ELISHA HANSON

THE #9

NATIONAL GEOGRAPHIC MAGAZINE

AN ILLUSTRATED MONTHLY

HONORARY EDITOR: JOHN HYDE

HONORARY ASSOCIATE EDITORS

A. W. GREELY W J McGEE ELIZA RUHAMAH SCIDMORE

VOL. VII—YEAR 1896

WASHINGTON
THE NATIONAL GEOGRAPHIC SOCIETY
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ILLUSTRATIONS

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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 over 1,200. 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 will be sent regularly to all members, both active and corresponding.

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THE

National Geographic Magazine

Vol. VII JANUARY, 1896 No. 1

INTRODUCTORY

With the present number the National Geographic Magazine commences a new series and makes its first appearance as a monthly publication. What shall be its precise scope and function has been the most difficult question its editors have been called upon to determine. From no other point of view is the interdependence of the sciences so manifest as from the geographic. Geography in its broader sense has to do not merely with the physical features of the earth's surface, but with the distribution of animal and vegetable life, with political divisions and subdivisions, with the growth and movement of population, with the progress of human society, with the development of the earth's natural resources, and with commercial intercourse between nations. To cover successfully so vast and so diversified a field is entirely beyond the capacity of any single periodical publication. Either it must restrict itself to physical geography and become largely technical, or it must content itself with briefly chronicling the more notable additions to geographic knowledge in those parts of the world in which its readers are less directly interested, and with becoming more especially the exponent of the geography—physical, political, and commercial—of the continent with which its publication more particularly identifies it. And surely in the case of an American publication this is a sufficiently broad field. There are vast regions of the New World that must continue to tempt the venturesome explorer for many years to come. Here, too, on this continent "the rudiments of empire are," in the words of one of our own poets, "plastic yet and warm;" political problems are being wrought out on an unexampled scale, a fusion of races hitherto without parallel is going on, and the bounty of nature is being poured out with a more lavish hand than in any other equally extensive portion of the globe. It will accordingly be the aim of the National Geographic Magazine to be American rather than cosmopolitan, and in an especial degree to be National. There is hardly a United States citizen whose name has become identified with Arctic exploration, with the Bering sea controversy, or with the Alaska boundary dispute who is not an active member of the National Geographic Society and a contributor to the pages of its magazine. In the Army and Navy the Society is also well represented, and from the gallant and accomplished officers of those important branches of the service it receives from time to time much valuable information. The principal officers and experts of the different scientific bureaus of the Government—the Geological Survey, the Coast and Geodetic Survey, the Smithsonian Institution, the National Museum, the Hydrographic Office, the Naval Observatory, the Weather Bureau, the Bureau of American Ethnology, the Biological Division of the Department of Agriculture, and others—have always been among the most active members of the Society, and the great work that is being done by these several bureaus—a work that is at once the wonder and admiration of foreign scientists—will be regularly discussed in the pages of the magazine by those who are in close touch with if not actually engaged in it. Turning from our own country to the sister republics of the two Americas, we find almost all of them connected with the Society in the persons of their diplomatic representatives, and through the cordial coöperation of these gentlemen the magazine will receive from time to time the latest and most authentic geographic intelligence concerning countries in which the people of the United States are now taking an exceedingly keen and friendly interest. That the magazine will not reach at a single bound the high standard at which those responsible for its management are aiming will scarcely be a disappointment either to its editors or its readers. The measure of its success, however, will not wholly depend upon the efforts of those conducting it. Nothing less than the generous support of that numerous class of the community which is interested in one or another of the different branches of geographic science will enable the National Geographic Society to make its magazine everything that it ought to be and properly equip it for the discharge of its function as The Magazine of American Geography. To possess a knowledge of the conditions and possibilities of one's own country is surely no small part of an enlightened patriotism, and to the patriotic impulses of the American people no appeal was ever made in vain.

RUSSIA IN EUROPE*

By Hon. Gardiner G. Hubbard, LL. D., *President of the National Geographic Society*

England, the United States, and Russia have each made greater territorial acquisitions during the present century than all the other countries of the world together. In the case of the British empire, these have been larger and more important than those of either the United States or Russia. The United States and Russia have only annexed contiguous territory, save Alaska. Russia when first enrolled among civilized nations, in the time of Peter the Great, had no outlet to any ocean except the Arctic, and consequently no possibility of a navy or of commerce. Since then she has extended her dominion northwest to the gulf of Bothnia and the Baltic sea, building St. Petersburg on the marshes of Finland, south to the Black and Caspian seas, southeast to Afghanistan and China, and in the extreme east to the river Amur and the Pacific.

The acquisitions of the Russian Empire within this century are greater in extent and importance than the whole of European Russia before that time. Her frontier has been advanced toward Stockholm 630 miles, toward Berlin 700 miles, toward Constantinople 500 miles, toward India 1,300 miles. Her territory in Europe comprises more than one-half of that continent; yet with all her great empire she has only three ports, and these on the Black sea, open to navigation throughout the year, the others being closed by ice from three to six months, while from those on the Black sea ships of war have no right to pass into the Mediterranean. Until within one hundred years southern and southeastern Russia were infested with hordes of Tartars and Kalmucks, who overran nearly one-third of Russia—wandering tribes without fixed habitation or permanent government, "marauders, slave-dealers, and vagabonds," who "came, conquered, burned, pillaged, murdered, and went." The first step of Russia when she determined that her empire should belong to the civilization of Europe was the subjugation of these tribes. This has been accomplished by compelling the Tartars

*Annual address delivered May 10, 1895.

and Kalmucks to live within fixed and permanent boundaries, by enrolling the Cossacks into bands of cavalry, and substituting the agricultural for the nomadic life. Many of the tribes, unwilling to give up their wandering life, retired beyond the Caspian sea, and from those regions continued their inroads upon the Russian settlements. Russia, for her own protection, was again obliged to subdue these unruly tribes, and thereby to extend her dominion still farther to the east, until it finally reached a barrier in the Pamir and the mountains of Afghanistan.

PHYSICAL FEATURES OF RUSSIA.

If nature ever made the boundaries of a nation, it determined those of Russia—the Arctic ocean on the north, the Ural mountains on the east, the Black and Caspian seas on the south, and the Baltic sea on the northwest, with Siberia and Trans-Caspia as the natural extension of her empire.

In August, 1881, I left London on a trip to Russia, passing through Antwerp, Berlin, and Königsberg to St. Petersburg; thence to Moscow and Nijni Novgorod. From Moscow I went southeast through Russia, over the Caucasus to Tiflis, in Asia; thence to Batoum and Sebastopol, on the Black sea, and from the Crimea north to Moscow. In all this journey of 3,500 miles we crossed no range of mountains, we saw no hills more than five or six hundred feet in height until we reached the Caucasus. It was one broad, level plain from Antwerp to Königsberg, 150 miles in width, bounded on the north by the Baltic, on the south by the Erzberg and the foothills of the Carpathian mountains. Entering Russia, the plain widens, extending northeast 1,800 miles along the coast of the Arctic ocean to the Ural mountains, south to the Black sea and the foothills of the Caucasus, and southeast 3,000 miles to the mountains of Afghanistan. My letters written from the foothills of the Caucasus say: "Only think of traveling from one end of Europe to the other over a plain, neither hill nor mountain in all the route, with scarcely a new scene from morning to night or from one day to another. After two days' and nights' traveling nearly due south from St. Petersburg we have not reached as far south as St. Johns, in Newfoundland."

"Yesterday our route was over great plains with rich black earth, occasional forests, pretty well watered; today, broad level steppes with sandy soil, without a tree in sight. We are traveling through the land of the Cossacks; men and women at every station have Asiatic faces, and wear generally a goatskin coat, with the fur inside, fastened by a girdle. No trace of cultivation, except on the streams which we cross from time to time. These streams flow in low, narrow valleys; the road descends two or three hundred feet into the valleys by curves, and then ascends to the plain to save grading, and this affords the only variation in the scenery."

In this great plain there are five distinct zones of land: The frozen, the forest, the black, the agricultural, and the barren steppes. The black zone, near the center, is the most fertile and thickly inhabited. To the north the country grows gradually less fertile, passing through the forest zone to the Arctic zone, entirely destitute of vegetation. To the south of the black zone the country likewise grows less and less fertile, passing through the agricultural zone to the dry and sandy steppes, entirely destitute of vegetation.

From 200 to 300 miles in width, the black zone extends from Austria, a little north of east, across Russia, over the Ural mountains, far into Siberia. It resembles our prairies; has a rich, black soil of great depth, unsurpassed in fertility. Réclus says that "all traces of glaciers disappear where the black lands begin and the forests end, while the contrast between the flora of the two regions is complete." American geologists believe that the glaciers extended over the whole of Russia to the Black sea, and that the great level plain which constitutes Russia is due to aqueo-glacial action.

In the northern part of the black zone are occasional groves of oak and birch; traveling north these are succeeded by forests of hardwood, with occasional evergreens. Gradually the hardwood disappears; then we enter the forest zone, pines and evergreens. About one-third of Russia is forest. In this region are immense districts, where the only roads are rivers flowing through interminable walls. Then comes a land of rocks, lakes, and swamps, with isolated and snowy masses rising above the forests and peat-beds. This is the Arctic zone, and here is Finland, a region of lakes, over eleven hundred in one province; the great forests of pine become small evergreens, reaching a height of 25 feet in 100 years, gaining their maturity in 300 years. Gradually they become yet smaller and are of slower growth. The giant of these forests is the willow, which sometimes reaches a height of 6 inches. A little farther north the rainfall exceeds the evaporation and river-flow and forms a woodless plain of small lakes and morasses, called tundra, on which neither man nor beast could set foot if the ground were not frozen to the depth of very many feet; in summer melting a little more than one foot. Into this treeless region in summer come innumerable birds of different kinds to build their nests and hatch their young. In autumn they fly south—some to the Crimea, some to Asia, others into Africa. So level is the country that in their flight they rarely reach a height of 500 feet above sea-level. This is the land of the Samoyeds, where agriculture is impossible, and the natives live by fishing and hunting. Still farther north, yet in Russia, is Nova Zembla, 75° north latitude, where no animal life exists; but even here, in this land of ice and snow, several hundred species of lichen have been found. Though the surface of the water is frozen for about nine months in the year, yet fish and animalculæ abound, the temperature of the fish varying with the water in which they live, here only a little above the freezing-point.

Returning to the black zone, near the latitude of Moscow, and traveling south, first the hardwood gives place to the rich prairie land; then we reach the agricultural steppe, a treeless land, susceptible of cultivation, though lacking in the rich, deep loam of the black zone. Farther south lie the vast barren steppes, in the west a sandy desert, in the east a vast saline plain, formerly the bed of a great lake, of which the Caspian and Aral seas formed a small part. This is the genuine steppe, a country level as the sea, without even a gentle undulation or a particle of cultivation—neither tree nor bush, nor even a stone, to diversify the monotonous expanse. The inhabitants lead a nomadic life, like those of the Arctic region.

The very diversity of the country and the occupations of the people of Russia tend to unity, for the north needs the grain of the south, and the south requires the wood of the north. Middle Russia, that great center of manufactures, without the north and south would lack markets for its manufactures.

MOUNTAINS.

The greatest extent of upland in Russia is near Great Novgorod, southwest of St. Petersburg, where the Valdai hills rise from 800 to 1,000 feet.

In the east the Ural mountains separate Russia from Siberia, a range of plateaus rather than mountains, attaining an elevation of from 3,000 to 5,000 feet, extending from the Arctic ocean south about 1,200 miles. They are rich in metals—gold, precious stones, iron, and coal—with large and productive mines. In the southeastern part of Russia are the Caucasian mountains, separating Europe from Asia and running from the Black to the Caspian seas, about 600 miles in length and 150 in width. The culminating point is mount Elburz, 18,572 feet above the sea level, 3,000 feet higher than Mont Blanc. Near the center of the Caucasus is mount Kazbek, 16,552 feet, 1,000 feet higher than Monte Rosa. These mountains are clothed with snow for several thousand feet, and down their sides flow many glaciers. The Russians have so little love of scenery that they rarely make excursions among these mountains or ascend Elburz, which, though half a mile higher than Mont Blanc, is much easier of ascent, because there is only a steady climb for several hours over smooth, frozen snow.

Near Kazbek is the pass of Dariel, 8,000 feet in height, the only carriage road through these mountains. In ancient times this pass, called the "gates of the Caucasus," was guarded by Tartar towers, which still stand, thousands of years old, overlooking the pass. Until Russia conquered the northern part of Persia, the two sides were never held by the same power.

At the southeastern extremity of the Caucasus, on the Caspian sea, at Baku, there stands an old temple, where for centuries a beacon was kept burning by the fire-worshipers of India and Persia. The people in the olden time believed that the fire was supernatural—the gift of the god of fire. Modern science shows that it came from oil wells, and modern enterprise has here developed a great industry. The old temple of the fire-worshipers remains; on one side of it are huge derricks, pumping the oil; on the other, a great stone embankment, stretching over a mile along the coast, where steam and sailing vessels and long trains of railroad cars load with oil. Here is a population of fifty thousand, where twenty years ago were less than fifteen hundred. The Parsee tending the fire symbolizes the past; the Russian with his oil wells, his railroads, and steamboats, the future. The petroleum is used for fuel on the Caspian and Volga steamers. It is sent up the Volga and its branches to all parts of Russia and is carried by rail from Baku to Batoum, on the

Black sea, and thence by steamer to different parts of Europe. It has superseded American oil in Russia and competed with it in Vienna and Berlin until consolidation of the American and Russian interests was made. In 1893 Baku alone produced 33,104,000 gallons, a production largely exceeding that of either of the two great oil-fields of America.

Another range of mountains, or rather a continuation of the Caucasus, runs across the Crimea. This range protects the coast on the southeastern side from the cold winds of the north, and here are Livadia and Yalta, where the late Czar died—the only places in all Russia where there is an equable climate like that of Nice and Mentone. The road from Livadia crosses this chain of mountains through a pass about 3,000 feet in height, with views of the Black sea resembling those of the Mediterranean near Amalfi, and then descends to Balaklava and Sebastopol, where the winter winds from the Arctic blow unbroken by any mountains.

RIVER SYSTEM.

In the plateau of the Valdai the principal rivers of Russia rise. The Volga and its branches flow east and south to the Caspian sea; the Dnieper and Don to the Black sea; others northwest to the Baltic. Russia is so level that its rivers are slow and sluggish, with little water except during the melting of snows. They are connected with each other and with the gulf of Finland and the Arctic ocean by canals, so that intercommunication between different parts of the country is easy in the summer. The rivers that empty into the Arctic ocean and into the Black and Caspian seas have several mouths, so that navigation from the river into the sea is very difficult.

There are 33,000 miles of navigable rivers, 81,000 vessels of various kinds, and 138,000 rafts.

CLIMATE.

In its climate, as in extent, conformation, and population, Russia differs from the other countries of Europe. These are bathed by the warm winds from the Atlantic and Mediterranean. The moisture of these winds is rapidly condensed as they pass over the Alps and Carpathians and the mountains of Norway and Sweden, the source of numerous rivers, and affording an abundant supply of rain to western Europe. These winds then blow over Russia, but they have become dry, without moisture; consequently the rainfall of western Russia is only about twenty or twenty-five inches, or half that of western Europe. This steadily diminishes toward the east, leaving the steppes of eastern Russia dry and barren, unless irrigated. The temperature diminishes rapidly from the west to the east. North of 50°, or far south of Moscow, it diminishes more rapidly from the west to the east than from the south to the north.

Over the vast plain of Russia the winds blow without obstruction. The cold winter winds bring from the Arctic ocean the temperature of the polar regions, while the warm summer winds from the Black sea convey the temperature of the torrid zone. Spring and autumn are almost unknown, for as soon as the frost is gone, about the middle of April or the first of May, the wheat and grain fields and the foliage of the trees burst forth with a rapidity unknown in our country.

RACES.

Although Russia is one of the most uniform and level of countries, yet few are occupied by as great a variety of races. Southern and middle Russia were for centuries the great highways over which vast numbers of barbaric hordes—Scythians, Huns, Mongols, and Vandals—passed from Asia through Russia into Italy, Hungary, Poland, Germany, and by the Dariel pass over the Caucasus into Asia Minor. Some of each of these tribes remained; all left their impress upon Russia. While these tribes were overrunning Russia the Slavonians came, to-day the predominant race, the last of the Aryans to leave their original home, and these retained when they entered Russia many Asiatic habits. In the fifth and sixth centuries they probably occupied the region now known as "Little Russia" and were the germ of the great Russian empire. When the Slavonians entered Russia they found Mongols, Finns, and Huns; with some they intermarried; others they pushed into northern and Arctic Russia, a region without temptation for the Aryan or other wandering tribes.

From the west came the Northmen, who settled the country about the Baltic sea and founded Novgorod the Great, the oldest town in Russia, and brought many of the customs and habits of western Europe. In the fifteenth century Novgorod was the largest and most important town in northern Europe and a member of the Hanseatic league. It lost its independence and was overthrown by Ivan the Terrible in 1570, and Novgorod as an independent State ceased to exist and is now a town of little importance.

In the thirteenth century the Mongol Tartars entered eastern Russia and for over 200 years, from 1238 to 1462, ruled, mingling their blood with the Russians. They in turn were conquered by the Russians and driven from central Russia into the valley of the Volga and the Crimea, where their descendants still live.

In the seventeenth century Poland, then one of the largest countries of Europe, undertook the conquest of Russia, and for some years there was a life-and-death struggle between the two nations. Moscow was captured and the king of Poland reigned there for thirteen years. The people of Nijni Novgorod the Great arose, selling their wives and daughters to buy arms, took Moscow, burning a large part of it, and finally expelled the Poles, but not until they had mingled their blood with the Russian. This was the last invasion of Russia that left its impress on the country.

The Great Russians, the inhabitants of the black zone in northern and central Russia, are the most numerous of the population of Russia. In the northwest they intermarried and mingled with the Finns; in the east with the Mongol Tartars. In southern Russia the inhabitants called Little Russians intermarried with the Cossacks and Crimean Tartars and are next in number to the Great Russians. The Cossacks are Russians who preferred the nomadic to the agricultural life, and therefore wandered into the steppes away from civilization and formed bands of horsemen, called often by the country in which they lived, as the Don Cossacks. They resemble in some respects the cowboys of America. They occupied the Crimea and the country north of the Black sea, with Tartar tribes from Turania, Kalmucks, and Bashkirs.

Besides the races named, there are Turanians, Armenians, Poles, Semites, Georgians, and Turks—in all, thirty different races—with Greek, Catholic, Shumanistic, Buddhist, Jewish, Mohammedans, Dissenters and pagan religions of all kinds. These various races formerly intermarried, but the introduction of the Mohammedan religion among the Tartar tribes has prevented further mingling of these various races and has proved a great obstacle to their elevation and civilization. I was struck with the variety of races at a dinner in Piatigorsk, a watering place at the foothills of the Caucasus, given by an officer of the Russian army. My host was a German; the other guests, his fellow-officers, were a Pole, a Jew, an Armenian, a Caucasian, a Georgian, a Tartar, a Mongolian, and, finally, a Russian.

In a Tartar and Russian village there is no blending of races. Near one end stands the Mohammedan mosque; at the other the Christian temple. In Finnish villages, on the other hand, intermarriages of the Finns and Russians is causing the blending of the two races.

CHARACTERISTICS OF THE POPULATION.

Russia in Europe, with a population of nearly 100,000,000, is very thinly populated, having only fifteen inhabitants to the square kilometer, while Germany has seventy-eight and England one hundred and fourteen. The population is increasing at a more rapid rate than in either of these countries.

A recent writer says: "The life that men live in the city gives the type and measure of their civilization. The word civilization means the manner of life of the civilized part of the community—that is, of the city men, not of the country men, who are called rustics." The cities of Russia, except St. Petersburg, are small, far apart, and have little connection with each other or influence on the population. The Russian peasant has therefore little knowledge either of city life or of this civilization. He lives far removed from it, and there is little of it in Russia. Only one-third as many in proportion to population live in the cities of Russia as in the cities of the United States.

Two-thirds of the population, including all the Great and Little Russians, live in the black zone, with Moscow as a center. It is estimated that over six-eighths of these are either serfs themselves or are the children of serfs, while 6,000,000 of the remainder are Poles and 2,000,000 Jews.

It is impossible that in one generation such a population of freedmen should have made any considerable advance. Their life and habits are, therefore, mainly such as they were as serfs. It should also be borne in mind that while these are descendants from Aryans, yet this blood has from time to time and in very many generations been mingled with the blood of the Asiatics, and therefore with nations less civilized.

The highly civilized man makes nature subordinate to his convenience and necessities, but with uncivilized nations nature dominates and man becomes subject to its influence. The character and habits of the Russians are therefore largely fashioned by their environments, which vary little in different localities.

Russia has only two seasons, summer and winter. During the long Arctic winter the people are without occupation, save the tending of flocks morning and night; the days are short and sunless; the nights long; the houses, without ventilation, are hot and close; the air bad. Even in my room, in the largest and best hotel in St. Petersburg, the windows in early November were sealed so tight that a breath of air could not get in. The rooms were heated by steam, which could not be shut off, and the only ventilation was by a small hole in the wall, through which a little fresh air could enter. The peasants wear the same clothes night and day; all sleep together on the large stoves, and are required by their priests to bathe every Saturday evening, using the vapor bath instead of soap. A large room or cave is dug in the earth and heated very hot; here they sit or lie down; fan themselves with a whisk brush; a profuse perspiration opens and cleanses the pores of the skin; they then often plunge into an icy stream or bathe in cold water. They lead idle, listless lives in winter, and when winter ends are little inclined to work. Then follow the long, hot summer days, the heat fully as enervating as the bitter cold. Without mental or bodily activity, they become heavy and lethargic. Their food for generations has been meager, of the poorest kind, almost entirely vegetal, and unsuitable to the climate. Those who survive to mature age have great power of endurance, which often becomes stolid stubbornness or passive courage and resignation. They are gentle-hearted, have little imagination, and therefore no inventive faculty. Every peasant, whether man or woman, wears a sheepskin in winter, bright colors in summer, the garment of nomadic tribes, not worn by any other European race. They have little desire to rule others, or to make the tribes whom they conquer subservient, and are therefore admirably fitted for the work of peaceful agricultural colonization. Wages are very low. The manager of the telegraph service of one section of Russia, with twenty-two offices under him, told us that his salary was 1,100 rubles, or about $550, a year; that the operators were on duty twenty-four hours every other day and received 15 rubles, or $7.50, a month. Wallace tells us that "a family of five, man and wife, boy, and two daughters, actually lived in the northern part of Russia on sixty-one dollars a year." There are few railroads in Russia, no stage-coaches, few daily and weekly papers, neither magazines nor books, for the peasantry can neither read nor write. They have little more knowledge of the nearest village than we have of the moon.

We can scarcely comprehend such a people or such a life and are not surprised to learn that they resort to cards and drink as the only relief from the dullness of the interminable winter. They never hurry, for time is not money. Among professional men and merchants in St. Petersburg business does not commence until after breakfast, at 11 or 12 o'clock; with dinner at 6 o'clock, little time is left for work, but a long evening for cards.

A typical Russian village consists of two lines of houses, one on either side of the street, each house, built of pine logs, standing alone, from ten to one hundred making a village; each cabin is like its fellow except in size; when you have seen one you have seen all. The floor is of earth; the walls, rough logs, the crevices stuffed with moss, without paint—the type of houses in England in the time of Queen Elizabeth. At one end of the village is the cruciform church, of an oriental aspect, a dome gilded and painted in bright colors, surmounted by a gilt cross. We visited Rostoff, the center of a large commerce with the interior of Russia, a city with a population of 50,000, at the mouth of the Don, inhabited by Russians and Cossacks. It has a large casino, containing a ball-room, gardens, billiard and refreshment rooms, where all grades of society assemble on Sunday to dance and hold parties of pleasure. We spent two hours here and took a drosky drive to the town about a mile distant. It is a long, dirty, straggling, unkempt village, with broad streets, paved in the time of Peter the Great, apparently never repaired since his death; the only difference in the streets is that some are worse than others; a few large stores and a great market place, with bread enough for an army; potatoes, quantities of beautiful-looking tomatoes, egg-plants, grapes, and pears. The place looked as though it had considerable trade, but is devoid of all interest. We saw no new or fine buildings; only old and dilapidated houses.

In Russia there is no middle class and little intercourse between the officials, who are the highest class—the nobles, who are the upper class—and the peasants. They live in a world as distinct as Europe and Asia. The upper class follow the customs and manners of the west. Formerly they used the German language, then the French, taking from France liberal ideas, but now Russian is the language of the court and has been adopted in polite society. The upper classes are as highly cultivated, as honorable, and as polished as any of the upper classes in Europe.

The peasantry, recently serfs, in their feelings and habits are Asiatics, faithful to ancient manners and customs. They look upon innovation or change with distrust. St. Petersburg is the type of the new ideas, Moscow of the old.

We now turn to northern and Arctic Russia, a country with inhabitants very different from that we have just described. In the west is Finland, formerly subject to Sweden, but annexed to Russia in 1800. The name and origin of the Finns is an ethnological problem. They are supposed to be of the same race as the Hungarian and Bashkirs. In summer the sun's rays are nearly constant, and the growth of vegetation continuous and rapid.

The people are tall, strongly built, and well proportioned, with faces rather square than oval. They are slow, dull, grateful and honest, industrious and energetic. Their peculiar language and literature have attracted much attention, and although writing seems to have been introduced only about three hundred years ago and printing about one hundred years later, yet nearly all can read and write.

In the written language phonetic spelling is employed with almost perfect consistency. One celebrated linguist says, " it is the most harmonious and sonorous of tongues." They are better educated, more highly civilized, and are improving more rapidly than the Russians. Serfdom was never introduced into Finland, and the Finns boast that they have never had a slave nor a noble in all their land. From these causes, while we regard the Russians as Asiatics, we must look upon the Finns as Europeans. Northeast of Finland, on the Arctic circle, and far to the north of it, where the shore-line stretches from Archangel toward the sunrise fifteen hundred miles, bound in ice chains for eight months of the year, where on the cliffs and ledges the snow never melts, a wandering tribe, sometimes called Samoyeds, live in a desert of ice and snow—a land without a road, without a field, without a name. Their dwellings are tents built of poles, open at the top to let out the smoke, and covered with loose reindeer skins, secured by thongs of seal and walrus hide; within are small compartments, the whole warmed by a fire in the center of the tent and a seal-oil lamp in each compartment. They own herds of reindeer, which alone make the region habitable. In summer they move frequently for food to fresh pastures of green moss, on which the reindeer feed, and on them the wild men of the country live, eating their food without cooking. In the winter they draw near the shore and live on seal and cod. They hunt the squirrel and fox and sell their skins to the Russians, and thus purchase a few of the necessaries of life. Their only arms are the bow and arrow. The Samoyeds are believed by some to be Finns, who, forced far into the Arctic region, have degenerated and lost most of the peculiar habits of the Finns.

South of the agricultural zone we come to a third civilization, to another and different life, in the lands of the southwest and in the saline steppes in the southeast. These were inhabited by Cossacks, Tartars, Bashkirs, Kalmucks, and other nomadic tribes, who wandered over the steppes to find pasture for their cattle.

Among these tribes one hundred years ago Catherine II planted colonies of Germans to cultivate the land, establish settlements, intermingle and intermarry with the people, and introduce agriculture, thrift, and habits of industry. This experiment failed, for the Germans have lived almost entirely among themselves, and, while acquiring many of the bad habits of the people, have done little toward improving them. Since the law compelled the Cossacks and Tartars to live in fixed habitations many have migrated into Turania, Armenia, and Turkey in Asia, while from Armenia and Turkey Armenians, Greeks, Druses, and other Christians have come and built flourishing towns and cities on the Black and Aral seas and river Volga. These new settlers are the most industrious and prosperous of the Russians, and immigration will continue as long as these countries are under Mohammedan rule. Before the emancipation of the serf, in 1861, the patriarchal system prevailed, under which each family was its producer and consumer. Since then manufactures have rapidly increased and have nearly doubled the last twelve years. The mining interest has also increased with like rapidity; the annual production of the mines is $67,000,000.

The mercantile or trading class and the manufacturers, usually the most important and influential, are in Russia less in proportion than in other civilized countries, and have little influence, either with the peasants, as they represent western ideas, or with the nobles, who look down upon them as traders.

This completes a general enumeration of the inhabitants of Russia. We have described the lives of the hunters and fishermen of the north, of the agricultural laborers of central Russia, of the nomadic population of southern and southeastern Russia, and the mercantile or trading class and the manufacturers, who live around Moscow and Tula.

Under one czar, Vladimir the Holy, the peasants could change their religion; under another, Peter the Great, they could change their dress, but time alone can change the Asiatic to the European.

The black zone of Russia is as rich as the prairies of America; the lands cost no more; yet the inhabitants of Austria and Germany, contiguous to this fertile land, immigrate four thousand miles to the prairies of America rather than cross the boundary line into this rich zone. One reason for their preferring America is that in Russia they will be called upon to serve in the army. While this is undoubtedly one cause for their preference of America, yet, as the Germans and Russians have never mingled when they have been brought into contact, it is probable that the difference in the habits and customs of the two races—the one European, the other Asiatic—has as much, if not more, influence in preventing the Germans from emigrating to Russia.

GOVERNMENT.

The diversity of races and languages was formerly much greater than at present, when each tribe had its own laws, religion and customs, more or less barbarous, but in all the paternal form of government. The head of the family and chief of the tribe had absolute power over the family and tribe; the czar a like absolute power over all the tribes. The czar is the head of the government, and the peasants believe him to be appointed by God to be their father and ruler. A republican form of government once existed in Novgorod the Great, and also at Pskoff, but these republics, after enduring one or two hundred years, were attacked by wandering tribes from the Orient and by armed bands from Germany, Sweden and Poland. For the purpose of repelling these invasions these cities were forced to unite with various tribes of Russia and form a strong imperial government under a czar.

Peter the Great organized municipal governments for towns and cities after the model of the German free cities, but these institutions having no root in the traditions and habits of the people, it has been impossible to maintain them or to interest the people in them.

For many generations there has been no convocation or assemblage of the people. The entire civilization has been Asiatic, differing greatly from that of the west. There was formerly no attempt either at uniformity in the government of the different provinces and nationalities or of symmetry in the administration. There were not only territorial peculiarities, but different systems in the same territory. Changes in the laws were frequently made, but they were only local.

The idea of an united Russia belongs to Czar Ivan Kalita, who reigned in the middle of the fourteenth century, though Peter the Great was the first to realize the necessity of a uniform and central administration if Russia was to become a great nation. He tried to bring order out of chaos and to introduce western civilization among the barbarous and oriental tribes of Russia, and, as there were no persons qualified for official positions, schools were formed to train men for office. Peter the Great had untiring zeal, perseverance, great ability, and genius. He tried many experiments, but frankly admitted their failure, and died, having overthrown many institutions, but without creating a system. His successors took up the work and carried it forward, each according to his ability, and by slow degrees they have created a centralized government, with a certain uniformity in its administration. There are ranks of nobility, but, unlike those of western Europe, the nobles have no political power or right of primogeniture. All their children are of equal rank, so that nobles are found among the drosky drivers of St. Petersburg; their influence depends solely on wealth and personal character.

A council and ministers or secretaries for the different departments of government have been established, but there is neither uniformity of action between the council and ministers nor between the several members of the council or ministry. For the purpose of obtaining fuller information and from a greater variety of sources, the czar, in important matters, often appoints committees to examine and report directly to him and advise what action, if any, shall be taken.

There is a code of laws, full of commentaries, with a vast number of orders, decrees, and statutes issued by the czar at different times and under different circumstances; also innumerable circulars, open and secret, general, special, and local, forming a tangled growth, so that it is impossible to decide either what the law is or what are the rights of the individual. It is difficult for the czar or his ministers to know how far an order has been executed, for with a censorship of the press it is impossible for either the people or the ruler to know much of the conduct of affairs.

