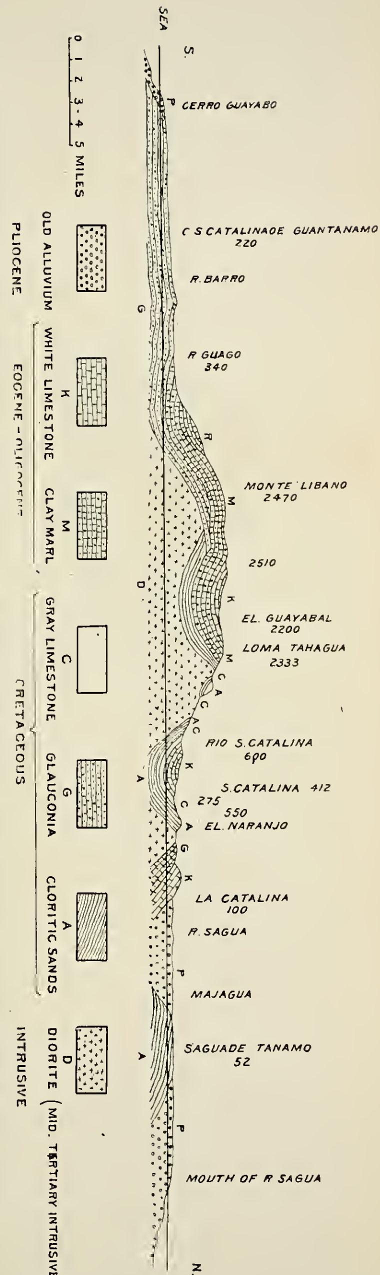
The higher eminences are true mountains of deformation, composed of disturbed sedimentary rocks with igneous intru-



COAST TOPOGRAPHY, EAST OF SANTIAGO DE CUBA, SHOWING MOUNTAINS AND ELEVATED TERRACES

From a Sketch by Prof. A. Agassiz

sions. The mountains of this class do not constitute a continuous axial backbone to the island, as popularly supposed, but occur in three distinct and independent groups, known as the eastern, western, and central, respectively, the trends of which overlap each other *en echelon*. The highest of these is the narrow, precipitous, eastern range, known as the Sierra Maestra, which dominates the straight east-and-west coast of Santiago de Cuba and culminates in the Pico del Turquino, which rises directly from the sea to a height variously estimated at from 8,600 to 9,000 feet. La Gran Piedra, in this range, near Santiago, is 5,200 feet high. This master range extends through 2½ degrees of longitude, from Guantanamo to Cape Cruz, and constitutes an independent feature topographically different from the rest of Cuba. Geographically it belongs to a class with the Blue mountains of Jamaica and the higher summits of Haiti, collectively constituting the master ranges of the Great Antilles, which have been thrown up directly at right angles to the trends of the continental Cordilleras and at a far more recent period of time. These mountains are composed of non-calcareous conglomerates and shales of Mesozoic and

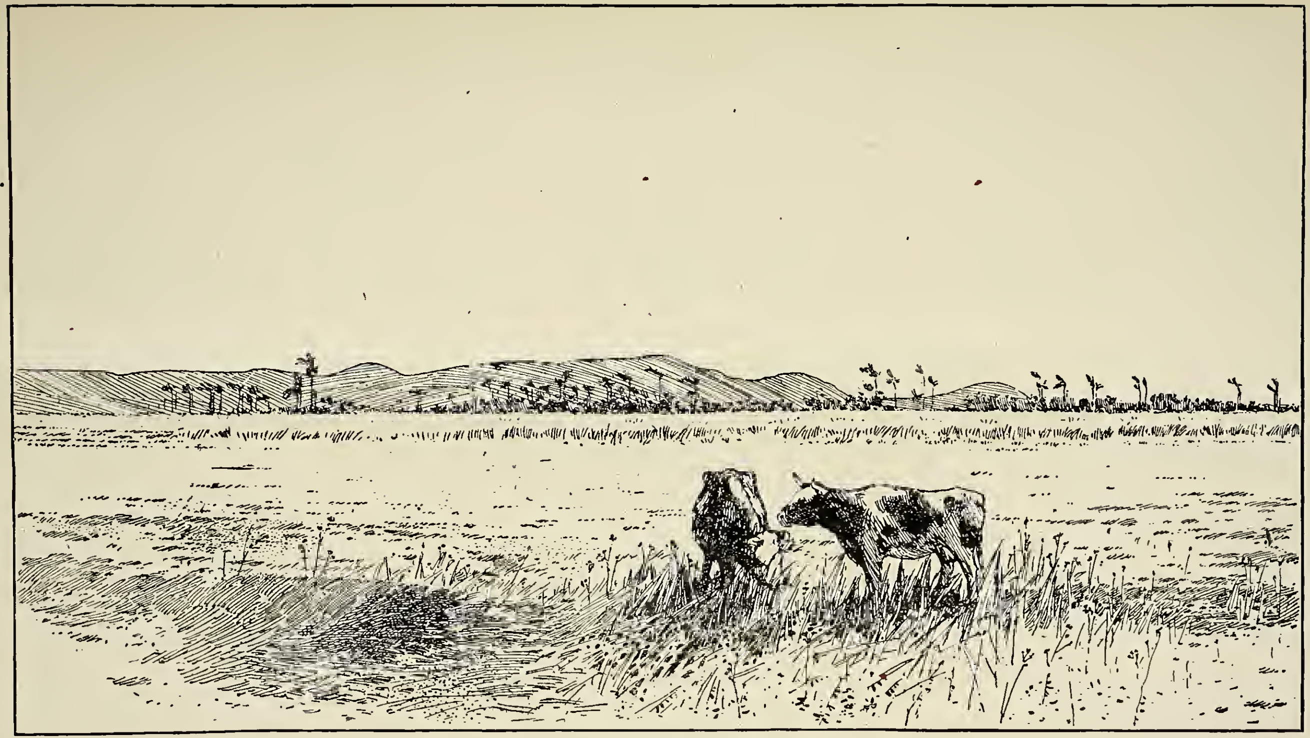


GEOLOGIC SECTION BY V. PELLITERO ACROSS EAST END OF CUBA—SECTION E–F OF GEOLOGIC MAP—THE AGE NAMES ARE ADDED BY THE WRITER

Eocene age, intruded by ancient mid-Tertiary igneous rocks, the debris of which makes a clay and gravel soil—one of the two contrasting types which constitute the greatest wealth of the island.

The Sierra Maestra crest closely parallels the adjacent sea-coast, toward which its slopes descend precipitously. Inland, toward the north, the slope is gentler, the eroded ridges leading gradually down to the valley of the Cauto, the deep indentation of which nearly separates these mountains from the region to the north. The second group of mountains, the Sierra de los Organos, is found in the extreme western province of Pinar del Rio, extending northeast and southwest between Mariel, near Habana, and Cape San Antonio. This range consists of lower ridges of geologic formation different from those of the Sierra Maestra. Its summits culminate in the Pan de Guajaibon, west of Habana, which has an altitude of 2,532 feet. Its rocks are composed of deformed sedimentaries of supposed Paleozoic, Triassic, Jurassic, and Tertiary age, the uplift of which may have been cumulative, but culminated during the close of the last-mentioned period. The Organos are covered with a growth of pine and flanked on either side by many beautiful slopes and valleys, those on the south constituting the famous Vuelta Abajo tobacco lands.

While the Sierra Organos proper cease just west of Habana, the strike of their uplift, accompanied by the same character of igneous protrusions flanked by Tertiary limestones, although void of the older rocks, is traceable by a series of low disconnected hills, in a gently curved line passing throughout the central plain of the island and to the north of the third or central group of Trinidad into the western part of the province of Puerto Principe. Thus, in a manner, this line of uplift, varying in intensity from the sharp ridges of the west to low flattened folds in the middle provinces, constitutes the nearest resemblance to an axial backbone of the body of the sinuous outline of the island, while the Sierra Maestra constitutes the head. The principal components of these interrupted summits of low relief dotting the plains of Habana, Matanzas, Santa Clara, and Puerto Principe are as follows: Almost due south of Habana, commencing east of the village of Santiago, is a range of low, timbered hills, surrounded by plains, including the Tetas de Managua, the Arcas de Canasi, Lomas de Camoa, the Escallera de Jaruco (which is visible from a great distance), and the Pan de Matanzas. Along the north coast between Habana and Matanzas there are many



MOUNTAINS RISING OUT OF CENTRAL PLAIN, SOUTH OF MATANZAS of these hills, which, as remarked by Humboldt, afford some of the most beautiful scenic prospects in the world. The occurrence of these lower timbered summits in a region which is generally level plain has afforded a safe retreat for bands of insurgents, who make them a base for frequent incursions upon the outskirts of Habana and Matanzas.

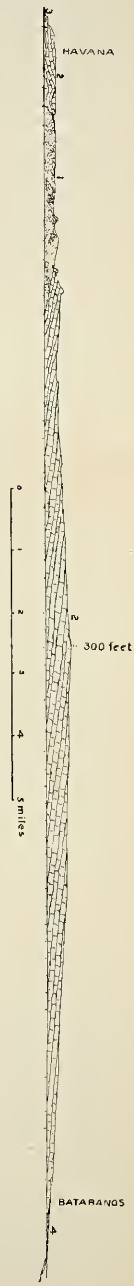
For a brief interval these hills die out in eastern Matanzas, but upon crossing into Santa Clara, and from thence on into Santiago de Cuba, they reappear as long crest lines and flat-topped plateaus, following a line near and parallel with the north coast, including the Sierras Zatibonico and Cubitas. The last-named ridge has been an impregnable insurgent stronghold during the present revolution and was for a time the seat of the insurgent government.

The third group of high mountains occupies a limited area between Cienfuegos and Santo Espiritu, on the south side of the central portion of the island, and to the northward of the city of Trinidad, and entirely south of the axial group above described. These are less angular than the eminences of the Sierra Maestra and consist of central summits with radiating slopes, the highest of which is El Potrerillo, 2 900 feet. They are composed of semi-crystalline limestones and shales which have been doubtfully considered of Paleozoic origin, flanked by highly disturbed Cretaceous and Tertiary beds. Interspersed between these mountains are numerous fertile valleys, giving to this part of Cuba a diversified landscape.

THE LIMESTONE PLAINS

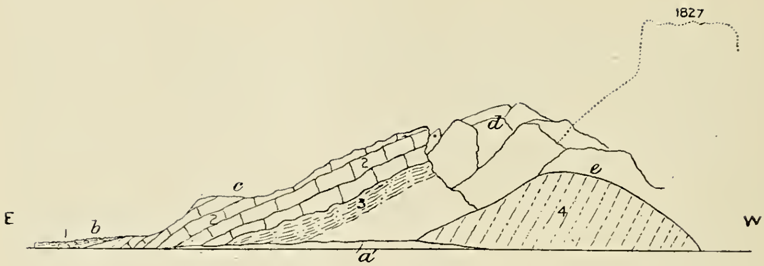
The three dominant groups of mountains above described are topographic irregularities surviving from earlier epochs or pushed up with the great sheets of Tertiary limestone which in all the intermediate and coastal areas comprise the dominant formation of the island. This limestone crust, gently warped and undulated in many directions, has great variation in altitude. Its maximum elevation is in the extreme east, and gradually decreases to the center of the island, rising again to the west. In the eastern and northern parts of the province of Santiago de Cuba it constitutes an elevated plateau, attaining a height of nearly 1,800 feet and embeds the base of the Sierra Maestra. Here it is so dissected by drainage that it gives a most rugged relief to the district which it occupies, and presents on the seaward side a remarkable series of terraced cliffs, representing successive elevations of the island in Pliocene, Pleistocene, and recent time. This topography is surmounted by extensive flat-topped summits like the Mesa Toar and the Junki (anvil) of Baracoa (alt. 1,827 feet), bordered by numerous sharp, knife-edged salients, known as cuchillas. Similar remnantal flat tops occur at rare intervals as far west as Matanzas, the most conspicuous of which are the Sierra Matahambre and the Pan de Matanzas (alt. 1,200 feet). To the westward, in the provinces of Matanzas and Habana, the arch of the plateau, which follows the northern side, descends nearer and nearer sea-level, and develops a longer but gentle slope toward the south coast, hence presenting a cliff topography to the north sea and gradually merging, as the great central plain of Cuba, into the Caribbean, producing the extensive cienega or swamp known as the Zapata on the coast opposite Matanzas.

Through Puerto Principe and Santa Clara, except where broken by the central mountains of Trinidad, this limestone stretch forms two wide coastal belts, each about a third the width of the island, separated by a central axial strip. West of Santa Clara these two belts unite into the broad plains of Matanzas and Habana, where they constitute the central sugar region of Cuba—the Vuelta Arriba—and again diverge west of the latter city along either side of the central mountains of Pinar del Rio, where it constitutes the Vuelta Abajo. These limestone districts weather into fertile calcareous soils, red and black in color, and of a quality and depth unequaled in the world, and their extent in the level region is an almost continuous field of sugar-cane. At two places throughout the length of the island there are depressions crossing it where the divide is reduced to less than 500 feet. The first of these is between Moron and the south coast, in Puerto Principe, and the second between Habana and Batabano.



GEOLOGIC SECTION ACROSS THE CENTRAL LIMESTONE PLAINS FROM HABANA TO BATABANO

1. Guanabacoa formation, Eocene clays intruded by Miocene igneous rocks. 2. Vicksburg limestones and Bowden marl. 3. Elevated reef rock. 4. Zapata swamp formation



SECTION AT BARACOA

1. Elevated reef
2, 3. Bowden Oligocene
4. Radiolarian beds, probably Vicksburg Eocene

a. Sea-level
b. Reef-level
c. Bench
d, *e*. Mountains

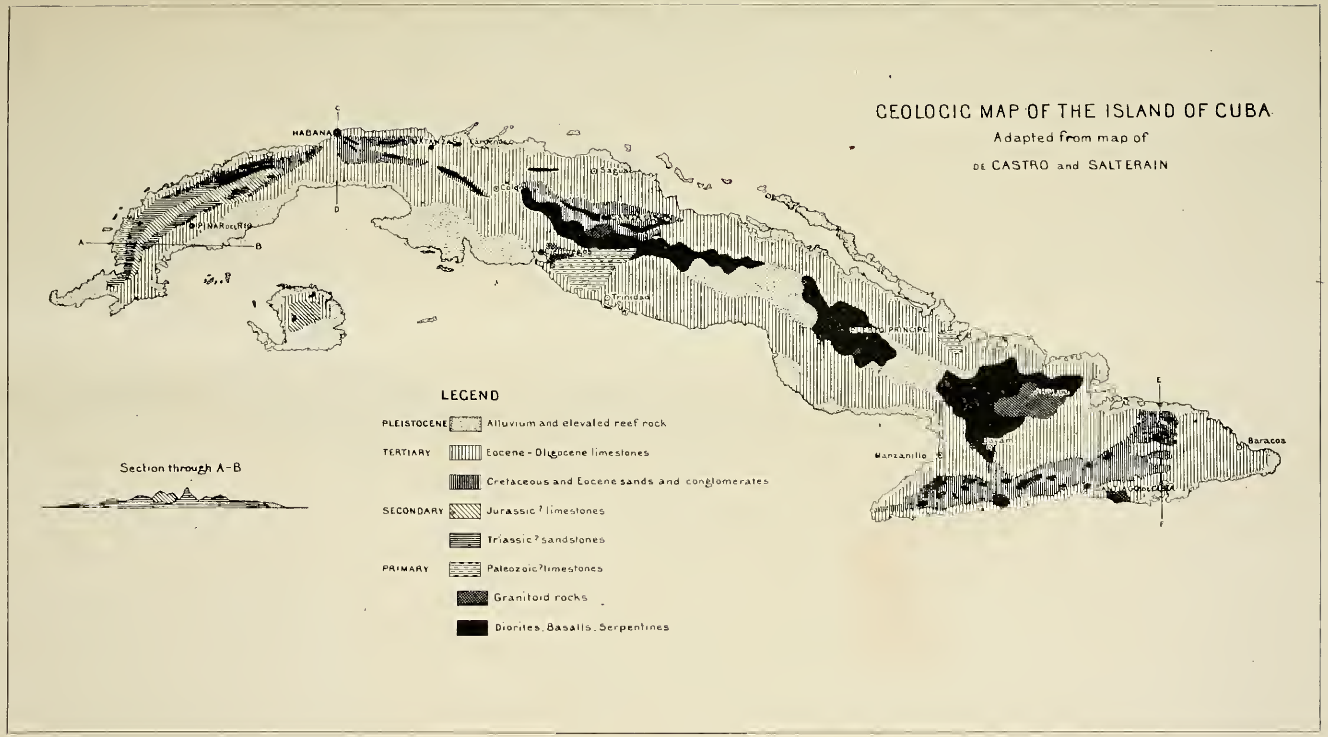
VALLEYS

In the more rugged eastern provinces there are many valleys of wide extent and great fertility. These are numerous also in Santa Clara and Puerto Principe. The most extensive of them, however, is that of the Rio Cauto in Santiago de Cuba. It is situated in a protected position between rugged eminences on the north and south and threaded by a navigable river. This valley is densely populated and has been one of the great strongholds of the present uprising.

By provinces the relief may be summarized as follows: Santiago de Cuba is predominantly a mountainous region of high relief, especially along the coasts, with many interior valleys. Puerto Principe and Villa Clara are broken regions of low mountain relief, diversified by extensive valleys. Matanzas and Habana are vast stretches of level cultivated plain, with only a few hills of relief. Pinar del Rio is centrally mountainous, with fertile coastward slopes.

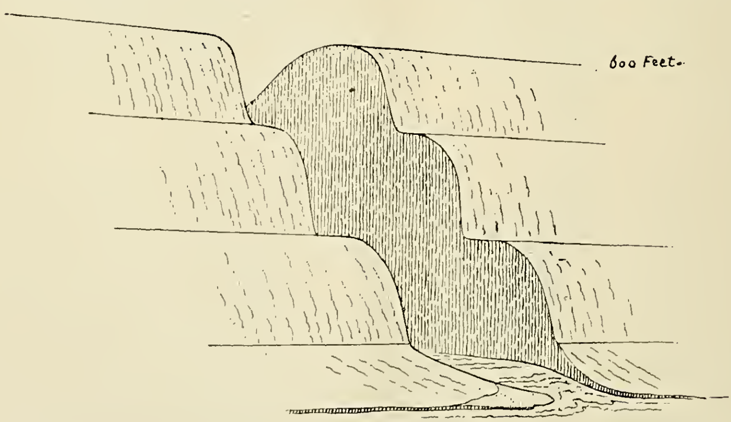
DRAINAGE

The drainage of Cuba is abundant, varying in character in different parts of the island. Considering the limited catchment areas, these streams are remarkably copious in volume. In the plains of the central and western provinces the streams flow from the central axis toward the corresponding coast and have opalescent waters, like those of the limestone springs of Texas and Florida. These streams run through widely sloping valleys, with only slightly indented streamways, and are remarkably free from lateral ramifications. Canyons are not developed until they reach the abrupt plateau edge of the north coast.

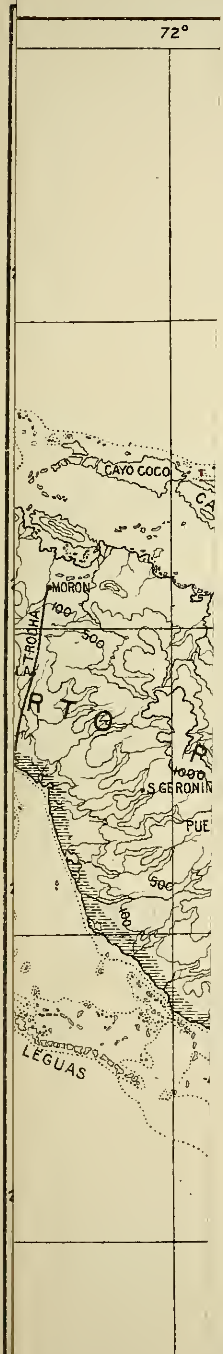

GEOLOGIC MAP OF THE ISLAND OF CUBA
Adapted from map of
DE CASTRO and SALTERAIN
HABANA
PINAR DEL RIO
Sagua
Colon
Trinidad
PRINCIPE
Manzanillo
Baracoa
A
B
C
D
E
F
LEGEND
PLEISTOCENE
Alluvium and elevated reef rock
TERTIARY
Eocene - Oligocene limestones
Cretaceous and Eocene sands and conglomerates
SECONDARY
Jurassic ? limestones
Triassic ? sandstones
PRIMARY
Paleozoic ? limestones
Granitoid rocks
Diorites, Basalts, Serpentines
Section through A-B

Many of the southward-flowing streams of this portion of the island do not reach the sea directly, but disperse into vast cienegas and swamps. Several of the stream valleys, like that of the Yumuri of Matanzas, are accompanied by some of the most restful and beautiful landscapes in the world. The Rio Armendaris, which nearly encircles Habana on the southward, affords that city an abundant supply of water. In this and other portions of the island where the limestone formation prevails, as in all the white limestone areas of the tropics, a large portion of the drainage is subterranean, accompanied by many remarkable caverns. The rivers Cuyajabos, Pedernales, Guanajay, Copellanias, San Antonio, and others along the south slope of Pinar del Rio disappear in limestone caverns, where they continue their seaward course. The falls of Rosario in this province are of great beauty, as also is an immense natural bridge.

In the province of Santiago and part of Puerto Principe the drainage is more complicated. The limestone plateaus of north and east Santiago de Cuba give rise to many rivers, the most remarkable of which are the Cabanas, the Yamanigacy, and the Moa, which in descending the escarpments of the high levels of the Toar disappear beneath the surface and reappear on a lower terrace, over the edge of which they are precipitated in cascades of 300 feet to the coast. Other streams of this region, such as the Yumuri of the east, find outlet through sharply cut canyons indenting the limestone cliffs of the back coast border. The central portion of this province is dominated by the Rio Cauto and its ramifications. This is the longest river on the island, and



MOUTH OF THE YUMURI OF THE EAST, NEAR BARACOA, SHOWING ELEVATED TERRACES



72°
CAYO COCO
MORON
LA TROCHA
S. GERONIMO
LEGUAS
72°


CUBA
COMPILED FROM BEST KNOWN AUTHORITIES
BY ROBERT T. HILL
SCALE 0 5 10 20 40 60 MILES
1898
H. S. SELDEN, DEL.
ISLE DE PINOS
CAPE ANTONIO
GULF OF BUENA ESPERANZA
DOCE LEGUAS
BANCOS DE LOS JARDINES Y JARDINILLOS
ZAPATA SWAMP
MATANZAS
SANTA CLARA
HABANA
NUEVITAS
MANZANILLO
BAYAMO
GUANTANAMO

flows in a westerly direction for a distance of 150 miles, draining the wide and fertile valley to which its name is applied. This stream is navigable for small boats for a considerable distance (80 to 100 miles), but its mouth has been obstructed by bars.

FLORA

The surface of the island is clad in a voluptuous floral mantle, which, from its abundance and beauty, first caused Cuba to be designated the Pearl of the Antilles. In addition to those introduced from abroad, over 3,350 native plants have been catalogued. Humboldt said, "We might believe the entire island was originally a forest of palms, wild limes, and orange trees." The flora includes nearly all the characteristic forms of the other West Indies, the southern part of Florida, and the Central American seaboard. Nearly all the large trees of the Mexican Tierra Caliente, so remarkable for their size, foliage, and fragrance, reappear in western Cuba. Over 30 species of palm, including the famous royal palm (*Oreodoxa regia*), occur, while the pine tree, elsewhere characteristic of the temperate zone and the high altitudes of the tropics, is found associated with palms and mahoganies in the province of Pinar del Rio and the Isle of Pines, both of which take their names from this tree.

Among other woods are the lignum vitæ, granadilla, the cocoa wood, out of which reed instruments are made, mahogany, and Cedrela odorata, which is used for cigar boxes and linings of cabinet work.

Although 300 years of cultivation have exterminated the forests from the sugar lands of the center and west, it is estimated that in the hills of those districts and the mountains of the east nearly 13,000,000 acres of uncleared forest remain.

Rich and nutritious grasses are found throughout the island, affording excellent forage for stock. The pineapples, manioc, sweet potato, and Indian corn are indigenous to the island. When the flora of Cuba is studied geographically, it will doubtless be divided into several subdivisions.

CLIMATE

Climatologic records are not available, except for Habana, and these are not applicable to the whole island, where it is but natural to suppose that the altitudes and position of the high mountains produce great variations in precipitation and humidity,

AVENUE OF PALMS ON SUGAR ESTATE — MATANZAS such as are observable in adjacent islands. The Sierra Maestra probably presents conditions of temperature very nearly the same as the Blue mountains of Jamaica, where the thermometer at times falls almost to the freezing point.

Everywhere the rains are most abundant in summer, from May to October—the rainy season. As a rule, the rains, brought by the trade winds, are heavier and more frequent on the slopes of the eastern end. At Habana the annual rainfall is 40 inches, of which 28 inches fall in the wet season. This rainfall is not excessive, being no greater than that of our eastern states. The air at this place is usually charged with 85 per cent of moisture, which under the tropical sun largely induces the rich mantle of vegetation. The average number of rainy days in the year is 102. There is but one record of snow having fallen in Cuba, namely, in 1856.

At Habana, in July and August, the warmest months, the mean temperature is 82° Fah., fluctuating between a maximum of 88° and a minimum of 76° ; in the cooler months of December and January the thermometer averages 72°, the maximum being 78°, the minimum 58° ; the mean temperature of the year at Habana, on a mean of seven years, is 77° ; but in the interior, at elevations of over 300 feet above the sea, the thermometer occasionally falls to the freezing point in winter, hoar frost is not uncommon, and during north winds thin ice may form. The prevailing wind is the easterly trade breeze, but from November to February cool north winds (*los nortes*, or "northers")—the southern attenuation of our own cold waves—rarely lasting more than forty-eight hours, are experienced in the western portion of the island, to which they add a third seasonal change. From 10 to 12 o'clock are the hottest hours of the day ; after noon a refreshing breeze (*la virazon*) sets in from the sea. In Santiago de Cuba the average is 80° ; that of the hottest month is 84° and that of the coldest 73°.

The whole island is more or less subject to hurricanes, often of great ferocity. The hurricane of 1846 leveled nearly 2,000 houses in Habana and sank or wrecked over 300 vessels. In 1896 the banana plantations of the east were similarly destroyed. Earthquakes are seldom felt in the western districts, but are frequent in the eastern.

All in all, the climate of Cuba is much more salubrious than it has been painted. The winter months are delightful—in fact, ideal—while the summer months are more endurable than in most of our own territory. The current impressions of insalubrity have arisen from an erroneous confusion of bad sanitation with the weather. While it is true that sickness follows the seasons, the former would be greatly allayed—almost abated—if public hygiene received proper official consideration.

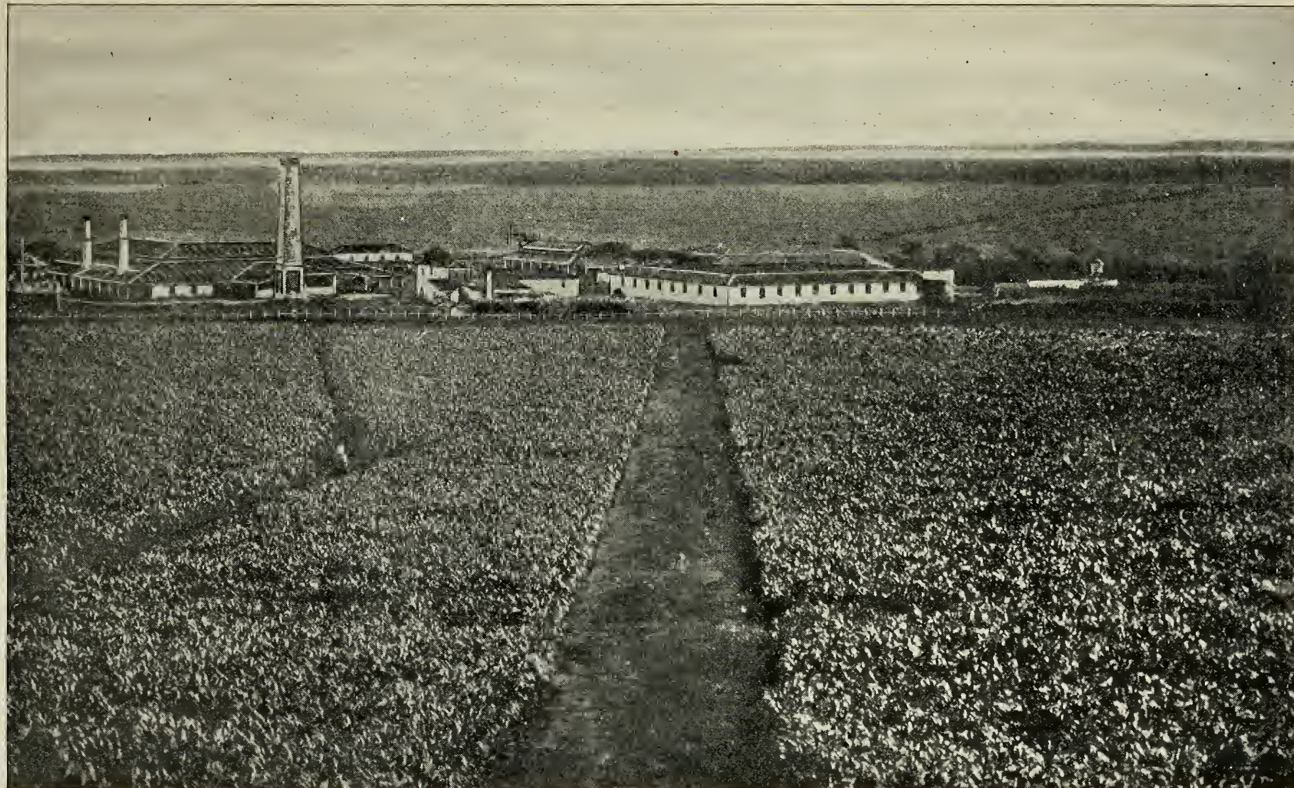
AGRICULTURE

The principal products of Cuba in time of peace are agricultural, and consist of sugar-cane, tobacco, coffee, bananas, corn, oranges, and pines, in the order named. The raising of sugar-cane overwhelmingly preponderates and heretofore has been the mainstay of the island. This industry originated in 1523, when a loan of 4,000 piastres to each person wishing to engage in it was made by King Philip I. The whole of the vast central plain and much of the region from the Cauto westward to Pinar del Rio, except where broken by hills, is one continuous field of cane, which yielded in 1892–93 1,054,214 tons, valued at $80,000,000, besides giving employment to large commercial and transportation interests. The sugar plantations vary in extent from 100 to 1,000 acres, and employ an average of one man to two acres.

The Cuban sugar lands are all upland soils, quite different from the lowlands of Louisiana, and excel in fertility those of all the other West Indies, the cane requiring to be planted only once in seven years, instead of every year, as in Antigua. The machinery of the estates up to the outbreak of the present revolution was the finest and most modern in the world. According to statistics elsewhere presented, this industry has been almost destroyed within the last three years.

Tobacco, while secondary to sugar, is far more profitable in proportion to acreage. This product grows well in all parts of the island, but the chief seat of its cultivation is along the southern slopes of the Cordillera de las Organos, in Pinar del Rio—the famous Vuelta Abajo region, which produces the finest article in the world. Good tobaccos are also exported from Trinidad, Cienfuegos, and Santiago.

In addition to the growth of the leaf, there are dozens of large cigar factories in Habana, giving employment to thousands of people of both sexes and all ages. In 1893 6,160,000 pounds of leaf tobacco and 134,210,000 cigars were exported. Large exports of baled tobacco are also made from the east end of the island, most of which is sent to the United States.



TYPICAL PLAIN — CENTRAL CUBA

Coffee was once extensively exported, but the trees have been mostly cut down and replaced with sugar-cane, in consequence of the greater profitableness of that product. The mountain sides and hill lands of the east are especially favorable for coffee, and a quality as excellent as that of the famous Blue mountain coffee of Jamaica can be readily grown. If the island should ever pass from Spanish hands, this will become a large and flourishing industry. There is still a considerable quantity of coffee grown, but it is nearly all consumed locally.

At the beginning of the present revolution the growing of bananas was a large and important industry, chiefly in the vicinity of Nuevitas and Baracoa, at the eastern end of the island. During the season, from February to December, an average of a ship load a day was exported from Baracoa. This fruit was the largest and finest received in the United States. It was grown upon mesas and plateaus, and let down over the precipitous cliffs by wire trolleys.

Capt. John S. Hart, of Philadelphia, who had large investments in this business and was one of the largest importers of the fruit into the United States, finding his business destroyed by the outbreak of the revolution, promptly turned his ships into filibusters, and after landing many cargoes of arms and ammunition was eventually tried and convicted in a United States court, and is now confined in the Eastern penitentiary, at Philadelphia.

Oranges of delicious flavor grow spontaneously in all parts of the island. No attention is paid to their culture for exportation, however. Pineapples are grown and exported in western Cuba and the Isle of Pines. If the island belonged to the United States, it would undoubtedly become one of the greatest fruit-growing countries. Mahogany and logwood are also exported in small quantities.

In the provinces of Santa Clara, Puerto Principe, and Santiago the cattle industry, owing to the fertile grazing lands, reaches large proportions, the product being large and fine animals of Spanish stock. Horses are also bred in all parts of the island. The Cuban horse is a stout pony descended from Andalusian stock, with the build of a cob and a peculiar pacing gait which renders it an exceptionally easy riding animal. Goats and sheep do not flourish in Cuba, the wool of the latter changing into a stiff hair like that of the former. Poultry flourishes everywhere and was abundant in all markets.

In addition to the large estates of the planters, the island possesses many small farms of less than 100 acres, devoted to products for which there is a demand in the local markets. In 1895 there were over 100,000 farms, ranches, and plantations, valued at $20,000,000.

MINERALS

The mineral resources of the island are iron ores, asphaltum, manganese, copper, and salt. A little gold and silver were mined in past centuries, but never in large quantities. The silver mines of Santa Clara yielded in 1827 140 ounces to the ton, but were soon worked out. The iron mines situated in the mountains a few miles east of Santiago de Cuba are of importance. The production of the Juragua Iron Company in 1890 was 362,068 tons, and constituted one-fourth of the total importation of iron ores into the United States for the same period. These mines were owned by an American company, which had invested extensive capital in them, but the production has been almost destroyed by the present revolution. The ores are mineralogically peculiar, being the result of replacement in limestone. They are mixed brown and red hematite (turgite).

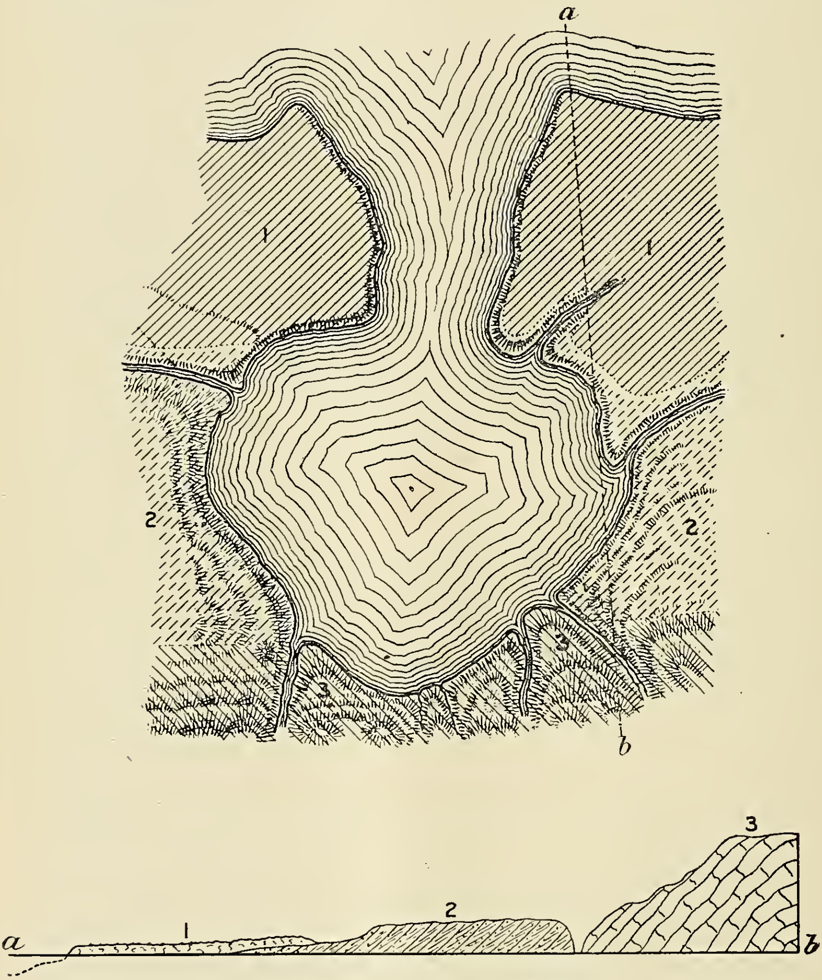
Asphaltum (chapatote) of unusual richness occurs in several parts of the island, in the beds of late Cretaceous and early Eocene age. At Villa Clara occurs an unusually large deposit of this material, which for forty years has supplied the material for making the illuminating gas of the city. American investors bought these mines the year preceding the revolution, and their investment up to date, which would otherwise have been profitable, has proved a total loss.

Copper of extraordinary richness has been worked on the leeward side of the Sierra Maestra range, 12 miles from Santiago de Cuba. In former years these mines yielded as high as 50 tons per day. Current report asserts that they are still very valuable, but are awaiting the return of peace and development. Salt of great purity is found in the cays adjacent to the north coast.

No manufacturing industries except those of tobacco and sugar have been encouraged, the persistent policy of Spain having been to promote the importation of manufactured articles from the mother country. In the writer's travels over the island only a single industrial establishment was seen, namely, a mill at Baracoa for extracting oil from cocoanuts and making soap.

HARBORS

The narrowness of the island and the abundance of good harbors make nearly all parts of it convenient to maritime transportation. Perhaps no country in the world is so blessed with harbors. Not only are they very numerous, but many of them are excellent and afford convenient outlets for the products of



GEOLOGY OF MATA BAY, A TYPICAL HARBOR

1. Elevated reef-rock forming entrance to harbor
2. Yellow beds of Bowden formation
3. Hard white limestones (Vicksburg)

the island and easy access for oceanic and coastal transportation. These harbors are nearly all pouch-shaped inlets indenting the coast, with narrow outlets pointed by elevated reef rock and capable of accommodating large numbers of vessels. They are so conveniently situated as regards different portions of the island that the trade of Cuba may be said literally to pass out at a hundred gates. The chief of these harbors are Habana, Matanzas, Nuevitas, Gibara, Nipe, and Baracoa, on the north coast, and Guantanamo, Santiago de Cuba, Manzanillo, Trinidad, and Cienfuegos, on the south. The last mentioned is said to be one of the finest harbors in the world. Habana, Cienfuegos, and Santiago are regularly visited by American and Spanish steamers, while coastal steamers circumnavigate the island, touching at the minor ports, which are also sought by many tramps and sailing vessels in search of cargoes.

SHIPPING

The shipping trade, both foreign and coastal, is extensive, the American tonnage alone amounting to 1,000,000 per annum. About 1,200 ocean vessels, steam and sail, annually clear from Habana, while the sugar crop finds an outlet at all the principal ports. Lines of steamers coast the island, the north coast being served by lines from Habana and the south by lines from Batabano, the southern entrepot of Habana. The tonnage of Habana and eight other ports for 1894 amounted to 3,538,539 tons, carried by 31,181 vessels.

RAILWAYS

The railways aggregate less than 1,000 miles of line, and consist principally of the united system of Habana, extending through the tobacco and sugar districts of the west and center, and connecting the capital with Matanzas, Pinar del Rio, Batabano, Cienfuegos, and Sagua, the system terminating at Santa Clara, 150 miles east of Habana. The entire half of the island east of Cienfuegos and Sagua is dependent upon water communication, although several short local lines extend interiorward from Nuevitas, Remedios, and Santiago.

There were about 2,810 miles of telegraph line in 1895, including nearly 1,000 miles of cable, connecting the cities of the south coast and the Isle of Pines with Habana, via Batabano.

HIGHWAYS

Good highways are both short and few. In past centuries a few good roads were established of the class called Camino el Rey (the King's highway), leading from Habana into Pinar del Rio and from a few interior cities to their entrepots. Aside from these roads, which were absolute necessities, the government has constructed no highways leading into the country through or around the island, and hence inland communication is much impeded. Had a more far-sighted policy of road construction been undertaken, such as has been carried out by England in the adjacent island of Jamaica,* Spain would have been in no danger of losing her colony, the lack of good military roads having been one of the factors which have made possible the success of the present revolution.

Although Cuba is so situated geographically as to command the commerce of the entire American Mediterranean, trade and communication with the adjacent regions, other than Mexico, have neither been cultivated nor encouraged. To reach any of the adjacent islands, such as Haiti or Jamaica—each less than 100 miles distant—it is usually necessary for the Cuban to proceed first to New York and thence to his destination. A perpetual quarantine appears to exist against the island on the part of all its neighbors. The completeness with which Cuba is isolated commercially is illustrated by the fact that not even the Habana cigar, the most far-reaching of its products, can be found in a single Caribbean city.

CITIES

Habana, which bears upon its escutcheon "Llave del Mundo," the "Key of the New World," is the political capital and principal city of Cuba. It is situated mainly on the west and south sides of a capacious harbor and surrounded by eminences rising to 150 feet in height. It is a picturesque and beautiful place, presenting, even in the midst of the most horrible tragedy of the centuries, the gay appearance of a European city. In fact, in population, interest, customs, and dominant political feeling the city (being the seat of the foreign government which rules the island) is thoroughly Spanish, and in this sense is entirely

*Jamaica, while only one-tenth the size of Cuba, possesses over 2,000 miles of superb highway, affording easy communication to every part of the island.

MATANZAS BAY

unrepresentative of the local customs and sentiments of provincial Cuba. Its commerce is ordinarily enormous, while large pleasure drives, parks, clubs, and public institutions give it picturesque variety. Conspicuous among notable objects are the wharves, fortifications, hospitals, the university, the botanical garden, government palaces, and several churches, including the cathedral, which claims to possess, like Santo Domingo, the remains of Columbus. This city was founded early in the 16th century (about 1519) nearly 100 years before the first colonization of our seaboard. Until recently it was badly supplied with water, and its sewerage is still abominable. In 1895 a modern system of waterworks was installed by New York engineers, who also prepared plans for the solution of the sewerage problem.

The foreign trade of Habana amounts to $50,000,000 yearly, and is chiefly carried on by American steamers. From the city radiate several lines of railway, which bring to it the products of the interior. The only cable connection with the United States is made here.

West of Habana there are several small ports, such as Mariel, Cabanas, and Bahia Honda, which are similar in their formation to that of Habana, but are places of secondary importance. South and east of the city were flourishing places, the largest of which is Guanabacoa, crowning a hill which commands a fine panoramic view of the capital, its roadsteads and environments.

Habana has easy access to the south coast by rail, terminating at the miserable village of Batabano, 25 miles distant, which is an entrepot for the city. Here the coastal cable from Santiago touches and from this point radiate various lines of steamers along the coast and to the Isle of Pines.

The second city and seaport of central Cuba is Matanzas, about 75 miles east of Habana. This city was founded in 1693. It is the chief outlet for that part of the sugar region which stretches south and east toward Cardenas, and which includes the most fertile lands in Cuba. The harbor, like many others, through the *laissez faire* policy of the Spanish government, has been allowed to fill with sediment, and hence the larger steamers are obliged to load in the roadstead.*

Cardenas, founded in 1828, is one of the few towns of Cuba which can boast of having been born in this century. It lies on

* In view of the strategic importance which Matanzas is assuming in the campaign which has opened since this article was written, the several illustrations given of this vicinity will prove of interest.

MATANZAS BAY AND YUMURI VALLEY

a spacious bay sheltered by a long promontory. It is one of the principal sugar-exporting places of Cuba, and is connected by rail with Habana, and by regular steamers with all the coast towns.

East of Cardenas for a considerable distance life and industry are shifted from the northern to the southern seaboard toward Cienfuegos and Trinidad.

Cienfuegos is a modern place, situated on a magnificent harbor. Although surveyed by Ocampo in 1508 and spoken of by Herrera as a haven unrivaled in the world, the town was only settled in 1819 by refugees from Santo Domingo. Within the past twenty years its port has increased enormously. It is now the second seaport in the island.

Trinidad, to the east of Cienfuegos, dates from the first years of the conquest, and has no fewer than three harbors and an excellent roadstead. It suffered largely from the incursions of the French and English buccaneers. The city has a picturesque setting, surrounded by high hills and mountains.

East of Trinidad, which is near the central meridian of the island, important cities begin to appear in the interior, such as Santa Clara, Esperanza, Puerto Principe, and Holguin. These places are the most truly Cuban and representative in their population of any towns on the island.

Santa Clara is a beautiful city, dating from previous centuries, and surrounded by charming scenery. It possessed, the year before the revolution, a cultured creole* population. The insurrection has raged most fearfully around this place, and it is probable that its most representative people have been largely driven away or destroyed.

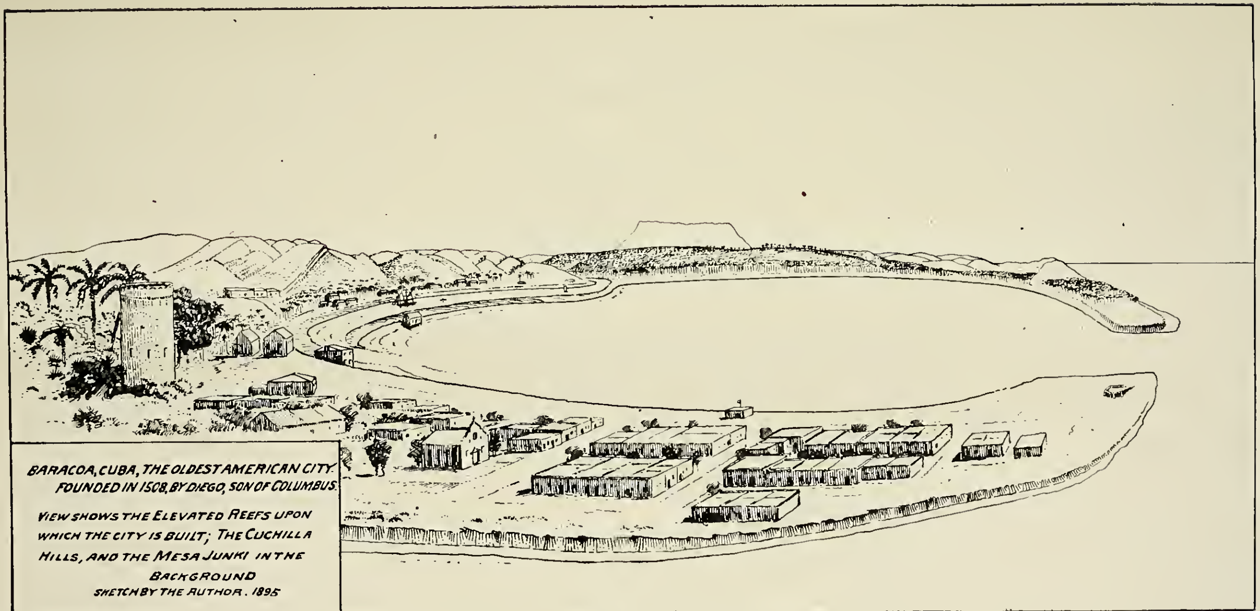
Camaguey, as the Cubans call the town, or Puerto Principe, as it is officially designated, although remote from the seacoast, is the chief interior city of Cuba, and claims to be the most creole of Cuban towns. The city lies on a plain about midway between the two coasts, and is connected by rail with Nuevitas to the northeast.

In the basin of the Cauto, Bayamo is the principal place. This is a very old town, which was founded on a southern affluent of the main stream during the first years of the conquest. It was at Yara, a little southwest of this place, that the great republican rising took place in 1868. The next year, when the Spanish troops made their appearance, the inhabitants themselves set fire to their houses. During the present revolution Bayamo has been an important stronghold. Holguin, lying to the northward of the Cauto, is also an important city of this portion of Cuba.

Returning to the northern seacoast, several important points remain to be described east of the central meridian of the island. Without considering the innumerable smaller landings, the principal towns are Nuevitas, Padre, Gibara, Banes, Nipe, and Baracoa. These are all antique and interesting places, possessing many old ruins and fortifications. Baracoa, the easternmost port of the north coast of the island, is of historic interest, inasmuch as it is the oldest continuous settlement of the New World, having been settled by Diego Columbus, the son of Christopher, in the year 1511.† The inhabitants still point with pride to the ruins of his house. It will also go down in history as the point near which, on the 25th of February, 1896, Antonio Maceo and his valiant band of nineteen followers, by a most daring and successful landing, started the present revolution, and from which within a year's time he marched to the western extremity of the

* The word creole, as used in this paper, means white descendants of the Latin races. The impression on the part of some people that the word implies a mixture of negro blood is an ignorant and, to the creole, an insulting mistake.

† In the illustration the date is erroneously given as 1508.



BARACOA, CUBA, THE OLDEST AMERICAN CITY. FOUNDED IN 1508, BY DIEGO, SON OF COLUMBUS.

VIEW SHOWS THE ELEVATED REEFS UPON WHICH THE CITY IS BUILT; THE CUCHILLA HILLS, AND THE MESA JUNKI IN THE BACKGROUND

SKETCH BY THE AUTHOR. 1895

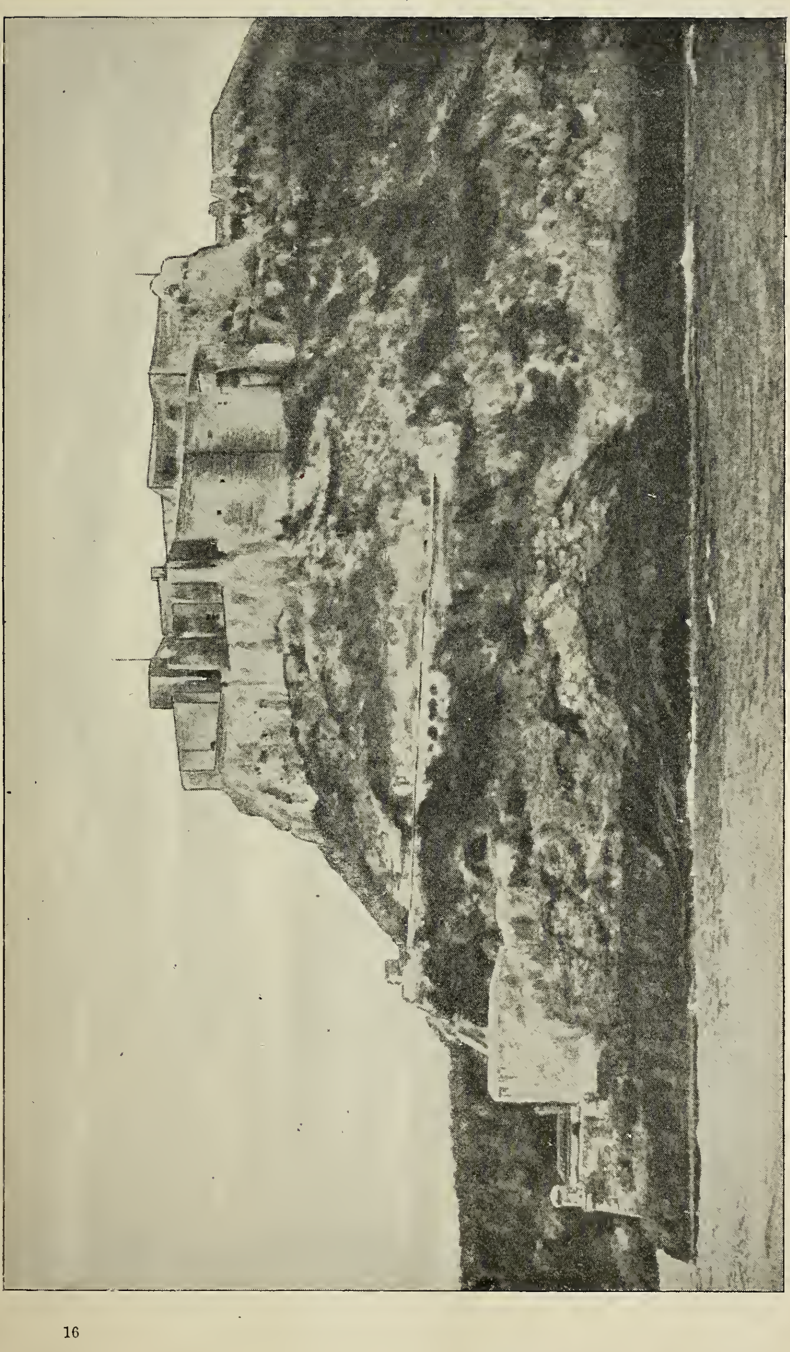
island, winning battle after battle, and was only checked by treachery and assassination. Baracoa at the beginning of the present revolution was again becoming an important commercial city, being the seat of the banana and cocoanut trades.

Returning again to the south side of the island, there are three ports of importance east of Trinidad, and these are all situated on the south or west coast of the Sierra Maestra peninsula. The westernmost of these is Manzanillo. This is the chief outlet of the fertile valley of the Cauto. Since the close of the ten years' revolution and up to the recent outbreak it was acquiring an increasing trade in tobacco, sugar, wax, honey, and other produce.

Santiago, as it is called by the Americans, Saint Jago or simply Cuba by the natives, is a port second only to Habana in strategic and political importance. It is the capital of the eastern department as well as its most flourishing seaport. It is located on one of the many pouch-shaped harbors which outlet to the sea through a narrow gateway, like that of Habana, but with an entrance dotted by many islands with handsome villas. At its narrowest part this outlet is only 180 yards wide, but it gives access to a magnificent basin, with many indentations, large enough to accommodate all the shipping of the island. Its many-colored structures, promenades, gardens, and superb prospects over the valley make Santiago one of the most marvelous cities of the Antilles. The town is well fortified and has been practically the only stronghold of the Spanish authorities in eastern Cuba during the present revolution. Back of the city the overtowering cliffs of the Sierra Maestra separate it from the interior. Several lines of railroad run from the city to the iron mines, 16 miles east, where Pennsylvania capitalists were employing nearly 2,000 hands at the date of the recent outbreak. The city is the telegraphic center from whence radiate the submarine coastal cables of the island for the western department, Mexico, Jamaica, South America, Haiti, Porto Rico, and the Lesser Antilles.

INHABITANTS

Perhaps there is no question upon which the American people are so ill informed as upon that of the population of Cuba. It is impossible to obtain accurate statistics, owing to the fact that no reliable census has been taken by the government for many decades. All figures which may be presented are merely estimates, and great variation is found in those given by different authorities.



OLD FORTIFICATION AT ENTRANCE TO SANTIAGO DE CUBA

The latest census of Cuba, published December 31, 1887, gives the population as follows:*

Provinces.	Area, sq. klms.	White.	Colored.	Total.	Pr. ct. of col'd race.	Density.
Habana	8,610	344,417	107,511	451,928	24	52.49
Pinar del Rio	8,486	167,160	58,731	225,891	26	26.62
Matanzas	14,967	143,169	116,409	259,578	45	17.34
Santa Clara	23,083	244,345	109,777	354,122	31	15.34
Puerto Principe	32,341	54,232	13,557	67,789	20	2.10
Santiago de Cuba	35,119	157,980	114,399	272,379	42	7.76
Total	122,606	1,111,303	520,384	1,631,687		
				Average.	32	13.31

The population of the principal towns has been estimated as follows:

	Towns.	Population.		Towns.	Population.
West	Habana	198,720	Central	Puerto Principe	46,640
West	Guanabacoa	29,790	Central	Cienfuegos	27,430
West	Regla	11,280	Central	Santo Espiritu	32,600
West	Matanzas	27,000	Central	Trinidad	27,640
West	Pinar del Rio	21,770	East	Santiago	71,300
West	Colon	20,400	East	Holguin	34,760
West	Cardenas	23,680	East	Manzanillo	23,200

Few realize the important fact that environment is quite as potent a factor as racial or political conditions in producing the social status, and nowhere is this great principle more plainly exemplified than in the West Indies and tropical mainlands, where adjacent islands present most striking contrasts in the character and conditions of their populations. The Antiguans, Barbadians, Barbudans, Martiniques, Jamaicans, Haitians, and Cubans are socially and racially as distinct from each other as are the inhabitants of the great countries of Europe. Were it not for the facts of history, one would believe that each population was indigenous to its habitat, instead of having been transplanted from the Old World within four centuries.

Nowhere are these distinctions more apparent than in the four Antilles themselves, especially as seen in the islands of Cuba,

* Published in No. 3, vol. XI, of the Revista de Cuba.

Haiti, and Jamaica, the people of which have hardly one trait in common.

Cuba and Porto Rico are the only two tropical islands where the white race has become thoroughly acclimated, and Cuba alone contains ten times more whites of Spanish stock than all the British West Indies contain whites of English stock.

FOREIGNERS

Of the total population of Cuba about 30,000 are Chinese male laborers. The Spanish born, not counting the present army of invasion, probably do not exceed 30,000, while counting all others there are not over 50,000 Caucasian foreigners. This foreign population, except the Chinese, is engaged in office-holding, trade, and shipping, and is largely confined by residence to the cities, which contain fully one-third of the total population. These foreigners, having no other interest in the welfare of the country than gain of wealth, and possessing no intention of permanent residence, should not be considered in any manner as representative of the Cuban people, although, alas, their voice has, in recent political events, almost drowned that of the true inhabitants.

To the Cubans the foreign Spaniards are known as Intransigentes, and between the two classes, the governors and the governed, owing to the despotism of the former, a bitter hatred has existed since 1812, and has been more strongly accentuated since the surrender of Zanjon, in 1876, when the rebellious Cubans laid down their arms under unfulfilled promises of autonomy and local self-government similar to schemes lately presented.

THE CUBANS

Seventy-five per cent of the native population of the island is found outside of the Spanish capital of Habana, which, being the seat of an unwelcome foreign despotism, is no more representative of Cuban life or character than is the English city of Hong-Kong of the rural Chinese. While the Habanese have had the freest communication with the United States during the last three years of the revolution, Americans have had little opportunity to hear from the true white Cuban population. The Cubans are mostly found in the provinces and provincial cities, especially in Pinar del Rio and the eastern provinces of Santa Clara, Puerto Principe, and Santiago. Although of Spanish

YUMURI CANON, BACK OF MATANZAS CITY

blood, the Cubans, through adaptation to environment, have become a different class from the people of the mother country, just as the American stock has differentiated from the English. Under the influence of their surroundings, they have developed into a gentle, industrious, and normally peaceable race, not to be judged by the combativeness which they have developed under a tyranny such as has never been imposed upon any other people. The better class of Camagueynos, as the natives are fond of calling themselves, are certainly the finest, the most valiant, and the most independent men of the island, while the women have the highest type of beauty. It is their boast that no Cuban woman has ever become a prostitute, and crime is certainly almost unknown among them.

While these people may not possess our local customs and habits, they have strong traits of civilized character, including honesty, family attachment, hospitality, politeness of address, and a respect for the golden rule. While numerically inferior to the annual migration of Poles, Jews, and Italians into the eastern United States, against which no official voice is raised, they are too far superior to these people to justify the abuse that has been heaped upon them by those who have allowed their judgment to be prejudiced by fears that they might by some means be absorbed into our future population.

Notwithstanding the disadvantages under which the Cubans have labored, they have contributed many members to the learned professions. To educate their sons and daughters in the institutions of the United States, England, and France has always been the highest ambition of the creoles of Cuba and Porto Rico. The influence of their educated men is felt in many countries, the most distinguished professor of civil engineering, two leading civil engineers of our navy, and the most eminent authority on yellow fever in our country belonging to this class. Thousands of these people, driven from their beloved island, have settled in Paris, London, New York, Mexico, and the West Indies, where they hold honorable positions in society, and even the exiles of the lower classes, with their superior agricultural arts, have been eagerly welcomed in countries like Jamaica, Mexico, and Florida, which hope to share with Cuba the benefits of its tobacco culture.

These are the people who are the leaders of the movement for Cuba Libre and who struggled so valiantly to throw off the yoke of an inferior governing class. No cause in all history has been more just than theirs, no self-sacrificing heroism greater, and yet the world, during all the agitation of the past three years, has known little of them, so completely have they been cut off from communication, while such little as has been heard has had to find its outlet through the stronghold of their enemies.

THE NEGROES

In addition to the white creole population, 32 per cent are black or colored—using the latter word in its correct signification, of a mixture of the black and white. This black population of Cuba has been as little understood in this country as has been the creole, especially by those who have alleged that in case Cuba should gain her freedom the island would become a second Haiti. The black and colored people of the island as a class are more independent and manly in their bearing than their brethren of the United States, having possessed even before slavery was abolished on the island the four rights of free marriage, of seeking a new master at their option, of purchasing their freedom by labor, and of acquiring property. While the negro shares with the creole the few local rights possessed by any of the inhabitants, their social privileges are greater than here, although a strong caste feeling exists. Miscegenation has also produced many mulattoes, but race mixture is no more common than in this country.

The colored people of Cuba belong to several distinct classes. The majority of them are descendants of slaves imported during the present century, but a large number, like the negroes of Colombia and the maroons of Jamaica, come from a stock which accompanied the earliest Spanish settlers, like Estevan, the negro, who, with the two white companions of Cabeza de Vaca, first crossed the United States from the Gulf of Mexico to California in 1528–36. The amalgamation of this class in the past century with the Spanish stock produced a superior class of free mulattoes of the Antonio Maceo type, unlike any people in this country with which they can be compared.

The current expressions of fear concerning the future relations of this race in Cuba seem inexplicable. The slaves of the South were never subjected to a more abject servitude than have been the free-born whites of Cuba, for they at least were protected from arbitrary capital punishment, imprisonment, and deportation without form of trial, such as that to which all Cubans are

VILLAGE BETWEEN HABANA AND MATANZAS

still subjected, and the white race of this or any other country has furnished few more exalted examples of patriotism than the mulattoes Toussaint L'Ouverture or Antonio Maceo.

The experiences of the past have shown that there is no possibility of Cuba becoming Africanized without constant renewal by immigration. The 520,000 colored people, one-half of whom are mulattoes, represent the diminished survival of over 1,000,000 African slaves that have been imported. The Spaniards had the utmost difficulty in acclimatizing and establishing this race upon the island. While Jamaica and other West India islands are a most prolific negro-breeding ground, the race could not be made to thrive in Cuba.

Those persons who undertake to say what the social conditions of Cuba would be under independence should look elsewhere than to Haiti for a comparison. Even were the population of Cuba black, as it is not, the island of Jamaica would afford a much better contrast. This island, only about one-tenth the size of Cuba, is composed of mountainous lands like the least fertile portion of Cuba; has a population wherein the blacks outnumber the whites 44 to 1; yet, under the beneficent influence of the English colonial system, its civilization is one of which any land might be proud, possessing highways, sanitation, and other public improvements even superior to those of our own country, and such as have never been permitted by Spain in Cuba. Even though Cuba should become a second Haiti, which it could not, there is some satisfaction in knowing, in the light of historic events, that Haiti free, although still groveling in the savagery which it inherited, is better off than it would have been had Napoleon succeeded in forcing its people back into slavery, as he endeavored to do.

Another fact which will stand against the Africanizing of Cuba is that it is highly probable that nearly one-half of these 500,000 colored people have been destroyed during the present insurrection. A large number of them had but recently been released from the bonds of slavery, and were naturally the poorer class of the island, upon which the hardships have mostly fallen, being generally the field hands in the sugar districts of Habana, Matanzas, and Santa Clara, where the death rate of the terrible Weyler reconcentramiento has been greatest. Three hundred thousand of the 500,000 blacks belonged to these provinces, and of this number fully one-half have been starved to death. The population of Cuba has undergone great modification since the collection of the statistics given. What changes the deplorable conflict has wrought can only be surmised. Beyond doubt, however, the population has at least been reduced to a million inhabitants by emigration of non-combatants, destruction in battle, official deportation of suspects and political prisoners, and by the reconcentration.

The rural population of the four western provinces of Pinar del Rio, Habana, Matanzas, and Santa Clara has been totally obliterated. Estimates of this extermination are all more or less conjectural, but the Bishop of Habana is authority for the statement that more than 400,000 people have been buried in the consecrated cemetery.

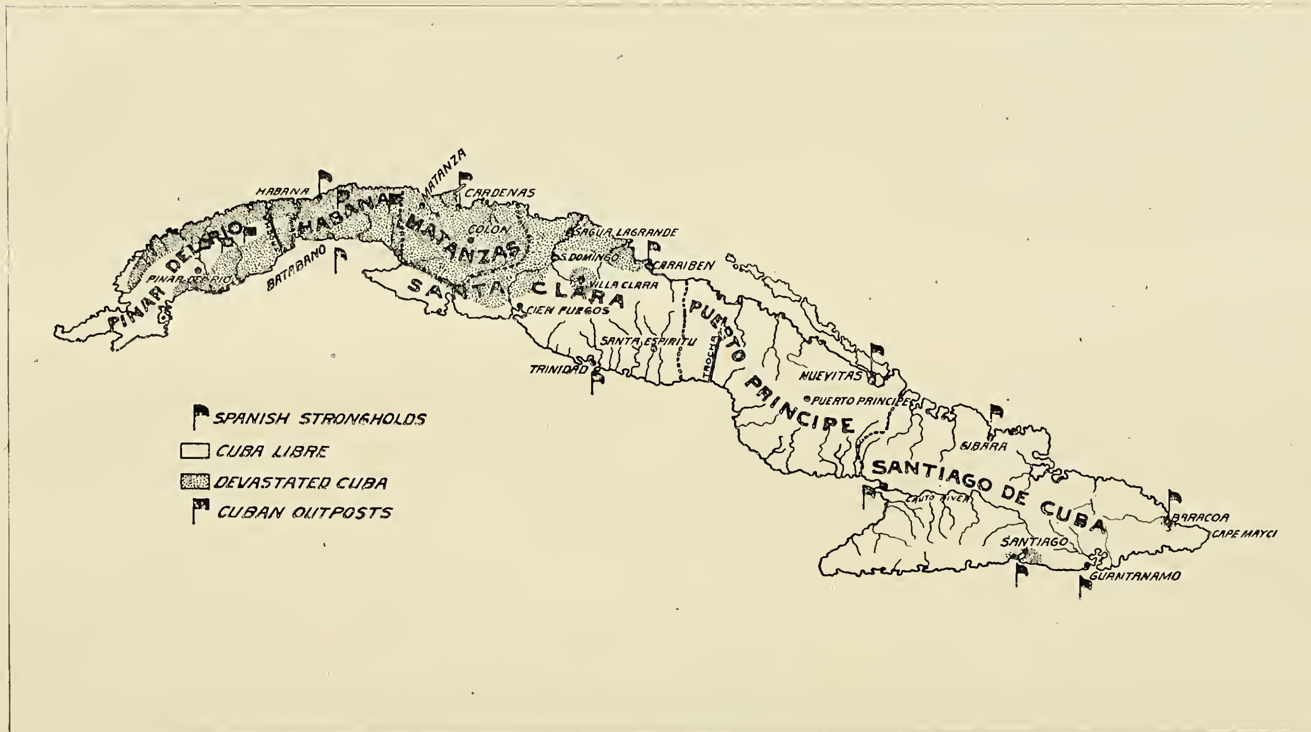
The shaded portions of the accompanying diagram show the depopulated portions of Cuba.

RELIGION AND EDUCATION

Cuba is divided into two dioceses, which are the archbishopric of Santiago de Cuba, containing 55 parishes, and the bishopric of Habana, containing 144 parishes. No Cuban-born priests are found in any church of importance. In the cathedral chapter at Habana there is only one Cuban, and only two natives have ever obtained any especial preferment—the miter never.

The same oppression obtains in the church as in the state, the former being used for base ends in thousands of instances, and against the protest of the authorities at Rome. While nominally Catholics, and so holding that church responsible for what they do, many Spaniards, in and out of Cuba, are very poor Catholics in fact, and they do hundreds of things which the church authorities by no means approve. For example, the Cuban native who becomes a Roman Catholic priest fares about as badly as does the Protestant preacher.

There is not a parish on the whole island that supports an endowed school. Recently there was a crusade against the civil marriage ceremony. The objection came because of the loss of fees to the priest. The crusade was led by the Spanish-born priest, who charges Cubans fees twice as high as he does Spaniards. Parishes are farmed out on account of profits—not by the church, but by the Spaniards. No priest gets these desirable parishes unless he happens to have been born in Spain. It is the Spanish blood that contaminates the church, and not the church that does the injury. It is partly the Spaniards' acts in introducing abuses into the church that brought about the pres-


SPANISH STRONGHOLDS
CUBA LIBRE
DEVASTATED CUBA
CUBAN OUTPOSTS
PINAR DEL RIO
HABANA
MATANZAS
SANTA CLARA
PUERTO PRINCIPE
SANTIAGO DE CUBA
PINAR DEL RIO
BATABANO
MATANZA
CARDENAS
COLON
SAGUA LAGRANDE
S. DOMINGO
CARAIBEN
VILLA CLARA
CIEN FUEGOS
SANTA ESPIRITU
TRINIDAD
TROCHA
NUEVITAS
PUERTO PRINCIPE
GIBARA
CAUTO RIVER
SANTIAGO
GUANTANAMO
BARACOA
CAPE MAYCI

ent insurrection. The insurgents are Catholics and love their church. The religious condition of the island is as bad as the political.

Education is still much neglected. The chief educational institutions are the Habana University, two professional schools, with meteorological observatories attached, one agricultural school, and two seminaries. There are several private as well as public schools, aggregating in all 750 institutions, with some 30,000 students and scholars.

The Habana University is modeled after the Spanish universities, and its curriculum is chiefly devoted to medicine, law, theology, and an obsolete system of philosophy. Its entire faculty was disposed of by imprisonment and banishment last year, while the students have always been looked upon with a suspicion of sedition. The public schools are decidedly few, most of the better Cubans patronizing the private institutions.

COURTS

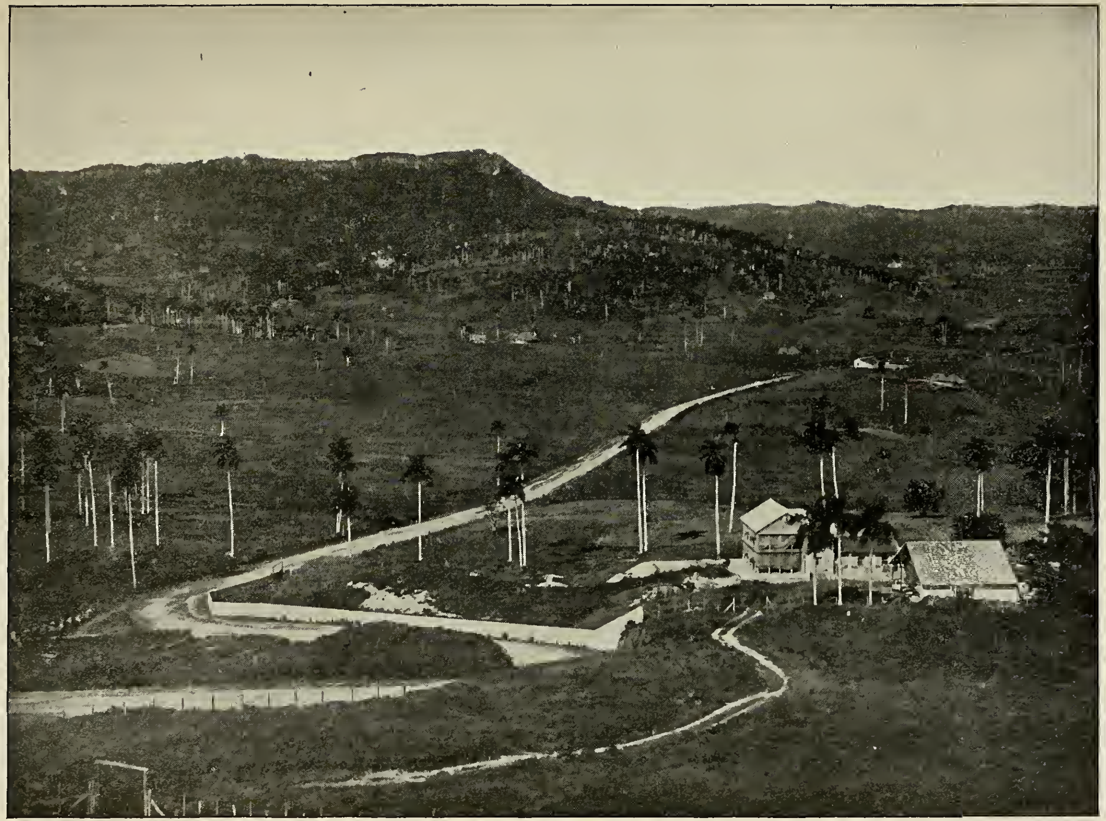
Cuba has two high courts; but the captain-general is above either court, as appears from the royal decree of June 9, 1878, defining his duties and prerogatives. His power not only overrules decisions of all the judicial authorities, including the justices of the court of judicature, but also enables him to withhold the execution of any order or resolution of the home government "whenever he may deem it best for the public interests."

ADMINISTRATION

Since its discovery Cuba has been a crown colony of Spain, occupying a relation to that country, so far as the absence of local self-government is concerned, comparable to that which Alaska occupies to this, but governed by military instead of civil authority. Some of the Spanish islands, like the Canaries and Balearics, are integral parts of the mother country, having equal rights with the people of the peninsula. Cuba, however, has ever been treated solely as a subordinate colony. The central and absolute authority of the crown has been represented by a governor, called the captain-general, controlling the land and sea forces and residing at Habana, and having the right of setting aside all judgments of the local courts. His authority has been backed, even in times of peace, by a Spanish soldiery larger than the army of the United States and with police powers unknown in this country. In addition to the army of soldiers, there is a vast horde of subordinate officials, all Spaniards, who collect the customs and attend to other minor executive duties.

The lower classes of the Habana male population—porters, draymen, and clerks—are organized into a dangerous and oftentimes uncontrollable military force, known as the volunteers, who, while never having been known to take the field, are a serious menace to the peace of the city, being feared equally by the authorities, over whose heads they wave the threat of mutiny, especially upon any indication of granting reforms, and by the resident and unarmed Cubans, over whom they hold the threat of massacre. Up to date the record of this organized mob has been a series of horrible crimes, such as shooting down a crowd of peaceable citizens as they emerged from the theater, firing into the office and dining-room of a hotel, assaulting the residences of Cuban gentlemen, and in 1871 forcing the authorities to execute 43 medical students, all boys under twenty, because one of them had been accused of scratching the glass plate on a vault containing the remains of a volunteer. Fifteen thousand volunteers witnessed with exultation this ignoble execution.

While the primary functions of the government have been to attend to the prerogatives of the Crown and the collection of revenues, its attention has been largely devoted to the personal enrichment of the officials through misfeasance and the prevention of the secession of the island. It has practically ignored the other functions of government, such as the collection of statistics, the promotion of education, and the establishment of public works and proper public sanitation. Few, if any, educational institutions have been erected at public expense; no public highways have been constructed, nor have any improvements of a public character been made outside of the city of Habana. Even when the Cubans have undertaken such improvements, they have been heavily taxed for the benefit of the Spanish officials. The administration of Cuba is and has been since the settlement of the island an absolute military despotism on the part of the mother country. At periods, dependent upon the personality of the captain-general, there have been epochs of peace and prosperity, but since the middle of the present century the island has been in a state of insurrection, dormant or eruptive, accompanied by a growing hatred between the governing and the governed classes, with constantly increasing restrictions upon the latter. At times the revolting people were reduced to subjection by promises of local self-government, which have invariably been broken.



THE YUMURI VALLEY, NEAR MATANZAS

During the present century the Spanish Crown has made various pretenses of giving to the inhabitants of the island greater political privileges, but all of these, down to the latest and present autonomy scheme, have been the merest subterfuges, void of the true essence of local self-government, with a string attachment by which absolute and despotic power remained in the hands of the Spanish governor-general. Thus it was that in February, 1878, the ten years' revolution was ended by General Campos. Under the stipulations of the treaty the island was allowed to be represented in the Spanish Cortes by 16 senators and 30 deputies; but restrictions were so thrown around their selection that Cubans were practically debarred from participating in the choice of these members, notwithstanding that these so-called representatives were utterly powerless to press any Cuban measure in the Cortes of over 900 members or to put it to a vote.

This military despotism has been accompanied by a system of exorbitant taxation, such as has never been known elsewhere in the world. This has included at times an average of 40 per cent on all imports, in addition to taxes upon real estate, the industries, arts, professions, the slaughtering of meats, and an odious system of stamp taxes, which even included in its far-reaching application the affixing of an impost stamp upon every arrival at a hotel. The processes of possible direct taxation being exhausted, the government even resorted to the establishment of a most nefarious and contaminating lottery system, which yielded a profit of $4,000,000 annually.

In 1879 the total revenue collected was about $35,000,000, or $25 per capita, all of which, except $98,000, was spent—mostly in the payment of the parasitic horde of intransigente soldiers and office-holders and the Spanish debt. In addition to the legal taxation, the commerce is burdened by a system of illegal taxation in the form of bribes, which are necessary to the securing of any legal action. Little or none of this money was devoted to education, science, public construction, harbor improvements, highways, sanitation, or other benevolent purposes, such as those to which our free government devotes its per capita tax of $13.65. It is also a remarkable fact, notwithstanding the extravagant taxation, that only about $100,000,000 have been remitted to the mother country during the past century, most of the revenue having been diverted to maintain the official classes. It is a common assertion that, with the exception of Martinez Campos, no captain-general has ever returned to Spain after a four years' intendancy except as a millionaire.

Above all the numerous edicts, decrees, customs, and police regulations, the fundamental law of the island is the will of the captain-general, enforced by the following decree of May 28, 1825, which is still in force:

"His Majesty, the King, our Lord, desiring to obviate the inconveniences which might result, in extraordinary cases, from a division of command, and from the interference of powers and prerogatives of the respective officers; for the important end of preserving in that precious island (Cuba) his legitimate sovereign authority and the public tranquillity, through proper means, has resolved in accordance with the opinion of his council of ministers to give to your excellency the fullest authority, bestowing upon you all the powers which by the royal ordinances are granted to the governors of besieged cities. In consequence of this His Majesty gives to your excellency the most ample and unbounded power, not only to send away from the island any persons in office, whatever be their occupation, rank, class, or condition, whose continuance therein your excellency may deem injurious, or whose conduct, public or private, may alarm you, replacing them with persons faithful to His Majesty, and deserving of all the confidence of your excellency; but also to suspend the execution of any order whatsoever, or any general provision made concerning any branch of the administration, as your excellency may think most suitable to the royal service."

Under this law, which has been utilized with terrible effect, misfeasance has developed beyond description and freedom has been a mockery. Year after year the least liberty of thought or expression of opinion or suspicion of liberal ideas on the part of the individual or the press has resulted in imprisonment, death, or deportation. Furthermore, the elsewhere obsolete punishment of torture has added horror to the cruelty of this edict. In 1844 over 3,000 people were executed under this law. During the ten years' war it is estimated that fully 20,000 people suffered its enforcement. The official records show that 4,672 people were executed during the first half of that war. The first act of the Spaniards upon the outbreak of the present revolution was to arrest, imprison, deport, shoot, or otherwise punish every man who was suspected of disloyalty. This class included all who were suspected of liability to become revolutionary sympathizers, such as the leading men of the learned professions—doctors, lawyers, editors, and the faculty of the University—who during the past three years have been imprisoned in the dungeons of Ceuta, Africa, where 730 leading Cuban citizens are now confined, or upon the Isle of Pines. Many women were similarly treated. This process is still in force, notwithstanding the recent assertion that liberal autonomy has been granted to Cuba. The following extract from the New York *Sun* of April 5, 1898, as I write this article, shows that the force of this despotic decree has not at all been ameliorated by the present farcical autonomous government:

"Many arrests are being made in the city among members of the best families for political causes. Mágdalena Peña Redonda, a well-known Cuban lady, was put in jail this morning upon a charge of conspiracy against the government.

"Alfredo Herrera, a young man of an aristocratic family, was arrested this morning in a house in Industria street upon a charge of rebellion. It is said that he was leading a band of insurgents near Habana a few days ago.

"Pablo Larrinago, Juan Romero, Candido Villaneuva, and others, all well known persons, also have been arrested, charged with conspiracy and rebellion."

The right of free speech on the part of the individual citizen has not only been restricted, but the rigorous press law of 1881 requires every editor or manager of a paper to send, duly signed by him, two copies of each issue to government headquarters and two other copies to the district attorney as soon as printed, that it may be seen whether any objectionable remarks are contained therein. Nearly every publication in Cuba has been suspended at some time or other, and its editor fined, imprisoned, or deported to the penal colonies.

The American who undertakes to investigate the history of the Spanish government in Cuba inevitably finds the details too revolting to be described. Greed, injustice, bribery, and cruelty have been practiced with such frequency that volumes could be filled with their horrible details. Above all these, however, stands the fact that Spain has thrice endeavored to wipe out by butchery and starvation the entire native population. The first of these attempts, practiced in former centuries upon the aborigines, was successful. The second attempt was made during the ten years' war by Valamaseda, who wrote:

"Not a single Cuban will remain on this island, because we shoot all those we find in the fields, on their farms, and in every hovel. * * * We do not leave a creature alive where we pass, be it man or animal. If we find cows, we kill them; if horses, ditto; if hogs, ditto; men, women, or children, ditto. As to the houses, we burn them. So every one receives what he deserves—the men with bullets, the animals with the bayonet. The island will remain a desert."

The intentions of this officer were only foiled by the arousal of foreign public sentiment against him, and his replacement by the humane General Campos, who tried to restore peace. The third attempt at extermination, a matter of present history, was made by Weyler, who expressed sentiments as ferocious as those of Valamaseda.

How successfully Weyler's policy has been partially carried out can be answered by the graves of a fourth of the population, which have been recently filled with starved or assassinated victims of his cruelty. Had not this government raised its voice and demanded his recall, the sole remnant of the Cuban people would now have consisted of the soldiers of Gomez.

We have now given in brief the geography, resources, and political conditions of this island. In all history no other country has presented such an unfortunate exhibition of misgovernment. Perhaps ere this article reaches the reader the great government which stands for the highest type of humanity and whose every interest—commercial, hygienic, and strategic—calls for a cessation of Spanish misrule, will have made its influence felt and established a permanent peace upon the island.

Supplemental Note on the Isle of Pines

The principal of the outlying islands considered geographically as a part of Cuba is the Isle of Pines, which is situated about 38 miles south of the coast of Pinar del Rio. This is the only one of the adjacent islands which is not merely an elevated reef or mangrove swamp, and which has a geologic structure and configuration comparable to the mainland. Its area of 1,214 square miles is almost equal to the combined area of the other 1,300 islands and islets.

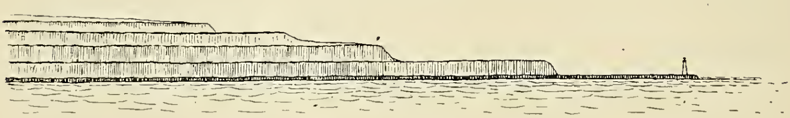
The island is circular in outline and almost divided by a bayou or salty depression into two divisions, the southernmost of which is a vast cienega or swamp, occupied only by a few fishermen. The main portion of the island is diversified, being dominated by a central ridge of low mountains extending from east to west, rising to 2,000 feet above the sea. Elsewhere the island is quite flat, consisting of land which represents a coralline plain recently reclaimed from the sea.

Steamers from Batabano run to Santa Fé and Nueva Gerona. The latter place is a very small town at the foot of the hills, with plains of palm trees in its neighborhood, the town itself being on the " Rio de Serra de Casa," some distance from its mouth. Santa Fé, which is the prominent place of resort for travelers, is of itself a miserable congregation of houses on the banks of the river of the same name, some distance from its mouth, and also some distance from the steamboat landing. This landing is a rough wooden wharf, from which carriages and stages ply to Santa Fé. Immediately in the neighborhood of Santa Fé there are beautiful drives and walks some distance back, where the country is more rolling and even hilly.

The climate of the Isle of Pines is delightful, the air is pure, dry, and balmy, and the winds coming from the sea, passing over pine forests, are gentle and invigorating.

The inhabitants of the island are a very simple, kind-hearted set of people and very fond of a chat with strangers. They have a natural dignity of manner, a courteously hospitable way, as also a degree of freshness and innocence.

For many years a large penal colony has been maintained on the island, consisting mostly of Cuban revolutionists.



CAPE MAYCI, EASTERN POINT OF CUBA

Lowest bench, elevated coral reef; Upper terraces, wave-cut cliffs

NOTE.—The date of the landing of Antonio Maceo and the starting of the present revolution, given on page 222 as February 25, 1896, should be February 20, 1895.

THE FLORIDA COAST LINE CANAL

The Florida Coast Line canal, which has been under construction since 1889, is now completed from Mosquito inlet to Miami. Boats of five feet draught traverse semi-weekly the entire distance from Titusville, on the Indian river, through Lake Worth, to Palm Beach. Three short cuts complete the canal—two between Matanzas and Tomoka and one uniting North river with Pablo creek. Eventually the canal will connect the St John river with Biscayne bay, rendering possible an inland passage along the Atlantic coast from Long Island sound to Key West.

THE ORIGIN OF WEST INDIA BIRD-LIFE

By Frank M. Chapman,

American Museum of Natural History, New York

A study of the origin of the life of any given area involves so extensive a knowledge of the factors governing the distribution of life that the ideal theory of the derivation of the fauna of a region should be based on the detailed reports of a corps of specialists, each one of whom should state without bias the *facts* in the case as they have been determined in his particular subject. Thus, before attempting to account for the origin of life in the West India islands, we should receive such reports from the geologist, hydrographer, climatologist, palæontologist, zoölogist, and botanist, and no theory can be satisfactory which does not consider the data presented by these specialists.

Acting on this principle, I offer the following synopsis of studies of West India bird-life made during the past ten years, the detailed results of which will be found in earlier papers:*

My remarks may be prefaced by the statement that, so far as its distribution is concerned, our knowledge of the resident bird-life of the West Indies is essentially complete. Haiti and San Domingo may hold some ornithological secrets, but our recorded information is not likely to receive any material accessions—a condition of affairs for which we have largely to thank Mr C. B. Cory, who has sent collectors to every West India island and published numerous reports on the results of their work.†

Of the 580 or more birds which have now been recorded from the West Indies, no fewer than some 305 are endemic. The remaining 275 are species of general continental or tropical distribution, or those of the surrounding mainland, about 170 being migrants from eastern North America, which occur in the West Indies as winter residents or as transient visitants. Of the 305 endemic species, 293 are land birds, 90 per cent of the resident land birds being therefore endemic—truly a surprising degree of specialization when we consider how near several of the islands

*American Naturalist, 1891, pp. 528–539; Bull. Am. Mus. Nat. Hist., iv, 1892, pp. 279–330; vi, 1894, pp. 8, 9; ix, 1897, pp. 29, 30.

†See his "Birds of the West Indies," in The Auk, iii, 1886, pp. 1–59 *et seq.*; and "Catalogue of West Indian Birds," published by the Author, Boston, 1892.

are to the mainland. One family (Todidæ) and 38 genera are peculiar. The latter are represented by 96 species, leaving 209 species belonging to genera of North, South, or Central America; but for the most part they have no near mainland allies, and in comparatively few cases can we point with probable exactness to their continental ancestors. In other words, taken as a whole, the endemic birds of the West Indies are widely differentiated from their parent stock.

Considering now the faunal relationships of the islands *inter se*, we find at once that they can be divided into the two groups of physical geographers—the Greater and the Lesser Antilles. With the former belong the Virgin islands and St Croix; with the latter Sombrero, Anguilla, and the other islands east of the Anegada channel and southward to and including Grenada. While some genera (*e. g.*, *Myiadestes* and *Quiscalus*) are represented by more or less closely allied species in both the Greater and Lesser Antilles, and while certain species characteristic of each group (*e. g.*, *Margarops*, *Bellona*, and *Mimocichla spp.*) intrude to some extent into the other, their avifaunæ are quite unlike. The more distinct West Indian species are found only in the Greater Antilles. Thus the Todidæ are represented in each of the larger islands of the Greater Antilles, but are known in the Lesser Antilles. In short, the relationships of the avifauna of these two groups are quite in accord with Mr Agassiz's statement that "the Windward islands were probably raised long after the range of the greater West Indian islands existed * * *"*.

Some 108 resident land birds have been found in the Lesser Antilles. Sixteen of these are South American, of which thirteen occur in the Lesser but not in the Greater Antilles, and fourteen are West Indian species, which occur in both the Greater and the Lesser Antilles. Eight genera are peculiar, whereas in the Greater Antilles twenty-four genera are peculiar. These eight genera contain seventeen species upon whose origin we can only speculate. Subtracting them from the eighty-one endemic land birds, we have left sixty-four species, which may be grouped according to their apparent relationships as follows:

Tropical	22
South American	19
West Indian	23

The South American element here shown to be present in the Lesser Antilles at once suggests the possibility of a former land

*Three Cruises of the *Blake*, ii, p. 113, foot-note.

connection between these islands and the continent, and without pausing to inquire into minor questions, let us at once proceed to Grenada, the last island of the group, in order to learn to what extent its avifauna has been influenced by its proximity to the mainland, and especially to the continental island of Trinidad.

Some 195 resident South American land birds are known from Trinidad. Of this number no fewer than sixty-five have been found in Tobago, which was evidently at one time connected with Trinidad, but only sixteen have been recorded from Grenada. In Trinidad these birds represent thirty families, in Tobago twenty-five, and in Grenada but eleven, and these eleven birds, with one or two exceptions, are members of families having wide distribution and extended powers of flight. So far as their avifauna is concerned, therefore, there has apparently been no connection between the Lesser Antilles and the mainland, and we may regard these islands as zoölogical dependencies of both South America and the Greater Antilles, from which, through more or less fortuitous circumstances, their avifauna has been derived.

Turning now to the Greater Antilles, we may at once dispose of the Bahamas as oceanic islands of more recent formation than any of the larger islands or mainland adjacent to them, from which they have evidently received their life. Only one genus is peculiar, and with the exception of its single species, the ancestry of the twenty-five forms peculiar to the Bahamas can be traced with more or less certainty, Cuba furnishing the greater number of parent forms. The Caymans, about 175 miles south of Cuba and 200 miles west of Jamaica, present an apparently similar case, most of the fifteen forms peculiar to them being closely related to Cuban or Jamaican species.

We have left now the four larger islands of the Greater Antilles, from which 174 of the 303 peculiar West Indian birds have been recorded. They are distributed as follows:

Jamaica, 66, of which 42 are endemic; Cuba, 68, of which 45 are endemic; Haiti and San Domingo, 56, of which 34 are endemic; Porto Rico, 46, of which 25 are endemic.

As I remarked in the paper on the "Origin of West Indian Bird-life," previously referred to: "It will be observed that although Jamaica is but little larger than Porto Rico, and is more isolated from neighboring regions than any island of the group, it is nearly as rich in endemic species, and has one more peculiar genus than Cuba. The latter island is not only ten times as large as Jamaica, but its proximity to Florida has given it at least four forms which have evidently been derived from Florida species. * * * Haiti and San Domingo, although about seven times as large as Jamaica, have eight endemic species less, while Porto Rico, nearly as large as Jamaica and favorably situated for the reception of Lesser Antillean species, has seventeen endemic species less than Jamaica, and but one genus is peculiar to the island.

"It is evident that, as Wallace has said, the islands 'were not peopled by immigration from surrounding countries while in the condition we now see them, for in that case the smaller and more remote islands would be very much poorer, while Cuba, which is not only the largest, but nearest to the mainland in two directions, would be immensely richer, just as it really is in migratory birds.'" (Distrib. Animals, Am. ed., II, 1876, p. 66.)

These facts in distribution and a study of hydrographic charts give us some suggestive evidence in regard to a past land connection between the West Indies and the mainland. Thus we discover that an elevation of only 100 fathoms would leave but two channels, the wider 75 miles across, between Jamaica and the Honduras coast. Wallace, in theory, completely bridged this gap, connected Cuba with Yucatan, and filled the sea thus enclosed with land, to which Sclater gave the name "Præantillesia;" but, as Mr Agassiz has remarked: "The deep soundings (over 3,000 fathoms) developed by the *Blake* south of Cuba, between that island and Yucatan and Jamaica, do not lend much support to the theory of an Antillean continent as mapped out by Wallace, nor is it probable that this continent had a much greater extension in former times than now, judging from the depths found on both sides of the West Indian Islands" (l. c., p. 116).

While the disproportionately rich avifauna of Jamaica and the shallow sea between this island and the mainland suggests the possibility of a continental land connection at this point, the absence of representatives of certain families of birds from the Greater Antilles is opposed to the theory of this connection ever having been complete. Thus, with the exception of *Hadrostomus niger* in Jamaica and *Colinus virginianus cubanensis* in Cuba, the following twelve families of Mexican and Central American birds are without representatives in the Greater Antilles: Troglodytidæ, Pipridæ, Cotingidæ, Dendrocolaptidæ, Formicariidæ, Galbulidæ, Bucconidæ, Momotidæ, Rhamphastidæ, Cracidæ, Tetraonidæ, Tinamidæ.

In his list of the birds of Costa Rica, Zeledon records no less than 140 species of birds belonging to these families, and their non-representation in the West Indies is a fact which cannot be ignored. Especially does their absence become significant when we consider that with few exceptions they are birds of terrestrial or sedentary habits, which we should not therefore expect to find on oceanic islands.

Although in previous papers I have proceeded to theorize on the facts here presented, I shall on this occasion adhere to the suggestion made in my opening sentence, and with this presentation of the more important results derived from a study of West India bird-life, leave the larger questions involved until we are in possession of the reports of other specialists.

TRADE OF THE UNITED STATES WITH CUBA

The trade of the United States with Cuba reached its high-water mark in 1892–'93, when it amounted to $102,864,204, the ratio of imports to exports being approximately as 10 to 3.

This total was almost equal to that of our entire Asiatic trade, was nearly four times that of our trade with China or Japan, and thirteen times that of our trade with Russia, while it even exceeded the grand total of that with Austria-Hungary, Russia, Sweden and Norway, Denmark, Turkey. Greece, Italy, Switzerland, and Portugal combined. Nor does this contrast derive its strength mainly from the largeness of the imports. The exports themselves, products of our own country, were nearly twice as great in point of value as our exports to Italy, over three times as great as those to China and Japan combined, nearly six times as great as those to Sweden and Norway, and over ten times as great as those to Russia; they amounted to almost half as much again as our total exports to Asia, and even exceeded our total exports to South America, exclusive of Brazil.

So much for the aggregate. What of the different items of which it is composed? These may best be considered in detail if presented in tabular form, and the accompanying tables will accordingly show the principal imports into the United States from Cuba and the principal exports of domestic merchandise

Values of domestic merchandise exported from the United States to Cuba during the ten years ending June 30, 1897

Articles.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.
Animals, live	$8,778	$14,264	$12,820	$42,631	$25,513	$29,411	$42,508	$24,763	$121,881	$433,089
Animal products	2,691,567	3,301,509	2,957,126	2,840,649	4,289,306	5,718,101	5,176,314	3,270,497	2,470,505	2,429,113
Breadstuffs	1,387,752	1,336,047	1,520,617	874,979	2,305,031	3,512,207	3,164,541	1,569,008	774,792	888,123
Coal and coke	460,584	581,094	722,856	776,526	1,041,751	931,571	918,528	1,103,765	626,935	639,427
Cotton, and manufactures of	112,281	126,180	140,318	102,173	114,112	148,670	120,183	67,441	63,834	67,452
Chemicals, dyestuffs, etc	219,389	249,710	277,171	259,028	387,377	286,562	291,916	272,269	197,054	195,950
Hay and straw	29,161	31,675	20,853	24,585	45,395	54,791	87,700	43,869	85,652	49,728
Iron and steel, and manufactures of	1,257,423	1,988,018	2,709,904	3,120,276	4,410,798	6,691,929	4,696,327	2,476,779	769,356	426,173
Manufactures	582,003	712,854	948,740	836,180	1,090,449	1,431,849	1,146,480	855,079	361,254	334,572
Manufactured products	322,039	457,355	567,235	581,782	516,394	329,525	297,325	133,164	110,205	94,404
Provisions, other than B. S. or A. P.	491,746	523,661	441,130	410,011	757,768	1,315,097	1,052,767	651,357	494,940	873,407
Oils	432,620	410,203	601,716	384,121	511,749	548,092	556,139	510,356	354,838	312,526
Paper, and manufactures of	226,600	245,078	321,589	202,124	210,509	198,970	192,503	147,329	88,909	272,551
Wood, and manufactures of	1,320,536	1,111,002	1,208,733	1,191,676	1,528,983	1,881,095	1,571,297	770,064	490,396	412,651
All other	181,645	208,548	218,701	282,864	387,276	526,224	540,709	638,120	301,797	170,591
Total domestic exports	9,724,124	11,297,198	12,669,509	11,929,605	17,622,411	23,604,094	19,855,237	12,533,260	7,312,348	7,599,757

Values of merchandise imported into the United States from Cuba during the ten years ending June 30, 1897

Articles.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.
Animal products	$238,687	$308,697	$338,236	$439,807	$279,282	$292,305	$187,038	$77,484	$184,281	$872,392
Chemicals	17,201	36,700	51,830	372,212	276,211	383,786	141,349	81,424	32,312	13,122
Wines, spirits, etc	44,969	45,780	45,100	54,586	53,864	43,022	20,131	(*)	(*)	16,247
Manufactured products	94,620	79,830	105,289	113,025	12,495	672,370	208,321	(*)	(*)	29,412
Ores, metals, and manufactures of	326,162	588,245	619,201	932,670	723,279	34,527	11,827	294,908	521,310	658,605
Fruit, vegetables, etc	1,519,408	1,649,633	1,852,997	1,805,250	2,264,056	2,464,191	1,985,715	989,738	1,070,490	354,590
Sugar, molasses, etc	38,680,821	39,644,362	39,099,802	46,830,047	62,642,686	61,718,722	64,296,266	40,872,497	24,231,309	11,995,179
Tobacco	7,941,516	9,261,441	11,088,240	10,484,604	10,802,690	11,727,088	7,881,468	9,311,980	12,707,352	4,277,281
Wood, and manufactures of	399,427	432,187	528,929	585,485	530,398	1,074,310	684,488	640,774	531,349	67,333
All other	56,276	83,748	71,967	96,709	346,710	296,185	261,658	602,454	739,327	122,654
Total imports	49,319,087	52,130,623	53,801,591	61,714,395	77,931,671	78,706,506	75,678,261	52,871,259	40,017,730	18,406,815

* Included in other classifications.

from the United States to that island for the ten years ending June 30, 1897.

The principal article imported is sugar, the largest importation of which was in the fiscal year 1893–'94, when it amounted to 949,778 tons of 2,240 pounds, or over one million tons of 2,000 pounds. This was equivalent to 30 pounds or more per capita of our population, and constituted about one-half of our total consumption. The next item in importance is tobacco, the imports of which reached their highest figures in 1895–'96, when they amounted in point of value to considerably more than one-third of the total value of our own tobacco crop. The only other class of imports that calls for special mention consists of fruit and vegetables, which had a value in 1892–'93 of nearly two and one-half million dollars.

The principal articles of export are, as will be seen from the table, meats, breadstuffs, and manufactured goods, the trade in all of which articles was rapidly assuming very large dimensions at the outbreak of the insurrection. Coal, coke, and oils were also exported in considerable quantities; indeed, so diversified were our exports that there is no considerable section of the entire country that was not to a greater or less degree benefited by the market for our agricultural, mineral, and manufactured products that existed in Cuba.

Between 1893–'94 and 1896–'97, however, our imports from Cuba suffered a decline of 75.7 per cent, and our exports to the island a decline of 61.7 per cent, the imports being reduced to less than one-fourth and the exports to little more than one-third of their previous volume. During the first year of the insurrection our trade fell off over thirty million dollars, during the second year a further sum of eighteen million dollars, and during the third year a still further sum of twenty-one million dollars, making a total decline of sixty-nine million dollars in the annual value of our foreign trade, and of a branch of it, moreover, that is carried almost entirely in American bottoms.

Is it any wonder that, entirely aside from the humanitarian considerations that have prompted the United States government to seek to put an end to the unfortunate conditions so long prevailing in the island, some justification for such intervention should have been found in the well-nigh total paralysis of our commercial relations with that once extensive and profitable market?

J. H.

CAPTAIN CHARLES D. SIGSBEE, U. S. N.

Captain Charles Dwight Sigsbee, U. S. N., whose portrait forms the frontispiece of this number of the magazine, was born July 16, 1845, in New York. He graduated from the Naval Academy in 1863 and served throughout the Civil War; was on board the *Monongahela* at the battle of Mobile bay, and in the Fort Fisher fights. In 1868 he was made a Lieutenant-Commander. In 1874 he was placed in command of the *Blake*, and during the succeeding four years was engaged in deep-sea exploration in the Gulf of Mexico and the Gulf of Maine. During part of this time Prof. Alexander Agassiz was upon the *Blake* directing the deep-sea dredgings.

Almost immediately after taking command of the *Blake*, Sigsbee instituted improvements in instruments for deep-sea sounding, and virtually designed a new machine for that purpose, which has since been adopted all over the world. The results of the deep-sea soundings made by the *Blake* under his command were published as an appendix to the report of the U. S. Coast and Geodetic Survey for 1880, under the title "Deep Sea Sounding and Dredging. A Description and Discussion of the Methods and Appliances used on board the Coast and Geodetic Survey Steamer *Blake*." This work has proved valuable in many ways, especially with reference to the intricate problems involved in the study of the Gulf stream. The report is a comprehensive and standard treatise on deep-sea exploration.

For several years prior to taking command of the *Maine* Captain Sigsbee was Hydrographer of the Navy Department. While thus in charge of the Hydrographic Office he developed many improvements tending to simplify and strengthen the data and material furnished the marine from both the practical and scientific sides. During his detail in charge of the Hydrographic Office Captain Sigsbee was a member of the U. S. Board on Geographic Names.

Captain Sigsbee's contributions to our knowledge of the sea bottom and its topography place him in the front rank of scientific hydrographers. As a naval officer and an American the events of the past two months have shown what manner of man he is.

H. G.

RECEPTION TO CAPTAIN C. D. SIGSBEE, U. S. N.

Not only has the name of Captain Charles D. Sigsbee become a household word throughout the length and breadth of the United States as that of the gallant commander of the ill-fated battleship *Maine*, but Captain Sigsbee himself, by the admirable self-restraint and judicial temper which he displayed in the most trying of all conceivable circumstances, has won "golden opinions from all sorts of people." In addition, however, to being a brave officer, a true patriot, and a just man, he has distinguished himself, as shown in the preceding article, by his valuable contributions to hydrographic science, so much so, indeed, that his position in the scientific circles of the National Capital is as well recognized and assured as his standing as a naval officer.

It was eminently fitting, therefore, that the National Geographic Society, of which Captain Sigsbee has long been an active member, should take advantage of his recent return to Washington to do him honor. Immediately on his arrival the following letter was addressed to him by President Alexander Graham Bell:

Washington, D. C., *March 30, 1898.*

Captain Charles D. Sigsbee, U. S. N., *Washington, D. C.*

My Dear Sir: You have earned the gratitude of America by your noble conduct in a great and terrible emergency, when your prompt, energetic, and wise action held in check the popular excitement which threatened to precipitate war between friendly nations.

The citizens of Washington are, one and all, anxious to greet the brave Commander of the *Maine*.

Your fellow-members of the National Geographic Society especially, to whom you have so long been known as a scientific hydrographer, desire to grasp you by the hand and welcome you back to the city once more.

On behalf of the National Geographic Society, allow me to tender you a reception, to be held in the parlors of the Arlington Hotel on Saturday evening, April second, from nine to eleven o'clock.

I am, my dear sir, yours respectfully,

Alexander Graham Bell,
President National Geographic Society.

To this invitation Captain Sigsbee responded as follows:

Washington, D. C., *March 30, 1898.*

Professor Alexander Graham Bell,
President National Geographic Society, Washington, D. C.

My Dear Sir: In acknowledging the receipt of your letter of today, wherein the members of the National Geographic Society tender me a reception on Saturday to meet my associates of the Society as well as other residents of Washington, I beg to thank you sincerely for the kind sentiments which you express. The honor which the Society proposes for me I accept most gratefully, not alone for the good will towards myself, but also because the occasion will reflect honor on those who served with me on board the *Maine* at Havana.

To come out of so great a disaster with honor and to have the fact confirmed in so positive a manner is a satisfaction that lies nearest the heart of every survivor of the *Maine.*

With full appreciation of your offer, which please express to the Society, I am,

Yours most sincerely and most respectfully,

C. D. Sigsbee,
Captain, U. S. Navy.

Three days later—namely, on the evening of Saturday, April 2—the parlors of the Arlington Hotel were crowded with one of the most brilliant and distinguished assemblages ever brought together in the National Capital, the President of the United States, the Vice-President and Mrs Hobart, and an exceptionally large gathering of statesmen, diplomatists, scientists, military and naval officers of high rank, and other distinguished persons to the number of 1,600 uniting to do honor to the Society's guest, to whom each of them was presented by President Bell.

Rarely has a purely scientific society performed a function so entirely *en rapport* with public sentiment and been so truly "national" in any of its doings. Everything conspired to give a national character to the occasion. In addition to the attendance of the Chief Magistrate of the Nation and of a gathering in which few states of the Union and few departments of the national life were not specially represented, a guard of honor was furnished by the U. S. Marine Corps, whose band, stationed in the ball-room, performed a selection of patriotic music, under special orders from the Secretary of the Navy, while the brilliant salons set apart for the occasion were decorated with the handsomest national flags and emblems the resources of the government could furnish.

J. H.

GEOGRAPHIC LITERATURE

Rand-McNally War Atlas, with Marginal Index. Pp. 16. Chicago and New York: Rand, McNally & Co. 1898. 25 cents.

Bulletin of the Department of Labor. No. 16. May, 1898. Pp. 216. Washington, 1898.

Statistical Abstract of the United States. 1897. Twentieth Number. Prepared by the Bureau of Statistics, Treasury Department. Pp. xii + 412. Washington, 1898.

It was surely a happy thought on the part of Rand, McNally & Co. to select from one of their high-priced atlases a series of maps of those portions of the world to which public attention is being directed in connection with the war with Spain, and to place them within the reach of every one by binding them up together for sale at 25 cents. The atlas is everything that can be desired, in its way. It is marvelously cheap, and cannot fail to have an enormous sale.

The May bulletin of the Department of Labor is largely devoted to a report on The Alaskan Gold Fields and the Opportunities they offer for Capital and Labor, by Mr Sam. C. Dunham, a special agent who was sent out to the Klondike by the Commissioner of Labor in July last. The report is accompanied by maps and illustrations and contains much valuable information. While written in a becomingly dignified style, it is occasionally enlivened by a vein of quiet humor, which adds greatly to its readability. Good examples of this are found in the statement: "If a visitor to the gulches prefers to ride, he can secure a saddle-horse in Dawson for $60 a day," and in the author's description of the proceedings of the improvised courts, the creation of a justice-loving community that has no regularly constituted judicial system or officers of the law.

As a compendium of information relative to the population, finance, commerce, agriculture, mining, railroads and telegraphs, immigration, education, public lands, pensions, postal service, prices of commodities, shipping, etc., of the United States, the Statistical Abstract has become an absolute necessity, not only to all economic writers and students, but to every one who would keep abreast of the growth of our institutions and the development of our resources as a nation. The Abstract has been almost completely transformed under the direction of Mr Worthington C. Ford, and it is not easy to see how it could be made more useful, except by increasing its circulation.

J. H.

Ninth Annual Report on the Statistics of Railways in the United States for the year ending June 30, 1896. Prepared by the Statistician to the Interstate Commerce Commission. Pp. 709 and map. Washington, 1897.

This report follows the same general plan and presents the same technical excellence that have rendered all the reports prepared by Prof. Henry C.

Adams as Statistician to the Interstate Commerce Commission especially acceptable to all trained statisticians.

The condition of the railway system of the United States on June 30, 1896, and during the twelve months ending with that date, was about as follows: The aggregate growth of the railways was 182,776.63 miles, of which 181,153.77 miles were represented by reports to the Commission. There were 10,685.16 miles of second track, 990.45 of third track, 764.15 of fourth track, and 44,717.73 of yard track and sidings, making the total mileage of all tracks 239,140.13. The railway construction during the period covered was slightly greater than during the fiscal year 1895, but less than during any other year covered by the statistical reports of the Commission.

Forty-four corporations operated 103,345.89 miles, or 56.89 per cent of the railway mileage of the country, the remainder being operated by 1,067 companies, of which 977 operated but 34,497.90, or 18.99 per cent of the total. Equipment consisted of 9,943 passenger locomotives, 20,351 freight locomotives, 5,656 switching and other locomotives, 33,003 passenger cars, 1,221,887 freight cars, and 42,759 cars employed in companies' service. The passenger service performed was equal to carrying 1,312,381 passengers one mile for each passenger locomotive, and 4,684,210 tons of freight one mile per freight locomotive, both of these items showing a gratifying increase in efficiency over the previous year. The resources of the Commission do not permit of the collection of statistics of cars owned by private companies. The number of employés was 826,620, having increased since June 30, 1895, from 785,034, but being less than the number employed on June 30, 1893. The number assigned to general administration was 31,792, to maintenance of way and structures 243,627, to maintenance of equipment 167,850, and to conducting transportation 373,747, the balance of 9,609 being unclassified. The average daily compensation of general officers was $9.19; of station agents, $1.73; of engineers, $3.65; of firemen, $2.06; of conductors, $3.05; of section foremen, $1.70; of other trackmen, $1.17, and of switchmen, flagmen, and watchmen, $1.74. The total amount paid as compensation for labor was $468,824,531, amounting to 61 per cent of the entire expense of operation, less than 2¾ per cent of the amount being paid to general officers. The total railway capitalization is reported as $10,566,865,771, and the average per mile of line as $59,610. These figures are not comparable with those of previous years for the reason that, at the request of the Association of American Railway Accounting Officers, the continuous coöperation of which with the Statistician has been a source of considerable advantage, "other forms of indebtedness," which in 1895 constituted $616,830,156, or $3,556 per mile of line of the capital reported, is no longer included. It is especially notable as a result of the railway financiering incident to the rehabilitation of those companies which have become bankrupt during the recent depression, that the increase in capital stock during the last two years has for the first time since the establishment of the Commission exceeded the increase in funded debt. As success in securing a definite aggregate profit upon capital stock is not essential, this change makes for permanent financial stability. Another transformation of capital tending in the same direction is shown by the fact that an increase in income bonds has been accompanied by an absolute decrease in the amount of mortgage bonds.

It is interesting also to observe that of the total stocks and bonds outstanding those having a par value of $1,501,346,914 are held by railway corporations. Of the total stock outstanding an amount having a par value of $3,667,503,194, or 70.17 per cent, paid no dividends, while $515,029,668, or 11.40 per cent, of bonds was similarly unremunerative to investors. The percentage of income bonds not receiving interest was 87.96. The total amount paid in dividends on common and preferred stock was $87,603,371, as interest on funded debt $249,624,177, and as interest on current liabilities $8,469,063. The public service performed was equivalent to carrying 13,049,007,233 passengers and 95,328,360,278 tons of freight one mile. Passenger service showed an increase over the preceding year, but was lower than that of 1894, 1893, and 1892. The freight service performed exceeded by more than ten billion ton miles that of the preceding year and exceeded that of 1893, the highest year previously recorded.

The total earnings from operation were $1,150,169,376, of which $266,562,533 was from passengers, $63,951,481 from mail, express, and other miscellaneous sources connected with passenger service, $786,615,837 from freight, $3,885,890 from miscellaneous sources connected with freight service, and $29,153,635 unclassified, or from other operations. The average revenue per passenger per mile was 2.019 cents, and that per ton of freight per mile .806 cent, the latter being lower than for any previous year covered by the reports of the Commission. Operating expenses amounted to $772,989,044, or 67.21 per cent of the total income from operation. The average cost of running a train one mile was 93.838 cents. From the summary of accidents it appears that 181 passengers, 1,861 employés, and 4,406 "other persons" were killed during the year covered by the report, while 2,873 passengers, 29,969 employés, and 5,840 "other persons" were more or less seriously injured. Comparing these data with the number of passengers and of employés, it appears that one passenger in every 2,827,474 carried was killed, and one in every 178,132 carried was injured, while one employé in every 444 was killed and one in every 28 injured. Of the "other persons" killed, 3,811 were trespassers, and of those injured, 4,468. The statistics of accidents to that class of employés whose duties involve their presence on running trains are particularly disheartening. They show that during the twelve months covered by the report one in every 152 of such employés was killed, and one in every 10 more or less seriously injured. The increased use of safety appliances does not seem materially to have affected this ratio, and it is to be doubted whether it will do so until all cars are properly equipped. Of the 1,333,599 cars in service, 448,854 were equipped with train brakes, the increase during the twelve months covered by the report being 86,356, while the actual increase in the number of cars was 27,339. The number equipped with automatic couplers was 545,583, being an increase during the year of 136,727; 9,816 of the 9,943 passenger locomotives in service were fitted with train brakes, as were also 17,921 of the 20,351 freight locomotives, and 3,895 of the 5,656 switching and other locomotives.

Such is the picture of the condition of the railways of the United States so far as it can be derived from this report, and if it fails to meet in any way with the reasonable desires of the student of transportation who seeks a complete numerical description of the business of interstate transportation of persons and property as conducted in the United States at the present time, the fault is in no way attributable to the statistician or to his assistants, but to the inadequacy of the legislation which provides for the collection of these statistics. The very excellence of the report from a technical standpoint causes greater regret that those who have had its preparation in charge have not been intrusted with the collection of those data which all intelligent students of transportation so seriously need. No statistical report can adequately present the business of transportation while omitting to deal with the business of express companies and that of interstate carriers operating via water routes. It is also to be desired that the classification of the data now collected be greatly extended and the supervision of the accounting of individual roads so perfected as to insure greater definiteness in the items included.

H. T. Newcomb.

GEOGRAPHIC SERIALS

The Geographical Journal for March contains a summary of Mr Peary's explorations in Greenland, under the title of "Journeys in North Greenland." Dr Sven Hedin commences a narrative of his "Four Years' Travel in Central Asia." Hon. D. W. Carnegie publishes a narrative of his "Explorations in the Interior of Western Australia."

The *Bulletin of the American Geographical Society*, No. 1, 1898, offers the following table of contents: "Relations of Irrigation to Geography," by H. M. Wilson; "From Cairo to Beni Hassan," the location of some of the most celebrated tombs of ancient Egypt, by D. Cady Eaton, and "Physical Geography of New York State," the third installment of a continued story, by Prof. R. S. Tarr.

The *Journal of the Royal Colonial Institute* for March is largely devoted to a paper by Henry Birchenough on "Some Aspects of our Imperial Trade," and an extended discussion. It is curious to find an Englishman complaining of the greater cheapness of foreign goods, of the want of adaptability of British manufacturers and traders, the superiority of foreign methods of pushing trade, and the lower freights of foreign shipping companies, especially when he instances the American as the chief competitor and as excelling the Briton in these respects. The article is extremely significant and very suggestive. Another suggestive article is by Mr Everard R. Calthrop on "Light Railways for the Colonies," in which he rehearses arguments in favor of cheap construction which, while perhaps new to his readers, have controlled the construction of the entire railroad system of this country.

H. G.

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Vol. IX JUNE, 1898 No. 6

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PHILIPPINE NUMBER

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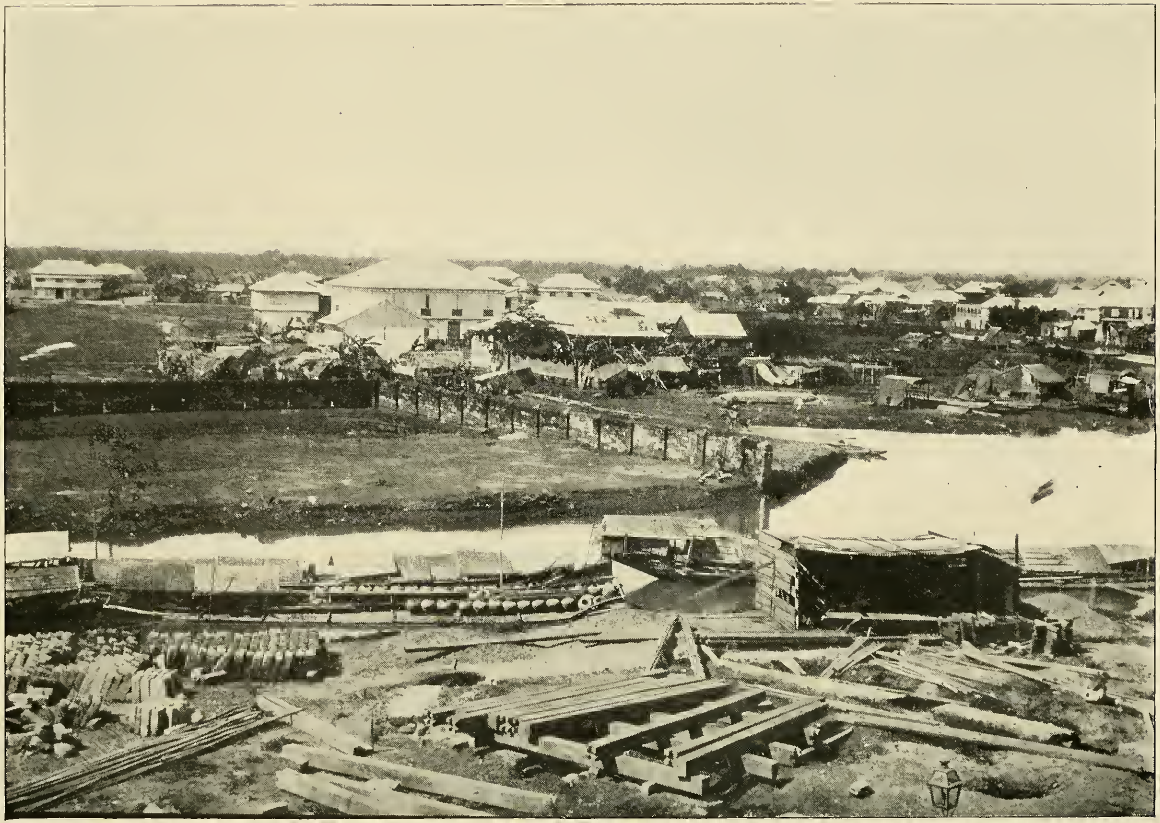
Donations for the founding of Prize Medals and Scholarships are respectfully solicited.



OUTSKIRTS OF MANILA

THE

National Geographic Magazine

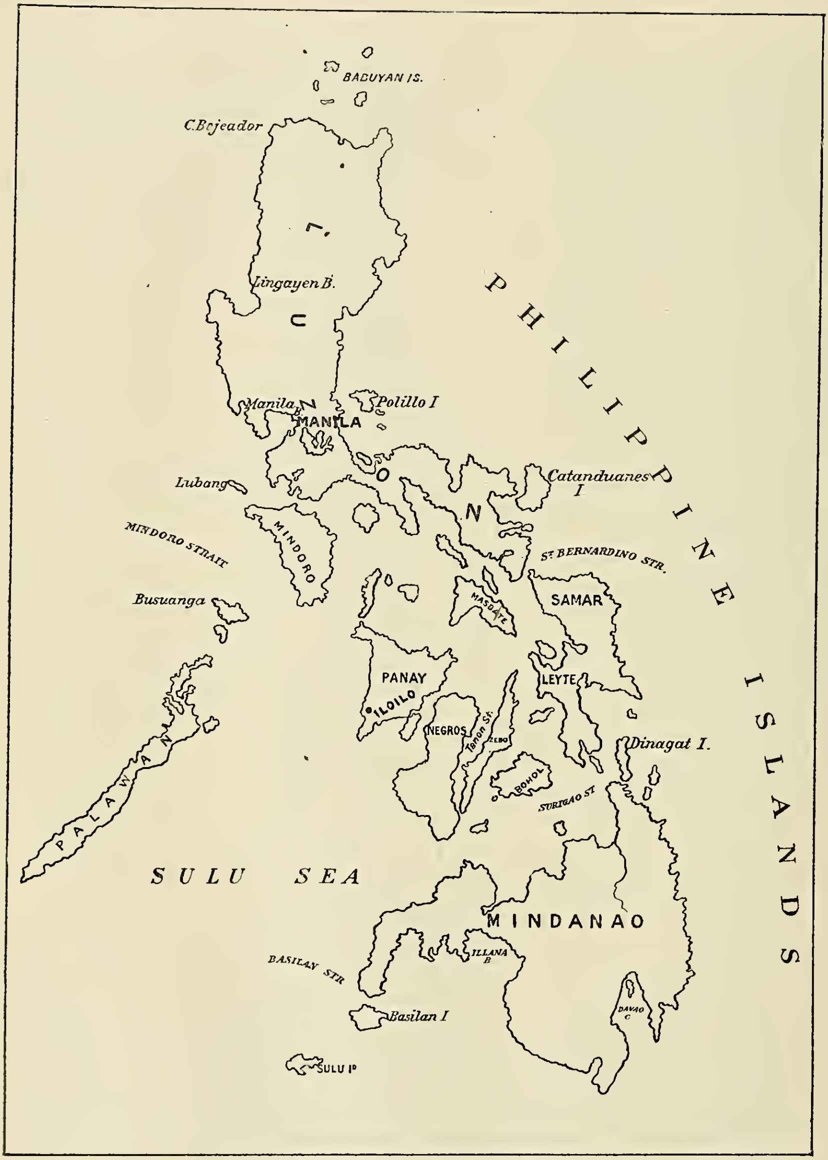
Vol. IX JUNE, 1898 No. 6

THE PHILIPPINE ISLANDS

By F. F. Hilder

To the southeast of the continent of Asia lies a vast archipelago, of which a considerable portion is occupied by the group called the Philippine islands, or, in Spanish, Islas Filipinas. The number of islands included under this denomination is not definitely known, and this uncertainty has given rise to some rather wild guessing. Some English authorities state the number as six hundred, while a late consular report issued by the Department of State places the number at two thousand, but this may perhaps be intended to include the Marianas, or Ladrones, the Carolines, and the Pelew islands, as all of these are included under the jurisdiction of the governor-general of the Philippines. Some of the Philippines are mere islets, too small for occupation, but others are important in size and resources and are very populous. The principal islands rank according to size in the following order: Luzon, Mindanao, Palawan, Samar, Panay, Mindoro, Leyto, Negros, Cebu, Bejol, and Maskato. The northern island, Luzon, on which Manila, the capital, is situated, is the largest, having an area of about 41,000 square miles, corresponding in size to the State of Ohio. Mindanao, the southernmost island, contains about 37,500 square miles. As no accurate survey of even the larger islands has ever been made, it is impossible to make a definite statement as to the aggregate land area of the group, but the most reliable estimate is 114,356 square miles, which is equal to the combined area of New York, New Jersey, Pennsylvania, and Maryland.

The islands are situated directly on the line of volcanic energy which extends from Japan to Java, and volcanic forces have



MAP OF THE PHILIPPINE ISLANDS

largely contributed to their formation and shaping, as is testified, not only by the existence of active volcanoes, but by the still larger number of mountains which show evidences of former igneous activity, the traces of its effects on the surrounding country, and the abundance of thermal springs which are found in different localities, in which the temperature of the water ranges from 180° Fahrenheit to the boiling point. Although situated in a region peculiarly adapted to the growth of corals, they do not exist to any great extent on the coasts of the Philippines. Occasional traces, sometimes amounting to a fringing reef, are met with in favorable places along the west coast of Luzon and some of the other islands of the group. This scarcity of coral formation may be accounted for by the presence of volcanic fires and the occasional deluges of hot water emanating from their outlets, which prevent the growth of the polyps. All the islands are generally hilly and mountainous, but none of the summits much exceed 8,000 feet in height. The loftiest peaks are, perhaps, Apo and Malindang, in Mindanao; Halcon, in Mindoro, and Mayon, in Luzon. The latter is an active volcano, which has been the scene of several disastrous eruptions within the past hundred years.

As a consequence of these subterraneous forces, earthquakes are frequent and violent. An English writer says:

"The destructive ravages and changes produced by earthquakes are nowhere more remarkable than in the Philippines. They have overturned mountains; they have filled up valleys; they have desolated extensive plains; they have opened passages for the sea into the interior and from lakes into the sea."

That this is not an exaggeration is proved by historical records, which contain many accounts of such disasters since the Spaniards first occupied the territory, and proofs that they have produced great geographical changes.

"In that of 1627 one of the most elevated of the mountains of Cagayan disappeared. In 1675 in the island of Mindanao a passage was opened to the sea and a vast plain was emerged."

The more recent of these convulsions occurred in 1863 and 1880, both of which caused great destruction of property. In the former the loss of life was greater, but the more massive buildings in the old city of Manila suffered more during the latter, the cathedral and many other edifices being completely wrecked.

As a result of these repeated experiences, the style adopted in the erection of buildings, especially of the better class of dwellings and stores, has been modified to meet these emergencies; consequently the liability to destruction and damage has been lessened. The islands are all well watered by rivers, streams, and lakes. Many of the latter are of large size, particularly the Laguna de Bay (Bay lake), which nearly bisects the island of Luzon. Mindanao derives its name from an Indian phrase indicating the abundance of its lakes.

NEW CATHEDRAL AT MANILA, WITH RUINED TOWER OF OLD STRUCTURE

By courtesy of Leslie's Weekly

In consequence of the island of Luzon having the capital and a very large proportion of the white residents located upon it, the interior is better known than that of many of the other islands. Its scenery, although mountainous, is charmingly diversified and will compare favorably with any of the countries of farther Asia. Its large lakes and rivers, broad plains and fertile valleys, teeming with luxuriant tropical vegetation and noble forests, add both to its beauties and productive capabilities.

ANIMALS

If a land connection ever existed between the Philippines and Borneo, the separation must have occurred long ages ago. It is true that the strait between them is narrow, but the water is very deep, and the larger animals included in the fauna of Borneo are not found in the Philippines, especially the elephant, tapir, and orang-outang. There are no beasts of prey in the Philippines except a small one—"el gato del monte"—a species of wildcat, and even that is not very plentiful. The wild animals are buffalo—not the bison of our western plains, miscalled buffalo, but the East Indian animal—deer, hogs, which are doubtless descendants of domesticated animals that have taken to wild life in the woods, and monkeys. There is also report of the existence on the island of Mindoro of a mysterious animal called tumarao, which the natives describe as a cross between the buffalo and deer.

The tamed buffalo, called the water buffalo, from its delight in wallowing in water and mud, is the most useful of the quadrupeds and is universally employed in agricultural work and the transportation of freight, both as a pack and draft animal. Goats, sheep, dogs, and cats are plentiful. Flying squirrels are numerous in the forests, and bats of enormous size, frequently measuring five or six feet from tip to tip of their wings.

Snakes, lizards, and other reptiles abound; also insect pests of various kinds, among which are the destructive white ants, mosquitoes, tarantulas, and other spiders of enormous size.

Pigeons and domestic fowls are abundant, and there is an immense variety of parrots and other wild birds, many of which are comparatively little known, even by name, to American or European ornithologists.

CLIMATE

The extreme length of the Philippine group being from north to south, their northern extremity reaching nearly to the northern limit of the tropical zone, causes considerable variety of climate, although the general characteristics are, of course, tropical. On the western side of Luzon, where Manila is situated, the hottest season is from March to June, the greatest heat being felt generally in May, before the rains set in, when the maximum ranges from 80° to 100° in the shade. The coolest weather occurs in December and January, when the temperature falls at night to 60° or 65° and seldom rises in the day above 75°; in fact, during the months from November to February the sky is bright, the atmosphere cool and dry, and the weather in every way delightful.

Owing to the insular conditions, this region enjoys an advantage which does not extend to tropical continental areas of similar elevation—that is, a considerable range in temperature during the twenty-four hours, averaging from 10° to 20°, which frequently affords the relief of a tolerably cool night even in the hottest season.

The following table of temperature, rainfall, etc., at Manila has been compiled by Prof. H. A. Hazen, of the United States Weather Bureau, from observations made at the Observatorio Meteorologico de Manila:

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Temperature (degrees F.):													
Mean monthly	77	78	81	83	84	82	81	81	81	80	79	77	80
Warmest month	79	81	82	85	87	85	82	82	82	82	81	80	82
Coolest month	74	76	79	81	82	81	79	80	79	79	77	75	79
Highest	91	96	96	99	100	98	95	94	94	95	94	92	100
Lowest	60	61	65	66	71	70	70	69	71	69	63	60	60
Humidity:													
Relative, per cent	77	73	71	70	75	80	84	84	85	82	80	80	78
Absolute, grains per cubic foot	7.75	7.60	7.90	8.42	9.27	9.39	9.33	9.53	9.33	9.24	8.59	8.06	8.75
Wind movement in miles:													
Daily mean	98	115	132	145	144	138	182	165	192	111	94	93	134
Greatest daily	152	187	220	229	236	361	267	264	282	196	164	153	204
Least daily	66	72	82	92	68	96	110	79	69	48	67	59	95
Prevailing wind direction	n.e.	e.	e.	s.e.	s.e.	s.e.	s.w.	s.w.	s.w.	n.e.	n.e.	n.e.	....
Cloudiness, per cent	45	37	35	32	47	65	74	68	72	58	54	53	53
Days with rain	4.3	2.2	3.4	3.5	9.2	15.4	22.1	19.8	20.7	14.4	11.3	8.4	135
Rainfall in inches:													
Mean monthly	1.15	0.47	0.65	1.11	4.30	9.68	14.70	13.88	15.01	7.47	4.92	2.09	75.43
Greatest monthly	7.59	1.97	3.94	5.37	10.11	25.81	29.71	43.20	61.43	23.65	15.27	13.67	120.98
Least monthly	0.02	0.00	0.00	0.00	0.00	0.98	5.28	5.15	2.00	0.90	1.17	0.01	35.65

Rainfall record for 32 years, 1865–1896; remaining data for 17 years, 1880–1896.

The seasons vary with the monsoons or trade winds, which blow from the northeast from November to April, and from the southwest from May to October, and produce what are generally called the dry and wet seasons; but there is no abrupt change from one to the other. Between those periods there are intervals of variable weather.

The Spaniards describe the seasons as—

> "Seis meses de lodo,
> Seis meses de polvo,
> Seis meses de todo;"

six months of mud, six months of dust, and six months of everything.

The northern islands lie in the track of the typhoons, which develop in the Pacific and sweep over the China sea from northeast to southwest during the southwest monsoon. They are liable to occur at any time between May and November, but it is in the months of July, August, and September that they are most frequent. In the early part of the season it is the northern part of the region subject to these storms that feels their greatest force. As the season advances they gradually work southward, so that the most dangerous time in Manila is about the end of October and beginning of November. They never pass further south than about 9° north latitude; consequently all the territory south of that line is exempt from their ravages. Sometimes the typhoon is of large diameter and travels slowly, so far as progressive motion is concerned; at others it is of smaller dimensions, and both the circular and progressive motions are more rapid; but they are always storms of terrific energy, frequently causing terrible devastation and destruction of crops and property on shore and of shipping on the sea.

Thunder-storms, often of astonishing violence, are of frequent occurrence in May and June, before the setting in of the southwest monsoon and commencement of the rainy season. During July, August, September, and October the rains are very heavy; the rivers and lakes are swollen and frequently overflow, flooding large tracts of the lower-lying country. The average rainfall in the neighborhood of Manila is stated to be from 75 to 120 inches per annum, and there the difference between the longest and shortest day of the year is only 1 hour 47 minutes and 12 seconds.

For a tropical climate, that of the islands may be considered healthful for people of the white race, and even for natives of northern regions visiting for the first time a tropical country if they pay ordinary attention to hygienic laws, particularly to cleanliness, and temperance in eating and drinking. In the majority of cases when foreigners suffer from change of climate in this or most other tropical countries the cause can be traced to their own imprudence and careless habits of life. The immoderate use of fruits, although novel and delicious, particularly after a long sea voyage, should be avoided, as they tend to disarrange the gastro-intestinal functions and produce dysenteric and diarrheal diseases, which are those most to be feared by newly arrived strangers. Alcoholic liquors, if used at all, should be taken with extreme moderation. Animal foods and fats, which are heat-producing, should be used sparingly and care be taken to provide against sudden changes of temperature by proper clothing. If these precautions are followed until he becomes thoroughly acclimatized, there is no reason why any person of good constitution should not enjoy good health.

Elephantiasis and leprosy prevail to some extent, and biri-biri is also common and fatal among the natives. Typhoid fever is also prevalent at times, but the white inhabitants seldom suffer from it or any of the other diseases which affect the natives. This immunity is due, without doubt, to better nutrition and sanitary conditions in their dwellings.

FOREST PRODUCTS

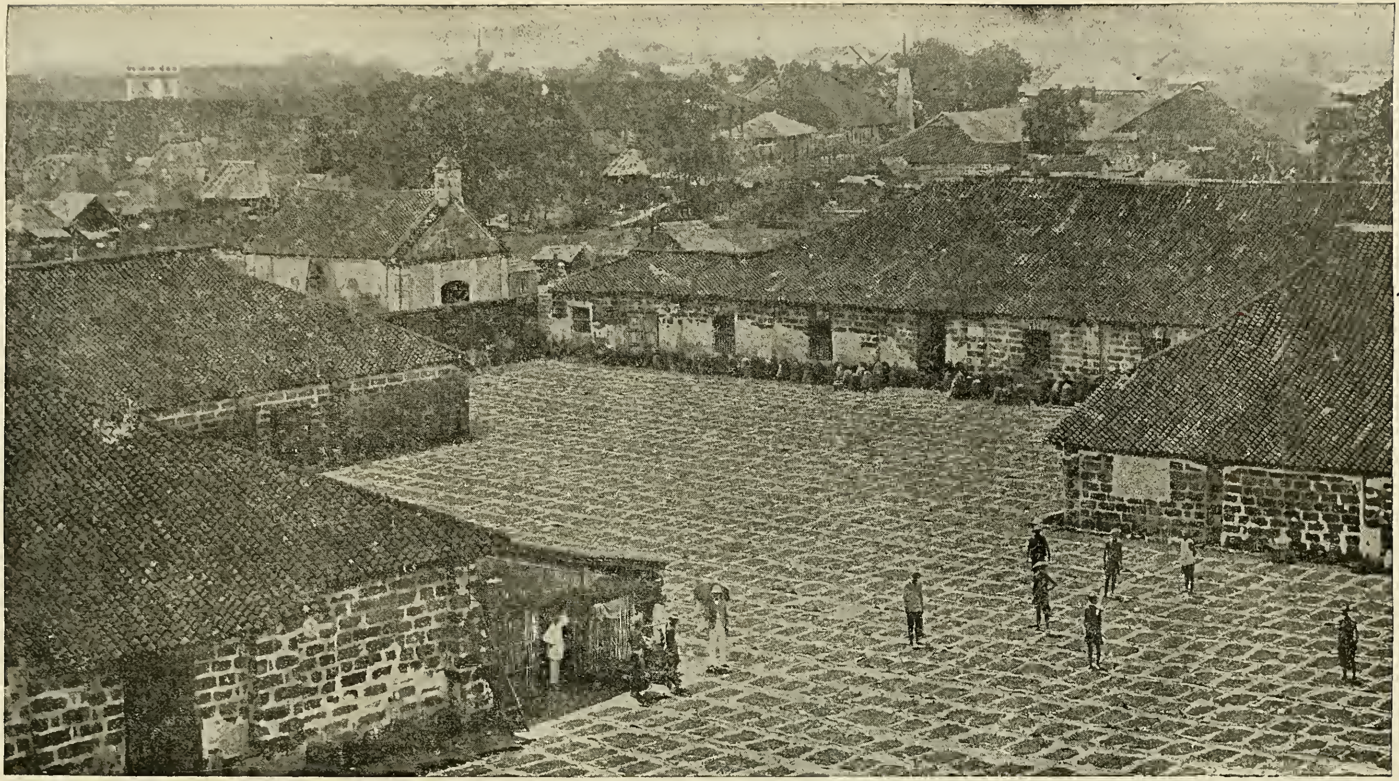
In estimating the natural riches of the islands the forest growths form an important factor. Ebony, cedar, ironwood, sapan wood, logwood, and gum trees abound, and in addition to these familiar trees there are hundreds of other varieties not generally known, even by name, which produce useful and ornamental woods available for many purposes. Gutta-percha is found in some localities, and the tall and graceful cocoanut palm, *Cocos nucifera*, is universal and contributes in no small degree to the comfort and prosperity of the natives. Its trunk, branches, leaves, fruit, shell, and husk are all turned to account. It produces fruit when seven years old that forms an important article of diet. It is eaten when the nut is young or at that stage when the shell is just formed, in a thin layer that can be cut with a spoon. When the fruit is mature or in the condition in which it is brought to our markets, it is valued only for its oil. To obtain that, the nut is broken and the meat scooped out and boiled in a large pan. As the oil rises to the surface it is skimmed off. When first made it has a rich, sweet taste and is used for culinary purposes and hair-dressing, but after a few days it becomes rancid and is used only for lighting and lubricating. Throughout the islands it was the only substance used for lighting until the introduction of kerosene, but it is still in almost universal use by the natives, particularly in the interior, not only from motives of economy, but from its being so easily manufactured or procured.

Of all the indigenous vegetal products, the bamboo, which, although botanically a grass, is practically a tree, is most plentiful, useful, and ornamental. It is scattered everywhere in profusion, and is always found near native habitations. It is put to an infinity of uses, from the construction of bridges and dwellings to the manufacture of furniture, domestic utensils of all kinds, pipes for conveying water, musical instruments, mats, fences, and scaffolds—in fact, the roots, trunks, branches, and leaves are all utilized. The varieties of bamboo are almost innumerable, some attaining a height of fifty or sixty feet and varying in diameter from eight to nine inches, while others are as small as a rattan. The forests also abound in the various classes of canes, rattans, and others of the calamus family, which are important and useful and serve for a great variety of purposes.

The Areca palm grows to about the same height as the cocoanut tree, and produces a nut about the size of a small hen's egg. It is called bonga by the natives, and the quantity used is enormous—men, women, and children all chew it. A piece of the nut is wrapped in a leaf of the betel pepper, which is smeared with shell lime made into a paste with water. In the city of Manila alone there are hundreds of places devoted solely to the sale of this article prepared ready for use, and it can be found on sale in every town and village.

AGRICULTURE

There is a great similarity between the agricultural products of Cuba and the Philippines—in both sugar and tobacco are the great staples—but the latter islands possess an unique product which hitherto it has not been found possible to raise successfully elsewhere, although attempts have been made to introduce it in Borneo, Cochin-China, the Andaman islands, and other places. It is known commercially as Manila hemp, but this is a misnomer, as it has no relation to the hemp plant. Its native name is abacá, and it is the product of a species of plantain or banana, *Musa textilis*, which differs very slightly in appearance from the edible variety, *Musa paradisiaca*. Its fruit, however, is small, disagreeable to the taste, and not edible. It grows to the height of twelve to fifteen feet. There is evidently some peculiarity of soil or climate, or of both, which enables these islands to retain a monopoly of this fiber which has become of such immense commercial value. It grows best in hilly or mountainous districts, and particularly in the volcanic regions in the eastern parts of the islands. It is hardy and suffers little from any enemy except drought. It has the advantage of being a perennial crop, like its fruit-bearing relative, month after month young shoots springing up from the original root.



DRYING SUGAR AT A FACTORY — ISLAND OF LUZON

By courtesy of Leslie's Weekly

In starting a plantation the timber and undergrowth are cut down and allowed to lie until dried by the sun, when they are burned and the young sprouts or suckers are planted. Nothing more is ever done in the way of cultivation except to cut down weeds and extraneous growths to allow access to the plants and to replace those that may die from accident or old age. They reach maturity in about three years, and should then be cut, as at that age they yield the best fiber. If they are cut earlier the fiber is short and lacking in strength, and if allowed to grow too old before cutting it becomes harsh, woody, and brittle. A large quantity of land is required to form a successful plantation, as the plants occupy considerable room, and it requires the product of five or six acres to produce a ton of fiber at each cutting.

The method of decortication is as rude as the agricultural process. It is true that many machines constructed on scientific principles have been experimented with, but none so far have proved satisfactory, and the crude native implement is still the only one in use; it consists of a rough wooden bench with a long knife-blade hinged to it at one end and connected at the other to a treadle. Strips of the plant are drawn several times between this blade and the bench, which removes the pulp and outer skin, leaving the fiber, which is then cleansed by washing, dried in the sun, and packed for shipment.

It is one of the most useful fibers known to commerce. Beside its value for making rope and cordage, it is extensively used in the United States for binding twine for harvesting machines. Nearly one million bales are exported annually, of which forty per cent comes to the United States.

Sugar is grown very extensively. The cane, *Saccharum violaceum*, is not of the same species as that cultivated in the Western hemisphere, but it is of the kind common throughout Malaysia and Polynesia. It is either a native of the archipelago or was introduced in prehistoric times. Several varieties are raised on the islands, some of which are used as food for man and animals and others for sugar-making. They are all rich in saccharine qualities, but the greater part of the sugar produced is coarse and of poor quality, and brings a low price in consequence of slovenly methods of cultivation and manufacture and the lack of high-grade machinery, such as is used in Cuba and the United States. The quantity produced, however, is very large, supplying all that is used for home consumption and furnishing for export annually an average of 250,000 tons, which could be indefinitely increased by the introduction of improved machinery, skill, and capital.

Tobacco is an important crop, and Manila cheroots and cigars are as famous and highly appreciated east of the Cape of Good Hope as the Havana product is among western nations. The quantity of the leaf raised is very great, but its cultivation is capable of much further development. It has been estimated that 20,000 or more persons find employment in its preparation and the manufacture of cigars, exclusive of those who raise the leaf. In one factory alone in the Binondo suburb of Manila about 9,000 young women and girls are employed. Tobacco was made a government monopoly by Captain-General José Basco y Vargas in 1781, and remained so until July 1, 1882, when the trade was thrown open.

Rice is largely grown, but its use is so general and the demand for home consumption so great that little is left for exportation, although a market could always be found in China for any amount that might be sent there. There are several varieties grown in the islands, but they may be classified under two heads: the upland or mountain rice and the water rice. The upland rice

GIRLS MAKING CIGARS

By courtesy of Leslie's Weekly

NATIVE AGRICULTURE OF PHILIPPINE ISLANDS — PLOWING

By courtesy of Leslie's Weekly

is sown broadcast on the hill lands after plowing and harrowing the soil. It matures in about three to four months and is harvested ear by ear. The water rice is sown later in the year, after the rains have commenced and the low land has become thoroughly water-soaked. The seed is sown in the mud and water, and in about six weeks the young plants are transplanted to the rice fields, which are kept thoroughly irrigated.

The cacao bean, *Theobroma cacao*, was introduced into the islands from Mexico by the Spaniards. It found a congenial home, as it grows luxuriantly and produces good crops, from which excellent chocolate is made, but principally for home consumption.

Corn, which was also brought to these islands from the Western hemisphere, is grown to some extent, as are also cotton, vanilla, cassia, ginger, and pepper. Coffee of excellent quality has also been produced, but of late years the crops have not been very successful, in consequence of disease among the trees.

All fruits suitable to the climate are plentiful, including the orange, tamarind, guava, and pineapple.

The mango grown in the Philippines is considered of very fine quality. The tree, *Mangifera indica*, is large and thickly branching, with bright green leaves. The fruit before it ripens is so acid that it forms a good pickle by merely preserving it in salt water, but when ripe it changes from green to bright yellow and has a rich aromatic flavor.

The mangostin, one of the most delicious of all tropical fruits, is grown in Mindanao and some other of the southern islands of the group. The tree on which it grows resembles a pear tree in size and shape, the reddish brown-skinned fruit is spherical in form, the outer rind is thick and tough, enclosing a white center, which is slightly sweet, but of most delicious and delicate flavor. This fruit is confined to the Malay peninsula and eastern archipelago, and all efforts to raise it elsewhere have failed.

Of all the native fruits, however, the banana is the most prolific and useful to the people, giving them a larger amount of nutritious food from a given area of land than any other crop, with a minimum expenditure of labor. Bananas as used in this country have been gathered while immature and have been bruised and heated in transportation; consequently they bear but small likeness to the fruit in its tropical home. A traveler who has partaken of a meal in a native dwelling in the Philippines, consisting of rice, boiled as only the natives can cook it, and ripe bananas full of delicious juice, melting in the mouth like cream, with the cool and fragrant water of the cocoanut as a beverage, can appreciate how much nature has done in those regions to supply the wants of man and how little of human labor is required to support life.

MINERALS

From what is known of the mineralogy of the islands, there is no doubt that a scientific geological survey would prove that they are rich in ore deposits of many kinds. Gold has been found in several of the provinces, but chiefly in the more mountainous and inaccessible localities, many of which are occupied by independent tribes that have never submitted to Spanish rule; but that the auriferous formations extend over a wide area on the island of Luzon is proved by the fact that in the alluvial deposits of every stream on the Pacific side some color of gold can be found. The islands of Mindanao and Mindoro are also equally promising fields for prospectors for gold. In many places the natives have extracted considerable quantities of gold dust by washing the alluvial deposits; in others gold-bearing rock is broken by them with hammers and ground in rude mills, such crude methods of course producing but poor results. It seems remarkable that with the knowledge that gold exists the Spaniards have not taken measures to prosecute the search for it, and to apply modern scientific means to obtain profitable results. This, however, may not appear so strange when we consider that for centuries the gold deposits of California were in their possession without being utilized.

Iron ore of excellent quality is abundant, but from lack of means of transportation and machinery it has not been found possible to manufacture iron as cheaply as it can be imported, so that whenever works have been started they have soon been abandoned as unprofitable.

Rich deposits of copper also exist, and many of them have been worked in a desultory manner by the natives, and more recently some of them have been operated by a company organized in Europe, but without any pronounced success. Galena and zinc blends have also been found. Several very promising coal-fields are known, and some of them have been utilized to a small extent, but the absence of roads and consequent expense and difficulty of transportation have proved a bar to development of this as well as of all other mineral resources. Sulphur is found in the vicinity of many of the ancient volcanoes, in quantities that would prove profitable if transportation facilities could be obtained.

MANUFACTURES

Shipbuilding is carried on to some extent, but the vessels built are principally small and intended for the coasting trade among the islands.

Considering that the Philippines are essentially an agricultural region, the manufacture of textile fabrics has attained considerable development; but it is not carried on in large establishments, and little has been done to introduce modern machinery. The looms are made of bamboo, and are of the simplest construction.

In some districts, particularly in the islands of Panay and Luzon, there are communities where almost every family possesses a loom, and in the houses of some of the well-to-do natives a number of looms may be found which are operated by hired labor. The products are principally cotton cloths, sail cloths, quilts, coverlets, etc. Coarse fabrics are also made from fibers extracted from the leaves of the sago palm, manila hemp, and other fibers. The most beautiful fabric produced on the islands is that called piña, which is made from fiber obtained from leaves of the pineapple plant. The plants are raised especially for this purpose. Before the fruit begins to form the crown is removed, which not only prevents the formation of the fruit, but causes the leaves to grow larger; when they reach maturity they are broken from the plant and the outer skin and pulp are removed by scraping. As the fibers appear they are cautiously raised and removed one by one, and after a thorough cleansing by washing are dried in the sun; they are then assorted according to lengths and qualities by women and tied together in packages for the weaver's use.

The weaving is a delicate process, requiring the greatest care on the part of the operator, and the fabric produced is so exquisitely fine that sometimes only a few inches are the result of a day's work. Sometimes silk, which is imported from China, is mixed with the anana fiber, but the plain piña is the most esteemed and is largely sent to Manila, where it is embroidered. In that city and the suburban villages large numbers of women are employed in this industry. The work is frequently of the most exquisite quality and is sold for extravagant prices. In the villages near Manila and in many other communities on the islands women are also employed in making hats somewhat similar to the celebrated Panama hats, cigar cases, and other small wares, in which they display great skill and taste. Mats are also largely manufactured, and as every one uses them to sleep on, the demand is constant. They are of various qualities, but some of them are beautiful in texture and are ornamented with colors and gold or silver threads.