Russia is divided into eighty-five governments and six territories of different areas and population, over each of which is a governor, responsible to the czar, and a council, with a strong centralized administration. The power of the governor is nearly as absolute and unlimited in his territory as that of the czar over the whole empire. Each government is divided into districts. The governor appoints officials in the various districts, who are responsible to him, and these officials appoint police officers in the several villages, responsible only to them. The salaries of the lower officers are very small, and as they are barely sufficient for their support this has led to more or less corruption, although in Russia, as in other countries, embezzlement has not been confined to any class or rank. This was greatly lessened under the late czar, Alexander III, in the central government and in the great administrations.

THE MIR.

In Great and Little Russia, wherever the Slav inhabits, the village community, called the mir, has been persistent and exists today in a form not widely different from that which prevailed in ancient Arya and all over Europe and Asia. There are 107,493 of these communes in Russia. All the land is held by the mir, owned in common, and is divided into three portions—arable, forest, and pasture. The homes are all in the village. The fields, cut into long, narrow strips, are periodically divided among the families, so that each family shall have strips according to its size and numbers. There is a redistribution every few years. Nearly all the women and the greater part of the men are engaged in the cultivation of the land. All the affairs and business of the mir are regulated in a council, composed of the adult men and of the adult women when heads of a family. This village assembly has power to try and punish criminals, and can even send them to Siberia. It is the only government of which the vast majority of Russians have any experience or in which they take an interest. The peasant governing the world in which he lives does not concern himself with the unseen and far away.

The mir, with the exception of community of property and judicial authority, is the counterpart of the New England town meeting, the corner-stone of our republican institutions.

The brightest men leave the commune and go to the cities to work as artisans, but they must first obtain permission from the mir, return to it when ordered, and send a part of their earnings to the village treasury or forfeit all their interest in the communal property and all connection with their ancestral home and kindred. The land and property being held in common affords little opportunity for that struggle for wealth and a better and higher life absolutely necessary for progress. It is indeed a communistic, socialistic system, which some, even in our day, propose to engraft upon our life.

Within fifteen or twenty years the power of the mir has been greatly limited by the establishment of the provincial government, with its police officer, the representative of provincial government, the police having much greater power in his village than formerly.

SERFDOM.

Serfdom and slavery, unknown in Russia before the fifteenth century, originated from several peculiar causes. Prior to the conquest of Russia by the Tartars, in the thirteenth century, the condition of the peasants of Russia and western Europe was in many respects very dissimilar. Russia never felt the benefits either of Roman law and civilization or of the Roman Catholic church; neither the influence of large towns with municipal rights and privileges nor of the feudal system. The Teutons had a sturdy independence and asserted their rights, while the most enterprising of the Russians, having a predisposition to a vagrant life, preferred to seek independence by wandering away from their communes, forming Cossack bands. This vagrancy was increased under the Tartar rule, when the present Asiatic dress of sheepskin was adopted and other Asiatic habits acquired.

Another marked difference between eastern and western Europe, which also led to serfdom, arose from the ownership of the land, in western Europe held in comparatively small parcels and divided between the church, the nobles, and the people, while in Russia the Czar, as owner of all the land, gave great tracts to a few families or to religious houses, retaining the remainder; but these gifts were of little value while the peasantry were allowed to roam, wherever and whenever they pleased.

Laws were passed to remedy this evil by confining the peasantry to certain parts of the country, and subsequently to the estates where they lived. Conscription of the serfs for the army was then introduced, the proprietor was made responsible for the entry of the conscript into the army, and from that arose the obligation of the serf to the master. As the serf could only be profitably employed on the rich black lands around Moscow and Kief, the number of serfs diminished with the distance from the black zone, while in the extreme north and the steppes of the south it never existed. They either worked three days in the week for their masters, having the rest of the week for themselves, or they gave a corresponding portion of their crops, or else one-half of their wages to their masters. It was by slow degrees, subsequent to 1450, that serfdom was established and the serfs became personal property. With this right of property came control of life and limb, and these successive changes, often regulated by laws passed for the relief of the serf, generally resulted in binding his chains tighter.

The act of emancipation in 1861 liberated 49,486,000 serfs, of whom 23,022,000 belonged to the nobles; 23,138,000 to the state, and 3,326,000 to the departments.

A portion of the land owned by the state and of that owned by the nobles and religious houses was by the act of emancipation given to the serfs. The government paid the nobles and religious houses sums fixed by arbitration for the lands surrendered by them, while the serfs paid the state for the land given to them by annual payments running over fifty years, secured by the land and also by the other property of the serfs. The last of these payments will not be due until the early part of the next century. Even now 40 per cent of the land is owned, by the state, 2 per cent by the imperial family, 33 per cent by the peasantry, and 25 per cent by private owners.

EDUCATION.

There has never been any national system of education in Russia. Many noble and wealthy families have English nurses and French or German tutors. The children are taught to speak French, English, and German and formerly were often better educated in those languages than in their native tongue.

There are nine universities in Russia, with between fifteen and eighteen thousand students, who are mostly from poor families and often support themselves by teaching. They strongly desire to reform the government, but are ignorant of any other way of accomplishing their object than by its overthrow. They have therefore become nihilists, hoping to improve the people without realizing how much evil they do. They have converted the universities into hot-beds of nihilism. The government has consequently subjected the students to very strict regulations, not only in their study but in their life outside as well as within the university, the tendency now being to restrict instruction and confine it to specified lines.

In addition to these nine universities, there are medical and professional schools for engineers, electricians, and mechanics, not included in the above enumeration. Each of the eighty-five governments has a grammar or high school, and the pupils on graduating from these schools can enter the higher seminaries.

There are also secondary common schools and gymnasiums, with 2,500,000 scholars, while there are 15,000,000 of school age. Of every ten Russian men, two may be able to read, but of every ten Russian women, hardly one. For the last ten years considerable sums have been appropriated by the government for educational purposes, and in 1893 $31,000,000 by the general and local governments; $175,000,000 a year were expended on the army and $22,000,000 on the navy, while in the United States $156,000,000 are annually expended for education.

Slight as are their educational privileges, and probably because they are so slight, the people have no desire for a better and fuller system. During my stay at Nijni Novgorod I was invited to go over the house of one of the wealthiest men in the place. It was a very magnificent house, with a broad marble stairway leading to the salon, the floor of which was mosaic and the hangings fine tapestry. I visited every room in the house; in only one did I see a book, paper, or writing materials of any kind, and that was the children's school-room. I was informed that neither the master nor mistress could read or write, but I was, perhaps, misinformed. On leaving I kissed the hand of the lady of the house, and in return she kissed my forehead, the invariable custom in old Russian families in bidding adieu to guests with whom they were pleased. The family, I was informed, lived in two or three small rooms, keeping the others for show and an occasional party.

Within the present century Russia has developed a literature of poetry and prose, history and romance, excelled by no other nation. Few novels are more read today than those of Tourgenieff and Tolstoi and other Russian writers. Most of them recount tales of Russia and Russian life, and have a wide circulation in other countries. The education of these writers and their mental training have been essentially Russian, and their writings, therefore, touch the heart of the Russian people, and this has led a constantly increasing number to learn to read. There is also a large number of folk songs and tales which are widely sung and recited among the peasantry. Science has also made as rapid progress as belles-letters. There are no better geologists and chemists in the world than the Russian, while other scientists are not far behind. In 1892, 9,588 books were produced, with an aggregate of 30,000,000 copies.

THE FAIR AT NIJNI NOVGOROD.

The geographical position of Nijni Novgorod is most favorable as a gathering place for people from all parts of Russia and the Orient. Situated at the junction of the Volga and Oka, it is easily accessible by these rivers and their branches and canal connections to people from all parts of Russia and from some parts of Asia. It is also the nearest large city to the lowest passes for caravans between Russia and China. This position makes Nijni Novgorod the natural place for the great fair of Russia. These fairs were formerly held in all the countries of Europe and were largely attended, but with good roads, steamboats, and railroads the necessity for them has ceased, excepting in Russia and some parts of Asia.

In 1881 I visited the fair at Nijni Novgorod. Held on low, flat ground opposite the city, for more than five hundred years this fair, though not always held at Nijni Novgorod, has been the great mart of exchange for the products of Russia, Siberia, China, Persia, Turania, and the Crimea. The fair is opened in

July and continues through August and September. Some of the articles for sale are brought by rail, but most by barges or steamboat. I counted fifty tugs from one point, while two or three times as many were anchored in other parts of the river.

From Siberia are brought furs and diamonds, precious stones, fine-toned bells, iron and wooden utensils, Siberian shoes, made of felt, impervious to snow or water, heat or cold. From China come caravan tea, worth $2.50 per pound, the finest tea that is drunk, and brick tea, the poorest, worth only 15 cents per pound. From Persia come precious stones, fruits, carpets, and silks; from Circassia, shawls, slippers, and oils; cotton from Khiva and Bokhara; oil and wool from Astrakhan; from western Russia, woolen, linen, and vast quantities of hardware, nails, and steel, while Germany, France, and England sell their goods by sample. There is a palace with salons for great and small balls and dinners. There are streets with buildings and stores of stone, brick, and iron. These were found insufficient, and three thousand bazaars of a temporary nature are often erected. The same merchants come year after year, and often from generation to generation, and occupy the same buildings. Some come on horseback with their stores, others with steam-tugs towing barges filled with merchandise. Near by on the river Oka are sheds, nearly a mile in length, filled with Siberian iron, rolled, bar, and cast iron rods, plate iron, and boiler plates, wire, hollow-ware, stoves, nails, and all descriptions of rough iron-work. Here also are churches for all creeds—Russians, Chinese, Tartars, Buddhists, Catholics, and Lutherans.

After the fair is over, by the middle or last of September, the place is deserted, stores and houses closed, the goods are taken away, and not a soul is seen in the place where only a few days before three or four hundred thousand people were gathered. The bridge of boats which connects the fair-ground with Nijni is taken down and removed for the winter.

TRAVELING.

The different methods of traveling show the habits and civilization of a people. In the far north of Russia the sledge and the reindeer are only used; in Finland, steam or sail boat or sledge. Travel in summer by land is unusual; they wait for sleighing or go by boat. In central Russia they travel by railroad or tarantass; over the Caucasus and generally through the country by tarantass.

In southeastern Russia the horse and camel are the sole means of locomotion, and travel is generally by caravan. In several of the large cities there are hotels, as in other parts of Europe, but in the country hotels are unknown; only rooms are furnished at khans or caravansaries, as all travelers carry their servants, provisions, bed, and bedding. Everywhere is found the samovar, a large copper vessel, with a long tube or funnel extending to the bottom, kept filled with charcoal, which when lighted smoulders all day long, keeping the water hot day and night, ready for making tea. In the conveyances for travel, in the hotels, and in everything else outside the large cities Asiatic customs prevail. There are regular stations where horses are kept, but they cannot be obtained without a prodovoina—a paper signed by the proper officer—which gives the traveler a right to claim the horses at a price fixed in the paper, which is usually very low.

From Berlin to St. Petersburg and Moscow the sleepers are large, roomy, and clean; the accommodations for sleeping are excellent; the stations and restaurants are well appointed, large, and handsome. After leaving Moscow, the first night we had pillow-cases and mattress in the sleepers, but no sheets; the second night neither pillow-cases nor mattress.

South of Moscow, when I was there the stations were poor, without restaurants, and even without water for washing. We reached Vladikavkaz at night and drove directly to a hotel which we understood was kept by a Frenchman, but he had left, and there was no one in the hotel, or apparently in the village, who could speak either French, German, or English. Fortunately we found a boy from one of the neighboring German settlements who could speak German.

The next morning we started on our trip, through the Dariel pass, across the Caucasus in a tarantass, a boat-shaped, covered carriage without springs or seats, for the roads are so rough that springs would soon break, without opportunity for repairs. We leaned against our trunks in the back of the carriage, filled with straw. We started with four horses abreast, driven with six reins, one to each of the outside horses and the other four to the pole-horses. We drove rapidly, but were often delayed at post-stations waiting for horses. While we were stopping, more than once, an official drove up. Horses were immediately harnessed and he drove on, although we had been told that there were no horses in the stables. We took a few provisions with us and found something to eat at one or two of the stations. At night there was only one common room, where all lodged and slept on the floors or benches, and as this is also used as a waiting-room for travelers by night while their horses are being changed, there was little opportunity for sleeping. The Russians carry their own beds and provisions, but we were not so fortunate, and so were obliged to lie on the boards, with straw for our beds.

At the end of the second day we were over the mountains and in Asia. We stopped at the post-station. Our provisions were gone, and we could get nothing at the station but a samovar with hot water; so, late at night, we drove on to Tiflis, a city of over one hundred thousand inhabitants.

Through Tiflis the river Kur runs, with beautiful views of mount Kazbek and the snow peaks of the Caucasus to the north. Steep banks on either side divide the city into two parts, the one new, with fine boulevards, European civilization, and handsome houses, occupied solely by Russian officials; the other, the old part, on hilly ground, inhabited by Persians, Armenians, Georgians, and others from the many different tribes of the Caucasus. Here are bazaars like those of Constantinople, Cairo, or Damascus, where goods from all parts of the Orient are sold.

CONCLUSION.

Many causes have been and are still at work that must arouse the Russians. The first great impulse arose in the early part of the present century, during the Napoleonic wars, when the Russian armies gathered from all parts of the kingdom, marched to Berlin and Vienna, and mingled with the armies of Prussia and Austria. Then came the invasion of Russia by Napoleon, the burning of Moscow, followed by the second march of the Russian armies through Europe, and their entry into Paris in 1814, in each case coming home with enlarged vision and new ideas. Second, the introduction of steamboats on the rivers; third, the Crimean war and fall of Sebastopol, which aroused the ruling class to the necessity for railroads and better intercommunication between the different parts of the empire, and led to the construction of three lines of railroad from the north to the south through the length of Russia, and three lines from its western to its eastern boundary, thus inviting the people to travel from place to place and to see more of the world; fourth, as a second result of the Crimean war was the freedom of the serfs in 1861 from a slavery of one hundred and fifty years; fifth, the construction of the railroad across the Ural mountains to Siberia, and its subsequent extension east, through the southern part of the country, to the Pacific, through the rich agricultural region of Siberia; sixth, the trans-Caspian conquest and the construction of the railroad along the borders of Persia and Afghanistan, across the desert and the river Oxus to Samarcand, opening up several countries and a large population to the manufactures and commerce of Russia; thus a large and profitable commerce has been created or diverted from England to Russia, which must greatly benefit Russia and trans-Caspia; seventh, the export of grain and petroleum from Russia to Europe, which is rapidly increasing, and the money obtained in exchange must greatly benefit the Russian farmer.

The destinies of Asia are in the hands of Russia and England, and are more intimately connected with Russia than with England, for the Russians have greater affinity with the Asiatics than the English, their influence over them is greater, and the Asiatics are more easily reconciled to the government of Russia than to that of the English.

This contact and intercourse tend to develop both Asiatics and Russians. The day of awakening, of progress, of education, of prosperity to the Russian peasant is sure to come; but whether this civilization shall be that of Europe and America or Asia and China is uncertain. Russia, with her empire extending from the Atlantic to the Pacific, will become the leading nation of the Orient.

U. S. REVENUE-MARINE STEAMER "BEAR" MOORED TO A FIELD OF ICE IN BERING SEA.

THE ARCTIC CRUISE OF THE UNITED STATES REVENUE CUTTER "BEAR"

By Dr Sheldon Jackson, *United States General Agent of Education in Alaska*

Expeditions to the Arctic have always had a fascination for mankind. From the early voyages of the Norsemen down through the successive expeditions of Davis, Baffin, and Ross to that of Peary the world has honored the men who have braved the dangers of the Arctic in voyages of discovery lasting from one to three years, but little account has been made of the whalers who have encountered these same dangers for many years in succession, and particularly of the United States revenue cutter service that has annually ventured into these icy regions for sixteen years past. The service began in 1880 with the sending of the little cutter *Corwin* into the Arctic in search of the *Jeannette*, and an Arctic cruise has been made each season since that time. In 1883 the steamer *Bear*, after the rescue of General Greely and party of the Lady Franklin bay expedition, was turned over to the United States Treasury Department and detailed for the Arctic service. She is a barquentine-rigged steamer, 198 feet long, 30 feet wide, and 18.5 feet deep, with a capacity of 714 tons. She was built at Greenock, Scotland, for the Dundee sealing and whaling fleet, and is an excellent sea boat—in fact the best in the Arctic ocean for work in the ice. The commanding officer from 1884 to the present time has been Captain Michael A. Healy, an officer justly rendered famous by his long, successful, and in many ways remarkable service in the dangerous waters of Arctic Alaska.

The annual cruise of the *Bear* to the Arctic ocean is unique in its multifarious duties and its practical usefulness. In addition to the ordinary duties of a revenue cutter in protecting the interests of the customs, more particularly by the prevention of smuggling by the whaling fleet, this steamer has performed the duty of a traveling life-saving station. During these twelve years it has rescued from the bleak and sterile coast of western and Arctic Alaska a thousand shipwrecked whalers and destitute mariners. Not a season passes without one or more whalers being wrecked and relief being furnished by the *Bear*. In addition to affording relief to the whaling fleet in times of disaster and peril, its record is equally brilliant in the protection of thousands of half-civilized natives from the rapacity of the white man and the demoralization that comes from the white man's rum. Along vast stretches of coast (from 10,000 to 12,000 miles) unknown to civilization, the flag of the revenue steamer is the only evidence of the authority of the Government that is ever seen and the only protection ever afforded. The cruiser *Bear* also furnishes the only medical attendance which the natives living along thousands of miles of coast ever receive. In 1890 the importance of its annual cruise was still further increased by its affording transportation to the United States general agent of education in Alaska in his establishment and supervision of Government schools in western and Arctic Alaska, and in 1891 still another addition was made to its usefulness by its being employed in the transportation of domestic reindeer from Siberia to Alaska. Its visits to the native villages upon the American coast and the search for reindeer along the coast of Siberia bring it into many bays and regions little known to the geographic world. During the establishment of schools and the introduction of domestic reindeer into Alaska the writer was enabled, by the permission of the Secretary of the Treasury and the courtesy of Captain Healy, to make five consecutive annual cruises along the Arctic coasts of Siberia and Alaska. The work being now well under way, his place was this season taken by the assistant agent, Mr William Hamilton. The cruise of the *Bear* in 1895 was over much the same course as in previous years.

After patrolling the North Pacific during May and June the *Bear* left the wharf at Dutch harbor, Unalaska, on June 24 for her Arctic trip. The next day she sighted through the fog first St. George island and then St. Paul. The sea being too rough to land, the ship pushed on to the northwest, passing St. Matthew island on June 26, and reaching anchorage at St. Lawrence island on June 28. Very soon the natives swarmed on board, bringing tidings that Mr and Mrs Gamble, in charge of the Government school on the island, were in excellent health and had had a very successful year. A sewing machine and a cabinet organ for Mrs Gamble, with supplies for the family and a twelve months' mail, were landed safely through the surf. Hoisting anchor on June 30 the *Bear* crossed over to Indian

HERD OF REINDEER LYING DOWN.

Photographed by A. L. Broadbent, U. S. R. M.

point, Siberia, about 40 miles distant. There two Cossack officers of the Russian army were found taking a census of the village. This was the first visit of Russian officials to that section of the Siberian coast in many years, and the natives brought the Russian coins they had received from them over to the ship to sell as curios. Here, as elsewhere on the trip, the ship's surgeon went ashore to treat the sick and ailing. The principal native of the village is Koharri, who is a noted trader all along the coast. He has a little frame whale-house filled from floor to ceiling with tobacco, flour, and looking-glasses, which he has obtained from the whalers and from which he supplies the country for hundreds of miles around. This man has been known to have as much as $75,000 worth of whalebone in his storehouse at one time. He does a business of probably $100,000 a year, and yet not a single coin of gold or silver nor a single bank note or bank check is used, nor are any books kept. All transactions are by barter, furs and whalebones being exchanged for tobacco, flour, and whisky. This wholesale merchant of the North Siberian coast can neither read nor write, nor can any one associated with him. Although so wealthy, he lives in an ordinary tent and sleeps on the ground, on a pile of reindeer skins.

On several occasions the *Bear*, in search of reindeer, has turned southward from Indian point and sailed up Holy Cross sound, at the head of Anadir gulf, some 300 miles into Siberia. In 1893, while in search of reindeer, we discovered a large river emptying into Holy Cross sound. After visiting a herd of reindeer, an officer and crew entered the mouth of this stream, the *Bear* being the first ocean steamer that had ever plowed those waters. This season the *Bear*, turning northward, anchored, on July 1, off South head, St. Lawrence bay. Peter and Kaimok, the leading men of that section, came on board and sold 40 head of reindeer. The herd, however, was on the opposite side of the bay and could not be reached until the ice should go out, a month later. Being unwilling to wait, the captain set sail for King island, which was reached the next morning. At this point during two previous seasons the *Bear* was caught and imprisoned in large ice floes.

Leaving the island at 8 a.m., the *Bear* soon encountered large cakes of ice at the entrance to Port Clarence. Forcing her way through the ice, she found seven whalers at anchor inside, and news was received of the successful winter of the reindeer herds.

The 4th of July was spent with the whaling fleet, at anchor. A baseball game on shore and a salute of twenty-one guns at noon, with a dinner on the *Bear* to the whaling captains, comprised the public celebration of the day. On July 5 the *Bear* left for St. Michael, where she arrived the following day. On July 8 anchor was hoisted and a trip was made to the native village on Sledge island. On July 9 the steamer made Bering straits, calling at East cape, where four or five influential natives were taken on board to aid in procuring reindeer. Learning that there was a large herd about 50 miles to the northward, the vessel entered the Arctic ocean. Early in the morning of July 11 the *Bear*, picking and pushing her way through the ice, reached Utan At this place 16 deer were purchased and brought on board. Continuing the trip up the coast, the *Bear* tied up to a huge ice floe near cape Serdze, Siberia. While there target practice was had at distant pieces of ice. On the 14th, learning that there were some deer at Chacoran, the vessel steamed over to that village, where 22 deer were secured. The ice closing in, the cutter was compelled to move a few miles farther south. At this point 73 head of deer were purchased, and at midnight the *Bear* got under way for the reindeer station at Port Clarence, passing through a gale on the 16th and reaching point Spencer on the 17th, where she anchored. About noon on the 20th, the gale having subsided, the *Bear* steamed over to the station and landed the deer. The brig *W. H. Meyer*, with the annual supplies for the several stations and schools, was found wrecked on the beach in front of the station, having gone ashore during the gale on the night of the 17th. The supplies for the reindeer station had fortunately all been landed, but those for the schools at cape Prince of Wales and point Barrow were lost.

On July 22 the *Bear* weighed anchor and headed for Siberia for another load of reindeer, and on July 23 she reached St. Lawrence bay. On the 24th she steamed to the head of the bay, where 43 head were secured. The next day she returned to the reindeer station, where the deer were landed on the 26th. On the 28th, the *Bear* having taken on board Mr and Mrs Hanná, who had been wrecked on the *W. H. Meyer*, with their supplies received from reindeer station, sailed for cape Prince of Wales, where they were landed that afternoon. Again hoisting anchor the steamer left for Kotzebue sound. On the way the schooner *Jessie* was boarded and examined. On July 30 the *Bear* anchored

SCENE AT POINT BARROW IN APRIL.

in the lee of Chamisso island. On the 31st, while the vessel was lying windbound, Dr Sharp and Mr Justice, of the Philadelphia Academy of Sciences, and Mr William Hamilton, of the Bureau of Education, together with a party of officers, made an excursion to Choris peninsula. On August 5 the steamer left for point Hope, where it arrived next day. Here the school and whaling stations were visited, and Dr Driggs, one of the teachers, who had been in that country for five years, was taken on board to return to the states for a vacation.

On August 7 the *Bear* started up the coast for point Barrow, wending its way through large packs of floating ice, and on the following day caught up with the whaling fleet at anchor near Icy cape, at the southern edge of the great Arctic ice pack. The whaling fleet had been at anchor for 19 days, waiting for the ice to open. The *Bear* lay there for 14 days longer, waiting for an opportunity to get farther north. Parties from point Barrow, who came down the coast for their mail, reported that the past winter had not been very cold, the lowest temperature being 30° below zero. Giving up all expectation of getting farther north, young ice forming on the sea and on the rigging of the vessel, the captain concluded to turn southward, which he did on August 22. The following day a shoal of walrus was sighted several miles away, and hunting parties were sent out and secured 10 of them. Picking up the walrus, the vessel continued southward, calling at point Hope the next day and reaching the reindeer station August 27. Two days were spent in securing requisitions and finishing up the business of the year. On September 1 the steamer, while near St. Michael, took on board 16 destitute miners from the Yukon region. On the evening of September 4 the vessel anchored off the St. Lawrence island village. The evening was spent in closing up the season's business at the station. Requisitions were made out for another year's supplies, last letters were received, farewells were spoken, and Mr and Mrs Gamble were again cut off from all communication with the outside world for another year. At 4 a. m. on September 5 the *Bear* was again under way. September 6 St. Matthew and Hall islands were passed, and on the 7th anchor was dropped at St. Paul island, where on the 8th a landing was made for a few hours. On September 9 a similar landing was made at St. George island, and at noon on September 11 anchor was dropped in Dutch harbor, Unalaska, closing the Arctic cruise of 1895.

THE SCOPE AND VALUE OF ARCTIC EXPLORATIONS*

By General A. W. Greely

In a brief twenty minutes one can touch only in a desultory way on this great topic that engages the thought and attention of so many famous members of the Geographical Congress, yet a somewhat general outline of the scope and value of Arctic exploration may not be amiss.

This, however, is neither time nor place to present in detail those phases of Arctic exploration that appeal so strongly to the popular fancy. If one would gain an adequate idea of the true aspects of such voyaging, he must turn to the original journals, penned in the great White North by brave men whose "purpose held to sail beyond the sunset."

In these volumes will be found tales of ships beset not only months, but years; of ice packs and ice fields of extent, thickness, and mass so enormous that description conveys no just idea; of boat journeys where constant watchfulness alone prevented instant death by drifting bergs or commingling ice floes; of land marches when exhausted humanity staggered along, leaving traces of blood on snow or rock; of sledge journeys over chaotic masses of ice, when humble heroes, straining at the drag-ropes, struggled on because the failure of one compromised the safety of all; of solitude and monotony, terrible in the weeks of constant polar sunlight, but almost unsettling the reason in the months of continuous Arctic darkness; of silence awful at all times, but made yet more startling by astounding phenomena that appeal noiselessly to the eye; of darkness so continuous and intense that the unsettled mind is driven to wonder whether the ordinary course of nature will bring back the sun, or whether the world has been cast out of its orbit in the planetary universe into new conditions; of cold so intense that any exposure is followed by instant freezing; of monotonous surroundings that threaten with time to unsettle the reason; of deprivations wast-

* Address delivered before the Sixth International Geographical Congress, London, at the Polar Session, July 29, 1895.

ing the body, and so impairing the mind; of failure in all things, not only of food, fuel, clothing, and shelter, for Arctic service foreshadows such contingencies, but the bitter failure of plans and aspirations, which brings almost inevitable despair in its train.

Failure of all things, did I say? Nay; failure, be it admitted, of all the physical accessories of conceived and accomplished action, but not failure in the higher and more essential attributes—not of the mental and moral qualities that are the foundation of fortitude, fidelity, and honor. Failure in this latter respect has been so rare in Arctic service as to justly make such offender a byword and scorn to his fellow-laborers and successors.

Patience, courage, fortitude, foresight, self-reliance, helpfulness—these grand characteristics of developed humanity everywhere, but which we are inclined to claim as special endowments of the Caucasian race—find ample expression in the detailed history of Arctic exploration. If one seeks to learn to what extent man's determination and effort dominate even the most adverse environment, the simple narratives of Arctic exploration will not fail to furnish striking examples.

There is a widespread impression that all Arctic voyages have been made for practically the same general purpose, whereas polar research has passed through three distinctive phases: First, for strictly commercial purposes in connection with trade to the Indies; second, for advancement of geographical knowledge, and, third, for scientific investigations connected with physical sciences.

Commercial interests dictated the grand series of voyages wherein England, competing with Spain from the period of the ventures of the Cabots to the discoveries of Baffin, sought for a short route to the Indies across the pole or by a northwest passage. As the futility of efforts by these routes became more or less apparent, and as the naval strength of Spain and Portugal ensured their continued monopoly of the growing and valuable trade of the Orient, the attention of England was turned in sheer desperation to the northeast passage as possibly offering a competing route. While this quest proved impracticable for the sailing ships of the sixteenth century, yet its prosecution inured to the great financial advantage of England through the establishment thereby of intimate and exclusive commercial relations with the growing and hitherto inaccessible empire of Russia.

The renewal of the true spirit of geographical exploration in the early part of the present century gave rise to a series of unparalleled voyages in search of the northwest passage, which resulted in the most splended geographical achievements of the century. These voyages were not splended alone from the definite results attained, nor from the almost superhuman efforts that ensured success, but also from the lofty spirit of endeavor and adventure that inspired the actors. The men who strove therein were lured by no hope of gain, influenced by no spirit of conquest, but were moved solely by the belief that man should know even the most desolate regions of his abiding place, the earth, and the determination that the Anglo-Saxon should do his part.

Franklin said: "Arctic discovery has been fostered from motives as disinterested as they are enlightened; not from any prospect of immediate benefit, but from a steady view to the acquirement of useful knowledge and the extension of the bounds of science, and its contributions to natural history and science have excited a general interest. The loss of life in the prosecution of these discoveries does not exceed the average deaths in the same population at home." Parry adds: "Such enterprises, so disinterested as well as useful in their object, do honor even when they fail. They cannot but excite the admiration of every liberal mind."

Of Chancellor's voyage to the northeast Milton said: "The discovery of Russia by the northern ocean . . . might have seemed an enterprise almost heroic if any higher end than excessive love of gain and traffic had animated the design." Modern critics except from dispraise the gallant men who in this century have given their lives from no sordid motive, and so merit Milton's full praise.

If not all, certainly some of these arctics have been animated with the noble thought of the poet:

> And this gray spirit yearning in desire
> To follow knowledge like a shining star
> Beyond the utmost bound of human thought.

Suffice it is to say, for geographic research, that it has remained for the nineteenth century, with its wealth of industrial inventions and store of indomitable energy, to make the northwest and northeast passages, to outline the northern coast of America, and to discover the archipelagoes and islands situated poleward from the three continents of the northern hemisphere.

Hudson's voyage to the Greenland sea, in 1607, was of vast industrial and commercial importance, for his discovery and reports of the incredible number of walruses and whales that frequented these seas gave rise to the Spitzbergen whale fishery.

The voyage of Poole for walruses and exploration, in 1610, was followed by the establishment of the whale fishery by Edge in the following year. Enterprising Holland sent its ships in 1613, later bringing in its train whalers from Bremen, France, and other maritime centers. The whale fishery, as the most important of Arctic industries, from which Holland alone drew from the Spitzbergen seas in one hundred and ten years, 1679–1778, products valued at about $90,000,000, merits at least our brief attention.

Grad writes: "The Dutch sailors saw in Spitzbergen waters great whales in immense numbers, whose catch would be a source of apparently inexhaustible riches. For two centuries fleets of whalers frequented its seas. The rush to the gold-bearing placers of California and the mines of Australia afforded in our day the only examples at all comparable to the host of men attracted by the northern fishery."

Scoresby says: "In a short time (whaling) proved the most lucrative and the most important branch of national commerce which had ever been offered to man." This emphatic statement is devoid of exaggeration in the slightest degree. Scoresby gives, year by year, the products of the Dutch whale fishery in the Arctic seas from 1668 to 1778, which aggregate in value over $100,000,000. When it is known that Scoresby himself caught in thirty voyages fish to the value of $1,000,000, it will not be considered extravagant to place the products of the British whale fishery at $250,000,000. Starbuck gives the product of the American whale fishery from 1804 to 1877 as $332,000,000, making the aggregate of three nations, America, England, and Holland, more than $680,000,000. How far this amount should be increased on account of seal, walrus, and other strictly Arctic sea game need not be considered, but Norwegian and Russian fishers have successfully exploited these sources for the past century.

The visit of Laikoff to the New Siberian islands added eventually a wealth of fossil ivory to Siberian trade that was only second in value to the extraordinary stock of furs that grew out of the explorations of the Arctic valley of the Kolima by Russian hunters. From Hudson's voyage to the bay of his name are attributable the initiation and development of the extremely valuable fur trade of the Hudson Bay Company. Bering failed to outline the definite geographic relations of the contiguous shores of Asia and America, but his voyages directly resulted in the very extensive sea and land fur trade which has proved so profitable through a century and a half.

Altogether, it may be assumed that in a little over two centuries the Arctic regions have furnished to the civilized world products aggregating twelve hundred millions of dollars in value.

Nor should it be inferred that commercial ends, scientific knowledge, or the glory of effort crystallized in accomplishment have alone turned man to the polar regions. The altruistic spirit of Egede lavished its wealth of effort in the turning of the Greenland Eskimo to Christianity and civilization, and it enkindled the flame of Christian endeavor that Crantz and the Moravian brethren kept alive during the critical phases of Greenland's history. As Cowper says:

> See Germany send forth
> Her sons to pour it on the farthest north.
> Fired with a zeal peculiar, they defy
> The rage and rigor of a polar sky
> And plant successfully sweet Sharon's rose
> On icy plains and in eternal snows.

In recent days Great Britain has had its Duncan, France its Petitot, and the United States its Jackson, whose evangelizing labors, acting through the more successful method—that of inculcating civilization and helpfulness—are a part of the glory of this time. The residence of Holm among the east Greenland natives and of Peary with the Etah Eskimo have, it is to be hoped, not been fruitless along these lines and should stimulate human sympathy for these dwellers on the northern edge of the world. Every lover of mankind will rejoice that Denmark, with the Christian solicitude that has always marked its policy towards the Greenlanders, has extended its unprofitable trade relations to east Greenland and established a missionary station at Angmagsalik for the benefit of the natives. May we not hope that some religious association may likewise plant the seeds of civilization and Christianity among the Cape York Eskimo?

There is neither intent nor time to worthily eulogize the deeds of living Arctic men, nor even to stimulate the eager rising youth who shall outdo all that has gone before; rather would this brief word add a leaf of laurel to the crowned dead whose Arctic fame forms part of each nation's historic heritage—hallowed for the past, priceless for the present, indispensable for successful futurity.

Shall I name the soldiers or sailors, the explorers or scientists, the trader or the whaler? Rather all, since science knows neither station nor profession, neither dialect nor nationality.

In the roll-call of the dead Austria-Hungary answers with Weyprecht, whose greatest fame will ever be associated with the establishment of the international polar stations.

Denmark follows, equally at home in American, Asiatic, or European waters, through Munk and Hamke, Jan Mayen and Vitus Bering.

Then France with De la Croyère, Pages, Blosseville, Fabre, Gaimard, Marmier, Martins, and Bellot, the last a name ever grateful to English ears.

Germany has generously loaned her talent to insure success wherever sound and important scientific work is to be done. Baer, Bessell, Petermann, and Steller are worthy successors to Frederick Martens, of the seventeenth century—men and work of which any nation may be proud.

Holland, in Barents, Nay, Tetgales, Rip, and Heemskerck, presents a roll of honor well in keeping with the notable work of the thousands of Dutch whalers that exploited the Spitzbergen seas.

The Italian contingent, from the Zeni of the fourteenth century through the Cabots to Bove of our own day, maintain here, as elsewhere, their geographic standing.

Norwegian Othere set in the ninth century the pioneer standard of Arctic exploration, which later, combined with the labor of exploiting the northern seas, has Mattilas, Carlsen, Tobiesen, and a score of others as worthy successors.

Russia finds the Arctic problem a domestic question, and from the time of Peter the Great to today has done an amount of work not generally appreciated or known. The Laptieffs and Deshneff, Tchirikof, and Liakoff, Anjou and Wrangell, Kotzebue and

Lütke, Pachtussof, Krusenstern and Zivolka, stand forth in the annals of the world.

In Hedenström and Torrell Sweden finds examples that have borne such abundant fruit in the late active labors of her enthusiastic sons.

Once it was said that the almighty dollar was the object and end of American endeavor, but when American treasure—not by the millions but by the billions—was poured out and lives by the hundreds of thousands were joyfully given for an idea the men of the new world rose to a higher place in European estimation.

A fellow-townsman of mine was a petty officer under Sir John Franklin, and among the hundreds engaged in the Franklin search none had a more altruistic and generous spirit than the American Elisha Kent Kane. Hayes left no danger undared to reach his "Open Polar Sea." Rodgers dared all, in Arctic ice as in the War for the Union. De Long and Ambler knew how to die, but not how to desert a helpless comrade. Hall followed the Arctic sledge to his very death. Lockwood, whose personal toil and suffering accomplished the farthest north and set the goal beyond which some more fortunate rival will soon pass, met with fortitude and sweetness the harsh fate which debarred the world from placing its laurel wreath save on his grave.

I can scarcely say aught of British effort in a field that has been peculiarly England's for the past three centuries. And how, among her innumerable Arctic dead, shall I single out representatives, worthy examplers of British courage and effort? Like Macbeth's kings, the line stretches out to crack of doom.

Great were the daring navigators of the sixteenth and seventeenth centuries—Chancellor and Davis and Frobisher, Hudson and Waymouth, Bylot and Baffin; but were they greater than in their way were Cook, Hearne, and Mackenzie in the eighteenth?

And when we come to their worthy compeers of this century, there is barely room for the names of these daring spirits. Here is Britain's unequaled roll:

Austin, Back, Beechey, Buchan, Clavering, Collinson, Crozier, Forsyth, Goodsir, Inglefield, Kellett, Kennedy, Lefroy, Lyon, McClure, Maguire. Mecham, Moore, the immortal Nelson, Osborn, Penny, Pim, Rae, Richardson, James C. Ross, John Ross, Sabine, Saunders, Scoresby, father and son; Simpson, and Stewart.

Close communion in spirit and thought with their recorded labors for many years has made for me many friends among the great Arctic dead, and so particularly segregates in my mind, from this alphabetical list, the twin Arctic compeers, Franklin and Parry, as *facile princeps* in this great company.

But the history of these men is inextricably interwoven with the wonderful development of the British Empire, and their deeds forever abide to the glory of the English-speaking race.

And of the Arctic dead of Europe, Asia, and America, from the earliest Othere of Norway and the Zeni of Italy to the latest fallen in Sweden, Nordenskiold the younger, promising son of his distinguished father, there may well be quoted the words of an American soldier:

> On Fame's eternal camping ground
>   Their silent tents are spread,
> And Glory guards with solemn round
>   The bivouac of the dead.

Storm-stayed and ice-beset no longer, their dust awaits the change and fate ordained by God's eternal laws.

The end they sought, the work they wrought, the courage and devotion they showed should stand as ideals and patterns for the men of the future in the accomplishment of the great Arctic work which it shall be their good fortune to undertake.

But now we look again to England to retake its former place in Arctic research. Shall we look in vain? I believe not.

Let her remember that the beginning of the end will have come for the ever extending and ever developing British power when this insular people would ever consent, for any sum in pounds and pence, that the Arctic relics of Greenwich should be scattered, or that there should ever be removed from Westminster Abbey, rich with its clustering memories and gathered treasures of a thousand years, the tribute of genius to heroism, of England's poet laureate to its Arctic dead.

Well has it been for Britain that hundreds of its youth have imbibed together learning and patriotism, love of the beautiful and admiration for glory, while translating into classic verse these immortal words:

> Not here. The white north has thy bones, and thou,
>   Heroic sailor soul,
> Art passing on thine happier voyage now
>   Towards no earthly pole.

OBITUARY

Dr Robert Brown, the distinguished botanical geographer, died October 26. He was in command of the Vancouver island exploration of 1864 and was in the Whymper West Greenland expedition of 1867, his glacial and natural history work attracting much attention. His "Manual of Botany" is his best work, although it is less widely known than are his "Peoples of the World," "Countries of the World," "Our Earth and its Story," "Africa," and "Science for All," which aggregate 24 volumes.

Admiral R. B. Pearse, R. N., died in November. He served as mate in H. M. S. *Resolute*, 1850–'51, and made a sledge journey of 208 miles, from Griffith to Bathurst island, during which he and one of his men were badly frozen. He rendered distinguished service to his country during the Chinese war of 1858–'60.

Henry Seebohm, the eminent ornithologist, died November 26. His investigations carried him over the greater part of the world. Two of his most interesting works, "Siberia in Europe" and "Siberia in Asia," were the outcome of his bird trips to the Lower Petchora in 1875 and the Yenisei in 1877, his ship being wrecked on the latter occasion. Seebohm's great works are the "History of British Birds," "Geographical Distribution of Plovers," and "Birds of Japan."

Rear Admiral Shufeldt, U. S. N., who died November 7, has left a record of unusual brilliancy. His most important geographical work was done while he was in command of the Tehuantepec and Nicaragua surveying expeditions. His reports, valuable documents illustrated by plates and maps, were printed by the Government in 1872 and 1874. The greatest service that Shufeldt rendered to America, and, it may be added, to the world in general, was the negotiation, in 1882, of the treaty by which Korea was thrown open to the commerce of the United States, first of all nations.

GEOGRAPHIC LITERATURE

Elementary Physical Geography. By Ralph S. Tarr, Assistant Professor of Dynamic Geology and Physical Geography at Cornell University. Pp. 488, with maps and 267 illustrations. New York: Macmillan & Co. 1895. $1.40.

This book appears well adapted to serve as a text-book of physical geography. It will commend itself by its perspicuous style to the favorable attention of those who may desire information concerning the most recent developments in this important field, without the labor of examining purely professional papers, and who do not care to depend on irresponsible newspaper reports. The chapters devoted to geology are, as might be expected, unexceptionable. In its treatment of ocean currents, however, the work is open to criticism. With regard to the temperature and wind theories the author fails to make himself clear. He also omits any explanation of the important part the salts play in the matter of ocean currents, and he entirely ignores the Yucatan channel current, the strongest one in existence. The general appearance of the book is excellent. The illustrations, with but few exceptions (as, for example, that of mount Vesuvius, on page 376), are very good and the price is exceedingly reasonable.

The Gold Diggings of Cape Horn: A Study of Life in Tierra del Fuego and Patagonia. By John R. Spears. Pp. 319, with illustrations. New York: G. P. Putnam's Sons. 1895.

So few books have been written about the *terra incognita* between cape Horn and the straits of Magellan that a new one by so well known an author as Mr John R. Spears will be heartily welcomed. It is written in the author's usual quaint style, with a vein of humor running all the way through; and while it does not claim to be a record of personal exploration like Beerbohm's or Lady Brassey's, but merely a collection of newspaper sketches written up at home from data gleaned during a cruise around the edges, it is full of valuable information. While the author's ideas of the gold diggings are a trifle too sanguine, his account of the Ona, Yahgan, Tehuelche, Alaculoof, and other Indians, as well as of the missionaries who are trying in vain to tame them, of the famous Welsh colony on Chubut river, of the general resources, and also of the birds, beasts, and reptiles, of lands at the tip end of the hemisphere is extremely interesting.

Stanford's Compendium of Geography and Travel (new series). Africa. Volume II, South Africa. By A. H. Keane, F. R. G. S., etc. Pp. 671, with 11 maps and 92 illustrations. London: Edward Stanford. 1895. American agents, J. B. Lippincott Co., Philadelphia. $4.50.

This admirable volume, fresh from the press, gives an authentic, "up to date" account of the geography, history, and political complexion of South Africa. It is illustrated by nearly 100 admirably chosen plates and text figures and a dozen excellent colored maps. Perhaps no part of the world has ever undergone so rapid and fundamental a metamorphosis as has South Africa "since the leading powers resolved, a few years ago, to transform this continent to a political dependency of Europe." "Occurrences of far-reaching consequence," says the author, "have followed in such swift succession that in the preparation of this work the chief difficulty has been to keep pace with the shifting scenes. In some instances many carefully prepared pages have had to be greatly modified, and even rewritten, owing to the unexpected turn taken by events in various parts of the continent." Madagascar, Mauritius, and other islands of the Indian ocean are included in the book, and the author adopts the very modern view of an "Indo-African continent" connecting South Africa through Madagascar with the Indian peninsula. While the work deals mainly, as would be expected, with the more purely geographic and political questions, it still bestows some attention on the fauna and flora, and it would have been well if these subjects had been referred to some of the eminent British naturalists who are so well qualified to speak on these topics.

National Geographic Monographs, published under the auspices of the National Geographic Society. Pp. 336, illustrated. New York: American Book Co. 1895. $1.40.

The first series, comprising Nos. 1–10, ends with December. It consists of memoirs by Powell, Shaler, Russell, Willis, Diller, Davis, Gilbert, and Hayes on geographic topics of primary importance. All geographers will find much that is interesting and instructive in these memoirs, but to American teachers and students they will be especially valuable. They have been published by the American Book Company in the hope that memoirs by authors ranking among the most eminent of American scientists would by their intrinsic worth and scientific interest advance the cause of higher education in the United States.

Tibet. Notes on the Ethnology of Tibet. Based on Collections in the United States National Museum. By W. W. Rockhill. Report of United States National Museum for 1893. Pp. 665–747, pls. 1–52. Washington, 1895.

Readers of these interesting pages will be gratified that so extensive a collection from this comparatively unknown country has been made by the National Museum. It is fortunate that the description of the different objects has fallen into the hands of one so competent by acquirements and experience as Mr Rockhill.

Chili. République de Chili. Cartes commerciales, physiques, etc. Par F. Bianconi. Librairie Chaix. Paris, 1895.

A valuable addition to the Chaix series, giving the latest information regarding the agricultural and mineral resources, commerce, railways, etc., of Chili, with a map, 1:2,500,000, embodying the latest surveys.

Special Consular Reports, Vol. 12—Highways of Commerce. The ocean lines, railways, canals, and other trade routes of foreign countries. Washington, 1895. Pp. 763, with 9 maps.

A timely publication, whose value is materially increased by a number of maps, of which the most important show the railways of Mexico, Siberia, Natal, and India. Some of the data, as seems unavoidable in Government publications, are nearly two years old. The railway mileage of the world on December 31, 1894, was 423,923, of which 189,576 were in the United States. At the end of 1892 the mileage of the principal countries and the average cost per mile as given by the German Minister of Public Works were as follows: United States, 174,747 miles, $59,300; Germany, 27,451 miles, $95,200; France, 24,014 miles, $131,900; Great Britain and Ireland, 20,321 miles, $131,000; Russia, 19,622 miles, $90,400; Austria-Hungary, 17,621 miles, $95,400; Canada and other British American provinces, 14,866 miles, $57,600; Italy; 8,496 miles, $114,600; Argentine Republic, 8,161 miles; Mexico, 6,624 miles; Brazil, 6,388 miles; Spain, 6,169 miles; Belgium, 3,379 miles, $131,000.

The information concerning the railways of South and Central Africa is of especial interest, although great progress has been made in the extension of transportation lines during the past year. The value of the report is enhanced by the insertion of the well known map of the world issued by the Hydrographic Office of the United States Navy Department in June, 1891, which shows tracks of full-powered steam vessels, with distances, and probably contains a larger amount of information on this subject than can be found elsewhere within an equally limited space. Its presentation on the map in both graphic and tabular form increases its usefulness. The distances between different ports on the east and west coasts of North and South America and the shores of the gulf of Mexico and Caribbean sea are also shown. The volume contains a full topical index.

EXECUTIVE REPORTS

The annual reports of the cabinet officers, recently transmitted by the President to Congress, contain some items of geographic interest.

War Department.—The Secretary of War states that since 1879 $29,500,000 has been appropriated for the improvement of the Mississippi river, of which $8,400,000 has been directly applied to general improvements to aid navigation. The greater part of this amount has been spent on two reaches of the river, each 20 miles long, one situated 80 miles above Memphis and the other 80 miles above Vicksburg. The result has only been to increase the depth of the river at low water by 18 inches. For the improvement of the Missouri river, which for years has had practically no navigation, $8,900,000 has been appropriated. The Secretary questions the propriety of further appropriations for this river.

With regard to the proposed Chicago drainage canal, a board of engineer officers state that the abstraction of 10,000 cubic feet of water per second from lake Michigan will lower the level of all the great lakes except Superior, and reduce the navigable capacity of all harbors and shallows, but to what extent cannot be foretold at this time.

The Yellowstone National Park has now 170 miles of good highways, permitting easy access from the railways to the principal points of interest. It is proposed that 25 miles of additional roads, now impassable for vehicles, be opened, which will complete the general scheme of highways.

The Apache Indian prisoners, comprising about 70 families, have been removed to the Fort Sill reservation, which is being gradually brought to a self-sustaining basis.

The defenseless condition of the principal harbors is dwelt upon and the necessity of liberal appropriations strongly presented.

Navy Department—*Surgeon General.*—Among valuable special reports are those of Surg. Gen. Tryon, on "The Relation of Naval Architecture to proper Sanitation; Dr H. G. Beyer, on "Normal Growth under the Influence of Exercise," and Dr E. R. Stitt, on "The Medical Aspect of the Nicaraguan Canal." Dr Stitt believes that while the construction of the canal would temporarily increase the prevailing malarial diseases, it would ultimately remove the most potent pestilential forces through changes in swamps and in the level of lake Nicaragua.

Post Office Department.—The Postmaster General states that the revenue of his department for the year 1894–'95 was in round numbers $77,000,000, and that the expenditures amounted to $87,000,000. Mail service has been established on electric and cable lines in Boston, Brooklyn, Chicago, New York, Philadelphia, and St. Louis. The net increase in the number of post-offices is 429, principally in Oklahoma, Indian Territory, and Virginia. Cape Colony has joined the postal union, leaving Korea, China, and the Orange Free State the only civilized nations not embraced therein.

Department of the Interior.—The Secretary of the Interior covers in his report the operations of many bureaus, of which the more important are treated under the following heads:

Patent Office.—There were 36,972 applications for patents, 20,465 patents were granted, 12,906 expired, and 3,208 were forfeited for nonpayment of fees.

Indian Bureau.—There are 161 Indian reservations, on which the problem of making the aborigines self-supporting is progressing with more or less rapidity. For schools alone $2,060,695 was appropriated, and nearly $7,000,000 for payment for lands and other treaty obligations. The school pupils have increased by 1,417 during the year. The total enrollment was 23,036, of whom 4,673 are in industrial training schools. Lands have been patented to 6,851 Indians during the year.

General Land Office.—Of public lands there have been disposed of to Indians 42,000 acres; by sale, 417,000; miscellaneous entries, 7,947,000. There remain undisposed of 599,000,000 acres, exclusive of Alaska. The vacant public lands are largely in the arid regions, and from 8 to 25 per cent. according to various estimates, may ultimately be cultivated by irrigation. The Land Commissioner recommends the establishment of forest reservations, and that legislation be enacted relative to public timber. to the surveying of public lands through the Geological Survey, and to the establishment of a district land office in Alaska.

Bureau of Education.—The number of pupils enrolled in schools in 1894 was 15,530,000, or 22.9 per cent of the entire population.

National Parks and Forest Reservations.—There are sixteen reservations, with a total area of 16,325,000 acres, embracing parts of Arizona, California, Colorado, New Mexico, Oregon, and Washington. The more important Yellowstone, Yosemite, and Sequoia parks are protected by military guards.

Geological Survey.—The operations of this important bureau are left for review until the publication of the full report of the Director of the Survey.

Census.—The cost of the Eleventh Census to June 30, 1895, was $10,-531,141. Of 25 volumes, with 22,000 pages, all are printed or in press, except parts of volumes on Population and Vital Statistics.

INTERSTATE COMMERCE COMMISSION.—The total number of miles of railway in the United States on June 30, 1894, was 178,708, an increase of 2,247 miles in twelve months. Miles of line per 100 square miles of territory, 6.02; per 10,000 inhabitants, 26.36. Stock capital, $4,834,075,659; funded debt, $5,356,583,019; other indebtedness, $605,815,135; total, $10,796,473,813, or $62,951 per mile. Passenger receipts in 1893–'94, $285,349,558; freight receipts, $699,490,913; other income, $231,338,131; total, $1,216,178,602. Expenditures, including fixed charges, $1,160,422,-632. Number of passengers carried, 540,688,199; average number per train, 44; average journey per passenger, 26.43 miles.

NEW MAPS

Western Hemisphere Charts, published by the Hydrographic Office, United States Navy, July–December, 1895, with size, scale in inches, and price.

Great Lakes, No. 1462, Lake Ontario, Toronto Harbor, 22.6 x 27.5; M. = 3.377; $0.50. No. 1469, Lake Huron, Georgian Bay, Cabot Head to Boucher Point, 29.6 x 39.7; M. = 0.75; $1.00. No. 1475, Lake Michigan, 24.4 x 34.5; D. Lat. = 5.91; $0.75. No. 1477, Lakes Erie and Ontario, 23.4 x 23.7; D. Lat. = 5.80; $0.75. E, The Great Lakes, Index to Coast, Special and Harbor Charts, 9 x 15.2; D. Long. = 0.6; $0.10.

Mexico, No. 1494, San Ignacio Lagoon, 26.3 x 37; M. = 1.5; $0.75.

Bermuda, No. 1495, Bermuda and Great Sound, including Grassy and Port Royal Bays and Hamilton Harbor, 21 x 25.75; M. = 4.0; $0.50.

Nicaragua, No. 1510, Entrance to Pearl Cay, 16.6 x 22.6; M. = 4.0; $0.50. No. 1517, Approaches to Pearl Cay Lagoon, with plans of Great and Little Corn Islands, 24.0 x 37.4; M. = 1.0; $0.75.

Guiana, No. 1512, Corentyn River, Approaches to Nickerie River, 16.5 x 20.7; M. = 4.0; $0.25.

Guiana, No. 1513, Entrance to Corentyn River, 7.1 x 9.4; M. = 0.5, and Entrance to the Coppename and Saramacca Rivers, 7.1 x 9.4; M. = 0.25; $0.25.

Argentina, No. 1515, Port San Julian, 14.3 x 18.6; M. = 2.0; $0.25. No. 1516, Port Santa Elena, 13 x 17.5; M. = 3.0; $0.25. No. 1518, Port San Antonio, 10.2 x 13.3; M. = 1.0; $0.25. No. 1519, Rio Negro, 11.1 x 12.6; M. = 1.0; $0.25. No. 1521, San Blas Harbor, 13.1 x 14.8; M. = 1.0; $0.25.

Brazil, No. 1520, Port Camamu, 21.2 x 30.4; M. = 2.0; $0.50. No. 1522, From Bahia to Ilheos Anchorage, 28.5 x 38.8; M. = 0.25; $1.00. No. 1524, Port Tamandare, 9.7 x 11.4; M. = 4.0; $0.25.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1895–'96

Special Meeting, October 11, 1895.—President Hubbard in the chair. Vice-President Greely delivered an address on The Sixth International Geographical Congress, London, 1895.

Special Meeting, October 25, 1895.—President Hubbard in the chair. Mr Ernest Flagg, Architect of the new Corcoran Art Gallery and of the Washington Episcopal Cathedral, read a paper, illustrated by lantern slides, on The Development of the Mediæval Cathedral.

Regular Meeting, November 1, 1895.—Vice-President Gannett in the chair. Vice-President Ogden addressed the Society, giving a narrative of explorations on the isthmus of Darien.

Special Meeting, November 8, 1895.—President Hubbard in the chair. Major Alfred F. Sears, C. E., read a paper, illustrated by lantern slides, on The Geographic Conditions that Create Great Commercial Centers.

Regular Meeting, November 15, 1895.—Vice-President Gannett in the chair. General topic: The Hydrography of the United States, divided as follows: Hydrographic Investigations, by Mr F. H. Newell, Chief Hydrographer, U. S. Geological Survey; The Work of the Weather Bureau relating to Hydrography, by Prof. W. L. Moore, Chief of the Bureau; Stream Measurements in the West, by Mr A. P. Davis; Hydrographic Studies in the Appalachian Area, by Mr C. C. Babb, and Hydrography of the Navigable Waters, by Mr Marcus Baker. Each paper was illustrated by maps and diagrams.

Special Meeting, November 22, 1895.—President Hubbard in the chair. Mr E. L. Corthell, D. Sc., C. E., read a paper, illustrated by lantern slides, on The Tehuantepec Route.

Regular Meeting, November 29, 1895.—President Hubbard in the chair. Mr Marcus Baker read a paper on Alaska and her Boundary, illustrating his remarks by a series of historical maps. The discussion that followed was participated in by Hon. J. R. Procter, Gen. A. W. Greely, and Dr W. H. Dall.

Special Meeting, December 6, 1895.—President Hubbard in the chair. Mr C. M. Ffoulke read a paper on The Tapestry-Producing Nations, and exhibited a number of typical pieces of tapestry from his valuable collection.

Regular Meeting, December 13, 1895.—Vice-President Dabney in the chair. Dr C. Hart Merriam read a paper on The Life of the Desert, with special reference to the fauna of the desert regions of the United States. Dr Merriam illustrated his remarks by means of a number of skins and of stuffed animals and birds: also by lantern slides of animals and of desert scenery.

Special Meeting, December 20, 1895.—President Hubbard in the chair. Admiral R. W. Meade, U. S. N., delivered an address, illustrated by maps and lantern slides, on The Caribbean Sea: the Mediterranean of the Western World.

Elections.—New members have been elected as follows:

October 14.—Walter C. Allen, Joseph A. Arnold, Gustav Ayres, Maj. Chas. Bendire, U. S. A., Frederick Benjamin, John H. Brickenstein, Prof. J. F. Chamberlain, Henry M. Chapman, Miss Josephine A. Clark, W. W. Cheshire, Miss Virginia E. Dade, T. H. Davies, John T. Devine, Mrs A. G. Draper, W. W. Duffield, Jr., Prof. M. J. Elrod, Maj. F. L. Evans, E. E. Ewell, Prof. D. C. Farr, Charles W. Fisher, Mrs Mary E. Gilpin, Dr Geo. O. Glavis, Capt. C. H. Gordon, U. S. A., Edward P. Hall, John H. Hinton, Miss Martha N. Hooper, Richard L. Howell, Ernest V. Janson, Thos. Kirby, Prof. F. Lamson-Scribner, John E. Lyons, J. T. Macey, Wm. J. Marsh, Mrs Cornelia N. Mason, Philip Mauro, Chief Engineer Fred. G. McKean, U. S. N., Mrs Y. W. Miller, Mrs V. A. Moore, Prof. Willis L. Moore, Dr A. C. Patterson, Daniel A. Ray, Dr E. W. Reisinger, N. H. Shea, Chas. W. Smiley, Capt. J. G. Sobral (Spanish Navy), Dr A. C. True, Dr F. W. True, Dr J. Van Rensselaer, Miss Mabel L. White, President B. L. Whitman, John C. Wilson, Hon. Wm. L. Wilson, J. W. Witten.

October 25.—Edmund Becker, Mrs Isabella M. Bittinger, Mercer D. Blondel, Eugene C. Brown, O. B. Brown, Mrs J. Mills Browne, Hon. Wm. R. Castle (Hawaiian Minister), James H. Crew, Surg. S. H. Dickson, U. S. N., Mrs Mary Fuller, S. C. Gilman, Col. A. Heger, U. S. A., Mrs Julia Henderson, E. C. Howland, Wm. A. Hungerford, Col. D. L. Huntington, U. S. A., George H. Judd, Miss Tessa L. Kelso, J. R. Marshall, Wm. H. McKnew, Mrs L. R. Messenger, Dr W. F. Morsell, Thos. Nelson Page, Miss Josephine Pickles, Mrs Fannie M. Reynolds, Rev. J. Havens Richards, S. J., Albert N. Seip, Mrs A. M. Shaw, Miss Juliet Solger, Baron Thielmann (German Ambassador), L. L. Thompson, Frank Vincent, Geo. W. Weber, H. A. Wierwille, Alonzo C. Yates.

November 8.—Chas. B. Bailey, Wm. H. Beck, B. W. Beebe, P. C. Claflin, Arthur J. Dillon, Miss J. C. Donovan, George E. Emmons, Miss Frances Graham French, Gen. L. P. Graham, U. S. A., H. A. Griswold, Miss Mamie E. Hale, Dr Theo. G. Hoech, A. B. Hoen, Dr Wm. H. Holmes, Henry M. Hubbard, F. A. Kendall, Miss Carrie M. Lash, C. R. Richards, Wm. P. Richards, C. E., Chas. J. Tilden, Heman D. Walbridge, Daniel Webster.

November 18.—Chief Justice Edward F. Bingham, Capt. G. Rodney Burt, Mr Justice Shepard, John K. Souther.

November 29.—Señor Jacobo Blanco, Prof. L. C. Glenn, Rev. Allen Hazen, Maj. W. P. Huxford, U. S. A., S. A. Moreland, Walter F. Rogers, Elmer G. Runyan, James C. Spriggs, Jr., Wm. P. Stearn, Gen. Richard Villafranca.

December 13.—Hon. C. B. Beach, M. C., Dr J. L. M. Curry, Hon. C. E. Foss, M. C., Dr E. M. Gallaudet, Baron Beno von Herman (German Embassy), W. J. Martin, Maximilien de Meck (Secretary, Russian Legation), Pak Yong Kiu (Chargé d'Affaires Korean Legation), Señor Don Edmundo J. Plaza (Mexican Legation), Dr J. L. Reeves, Rev. Prof. René de Saussure, Alexander de Somoff (Chargé d'Affaires Russian Legation).

The following delegates from The National Geographic Society attended the Sixth International Geographical Congress, held in London in July last: General A. W. Greely, Assistant Secretary of State Rockhill, Miss E. R. Scidmore, Miss Aileen Bell, Miss Lilian Hayden, Lieut. Commander W. S. Cowles, U. S. N., Lieut. Everett Hayden, U. S. N., Cyrus C. Adams, and W. C. Whittemore.

NORTH AMERICAN NOTES

The convention between the United States and Great Britain to provide the requisite topographical data to determine the boundary between Alaska and British Columbia expired by limitation December 31. Another commission will determine the location of the line.

Greenland. The National Geographic Society welcomes back one of its members, Engineer R. E. Peary, U. S. Navy, from his perilous and terrible journey across Greenland. If he failed to surpass his own record of 1892 he paralleled it, thus emphasizing a success far beyond that of any other explorer of the inland ice. Ethnologists look confidently for important data relative to the Etah Eskimo, and American universities have profited largely by the natural history collections.

Rhode Island. According to the state census of 1895 the population of the state is 384,758, as against 304,284 in 1885 and 345,506 by the federal enumeration of 1890. Cities over 20,000 are as follows: Providence, 145,472; Pawtucket, 32,577; Woonsocket, 24,468; Newport, 21,537, and Warwick, 21,168. The drift of migration is from agricultural districts to manufacturing centers.

Florida. Palm Beach, the terminus of the Florida East Coast Railway, has been created a port of entry in connection with a line of steamers, which leaving in the afternoon reach Nassau the next morning, thus opening a new route, important both to commerce and tourists.

Block Island. A land-locked harbor, 1,600 acres in area, has been constructed in the interior of Block island at a cost of $100,000. The channel to the Atlantic is 12 feet deep at low water and 300 feet wide, with a breakwater extending 600 feet into the sea. It is proposed to double the depth and width of the channel.

The February Number

OF

The National Geographic Magazine

WILL CONTAIN SPECIAL ARTICLES ON THE

PANAMA, NICARAGUA, AND TEHUANTEPEC ROUTES.

ALSO AN ARTICLE ON

VENEZUELA,

. . . BY . . .

Mr. WM. E. CURTIS,

Late Chief of the Bureau of the American Republics.

Entered at the Post-office in Washington, D. C., as second-class mail matter

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A W GREELY   W J McGEE   ELIZA RUHAMAH SCIDMORE

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ORGANIZED JANUARY, 1888

SECRETARY'S OFFICE, 1515 H STREET N. W., WASHINGTON

The National Geographic Society, the object of which is the increase and diffusion of geographic knowledge, has a paying membership of over 1,200. 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 will be sent regularly to all members, both active and corresponding.