Cotton rugs of handsome designs are also made in some of the islands. Horn is also softened and fashioned into bowls and other utensils. Many of the various articles produced by native workmen are remarkably artistic and beautiful, considering that all their tools and implements are of the simplest and rudest character.

COMMERCE

The earliest development of commerce between the Philippines and the outside world was in the direction of China and Japan, which gradually increased in importance. The Chinese were the founders of this interchange of products. At first their merchants came and returned each year, but as the trade increased they found it more profitable to remain permanently, and founded that Chinese commercial colony which, in spite of occasional outbursts of fanatical persecution and of oppressive taxation, has really been the mainstay of commerce in the islands.

The earliest efforts of the Spaniards after obtaining possession of the country were directed to securing for Spanish subjects a monopoly of the trade, precisely as they did in their American possessions, and to this end for a long time only a single ship was allowed to make the voyage each year from Mexico to the Philippines and from the Philippines to Mexico. These ships, called by the Spaniards the Acapulco ships and known to the English as the Spanish galleons, were equipped as ships of war and commanded by officers of the navy. This monopoly insured enormous profits to the adventurers who supplied the cargoes, but the whole business was permeated by corruption and roguery of the worst description. This condition existed, but with diminishing success, until 1815, when the last of these vessels was dispatched from Acapulco, as their monopoly had been gradually absorbed by a company chartered in Spain in 1784, called "Compañia de Filipinas," which by opening direct commerce with Spain caused the decline and final extinction of the trade via Mexico. This company, however, in consequence of bad management and injudicious ventures, did not prove successful and passed out of existence at the end of fifty years. In the meantime some relaxation of the narrow-minded exclusive system had taken place; in 1789 the port of Manila was opened to foreign vessels, and in 1809 an English firm received permission to establish a business house in Manila, being the first foreigners to receive such concession. In 1814 this permission was made general.

It is, however, only since 1834, when the operations of the Philippine company came to an end, that greater freedom of intercourse and larger introduction of foreign capital and business methods has affected materially the development of the great natural resources and a foreign commerce has resulted which, although far smaller in amount than it ought to be, is a fair indication of what it might and would become if the country should be controlled by a liberal and progressive government. The statistics published in another part of this issue will give a good idea of the progress and present condition of the commerce of the islands.

Internal commerce as well as the export trade suffers from the lack of facilities for transportation. This is more marked during the rainy season, when the stormy weather which accompanies the southwest monsoon renders coastwise navigation dangerous to coasting vessels, and land carriage is impeded by bad roads and the absence of bridges, necessitating the floating of goods across the streams on rafts, while facilities for personal travel have been confined to horseback or to uncomfortable two-wheeled vehicles called *carromatas*, over roads execrable in the dry season, but which in the wet season become seas of mud, only to be traversed by a rude sledge drawn by buffaloes—in fact, sleighing on the mud in place of the snow of northern climes.

But in this direction also there is a hopeful sign of progress, as the first railroad has been built and is in operation from Manila to Dagupin, 123 miles in length, connecting the capital with the rice-growing districts of Pangasinan. It is a single-track road, well and substantially built, and its earnings have been sufficiently remunerative to encourage an extension of railroad facilities whenever the islands may enjoy the blessings of peace and liberal government.

The traveler in the interior of Luzon will find no hotels nor inns for his accommodation, but every village has a public building—often, indeed, a very rude structure and sometimes a mere hut—where he is entitled to shelter and where he can obtain food, frequently of poor character, at a fixed tariff rate. Wherever a priest or a convent is located he is sure of more commodious quarters and better fare.

HARBORS

The immense coast line of the islands contains a great number of good harbors, but in consequence of the exclusive policy of the Spanish government in closing them to foreign commerce very little is known of them except to coastwise navigators. The foreign trade is confined chiefly to Manila, Iloilo, Cebu, and Sual. Zamboanga, on the island of Mindanao, is also an open port, but the amount of business transacted there is insignificant.

The bay of Manila, one of the finest in the world, is about 120 miles in circumference, with deep water and very few dangers to navigation. The entrance is divided into two channels by the islands Corregidor and Caballos, the northern about two miles in width and the southern five miles. The anchorage for large vessels is good within a short distance from the mouth of the river Pasig, on which the city of Manila is situated and which enters the bay on its eastern side, where it is prolonged into the bay by two piers, which terminate the one in a small fort and the other in a light-house. During the stormy weather of the southwest monsoon this anchorage off the city is not considered very safe, but there is good shelter for ships at Cavite, which lies about eight miles southwest of Manila in a direct line by water or fourteen by land. Here the Spaniards have a naval establishment, with a marine railroad capable of taking from the water vessels of 2,000 tons displacement; a dock for gunboats and small vessels, and shops containing machinery and appliances for repairs; also an arsenal and hospital.

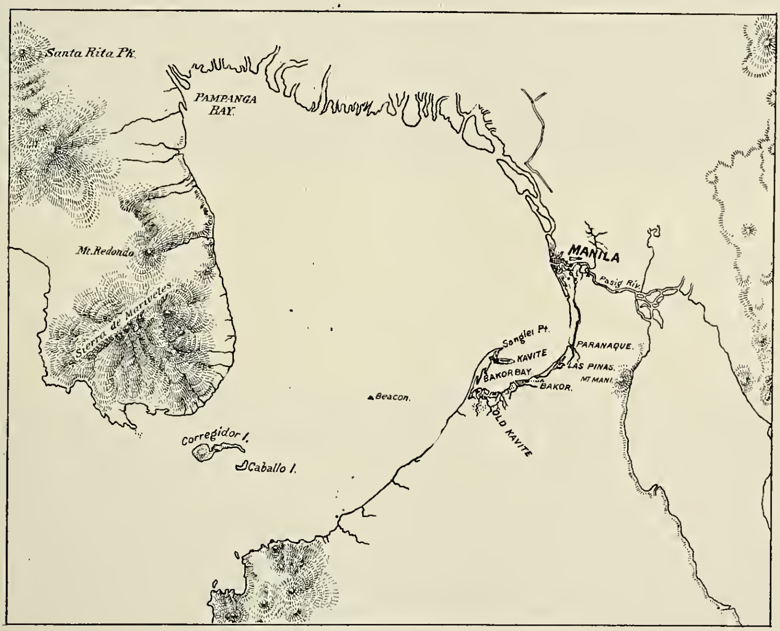


CHART OF MANILA BAY

Iloilo, the second port in importance, is on the island of Panay, near its southeastern extremity, distant about 250 miles in a direct line from Manila. The approach to the harbor is by a channel between a sand bank and the island of Guimaras, which lies about two and a half miles from the shore. The anchorage for large vessels, which is well protected and naturally good, is outside the mouth of the Iloilo river, but small vessels enter it and discharge their cargoes at the wharves of the town which faces both on the sea and on a bend of the river.

CITIES AND TOWNS

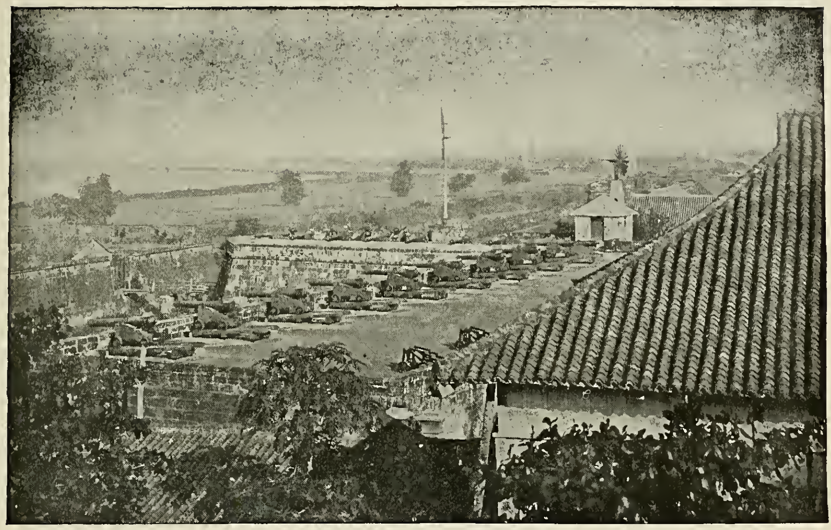
Although there are innumerable villages and many considerable towns in the Philippine islands, the restrictive policy of Spain and the centralization of civil, military, and ecclesiastical power at Manila have prevented the growth of any other great community; consequently it is the only important city.

The geographical conditions, principal among which is the connection of Manila bay with Lake bay by the river Pasig, affording facilities for communication with the interior, led to the foundation of a settlement at the mouth of the river in prehistoric times, as when the Europeans first landed there they found a native town, enclosed by a stockade for defense, called by the natives Maynila.

Although the name Manila is generally applied to the city on both sides of the river Pasig, which forms the metropolis of the islands, it is only the old walled city or fortress situated on the left, or south, bank of the river to which the designation was originally applied. It was founded in 1581, and King Philip III of Spain gave it armorial bearings and conferred on it the title of "La muy noble ciudad," the very noble city of Manila. It is a typical old-fashioned Spanish town, surrounded by ramparts, and has seen very little alteration or improvement during

NATIVE VILLAGE OF ALBAY

By courtesy of Leslie's Weekly



SPANISH FORTIFICATIONS NEAR MANILA

By courtesy of Leslie's Weekly

the past two hundred years. It contains seventeen streets, laid out at right angles. The governor's palace, the cathedral, and archiepiscopal residence face on the plaza, or public square, which is adorned with magnificent tropical shrubbery and flowers, surrounding a statue of Charles IV, which stands in the center. The barracks for the military forces, the government offices, and custom-house are all located in this old town; but as there is very little business or commercial activity there, it is intensely dull and life there is monotonous. Just outside the fortifications is a broad road called the Calzada, which is to Manila what the Paseo de la Reforma is to the City of Mexico, Hyde park to London, or the Champs Elysées to Paris. Every fine evening from 5 o'clock to dusk it is crowded with carriages and equestrians, seeking relief in the cooler evening air after the heat of the day, and society enjoys the luxury of seeing and being seen.

Near the river stands a stone column erected to the memory of Fernando de Magalhæs, the Portuguese navigator and discoverer of the islands. It stands on a marble pedestal, and is surmounted by a bronze sphere, and decorated midway with dolphins, anchors, and laurel wreaths.

On the opposite side of the river, and connected with the old city by several bridges, is the newer town, which is the commercial metropolis, called by the Spaniards Binondo, but is now universally included in the designation Manila. It is full of animation and activity and forms a startling contrast to its sleepy old neighbor across the river; in passing a bridge from the old city the passenger seems to step at once from the sixteenth to the nineteenth century. Here all is life and bustle; the principal street, called the Escolta, is lined with stores and business places of all classes, and from morning to night is thronged with a motley crowd of many races and every shade of color, while electric lights and street cars attest that the spirit of progress is gradually encroaching on the conservative ideas of the past.

In the old city and the older parts of the newer town most of the buildings were of brick and stone, with tiled roofs, but repeated shocks of earthquake have taught the lesson to build in anticipation of them. It is now very rare that stone or brick is used in the construction of buildings above the level of the ground. Modern houses are seldom more than two stories in height, with galvanized iron roofs supported by wooden pillars, so arranged as to allow of a certain amount of oscillation independent of the walls. The native houses are built of wood or bamboo and thatched with palm leaves; they are of course very combustible, but practically earthquake proof.

The population of the metropolis and its suburbs is about 250,000 to 300,000. Many of the suburban villages are very populous. Tondo, a short distance on the Binondo side, has upward of 30,000 inhabitants, Santa Cruz has 12,000, and Santa Ana, a pretty village where many of the wealthy citizens of Manila have country residences, contains about 7,000 people.

POPULATION

Spanish statistics are notoriously unreliable and no accurate census has ever been taken, but the number of inhabitants is about 8,000,000. The bulk of the population is of Malay origin. On their first arrival the Spaniards found part of the natives in possession of some amount of civilization. They had a written language, of which some specimens have been preserved, though of no value in throwing light on their former history, and their traditions are very few. The Spanish priests here, as in Mexico and Central America, did all in their power to extirpate all mythological and other lore that existed, and unfortunately with almost complete success; but fortunately for the inhabitants they were treated more mercifully than in most of the other newly

THE ESCOLTA — MAIN BUSINESS STREET OF MANILA

By courtesy of Leslie's Weekly

CERVANTES SQUARE, MANILA

By courtesy of Leslie's Weekly

discovered countries acquired by Spain, so that they have increased in numbers instead of being exterminated, as in many places in the Western hemisphere. This was not due, however, to any magnanimity on the part of the Spaniards, but to the fact that the great distance of the islands from Spain prevented their being overrun by greedy and cruel adventurers, as was the case in the West Indian islands and adjacent mainland.

In Mindanao and some of the other southern islands there are some pure Malays, who are Mohammedans. They are called "Moros"—Moors by the Spaniards—and at times give them as much trouble as the African Moors gave their ancestors in Spain.

There are also in the interior of Luzon and other islands many semi-savage tribes, who have never submitted to Spanish rule or to Spanish taxation, and when they escape the latter it is pretty certain that they are not under control. They are as untamed and are living as primitive a life as they were when the Spaniards landed on the islands, more than three centuries ago.

The Philippine Malays are a superior race to many other Asiatic people; they are orderly, amiable, courteous, honest, and hospitable, exceedingly superstitious, and when they profess Christianity are easily influenced by the priests. Like most tropical people, they are intermittent rather than steady workers. Their wants are easily provided for, and they take life easy. They are lacking in energy when at peace, but their hot tropical blood makes them fierce and revengeful in war. They are fond of music, dancing, and amusement of all kinds, but are born gamblers, and cock fighting is their great passion. Every native, however poor, owns a game cock, and is always ready to bet his last coin on its prowess. Every town and village has its cock-pit, and in the larger communities the spectators may be numbered by thousands. Of course, this amusement, like everything else in the Spanish colonies, is heavily taxed, and a considerable revenue is derived from this source. Advantage is also taken of the taste for gambling by running a lottery for the benefit of the government.

The mestizos or mixed races form a numerous and influential portion of the population. The descendants of Spanish fathers and native mothers are numerous. A large proportion of the merchants and landed proprietors are of this class, and most of the subordinate and clerical offices of the government are filled by them. Another element is the Chinese and half-breeds of mixed Chinese and native blood. Few Chinese women come to the islands and the men intermarry with the native women; in their offspring the paternal type seems to absorb the maternal and to be persistent for generations. Throughout the islands, or at least in all the larger towns, the bulk of the retail trade, banking, and money-lending is in Chinese hands. They are industrious, persevering, economical, and many of them possess considerable wealth. There are probably not more than fifteen or twenty thousand Spaniards or people of pure Spanish blood who are permanent or temporary residents, and the number of other foreigners is not large. The majority of them are in Manila.

NEGRITOS

By courtesy of Leslie's Weekly

The English have established a club at Sampalog, in the suburbs, which has become the center of foreign social intercourse.

HISTORY

The Philippine islands were discovered by the Portuguese navigator Fernando de Magelhæs on the voyage from which only one of his ships returned after circumnavigating the globe. He first sighted them on St. Lazarus' day, 1521, from which circumstance he named them Archipelago de San Lazaro. His first landing was on the eastern coast of the island of Mindanao. He afterwards went to Cebu, where he became friendly with the native ruler and accompanied him on a warlike expedition in which he was killed.

From this time until 1542 several expeditions were dispatched from Spain to take possession of the islands, but from a variety of causes all failed. In 1565 another expedition, commanded by Miguel de Legaspi, was dispatched by Philip II to secure the islands, which had been named the Philippines in his honor before his accession to the throne. Legaspi made good his footing in Cebu, but afterwards transferred his headquarters to Luzon, and the city of Manila was founded in 1581. From this time the islands were gradually brought under the dominion of Spain—that is, so far as their subjection was successful, which really extended to little more than the seacoasts and such towns and villages as have been created by the Spaniards or held by their military forces or by the power of the priests. That this dominion has continued is solely from lack of organization among the natives, and risings have taken place from time to time, but have always been suppressed. The islands have also been frequently threatened from without, but have never been wholly lost to Spain since Legaspi first planted the Spanish standard on them. For a long time the attacks were made principally by the Portuguese, who were jealous of the increasing power of Spain in the Orient; later the Dutch, incited by a similar feeling, endeavored to obtain possession of the islands. These attacks, however, were never very serious affairs, and the only really dangerous invasion was in 1754, when Li-Ma-Hong, a Chinese pirate, attacked the Spanish possessions with a powerful fleet of 95 war junks, but was defeated and compelled to retreat; and again, in 1762, when the English captured the city of Manila and held it and the neighboring country until 1764, when, peace having been restored, the captured territory was returned to Spain.

The more civilized natives and particularly the half-breeds, who are sufficiently educated to crave for greater freedom, have long been in a chronic condition of discontent, induced by oppressive taxation and tyrannical rule, in which the ecclesiastics have always used their authority to support the government. This produced a crisis in 1896 and led to the serious insurrection which has been in progress, with various ebbs and flows of fortune, until the present time.

ADMINISTRATION

In Madrid there is a council of state for the Philippines, which has in charge the interests of the colony and acts as an advisory board to the Minister of the Colonies. At Manila the administration of the government has for its head and chief a governor-general. Next to the captain-generalship of Cuba, this is the most important and lucrative post at the disposal of the home government. This jurisdiction also extends over the Mariana or Ladrone islands, the Carolines, and the Pelew islands.

There is also a lieutenant-governor, who takes the place of the captain-general in case of his death, and a council in Manila, which has a voice in all questions concerning the internal affairs of the islands. The archbishop also exerts considerable power, and the ecclesiastical authority is interwoven in all the machinery of government.

The islands are divided into provinces subject to politico-military governors or alcaldes mayores, who are generally civilians. The provinces are subdivided into districts, and these again into pueblos or parishes, over which is an officer called a gobernadorcillo, a diminutive of governor, who is elected annually by the people; but the real power in these communities is generally the priest, who not only looks after the spiritual welfare of the people, but directs their material affairs. For the imposition and collection of taxes Spanish ingenuity has been exercised to the utmost; but the basis of the financial system in the Philippines is the poll tax, which every adult, both male and female, under sixty years of age has to pay, and unhappy is the lot of the native who fails to meet the demands of the tax-gatherer. He is arrested and imprisoned or deported to a penal settlement, and his family, if he has one, is left to shift for itself.

RELIGION AND EDUCATION

The Roman Catholic is the established church in the Philippine islands, which contain one archiepiscopal see and three bishoprics. Most of the ecclesiastical authority is in the hands of the various religious orders—Dominicans, Augustines, Franciscans, etc.—who are the real rulers of the country, as their power among the natives far exceeds that of the civil or military authorities, and of this power they are very jealous, as is evidenced by the long record in the history of the islands of bitter controversies between the church and the civil authority and the quarrels of the religious bodies among themselves in their efforts to maintain ascendency. There is no doubt that among the priesthood there are many devout, sincere men, who do their duty faithfully and devotedly and exert an immense and beneficial influence on the natives under their charge; but, on the whole, religious affairs on the islands are behind the age and would be more useful to the people, who are naturally devout, if they were infused with the more modern ideas and methods of the Church in Europe and America.

Education is much neglected. Both the institutions for higher education and primary schools are antiquated in their methods and altogether behind the times, and although in nearly every town and village that is under the control of the government a school may be found, neither the quantity nor quality of the instruction it imparts is satisfactory.

NOTES ON SOME PRIMITIVE PHILIPPINE TRIBES

By Dean C. Worcester,

University of Michigan

Should the Philippine islands become a permanent possession of the United States or of any other civilized nation, the problem of giving them good government and of developing their enormous latent resources will be by no means a simple one, although it will, in my judgment, be one that will richly repay successful solution. Spain has never seriously attempted to solve it. From the time of its discovery until now the archipelago has been one vast plundering ground for her hungry officials. She has conquered so far as greed of gain made conquest desirable or safety demanded it, but there she has stopped.

Although it is 377 years since Magellan discovered the Philippines and 334 years since Legaspi began his active campaign against the islanders, there still remain in the great islands Luzon and Mindanao, as well as in Palawan, Mindoro, and the highlands of Negros and Panay, tribes which are as independent of Spain as they were when the eyes of the famous discoverer of the passage from the Atlantic to the Pacific first rested on the mountain peaks of Mindanao.

It was primarily in search of rare or new birds and mammals that I visited the Philippines, and as that necessarily took me into the wildest and least explored islands, I was repeatedly thrown in contact with representatives of these slightly civilized or wholly savage tribes. While it would be idle to attempt to give within the limits of the present article any comprehensive account of even those savage peoples among whom I and my companions actually lived, brief notes concerning the more important of the tribes in question may not be entirely without interest at the present time.

Without doubt the most primitive of Philippine peoples are the Aëtas or Negritos, a race of blacks of almost dwarfish stature, with flattened noses, thick lips, and closely curling black hair. They are believed, and with reason, to be the true aborigines of the islands, who even at the time of the Spanish conquest had begun to go to the wall in the fierce struggle for existence which was then being waged between them and the encroaching Malay

CHURCH, CONVENTO, AND WATCH TOWER — DUMAGUETE, NEGROS ISLAND

tribes on the one hand and between the mohammedan and pagan Malays on the other. At present they are well nigh extinct and in a fair way to become entirely so. They seem to be confined to the higher mountain ranges in Luzon and Negros, although it is said that a few of them still exist in the mountains of northwest Panay, and they may yet be discovered in Mindanao. We encountered them but once. They wander through the forest, living for the most part on what they can pick from the trees or dig out of the ground, although the men sometimes make use of bows and arrows or rude lances in hunting. They sleep wherever night overtakes them, often without troubling to build so much as a leaf shelter. They are a sickly, wretched set; their birth-rate is said to be steadily falling off, and they must be regarded as a rapidly disappearing race.

The remaining Philippine tribes, whether pagan, mohammedan, or christian, are of Malay extraction, although in some cases there has doubtless been an admixture of Japanese, Chinese, Negrito, or even Papuan blood.

THE MANGYANS OF MINDORO

The most interesting of the Malayan tribes encountered by us were the Mangyans, who people the interior of Mindoro. Although its capital is distant but 120 miles from Manila, Mindoro is one of the least known islands in the archipelago, its pestiferous climate and the unsavory reputation of the renegade Tagalogs who inhabit its coasts having combined to discourage exploration, while there has been little to encourage exploration on the part of the Spanish, for the Mangyans have nothing to steal and could not well be taxed.

Mindoro was formerly known as "the granary of the Philip-

TAGALOG HOUSE — MINDORO

MANGYAN GROUP, WITH HOUSE — MT HALCON, MINDORO

pines," on account of the enormous rice crops raised in the fertile lowlands to the east and west of its central mountain chain, but the mohammedan pirates from the south preyed upon its civilized inhabitants, decimating the population; an epidemic nearly exterminated the buffaloes depended on for tilling the soil, and today the once fertile fields have for the most part grown up into forest land, while the coasts are peopled chiefly by escaped criminals from the neighboring islands, who find in the miasma of the forests a most effective ally against the troops which are from time to time sent against them. They band together and organize forays against the peaceable Spanish and native planters, and are a constant terror to the region around.

Even in the days of its greatest prosperity the cultivated district in Mindoro was restricted to a belt along the coast. The interior of the island stands today as it was in the beginning. Under the perpetual shadows of the mighty lowland forests, and in little clearings on the mountain sides, dwell a tribe of natives who show little kinship in speech or customs and none whatever in dress with the remaining Philippine peoples. They are called by the Spanish "Mangyanes" or "Manguianes," but I adopt their own pronunciation of their name, and call them *Mángyans.*

At the time of my first visit I was unable to learn anything as to conditions in the interior from the half dozen officials who with a few friars and a couple of Spanish merchants constituted the Spanish population of the island. I was informed, however, that the Mangyans were head-hunters and cannibals.

We began our explorations at a most unfortunate time. The rainfall is enormous in this island, and the rains were just beginning at the time of our arrival. The daily showers increased in duration and violence until they became almost continuous, and finally, after thirteen days and nights of uninterrupted downpour, we beat a retreat.

We returned to the island a second and yet a third time, however, and profiting by our first experience, began operations at the commencement of the dry season. By utilizing canoes where streams were sufficiently deep, and by tramping along their dry beds when water failed, we were able to quickly penetrate to the very center of the island. We found that most of the surface details given on our charts were incorrect, and explored two large rivers where, according to the charts, no rivers should have been.

The Mangyans fled at our approach, but we eventually succeeded in gaining their confidence, and found that the alarming accounts which we had heard of them had very little foundation in fact. They proved perfectly harmless when decently treated. The men were clad in the usual clout, and in that alone. The dress of the women is different from that of any other Philippine tribe. It consists of numerous coils of a cord braided of split rattan, or other similar vegetable substance, wound around the body at the hips and supporting a clout of bark. This bark is made soft by careful pounding between stones, and at a short distance it looks exactly like cloth. The cord is usually stained black, although a kind woven in black and yellow check is especially prized.

Girl babies are provided with two or three coils as soon as they can toddle, and the quantity is constantly added to as time goes by, so that the appearance presented by some of the old women is ludicrous in the extreme. This cord usually constitutes the only earthly treasure of the wearer, although the women sometimes ornament themselves with armlets or anklets of twisted rattan and beads made from the seeds of plants. Coins, copper wire, and bits of bright metal are highly prized as ornaments, but feathers are never used.

Married women are distinguished by the fact that they expose the breasts, while unmarried girls cover them with a peel from one of the plantains, ornamented with finely braided rattan cord.

During the dry season the lowland Mangyans often wander through the forest with no fixed place of abode. Where night overtakes them, there they sleep, each person making a shelter

MARRIED MANGYAN WOMAN, SHOWING TYPICAL COSTUME — MT HALCON, MINDORO

for himself by cutting off a couple of rattan leaves, fastening their buts together, and sticking them into the earth at such an angle as to give the leaves a suitable inclination. Under this quickly extemporized roof he sleeps, usually squatting on his heels.

When a company are planning to remain for several days in one place, they sometimes construct low thatched roofs, under which they build sleeping platforms of small poles. Such structures are usually planned so that each accommodates but a single person, but they may be large enough for an entire family.

During the rainy season more elaborate, or at least larger, structures are erected, in which several families not infrequently find shelter; but even these more pretentious dwellings are, in the case of the lowland Mangyans, usually left without sides. The more thrifty mountaineers, however, build tiny huts which are both roofed and sided with palm or rattan leaves, and are

UNMARRIED MANGYAN GIRLS, SHOWING TYPICAL COSTUME — MT HALCON, MINDORO

provided with a single opening which serves the triple purpose of door, window, and chimney.

The cooking, which is of the most primitive sort, is done over an open fire built on a pile of earth in one corner of the hut. Fire is obtained by striking flint with a bit of steel or iron and catching the sparks on a bunch of dry plant hairs. When the necessary materials cannot be had for obtaining fire in this way, the rubbing together of two ingeniously shaped pieces of dry bamboo speedily accomplishes the desired end.

As a rule, Mangyans live on the forest products which they

NATIVE SAIL BOAT — MINDORO — MANGROVE SWAMP IN BACKGROUND find at hand. The lowland people do not practice agriculture, but subsist for the most part on sago, which they get by felling the trees, cutting them into two-foot lengths, splitting these, pounding out the inner fiber with rude wooden mallets, running water through it to wash out the starch, catching the water in large leaves or rude troughs, allowing the starch to settle, and finally drawing off the water.

The starch may be eaten raw or toasted in an earthenware dish. Sometimes it is rammed, while still damp, into a joint of green bamboo, which is then put in the fire and allowed to remain there until nearly burned through, by which time the mass of sago has been converted into a solid roll, which would make an effective substitute for a policeman's billy.

The more vigorous and enterprising mountaineers have begun to practice, after a fashion, the art of tilling the soil. They have no other tools than the rude iron knives which they purchase from the coast natives and such wooden implements as they fashion for themselves; but with infinite pains they clear away small patches of forest, cutting through the trees at some distance from the ground, where the trunks are smallest.

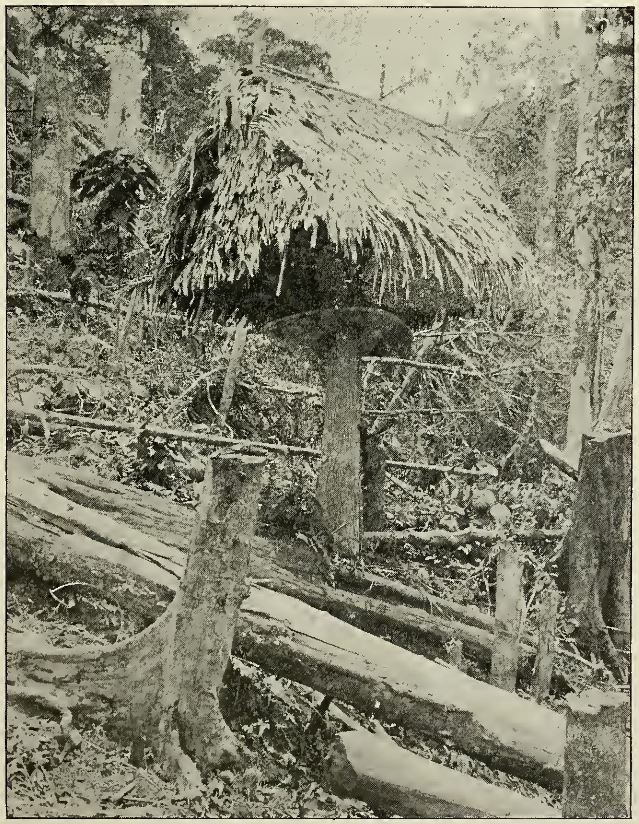
After burning the felled timber, so far as practicable, they plant sweet potatoes or mountain rice in the ground thus laid bare. Sweet potato vines grow with such luxuriance as to practically exclude weeds, so that a patch once started lasts for several years.

It should not be supposed, however, that the Mangyan is a vegetarian. He fashions lance, bow, and arrows for himself, and makes the wooden tips of his weapons tremendously effective by dipping them in a virulent poison. No bird or beast is too filthy for him to eat. Fish eagles, herons, carrion crows, and buzzards are acceptable luxuries, while crocodiles and certain species of snakes are delicacies to be highly prized. The huge white grubs which bore in the trunks of the sago palms are regarded in the light of confectionery. I fancy that the starch with which they are filled turns to sugar as it is digested, giving them a sweet taste, but must admit that I have never demonstrated this point experimentally. The Mangyans eat them alive, with many evidences of great satisfaction, and evidently find the flavor delightful.

I have seen them devour with satisfaction the flesh of buffaloes which we had killed two or three days before. It was swarming with maggots and smelled to heaven, but they gorged themselves with it until they could hold no more, getting up and running round from time to time in order to stimulate appetite and increase capacity. The grewsome meal ended, they lay down to sleep it off. Why it did not kill them I could never make out.

The lowland Mangyans signal to each other by pounding upon the roots of certain trees with large clubs, thereby producing a booming sound which can be heard for several miles under favorable circumstances. Their standard for measuring distance is based on the carrying power of the human voice, a given thing being so many "calls" away.

Their numerals usually stop at three, but their professors of mathematics are able to count up to twenty by making use of fingers and toes. As they always count in a definite direction,



MANGYAN STOREHOUSE FOR GRAIN — MT HALCON, MINDORO each digit comes to have a permanent numerical value. In actual practice, if we desired to tell a man to return in five days, we used to tie five knots in a bit of rattan and direct him to untie one of them every morning until they were gone, and then return.

When shown their own photographs they failed to recognize themselves, although they at once pointed out the likenesses of their friends. They made the most ludicrous attempts to catch or find the persons who stared back at them from our pocket mirrors.

Adult women would entertain themselves for hours with rattles which we extemporized by putting a few shot into a small metal box. At Naujan lake the people came from miles around to watch the spinning of a top which we happened to have among our belongings.

They are fatalists. The most dire misfortune serves only to call forth the remark, "So it is appointed."

We never saw the slightest indication of worship of any kind, nor could we learn by the most diligent inquiry that they ever practiced anything of the sort. They deny belief in a life after death. Persons who fall seriously ill are deserted. A hut in which a death has occurred is abandoned, the corpse and everything in the hut remaining untouched. Relatives of a deceased person change their names in order to insure better luck. The morals of this simple people are astonishingly good. Although the women seem utterly destitute of any sense of modesty, unchastity is very unusual and adultery so rare as not to be provided for in their criminal code. Although they had every opportunity to steal from us, they never took anything but a little tobacco, and even this they explained was not exactly thieving, since they put it directly into their mouths and took only enough for their immediate needs! Guilt or innocence is determined by the old fire test. A person against whom there is serious suspicion is compelled to snatch from the fire a piece of hot iron. They profess to believe that if he is innocent he will not be burned. The death penalty is not inflicted. A murderer forfeits his property to the relatives of his victim. Polygamy is lawful for those who can afford it. All we could learn of the marriage ceremony was that "the old folks get together and talk."

The few half-hearted attempts which have thus far been made to civilize the Mangyans have proved abortive. The priest at

Naujan told me with deep disgust of the reply of a Mangyan to whom he had attempted to demonstrate the benefits of civilization and christianity. The unregenerate savage had replied that if he adopted civilization and became a christian it would cost money to be born, money to be allowed to live, money to marry, money to die, and money to be buried, and he considered himself better off as he was. Inasmuch as his statement of the case was strictly correct and as it was my observation that morality increased among the Philippine natives as the square of the distance from Spanish centers of "civilization," I could not but feel that this mountain philosopher had decided wisely.

THE TAGBANUAS OF PALAWAN

Palawan or, as the Spaniards call it, *la Paragua*, is the westernmost of the Philippine islands. Although some 300 miles long, it is very narrow, and there are a score of points where it could be crossed in a day; so that the only difficulties attending its exploration would be the obtaining of porters and food. The fact remains, however, that little is known about the island. The only Spanish settlement is a penal colony at Puerto Princesa, the capital of the island, although there are a few little military outposts in the southern and western districts.

The island is covered with magnificent forest, in which are to be found many woods of great value. There are also numerous "mines" of damar, which are worked a little by the natives. Like most of the large islands in the Philippines, Palawan has a central mountain chain extending in the direction of its greatest length. Toward the south the mountains are covered to their summits with vegetation, but at the north they are as jagged and bare as our own Rockies.

Three tribes inhabit Palawan. These are the Moros, or piratical mohammedans of the south, the mountain-dwelling Battaks of the north, who are said to resemble the Papuans, and the Tagbanuas, who occupy the central portion of the island and the northern coast region. Three distinct dialects are spoken by the Tagbanuas alone, and I was informed that in one instance the inhabitants of two towns 15 miles apart did not understand each other.

Mr John Foreman, in his excellent book on the Philippines, has rightly said that the Tagbanuas are little known. He further informs us that they never bathe intentionally, and that they eat their fish and flesh raw. Apropos of their not bathing,

TAGBANUA MEN — PALAWAN

I may say that the river in front of our house at Iwahig was full of children half the time, in spite of the crocodiles, while an afternoon stroll along the bank of a small stream near the village was quite sufficient to have convinced the most skeptical observer that men, and women also, bathe upon occasion. While I am not prepared to say that Foreman did not see them eat their fish and flesh raw, it is certainly true that during my sojourn among them I never knew them to touch uncooked animal food.

The men are of medium height and are often fairly well developed physically, although skin diseases, digestive troubles, fevers, and starvation keep many of them in wretched condition. Young girls are frequently possessed of considerable comeliness, but they often marry in childhood, and they mature and age rapidly.

The Tagbanuas are a dark-skinned people. With many of them the hair shows a decided tendency to curl. It seems probable that they are a hybrid Aëta-Malay race.

Their dress is a rather unsafe subject for generalization. Many of the men wear clout alone. In the south, where they have

TAGBANUA WOMAN AND CHILDREN — PALAWAN

come more or less in contact with the Moros, they have in some instances adopted the trousers, tight jacket, and turban of the latter tribe, while near Puerto Princesa a few of the men are the proud possessors of cast-off articles of European dress. In approaching the Spanish town they carry their fine clothing under their arms until at its outskirts, and then dress beside the road. Women, when at work, wear a strip of cloth wound around the body and reaching from waist to knee. Most of them possess in addition a longer skirt and a semi-transparent shirt for state occasions.

Agriculture is more commonly practiced than among the Mangyans, but many of the men live for the most part in the forest, where they hunt, trap, and search for damar, wild honey, and wax. The structures in which they make their abode at such times hardly deserve the name of houses. They consist of leaf roofs, with a platform of poles underneath, and are usually large enough to accommodate an entire family. Under the sleeping platform a smudge is maintained to drive away insect pests, and it is common to see a whole family squatting contentedly in smoke that would asphyxiate a white man. A few empty cocoanut shells, some baskets for burden-bearing, and two or three earthen pots complete the list of household effects. Unlike the Mangyans, they work iron to some extent, constructing rude forges, with piston bellows made from large bamboo stems.

Although much of the Tagbanua's time is necessarily spent in the forest, he is naturally social, and especially during the long rainy season he seeks the society of his fellows, returning to his hut in some one of the numerous large villages.

The village houses are built of bamboo, nipa palm, and rattan, and differ from those of the civilized natives only in their smaller size, and in being perched at a much greater elevation above the ground. One often sees a young couple working away contentedly at their future home with no other tools than their fingers and a rude knife.

In the villages near Puerto Princesa there exists a travesty of the form of local government found among the civilized tribes, each village being presided over by a *gobernadorcillo* or petty governor, assisted by a "justice of the peace," and other more or less useless officials. No taxes are collected, however, and few burdens are imposed on these partially civilized Tagbanuas by the Spanish, who are trying to gradually accustom them to the yoke, in the hope of eventually bringing them to the full dignity of citizenship, which to the Philippine native means merely the paying of crushing taxes without receiving any adequate return.

A little distance from the Spanish town I found the people friendly and unsuspicious. They informed me that "in the early days" they were governed by a great chief, chosen by the will of the people, who held office for life. If he proved a good ruler, his eldest son was allowed to succeed him; otherwise a new chief was chosen.

BISAYAN NATIVE AND HOUSE — SALAG DAKO, GUIMARAS ISLAND

At present, however, there is no ruler for the whole tribe. The affairs of each community are directed by a council of elders, who administer justice according to their own ideas, with little regard for Spanish customs and requirements.

The method employed to determine the guilt or innocence of a person accused of crime is both novel and effective. The old men conduct accused and accuser to the bank of some deep pool, and there, in the presence of relatives and friends, the two dive into the water at the same instant. The one who remains longest beneath the surface is adjudged to have spoken the truth. Theft is punished by the infliction of a fine equivalent to twice the value of the stolen article. If the culprit be too poor to pay the fine, he is whipped. A murderer is killed by the relatives and friends of his victim. In a case of adultery an injured husband may kill both his wife and her paramour, but may not kill the one and not the other. If not murderously inclined, he can collect a heavy fine.

A father with marriageable daughters sets a price upon each. Whoever wishes to marry one of them must pay the price demanded. Should a father object on personal grounds to a suitor willing to pay the prescribed price, he must himself pay a fine to the suitor by way of balm to his injured feelings.

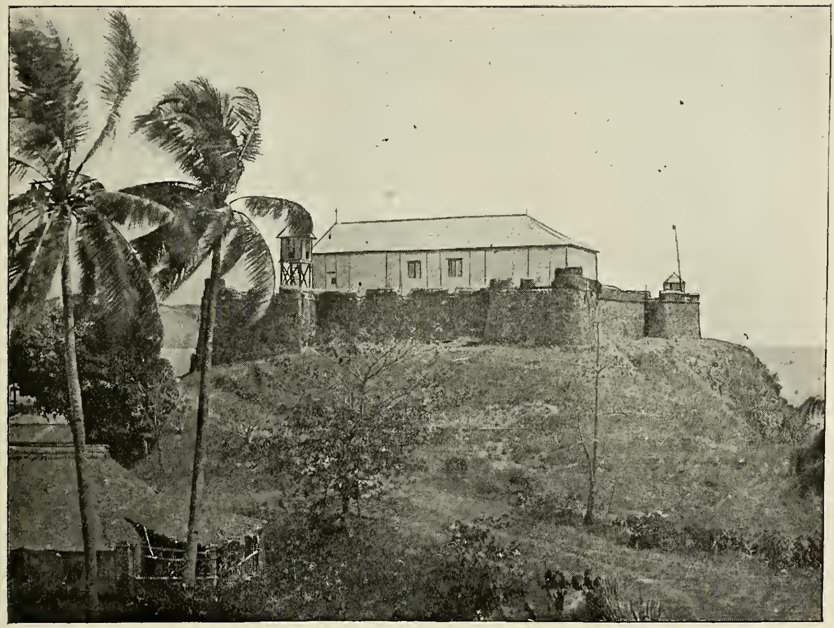
Child marriage seems to be the rule. Women are apparently less numerous than men, and their hands are much in demand. A curious reversal of this state of affairs exists in the island of Cuyo, where it is said that more than ninety per cent of the population are women. This remarkable result is not due to any abnormality in the birth rate, but rather to the fact that the men all run away as soon as they get large enough. The Tagbanua women are well treated and are allowed a considerable amount of personal liberty, but are expected to do their full share of hard work. It is not unusual for a woman to bathe and go about her customary duties the day after bearing a child. The Tagbanuas have a secret medicine for use at the time of childbirth, the nature of which they guard with the most jealous care.

When a death occurs the relatives set a time for the funeral. At the appointed hour the house of the deceased is torn down and his body is carried to the woods and buried in the earth. Dishes and earthen pots belonging to him are broken over the grave to mark it.

The Tagbanuas have a simple syllabic alphabet, which is in common use. The characters are scratched on smooth joints of bamboo in vertical columns.

Much might be added in regard to each of the people discussed, but enough has been said to give some idea of the methods of life and of the general characteristics of two fairly typical savage Philippine tribes. What holds true of them will hold in a general way, *mutatis mutandis*, of the other wild peoples. They are as a rule extremely ignorant, but harmless and inoffensive so long as they are well treated.

They will afford an interesting problem in civilization to the nation whose flag is in future to float over their islands. They will also afford a most interesting study to the anthropologist, and it ought to be made before the record of the daily life, the thoughts, and the ideals of these harmless and simple children of nature has been forever blotted out by the encroachment of that new order of things which is sure to follow when the blight of Spanish domination is finally removed from the islands.



OLD FORT, WITH CHURCH INSIDE — CULION ISLAND

COMMERCE OF THE PHILIPPINE ISLANDS

During the year 1896 the total foreign commerce of the Philippine islands amounted to $30,806,250, the exports amounting to $20,175,000 and the imports to $10,631,250. Of the total foreign trade, that with the United Kingdom amounted to $9,934,590, that with the United States to $5,145,303, that with France to $3,782,800, with Japan to $1,486,691, with Germany to $968,628, and with other countries, including Spain, to $9,488,238.

The ratio of imports to exports, among these different countries, varied in a very striking and highly significant way. While the United States purchased 4,982,857 dollars' worth, or 24.6 per cent, of the exported products of the islands, she sold to them in return only 162,341 dollars' worth of the products of her own mills and mines and forges. From the United Kingdom, however, the islands purchased commodities to the value of $2,467,-090, or about one-third of the value of their exports to that country. France sold to them almost as much as she bought from them, while Germany sold them more than three times as much as she took from them.

The principal articles of export are manila hemp, sugar, copra, and tobacco. During the ten years ending June 30, 1897, the average annual exports of sugar were 301,814,668 pounds, of which the United States took annually an average of 167,414,906 pounds and the United Kingdom an average of 128,145,274 pounds, the United States taking a larger amount than the United Kingdom six years out of ten. The exports of sugar attained their maximum in 1889, when they amounted to 408,722,161 pounds, of which the United States took 284,654,552 pounds, or 69.6 per cent, and the United Kingdom 113,143,941 pounds, or 27.7 per cent. In 1897 the total amount exported was only 153,576,125 pounds, of which the United Kingdom took 106,578,638 pounds, or 69.4 per cent, and the United States 43,261,182 pounds, or 28.2 per cent.

During the same period of ten years, 1888 to 1897, the total exports of manila hemp averaged 651,897 bales per annum, of which the United Kingdom took an average of 380,767 bales and the United States an average of 265,344 bales, the United Kingdom taking a larger amount than the United States seven years out of ten. The exports of this product reached their maximum in 1897, when they amounted to 825,028 bales, of which the United States took 417,473 bales, or 50.6 per cent, and the United Kingdom 385,182 bales, or 46.7 per cent.

Copra is exported mainly to the continent of Europe, the shipments in 1897 reaching a total of 801,437 pounds. The same year the exports of leaf tobacco amounted to 69,803,325 pounds, of which exactly 80 per cent went to the continent of Europe. The cigars exported aggregated 156,916,000, of which 81,670,000 went to China and Japan. There were no shipments of leaf tobacco to the United States, and the cigars exported to this country amounted only to 2,285,000.

The chief imports of the Philippines are rice, flour, dress goods, wines, coal, and petroleum. Of the exports from Spain to the islands in 1896, the cotton fabrics alone were valued at $4,915,851, and of the British exports for the same year cotton manufactures and yarn had a value of $1,494,108. In the exports of the United

States to these islands, however, the various manufactures of cotton figure only to the extent of $9,714! Manufactures of flax, hemp, wool, and silk appear in the Spanish exports to the value of $286,841, or 76.7 per cent more than the entire export trade of the United States to the islands in the year in question. The exports of paper, leather, and wood from Spain in 1896 had an aggregate value of $585,120, or nearly four times that of the total exports from the United States. All these products, as well as others that might be mentioned, could just as well be supplied from this country.

Of what the exports and imports to and from the United States principally consist is shown in the following tables. The insignificance of almost every item in the table of exports suggests, in conjunction with the foregoing statements, the enormous possibilities of an extended commerce that now lie within our reach as a nation:

Values of domestic merchandise exported from the United States to the Philippine Islands during the years ending June 30, 1893–1897.

Articles.	1893.	1894.	1895.	1896.	1897.
Wheat flour................	$7,800	....	$11,250	$18,290	$10,068
Chemicals, etc.............	1,667	$1,453	320	3,390	3,316
Cotton, manufactures of ..	8,444	45,761	3,355	9,714	2,164
Iron and steel, manufactures of....................	9,006	16,388	13,343	10,204	9,655
Oils, mineral, refined......	105,936	35,325	67,837	89,958	45,908
All other articles...........	21,525	46,539	23,150	30,785	23,486
Total domestic exports..	154,378	145,466	119,255	162,341	94,597

Values of merchandise imported into the United States from the Philippine Islands during the years ending June 30, 1893–1897.

Articles.	1893.	1894.	1895.	1896.	1897.
Sugar, cane and other..	$2,865,966	$3,655,627	$1,111,006	$2,270,902	$1,199,202
Textile grasses:					
Manila.	6,217,192	3,324,223	3,572,236	2,499,494	2,701,651
All other........	....	....	11,851	68,838	384,155
Oils..................	11,221	3,041	....	6,237	1,820
Straw, manufactures of.	29,039	12,353	26,148	81,352	72,137
All other articles.... ..	36,439	13,098	10,125	56,034	24,775
Total imports....	9,159,857	7,008,342	4,731,366	4,982,857	4,383,740

J. H.

THE DISPOSITION OF THE PHILIPPINES

The following forcible article by Mr Charles E. Howe is taken from *The Financial Review* of May 27:

What commercial benefits can accrue to any European nation in purchasing these islands which will not accrue to us? Since we are well able to retain them, would it not be a short-sighted policy to dispose of them? With Hawaii and the Philippines, we shall control the trade of the Pacific. With Japan as our ally and England as our friend, we have nothing to fear from other foreign nations. What claim can any power advance, or by what right can they demand that our government evacuate these islands? None!

Our government can no longer pursue a policy of isolation. The times demand that we take our rightful position among the nations of the world, and especially in the unfolding commercial possibilities of the East. There await untold advantages to the nation which encourages the awakening of the Orient from its long sleep and assists it in taking a prominent part in its trade relations with other nations. Are we to refuse to seize this golden opportunity and allow some European power to outwit us? We cannot afford to barter away our newly acquired territory for a few pieces of silver.

What other form of government will do more to civilize these natives than our own? It may be said, "What shall we do with the natives of these islands?" I may ask, "What will any other nation do with them?" What are we to do with the natives of Hawaii? What of our responsibilities with the inhabitants of Cuba and Porto Rico? Our responsibilities will be practically the same in all these cases. The truth is, we are face to face with a new foreign policy for America. We must meet it and not shirk it!

The welfare of our nation lies largely in the development of our trade with the nations south of us and the countries of the far East. We cannot hope for any wonderful expansion of our manufacturing trade with Europe. From the West Indies, South America, China, and Japan we can rightfully expect a marvelous growth of trade, and especially a demand for our various manufactured goods.

We shall find that this war will result in untold advantages to the United States. Our aim was to banish Spain from the Western continent and free an oppressed people. Our reward is the unexpected acquirement of territory and control of the trade of the Antilles, and a foothold in the development of the Orient. If Spain never pays our government a farthing for the cost of this war, still we shall be well repaid in a very few years from the revenues to be derived from these several countries.

Our policy in the future must be an aggressive one. Our markets must be the world and our base of supplies the United States. All Europe recognizes this newer policy as the only true one for the healthy growth of nations. From a political, naval, and industrial standpoint, we must retain our new territory.

In connection with the annual meeting of the National Educational Association, to be held next month in Washington, a geographic exhibit, illustrating the physiography, geology, ethnology, climate, and industries of the United States, will be on view at one of the city school buildings July 7 to 12, inclusive.

The publishers of Leslie's Weekly will send that well-known illustrated newspaper from now until October 1 for only $1.00, which is little more than half-price. Leslie's Weekly has staff artists at all points of possible conflict in the war with Spain, and it offers to its readers for a merely nominal sum an admirable pictorial and literary history of the war.

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A recent number of the Medical Record contained a notable article on the Asheville Plateau in the Mountains of Western North Carolina, by S. Westray Battle, M.D., U.S.N., in which the attractions of that famous region are admirably set forth. The Asheville Plateau or "The Land of the Sky," to give it the name by which it is popularly known, is from 2,000 to 2,500 feet above sea-level, and contains a large number of peaks from 4,000 to 6,000 feet and upward in height. Its scenery is highly diversified, and its climate as healthful as it is delightful. The Southern Railway, which has done so much to popularize this region by its admirable train service, will furnish any information that may be required by intending visitors on application to any of its agents.

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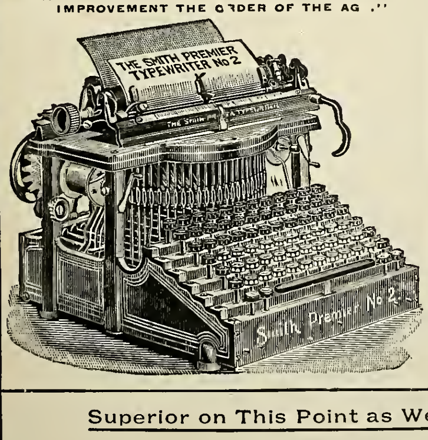

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THE

National Geographic Magazine

Vol. IX JULY, 1898 No. 7

AMERICAN GEOGRAPHIC EDUCATION

By W J McGee,

Vice-President of the National Geographic Society

The Capital of the Nation gives greeting to the National Educational Association. The American Republic, more than any other nation, owes character to knowledge diffused among its people; and in no other nation is the diffusion of knowledge so broad and general. This diffusion of knowledge involves education, and the development and maintenance of educational institutions. In accordance with the plan of government by the people, of the people, and for the people, our educational facilities are brought within reach of every citizen, our educational methods adapted to the needs of the masses. Some governments strive to build intellectual structures from the top downward, only to find their lower bricks on a foundation of sand; our system is founded on the rock of popular education, and the upper portions of the structure are left free. Therein lies a fundamental distinction, the diametrically opposed nature of monarchic policy and republican policy in educational matters. Under the republican system the twig is bent—the youthful mind is started aright; thenceforth it grows and strengthens spontaneously, and in good time gives strength to the Republic. Other nations cramp thought and enslave minds by Procrustean systems based on the knowledge of previous generations, while our nation plants the seeds of knowledge to be supported by its fruits, and so rises constantly to higher and higher planes with a rapidity unprecedented in history; our state does not so much shape education as our education shapes the state. Yet the interest of the state in the progress of education is not diminished but only increased by this national policy; and so the National Capital welcomes the educators of the nation more warmly than the wise men of any other nation would be welcomed in their capital; and the welcome is only the warmer still because the organization of educators is voluntary and spontaneous.

The National Capital is not without educational facilities and agencies. As the nation grew, inquiries concerning resources and the conditions of material development became necessary, and offices of inquiry were created. Several of these offices have grown into bureaus and departments, constantly at work not only in increasing but also in diffusing knowledge—*i. e.*, they have become educational institutions of the highest order. As the offices grew, experts and makers of knowledge were assembled until the National Capital became a center of practical learning. In time the experts voluntarily met for mutual benefit and grouped themselves in unofficial organizations, which now stand in the front rank of learned societies of the world; and official bureaus and unofficial societies are one in purpose, and that the highest within human reach—the increase and diffusion of knowledge for human weal.

The unprecedented growth of our national institutions of practical learning has been due to several causes, but especially to two—the freedom and spontaneity of knowledge under republican conditions, and the vast extent and varied resources of the national domain. Particularly influential has been our national bigness. In the first place geographic ideas are daily developed through that current news which is one of the features of American life; in the second place engineers and surveyors have found full scope for their talents, and have come to lead the world in railway-laying, bridge-building, and the invention of innumerable attendant devices. Then the resources of our rocks have stimulated geologists, and the science has advanced with such giant strides that today the geology of the world is shaped in America. At the same time our broad territory is so conditioned with respect to continental features and sources of aqueous vapor that our meteorologists have been inspired to lead the world in weather science. So, too, our ethnologists and anthropologists have profited by the unequalled opportunities found in the assemblage of peoples and in the range of culture-grades from savagery to enlightenment, which it is theirs alone to survey, and have reconstructed the science of man on a higher plane than is known abroad. Thus America has outstripped the rest of the world in scientific development, especially during the last quarter-century, and while the progress has gone forward at equal rate in every part of the land its center is the National Capital, where the federal offices and several of the scientific societies are located; and the assembling of our educators in our Capital City is a fitting conjunction which must benefit both.

The largest learned body domiciled in the Capital City is the National Geographic Society. Although the major portion of its members are residents of the District of Columbia, it has a membership distributed over all of the states and territories, especially in the leading educational institutions. The express function of the Society is "the increase and diffusion of geographic knowledge." These ends are attained by means of public meetings for the presentation and discussion of communications, by the publication of a magazine, and in other appropriate ways. It is, in the best sense of the term, an educational institution; and the success of its work is attested by its unprecedentedly rapid growth in membership and influence.

The National Geographic Society is among the institutions of the National Capital striving to render the meeting of the National Educational Association agreeable and profitable. It has secured the coöperation of the scientific bureaus in the preparation of an exhibit illustrating the work of the federal government in knowledge-making, and indicating the educational facilities of the Capital; this exhibit is installed in the Central High School building, and will be in immediate charge of custodians able to explain the maps, apparatus, and other objects exhibited, and to describe the work of the bureaus. It has arranged a field-meeting in the interest of the Association, at which the methods and purposes of the Society will be illustrated by addresses on phases of geography by the leading living specialists. It has devoted a special number of THE NATIONAL GEOGRAPHIC MAGAZINE to the Association, and provided for its sale to members at a fraction of the customary price. Finally it was one of the institutions of the National Capital to cordially invite the educators of the country to Washington; its officers and members are serving on local committees and contributing in other ways to the convention; and it stands second to no institution in welcoming the educators of America to the fair city by the Potomac which has become the world's center of enlightenment.

ORIGIN OF THE PHYSICAL FEATURES OF THE UNITED STATES*

By G. K. Gilbert,

United States Geological Survey

Fifteen years ago, on a September morning, I stood on a housetop in Zuñi, waiting for the rising of the sun. On other housetops here and there were other watchers, sitting or standing with their faces toward the east, and close at my side stood a venerable priest of the Sun, oblivious of all else and gazing intently on the spot where the sun should appear. From his neck hung a small bag containing sacred meal. When the first streak of light appeared above the eastern mesa his lips began to move, and he repeated slowly and with low voice an invocation to the Sun. Then, taking from the bag a small offering of the consecrated flour, he breathed upon it and cast it toward the east. Cushing, who became a Zuñi Indian that he might learn their lore, tells us that this sun-rise ritual contains archaic words of which few modern Zuñis know the meaning—words related to the modern Zuñi tongue as Norman French to modern English, and showing that the Zuñi sun-worship began in remote times, far beyond the possibility of historical determination.

The Zuñi's reverence for the sun-god is shared by many savage tribes, and belongs to the early history of many civilized peoples. In later stages of culture it is succeeded by the worship of animals, of the personified powers of nature, and of personified mental power, so that with civilized man the old sun-worship has disappeared; but there is a new sun-worship, introduced and fostered by science, for science has discovered in the sun a creator of wonderful versatility and power.

Geographers worship also another nature-god, the inner earth or the underground, a creator also and co-worker with the sun. These two gods of physical geography were known to the Greeks as Helios and Hades, to the Romans as Apollo and Pluto. In

*The course of afternoon lectures arranged for the winter and spring of 1898 was planned by the late President Hubbard to present the effect of geographic environment on the civilization and progress of the United States. The present essay was prepared at his request as the introductory lecture of the course, dealing with general principles and the most comprehensive groups of natural features.

later centuries Apollo, as the stimulator of life, developt into the god of culture ; but to early tradition he is the sun, a nature-god coördinate with Pluto, the underground. Geology has long recognized Pluto, but has made him coördinate with the sea-god, Neptune, naming her rocks in two great groups, the plutonic and neptunian. Neptune has place also in the pantheon of geography, but only as a vassal of the mightier Apollo.

Apollo gives to the earth light, heat, frost, storm, and rivers, and is daily the creator of motion and life. Pluto is an unknown god, hidden and mysterious. The Greeks named him Hades, the unseen. His only attribute of which we are altogether sure is heat. Imagination pictures him in various ways, but imaginations differ, and their conflicting sketches need not claim our attention today. He made the continent and is never tired of remaking it. But for him the globular earth would be envelopt in an endless ocean, and life would be far different from the life we know. By ridging the outer rind of the earth he created the land and set a limit to the sea, and from age to age he swells broad land tracts upward or draws them downward, so that the outlines of sea and land are ever changing. Crushing the rock together here and there, he forces up mountain ridges ; fusing it, he pours out lavas that congeal and build up other mountains.

Apollo dips up water from the sea and sprinkles it on the rock to moisten and soften it. By alternate heating and chilling he cracks it into bits ; and by a complex chemistry which, despite our studies, still seems magical, he changes it to fine soil, in which plants may grow and in which the husbandman may delve. Lifting more water from the sea, he pours it broadly on the land to make rills and rivers, which wash the soil away, spreading it in the hollows and building plains. This scouring cuts the uplands into hills, but eventually they, too, are worn down, so that the plain is the end and aim of the water work. Preparing for the plow the yielding soil and level surface which make its labors light, and showering the fields with fertilizing moisture, he is the beneficent patron of agriculture.

The mountains of Pluto, lifted to the region of clouds, intercept and engender storms and are the perennial sources of streams. Rugged with gorges and crags and scantily clothed with soil, they extend no welcome to the farmer, but instead they harbor a forest growth, storing timber and fuel; and in some lands their huge banks of winter snow are reservoirs for the water of irrigation.

Pluto and Apollo separate the earth stuff into kinds. If all the minerals of the land were mingled in one complex but homogeneous substance, the problem of civilization would be a problem of separation and would be chemical; but the gods have classified and arranged, sorting the more abundant materials into broad layers, and gathering the rarer into crevices and pockets; and so the problem of civilization is a problem of exploration and discovery, or a problem of geographic distribution.

Pluto sorts by creating a slow circulation of water. As far as mines and borings have penetrated the earth the pores of the rocks are full of water, and the downward limit of this saturation is unknown. The upper rocks are comparatively cool; the lower rocks are hot; and the contrast sets the water in motion. The upper water, denser because cold, tends downward; the under water, expanded and made lighter by heat, is forced upward, and though motion is exceedingly slow, there is a continuous circulation. The chemistry of the upper water is different from the chemistry of the lower. Each can dissolve certain substances, but the substances are not the same. The properties of water change as heat and pressure increase, and again as heat and pressure decrease. So the slow-moving water picks up certain substances in one region, and in another deposits them so as to receive other substances, and in this way it sorts out many of the rarer things, gathering together or concentrating ores of gold, silver, platinum, mercury, lead, zinc, copper, and iron.

Apollo sorts by the free circulation of water at the surface. The soil that is washt away from mountains and uplands and spread by the streams in lowlands and submerged plains is not deposited in one promiscuous mass, but is classified according to kinds—marl in one place, clay in another, and sand in another—and in time these become limestone, shale, and sandstone. The tissues of plants are gathered in swamps and changed to peat, then buried under shale and sandstone, and finally transformed to coal. The tissues of plants and animals, intimately mingled with mud that changes underground to shales, are slowly distilled in after ages to fill rock reservoirs with oil and gas. In other places and by other special processes iron, salt, gypsum, and phosphates are separated; and where Plutonic stores of the metals are ravaged by storm and stream, the gold is separated by its weight and gathered in the river gravels.

The origin of the features of all lands having been thus briefly sketcht, we may now consider in a broad way the physical

THE UNITED STATES IN RELIEF, SHOWING THE PRINCIPAL PHYSICAL PROVINCES

Photograph from a model prepared for the U. S. Geological Survey by Edwin E. Howell characters of the United States, and for this purpose it is convenient to divide the country into a few broad provinces.

Parallel to the Atlantic coast is the Appalachian Mountain belt, running northeastward from Alabama to New England. East of it lies the Atlantic plain. West of it the Central plain, consisting largely of the valley of the Mississippi, stretches to the base of the Rocky mountains. Thence to the Pacific coast is a mountainous province known to geographers as the Cordilleras. A fifth province, the province of the Lakes, overlaps the northern portions of the other four and reaches from ocean to ocean along our Canadian border.

The Cordilleran province, comprising the western third of our country, is characterized by mountain ranges. The dominant trend is with the meridian, swerving in some districts toward the southeast, and in others toward the southwest; and in each district there is a general parallelism. The ranges are definitely Plutonic, each one having been caused by a distinct local uplift; but they are not altogether independent, for there is much evidence of system in their arrangement. Not only are neighboring ranges approximately parallel, but they are evenly spaced, so that in crossing the system one finds a regular alternation of ridge and valley. Through extensive districts the alluvial waste from the erosion and sculpture of the ranges is gathered in the intervening valleys, making of each one a shallow basin or gently concave plain, where roads may run at will. Here and there some of the lower ranges are almost buried by the alluvial filling, so that their summits project as craggy islands above a sea of rock waste. Elsewhere, and especially where the mountains are highest, the intervening valleys are drained by vigorous rivers, which carry off the waste and prevent the building of extensive plains. In one important district uplift has not completed its work of mountain-making, and the land forms a system of plateaus of various heights, through which the Colorado and its tributaries have carved their wonderful system of canyons. Volcanoes, also, have made extensive contributions to the topography, building many great cones and a multitude of cratered hills, and adding voluminous beds of lava to the alluvial strata of the valleys.

In the extreme northwest the rainfall is exceptionally abundant, causing a forest growth so luxuriant and dense that the farmer cannot afford the labor of its subjugation as the purchase price to Nature for his land. Much of this district, also, is too rugged for the plow, so that it constitutes a great natural forest reserve, needing only protection from fire to insure a perpetual supply of timber. In the remainder of the province the rain tribute is scant, falling far short of the farmer's needs, so that crops must be irrigated. The downfall is greater on mountains than on valleys, and about their cool summits the winter's snow lingers through spring and summer, doling out water to mountain streams, which may be utilized for the irrigation of valley lands. But the acres which can thus be nourisht are only a small share of those whose smooth surface invites the plow, and the valleys as a whole belong to the herdsman rather than the husbandman. Their grasses are scant, but this fault is half compensated by their immense extent, and they must be counted as a valuable resource, an important reserve of grazing land that can never be monopolized by agriculture. On the higher plateaus and in the recesses of the mountains are tracts and patches of forests, many of which are protected against hasty consumption by inaccessibility, and these supplement the great reserve of the extreme northwest. In the mountains, also, are Plutonic stores of the precious and other metals, and a score of valleys hold Apollonic magazines of coal. The mountain streams, in addition to their tribute to agriculture, afford power to the manufacturer. Untamed and fickle, subject to enormous floods and irregular droughts, their control is not easy; but if they shall ever be subdued and harnest, there is hardly a limit to the tasks they may perform.

The Central Plain, comprising half of all the land, has been shaped by Apollonic forces. The geologist tells us of many uplifts, dislocations, and flexures of the crust; but all these have been reduced to approximate evenness by the coöperative work of rain, frost, and rivers. Where hollows were made they have been filled; where hills and mountains had grown they have been pared away, so that only their roots, with a few low stumps, remain. In types of detail there is much variety, and there are many rugged tracts; but the characterizing feature is evenness, and agriculture is the great industry for which the province is naturally destined.

On this broad fact, however, climate imposes an important qualification. Over most of the province the spring and summer rains suffice for the farmer's need, disappointing him only by an occasional drought, but in a western belt following the base of the Rocky mountains, and including much of the sub-province known as the Great Plains, the rainfall is so scant that agriculture must depend on irrigation, just as in the Cordilleras. Here, again, grazing may flourish without need to compete with agriculture for possession of the land, and the domain of the herdsman is thus naturally set apart.

Of the rarer mineral resources the Central Plain has greatest wealth in coal, which underlies broad tracts and is easily mined. It is rich also in iron, both Plutonic and Apollonic, and has abundant salt and gypsum. Throughout its broad extent wagon roads and railroads are easily constructed, and its grain for export finds cheap water transportation from interior districts to the sea by way of the Mississippi and the St Lawrence.

The mountains of the Appalachian Province were formed by the coöperation of Pluto and Apollo. Long ago the crustal rocks were crowded together in a great system of wrinkles, the crests of which were then wholly pared away so that the Central and Atlantic plains were joined in one. Then came other disturbances along the folded belt, but without new folding. The plain was locally lifted into a long plateau, with gentle slopes on either side, and from this plateau the mountains have been carved. Through the remnants of the old truncated folds ran long outcrops of various and diverse rocks, trending northeast and southwest, and these rocks have been wasted unequally by the eroding waters. Where there were soluble limestones or weak shales, the streams opened valleys; where there were resistant sandstones or quartzites, mountain ridges were left; and so the Appalachian ranges are a complex cameo of Nature's carving. The broader valleys were smoothed in the carving and prepared for agriculture, the mountains left rough and reserved for forest. The region is rich in iron, both Apollonic and Plutonic, and peculiarly rich in what may be called Plutonic coal—coal made, indeed, by Apollonic processes, but converted to rich anthracite by Plutonic heat. Water power is abundant, and though less magnificent in its possibilities than the power associated with the loftier Cordilleras, of greater present value because more tractable, and because associated with tillable plains that are qualified by climate for the primary industry of agriculture.

The Atlantic plain resembles the Central in that both cutting and filling have contributed to its formation, but the constructive factor is here more important. While the Appalachian folds were being reduced, part of the waste went eastward, burying the Atlantic margin of the continent and extending it seaward. Later, when the Appalachian cameo was carved, the accumulation of waste was continued, and so the eastern part of the Atlantic belt is what geographers call a constructional plain. But there is another part, lying close to the mountains, which shared in the Appalachian uplift and also in the Appalachian carving, and was finally reduced so nearly to sea level that it constitutes an inseparable part of the Atlantic Province. It consists of ancient rocks, graded down nearly to a uniform level, and is clast by geographers as a destructional or eroded plain. As Pluto raises and lowers the land the ocean is caused to alternately recede and advance, and this low-lying plain is peculiarly susceptible to its encroachment. In our day the fourth part of it is submerged, so that its actual limit as a physical feature lies many miles beyond the coast, where there is an abrupt change from shallow soundings to abyssal depths. The land of the Atlantic Plain is shaped for agriculture, and much of it is cultivated; but there are broad tracts of soil too poor to compete with the fertile land of the Central Plain and utilized only for timber and other forest products. Water powers, afforded by the moderate fall of large streams, have great value by reason of their proximity to tidewater and consequent facilities for cheap transportation of the raw materials and the products of manufacture.

The Lake Province, overlapping all other provinces from the north, is a marginal overflow of Canadian topography, and resulted from the great prehistoric invasion of our land by Canadian ice. The colossal ice-sheets of the eastern and central British provinces and the contemporary glaciers of the northern Cordilleran mountains remodeled the topography of all the provinces, carving the valleys into new shapes and heaping the débris in irregular mounds and ridges of peculiar type. When the ice was melted and rains fell again upon the land, the streams could neither find nor follow their old courses, and the waters were compelled to fill many a hollow before they could flow away at all; so while the old types of mountains and plains remained as broad features characterizing the several provinces, there was added the feature of obstructed drainage, markt by a multiplicity of lakes. Of these are the lakes and ponds of New England and New York, the great Laurentian lakes and their host of associated lakelets, the mountain lakes of Idaho and Montana, and the curious linear lakes of northern Washington. The distribution of ores was not affected, though facility of discovery and exploitation was locally modified, being partly impaired and partly improved. The surface conditions bearing on agri-

THE SOUTHERN PART OF THE PREHISTORIC CANADIAN ICE-SHEET. A DARK TINT SHOWS THE EXTENT AT AN EARLY STAGE. THE LIGHT TINT SHOWS A LATER STAGE, OF GREATER IMPORTANCE IN MODIFYING GEOGRAPHIC DETAILS

Photographt from a model. The glacial data are on the authority of T. C. Chamberlin

culture were greatly changed. Large tracts denuded of soil were relegated to the growth of timber; others were made hilly by the heaping of drift, and yet others were smoothed by sedimentation in the beds of temporary lakes. The new soils have a special quality as compared to those resulting from the decay of rocks, for rock decay involves leaching and the loss of soluble minerals. The ice-mill ground together unleacht samples of many rocks and deposited them with little sorting, so that the glacial soils are often rich in materials which elsewhere need to be artificially supplied.

The confusion of drainage has yielded results as important in their way as those from the traditionary confusion of tongues at Babel, for the disconcerted streams, having their descent arrested by basins and lakes, are compelled elsewhere to tumble down rapidly, making convenient water powers; and these water powers have special value because the associated lakes are natural reservoirs, protecting them from flood and drought. As the greater lakes are also natural avenues for commerce, the province of the Lakes, associating water power with commercial facility, is the natural home of manufacture.

The physical characters which, after mineral resources and climate, have greatest influence on industrial activities are internal routes for commerce and maritime harbors in their relation to external routes. The lines followed by pioneer settlement as well as those to which internal transportation ultimately adjusts itself are greatly influenced by topographic configuration, continuous mountain ranges acting as barriers and low passes through ranges serving as avenues. Long lines of navigable water also have their influence, and for districts whose most practical product is so abundant as to yield a surplus for exportation facility of transportation means progress in population and wealth. The consideration of these conditions is attractive, but as they affect various localities unequally their discussion may properly be left for the lecturers who are to speak of more limited districts.

Harbors, however, though their local quality has local value, are of primary importance to the country as a whole and may be considered today. They are naturally formed in many ways, but only the principal types need be mentioned. Wherever a river reaches the sea the continuous contour of the coast is broken, and there would be a natural harbor but for the opposition of the waves. The outflowing river endeavors to scour a channel through which ships may enter. The waves, buffeting the coast and drifting sand and gravel to and fro, endeavor to clog the riverway with submerged bars, making the water too shoal for shipping. Over small rivers the waves are victorious, and unless engineers coöperated with the rivers the entrance-ways are sealed. Large rivers overpower the waves and clear their channels faster than the waves can clog them. Only one of our rivers, the Mississippi, has proved competent to maintain its channel to the sea, but that affords a harbor of peculiar value, in that it is connected with a system of inland navigation hundreds of miles in extent.

The fiord harbors associated with prehistoric ice-fields are an important group. The ice descended to the shores of both oceans, and by its remodeling of the surface left steep slopes with a tortuous contour, creating a great abundance of deep harbors. New England at the east and Washington at the west are thus endowed, and their maritime commerce requires neither piers nor dredges to maintain its natural channels.

Natural harbors of a third class are connected with vertical movements of the land. When the margin of the continent is lifted the coast line, following a slope new-risen from the sea, is a simple contour on an even plain, and there are no harbors; but when the land is deprest the sea-water enters each valley of the coastal plain, making a bay. Then the waves, driving sand and other land waste along the coast, build a spit across the mouth of each bay, converting it into a sheltered harbor, whose entrance is scoured four times a day by the incoming and outgoing tide. Into the estuaries thus formed the streams build deltas, gradually filling and obliterating them; but so long as subsidence continues they remain open and available for commerce. It is our good fortune that nearly the whole of our coast, both Atlantic and Pacific, is now subsiding,* so that estuaries are numerous and the maintenance of serviceable harbors requires only moderate aid from the engineer. The bays and sounds of San Francisco, Galveston, Mobile, Tampa, Savannah, Charleston, Wilmington, Pamlico, Chesapeake, and Delaware are of this type; and the Hudson estuary, which is also a fiord, carries tidewater one hundred and fifty miles from the coast.

Climatically the United States lies within the zone of variable winds. Instead of being swept by continuous trade winds or

*Strictly speaking, the determined fact is that the relation of land to sea is changing, and we do not know which one actually moves.

periodic monsoons, it is traverst at short but irregular intervals by the broad air whirls called cyclones, which bring with them rapid alternations of warmth and coolness, sunshine and rain, breeze and calm; and the direction of the wind is continually shifting. In other words, we are endowed with weather instead of mere climatic monotony.

In all parts of our land there is so much of winter that man must provide himself with clothing, shelter, and fuel. Natural fruits, to be had for the plucking, will not sustain him, and he is compelled to earn his food. Thus Nature forces him to labor and to contrive, and his physical and intellectual faculties are developt, like the athlete's muscle, by exercise. From variety of configuration, of mineral resources, and of climate, flow varied and complementary industries. Agriculture flourishes in the Atlantic and Central provinces, on the morainic hills and lacustrine plains of the Lake district, and, with irrigation, in intervales of the Cordilleras. Its products range from the hardy apple to the frost-shunning banana. Along the western borders of the Central plain and in Cordilleran valleys the herdsman tends his bands of horses, kine, and sheep. In the humid northwest, in the recesses of the mountains, and on tracts of inferior or scanty soil are forests for the lumberman. In mountains and roots of mountains are ores for the miner, and from the hills he draws fossil fuels. Manufacture finds natural power in waterfall, coal, and gas, and the way of commerce is made easy by the harbors of the coast. Thus Pluto and Apollo have prepared the land for that diversity of product and industry which gives national independence and have provided a commercial facility which joins us to the brotherhood of nations.

GEOGRAPHIC DEVELOPMENT OF THE DISTRICT OF COLUMBIA

By W J McGee

The District of Columbia lies on the boundary between two great natural districts or provinces, the Piedmont plateau and the Coastal plain.

The Piedmont province is a low plateau composed of ancient crystalline rocks, extending westward to the Blue Ridge and stretching far northeastward and southeastward. This plateau is trenched by Potomac and other rivers and their tributaries, and its surface has been carved into hill and vale, broad divide and narrow valley, by the action of running water. During the ages past it was a high plateau or mountain range, which was first canyoned and afterward carried away by the Potomac and neighboring rivers of eastern United States.

The Coastal province is a broad lowland made up of sedimentary formations. It extends from the capital to the coast, and thence as shallow sea-bottom for over a hundred miles into the Atlantic, ending in a steep slope toward the ocean-depths; and it stretches northward to New York and southward to the limits of the continent. Thus the Coastal plain is about half land and half sea-bottom. Through the land portion broad estuaries pass, bearing the waters of Potomac and other rivers to the sea; and in the bottoms of the estuaries and in the sea-bottoms beyond, certain channels have been revealed by soundings.

The history of the development of the region may be read from the land-forms of the two provinces, and from the sedimentary formations or deposits of the Coastal plain.

DEFINITIONS

The student of geographic development takes note of (1) processes or agencies, and (2) products. The chief agency concerned in making this region is water, and the chief processes are (*a*) erosion, and (*b*) transportation by running water, together with (*c*) deposition of the transported material in slack water; or, in more general terms, degradation and subsequent aggradation.

When a considerable area of earth-crust rises in such manner as to transform smooth sea-bottom to dry land, certain changes are wrought on the surface: When the rains fall, a part of the water lies long on the level surface and forms marshes, but here and there rivulets form and flow down the gentle slopes toward the sea; the rivulets cut rills and, as the waters gather strength with increased volume, dig gullies; eventually the rills unite in streamlets and brooks, and the gullies expand into ravines and valleys; and in time streams and rivers are formed, each flowing in a gorge or valley of its own making. In this way the surface of the uplifted sea-bottom is carved into valley-systems, and the forms of the valleys determine the forms of the hills and divides by which they are bounded. It is in this way that the lands of the earth are sculptured; and the sculpture of running water produces a characteristic topography.

The earth-matter cut out of the rills, gullies, ravines, and valleys is transported by the running water into the adjacent lake or sea, where it is dropped, swept here and there by the waves, and eventually built into sheets of sediment, or formations. So long as land and sea maintain their relative position, the sediments are accumulated continuously and constitute a single formation; but if the earth-crust rises or sinks, the formation changes: If the earth-crust rises, the ocean withdraws and sea-bottom is converted into land to be sculptured into land-forms; if it sinks, the ocean advances and sediments are laid down over the land-forms sculptured by the running waters, and an unconformity is produced.

Thus in regions like the Coastal province there are two important classes of products, (*a*) land-forms, and (*b*) formations; and the unconformities separating the formations are old land-surfaces.

The development of the region is recorded in land-forms, formations, and unconformities produced in this way.

THE LAND-FORMS

Above the mouth of Rock creek, Potomac river flows in a steep-bluffed gorge cut sharply in the Piedmont plateau; Rock creek, too, occupies a narrow and rugged valley cut in a plain—a plain so definite that the eye catches its continuity and fails to note the valley save when near its brink. The lesser tributaries of the Potomac and of Rock creek flow in narrower valleys, gorges, and ravines, each proportionate to the length and strength of its stream. Thus the western part of the district is a land of sharp-cut gorges and ravines, with rugged hills between; while toward the main divides the waterways diminish in depth and the surface becomes a gently undulating plateau. And it is evident that each channel, great and small, was carved by the great or small stream now occupying it; it is evident, too, that the channels are deep because this part of the land stands high above the level of tide; and after a little study of the steepness of the valley-sides, it is evident also that the period of valley-cutting was not very long—for the steep slope is a sign of rapid stream-work.

Below Rock creek, Potomac river expands in a tidal estuary flanked by moderately steep bluffs and lined with alluvium or river-mud. Anacostia river occupies a similar but smaller trough, relatively broad and shallow as that of the Potomac;

and its bluffs rise to a moderately uniform plain in which the trough is excavated. The lesser tributaries are estuaries toward their mouths, but flow in steep-sided gorges and ravines much like those of the Piedmont toward their sources; while the divides are broad, flat plains in which the drainage systems are imperfectly developed. Thus the eastern portion of the district is a land of steep-bluffed tidal estuaries, narrowing above into gorges and ravines, with ill-drained expanses between. The history recorded in these land-forms is a little more complex than that recorded in the Piedmont: Since the valleys are proportionate in size to their streams, it is evident that all were cut by the streams now occupying them; since the head-water ravines do not unite in the broad divide-plains, and since the slopes are steep, it is evident that the land has not stood above the ocean long enough to permit the drainage-systems to extend themselves over the entire surface; and since the larger valleys are occupied by tide-water and lined with alluvium, it is evident that the land formerly stood higher than now, and has since subsided so far as to permit ocean-water to drown the larger river-cut valleys. So the land forms of the district tell of certain agencies and movements concerned in the development of the district.

THE FORMATIONS

Washington is located in a triangular amphitheater opening southward through its southern angle. This amphitheater is lined with a peculiar deposit not found over the higher bounding hills; it is composed of brown loam or clay mixed with sand, gravel, and bowlders. This is the Columbia formation. It is generally coarser below and finer above, the upper portion being used as brick-clay; and in general it is coarser toward the gateway in the wall of the amphitheater through which the Potomac enters in the western part of the city, and finer in the eastern and southern portions of the amphitheater. On comparing this deposit with the alluvium dredged out of the river-bottom there is found so close similarity as to warrant the conclusion that both were produced by the same agency—that just as the river is depositing the alluvium at the present time, especially during the spring freshets, so the Columbia formation was deposited by the river during the freshets of past ages. This conclusion involves the supposition that during the Columbia period the land stood lower than now, so that the Potomac estuary occupied the entire amphitheater. Comparison of the alluvium with the Columbia deposits reveals certain minor differences in the deposits, notably a larger proportion of brown loam and a larger number and size of bowlders in the ancient one; and these differences suggest that during the Columbia period the climate was colder than now, the bowlder-bearing ice-floes larger, and the thaw freshets more destructive to soil than at present. These features suffice to correlate the Columbia formation with the glacial deposits of northern United States. Thus the Columbia formation records definitely a period during which the land stood lower than now and the sea encroached further, and when the climate was colder than now. Detailed study of the formation indicates that there were two epochs of depression of the land, separated by a stage of elevation, the submergence during the earlier period being much the greater. The earlier Columbia deposits are found over the lower hills and uplands flanking the Washington amphitheater up to 200 feet above tide; the later Columbia mantles Capitol hill and other portions of the amphitheater up to about 100 feet above tide.

The distribution of the Columbia deposits is such as to indicate that the great estuaries of Potomac and Anacostia rivers and the narrower rock-bound gorge of the Potomac from Great Falls to its source were carved out in nearly their present form before the Columbia period; thus these great geographic features record a pre-Columbia period during which the land stood far above its present level so that the ocean retreated far beyond the present shore-line, probably to the great submarine scarp 100 miles off shore. This period was one of great importance in the development of the district, though it has only recently been defined through recognition of principles discovered during researches in the district. At that time the entire Coastal plain was land, so far elevated that rivers and brooks flowed swiftly across it and down its slopes, producing characteristic land-sculpture—a surface now represented in one of the strongest unconformities in the Coastal plain.

On some of the highest hills bounding the Washington amphitheater there is found a deposit of red clay and well-rounded pebbles of quartz and quartzite somewhat resembling the Columbia, but differing in that the pebbles are harder and more worn, and in that the deposit is more uniform and homogeneous; this is the Lafayette formation. Outcrops of the Lafayette are found on Good Hope hill, in the uplands about Soldiers' Home, and on the hills toward Tenly; and most of the broad divides between the head-water ravines in the eastern part of the district and still further eastward are floored with the deposit. The structure of the deposit indicates that it was arranged by waves and currents along the shore of a shallow ocean, stretching far northward and southward; and its uniformity indicates that the deep valleys of the modern estuaries did not exist, and that it was laid down on smooth sea-bottom, a former smooth land-surface, before the post-Lafayette period of high level. It is composed of materials which are either decomposed and thus degraded chemically (the brown loam), or of great chemic obduracy (the quartz and quartzite); and the simplest explanation of its composition is that its materials were gathered by swiftly flowing streams over a land which had long been subjected to the action of chemical rather than mechanical agencies—*i. e.*, land lying low for a long period so that running water was sluggish and impotent, while decomposition of the rocks and soils went on apace.

So the Lafayette formation tells of a time when the land was low, so low that the Atlantic encroached beyond the longitude of Washington; it tells, too, of a seaward tilting of the Piedmont whereby the streams were made swifter than before, so as to tear up residuary soils and ancient quartz ledges. The distribution of the Lafayette indicates that it was originally a continuous mantle stretching from the Piedmont far seaward and northward and southward throughout the Coastal plain; but that during the subsequent period of high level it was entirely cut away along the larger and many of the smaller streams so that it is now represented only by a series of remnants on the higher divides.

Thus, the Lafayette formation is a definite record of a great subsidence and seaward tilting of the land; and at the same time it records a previous geographic condition during which its materials were prepared by chemic processes, and a subsequent geographic condition during which most of its volume was carried away by running waters.

THE COMBINED RECORD OF LAND-FORMS AND FORMATIONS

The margin of the Piedmont plateau reaching the district is a land of fairly smooth contour, albeit trenched by gorges and ravines, and its rocks yield red clays and quartz fragments on decomposition; and these conditions are in accord with the evidence of the Lafayette formation. Thus, the period of the shaping of the plateau may be correlated with the period closed by the deposition of the formation.

The great gorges of the Potomac and Anacostia and of Rock creek and other tributaries tell of a period when the land stood high above its present level; and this is in accord with the degradation of the greater part of the Lafayette, and permits correlation of the land-forms in the two provinces.

The lining of the Washington amphitheater with Columbia deposits records a period when the land stood low and when the climate was cold, and this gives a date for the correlation of local geologic history with general geologic history.

Thus the land-forms and the formations, when carefully studied and interpreted, yield a record of the development of the District during the ages: The streams flowed down to the sea, the waves rolled along the shores, sediment was gathered here and deposited there, the earth-crust alternately heaved and sank; as time passed valleys were born and hills were fashioned, and the face of the land was transformed again and again; each new geography was wrought from the old, and each can be restored in mind or in picture from the study of hill and rock; and each stage in evolution was an important episode in the geographic development of the District of Columbia.

THE HISTORICAL DEVELOPMENT OF THE NATIONAL CAPITAL

By Marcus Baker*

Among all the great capitals of the world the capital of the United States stands out unique. In its origin, development, and government, Washington has no counterpart. There is but one Washington. That the National Capital is unlike other cities in the United States is matter of common observation and remark. Its wide, asphalt-covered avenues, its shaded streets, its parks, and public statues—these outward shows usually first arrest attention and excite comment. The roominess of the streets and the leisurely air of those who use them are also often

*Mr Marcus Baker, of the U. S. Geological Survey, was one of the founders and the first Secretary of the Columbia Historical Society and is now Chairman of its Publication Committee.—Ed.

remarked on by visiting strangers. The smoothness and spaciousness of the highways seem to be a perpetual source of delight, while the want of commercial bustle and rush and turmoil in the streets is to many a visitor visible evidence of the laziness and indifference engendered by the public service. Whether this judgment be wise or otherwise, it is not for those judged to determine; yet we know that though first impressions are prone to last, it is not because of their accuracy; and from judgments we often learn more of the quality of the judge than of that concerning which he pronounces judgment.

Most of our large cities are given over to manufactures and commerce. The energy of the citizens is given to making things, to transporting them, to buying and to selling. Business activity and prosperity, to the resident of such cities, means crowded and noisy streets, filled with endless streams of men, women, and traffic. horses, trolley cars, cobblestones, policemen, street fakirs, big wagons, little wagons, automobiles, with fake extras of yellow journals shouted above all the din. To those whose lives are spent in such surroundings, Washington seems dull and stupid.

Washington is now nearly a century old, it having been first occupied as the seat of government in 1800. It was on June 15 of that year that the public offices were first opened, and on November 22 following that Congress for the first time met in Washington.

At the close of the Revolution, when Congress was in session in Philadelphia, it will be remembered some of the unpaid soldiers grew impatient at the delay in settling their accounts. To hasten a settlement and stimulate what they deemed a dawdling and lazily deliberative Congress to prompt action, these soldiers made a threatening demonstration about the old Statehouse where Congress was then in session.

Just as the present war with Spain has suddenly and profoundly affected the thinking, the outlook, and the points of view of all who think, so this little demonstration to hasten the payment of money due taught Congress, the apt pupil, a lesson which the teacher, a mutinous soldiery, neither knew nor dreamed of. Our forefathers had chafed under the presence and support of an army maintained against the citizens at the cost of the citizens and in the interest of the sovereign. When their own citizen soldiery grew mutinous, a new view suddenly appeared and with it a new danger. Out of this new view and from this real or supposed menace came the decision, thoughtfully and resolutely taken, that the seat of government of the *United* States must be where only those United States have exclusive jurisdiction and control. This new created State, this then small star in the galaxy of nations, was designed to be and its founders believed it was to become a great nation. So believing, they deliberated and determined that it should have a permanent home of its own, where its laws could be made, interpreted, and executed without improper interferences or influence of any kind or from any source. The conclusion was to select a tract and build a permanent home as the seat of government. Most capitals have been established or have grown up in towns or cities already existing. Not so the city of Washington. When, in April, 1789, President Washington first entered upon his high office, there was no city of Washington. Yet there was to be a "Federal City." The Constitution, framed and signed in 1787, provided that Congress might "exercise exclusive legislation . . . over such District (not exceeding ten Miles square) as may, by Cession of particular States and Acceptance of Congress, become the Seat of the Government of the United States."

Under this authority Congress, by a law enacted on January 16, 1790, and amended July 16 following, selected the present locality on the banks of the Potomac.

Down to 25 years ago there was talk from time to time of moving the capital to a more central location. The discussers rarely or never, however, gave evidence of any acquaintance with the labor involved or the traditions of the compromise which resulted in the selection of the present site. Whoever will take the trouble to learn what it cost to do this will be either a very bold or a very foolish man to hope or expect that a removal of the capital is possible.

The original grant by Virginia and Maryland, accepted by Congress in 1790 as the permanent seat of Government, consisted of a tract of 100 square miles, lying on both sides of the Potomac river. Under the direction of three Commissioners, appointed by Washington, this tract was surveyed by Major Andrew Ellicott in 1791. The boundary was traversed, chained, and cleared of timber and a topographic map prepared of the 100 square miles comprised within these boundary lines. As the survey approached completion in the autumn of 1791, Ellicott asked the Commissioners for the title or name to go on the map; whereupon the Commissioners formally passed on the matter. They answered, "The City of Washington, in the Territory of Columbia." Thus the "City of Washington," as yet an airy nothing, but with a local habitation in the "Territory of Columbia," now received a name. This was in 1791. Yet it took time to get the names into use. The imaginary city continued to be referred to chiefly as a jest under the old descriptive phrase, *Federal City*. When in 1792 the boundary monuments were set along the Maryland part of the District boundary line the word Maryland was cut upon that side of each stone which faced Maryland, but upon the side which faced what we now call the District of Columbia the word Columbia does not appear. Instead of it there appears in clear, large, and deep-cut letters the words "*Jurisdiction of the United States.*" Obviously this fact, rather than a name, was uppermost in the minds of the Commissioners in 1791. And this fact is still unique in the history of all capitals. Congress legislates for the District of Columbia absolutely, and thus we have for the national capital this curious anomaly. It is legislated for, taxed, managed, controlled, and governed by the united voices of all the voters of the United States except its own. The citizens of Washington itself are the only ones in the United States who are by law deprived of all voice as to the management or control of Washington affairs. And what seems stranger still, these strange Washingtonians are well content with this hard fate, and would, it is believed, refuse to change it even if they had the power.

Washington, it must be remembered, differs from other cities because it was intended to be different. Its site, when choice was made, is described as a wilderness, and for more than half a century did not cease to be ridiculed as such; and the plan of the city was completely drawn out on paper and marked out on the ground before any buildings appeared—just as happens with modern boom towns, but with this difference: In the boom town the real estate speculation is the main motive; in the founding of the nation's capital it was only an incident, and an incident which Jefferson strove to minimize by letting out either none or misleading information as to plans for public buildings and "appropriations," as tracts reserved for the general government were called.

The plan for the city was drawn up by a French engineer, Major Pierre Charles L'Enfant, and his plans were doubtless examined, criticised, and approved by Washington. His original manuscript map, now faded and worn, is in the War Department in the custody of the Chief of Engineers. Some ten years ago this now precious manuscript was taken to the Coast Survey office, where it was carefully traced, photolithographed, and published. Copies of it are (or were) obtainable at the Coast Survey office. This map may be said to represent Washington in embryo. Great praise is due to the proud L'Enfant for the part he took in designing the city; but his zeal, his pride, and his impetuosity soon brought a rupture; his services were dispensed with; the pay tendered him was spurned as unworthy of him. His remains rest in an unmarked grave in private grounds in the northeastern suburbs of the city. The relative credit due to L'Enfant and to Ellicott for the part taken by each in designing and laying out the city is still a mooted question, and the disagreement as to this is doubtless the reason why to this day no suitable public recognition of their services has ever been made.

The interval between 1791 and 1800 was spent in erecting public buildings—"the President's House," "the Congress House," and others. In 1800 the government records were all brought over from Philadelphia. On June 15 the public offices were first opened. Thus June 15, 1900, will be a suitable day for a public holiday in Washington for commemoration and retrospect. Men still live in Washington whose fathers served the United States in Philadelphia and who followed that little bunch of records—the entire archives of the Republic—to the imaginary city in the real wilderness on the Potomac, nearly a century ago.

According to the census of 1800, the "inhabitants of the city of Washington numbered 3,210 souls." Down to 1850 or later Washington continued to be a great straggling village. It grew, but it grew slowly. The foreign ambassador whose assignment brought him to Washington was prone to feel that he was banished. No pavements, no water supply save from pumps in wells scattered here and there, no sewerage system, no street cars, few schools and poor, and distances "magnificently great." Indeed, Washington's greatness still existed chiefly in the imagination of its projectors. No manufactures brought workmen here; it was not a commercial center. Indeed, it might be likened to a great straggling college town, where all life is derived either at first or second hand from the college. So here there grew up about the government offices boarding-houses for the transients and shopkeepers to supply the boarding-houses.

The war of 1812 had made little impress on the capital. The

British troops occupied the city for a few hours in August, 1814, burned the White House, set fire to the Capitol, and retired. But the civil war, 1861–1865, had a very different effect and made a lasting impress. Washington for four years was one great military camp and hospital. A cordon of earthworks many miles in extent surrounded the city. Bluecoats were everywhere, and the passing of endless trains of bronzed veterans, of sick and wounded, of artillery, of supplies, was too common a sight to attract either notice or comment. Into this camp there came by railroad one evening Mrs Julia Ward Howe. Long abominating slavery, she saw in all this stern turmoil the fruition of the abolitionists' hope, and that out of this war was to emerge freedom for black and white alike. From the car windows could be seen the camp-fires stretching miles away. After making a round of visits to various camps, the following day she returned to her hotel, her heart all on fire, and there wrote that immortal Battle Hymn of the Republic, beginning—

> Mine eyes have seen the glory of the coming of the Lord,
> He is trampling out the vintage where the grapes of wrath are stored.

Recalling the circumstances under which the lines were penned, we can the better understand such a line as this:

> I have seen Him in the watch-fires of a hundred circling camps.

But the war ended at last. During it even Pennsylvania avenue, a street now as widely and as favorably known as any in the world, was at times a veritable mud-hole, wherein artillery and wagon trains sometimes stalled. The "White lot" and the "Monument grounds" ceased to be used for slaughtering cattle for the army; the great mule-drawn wagons no longer went daily to the Capitol for the tons of bread baked in the little rooms under its west steps; the churches no longer housed the war-mangled and disease-stricken, and the war scars about the city began quickly to heal. The unsightliness of the half-finished dome of the Capitol faded with its completion. The tract of neglected undergrowth and wild woods, with its surrounding dilapidated picket fence, was transformed into the park which now faces the east front of the Capitol. The Washington monument, which all during and for years after the war stood as an unsightly stump surmounted by wooden scaffolding, grew to a stately shaft, a thing of beauty, and the débris and litter which for twenty years or more had cumbered the ground at its base at last vanished. The old system of schools gave way to the new and in 1876 Washington for the first time had a high school. Its Baptist college, now Columbian University with 1,000 students, dates from 1821, while the Jesuit college in Georgetown is yet older.

The unique character of Washington and of its attractions steadily grows. Little by little with passing years men and women so circumstanced that they may live where they will select Washington for a home. The opportunities it affords for much of all that makes life attractive have been well expressed by one who has come to abide here: "Four years in Washington to one who will take what may be had for the taking, much less the asking, is equivalent to a college education."

GEOGRAPHIC WORK OF THE GENERAL GOVERNMENT

By Henry Gannett,

United States Geological Survey

The United States is engaged, through the agency of a number of bureaus and departments, in extensive geographic work, both within its own borders and in various parts of the world. The results of this work are embodied in maps, charts, and reports, which furnish a vast amount of information; indeed, these form the principal original source of information regarding the geography of the United States in all its aspects—topographic, climatic, geologic, biologic, and industrial. Many of these reports and maps are furnished free, while others are, under the law, to be obtained only by purchase.

The following are the principal bureaus and departments which are engaged in geographic work:

Coast and Geodetic Survey.
Hydrographic Office, U. S. Navy.
Engineer Corps, U. S. Army.
Geological Survey.
General Land Office.
Weather Bureau, Biological Survey, and other divisions of the Department of Agriculture.
Smithsonian Institution and its dependencies.
Fish Commission.
Light-house Board.
Bureau of American Republics.
Intercontinental Railway Commission.

GEOLOGICAL SURVEY

The Geological Survey is charged by law with the examination of the geological structure, the mineral resources, and with the classification of the public lands of the United States. It was organized in 1879, upon the discontinuance of the Hayden, Wheeler, and Powell surveys of the Rocky Mountain region.

As the successful prosecution of the work confided to it required the possession of accurate topographic maps, the preparation of such maps was commenced in 1882, and a large proportion of the appropriations for the Survey have been devoted to this work.

The work of the Survey, as at present organized, is as follows:

The preparation of topographic maps.
The preparation of geologic maps.
The technical and statistical study of mineral resources.
The study of the water resources of the arid region.
The examination of the forests of the west.
Chemistry and paleontology as accessories to the geologic work.

The Geological Survey began, in 1882, the construction of a topographic map of the country. The work has now been in progress 16 years, and about 650,000 square miles have been mapped. The areas shown on these maps are scattered widely over the country, and represent a great variety of topographic features, and the map sheets can be used to illustrate topographic forms. These maps differ in scale. Some of them are on the scale 1 : 62,500, which is very nearly one mile to one inch. Another scale is 1 : 125,000, which is very nearly two miles to one inch, and a third scale is 1 : 250,000, or nearly four miles to one inch.

Sheets.—For convenience this map is published in sheets of nearly uniform size, the portion of the sheet covered by the mapping being usually 17½ inches in height, with a breadth ranging, according to latitude, from 12½ to 15 inches. Each sheet on the scale 1 : 250,000 includes what is commonly called a "square degree," an area one degree in extent in each dimension (for instance, latitude 40° to 41° and longitude 90° to 91°). A sheet on the scale 1 : 125,000, which is of approximately the same size, includes a tract of country 30′ in latitude by 30′ in longitude, or one-fourth of a square degree, and a sheet on the largest scale, 1 : 62,500, includes an area 15′ in latitude by 15′ in longitude, or one-sixteenth of a square degree.

Contents.—This map shows features which, for convenience, may be classed in three groups, viz: water features, including the sea, lakes, ponds, rivers and other natural streams, and canals and irrigation ditches; land features, including mountains, hills, and valleys; and cultural features, or the works of man, such as towns and cities, roads, railroads, boundaries, and names.

Water features.—All water features are shown in blue, the smaller streams and canals in full blue lines, and the larger streams, lakes, and the sea by wavy blue lining. Certain streams, however, flow only a part of the year, being dry at other times, and such streams are shown not by full lines, but by dotted blue lines. Fresh-water marshes and swamps are shown by broken horizontal lining, interspersed with tufts of blue. Salt-water marshes are shown simply by horizontal blue lining.

Culture.—The works of man are shown on the map in black, in which color also is printed the lettering. They are enumerated, and the characters used to represent them are given in what is called the legend at the side of the map.

Land features.—The land features, commonly called the relief, include all the variations of the surface, the alternation of mountain and valley, plateau and canyon, hill and plain. These features are represented by means of contour lines, or lines of equal elevation above the level of the sea. The line of sea-coast itself is a contour line—the line at zero elevation. The contour line at, say, 20 feet above sea-level is the line which would be the sea-coast, if the sea were to rise or the land to sink 20 feet. Such a line would run back up the valleys and forward around the points of hills and spurs. On a gentle slope this 20-foot contour line would be far from the present sea-level, while on a steep slope it would be very close to it. So a succession of these contour lines, one above another, with equal vertical spaces between them, would, if they were far apart on the map, indicate a gentle slope; if they were close together, a steep slope; and if they were run into a single line, as if they were on top of one another, they would indicate a cliff. The contour lines of any region, when represented on a map, show the elevation of any part of the map above the sea. They also show the slopes of the ground and the forms of the mountains, hills, and valleys; in short, of all the relief features. These contour lines are printed in brown.

The geological work proper of the Survey consists in a study of the rock formations and in the mapping of their extent and form. The results are published in annual reports, in monographs, and in geological folios.

The Division of Hydrography in the Geological Survey has in charge the examination of the water resources of the United States, both above and under ground. Measurements are made of the amount of water discharged by various rivers in different parts of the United States, and from the facts thus obtained computations are had of the daily flow, thus giving the fluctuations through periods of seasons and years. At the same time, a careful study is carried on in certain localities of the geologic structure with especial reference to the ability of the rocks to receive and transmit water, and, where practicable, maps are prepared showing the depth of the principal water-bearing strata, so that it is possible for any person to form a fairly definite idea as to the probability of obtaining supplies for various purposes. The economic bearing of information of this character is readily recognized when consideration is had of questions of development of water-power, the supplying of cities or country homes with water, or the extension of agriculture through irrigation. In the west, where the farmer must apply water artificially before a crop can be raised, it is obvious that the supply must be ascertained before a great extension of tilled land can be possible. We know that the amount of water available in the arid region is far less than the demands made upon it; so much so that it may be said that all land value depends upon the water supply. The United States, being the great landowner, has before it the problem of the reclamation of this vast extent of fertile country, and each citizen, as part owner, is concerned in seeing that the largest use is made of the water.

The Forest Division is engaged in making an examination of the forest reserves in the west, with a view to learning the amount of timber contained therein, the distribution of species, the conditions of growth, and a large group of facts essential for the proper management of these reserves. It is engaged further in the collection of statistics for standing timber throughout the west.

The first report of this division will appear as a part of the Annual Report of the Survey for the past year, and will be accompanied by a portfolio of maps.

The Division of Statistics collects the statistics of production of metals and minerals and publishes the results in an annual report.

The publications of the Survey consist of atlas sheets and other maps, geological folios, annual reports, bulletins, and monographs. The atlas sheets are sold individually at five cents, or two dollars per hundred. Other maps are sold at different prices, depending upon their size. The annual reports are free to applicants. The monographs and bulletins are, under the law, sold at certain stated prices.

SMITHSONIAN INSTITUTION AND ITS DEPENDENCIES

The Smithsonian Institution was created in 1846, under the provisions of a bequest by James Smithson, and has since been maintained by use of the interest on the sum originally bequeathed and the various additions made subsequently. Accordingly the work of the Institution is not conducted under the auspices of the government, though the fund is administered by a regency appointed by the government, and different lines of scientific work undertaken by the government have been from time to time conducted under the direction of the Institution.

During its earlier years the Smithsonian Institution gave much attention to the encouragement of geographic work and began a series of meteorologic observations now continued in the Weather Bureau. It also promoted geologic work and aided in the establishment of the Federal Geological Surveys. Throughout it has been the policy of the Institution to initiate lines of scientific work of public importance, to maintain them until their importance came to be recognized, and then to transfer them to the general government. In carrying out this policy the Institution has contributed in large measure to the development of the scientific institutions of the National Capital.

There are now three federal bureaus connected with the Smithsonian Institution, but maintained by federal appropriations, viz., the United States National Museum, the National Zoological Park, and the Bureau of American Ethnology. The National Museum issues an annual report and other publications relating to its work and the collections made and displayed, while the superintendent of the Zoological Park issues an annual report in connection with that of the Institution. No surveys or extensive field researches are made by these bureaus.

The Bureau of American Ethnology is engaged in researches relating to the American Indians, its operations extending over the United States and other American territory, and the distribution of the aborigines being mapped from time to time. It issues annual reports, which are well illustrated and commonly accompanied by maps; these are distributed chiefly by Congress.

THE CENSUS

The Census Office is a temporary organization created for the purpose of taking the decennial census. The census obtains statistics regarding population, including age, sex, race, nativity, and, in the case of native-born, the state of birth and the occupations of the people; it obtains statistics of illiteracy and education, of mortality, of the insane, deaf, dumb, and blind, and other social statistics; it obtains statistics of industries, including under the head of agriculture the number, size, and value of farms, the amount of cultivated land, the magnitude of all principal crops, amount of live stock, etc.; under the head of manufactures the number of each kind of establishments, with their capital, material used, product, and employés; under the head of mining it obtains statistics of the number of mines and their character and product; under the head of transportation it obtains statistics concerning the operations of railroads (including street railroads), canals and navigation, coastwise and on our lakes and rivers. The results are published in a series of quarto volumes, and are summarized in a compendium and in an abstract. They are further summarized, mainly in pictorial form, in a statistical atlas. All these publications can be obtained on application to the Secretary of the Interior.

HYDROGRAPHIC OFFICE

This is a branch of the Navy Department and is in charge of a naval officer, known as the hydrographer. The function of this office is to prepare from the best available sources and to publish charts of foreign coasts for the use of our navy and the merchant marine.

Besides this work, the office is engaged in a study of terrestrial magnetism and its distribution over the earth, as an aid to the navigator, and in the study of marine meteorology and ocean currents.

The navy has charted great extents of coast of barbarous nations, and the results have been published by this office. It has also made valuable contributions to our knowledge of the sea bottom, particularly in the Gulf of Mexico and Caribbean sea, by deep-sea soundings.

The charts published by this office are sold at prices differing with the size of the chart.

GENERAL LAND OFFICE

This office is charged with all matters relating to the disposal of the public lands. In pursuance of this duty its first function is to subdivide these lands into parcels suitable for sale or other mode of disposition. The method of subdivision of the public lands has been, in its main features, a consistent one from the beginning. The land is divided by survey into townships six miles square, and each of these into sections of one square mile. These sections may be in turn subdivided. This work is done in the main by contract, at certain rates per linear mile. The surveyors are required to prepare and file maps or plats of the townships subdivided, and thus there has accumulated in the Land Office a vast body of maps, representing an area of over a million square miles. These maps are upon the uniform scale of two inches to one mile, but they are of varying degrees of excellence. From these plats the Land Office compiles and publishes state maps, at present upon a uniform scale of twelve miles to an inch, and these maps form the basis of most of the atlas maps in use. Besides this series the Land Office compiles a map of the entire United States, upon a scale of about forty miles to one inch. The state maps can be obtained upon application to the Commissioner of the General Land Office. The United States maps are sold at a price of $1.00.

Besides this work of subdivision, with the resulting maps, this office superintends the survey of the state and territorial boundaries.

THE LIGHT-HOUSE ESTABLISHMENT

The Light-house establishment is in charge of the Light-house Board, under the Secretary of the Treasury. Its duties are to maintain upon the coast, lake shores, and navigable rivers a system of lights and buoys for the guidance of mariners.

COAST AND GEODETIC SURVEY

This organization was created by Congress in 1807, but little work was done under this act until 1832. Since that time the Coast Survey has been in continuous operation. It is charged with the survey of the Atlantic, Gulf, and Pacific coasts of the United States, including rivers to the head of tide-water or ship navigation. It has carried on extensive deep-sea soundings, together with temperature and current observations, especially in that part of the Atlantic traversed by the Gulf stream. It conducts also magnetic observations for the determination of the direction, dip, and force of the earth's magnetism, and measures the force of gravity by means of the pendulum. It is carrying on accurate triangulation in the interior of the country, having already completed a belt across the continent from east to west, together with a large amount of similar work done in aid of state surveys. In addition to this triangulation in the interior, lines of accurate levels have been run over many thousands of miles.

The results of this work are published in the form of charts of the coast upon various scales, upon some of which the relief is represented by hachures, upon others by contours. These charts are sold at prices differing with the size of the chart. There are also published annual reports, in which are contained papers upon geographic subjects pertaining to the work of the Survey.

CORPS OF ENGINEERS, U. S. A.

The War Department carries on a great variety of geographic work, mainly through its Corps of Engineers. By this office has been executed a complete survey of the shores of the Great Lakes and of the St Lawrence. The charts resulting from this survey are upon various scales, dependent upon the needs of navigators, and are sold at prices differing with the size of the chart. The Mississippi and Missouri River Commissions are in the nature of advisory boards to the Chief of Engineers. By the Mississippi River Commission that river has been mapped from its mouth far up into Illinois and the results published upon various scales, the largest being 1 : 20,000, in contours; another on a scale of one mile to an inch, while the whole alluvial region of the Mississippi, from Cairo to the Gulf, has been issued in one large map, on a scale of four miles to an inch, in eight sheets.

The Missouri River Commission has mapped that river from its mouth to the Three Forks, in Montana, publishing the maps upon various scales, ranging from one mile to an inch upward.

The Engineer Corps has mapped also the Ohio river from Pittsburg to its mouth, the Arkansas, Red, White, and Yellowstone rivers. Copies of these maps can be obtained by application to the Chief of Engineers.

To this organization has been entrusted also the survey of parts of our international boundary.

Between 1867 and 1878 extensive surveys and explorations of the west were made under Maj. George M. Wheeler. Of many parts of the west the maps prepared by this organization are the only ones to be obtained. They were published upon a scale of four and eight miles to an inch, in hachures. These maps are now extremely scarce and difficult to obtain.

The Corps of Engineers is charged with the improvement of harbors and rivers, in aid of navigation, and in pursuance of this work it has carried on extensive surveys, but mainly of small areas. The resulting maps are published in the annual reports of that office, which can be obtained from the Chief of Engineers.

WEATHER BUREAU AND OTHER OFFICES AND DIVISIONS OF THE DEPARTMENT OF AGRICULTURE

The primary function of the Weather Bureau is to predict the weather. This work requires the constant maintenance of hundreds of meteorological stations, scattered over the country, at which continuous observations of pressure, temperature, rainfall, humidity, and winds are made, thus furnishing the material for an exhaustive description of the climatology of the country. It involves also an exhaustive study of the science of meteorology. It includes also a close watch of the great rivers for the purpose of predicting floods.

The publications of this office are voluminous. They consist of a weather map, published daily, showing the climatic conditions prevailing in all parts of the country on that morning; weekly weather maps, showing summaries of the conditions; a monthly weather review and annual reports. In addition to these, bulletins are published containing treatises on meteorologic and climatologic subjects, summaries of statistics, etc. All these may be obtained on application to the Chief of the Weather Bureau.

Besides the Weather Bureau, the Department of Agriculture contains a number of divisions and offices, much of whose work is geographic. The Biological Survey, the Divisions of Forestry, Botany, Agrostology, Entomology, and Pomology are concerned, in great part, with the distribution of life in the country, and in so far their work is geographic.

The Biological Survey studies the geographic distribution of animals and plants, and maps the natural life zones of the country, besides investigating the economic relations of birds and mammals.

The Division of Forestry is engaged in the study of sylviculture, and in the management, protection, and utilization of our forests.

The Division of Agrostology investigates the natural history, geographic distribution, and uses of grasses and other forage plants.

The Division of Botany investigates the purity and value of seeds, methods of controlling the spread of weeds or preventing their introduction. It studies the native plant resources of the country.

The Division of Entomology studies insects injurious to vegetation, their distribution and spread, and the methods for reducing their ravages.

The Division of Pomology has to do with the culture of fruits.

The publications of this department are of three classes: first, serial publications; second, scientific and technical reports. These two classes are issued in limited editions and are not intended for general distribution, being particularly designed for libraries, institutions of learning, and scientific students. Third, popular bulletins, which are issued in large editions and are sent free to applicants. Lists of the publications are sent on application.

FISH COMMISSION

This office was created for the purpose of maintaining and increasing the supply of food fishes, both upon our shores and in our rivers. As a necessary adjunct to this work, exhaustive studies are being made of the life history of fishes and of their distribution. The publications of the Fish Commission consist of an annual report.

BUREAU OF AMERICAN REPUBLICS

The function of this Bureau is to obtain and publish commercial information concerning the American republics. Its publications consist of handbooks of these countries, a monthly bulletin containing the latest information regarding their resources and commerce, and a commercial directory.

INTERCONTINENTAL RAILWAY COMMISSION

This Commission was formed for the purpose of examining the best routes for an intercontinental railway to connect the United States with the republics of Central and South America. Its work is completed and reports and maps will shortly be issued.

THE GEOLOGIC ATLAS OF THE UNITED STATES

In the course of his study of the elements of greatness of nations, Buckle concluded that there are three normal stages in national development—the stage of agriculture, followed first by the stage of manufacture and eventually by the stage of foreign commerce. Buckle's conclusions were based on the study of nations confined by territorial limits, and so situated as to derive support through commerce with other nations of different resources and (generally) inferior intelligence and industry. Since Buckle's time the population of the world has increased and spread far beyond his realization, and new factors have been introduced in the problems of statecraft. This is particularly true of the First Republic of America, which controls a vast territory and possesses within itself nearly every necessary resource. By reason of the new conditions, the actual history of this republic has become a great object lesson in statecraft; and the experience of the nation, built as it were on a new foundation, has wrought out conclusions of even weightier significance than those of Buckle. One of these conclusions is that the nation desiring to progress well in the race for success must have within itself the territory requisite for agriculture, the resources for manufacture, and the facilities for extended commerce, all growing up together and all fostered by a single people united in interest and purpose. Another conclusion wrought out by national history is related to those formulated by Buckle; it is that national progress is assured by increase in intelligent activity on the part of masses and leaders alike. With the normal increase of population and of national intelligence, the economic problems and the means of meeting them gradually change; intensive agriculture makes "two blades of grass grow where one grew before" and converts coarse vegetal tissue into richer animal food, wholesale manufacture diversifies industries, and abundant commerce at once differentiates the individuals and welds their interests into perfect solidarity. As agriculture grows intensive through more intelligent cultivation, so all industries are made intensive by pressure of need and reaction of intelligence; and current thought adjusts itself to constantly changing conditions.

A significant expression of the national growth of the United

States is found in the development of geographic problems and results. In earlier decades the geographic work was exploratory, and bent toward the discovery and conquest of unknown or little-known territory. As time passed, more and more attention was given to the resources of the newly discovered valleys and plains, mountains and forests; and, now that the exploration of our territory is complete, the efforts of the pioneers are devoted to discovery of new resources. This change in purpose, albeit gradual, cannot be too strongly impressed. The earlier work was areal and largely limited to the surveys of the land, the present work has a vertical element reaching toward the resources of the rocks below and the powers of the air and vapor above; the earlier studies related to materials, the present investigations relate to natural powers and potentialities—in brief, the one sought to subjugate matter, the other seeks to make conquest of force. Various instrumentalities of national character have contributed toward this transformation in beneficent activity, but none have contributed more, especially during the last dozen years, than the U. S. Geological Survey.

During the earlier years of its existence the Geological Survey devoted chief attention to topographic surveying and mapping, the maps being designed for subsequent use by the geologist; and the bureau came to be known favorably throughout the country and the world by reason of the extent and excellence of the topographic maps. During this period a corps of geologists were employed in researches designed partly for the development of a system of classification adapted to the subsequent geologic mapping. The two branches of the work were judiciously coördinated by Director Powell, so that when the topographic surveys were sufficiently advanced in different districts the geologists were provided with adequate classific systems, and were able to proceed at once to effective geologic work; and this coördination has been continued by Director Walcott with the normal increase in production of geologic maps.

The plan of publication adopted by the Survey marks an epoch in the history of practical scientific work; for it is designed to bring the results of the most advanced scientific research within the reach of every citizen of the nation, and within the mental grasp of every graduate from the public schools of America; the plan represents more fully than any hitherto devised in any country the idea of distributing broadcast among the people the rich boon of scientific knowledge. Only a generation ago several of the world's intellectual leaders occupied themselves most laudably in teaching the beneficence of science and its freedom from mystery; today the teaching has become an object lesson through the Geologic Atlas of the United States.

An example—it may not be invidious to say the finest example to date—of the "atlas folios" issued by the Survey is the Pueblo Folio, by G. K. Gilbert.* Like the rest of the series, it is a thin folio, 21¾ by 18½ inches, bound in a moderately stiff manilla paper. The first cover page bears an index map showing the position of the area represented, and also of other published folios, with respect to considerable adjacent territory; while the second and third cover pages contain an elementary "Explanation" setting forth in simple language the principles and methods of topographic mapping, and the classification and conventions used in the geologic mapping. This text is general, equally applicable to all atlas folios, and signed by the Director. Like most of the other examples, the folio proper comprises (1) a preliminary descriptive text, followed by (2) a topographic atlas sheet representing the "quadrangle" (or tract) to which the folio is devoted, (3) a geologic map of the same tract, (4) an economic map of the tract showing the distribution and indicating the value of the important resources, (5) a sheet of sections exhibiting the structure of the tract, and (6) special supplementary illustrations. In this instance the special illustrations comprise (*a*) a lithographic reproduction of a model showing the deformation of the tract during a particular epoch, (*b*) a map showing the distribution and depth of phreatic water within reach of artesian and pumping wells, (*c*) a series of columnar sections showing in detail the structure and thickness of the beds, and (*d*) illustrations of typical fossils and rock-structures. Like other folios of the series (of which this is No. 36), the work is distributed to certain libraries and other depositories, and is sold, on application to the Director of the Survey, for 50 cents.

The "Description of the Pueblo Quadrangle" forming the authorial text of this folio is especially noteworthy as representing the work of one of the foremost geologists of the world in a peculiarly instructive geologic province. It begins with an introduction in which the terminology is explained. This is followed

* Department of the interior | United States Geological Survey | Charles D. Walcott, Director | Geologic Atlas | of the | United States | Pueblo Folio | Colorado. [Index map, list of sheets, etc.] Washington, D. C. | Engraved and printed by the U. S. Geological Survey | Bailey Willis, Editor of Geologic maps. ——— S. J. Kübel, Chief Engraver | 1897.

by a summary account of the geography, including climate and vegetation, agriculture, etc. Next follows an account of the general geology, including a history of physical changes, set forth verbally and graphically. In this division of the work the characteristics of the formations are described, the sources of materials are considered, the subsequent alterations recorded in texture and structure are investigated, and the great orogenic and epeirogenic movements that produced the majestic Rocky mountains and (especially) the broad plains at their base are interpreted—*i. e.*, the phenomena are treated both locally and comparatively, and in remarkably luminous and attractive fashion. The formations range from recent alluvium through earlier Pleistocene, Neocene, Cretaceous, Juratrian, Carboniferous, and Silurian to the Archean nucleus exposed in the ranges; and there were several periods of deformation, the movements of which have been analyzed and clearly set forth. In describing the formations and discussing the deformations full recognition is given to the principles of geomorphy and to homogenic correlation, and the history of the tract is thereby made clear and definite. There is a final chapter on economic geology in which the resources, including phreatic water, are fully described.

This synopsis merely indicates the scope of a notable publication; it does not and cannot give any adequate idea of the high scientific and educational value of a great work which can be properly appreciated only after examination. It is not too much to say that this atlas folio by itself would, in the hands of a competent teacher, serve as a complete introduction to geology, by means of which any pupil might gain an elementary knowledge of the science; or that in the hands of a competent teacher (or, indeed, of an intelligent student without a teacher) within the tract described the work would be more serviceable than any manual or text-book of geology ever written. The publication of these atlas-folios representing particular tracts in all parts of the country is bound to revolutionize geologic teaching quickly, completely, and permanently. W J M.

At the annual meeting of the Royal Geographical Society, held recently in London, the Founders' Medal of the Society was conferred on Dr Sven Hedin for his explorations in Central Asia, and the Patrons' Medal on Lieut. Robert E. Peary, U. S. N., for his work in Greenland.

THE TOPOGRAPHIC ATLAS OF THE UNITED STATES

"In 1882 the United States Geological Survey began the construction of a topographic map of the country. The work has now been in progress fourteen years, and about 600,000 square miles have been mapped. The areas shown on these maps are scattered widely over the country and represent a great variety of topographic features, and the map sheets, with the aid of descriptive text, can be used to illustrate topographic forms. This led the Director to propose the publication of an educational series of folios, for use wherever geography is taught in high schools, academies, and colleges. Authority for their publication and sale was granted by Congress in an act approved March 2, 1895. . . . The first folio of the series presents on ten maps illustrations of some of the simplest and most characteristic types of topography to be found in those parts of the United States which have thus far been mapped. Succeeding folios will illustrate more complex forms."

So Henry Gannett, Geographer of the United States Geological Survey, introduces an illustrated treatise in folio form on the "Land Forms of the United States."*

When geographic exploration brought to the knowledge of men the unparalleled Grand Canyon of the Colorado and the picturesque plateau country adjacent, the way was prepared for the discovery of new principles in geographic development; in good time Powell descended the Canyon, and he and his collaborators surveyed the plateau country, and as the work progressed the "baselevel of erosion" was recognized. The idea quickly took root, and grew into one of the fundamental principles of earth-science; spreading eastward into provinces already reconnoitered or surveyed, it was found to afford a new means for interpreting earth-history, and thereafter the later stages in the geographic development of the continent were read from land forms as well as from fossil plants and animals. The principle

*Department of the Interior | United States Geological Survey | Charles D. Walcott, Director | —— | Topographic Atlas | of the | United States | Physiographic Types | by | Henry Gannett | —— | [List of Contents, etc.] | Folio 1 Physiography | Washington, D. C. | Engraved and printed by the U. S. Geological Survey | S. J. Kübel, Chief Engraver | 1898.

was applied in southeastern United States, where the important episodes in continental history are clearly recorded in the plateaus and canyons of the Piedmont region, and where the minor movements are recorded in unconformities separating the deposits of the Coastal plain; it was applied most successfully in New England and elsewhere by Professor Davis, who reads earth-history from topographic maps. Within a dozen years the principle has been widely recognized among investigators, and has given birth to a science—Geomorphology or the New Geology. Thus far this line of learning has mainly been confined to a limited number of original investigators and teachers in high grade educational institutions, and has lain beyond the reach of the general school and the citizen; but now Mr Gannett's treatise, issued by a public office, brings this distinctively American advance in science within reach of the American public.

The atlas comprises ten maps, of which the first three are devoted to the now well-known stages in topographic development—youth, maturity, and old age. The fourth illustrates a rejuvenated region, typifying the Piedmont plateau. The fifth map represents a young volcanic mountain, its subject being our magnificent volcanic cone, Mount Shasta. Moraines and drumlins, representing characteristic phases of ice-work, are shown on the sixth and seventh sheets, and a fiord coast, with its picturesque record of ice-work half drowned in ocean, forms the subject of the ninth sheet. The two remaining sheets illustrate river flood-plains and a barrier-beach coast. The text includes an exposition of the conventions used in topographic mapping, and a full description of each of the sheets with a fuller interpretation of its features as records of geographic development.

The issue of this folio marks an epoch in geographic teaching. Hitherto teachers have been limited in their work to glittering generalities in the books, or to the maze of little-understood realities in their sight; but now comes a series of American illustrations, shown in such detail that any teacher may correlate the features with those of his own landscape, and these are interpreted by the hand of a master so clearly that even the average pupil cannot fail to read aright.

The atlas folio may be obtained at the nominal price of 25 cents on application to the Director of the Geological Survey.

W J M.

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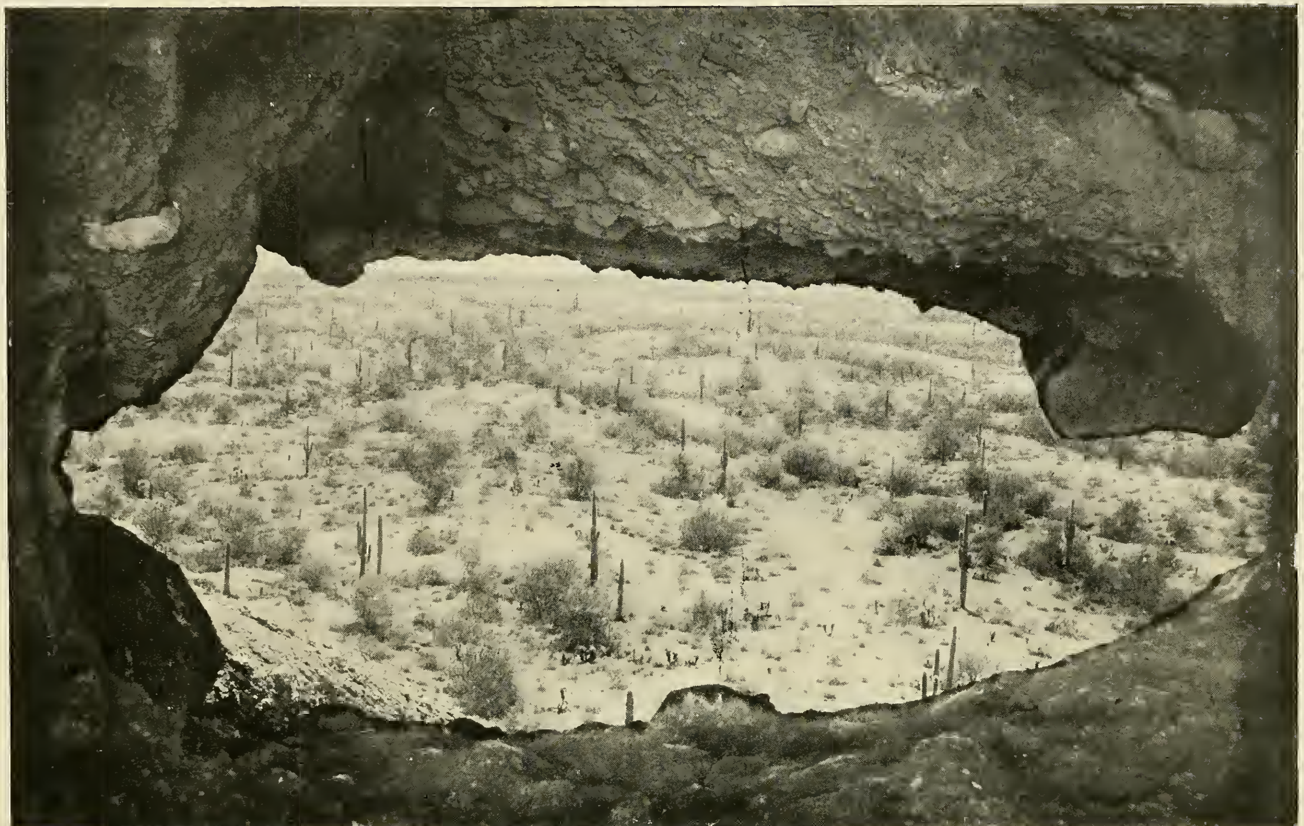
The National Geographic Society, the object of which is the increase and diffusion of geographic knowledge, has a total membership of 1,600. Its membership is not restricted to practical geographers, but is open to any person in good standing who may be sufficiently interested in its work to seek admission. The annual subscription is: for active members, $5.00 per annum; for corresponding members, $2.00 per annum. THE NATIONAL GEOGRAPHIC MAGAZINE is sent regularly to all members.

Donations for the founding of Prize Medals and Scholarships are respectfully solicited.



VIEW FROM "HOLE IN THE MOUNTAIN" NEAR TEMPE, ARIZONA (TYPICAL SUB-DESERT LANDSCAPE)

THE

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PAPAGUERIA

By W J McGee,

Bureau of American Ethnology

Following a custom which became well established in the days of Mexican colonization, the priestly pioneers called the arid region beyond the Sierra Madre mountains *Papagueria*—*i. e.*, the Land of the Papago—from the tribe of Indians native to the country; and in time the tribesmen, and after them the American and Mexican settlers on their border, adopted the designation. The district lies south of Gila river and southwest of the Sierra Madre, in what is now Arizona and Sonora, and is bounded on the southwest by the Gulf of California and on the south by the ill-defined district known as Seriland; it is some 200 miles wide in the north, narrowing somewhat southward, and over 300 miles in length from north-northwest to south-southeast, the area reaching over 50,000 square miles, or about that of New York or Iowa. The larger part of the district lies in Mexico, in the state of Sonora, though the greater part of the aboriginal population is gathered in the northern portion, within the territory of Arizona.

The Papago Indians (Pa-paf′ in their own language*) are, in distinctiveness and persistence of characters if not in population,

*Their proper name in their own language is Aw′-aw-tum (Men, or People), while the name by which they were known to neighboring tribes of their own and other linguistic stocks is that of a legume cultivated and consumed by them in prehistoric times and later; this, in the Piman dialects, is called "paf" in the singular, "pa-paf′" in the plural, so that the literal designation of the tribe may be rendered "Beans." Since the same term is applied to the field in which the legumes are grown, the term might be considered to mean "Bean-patch;" but in reality it means "Bean people," the second element being understood. This alien designation was apparently used

CIENEGA: MEXICAN-INDIAN VILLAGE OF PAPAGUERIA the leading branch of the Piman stock or linguistic family. According to several authorities, the Piman is related to the Nahuatlan of Mexico, the great and highly advanced stock of the Montezumas. Besides the Papago, the Piman group includes the Pima tribe of southwestern Arizona, the Opata of the border, and four or five tribes altogether in Mexico. The Opata have been assimilated by the Mexicans, and the Pima Indians are largely gathered on reservations; the Papago remain distinct, and while a small number are domiciled on the reservation at San Xavier (near Tucson) the greater part of the tribe retain their independence and essential autonomy.

The Papago population within the limits of the United States in 1890 was 5,163, according to the census of that year. These figures were based largely on estimates. The population estimate for the entire tribe made during the explorations by the Bureau of American Ethnology in 1894 and 1895 was 4,000, of whom ten to forty per cent, according to the season, are in Mexico.

Papagueria is perhaps the most arid region on the continent. The surface slopes southwestward from the imposing Sierra Madre with its subordinate ranges, and is relieved by many lesser ranges generally trending parallel with the main chain. As the vapor-laden air drifts from the Pacific and the gulf over the sun-parched land it is heated to dryness; but about midsummer and again about midwinter the air is chilled again as it drifts over main or minor crests, and fierce storms occur in the mountains and occasionally sweep into the plains. The annual precipitation along the margin of the Sierra is recorded as 15 inches, and in the higher portions it probably reaches 20 inches; but it quickly diminishes westward to 10 inches, to 5 inches, then to a trifling or unmeasurable amount representing the product of local storms, perhaps separated by intervals of years, the average rainfall throughout Papagueria probably falling short of 5 inches. Thus the greater part of the district is practically a desert, although, as in most other American deserts, vegetal and animal life maintains a feeble existence. The high Sierra is scantily clothed with pines, and at lower levels gnarled, scrubby, and thorny oaks and chaparral thickets occur sparingly. In the val-

by the tribe in their dealings with their neighbors, and so came into use among the Spanish priests and settlers; and in time the Mexican users of the term lost the soft final and then emphasized the terminal vowel and, when they came to write it, strengthened the vowel sound still further by introducing the semi-silent but sub-guttural *g* of the Andalusian. This orthography has been adopted by Americans and the pronunciation modified to fit, though the local Mexican pronunciation is hardly distinguishable from that of the Indians themselves.

BABOQUIRERA PEAK, SEEN FROM FRESNAL (SHOWING THE RUGGEDNESS OF A TYPICAL RANGE RISING FROM A PLAIN) leys the deep-rooted mesquite dots the surface in similitude of scattered and ill-kept orchards, or gathers with a dozen other trees in scraggy forests along permanent waterways, while monstrous bizarre cacti haunt the foothills and the lower slopes, and scattered grass-blades faintly tinge the acres intervening between cacti and mesquites. The plant forms abound in pulpy structures and impervious rinds for conserving moisture, even more than in thorns and other protective devices; for in this hard region the struggle for existence is not so much between organism and organism as between organism and environment, and the organisms persist less by the multiplication of progeny than by the prolongation of individual life. Animal life, in insect, reptile, bird, and mammal, occurs in much the same proportion to vegetal life as in humid regions, but is more largely nocturnal and crepuscular. Ants of many kinds (including the ingenious and successful farmer ant), wasps, flies, and other insects follow the sparse flora. Gaudy and swift efts, as well as somber and sluggish lizards, accompany the insects, while ground-squirrels and field-mice contribute a quota of vitality. In the more humid valleys, and on the mountain sides moistened by drainage from above, rabbits, quail, deer, and other herbivorous and graminivorous things collect in limited numbers, while serpents find subsistence in the more fertile spots; and over the hills, valleys, and plains on which lower life prevails the coyote on the land, and hawks, owls, and eagles in the air, are not wanting (for it is only in the western part of Papagueria, where the rainfall is trifling, that life is unable to hold its own). Yet, as among plants, the struggle of animal life against inorganic nature and alien organisms is severe, and an exceptional number of the animate things are armed with mandibles, stings, fangs, talons, poison glands, and other protective devices. The distribution of life conforms to the distribution of water; it is most abundant over the rugged summits and rocky slopes of the high Sierra, as well as along the gulches and gorges—barrancas of the local vernacular—of the foot slopes and the broad sand washes or arroyas of the narrower valleys; it is less abundant on the foothills and over the lower ranges, where the storms are feebler and rarer; it is still more meager over the broad intermontane valleys constituting the greater part of Papagueria; but it is only in the western portion of the district, where clouds rarely gather and whither streams never flow, that the shifting sands and black-burned scoriæ of dead volcanoes (the "mal-pais" of the Mexicans) are utterly barren.

The distribution of water in Papagueria is correlated with the configuration of the surface. As the vapor-charged air drifts up the long slope to the base of the Sierra and up the steeper slope toward the crest, a part of the vapor distills as dew or falls as rain, while the lesser ranges lying athwart the long slope extract a part of the boon ; so there are storm-fed streams in all of the higher mountains, rushing torrents in the lofty Sierra, slender streams in the lower ranges, and a part of the flood soaks into the thirsty soil to form ground water, which may reappear as springs toward the mountain bases or in the narrow upland valleys. During the midsummer storms, and still more during those of midwinter, the mountain-born floods stretch far into the plains, cutting channels broad and deep as those of the Connecticut, Susquehanna, and Savannah, which for eight or ten or eleven months of the year are naught but wastes of burning sand. The typical drainage system of Papagueria during the wet season is a long series of nearly parallel mountain torrents flowing down the side of the range in deep gorges, joining in part in the foothills, and finally uniting in the adjacent plain as vast sheetfloods, miles in width and inches in depth, flowing swiftly and boldly adown or athwart the broad valleys toward the sea, to finally gather in great rivers; yet throughout the whole district these broad streams are quickly swallowed by the sands or consumed by the blistering air, and from the Gila to the Yaki, 500 miles away, no river of Papagueria has reached the sea during the memory of men. As the dry season approaches the rivers are cut off in their lower reaches, mile by mile, and as they shrink toward their sources the drainage systems contract and most disappear, leaving a few slender streamlets in the deeper gorges each heading in a spring or seepage basin and rippling feebly over the sands a few rods or miles before fading in the sun ; and so delicate is the adjustment of climate and earth-water that the streams stretch by night and shrink by day, sometimes for miles. A few streams heading in the high Sierra indeed flow for scores of miles ; but these have mainly been taken by other peoples and hardly appertain to Papagueria. There are other streams which, during the dry season, are practically subterranean, and only to be found in storm-cut tinajas or reached by digging. And all the way from the high Sierra toward the gulf, over the lessening mountains and toward the broadening plains, earth-water on the surface or at depths grows scantier and scantier until it is gone.

RIO SECO: A TYPICAL SANDWASH OF PAPAGUERIA (MUMMY OF FAMISHED COW IN FOREGROUND)

This characteristic waterflow has reacted on the topography during the eons of geologic history, and has developed a configuration no less distinctive than the drainage systems. To the traveler by rail along the northern border of Papagueria the region seems one of remarkably rugose and irregular mountain ranges, buttes, picachos, and precipice-walled mesas; for the jagged mountains are always in sight and the clear air brings them close to the eye. At first the traveler in the saddle sees the region in similar light, the exceeding ruggedness of the mountains giving them undue prominence; but after spending days in traversing the intermontane plains and hours in crossing or circumscribing ranges and mesas for a month or two he learns to see the land-forms in true proportion, and finds that only a fifth or a tenth of the surface is mountain and four-fifths or nine-tenths plain or valley so smooth as easily to be traversed by pack-animals, and for the most part by wheels. So rugged are the mountains and so smooth the plains that the region has been likened by a careful observer to a series of great ranges buried to their ears in alluvial deposits; yet more thoughtful study shows that half the area of the plains is smoothly planed rock similar to that of the mountains, the planing being the work of the sheetfloods into which the freshet waters gather. In general, the plains incline toward the great trough half filled with the waters of the Californian gulf; and, on crossing the northwesterly-southeasterly trending ranges toward the gulf, each intermontane plain is found to lie lower than the last, down to the tide-swept shore. This inclination is a part of that southwestward tilting which accompanied the uplifting of the great plateau region and the birth of the Colorado canyon. In arid Papagueria, where the work of the feeble streams is long drawn out, it has resulted in a regressive erosion, whereby the streams flowing southward and westward have cut far into and often through the ranges in which the waters gather, pushing the divides into the plains beyond. The habitability of Papagueria is largely due to this fact, for it is only in the narrow gorges cut into and through the ranges by regressive stream-work that the scant ground-water approaches the surface in springs or seepage from the sand-washes.*

The Papago Indians, primitive and present holders of this district, are preëminently children of the desert. So strongly ad-

*The topography and its development in this interesting region are set forth in greater fullness in "Sheetflood Erosion" (Bull. Geol. Soc. Am., vol. 8, 1897, pp. 87–112).

COYOTE: PAPAGO VILLAGE (SHOWING ABRUPT TRANSITION FROM SMOOTH PLAIN TO RUGGED MOUNTAIN) verse are the physical conditions of life that the struggle for existence among plants and animals is modified, all striving against inorganic nature rather than against each other; and this peculiar strife has led to a coöperation among unrelated organisms so complete that the district is segregated into a series of colonies in which grasses, trees, cacti, insects, reptiles, birds, and mammals dwell together in harmony and mutual helpfulness. It is in part through this system of coöperation or communality that life is enabled to exist throughout the region. Now just as the lower organisms have become fitted to an adverse physical environment and adjusted to each other, so the Papago Indian has, through the generations, developed fitness to his desert habitat—he has joined the general system of communality, and lives in harmony with the desert flora and the desert fauna in a land so bitterly inhospitable that marauding Apache, pastoral Mexican, and gold-seeking American commonly pause on its borders. The Papago prefers to live where other peoples famish; he is able to do so by reason of the remarkable adjustment of his habits, his food and raiment, his industries, his social organization, to a peculiar assemblage of conditions; and thereby the tribe acquires a peculiar interest.

Three and a half centuries ago Spanish explorers came in contact with the Papago Indians, and over two centuries ago established missions among them, especially in the eastern and better-watered portion of their territory. With hardly an exception, the invaders found the tribesmen fearless and dignified, yet kindly and hospitable; and this character has been maintained until the present time. The Papago chiefs met the Spaniards as peers, and interchanged courtesies and commodities, yet the exchange went on with a certain reserve. Through the exchange, the Papago acquired burros and horses, goats and kine, sheep and dogs, as well as a number of garden and field plants and a variety of agricultural arts. They also adopted gradually the costume of civilization, and apparently by reason of certain similarities (perhaps superficial) in the ceremonials, they viewed favorably and in some measure adopted the imported doctrines. They also adopted, albeit slowly and cautiously, the adobe architecture, with the architectural type previously borrowed by Spain from the desert borderland south of the Mediterranean. In return, they gave the Spaniards temporary sustenance, and were among those who enriched the civilized world by the gift of corn and other indigenous plants, including the legume which gave them name; and gradually a system of barter grew up under which the Spaniards acquired the means and arts of life in a desert region, the Papago meantime forgetting their arts of weaving, hand-culture of the soil, and other operations rendered needless by their new acquisitions. Here the commerce ended; the Papago refused, save in exceptional cases, to attach themselves to the Spaniards' households, refused to surrender their tribal autonomy, refused to intermarry with the whites, refused to countenance relations in which they would be subject to bondage or prevented from coming and going freely as the migratory bird; and, save for a partial and rather superficial assimilation of ceremonies and concepts, they clove unto and still retain their primitive philosophy.

Whether it be ascribed to peculiar environmental conditions or not, the fact remains that the Papago tribe is characterized by exceptional force and stability of character. For over three centuries they have been known among white men (albeit a few only) as peaceful yet brave, hospitable yet independent, amiable yet dignified; and they have equally been noted as industrious and virtuous. When attacked, or in reprisal, they have always gone forth to meet the Apache, even in greatly superior numbers, and have protected their fatherland against all marauders. They scorned control by alien races, and are today known in Mexico for their constant and consistent avoidance of peonage, under which neighboring tribes were ground. They have engaged in mining in desultory fashion at various times, but have never been coaxed or coerced by alien capital; and almost without exception they have maintained the purity of their blood, despite the pressure of frontier life and conditions. Neighboring peoples, including most of the kin-tribes, have been assimilated or modified; but the greater proportion of these people of the desert are still known as "wild Papago" or "roaming Papago," and their habits and modes of thought are little changed since the white man came."

While the Papago Indians have been notably stable during three centuries of contact with alien races, there is reason for considering them descendants from a people of superior aboriginal culture. Throughout much of Papagueria, especially in Mexico, there are abundant relics of a prehistoric population and agriculture. The ruins, like the first settlements, are found in the moister localities, in the foothill gorges and in the broader valleys, their distribution indicating that the prehistoric people pushed further into the valleys than the historical population. The prehistoric relics comprise ruined houses and villages, weathered to inconspicuous mounds, but known from occasional foundation remnants to have been constructed, at least in part, of a mixture of adobe and coarse pebbles; abundant fragments of pottery, finer in texture and decoration than that now made by the Papago; extensive acequias and other irrigation works; small corrals or stock yards containing reservoirs; dominating structures in each considerable village, in the ruins of which the finest pottery is found; and well shaped and polished stone axes, pestles, mortars, etc. Comparison of these vestiges with the works of the modern Indians indicates that the prehistoric population was the more advanced in industries and much the larger in numbers. The ancient agriculture, particularly, occupied a higher plane than that of the present; for the prehistoric farmers constrained and restrained the running waters to the needs of their kind, while the modern Indians chase and seek the waters just as they chase game and seek wild fruits. By reason of the control of the waters the fruitfulness of the valleys was undoubtedly multiplied, and large tracts of the desert must have blossomed and borne fruit at the behest and for the benefit of the primitive husbandmen. The ancient acequias were much larger than the modern ditches—*e. g.*, in Arivaca valley, in southern Arizona, the main prehistoric acequia was raised so as to flood the entire bottomland, was lined almost continuously with houses, and was 150 feet wide, while its modern representative, introduced by Caucasian skill, is a simple ditch excavated below the surface and 8 or 10 feet wide. The ancient villages are much more numerous and extensive than the modern Indian, Mexican, and American villages combined. The great number of habitations might be ascribed to successive occupation and abandonment were it not for the testimony of the irrigation works; for the old ditches were not only more extensive, but were carried further up the sides of the valleys in such manner as to permit the synchronous cultivation of larger areas than are now cultivated, and in a manner, moreover, which would have been extravagant and useless unless a large population in each valley was dependent thereon. The dominant structures in each village suggest a cult and social organization somewhat different from that of the modern Piman tribes, whose villages are without council-houses or temples, the ancient structures corresponding in some measure with the "casas grandes" found in Arizona, Chihuahua, and elsewhere, and with the ceremonial places of the pueblos. In central and southern Papagueria "trincheras," or entrenched mountains, are occasionally found in and alongside the better watered valleys in the vicinity of ruined villages. These works are more or less inaccessible buttes or mesas, whose precipices and slopes are extended and reinforced by artificial walls of loose-laid stones, while on the easier slopes the walls are multiplied and bastioned in such manner as to convert the eminences, when protected by a limited force, into impregnable fortresses. Some of these places of refuge are without traces of permanent habitations or storehouses, and also (what is still more significant in this arid region) without sources of or reservoirs for water, so that they could have been occupied only temporarily or interruptedly; while elsewhere (*e. g.*, the great fortified buttes near San Rafael de Alamito, in Altar valley) there are remains of permanent domiciles. In brief, the archeology of Papagueria indicates that during prehistoric times the foothills and valleys had a considerable agricultural population, supported by means of a highly developed system of irrigation; that this population was peaceful and highly organized socially; and that, through the development or invasion of predatory enemies, the peaceful people were driven to seek refuge, and later, as the irrigation works were destroyed, were either annihilated or driven into the desert to enter into enforced communality with the meager flora and fauna and find protection in the bitter inhospitality by which all human enemies were held at bay. There is accordingly a strong probability that the modern Papago Indians are descended from the more cultured inhabitants of this purview of the land of the Montezumas.

The modern Papago is of medium or slightly below medium stature, the women being apparently relatively larger than the men. There is a tendency toward heaviness of feature, particularly among the more sedentary groups toward Gila river; with this exception, the features are more delicately moulded and the expression more vivacious than among neighboring tribes. The men cut the hair, rarely about the neck, commonly shingled more or less closely; the women allow the hair to grow long, and frequently braid it or arrange it in pendent tresses. The color of the skin is somewhat variable, but of the usual coppery cast. Among the adults, and more rarely among the children, a blotched appearance is not uncommon, and many faces are pitted by smallpox. Usually the body and extremities are rather slender, but lithe and vigorous.

Of late the men are addicted to intemperance in smoking and drinking; most of them smoke cigarettes whenever they can be obtained, and nearly all drink mescal (an alcoholic liquor distilled from the mescal or agave plant) inordinately whenever opportunity offers—*e. g.*, during a stay of three days at Poso Verde, near the international boundary in Sonora, only two men were found not continuously intoxicated. It seems certain that the natural features and probable that the stature and other physical characters of the men have been injured by this excessive use of narcotics and stimulants. The women are largely free from these vices.

Among both sexes the dignified hospitality and reserve noted by the Spaniards three centuries ago persist. Papago etiquette demands an interval of affected unconsciousness of the presence of a visitor, whether from neighboring village or strange lands; so the visitor enters the village and rides to the very threshold of a leading tribesman without receiving other attention than furtive glances from the children; he dismounts in the shade of the vah′-toh (which takes the place of the porch or balcony of civilization), and rolls his cigarette nonchalantly as in the desert. In the course of five or ten minutes the head of the house for the time, be it man, matron, or maid, addresses a casual remark to him. At first the conversation is fitful, but gradually the intervals of silence shorten, the host or hostess turns attention from the occupation of hands or eyes toward the visitor, and cordial relations are established. If the visitor is an old friend, the interval of ceremonious silence is shortened and is sometimes terminated by friendly greetings, though commonly these are reserved for the parting; if a white man of distinguished bearing, a seat is placed, or a mat spread, for his use soon after his presence is recognized, and a melon or some other article of food, or a bowl of water, is placed within his reach. The visitor may then extend a general invitation to the household or village to eat with him in his camp, and may rest assured that, howsoever slender his larder, there will not be too many guests, and will find, moreover, that even after they present themselves at the camp, each guest must be personally invited once, twice, or three times (the custom varying in different villages) before he will be seated. White visitors having no appearance of distinction are treated with less consideration, and are usually expected to help them-

THE CHIEF'S HOUSE, FRESNAL (ACCULTURAL STRUCTURE OF ADOBE, WITH VAH'-TOH ON THE RIGHT)

selves to water or food, while the Indians are correspondingly unceremonious in the visitors' camp, though almost without exception the courtesy of the Indian exceeds that of his visitor.