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

NOTICE TO MEMBERS

Binding.—The following favorable terms have been secured for binding The National Geographic Magazine: Full cloth, 40 cents per volume; half roan or half American Russia, 50 cents; half morocco, 80 cents; full roan, $1.00; full morocco, $1.60. Choice of black, blue, or red is offered, except as to American Russia, which is in red only. Until March 1 volumes will be received by the Secretary, at 1515 H street N. W., Washington, for binding, on condition that the style and color required are distinctly stated, and that the cost, including return postage or express charges, is remitted at the same time. Odd numbers necessary to complete back volumes can in many cases be supplied.

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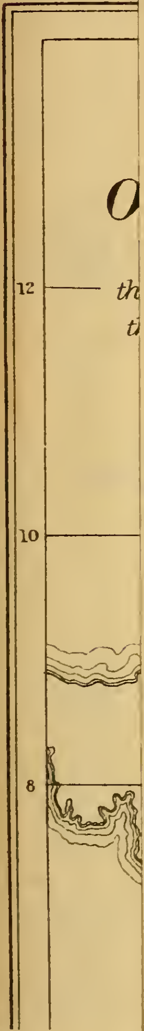


MAP
of the valley of the
ORINOCO RIVER
showing
the extent of territory drained by that waterway and
the bearing it has on the Venezuelan question.
Compiled by
T. HEYWARD GIGNILLIAT.
1896.
For description see page 92.
Scale:
SEA OF THE ANTILLES
ATLANTIC OCEAN
PACIFIC OCEAN
VENEZUELA
COLOMBIA
ECUADOR
BRAZIL
BRITISH GUIANA
S. NEVADA DE STA MARTA
MARACAIBO
LA GUAYRA
LA SILLA DE CARACAS
PUERTO CABELLO
CARACAS
VALENCIA
PORT SPAIN
Trinidad I.
COLON
PANAMA
CIUDAD BOLIVAR
Orinoco River
EL CALLAO
GEORGETOWN
ORIGINAL DISPUTED TERRITORY
Schomburgk Line
SIERRA DE LA PARIMA
BOGOTA
QUITO
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Negro River
Blanco River
Essequibo River
Demerara R.
Mazaruni R.
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National Geographic Magazine

Vol. VII FEBRUARY, 1896 No. 2

VENEZUELA: HER GOVERNMENT, PEOPLE, AND BOUNDARY

By William E. Curtis,

Ex-Director of the Bureau of the American Republics

Along the Spanish main, from Trinidad to the isthmus, is a mixture of Florida and Switzerland, where one can find within the radius of a single day's journey any climate or scene to suit his taste, from a tropical jungle swarming with tigers and 'gators to mountain crests crowned with eternal snow. The Andes and the Cordilleras, forming a double spinal column for the continent, split and scatter and jump into the sea. At the very edge of the ocean, within view of passing vessels, are peaks whose snow-capped summits seem to hang in the air. The Nevada de la Santa Marta, 17,500 feet high, affords one of the most majestic spectacles in all nature. Tourists are always incredulous when the peak is pointed out to them, for it resembles a bank of clouds, but they are finally compelled to admit the truth of geography, for clouds do not stand transfixed in the sky, unchangeable and immovable, like this phenomenon.

Between these mountains and along the coast are narrow valleys of luxurious tropical verdure and a rich soil—valleys which yield three harvests annually and are densely populated. Coffee, sugar, and chocolate are the staples of the lower region, called *tierre caliente* (hot earth); corn, beans, and other products of the temperate zone are raised upon the mountain sides, and higher, seven or eight thousand feet above the level of the sea, are herds of goats and cattle.

The population of Venezuela is about two and one-half millions, not including 260,000 Indians, and there are nine states, one federal district, and five territories. The country is still in a primitive and comparatively undeveloped condition. Outside the principal cities it has made little or no progress since the yoke of Spain was thrown off, and the population is believed to be less than it was then.

Agricultural and industrial development has been retarded by political revolutions and a lack of labor and capital, but the property of foreigners who do not meddle with local affairs is seldom disturbed and the government offers liberal inducements for colonization and investment. Manufacturing establishments are almost unknown. There is little machinery in the country, and industry is generally carried on in the households and by the most primitive processes. There is an abundance of convenient water power, but fuel is scarce and expensive; therefore the future wealth of Venezuela, as well as her present prosperity, lies in the development of her agricultural resources, which are almost boundless, and her mineral deposits, which are among the richest and most accessible. Coffee is the great staple, and the product is unsurpassed.

It has been the unhappy lot of Venezuela to have been the scene of almost constant warfare. There is not a country in the world whose history is more stained with blood. She is the Hungary, the Poland, of South America. There is scarcely a city or a settlement within the limits of the republic which at some time or another has not suffered total or partial destruction, and scarcely a mountain top from which some battlefield may not be seen. During colonial times Venezuela was cuffed and kicked about by Spain so that her people were in almost constant rebellion, and since her independence was established, three-quarters of a century ago, her political leaders have kept her like an armed camp. Most of her rulers have been elected by bullets and bayonets instead of by ballots, and most of her great men have died in exile, to have their bones brought home in after years with tremendous honors and buried under monuments of marble and statues of bronze.

The president of Venezuela is assisted in the performance of his duties by a cabinet of eight members. He receives a salary of a thousand dollars a month, a house to live in, horses and carriages, servants and furniture, and, in fact, everything except his food. He conducts himself very much like the President of the

United States; his daily routine is similar, and he is annoyed by office-seekers to about the same degree. He commences business at half-past six o'clock in the morning, and often has cabinet meetings as early as seven. The government offices open at seven, when all the clerks and officials are expected to be on hand, no matter how late they were dancing or dining the night before, but they knock off work at eleven for their breakfast and siesta, and do not return to their desks again until two.

Cabinet ministers are paid $6,000 a year and congressmen $2,500, without any additional allowances, but the sessions do not last more than three months usually, so that they may engage in their regular occupations the rest of the year.

The standing army is composed of five battalions of infantry, 1,842 men; one battery of artillery, 301 men, and one regiment of cavalry, 325 strong. Besides these regulars, who garrison the capital and the several forts throughout the country, there is a federal militia which is drilled annually and required to respond to the call of the government at any time.

The rank and file of the army is composed exclusively of Indians, negroes, and half-breeds. They are obedient, faithful, and good fighters. Some of the fiercest battles the world has ever known have taken place in Venezuela with these poor fellows on both sides. Their uniform in the field is a pair of cotton drawers, a cotton shirt, a cheap straw hat, and a pair of sandals, but when they come to occupy the barracks in town and do guard duty around the government buildings they are made to wear red woolen trousers, blue coats, and caps of red and blue, with regular army shoes.

The officers are generally good-looking young fellows of the best families, who take to military service and enjoy it. They wear well kept uniforms, have good manners, and are usually graduates of the university.

The government has established a school of industry for the education of the Indian children, and every year a commission is sent to obtain recruits for the army among them. The boys are taught trades and all sorts of handicraft, as well as reading, writing, and arithmetic, and the girls are drilled in the duties of the home. When they have reached an age when their faculties are fully developed and their habits fixed they are sent back among their tribe as missionaries, not to teach religion, but civilization, and the Indians are said to be improving rapidly under the tuition of their own daughters and sons.

The chief towns of Venezuela are Caracas, the capital, and La Guayra, its seaport; Valencia, which lies upon a curious lake, one of the most interesting of natural phenomena; Puerto Cabello, where Sir Francis Drake died and was dropped into the water with a bag of shot at his heels, and Maracaibo, upon the lake of the same name, from which we get much of our coffee.

The chief seaport of Venezuela, La Guayra by name, has the reputation among sailors of having the worst harbor in the world. It is merely an open roadstead, beset by almost all the dangers and difficulties which seamanship can encounter. Even in calm weather the surf rolls up with a mighty volume and dashes into spray against the rocks upon which the town is built; but when a breeze is blowing, and one comes almost every afternoon, the waves are so high that loading or unloading vessels is dangerous and often impossible.

Between La Guayra and Caracas is a mountain called La Silla, which reaches nearly 9,000 feet toward the sky and springs directly from the sea. There is only a beach about two hundred feet in width at the foot of the peaks, along which La Guayra is stretched two miles or so—a single street. Part of the town clings to the side of the monster like a creeper to the trunk of a tree, and one wonders that the earthquakes, which are common there, do not shake the houses off into the ocean.

The distance in a straight line through the base of the mountain would be only about four miles, and a Washington engineer once made plans for a tunnel and a cable railway, but it was too expensive an undertaking. Over the dip in the saddle is an Indian trail about eight miles long, and in 1883 English engineers and capitalists built a railroad twenty-four miles long between the two places, which climbs 3,600 feet in about twenty miles, and creeps through a pass to the valley in which the capital is situated. It is a remarkable piece of engineering and offers the traveler a scenic view whose picturesqueness and grandeur have been extolled from the time the Spanish invaders came, in 1520, until now. Humboldt says there is no picture combining the scenery of the mountains and the ocean so grand as this, except the peak of Teneriffe. It is as if Pike's peak rose abruptly from the beach at Long Branch.

There is nothing Indian about Caracas except its name, and it is one of the finest cities in South America. The climate is superb, being a perpetual spring, the thermometer seldom rising above 85 degrees and seldom falling below 60; there is not a

LA GUAYRA—FROM THE EAST.

stove, nor a fireplace, nor a chimney in the town; there is no glass in the windows; the nights are always cool, and in the daytime there is a difference of ten or twelve degrees in temperature between the shady and the sunny sides of the street.

In 1812 the city was entirely destroyed by an earthquake and twenty thousand people were killed. It came on Holy Thursday, when the citizens were preparing for the great religious fiesta of the year. There was not a cloud in the sky and not a thought of danger in the minds of the people, when suddenly the town began to rock, the church bells tolled voluntarily, and a tremendous explosion was heard in the bowels of the earth. In a second the city was a heap of blood-stained ruins and the air was filled with shouts of horror and the shrieks of the dying.

There have been several earthquakes since, attended with serious casualties, and while the people profess not to fear them they build the walls of their houses three and four feet in thickness and seldom make them more than one story high.

The people of Caracas have an opera supported by the government, a university, art galleries, public buildings that are beautiful and expensive, and homes in which one can find all the evidences of a refined taste that are known to civilization. While in some respects the people are two hundred years behind our own, and while many of their manners and customs appear quaint and odd when judged by our standard, there is no social station in America or Europe which the educated Venezuelan would not adorn. Their women are proverbial for their beauty and grace and their men for their deportment.

There is no convenient way of getting from Caracas to the Orinoco country except by sea. Of course, one can "cut across lots," and many people, armies, indeed, have gone that way, but it is a long, tedious, and difficult journey, and dangerous at times, because of the mountains to be climbed, the forests to be penetrated, the rivers to be forded, and the trackless swamps. To a naturalist the trip is full of fascination, for the trail leads through a region prolific with curious forms of vegetable and animal life.

To reach Ciudad Bolivar, formerly known as Angostura, the political capital as well as the commercial metropolis of the Orinoco country, is neither difficult nor expensive, and, aside from the heat, the journey is comfortable. It is like going from New York to Memphis by sea, however, although not so great a distance. There are no native means of transportation, but you can take any of the English, French, or German steamers, and they are usually leaving La Guayra as often as twice a week to Port-of-Spain, on the British island of Trinidad. At least once a week, and generally twice, a steamer leaves Port-of-Spain for the upper Orinoco. The time required to make the journey depends upon the season of the year and the condition of the river. If you are going during the rainy season—that is, from the first of May to the first of November—you can reach Ciudad Bolivar in three days; but during the dry season, when the river is low, navigation is slow and difficult because of snags, bars, and other obstructions. At Ciudad Bolivar the traveler shifts his baggage to a smaller craft, similar to those that ply the Ohio, Tennessee, and other streams of the United States, and starts onward for the head of navigation, wherever that may be.

It is possible to go within two days' journey on mule-back of Bogota, the capital of Colombia, by taking the Meta, one of the chief affluents of the Orinoco, and by passing southward through the Cassiquiare the Amazon can be reached. Few people are aware that a boat entering the mouth of the Orinoco can emerge again into the sea through the Amazon without leaving the water. This passage is not navigable for large steamers because of rapids and obstructions, but it might be made clear at an expense that would be very slight in comparison with the advantages gained.

Another branch goes nearly to Quito, the capital of Ecuador, and in fact its affluents are so numerous and so large that in all the five hundred thousand square miles of territory drained by the Orinoco there is scarcely a point more than three or four days' journey by mule from navigable waters, and there are said to be four hundred and thirty navigable branches of the river.

From the Atlantic to the Andes, from the chain of the Cordilleras that hugs the coast of the Caribbean to the legend-haunted Sierra de la Parima, there is an area as large as the valley of the Mississippi, and similar in its configuration, capable of producing mighty crops of nearly everything the world feeds on, and affording grazing ground for millions upon millions of cattle. From the foothills of the mountains in which the sources of the river are, two thousand miles to the sea, are great plains or llanos, like those of Iowa and Illinois, almost entirely destitute of timber, except along the courses of the rivers, where valuable trees are found.

The scenery for the greater part of the voyage is interesting, but as you reach the upper waters and enter the foothills of the

VALLEY OF CARACAS, EAST OF THE CAPITAL, WITH COFFEE AND SUGAR PLANTATIONS.

Andes it becomes sublime; but there steam navigation ceases, and canoes paddled by Indians are the only means of transportation. The heat along the lower river is intense, but the boats are built so as to protect the traveler from the sun and afford the greatest degree of coolness possible. The water is turbid and muddy; the banks are low, and the Orinoco, like the Missouri, often tires of its old course and cuts a new one through fields or forest; on either side the coarse grass and reeds grow tall, and toward the end of the season are topped with tassels that nod and droop in the sun.

At daybreak long lines of pelicans and other water birds awakened by the breathing of the steamer go clanging out to sea, and as morning wakens, the thin blue mist that nature nightly hangs upon the river rises and leaves the slender rushes that line the banks to quiver in the burning glare. Toward noonday a breeze springs up, which is as regular and faithful as the stars; it cools the atmosphere, covers the surface of the river with pretty ripples, and makes life possible under a tropic sun. There is no twilight; the sun jumps up from below the horizon in the morning and jumps down again at night, and then for a few moments the sky, the river, and the savannahs are one vast rainbow, livid with colors so spread and blended that the most unpoetic eyes cannot behold it without admiration and awe.

The smaller streams are sheltered by flower-bespangled walls of forest, gay with innumerable insects and birds, while from the branches which overhang them long trailers droop and admire their own gorgeousness in nature's mirror. Majestic trees whose solitude was undisturbed for centuries are covered with decorations that surpass the skill of art; their trunks and limbs concealed by garlands finer than were ever woven for a bride—masses of scarlet and purple orchids, orange and crimson, blue and gold—all the fantastic forms and hues with which nature bedecks her robes under the fierce suns and the faltering rains of the tropics.

The only place of real importance, the entrepôt of all commerce, the headquarters of all trade, the source of all supplies, and the political as well as the commercial capital of nearly half of the republic of Venezuela, is Ciudad Bolivar. It has about 12,000 inhabitants, representing almost every nation on earth; it is built upon a clay bluff about seventy feet above high-water mark, so that it is in no danger of being swept away. During the six months of dry season, when the water is low, most of the shipping business is transacted upon the beach. The government has concentrated at Ciudad Bolivar the civil and military authority. It has the only custom-house upon the entire Orinoco system and practically the only courts.

The city resembles other Spanish-American towns, for they are all alike, has a number of pretty foliage-shaded squares, several rather imposing government buildings, a cathedral, a public market, a theater, a college, and the inevitable statues of Bolivar, the liberator, and Guzman-Blanco, the regenerator of Venezuela. The volume of business done there is enormous in proportion to the population, as it is the supply point and the port of shipment for a large and productive area. Within the last few years the exports of gold alone from that little town have been valued at $39,000,000. The principal merchants are Germans, the restaurant keepers are Italians, and the laboring classes are negroes from the West Indies or Canary islands. Ships from all ports in the world land at the piers, and the flags of every nation may be seen floating from the poles on the house-tops. The manufacture of cigars is extensive, as excellent tobacco is cultivated in the neighborhood, and in almost every household the women employ their spare time rolling the leaves into what are known in the nomenclature of North America as "Wheeling stogas." These are used in amazing quantities by the negro roustabouts, and are sent down the river to Los Tablas, from whence they are carried on mule-back 150 miles into the interior to the mines.

The most profitable mine in Venezuela, and one that is famous all over the world, is El Callao, situated on the borders of the disputed territory, in the state of Bolivar, about one hundred and fifty miles south of the Orinoco river.

I suppose that the richest gold mine ever discovered was the Consolidated Virginia, the mine from which so many of the California mining kings drew their enormous fortunes. It is difficult to calculate the output of the old Spanish mines in South America, but El Callao is reckoned second to the Consolidated Virginia in the amount of gold produced, and I understand that it has already produced more "free gold" than any other ever opened. It was worked by the Indians long ago; at least its location corresponds with that of a legendary deposit from which the savages of Venezuela got much of the gold taken from them by the Spaniards, but after the latter took possession of the country its existence was a matter of much doubt, until four Jamaica negroes happened to run across it on a prospecting tour.

VALLEY OF CARACAS, WEST OF THE CAPITAL, WITH PLANTATIONS AND SUGAR FACTORY.

Three agreed to sell their share in the discovery to a party of Corsicans for a nominal price. The fourth negro decided to keep his interest, and has always been glad that he did so, for within the next two or three years he was able to return to his native island, where he has since lived like a nabob at the city of Kingston, the richest man in Jamaica.

The Corsicans, when they began to realize the value of the property, sent two of their number to England, and succeeded in raising sufficient money to build a stamp-mill and introduce other necessary machinery; but they did not capitalize their company at ten or twenty millions of dollars, as is customary in the United States, nor did they put any of their stock on the market. They issued only thirty-two shares, which were sold originally at $2,500 a share cash, making their entire capital $80,000. These shares have since sold for half a million dollars each, at which rate the mine would be worth $16,000,000; but most of them are still in the possession of the original subscribers.

There is little immigration and labor is scarce. Most of the miners are negroes from Jamaica, Trinidad, and other West India islands. They appear to be the only class of human beings who can endure the climate, for the land is low and the mines are situated almost directly on the equator. The country is comparatively healthy, but the rays of the sun are intense, and until a man becomes acclimated he is easily prostrated by exposure. Wood is the only fuel, and a very poor quality costs seven dollars a cord.

Some of the mines are within and some without the territory claimed by England, but Great Britain has two gunboats upon the Orinoco, and at the first possible excuse will take possession of the entire mineral district. Such an act would be audacious, but would be heartily welcomed by the people, who would very much prefer an English colonial government to Venezuelan rule. I have been told by dozens of men—Americans, Germans, native Venezuelans, and representatives of other nations—that if the question were submitted to the miners the decision would be almost unanimously in favor of England. The most popular and populated diggings are on the Barima river, in the disputed territory, where several million dollars of foreign capital, mostly British, is invested, and some twenty thousand miners are at work.

The colonial authorities of Guiana have calmly occupied this territory, organizing police, appointing local magistrates, assuming legislative as well as executive jurisdiction, providing laws and regulations for the government of the mining camps, requiring prospectors to obtain licenses from the colonial officials at Georgetown before commencing work, and to advertise their claims and locations in the Official Gazette of the colony.

These regulations have been imposed by the British colonial authorities within a territory to which they did not claim ownership until the discovery of gold, and over which they did not attempt to exercise jurisdiction until 1883; and as new mines have been discovered they have gradually pushed their frontier line westward until it now includes nearly twice as much territory as they claimed twenty years ago and seven times as much as was ceded to Great Britain by Holland in 1814. It is true that the Venezuelans have shown no enterprise or activity in developing their own resources. They have permitted foreign prospectors to enter and occupy the mining districts at their will, and have never attempted to exercise police or even administrative control in the mining camps. The original prospectors, being Englishmen, naturally looked to the colonial government at Georgetown for protection, and the other foreigners fell in without a question, acknowledged British sovereignty and obeyed British law.

It was within this disputed territory, between the Orinoco and the Amazon, that the ancient voyageurs located the mythical city of Manoah, the El Dorado upon which the wonder and greed of two centuries were concentrated. Tidings of its barbaric splendor were brought home by every voyageur, and each caravel that left the shores of Europe carried ambitious and avaricious men, who hoped to share its plunder before their return to Spain; but the alluring El Dorado was not a place; it was a man. The term signifies "the gilded," and was originally applied to a mythical king who every morning was sprinkled with gold dust by his slaves. The nuggets of gold and the rudely wrought images which Sir Walter Raleigh laid at the feet of Queen Elizabeth when he returned from his exploration of the Orinoco doubtless came from the now famous mine of El Callao. But the El Dorado was never found; no courage could overcome, no persistence could discover, what did not exist, and the fabulous king of the fabulous island still sits on his fabulous throne, covered from his fabulous crown to his fabulous sandals with the fabulous dust of gold.

[Note.—The foregoing article is an abstract of a lecture delivered before The National Geographic Society by Mr Curtis, January 10, 1896. The lecture itself consisted of selected extracts from Mr Curtis' book, "Venezuela: A Land Where it's Always Summer," which will shortly be published by Harper & Brothers.]

THE PANAMA CANAL ROUTE

By Robert T. Hill,
United States Geological Survey

Within the space assigned to me for the discussion of the most unpopular of the three rival isthmian routes, I can do little more than present a brief summary of the facts concerning the Panama canal. At the outset it may be stated that if the Nicaragua route could be exclusively controlled by the United States, even if it was far more costly, my personal preference would be for it. In no case, however, does such personal preference necessitate or justify misstatements as to the rival Panama route, concerning which, since it was allowed to pass out of American control into the hands of the French and to become involved in serious financial difficulties, public opinion in this country seems to be singularly misinformed.

That this route is in control of a foreign power; that it is a rival enterprise to one supposedly controlled by a private corporation in which American citizens and officials are interested, and that it has fallen into ill repute through scandalous mismanagement are facts which are undeniable.

These questions of administration have, however, little to do with the purely scientific problem of what constitutes the most feasible route for uniting the two oceans by a maritime canal. Some patriotic Americans, while admitting that national prejudices draw them to a preference for the rival route, can yet see the arguments on both sides of the question and can distinguish the proposition that the financial failure of the Panama Canal Company in Paris is no condemnation of the feasibility of the Panama canal route.

The engineering investigations that have been conducted since the practical suspension of operations on any extensive scale on the canal itself have been singularly overlooked. At least three thoroughly equipped corps of engineers have resurveyed the entire route and recommended modifications in the plans. The reports of two of these commissions describing the improved lock-level system are in print. The third and more recent commission was engaged in studying the canal during my visit to the isthmus in January, 1895. It comprised a large and competent body of skilled engineers, and my final word must be held in reserve until this commission has made its report.

In the meantime, what are the principal facts concerning the feasibility of the Panama route?

1. It is the shortest of all, being only 42½ miles from sea to sea, across about 20 miles of which the canal has been completed to 28 feet below sea level, making the actual present distance between the two oceans less than 25 English miles, or about one-seventh of the actual distance (170 miles) to be overcome between Greytown and San Juan in the case of the Nicaragua route.

2. It is the only possible tide-water route in the whole isthmian region. To accomplish it would, it is true, require great engineering and constructional feats, but in no respect impossible ones.

3. It is said by competent and reliable engineers to be feasible for a lock-level route. The plan proposed involves the construction of a dam at Bujio or San Pabloa of about the same size as that which is admitted to be necessary at San Carlos on the Nicaragua route, together with six locks. The construction of this dam would create a summit lake 125 feet above tide water and 12 miles in length if placed at San Pabloa, or 21 miles if located at Bujio. In addition to giving free summit navigation, such a lake would control the floods of the Upper Chagres, storing them in the rainy season and supplying water to the summit lock-levels.

4. It is in a region comparatively free from seismic disturbance and one in which no volcanic action has occurred since late Tertiary time. The Nicaragua route is within a zone of topographically destructive volcanic disturbance, where earthquakes are frequent.

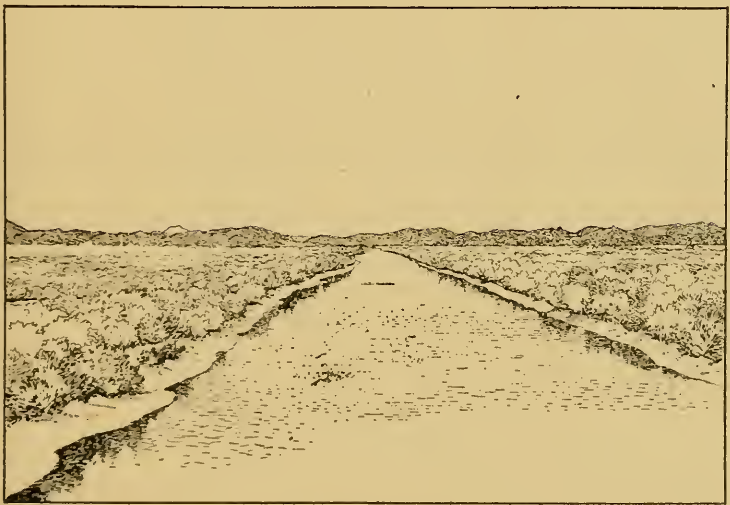
5. It has what no other route possesses: excellent terminal harbor facilities, with anchorage at both oceans so improved that ships can enter and leave at will.

6. It has been minutely surveyed. Every foot of the "trace" has been cleared of vegetation and partially excavated and tested by borings, so that the actual problems of construction are approximately known. As to problems that will surely arise in the work on the other route we have absolutely no data.

7. It has on the Caribbean side only 31 miles of flooded thalweg

(21 of the Chagres and 10 of the Obispo) to be threaded and controlled, against 111 miles in the case of the rival route. It is true that the Nicaragua route proposes to avoid a part of the San Juan by a cut of 40 miles, but the control of the remainder will be a similar and probably as serious a problem as that presented by the Chagres. From 10 to 15 miles of the latter have been completely diverted and the remainder can be controlled by the proposed summit-level lake. In the case of a sea-level plan the diversion would still be a great problem, but by no means an insurmountable one.

8. It will be the cheapest route to construct. The plant already furnished, with two-fifths of the excavation now completed for a



PANAMA CANAL,
SHOWING A PORTION OF THE 13½ MILES COMPLETED ON THE CARIBBEAN SIDE. WIDTH, 80 FEET. TOPOGRAPHY OF CENTRAL PORTION VISIBLE IN BACKGROUND.

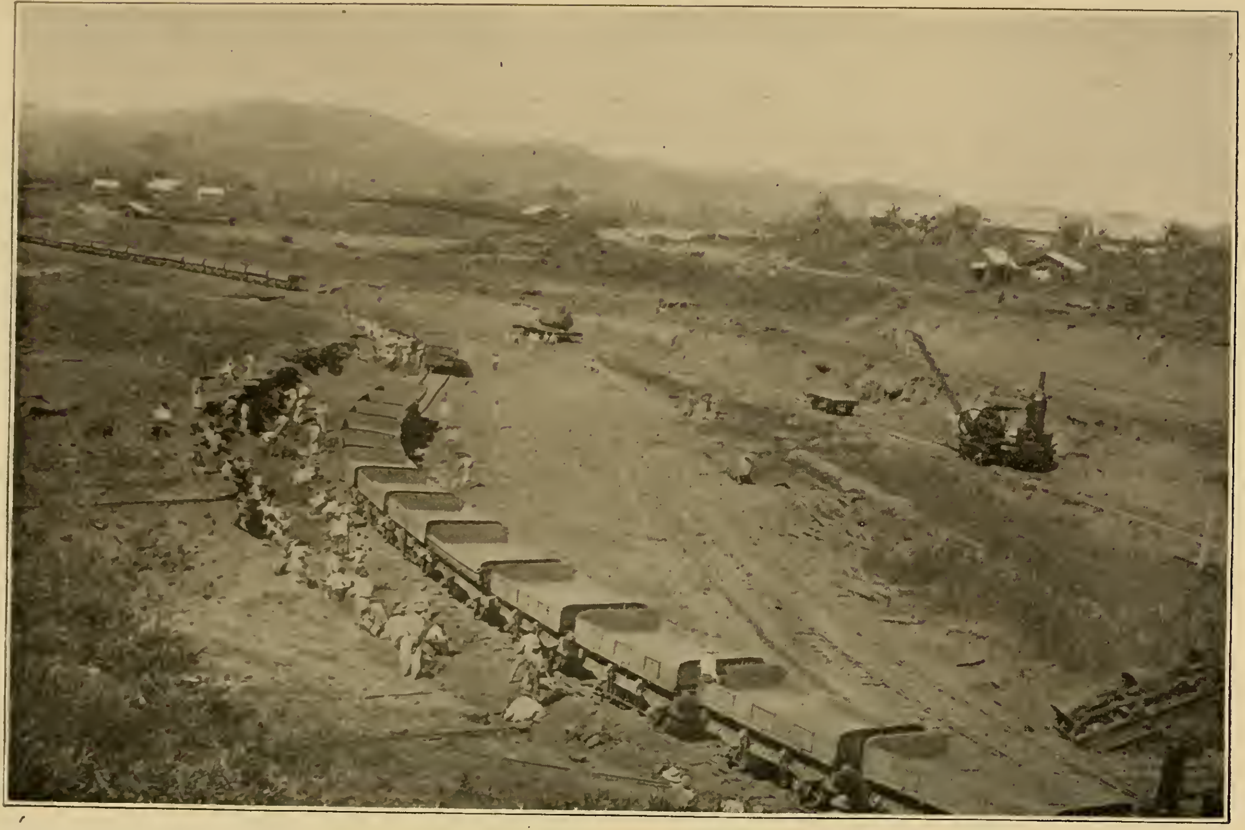
sea-level route, including expense of administration and machinery, has actually cost \$150,000,000. Upon this basis it is estimated that the entire length of 42½ miles will cost \$116,000,000 more upon the lock-level plan. A sea-level route would cost \$200,000,000 more. The amount of work necessary to complete the Panama canal is far less than would be required to construct the Nicaragua route. Engineers admit that 40 miles of excavation—almost equivalent to the entire length of the Panama canal—are necessary along the rival route. What the cost of the construction of the Nicaragua route will be can never be told until the actual work is well under way.

9. It is nautically the most important route, being more centrally situated relatively to the two continents. Its Caribbean terminus is as near by sailing and steaming routes both to the North Atlantic and European ports as is Greytown, while its Pacific terminus is far more convenient to the South American trade.

10. Politically it is the only route at present possessing treaty rights under guaranteed neutrality with any isthmian country by which canal construction can be permitted. The region through which it passes is American in interest and practically under our protectorate, and a neutral canal across it, even though the French construct it, would give us all the privileges now apparently to be obtained via Nicaragua under the Bulwer-Clayton treaty.

The foregoing are the salient facts concerning the Panama route. An important point to remember is that underground conditions, both favorable and unfavorable, and which were not anticipated from the preliminary surveys, have been encountered in the course of construction. For instance, the 25 kilometers of the canal on the Caribbean side were contracted for and paid for as rock-cutting, when the material proved to be, for the most part, the easiest kind of earth excavation. On the other hand, an utterly unlooked-for obstacle developed in the creeping of the clays for about a mile along the Culebra summit. These are geological considerations with regard to which we have absolutely no information along the Nicaragua line, and it is urgently needed.

Although not essentially pertinent to the subject of feasibility, a few words concerning the actual present status of the canal construction may be of interest. The company has passed through the ordeal of experimentation and financial failure and its affairs are now in the French courts, under whose direction accurate researches have been prosecuted during the past year to ascertain the exact expenditures of the late company and to determine what steps are necessary to complete the work. Upon the report of the commission will depend the completion of the canal. The French people have put too much money into the enterprise not to complete it, and Americans need not deceive themselves with the expectation that the work is abandoned or that the company is utterly bankrupt. Almost the entire plant, including dredges,



CONSTRUCTION WORK ON THE PANAMA CANAL, NEAR THE SUMMIT, IN 1895.

Photographed by Robert T. Hill.

railway locomotives and other machinery, track, barges, steam vessels, pontoons and locks, houses, shops, etc., for the completion of the work is on the ground, and this alone represents a large proportion of the money expended by the old company. This plant is not undergoing the ruinous decay that has been represented in this country, but, on the contrary, it is kept in scrupulously good order and will be available for the completion of the work.

The old Panama Company was responsible for nearly $266,000,000, of which it spent $150,000,000 upon the plant and construction and criminally distributed nearly $100,000,000 among the dishonest parties who brought the company into disrepute. In the hands of the courts, however, there still remains some $20,000,000 awaiting the reorganization of the company. That the present commission does not consider the route impracticable is attested by the fact that they have kept the work progressing, about 2,000 laborers having been employed upon the construction of the canal during the past year. When, in February, 1895, I took the photograph reproduced as an illustration to this article I counted five locomotives at work carrying away the excavations from the Culebra summit.

No available news comes to this country from France concerning the operations of the canal. *The Outlook*, however, in a recent issue, makes the following statement:

"It was announced recently that the French company in charge of the work on the Panama canal is now collecting 2,000 more men from Jamaica and other West Indian islands to add to the 1,800 now at work, and that it is intended eventually to increase the force to 6,000 men. The New York *Evening Post* declared that it had received information which it considered trustworthy that the money to finish the work on the present plan has all been furnished, and that nothing can prevent the opening of the canal at the appointed time, except accidents and obstacles not now anticipated. The managers even expect that the work will be completed in six years. This is quite in line with the report made by Sir Henry Tyler, the late president of the Grand Trunk railway, who has been visiting Panama. He says that it is proposed to construct two large dams, one across the Upper Chagres and one on the Lower Chagres river. Two lakes will thus be formed, the upper one supplying water to the higher portion of the canal, while the lower one will be mainly used to furnish water for the navigation of the lower part. Ten locks will be built, enabling the canal to reach a height of 170 feet above the sea level. Sir Henry holds that there is no insuperable difficulty in the completion of the canal in six years, at a cost of $100,000,000, by utilizing the work already done for a distance of sixteen miles from Colon and four miles from Panama."

COMPARATIVE TABLE: NICARAGUA AND PANAMA ROUTES.

	Nicaragua.	*Panama—Lock-level plan.*
Natural distance, sea to sea..........miles..	169.5	42.5
Present distance, sea to sea..........miles..	169.5	25
Natural altitude, continental pass.....feet..	147	260
Same, as reduced by artificial cutting..feet..	147	246
Miles of river course, Caribbean side..	111	31
Miles of river course below site of proposed dams..................................	32	21
Proportion of above diverted by artificial cutting..................................	......	10
Proposed height, summit level........feet..	110	125
Proposed dams to create summit level	1	1
Miles of proposed summit navigation	144.8	12 or 21
Proposed locks	7	6
Excavation (miles originally proposed)......	40.3	42.5
Miles of excavation completed for lock plan.	0	15–20
Miles of excavation to be completed for lock plan..................................	40.3	10[1]
Terminal harbors..........................	None.	Completed.
Plant on ground for completion............	.....	All.
Estimated cost to complete canals...........	$133,500,000[2]	$116,000,000

[1] The adoption of the lock-level plan will avoid several miles of excavation originally contemplated in sea-level plan. [2] U. S. Commission.

THE TEHUANTEPEC SHIP RAILWAY

By Elmer L. Corthell, C. E., D. Sc., etc.

The world is still discussing the question of the best route by which to facilitate interoceanic traffic between the Atlantic and the Pacific. Commercial interests now center on three routes—Panama, Nicaragua, and Tehuantepec. The first has entailed enormous expenses on France and involved many of its prominent citizens in serious complications; the second has been specially urged on the United States as the American route; the third, advocated for many years by a great genius, has been advanced to such a stage by Mexico as to be the only work that present conditions have justified.

Addressing ourselves to the advantages of the Tehuantepec route, its interesting constructive, commercial, and geographic features must be prefaced by a brief historical résumé. The

Mexican republic in 1824 invited proposals to open the isthmian route, but internal dissensions delayed action. In 1842 Santa Anna granted a charter to José de Garay, but the only tangible result was the complete survey of the isthmus by Gaetano Moro, an able Italian engineer. In 1850 efforts to negotiate treaty rights for the United States in this respect failed; but by the Tehuantepec Railroad Company, chartered by Mexico, exhaustive surveys of the route were made, under the direction of Gen. J. G. Barnard, U. S. A., by Mr J. J. Williams, whose report of 1852 is the most complete ever published. In 1868 the Louisiana Tehuantepec Company conducted a large transportation business of freight and passengers over a partly built wagon road, but its charter of 1857 was soon forfeited. The life of the La Sere grant of 1867, nullified in 1879, was marked by the active interest of the United States in the problem of interoceanic communication. In 1870 Commodore Shufeldt, sailing with an able corps of army and navy assistants, exhaustively surveyed Tehuantepec and Nicaragua, and in his report strongly advocated the Tehuantepec route for its many advantages. Mexico coöperated in an independent survey under Señor M. F. Leal, now her secretary of public works.

It was President Diaz who initiated railroad construction and has so earnestly persisted in efforts to open an international route across this isthmus. Under the charter of 1878 Mr Edward Learned, an American, constructed 22 miles, receiving a subsidy of $12,000 per mile, but in 1882 he surrendered his charter to the Mexican government, receiving, by arbitration under charter provisions, $125,000 in Mexican silver and $1,500,000 in gold. These futile private efforts led Mexico to undertake the work herself; but she soon reverted to the contract system, and under Mr D. Sanchez, a Mexican, some miles of track were laid on the Atlantic and Pacific sides at an expense of $1,434,135 in Mexican silver. In 1882 a loan of £2,700,000 was negotiated, and Mr E. McMurdo, of London, contracted to repair the track built and complete the road proper. Much work was done, but Mr McMurdo died and the contract was abrogated, the company having failed to comply with its terms. Some $2,000,000 of Mexican silver remained, and with this sum and an additional appropriation of $1,111,035 in silver Messrs C. S. Stanhope, J. H. Hampson, and E. L. Corthell completed the railroad in 1894. Mexico now operates it and is spending $1,000,000 in gold, under a contract with Mr S. Hermanos, to perfect the equipment and finish some permanent structures. Since 1878, including the last contract and excluding interest, Mexico has spent on the route $16,000,000 in gold and $2,670,170 in Mexican silver.

The completion and operation of this railroad will greatly facilitate the construction of the ship railway when the time arrives to build it, as it may with great advantage be employed to distribute supplies, materials, and laborers along the line of the ship railway, and thus be used as an auxiliary line, which Mr Eads had intended to build in advance for this purpose.

Permit me now to state the part taken by Mr Eads in solving the problem of interoceanic transit. In a letter to the New York *Tribune*, June 10, 1879, he advocated a ship railway at Panama instead of a ship canal. As against the doubtful project of a ship canal and in favor of a ship railway he said:

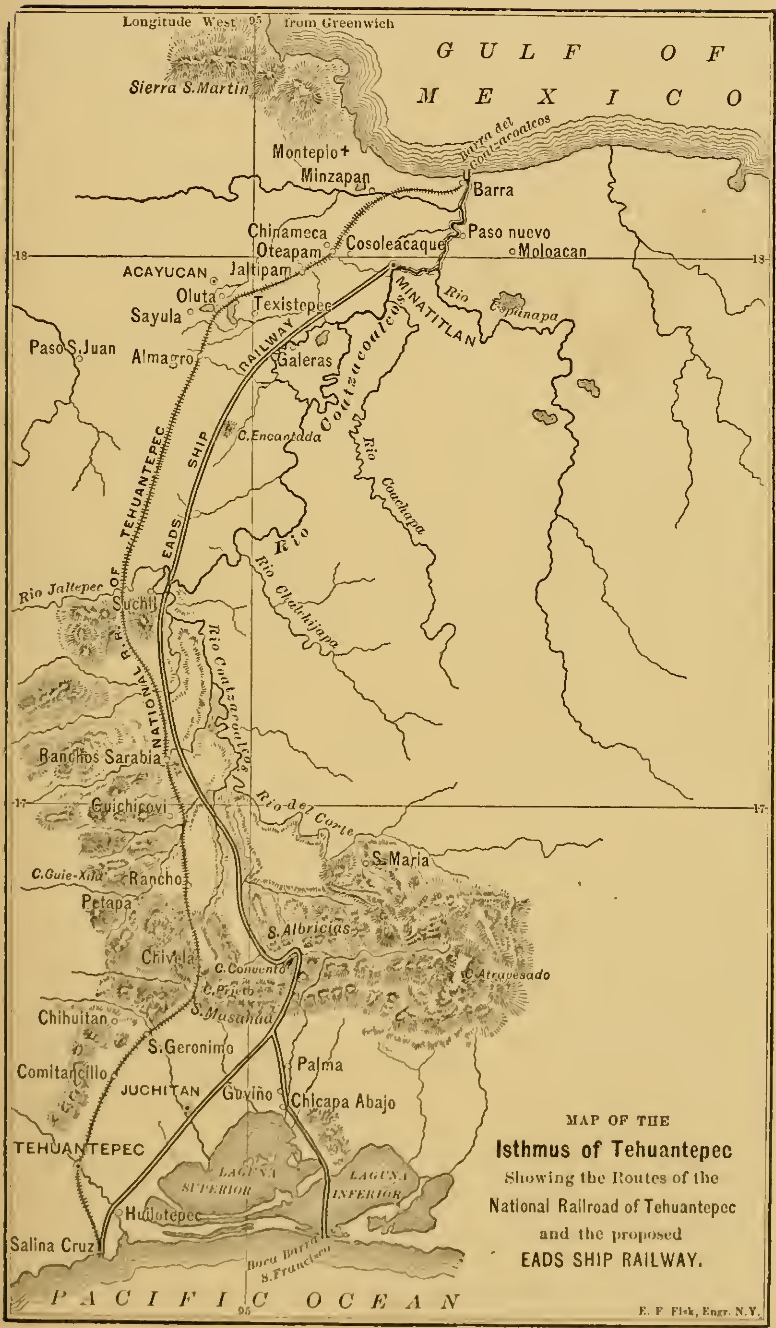
"My own studies have satisfied me of the entire feasibility of such transportation by railroad, and I have no hesitation in saying that for a sum not exceeding one-third of the estimated cost of the canal, namely, about $50,000,000, the largest ships which enter the port of New York can be transferred, when fully loaded, with absolute safety across the isthmus, on a railway constructed for the purpose, within twenty-four hours from the moment they are taken in charge in one sea until they are delivered into the other, ready to depart on their journey."

He urged the construction of a ship railway on De Lesseps, but the great Frenchman said, "A canal at sea level or nothing." He found nothing, at a cost not of $120,000,000, but of $250,000,000.

Mr Eads then turned his attention to the much more advantageous route at Tehuantepec, only 800 miles from the Mississippi jetties, and it was my good fortune to be henceforth associated with him until his death.

The concessions of May, 1881, modified in 1885, provided for the construction and operation of the ship railway for 99 years. Many liberal provisions were included, such as the donation of about 2,700,000 acres of land, ample rights of way, right to collect tonnage and wharf dues. Far the most valuable grant was the guaranty that one-third of the net revenue of the company for fifteen years from the opening of the railway should amount to $1,250,000, with the right to secure a similar guaranty for $2,500,000 to cover the remaining two-thirds of the interest from foreign nations, but with the understanding that this guaranty should be sought from the United States.

Mr Eads made the plans with his customary skill, and after obtaining the approval of many prominent naval architects and



MAP OF THE
Isthmus of Tehuantepec
Showing the Routes of the
National Railroad of Tehuantepec
and the proposed
EADS SHIP RAILWAY.

engineers came to the United States Congress with a bill for the charter contemplated in the Mexican concession. Scarcely two months later the promoters of the Nicaragua canal came before Congress with a somewhat similar measure, and the two projects antagonized each other up to the death of Mr Eads, in 1887.

Meanwhile the most exhaustive surveys were made and a satisfactory route was laid down between the ocean terminals of the isthmus. The requirements of the charter as to beginning construction work were fully complied with, and the amount of construction work done by Mr Eads will be best appreciated by the statement that about $500,000 in gold was expended.

From the Tehuantepec railroad to the Panama railroad, measured along the Pacific coast, is about 1,200 statute miles, and to the Nicaragua canal about 800 miles. All commerce from these more southern routes must pass directly by the Pacific terminus of the Tehuantepec railroad in going to San Francisco, Oregon, Yokohama, or Hongkong. On the Atlantic side Tehuantepec has similar advantages in distance over southern routes. The calculation shows that on eighteen routes to be affected by opening up Tehuantepec the aggregate saving in distance over the present cape routes and Panama is over 125,000 miles and by sail routes nearly 200,000 miles.

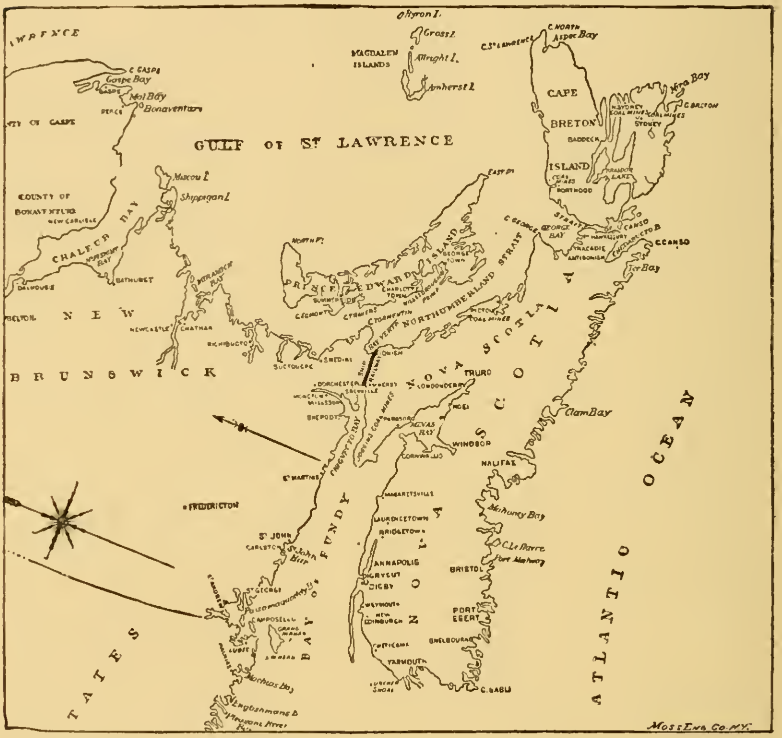
Mr Thomas J. Vivian, an expert statistician of the Census Office, was engaged to make a report upon the probable traffic on the proposed ship railway. The results of his very careful and extended investigation and his clear analysis and grouping of a great number of facts fully justified his selection. The detailed estimates show that in 1896 we might expect a traffic of 5,288,000 tons of freight, if the railroad were fully equipped and sufficient time had elapsed to develop the new commerce. At a rate of $2 per ton, to include handling and transporting from ship to ship, and adding to the total receipts from freight the passenger receipts, we will have a gross income of $10,576,000. Estimating the operating expenses at 60 per cent of the gross receipts, which for through traffic is sufficient, we shall have a net income of $4,294,000. The estimates of traffic for a ship railway, in the same conservative manner, give a total traffic for 1896 of 7,263,000 tons, which at $2 per ton would yield a gross income of $14,526,000. Assuming the cost per ton for transporting from ocean to ocean, including all expenses, at 50 cents, the net income would be $11,044,000.

The cost of moving steamships through any canal on the

American isthmus will amount to more than the cost of operating the ship railway. The time in transit through the restricted channels and locks at Nicaragua will be twice as great as the time required on the ship railway, and will even exceed the time required on the railroad to load on the cars, haul across the isthmus, and reload into vessels. The Suez canal, immeasurably easier to maintain than any canal would be at either Panama or Nicaragua, cost for maintenance and working in 1883 $2,784,869. A careful study of the cost of operating the ship railway gives a safe estimate of 30 cents per ton. I have no doubt that with a traffic of 7,000,000 tons this is ample, but I have decided to use 50 cents per ton in the present estimate. As to the cost of preparing the three routes under comparison for a large traffic, the ship railway, fully equipped for carrying vessels weighing 10,000 tons and 7,000,000 tons of freight, will cost on a cash basis about $60.000,000. I shall not estimate the cost of building a ship canal at Panama or Nicaragua. The former, partly completed—certainly not over one-half—has already cost probably $250,000,000 in cash and the plan changed from a sea-level canal to a lock canal, the practicability of which is extremely doubtful, due to inadequate water supply in the dry season ; and as to Nicaragua, we must rely upon the report, soon to be made public, of the able board of engineers appointed by the President.

The presentation of the subject will not be complete without a résumé of the proposed method of carrying ships overland by railway, for we are accustomed to regard any method that has not the sanction of use as visionary.

Many projects for commercial ship railways have been made during the last thirty years. In 1872 Brunlees and Webb, of Great Britain, made plans for a ship railway across the American isthmus at Honduras, which would have been built but for the financial depression that soon followed. It was intended to transport vessels of 1,200 tons register. The United States engineers have designed a steamboat railway to avoid the dangerous navigation of The Dalles of the Columbia river. The project and plans have received the approval of Congress and an appropriation of $100,000 has been made to begin work. The ship railway of Nova Scotia, designed by Mr H. G. C. Ketchum, Sir John Fowler, and Sir Benjamin Baker, to connect the gulf of St. Lawrence with the bay of Fundy, deserves special attention, as it is nearly completed. Of the $5,500,000 required, all but $1,500,000 has been expended. The line is about 17 miles long, and hydraulic lifts are used for raising the vessels. The platform on which the car and vessel rest is about 40 feet wide. There are 20 hydraulic presses, each 25 inches in diameter, with a stroke of 40 feet, and the system is capable of lifting a vessel carrying 1,000 tons of cargo. There are two tracks of standard gauge, 18-foot centers, with rails weighing 110 pounds per linear yard. This ship railway would now be in operation but for the lapse



MAP SHOWING THE LOCATION OF THE CHIGNECTO SHIP RAILWAY, TO CONNECT THE GULF OF ST. LAWRENCE AND THE BAY OF FUNDY.

of the government charter during a temporary failure of funds for construction. It is confidently expected that a renewal of the charter and an extension of time will soon be granted. The hopes of all advocates of ship-railway methods are centered in this comparatively small railway at Chignecto.

The main features of the ship railway designed for the Tehuantepec isthmus are terminal docks provided with a great lifting steel pontoon, which was sunken with the ship carriage to the bottom of a dock, guided in its movements by a large number of vertical cylinders. The ship is then floated in over the carriage and placed in exact position, the pontoon is pumped out, and the continuous keel block comes in contact with the keel of the vessel, when a system of hydraulic rams working through the deck of the caisson pushes the keel block closely against the keel and also a large number of bilge blocks and side supports against the side of the vessel. Each one moving up vertically comes in contact with the ship, when the adjustable surfaces of each support, which is faced with rubber, take the form of the vessel by means of a universal hinged joint. The weight of the vessel is thus uniformily distributed, according to the principle on which the hydraulic system was designed.

The locomotives are then coupled on and the vessel hauled to the opposite terminal, where it is set afloat by exactly the reverse process. At two points on the isthmus it becomes necessary, in order to obtain grades of not more than 1 per cent and to secure a practically straight line, to arrange for an abrupt change of direction, which is done by a great floating turntable, simply a hollow pontoon grounded on the bottom of a masonry basin when the car is hauled upon it, and then raised slightly upon its bearings by pumping water into the basin and made to revolve around a vertical central axis or guide until it takes the new direction.

There is an important advantage which the ship railways have over the ship canals in the American isthmus, particularly in such rainy portions of it as Panama and Nicaragua, the rainfall at the latter place ranging from 200 inches to 300 inches per annum. The advantage lies in the fact that a ship railway is always above the floods, while the canal is always below them and menaced at all times by most serious dangers.

The Nicaragua route has been considered the American route. If it is so, then the Tehuantepec route is still more American in reference to all commercial features, and certainly is of more importance to us from a strategic point of view than any route out of the Caribbean.

The clear and decided views of Admiral Shufeldt upon its advantages were expressed as follows:

"Each isthmus rises into importance as it lies nearer the center of American political and commercial influence, and the intrinsic value of this eminently national work ought to be based upon the inverse ratio of the distance from that center. A canal through the isthmus of Tehuantepec is an extension of the Mississippi river to the Pacific ocean. It converts the gulf of Mexico into an American lake. In time of war it closes that gulf to all enemies. It is the only route which our Government can control. So to speak, it renders our own territory circumnavigable. It brings New Orleans 1,400 nautical miles nearer to San Francisco than a canal via Darien."

The Tehuantepec route can be made more easily accessible to the United States and Mexico by railroad, over which armies and munitions of war can be quickly transported. The gulf of Mexico is clear of foreign complications, belongs to these two great republics of the New World, and when Cuba shall have become a State of the Union, as it may in the near future, we shall hold the entire circuit of this great sea. If, on the other hand, you look upon any English map of the Caribbean sea you will notice that this great power holds every entrance to it. Belonging to Great Britain there are about twenty-five different countries and islands, from British Guiana on the east to British Honduras on the west, which lying directly in front of Panama and Nicaragua guard all approach to them. This important fact is not sufficiently appreciated in our plans for making the Nicaragua canal a United States canal, to be controlled, fortified, and defended by our comparatively small navy against the preponderating naval powers of Europe.

President Diaz is so fully convinced of the superior advantages of even an ordinary railroad at Tehuantepec over any other route located at more southerly points that, in the face of the constant menace of the Nicaragua project, he has gone forward, in spite of stringent financial conditions in Mexico, to complete the National Railroad of Tehuantepec, and now that it is completed to provide adequate harbor terminal facilities and equipment for a large interoceanic traffic. He looks upon the consummation of this great commercial undertaking as one of the most beneficent works of his long and glorious administration.

[NOTE.—The foregoing article is an abstract of a lecture delivered before the National Geographic Society, November 22, 1895. The lecture was considered so important a contribution to the literature of interoceanic communication that it has been printed in full as a public document by order of the Senate. See Senate Document No. 34, 54th Congress, 1st Session.]

THE PRESENT STATE OF THE NICARAGUA CANAL

By General A. W. Greely,

Chief Signal Officer, United States Army

The economic, physical, political, and strategic advantages of the Nicaragua canal have been so fully dwelt upon that their presentation here is not called for, especially in view of the forthcoming report to Congress of the National Commission on this interoceanic waterway. This article is viewed as supplementary to the articles on the Panama Canal Route and the Tehuantepec Ship Railway, in order that the readers of The National Geographic Magazine may know the amount of work done on the Nicaragua canal to date, its possible cost as given by the corporation engineers, and also as estimated by the National Commission, which latter forecast by the press is subject to correction. The following summary covers the main features of the work.

The concession for the canal was granted by Nicaragua to the Maritime Canal Company of Nicaragua, incorporated under act of Congress February 20, 1889, which company reports annually to the Secretary of the Interior. Statements relative to work done are drawn from its report of December 3, 1892. This corporation contracted with the Nicaragua Construction Company for the construction of the canal. In the spring of 1889 detailed surveys of canal, locks, harbors, etc., were completed, the final location of the route was practically determined, and, after preliminary operations, the work of actual construction began October 9, 1889. To restore Greytown harbor a breakwater extending 1,000 feet into the ocean was built and filled in with brush mattresses, rock, and hydraulic-cement concrete. A channel of 10 feet formed naturally, which was increased by dredging to 15 feet, and thus maintained until the accretions to the beach on the windward side of the jetty reached its outward extremity, when the sand passed to leeward and partially closed the new entrance. Five groups of permanent buildings were erected near San Juan, including offices, hospitals, storehouses, etc., which covered an area of 1⅞ acres. In addition, freight wharves, machine shops, etc., were built, and the more important establishments were connected by tramway. A clearing 468 feet wide was made through the dense forest growth from Greytown inland a distance of 10 miles, and a similar clearing of 9 miles was made to the west of Lake Nicaragua. A telegraph line of 60 miles extended inland to Castillo, and this system was supplemented by telephonic side service. A harbor wharf 269 feet long was built and equipped with modern steam conveniences for handling freight. A railway was constructed from Greytown a distance of 12 miles, with sidings, and was equipped with four locomotives, fifty cars, and suitable modern apparatus for railway and canal construction. The road built is of the most difficult character, as it traverses for 6 miles a swamp considered impassable, where a large amount of corduroy and fill-work was required. The railway line was surveyed to Ochoa and its location determined, as well as from Lake Nicaragua to the Pacific.

The contractors secured for their work the plant of the American Dredging Company, formerly used at Panama, consisting of seven powerful dredges, two tugs, twenty lighters, pumps, etc. Dredging commenced west of Greytown harbor in 1890, and there was opened to a point well inland—1½ miles—a channel 17 feet deep and from 150 to 230 feet wide. The Machuca rapids, San Juan river, were materially improved for steamboat navigation. In addition to this, exhaustive surveys and borings were made in connection with the Ochoa dam, La Flor dam, and other important points on the route. The superior employés were American, while the unskilled labor was performed by natives of Central America and by Jamaica negroes. The health of the employés has been unusually good, the total deaths in three years giving a rate of 1.48 per cent of cases treated.

On November 9, 1890, the Nicaraguan government officially declared that the company had complied with the article requiring an expenditure of $2,000,000 during the first year of work, thus confirming for a term of ten years the company's concessionary rights. The financial troubles of 1893 first compelled the Nicaragua Canal Construction Company, under contract to build the canal, to limit its expenditures to the preservation of its plant, and finally to suspend all payments, which resulted in a receiver being appointed by a United States court in August, 1893. The reconstruction of the contracting company has been accomplished, under the name of the Nicaragua Company, and it is now making preparations for resuming work on the canal.

Meanwhile the United States Senate, in connection with bills for aiding the construction of this canal, has carefully considered the whole subject, including the operations of the corporations mentioned above. Three favorable reports have been made—two by Mr Sherman, No. 1944, Fifty-first Congress, Second Session, and No. 1142, Fifty-first Congress, Second Session. The last, by Mr Morgan, No. 331, Fifty-second Congress, Second Session, on April 14, 1894, adopts and reprints the first two reports. It appears that the Maritime Canal Company expended between October 5, 1889, and October 7, 1890, $3,099,971, and that the total expenditures of the construction company aggregate $4,451,568.

The total length of the canal is to be 169.45 miles, of which 26.78 miles will be excavated canal and 142.67 free navigation, and there will be three locks on each side of Lake Nicaragua. The cost of the canal, equipped for full service and extending to deep water in both oceans through completed harbors, was estimated by Chief Engineer A. G. Menocal at $65,084,176, including 25 per cent for contingencies. These estimates were increased by a revisionary board of five distinguished engineers—J. Bogart, E. T. D. Myers, A. M. Wellington, H. A. Hitchcock, and C. T. Harvey—to $73,166,308, which amount other special contingencies augmented to $87,799,570; interest charges would raise the grand total to $100,000,000. The Senate committee states, however, that all work done has fallen within Mr Menocal's estimates. The reports dwell upon the value of this interoceanic waterway to the United States, strategically, politically, and also economically. The committee placed the outside limit of the cost of the Nicaragua canal at $100,000,000, and it therefore recommended that the United States guarantee $70,000,000 of 3 per cent bonds, which would vest the United States with the ownership of 70 per cent of the entire capital stock.

The final outcome of this report was the authorization by Congress of the appointment of a commission of engineers to examine and report upon the route and surveys of the Nicaragua canal.

This commission, consisting of Col. W. P. Ludlow, U. S. Army; M. T. Endicott, U. S. Navy, and Alfred Noble, in the summer of 1895 examined the route and such of the work as had been done, and submitted its report to the President, by whom it will be transmitted to the present Congress. The character and substance of the report have not been officially made public.

The New York *Herald* of November 25, 1895, put forth detailed accounts of the report, which lack official confirmation. The salient features of this article set forth that the commission has increased the canal company's estimate of $69,893,660 to a "provisional" estimate of $133,472,893. Authoritative estimates can be obtained only at the cost of $250,000 for an exhaustive survey covering two dry seasons. The present location from Greytown to Brito is practically condemned, and it is suggested that the entrance to Greytown harbor should be moved eastward and its depth increased to 6 fathoms; that the Brito harbor should be moved southeastward and its breakwater extended considerably, and that the canal should be moved south of Bernard lagoon and be straightened, etc. The proposed rock-filled dam at Ochoa, across a powerful river and on a sand foundation, presents grave difficulties, and should be built only after careful study; it should preferably be replaced by a masonry structure. The physical conditions and regimen of San Juan river and Lake Nicaragua should be carefully studied; the proposed channel excavated to widths varying from 250 to 400 feet instead of from 125 to 150 feet; all locks should be widened to 80 feet, so as to permit the passage of war vessels; rainfall observations should be instituted over the whole route; all streams be gauged, and full explorations of alternative routes be made in the eastern division.

These recommendations of the commission for a deeper and wider channel, for the construction of passing points, a reduction in lock-lift, more capacious and deeper harbors, and a more stable construction, are in the direction of desirable improvements, which, however, practically double the cost of the canal.

Even should these enhanced estimates be correct, and should the conservative judgment of the commission be fully indorsed by other engineers, it remains to be seen whether a few millions of dollars, more or less, shall stand in the way of securing an interoceanic communication which the Senate committee has said "is indispensable to our physical and political geography and to the proper care of the Government for the protection and prosperity of our Pacific coasts."

In view of the national interest taken in this question, and especially at this juncture, it would seem that no backward step should be taken that would tend to weaken the power and influence of the United States as the dominating factor in the welfare of the American continents. From an American standpoint this canal seems to be a necessity, not only for our own commercial interests and national protection, but also as part of our "public policy of uniting the republics of America by works of peaceful development."

EXPLORATIONS BY THE BUREAU OF AMERICAN ETHNOLOGY IN 1895

By W J McGee

The most extended exploratory work of the year was that of an expedition in charge of the writer through the territory occupied by the Papago Indians in Arizona and Sonora, and by the Seri Indians in western Sonora and on Tiburon and Alcatraz islands, in the gulf of California. During 1894 an expedition was carried through Papagueria and into the borderland of the Seri country for the purpose of making collections among the Indians of both tribes, and the object of the expedition of 1895 was to obtain supplemental information concerning the social organization of the Papago Indians, but especially to explore the territory of the Seri and to make studies of and collections representing the maritime habits of these Indians. The party outfitted in Tucson early in November, crossed the frontier at Sasabe, and spent three weeks in visiting the villages of Papagueria and in surveying extensive prehistoric works left by a people of somewhat advanced culture, probably the ancestors of the modern Papago. Mr Willard D. Johnson, who formed one of the party, carried forward a planetable survey, which will yield the first trustworthy map of the region. Entering the Seri territory early in December, the party explored the area lying west of Bacuachi river and the delta of Sonora river, making a station on the highest point (about 5,000 feet) in the range provisionally designated the Seri mountains, and afterward embarked in a small boat in that portion of the gulf of California commonly mapped as Kino bay, coasted to the strait El Infiernillo, and crossed over to and explored and surveyed Tiburon island. The country of the Seri Indians was found to be clearly set apart by natural features from the body of Sonora. Tiburon island is separated by a turbulent strait from the mainland, while the mountainous mainland area contiguous to the strait is still more effectively barred from interior Sonora by a broad desert zone of saline playas and sand dunes something like the Mojave desert of California; indeed, some of the observations indicate that this zone lies below sea level, and that it was during recent geologic times cut off from the gulf by the delta of Sonora river and afterward desiccated by evaporation. The territory bounded by this desert barrier is mountainous, yet exceedingly arid; it is two or three thousand square miles in area, including about five hundred square miles comprised in Tiburon island. The territory is claimed and exclusively held by the Seri Indians, a distinct aboriginal stock, who have been at war with all other peoples almost constantly from time immemorial and are now reduced to some 400 in number. These Indians are of especial interest from their isolation, from a more warlike disposition and a more primitive culture than appear among other known people of North America, and from a variety of features connected with these characteristics. They are of splendid physique, with notably dark skin; they live chiefly on the flesh of turtles and other marine organisms, partly on game and wild fruits, most of their food being eaten raw; they are without agriculture, and have no domestic animals save a few dogs; their habitations are flimsy lodges of shrubbery and turtle shells; they are scantily clothed, chiefly in pelican skins; they navigate their waters by means of the balsa, manufacture simple baskets and a distinctive pottery, and make efficient use of excellent bows and arrows, yet their stone art is below the stage commonly called paleolithic; and they have a singular marriage custom tending to perpetuate their isolation. No prehistoric works, save such as they now produce, are found in their territory. While the Indians fled at the approach of the party, considerable collections were made in the rancherias they had just deserted, the articles designed for barter with them being left in exchange. In addition to the ethnologic researches and mapping, somewhat careful studies were made of the flora, fauna, and geologic development of the entire area traversed by the expedition. The exploration of the Seri country, hitherto unknown except as to the coast, was attended with some risk and hardship, due chiefly to dearth of water, but was without casualty.