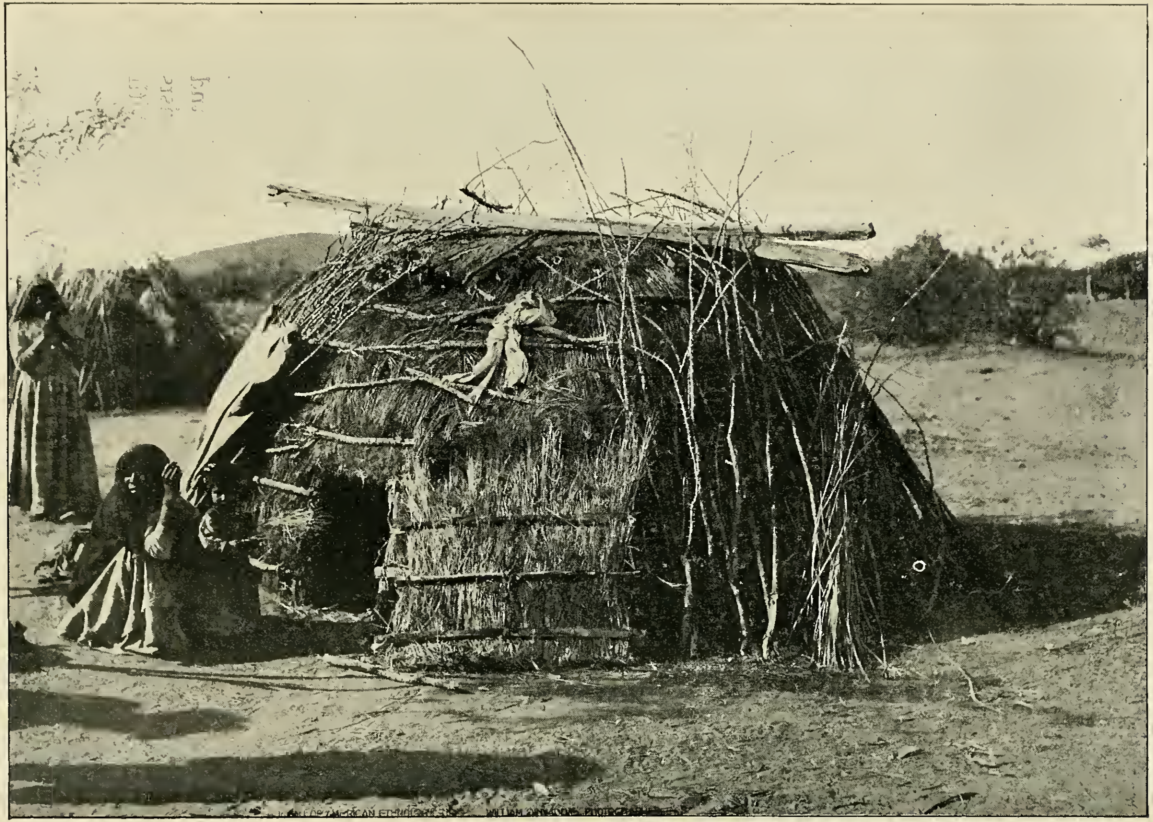
Throughout the tribe the man is the hunter, the herder, and the chief laborer in the field; the woman is the potter, the water-bearer, and the collector of easily accessible wild food supplies. The children are vivacious and happy, the boys playing with the riata or lasso, with which they make miserable the lives of burros, calves, and dogs, or with the bow and arrow, while the girls play at household operations or troop away after mesquite beans and prickly pears. Many of the men are expert riders and ropers, quickly subduing the most vicious buckers among their bronchos, and almost invariably looping their riatas about the horns, neck, fore foot, or hind foot of stock, at will, at the first throw.

Living a hard life as they do, the Papago Indians are subject to a variety of accidents. Until within a generation they were almost constantly engaged in defensive warfare against the Apache, and nearly every village still has its battle-scarred veterans; vicious bronchos and crabbed bulls score a victim now and then; drunken brawls frequently have fatal endings; often the only water obtainable for weeks and months is a reeking spume of organic poison; above any and even all of these is the ever-present danger of the drying up of the spring, the tinaja, or the rivulet on which the villages or travelers depend, and the quickly consequent delirium, ending in the most terrible of deaths. Yet despite all their hardships and dangers, the Papago appears to live long; few invalids are seen, old men who clearly remember the events of 50 or 60 years past are found in nearly every village, and withered crones, shrunken to living skeletons, yet able to perform the most arduous of domestic duties, are surprisingly numerous. While statistics are lacking, there is reason for supposing that the average expectation of life in the desert is greater than in more favored lands.

A considerable agricultural reservation has been assigned to the Papago Indians, including the old Spanish mission of San Xavier, in Pima county, nine miles south of Tucson, Arizona. This reservation is on the northeastern margin of Papagueria. About a hundred families are collected on the reservation, where they are judiciously controlled by a sub-agent of the Indian Bureau. The reservation Indians are supplied with vehicles and agricultural implements, and occupy themselves in the planting and harvesting of corn, small grains, beans, melons, squashes, etc., for home consumption and for the Tucson market; the women manufacture pottery in considerable quantities for the market, as well as for domestic use. Most Indians on the reservation continue to occupy primitive houses, and the culinary and other domestic operations are preëminently primitive; but their habits and modes of thought are so far changed that they are regarded as alien or semi-alien by the great majority of the tribe. The southern portion of Papagueria is somewhat more diversified as to surface than the main body of the district, and is somewhat better supplied with water; accordingly the Yaki and other tribes, as well as Mexican stockmen and farmers, and Mexican or foreign miners have pushed into the region; and thus the primitive holders of the land have been in large part displaced and remain only in scattered rancherias or villages, sometimes adjoining Mexican towns, sometimes isolated. In general the permanent part of the Papago population in Mexico may be considered stationary; and the families have acquired Mexican customs and are affiliated commercially, though seldom in blood, with their neighbors. Perhaps a fifth or a quarter of the Papago Indians are either located on, or in some way tributary to, the reservation of San Xavier; about another quarter are on, or south of, Rio Altar or its tributaries in Mexico; the remainder or fully one-half of the tribe are roamers of the desert, living in a peculiar manner which is neither exactly nomadic nor exactly agricultural, but a unique combination of these modes of life. It is this half of the tribe—the "wild Papago"—that is of especial interest to the ethnologist.

During a considerable part of the year the "wild" Papago occupy rancherias or nominally permanent home villages; tributary to each rancheria there are usually several (sometimes but one or two) temporales, or temporary farm domiciles; and many of the families or family groups have winter domiciles, either for hunting or for pottery-making, in the mountains or settled valleys of Mexico.

So far as the meager water supply of Papagueria permits, the household gods are enshrined about permanent springs; but, since the family groups many times outnumber the continuously flowing springs, rancherias are frequently established about temporary springs, born of an exceptional succession of storms, or even about water pockets in the bottoms of barrancas, or ponds produced by single storms. Some villages in the eastern part of Papagueria were formerly located on fairly permanent, though slender, streams heading in the Sierra, but these sites have generally been taken by Mexican and American invaders. The rancheria includes a separate dwelling for each family, with one or more stock corrals, and, if the soil is fit, a few truck gardens adjacent to the houses of the more enterprising families. The dwellings are scattered; commonly each is several rods from the nearest neighboring domicile, and thus a village of fifty or more houses frequently extends over the greater part of a quarter-section of land. The dwelling comprises an enclosed house, with usually an adjacent shelter and a cooking circle a few yards distant. The typical house consists of a dome-shape framework of mesquite saplings, thatched with sacaton or other coarse grass, or sometimes with leafy shrubs or bushes, or even with cornstalks, the thatch being sewn to the framework with slips of yucca stipes. Such a house is circular or elliptical in plan, 12 to 18 or 20 feet across and 5 to 8 feet high; the roof portion is often flattened and covered with a layer of earth two or three inches in thickness. The doorway is a simple opening two feet or less in width and usually little more in height; sometimes a door made of sacaton lashed to



TYPICAL PAPAGO HOUSE

light sticks is used, but ordinarily the aperture remains open. There are no smoke-holes or window openings, and the interiors are begrimed and sooty. Sometimes the framework is made of mesquite posts and stringers, in which case the roof is commonly more flattened, more deeply covered with earth, and, to support the weight, the framework is reinforced by poles, which may be either ribs of the sahuaro (*Cereus giganteus*) or branches of the okatilla (*Fouquiera splendens*). Frequently the house is protected from the ravages of cattle and horses by an armature of thorny okatilla stems erected about it and attached by withes or yucca lashings. Sometimes the houses are rectangular, this form being probably accultural. The rectangular houses may be of adobe (sun-dried bricks), cajon (adobe mud, either mixed with stones or not, molded directly into walls), stone plastered with adobe mud, sacaton grass, okatilla stems and sahuaro ribs, or combinations of these. The adobe construction is undoubtedly derived from Mexican neighbors and has not been long in use; the adobe or adobe and stone structures are flat-roofed like the ordinary Mexican houses, covered with earth, and sometimes provided with rainspouts; such houses usually have smoke-holes, and in some of the eastern and southern villages they have rude chimneys with chimney-pots (ollas with broken bottoms). The doorway of the accultural house is usually five or six feet high, something over two feet in average width, but considerably wider at bottom than at top, and commonly extending not quite to the ground; doors are unusual, save in the more acculturized villages, when they are either carpenter-made or composed of okatilla stems lashed together. The simpler rectangular houses grade in structure, material, and appurtenances into the primitive, dome-shape type. The adjacent shelter (vah′-toh) appears to be an innovation derived from Spanish contact; it consists of four, nine, or more crotched posts of mesquite, set in a rectangle and carrying stringers of mesquite or paloverde and cross-sticks of okatilla or sahuaro, sometimes thatched carelessly with sacaton, more frequently covered with leafy shrubbery, coarse sticks, etc, or with hides, bits of canvas, blankets, etc. The cooking circle or roofless house is primitive; it consists of a series of mesquite posts, four or five feet high, set in a circle four to six yards in diameter, connected save at one point (which serves as a doorway) by two or three horizontal binders, usually of mesquite sapling, to which a layer of sacaton grass is lashed. During fair weather—and nearly all days are fair in Papagueria—culinary operations are performed in this airy structure; it is only during stormy weather that fires are built in the houses. Toward midday men, women, and children take refuge from the burning desert sun, whose rays are intense beyond imagining in humid lands, under the vah′-toh or in the house. At night the men usually sleep either out in the open or under the shelter, the women and children more commonly in the houses. It is to be remembered that the Papago house is primarily a place for storing properties and taking refuge from the sun, and only subordinately a protection from storm and cloud.

The corral is an accultural feature introduced with horses and cattle from Spain. Usually it is a double stockade of gnarled mesquite logs, filled in between with trunks and branches of mesquite and paloverde, sahuaro ribs, and okatilla stems, the whole lashed firmly with rawhide. Sometimes the wall is partly or wholly of stone, in the form of rubble laid loose. The corral is communal; it is the property of the village, though sometimes it is controlled by the chief or two or three head men, who permit their less energetic neighbors to make use of it. It is usually open, when horses and cattle are merely headed into it in order that they may be lassoed more readily than outside. When closed it is with a barrier of great logs, usually of pine brought down from the mountains, for nothing lighter will withstand a stampede of the half-wild stock.

The spring is usually protected by a corral, with a partition of stockade which prevents the cattle from miring in the deeper part of the pool. As the waters dwindle in the dry season or with a succession of dry years, the spring is gradually deepened and sometimes converted into a well from which the water is drawn, after the Mexican fashion, in bags, which may be made of the skins of oxen, with the aid of horses. A heavy rawhide riata attached to the bag passes over a cross-beam (rarely supplied with a pulley), and is given a twist or two about the pommel of the saddle by a horseman; or, if he rides the typical straw saddle of the Papago, the riata is passed about the breast of the animal and brought up over the withers, to be firmly grasped in the right hand. The spring corral is usually kept up. It is repaired and protected by cacti, poles, stones, and any other material; perhaps the most effective of all being the carcasses of bulls slain in the terrific battles at the water side, which become desiccated and mummified in the dry air into tenacious masses of rawhide and bone, far stronger than wood; and no carcass is allowed to go to waste when the corral needs repair.

No council-houses or other public, ceremonial, or dominant structures are found in any of the villages, though there are sacred places near most of them, and sites of the events in their Book of Genesis in several places. The devotional instinct finds relief chiefly in pilgrimages to the sea and in a curious sea-cult half concealed under common-place phrases.

At the center of the typical grass house there is a fireplace, consisting of nothing save the ash-covered spot reserved for the purpose, with the three loose cobble-stones required to support the olla when placed on the fire; sometimes consisting of an annulus or circular wall of adobe mixed with ashes, 15 to 18 inches in diameter, and 6 to 10 inches high, open to the ground on one side. The metate—a slab of granular or vesicular stone commonly a little over a foot in width and perhaps two feet in length, bolstered up on cobble-stones or blocks of wood—and a grinding stone or two belong hard by the fireplace. About the walls of the house lie two or three beds consisting of agave-stipe mats, while between the beds are piled grain-filled or empty ollas, squashes, melons, and corn, with saddles, riatas, stray articles of apparel, and other domestic impedimenta, in such profusion as the season and family thrift permit. The cooking circle is like the enclosed house in respect to fireplace and culinary appurtenances, but the stores and other valuable property are kept in the house proper. When there is no cooking circle—and many, indeed most, houses in the large villages are without this feature—there is frequently a fireplace in the vah′-toh, and there the metate, the essential family nucleus, is set up. Hour by hour the housewife, kneeling at the upper end of this primitive nether millstone, drives the grinder back and forth with a persistent energy that the athlete might envy, producing meal or pinole at a hardly perceptible rate; the children cluster about within easy reach of admonition; unless otherwise occupied, the men recline near by, rolling and smoking cigarettes, and, between smokes, taking pinches of the toothsome pinole; the dogs lie near as occasional cuffs and objurgations allow, in enjoyment of the aroma and in the hope of a furtive taste now and then; and at irregular intervals, determined by the state of appetite or the quantity of meal, the daughter or daughter-in-law mixes a batch of dough, places a plate of tin or thin iron over the fireplace or olla stone, and with marvelous deftness molds, stretches, and bakes the

POSO VERDE: PAPAGO VILLAGE

dough into nutritious and wholesome tortillas—the staff of life of Mexican and Indian alike. Within the shelter stands a three-branched post of mesquite supporting a large olla of porous ware filled with water, deliciously cooled by the slow exudation and evaporation in the dry air. This family olla is kept filled by the women, generally the younger of the household, though sometimes by crones, who, at eventide or at other times if need be, go forth in trains to the spring or water hole, returning with huge jars balanced, not on the shoulder, as in Babylon of old and in eastern Mexico today, but on the head. In this way the water required for all domestic purposes, save the laundry, is transported to the houses. When garments require washing—and the Papago are a cleanly folk—they are taken to the waterside and rubbed with the hands and beaten with cobbles on a large stone, while the saponaceous lather of the soap agave is applied, and water is sprinkled or poured over them.

The temporale is much like the permanent domicile of the more primitive type, save that it is usually smaller in size, lighter in framework, and even more ephemeral in character; while around it or near by the narrow fields whose few acres are all but lost in the vast extent of the intermontane valleys. Sometimes the fields are open, when the watchers rely on their own vigilance for the protection of the growing crops; usually they are enclosed by flimsy fences of mesquite and cactus. There may be but a single field in a temporale, and that may be cropped but a single season, though usually there are half a dozen or more fields in a locality, and these may be used during several successive seasons; but the Papago husbandman is constrained by an intuitive geometry, and usually saves fencing by making his field elliptical or circular rather than rectangular; and in most villages line fences are unknown. The location of the temporale, like that of all other things human in the desert, is determined primarily by the occurrence of water, secondarily by character of soil. A favorite situation is the seaward terminus of the arroya on whose middle reach the rancheria is located; thither flows the unevaporated residue of the winter storm floods, soaking the soil and fertilizing it with a veneer of fine mud, just as the valley of the Nile is fertilized by the Nilotic flood; and even if the storm freshet fails on the surface its waters permeate the subsurface sands within reach of the roots. Sometimes the temporale is located where a single great deluge, the product of a single storm, soaks the soil and vivifies the plants into a short-lived oasis;

sometimes the hut of the temporale is pitched and its field laid out alongside a temporary water hole, cut out by a single storm or during one wet season, far out on the plain. When the temporale is by a valley water hole, the husbandmen share the precious liquid with their herds of stock, that daily trample through it and fight to the death on its brink, and with the myriads of insects, great and small, that swarm about and within the water to revel in its liquidity or consume its filth, while the pool seethes in the sun and festers and putrifies into foul-odored mud. When the subsurface sands are water-bearing, sometimes wells are sunk; and again the temporales are without water save as it is carried perhaps for a dozen or score of miles in ollas swung over the backs of burros or carried on the heads of withered crones.

Usually the temporale of each family is occupied only by a young or middle-aged couple, sometimes by a sire and two or three boys, again by most of the family. While the women grind meal on the metate or scour the valley for fruits and material for baskets, the men plow or fence their field and plant their seeds and harvest their crops in season, the produce, except such as is consumed on the ground, being transported to the rancherias. But the season is a variable one; the season for planting is the time of storm or freshet, come when it may; and the season of harvest is the time of maturing or ripening of the produce, be it May or September, for advantage is taken of the summer freshet as well as of the winter one. If the temporale is used but a season or two, the domicile may be little more than a bower of mesquite bushes; and when the temporale is long and numerously occupied and the fields are grown to 5 or 10 acres in extent, such bowers are occasionally erected here and there in the fields or about the fences, in order that the watchers may find shelter, or the harvesters may repose in their shadow. In some cases the rancherias and the temporales approach and even merge; and some groups have no temporales or other fields except the meager patches scattered about the rancheria, while other groups have fresh temporales and no permanent rancherias, their winters and autumns being spent in Mexico or in neighboring rancherias among which the individuals scatter when not engaged in agriculture.

Somewhere in the vicinity of nearly every town and village in northern Sonora, and of many of those in the central and southern part of the state, there is a Papago pueblo which is commonly occupied during the winter and abandoned or left in charge of one

POTTERY-MAKERS AT WORK IN TYPICAL BOWER

or a few families in summer. Then as the migratory birds fly southward, the Papago clans of Arizona drift after them in irregular fashion; the pueblos are gradually filled, chiefly by families in which there are many women. Other families migrate in similar fashion, save that, instead of locating in the pueblos, they scatter through the mountains to hunt deer and other game. The hunter is usually accompanied by his wife, and perhaps by children, and sometimes several hunters coöperate; their method is to build temporary lodges, usually of the boughs of trees, related in form to the typical domiciles of grass, though frequently the trunks and low-hanging branches of mesquite or oak trees take the place of part of the ordinary framework, and the hunters normally wander but a little way from their lodges, preferring to await the coming of game rather than to seek it afar. Much of the small game is consumed by the hunter and his family, but deer and some smaller animals are taken down the mountain sides to the Mexican towns and sold or bartered. Meantime the Papago women in the pueblos dig clay and make pottery, which they also sell or barter to the Mexicans. Thus many Mexican villages are supplied with venison and ollas at small cost, while the temporarily immigrant Papago obtain money and goods, albeit in small quantities, and develop a simple commerce. At the same time they acquire something of the Mexican culture, habits of life, fashion of dress, language, and religion. The pueblo house is usually of adobe, and in no way different from that of the neighboring Mexican family. The metate is usually obtained by barter, and is frequently a shop-made article like that of the more pretentious Mexicans; the skirts and rebosas of the women are in no way distinguishable from those of the señoras and señoritas, and the women and some of the men attend the church fiestas and avail themselves of the opportunities for confession and baptism and even formal marriage, while the men outherod their Mexican mates in mescal drinking. It is largely through this winter association of the Papago with the Mexicans during many generations that the desert tribe has been acculturized and in part Mexicanized; and it is partly by reason of this prior association and alien acculturation that it is so difficult for the Papago to affiliate with the American pioneers and institutions.

So the life of the Papago is a round of migrations and wanderings, largely in search of the means of subsistence, of which the first and the second and the third are water, *water*, WATER—water to alleviate his own thirst in the sun-parched deserts, water to sustain his horses and burros and kine, water to vivify the plants of which man and his creatures eat. While the late winter rains are bringing verdure to the mountains and sending slender streamlets into the arid valleys, the tribesmen gradually return to their rancherias, remove the barriers of stones and sticks from their doorways, and await the fit moistening of the soil at the temporales. At the proper day they go forth to plow and plant, and watch the rapid maturing of the crops. With the harvest time the temporale is normally abandoned and the produce transported to the rancheria. At about the same time the fruits of the sahuaro and other cacti ripen, and soon afterward the beans of the mesquite mature, and these uncultivated crops are in like manner gathered and stored. Then follows a season of idleness and feasting, interrupted by primitive ceremonial and attendance on Mexican fiestas, perhaps scores or hundreds of miles away; and as autumn advances, the homes are again deserted by a part of their inhabitants, who wander to other rancherias to participate in the votive festivities or set out on the annual migration southward.

GOMEZ AND THE NEW YORK GULF

Some interesting conclusions in regard to early American discovery seem to result from the study of an old Spanish map published by Mr Harrisse in his "Discovery of North America," p. 241. Writers on early cartography have identified the Rio de San Antonio of early maps with the Hudson river and found evidence thereby that the Spanish were familiar with that stream long before Hudson himself came in 1609. The evidence of Mr Harrisse's map tends to disprove this claim. The map was made to accompany the "Islario Generall," written by Alonzo de Santa Cruz in 1560, and Mr Harrisse gives the opinion that it is based upon the lost Chaves map of 1536.

Whatever knowledge of the North Atlantic coast from Chesapeake bay to the Penobscot the Spaniards may have had in 1536 depended, so far as we know, on the explorations of Gomez in 1525. His exploration had been an official one, resulting, presumably, in fairly accurate data, which would naturally have been used for the official Chaves map seen and described by Oviedo in 1527, but now lost. Efforts to trace Oviedo's description in the unofficial Ribero-type maps of 1527–'29 have been unsatisfactory. So also have been the efforts to find correspondence between the Ribero-type contours and the real American coast-line. The significance of the Santa Cruz map, therefore, lies in this—that it alone among early maps corresponds to Oviedo's description of the Chaves map and should indicate the exact extent of Gomez' discoveries by an actual resemblance to the American coast.

In a single feature does the Santa Cruz map seriously depart from Oviedo's data. Its latitudes are all marked one degree farther north than Oviedo gives them. But this question of latitude brings out another curious point. The Santa Cruz map purports to represent the American coast from 38° to 45°, yet it obviously does not represent the coast-line of that space, while it does resemble quite well the coast of New England from Nantucket to the Penobscot. This discrepancy of latitude may be set aside for the moment. The real test of the map is its resemblance to the New England coast. Beginning at the north, the islands of the Maine coast are shown and the legend "montañas" is placed just where Kohl says that mariners can see the distant peaks of the White mountains. Turning then southwest and south, the coast makes a deep indentation suggestive of Massachusetts bay, turns sharply to a north-pointing cape like Cape Cod, and then southward again as if to the point of Nantucket, where it makes a sharp turn to the westward before merging in the land discovered by Aylon. In its relative proportions the Santa Cruz map corresponds with the New England coast, except in an unusual lateral extension of the Maine coast. The map is one such as would be expected from a sixteenth century official explorer—not true in all details, but fairly accurate in general features.

Under this interpretation of the map the Rio de las Gamas of Gomez becomes the Penobscot, Cabo de Santiago becomes Cape Cod, Cabo de las Arenas becomes the Point of Nantucket, and the Rio de San Antonio becomes, not the Hudson, but the Merrimac or Salmon Falls. It is interesting to note how the inaccuracy of the Ribero-type maps has transferred the east-pointing Cabo de las Arenas of Gomez to the place of the north-pointing Cabo de Santiago. That the island of Nantucket is made one with the mainland is natural, since Gomez, aware of the shoals and shallows of that region, would hardly have tempted fate by running close to shore, but, passing to the southward, might have remained unaware of the passage between it and the main.

If, then, the Santa Cruz map from Cabo de las Arenas northward represents New England, where shall we look for the Gulf of New York? Ayllon is not supposed to have explored north of the latitudes of Virginia. If Gomez explored the Gulf the map constructed from his data should show it, but from Cabo de St Juhan, Ayllon's northernmost discovery, the coast extends north-north-east 30 leagues to Cabo de las Arenas without a hint of the peculiar coast features so carefully noticed north of Arenas. The inference seems unavoidable that Gomez merely rounded Nantucket and then turned homeward; otherwise he would hardly have failed to note some of the peculiar features of the coast west of Nantucket.

While the New York gulf thus seems unknown to the Spanish cartographers who depended on Gomez' data, the Spanish maps, nevertheless, confess no gap whatever in Spanish knowledge of the coast. It is a curious and perhaps unique feature in early cartography that seems to find its best explanation in Spanish desire to leave no flaw in a claim of possession of the entire coast by right of discovery. Certainly Gomez would hardly have erred so much in the taking of latitudes, nor does there seem reason for deception on his part of the home government. The curious point is the conscientious way in which the introduction of false coast-line was avoided by the falsification of latitudes.

L. D. Scisco.

University of Michigan.

WELLMAN POLAR EXPEDITION

Owing doubtless, in large measure, to the ambition of Arctic explorers to traverse the unknown regions about the North Pole before the close of the present century, there is an activity in polar exploration that is altogether unprecedented. With one of the expeditions from the United States—that in charge of Mr Walter Wellman—the National Geographic Society was recently asked to coöperate (1) by a formal approval of the aims and purposes of the expedition, (2) by the appointment of a committee to advise with the leader as to the scientific work to be undertaken, and (3) by the contribution of a sum of money in aid of the expedition, with the condition that, in the event of the expedition being successful, the amount so contributed should be refunded. After full consideration the Board of Managers decided to coöperate, in some measure, with this expedition, and a committee, consisting of President Alexander Graham Bell, Gen. A. W. Greely, U. S. A., Prof. G. K. Gilbert, Dr C. Hart Merriam, Commodore George W. Melville, U. S. N., and Prof. Simon Newcomb, was appointed to advise Mr Wellman concerning the scientific work to be undertaken. This committee drafted a statement indorsing the aims and purposes of the expedition, and suggested the addition to the exploring party of three scientific observers, a suggestion that was promptly acted upon.

The Board has also undertaken to make a financial contribution to the expedition, with the understanding that in the event of the amount so contributed being refunded it shall be applied to a permanent fund for research. Subscriptions to the amount of one thousand dollars have been received from members of the Board of Managers and of the Society in general, and have been applied to the purposes of the expedition. Further contributions, from one dollar upward, may be sent to the Treasurer, Mr Henry Gannett, U. S. Geological Survey.

Mr Wellman and his party sailed from Tromsö on Sunday, June 26, in the S. S. *Frithyof.* Four days later, when in the White Sea, Mr Wellman wrote President Bell a letter, of which the following is an abstract:

"We expect to be at Archangel, where eighty dogs are waiting for us, on Saturday. The *Frithyof* is a good steamer, very strong and well equipped. In only one particular is she a disappointment—she does not steam as many knots an hour as had been represented to us. Still she is fast enough for the work. The reports from the ice are that it is a very unfavorable year, but my experience is that such reports do not count for much. A day or two of different wind may change conditions radically. In less than ten days we expect to be at the ice to see for ourselves.

"The only financial affair now worrying me is that we have not the funds for a steamer to come after us next year. In all probability it will not be necessary to hire a steamer specially, as there will be other ships going to Franz Josef Land. This matter is left in the hands of Consul Andrew Aagaard, of Tromsö, Norway, a most estimable gentleman. I have asked him to communicate with my friends in America in good season; and while I have not the slightest idea it will be necessary to hire a ship, if it should be I hope my friends will stand by us. Even if a ship is needed, it will not be very costly, as it may start later in the year than we are going.

"Our party consists of nine—four Americans and five Norwegians. Prof. Gore does not go to Franz Josef Land with us. Instead he goes to Spitzbergen. He was afraid he might be too long delayed in getting back from the former region. I am pleased with all the men, and we shall do our best to give you good news from us next year."

The latest advices are that on July 11, when in latitude 77° N. and 170 miles south of Franz Josef Land, the *Frithyof* found heavy pack-ice barring the way. She afterward proceeded westward to Prince Charles Land, to the east of Spitzbergen.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1897–'98

Special Meeting, February 28, 1898.—President A. Graham Bell in the chair. Mr Bailey Willis gave an illustrated lecture on the Appalachian Region, describing the influence of the topography upon the migrations into and through the great valley of Virginia.

Special Meeting, March 4, 1898.—President A. Graham Bell in the chair. Mrs J. Howard Gore gave an illustrated lecture on Picturesque Sweden.

Special Meeting, March 7, 1898.—President A. Graham Bell in the chair. Rev. Randolph H. McKim, D. D., gave an illustrated lecture on Tidewater Virginia in the Olden Time.

Regular Meeting, March 11, 1898.—President A. Graham Bell in the chair. Mr F. V. Coville gave an illustrated lecture on The Cascade Mountains of Oregon.

Special Meeting, March 14, 1898.—President A. Graham Bell in the chair. Mr Edward Eggleston delivered an address on The Development of the Early Colonies and the Influence of Geographic Environment upon the Character of the Population and their Industries.

Annual Reception, March 16, 1898.—The Annual Reception of the Society was held in the new building of the Corcoran Gallery of Art, from 8 to 10 o'clock p. m. President A. Graham Bell, with the ladies of the Reception Committee, received the members and guests of the Society, to the number of 700.

Special Meeting, March 18, 1898.—President A. Graham Bell in the chair. Capt. Z. L. Tanner, U. S. N., gave an illustrated lecture on Bering Sea and the Explorations made during the Voyage of the Steamer *Albatross.*

Special Meeting, March 21, 1898.—President A. Graham Bell in the chair. Hon. John R. Procter, President of the Civil Service Commission, gave an illustrated lecture on The Blue Grass Country of Kentucky.

Regular Meeting, March 25, 1898.—President A. Graham Bell in the chair. Col. F. F. Hilder delivered an illustrated lecture on The Afghan Frontier and the Punjab, after which Mr Hira Singh Puri made an address on the Sikh people.

Special Meeting, March 28, 1898.—President A. Graham Bell in the chair. Judge R. S. Taylor, of Fort Wayne, Indiana, gave an illustrated lecture on The Lower Mississippi River.

Special Meeting, April 1, 1898.—President A. Graham Bell in the chair. Professor Angelo Heilprin, President of the Philadelphia Geographical Club, gave an illustrated lecture, entitled "Across the Atlas Mountains and into the Sahara."

Special Reception, April 2, 1898.—A Special Reception in honor of Capt. Charles D. Sigsbee, U. S. N., was held at the Arlington Hotel from 9 to 11 p. m. About 1,500 members and guests of the Society were present, including the President of the United States, the Vice-President, members of the Cabinet, Diplomatic Corps, and officers of the Army and Navy.

Special Meeting, April 4, 1898.—President A. Graham Bell in the chair. Mr W J McGee gave an illustrated lecture on the Prairie States.

Regular Meeting, April 8, 1898.—President A. Graham Bell in the chair. Mr F. H. Newell gave an illustrated lecture on Mount Rainier.

Special Meeting, April 11, 1898.—President A. Graham Bell in the chair. Mr G. K. Gilbert gave an illustrated lecture on The Great Interior Basin of the United States.

Special Meeting, April 15, 1898.—President A. Graham Bell in the chair. Miss Annie S. Peck gave an illustrated lecture, entitled "A Visit to Mexico, including Ascents of Popocatepetl and Orizaba."

Special Meeting, April 18, 1898.—Mr W J McGee in the chair. Professor Israel C. Russell, of the University of Michigan, gave an illustrated lecture on The Great Lakes and Lake Region.

Regular Meeting, April 22, 1898.—Mr W J McGee in the chair. Proposed amendments to the by-laws were presented in writing and read by the Secretary. Mr Gifford Pinchot gave an illustrated lecture on The Olympic Forest Reserve.

Special Meeting, April 25, 1898.—Mr W J McGee in the chair. Professor W. H. Brewer, of the Sheffield Scientific School, Yale University, gave an illustrated lecture on The Forest States, Park Reservations, and Forestry Laws.

Elections.—New members have been elected as follows:

February 4, 1898.—Frank Boteler, C. W. H. Ellis, Mrs J. Kerr, Mrs N. R. Mullin, Miss Sarah Fuller, Miss Caroline A. Yale.

February 25.—Col. Wm. S. Brackett, Mrs T. L. Cornell, Horace S. Cummings, O. P. Maxson, M. D., Frank Julian Price, W. H. Singleton, G. F. C. Smillie.

March 4.—Rafael Garcia y S. Tacio, James M. Hubbard, Paul M. Hubbard, Chief Eng'r Harrie Webster, U. S. N.

March 25.—Professor O. P. Morton.

April 1.—A. A. Anderson.

April 8.—Jas. E. Fitch, Laurence Sands.

April 15.—Professor Pomeroy Ladue, Mrs Ellen Laird, Lieut. J. A. Shipton, U. S. N., Grant Squires.

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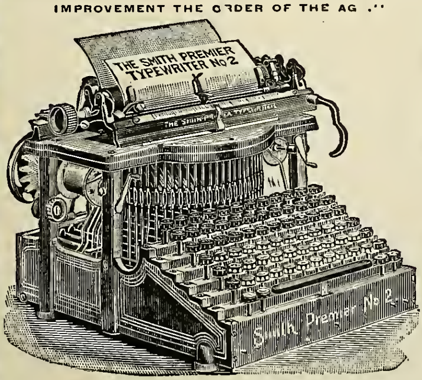

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Donations for the founding of Prize Medals and Scholarships are respectfully solicited.

CREST OF BITTER ROOT MOUNTAINS

THE

National Geographic Magazine

Vol. IX SEPTEMBER, 1898 No. 9

THE GROWTH OF THE UNITED STATES*

By W J McGee,

Vice-President of the National Geographic Society

With the annexation of Hawaii an end came to America's longest period of inactivity in territorial expansion. During this period of thirty-one years—nearly an average generation—the great fact of almost unparalleled expansion in earlier decades has been half forgotten.

Beginning with an area of 827,844 square miles and a marine coast line of full 1,500 miles, the nation concentrated energy on internal affairs for twenty-three years; then, in 1803, the Louisiana purchase was consummated and Oregon territory was acquired, adding 1,171,931 square miles to the national domain and 1,000 linear miles to the coast line; so that at a single bound the territory was more than doubled and the coast line nearly doubled, while an outlet was gained on the Pacific. The material expansion was quickly reflected in a widening of intellectual horizon among the people, who were thereby confronted by new problems; for, under republican organization, national problems are problems of the people rather than of leaders only. The immediate result was renewed intellectual and industrial activity and the implanting of a trait which has since become national, *i. e.*, enterprise; the more remote effects included development of interior commerce, the application of steam to inland navigation, the founding of a foreign carrying trade, and the real opening of that career of invention and manufacture which has given character to the American people.

*An address delivered at the Joint Session of the National Geographic Society and the American Association for the Advancement of Science, Boston, August 25, 1898.

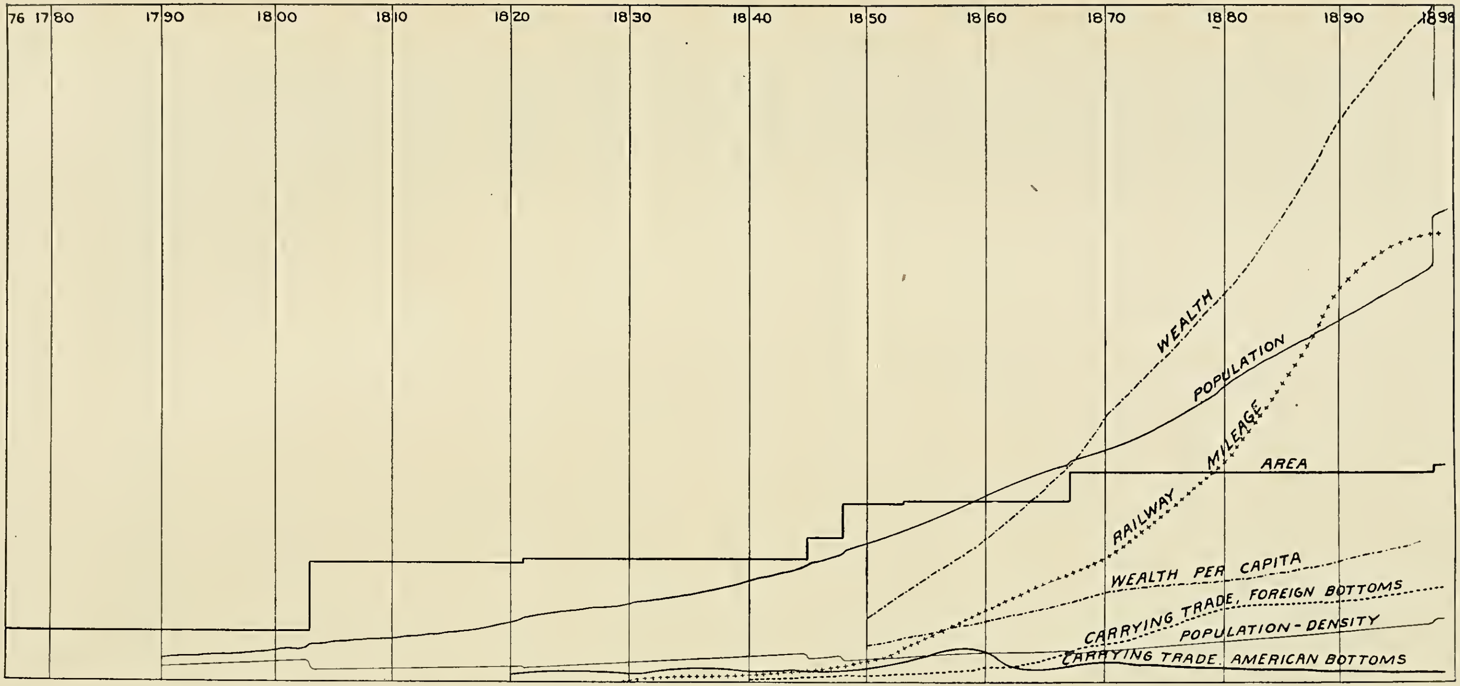
After eighteen years of internal development, with a single international episode, Florida was acquired (in 1821), adding 59,268 square miles of territory and nearly 1,500 miles of coast line; and such further impetus was given to enterprise that the more southerly Americans soon found their territory too narrow and pushed beyond the border. A consequence of this overflow was the separation of Texas from Mexico, followed in 1845 by the annexation of this empire of 376,163 square miles, with 500 miles of coast line; another consequence was the treaty of Guadalupe Hidalgo in 1848, bringing in California and adjacent territory amounting to 545,753 square miles and adding another 1,000 miles to the coast; and a less direct consequence was the Gadsden purchase in 1853 of 44,641 square miles, rounding out the home territory to its present area of 3,025,600 square miles, with some 5,500 miles of open coast.

This career of territorial expansion in the half century from Louisiana purchase to Gadsden purchase forms the most striking chapter in national development afforded by the history of the world. In the first place, the actual expansion in territory and coast line was almost unparalleled; the area was nearly quadrupled and the coast line more than tripled. In the second place, the greater part of the acquisition was amicable, coming in part as a voluntary offering, while in no case did armed force play more than an incidental role; there was no conquest in the sense in which the term is used in other countries. In the third place, the expansion was beyond precedent in the completeness and promptness with which the new territory was utilized and the new conditions assimilated; with each areal addition national enterprise merely found a curb removed and sprang spontaneously to meet the new tasks and new problems presented by the new territory; and the energies of the people, withheld from martial conquest by moral sense, turned with unprecedented vigor to the conquest of nature, to the conversion of natural forces for human weal. Finally, the effect of the expansion on national character—foreshadowed by the advance of 1803—was beyond all parallel; for enterprise interacted with enterprise, and brought forth an individual and collective activity among the mass of citizens such as the world had not seen before.

After 1853 the nation rested from expansion for fourteen years, of which four were devoted to the solution of grave internal problems; then (in 1867) a bargain-counter acquisition, giving little promise of early profit, was made, whereby a territory estimated at 531,000 square miles, with a relatively extensive coast line, was added to the national possessions. The influence of this purchase on national progress and on national character was limited, save as a hard-worked occasion for criticism of the policy of territorial development. The reaction from the internal tension of the early '60s and from the nearly profitless expansion of '67 naturally made itself felt in public policy; it is expressed in the thirty-one years of respite from external growth. Now, after long begging for admission, as Texas begged fifty years before, Hawaii is admitted, with 6,640 square miles of area and a wealth of coast line; the garden island of Porto Rico, 3,670 square miles in area, is gladly entering the domain of America as an incident of a war for humanity's sake; and the hundreds of Philippine islands, comprising 114,326 square miles of aggregate territory, are looking to America for protection and ultimate absorption. Considered merely as territory, these additions, aggregating 124,636 square miles, would form but a ripple on the stream of national progress, even if consummated at once; the area is little more than twice that of the Gadsden purchase, less than twice that of the Florida purchase, only a third that of the Texan annexation, less than a quarter so large as either the Californian acquisition or the Alaskan purchase, less than an eighth of the nation-shaping acquisitions of 1803, less than 4 per cent of the previous area.

Apart from the events of 1898, one of the striking features of American history has been almost unparalleled territorial expansion with quite unparalleled territorial assimilation; and, viewed in the light of this history, the comparatively slight expansion of 1898 but marks the resumption of a career temporarily checked by a combination of circumstances.

The territorial growth of the United States has been shaped constantly by natural conditions rather than national policy; for, since the days of the first President, it has been the idea of the American citizen to avoid "entangling alliances" and foreign complications. Partly for this reason, the rapid enlargement of the domain of the United States met opposition at every step from conservative statesmen. The Louisiana purchase was almost a surprise even to those by whom it was consummated, while a large part of Oregon territory was literally thrown away in 1846 by dint of political maneuvering, despite political platforms and the wishes of the inhabitants; and the self-pro-



Elements of growth.	1790.	1800.	1810.	1820.	1830.	1840.	1850.	1860.	1870.	1880.	1890.	1898*a*.	1898*b*.
Area in square miles...	827,844	827,844	1,999,775	1,999,775	2,059,043	2,059,043	2,980,959	3,025,600	3,556,600	3,556,600	3,556,600	3,556,600	3,681,236
Total population	3,929,214	5,308,483	7,239,881	9,633,822	12,866,020	17,069,453	23,191,876	31,443,321	38,558,371	50,155,783	62,622,250	71,000,000	79,000,000
Population-density......	4.75	6.41	3.62	4.82	6.25	8.29	7.78	10.39	10.84	14.10	17.61	20.00	21.46
Wealth	....	....	....	....	....	....	$7,136,000,000	$16,160,000,000	$30,069,000,000	$43,642,000,000	$65,037,091,197	....	....
Wealth per capita	....	....	....	....	....	....	$308	$514	$780	$870	$1,036	....	....
Railway mileage	....	....	....	....	23	2,818	9,021	30,626	52,922	93,296	166,691	190,000	....
Carrying trade, foreign bottoms.........			....	$14,358,235	$14,447,970	$40,802,856	$90,764,954	$255,040,793	$638,927,488	$1,224,265,434	$1,371,116,744	$1,600,000,000	....
Carrying trade, American bottoms.........			....	$113,201,462	$129,918,458	$198,424,609	$239,272,084	$507,247,757	$352,969,401	$258,346,577	$202,451,086	$190,000,000	....

posed annexation of Texas was successfully resisted for years. The acquisition of California was regarded as a special menace, for the reason that its fertile valleys and commodious harbors were distant three months' journey by land and six months' voyage by water, while the territory was inhabited partly by treacherous aliens but mainly by savage tribes; yet cautious statesmen, emboldened by the success of the Louisiana purchase, ventured on the step despite the fact that America was still an experiment in nation-making, with no standing among the powers, with a population of but 20,000,000, and with narrow commercial and industrial resources; and the step proved the most important in the career of the nation. In this as in other cases the territory was ripe for acquisition by an enlightened nation; the inhabitants were ill-governed and desirous of change; there was a need, more or less fully felt, for the extension of enlightenment in the dark places. In no case, save possibly that of Alaska, has expansion grown out of mercenary motives; yet in no case, save possibly Alaska again, has the acquisition of territory failed to benefit the inhabitants of the territory acquired, the nation which made the acquisition, and the world at large. America's progress in territorial development has never been the outcome of ulterior policy; it has always been an expression of manifest destiny.

The various elements of national growth are intimately related; some of them are shown graphically in the accompanying table and diagram.* The fundamental element is area, which is indicated in the line platted by ordinates and abscissas in such manner as to show quantitatively the territorial accessions and the intervening periods of inactivity, the line being projected on the assumption that the entire area of the Philippines as well as Hawaii and Porto Rico will be absorbed during the year. The next element is population, which is shown graphically from the Census figures of 1790 and later decades; it, too, is projected on the assumption that the 109,000 people of Hawaii, and also the 807,000 people of Porto Rico and the 7,000,000 people of the Philippines, will be added to our population during the year. A function of these elements combined is population-density (*i. e.*, the average population per square mile), which is platted

* The values are mainly taken from Gannett's "Statistical Atlas," recently published by the Census Office, partly from the "Statistical Abstract" for 1897, recently published by the Bureau of Statistics of the Treasury Department, partly from the "Statesman's Year Book" for 1898.

from the Census figures with the same assumptions concerning expansion during 1898. The three lines of the diagram express several salient facts in American history: The territorial acquisitions have been enormous, much more than quadrupling the original area; no accession (up to 1898) has materially affected the population curve, yet the population has steadily increased by a normal growth of beautiful symmetry; the density of population has also increased in a symmetric normal, interrupted by each of the greater accessions in area. The only noteworthy break in the population curve is that representing the teeming Filipinos, though even this does not materially affect the density curve.

The steady increase in density of population in the United States is a striking and promising feature of national development; it is an equally striking and still more hopeful fact that, so far as the Census values permit determination, each accession has stimulated the increase of population and has soon been followed by an increased population-density.

While each accession of area has tended to hasten the increase in population, other effects of even greater significance have followed, though figures for the expression of these effects are lacking for the earlier decades in the history of the United States. The immediate effect of the acquisition of Louisiana and Oregon was increase in navigation, both oceanic and interior, with a decided advance in domestic commerce; budding enterprise was directed to invention and steamboats were placed on the rivers, while improvements in agriculture were diligently sought. These advances were stimulated anew when Florida was acquired, and American carrying trade came to be a factor in the progress of the world. During the period of concentration following these acquisitions, canals were projected as auxiliaries to the natural waterways, while railroading was gradually introduced as a sort of auxiliary to river and canal. Then came the epoch-marking accessions of the mid-century, with the necessity for more expeditious transportation facilities than navigable waterways and ocean-going vessels could possibly afford; and native genius responded by improving locomotives and railway-building beyond the most sanguine dreams of progressive statesmen, and made America a railway nation; and the curve representing railway development is one of the striking features in the graphic history of the United States.* The carrying trade

*The decline in railway building after 1890, shown in the diagram, should not be misinterpreted: it merely marks the gradual substitution of electric locomotion, bicycles, etc., for steam locomotion.

in American bottoms also was stimulated, and its increase for a time almost kept pace with the growth of railroading; but the natural conditions which rendered the railway a necessity did not force genius and capital toward ship-building and maritime commerce, and, when internal conditions checked these activities in the early '60s, they were not resumed but permitted to fall into foreign hands. Accordingly there is a single element of American growth which is of negative character, a single direction in which the less brilliant genius of non-American promoters has been allowed to sap American strength, as shown by the curves representing the American carrying trade in American and foreign bottoms from 1820 to 1897.

The growth of the nation is indicated in an external or superficial way by the increase in area, population, and commercial agencies, and that growth has been unprecedented in uniformity and rapidity, as indicated by the lines in the diagram; yet the essential elements of American growth cannot be expressed in square miles of area, in linear miles of railway and waterway, in transportation tonnage, or in other definite units; the real growth lies in the development of enterprise, intellectual and moral and physical vigor, or, in brief, intelligent individuality. The strength of America is indeed faintly suggested by broad territorial expanse, teeming millions of people, and half the railways of the world; the real strength lies in the immeasurable capabilities of individuals, who have already made noble conquest of nature's forces; and there are no units for measuring the spontaneous powers of freemen united by common impulse in the common task of elevating mankind and bettering the world. While there is no direct way of measuring the individuality—much less the unity—of the American people, there are certain values indicating this quality even more clearly than area or population; one of these is wealth, individual and collective.* Unfortunately, early figures for the expression of wealth

* Mulhall's latest estimates of national wealth in the several countries are as follows:

United States	$81,750,000,000
Great Britain	59,030,000,000
France	47,950,000,000
Germany	40,260,000,000
Russia	32,125,000,000
Austria	22,560,000,000
Italy	15,800,000,000
Spain	11,300,000,000

These computations are based upon values as shown by real-estate records, buildings, merchandise, and railways, as well as the circulating medium in each nation.—*Financial Review, vol. vii, No. 9, 1898, p. 5.*

are lacking, but since 1850 wealth has increased more rapidly than any other measurable factor in national progress, as illustrated by the remaining curves in the diagram. In the last half-century the population of the United States has more than tripled, yet the wealth has more than thrice tripled, and the per capita wealth of the American citizen has risen far above the corresponding value for the other countries. This element of growth, too, is correlated with the increase in area, especially the epochal accession of half a century ago; for, although the statistics are wanting for the first half of the century, mere inspection of the later curves shows that the rate of increase must have been at least doubled or tripled almost immediately after the acquisition of Texas and California.

On reviewing the factors of national development, it becomes clear that territorial expansion, great as it has been, is not the principal one; for population has increased much more rapidly than area, while wealth (a partial expression of individual enterprise) has increased three times more rapidly than population—it becomes clear that American progress resides in the conquest of nature rather than in conquest of nations. Yet it is equally clear that every territorial accession gave new opportunity for growing enterprise, and was soon followed by new industries, new associations, new lines of thought, all contributing to increased individual wealth and augmented national strength. It is no less clear that the character of the territorial accession has shaped the character of the consequent progress: The Louisiana purchase created a demand for navigation of the Mississippi and its tributaries; the demand was met by the native genius which is always with us, and the finest steam-packet system in the world was developed to meet it. The conquest of California created a demand for transportation facilities; it was met by the development of the American railway system. The pushing of population into the arid districts created a demand for irrigation; it has been met by the development of irrigation engineering, irrigation laws, and other features of an irrigation system which marks an era in national history. On the whole it seems clear that the several factors of development are interrelated in a manner so natural and necessary as to produce that normal growth so conspicuous in the history of the United States; that the rapid territorial expansion of early decades was not too rapid for assimilation in the national structure, yet was rapid enough to meet national needs.

A glance from the history of the nation to the century's history of the world indicates the force and beneficence of the American example; the relations are too many for even summary statement; it may only be noted that the absorption of American ideas and the imitation of American methods by other peoples and nations proves that the progress of this nation is meeting a need of the world.

Cautious students presage the future from the history of the past; and the American of today must look to the lessons of 1803, 1821, 1845, and 1848 for indications of results to follow from expansion in 1898. The trend of these lessons is clear. After a generation of concentration, American energy is more tense than ever before; American enterprise and capital are overflowing in every direction—in Canadian mines, in Mexican railways, in South American plantations, and in scores of other ways; American progress has outstripped that of the rest of the world in every line save that of oceanic shipping; American genius will not be pent and is bound to diffuse itself by individual effort if not by national action. Such is the present condition of the United States, as demonstrated by any fair arrangement of figures or growth-curves—the young giant is rending his chains. The prospect is definite: Just as the Louisiana purchase in 1803 made America a steamboat nation, and just as the acquisition of California in 1848 made America a railway and telegraph nation, so the acquisition of Hawaii and Porto Rico and above all of the Philippines in 1898 must make America the naval nation of the earth; for the problem born of the accession would be that problem of navigation which needs American genius for its final solution, while America needs the incentive to strengthen that element in which alone she is weak. The Philippines are remote—only a fraction so remote in time as was California a half-century ago, yet remote enough to compel the invention of devices for shortening time and annihilating space; and the problem of bringing Manila within a fortnight of San Francisco is one worthy the genius of the inventors of the innumerable devices involved in steamboating, railroading, and telegraphing. Given swift vessels, the other problems presented by the Garden of the East are of little consequence save as forecasting directions for the profitable expenditure of long-pent energy; the 7,000,000 pastoral natives and tax-gathering Spaniards are a far less menace to our quadrupled population and multiplied power than were the savage tribes and resident Mexicans of California; while it is the special function of the republican form of government to render the inhabitants of acquired territory not only self-supporting but self-governing. The progress of mankind may be measured by advance in speed of locomotion, beginning with fleetness of foot, coming up through fleetness of ridden and driven animals, and ending with swiftness of locomotive engines and sea-going craft; and, with vessels of sufficient swiftness and projectiles of sufficient velocity, there need be little fear of foreign complications, little occasion for maintaining great navies; for, if commercial competition be but aroused, individual effort may be trusted to develop the devices required for national protection. The fact that a quickly converted merchantman commanded by a Sigsbee, or that a hastily armed yacht commanded by a Wainwright can wreck torpedo-boat destroyers and naval theory together is full of promise, since it is the normal function of a free nation to produce Sigsbees and Wainwrights, to develop swiftness and certainty of action, and to meet emergencies as they arise. Nor need there be fear of occasion for large standing armies, since citizens require no such restraint and constraint as unwilling subjects, and are ever ready to rise in patriotic and thinking might to support the nation of which they are voluntary parts.

The history of the growth of the United States is one of unequaled progress in territorial acquisition, in normal development of population, in augmentation of wealth, and, above all, in development of a national character in which individual enterprise and capacity are the most conspicuous traits. There is but a single line in which progress has been sluggish, and that is the line which must inevitably be strengthened through the stirring episodes of 1898; and, in case the accession extend to far Luzon and Mindanao, America must soon lead the world in ocean navigation as in other directions, and begin a conquest of the sea no less complete and noble than the conquest of the land already wrought. More than all else, the territorial acquisitions must contribute toward the extension of enlightenment, toward the elevation of humanity, and toward the ultimate peace and welfare of the world.

He errs who forgets the history of his country. Every citizen of the United States would do well to remember the decades past, and realize that the growth of 1898 marks no new policy, and is but the normal continuation of a course of development successfully pursued for a century.

BITTER ROOT FOREST RESERVE

By Richard U. Goode,

U. S. Geological Survey

As a result of inadequately framed laws, of the indifference of those charged with the execution of these laws, and of the reckless greed of private enterprise, the forests of this country, which at one time were of vast and apparently inexhaustible proportions, are gradually wasting away. In 1860 there were about 20,000 saw-mills, in 1870 about 26,000, and in 1880 about the same number; in 1890, however, the number was reduced to about 21,000, this reduction being largely due to the fact that the supply of available material was becoming scarcer and more inaccessible.

Practically, it has been impossible to place any restraint upon those desiring to use the timber on the public lands for any purpose whatever. One law provides that citizens may cut and remove for building, agricultural, mining, and other domestic purposes any trees growing on mineral lands, while another permits residents to take timber from non-mineral lands—and the land is usually held to be mineral or non-mineral as may suit the particular case. There are numerous other laws on the statute books under which timber may be taken under some show of legality, and in taking out the matured trees no attention has usually been given to the preservation of the young growth, and much that could not be used has been destroyed. Added to the above causes have been the forest fires, started either through accident or design, so that the question has begun to assume such a serious aspect that prompt measures have been deemed necessary by those interested in the preservation of the forests.

As a result of this agitation, a commission of the National Academy of Sciences was appointed in 1896 for the purpose of making an investigation of the subject. This commission submitted a report recommending the establishment of thirteen forest reservations, containing an aggregate area of 21,379,840 acres, or about 33,400 square miles. In conformity with this recommendation President Cleveland, under date of February

22, 1897, set apart from entry or settlement the various areas as recommended, one being the Bitter Root Forest Reserve. Previous to this there had already been established by Executive proclamation, in various localities in the West, reservations comprising a total area of 17,500,000 acres, or about 27,300 square miles.

Following immediately upon President Cleveland's proclamation protests and complaints began to pour into the Executive Mansion, and when President McKinley came into office he found himself in a somewhat embarrassing position, people having interests that were supposed to be detrimentally affected claiming that the reservations had been made without thorough investigation and without consulting local requirements. In order to relieve the situation and to obtain time for further investigation, legislation was enacted providing for the survey by the U. S. Geological Survey of all lands heretofore designated as forest reserves, suspending President Cleveland's proclamation, except as to the reservations in California, and restoring all others to the public domain, but providing that such lands not otherwise disposed of before March 1, 1898, should again become subject to President Cleveland's proclamation.

The function of the Geological Survey in the matter has been to ascertain and report on the facts relating to the forest reserves, so that intelligent action may be taken at the proper time as to the disposition of the whole question.

There is probably no portion of the country, exclusive of Alaska, about which there was so little known as of the territory included in the Bitter Root Reserve. It therefore became necessary to commence *ab initio*, as nothing whatever was available from a geographic standpoint. In considering questions of this kind the value of reliable maps cannot be overestimated. The engineer, the geologist, the botanist, or any one practically interested in any of the sciences, pure or applied, must have an accurate map as a basis for any thoroughly satisfactory investigation, and it thus came about that a large proportion of the amount appropriated for the forestry surveys was expended in the preparation of topographic maps.

The first step was to determine an astronomic position, measure a base line, and expand a system of triangulation which would serve to furnish starting and control points. A location for the astronomic station was selected in the town of Hamilton, Montana, and the latitude and longitude of a masonry pier built at this point was determined. This work was performed by Mr S. S. Gannett, who had the coöperation in the longitude work of Professor H. S. Pritchett, then of the Washington University at St Louis, and now Superintendent of the U. S. Coast and Geodetic Survey. The latitude was obtained by circumzenith observations on 56 pairs of stars, and the longitude by time observations and telegraphic exchange of clock signals with St Louis on five nights. The probable error of the results obtained for this position was very small, so that it was certain within a few feet, the surface of the whole terrestrial globe being taken into consideration. The next process was to measure a base line one end of which would be connected with the astronomic pier. This line was measured along a tangent of the Northern Pacific Railroad. The total length of it was 5.33 miles, and the difference between the two measurements after all corrections had been applied was about 1 inch—that is, the probable error was about 1 : 338000 part of the length.

From this base line was expanded a system of triangulation, which was executed with great care within certain limits, the triangles closing with an average error of 2 seconds. Beyond these it was extended as a reconnaissance survey, but it is believed that the results obtained will be entirely sufficient for map-making purposes, although it will eventually be completed in a more refined way. The surveys were under the general direction of Mr E. C. Barnard, who was personally in charge of a party engaged in the detailed mapping of the Bitter Root valley and the adjacent mountains. He had as assistants in charge of sub-parties Messrs J. B. Lippincott and H. S. Hackbusch.

The bounding lines of this Reserve are defined in part by the land lines of the public land system, none of which had been surveyed. For the purpose of locating these boundaries and also for establishing a basis from which other township and section lines could be projected a special party, under Mr Hackbusch, was organized, and the results of this work were the determination and marking of the greater portion of the eastern boundary. The existing law relating to the subdivision of the public land requires that all linear measurements shall be made with a chain, a method which in a heavily timbered and mountainous country is very inaccurate and laborious. The men engaged in this class of work encountered many hardships, exhausted their physical strength, and were able to accomplish so little at a large expense that the question of the feasibility of doing it by triangulation presented itself, and legislation has been proposed granting authority to the Geological Survey to locate township corners in the forest reserves by this method.

The area of the Bitter Root Forest Reserve is about 6,500 square miles. about one-sixth being in Montana and the remaining portion in Idaho, the crest of the Bitter Root mountains forming the boundary line between the two States in this locality, and the problem presented itself as to how a satisfactory map, for the purpose of illustrating the forestry features, could be prepared in the comparatively short field season that the weather

YELLOW PINE GROVE

conditions made possible. A reconnaissance map was decided upon, and the assistant, Mr J. B. Lippincott, who executed the triangulation, was instructed to take with him a light plane-table outfit for the purpose of making such a map. The map prepared does not lay claim to absolute accuracy, but it is considered sufficiently so to answer the purpose for which it was made—that is, to show the drainage system, the general character of the forests, etc. Contours were sketched to show the relative differences of elevation and slopes, and such elevations as were mathematically determined are given in figures. Also on the maps are indicated all the trails and such wagon roads as exist. Mr Lippincott was also instructed to secure numerous photographs and to obtain all possible information relating to the forestry, the agricultural and mineral development, and the hydrography of the Reserve, and many of the facts mentioned here are taken from his report.

No exact definition of what might be properly included in the Bitter Root mountain range has ever been authoritatively determined, and it is very doubtful if sufficient information as to the physiography of the region exists to satisfactorily settle the question present; but there can be no doubt that all of the Reserve under consideration is within the limits of the Bitter Root mountains. The conclusions of the writer in the matter are therefore to be taken as a broad generalization, to be modified as new facts are brought to light.

First, with reference to the crest line. This may be considered as extending on the north from the vicinity of Lake Pend d'Oreille to the low divide at the south end of the Bitter Root valley between the drainage of the Bitter Root creek and that of the north fork of the Salmon river. It is thought that these mountains should not include territory further southward, as it is considered desirable to classify the Bitter Root range as entirely tributary to Pacific drainage. The continuation of the divide southward is drained to the eastward by the tributaries of the Missouri and should properly be included in the Rocky Mountain system. The northern portion of the Bitter Roots, as thus defined, will include the Cœur d'Alène mountains, as it is believed that the latter should not have a coördinate rank in the orography of this region, but should be assigned as a subordinate range of the Bitter Root system. If an attempt is made to differentiate these two ranges as independent systems, St Regis pass would serve to break the continuity. With the assumption of continuity, the eastern and northeastern limits of this system become very easily defined—that is, by the drainage of the Clarke's Fork of the Columbia. It seems also very clear that the Salmon river should define the southern limits of these mountains. Just how far to the westward they should be considered as extending is not clear, but, as a preliminary classification, they may be determined as extending toward the Snake river plains until they lose their identity as mountain masses. This classification would assign the Clearwater mountains to a secondary position in the same manner as the Cœur d'Aléne have been subordinated.

In detail, the principal drainage systems in and adjacent to these mountains are the Bitter Root, the Clearwater, and the

Salmon rivers. On the eastern slope is the Bitter Root river, one fork of which heads in the southeast corner of the Reserve and flows northward through the fertile valley of the same name. This valley separates the Rocky mountains from the Bitter Root range for a distance of about 100 miles and at present has a good agricultural development. The main valley has a width of about 8 or 10 miles, its floor being comparatively level, composed of lacustrine deposits and very fertile under irrigation. When the drainage of the ancient lake occurred there was left a heavy deposit of gravel and other sediment, through which the Bitter Root river is still cutting, and this process has shifted the flood-plain back and forth, the result being that in some portions of the valley well defined terraces have been carved out corresponding to the older floodplains.

The Bitter Root river joins the Missoula near the town of the same name and ultimately finds an outlet in the Columbia river through Clarke's Fork and Lake Pend d'Oreille. The streams constituting this drainage are remarkably straight and of a very steep gradient. Their tangent-like course is due primarily to glacial agencies, and they have not become modified on account of the extreme hardness of the rocks. They seek the straight and direct course and do not loiter amid the inhospitable granite to carve out for themselves gentle curves. In their haste to reach the valley they leap and jump and are tossed from boulder to boulder, now lashing themselves into fleecy whiteness and now circling in emerald eddies as they plunge into some quiet pool, where they find a moment's rest and gather strength for their ever-downward course. The beds are filled with boulders, and the sides of the canyons are precipitous and almost entirely bare of vegetation. These streams in their incessant activity are not only continually deepening their own beds in the attempt to reach baselevel, but are gradually working their way westward and capturing the tributaries of the less active affluents of the Clearwater, causing what is termed a migration of the divide. The shifting or migration of a divide is due to the weathering or wasting away of the crest line, and may result from various causes. It seems probable that the main crest of the Bitter Roots has moved to the westward, owing to the fact that the highest points at present are all east of the crest line. Ward peak is 8 miles to the east and about 800 feet higher than the general elevation of the divide, and St Mary's and El Capitan peaks each attain an elevation considerably higher than the divide.

CEDAR FOREST ON MOOSE CREEK

The portion of the Reserve west of the summit of the Bitter Root mountains (that portion in Idaho) is drained by the Clearwater and Salmon rivers, about 90 per cent of the territory being tributary to the former. Both of these streams are affluents of the Snake river, the Clearwater forming its junction at Lewiston and the Salmon about 50 miles above, to the southward. The Salmon has no important tributaries within the limits of the Reserve. The Clearwater has four principal branches—the North Clearwater, the drainage area of which is largely north of the Reserve; the Laksha, or Middle Clearwater, which has its source about the base of St Mary's and St Joseph's peaks; the Main Clearwater, which drains the crest line from Lost Horse pass to the Nez Perces pass, and the South Clearwater, or American river, the smallest of the four, whose drainage basin is in the southwestern portion of the Reserve and extends within a few miles of the canyon of the Salmon river. It may be mentioned that the location of the Salmon river in this locality, as shown on the best existing maps, was found to be in error by from 10 to 15 miles.

The streams constituting the Clearwater system flow generally in a western direction, and while the various affluents come from almost every direction, the general result is a series of secondary east and west ranges which have no well defined connection with the main range. The summits of the ridges are from 3,000 to 5,000 feet above their enclosing canyons, and each ridge rises to the same general elevation, so that were a surface laid through all the crest lines it would be of an undulating and moderately irregular character. We may therefore assume with some degree of certainty that the surface represents an old topographic form—an old plain or peneplain of denudation to which the country was reduced after a long period of erosion.

The rocks of the Bitter Root mountains are granites and slates, the granite formation being the northward continuation of the enormous granite mass of southern Idaho, one of the largest in the United States. The slates, which are confined to the northern portion of the Reserve, constitute a part of the Belt formation, these rocks being the oldest stratified beds of the Rocky Mountain region. At some period since the Carboniferous the great body of granite out of which this immense tract was carved was injected as a molten fluid mass from below upward into the slates. This molten rock cooled slowly, as is shown by its coarseness of grain, and it must have cooled beneath a cover of slates; but this cover has been almost entirely removed and the

MAP OF THE BITTER ROOT FOREST RESERVE

granite itself deeply cut and dissected. At the time when volcanic activity was so predominant a feature in the Yellowstone Park and the great lava flows of basalt dammed up the Snake and Columbia rivers west of these mountains, the Bitter Root valley was effected by tilting of the earth, so that the drainage was in many cases reversed and the Bitter Root river was dammed back, forming the Bitter Root lake, which was over 1,000 feet in depth.

The overflowing waters of the lake gradually deepened the outlet and drained the lake, clearing out a large part of the sediment, a work not yet entirely accomplished, as the valley has not been cut down to its former level. The many lakes which nestle in the mountain amphitheaters and dot the plateaus are the result of glacial occupancy.

In connection with the reconnaissance survey a forest map was prepared, and it is published herewith. This map indicates the features of the forest in the broadest way, no attempt having been made to differentiate the species. Two zones of forest trees are native to the Montana slopes of the Bitter Root Reserve, the yellow pine and the subalpine fir, about one-fourth of the growth belonging to the former, which has a range from the lowest elevations to 5,800 feet, and three-fourths to the latter, which has a range from 4,200 feet to the highest altitudes. In the yellow-pine zone the yellow pine constitutes about 20 per cent of the growth and the hemlock spruce about 60 per cent, the remaining 20 per cent being distributed among the other trees included in the zone, the lodge-pole pine, white fir, and balsam fir. In the subalpine zone the lodge-pole pine constitutes by far the greatest portion (about 90 per cent) of the growth, the remaining 10 per cent being Lyall tamarack, subalpine fir, white-bark pine, white fir, Engelmann fir, and yew. Strictly speaking, only the yellow pine should be classed as commercial timber, as it alone is used for lumbering purposes; but on the map are included under this head the tamarack, the fir, and the white-bark pine, as they may be applied to local purposes and have to that extent some commercial value. The yellow pine may be considered as constituting the entire growth, as shown on the map, between the Bitter Root valley and the summit.

The areas indicated as bare on the map are not wholly so, there being no portion of the Bitter Root Reserve entirely above timber line, as everywhere, even on the loftiest summits and most precipitous ridges, especially on the southern slopes, are found straggling trees, but for the purpose of graphic illustration it has been represented as it has.

Along the crest the growth is very sparse, but as the projecting spurs reach out to the westward and attain lower altitudes they are usually covered with a forest growth, except where their sides are too precipitous to admit of vegetation. There are on the western slopes of the Bitter Root mountains three primary forest zones, namely, the subalpine fir, the white pine, and the yellow pine. The subalpine-fir zone extends from the crest altitudes to about 5,800 feet above sea-level and includes the white-bark pine, the lodge-pole pine, the Engelmann spruce, the Lyall larch, and the subalpine fir. The white-pine zone has an approximate range from an altitude of 5,800 feet to about 2,000 feet, and includes the white fir, the lodge-pole pine, the Engelmann spruce, the cedar, and the yew. The yellow-pine zone extends from elevations of 2,500 feet in the valleys to nearly 6,000 feet on the western and southern slopes, and to 4,500 on the northern and eastern slopes, and includes the yellow pine, the white fir, the hemlock spruce, the lodge-pole pine, the western birch, the paper birch, the balm of Gilead poplar, and the aspen, besides various willows and alders. The distribution of the growth in the subalpine zone is about the same as in the similar zone east of the crest. The trees constituting the white-pine zone are divided approximately into three equal portions, the white fir forming one portion, the cedar the second, and the lodge-pole pine and Engelmann spruce the third. The species of trees occurring in the yellow-pine zone may be divided approximately into two portions, the hemlock spruce constituting one and the yellow pine and white fir the other, the former, however, being about three times more abundant than the latter. From the foregoing it will be observed that at least 98 per cent of the trees in the Reserve are coniferous, the exceptions being a few cottonwoods, maples, and various bushes bearing berries.

The most striking feature presented by this map is the large portion of it that has been burned over, nearly all of it having been visited at different times by fires and at least one-third of the standing timber having been destroyed. The map indicates clearly the burned zones, and an attempt has been made to show by the percentage figures the proportion of the timber that has been completely destroyed.

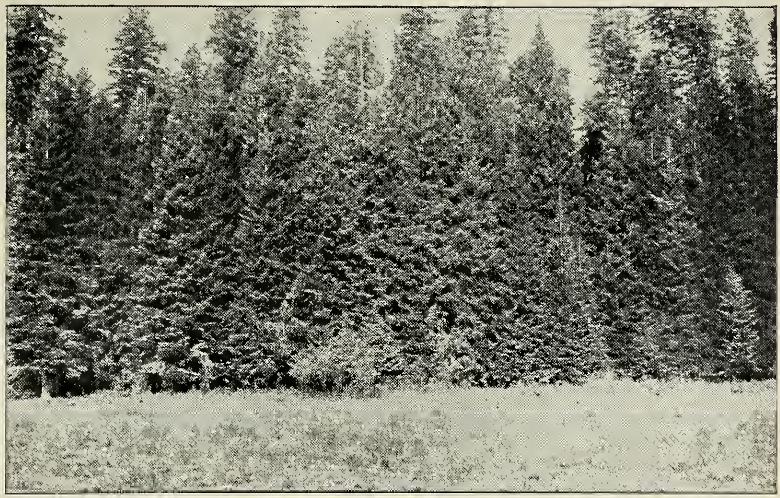
BURNT FOREST

The foregoing illustration depicts a scene of which all Americans should be ashamed. The aborigines held this region for many ages as a sacred trust transmitted from generation to generation. They recognized its beauty and utility and did naught to impair the grandeur of the one or the permanence of the other. And what has the Anglo-Saxon done? As a community is visited by a devastating scourge, as a face is disfigured by some foul disease, so have the forests been visited and disfigured by him. Reaping where he has not sown and failing to restore where he has destroyed, a noble heritage is slipping away through carelessness and cupidity. A hunter or traveler leaves his campfire unextinguished, a herder starts a fire in the fall that the coarse grass may be burned and in the spring be replaced by a tender growth which is more nutritious to his flock, the prospector burns the undergrowth that the mineral-bearing rocks may be uncovered, the result being that thousands of acres are devastated.

Illustrations are presented showing groves of yellow pines, cedars, and firs that have been undisturbed by fire, an area that has been burned over, and a view of the crest of the Bitter Root mountains.

The question may suggest itself as to why the area included in the Bitter Root Reserve should be set aside from entry or settlement. Three distinct reasons exist from a forest standpoint, and there are other interests that would be incidentally subserved.

First. The numerous streams which have their sources in the Reserve furnish the water supply for the irrigation of the Bitter Root valley on the east, and could be turned to a profitable account for a similar purpose to the westward. Indeed, it has been forcibly suggested that the possibility of irrigating the extensive plains of southeastern Washington exists only in the utilization of the Clearwater river for this purpose. There is at present considerable hydraulic mining in the Idaho portion of the Reserve, and this industry is limited only by the amount of available water supply, which, according to the testimony of the miners, has been materially decreased since the forest fires have become so extensive. It is safe to say that fully 98 per cent of the Reserve is unfit for agricultural purposes on account of the altitude and irregularity of the surface. The only possibilities in this respect, or even for grazing, are in the numerous alpine meadows; but it would be a dangerous experiment either to disturb the surface of these meadows with a plow or to allow cattle to occupy them extensively, as in either case they would lose



SUBALPINE FIR THICKET AND MEADOW ON MUSSEL SHELL CREEK

their peculiar sponge-like character, which makes possible the retention of the water deposit. Thus it seems clear that the reservation, if it were administered in such a manner as to prevent or at least check forest fires and keep out herds of cattle and sheep, would have a beneficial effect on the regimen of the streams.

Second. An important purpose to be subserved would be the prevention of the injudicious cutting of trees over large areas. It is not proposed to prohibit cutting to a sufficient extent to meet necessary demands, but to have it done under proper supervision, so that the young and immature growth may be protected and the production utilized in an economical manner. In other words, it is desired to provide for the handling of the tree crop with the same prudence and foresight as any other crop would be looked after.

Third. Large areas have been burned over, and it is a debt due to posterity that the damage be repaired. This end can be accomplished only by a systematic effort under proper direction. The Yellowstone National Park and the Yosemite Park have for several years past been patrolled by troops of cavalry of the U. S. Army, who have not only been able to keep watch on the class of people to whom these fires are usually traceable, but, by going promptly to localities where smoke is visible, have been able to extinguish with little exertion fires which, if left alone, would in a short while have devastated large areas. In some European countries it has been found necessary in order to produce certain results in reforestation to transport soil in baskets by the hands of men to form a new covering for the naked rock, so that vegetation may be reëstablished. It is not probable that we shall ever be reduced to such extremities in this country, but we should resist all influences that have a tendency to produce such a condition.

Incidentally the game will be protected and the scenery preserved or restored to its original beauty. This section is the natural home of the moose, elk, bear, deer, mountain goat, and mountain sheep, but during the past season scarcely any of the above were encountered and very little sign of their presence was observed. The deer are killed in large numbers by commercial hunters to bait bear traps. In one locality 120 bears were trapped in two seasons, and it is considered a conservative estimate that for each bear secured 1,000 pounds of game meat is ordinarily used. The elk and the moose are nearly exterminated, and the region which once attracted sportsmen from all portions of the country, and also from Europe, has almost completely lost its attraction as a hunting ground.