In December, 1894, Mr James Mooney began a special study of the Kiowa Indians in Oklahoma. He recently returned from the field, after nearly ten months of successful work. The Kiowa Indians possess a highly interesting calendar system of strictly aboriginal character, and this system was one of the subjects of Mr Mooney's researches. Leading personages of the tribe keep a sort of year book in which the principal events of the seasons are recorded in rude conventional symbols, the years being indicated by conspicuous symbols for the winter season, in consequence of which the records are sometimes denominated "winter counts." Mr Mooney was able to collect a considerable number of these calendars, which are of special interest as records of the history and migrations of the tribe during the last half century. From the records and from accompanying verbal statements, carefully checked by comparing different accounts, it is learned that this tribe of the plains is among the widest wanderers of their race. Although their original habitat was in the middle plains, they were accustomed to send parties on trading and marauding expeditions eastward into the trans-Mississippi forests, westward into and beyond the Rocky mountains, northward to the Saskatchewan, and southward over the deserts of northern Mexico as far as Durango, and even across the Sierra Madre to the vicinity of the Pacific, near Mazatlan. These records of the Kiowa calendars explain the wide distribution of primitive art products over the United States and corroborate the evidence of widely scattered obsidian, copper, sea shells, etc., as to the extent of aboriginal commerce.

A notable expedition of the season was that of Dr J. Walter Fewkes, who explored the little-known canyons of the Mogollon escarpment in central Arizona and afterward made extensive collections of prehistoric pottery near Keams canyon. While on the headwaters of the Rio Verde, along the face of the great escarpment, he was so fortunate as to discover extensive ruins of cliff-houses, some of which showed no evidence of exploration, and from these considerable collections of interesting archeologic material were made. His principal results were obtained at the prehistoric pueblo of Sikyatki, near Keams canyon. Here, in company with Mr F. W. Hodge, he excavated a ruin known from tradition, as well as from the collection of objects discovered, to be prehistoric. A large quantity of finely decorated pottery with associated objects was obtained. The pottery includes many examples of the finest grade of aboriginal work in texture, finish, and decoration. The collection, which comprises nearly 700 earthenware utensils, beside numerous objects of wood, stone, bone, etc., has been brought to Washington and is now in the National Museum. Competent judges are of opinion that it is the finest single collection of prehistoric pottery thus far made on the Western Hemisphere.

After leaving Sikyatki Mr Hodge made a tour of the pueblos of New Mexico, beginning at Zuñi, then visiting Laguna and Acoma, and in turn the villages scattered along the upper Rio Grande and tributary valleys from Isleta to Taos. The primary object of this reconnoissance was the identification of the names of certain "provinces," tribes, and pueblos mentioned by Spanish explorers in the sixteenth and seventeenth centuries and the collection of data relating to the ethnology, and especially to the kinship systems, of the Pueblos, of which comparatively little has hitherto been known. In these investigations Mr Hodge was very successful, for except among the Tiwa he was enabled to obtain complete records of all the clans, both existing and extinct, and from all the tribes (including the Pecos, of whom there are but two survivors) much valuable data which will contribute to the identification of tribal and village names of Spanish record, as well as bearing on their cosmogony, migrations, etc. He also succeeded in locating on the Rio Grande the village whence the Hano people of Tusayan migrated nearly two centuries ago; in determining quite clearly that the pueblos of Kawaika and Paiyupki at Tusayan were abandoned during the historic period, the inhabitants moving to Laguna and Sandia respectively, and that descent among the Tewa people, at least in Nambé, Santa Clara, and Tesuque, is agnatic, while among all other pueblos descent is invariably in the line of the mother. These and many other problems which in the past have puzzled ethnologists not a little Mr Hodge has at last been able to solve.

GEOGRAPHIC LITERATURE

The Yellowstone National Park: Historical and descriptive. Illustrated with maps, views, and portraits. By Hiram Martin Chittenden, Captain, Corps of Engineers, U. S. A. Pp. 397. Cincinnati: The Robert Clarke Company. 1895. $1.50 net.

This book comprises three parts, "Historical," "Description," and "The Future." The first contains an excellent summary of the early trappers' tales regarding this region, showing, as is well known, that they were not unacquainted with its marvels. It recounts the Washburn and Hayden expeditions, the legislation establishing the National Park, and the numerous army expeditions which for exploration or pleasure have traversed it. It summarizes also the administration of the park. The second part describes rather inadequately the topography, geology, fauna and flora of the region, and then, in the ordinary guide-book form, describes "a tour of the park." The third part, which is very brief, only

18 pages in length, is devoted mainly to re-stating the well-known arguments against permitting the entrance of railroads. The book closes with a series of appendices comprising a list of geographic names, with their origin, the legislation affecting the park and rules for its administration, a statement of appropriations for its maintenance, a list of its superintendents, and a bibliography. It is difficult to place this book. It ranks far above the ordinary guide-book, yet as a history its value is lessened by the military bias of the writer, and as a geographic work, descriptive of this interesting region, it may be characterized by the statement that only 14 pages are devoted to its geography and geology, 13 to geysers and hot springs, and 11 to the native life of the region. The book is profusely illustrated with beautiful cuts, and contains several maps, but the latter are not in keeping with the typography and with the other illustrations.

Sixteenth Annual Report of the United States Geological Survey. Part III: Mineral Resources of the United States, 1894, Metallic products. Pp. 646. Washington, 1895.

It is not easy to recognize in the handsome royal octavo volume before us the mineral report of the Geological Survey, which has hitherto appeared in so much less attractive a form. Although Dr Day's reports no longer constitute a series by themselves, they cannot be said to have lost even in individuality, for the new volume is so profusely illustrated with maps and diagrams and is in almost every other respect so distinctly superior to its predecessors as not only to add greatly to its practical value, but to place it in the very front rank of those admirable publications with which the United States government enriches from time to time the scientific literature of the world. The report contains statistics of the production of the various metallic minerals (those of the non-metallic are to follow in a separate volume) in the different states of the Union; but it does more than this. It presents like statistics (in many cases extending over a long series of years) for other countries, together with tables of exports and imports. In addition to these statistical compilations it contains several hundred pages of interesting and instructive text on the geographic distribution of the mineral resources of the world, in the preparation of which several eminent experts have been specially employed. The volume is, in short, a veritable mine of valuable information concerning some of the most important branches of human industry.

Terrestrial Magnetism: An International Quarterly Journal. Published under the Auspices of the Ryerson Physical Laboratory, A. A. Michelson, Director. Chicago, University Press. Vol. I, No. I, January, 1896. Edited by L. A. Bauer, with the Coöperation of a large Number of American and Foreign Associates.

The compass is a very old invention, the discovery of its north and south pointing property having been made by the Chinese centuries ago It is more than four centuries since it received a fixed place in navigation under the name Mariner's Compass. That it does not point truly north and south but departs or declines from the meridian was known in Columbus' day. At that time it was supposed that the departure from true north, or declination of the needle, was constant for any one place, though not the same in all places. That it is not always the same at any one place is said to have been discovered by Columbus; so that the variation of the variation is a discovery four centuries old. That the needle, if free to move in any direction, would not "hang level," but that one end would decline or dip below the horizon, is also an old discovery, having been discovered by Georg Hartmann in 1544; and, lastly, that the force that acts upon the needle to make it point north and south is not the same in all places has been long known.

The true cause of the behavior of a compass needle has been a field for speculation and study ever since its peculiar behavior was observed, and a few students had up to the time of Gauss proposed and laboriously worked out ingenious theories to explain the phenomena observed. The publication of Gauss' great work in 1838, however, marked a great advance and gave a new and powerful impulse to the subject. The Magnetic Union, formed in the third decade of the present century, chiefly owing to the researches of Gauss, caused the establishment in various parts of the world of magnetic observatories, founded and maintained by various governments. Of those so founded in the forties, several have maintained a series of almost uninterrupted observations to this day. This period of 60 years has seen progress in our knowledge of terrestrial magnetism, but without any epoch-marking event. A vast number of observations have been accumulated, the 24 constants in Gauss' fundamental formula have been more accurately determined, and a number of minor phenomena observed and explained, but the subject is far from being exhausted. The modern applications of electricity to practical affairs is not without its effect upon the subject of terrestrial magnetism.

Is not the journal before us, then, to mark a new epoch in our knowledge of this subject? It seems strange that, when almost every other branch of science has long had its special journal or organ, we should have waited almost for the dawn of the twentieth century for the first number of the first journal devoted to a matter of such great practical moment and for four centuries known by all civilized men to be important.

We welcome this journal, then, as a needed one, rightly conceived and giving promise of usefulness. It enters, and enters under favorable auspices, a field not hitherto occupied by any scientific journal. The names of the editors, the laboratory, and university from which it comes all combine to promise excellent results. It will be strange indeed if distinct gains in human knowledge do not result from this enterprise.

The editor, Dr Bauer, though a young man, is a most enthusiastic student in his chosen field. After several years of service in the United States Coast and Geodetic Survey, devoted chiefly to magnetic computation, he went to Europe and devoted his energies to magnetic studies. His doctor's degree was obtained last year, as the outcome of these studies. To him more than to any other belongs the credit of founding the first journal given wholly to the subject of terrestrial magnetism, and patriotic Americans will perhaps derive some satisfaction from the fact that the journal was founded in the United States.

To the editor and his associates and to the University of Chicago we tender our congratulations and hope for them a large measure of success.

YUCATAN IN 1895

The following is taken from a valuable report recently received at the Department of State from Mr R. L. Oliver, United States consul at Merida:

The government census is approaching completion, and from data already received it is apparent that the total population of the state approximates 500,000, of whom 60,000 are in Merida.

Yucatan has always been considered among the most advanced states of Mexico in point of education. Schools have attained a high order since the advent of independence. While under the control and supervision of the local governments, the system of matriculation and education is mapped out by the federal and state authorities through their respective boards of education. The law is compulsory, and though it is not strictly enforced in Yucatan, reports show a good attendance.

Sectarian schools are in decadence—in fact, they are only primary schools for the young. The revenue for their support is derived from donations by patrons. The non-sectarian or public schools are maintained at the expense of the state. The governor appoints directors, who in turn select professors and teachers. The total expenditure for public instruction for the scholastic year 1894–'95 has been about $100,000 (gold); this sustained 435 schools.

Manufactures are confined to articles for local wants, such as soap, matches, candles, shoes, rope, etc.

There are four railways, owned and operated exclusively by natives. One broad-gauge road has 75 miles in operation; the others, narrow-gauge average about 60 miles each, completed, but are in course of extension. Tariffs for passengers and freight are about one-half the rates charged for local business in the United States.

Except wheat, rye, and other small grains, almost any plant will thrive, but the principal products are corn, beans, sugar, and hemp. The last named is a phenomenally hardy plant and flourishes almost equally well with or without rain; corn, beans, and sugar require irrigation and yield barely sufficient for home requirements. If there is a failure, as at present in corn, the deficiency is supplied from Mexico or the United States. The interior being unable to make up the deficiency in corn, the legislative authorities of Yucatan petitioned the federal government to reduce the import duties on foreign corn that this necessary article might be within the limit of moderate price. The government scaled the tariff 50 per cent, pending the next harvest, and several cargoes have been imported from the United States.

The people are very industrious. Necessity would impel them to be so were they otherwise, for although Yucatan is not an over-populated country the industries are so concentrated, so lacking in diversity, and so monopolized that the less fortunate are continually at a disadvantage and must necessarily be on the alert to share in the inadequate distribution. This applies also to the professions.

Laborers in the cities average eight hours' work, are paid by the piece in industrial pursuits, and earn about 50 cents (gold) per day. Railway and skilled laborers earn from 75 cents to $1 per day. They wear the same clothing, chiefly cotton and linen, during the entire year; sandals of the ancient Egyptian pattern are worn instead of shoes. Trade unions do not exist and coöperative action is infrequent, except in cases of foreign intervention, concerning which they are extremely sensitive.

On the plantations, where it is necessary to be exposed to excessive tropical heat under the direct rays of the sun, no laborers have withstood it as have the native Indians. In past times unsuccessful colonies were formed by Europeans; later, Chinese were contracted for to work on the hemp plantations. They were not altogether satisfactory, as they are physically unable to complete the daily task allotted to the native laborers—that is, to cut a certain number of leaves of hemp (sisal) for a stipulated price. The daily task is two or three thousand leaves, at the rate of 16 cents (gold) per thousand. On this largely depends the pecuniary success of the planter; not that his margin of profit is so limited in what it actually costs to produce this fiber, but there is the enormous outlay for the preparation of the lands and for the planting; the necessary delay of four or five years before the plant is large enough to cut; the instability of the market, which is ever fluctuating; the onerous export duties, state and federal; the large personnel of the plantations—mechanics, overseers, and servants—who, independent of their wages, are advanced provisions and clothing and furnished medicine and medical attendance by the proprietor. There is now a great scarcity of laborers, and with the new applications of the sisal fiber and its consequent increasing demand it is becoming a serious question how to meet prospective emergencies.

A project is on foot to subdue and domesticate the Maya Indians, variously estimated at from 10,000 to 20,000 in number, who have from time immemorial held invincible sway over the southeastern part of Yucatan. It is hoped to augment from them the number of farm hands; but even in the event of accomplishing the subjugation of this semibarbarous race, it is exceedingly doubtful if the present generation can be utilized, so refractory are they to civilized pursuits and so indolent and thriftless. Their trading-posts are on the boundary lines of British Honduras. At times their chiefs visit Belize to purchase cloth, replenish their ammunition, and renew their contracts with the timber merchants, who pay them so much per ton for the privilege of cutting wood in their territory. They are friendly with the British and never interfere with negro cutters sent from Belize, but a Mexican or a native of Yucatan dares not encroach upon their lands. As this part of Yucatan is more healthful and its soil better adapted to the cultivation of fruits, sugar cane, and grains, it is not improbable that after the pacification of the Mayas the government will offer inducements to foreigners seeking homes in the tropics. The geographical and the topographical situation of this part of the peninsula would indicate that it is essentially a horticultural district. Down by the Caribbean sea it is easily accessible to shipping, and its products would find a market. It lies in the path of vessels that now ply between the southern ports of the United States and ports of British and Spanish Honduras. This would also be the route for vessels to and from Nicaragua in the event of the building of the canal. Another advantage of transcendant importance is that of Ascension bay, which is one of the largest and deepest harbors in all Mexico, and with the exception of Acapulco, on the Pacific, affords a safer anchorage than any other. This is a desideratum of no little magnitude when it is known that most of the Mexican gulf ports are open roadsteads and that in the winter months, when northers are frequent, shipping is hazardous and uncertain.

Up to 1891–'92 the credit of Yucatan in Europe was unlimited and her merchants enjoyed an enviable reputation for integrity, but they were overtaken by the financial crisis, which found them overstocked and deeply indebted. Collateral securities shrank, debts contracted in gold had to be met with its equivalent in silver, which had coincidently depreciated in its paying value 50 per cent; money became stringent and finally the collapse came. Many large dealers in dry goods and miscellaneous articles were forced to suspend. They represent to European creditors millions which are hopelessly lost. This unfortunate state of affairs is largely due to the long credit system. However, this salutary lesson has had the effect of restricting them to more business-like methods. The tide of trade will eventually turn to the United States, this market affording quicker transportation facilities.

The chief articles of import embrace groceries, canned goods, etc.; dry goods, notions, cashmeres, men's furnishings, millinery, and hardware of all descriptions, except plows, hoes, etc., which are not used.

Hennequen (sisal) is the chief export. The annual output is nearly 400,000 bales of 400 pounds each. In the first quarter of the present year there were shipped 81,030 bales, valued at $582,932.50, United States currency, on which state and federal duties amounting to $132,481 ($71,612 United States currency) were paid; over 12 per cent ad valorem. Of the 81,030 bales shipped, 66,269 were destined for the United States. With the exception of a small fraction, they were transported in other than American vessels. The August, 1895, imports amounted to 6,568 tons; 2,133 tons were imported in American vessels; 4,435 tons in English, Norwegian, and German vessels. The exports amounted to 6,600 tons, of which 560 tons were exported in American vessels and 6,040 tons in English, Norwegian, and German vessels.

From January to June, 1895, there were shipped to interior points of Mexico 3,070 tons of coarse, unrefined salt. The high tariff on foreign salt makes it an expensive article. The home mines are difficult to work, and as in most cases they are only surface deposits of the sea the yield depends greatly upon the weather.

The exports of logwood for the first three months of 1895 show 2,634 tons, valued at $80,000 in United States currency, cleared for European countries. Other articles of export in small quantities are hides, hammocks, sarsaparilla, etc. The total declared exports to the United States for the fiscal year ending June 30, 1895, were: From Progreso, $2,062,909; from Merida, $897,702; total, $2,960,611 in United States currency.

Value of imports during the fiscal year 1894–'95, $1,092,981; value of exports, $8,376,680. Total amount of federal duties paid thereon, $1,155,932.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1895–'96

Regular Meeting, December 27, 1895.—President Hubbard in the chair. Amendments to the by-laws were adopted as follows:

ARTICLE IV—*Officers.*—The business of the Society shall be transacted by a Board of Managers composed of eighteen members, six of whom shall be elected by the Society at each annual meeting. They shall serve for three years, or until their successors are elected. A majority vote shall be requisite for election. Vacancies arising in the Board shall be filled by the Board.

The Board of Managers shall elect annually from their number a President, six Vice-Presidents, a Treasurer, a Recording Secretary, and a Corresponding Secretary.

The following resolution also was adopted:

Whereas the Society has adopted certain amendments to its by-laws, by which it is provided that the members of the Board of Managers be elected hereafter for terms of three years, and one-third of its members retire each year: therefore,

Resolved, That the Board of Managers is hereby instructed to group its members in three classes, the first of which shall retire in May, 1896, the second in May, 1897, and the third in May, 1898.

Vice-President Ogden delivered an address on Coast Hydrography and its Uses, and Mr G. W. Littlehales read a paper entitled, "Why the Sea is Salt."

Special Meeting, January 3, 1896.—President Hubbard in the chair. Dr D. C. Gilman, President of Johns Hopkins University, gave an address on The Geographic Development of Universities.

Regular Meeting, January 10, 1896.—President Hubbard in the chair. Mr William Eleroy Curtis read a paper, with lantern-slide illustrations, on Venezuela: her Government, People, and Boundary.

Special Meeting, January 17, 1896.—President Hubbard in the chair. Mr Robert E. Peary, Civil Engineer, U. S. Navy, delivered an address, with lantern-slide illustrations, entitled, "Explorations in the Far North," relating more particularly to his recent expedition to northern Greenland.

Regular Meeting, January 24, 1896.—Joint Meeting with the American Forestry Association. Hon. J. Sterling Morton, Secretary of Agriculture, in the chair. Addresses on the subject of the Public Forests, Lands, and Waters of the United States were delivered by Hon. Fred. T. Dubois, U. S. S., Hon. John F. Lacey, M. C., Hon. Thomas C. McRae, M. C., and Mr William E. Smythe, of Chicago.

ELECTIONS.—New members have been elected as follows:

December 27.—Hon. Wm. M. Aiken, Chief Engineer G. W. Baird U. S. N., Col. J. W. Barlow, U. S. A., Ensign L. C. Bertolette, U. S. N.

Capt. Nathan Bickford, Lieut. E. B. Chambers, E. R. E. Cowell, Pickering Dodge, D. J. Evans, Capt. M. C. Goodsell, U. S. M. C., H. R. P. Hamilton, Hon. John B. Harlow, Robert S. Hatcher, Mrs Mary B. Jackson, R. M. Johnson, Capt. Louis Kempff, U. S. N., Miss Grace D. Litchfield, Miss Cordelia L. Mayo, A. E. H. Middleton, Hon. Joseph S. Miller, Rev. Dr W. H. Milburn, Maj. Hannibal D. Norton, Maj. G. C. Reid, U. S. M. C., Capt. George C. Remey, U. S. N., George R. Simpson, Hon. O. P. Tucker, Maj. W. M. Waterbury, U. S. A.

January 10.—Señor José Andrade (Venezuelan Minister), Mrs D. C. Chapman, W. V. Cox, John F. Davies, John F. Downing, J. B. Fellheimer, Miss Ellen B. Foster, Capt. S. W. Fountain, U. S. A., Maj. E. A. Garlington, U. S. A., Prof. Edward L. Greene, Lieut. C. H. Harlow, U. S. N., Comdr. J. N. Hemphill, U. S. N., Franklin H. Hough, Dr J. C. Hvoslef, Medical Director Samuel Jackson, U. S. N., Dr P. E. Joslin, Lieut. J. F. Reynolds Landis, U. S. A., W. H. Pennell, Miss Alice C. Pugh, Mrs Nellie Grant Sartoris, Henry A. Seymour, Dr R. M. Thornburgh, Mrs John N. Webb, Alfred Jerome Weston, Hon. Carroll D. Wright.

January 24.—Miss Harriet Bartlett, Dr Frank K. Cameron, Richd. T. Fussell, C. A. Gilman, Dudley W. Gregory, Dr G. T. Howland, Mrs Ida Rome Knapp, Mr E. de Kotzebue (Russian Minister), George A. Lewis. James McCormick, Mrs J. C. McKelden, Hon. Richard Olney, Wilson N. Paxton, Judge M. E. Poole, Gov. A. R. Shepherd, I. C. Slater, James H. Thomas, James A. Watson, John E. Wright.

Obituary.—The Society has to deplore the deaths of the following members during the month of January: Mr E. B. Wight, a well known and much respected journalist, representing the Boston *Journal* and the Chicago *Inter-Ocean* at the National Capital, and Mr S. C. Gilman, a promising young civil engineer and explorer, residing at St. Cloud, Minnesota, who, only a few days before his untimely death, contributed a valuable paper on his explorations in the Olympian mountains, Washington, to appear in an early number of this magazine.

GEOGRAPHIC NOTES

NORTH AMERICA

Franz Josef Land. The published statements of Mr A. Montefiore, the spokesman of the Jackson-Harmsworth expedition, now enable one to definitely outline the outcome of the expedition down to July last. Jackson left Khabarowa in the *Windward* August 16, 1894, and met the ice-pack in 76° 49′ N., 49° E. Bell island was sighted, 30 miles distant, August 25, but unfavorable ice conditions prevented landing there or at cape Grant, which was in sight six days later, distant 40 miles. A landing was made, September 6, at Bell island, and the ship was frozen in while discharging cargo, September 13. Jackson, with his chosen explorers, passed the winter very comfortably in a wooden house erected at cape Flora. The ship's crew wintered on the vessel and lost one man, the health of others being unfavorably affected. About sixty polar bears were killed, four being females. An autumnal depot was laid down at cape Barents and a spring one, in March, 1895, by a trip of six days, at Peter head, entrance of Markham sound.

The long journey, in which four ponies were used with great advantage, occupied from April 16 to May 13. Softening sea-floes and signs of open water constrained a return from the farthest north, 81° 20′ N., 54° 53′ E. Payer's map of 1874 is said to be inaccurate and misleading. Zichy, Alexandra, and Oscar lands resolve themselves into groups of islands, and Richthofen peak, of Payer, could not be located.

Mr Montefiore, it is said, declares that Jackson's success in his first year is unprecedented. If such report be correct, this will not be the first capable explorer who may ask protection from injudicious friends who seek to aid him by unfounded aspersions of others. European explorers are able to refute on their own account Montefiore's claim, especially Payer, who, starting from a more southerly point, surpassed Jackson's latitude by 37 miles.

For America, it is indisputable that Hall, in 1870–'71, far exceeded Jackson's latitude and opened up a new route and region, surpassing in importance and extent anything that Jackson has done; this with the loss of one man—himself. Greely in his first year, 1881–'82, explored 4,000 square miles of new land and surpassed the highest latitude, made before or since, without the loss of a man. Peary, in 1891–'92, made the most remarkable inland ice journey on record, crossed Greenland to a point far beyond his predecessors on the east Greenland coast, with the loss of a single man, by accident. Against this is Jackson's northing of some 80 miles, with a loss of three men, one at cape Flora and two on the return voyage of the *Windward*.

ALASKA. Congress is to appropriate $75,000 to mark the Alaskan boundary along the 141st meridian of west longitude, on which meridian have been determined three important points—Mount St. Elias, Forty-mile creek, and Porcupine river. By independent surveys, by United States and Canadian engineers, the points established differ only six feet at Mount St. Elias and 400 feet at Porcupine river. Canada desires to establish the meridian astronomically by joint scientific survey, which would require several years. The United States favors, as a less difficult and more speedy plan, a survey based on the points already established.

MEXICO. According to the last message of President Diaz, 566 miles of new telegraph lines have been built, the most important uniting Tacotalpa, Chiapas, with Penosique, Tobasco, opening a new route with Guatemala, and making a total mileage of 56,442 miles. Among important railway extensions is that from Monclova to the Pacific, of which 292 miles have been approved. The surveys of the road from Merida to Campeche are progressing and the plans of the lines from Merida to Progreso have been adopted. The drainage works of the valley of Mexico are almost concluded, the excavations have amounted to 53,160,000 cubic feet, and the tunnel is finished for a length of 32,140 feet. The grand drainage canal is nearly 30 miles long.

Surveys have been completed for a cable road to connect the Interoceanic Railway with the summit of Popocatepetl, ascending from the ranch Semacas, on the northwest side. The railway is mainly for the transportation of sulphur from the volcano, but it will be available for tourists. Work has been commenced on a line from Baroteran, on the Mexican International Railroad, to Laredo, Texas, and thence to Mier, Mexico, on the bed of the Gould railroad, graded about ten years ago between these points. The government has modified its tax on minerals, which now amounts to 5 per cent of the value of silver and gold. It is divided into a federal stamp tax of 3 per cent and a coinage tax of 2 per cent. Mexican smelters operating under governmental concessions are not liable for the coinage tax on silver extracted from low-grade lead and copper ores.

CENTRAL AMERICA

NICARAGUA. A telegraph line has been built between Acoyapa and Rama. The work on the railway between Rama and San Ubaldo, 178 miles, began July 28, 1895, and should be completed in two years.

THE Nicaraguan government has extended its monopoly of native distilled spirits to its Atlantic coast districts, except to the free port of San Juan, and imposes corresponding duties on foreign spirits.

SOUTH AMERICA

THE Emperor of Brazil once gave a concession to an Englishman to open the channel connecting the Orinoco with the Amazon, and the latter was to have the exclusive right to navigate the waters for a term of twenty-five years as a reward for his enterprise, but for some reason or another the contract was not carried out.

THE bronze statue of George Washington erected by Guzman Blanco at Caracas is believed to be the only statue of the Father of his Country outside the United States. The inscription upon it states that Washington "Filled one world with his benefits and all worlds with his name," a unique tribute to his greatness that was probably written by Blanco himself.

DURING the visit of Bolivar to the United States he spent a day at Mount Vernon, where, placing his hands reverently upon the coffin of Washington, he made a solemn vow to devote his life to the liberation of his country. Reaching his native land, he became active in the revolutionary propaganda and soon had to seek refuge in Europe. Fifteen years later, however, after a struggle to which that of our revolutionary fathers offered no comparison, he sat in the capital of Bogota, the founder of five republics—Venezuela, Colombia, Ecuador, Peru, and Bolivia—the last having been named in his honor. At that time the states were consolidated under a single government, with Bolivar as president. After having for the fourth time been elected president he was driven from the country and died in exile.

On the upper Orinoco, during the struggle of Venezuela for independence, occurred the only naval battle that was ever fought on horseback. Bolivar, at the head of his army, had been trying to cross for several weeks, but was prevented by several Spanish gunboats that moved up and down the stream as he did. Becoming exasperated, General Paez one night spurred his horse into the stream, followed by three thousand llaneros, or cowboys, whose horses had been taught to swim as well as to gallop. The Spanish fleet was taken entirely unawares. The llaneros clambered from their saddles to the decks of the vessels and let their horses swim back to shore alone. Thus, after cutting off their own retreat, it was a question of win or die, and so desperately did they fight that every vessel was captured.

The Ceiba railroad, in Venezuela, originally 30 miles long, has been extended from Mendoza eastward a distance of 32 miles, to connect with the branch from Valera, 15 miles long. Another line is under construction from Encontrados to La Fria, 62 miles. It is intended to extend the road 25 miles farther to San Cristobal, the commercial center of a great agricultural section. Contracts have been made also for railroad lines from Maracaibo to Perija and from Lake Maracaibo to Carora. The former is to be built within two years and the latter within five.

ASIA

Syria. The first railway was opened August 3, 1895, under French management. It extends from Beirut to Damascus, a distance of 91 miles.

China. M. Berthelot, French Foreign Minister, says that the Franco-Chinese treaty opens to French trade a region containing 100,000,000 inhabitants. Its capital is Chung-king.

Persia. Concessions have been granted to Herr Moral to construct a carriage road from Teheran to Bagdad, and a steam or electric railway from Teheran to villages 10 miles north. A Russian company has been granted a concession to construct a harbor at Enzeli.

Japan. The sum of $13,000,000 has been voted for a double-track railway to be built between Tokyo and Kobé, 376 miles, passing through Yokohama, Kyoto, and Osaka. Previously 29 concessions had been granted, covering 2,193 miles, of which 1,549 miles have been opened. Of state railways, 580 miles have been completed and 398 miles are in course of construction.

India. The efforts of Mr A. F. Mummery and three others, in August, 1895, to explore the Nanga Parbat region of the Himalaya mountains ended in the death of the leader and two Gurkha soldiers. Mummery was turned back, by the illness of a Gurkha, at the height of 20,000 feet on the main peak of Nanga Parbat. Later, Mummery and the two soldiers were lost while exploring a side glacier, being presumably buried under an avalanche.

The Mekong. The French are rapidly developing the region lately ceded by Siam. A telegraph line is to be constructed from Attopeu, the center of the Nam-Kong gold district, and post-offices are also being established. Steamers will soon be plying on the Mekong. That river has been found navigable for 1,500 miles. Lieut. Simon, in the French gunboat, *La Grandière,* steamed 900 miles, from Stung-Treng to Luang-Prabang, and reports that at high water the rapids are navigable to Kiang-kong, 220 miles higher up the stream.

Siberia. Last summer the veteran Arctic skipper, Captain Wiggins, took 400 tons of English merchandise up the Yenisei to within 180 miles of Yeniseisk. The Russian government admitted the goods free, so as to encourage navigation to Siberia by way of the Arctic ocean.

The completion of the Trans-Siberian railway seems to be assured by the negotiation in Berlin of three Russian railway loans, aggregating $55,000,000. Whether Russia has secured from China authority to cross Manchuria to an ice-free port is yet a mooted question.

AFRICA

Ashanti. A telegraph line is being constructed from the coast to the interior, along the principal trade route.

Egypt. A geological survey, to be completed within three years at a cost of £25,000, has been sanctioned by the Khedive. It will be carried out under the direction of Capt. Lyons, R. E.

Abyssinia. The Italian army is constructing a good military road between Adowa, Adigrat, and Makaleh. An administration is being established, with a view to promoting colonization.

Kongo Free State. According to the statements of the Rev. John B. Murphy, an American Baptist missionary, who speaks from an experience of several years, the authorities of the Free State are committing shocking barbarities in connection with the exploitation of the rubber trade. The natives, as far as practicable, are abandoning the Belgian for French territory, where they are well treated.

South Africa. The delimitation of the railway strip on the eastern frontier of Bechuanaland is in progress, the survey being made by Colonel Goold-Adams. This delimitation is made under an agreement with the native chiefs regarding the extension of the railway to Matabeleland. The railway company surrenders a subsidy of $1,000,000 for land grants, enhanced police powers, etc., which insures its future control of the trade routes to this region. The Natal-Transvaal railway is now in operation as far as between Durban and Heidelberg, and the section from the latter point to Johannesburg is in process of construction. The heavy spring rains have postponed the opening of the through railway service from Natal to the Rand. The Transvaal is now served by three lines, the others being the Cape and Free State and the Delagoa bay. Telegraph communication between Cape Town and the East Coast is now continuous, through the opening of the line between Umtali and Beira. The necessity of concerting measures to prevent the utter extinction of the African elephant is again being urged. It is said that the Germans are taking steps to protect the few herds remaining in German territory, and it is to be hoped that the British colonial authorities will lose no time in following their example.

THE VALLEY OF THE ORINOCO

By T. H. Gignilliat

United States War Department

In the map of the valleys of the Orinoco and Esequibo rivers, showing Venezuela and British Guiana (Plate V), the territory between the shaded area and the Corentyn river shows the extent of British Guiana as given in a map published by William Fadon, Geographer to His Majesty, January 1, 1820. This country, acquired by the English through conquest and formally ceded to them by the Dutch in 1814, then contained some 20,000 square miles.

The lighter portion of the shaded territory shows the first extension of British Guiana to the west after Fadon's map of 1820. This expansion appears on a map published in London in 1840 by Robert H. Schomburgk, which included the light-shaded area above mentioned, about 40,000 square miles. Schomburgk held an English commission to draw the boundary line, but it does not appear that Venezuela was represented in the survey. The darker portion of the shaded territory shown on Plate V represents the subsequent extension of British Guiana, as shown by a series of many recent publications. Since 1840, maps and other publications have appeared, drawing line after line farther to the west, until some 49,000 square miles have been added to Schomburgk's acquisition. In this way the area of British Guiana has increased from about 20,000 square miles, as shown on the Fadon map of 1820, to 109,000 square miles, the area given in the Statesman's Year-Book of 1895.

Gold was discovered in a new section of this area, to the northwest, in 1884, and an official Venezuelan report places the gold output of this section in 1890 at $1,000,000. But there is a larger interest at stake than all this territory, with all its gold. It is the control of the valley of the Orinoco, an area of about 600,000 square miles, which comprises a very large portion of South America north of the Amazon river.

It is not generally known that the best entrance to the Orinoco river is within the original Schomburgk line. Dr Muñoz Tébar, the successor of Señor José Andrade as president of the state of Zulia, Venezuela, states, after a personal examination, that the best entrance to the Orinoco river is through the Guaima river and Mora passage to the Barima river, and thence to the Orinoco. Authorities appear to agree that the other mouths of the Orinoco are shallow and obstructed by sand bars. Dr Tébar gives the depth of the Mora passage as over 60 feet, and would lead us to infer that there was no bar at the entrance of the Guaima. If this means that there is a clear channel over 60 feet from the sea through the Mora passage to the Orinoco river, it is a most important piece of information. The square black marks in this locality show the position of English trading stations, established between 1885 and 1887.

In addition to the authorities above quoted, the "commercial" map of F. Bianconi, Paris, 1888, was used in compiling the map on Plate V.

THE

National Geographic Magazine,

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

Mr. Cyrus C. Adams, New York.
Dr. Cyrus Adler, Smithsonian Institution.
Mr. Marcus Baker, U. S. Geological Survey.
Capt. John R. Bartlett, U. S. N.
Dr. Francis Brown, Union Theol. Seminary.
Mr. E. L. Corthell, C. E., New York.
Dr. Elliott Coues.
Mr. Frank Hamilton Cushing, Bureau of American Ethnology.
Dr. Charles W. Dabney, Jr., Assistant Secretary of Agriculture and President (on leave) of the Tennessee State University.
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Mr. Frank Vincent, New York.
Hon. Charles D. Walcott, Director of the U. S. Geological Survey.
Mrs. Fannie B. Ward.
Mr. Bailey Willis, U. S. Geological Survey.

Among the contents of forthcoming numbers will be articles, for the most part illustrated, on the Geography, People, and Resources of Costa Rica, by General Richard Villafranca, Commissioner-General to the Atlanta Exposition; on Some Recent Explorations in the Foothills of the Andes of Ecuador, by Mr. Mark B. Kerr; on Hydrography in the United States, by Mr. Frederick H. Newell; on Free Burghs in the United States, by Mr. James H. Blodgett; on the Topographic Work of the United States Geological Survey, by Mr. Henry Gannett, and on the Tapestry-Producing Nations, by Mr. C. M. Foulke.

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SUBMARINE CABLES OF THE WORLD,

AND ALSO THE

PRINCIPAL LAND LINES

AND THE COALING, DOCKING AND

REPAIRING STATIONS.

This valuable Chart, which is now published for the first time, has been prepared in the Hydrographic Office of the Navy Department. It is not intended for public distribution, and its use in connection with THE NATIONAL GEOGRAPHIC MAGAZINE will considerably increase the cost of the March number.

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THE

National Geographic Magazine

Vol. VII MARCH, 1896 No. 3

THE SO-CALLED "JEANNETTE RELICS"

By Professor William H. Dall

Much interest has been excited by the recent rumor that news had been received from Nansen, via Siberia. In discussing the rumor I mentioned that the supposed relics of the *Jeannette* found off Julianchaab in Greenland, were in all probability in no way connected with the *Jeannette* expedition, but were due to a boyish prank of some of the members of the Greely relief expedition of 1884. In attempting to formulate his impressions of an interview with me during which the subject was discussed, and which were not revised by me, the reporter unfortunately fell into some inaccuracies, not unnatural in a person unfamiliar with the technicalities of arctic exploration, but for which the telegrams to the press made me responsible. It seems desirable, therefore, to lay before those interested in such matters a statement of the facts bearing on the two questions involved, namely, Were the relics really derived from the *Jeannette* expedition? and, if not, were they the result of a mystification, as above suggested? The first is of course the only one of importance to geographers, for if the relics were spurious it matters but little whence they were derived. The facts are now in order.

1. The *Jeannette* sank June 11, 1881, in the Arctic sea, about 180 miles northwest from the New Siberian islands.

2. The Greely relief expedition of 1884 reached the coast of Greenland in May; the *Bear* met the pack ice near Godhavn about May 13; the *Thetis* and *Loch Garry*, May 22; the *Alert* on

June 5. The latter left Godhavn June 9 and reached Upernivik June 13.

3. On June 18 some Eskimo found on the surface of an ice floe off Julianehaab, in southwest Greenland, some articles, which were turned over to the Danish officer in charge of that settlement, Herr Lytzen, who sent them to a friend in Copenhagen. These comprised, among other things, some broken biscuit boxes, a pair of oilskin trousers, said to have been marked Louis Noros (the name of one of the *Jeannette* survivors, who was a member of the Greely relief expedition of 1884), and a number of written papers, especially a list of the boats of the *Jeannette*, and a list of provisions signed by De Long, the commander of the *Jeannette* expedition, and stated to be entirely in his or a single handwriting.

4. The Greely relief expedition left Greenland from Godhavn July 9, without touching at Julianehaab.

5. In the latter part of the winter of 1884–'85 a Danish correspondent wrote to Dr Emil Bessels, formerly of the *Polaris* expedition and a well-known arctic expert, at Washington, stating that news of these various relics had been received in Copenhagen and requesting his opinion as to their authenticity. The substance of this letter was communicated to me by Dr Bessels, who was much interested in the find, as, if genuine, it obviously furnished important data toward a knowledge of the drift in the polar regions. The presence in Washington during 1885 of many members of the relief expedition, in connection with the various investigations which followed their return, enabled Dr Bessels to interview many of the seamen as well as their officers and to accumulate a large mass of notes from his examination of them. On one or two occasions I was invited to be present when some of these men called on Dr Bessels. The well-known tendency of articles on the surface of ice, under the influence of the sun, to sink through it to the level of the water—even such trifles as bird's feathers or dead leaves being rapidly engulfed, as I have often personally noticed—led to doubts as to the possibility of the articles mentioned having remained on the surface of the ice for three years during a drift of 3,000 miles, exposed to the elements. The possibility of the preservation of written papers under such conditions seemed almost incredible. The close approximation of the dates of the presence of the relief expedition on the west Greenland coast and that of the finding of the relics was also suspicious. The testimony of the seamen interviewed was, in

brief, to the effect that the presence of *Jeannette* survivors on the relief expedition had suggested to some one the possibility of producing a sensation in the fleet which for some time followed the foremost vessels; that in a spirit of boyish levity this hoax was conceived and carried out, with no intention of serious deception or thought of the possible consequences. No names were mentioned and the evidence was to the effect that a general impression prevailed among the men that some such prank had been played rather than that any particular man questioned was personally cognizant of the act. Dr Bessels gathered an amount of evidence tending to support this hypothesis, which he showed me and which covered forty or fifty pages of foolscap. This record was afterward burned, with his library and other papers, in a fire which destroyed his residence at Glendale, D. C. In consequence Dr Bessels communicated to his European correspondents his belief that the relics were fictitious and the result of a hoax. I stated to Dr Rink and others who inquired of me the same conclusions.

6. In 1888 Dr Nansen made his celebrated journey across Greenland and presumably heard of the relics there. Before his return, Dr Bessels died in Germany, where he had taken up his residence. Up to this time either the doubts which had been thrown on the authenticity of the relics, or some other reason, had prevented them from exciting much interest, and the owner seems to have resisted any attempt to verify their authenticity by sending photographs or originals of the papers to America when requested. The papers and other objects were placed in a box in a garret and, after the death of the owner, were burned as worthless, with the acquiescence of the widow. As Herr Lytzen had published an account of them (Geogr. Tidskr., viii, 1885–'88, pp. 49–51) and the finder and possessor alike acted in perfect good faith throughout, it is probable that after Dr Bessels' opinion was communicated to him, the owner attached no great value to the objects, otherwise his wife could hardly have been ignorant of it.

When Dr Nansen endeavored to examine these objects with a view of determining their authenticity, they were no longer in existence.* One of his friends, whose name has slipped my memory and whose letter is temporarily inaccessible, wrote to me on Nansen's behalf, as he explained, asking my opinion,

* See Roy. Geog. Soc. Proc., Nov. 14, 1892, in Geog. Journal, Jan., 1893, pp. 1-32.

which was sent some time before the starting of Nansen's latest expedition. Baron Nordenskiöld was also informed some time before Nansen sailed, so that there is no doubt that Nansen was cognizant of the fact that the authenticity of the relics was seriously questioned. He had previously admitted as much in his paper above cited, but did not on that account relax his faith in them.

Conclusions.—It is evident that the proof that the relics were the result of a hoax is not complete, and, in the nature of things, unless the parties actually concerned shall admit it, is never likely to be completed. Each person will form his own opinion from the data submitted. I have spent some ten years of my life at sea, nearly half of the time in command of a United States surveying vessel, and I am quite aware of the nature of sailor men and sailors' evidence. Dr Bessels was for years my intimate and valued friend and associate, and in all our intercourse nothing ever occurred to lead me to doubt his earnest endeavor to get at the truth of this matter. My own conclusions are, first, that the relics were not authentic, and, second, that they were probably due to a hoax, as stated above. In support of the first conclusion, beside the data given, the probability that De Long himself would be writing out receipts for stores is very small. There has been since 1848 an average of two or three ships a year lost in the ice north of Bering strait, and in the vicinity of the point where the *Jeannette* entered the pack. Not a single relic of all the enormous fleet of over one hundred wrecks has ever been identified on the Greenland coast, where wood has always been of the greatest value. Driftwood from northern rivers is cast up on the Greenland coast more or less every year, but there is no evidence that it comes from points east of Nova Zembla. It is not impossible that some of it does, but it cannot be proved. Some twenty-odd years ago a throwing-stick, of the pattern used at Port Clarence, near Bering strait, came ashore on the coast of Greenland, near Godhaab, and was presented to the museum at Christiania by Dr Rink.* When one remembers how the crews of whaleships collect curios which they carry to all parts of the world, and which are often thrown away or lost in the most unexpected places, the certainty that this stick drifted from Port Clarence, a distance of not less than 4,000 miles, is evidently not to be taken for granted. I have received from lagoons on the

*Cf. Geog. Tidskr., ix, No. 4, pp. 75–6, Copenhagen, 1887.

west side of the peninsula of Lower California, formerly frequented by whalers, marine shells unquestionably of north European origin, *Buccinum undatum* especially, which is not known in the Pacific at all, and I have also received Indo-Pacific species, as well as cocoanut shells, collected by John Murdoch, from the shores of the Arctic ocean, north of Bering strait. That the drift of the *Jeannette* was due to the prevalent winds is beyond question, as already shown by Melville, and as may be worked out by anybody from the data. That, if continued, it would have passed across the Pole, as argued by Nansen, is a pure assumption, though a very enticing one. Certainly no one interested in arctic work but must most heartily wish that that courageous explorer may succeed in proving his hypothesis and return in safety to claim the laurels his success would earn.

In regard to the second point, that of the origin of the so-called relics, if regarded as fictitious, I have already stated my conclusion that the story of the hoax seems sufficient to account for them. To be perfectly impartial, however, one must admit that the currents about southwest Greenland are such that objects set adrift on the ice from any great distance to the northward of Julianehaab would usually be set over to the westward rather than in shore, although this general rule is subject to exceptions, due to strong westerly winds. This fact alone I suspect was sufficient to satisfy Nansen, whose hypothesis was already framed; but it must be remembered that the Greenland current does not round cape Farewell with equal strength at all seasons of the year; that the advent of the relief expedition was exceptionally early; the influx into Baffin's bay had not begun, and that along such a coast as that of Greenland eddies and reverse currents cannot fail to occur. While not without weight, I cannot assign to Nansen's objection sufficient weight to overcome the other indications, which for me, at least, lead to the conclusion that the so-called *Jeannette* relics have not been shown to have any certain connection with the *Jeannette* expedition. Furthermore, there is no certainty that the Alaskan throwing-stick was brought to the coast of Greenland by oceanic currents, and even if it was, the time occupied in the transit and the route are alike absolutely unknown, so that speculations as to a drift across the region of the Pole receive from this incident no positive confirmation.

Admiral Sir E. Inglefield, the distinguished Arctic traveler, at the meeting of the Royal Geographical Society called to discuss

Nansen's plans, told of finding a fresh stick of Siberian pine, with the bark still upon it and which seemed to have been only a few months in the water, on the west shore of Wellington channel, which enters Baffin's bay from the west.* If such a tree could be carried eastward in a few months from Siberia to a point accessible by ships from Baffin's bay, why is it not more probable that this throwing-stick, lost near Port Clarence, was carried north and east by the well-known northeasterly shore current past point Barrow and so on to Baffin's bay and the Greenland coast?

At this meeting such Arctic authorities as Admiral Sir George Nares, Captain Wharton, Hydrographer R. N., ex-Hydrographer Sir George Richards, R. N., and Sir Joseph Hooker united in the opinion that nothing was known about the direction or existence of sea currents in the region Nansen hoped to traverse, and that all opinions in regard to them must be purely speculative. The doubtful character of the so-called *Jeannette* relics was also distinctly pointed out.† It cannot be said therefore that Nansen pursued his plans in ignorance of the doubtful elements of his hypothesis, but rather that his courage, energy, and audacity were such that he was willing to risk everything to put his speculations to a final test.

NANSEN'S POLAR EXPEDITION

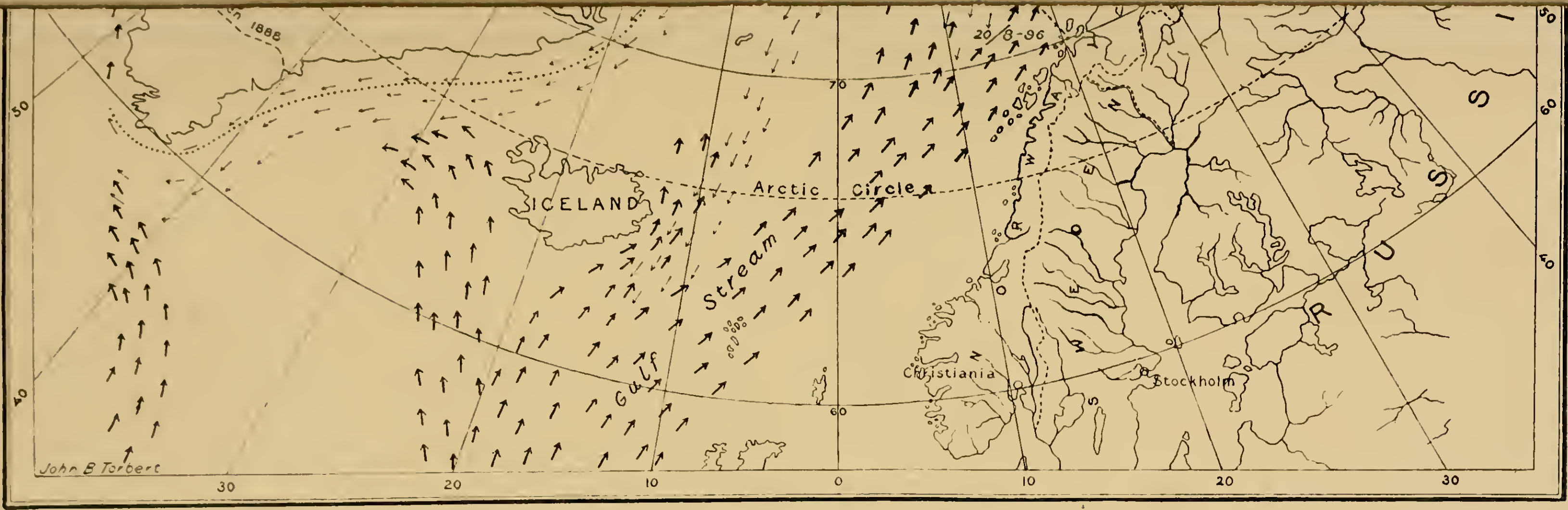
By General A. W. Greely,

Chief Signal Officer, United States Army

The continuing interest of the unsolved polar mystery has been strikingly illustrated by the eagerness with which the press of the world has caught at every word that seems to indicate the success and safety of the brave Norwegian in his dangerous drift-voyage toward the north pole.

Dr Fridtjof Nansen, born in 1861, became famous by crossing, first of all men, the inland ice of Greenland in 1888 from Umivik, 64° 45′ north, on the east coast, to Kangersunek fiord, 50 miles south of Godthaab. Later, he conceived a novel and dangerous plan for polar work. Ignoring the accepted rules of

* Geographical Journal, Jan., 1893, p. 25.
† Op. cit., pp. 22-32.



THE ARCTIC REGIONS

SHOWING ROUTES TRAVERSED BY THE NANSEN EXPEDITION

OF 1893-96

– – – – – Route of Fram up to the time Nansen left for his dash towards the Pole

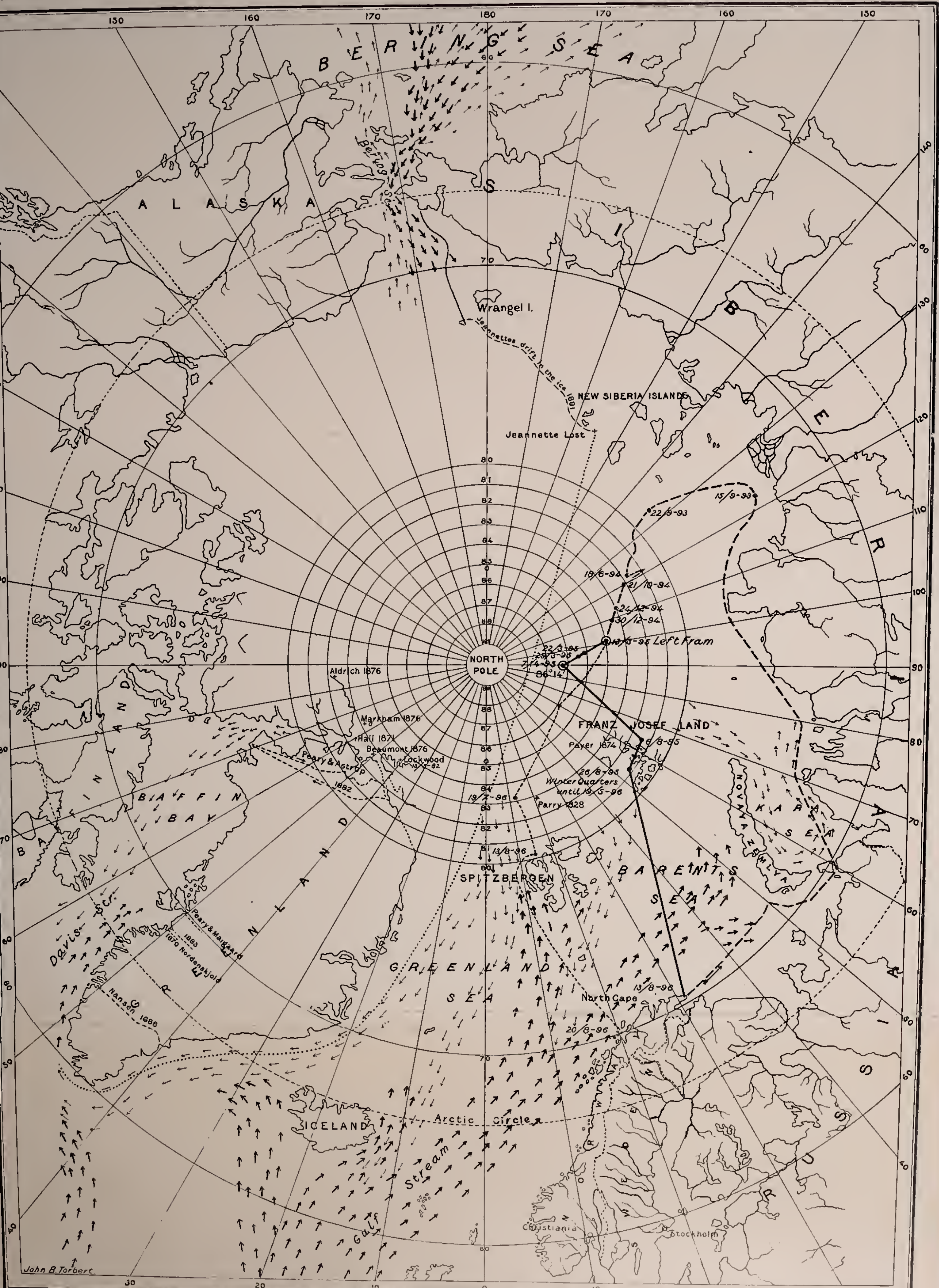
- - - - - - - - - Route of Fram after Nansen's departure

———— Nansen's route after leaving Fram

.... Nansen's idea of route of supposed Jeannette relics

→ → → Warm currents

← ← ← Cold currents



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- → → → Warm currents
- ← ← ← Cold currents

DR FRIDTJOF NANSEN

ice navigation—of avoiding besetment and following the protected lee of land-masses—he decided to put his ship into the ice to the north of the New Siberian islands, whence he believed that he would be carried by ocean currents across the pole to the Spitzbergen sea. His steamer, *Fram*, 125 feet long, with an oak hull 30 inches thick and sheathed with greenheart, was built so as to rise under ice pressure, as he claimed. The crew of twelve were provisioned for five years, though he expected, by a drift of a little over two miles per day, to reach the Atlantic in two years. No explorer of experience endorsed the plan, but with undaunted courage Nansen sailed June 24, 1893, and entering the sea of Kara was last seen to the east of Nova Zembla in September, 1893. He visited neither the Taimur peninsula nor the New Siberian islands, as events have since shown.

February 13, 1896, a dispatch from Irkutsk, on the authority of Konchnareff, an agent of Nansen, stated that the explorer, having reached land-masses at the North Pole, was now returning. Two days later a dispatch from Archangel confirmed the first report in general terms only. From the beginning no credit was given to these dispatches by any American arctic explorer or student. Melville, Schutze, Dall, and the writer were strenuous in disbelief, but the story was credited by scores of persons, both in Europe and this country, who did not find it peculiar that a story from the center of Asia was confirmed from the north of Europe, nor were surprised that such news came from the Siberian ocean in midwinter. Through the Norwegian press Nansen's relatives announce their disbelief in this rumor.

As to the drift-relics found on the west coast of Greenland, which were relied on by Nansen as practical proof that his theory of a drift voyage was correct, it may be said that Melville, the man best qualified to speak about the *Jeannette*, denied at the time their genuineness and endeavored without avail to have them brought to this country. The writer publicly called Nansen's attention to this question, which for the first time seems to have created doubts in his mind. Nansen made efforts to find the relics for verification, but they had disappeared *in toto*.

While Nansen's journey is exceedingly dangerous, it would not be astonishing if he was able to return from his ship, if it was lost south of 81° north, to the Asiatic coast, but if he really approached the North Pole, as is possible, before his vessel was destroyed, it is safe to say that he will pay for an unequaled latitude with his life and carry the secret of his well-earned success to his grave.

The numerous errors lately set forth in the press indicate the need of accurate data relative to latitudes attained.

The tendency to unfairly present data in the interests of individuals or nations is of constant occurrence, and it is not surprising that the general public should be unfamiliar with all the facts. This is especially true in Arctic matters, as is shown by the North Polar chart in "The Times Atlas," 1895, so much lauded for its fullness and accuracy. On this chart the highest north of the German, Swedish, and English (Parry's, 1827) expeditions is so described in full by text and latitudes. In the case of Beaumont, the English explorer, his latitude is given as 82° 54′ north, which is 33 miles too far north, and his record is spread on the map above that of Lockwood, while the last-named explorer, who actually made the highest north ever attained, has not even his latitude entered. In this remarkable case of *suppressio veri* an American explorer loses his nationality, his latitude, and his hard-earned record, all other nationalities having their data entered in full.

Under these conditions it seems to be rendering a geographical service to reproduce here a table extracted from a "Handbook of Arctic Discovery," written by myself.

*Records of the Highest North made since 1587 in the Eastern and Western Hemispheres by Land and by Sea.**

EASTERN HEMISPHERE.

Commander.	Date.	N. lat.	Long.	Locality.
William Barents ..	July 14, 1594	77° 20′	62° E.	Near cape Nassau, N. Z.
Ryp and Heemskerck (Barents' third voyage).	June 19, 1596	79° 49′	12° E.	N. Spitzbergen.
Henry Hudson....	July 13, 1607	80° 23′	10° E.	Spitzbergen sea.
J. C. Phipps	July 27, 1773	80° 48′	20° E.	" "
William Scoresby..	May 24, 1806	81° 30′	19° E.	" "
W. E. Parry......	July 23, 1827	82° 45′	20° E.	" "
Nordenskiold and Otter.	Sept. 19, 1868	81° 42′	18° E.	Spitzbergen sea, highest by ship.
Weyprecht and Payer.	April 12, 1874	82° 05′	60° E.	Franz Josef Land, by Payer, *highest land.*

* NOTE.—This table is reproduced by permission of Roberts Brothers, Publishers.

WESTERN HEMISPHERE.

Commander.	Date.	N. lat.	Long.	Locality.
John Davis........	June 30, 1587	72° 12′	56° W.	W. Greenland.
Henry Hudson....	June 20, 1607	73°	20° W.	Off E. Greenland.
William Baffin....	July 4, 1616	77° 45′	72° W.	Smith sound.
E. A. Inglefield....	Aug. 27, 1852	78° 21′	74° W.	Smith sound.
E. K. Kane.......	June 24, 1854	80° 10′	67° W.	Cape Constitution, Greenland, by Morton.
C. F. Hall........	Aug. 30, 1870	82° 11′	61° W.	Frozen sea.
C. F. Hall.......	June 30, 1871	82° 07′	59° W.	Greenland, by Sergeant Meyer, Signal Corps, U. S. Army.
G. S. Nares........	Sept. 25, 1875	82° 48′	65° W.	Grinnell Land, by Aldrich.
G. S. Nares...	May 12, 1876	83° 20′	65° W.	Frozen sea, by A. H. Markham.
A. W. Greely.....	May 13, 1882	83° 24′	41° W.	New Land, north of Greenland, by Lockwood and Brainard.

Doubtless the name of some whaler should follow that of Baffin in the above list, but the inexactitude of most high latitudes reported by whalers is well known. Possibly the reported northing of Lambert, 78½ degrees north, in 1670, on the east Greenland coast, may have exceeded Inglefield's exact latitude of 78° 21′.

Sweden holds the *ship's* record in the old world, but Parry beat it by *boats*. It will be noted that England held the honors of the farthest north through Hudson, 1607; Phipps, 1773; Parry, 1827, and Nares, by Aldrich, 1875, and by Markham, 1876. This record, unbroken for 275 years, passed to the United States through the efforts of the International Polar Expedition, under Lieutenant Greely, which, by Lockwood and Brainard, reached 83° 24′, the most northerly point, whether on sea or land, ever attained by man, which Nansen or Jackson may possibly excel.

Among other high latitudes attained, but not pertinent to this table, are the following: Hayes, about 80° 10′, in 1861; Jackson, 81° 20′, in 1895; Peary, 81° 37′, in 1891 and 1895; Beaumont, 82° 21′, in 1876; Pavey (with Greely), 82° 54′, in 1882, and Aldrich, 83° 07′, in 1876.

THE SUBMARINE CABLES OF THE WORLD

By Gustave Herrle

The English give Professor (afterward Sir) Charles Wheatstone the credit of being the originator of submarine cables, that gentleman having laid before the House of Commons in 1840 a scheme for the laying of a telegraph cable across the channel between Dover and Calais, but his plans do not seem to have been fully matured.

In the United States, in 1842, Professor S. F. B. Morse experimented with a submarine cable between Castle Garden and Governor's island, New York harbor, and a year later, in detailing the results of his experiments with an electro-magnetic telegraph in a letter to the then Secretary of the Treasury, J. C. Spencer, he said :

. . . "The practical inference from this law is that a telegraphic communication on the electro-magnetic plan may with certainty be established across the Atlantic. Startling as this may seem now, I am confident the time will come when this project will be realized." . . .

It was not, however, until 1850 that the first submarine cable in the open sea was laid. This was the cable across the channel between Dover and Calais. It was made of copper wire, covered with gutta-percha to half an inch in diameter, the shore ends of the wire being doubly covered with cotton, overlaid with a coating of India rubber, and the whole inclosed in a thick lead pipe. This cable did not work successfully, on account of defective insulation, and had to be abandoned. Another authority states that telegraphic communication was maintained for a few hours, when it was suddenly interrupted, the cause being, as was afterwards discovered, the cutting of the cable by a French fisherman, who, it is said, exhibited a piece of it to the astonished people of a neighboring town as a rare specimen of sea-weed with its center filled with gold. Be that as it may, to guard against such casualities the new cable, laid in the following year (1851), between Dover and Calais, was made much stronger, consisting of a wire insulated with gutta-percha and forming a core to a wire rope as a protector. This cable was an entire success, and, as a consequence, the establishment of a number of short submarine cables in Europe and America followed shortly afterward.

In 1854, Mr Cyrus W. Field, whose memory will ever be dear to the hearts of Americans, took up, in company with American and English capitalists, the project to connect Europe and America by a submarine cable, and on August 7, 1857, the laying of the first Atlantic cable was begun by the U. S. frigate *Niagara*, which sailed from Valentia, Ireland, in the direction of Heart's Content, Newfoundland. When about 400 miles had been laid, the cable broke and the steamer returned. In the following year, 1858, the attempt was renewed, H. M. S. *Agamemnon*, with one portion of the cable, and the U. S. frigate *Niagara*, with the other portion, meeting in mid-ocean, in about latitude 52° 02′ north, longitude 33° 18′ west, to splice the cable there, and then to lay it, one ship sailing eastward and the other westward. In this attempt also the cable broke and the steamers returned to port, but a sufficient length of cable being left, another attempt was made later in the year and the laying was successfully accomplished over the whole distance. America and Europe were united by telegraphic communication on August 5, and congratulatory messages were exchanged between the two continents. This is what the Queen of England telegraphed to the President of the United States:

"The Queen desires to congratulate the President upon the successful completion of this great international work, in which the Queen has taken the deepest interest. The Queen is convinced that the President will join with her in fervently hoping that the electric cable which now connects Great Britian with the United States will prove an additional link between the nations whose friendship is founded upon their common interest and reciprocal esteem. The Queen has much pleasure in communicating with the President, and renewing to him her wishes for the prosperity of the United States."