[The foregoing article was presented at the Joint Session of the National Geographic Society and the A. A. A. S., Boston, August 25, 1898.]

ATLANTIC ESTUARINE TIDES *

By Mark S. W. Jefferson

The tidal phenomena of a number of commercially important estuaries on the Atlantic coast suggest a simple geographic classification.

There are two distinct tidal types, with corresponding types of geography. Both are united in the Delaware. Ascending the bay from the capes, a four-foot tide increases to six feet and falls off in speed from 23 miles to 11 miles per hour. Ascending the river, the range again diminishes from six feet to four feet, with a speed varying irregularly between 7 and 15 miles. The geographic types here are the bay, from the capes to Delaware City, and the river above. The combined type corresponds to the

* Extract from Thesis in research course in Geography at Harvard University, under Prof. W. M. Davis. Read at the Joint Session of the National Geographic Society and the A. A. A. S., Boston, August 25, 1898.

rias of northwestern Spain, tidal rivers emptying into tidal bays, both resulting from the drowning of older river valleys in the sea. The simple type is a valley cut in rocks of uniform texture, and flares uniformly toward the sea.

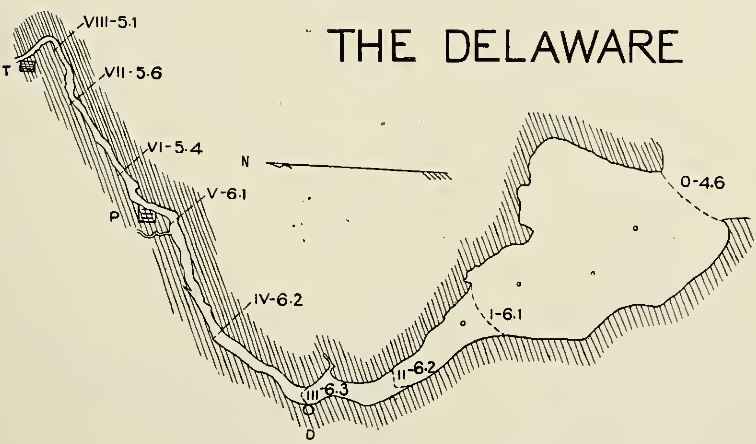
While the Delaware furnishes a good illustration of the combined type, the Chesapeake affords an exception of almost equal interest.

The following table summarizes the facts for the Delaware:

DELAWARE TIDES

0	I	II	III	IV	V	VI	VII	VIII	IX	H. W. interval from capes.
0	23	16	11	14	15	11	10	7	13	H. W. advance in last hour (miles).
4.6	6.0	6.2	6.3	6.2	6.1	5.4	5.6	5.1	4.1	Mean tide range (feet).
h. m.	*h. m.*	*h. m.*	*h. m*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	
6 25	5 43	5 37	5 25	5 25	5 19	5 7	4 49	4 43	3 55	Duration of rise.
6 0	6 42	6 48	7 0	7 0	7 6	7 18	7 36	7 42	8 30	Duration of fall.

The dotted lines on the map represent the positions of the progressing wave-front at successive even hours after it passes the capes. They are numbered with Roman numerals to the right,



the feet of range being also given in Arabic numerals. T = Trenton, P = Philadelphia, and the dots in the lower bay represent observation stations on shoals that enable us to ascertain the convexity of the advancing wave-front. From the table, and still more from the map, it appears that for the first three hours the tide advances with decreasing speed—23 miles the first hour, 16 miles the second, and 11 miles the third. During the same period the mean tidal range is increasing from 4.6 feet to 6.3 feet. These two characters are taken to define the bay type of tides:

(1) Progressive loss of speed } up the bay.
(2) Increase of tidal range }

Above Delaware City there is observed a steady falling off in the range. The rate of progress is here somewhat irregular. These two characters define the river type of tide:

(1) Irregular advance, commonly 10 or 12 miles per hour.
(2) Decrease of tidal range.

The last two lines in the table indicate a feature common to both types—the steepening of the front of the advancing wave, manifested in the times by quicker rise and slower fall. Outside of the estuaries, all along our Atlantic coast the times of rise and fall are equal. While bay and river together go to make up the geographic estuary, it may happen that one of the parts is missing, as with the Kennebec, which enters the sea by a narrow fiord and has no bay, or the Penobscot, shown by its tides to be wholly of the bay type. The Connecticut river has a sort of bay, but so choked with sediments as to be tidally inefficient. The Hudson enters the side of Raritan bay, both being good types of their kind, but not parts of one geographic whole. Chesapeake waters are anomalous.

The following are the ranges of the best illustrations in the area:

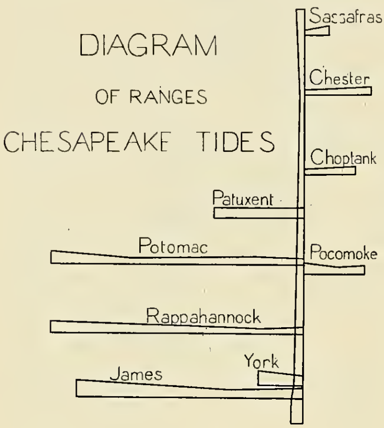
	Bay.	River.
St Lawrence	11′ to 14′	14′ to 0.9′
St John	....	26″ to 6″
Penobscot	9′ to 13′	....
Kennebec	....	8.3′ to 4.3′
Connecticut	....	3.6′ to 0.8′
Hudson	....	4.6′ to 2.3′
Raritan	4.6′ to 5.4′	....
Delaware	4.6′ to 6.3′	6.3′ to 4.1′

CHESAPEAKE TIDES

The Chesapeake is a drowned river valley into which drowned branch valleys pour abundant waters. Deep water is found within, yet the communication with the ocean is narrow and shal-


TIDAL HOURS
in the
CHESAPEAKE
Washington
Richmond
SASSAFRAS
CHESTER
CHOPTANK
PATUXENT
POTOMAC
RAPPAHANNOCK
YORK
JAMES
POCOMOKE
XIV
XIII
XII
XI
X
IX
VIII
VII
VI
V
IV
III
II
I

low. This constriction toward its mouth is shared by a number of the tributaries. The result is, in the main bay, a tide rather of the river or sound type. For two-thirds its length the range uniformly diminishes from 2.6 feet at the capes to 0.8 feet near Annapolis, a distance of 120 miles. So in the lower courses of the greater tributaries, the James, the Rappahannock, and the Potomac, ranges decrease or waver, as may be noted in the accompanying diagram. The rate of high-water advance is also irregular, as appears on the map; but the upper course of the bay and larger rivers and the whole course of the smaller streams have bay tides as far as ranges are concerned—*i. e.*, the tide range increases upstream. Though this is not accompanied by the progressive retardation of the true bay tide, it makes the Chesapeake waters present a curious inversion. Ranges of the river type are interposed between bay tides and the ocean. Two-thirds of the Chesapeake is rather river than bay, and two-thirds of the Potomac is rather bay than river. The narrowing and shoaling at the bay-mouth, imitated in the tributaries, explains the anomaly. Thus it happens that a range of 2.6 feet at the capes diminishes up the bay, but again increases to 4 feet at Richmond and 3 feet at Washington. The rate of progress of the tide-wave is here, as commonly, 10 to 12 miles per hour. When one tide is just above Washington another is entering the bay from the Atlantic, and high water reaches Havre de Grace, on the Susquehanna, as the following high water enters the mouth of the Rappahannock. The wave-front shows the usual steepening with advance. At Richmond the duration of rise is 4 h. 25 m.; at Fredericksburg, 4 h. 19 m.; at Washington, 5 h. 45 m. Port Deposit, on the Susquehanna, has the phenomenon of steeper back than front. A similar aspect is given at Galveston and perhaps at Falmouth by interference and a special development of the diurnal wave.



In every river an ascending wave must finally disappear. Of the Chesapeake rivers only the Elk shows this. The Pocomoke probably does; but we have no observations above Snow Hill, and so far the ranges are still increasing. The larger rivers are interrupted by rapids at the fall line before the ranges diminish, usually close to the highest station observed.

ST LAWRENCE TIDES

The St Lawrence is an excellent example of a tidal estuary, and it is to be desired that more and more reliable data may some day be forthcoming for its study. For the present purpose we must exclude the portion of the so-called river between Pointe des Monts and Anticosti, where the tides are unexplained. The "bay" and river remaining are 283 miles long and 40 miles wide at the mouth. When high water has reached Three Rivers a second high water appears at the east end of Anticosti. The bay includes the waters between Pointe des Monts and Isle Royale, whence it is river to Three Rivers. The U. S. Tide Tables give 22 stations here, from which a table has been prepared as before.

St Lawrence Tides

0	I	II	III	IV	V	VI	VII	VIII	IX	H.W. interval from Pointe des Monts.
0	125	30	26	21	23	14	17	13	14	H. W. advance in last hour (miles).
9.2	12.9	13.3	14.4	13.9	13.3	11.0	8	3	2	Mean tide range (feet).
h. m.	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	
6 20	5 55	5 47	5 33	5 30	5 11	5 10	5 10	5 7	5 5	Duration of rise.
6 5	6 30	6 38	6 52	6 55	7 14	7 15	7 15	7 18	7 20	Duration of fall.

During the first four hours the tide travels up the bay with lessening speed, while the tide range steadily augments; then the advance is irregular and the range diminishes. At Three Rivers, the head of observations, the rise of tide lasts 5 h.; the fall, 7 h. 25 m.—not a strong steepening of the wave front after 283 miles of travel. This may be due to the great depth of the St Lawrence. The Penobscot is in these respects comparable.

The Bay of Chaleurs, a hundred miles long and twenty miles wide at the mouth, affords a good bay, the ranges mounting up from 4 feet to 7.6 feet and high water being delayed. There are but nine stations in the tide tables, which rather hint at the facts than elucidate them. It is clear that the tide-wave advances with its front looped deeply into the bay, as is probable with the St Lawrence and all deep bays.

ST JOHN RIVER TIDES

Our data here are all for mean springs of July and August, being due to a study by A. Willmer Duff.* In putting these data into the usual form, the time intervals have been taken from Indiantown. Although the tides are of a good river type, there is a unique feature in the tidal falls at the river's mouth. The entrance to the Bay of Fundy at the city of St John is by an estuary five miles wide in deep water. Spring-tide ranges at the city are of 27 feet; time of rise, 5 h. 40 m.; fall, 6 h. 45 m. Back of the city "the waters of the river, previously occupying a channel remarkable for its extent and breadth, become abruptly confined in a narrow gorge [which] has its immediate origin in a band of pre-Cambrian rock crossing the stream obliquely and forming a barrier, over which the waters of the river and of the bay flow alternately. From the relative levels of the harbor and river and the known rise of the tide, it would appear that the inward fall over the barrier at the suspension bridge is from nine to ten feet; but as this inward fall is wholly confined to the last third of the flood-tide, attaining its maximum with the latter and again rapidly receding, the interval during which the river is effectively resisted is greatly limited, not exceeding three or four hours out of every twelve. Notwithstanding the limitation, however, the effect is so far to set back the stream as to produce, except in time of freshet, an alternation of upward and downward currents, accompanied by a corresponding change of level, which is appreciable even at Fredericton, a distance of over 80 miles from the mouth, resulting at low water, in a rise and fall of not less than 10 inches." † Four times in the twenty-four hours there are ten-minute periods of level water,‡ and then steamboats can safely pass.§ At very high freshets in April and May there is no inward fall, as the tide does not rise high enough.‖

There has been some discussion as to the propriety of calling the oscillations that result in the St John river *tides*. Mr Duff's investigation, however, seems decisive. The oscillations are tidal in shape, period, and progression, and are visibly born of the Fundy tides in the Narrows; they are therefore tides. The distances in the table accompanying are from Indiantown, just upstream from the Narrows; the ranges in inches.

* Bulletin of Nat. Hist. of New Brunswick, vol. xv, 1897.

† L. W. Bailey, Roy. Soc. Can. Trans. 1882, p. 281.

‡ J. W. Bailey, St John River, p. 135.

§ Ward's Account of the River St John, p. 17.

‖ Lockwood's Nova Scotia, p. 97.

St John River Tides

0	I	II	III	IV	V	VI	VII	H. W. interval from Indiantown.
0	19	10	8	8	10	10	10	H. W. advance in last hour (miles).
26	15	11.5	10.3	9.7	8.6	7.7	6.2	Mean tide range (inches).
h. m.	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	
5 40	5 16	5 16	5 16	5 17	5 17	5 18	4 48	Duration of rise.
6 45	7 9	7 9	7 9	7 8	7 8	7 7	7 37	Duration of fall.

At Fredericton, over 70 nautical miles from Indiantown, the mean levels are 14 feet 4 inches above mean sea-level. The railroad levelings are used in this determination and may be open to some doubt; but Young asserts that tide runs 100 feet above sea in the Amazon,* and Airy † says the same thing happens in the Firth of Clyde, and, moreover, should happen from theory. As the wave progresses upstream 10 miles an hour, it is not to be supposed that the water poured inward from the Bay of Fundy travels upstream to cause the rise of water. The water is merely set oscillating. The Indiantown tides are themselves two hours later than the tides at St John, and the five-inch wave that reaches Springhill, 78 nautical miles upstream, spends over nine hours in the transit. Salt water is said to be detected 48 miles up the river, which is surprising.

PENOBSCOT TIDES

Penobscot bay has its outer waters so full of islands that the tidal bay must be counted to have its mouth from Camden to Castine. Thence to Bangor the ranges mount up steadily—9.7, 9.8, 10.2, 10.6, 12.0, 13.1 feet in 26 miles. The times indicate a clear retardation, though the series is short. Tide passes from Matinicus, the outer island, to Bangor in two hours. Above Bangor the river part is cut off by falls, and no river part is present. Only depth of water and freedom from sediment can allow such tides in a narrow channel.

KENNEBEC TIDES

The tide progresses from the sea to Augusta (45 miles) in four hours, with somewhat irregular speed and diminishing range.

* General Astronomy, p. 258.

† Encycl. Metropolitana, vol. iii, p. 338.

Kennebec Tides

0	I	II	III	IV	H. W. interval from mouth.
0	11.5	8.5	16	8	H. W. advance in last hour (miles).
8.5	6.9	5.5	5.1	4.3	Mean tide range (feet).
h. m.	*h. m.*	*h. m.*	*h. m.*	*h. m.*	
6 23	5 57	5 53	5 36	5 1	Duration of rise.
6 2	6 28	6 32	6 49	7 24	Duration of fall.

Thames river, Connecticut, seems to have a small but typical bay tide. There are but two observation stations.

CONNECTICUT TIDES

The Connecticut has its mouth in the sand-bar region of the Middle bay, and itself discharges no small quantity of sediments, that make its exit to the sound an embarrassed one. Tide progresses up to Hartford (43 miles) in 4 hours and 48 minutes, with fairly constant speed, the ranges steadily diminishing.

Connecticut River Tides

0	I	II	III	IV	V	H. W. interval from sound.
0	9	9	11.5	7.5	9	H. W. advance in last hour (miles).
3.6	2.7	2.0	1.4	1.0	0.6	Mean tide range (feet).
h. m.	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	
6 18	5 36	5 18	4 54	4 43	4 8	Duration of rise.
6 7	6 49	7 7	7 31	7 42	8 17	Duration of fall.

The stream is narrow, from a quarter to three-quarters of a mile, and shallow. The local geography affords a rational explanation for the lack of the "bay." The lower course of the river is cut in rocks so much harder than the upper course that the lower valley was gorge-like before drowning. The departure from the *ria* type is in the lack of uniformity of rock texture along the river.

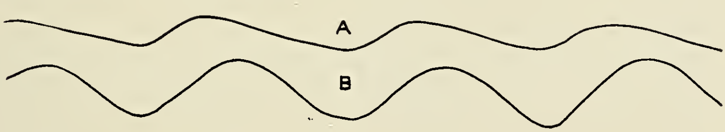
HUDSON TIDES

The Hudson also flows in a narrow gorge in its lower course and has no bay nor bay tide. Nearly as narrow as the Connecticut, but deep, it allows a more rapid transmission of the tide wave. The 141 miles to Albany are traveled in 10 hours and 8 minutes.

Hudson River Tides

0	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	H. W. interval from Sandy Hook.
0	19	15	19½	21½	16½	11½	9½	10	9½	9½	8	H. W. advance in last hour (miles).
4.6	4.2	3.6	3.3	3.3	3.3	3.4	3.2	3.0	2.9	2.4	....	Mean tide range (feet).
h. m.	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*	
6 7	5 49	5 49	5 44	5 47	5 43	5 27	5 19	4 57	4 52	4 42	....	Duration of rise.
6 18	6 36	6 36	6 41	6 38	6 42	6 58	7 6	7 28	7 33	7 43	....	Duration of fall.

The two curves below, which I owe to the courtesy of the Superintendent of the Coast Survey, show 48 hours of continuous observation at Albany and Sandy Hook. Both are on the same scale, and they well illustrate the extremes met in a river. The Albany tide, figure A, shows the characteristic steep front of waves that have traveled far in shallow water. The Hudson gets aid in its struggle with coastwise sands at Sandy Hook from the constant westward flow of water from Long Island sound through East river and out to sea.*



In closing this examination of estuary tides it appears that they vary from the type in our area only as their estuaries vary from the type of a river valley, narrow above and wide below, partly drowned in the sea. The commonest modification of this geographic type on the Atlantic coast results from the tendency of coastwise sands to close the bay mouths. This agency is evident at the mouths of the Hudson and Delaware; it gives the Chesapeake tides of a river type and encloses the mouths of the drowned valleys further south, forming the sounds in which lunar tides are less significant than the effects of prevailing winds.

* H. Mitchell: Ann. Rep. U. S. Coast Survey, 1886.

THE FOREST CONDITIONS AND STANDING TIMBER OF THE STATE OF WASHINGTON*

By Henry Gannett,

U. S. Geological Survey

During the past year I have been actively engaged in collecting information regarding the forest resources of this state, one of the richest in timber and the state in which the lumber industry is most active west of the Mississippi river. The information which has been collected consists of the reports of timber cruisers, showing the total amount of timber contained in the areas examined and its distribution among the five species recognized by the lumbermen of this part of the country—*i. e.*, red fir (*Pseudotsuga taxifolia*), Sitka spruce (*Picea sitchensis*), hemlock (*Tsuga mertensiana*), cedar (*Thuja plicata*), and yellow pine (*Pinus ponderosa*).

The figures, as they came to me, are by townships, showing the area cruised within each township and the amount of timber of each species. The figures are accompanied by maps, showing in considerable detail the areas which have been logged, burned, or are naturally devoid of timber, and those which are still timbered. Altogether I have in the state of Washington actual cruisings of 1,679,402 acres, or 2,600 square miles, which are pretty thoroughly scattered over the state. In addition to this are the examinations made of the Washington Reserve, an area of about 6,000 square miles, made during the past season. The cruisings, although scattered widely, are much more abundant and cover the area much more closely west of the Cascade range, in the most important timbered portion of the state, than east of those mountains.

The forests of Washington cover the Cascade range and the entire country west of it to the Pacific coast, with the exception of a few high summits of the Olympics and of the Cascades. They extend eastward along the northern part of the state to its east boundary, covering all the country southward as far as the Columbia river, and extend southward along the east bound-

*Presented at the Joint Session of the National Geographic Society and the A. A. A. S., Boston, August 25, 1898.

ary in a narrow fringe to its southeast corner, where the forests of the Blue mountains cover a considerable area. Altogether I estimate that out of the total area of the state 47,700 square miles, or 71 per cent, are wooded. All this is not, however, covered with merchantable timber, inasmuch as much of it is inferior in character, and other large areas have been cut or burned and are now growing up again.

From the data collected I estimate the total amount of standing timber in the state to be in the neighborhood of 187,000,000,000 feet, of which amount more than two-thirds, or 137,000.000.000 feet, are found west of the crest of the Cascade range, the remainder, 60,000,000,000, being upon its east slope and in the northern and eastern portions of the state. This is the amount as estimated upon the basis of the practice of the lumbermen of the west coast, where the standard for lumber is extremely high and the practice in cutting very wasteful. For instance, in this region no tree is cut unless it will furnish at least two sticks each 20 feet in length, and each of which will square 15 inches, or have a diameter on the trunk of at least 2 feet, nor is anything used which is at all knotty, only clear lumber being cut. The remainder of the tree, after selecting the parts above described, is left to rot or to add to the conflagrations which sweep through the region every summer.

The forests west of the higher parts of the Cascade range are composed of 62 per cent of red fir, 16 per cent of cedar, 14 per cent of hemlock, and 8 per cent of spruce. The fir is found most abundantly in the depression between the Cascade and Coast ranges, where the forest is almost entirely composed of it. Its range extends up the mountains to an altitude of about 3,000 feet, where its place is taken by hemlock and cedar. Toward the Pacific coast the proportion of fir diminishes and its place is taken by spruce, which is most abundant immediately on the coast, and by cedar. Hemlock is found mainly upon the mountain slopes, which it climbs to a much greater altitude than fir.

Yellow pine is found only east of the crest of the Cascades, but throughout this region it is the predominant growth. At considerable altitudes its place is taken, to a large extent, by lodge-pole pine (*Pinus murrayana*), which throughout this region is regarded as of no possible use, although farther east, where timber is scarce, it is considered to be of value.

The portion of Washington west of the crest of the Cascades, concerning which I have the fullest data, is one in which lumbering has been carried on very extensively for nearly a generation, and the results of these extensive operations, coupled with the terrible fires which devastate the region, are of much interest. From the maps which have been obtained I find that of the accessible part of this region—*i. e.*, those parts which are regarded by the present lumber practice as containing available timber—not less than 45 per cent have been cleared, either by cutting or fire, within recent times. About 23 per cent of this entire area has been logged; about 22 per cent has been burned. Presumably the amount of timber cut and burned and its value are at least proportional to the areas, and therefore it would follow that not very much less than one-half of the available lumber in this part of Washington has been destroyed since its occupation by whites. We cannot complain of the cutting, providing it is done with some sort of economy, but no condemnation can be too severe for the carelessness which allows such an enormous amount of wealth to be destroyed by fires.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The Fiftieth Anniversary Meeting of the American Association for the Advancement of Science was held in Boston, August 22 to 27. As was anticipated, the return of the Association to the city of its birth for the celebration of its semi-centennial was the occasion of an unusually large attendance, it excited more than ordinary local interest, and resulted in a very large accession to the membership.

Of the 330 or more papers presented, many contained important contributions to the different sciences. Those of especial geographic interest were for the most part read in Section E, which held a joint session with the National Geographic Society on August 25. On that occasion Dr Marcus Baker, cartographer to the Venezuela Boundary Commission, discussed the Venezuela-British-Guiana Boundary Dispute; Prof. W J McGee, Vice-President of the National Geographic Society, traced the Geographic Development of the United States; Mr Mark S. W. Jefferson explained the peculiar characteristics of Atlantic Estuarine Tides, and the Statistician of the Department of Agriculture set forth the Considerations that have governed recent Movements of Population. The following papers were also presented: "Some

New Lines of Work in Government Forestry," by Mr Gifford Pinchot; "The Forestry Conditions of the State of Washington," by Mr Henry Gannett; "The Bitter Root Forest Reserve," by Mr Richard U. Goode, and "The Five Civilized Tribes and the Topographic Survey of Indian Territory," by Mr Charles H. Fitch. Of these various addresses and papers four are published in the present number of this journal.

Among the papers read at other times or before other sections and of interest to geographers may be mentioned the following: Before the Section of Geology and Geography, "Geography and Resources of the Siberian Island of Sakhalin," by Prof. Benj. Howard, of London; "The Development of the Ohio River," by Prof. W. G. Light, and "The Continental Divide in Nicaragua," by Mr C. Willard Hayes; before the Section of Anthropology, "The Maori of New Zealand; His History and Country," by Hon. Hugh H. Lusk, of London; "Origin of the Confederacy of the Five Nations," by Mr Ch. H. Henning; "The Disappearance of the Cliff Dwellers," by M. Desire Charnay, of Paris; "The Smith Sound Eskimo," by Mr A. L. Kroeber; "The Philippine Islands and their People" and "Moros, or Malay Pirates of the Southern Philippines," by Prof. Dean C. Worcester; and before the Section of Economic Science and Statistics, "Cuba: Past, Present, and Future" and "Nicaragua and the Canal," by Dr Wolfred Nelson; "The Development of Colonial Policy," by Prof. John Davidson; "The Progress of the Maritime Commerce of the World during the past Fifty Years," by Dr E. L. Corthell, C. E., and "Cuba," by Prof. Robert T. Hill.

It is much to be regretted that at several sessions the large number of papers to be presented precluded all possibility of discussion, and it may be doubted whether it would not contribute to the usefulness of future meetings if some limitation were imposed by the Committee upon the number and length of the papers to be submitted.

Not even this brief narrative of the proceedings of the Association in one single direction should be permitted to go without reference to the admirable arrangements made by the Local Committee, to the generous hospitality of the citizens of Boston, Cambridge, Salem, Lexington, and other places, and to the extreme gratification it afforded the Association to have occupying the presidential chair its indefatigable secretary for 25 years, Dr Frederic Ward Putnam, the distinguished Peabody Professor of American Archæology and Ethnology in Harvard University.

J. H.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1897–'98

Special Meeting, April 29, 1898.—Mr W J McGee in the chair. Professor J. L. Ewell, of Howard University, gave an illustrated lecture on Old Germany before the Reformation.

Special Meeting, May 2, 1898.—Mr W J. McGee in the chair. Professor Josiah Royce gave an illustrated lecture on The Pacific Coast, particularly describing the influence of geographic environment on the early inhabitants.

Regular Meeting, May 6, 1898.—Mr G. K. Gilbert in the chair. Mr N. H. Darton gave an illustrated address on the geologic and geographic environment of Harpers Ferry, and Major H. E. Alvord, C. E., described the principal events which occurred there during the civil war.

Special Meeting, May 9, 1898.—Mr W J McGee in the chair. Mr William E. Curtis gave a description of Porto Rico, and Col. F. F. Hilder spoke on the Philippine Islands, both addresses being illustrated with maps and views.

Annual Excursion and Field Meeting, May 14, 1898.—An excursion, postponed from May 7 on account of unfavorable weather, was made to Harpers Ferry, leaving Washington by special train at 8.50 a. m. The day's proceedings included a field meeting, at which addresses were delivered by Mr W J McGee and Col. H. C. Rizer, and the visiting of the different points of geographic and historic interest for which the district is famous.

Annual Meeting, May 20, 1898.—Vice-President A. W. Greely in the chair. The report of the Recording Secretary was read and approved. The report of the Treasurer was presented, and referred to an auditing committee, consisting of Prof. Willis L. Moore, Mr Weston Flint, and Col. H. C. Rizer, after it should be brought down to the end of the fiscal year expiring May 31.

Dr Alexander Graham Bell, Mr Henry Gannett, Gen. A. W. Greely, U. S. A., Mr John Hyde, Prof. W J McGee, and Mr F. H. Newell were reëlected members of the Board of Managers.

The amendments to the By-Laws, presented in writing at the meeting on April 22, were taken up and read section by section. After debate and a slight amendment to article 6, section 4, they were adopted by a two-thirds vote of the members present, the By-Laws, as approved, being as follows:

ARTICLE I.—*Name.*

The name of this Society is 'THE NATIONAL GEOGRAPHIC SOCIETY.'

ARTICLE II.—*Object.*

The object of this Society is the increase and diffusion of geographic knowledge.

ARTICLE III.—*Membership.*

SECTION 1. The members of this Society shall be persons interested in geographic science. There may be three classes of members—active, corresponding, and honorary.

Section 2. Active members only shall be members of the corporation and may vote and hold office.

Section 3. Persons residing at a distance from the District of Columbia may become corresponding members.

Section 4. Persons who have attained eminence by the promotion of geographic science may be elected honorary members.

Section 5. The election of members shall be entrusted to the Board of Managers.

Section 6. Corresponding members may be transferred to active membership, and active members to corresponding membership, by the Board of Managers.

Article IV.—*Officers.*

Section 1. The administration of the Society shall be entrusted to a Board of Managers composed of eighteen members, six of whom shall be elected by the Society at each annual meeting to serve for three years, or until their successors are elected. A majority of the votes cast shall be necessary for election.

Section 2. The Board of Managers shall elect annually from their own number a President, a Vice-President, a Treasurer, a Recording Secretary, and a Corresponding Secretary.

Section 3. The President shall preside at the meetings of the Society and of the Board of Managers, or shall delegate this duty to the Vice-President or other member of the Board. The President and Recording Secretary shall sign all written contracts and obligations of the Society.

Section 4. In the absence of the President his duties shall devolve on the Vice-President.

Section 5. The Treasurer shall have charge of the funds of the Society, under the direction of the Board of Managers, and shall make collections and disbursements, and render an annual report; and his accounts shall be audited by a committee of the Society, not members of the Board, annually and at such other times as the Board may direct.

Section 6. The Recording Secretary shall record the proceedings of the Society and of the Board of Managers, and make an annual report. The Corresponding Secretary shall conduct correspondence on behalf of the Society.

Section 7. The Board of Managers shall fill vacancies arising in the Board.

Section 8. Absence of a member of the Board of Managers from five successive Board meetings may, in the discretion of the Board, be considered equivalent to resignation.

Article V.—*Committees.*

Section 1. The committees of the Society and of the Board of Managers shall be appointed by the President, except when otherwise provided by resolution. The President shall be a member *ex officio* of every committee

Section 2. There shall be Standing Committees on Publication, Communications, Admissions, Research, and Finance, whose chairmen shall be members of the Board of Managers. These committees shall be appointed at the beginning of each fiscal year to serve until their successors are designated.

ARTICLE VI.—*Dues.*

SECTION 1. The annual dues of active members shall be five dollars, of corresponding members two dollars.

SECTION 2. The fiscal year of the Society shall begin on the first day of June. The annual dues of new members shall be payable within thirty days after election. The dues of members elected in April or May shall be credited to the following year.

SECTION 3. Annual dues may be commuted and life membership acquired by the payment at one time of fifty dollars.

SECTION 4. Members in arrears shall not be entitled to vote at the annual meeting, and members two years in arrears shall be dropped from the roll.

ARTICLE VII.—*Meetings.*

SECTION 1. Regular meetings of the Society shall be held on alternate Fridays from November until May.

SECTION 2. Special meetings may be called by the President.

SECTION 3. The annual meeting shall be the last regular meeting in May.

SECTION. 4. Twenty-five active members shall constitute a quorum.

SECTION 5. Regular meetings of the Board of Managers shall be held on the same days as the regular meetings of the Society; special meetings may be held at the call of the President or on notice signed by five members of the Board.

ARTICLE VIII.—*Publications.*

The Society shall publish a journal or periodical under the title, THE NATIONAL GEOGRAPHIC MAGAZINE, which shall be sent to all members of the Society not in arrears, and may be placed on sale.

ARTICLE IX.—*Amendments.*

These By-Laws may be amended by a two-thirds vote of the members present at any regular meeting, provided the proposed amendments are reported by the Board of Managers, and provided that printed notice thereof has been sent to all active members of the Society not less than three nor more than thirty days before the meeting.

ELECTION OF OFFICERS.—At a meeting of the Board of Managers, held June 3, officers for the ensuing year were elected as follows: President, Dr Alexander Graham Bell; Vice-President, Prof. W J McGee, Treasurer, Mr Henry Gannett; Recording Secretary, Mr F. H. Newell; Corresponding Secretary, Miss Eliza Ruhamah Scidmore.

ELECTIONS.—New members have been elected as follows:

May 6.—H. E. Orsborn, S. W. McCallie.

June 3.—Mrs C. Atwater Day, Hon. Lewis E. Payson, W. W. Burdette, Rev. Charles D. Kreider.

June 24.—J. B. Bottineau, H. Hayden Sands, S. J. Caswell, M. D.

July 18.—Walter E. Colwell, Eugene La Grove, Dr J. C. Gordon, G. Shelby Crump.

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The National Geographic Society, the object of which is the increase and diffusion of geographic knowledge, has a total membership of 1,600. Its membership is not restricted to practical geographers, but is open to any person in good standing who may be sufficiently interested in its work to seek admission. The annual subscription is: for active members, $5.00 per annum; for corresponding members, $2.00 per annum. THE NATIONAL GEOGRAPHIC MAGAZINE is sent regularly to all members.

Donations for the founding of Prize Medals and Scholarships are respectfully solicited.

F. W. Putnam

THE

National Geographic Magazine

Vol. IX OCTOBER, 1898 No. 10

LAKE CHELAN

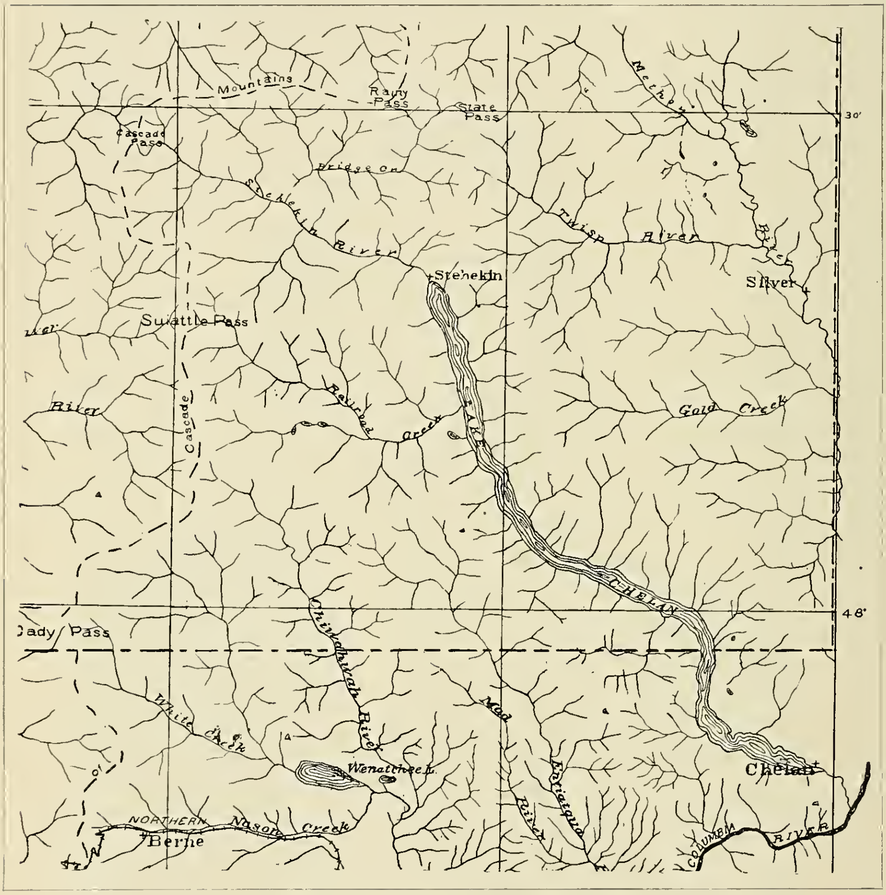
By Henry Gannett,

Chief Geographer, U. S. Geological Survey

To most readers, especially those of the East, this title conveys little information, for it is an almost unknown lake, in an almost unknown region. It lies in the northwestern part of the state of Washington, upon the eastern slope of the Cascade range, its lower end being near Columbia river, into which it is drained; thence it stretches northwestward in a long, winding ribbon, far up toward the heart of the range. Into the head of the lake flows Stehekin river, whose sources are in Cascade pass, at the summit of Cascade range. The river has numerous branches, all of which head in high, snowy mountains, among small glaciers, and it consequently brings a considerable volume of water to the lake.

In the northern part of Washington the Cascade range consists of a broad and extremely rugged mass of granite mountains, whose highest summits are between 10,000 and 11,000 feet in altitude. High up in the heads of the gorges and at the foot of the peaks are many small glaciers, the remains of others, much larger, which in times past extended far down the present stream valleys, filling them to great depths with streams of ice. Evidences of these are present in all the valleys and gorges of this part of the Cascade range. The occupation of these gorges by glaciers is so recent that in many of them the subsequent work of the streams by which they are now occupied has produced but trifling results. Only in a few places are evidences of extensive stream erosion seen.

The bed of Lake Chelan and its principal tributary, Stehekin river, together with the branches of that river, were at one time filled by a vast glacial system, extending from the crest of the Cascades southeastward nearly to Columbia river. The glacier was nearly 100 miles long, and when it was in its prime the ice must have been several thousand feet in thickness.



MAP OF LAKE CHELAN AND VICINITY, IN THE STATE OF WASHINGTON, 1898

A glacier is a river of ice, and it behaves almost precisely as a river of water does. Its effects upon its channel are almost precisely similar to those of a river upon its channel, excepting in the fact that all its operations are on a vastly greater scale. The channel of a river may be measured by yards or hundreds of yards, while that of a glacier is measured in miles. The depth of a river may be a few feet only or a few scores of feet; that of a glacier may be thousands of feet. It is this greater size, volume, and weight which makes glacial ice behave like water. In such large masses ice is plastic, accommodating itself to inequalities of its bed, flowing with some freedom, spreading out and contracting, much as water does.

A word of caution must here be interpolated. The channel of a river, in which its water flows, must not be confused with its valley, which it drains. The above comparison refers to the *channel* of a river, not to its valley.

Glaciers in mountain regions commonly head in amphitheaters or cirques—basins lying directly at the heads of cañons, under the shadow of the summit cliffs. An amphitheater is surrounded on three sides by vertical walls or steep slopes, down which the ice and snow slide in avalanches, accumulating in the bottom. The effect is precisely like that of a waterfall. The falling snow and ice dig a hollow or depression at the foot of the steep descent just as water does. Such amphitheaters are found at the heads of all glacial gorges in high mountains, and today are found to contain small alpine lakes in place of the ice which once occupied them. From its head in the amphitheater the glacier moves down the gorge, scouring and cutting the bottom and sides as it travels. The ends of the mountain spurs are planed off instead of being trimmed to sharp, angular points, as is done by streams in gorges cut by them. If the bottom of the cañon be uneven, if it contain abrupt elevations and depressions, the glacier flows over them as water would flow over similar obstacles in its channel, gradually cutting them away. Where the descent becomes abruptly steeper the ice, in bending to follow the surface, is commonly cracked, forming a network of crevasses, making travel over its surface very difficult and dangerous.

Where the main glacier is joined by a branch, the bed of the branch is commonly found to be at a higher level than the bed of the main glacier, because being larger and heavier the main glacier has greater cutting power; indeed, in many cases the beds of small branches are hundreds, or even thousands, of feet higher than that of the main glacier to which they are tributary. The parallelism between the glacier and the river in their channels is further illustrated by this fact. The surface of the ice in the main glacier and in the branch must have been at the same level, although the bottoms, as stated above, differ greatly in elevation. So it is with a river at the point of junction of branches. The surface of the water must be practically at the same level in all cases, but the bottoms of the channels differ by the difference in depth of the streams at their point of junction. This fact affords us a measure of the minimum thickness of the ice at any place. It cannot have been less than the vertical distance between the bed of the main glacier and that of the tributary, and, indeed, must in all cases have been greater, owing to the thickness of the tributary.

LAKE CHELAN, AT THE NARROWS

To extend the comparison between a river and a glacier, it may be added that the central portion of the glacier flows faster than the bottom and sides, as they are retarded by friction, just as in the case of a stream. This is demonstrated by the gradually increasing curvature of the lines crossing the glacier, such as transverse lines of dirt or crevasses. In the upper portion of the glacier these may be straight, or nearly so, but lower down become more and more curved, with the convexity downward.

A glacier is constantly receiving upon its surface rock, gravel, etc., which fall upon it from its walls. In its long journey from its source to its melting point, a journey which may occupy many years, large quantities of such material accumulate, and it naturally falls mainly upon the edges of the glacier, forming lateral moraines. Where two branches join, the two lateral moraines on the inside join and form a medial moraine, and thus in a complicated glacier system the main glacier below the junction of a number of branches may bear upon its surface many

WEST SIDE OF HORSESHOE BASIN

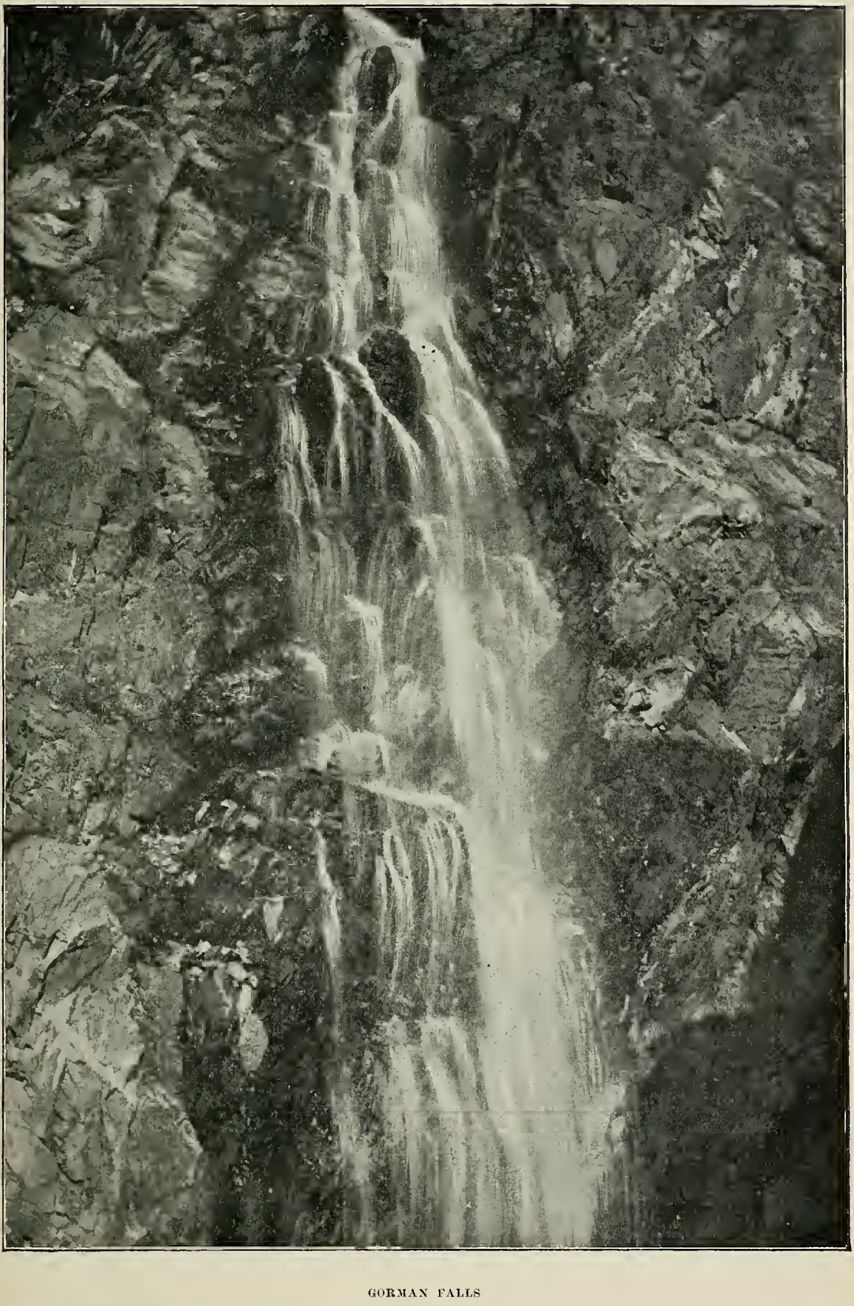
moraines lying lengthwise with the glacier. At the melting point all these moraines are dropped in a confused heap, forming the terminal moraine. This may extend for a considerable distance up and down the valley, because the foot of the glacier moves backward and forward according to the season. In a wet, cold season the foot advances down the gorge, while in a warm, dry season it retreats toward its source.

Herein we may see another point of similarity between the glacier and a certain type of river. In the arid regions of the West the streams which have their sources in the mountains flow down into the valleys and disappear, being absorbed by the dry soil and the thirsty atmosphere. These streams, like glaciers, bear detritus down from the mountains, and upon their disappearance in the valley they drop this detritus as the glacier does.

There are, therefore, certain characteristics by which the gorge produced by glacial erosion may be distinguished from that produced by aqueous erosion. The glacial gorge has the shape of

CASCADE PASS AND AMPHITHEATER

the capital letter U, while the waterworn gorge is a V-shaped notch. In a glacial gorge the spurs separating the tributaries have their ends blunted or planed off, while in a waterworn gorge they are sharp and angular. In a glacial gorge the tributaries enter the valley above its level, while in a waterworn gorge they commonly grade down to its level. A glacial gorge has an amphitheater at its head; a waterworn gorge has not. A glacial gorge is commonly lined near its lower end with lateral moraines and across its foot stretches a terminal moraine, and often this terminal moraine has formed a lake.



GORMAN FALLS

With the exception of lateral moraines, Lake Chelan and its tributaries present all these features peculiar to glacial erosion, and owing to the fact that the ice has but recently abandoned the gorge, aqueous erosion has made but little progress, the glacial forms are but little masked and are still the most prominent features in the landscape.

Crossing Cascade pass from the west, one descends immedidiately into an amphitheater, enclosed on the west and south by a mountain wall surrounded by high peaks. On the north is the pass and on the east the land rises slightly, forming the lower rim of the amphitheater. The hollow of this amphitheater contains, all the year around, a great snow-field a mile or more in length, which gives rise to Stehekin river. The accompanying illustration is taken from the rim of the amphitheater, looking toward the pass, which appears in the background, with the snow-field below it.

From the summit of the lower rim of the amphitheater there is a steep descent of several hundred feet, down which the Stehekin plunges in a series of cascades. The valley, at first narrow, broadens as it becomes deeper and the U-shaped form of a glacial valley becomes more pronounced. On either side at short intervals small branches join the stream. These head among the high mountains and flow with gentle courses through ancient glacial valleys to the edge of the glacial gorge of Stehekin river, over whose walls they leap in great falls. One such stream heads in Horseshoe basin, on the left-hand side of Stehekin river, where its waters are derived from a small glacier. The waterfall known as Gorman falls is the leap of the stream over the edge of the glacial wall, which here is practically vertical.

The walls of the gorge along Stehekin river range from 4,000 to 5,000 feet in altitude above the bottom of the valley, and the angle ranges from near verticality at the top to 40° or 45°. Near the mouth of Company creek, some 15 miles above the head of the lake, the wall is fully 5,000 feet in height, descending in one great sweep from the summit of the mountains down to the bottom. Company creek, coming in on the right, though a large stream, flows on a level several hundred feet above the bed of Stehekin. Bridge creek, which joins the Stehekin three or four miles farther down, coming in from the right, also a large branch, flows in a valley several hundred feet above that of the Stehekin, descending to it by a series of cascades and waterfalls in a waterworn gorge 200 or 300 feet deep, which it

STEHEKIN VALLEY, AT THE MOUTH OF COMPANY CREEK has cut since the retreat of the glacier. Bridge creek has numerous branches, and at the junction of each of these branches similar phenomena are observed, although in case the branches are nearly equal in size the bench or rise in the glacial valley is not as marked as in the case of smaller branches. From all indications it appears that the ice must have been at least 3,000 feet deep in this gorge of the Stehekin, since several of the smaller branches join the main glacier at that height above its bed.

Lake Chelan is between 50 and 60 miles in length and from half a mile to a mile or more in breadth. Except near its lower end, it is enclosed throughout its course between high steep walls, rising at angles of 40° to 45° directly from the water's edge to an altitude of 5,000 or 6,000 feet above the sea. The elevation of the lake above the sea is 1,100 feet, and its cañon walls rise 4,000 or 5,000 feet above its surface. Nearly all the streams which flow into it are small, and tumble over its walls in a series of cascades. There is but one stream of magnitude, Railroad creek, which is tributary to it. This, which is upon the west side, heads in the divide of the Cascade range, among the high peaks, where its sources are fed from living glaciers and its valley is a glacial gorge.

Near its upper end the lake is narrow and its depth increases gradually, but about midway of its length it reaches a depth of fully 1,400 feet, its bottom being, therefore, 300 feet below sea-level. Thence its depth diminishes gradually to its lower end, but not as regularly as it increases. The rock walls which enclose the lake are strikingly parallel to one another. The high mountains which border it at its head extend down nearly to its foot, and then suddenly break away to the lower country, first upon the east side and then upon the west.

The dam by which the lake is formed is the terminal moraine of the glacier. The lake is now drained by a stream which has cut through this terminal moraine, and after a short course of three miles and a descent of 400 feet joins the Columbia. Above the present outlet are indications of former outlets of the lake in the shape of coulées, cut through from the west, or rather south, side of the lake to Columbia river. The lower of these, Knapps coulée, which leaves the lake at about three miles above its present outlet, has an elevation, at its summit, of about 300 feet above the present level of the lake, with a sharp descent to Columbia river at its lower end. The other leaves the lake at a point about 10 miles above its present outlet, and is much

MOUNTAINS BORDERING ON LAKE CHELAN

lower, its summit being only about 100 feet above the present lake level.

Lake Chelan is not difficult of access. The traveler leaves the Great Northern railway at Wenatchee, on Columbia river; thence twice a week a little steamer stems the swift current of the Columbia for forty miles, to the mouth of Chelan river, and a stage covers the remaining three or four miles to the outlet of the lake, where is situated the little town of Lakeside. On the days when the steamer does not run on the Columbia the journey from Wenatchee to Lakeside may be made by stage. The lake is traversed by a small steamer which, leaving Lakeside in the morning, reaches Stehekin, at the head of the lake, where there is a hotel, late in the afternoon, returning the next day. On the shores of the lower part of the lake there are numerous ranches, but within the mountain portion the only signs of habitation are a few landings, and above Stehekin there are no settlements, and travel in this region must be upon horseback, with pack train.

TYPICAL VIEW FROM A BOAT ON LAKE CHELAN

FREDERIC W. PUTNAM,

President of the American Association for the Advancement of Science; Fiftieth Anniversary Meeting, Boston, 1898

The presidency of the American Association passed last month from a chemist to an anthropologist, and that of the British Association from an anthropologist to a chemist, and there are no more illustrious rolls in the scientific annals of the world than those upon which the names of Gibbs and Putnam, Evans and Crookes are now inscribed. The election of Professor Frederic Ward Putnam as President of the American Association was an event of more than ordinary interest and satisfaction to American scientists, Professor Putnam having not only established his claim to such recognition by forty years' scientific work of the highest character, but also won the admiration and regard of scientific men everywhere by the signal ability, the marvelous tact, the untiring zeal, and the unfailing courtesy with which he has served the cause of science for the long period of twenty-five years as permanent Secretary of the American Association.

Frederic Ward Putnam was born in Salem, Massachusetts, April 16, 1839. His immediate ancestors were the Putnams, Fiskes, Wards, and Appletons, who came from England during the first half of the seventeenth century. Young Putnam received private instruction until 1856; and as he displayed unusual aptness for the study of natural history his parents afforded him every facility for the pursuit of his favorite study. When he was but sixteen years of age he had compiled a "Catalogue of the Birds of Essex County, Massachusetts," and about the same time he was made curator of ornithology in the museum of the institute.

At this time the attention of Louis Agassiz was drawn to the young man's devotion to natural history, and through his influence Putnam went to Cambridge, where he entered the Lawrence Scientific School, intending to devote himself to medicine. This intention was not carried out from the fact that he was soon made assistant in the Zoölogical Museum and afterward appointed curator of the Peabody Museum. His natural aptitude for scientific pursuits, aided by the excellent methods imparted to him by his friend and master, Agassiz, prepared young Putnam in a most admirable manner for his life work in science, and from the day of his acceptance of the position in the Essex Institute he has always been in demand for places of honor and trust in scientific work. In 1859 he was made curator of ichthyology in the museum of the Boston Society of Natural History. In 1864 he became director of the museum of the Essex Institute, and three years later was made superintendent of the East Indian Marine Society's museum, and when the Peabody Academy of Science was established he was made director of the academy. In 1873 he was elected permanent secretary of the American Association for the Advancement of Science. In 1874 he was appointed member of the Kentucky geological survey for the special investigation of the caves of that state. In the summer of the same year he was for a time instructor in the school for natural history at Penikese, and in the fall, on the death of Professor Jeffries Wyman, he was called to the charge of the Peabody Museum. In January, 1875, he was formally appointed curator of the museum. The next summer found him again in charge of the department of fishes in the Museum of Comparative Zoölogy, and for two years he divided his time between this institution and the Peabody Museum.

In 1876 he was appointed by the government to report on the collections made by the survey west of the one hundredth meridian, which report was finished in 1879. In 1887 he was elected president of the Boston Society of Natural History, retaining the office two years. In 1882 he was appointed state commissioner on inland fisheries by Governor Long, in which office he remained for seven years. In 1886 he was appointed to the new chair of American Archæology and Ethnology in Harvard University. Since 1890 he has been president of the Boston branch of the American Folk-Lore Society, and in 1891 was president of the parent society. In 1891 he was made chief of the Department of Ethnology at the Chicago exposition, retaining this office until the fair closed. In April, 1894, he was appointed curator of the Ethnological Department of the American Museum of Natural History in New York, and his time is now divided between the institution and the Peabody Museum in Cambridge.

Until 1876 Professor Putnam was an ardent worker and an authority in zoölogy, making for himself an enviable name by his constant and conscientious work; but since that date his efforts have been in the department of ethnology. His interest in these studies was aroused as early as 1857, when during a visit to Montreal he dsicovered a shell-heap and on investigation determined it to be the site of an ancient habitation. He was one of the first in this country to attribute these relics to man, and since that time he has personally explored shell-heaps, burial mounds, village sites, and caves in various parts of North America, and has directed extensive explorations in the United States and Mexico and in Central and South America. He has been the director of large bodies of assistants in ethnological and somatological investigations, the results of which are evidenced in the collections in the Peabody Museum, the American Museum of Natural History in New York, and the Field Columbian Museum in Chicago. In connection with these researches he has published more than three hundred papers. He was the originator of the *Naturalist's Directory;* he was one of the founders of the *American Naturalist* and an editor of it till 1874. He has edited the reports and proceedings of at least a dozen societies and institutions, and has contributed not a little to the more popular magazine literature of the day. J. H.

MESA VERDE

By F. H. Newell,

Chief Hydrographer, U. S. Geological Survey

The Mesa Verde, situated in the extreme southwestern corner of Colorado, has been made known through the beautifully illustrated book of Nordenskiold, entitled "The Cliff Dwellers of the Mesa Verde." Besides ethnologic interest, it has many attractions for the geographer or geologist. It is a remnant of an ancient plain which formerly stretched southerly and westerly from the country where now are situated the high La Plata mountains. During the course of geologic time the same force presumably which uplifted the La Platas tilted this plain and, erosion being facilitated, it was deeply trenched, until now the Mesa Verde stands as a great table-land slightly tilted toward the south, presenting to view from all sides sharp precipitous edges. On the north is the bold promontory known as Point Lookout, facing toward the La Plata mountains; on the west is the broad Montezuma valley, drained by tributaries of McElmo creek; on the east is the valley of Mancos river, and on the south the narrow canyon through which Mancos river discharges on its way from the La Plata mountains to San Juan river.

Standing on the southern edge of the Mesa Verde and looking across the deep canyons of the tributaries of the Mancos, it is seen that the same plain extended originally far to the south into New Mexico; but what appears to be a level surface is found upon traversing the country to be a land deeply dissected and almost impassable except along the flat-topped ridges or valley bottoms.

The Mesa Verde derives its name from the fact that its top is densely covered with a growth of cedar and piñon trees, contrasting with the arid and almost desolate lowlands. In viewing the mesa from a distance and in going around it the impression is derived that its surface must be a plain, but upon laboriously climbing to the top of it it is found that it is in reality more like a hollow shell. The whole interior has been dug out, not in one great valley, but in almost innumerable small narrow canyons, which converge toward the south and enter the Mancos. The plan of the surface of the mesa would give the appearance of a number of fingers stretching up from the south and spreading out toward the northern end. In other words, the fingers of time have, as though drawn from north to south, dug out the long narrow valleys, leaving only thin parallel ridges rising almost to the original height. Traveling along the top of these ridges is easy, as the surface is smooth. Numerous cattle trails wind in and out among the trees, and on horseback the ground can be covered as rapidly as the rider can dodge the stiff-pointed, dead, lower branches of the trees; but in attempting to go from side to side it is found to be almost impossible to make progress. Reaching the edge of a precipice, the explorer wanders up or down until by chance he finds a place where the rock has been broken down, and on reaching the bottom of the valley he must again search perhaps for miles for an opportunity to climb out.

About the only sure and practicable way of visiting various parts of the mesa is to ascend near its upper edge, at Point Lookout, and then keep on this narrow rim, in this way passing around the head of the different finger-like gorges. There is here a trail traveled by pack animals. At places the ridge is so narrow that the rider looks down almost vertically on one side into the Montezuma valley and on the other into the head of the small canyons that lead to Mancos river. A misstep would throw a pack animal far down either slope.

The peculiar form of the mesa is due largely to the existence of a heavy bed of sandstone which forms the top-capping and protects the softer underlying rock. This weathers and cracks in almost vertical cliffs all around the outer edges. In the interior of the mesa, however, at the head of the numerous small canyons, erosion has proceeded in a peculiar manner, and one which was found by the aborigines to be highly favorable to their purposes. Along the edges near the top of the canyon certain portions of the sandstone have weathered, leaving great shelves, protected above by the overhanging masses. These shelves can be reached often with great difficulty, as the cliffs below them may be 100 feet or more vertically, and access from the top is almost impossible. The roof of these openings gradually slopes down to the floor, so that these great horizontal crevices or caves, as they are sometimes called, may extend back 50 or 100 feet, and in length may stretch for several hundred feet.

Around and on the mesa are found numerous fragments of pottery or of chipped stone, and here and there mounds of refuse, showing the location of ruined houses or towns. The innumerable objects testify to the former presence of a large population. Ruins of stone towers on prominent points show that the arts of defense were an important feature of their life. It is, however, under the shelter of the great overhanging rocks that we find the ruins almost in perfection. Here, in the dry climate, protected from the occasional fierce storms, the dust of centuries has accumulated, and even organic matter has hardly undergone any change. The great stone houses and towers rise story upon story, and behind, in the piles of refuse thrown in the part of the cave where the roof approaches the floor, are the worn-out sandals, the broken pottery, and all the rubbish of a town. Here, evidently, were kept great flocks of turkeys, and in the rubbish sometimes graves were made, the bodies now being dried to the condition of tough leather, being perfectly preserved mummies. The clothing on these, such as the feather robes, has retained its texture and even in places its color. No fragments of metal have been found, but all the implements are of bone, wood, or stone.

The buildings are constructed of carefully squared rock, each of which must have been brought some considerable distance up steep ladders or along the narrow trails which lead to the towns. Water was had in some cases by small springs or seeps within the rock; in others it was brought in earthen jars, carried, presumably on the heads of the women, from the springs far down in the valley. The foot and hand holes cut in the rock still show the path by which the dwellings were reached, but in places these terminate on overhanging cliffs, where it is obvious that ladders must have been employed.

These ruins have been an object of superstitious dread by the Utes and other Indians living in the neighborhood and have not been disturbed by them through centuries; but with the advent of the white men destruction has come, and many of the finest have been wantonly pulled to pieces or injured in the search for relics. In particular an estufa or council chamber situated below the surface of the ground and the only one remaining in perfect condition was partially pulled to pieces in order to take some of the logs of the roof to exhibit at the World's Fair at Chicago. Various individuals have made a business of collecting the pottery from these ruins, rifling the graves and selling the material thus obtained to tourists or to collectors of curiosities. Several museums have sent exploring parties into the vicinity and have obtained material for exhibition. Although these ruins are presumably the property of the National Government, little, if anything, has been done to preserve them, and the National Museum possesses comparatively few objects from this locality. It is a matter of regret that these interesting ruins are not being preserved, as even from a commercial aspect they would have an ever-increasing value to that part of the State in attracting tourists from all over the world. In spite of the difficulties of access, it is estimated that at present 75 parties a year visit the more important of these cliff-houses. The trip is made from Mancos, a town on the Rio Grande Southern railway, a day being spent in reaching the ruins on horseback, another day or more in visiting the ruins, and the greater part of one day in returning to the railroad. It might be practicable to construct a wagon road, but no steps of this kind should be taken to facilitate travel until ample protection is provided to prevent the defacing and injury of the buildings by careless visitors.

THE GEOSPHERES *

By W J McGee,

Vice-President of the National Geographic Society

Perhaps it is my first duty, as it is a privilege, to offer you a word of welcome on behalf of the Society which I have the honor to represent—one of the institutions of the National Capital engaged in its own way in educational work. Speaking for that Society, Mr President and ladies and gentlemen of the National Educational Association, I bid you cordial welcome to Washington, and place at your disposal all the facilities which are ours.

Before leading you away from the earth's surface, which has been so admirably described by the last speaker, I wish to confess that I labor under a certain embarrassment. In the first place, I am attempting to speak for another man, and on his subject. The subject was chosen by Major J. W. Powell; first an educator like most of you; then a soldier who left an arm at Shiloh; next the explorer of Colorado canyon, the boldest piece of exploratory work in the history of our country; then a geologist and long Director of the U. S. Geological Survey; at the same time an ethnologist and founder of the Bureau of American Ethnology; and from first to last a philosopher, one of the most vigorous thinkers America has produced. It is but natural that I should shrink from discussion of a subject developed by so original a thinker and selected by him for presentation before you in his own inimitable way.

Again, I belong to the class of knowledge makers who most feel their own limitations in appearing before those who assimilate and apply knowledge, placing it within reach of the people and thereby performing the real work of raising humanity from plane to plane as time goes on. I apprehend that my ideas may seem vague and my expressions obscure, but I confidently appeal to your intelligence to aid in making the ideas clear and useful to the multitude of American youth for whom you stand sponsors.

* An address delivered before the National Educational Association, Washington, July 9, 1898.

First as to definitions—definitions rendered the more necessary for the reason that the essential ideas which I wish to express have not yet found their way into the dictionaries. Since early in the history of knowledge, men have recognized the *atmosphere—i. e.*, the body of air above the earth. At first the recognition was vague; it became more and more definite as time went on; and now educated men and women and children know the atmosphere as a gaseous envelope surrounding the solid earth, an envelope composed of a complex mixture of substances, chiefly of oxygen and nitrogen. This atmosphere is one of the geospheres, the outermost of four.

Since the beginning of knowledge, too, men have perceived the waters of the earth; and, as time has gone on, they have recognized more and more clearly the substantial unity of the standing waters of ocean and bay and lake, the running waters of springs and rivers, and the solid waters of Arctic and Antarctic snows and the glaciers of mountain and pole; and they are coming to extend the unity to include the aqueous vapor of the air, one of the constituent gases of the atmosphere. Water is a definite mineral substance existing in three forms, as solid, liquid, and gas, though chiefly in the second form; it constitutes a *hydrosphere*—the second of the four geospheres—covering the greater part of the solid earth and covered by the greater part of the atmosphere.

Human knowledge began with the recognition of the solid earth; as time passed the knowledge became definite through the endless interactions between human mind and human environment; and today most intelligent people recognize a terrestrial sphere beginning with the soils and rocks beneath their feet, passing beneath river and lake and ocean to the antipodes, and extending from equator to pole in a spheroidal mass forming the visible solid part of our planet. Now it is only the superficial portion of this spheroidal mass which lies within reach of observation; this is the rocky crust of the earth, the object-matter of the science of geology; it consists of a wide variety of mineral substances, mainly combined in rocks of a specific gravity averaging about 2.70. This earth-crust forms the lands of the earth and the basins of the oceans; all of the geographic and topographic features so well described by Dr Redway are built up or carved out of it; the continents, the islands, the valleys, the mountains of the world represent this vast mass of rock-matter, which it is convenient to call the *lithosphere*—the third of the four geospheres.

While observation of terrestrial things ends with the atmosphere and hydrosphere and lithosphere, definite thinkers find it necessary to form some idea of the constitution of the interior portions of the planetary mass at depths below the reach of direct vision. Now knowledge of the earth's interior is gained not through geology but through the sister science, astronomy. You are aware that within recent years astronomers have reduced to system our sun, the planets and asteroids which circle about it, the satellites which follow the planets, and the long-mysterious rings of Saturn—the various constituents of our solar system; and the paths of the planets and satellites have been surveyed, while each of the bodies has been measured and weighed, so that their volumes and densities are known with considerable accuracy. Let me indicate the accuracy with which this astronomical work has been done by saying that sun, planet, and satellite have been weighed with an accuracy no less than that of the grocer in dealing out sugar and tea, and that the orbits of planets, satellites, and asteroids have been surveyed as accurately as the roadways and even the railways of the earth's surface. The earth itself has been weighed, with somewhat less accuracy than the other planets, it is true, yet with sufficient accuracy to indicate that its mean density is nearly six times that of water ($5.6 \pm$), or more than twice that of the known lithosphere. Accordingly it is known beyond peradventure that the earth has an interior portion much denser than the known exterior; and this somewhat vaguely defined part of the earth may conveniently be called a *centrosphere*—the innermost of the four geospheres.

In the light of these definitions, you will understand that my object in coming before you is not so much to say new things as to try to establish a new point of view. Knowledge progresses in two ways which are interrelated yet fairly distinct; the first is analysis and the second is synthesis; the sum of knowledge is increased by analysis, while its quality is improved by synthesis. I am now attempting, not to bring new facts before you, but to put old facts together in a new way, and thus to carry you to a higher plane in the synthesis or generalization of a wide range of observations; and I am seeking to do this in such manner as to reflect the workings of another man's mind—the mind of the real author of this address.

Let us now consider the relations between the geospheres.

In the first place, the matter of the geospheres is unlike in state or physical condition. The atmosphere is almost wholly gaseous; the hydrosphere is for the most part liquid, though in part solid and in small part gaseous; the lithosphere is almost wholly solid, though a minute part is gaseous (chiefly as impurities in the air), while a small part may be liquid under temporary and local circumstances; for the present the centrosphere may be considered a transolid. Thus the four geospheres represent the three well-known states of matter, together with a fourth state which is not certainly known from direct observation. It is the marvelously delicate interrelation between the three exterior geospheres that gives character to the earth as the theater of life and the home of humanity; for plant and beast and man are alike dependent on the lithosphere for the solid part of their bodily substance, on the hydrosphere for the greater part of their sustenance, and on the atmosphere for the breath of life.

In the second place, the exterior geospheres at least are, despite the differences in physical condition, in some degree intermixed. The greater part of the atmosphere floats over the waters and lands of the earth as a thin mantle growing more and more tenuous outward; an early estimate of its thickness was forty-five miles, but the American physicist Woodward has recently shown that the outer portion is much less dense than at first supposed, and that the total thickness of the mantle exceeds the radius of the solid earth. A small part of the atmosphere is intermixed with the waters of the hydrosphere, especially the running waters of rivers and brooks; another part pushes down into the lithosphere, filling interstices in the rocks and playing an important role in the chemical and physical changes ever proceeding in the earth-crust. In like manner, while the greater part of the hydrosphere exists in the oceans, lakes, rivers, snow-fields and glaciers, a considerable volume rises far into the atmosphere in the form of aqueous vapor, and a much greater volume permeates the lithosphere as ground water or in still more intimate combination with the solid earth-substance. So, too, the material of the lithosphere is in small part dissolved or suspended in the waters or afloat in the air; at the same time there is an obscure interrelation between the lithosphere proper and the centrosphere, manifested in volcanic and other phenomena and perhaps in the presence of metals among the rocks, for there are certain reasons (which cannot now be set forth) for regarding the centrosphere as an aggregation of metalloid substances, much as the lithosphere is an aggregation of lithoid substances. The blending of the exterior geospheres is especially intimate where the three are in normal contact, *i. e.*, about the terrestrial surface on which men live and with which geographers deal; and the soils, the plants which subsist on the soils, the animals which consume the plants, and the crowning human organism which dominates all the others are products of the commingling.

Just as the geospheres are intermingled in material, so they are, in some measure, interrelated in normal movements. The atmosphere is an aerial ocean, ever astir with currents due primarily to the rotation and revolution of the sphere, *i. e.*, to movements depending on the density and volume of centrosphere and lithosphere; the waters of the ocean are evaporated into the atmosphere, carried far in its currents as aqueous vapor, and then precipitated to flow back again as fresh water, while the body of the ocean is enlivened by currents set in motion by the ever-moving atmosphere as well as by tides produced by rotation and revolution; the lithosphere is constantly destroyed and reconstructed by the moving waters of the hydrosphere, while the earth-crust is warped and continents are lifted and sea-bottoms depressed by the obscure but potent movements of the centrosphere. So the normal movements of the geospheres are interrelated; and most of them, from the rhythmic rise and fall of the earth-crust through which continents are lifted and submerged to the trade-winds and oceanic currents, may be traced to the motions of the centrosphere.

Let us now consider for a moment how the conditions and motions of the exterior geospheres would be affected by circumstances which, at first sight, might seem trivial; for thereby we may see more clearly how delicate are the interrelations on which terrestrial life and human activity depend. Suppose the temperature of the earth were raised, say, 200° F., what would follow? Your common sense, born of experience, tells you that much or all of the hydrosphere would cease to exist as such and become a part of the atmosphere; that the atmosphere would thereby be multiplied in volume and density, changed in substance, and modified in movements, yet that the lithosphere would remain substantially unchanged save that some of its substance would be dissolved in the densified atmosphere. Probably the centrosphere would not be greatly affected; yet even so slight a change in circumstance as an increase of temperature by only 200° would remove the hydrosphere from the earth and greatly modify the atmosphere.

Let us next consider the effect which would follow the reduction of the temperature of the earth by, say, 400° F., something we should have been unable to do a generation ago, but which we can now do easily by reason of recent experiments and discoveries in physics. You will remember that about a score of years ago Cailletet of France and Pictet of Switzerland began to liquefy different gases by the application of pressure at low temperature; many of you know that this line of experimentation was continued by the distinguished chemist and physicist of London, Dewar, who liquefied one gas after another until every gaseous substance known to man, including hydrogen, has been reduced to the liquid state; and I am sure many of you know that an American, Tripler, has recently improved on the work of our European cousins and has learned to liquefy air in large quantities, at low cost, by the skillful application of pressure and artificially reduced temperature. Tripler's work, by the way, is worthy of more than passing note, for his advance has given mankind a new hold on the powers of nature, with a promise of practical applications yielding benefits much greater than were promised by electrical control when inventors first began to utilize electricity for mechanical and other purposes; but this is a digression. Now, liquid air is a little lighter than water and boils or evaporates at about 312° below zero, F. So we know that if the temperature of our planet were to be reduced by 400° the atmosphere would cease to exist as such and would shrink to one eight-hundredth of its present bulk and be converted into a hydrosphere; we know, too, that long before the reduction was completed the hydrosphere would cease to exist as such and would become a part of the lithosphere, for the waters of ocean and lake would be congealed (as we know from Tripler's experiments) into a dry powdery mass of crystals, crumbling under blows or pressure just as granite and limestone and other rocks crumble at our present temperature; the waters would become rock added to the rock which now exists. By this transformation the volume of the lithosphere would be augmented by that of the present oceans, the present sea-level would become sea-bottom, and a lighter sea of liquid air (only a dozen or a score of yards in depth) would wash the frozen globe, leaving continents and islands rising above its surface in a geographic configuration differing not greatly from that of the present. Over this globe no air would float, save possibly a light vapor scantier than the aqueous vapor now borne in our atmosphere; and no man or beast or plant, no trace of life could exist.

Consideration of the profound modification in the exterior geospheres necessarily following changes in temperature which can only be considered as slight in comparison with the wide temperature range even of our solar system aids us in understanding something of the conditions which attended the early stages in the development of our planet. The earth as a whole is apparently a cooling body, though the rate of cooling may be—indeed must be—almost infinitesimally slow. So the planet primeval must have been warmer, a greater part of its water must have been afloat as vapor in the atmosphere, which must have been heavy with vapors and the fumes of solids soluble in hot water. In like manner the changes necessarily produced in the geospheres by diminished temperature enable us to take a long look into the future and foresee the fate which awaits the aging planet—unless, indeed, this fate may be averted by aid of human ingenuity. There are many indications that the mechanism of the solar system, and, indeed, of the stellar system, is running down. We know that the water of the earth is going into new combinations from time to time as a constituent of the rocks of the lithosphere; we know that the water area of the globe is diminishing from age to age as the eons run, for the clastic deposits with which geologists are most concerned were laid down in water, while those now forming are largely if not mainly accumulated on land; there are deserts on every continent today, while the record of geology indicates that during the Carboniferous and earlier ages all the lands of the earth were fertile and humid. And just as the hydrosphere is going into the lithosphere by chemic absorption as well as by interpenetration, so the commingled oxygen and nitrogen of the atmosphere are slowly seperating and combining with the substances of the lithosphere, and probably also with the substance of the hydrosphere. The changes yield a glimpse of planetary history; they suggest a time when the now deep-buried centrosphere was enveloped only by heavy atmosphere, with no lithosphere save possibly its own scums and slags, and no hydrosphere save possibly viscid lakes of its own substance half liquefied by relief from pressure like the lavas of later time; they raise visions of slowly segregating waters and accumulating rocks formed through interaction between the condensing atmosphere and the cooling centrosphere; they indicate the differentiation of the geospheres in nice adjustment to temperature and other conditions. The changes indeed give a threat of ultimate absorption of air and water into the rocks, leaving a dead planet of centrosphere and lithosphere only, swinging helpless through space like our frozen moon; yet there is a faint promise in a fifth geosphere produced through delicate interaction among the three exterior spheres of the earth, lying about the common boundary of the three, dependent on all, yet able (at least in some measure) to control their relations—a *psychosphere*, comprehending the scanty but potent and ever-growing mantle of thought which today envelops the world.

Just a few words more, if you please, concerning the general relations among the geospheres: The atmosphere is a body of gas conditioned primarily by temperature; the hydrosphere is a volume of liquid conditioned by temperature and gravity; the lithosphere is a shell of rock conditioned by temperature, gravity, and a more complex chemic affinity than is found in the mixture air or the compound water; the centrosphere is a transolid and probably metalloid body, conditioned in ways that are not well known; the several geospheres combine to form a planet conditioned by temperature, gravity, chemic affinity, and perhaps other agencies, which extend to other planets and satellites and suns of the cosmos. So the features of the geospheres, *i. e.*, the characteristics of our planet, are largely determined from within; yet it is not to be forgotten that each geosphere contributes to the making of the others, and thus to the molding of the planet and in some measure to the shaping of the cosmos. This has already been indicated incidentally.

Let us now proceed to consider a few of the special relations among the geospheres which affect cosmic economy: We have good reason for supposing that the earth is a cooling body, that some of its primeval heat is constantly passing into space to affect (howsoever infinitesimally) other bodies; but do we know why the temperature of the earth is not lowered more rapidly—why the lowering is so slow as not to be detectable by the observations of history? We know that if the earth were simply a ball swinging through interstellar space and cooling by the radiation of its heat into space it would soon be refrigerated; we know too that in this case the temperature of its surface would be determined solely by two factors, viz: (1) the temperature of the ball itself, and (2) the temperature of interstellar space. Now, on examining our planet as an actual thing and not as a figment of the imagination, we do not find that the temperature of its surface is determined, or even perceptibly affected, by its own proper heat; we do find that the temperature of the external earth is determined by the heat received from the sun. It follows, of course, that the earth is not merely a cooling ball suspended in cold space. On examining more critically the conditions determining our temperature we find there are two, viz: (1) insolation or accession of solar heat, and (2) conservation of a considerable part of this heat for a time by a terrestrial mechanism. This mechanism resides chiefly in interrelations among the exterior geospheres. The most important conservative agency is the aqueous vapor of the air, which not only stores quantities of heat to be given off on condensation, but serves to check radiation from the earth into space. When the sun shines on the ocean, a film of water is evaporated to be borne high in the clouds and carried far over the mainland; when it is condensed a part of its heat is employed in raising the temperature of surrounding air, water, and rock; so that water, chiefly in the form of vapor, stores heat more effectively than any other substance with which we are acquainted. Still more efficient is aqueous vapor as a blanket checking evaporation; dry air is diathermous, but vapor-laden air checks radiation from the earth as a garment checks radiation from the body. Since there is no part of the earth, even on the deserts and polar ice-fields, in which there is not an appreciable quantity of aqueous vapor in the air, this substance forms a clothing for the earth, determining its temperature, rendering it habitable, and making it what it is today, the stage of human activity.

There is another class of special relations between the geospheres which I should like to bring before you, partly as a new discovery. As before pointed out, the rocks of the earthcrust or lithosphere are permeated by water in the form known technically as ground water or phreatic water. Now one of our most distinguished geologists, Professor Van Hise of the University of Wisconsin, has recently shown that this ground water plays an important role in changing the texture and structure of rocks, especially at depths where the pressure is great and the temperature higher than at the surface. It is a well-known property of water to dissolve certain substances, and its efficiency in dissolving many rock-substances is greatly increased when the substances are subjected to pressure and heat; and, under these conditions, it also ionizes complex substances—*i. e.*, separates them into their simple components or ions. Accordingly when moist rocks are subjected to strong pressure at high temperature, as is frequently the case deep in the earthcrust, the rock-matter is dissolved at the points and planes of greatest pressure and precipitated or redeposited at neighboring points and planes of less pressure; so that, for example, a crystalline cube of wet and hot rock-matter may be permanently distorted by long-continued pressure on opposite faces, the crystals gradually yielding to the stress in the direction of pressure and elongating themselves in the orthogonal directions. Through its property as a dissolving and ionizing agent, that portion of the hydrosphere which penetrates and suffuses the lithosphere has determined the texture and structure of most of our rocks; it has transformed the muds and sands and slimes of original deposition into shales, sandstones, and limestones; in some instances it has reconverted or metamorphosed these rocks into schists, quartzites, and marbles; still more significantly it has aided in remetamorphosing deep-seated rocks into lavas and other crystallines. This extreme effect of water is peculiarly instructive in that it reveals something of the character of the centrosphere, whose dense materials are brought within reach of observation only by water as a solvent and sublimant in the form of lavas, vein-stones, and other rocks of hypogean origin. There is reason for regarding the atmosphere as a differentiating and dissipating factor, and the hydrosphere as a unifying and conserving factor, both interacting with the centrosphere in such manner as to develop the lithosphere and convert it into the terrestrial home of humanity; but this relation need not be pursued for the present. Yet it is worth while to note a curious relation between lithosphere and centrosphere which is apparently controlled by the waters both of the surface and the depths: The two inner geospheres are in unstable equilibrium; this is shown by the occasional escape of the deep-seated materials from the foundation of the lithosphere (if not from the centrosphere itself) in the form of extruded lavas and sublimated vein-stones; it is shown also by the interminable heaving of the centrosphere manifested in continental oscillation and, to some extent, in the uplifting of mountains; it is indicated further, in still more interesting though obscure fashion, by the apparent reduction of loose-textured solids to the denser transolid condition in provinces subject to loading through deposition of exceptional volumes of sediment—*e. g.*, the Gulf of Mexico, the world's most notable province of loading, whose configuration suggests a hypogean "slump" which may be imitated experimentally by pouring a few drops of heavier and cooler liquid into a viscid liquid at the critical (or boiling) point; but this most interesting relation may also be passed over for the present with the simple suggestion—made by many phenomena—that the solid lithosphere and transolid centrosphere appear to be interconvertible at a critical point of temperature and pressure, much as the atmosphere and hydrosphere may be considered interconvertible in state and in substance on passing a critical point conditioned by the same factors, and that the hypothesis of interconvertibility explains some of the most puzzling facts in geology.

There are other interrelations between the geospheres, interrelations innumerable; time will not permit me to mention a tithe or even a hundredth part of them; yet there is one more relation which appeals strongly to those geographers who, like myself, always see the lands and the waters from the human standpoint, and I beg your indulgence for the three minutes required to set it forth briefly. My predecessor, Dr Redway, has admirably defined for you the natural provinces of America, and shown you that the features of the land, formed during the ages by the work of running waters, shape the character of our people. I trust he will permit me to add a word to his theme, as well as to that of the thinker for whom I am speaking: In what we call the western hemisphere the land and the waters are so related as to form a broad continent, the North American continent, mainly in the North Temperate zone; during the ages the centrosphere has heaved and sunk according to its wont, and has interacted with the atmosphere and hydrosphere in such manner as to produce a lithosphere of far-reaching formations, crumpled here into mountains, stretching there in broad plains, modified everywhere at the surface into fertile soils, charged often at the depths with mineral treasures—the whole a rich patrimony wasted on unintelligent aborigines until men of thought and action came to claim it. Then, since the lands were broad and fertile, agriculture spread more rapidly than ever before, more rapidly than would be possible under other conditions; next the magnificent distances and rich produce compelled improved transportation facilities, and steam was harnessed more effectively than would be possible under other conditions. Meantime the broad problems presented by a broad land widened the views of men already inspired by political freedom, and America became a nation of inventors, a people of applied science; geography was studied more broadly than would be possible in a petty province; it grew into a science of geology, inspired by the breadth of the formations and their wealth in resources, guided by intelligence broad as the land, and today the geologists of this country lead the world in their science. The sister sciences were invigorated by the association. I have said that the solar system has been weighed and measured with unparalleled accuracy during recent years, and may now add that the work was done by American genius, and that today the shipping of the civilized world is guided by nautical almanacs based on this American work. Another science, regenerated in America by reason of favorable conditions, is anthropology. We have had better opportunities than the students of other countries for research concerning mankind; we have in Washington and in other cities representatives from every important country on the face of the earth, representatives of every living race, of every blood in human veins; then we have a wider range of culture constantly before us than any other nation, a range running from savage aborigines through barbaric tribes up to the representatives of the kingdoms and empires from other countries, and finally to our own enlightened people, standing on the highest plane which mankind has ever attained—the plane on which social organization is based on intellectual freedom. We have every stage in human culture before us, and hence have been able to develop a broader and profounder science of anthropology than the world has seen before. Especially during the last half century our country has sprung forward in the race for intellectual attainment, surpassing all other nations; and our application of scientific principles has kept pace with our development of knowledge. Today if English promoters in Egypt want locomotives furnished on short notice, they send to America, knowing that, despite the doubling in distance, the order can be filled more quickly than at home; today if a bridge is to be built more rapidly than the engineers of other countries can do it, American engineers are called to the task. Our progress in application has combined with our progress in knowledge to strengthen individual character, to produce a free and forceful individuality greater than other countries know—an individuality splendidly expressed in the faces before me. This exalted individuality is displayed in more perfect coördination of thought, in more complete union of hand and brain than the world has ever seen before; it is revealed in moral uprightness and strength of character, in personal courage, even in that splendid marksmanship—the highest expression of coördination between mind and muscle—which is America's latest revelation to the world. The individual character of Americans gives national character to America; our patriotism, the spontaneous product of free minds, is broader and deeper than any sentiment brought out by royal edict; no other country could match the recent impulse which prompted the millionaire clubman of New York and the roving cowboy of Arizona to stand shoulder to shoulder in a war for humanity's sake. It is the unequaled individuality of the free citizen, united and controlled by a dominant idea, that forms the basis of our indomitable social organization, a social organization faintly expressed by that coördination in army and navy which overwhelms opposition. Complete as is our coördination in military matters, it is much more perfect in civil life, in that unceasing conquest over nature toward which our deepest thoughts are bent; and our 70,000,000 individuals, each a tower of individual strength, are kept in touch by telegraph and telephone and press, united in thought and purpose, knit into the strongest social and political fabric the world has seen. It is this social fabric, the expression of thought and purpose, which I have in mind in referring to the psychosphere, most delicate yet noblest of the geospheres, which seems to be enveloping our planet and commencing the control of the rock-sphere, the water-sphere, and even the air-sphere for the good of humanity. And it is this conquest of the powers and resources of the exterior spheres, inspired by intellectual freedom and guided by liberal education like that which you dispense, that has placed America in the foremost rank among the nations of the earth.

PROPOSED COLLECTION OF FORESTRY STATISTICS

At a special meeting of the National Geographic Society, held in the Lecture Hall of the Boston Society of Natural History, Boston, Massachusetts, August 25, 1898, Vice-President W J McGee in the chair, the following resolutions were adopted:

Whereas, through the increasing consumption of forest products, the destruction of forests, and the vast extension of means of transportation, questions hitherto of restricted bearing are rapidly assuming grave international importance; and

Whereas the National Forest Association of Germany has undertaken to collect throughout the world forest information and statistics of commercial importance:

Resolved, That the National Geographic Society express its deep sense of the value to mankind of the work thus begun, and pledge its countenance and support to the investigation; and

Resolved, That a committee of three be appointed by the chair to communicate these resolutions to the National Forest Association of Germany, and to take such other steps as may be necessary to carry them into effect.

In conformity with the resolution, the chair appointed Mr Gifford Pinchot, of Washington, chairman, and Messrs William H. Brewer, of New Haven, and Arnold Hague, of Washington, as a committee to take requisite action on behalf of the National Geographic Society.

MISCELLANEA

It has recently been ascertained that the British consumption of sugar (1,566,000 tons per annum) is almost equal to that of France, Germany, Austria, Holland, and Belgium combined.

The import trade of Canada during the fiscal year 1897–1898 amounted to $140,305,950, an increase over the preceding year of $21,000,000. The exports had an aggregate value of $159,485,770, an increase of $25,482,000.

A Danish expedition to explore the east coast of Greenland between the 66th and 70th degrees north latitude sailed from Copenhagen on August 16, under Lieut. Amdrup. The ship, the *Godthaab*, has a complete scientific equipment and is provisioned for two years.

The Duke of the Abruzzi (Prince Luigi of Savoy) has added to his achievements in mountaineering by a successful ascent of the Aiguille Sans Nom, an Alpine peak that has hitherto defied the efforts of the most intrepid and determined explorers. The daring feat was accomplished on August 16.

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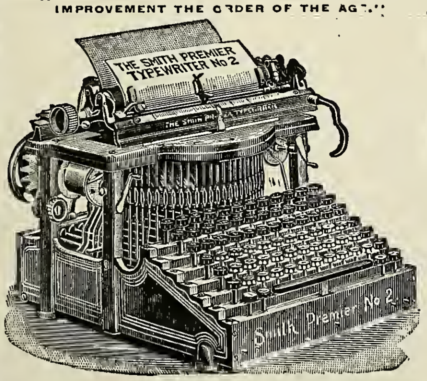
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Donations for the founding of Prize Medals and Scholarships are respectfully solicited.

THE

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SUMATRA'S WEST COAST

By David G. Fairchild,

United States Department of Agriculture

The island of Sumatra is undoubtedly one of the most valuable of all the Dutch possessions in the East. Its resources are almost wholly undeveloped and its interior is scarcely even known, only one or two expeditions ever having crossed the island in its widest part. It contains a great variety of mineral and vegetable products, and its trackless forests are filled with still unconquered tribes of men—remarkable cannibals among them—numerous rhinoceroses, and large herds of elephants. It possesses a chain of verdure-clad volcanoes which give to its west coast one of the most salubrious climates in the archipelago, and its scenery surpasses in beauty the famous scenery of Java, which has been called the most beautiful tropical island in the world. The island is held by a small force of Dutch and native soldiers and governed by a body of Dutch officials scattered along the coast cities, whose control over the natives is more moral than physical.

That such a marvelous island should have remained so long comparatively unexplored simply illustrates the slowness with which the work of exploration is being conducted by the Dutch home government, which hampers in every way the movements of the more progressive colonial government. As American interests in the East are increasing, the readers of this magazine may find acceptable a few notes regarding one of the largest and certainly the most beautiful island of the whole archipelago. Miss Scidmore has called Java the Garden of the East in her charming account of travel among its miniature bamboo villages and paddy fields. Sumatra is compared by the Dutch, although incomparably grander and totally different, to Switzerland. You approach Java with a feeling of how beautiful and lovable everything seems, but as you steam into Emma harbor, on Sumatra's west coast, your mind is overpowered by the sight of the verdure-covered volcanoes and trackless forests stretching away into the unknown and undiscovered.

ON THE WEST COAST OF SUMATRA — EARLY MORNING

The western coast of this wonderful island, famed among the Dutch as *Het Boven Land van Sumatra*, is as near a tropical Switzerland (if such an appellation does not convey a confused notion) as is to be found anywhere on the globe. New Zealand can boast of glaciers of surpassing beauty, justly entitling it to the place it holds as the Switzerland of the southern hemisphere, but I am confident that after the sources of the Amazon have been thrown open to the tourist and Orizaba has been surrounded by winter hotels, the most luxuriant vegetation and most wildly fascinating scenery in the world will be sought for among the chain of volcanoes that forms the backbone of Sumatra.

There are several ways of visiting Sumatra, none being very direct, but the pleasantest is to take one of the comfortable steamers of the *Koninklijke Paketvaart-Maatschappij*, either from the island of Penang, where tourists call going either way around the world, and steam west to the north point of the island and southward along its western coast to Padang, the principal port, or do as my friend Mr Barbour Lathrop and I did, leaving Batavia on the north coast of Java and steaming west through the straits of Sunda past the famous volcano of Krakatua and northward along the coast, stopping at Padang over one steamer and catching the next, which landed us finally at Penang. The city of Padang seemed on the first night of arrival one of the hottest and wettest places it were possible for water and sunshine to concoct; but where the sunlight pours down its rays perpendicularly and the clouds every afternoon empty an almost unlimited quantity of water, palms are able to live a life really becoming such royal representatives of the vegetable kingdom. You feel oppressed with the inconceivable power of the living matter, the protoplasm, which surrounds you. In temperate regions you have become accustomed to the supremacy of man. He cuts down and destroys and clears big patches of ground free almost of every living thing. Here you feel as if the plants merely tolerated your presence.

The hotels serve to distract your attention from nobler thoughts by their insufficiencies and limited capacity. I have often wondered what a party of Cook's tourists would do if they landed and found only four or five beds at the disposition of new arrivals and not sufficient bananas to go around. To be met at your first meal in the tropics when you look forward to reveling in the delicious new sorts of bananas with the incomprehensible statement of "*tida ada lagi*," which, being interpreted by your Dutch acquaintance, means "There are no more," is a hard and unforgetable experience, the more inexplicable since the level plains about the town are filled with immense banana plantations. One small banana is not enough for an appetite whetted by a long ocean voyage. This is, however, an introduction to one of the many peculiarities of the tropics which irritate you until you find the absurdity of being irritated by the unavoidable.

Padang as a town has nothing to recommend it. Its public buildings and houses are embowered in the most gorgeous tropical vegetation, but they themselves are plain, and look as if they were moth-eaten. Termites work rapidly upon the corner

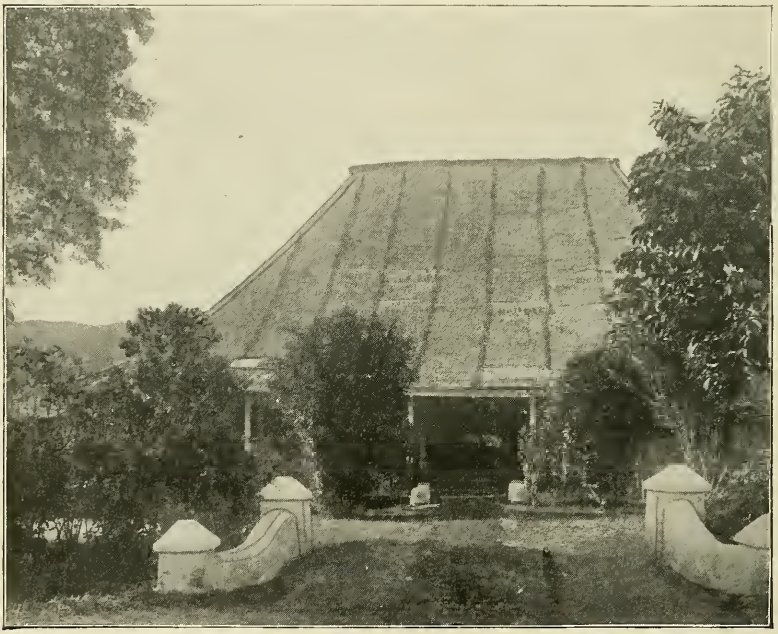
COURT-HOUSE NEAR PADANG PANDJANG, SUMATRA

posts, and decay soon makes new buildings old. Then, too, the malarial plasmodium finds in the region a most congenial home, and the pallid faces and slow gate of the Europeans tell too plainly of an unequal struggle between blood corpuscles and the invading army of parasites. I do not know that Padang is celebrated for its fevers, though it is certainly not a healthy place. But it is for other reasons that travelers do not stay long in Padang. As the terminus of a most remarkable mountain railroad, worthy of a Meiggs, one of the earliest cog railways ever constructed for freight purposes, it affords the traveler unrivaled opportunities to "get into the interior," as explorers express it. The Ombilin coal-fields send to Padang by means of this road the coal for the Netherland steamship line, which calls here both in and out bound. It is not a great way from this region that some of the petroleum fields have been discovered, which the Standard Oil Company tried in vain to get control of, being checked, so the newspapers report, by a suspicious paternal home government, which wishes to hold everything valuable in its own hands. Stretches of low swampy jungle line the track on both sides. Thickets of the Atap palm, with its creeping stem and rigid upright leaves, whose leaflets flutter incessantly in the slightest breeze, rise out of deep weed-overgrown pools, suggestive of all sorts of serpents, leeches, and water insects. Immense plantations of bananas, overgrown with masses of tangled morning glories, with their light-blue blossoms, have crowded out the more varied natural vegetation in places and stand as evidences of the cultural skill and indomitable energy of those greatest of all tropical colonizers, the Chinese.

But soon the train whirled us into the klof or gorge itself, and for several hours our eyes were busy with scenes of the most gorgeous freshness and beauty. The charm of tropical verdure is largely due, I believe, to the abundance of broad-leaved plants which it contains. Nothing illustrates this more than a comparison of such plants as the banana or talipot palm with a South African fine-leaved heath or a North woods pine. As individuals all are beautiful, perhaps equally so; but the water-colors of the tropics are painted in splashes and with a broad, free hand, while the foliage of the temperate regions is painfully etched on copper plate. This gorge is compared by the Dutch with the Gotthard Strasse below Andermatt; but they belittle it by such comparison, for the Klof van Aneh, with its countless waterfalls, rushing mountain streams, cloud-covered hillsides, and floating mists, added to its endless variety of flowering shrubs, feathery fern fronds, waving palms, and tall, imposing forest trees, makes a composition of the first rank among scenic masterpieces and entitles it to the first place on the line of the world's gallery.

Padang Pandjang, a village some 700 meters above the sea-level, with a comfortable hotel of brick and thatch, after the Dutch style, forms a most delightful stopping place just above the gorge. The natives here, although of the Malay race, are quite distinct from those of the island of Java or the peninsula of Malacca. They are a well-to-do, even wealthy race, and build costly houses of indisputable beauty, making them of teak or other wood, paneling them with great care, carving and painting them after patterns often of considerable taste and beauty. The roof structures, with their gables rising one above the other, resemble more those of the Siamese temples than any other

Oriental structures. The floors of nearly all sag in the middle and the ends of the houses are raised on high posts, frequently carved and sometimes filled with bamboo wickerwork. They are often communal in nature, as many as three or four families living in the same dwelling. In front of each dwelling-house stands a small square building, more highly decorated often than the house itself, which is used for a *goedang* or rice granary, and no native compound of houses is complete without such a *goedang*. The interiors of these houses are not without modern



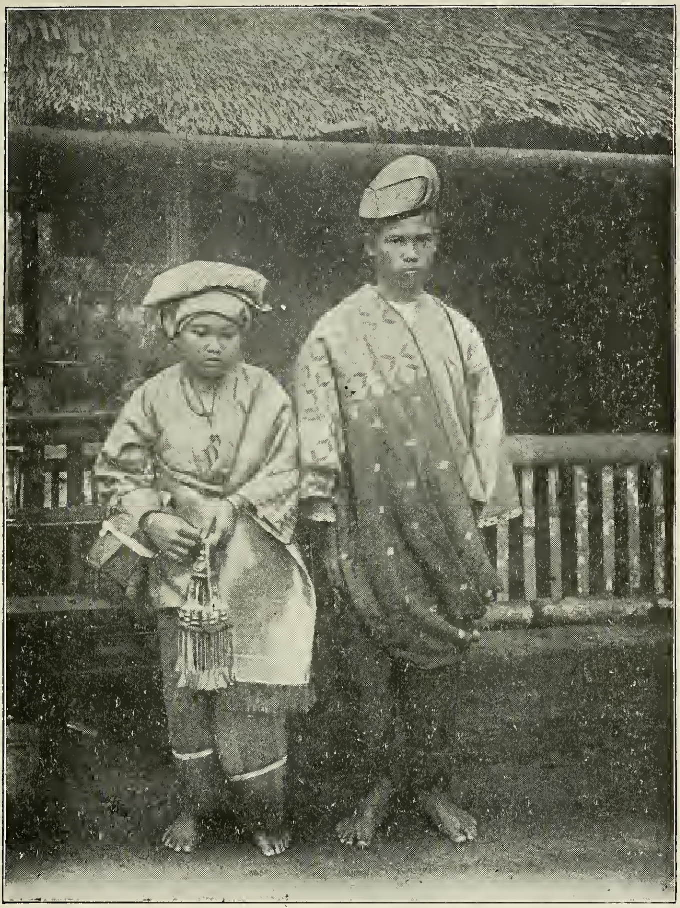
HOTEL AT PADANG PANDJANG, SUMATRA

conveniences in the way of comfortable beds, with pillows and canopies, the better of the latter being often decorated with curious and showy pendent ornaments made entirely of the white pith of some tropical plant. These houses are more comfortable than those of any other race in the Dutch East Indies, and seem luxurious when compared with the dirty hovels of the Maoris or the pebble-floored homes of the Samoans.

Although my friend and I were prepared by the enthusiastic accounts of the Dutch officials to see a more comely race than the Javanese in Sumatra, we were surprised and charmed by the picturesque and highly colored costumes of the natives. Nowhere did we see these costumes so abundant or striking as at a little market or *passer* half way to the larger market of *Koeboe Krambil*, to which we drove behind a crazy pair of ponies in a very uncomfortable "herdic." There in a little clearing in the dense vegetation about one of the prettiest of native public houses, where public declarations are made and cock-fights witnessed, was gathered the most effectively gaudy and picturesque group of natives I had ever seen. Immense Roman and Egyptian-like head-dresses, carefully colored sarongs tightly but gracefully folded about the shapely forms, jackets of soft, loosely woven black, trimmed with gold and silver braid, and bracelets and bangles in great profusion, reminded one of a gala day in some Italian or Spanish town. But the most curious feature of the native dress is their earrings, or ear-buttons, as they would be more properly called, for they are sometimes an inch or more in diameter and of light but solid metal. All stages in the preparation of the ear for the reception of these buttons were to be found. There were mere babies with a single small puncture,

SUMATRAN DWELLING-HOUSE, SHOWING BAMBOO WICKERWORK AND ELABORATE CARVING AND PANELING sweet-faced children of four with a coiled bit of springy banana leaf rolled tightly and passed through the puncture to continually expand it to the proper diameter by the pressure of the unrolling leaf, and graceful young belles with gold and silver buttons tastefully elaborated as large as the top of an after-dinner coffee cup. The young girls, we were told, could wear their earrings or not as they chose, but if they knew how ugly they looked when the buttons are removed and the lobe of the ear appears as a loop of gristle which dangles and flaps against the cheek, they would wear them always. Upon marriage, however, the bride must wear the buttons, as with us the wedding ring. After the birth of the first child, or when five years have elapsed, she must take them out and lay them aside. The old women are generally ugly, as they have buttonless ears, though as far as their other features go they are remarkably well preserved. Then, too, there is more significance in the dress of these natives than there is in that of the Javanese. If a woman is poor she wears a single dark skirt or sarong; if she is well-to-do she puts a second more costly over it, covering all but the bottom; if she is rich she puts on a third, covering the major part of the second, and if she is very rich she dons a fourth. The strange carved and gilded light wooden head-dresses and still stranger box-like bracelets, as well as the delicately formed bangles and diamond-set pins and bracelets, one of which we priced and found to be worth $150, testify to a skill as gold-workers which rivals that of the natives of British India. The golden sarongs, for which the women ask $50 or more apiece, are too somber and in this regard are disappointing, lacking that originality of pattern we are used to attribute to the Orient. The silver filigree work of the men, were you not on the other side of the world, you would swear was made in Mexico, it so nearly resembles it in fineness of detail and originality of design. Their beaten ware and heavier pieces are distinctly inferior to the British Indian work.

The surroundings of Padang Pandjang rival the famous scenes from the little Javanese town of Buitenzorg, accounted one of the three or four most beautiful spots in the world. The sunsets over the volcanoes Singgalang and Merapi, with their low-drifting clouds of peculiar violet, purple, and lilac hues, form sights never to be forgotten. The famous sunsets in the Indian ocean are no more wonderful. Pathways lead off from the well-traveled road at every turn, and you have only to follow one of these



SUMATRAN BRIDE AND GROOM

From a photograph by David G. Fairchild

for a few minutes to find yourself in the midst of the most luxuriant forest, with overtowering bamboos and treeferns, palms and flowering shrubs, thickets of impenetrable rattan palms, low bushes over which immense numbers of large black ants are running, moist moss-covered banks, a tangled mass of liverworts, filmy ferns, and lichens, with here and there an insect so closely resembling the bits of lichen that even an expert entomologist might pass it by unnoticed. Close by the path, in one of the most fascinating of these many valleys, there was growing a clump of bamboo, some of the shoots of which, although eighty feet or more in height, were evidently newly grown, with leaves still immature. I shook one of these young shoots lightly with my hands, and, to my surprise, the whole top, fifteen feet or more in length, snapped off, and, falling at my feet, was broken into a half dozen fragments. Few experiences could give one a better idea of the rapid growth of plants in the tropics than this—growing like a giant asparagus shoot at the rate of a foot or more a day, in a short three months it is a tree of the forest towering above the tops of many century-old monarchs, and yet, after all, it is botanically nothing but a grass.

Though acquainted with the luxuriance of vegetation for which Java is justly celebrated, I was little prepared for the overwhelming exuberance of growth around Padang Pandjang, and when the time came for us to leave I was almost ready to abandon the enticing trip already promised me by my friend in favor of a little longer sojourn amid its beauties.

Fort de Kock, our next stopping-place—940 meters above the sea—is known all over the Dutch East Indies as a sanitarium

ROW OF SUMATRAN HOUSES NEAR FORT DE KOCK, SHOWING CURIOUS GABLES for the Dutch army. Officers and men are sent there from other portions of the archipelago to recover from the malarial fever or the berri-berri, the two most prevalent and dangerous diseases of this portion of the world. The cool, dry mountain air soon fits them for active service again. The town itself has little of interest. The hotel, filled as it is with convalescent soldiers and their faithful wives, is poor enough, being kept by half-castes with more kindliness than business ability. The surrounding country is open prairie, dotted with clumps of bamboo and bits of thick woodland, and makes a very different impression from the scenery about Padang Pandjang. The native villages, surrounded by fruit trees and patches of upland rice, contain a well-to-do race of people, some of whom manufacture jewelry, expensive gold-woven cloths, and beaten silverware, Kota Gedong being the center for this kind of work. It was interesting to notice the independence of the native women, which in fact is one of their marked characteristics, either an outgrowth or consequence of their marriage customs. A man and woman upon marrying do not form a home of their own, but the husband remains among his own circle of relations and resides only temporarily with his wife. The children remain with her and inherit all her property and a half of that earned by their father and mother together. The remaining half goes to their father's sisters or to the children of those sisters.

From Fort de Kock to the little village of Pajo Kombo, the end of this branch of the railroad, is only a few miles. It is the farthest inland town that can be reached by rail, and its principal street, a broad, straight avenue of casuarinas, is lined on either side with innumerable small villages and curious messigits or Mohammedan temples. Near the center of this avenue is a large open square or market-place, in which on "Passar" or market days the natives gather with their curious wares. It is on such market days that the Pajo Kombo women, noted all over the Dutch East Indies for their beauty, are to be seen arrayed in their costly sarongs and decked out with their bangles, ear-buttons, and bracelets. Whether or not we really saw a special market or *Passar besar* I do not know, but there were thousands of people there whose costumes to our eyes did not compare favorably with those worn at the modest little passar near Padang Pandjang. Few sights can surpass a Malay passar, however, in interest. There is a wonderful array of strange fruit and vegetables, devices for striking fire, children's toys, ornaments for

SUMATRAN MESSIGIT OR TEMPLE, NEAR PAJO KOMBO

From a photograph by David G. Fairchild

head-dresses, cooking utensils, cloths of bright but tastefully blended colors, and a whole host of light refreshments—palm wines, peanut cheeses covered with heavy growths of green and yellow molds, pineapple sauces, inviting-looking curries, and cooling drinks innumerable. The live-stock market near by showed that the resources of the island in this direction were excellent, as cattle after the Alderney type, and hogs, tough little ponies, goats, and Indian buffalo were exhibited in profusion.

One visits Pajo Kombo because it is the nearest point to the klof or gorge of Harau and the waterfalls of Batang-Harau, called by the Dutch the Lauterbrunnen and Staubbach respectively of their Indies. It is curious to note how the Dutch compare scenes in Sumatra with noted points of interest in Switzerland, whereas in fact there is little comparison and absolutely no similarity, the rugged grandeur of Switzerland in no sense recalling the foliage-softened outlines of Sumatra. An hour's ride in an uncomfortable native cart brought us to the entrance of this little-known but certainly most wonderful gorge. As we approached, the tall gray marble cliffs rose perpendicularly before us to a height of 200 or 300 meters; on either side, like silken threads, we counted fifteen waterfalls tumbling down from the table-land above. The niches and crevices of this gray marble formed footholds for the most varied of tropical plants, and these in their growth covered great patches with luxuriant verdure or brilliant coloring. Bathed in spray from the waterfalls, there were countless tropical ferns and lichens, algæ, liverworts, and mosses. Through the gorge, at places not more than 70 feet wide, flowed a stream of clear water, its banks and bed clothed with insectivorous water plants and overhung with flowering shrubs and rank growing grasses and sedges. The fall of Batang-Harau suggests by its height and volume the Staubbach near Lauterbrunnen, but at its foot is a mass of moss and fern-covered boulders instead of the barren shale, worn by tourists' feet. Instead of the flower-covered carpet of the Alps the narrow valley was filled with palms, rank grasses, small rubber trees, and a host of strange shrubs and flowering plants, among them curious melastomas and a large orange-fruited fig which decorated the

SUMATRAN MESSIGIT OR TEMPLE, WITH PRIEST IN FOREGROUND—PAJO KOMBO cliffs with its fruit and foliage. No orchids were to be seen anywhere in the gorge, and it is possible that they had been taken out by some orchid-hunter.

After a morning spent in exploring the resources of this wonderful gorge, we returned to the comfortable little hotel at Paja Kombo, where that most remarkable of rice lunches, the *rijs tafel*, was being prepared for us. The next morning we returned by rail to Padang Pandjang and passed again through the Klof van Aneh, where drifting clouds and occasional showers served to heighten the glory of its scenery.

The comfortable steamer *Maetsuijcker* of the Royal Packet Company, the great steamship monopoly of the archipelago, was at anchor the next day at Emma harbor when we arrived by train from Padang. Over five hundred soldiers were ticketed to leave by her, and the wharf was swarming with the soldiers and their wives. It was not either, as might be expected, a scene of leave-taking, for in the Dutch Indian army the soldiers take their wives with them into the field—that is, a certain number of them chosen by lot for each company—native wives, be it understood. Decks were strewn with blankets and camp utensils and every available inch of space was occupied. They were all bound for Atjeh, the northern point of the island, where for the last 25 years the Dutch have been trying to conquer one of the most warlike and stubborn races of savages in all the Orient. For several months past the Dutch troops had been unusually active in Atjeh, or Achin, as it is called in English, and this accounted for the large body of troops going north at this time. Little or nothing regarding these movements of the Dutch troops against the Achinese gets into our press, but nevertheless they are of a serious nature and entail yearly the sacrifice of many lives and the expenditure of large sums of money. That their campaigns are not prosecuted with that vigor which would seem to an American necessary and economical can scarcely be questioned, but certainly the difficulties of climate and position are great and the bravery and persistence of the Dutch troops, who sooner or later fall victims to the dreaded malaria, are of the most praiseworthy character.

The journey by sea up the west coast of Sumatra, unless it be made on one of the small coasting steamers, is generally uneventful. The low-lying islands of Nias and Poelo Tello, however interesting to a naturalist or ethnologist, are only low-lying islands of little interest as seen from the vessel. Two whole days steaming brought us to anchor in the roadstead of Oleh-leh, the port of the old capital of Achin, the fortified town of Kota Radja.

Under the kind escort of the captain we landed that Christmas morning and drove from the port a distance of several miles to Kota Radja. The city, which contains some 20,000 inhabitants, is surrounded by a ten-foot iron picket fence, through which access is gained at carefully guarded gateways. Inside the town lies the walled fort, where the officers' quarters are found, and which is also guarded, so that in case of a general attack it may form a place of retreat. A string of some fourteen forts and blockhouses has been thrown—horseshoe-like with either end on the coast—about the town of Kota Radja and are all connected by a narrow-gauge railroad with each other and with Kota Radja itself. The coaches are provided with iron plating and serve for the transport of supplies, of troops, and seemingly of school children as well, for, as we made our visit to the blockhouses along the line, some bright-looking girls scrambled in, books in hand, bound for the day school in Kota Radja, and they seemed quite as unconcerned as if no war was in progress and heedless of the fact that from the jungle in the near distance might at any time issue a hail of bullets.

These forts and blockhouses contain from 150 to 700 men each and several Maxim guns. They are made of piles 10 or more feet high, driven closely together, and are protected by a mass of wire stretched over low iron posts, barbed-wire fences, and a broad border of century plants arranged in closely planted rows; in fact, everything uncomfortable to bare feet is thrown about these stockades. For a half mile or more about this line of blockhouses the forest is entirely cleared away, leaving a clean sweep for the Maxim guns, while inside the line of railway the friendly natives are allowed to plant their rice. They are prevented, however, from harvesting it until they shall have spied out and delivered to the Dutch for punishment a certain number of their warlike neighbors.

It would be hard to imagine a more uninteresting life than that led by the officers and soldiers who garrison these blockhouses. Narrow, low houses, with a single thickness of corrugated iron to keep out the heat of that burning tropical sun, few trees or often none to shed a grateful shade, and no intercourse with the outside world save through the occasional newspaper or magazine—no seasons, no change from the daily routine of the tropics—it is no wonder that cases of insomnia are frequent and insanity one of the most dreaded of results. There are no more touching instances to be found of self-sacrifice than those of the wives of Dutch officers in Achin, who prefer short lives with their husbands under such uncomfortable conditions to long lives at home in snug little Holland.

On our return to Kota Radja we were shown through the truly wonderful army hospital, where patients both civil and military are cared for, and where, between April 24 and December 24 of 1896, 1,265 cases of wounded men and several thousand civilians and soldiers, for diseases other than those arising from wounds, were treated. The minor cases were treated in the hospitals of the various forts, and when we take into consideration the heavy per cent of deaths we get an idea of the serious nature of the fighting. One corner was occupied by the cholera huts—temporary structures which are burned after each patient is treated and buried—for, according to the commanding surgeon's statement, no real cases of Asiatic cholera have, in his experience, yielded to treatment. Achinese, Dutch, or Malay soldiers are faithfully treated, and though the Achinese, as soon as well and free, sometimes escape and return to their people to fight against the Dutch, when picked up as wounded prisoners they receive as careful treatment as though they were loyal subjects.

Leaving Oleh-leh late that night after a charming experience of Dutch hospitality, we anchored next morning off Segli, considered the most dangerous benteng or fort in Sumatra. Later in the day we landed at Telok Semawe, a fort further down the coast, protected by a most formidable series of high barbed-wire fences and agave. There was an air about these blockhouses or bentengs reminding one forcibly of the Indian blockhouses of our forefathers, and should we see fit to undertake the control of such an archipelago as the Philippines, the training of our regulars as Indian fighters would come into excellent play, though the races there are perhaps not comparably as stubborn as these long, lithe muscular Achinese.

The trip from Telok Semawe to Penang was uneventful, and both my friend and I felt that in seeing this corner of the world our eyes had been opened to a war of more importance than we had either of us dreamed of finding there, and to the beauties of an island which has probably no equal for tropical beauty and grandeur in the world.

WHAT IS THE TIDE OF THE OPEN ATLANTIC?*

By Mark S. W. Jefferson

The writer has sought to collect the known facts of the tides of Atlantic North America and study them in relation to the geography.

At the present date the mathematical theory of the tides has reached a considerable degree of perfection. The theory of geographic influences can hardly be said to have been formulated. Analysis has succeeded in predicting the tides of tomorrow from those of yesterday, but no description of shore configuration and submerged topography will yet enable the mathematician to predict the time and height of the tide at an unknown port. Give him a series of observations at that place, and he will learn from them the local constants and compute the future tides with accuracy. This is indeed the only end he has had in view, and it is of great practical importance. The results now accumulated are sufficiently accurate and numerous to deserve comparative study. Furthermore, much light is shed upon this study by the hints that analysts have dropped by the way, if a layman may venture to interpret them. But for Ferrel's "Treatise on Tides" the present paper could not have been written. Most readers would find the mathematical work veiled in mystery, and not all mathematicians condescend to draw aside the veil. Diurnal inequality, for instance, affects low water little or none and high water much. A mathematician states that harmonic analysis shows it must be so, and we may get what enlightenment from it we can.

In such a study one is immediately struck by the twofold aspect of the problem:

(1) The tides of theory reside in the deep ocean.

(2) The tides of observation belong to the margins of the land.

Data given for tides in the open ocean refer merely to the shores of oceanic islands, and it should be borne in mind that tides on the ocean do not admit of measurement by any means as yet at our command, though it is not inconceivable that a gauge might be lowered to the ocean floor which should record

* Extract from Thesis in research course in Geography at Harvard University.

fluctuations of pressure by means of an electrical communication with the surface.

All study of the tides must therefore proceed from the shores.

SUBDIVISION OF AREA

The tidal stations for our area fall naturally into two groups as regards distribution in (1) the land-locked waters of the shore itself and (2) the shallow waters bordering North America on the east. Brief notes on the tides of the first area (estuarine) have already been published in the September number of this magazine. Certain water bodies of form not unlike the estuaries there studied could not be included in that paper from the anomalous character of their tides. These are the Bay of Fundy, Vineyard sound, Buzzards bay, Narragansett bay, and Long Island sound. For these waters and the general tidal phenomena of the shallow offshore waters we get light from the consideration of the tides in the open Atlantic, and we immediately see that the older view of the ocean tides is in conflict with the facts now widely observed. This was the view of the progressive wave and the cotidal lines. Many difficulties are smoothed over by limiting this conception to the shallower shore waters and supposing the ocean basin to be the seat of a stationary wave with vibration period adjusted to the motion of the moon.

PROGRESSIVE AND STATIONARY WAVES

A pebble dropped into still water sends circling ripples in every direction from the point of plunge. The ripple is a little wave that travels off till overcome by frictional resistances or stopped by the shore. It is a progressive wave. To form it a number of water particles *in succession* move up, forward, down, and back, as may be noted by floating sticks and straws. Such a wave is produced at or off the mouths of estuaries and travels up them. The velocity is supposed to be that acquired by a body falling freely through one-half the depth of water.*

If you lift one side of a basin or tub partly filled with water and quickly lower it again, the water within oscillates as a whole in a time dependent for any one vessel on the depth of water. The water on opposite sides rises and falls, up at one side when down on the other. Along a line across the center there is no

*To make this available in rivers we need a formula for integrating the varying depth and recognition of the effect of width. Now that the Delaware has been gauged, such a study is possible.

vertical motion. It is a stationary wave with a central node. As with a pendulum, successive oscillations are in the same period, but the period may be changed by changing the depth of water. If the nodal axis lies north and south, as when the east end of the vessel has been lifted, the motion of the water particles is simultaneously to the west, then simultaneously to the east. A fall on the east corresponds to a rise on the west, the amount of rise and fall depending on distance from the node and (much more) on local configuration. Stationary waves may be studied in a tumbler of water, and the experiment should be tried.

THE EARLIER VIEW

It is usual in tidal discussions to assume a general case of convenient conditions and come later to the real problem—the tides in the case of nature. The general case supposed was a sphere uniformly covered with water. The moon was considered to have the power of heaping up the waters at the points of the earth nearest to itself and farthest away. The deepening of the waters at these two points would be accompanied by a shallowing around a circle equatorial to these points as poles. Thus the ocean would assume the shape of a prolate spheroid with longer axis always pointed at the moon. The earth would always have its two high waters at its opposite points, with low waters between. In the mean 6h. 13m.—a half lunar day—would intervene between high and low and between low and high. This spheroidal shell would seem to revolve about the earth with the moon, alternately elevating and depressing the water surface of any place. The first assumption to reject for the actual world is the earth's uniform envelope of ocean. The Atlantic is barred east and west by continents. The apices of a tidal spheroid cannot come to this water body in a daily swing about the earth. When the moon is over the eastern border of the ocean it might heap the waters there in a tide that would accompany it in its apparent westward path across the ocean; but at the American continent this action must for the moment cease. Each ocean would see the birth and death of a tidal wave at its eastern and western bounds.

Below the southern continents, in latitude 60°, is a ring of continuous ocean, with tides probably simultaneous, 180° apart.* This belt alone, then, conforms to ideal conditions. It is hard to

*South Georgia and Aukland island, near this circle, are distant 9h. 15m. of longitude; their tides differ in time 9h. 47m.

say when the idea of deriving tides from this southern ocean arose. Lieut. J. Cook, reporting tidal observations for the south Pacific, asserted, in 1772,* "I am fully convinced that the flood comes from the southward, or rather from the southeast." Laplace seems to have entertained a similar idea for the Atlantic, and assigned a day and a half as the time it took a wave to come from the "main ocean."

The earliest attempt to draw cotidal lines was in 1807, by Dr Thomas Young.† It is a sketch of the British islands, with coasts

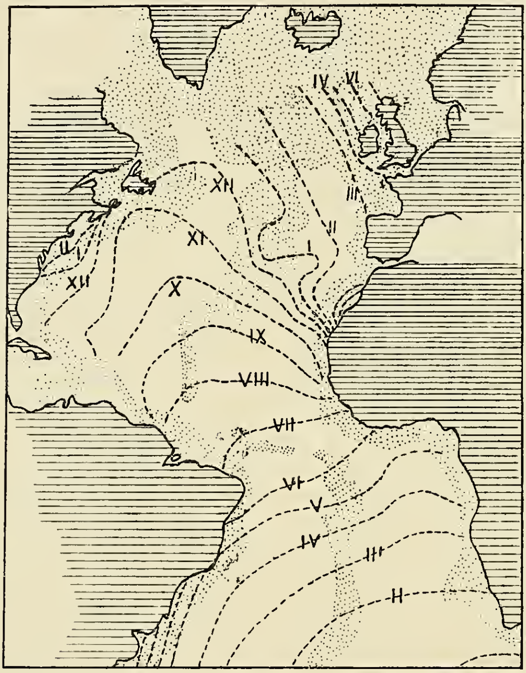


FIGURE 1

of France and Norway and progressive tidal lines. The lines were drawn straight, crossing the English channel nearly at right angles to its axis, and in other places springing squarely off from the shores. In a supplement to the Encyclopædia Britannica, written in 1823, Dr Young suggested the tracing of cotidal lines, indicated sources of data, declared the scheme impracticable, *but collected and reduced the data for 150 stations*, and described

* Phil. Trans., 1772, p. 357.

† Lectures on Natural Philosophy, vol. i, pl. xxxviii.

the general course of a tidal wave advancing up the Atlantic at least as far as Gibraltar.

Dr William Whewell took up the investigation in the thirties. From all the charts, sailing directions, and ocean pilots he could obtain, he computed cotidal hours for points all over the world, being the time of high water on the day of new or full moon. From these data he traced the progression of the tide up the Atlantic to the coasts of Europe and America, deriving it from the belt of ocean to the south. He published his cotidal chart in 1833.* He was fully conscious of the very crude data given him at times by observers who fancied the tides always occurred at the same hour, and he closed his first essay with the warning that the results were only tentative. Figure 1 reproduces the Atlantic portion of this chart.

Dr Whewell was moved by this lack of good data to seek the coöperation of the admiralty to have careful observations made simultaneously at least about the British shores. He not only accomplished this, but was enabled in 1835 † to publish observations made according to his instructions at 666 stations in America and Europe, with two at the Cape of Good Hope, for every tide between the 8th and 28th of June of that year. The greater part of these were about the British isles, and for this region he published a revision of his chart. For the American coast he contented himself with pointing out some errors in his first chart. The rest of the chart he abandoned until a wide range of good observations should be at hand.

DIFFICULTIES OF THE EARLIER VIEW

Now defects in the general scheme of cotidals are defects in the theory of a wave progressing up the Atlantic from the south. These defects Whewell found to be based on (1) the extraordinary manner in which the cotidals contour about the lands, together with the difficulty of including the oceanic islands in the system, 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.

* Phil. Trans., 1833, p. 147. This chart is reproduced in numberless excellent works, though abandoned by its author in the first two years of its existence, and it is usually reproduced, even in America, without the correction the author indicated for the xiih. line on our coast. Thus in Young's General Astronomy, for instance, 1889, p. 287.

† Phil. Trans., 1836, p. 289.

A comparison of Whewell's two maps of British cotidals, figures 3–4, with Dr Young's 1807 sketch, figure 2, shows the growing appreciation of the contouring tendencies of cotidals. With the abundance of fairly good data at hand today, it is everywhere observed that cotidal lines adjust themselves closely to the shore line. With reasonable depth, it is quite usual for high water to appear far up a bay as early as at its mouth. High water reaches the head of Placentia bay, Newfoundland, about a half hour *before* it reaches the headlands on either side of the mouth, as may be seen on the accompanying sketch, figure 5, where three stations are shown; at the bay head and at either side of the entrance. The upper figures at each place indicate the interval between high water at St Johns and local high water. The lower figure indicates the tidal range in feet. From the line of 100 fathoms it is

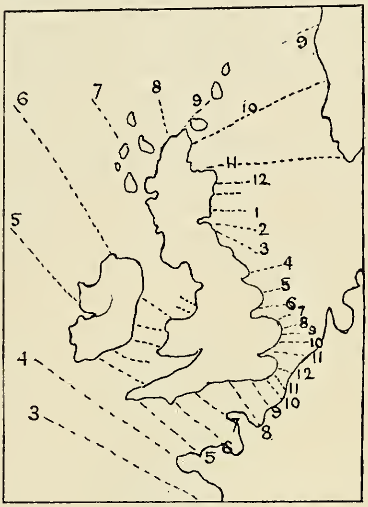


FIGURE 2

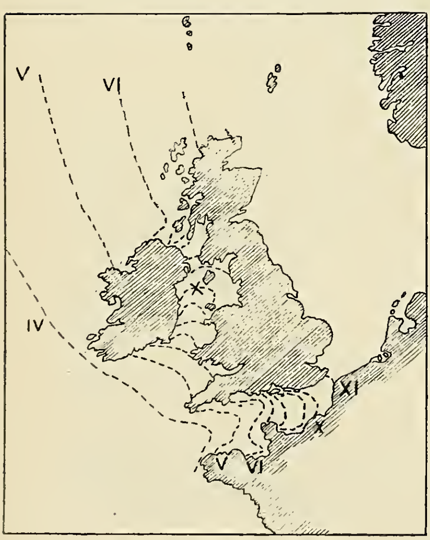


FIGURE 3

FIGURE 4

evident that the impulse is transmitted to the various stations with a delay dependent on distance from the deeper water, yet there is no tide of the progressive estuarine type. This failure is complete in the three characteristics of time, range, and front steepening, since the interval from high water to low water is 6h. 13m. at all three stations, implying equal front and back slopes in the tide wave.

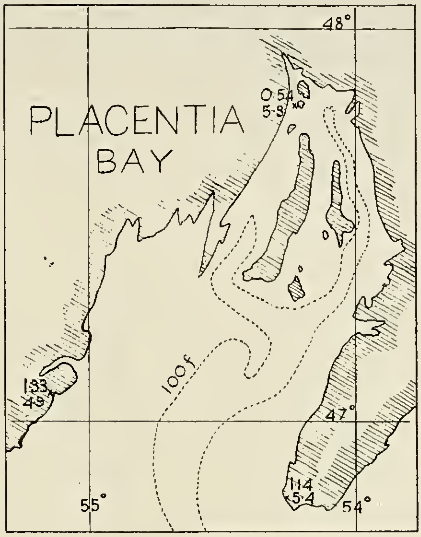


FIGURE 5

Buzzards bay has tides that reach almost all its shores at the same time, as if originating at some point central to the bay. Dr Bache, in 1864, noted the essential feature that its tides are nearly synchronous at the head and all about the bay. To illustrate this, figure 6, besides showing the tidal interval for each station from No Mans Land, shows also the 30m. cotidal. There is certainly no progression up the bay here, nor is there any perceptible increase in tide ranges.

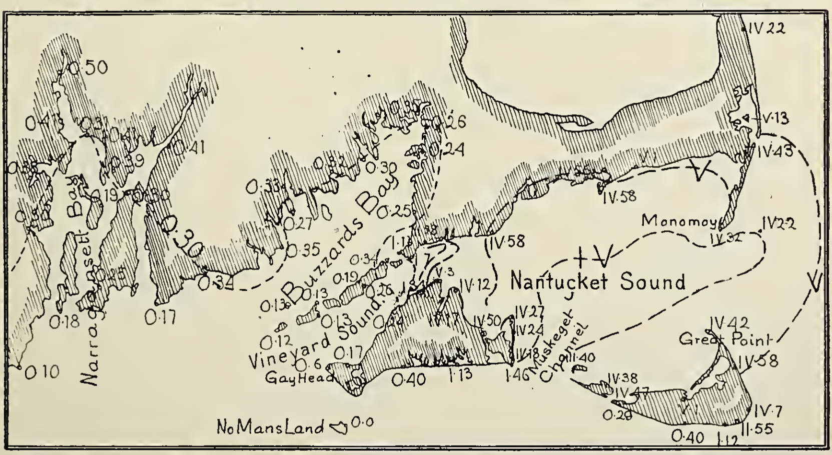


FIGURE 6

The duration of rise is greater than that of fall, and grows still more so up the bay.

Westport, bay mouth: rise 6h. 31m., fall 5h. 54m.

Wareham R., bay head: rise 6h. 55m., fall 5h. 30m.

This is anomalous, yet it is to be remembered that there is no progression between these points—the tide reaches them about the same time.

Narragansett bay is an undoubted drowned river, or rather two of them. The several channels complicate the topography. The ranges mount up from 3.1 feet and 3.6 feet at the entrance to 4.9 feet at Nayat point. Thence it diminishes to 4.4 feet at Providence. Even here the close adjustment of cotidals to shore contours appears in the fact of nearly simultaneous high water at Sakonnet, Prudence light, and Point Judith. The lingering rise of the tide noted in Buzzards bay appears here also.

Bay mouth: rise 6h. 25m., fall 6h.

Bay head: rise 7h. 5m., fall 5h. 10m.

The bay-head observation is at Providence, where there is some tidal progression. In this case, then, the wave has become less steep-fronted as it advances.

In Vineyard sound again the cotidals are seen to be contouring ones and strongly contouring. It is difficult to comprehend how this can be a local development of a long wave front progressing across the Atlantic. Only from Gay Head to Woods Holl are there clear signs of progression.

In the Bay of Fundy high water reaches points near the head of the main bay a few minutes *before* reaching the Maine coast, just outside the bay entrance. Long Island sound gives another surprising illustration of the same tendency. This conception of a *contouring* wave front seems to introduce an element of confusion. There is something very reasonable, simple, and satisfactory in the earlier idea of a long wave-crest, straight or only gently curving on a long radius; yet even in the shallow waters that rear up considerable waves this view is seen to be untenable. Thus the tide reaches Sandy Hook 30 to 45 minutes earlier than points farther out to east and south; so also in St Peters bay, Cape Breton island. As already stated, this contouring tendency of the cotidals became evident to Dr Whewell as soon as he had good data to work on. He saw that on the Atlantic coast of North America, too, the lines must be bent along shore, though he did not draw them.

Airy, in the Encyclopædia Metropolitana, suggests that the cotidal line is to be regarded as the crest-line of a great wave, sweeping from shore to shore, as it might be seen by an eye far above the earth. The characteristic feature of such a wave is that every point of the ocean is regarded as first rising, then falling. Such was probably Whewell's conception, and it is widespread today; yet with the abundant data of today it is not possible to comprehend how a progressing wave should adapt itself so completely to the shores as is found to be the case. An advancing wave would doubtless tend to adjust itself to the shores of an estuary, but the adjustment observed is more than a tendency.

Opposed to this conception is that of a stationary wave, conceived to have a medial point without vertical motion, called a node. Contemporaneous with a rise of water on one side of this node occurs a fall on the other. For the ocean there is no progression of high water; the whole water body swashes alternately east and west. For an ocean to oscillate about a node in adjustment to the moon's apparent motion is only possible with a given relation between depth and width. By counting the oscillations in 5 or 10 seconds with various depths of water in a bowl or tumbler, the reader may satisfy himself that for each combination of width and depth there is a constant period of oscillation. If the North Atlantic has such an oscillation in a period of a lunar half day, it must have the width and depth that correspond.

GROWTH OF THE LATER VIEW

The first suggestion of such an oscillation was by Young:* "We may therefore consider the Atlantic as a detached sea about 3,500 miles long and 3 miles deep." The depth he assumes from theoretical considerations. He considers that the wave from the southern ocean might meet the local oscillation about Gibraltar, when it would doubtless superpose itself upon it. The moon's relation to the motion of the detached ocean is thus suggested by Dr Young:† "The oscillations of the sea, . . . constituting the tides, are subject to laws exactly similar to those of pendulums capable of performing similar vibrations in the same time and suspended from points which are subjected to . . . regular vibrations, of which the . . . periods are completed

* Natural Philosophy, vol. 1, p. 581.
† Nicholson's Journal, 1813, August, p. 217.

in half a lunar . . . . day." Just as the hand that supports a pendulum may maintain its motion by a gentle lateral movement, so the moon's attraction may apply a periodic impulse to a body of water deep and wide enough to oscillate in half a lunar day, and thus make its oscillations perpetual.

Admiral Fitzroy,* in 1863, republished some suggestions of his own of earlier date, that the North Atlantic tides (among others) seemed better accounted for as an "oscillation, as of water in a basin; or a libration, as a mass of jelly," than as a progression of a southern tide wave. His argument points to irregularities in any system of cotidals, the absence of significant tide in the Plata estuary, opening fairly to the supposed ocean tide, and the relation between times of high water on opposite shores. In the North Atlantic he found high water on the American shore fairly synchronous with low water in Europe. In 1879 Mr Henry Mitchell † pointed out that high tide is fairly synchronous from Newfoundland to Hatteras, omitting the Gulf of Maine. Moreover, along this outer coast flood tide current sets to southwest and ebb to northeast. These two facts and the phenomena of the Gulf of Maine are more intelligible on the hypothesis of an oscillating North Atlantic than on any other. The current would result from the northeast-southwest trend of the coast, confining an ocean oscillating east and west, a portion of the westward motion being resolved parallel to the coast.

THE STATIONARY WAVE IN THE NORTH ATLANTIC

It has been noted above that Dr Whewell's data of 1836 showed him that the American cotidals were imperfect. Though he did not redraw the line, he stated that the xii-hour cotidal should be nearer the coast, and Dr Bache ‡ drew it closely contouring from Nantucket to Hatteras and south. It is well established now that, omitting the Gulf of Maine and other enclosed areas, the tides are fairly synchronous from New Foundland to Florida. The great Atlantic oscillation belongs to the deep basin. Across the continental shelf, both east and west, the disturbance is transmitted as a progressive wave, and of course delayed in transmission. As a rough outline of the Atlantic basin, I have dotted in figure 1 the portions less than 2,000 fathoms deep, not that

* Weather Book, Appendix on Tides.

† Ann. Report U. S. Coast and Geodetic Survey, p. 175.

‡ Ann. Report U. S. Coast and Geodetic Survey, 1857.

the continental shelf attains anything like that depth, but the descent from the shelf on east and west falls rapidly to that figure. The ocean basin is thus slightly larger than the parts left white on this sketch.

The Atlantic basin is seen to approach much nearer the Spanish and African coasts than the American or the English and Scandinavian. Sable island, east of Nova Scotia, lies close to the margin of the continental shelf and has its high water 6h. 28m. after high water on the west coast of Spain and about two hours before the actual American coast farther west, just as the Spanish coast has its tides earlier than the British isles and northern Europe generally, where a true progressive wave exists and travels across the shallow waters. This oceanic basin is so shaped and proportioned as to possess an oscillation period of half a lunar day, and twice a day the moon's attraction inclines its surface now east, now west. The figures for Sable island and Spain show that low water on the east coincides with high water on the west. As the ocean basin is not bounded by straight lines, every tongue of deep water that advances among shallows toward the land transmits the tidal impulse synchronously with the swaying of the Atlantic. In the shallows progressive waves carry the impulse further. Whole bays respond to the oceanic movement, and only in exceptional areas can cotidals be truly drawn. The Irish channel in Whewell's second chart and the Gulf of St Lawrence well illustrate the limitations of the cotidal. The great coastwise ebb and flow of the Atlantic currents govern the long lines of bars and sand islands of the eastern United States.

It is noteworthy that the so-called Atlantic ridge, really a broad, gentle swell, must occupy about the same position as the node of the ocean oscillation. One is tempted to speculation on possible accumulations of finest ocean silts in this stiller axis of the swaying mass through the long ages of geologic time. One may wonder again if the moon's periodic impulse does not forbid a departure of the ocean basin from the form demanded for an oscillation in harmony with lunar time—in other words, whether the moon may not have contributed to the permanence of oceanic basins in governing oceanic tides. The tide must resist any attempt to change its period.

THE PEAK OF ITAMBE

In a private letter, dated September 16, 1898, Lieut. James A. Shipton, U. S. A., Military Attaché to the U. S. Legation in Brazil, writes as follows:

I have just returned from a trip to Diamantina, in the state of Minas Geraes. While there I climbed the peak of Itambé, in company with Mr Beaumont, the secretary of the English Legation, and a Mr Coleman, the latter, however, not reaching the summit. We are supposed to have been the first men ever on the summit of this peak. From where we camped the last day it was about four hours' work, in spite of the assurance of our four Brazilian guides that we should require four days more. There were only two places of difficulty, but it was hard to convince the inhabitants that we had been on top. We started a fire in the grass on a small plateau near the highest rocks and on the highest point left a part of our bottle of wine, carried by the only one of the guides who accompanied us to the summit. The people of the neighborhood believed that there was a lake on top and a beautiful lady, of course. There are many onças (tigers) and antes (tapirs), their paths being plainly visible in the long grass. Our Brazilian guides kept up a fire to keep the onças from our mules while we slept. From Diamantina we were gone four days and rode 75 miles. Nine rivers have their sources on this peak, and one does not wonder when one sees the number of springs and marshy places on the mountain. Only twice we had to cut a road through the brush and one night our supper consisted of a parrot stew.

GEOGRAPHICAL ASPECTS OF THE MONROE DOCTRINE

That our German friends view American aggressions with suspicious eye. and detect the Monroe doctrine lurking in unexpected places, is evidenced by the following extract from *Petermann's Mittheilungen*, 44 vol., 1898 (p. 47, America):

"The U. S. Board on Geographic Names, which has done good work in fixing the names of localities, mountains, and rivers within the United States, and has thereby eliminated many erroneous designations, cannot avoid overstepping from time to time their prescribed limits and extending their activity to regions not within their jurisdiction.

"Occasioned by the discovery of the gold fields on the Klondike, it has subjected the usual and often varying names in the Yukon district to severe criticism. Many real errors have thereby been corrected, and the discoverers, as well as those who were honored by them in the matter of naming localities, have been given their just dues.

"The name of the river has been confirmed Klondike; instead of the names Labarge and Lindemann or Linderman for the lakes of the Upper Yukon, Lebarge and Lindeman are given; Taiya instead of Dyea (a town on the Chilcoot inlet), etc. (*Science*, Oct. 15, 1897.)

"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."

GEOGRAPHIC LITERATURE

The Louisiana Purchase and Our Title West of the Rocky Mountains, with a Review of Annexation by the United States. By Binger Hermann, Commissioner of the General Land Office. Washington, 1898. Small quarto. Pp. 1–87, with several maps and portraits.

In this work, just issued from the Government Printing Office, the United States General Land Office takes a new departure and falls into line with those federal bureaus which aim to advance knowledge in connection with their administrative work. Hitherto the more important publications of the General Land Office have been limited to maps—maps of the land-survey states on separate sheets and a general map of the United States on a scale of about forty miles to the inch. Some months since a new edition of this general map was issued showing, in addition to the general and special cartographic features with which the Land Office is directly concerned, the political structure of the United States—*i. e.*, the original territory together with the several territorial acquisitions. On this map the "Louisiana purchase" and "Oregon Territory" were combined as a single acquisition. Now comes Commissioner Hermann with a correction of this error, supported by original documents and maps, and with a full recital of the historical events connected with the purchase of Louisiana territory from France and with the discovery and settlement of Oregon. Incidentally he addresses himself to current issues, at least between the lines, by taking up the general discussion of territorial acquisition in the history of the United States and showing the consequent benefits to the nation. Referring to the cost of the enormous territorial acquisitions, quadrupling the original area of the country, he says: "The grand total of the sums paid for our foreign acquisitions amounts to $52,200,000, a sum less than the value of one year's output of Montana's minerals, of Minnesota's annual wheat-yield, or of the cattle and hay product of California for one year" (page 70); then he proceeds to analyze the early objections to annexation, to inquire into the constitutionality of annexation, to forecast our future destiny, and to extol the wisdom displayed by our statesmen in the acquisition of the Sandwich islands, leaving for his last word a forcible plea for the construction of the Nicaragua canal. The book is timely, valuable, and an occasion for congratulating the Land Office on this new display of interest in public affairs.

W J M.

The State: Elements of Historical and Practical Politics. By Woodrow Wilson, Ph. D., LL. D., Professor of Jurisprudence and Politics in Princeton University. Revised edition. Boston, D. C. Heath & Co., 1898. 8°. Pp. xxxv, 656.

This work, issued in 1889, several times reprinted, now revised, presents an outline of government from primitive forms to typical states—ancient Grecian states and Rome, present France, Germany, Switzerland, Austria-Hungary, Sweden, Norway, Great Britain, and the United States. By rearrangement, Hellas, a region, precedes Sparta and Athens. Changes in the text upon Rome, France, Germany, or Great Britain involve more space than those relating to the United States, to which immediate interest and limited space mainly restrict these notes. The work includes three topics, regarding which confusion often exists in text-books of geography, history, and government: I. Cession of territory; II. Towns or township; III. Cities.

I. The difference between cession of jurisdiction and giving title in fee is clearly recognized in this work, but absolute accuracy is not maintained in particulars.

After stating (sec. 1266) that Maryland and Virginia granted territorial jurisdiction for a seat of national government, and that the government buys sites for arsenals, dock yards, forts, and light-houses, receiving from states exclusive jurisdiction, to lapse when the public use of the property ceases (sec. 1269), the author says (sec. 1272): "The post-offices, federal court chambers, custom-houses, and other like buildings erected and owned by the general government in various parts of the country are held by the government upon the ordinary principles of ownership, just as they might be held by a private corporation. Their sites are not separate federal territory."

The Constitution of the United States says: "The Congress shall have power . . . to exercise exclusive legislation in all cases whatsoever over such district as may . . . become the seat of the Government . . . and to exercise like authority over all places purchased by the consent of the state in which the same shall be for the erection of forts, magazines, arsenals, dock yards, and other needful buildings." (Art. I, sec. 8, clause 17.)

The United States statutes prescribe that "no money shall be expended upon any site or land purchased by the United States for . . . any . . . public building, of any kind whatever, until the written opinion of the Attorney General shall be had in favor of the validity of the title, nor until the consent of the legislature of the state in which the land or site may be to such purchase has been given." (U. S. Rev. Stat., 1878, sec. 355.)

The laws of Massachusetts provide that the United States, with the acquirement of a title in fee, shall "have jurisdiction over any tracts of land within the commonwealth which may be necessary for the erection of marine hospitals, customs offices, post-offices, life-saving stations, . . . but the commonwealth shall retain concurrent jurisdiction . . . so far that all civil and criminal processes issuing under authority of the commonwealth may be executed thereon . . ." (Pub. Stat. Mass., 1882, chap. 1, secs. 3, 4.)

"The following property . . . shall be exempted from taxation: First. The property of the United States." (Idem, chap. 11, sec. 5.)

Such acts vary in detail, but even, uniform exemption from taxation distinguishes the federal title from the title of a private corporation.

II. There are in the United States: 1. Towns: (*a*) bodies corporate of a grade below cities; (*b*) rural bodies with democratic control of certain local affairs, sometimes including schools. 2. Townships: (*a*) the towns last defined, under another name; (*b*) bodies for school administration only; (*c*) congressional townships, simply areas, of 36 square miles, laid out by government surveyors, often the bases for school townships.

Two forms of local government are technically: County government, township organization. Usually one form prevails throughout a state. Illinois and Missouri, however, originally under county government, authorized counties desiring it to adopt township organization, and both forms are found in each of these states, at least. Each was laid off in congressional townships, in which the sixteenth or school sections were for the township. The school township prevails throughout both states, and yet not of course. In Louisiana, with a like survey and a like land grant, there is no corporate township. That state, recognizing a township only as a peopled area with a title to the school section, has acted as trustee and keeps accounts with congressional townships in distributing revenue from the land to schools therein.

The grant was not uniformly "to a township" (sec. 1255), but in a township, sometimes to the state, as in Florida and in Kansas, where a corporate school township has not grown from the congressional township.

A congressional township, a school township or town, and a civil town or township may occupy the same area at the same time, and a city corporation may be coincident upon more or less of the same area. The greatest variety of civil bodies corporate can probably be found in Illinois or Missouri especially, with the early charters still valid. The student of "The State" will have occasion to supplement its explanations, as, indeed, the author suggests.

III. This edition is apparently the first text-book to recognize the independence of residents in certain cities from county taxes and county control.* The student may advantageously look for kindred cases. In arranging the functions of Boston and Suffolk county, some of which are interchangeable, it is provided that "Chelsea, Revere, and Winthrop shall not be taxed for county purposes" (Pub. Stat. Mass., 1882, chap. 11, sec. 47). In Kentucky, in counties containing cities maintaining separate

*The conditions in Baltimore, St Louis, and the cities of Virginia were published in the NATIONAL GEOGRAPHIC MAGAZINE, March, 1896.

schools, a county superintendent and the voters who elect him must reside in that part of the county outside the cities.

"There is no complete and general municipal incorporations act in any of our states; . . . the largest towns are left to depend for their incorporation upon special acts of legislation" (The State, sec. 1245). One constitution at least (Illinois, 1870, art. iv, sec. 22) prohibits local or special laws for incorporating cities, towns, or villages, or changing or amending their charters, and communities of any size can act under laws harmonious with it.

The discussion of national citizenship and state citizenship does not seem wholly consistent. Some day an "inhabitant" who has legally voted in one state for a representative in Congress and has been denied the right so to vote in a state to which he has removed may secure a decision from the Supreme Court that will warrant positive assertions. Till then the author may well say: "A very considerable amount of obscurity, it must be admitted, surrounds the question of citizenship. . . . It has become extremely difficult to draw any clear line between citizens and aliens" (sec. 1121).

While the diversity of our marriage and divorce laws is demoralizing, it is not quite clear how "it may be possible for a man to have different wives or a woman different husbands in several states at one time" (sec. 1110), except as a criminal.

The superintendent of public documents is now under the Public Printer, not under the Secretary of the Interior (sec. 1348).

This edition is neater than the first, the paragraphing is better, the reference lists are made alphabetical (pp. 160, 161 excepted). The book has no rival for its particular place in the class or in the library.

James H. Blodgett.

MISCELLANEA

During 1897 the gross reduction in the effective mercantile marine of the world, through wrecks and condemnations, amounted to 1,045 vessels, aggregating 726,800 tons. From this number vessels of less than 100 tons were excluded. Of the above total 293 vessels of 398,207 tons were steamers and 752 of 328,593 tons were sailing-vessels. The United Kingdom shows the smallest percentage of loss, viz., 2.7 per cent of the vessels owned, and Norway has the highest, with 7 per cent.

The Florida Coast Line canal, after nine years' work, is now completed from Mosquito inlet to Miami. Boats drawing five feet pass semi-weekly the entire distance from Titusville on the Indian river through Lake Worth to Palm beach. Three short cuts complete the canal—two between Matanzas and Tomoka and one uniting North river with Pablo creek. Eventually the canal will connect the St John river with Biscayne bay, and render an inland passage possible along the Atlantic coast from Long Island sound to Key West.

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NOTICE OF REMOVAL

On and after January 1, 1899, the office of the Secretary of the NATIONAL GEOGRAPHIC SOCIETY will be at Rooms 117–118, Corcoran Building, Fifteenth and F Streets N. W., Washington.

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THE

National Geographic Magazine

Vol. IX DECEMBER, 1898 No. 12

THE FIVE CIVILIZED TRIBES AND THE SURVEY OF INDIAN TERRITORY *

By C. H. Fitch,

Topographer, U. S. Geological Survey, in Charge of Indian Territory Surveys

Mr Henry Gannett, Chief Geographer of the U. S. Geological Survey, presented to the readers of The National Geographic Magazine in March, 1896, an article on the survey and subdivision of Indian Territory and the progress made in the survey up to the time of writing. Now that the survey has been completed, a summary of the work, with some remarks upon the present condition of affairs in the territory, may be of interest.

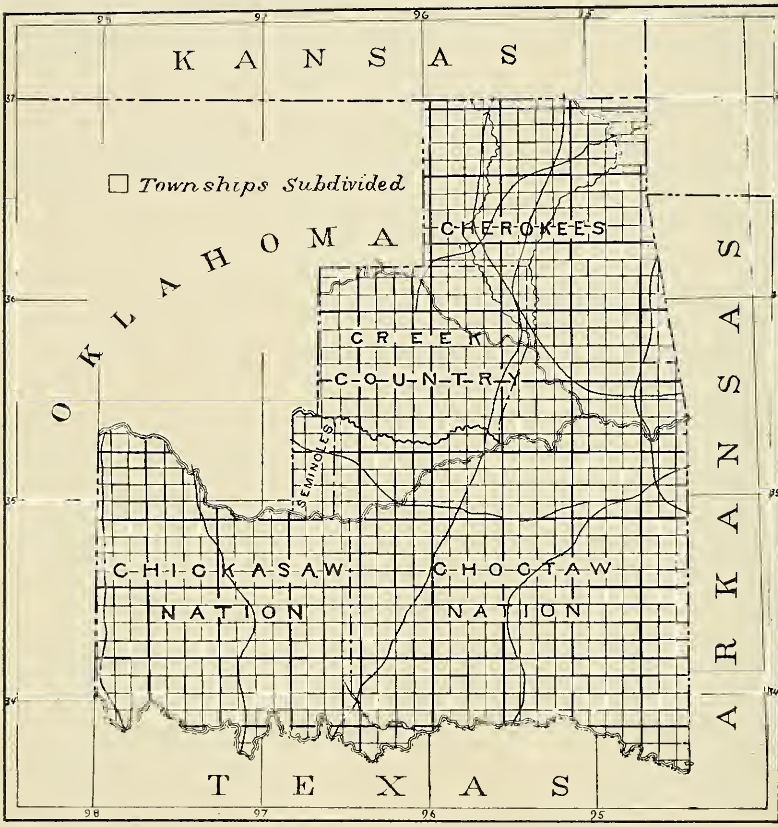
An impression prevails among many eastern people that Indian Territory is in the Cherokee strip, or is at least a part of Oklahoma, or somewhere in the remote west, and yet apparently much interest is being shown at this time in the condition of affairs in the country occupied by the Five Civilized Tribes.

Indian Territory lies between latitude 33° 30′ and 37° north and longitude 94° 30′ and 98° west. The lands held by the Five Civilized Tribes comprise nearly all the territory, and cover an area of about 31,000 square miles.

This territory, as well as that of Oklahoma, was originally granted to certain tribes in exchange for lands east of the Mississippi, which were demanded for settlement by whites. The Five Civilized Tribes consist of the Cherokee, Chickasaw, Choctaw, Creek, and Seminole nations, and they have been occupants of these lands since 1833, when their removal from the south-

* Presented at the Joint Session of the National Geographic Society and the A. A. A. S., Boston, August 25, 1898.

eastern states was effected. These Indians are self-sustaining, but large sums of money have been paid to them from time to time for lands purchased, and large sums are still held in trust for them by the general government. Each tribe or nation has an organized government on the general plan of the states, and they elect legislators to enact laws, and governors, judges, and other officials to enforce them. They are law-abiding, but the



full bloods are unprogressive, and most of them are opposed to any change in their tribal government. By law they are allowed to become citizens of the United States, but they have failed to avail themselves of this privilege.

There are about 50,000 Indians in the Five Civilized Tribes and about 18,000 negroes, who are Indian citizens. A large number of the Indians are quarter and half-breeds, and among them are many intelligent and educated men. To them and to the white men who have gained a foothold whatever progress has been made is due. The white or non-citizen population is variously estimated at from 250,000 to 350,000, outnumbering the citizens by at least four to one.

There is a United States agent for the Five Civilized Tribes located at the Union agency at Muscogee, in the Creek Nation. All business of the Indians with the Department of the Interior is conducted through this agent. He has under his control the Indian police force, numbering some forty men.

There are three United States judicial districts and four judges who together constitute the U. S. court of appeals. The jurisdiction of these courts was at first limited to civil cases, the criminal business relating to non-citizens being tried in certain U. S. courts in Arkansas and Texas, but the courts of these States have at present no jurisdiction within the territory. A United States statute prohibits the introduction into the territory of any kind of intoxicating liquor, but the law is continually being violated, and at least one-half of all the indictments are against whiskey-peddlers for "introducing."

There is a general impression that the Indian Territory is an extensive prairie with very little timber within its limits. On the contrary, the major portion of the country is rugged and mountainous, covered with forests, which are principally oak. There are also some large forests of yellow pine, mainly in the southeastern section of the Choctaw Nation. In the same nation there is much black walnut timber, some of which is being shipped out of the territory. From Talihina, on the line of the "Frisco" road, in the Choctaw Nation, cedar is being shipped abroad for the manufacture of lead-pencils. In many localities sawmills are engaged in cutting pine.

Along the valleys of the Arkansas, North Fork, Canadian, Grand, and Verdigris rivers the soil is extremely rich and fertile, producing good crops of cotton, oats, wheat, etc. Elsewhere the soil is diversified, ranging from good, rich prairie land to stony hillsides, and a large proportion is practically worthless for agricultural purposes. On the rolling prairies in the Cherokee, Chickasaw, and small portions of the Choctaw nations a large quantity of wild hay is annually cut for the purpose of winter feeding to the cattle which range over these prairies. Great herds of cattle are brought from Texas to fatten before final shipment to market, and immense pastures are fenced in for their use. Some stock, including horses, mules, sheep, and

A STREET IN SOUTH MCALESTER, INDIAN TERRITORY, 1898 hogs, is raised in the territory, but no particular attention is paid to improving the breeds. The hogs are of the razor-back variety, and roam the woods, half wild, in search of food. The Indians live upon very little; fresh pork and a small quantity of corn raised for the preparation of "sofky" seem to be about all that many of them have. The woods may be full of deer, turkeys, and smaller game, but their existence is apparently ignored.

The carboniferous coal measures of Indian Territory probably underlie the eastern half of the territory, together with the western portion of the Creek country. The only development of coal that has been made is along the lines of the Missouri, Kansas and Texas and the Choctaw, Oklahoma and Gulf railroads. The coal so far developed is excellent for the production of steam, gas, and coke. The report of the U. S. Mine Inspector for Indian Territory shows that the output of coal for the year ending December 31, 1897, was 1,334,795 tons and the number of men employed in the mines 3,411. A considerable part of the revenue of the Choctaw Nation, in which these mines are situated, is derived from the coal leases.

The several governments of the Five Civilized Tribes derive an income from leased lands, licenses, and permits to non-citizens. All lands are held in common, and no Indian can be taxed for the land he occupies. No attention is paid to the improvement of roads, and there are no public bridges or ferries. Numerous towns, some of them of considerable size and importance, have sprung up along the seven railroad lines within the territory, but they are without legal existence and have no recognized town or city government. They are without proper officers to enforce laws, have no water supply or fire departments, sidewalks or other street improvements, no schools, except private ones, and no systems of drainage or sewerage. The title to town lots, if title it can be called, does not allow the purchaser to build a house and rent it; he must either sell or occupy, for if vacant it is liable to be "jumped." Only the Indian citizens have the privilege of renting houses and lots.

The question of the allotment of lands in severalty to the Five Civilized Tribes and the enactment of a townsite law has been agitated for several years. A commission composed of five members, commonly known as the Dawes Commission, was authorized by Congress, and has for a number of years been endeavoring to treat with the Indians with such allotment in view, but

INDIAN LIGHT-HORSEMEN ON A SCOUT FOR HORSE THIEVES

CAMP OF A U. S. G. S. SURVEYING PARTY, INDIAN TERRITORY, 1897 the Indians are slow to think and slow to act, and have persistently opposed any change in their tribal relations. Recently, however, some progress has been made in this direction, and agreements have been prepared and signed by representatives of certain of the tribes and the Dawes Commission. A bill providing for the protection of the people of Indian Territory, commonly called the Curtis bill, has recently become a law. Its most important provisions are for the allotment of lands in severalty to the Indians of the Five Civilized Tribes, and for the laying out of towns, leasing of coal lands, etc.

To allot the lands there must of necessity be a subdivisional survey. The only survey that had ever been made was that of several outboundaries of the nations, and the subdivision of the Chickasaw Nation, accomplished about twenty-five years ago. Under the provisions of an act of Congress approved March 2, 1895, an appropriation of $200,000 was made for the survey and subdivision of lands in the Indian Territory, under the rectangular system. The act referred to provided further that the Secretary of the Interior might in his discretion place the work under the supervision of the Director of the U. S. Geological Survey. Usually, surveys under the rectangular system are executed under contracts let by the surveyor general for the district in which the surveys are to be made. Where there is no surveyor general, as in this case, the contracts are awarded by the Commissioner of the General Land Office, with the approval of the Secretary of the Interior. The contracts are let at stipulated rates per linear mile, as fixed by law.

The Secretary of the Interior decided, under the authority granted by Congress, to place the work of the subdivision of the Territory in charge of the Director of the Geological Survey, and a plan of operations was drawn up by the latter officer and approved by the Secretary March 21, 1895. Immediate steps were taken to begin the work and by April 1 the first parties were in the field.

The force was increased as rapidly as was consistent with economy, until two parties were engaged in establishing the standard meridians and parallels at intervals of 24 miles; six parties were engaged in running township exteriors within the blocks bounded by standard lines; and four parties, each consisting of two camps with two surveyors or transitmen in each camp, were engaged upon the subdivision of townships. Each of the subdivision parties was placed under the control of a topographer of the permanent force of the Geological Survey, whose duty consisted in the inspection of the work of the land survey and the preparation of the topographic maps. With the commencement of surveys in the Chickasaw Nation the force was further increased. The field-work has been practically continuous, having been prosecuted throughout the heat of summer and the cold and storms of winter.

An additional appropriation of $200,000 was made by Congress in June, 1896, and in June, 1897, a further sum of $100,000 was appropriated. At the same time an appropriation of $141,500 was made for the resurvey of the Chickasaw Nation. In January, 1898, a further amount of $30,000 was appropriated to complete the survey of Indian Territory. The last appropriation was rendered necessary by the discontinuance of the survey in the spring of 1897 owing to lack of funds, and the reorganization and the long distances to be traveled after the appropriation was passed in June, 1897.

Under the provisions of the appropriation act of June, 1896, an iron post was required to be set at each township corner. These monuments are four inches in diameter, four feet long, and are set three feet in the ground. They have been placed at every township corner, including those established by the surveys executed prior to the enactment of the law. In addition to the usual marks referring to township, range, and section, the elevation above sea-level is marked upon the brass cap of such posts. The elevations are determined by means of spirit levels. Prior to beginning the work upon the township lines, double lines of levels were run over the tracks of the railroads traversing the country, with frequent bench-marks as checks to the township lines crossing them. The datum point for the level work is a bench-mark established at Fort Smith, Ark., by the U. S. Coast and Geodetic Survey.

A system of triangulation has been carried over the area surveyed, the base for which was measured near Savanna, on the line of the Missouri, Kansas and Texas railroad, in the Choctaw Nation. This triangulation is a basis for the topographic survey, and a means of checking and correcting errors, and will assist in the recovery of missing corners should they become lost or disappear in after years.

The topographers in charge of subdivision parties, with the aid of assistants, have mapped the topography of the area subdivided. They first plotted upon the field sheets the objects noted by the surveyor, including the crossing of streams, roads base and summits of hills, ridges, or mountains. The elevations

CHOCTAW CABINS, INDIAN TERRITORY

of the exterior lines were furnished by the levelmen, and additional elevations were obtained by means of vertical angles run through the interior of the township, checked upon the levels.

The progress made in the survey of the Indian Territory to the end of June, 1898, when the field-work was completed, is shown by the reports submitted to the Director of the Geological Survey. As appears from these reports, 138 triangulation stations have been established, from all of which angles have been observed.

In the land survey 63,881 miles have been run, as follows: Standard lines, 2,491 miles; exterior lines, 7,777 miles; subdivision lines, 50,931 miles; meander lines, 2,149 miles, and boundary lines reëstablished, 533 miles. In addition, level lines have been run as follows: Railroad levels, 1,613 miles; other level lines, 7,690 miles. Vertical angles have been run over 8,595 miles. The total mileage of the land survey, level and vertical angle lines, since the beginning of the work is 81,778.

The Geological Survey has not only executed the land or subdivision survey of the area, but has in addition carried on the triangulation, the topographic survey, including many miles of spirit-level lines, and has also set the iron posts or bench-marks, a labor not required of contractors, and all this has been done at a great saving to the government from the amount which it would have cost under the contract system. There has been some trouble occasioned by the destruction of corners and bearing trees by Indians, but warnings from the Indian agent and from the several Indian governors abated this annoyance. No interference has been attempted by Indians with the surveyors in the field.

During the late summer and early fall months of the several seasons malarial fevers have been prevalent among the men, and at times have seriously interfered with the work. The summer of 1896 was remarkable for its intense heat, and the hottest part of the United States seemed to be that section included in the Indian Territory. Only one death from sunstroke occurred, however, and as a rule the health of the different parties and the immunity from accident of the 300 or more men employed have been remarkable.

The headquarters camp and office were located at South McAlester, in the Choctaw Nation, until June, 1897, when, for convenience, they were transferred to Denison, Tex., near the border of the Chickasaw Nation. The work of preparing transcripts of field-notes, township plats, and topographic maps has progressed rapidly, but some of the office-work still remains to be completed.

CAMP OF A U. S. G. S. SURVEYING PARTY, NEAR ARDMORE, INDIAN TERRITORY, 1898

NORMAL APPEARANCE OF THE HIGH PLAINS

CLOUD SCENERY OF THE HIGH PLAINS*

By Willard D. Johnson,

U. S. Geological Survey

There is no scenery of the High Plains except that which once a year for a brief period the sky affords, and which then on a vast scale it builds upon them in clouds of extraordinary splendor, or lends to them in elaborate illusion of light and shadow.

Ordinarily, through nearly the entire annual round, there is no material for landscape effect, except the straight line of the horizon, with a featureless breadth of sun-faded brown below it and above a merely broader space of faded blue. There is nowhere a curving line, and though as a scientific fact there is vast extension of dead flat plain, there is little suggestion of it to the imagination when the sky is empty of clouds.

The horizon is, in fact, not distant, as seen from the ground. It is not so distant as that at sea, for normally it is viewed from an elevation much lower than the deck of a ship, and there is no lift of a wave at intervals to extend it. The ranchman gets a widened view from his windmill tower on oiling days, but his accustomed point of observation is the back of a horse. With his motion in the saddle, antelope, feeding along the sky-line, will have the deceptive appearance of moving vertically in unison, so responsive is that boundary of vision to vertical change in the position of the eye. The ranchman's wife views the world from the doorway, and hers is a still narrower horizon. And the small boy, as he soon learns, can step off the radius to his. He finds, moreover, that to do so is no great adventure. He lives in a pent-up Utica, but he has the measure of it. He discovers that he is tethered in effect to his windmill tower; that to put that familiar object hull down, and finally out of sight, is to go adrift. Beyond would be the open sea. Indeed, he has his foot at the edge of it when, on looking back, tiptoeing, he can but just discern the rim of the windmill wheel turning dark and solitary against the sky.

* The photographs from which the accompanying illustrations were made were taken by the author near Meade, southwestern Kansas, in June, 1897. A bichromate of potash ray filter was used, and isochromatic plates. The time of day was immediately after sunset. The direction faced was due south.

There are towns on the High Plains. At least there were towns in the days of the great "boom." Of some of these there now remain neither population nor buildings; others show a scattering of buildings, though empty ones, and in a few, among many empty buildings, is to be found a family here and there. These vestiges of boom creation have been merely waiting for something that has never happened, that never can happen—the blossoming of the desert. At one time across the interspaces the farmer swarmed, but he, too, now is gone, as a class. As in the towns, so on the great flats in between, of the flocks that once settled down and then took flight again a lingering representative is still to be found here and there; and he is waiting for a change of climate, for the farm on the High Plains is nothing more than a body of land surrounded by wire fence. It can never be anything else except as, in half a decade or so, sod finally heals the furrows of the futile plow and it goes back to prairie and to cattle.

The diversions of the people of the great uplands are altogether indoors. For those of the "towns" there is nowhere to go; beyond the sky-line there is nothing, only extended myriads of other empty acres and townships; and for the occasional farmer, except it be the oiling of his windmill, there is nothing to do. It is of no use to plant wheat that does not grow; that again and again in this fertile soil, through arid seasons of unanswered prayer, has refused to grow. To be sure, once in a decade, more or less, there will come a year of plenty—a year of general and comparatively abundant rainfall—as, for example, this present one of 1898, behind which the lean years in unbroken succession were just a dozen; but these exceptions are not answers to prayer; they are rather to be regarded as interpositions of the evil one and a trap.

The single diversion of the people of the High Plains is the dance. Mention of it here is not irrelevant. The dance of the upland plains country is properly to be regarded as a psychological phenomenon to which the mute emptiness of all outdoors is a compelling cause. It is not the celebration of an event, but is the event itself, and enlists the serious energies of old and young alike. It is spontaneously recurring—an impulsive getting together out of the void; and the impulse is as mysterious in origin, as swift and all-embracing, as a prairie fire. It is a galvanic, nervous reaction from the strain of monotony.

The High Plains are the central plains region, or, more accu-

CLOUD SCENERY OF THE HIGH PLAINS—OPENING DEMONSTRATIONS

From a photograph by Willard D. Johnson rately, they are a close assemblage, in north and south belt form, of low and broad plateaus within that central region. They are immense remnantal tables, in light relief, of an older and originally perfect plain, which a few long and feeble streams, wide apart, extending eastward from the distant mountains in parallel courses and without tributaries, have thus blocked out by dissection. Of the Great Plains area these midway plateaus of faint elevation constitute the only true plains—the plains proper.

The climate of the Great Plains slope has a range from humid in the east to arid in the west. Midway, therefore—a unit according to climate as it is a unit topographically—the High Plains subdivision is subhumid or semiarid. A subhumid climate may be defined as one to which drought is normal, the difference between a region of complete aridity—*i. e.*, a desert—and one of prevailing drought being that, while both are outside the boundaries of "God's country," the latter directly borders upon it, and periodically becomes the crowded lumber field for its atmospheric paraphernalia out of use, receiving therefrom for a time its accidental leakage.

And then the inhabitant gets out of doors. He stretches forth his arms and breathes in a modicum of the real joy of living, with the promise of moisture. He no longer sits stolid, just without his threshold, with back to the landscape. The house dog, too, takes up position at an unaccustomed distance and barks defiance to the multitudinous cry of the ventriloquist coyote; and the eldest son greases the wagon and the family go over the horizon to visit their neighbor.

The clouds come in with a gradual maturing at some point along the sky-line; and immediately that point recedes into infinite distance. Multitudes of fragments detach themselves, and radiate high over the great flats in drifting flocks of cirrus,

"Shepherded by the slow, unwilling wind,"

and come to rest as outposts. Then begin the heavy marshalings and for some days these continue. Ranches disappear in premature night under mere accumulation of shadow, and again are sought out in the glare of recessed furnaces of illumination and seemingly consumed. The plain is thundered over continuously, and penetrated at innumerable points by vertical lightning. Fires thus are sometimes originated, and areas as great as a New England state become blackened over with a film of grass charcoal, which the later winds whirl into columns as much as a mile in height and trail along both plain and sky.

In this display there is grandeur in the magnitude of details and the deeply glowing colors, but there is no diffused coloring; there are no stratus clouds as yet; no lines of order. Soon, however, arise the winds, and slow evolution gives place to tumult. The solitary inhabitant, wherever the occasion may have found him, drops all pretense of occupation, and with hat gripped in both hands, leaning back against the rush of air, surrenders himself to awed contemplation of the spectacle.

Finally space is cleared. Around the circle of the immeasurably remote sky-line the lumber of atmospheric scenery becomes packed away in horizontal tiers and overtopping piles, and the great flats settle down to silence, except for a far marginal murmuring never entirely stilled. Then illusion comes forth, and over them maneuver beauties disembodied and immaterial. This is the desert equivalent of the eastern Indian summer. Though there is no color of autumn foliage, there is yet the effect of it, and toward evening, inaugurated by mild disturbances in atmospheric density, there is a marvelous lifting and stir over the vast stage as of a ballet color-play of flaunted draperies.

But the closing effects especially are stupendous, the coloring more lavish, the cumulus masses of incredible height and volume. They take their course swiftly to an end, and the magic goes out with a blink. A last thunderhead, reared in far retreat, glimmers and mutters from beyond the horizon. With its sinking the commonplace has abruptly returned. To the "short-grass country," to the interminable spread of level lands that "literally scream for water," the net result of these heavy labors will have been but a pattering of drops, with sudden and mighty downpours over abandoned and forgotten townships here and there, many miles apart, and an ephemeral carpeting of green, but no continued soaking, no "gray veils of rain."

And yet the High Plains have a future. The "boomers" were birds of passage; another population with different ideas will come to stay. The windmills then will largely multiply, but the newcomers will not be farmers, and it will not be for irrigation that the meager leakage from the clouds which had soaked into the ground will be pumped out again. The most effective utilization of that scant supply will be recognized as secured when, toward evening, along radial trails in all directions extending out to the horizon, cattle are seen, in long lines, coming in to water.

CLOUD SCENERY OF THE HIGH PLAINS — THE CLOSING SCENE

From a photograph by Willard D. Johnson

ATLANTIC COAST TIDES*

By Mark S. W. Jefferson

The tides of the eastern American coast are oscillations of the shallow waters on the continental shelf communicated from the swaying ocean beyond.

The area must be subdivided into the coast proper, facing the open waters of the shelf, and the shallow basins included behind islands and banks.

The continental shelf is a submerged platform along our shores, sloping so gently that it would appear flat to the eye if it were a land surface, and margined eastward by the line of 100 fathoms soundings.

From Long island northward a line of banks rear their summits to within 30 fathoms of the surface along the eastern margin of the shelf, with deeper waters between them and the land. Between these banks, however, are numerous deeper openings, through which tidal movements are communicated landward as well as over the shallow banks.

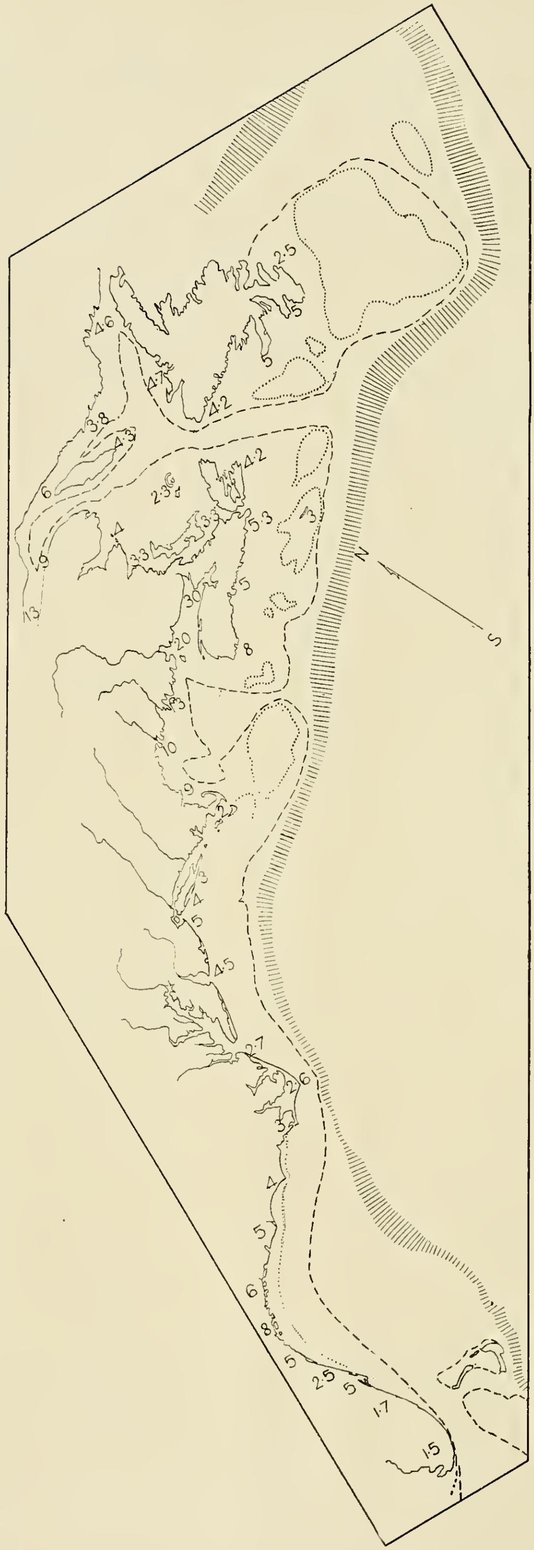
Southward from Long island the descent of the shelf is beach-like and uninterrupted from the shore to the line of 100 fathoms. Only in the waters east of southern Florida do the Bahamas come in to interrupt the descent to the ocean depths. This general configuration is shown on the accompanying sketch (see p. 498), where a broken line represents the 100-fathom line and the approximate boundary of the continental shelf, the dotted lines inclose the banks, and the band of shading indicates the steep slope to depths of 2,000 fathoms. Numbers indicate tide ranges. The northern half of the shelf is seen to be wider than the southern, besides being distinguished by the line of banks.

Within this area lie the inclosed basins—Long Island sound, the Gulf of Maine, and the Gulf of St Lawrence. They increase in depth and size from south to north.

TIDES ON THE COAST PROPER

An examination of the whole coast line shows an intimate relation between time and range of tide and the form of cross-section of the continental shelf off each station. In a few cases

* Extract from Thesis in research course in Geography at Harvard University.



it is difficult to decide in what direction the cross-section should be drawn, but in general an east-west line gives satisfactory results, besides according well with the general conception of the Atlantic tidal oscillation. But it is certain that the tidal impulse is not limited closely to transmission in one direction. The tidal range appears to vary with the width of the continental shelf where the descent to the sea is unbroken; where shoals stand on the shelf margin the range is thereby diminished, being greatest opposite the openings between the shoals.

The general tide relations on the coast are as follows:

In the north, in the Nova Scotia-Newfoundland area, the line of 100 fathoms is about 200 miles offshore, if measured on an east-west line. A series of banks lies just within this line, while close without the descent is rapid to 2,000 fathoms. The tide-ranges are from $4\frac{1}{2}$ to 7 feet.

In the Middle bay, from Nantucket to Hatteras, 100 fathoms and the descent to oceanic depths are alike some 70 miles out. Tides range from 2 to 4 feet.

In the Southern bay the 100-fathom line is 30 to 80 miles from land, while the descent to 2,000 fathoms lies 240 miles out. Tide-ranges are here from 4 to 8 feet.

THE NORTHERN AREA

The tide reaches shore first at Country harbor, well up toward the Gut of Canso, and due west from the deep entrance to the Gulf of St Lawrence. Thirty minutes later it has reached the southwest end of Nova Scotia and the northeast end of Cape Breton island. After another half hour it reaches the south coast of Newfoundland.

The tidal impulse seems to enter these waters by the entrance to the St Lawrence, the Banks of Newfoundland barring off the ocean to the east. If this be true, it is here transmitted along a southeast-northwest line. That this is so is confirmed by the fact that the tide reaches the south side of Sable island an hour before it appears on the north side. Sable island stands close to the eastern margin of the shelf, southeast from Country harbor. The smaller ranges occur on the south coast of Newfoundland, where the tide has only indirect access to shore.

MIDDLE BAY TIDES

The Middle bay lies in a 120° angle of the coast, with vertex at Sandy Hook and the sides resting on Nantucket and Hatteras respectively. The continental shelf in this bay is widest off Sandy Hook, where it is channeled across by the submerged valley of the Hudson. Tidal ranges increase from about 2 feet at Nantucket and Hatteras to more than 4 feet at points on the Jersey shore and at Sandy Hook.

The extreme difference of times throughout the bay is about an hour, the distribution being somewhat irregular. There are three points of early, almost simultaneous, high water—

No Mans Land, near Marthas Vineyard;
Fire Island inlet, on the south coast of Long island;
Cape Hatteras.

At four other points high water arrives almost simultaneously an hour later:

Nantucket, south shore;
Montauk point, entrance to Long Island sound;
Delaware Bay entrance;
Chesapeake Bay entrance.

Between these points there is a good progression of times from early to late. It will be noticed that the entrance to New York bay is not a late point, like the Delaware and Chesapeake entrances, yet there is some delay from Fire island to Sandy Hook. In general, the time differences are of a magnitude perfectly explicable by variations of depth and shore configuration. The expectation that weak tides should early reach the headlands, Nantucket and Hatteras, and progress thence toward the bay head is not realized, save for amplitudes. The times are as early within as at the bay headlands. The amplitudes do increase up the bay.

This portion of the American shore is nearest to the swaying ocean, with its ebb and flood currents alternating along the shore. The characteristic of the coast-line is longshore transportation, cut headlands, and long beaches and bars, to which the soft material of the coast readily lends itself. The only considerable interruptions in the continuous beaches from Montauk point to Hatteras are at the remoter portions. These openings are aided at New York and New Jersey by the stronger tides, and at the Chesapeake by the outflowing waters of the northern half of the Appalachians.

SOUTHERN BAY TIDES

The shores here have three types—the cuspated capes in Carolina, the Georgia entrances, and the Florida sand bars. The tide-ranges are roughly proportional to the distance from the 100-fathom line. The tide reaches Hatteras about the same time as the general northern coast. The range is there 3.6 feet and the escarpment 30 miles away. As far south as Savannah entrance distances from the 100-fathom line increase steadily, the range mounts up to 7 feet, and the tide is an hour later. The line is here 80 miles distant. From this point southward the line draws in toward the coast, the ranges diminish, and the delay increases, as the tide-impulse is now transmitted down the coast, the Bahamas barring off the ocean to the eastward. At Canaveral configuration of shallows heaps up the range to 5 feet, but this is local only. The coastline has analogies in the matter of longshore carriage to the middle bay. At the bay-head the greater tides break the continuity of the sand bars and play in and out by innumerable channels.

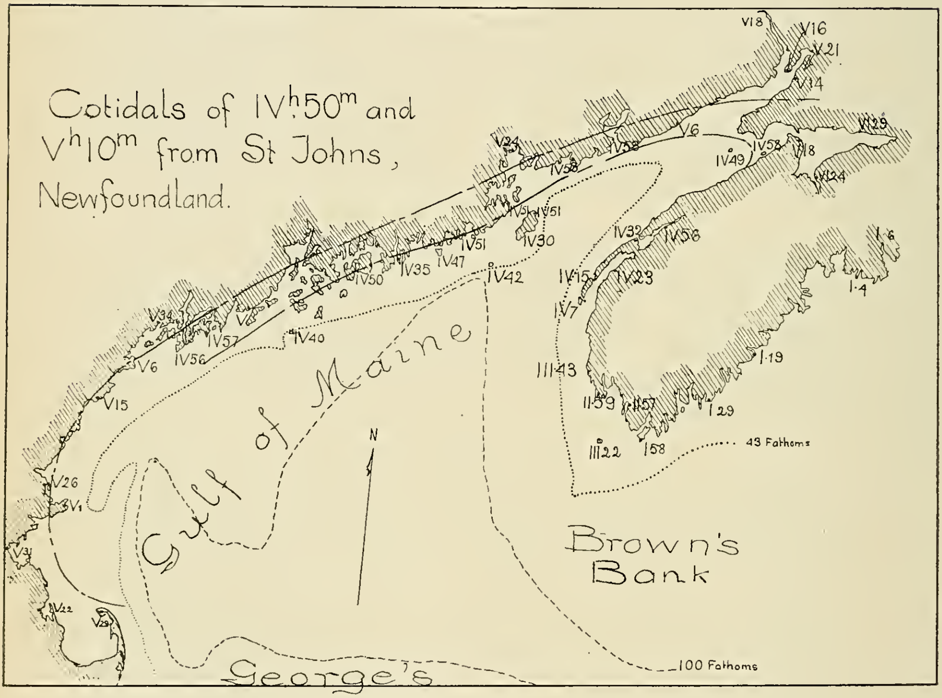
THE BASIN TIDES

Long Island sound, the Gulf of Maine, and the Gulf of St Lawrence have their tides respectively 4, 3, and 2 hours after the open coast tides. This delay and a simultaneity of high tide for at least a part of their area constitute their common tidal features.

GULF OF MAINE TIDES

The Gulf of Maine, according to the usage of our Coast Survey, includes the waters of the New England coast from Monomoy to Cape Sable, Nova Scotia. Its basin is partially barred to the south by the Nantucket and Georges shoals, to the east by Browns bank. On these shoals soundings of 30 to 40 fathoms prevail. Between Browns and the Georges is a 16-mile wide channel across the continental shelf, connecting the ocean with the deep gulf center. Here, over an area measuring perhaps a third that of the whole gulf, soundings range from 100 fathoms to near 200. About two-thirds the area is in more than 43 fathoms. The continental escarpment lies 200 miles from the Maine coast, but the shelf is interrupted by the Gulf of Maine and margins around it. The shoals to the east and south have been well named by Mr Mitchell the Sill. To the north the Bay of Fundy extends from the deep area of the Gulf to Cape d'Or, Nova Scotia; to the southward lie Massachusetts bay and Cape Cod bay, all on the continental shelf.

The Maine coast opposite the deep area is deeply and minutely dissected. For each of the 159 tidal stations in this area the lunitidal intervals have been taken from the tide tables of the U. S. Coast Survey, and referred to the time of high water at St Johns, Newfoundland. The datum resulting is the mean solar time interval between high water at St Johns and local high water. It is corrected for difference of longitude and the moon's motion. It differs from a cotidal hour such as Whewell used in being referred to another station than Greenwich and by



being expressed in mean solar instead of lunar time. All the stations have been examined, and on the American coast, where stations are very numerous, a few have been selected that agree well with those in their neighborhood. These, with all the stations on the New Brunswick and Nova Scotia coasts, appear on the accompanying map.

On looking over the mean tidal ranges throughout the gulf, we observe that this is the area of greatest tides of our whole coast, ranges of 10 or 12 feet prevailing. The least range on the mainland is about 8 feet, near Newburyport, increasing southward to nearly 11 feet in Cape Cod bay, and northward to about 15 feet at the entrance to the Bay of Fundy. On the coast of Nova Scotia there is a similar increase northward from the 7-foot tide of Cape Sable. Up the Bay of Fundy the increase in tidal range is rapid and parallel on the two shores—*i. e.*, a line at right angles to the axis of the bay connects points of equal range. At the head of the bay the range is about 30 feet, and thence it rapidly increases in the narrowing channels to 41 feet at Monckton, on the Chignecto river, and 43½ feet in the Basin of Minas.*

On examination of the times, it appears that high water reaches the coast almost simultaneously from Cape Cod to the head of the Bay of Fundy. Lines are sketched on the map through places with the intervals IV h. 50 m. and V h. 10 m. to illustrate this fact. These intervals are chosen because they are means of a considerable number of stations and can therefore be drawn with some confidence. Of particular value is the IV h. 50 m. line, closely determined on the Maine coast, on Grand Manan, and at two stations in New Brunswick. Across the Bay of Fundy, at its head, the island stations of Isle Haute, IV h. 49 m., and Black Rock, IV h. 58 m., fix the position of the line equally well. That it cannot flex far to southwest before going ashore is indicated by the spacing of the intervals along the Nova Scotia coast. Annapolis must not be used for this purpose, as it has a delayed bay-head tide.

If the tide-wave advances on a line at right angles to its front, we expect to find its front at right angles to the bay axis—that is, northwest-southeast. It appears that the wave does not advance up the Bay of Fundy because, drawing the IV h. 50 m. line with the utmost partiality to such a view, the greater part of its length in the Bay of Fundy trends northeast-southwest. In other words, the southern half of Nova Scotia seems to have almost no effect on the direction of the wave advance—or front, at any rate—in the Bay of Fundy. Either the wave advances from southeast to northwest, which is not here supposable, or the tide in the main bay is not a progressive wave at all.

The cotidals are drawn on the assumption of a progressive wave. The result is the *reductio ad absurdum* of that assumption. The analysis of Mr Henry Mitchell † is in brief as follows:

* These are *mean ranges*.

† Physical Hydrography of the Coast of Maine, 1879. Ann. Rep. U. S. Coast Survey, p. 175.

(1) High tide occurs at about the same time from Labrador to Florida, except in the Gulf of Maine, where it is three and a half hours later.

(2) A flood-current to southwest appears simultaneously along the whole outer coast preceding high water, which is followed by a general ebb-current to northeast; also appearing simultaneously along the whole coast.

(3) Soon after high water outside, which is a time of level within the gulf, a current sets strongly to N. N.W. over the Sill into the Gulf of Maine and the water rises within the gulf. "An impulse observed at one of our current stations is almost immediately followed by a vertical change on the most distant shore." The current continues to flow thus *uphill* until high water in the gulf, when it slacks and turns. Three hours later it is flowing out with maximum strength, the gulf is level, and low water is established outside. While the water rises outside and the general flood-current of the coast sets to southwest, the gulf current continues to flow out over the Sill, again *uphill*, until three hours before high water without, when low water prevails in the gulf.

(4) The water bodies move from top to bottom. A diver on the coast of Maine observed distinct motion in 23 fathoms.*

Conclusion.—The Gulf of Maine and Bay of Fundy offer a "dead angle" to the general flood-current to southwest, while the ebb-current finds in it "a pocket into which the waters are crowded and, by virtue of their *vis viva*, piled up in the Bay of Fundy." After comparing with a fluid oscillating in a bent tube with two arms of very unequal size and inclination, the author suggests that the Bay of Fundy tides are a result of a rocking of the ocean into a contracting flume.

Mr Mitchell regards the Sill as a node and the oscillations in the Gulf of Maine as produced by the periodic impulse of the North Atlantic oscillation. It is not clear why there is no tendency toward "pocketing" the flood-current in Cape Cod bay. There also seems to be a difficulty with the period by which the gulf tides follow those of the outer shore. If there is a node on the Sill, and that the only node, the tides without and within should differ in time by six hours. From Mr Mitchell's explanation of the Gulf of Maine tides, however, he evidently does not mean by node here what is usually meant by the word.

* P. 176.

His study is important for its actual detection of oscillatory slopes in the gulf, its notice of synchronism of tides and currents in each of the two areas, and its frank abandonment of the progressive wave.

A more satisfactory reason for the delay in the Gulf of Maine tides may perhaps be found in the insistence on the east-west direction of the ocean oscillation that originates the shore tides. The deep entrance to the gulf is about 200 miles from shore on a northwest-southeast line. An east-west cross-section on the shelf in latitude 43° measures more than 400 miles, reaching the steep descent from the shelf a little south of the Sable Island bank. Supposing the earliest impulse to enter the Gulf of Maine be that by the deep channel, this must be followed and augmented by the progressive waves across the bench, and later by those that have come across the shallower banks. Such an impulse would need to be a bodily transfer of the water-mass; observed currents are not incompatible with the idea, a northward deflection of all water entering the gulf being brought about by the gradient into the Bay of Fundy.

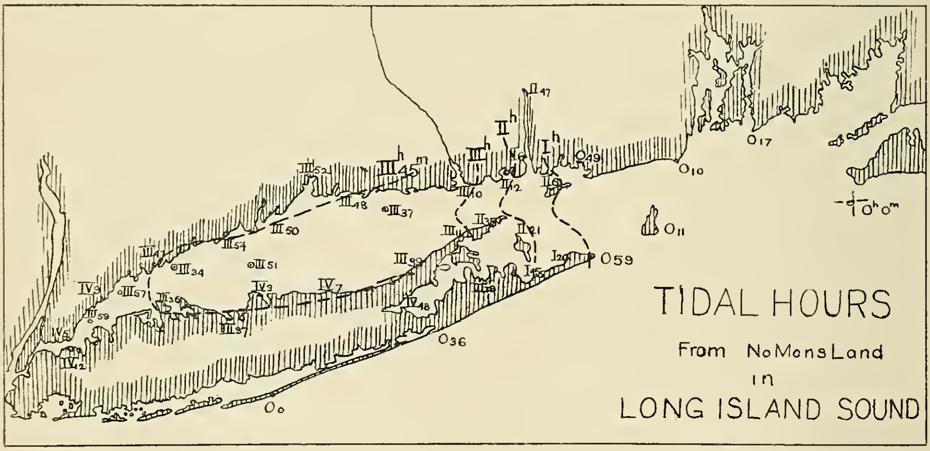
It is interesting that true nodal oscillations have been detected in the Bay of Fundy by Mr A. W. Duff.* He finds an oscillation of the waters between St John, N. B., and Digby Gut (?) in three segments and a period of 42 minutes, according well with the depth and width of the section and having the northwest-southeast direction indicated by our cotidal wave-front. A similar oscillation of much shorter period is noted in the mouth of the St John river. The free oscillation period of the Gulf of Maine, however, would be much less than the observed one of a half lunar day. The only tenable conception of the Gulf of Maine tides as oscillations with a node on the Sill requires that the whole ocean from the Sill to Europe form the outer segment to the gulf waters, and this, of course, requires the gulf times to agree with general coast times.

LONG ISLAND SOUND TIDES

No application of Mr Mitchell's analysis to the tides of Long Island sound is possible, as the tide unquestionably enters on the east; yet the tide is certainly more belated here than in the Gulf of Maine, and shows a close analogy to the *fluming* observed in the Bay of Fundy. What happens in the entrance to the basin is better known here, since the passage is a narrow one,

*Am. Journal of Science, 1897, p. 406.

with tidal stations on either hand and even on islands out in the channel. This entrance to the sound has a depth of 30 fathoms. The deep axis of the sound lies near the southern shore in 15 to 20 fathoms, with a constant gentle rise to the north. The main water body clearly oscillates en masse. This is evident from the synchronism of tides throughout the sound. It seems equally clear that the impulse comes from the outer coast as a progressive wave, perhaps combined with a massive movement, which consumes two hours in advancing through the 10-mile entrance. In this reach of slow progression the ranges are naturally slight, and there is little gain, but the narrowing and shoaling of the western end of the sound causes the tide to augment its range



rapidly in that direction from 2 to 7.2 feet. This is accompanied by a gentle steepening of the wave front, and is the natural result of bodily fluming the water into a narrow, shallow bay head, whatever the driving force, as we shall see presently.

For the times it is striking that from No Mans Land to Block island there should be a difference of but 11 minutes, while the far shorter distance to Montauk point consumes three-quarters of an hour. Some light may be had by referring again to the east-west line of the oceanic oscillation. The nearest deep water to Montauk point, Block island, and No Mans Land is some 70 miles to the south. From this point, though at right angles to the direct line of the motion, the earliest tidal impulse would probably arrive, and the indications of early time at No Mans Land and Block island result. This would not, however, prevent the transmission of the direct impulse across the Georges and Nantucket shoals, nearly 250 miles in an easterly direction. This impulse would be faint and retarded by the long journey across the shoals. Reaching the islands in comparatively open water, the effect will be there to check the falling tide in its descent. At Montauk point, however, where the waters are confined and the range is small, the eastern tide may overtake the local tide soon after its greatest height and make highest water come later than the local tide would have come. We must think of a massive westward motion of the water here rather than of a progressive wave or in addition to it. The accompanying diagram (see p. 506) shows a number of tidal stations with their times and such cotidals as can be drawn 1 h., 2 h., 3 h., and 3 h. 45 m. No Mans Land is marked with a heavy cross.

GULF OF ST LAWRENCE TIDES

The tidal data for this area are not so numerous as is desirable. Like the basins described above, the deep connection with the ocean is by a channel much inclined to the direction of ocean movement. Here the axis of the broad entrance trends about northwest-southeast. Impulses across the shelf by the Grand and St Pierre banks must enter the gulf later, and may produce the delay in high water, as before.

The tides range about four feet in amplitude at the gulf entrances and swash out flatter in the wide space within. Throughout the deep area between Anticosti, Labrador, and Newfoundland high water is fairly simultaneous, about two hours after the outer coast tide. In the shallower southwest corner of the gulf a tide wave progresses from the deep channel near Anticosti along the New Brunswick coast to Prince Edward island, on which it divides, passing both north and south of the island and presently meeting tides that come westward from the Cape Breton entrance and the Gut of Canso. Ranges of three or four feet prevail save in narrow passages. The meeting of the tides marked on the north and south of Prince Edward island on the charts is a meeting of *currents*, and in the whole southwest area there is a steady progression not only of the point of high water, but also of the currents.

All the tide-waves in the southwest rise in 25 minutes' less time than they spend in falling. This is found typical of progressive waves in shallow waters. We call such waves steep fronted and find their extreme case among tides in bores, and in ordinary short waves in the surf of the beach, with quick straight uprise of water in front and long gentle slope behind. In the northeast, as in the shelf waters generally, rise and fall are of equal duration.

BAY OF FUNDY TIDES

A brief note follows on a region geographically intermediate between the estuaries and the shelf basins.

These are of a special character, as was implied in the discussion of the Gulf of Maine. It is not a typical estuary. The fact that its area is almost coextensive with the soft Triassic sandstones that appear in patches all about its shores, together with the fact that it is now rapidly cutting these remnants away, is perfectly compatible with the former existence of Triassic rocks through most of the area with an axial valley, narrower and more typical in form, through which the Petitcodiac, St John, and St Croix poured their waters into the Gulf of Maine. Given such conditions, the rushing tides resulting from the massive oscillation of the gulf waters into the estuary must have tended toward the present conditions.*

A good description of the Fundy tides is still lacking. The greatest mean range is of 43.5 feet in the Basin of Minas, 50 feet at mean springs. Favoring meteorological conditions may increase this by nearly one-half on rare occasions, so that a 70-foot tide is not incredible. It is found that narrowing bays multiply an accidental or non-lunar disturbance of water level in the same proportion that they do the tidal oscillation. Thus Geneva is situated at the head of a narrowing shoaling arm of the Lake of Geneva, perfectly comparable to the Bay of Fundy, with but a sixteenth the water volume of the whole lake. The seiches or swaying oscillations of the whole lake produce a wave two or three times as great at Geneva as at points anywhere in the main lake, for large oscillations or for small.†

Similarly, barometric disturbances over the Gulf of St Lawrence that cause only a slight change in the small local tide add six or seven feet to the 17-foot Quebec tide.‡ During a storm which raged in Chesapeake bay in September, 1876, the water rose four feet two inches above mean high-tide level at Alexan-

* Similarly Delaware bay is believed to have been widened by the tide, though longshore action in the shallows outside is continuously striving to dam it off from the sea.

† Forel, Le Léman, vol. ii, Seiches.

‡ 30 Jan., 1894, and 8 Feb., 1895. W. Bell. Dawson, Royal Soc. Can., 1895, vol. i, p. 26.

dria.* Mean spring range at Alexandria is but 3 feet. So a "storm rise" of four feet on the open coast was 8 feet at Hell Gate.† During the gauging of East river "a moderate northeast wind" heaped up the western end of Long Island sound nearly a half foot above the harbor on one occasion. It is just as easy for "weather" to add 20 feet to the tidal rise in the Basin of Minas as 5 feet at Lynn, Mass. (Jan. 23, 1898), where spring range is but 11 feet.

A bore apparently exists in both Chignecto bay and the Minas basin, where it has been described as coming in in two lines. To judge from photographs, the bore is but a few feet high. Details about it are not given.

A well-established feature of these tides is the extraordinary amounts of sediment deposited at the estuary heads. In a hollow iron cylinder at Windsor, Murphy ‡ measured 30 inches of fine sand and mud deposited from the tides in 122 days, being uncovered at low water. W. L. Goodwin § states that thousands of acres of bogland have thus been built up by the tide in Westmoreland county, N. B. A lake 15 feet deep in 1867 was kept in communication with the bay by a canal that the tides might have free access. In 1892 it was quite filled and yielding hay. In Sackville county 3,000 acres have been reclaimed. Mr Goodwin seems to refer the origin of the mud in the water to the wearing of the rushing tides on the soft shales. Dr R. T. Jackson states that this is very marked at Joggins, N. S.

The steepening of the wave-front is inconsiderable and an advance of high water as a progressive wave hardly exists where our observations are distributed.

PRESIDENT ALEXANDER GRAHAM BELL ON JAPAN

The President of the National Geographic Society, Dr Alexander Graham Bell, is now in Japan, where he has been received with distinguished honors. On October 22 he was presented to the Emperor in special audience, and on October 29 to the Empress by special command. On November 6 he was entertained at dinner at the Imperial hotel, Tokyo, by the International Journalists' Association, as a tribute equally to his illustrious

* U. S. Coast Surv. Ann. Rep., 1878, p. 24.
† U. S. Coast Surv. Ann. Rep., 1886, p. 431.
‡ Nova Scotian Institute, vol. vii, p. 51.
§ Can. Record of Science, 1897, p. 364.

scientific career and his philanthropic work in behalf of the deaf and dumb. The proceedings are reported at great length in the *Japan Daily Mail* of November 8, and the following abstract of the interesting address delivered by Dr Bell in responding to the toast of his health is taken from the report in that journal. Beginning with a graceful acknowledgment of the honor of which he was that evening the recipient and an expression of the pleasure he had derived from his long-looked-forward-to visit to that marvelously progressive country, Dr Bell proceeded as follows:

Hundreds of years have passed since Columbus, sailing westward, discovered the land of the setting sun, and now we, looking seaward from that land, see a new light upon the horizon, and ask ourselves what is this strange effulgence, what is this novel luminary which begins to glow in the firmament? That question has been present in our thoughts for several years, and it is with no small satisfaction that I find myself able to see your country more closely, and to observe the conditions that give such earnest of a great future. An eminent man of science in America, Professor Marsh, recently delivered a lecture on the teachings of geology, and pointed out a very interesting fact. He said that on examining the fauna of successive geological strata, a series of progressions was distinctly visible. Thus the crocodile of one stratum was found to have a smaller brain than the crocodile of the immediately superior stratum, and the latter a smaller brain than the crocodile of the next stratum, and so on. The same rule seems to apply to human beings. If we look back to the pit-dwellers of primeval times we find a brain cavity perceptibly smaller than that of man in later eras, and it may be confidently said that the progress of the growth continues even to our own time. Well, gentlemen, Professor Marsh concluded his lecture with a remarkable statement. It was contained in a single, short sentence, but it was a very pregnant sentence. He said, "It is worthy of note that the brain of the average Japanese is larger than the brain of the average European." I do not pause to draw any inferences, but I quote the fact as something of which you may be proud—something which your recent history seems to illustrate. Small in stature, if you like, but large in brain; and during my travels through your country I have been struck by the fact that nature seems to have prepared for you a great and prosperous career. Everywhere I see long ranges of lofty mountains with comparatively narrow planes lying between their feet and the coast line. That indicates a grand gift. It indicates that your country should be the very home of electrical enterprise, for such a geographical formation shows that water power is available everywhere throughout the lowlands; that reservoirs of force convertible into electric power can be formed at points within easy reach of all your centers of commerce and industry, so that you are in the happy position of being able to base the economy of your country on electricity; to drive your vehicles with electricity; to substitute electricity for steam; to carry on your manufacturing enterprises by the agency of electricity. One cannot exaggerate the value of this boon which nature has conferred on you, and that you will one day utilize it fully may be confidently inferred, I think, from the story of your progress during the past twenty-five years. I am particularly interested in observing that you appreciate the great truth which we in the West have come to recognize: the truth that education is the basis of progress and prosperity. Educate the masses, elevate their standard of intelligence, and you will certainly have a successful nation. That is what we tell ourselves, and the latest reports of your department of education show that it is what you tell yourselves also, for I learn from the reports, if my memory serves me, that no less than 64 per cent of your school-age children throughout the empire are receiving education, and that, in the case of male children, the percentage is as much as 79. Those are highly creditable figures, and they may be accepted as evidence that your progress stands on a really sound basis. But I do not find things equally satisfactory throughout the whole field of education, for whereas 64 per cent of your healthy children are receiving instruction, only 3 per cent of your deaf and dumb are similarly fortunate. Your educational statistics show that among your children of school-going age there are no less than four thousand afflicted with the calamity of deafness. How many of them are receiving education? Only a hundred and twenty. Think of what that means. I do not speak much of the blind. With them I have not had much to do. Their calamity seems too terrible. It necessarily limits the range of possible effort on their behalf. But the deaf and dumb appeal to our sympathy all the more strongly, inasmuch as we can do much to assist them. It is generally supposed that dumbness indicates some radical defect of the vocal organs. In the vast majority of cases such a supposition is entirely mistaken. Dumbness comes from the fact that a child is born deaf, and that it consequently never learns how to articulate, for it is by the medium of hearing that such instruction is acquired. Put a Japanese child in America, and you find that it easily and without any apparent effort learns to speak English. Put an American child in Japan, and you will soon hear it speaking Japanese. The whole source of trouble, then, is that the ears of these unfortunates are closed. Their brains, their minds, are as fully developed or as capable of development as yours or mine. Imagine the horror of being shut off from the intellectual world that surrounds you, debarred from all intercourse with your fellow-creatures, though all your faculties with a solitary exception entitle you to take your place in that world and enjoy that intercourse. I am proud to think that we in America have recognized these facts and acted upon them. The money devoted in America to the education of the deaf and dumb is two million dollars annually, four million *yen*—nearly as much as the total sum spent out of the public funds for all educational purposes in Japan. We have forty thousand deaf mutes in the United States, and we have upward of eighty schools, with an attendance of about ten thousand pupils. In the city of Philadelphia there is a school whose buildings and other property are valued at a million dollars, or two million *yen*. You in Japan must have about twenty-five thousand deaf mutes in the empire, and yet you have only two schools for their education, one in Kyoto and one in Tokyo. That is indeed a state of affairs that calls for remedy. Besides, this is not a mere question of humanity; it is also an economic question With proper education the deaf and dumb can be fitted for almost any walk in life. All the range of intellectual achievement is open to them. They can become authors; they can become painters; they can become journalists; they can discharge a number of valuable and wealth-earning functions. There are actually forty newspapers and periodicals in the United States written and edited by deaf mutes, chiefly for the use of their fellow-unfortunates. We spend four million *yen* annually upon the education of our deaf and dumb, but we find that their contributions to the wealth of the country after they are educated exceed that amount, so that, instead of being a burden to the state, they become a factor of prosperity. You see what interest this problem has from every point of view, and you will agree with me, I am sure, that what Japan is doing is sadly inadequate, and that, instead of only two schools in the whole empire, you should have at least a school in every province, as we have schools in every State of America. You of the press are the eyes and ears of society, and you can also be its leaders. I know the immense influence you can exercise upon public opinion, and I trust that you will exercise it in this noble and useful cause.

J. H.

GEOGRAPHIC LITERATURE

Cuba and Porto Rico with the Other Islands of the West Indies. Their Topography, Climate, Flora, Products, Industries, Cities, People, Political Conditions, etc. By Robert T. Hill, of the United States Geological Survey. Pp. xxviii + 429, with 2 maps and 79 plates. New York: The Century Company. 1898. $3.00.

This is one of the books of the year. It is made notable by timeliness, and still more by breadth of view and strength of grasp. The author is a well-known geologist and geographer, a leading authority on the structure and development of the Antillean region as well as Central America, Mexico, and southern United States; yet this latest publication is his magnum opus, and displays his ability to deal with scenic features, social problems, questions of statecraft, historical events, and softer literature no less efficiently than with the technical problems of his special science. The work of the publishers is equally creditable; no more tasteful and elegant specimen of book-making has ever left the De Vinne press and Century house. Most of the abundant illustrations are delicately tooled halftones, and the cover is a work of art; the lists of contents and illustrations are full, the introduction is germane, and the index is adequate. The first chapter is devoted to the geographic relations of the West Indies; the second to the West Indian waters, including submarine configuration and conditions; the third to the geographic classification of the West Indian islands; and these form an admirable summary of current knowledge, illumined and interpreted by personal observation. The fourth chapter is an original description of the Greater Antilles in terms of physical and political characters, with constant reference to natural resources and social conditions. Then come ten chapters on the island of Cuba, depicting the physical features and the climate, flora, and fauna, describing the conditions of health and sanitation, defining the geographic subdivisions, setting forth the resources of the island and the facilities for commerce and transportation, analyzing the population, describing the cities, and discussing the future of the island. These chapters are based chiefly on first-hand knowledge, supplemented by historical and statistical research; they give a remarkably clear picture of the Pearl of the Antilles and her people, and bear inherent evidence of fair and dispassionate judgment. In discussing health and sanitation, the author departs from his customary impersonal treatment long enough to offer suggestions which every tropical traveler would do well to note. "Three rules I have followed invariably: first, to adapt my habits of dress, food, and hours of work and rest to those of the people of the country; secondly, never in any circumstances to drink a drop of native water where it could possibly be avoided, and if so always to boil it. For this purpose I have always carried an alcohol-lamp and a tin canteen, in which, when boiled water could not otherwise be obtained, I could myself attend to the matter. Twice when, in desperation after tedious exercises, I yielded to the temptation of drinking the native water unboiled, the results were almost fatal. The third rule has been never to linger around the densely crowded and unsanitary areas of cities, and always to choose a room facing on the street" (page 60). He also advises against miscellaneous eating of fruits. The chapters on the people of Cuba and the future of the island are warmed by appreciation of a kindly and hospitable folk who, despite languorous antecedents and enervating climate, have struggled long and shed their blood freely for civil liberty. Chapters fifteen to nineteen are devoted to the island of Puerto Rico, and present a clear picture of this newly acquired insular territory of the United States; then follow three chapters on Jamaica, the well-ordered island, justly considered a model British colony. The lively paragraphs, enriched by well-chosen incident, indicate that while the colony is indeed British, the white Anglo-Saxon nucleus about which the darker plasma flows is very small, and, albeit effective in governmental control, of only moderate influence in shaping the current thought of the prevailing population. "The Jamaica negroes are *sui generis*; nothing like them, even of their own race, can elsewhere be found—not even elsewhere in the West Indies" (page 227). The twenty-third chapter describes the much-named island of Santo Domingo—the designation preferred by the author if the old name "Hispaniola" must be abandoned; and a chapter is devoted to each of the two republics planted on the island. The central body of the Antillean group, this island is the most striking of all in its culminating altitude, in topographic diversity as well as in natural picturesqueness, and even more interesting in historical associations; the site of the first European colony in the New World, the place of introduction of African slavery into America, the field of frequent battle and reeking bloodshed, the scene of the dark tragedy of Toussaint l'Ouverture and site of the Black Republic, this miniature continent has played a leading rôle in the history of several nations, as Mr Hill's pages happily show, and has given origin to two of the world's significant experiments in popular government. The subject of the twenty-sixth chapter is the Bahamas; then the Lesser Antilles—including of course storied Martinique, motherland of Josephine—and the Caribbees, the South American islands of Trinidad and Tobago and Curaçao, and last of all Barbados, are treated in nine chapters. A chapter on the geological features of the West Indies cannot fail to attract scientific geographers, while the final (thirty-seventh and thirty-eighth) chapters on race problems in the West Indies and on the future of this insular realm are worthy the scrutiny of statesmen. The scope of the book cannot better be indicated than by noting that it represents the recent observations and generalizations of a trained geographer, expressed in non-technical language; that it contains the best account extant of Cuba and its people; that it embodies the latest and largest accessible information concerning Puerto Rico; that its chapters on Jamaica form the most convenient description of that island printed on this side of the Atlantic; that its account of Santo Domingo and its two republics is the only full and trustworthy one available; and finally that the work, as a whole, is by far the most complete and useful description of the West Indies, considered collectively, issued during recent years—indeed, it is the only modern handbook of the mid-American isles, and the best source of general information concerning each of them. Members of the National Geographic Society will feel a direct interest in the book as the work of one of their number; and the interest will be the greater in that it took inception in addresses before the Society and a widely read paper in THE NATIONAL GEOGRAPHIC MAGAZINE for May last. While there are a few marks of haste in putting the material together—*e. g.*, the misspelling of the name of a surgeon-general in body and index—the volume conveys the impression of large personal acquaintance with, and of mature thought concerning, its important subject.

W J M.

Railway Economics. By H. T. Newcomb. Pp. 152. Philadelphia: Railway World Publishing Company. 1898. $1.00.

Into this exceedingly well-printed and in every way attractive volume Prof. H. T. Newcomb, whose contributions to periodical literature long ago gained for him an enviable reputation as a clear, sound, and forcible economic writer, especially on railroad subjects, has compressed an immense amount of valuable information bearing upon the transportation problem. The book is principally devoted to the development, classification, and analysis of facts concerning railroad rates and rate-making, and conclusions, except those most essential and obvious, are left to the reader. It is interesting to observe that, having approached the subject from the view-point of public interest, the author's examination of the history and present condition of railroad transportation tends unmistakably to justify the limitation of competition, which, as between railroads, he plainly regards as costly and mischievous.

J. H.

The Philippine Islands and their People. A Record of Personal Observation and Experience, with a Short Summary of the More Important Facts in the History of the Archipelago. By Dean C. Worcester, Assistant Professor of Zoölogy, University of Michigan. New York: The Macmillan Company. 1898. Pp. xix + 529, with 2 maps and many illustrations in text.

This is primarily a book of travel—incidentally one of adventure. It is enriched by an introductory chapter in which the history of the Philippines is summarized, and by an appendix of eighteen pages in which the natural resources of the islands are described in such detail as to render this part of the book a standard source of information, more comprehensive than any other now available. Professor Worcester first visited the Philippines in September, 1887, as an amateur naturalist attached to a scientific expedition; he remained eleven months, reaching fifteen of the principal islands. His second visit began in July, 1890, and extended over more than two years, during which period he remained on each of nineteen islands "long enough to get a fairly representative collection of its birds and mammals" (page x). The scientific results of his work and that of his companions (especially Dr Frank S. Bourns) have been turned over to various scientific institutions, notably the U. S. National Museum, which now has in press an elaborate report on the ornithology of the island prepared by these naturalists. The narrative of the journeys and experiences, and the observations on people and things in general, are incorporated in the book under notice. The graphic paragraphs present a succession of living pictures combining to create realistic impressions concerning the islands and their people; and, while the story is told in the first person, the unaffected language and contagions good humor of the author combine to render it attractive and easy of assimilation. Passing over fields previously untrodden by the Caucasian, as he did in different places, Professor Worcester was able to make substantial contributions to different branches of science. New water-ways were discovered and mapped, important details of topography were noted, and the distribution of plants and insects, as well as of birds, was ascertained; he was apparently the first white man to visit certain native tribes, and one of the first to see the curious and ferocious little wood buffalo, the timarau—the mythic unicorn-cyclops of the Mindoro jungles; his descriptions of the Mangyan and Tagbanua tribes are noteworthy contributions to ethnology; while his visit to the Taäl volcano of Luzon cannot fail to convey useful impressions to the geologist. The chief value of the book to serious students lies in the description of civil misrule under the so-called government, and in his accounts of the characteristics of the Filipinos. The reflections on civil affairs are evidently temperate and carefully guarded—indeed no serious criticism is uttered without reference to Foreman, whose sympathies were with the established church and state. For example, Worcester remarks of the Spanish officials, "They are expected to steal more or less. That is what they are there for, and they do not hesitate to admit it. Time and again I have heard them say of themselves, when discussing the matter, 'We are a nation of thieves'; and if I may judge from what I myself saw, much might be said in support of this view of the case. If peculation becomes too extensive, however, so that the perquisites of those in high places are interfered with, an investigation is ordered" (page 469). But Foreman says, "If the peculations by the government employés, from the highest circles downward, could be arrested, the inhabitants of this colony would doubtless be several millions richer per annum. One is frequently hearing of officials leaving for Spain with sums far exceeding the total emoluments they have received during their term of office. Some provincial employés acquire a pernicious habit of annexing what is not theirs, by all manner of pretexts. To cite one of many instances: I knew a governor of Negros island who seldom saw a native pass the Government house with a good horse without begging it of him; thus, under fear of his avenging a refusal, his subjects furnished him little by little with a large stud, which he sold before he left, much to their disgust" (page 471). The taxes and the methods of collecting them are atrocious: The comandante of Panay "reconcentrated" his people in villages in order to facilitate the collection of taxes; and he amused himself by riding about the country and firing the houses of those who delayed gathering in the villages designated. "We one day saw him burn three native huts. He gave the inmates no warning, but in each case jumped from his horse, pulled a bunch of dry grass, lighted it and thrust it into the thatch, which burned like tinder. Those within jumped from doors and windows in their haste to escape. When a house was completely burned, he very courteously suggested that it might be well for its occupants to look for a site in town when ready to rebuild" (page 234). The same comandante had an ingenious device for bringing delinquent tax-payers to terms: "He caused them to be caught and tied to trees, and then set a large and vicious dog on to them, and encouraged it to worry them" (page 234). An equally ingenious officer armed his tax-gatherers with a sort of cat-o'-nine-tails made from vines of the bejuco, which are circled at intervals of an inch or two by rings of recurved thorns; with these bloody devices the delinquent was lassoed and dragged before the tribunal, where he was stripped to the waist, extended on a bench, and flogged methodically with a rattan which cut the skin and brought blood with each blow. "We were often forced to witness these cruel whippings during our stay. Some of the victims lay still and bore their torture in silence; others cried out, and threw themselves from the bench, with every blow. If they made too much trouble in this way, they were tied in place. After the whipping they were shut into the jail beneath the tribunal, and kept there until relatives or friends paid their debts. If there was too much delay, another whipping followed. Men sometimes died from the effects of these beatings, and women were subjected to the same inhuman treatment as men" (page 256). The bejuco itself was sometimes used for flogging, but not commonly, since the results were too often fatal. The taxes so barbarously collected were levied on almost every conceivable form of property or privilege; the annual tax for the *cedula personal*, or document of identity, varied from fifty cents to twenty-five dollars according to the supposed means of the applicant, and no person could transact business or travel without such a document; cocoanut trees were subject to an annual tax of five cents, and a tax was required for the license to run the oil-press for extracting value from the ripe cocoanuts. The producer had to pay for a license to sell his bananas or rice or milk ; the owner could not kill his buffalo or his hog for needed meat without a tax of two to four dollars ; he could not even fell a tree on his own homestead without paying for the privilege. "It must be remembered that a man's wages are frequently not more than five or ten cents per day ; that a large majority of the people cannot get work at any price ; and that the taxes are not the whole story, for the village friar is yet to be reckoned with, and he has ways of his own for relieving his parishioners of their pence" (page 237). Sometimes the friars were kindly and generous, but so many were otherwise as to lower the average, and apparently more than nullify the occasional benefit of their presence. Their charges for marriage were so extortionate "as to give rise to a widespread and almost necessary custom of dispensing with it" (page 347) ; the minimum charge for burial in Masbate was fifty dollars, or seventy-five if a coffin was used (which itself was sold by the priest at a good price); one padre was not content with prohibiting the burial in holy ground of bodies whose families could not pay the charges, but "caused them to be exposed on the trees about the village square, where they were left to the tender mercies of carrion-eating birds until such time as relatives or friends compensated the holy father in advance for his services" (page 314). On the whole, it seems evident that the civil conditions in the island have been such as to check progress, to prevent industrial development, and to render miserable the lives of the people. Referring to the people themselves, Professor Worcester says: "The writers in our current literature who lump the whole population of the Philippines as barbarians and savages are grossly in error" (page 472). In addition to the Caucasians, Chinese, and a few Japanese, there are more than eighty distinct tribes, conveniently grouped as Negritos, pagan Malays, Mohammedan Malays, and civilized Malays. The Negritos "are rapidly disappearing, and seem destined to speedy extinction" (page 473); the pagan Malays comprise the important tribes of aborigines retaining primitive characteristics. Some of them are savage in disposition and are given to head-hunting and other bloodthirsty customs, though most are harmless and docile and eminently susceptible to civilization. The Mohammedan Malays, or Moro, retain divers traits of savagery, some of them intensified by the fanaticism of a barbaric religion ; the most obnoxious of them are the *juramentados*, who, having taken oath to die killing Christians as the price of eternal glory, arm themselves, enter the nearest town, and run amok among the residents, slaying every living being within reach until themselves slain ; but even these people yield to wise government combining justice and firmness, as shown by the success of General Arolas in dealing with them. The civilized Malays are hospitable, cheerful, fairly honest according to their lights, self-respecting, genial, and notably ready to tolerate judicious government ; most of them are constitutionally indolent, though in those islands in which hard natural conditions make it difficult to earn a livelihood they are noted for their industry ; yet it is not to be forgotten that they are primitive people, without the strong hereditary character of civilized and enlightened men—*i. e.*, in the words of an observing priest, they are "big children who must be treated like little ones" (page 482). The book is rather sumptuous, printed on thick paper in large type (composed in England, judging from the laboured orthography), supplied with a good map, and illustrated with excellent halftone reproductions of the author's photographs.

W J M.

Volcanoes of North America: A Reading Lesson for Students of Geography and Geology. By Israel C. Russell, Professor of Geology in the University of Michigan, etc. Pp. xiv + 346, with maps and illustrations. New York: The Macmillan Company. 1897. $4.00.

It is gratifying to note that after many years of ultra-specialization a geologist and geographer has undertaken the task of summing up the knowledge of the broader features of our continent. In this work Professor Russell has presented a summary of the distribution of the volcanoes, living and extinct, of the North American continent, and has succeeded in producing a readable and admirable volume. The first quarter of the book is devoted to a discussion of the characteristics of volcanoes in general, dealing with the types of volcanic eruptions, the nature of the ejecta, the life history of eruptions, the geomorphology of volcanic forms, subterranean intrusions of igneous rocks, and classification of igneous rocks based upon mineral characters. While these subjects are ably treated by Professor Russell and would well become a text book of geology, we cannot but begrudge the valuable space they occupy, which later necessitated a condensation of his descriptions of the volcanoes themselves. It is also regrettable that the author, in illustrating the character of volcanic action, should have used so many foreign examples, when abundant material could be found at home. He need not have gone outside of North America and the adjacent Hawaiian and West India islands to have found illustrations of every known type of volcanic activity and productivity. We doubt if even the explosion of Krakatoa itself, which the author so freely cites, much exceeded in wide-reaching effect the tremendous catastrophe of Morne Garon, St Vincent, in 1812, which affected American geography from Chili to New Madrid, destroying many cities, notably Caracas. In the mud craterlets of the Sonoran coastal deserts, the frequently active Colima of southern Mexico, the numerous active volcanoes of Central America, and the volcanoes of the Aleutian and Hawaiian islands, the author could have found abundant illustrations of all known volcanic phenomena.

Following the geological introduction is a compendium of the distribution of volcanoes of North America, active and recent, which is the best that has ever been presented. This is most instructive reading and will be exceedingly useful to the future student who will take up this subject and pursue it more extensively, for there is no more tempting or more profitable field for research on the part of some one who has means and opportunity than a systematic exploration and description of the North American volcanoes, especially those of Mexico and Central America and the Caribbee islands.

Into 38 pages the author crowds a valuable compilation of the known facts concerning the Central American volcanoes, 64 of which are enumerated. Only 18 pages are given to the volcanoes of Mexico, including those wonderful giants of the New World, Popocatapetl, Ixtaccihuatl, Xinantecatl, Tuxtla, Perote, etc., which lie almost at our very doors, and are so accessible to all who are in search of knowledge. It seems somewhat disproportionate, after so briefly describing the sites of greatest North American volcanic development, that 90 pages should be given to the relatively trivial and mostly prehistoric volcanic phenomena of the United States; but when we consider that these are here more fully and comprehensively presented than hitherto attempted, we feel grateful to the author and overlook his brief consideration of the more typical North American volcanic areas. It would have been well had Professor Russell included on his map and in his text some mention of the latter, which stretch across the eastern gateway of the American Mediterranean, and of the volcanic cinder cones, perhaps the most perfect in the United States, occurring east of the Rio Grande in New Mexico; and since he included dead volcanoes, also the stocks of southwestern Texas, the only ones of the kind, so far as we are aware, occurring within the Southern Atlantic Coastal plain of the United States.

As a whole, Professor Russell's work is thoroughly commendable and will not only prove a welcome addition to the library of those scientifically inclined, but will accomplish much in the laudable direction of placing within the hands of the layman a most readable treatise upon a technical subject.

R. T. H.

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

Regular Meeting, November 4, 1898.—Col. Henry F. Blount in the chair. Lieut. D. H. Jarvis, U. S. Revenue Cutter Service, gave an account of the Point Barrow Relief Expedition, winter of 1897–'98, illustrating his remarks by lantern slides.

Regular Meeting, November 18, 1898.—Mr W J McGee in the chair. Prof. Robert T. Hill delivered an address on Cuba and Its People, illustrating his remarks by lantern slides showing the architecture, manufacturing establishments, mode of travel, scenery, and types of inhabitants of the island.

Special Meeting, November 25, 1898.—Mr W J McGee in the chair. Chief Engineer Harrie Webster, U. S. Navy, gave an illustrated lecture on Korea.

Regular Meeting, December 2, 1898.—Mr W J McGee in the chair. Prof. W. Edwin Priest, Central High School, Washington, D. C., gave an illustrated lecture on the Spanish in Europe and America.

At the conclusion of the lecture an informal reception was given to members of the Cuban delegation, the receiving party consisting of General José Miguel Gomez, Colonel Manuel Sanguily, Dr Jose A. Gonzales Lanuza, Señor Quesada, and Señor Ricardo Diaz-Albertini.

Elections.—New members have been elected as follows:

September 14, 1898.—Mrs Emma Shaw Colcleugh, Porter Graves, Miss Belle H. Stone.

October 7.—Miss Mabel L. Allen, Floyd N. Barber, Miss Etta Blowers, William S. Campbell, Charles R. Dean, Jerome F. Johnson, Henry Landes, Miss Sarah M. Lilley, Miss Kate Marsden, F. F. Murdock, Mrs Ellen S. Mussey, Samuel Hubbard, C. N. Osgood, Walter S. Parker, Miss Louise C. Patterson, R. B. Tuley, Rev. John D. Whitney, Major Edmund Wilkes.

October 21.—Miss Laura A. Colbath, Miss Maude Fierce, Mrs J. Ellen Foster, W. C. Haldeman, C. Munro Hall, Frederic H. Holmes, William T Horine, Major Jed Hotchkiss (life), A. J. Knowlton, Miss Harriett B. Sargent, Mrs Helen M. Wilcox.

November 10.—Mrs M. F. Adams, Miss Belle Allen, Rev. Henry Baker, George F. Bird, Dr J. H. Clark, U. S. N.; Prof. John L. Ewell, Miss Elizabeth S. Hungerford, Homer M. Kintz, Lieut. Francis A. Levis, U. S. R. C. S.; Le Duc de Loubat (F. Loubat), life, F. W. McReynolds, J. Oliver Moque, Dr Nora Moyer, J. H. Ralston, Dr Eugene C. Rice, Dr Thomas E. Ridgway, Miss Helen Frances Shedd, W. H. Singleton, Mrs Elizabeth C. Sloan, J. Henry Smith, Dr William H. Spencer, Lieut. John W. Stewart, U. S. N.; Dr William A. Stewart, Miss Alice B. Train, Alexander G. Uptegraff, M. A. Winter, D. W. Woods.

November 18.—Willard Abbott, William J. Acker, Mrs F. E. Bach, Edwin C. Clark, Randolph D. Hopkins, Mrs Clara K. Ingersoll, Bernard H. Lane, Dr Hanson T. A. Lemon, Miss K. L. Patterson, Electus A. Pratt, Dr William Seaton, W. H. Tapley, Charles W. Taylor, Waldo B. Truesdell, George Westinghouse, Jr. (life).

Upon nomination by Prof. W J McGee, William McKinley, President of the United States, was elected an honorary member.

December 2, 1898.—Miss May W. Cameron, J. B. Collins, Mrs Carrie R. Cox, Mrs Charlotte E. Danforth, Ernest P. Goodrich, Miss Annie Grey, Alfred Holmead, Miss A. S. Mallett, Francois E. Matthes, Mrs S. W. McCall, E. Meade, Hon. F. W. Mondell, Miss Elvira G. Parker, Miss Katherine Raber, Major Henry Romeyn, U. S. A., Frank R. Rutter, Ph D., Norman E. Webster, Jr., Mrs John T. Wood.

Elections to fill vacancies on Board of Managers:

October 21.—Prof. Willis L. Moore, Chief of the U. S. Weather Bureau, was elected a member of the Board of Managers to fill the unexpired term of Lieut. Everett Hayden, U. S. N., removed from the city and transferred, at his own request, to corresponding membership.

November 18.—Prof. Henry S. Pritchett, Superintendent of the U. S. Coast and Geodetic Survey, was elected a member of the Board of Managers to fill the unexpired term of Prof. G. K. Gilbert, resigned.

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ERRATA

Page 108, line 1, for "George C. Davidson" *read* George Davidson.
Page 467, line 23, for "half" *read* quarter.
Page 472, line 21, for "Vineyard" *read* Nantucket.