To this President Buchanan replied as follows:

"The President cordially reciprocates the congratulations of Her Majesty the Queen on the success of the great international enterprise accomplished by the science, skill, and indomitable energy of the two countries. It is a triumph more glorious, because far more useful to mankind, than was ever won by conqueror on the field of battle. May the Atlantic telegraph, under the blessing of Heaven, prove to be a bond of perpetual peace and friendship between the kindred nations, and an instrument destined by Divine Providence to diffuse religion, civilization, liberty, and law throughout the world. In this view will not all nations of Christendom spontaneously unite in the declaration that it shall be forever neutral, and that its communications shall be held sacred in passing to their places of destination, even in the midst of hostilities?"

But, alas, the joy over the greatest triumph of the age was destined to be of short duration. In less than a month the cable refused to work, owing to some fault the nature of which could not be definitely ascertained. It was at last abandoned in despair, and no further attempt to lay another one was made until 1864, when the Atlantic Telegraph Company made with the Telegraph Construction and Maintenance Company a contract for a new cable between Valentia and Heart's Content and chartered the steamship *Great Eastern* to lay it. This cable was 2,273 nautical miles* long, and its weight was 300 pounds per mile. Its laying down commenced on July 23, 1865, Mr Cyrus W. Field being on board the ship, but on August 2, after about 1,400 knots had been paid out, the cable parted and the broken end disappeared from view. The *Great Eastern* remained near the scene of the accident until August 11, when she gave up the attempt to recover the cable and returned to Europe. Thus another hope, another aspiration, was buried, and we may well imagine the feelings of those who had put their faith and their money into the undertaking.

The story of this attempt and of the successful recovery of the lost cable a year later by means of grapnels from a depth of over 2,000 fathoms forms one of the most interesting chapters in the history of submarine telegraphy; but after all the disheartening failures which had attended the laying of the first three Atlantic cables, the indomitable pluck and energy of Mr Field and his associates were to be finally rewarded with success. A new cable was ordered, and on July 13, 1866, the *Great Eastern* again started from Valentia and, without further serious mishap, finished the laying over the whole distance on July 27, when the cable was spliced to the shore end at Heart's Content. Moreover, on September 1 following, the *Great Eastern* recovered the lost cable of the previous year, spliced it to the cable on board, and completed the laying of it toward Heart's Content, thus establishing a duplicate line. Ever since that time we have had uninterrupted telegraphic connection with Europe, and this 1866 cable thus became the pioneer of the long-distance, deep-sea cables.

Immense progress has since been made in the establishment of submarine telegraph lines. A fleet of between thirty-five and forty steamers, specially constructed and equipped for cable

*A nautical mile, as defined by the United States Coast and Geodetic Survey, equals 6,080.27 feet, or 1.1516 statute miles.

service, sprang into existence, and the present total length of the submarine cables of the world is, in round numbers, 160,000 nautical miles, or enough to girdle the earth seven and one-half times at the equator. At an average cost of $1,200 per mile, the entire system represents an outlay of $192,000,000. Of the total mileage about one-eighth is under the control of various national governments.

The Hydrographic Office issued, in 1892, a book on "Submarine Cables," prepared by Mr G. W. Littlehales as a part of the report of that Office on the survey made by the U. S. ships *Albatross* and *Thetis* for an ocean cable route between San Francisco and Honolulu. It contains a large amount of interesting information, including valuable statistical data, among which is a complete list of the Submarine Cables of the world, in detail. The tables being much too voluminous for publication in these pages, the following list of the more important cables has been compiled from them, the reader being referred to the original report for information concerning the shorter cables and for more complete data generally :

CABLES OVER FOUR HUNDRED NAUTICAL MILES LONG, OPERATED BY GOVERNMENTS.

France: Marseilles to Algiers, 3 cables, 488, 496, and 500; Teneriffe to St. Louis, Senegal, 865.

Cochin China and Tonkin: Cape St. James to Thuan-An (Hué), 530.

British India: Manora to Jask, 531; Jask to Bushire, 2 cables, 519 and 500.

CABLES OVER FOUR HUNDRED NAUTICAL MILES LONG, OWNED BY PRIVATE COMPANIES; ALSO TOTAL LENGTH OF CABLES OPERATED BY EACH COMPANY.

Direct Spanish Telegraph Company, total, 708: Kennack Cove, Cornwall, to Las Arenas, near Bilbao, 487.

Halifax and Bermuda Cable Company: Halifax, N. S., to Hamilton, Bermuda, 850.

Spanish National Submarine Telegraph Company, total, 2,159: Cadiz to Santa Cruz de Teneriffe, 864; Tejita, Teneriffe, to St. Louis, Senegal, 865.

West African Telegraph Company, total, 3,015: Kotonu to St. Thomas, 486; St. Thomas to Loanda, 760.

Great Northern Telegraph Company, Europe and Asia, total, 6,932; Newbiggin, England, to Arendal, Norway, 424; Newbiggin to Marstrand, Sweden, 510; Newbiggin to Hirtshals, Denmark, 420; Amoy to Gutzlaff, China, 590; Gutzlaff to Nagasaki, Japan, 427; Gutzlaff to Nagasaki, 416; Nagasaki to Vladivostock, Russia, 2 cables, 753 and 766.

Eastern Telegraph Company, total, 27,453: Porthcurno, Land's End, England, to Lisbon, Portugal, 2 cables, 850 and 892; Porthcurno to Vigo, Spain, 622; Gibraltar to Malta, 2 cables, 1,118 and 1,126; Marseilles, France, to Bona, Algeria, 2 cables, 447 and 463; Trieste, Austria, to Corfu, 593; Malta to Alexandria, Egypt, 2 cables, 928 and 911; Suez, Egypt, to Suakim, Soudan, 3 cables, 936, 811, and 811; Suez to Aden, 794; Suez to Perim Island, 1,331; Suakim to Perim Island, 597; Suakim to Aden, 2 cables, 794 each; Aden to Bombay, 3 cables, 1,850, 1,859, and 1,885.

Eastern and South African Telegraph Company, total, 6,796 (increased since 1892 to 8,841): Aden to Zanzibar, 1,909; Zanzibar to Mozambique, 2 cables, 644 and 686; Mozambique to Lourenço-Marques, Delagoa bay, 970; Cape Town to Port Nolloth, 433; Port Nolloth to Mossamedes, 1,052.

Eastern extension, Australasia, and China Telegraph Company, total, 17,342: Madras to Penang, 2 cables, 1,462 and 1,389; Rangoon to Penang, 864; Singapore to Saigon, Cochin China, 628; Haïphong, Tonkin, to Hongkong, 470; Fuchau to Hongkong, 472; Saigon to Hongkong, 990; Saigon to Thuan-An, 516; Hongkong to cape Bolinao, island of Luzon, 529; Singapore to Batavia, Java, 541; Singapore to Banjuwangi, Java, 921; Banjuwangi to Port Darwin, Australia, 2 cables, 1,143 and 1,124; Banjuwangi to Roebuck bay, Australia, 892; Sydney to Nelson, New Zealand, 2 cables, 1,284 and 1,322; Hongkong to Fuchau, 472; Fuchau to Shanghai, 449.

Anglo-American Telegraph Company, total, 10,400 (increased to 12,290 since 1892): Valentia, Ireland, to Heart's Content, Newfoundland, 3 cables, 1,846, 1,881, and 1,899; Minou, France, to St. Pierre, 2,718; St. Pierre to Duxbury, Massachusetts, 809.

Direct United States Cable Company, total, 3,099: Ballinskelligs bay, Ireland, to Halifax, 2,564; Halifax to Rye Beach, New Hampshire, 535.

Compagnie Française du Télégraphe de Paris à New York, total, 3,496: Brest to St. Pierre, 2,282; St. Pierre to Cape Cod, Massachusetts, 828.

Western Union Telegraph Company, total, 7,743: Penzance, England, to Canso, Nova Scotia, 2 cables, 2,531 and 2,576; Canso to New York, 2 cables, each 888.

The Commercial Cable Company, total, 6,938 (since increased to 9,075): Havre to Waterville, Ireland, 510; Waterville to Canso, 3 cables, 2,138, 2,350, and 2,388; Canso to New York, 841; Canso to Rockport, Massachusetts, 519.

Brazilian Submarine Telegraph Company, total, 7,369: Lisbon to Madeira, 2 cables, 627 and 631; Madeira to St. Vincent, Cape Verde island, 2 cables, 1,168 and 1,209; St. Vincent to Pernambuco, Brazil, 2 cables, 1,862 and 1,872.

African Direct Telegraph Company, total, 2,746: Santiago to Bathurst, 471; Bathurst to Sierra Leone, 463; Sierra Leone to Akkra, 1,020.

Cuba Submarine Telegraph Company, total, 1,590: Cienfuegos to Santiago, Cuba, 3 cables, 400, 420, and 420.

West India and Panama Telegraph Company, total, 4,557: Kingston, Jamaica, to Colon, Panama isthmus, 630; Holland bay to San Juan, Porto Rico, 683; Holland bay to Ponce, Porto Rico, 647; St. Croix to Port of Spain, Trinidad, 541.

Société Française Des Télégraphes Sous-Marins, total, 3,754 (since increased to 4,544): Porto-Plata, Santo Domingo, to Fort de France, Martinique, 787; Fort de France to Paramaribo, Dutch Guiana, 777; Cayenne to Vizeu, Brazil, 662; Santo Domingo to Curaçao, 453.

Western and Brazilian Telegraph Company, total, 3,964 (since increased to 6,144): Maranham to Ceara, Brazil, 406; Ceara to Pernambuco, 476; Bahia to Rio de Janeiro, 837.

Mexican Telegraph Company, total, 1,523: Galveston, Texas, to Tampico, Mexico, 490; Galveston to Coatzacoalcos, Mexico, 822.

Central and South American Telegraph Company, total, 7,497: Salina Cruz, Mexico, to Libertad, Salvador, 434; San Juan del Sur to Panama, 721; Buenaventura to St. Elena, Ecuador, 486; Paita to Callao-Lima, Peru, 553; Callao-Lima to Iquique, Chile, 747; Iquique to Valparaiso, Chile, 877.

West Coast of America Telegraph Company, total, 1,699 (since increased to 1,964): Callao-Lima to Mollendo, Peru, 510.

NOTE ON COMPILATION OF CHART.

This chart (see frontispiece) was compiled in the U. S. Hydrographic Office from the latest information, and is a facsimile of H. O. chart* No. 1530, just issued by that Office.

The twelve cables across the North Atlantic ocean were plotted, from their terminal points on the American continent to meridian 40° west, from positions furnished by the respective cable companies, with the exception of three—the Western Union of 1881 and 1882 and the Mackay-Bennett of 1894—for which positions were furnished all the way across. From the European terminal points to meridian 40° west, the cables, with the exceptions just mentioned, were plotted from information deposited in the Office of Naval Intelligence.

A map furnished by the Western Union Telegraph Company was used for the plotting of the principal connecting land lines in the United States.

The cables and land lines of Japan were taken chiefly from the Outline Map of Japan showing the principal Post, Telegraph, and Railway Routes, published by the Japanese Department of Communications in 1888, and which accompanies "A concise Dictionary of the principal Roads and Chief Towns and Villages of Japan," by W. N. Whitney, M. D., formerly Interpreter at the U. S. Legation at Tokyo.

The other cables and land lines of the World were taken chiefly from the "Carte des Communications Télégraphiques du Régime Extra-Européen dressée d'après des documents officiels par Le Bureau International des Administrations Télégraphiques," Berne, 1888.

The Coaling, Docking, and Repairing Stations of the World and their different grades of facilities were compiled mainly from a publication of the Office of Naval Intelligence, entitled "Coaling, Docking, and Repairing Facilities of the Ports of the World," 1892, and corrections thereto up to December, 1895, and from the British Dock book of 1894.

*This chart is sold by the Hydrographic Office and its agents at 50 cents per copy.

PETER COOPER AND SUBMARINE TELEGRAPHY

In presenting to its readers a chart of the submarine telegraph cables of the world, THE NATIONAL GEOGRAPHIC MAGAZINE was unwilling that this graphic representation of intercontinental communication should be unaccompanied by some reference to one of its earliest and most effective pioneers, the late Peter Cooper. It is well to recall to the rising generation its indebtedness to Mr Cooper for his eminent services in fostering the initiation of this now elaborate network between the widely separated continents of the earth. With considerable reluctance, and only after repeated urging, one of the actors in this great work, the Honorable Abram S. Hewitt, has outlined, in a letter all too brief, the part played by Mr Cooper. The letter is as follows:

"The story of the Atlantic Cable has been so fully and so well told by the Rev. Henry M. Field in his history, published in 1892 by Messrs Scribner & Sons of this city, that only the briefest outline is necessary to call public attention to the origin of an enterprise which, at the time of its inception, was regarded with incredulity, and whose prosecution and final success have all the elements of a romance.

"My first knowledge of the enterprise was in 1854, when Mr Cyrus W. Field invited Mr Peter Cooper and other gentlemen to listen to the propositions of Frederick N. Gisborne, who had come to New York for the purpose of interesting capital in constructing a line of telegraph across Newfoundland, so as to get the news at cape Race from the European steamers and transmit it thence overland to the gulf of St. Lawrence and thence by fast steamers to cape Breton, whence land lines had been constructed connecting with our American system. In that interview no suggestion was made for a cable across the gulf of St. Lawrence, because it was doubtful at that time whether submarine communication of such length could be established and maintained. The amount of money required was not very considerable, and the gentlemen appealed to, being all men of large views, came to the conclusion that they would contribute the amount, not so much as a commercial speculation as from considerations of the advantage of early news in business transactions affecting the two continents. The Newfoundland Company was organized, with Mr Cooper as its president and Mr Field as its active manager. The other gentlemen concerned in the undertaking were Moses Taylor, Marshall O. Roberts, Chandler W. White, and, at a later period, Wilson G. Hunt. David Dudley Field also took an interest and was legal advisor of the company.

"Arrangements were made for the construction of the land line without delay, and later, when the experience of the European submarine cables established the practicability of longer lines, it was decided to lay the cable across the gulf of St. Lawrence, a distance of about eighty miles. The first attempt to lay this cable was a failure, owing to the imperfect arrangements for transporting the cable across the gulf, and the occurrence of a storm which caused the severance of the cable when the vessel engaged in laying it was midway between the two termini. It was determined, however, to renew the attempt, and in the following year a cable was successfully laid, and the original plan of the company for intercepting news at cape Race was carried into effect. As a matter of course, the enterprise was not a commercial success, but its advantages were so apparent that the parties in interest concluded that the time had come to make the attempt to continue the cable from Newfoundland to the coast of Ireland. The idea was a daring one, but the highest electrical authorities concurred in opinion that it was feasible. Mr Field proceeded to England to organize a company, in which he succeeded, and which resulted in the attempt to lay the cable in 1857, made by the *Agamemnon* on the British side and by the *Niagara* on the American side. I need not rehearse the story of the successive failures, but the first one occurred in 1857, during the panic of that year, which spread wide ruin throughout the country. Among others, Mr Field was compelled to succumb, and it seemed probable that any further attempt to construct and lay the cable would be abandoned. It was at this juncture that the strong common sense and unshaken faith of Peter Cooper came into play. When the financial storm had abated, he urged Mr Field to undertake the resuscitation of the enterprise, and he offered to advance, and actually did advance, the money required for Mr Field's expenditures, until such time as the success of the cable might be demonstrated and assured. Some of the other gentlemen declined to participate in these advances, and hence the burden upon Mr Cooper was very onerous and gave great concern to his family. Nevertheless Mr Field soon recovered his confidence, and with indomitable courage

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and indefatigable industry he finally succeeded in accomplishing the difficult undertaking with which his name and fame are justly identified. So far as Mr Cooper and his family were concerned, they did what they could to secure the success of the enterprise, and I think it may be justly asserted that, without Mr Cooper's assistance and absolute faith in the final success of the undertaking, its realization would have been postponed for many years. In the end he was fully indemnified, and perhaps amply rewarded, for his investment, but without detracting in the slightest from the credit which is justly accorded to Mr Field, I think I am justified in making, at your request, this brief statement, in order to show that without the unflinching courage and coöperation of Mr Cooper, Mr Field would hardly have been in a position to achieve the triumph which he finally secured, and for which his memory is entitled to the veneration of succeeding generations."

THE RUSSO-AMERICAN TELEGRAPH PROJECT OF 1864–'67

By Professor William H. Dall

The possibility of constructing a line of telegraph overland through Siberia and northwestern America had doubtless occurred to many, but the first person to endeavor to give practical effect to the conception appears to have been Mr Perry M. Collins, of California, who in 1856 and for some years subsequently was United States consular agent at Nikolaievsk, on the Amur river, eastern Siberia. By dint of constant activity and perseverance, Mr Collins succeeded in obtaining the concessions necessary to the construction of a line of telegraph, with all needful accessories, from the Amur to the British Columbian line through eastern Siberia and the Russian-American colonies, and also through the British territories in America.

Continual mishaps in the course of the attempts to lay a workable cable across the Atlantic had led many telegraphers to believe that the plan was impracticable, though they had no doubt of their ability to construct and keep in working order shorter lines, such as that proposed across Bering strait. The propositions of Mr Collins were laid before the Directors of the Western Union Telegraph Company, March 16, 1864. They ac-

WILLIAM H DALL

cepted, by a unanimous vote, the transfer of his rights and interests, and on March 18 completed an organization for the carrying out of the project.

An expedition to explore the proposed route, under Col. Chas. S. Bulkley, formerly of the United States military telegraph corps, was immediately organized. Col. Bulkley reached the Pacific coast in January, 1865. The exploration of the British Columbian line was directed by Edmund Conway, that of Russian America by Robert Kennicott and that of eastern Siberia by Sergius Abasa. The United States detailed Capt. C. M. Scammon, of the Revenue Marine Service, and two other officers to the fleet fitted out by the company, and the Russian government lent the aid of the corvette *Vsadnik.* The first visit was paid to the Russian authorities at Sitka in March, 1865. In July parties were on the way to Siberia, Alaska, and Bering strait. Explorations during this and the following season demonstrated the practicability of the route selected, and saw a small amount of line constructed, every endeavor being made to carry out the project.

In 1867 the Atlantic cable at last proved itself a working success. On the other hand, the experience gained by the expeditions sent out in connection with the Russo-American project showed that the maintenance of the projected line would be so expensive as to make it impossible for it to compete with the Atlantic cable, commercially. Consequently the company decided to withdraw from the enterprise and in the autumn of 1867 the parties returned to California.

The route chosen was up the valley of the Fraser river in British Columbia and down the Yukon to the Nulato bend, thence across country to Port Clarence, where a cable was to connect with the Siberian lines. The latter would leave the Chukchi peninsula, cross the neck of the peninsula of Kamchatka and skirt the shores of the Okhotsk sea, joining the Russian lines at Nikolaievsk. It is stated that a large part of the fourteen millions of dollars represented by the stock was actually expended in the work ; at all events a large amount of money was spent, and the only returns were those public benefits implied by an increase of geographical and other scientific knowledge and the training of a number of explorers and investigators.

SURVEY AND SUBDIVISION OF INDIAN TERRITORY

By Henry Gannett,

Chief Topographer, United States Geological Survey

The condition of things in Indian Territory is anomalous. The Territory is an area of some 31,000 square miles, divided among what are called the Five Civilized Tribes—the Cherokees, Choctaws, Chickasaws, Creeks, and Seminoles—the reservation of each tribe being owned by the tribe. Such a thing as private ownership of land is unknown. Each individual entitled to do so is, however, permitted to take up and occupy any land which is not already occupied, but in so doing he does not acquire title.

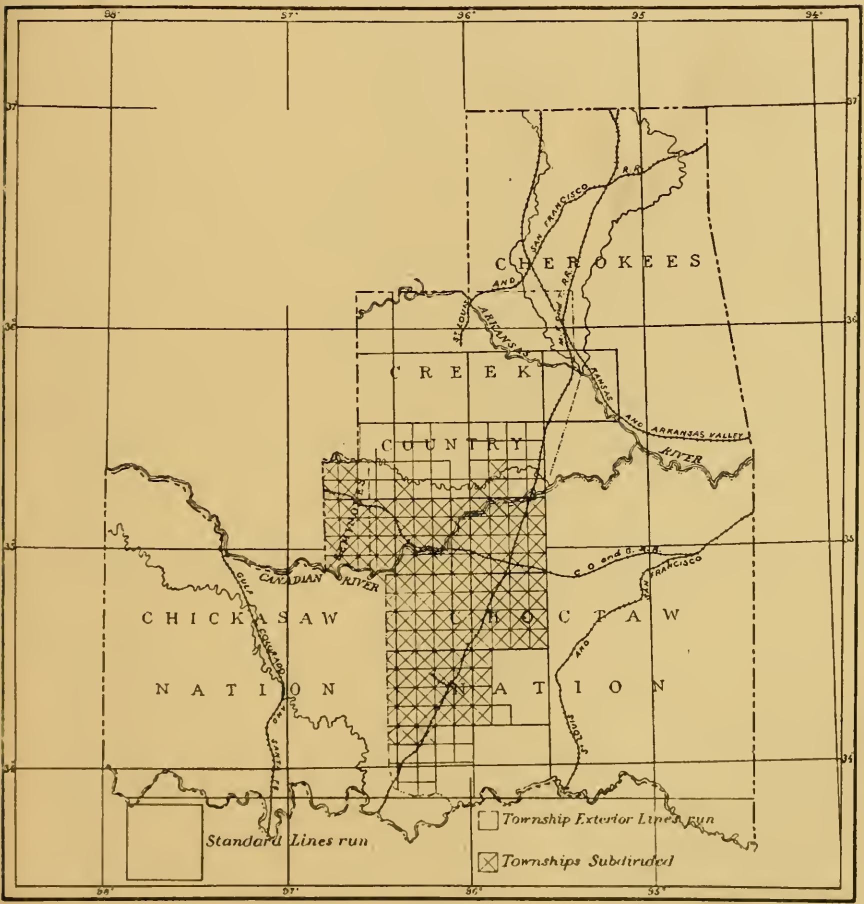
The population of the Territory consists of some 50,000 Indians, a few whites who have married Indian women and have thus acquired membership in the tribe, with the accompanying privileges and emoluments; a few thousand negroes, mostly the descendants of slaves, and a large number, variously estimated at from 100,000 to 200,000, of whites, who are living in the Territory on sufferance, some legally upon the payment of a small tax, others without the shadow of right or authority. These latter are known as interlopers.

As might be expected under this condition of affairs, the whites who have married Indian women, being much shrewder and more experienced than the Indians, have acquired by the right of occupation nearly all the landed property which is worth having in the Territory. They own, if it can be called owning, all the best farming and grazing land, all the timber land which is of immediate value, all the town sites, and all the mineral land which is worth having. and by leasing this property to whites they are rapidly acquiring great wealth.

Although in many respects quite advanced in the arts of civilization, the governments established by these Indians are weak and insufficient. So far as the control of the Indians themselves is concerned, they may have ample power, but at present they are called on to cope with and control a large body of whites, outnumbering themselves at least three to one, and composed largely of the rough, lawless, frontier element; indeed, were not the tribal governments reinforced by the power of the United

States courts the Territory would long ago have been in a state of anarchy.

This situation of affairs, instead of improving with time, is rapidly becoming worse, inasmuch as the number of interlopers in the Territory is constantly and rapidly increasing. The remedy



OUTLINE MAP OF INDIAN TERRITORY, SHOWING PROGRESS OF SUBDIVISION SURVEY UP TO JANUARY 1, 1896.

for this threatening aspect of affairs is plainly the substitution of a territorial government by all inhabitants for the present tribal governments of the Indian minority, the allotment of land to the Indians, and the consequent establishment of land titles.

Foreseeing the necessity of this solution, Congress has for the past two years been endeavoring to treat with the tribes for the purpose of inducing them to accept their lands in severalty. In pursuance of this object two different commissions have been appointed, each of which has spent several months in the Territory endeavoring to obtain a hearing from the tribes, but thus far without the slightest result. The tribes have declined absolutely to treat with them upon this subject.

During the progress of these attempts at negotiation Congress has taken another step in the same direction. In March, 1895, an appropriation of $200.000 was made by Congress for commencing the survey and subdivision of the lands of the Territory, being the necessary preliminary step toward allotment. This work was placed by the Secretary of the Interior in the hands of the Director of the Geological Survey, instead of being let out on contract, as has been done in all cases of subdivision heretofore. The Chickasaw nation was excepted, as it was subdivided in 1873. The work was commenced in April under the following plan: The Indian base line, which forms the base line of the Chickasaw nation and of Oklahoma, was adopted for carrying the work into the other nations. The second guide meridian east of the principal meridian of the Chickasaw nation was run northward and southward as a principal meridian for the other nations. Thus while the general system of surveys conforms to that in the Chickasaw nation and in Oklahoma, the work has been so planned as to make it independent of any errors which may have accumulated in the earlier work.

Two parties have been engaged continuously since April last in running standard lines (guide meridians and correction lines) by which the country is divided into blocks twenty-four miles on a side. The township exteriors were run by distinct parties, two parties being at first organized for this work, which were subsequently increased to four. The subdivision of townships into sections was carried on by still a third set of parties, eight of which were organized and placed in the field during the month of May, and the number was subsequently increased to sixteen. Thus the entire work of subdividing the land is carried on by three distinct sets of parties, the work of each checking that of another.

Furthermore, a system of triangulation has been carried over the area subdivided, and the stations in this triangulation have been connected with section and township corners. This is done not only for the purpose of checking and correcting errors, but also to form reference points for the recovery of missing corners,

INDIAN TERRITORY — CAMP OF A SURVEYING PARTY OF THE U. S. GEOLOGICAL SURVEY, 1895

the triangulation points being marked in a very permanent manner. The triangulation rests upon a base line measured on the track of the Missouri, Kansas and Texas railway near Savanna, and the astronomical position of this place was determined as the initial position.

The subdivision parties, by which is to be understood the parties engaged in running the section lines, are grouped, four of them being in charge of an experienced surveyor connected with the permanent corps of the United States Geological Survey, who supervises the work closely and attends to the executive management of the outfit, and who, moreover, commonly with the aid of an assistant, maps the topography of the area subdivided. This latter duty is rendered light by the fact that the surveyor in running the lines locates the points of crossing of every stream, road, or other natural or artificial feature which he encounters in the course of his line. Thus at intervals of a mile or less all the features are located and little remains for the topographer to do except to sketch these features between these points of location.

The progress made in this survey up to the end of January of the present year is set forth in a report which has been made to the Secretary of the Interior. It appears from this that in the primary triangulation 49 stations have been selected, signals built upon them and angles measured from them. By means of these stations an area of about 10,000 square miles, or about five-twelfths of the area of the Territory, excluding the Chickasaw nation, has been controlled. In the subdivison work 11,770 miles had been run out of an estimated amount of 47,000 miles to complete the Territory, or about one-fourth of the entire work. Of the above mileage 970 miles are of standard lines—that is, standard parallels and correction lines; 1,790 miles are exterior lines of townships, 8,770 miles are section lines, and the remaining 240 miles are the meander lines of streams. The work thus far done completes the subdivision of 128 full townships and 26 fractional townships. It is included mainly in the western part of the Choctaw nation, embraces all of the Seminole country and some of the Creek country, while standard lines have been run into the Cherokee nation. The progress is represented upon the sketch map accompanying this paper.

The mapping of topography has followed closely after the work of subdivision, and up to the date given above an area of 4,200 square miles had been thus mapped.

"FREE BURGHS" IN THE UNITED STATES*

By James H. Blodgett,

Late Special Agent of Census in Charge of Education

Three bridges across the Potomac river connect the District of Columbia with the State of Virginia. The upper one, known as the Chain bridge, just below the Little falls, the head of tidewater, is too far from dense population to be frequented by foot passengers. Three miles below the Chain bridge is the Aqueduct bridge, practically the head of navigation, since only small pleasure boats and scows to bring stone from the quarries go above it.

Along the Virginia shore, above the Aqueduct bridge, are various "resort houses," more or less permanent, ostensibly for legitimate relaxation and pleasure, but viewed with suspicion by the authorities on both sides of the river, justified by results of occasional raids by officials. At the Virginia end of the same bridge is a straggling group of houses known as Roslyn, a favorite place for those who want to go beyond the police restraints of the District of Columbia, and particularly for those interested in the gambling device known as policy, a sort of lottery, especially attractive to the colored people.

Between the Aqueduct bridge and the Long bridge, two miles or more farther down, at the upper extreme of dense habitation, the low ground on the Virginia side is brushy, with but few houses, and is a rambling place for various kinds of boys and men, who find the towpath of the abandoned canal a convenient footway. The high lands contain the Government reservation, comprising Fort Myer and the Arlington national cemetery. Close to the Virginia end of the historic Long bridge are a few houses known as Jackson City. Freedom from rigid police control has made this a convenient place for gambling in various forms. Close by, known as Alexander's island, is maintained, irregularly, a race-course. Three miles farther is another race-course, known as St. Asaph. A good part of the racing in sight

*This article, written for The National Geographic Magazine, is less technical and has less of legal citation and quotation of authorities than a paper bearing the same title read before the Anthropological Society of Washington, November 5, 1895. The latter, valuable for purposes of reference and verification, will be printed by the American Historical Association.

of the Capitol has been that known as "outlaw racing"—that is, with horses or with jockeys not in good standing with the regular racing associations. Just below St. Asaph is the city of Alexandria, which is popularly regarded as a part of Alexandria county, to share whatever of good or bad repute attaches to it.

At the census of 1790 all this vicinity was part of Fairfax county, except that Alexandria already had a separate court and was exempt from county taxes. For the organization of the District of Columbia, Virginia ceded to the General Government the jurisdiction * over a tract bounded by the line extending ten miles northwest from the mouth of Hunting creek, a line northeast from the terminus of the first, and the river, containing an area said to be thirty-two square miles. In 1801 Congress erected the area ceded by Virginia into a county, to be called Alexandria county, but expressly retaining for Alexandria all existing chartered rights. In 1846 the United States re-ceded the tract to Virginia, which has continued to be generally known as Alexandria county, though the policy of separation of city and county, suspended for half a century, has been renewed. The combined population of city and county in 1890 was 18,597, of which 14,339 persons were in the city of Alexandria, which is not a part of Alexandria county, although its name, its vicinity, its recent affinity with the county, and the presence of the county buildings † tend with most persons to make the residents municipally responsible for the unlawful conduct near by. Many persons, while rejoicing in the measure of success attained, do not see why the energetic governor of Virginia sent officers to break up disreputable practices in the county. They do not appreciate the weakness of the real Alexandria county when the gambling elements of the neighboring cities flow out upon it. It has but a little over 4,000 population (1890), of whom, after deducting 164 on the military reservation, over one-half (2,123) are of negro descent, and not yet of much proprietary responsibility.

Alexandria is but an example of the cities of Virginia from the earliest days. James City, better known as Jamestown, and now extinct, was established as the chief city in 1639. Williamsburg was set apart as a city, to be used for no other purpose whatever, and defined as the capital in 1699, and again in 1705, in advance of population. There was a general plan to put in each county

* The ownership remained in the existing proprietors. Certain authors erroneously state that the title or possession was transferred.

† A bill is pending for erection of county buildings outside of the city.

a similar town for commercial purposes, especially for warehousing and marketing tobacco. Norfolk, chartered as a borough in 1737, has lost that name, but its relations to the county are to-day like those of the original charter, gradually defined, strengthened, and confirmed, in points of dispute, in favor of the municipality. At first the Norfolk county buildings were in Norfolk, and a special clause in the charter reserved proprietary rights in them to the county. Later legislation authorized their sale and the erection of county buildings outside of Norfolk. The buildings are now in Portsmouth.

In 1776 many boroughs which had been given separate representation in the assembly were cut off by a law which prescribed that no borough with a population less, for seven successive years, than half that of any county should be separately represented. In the same year the delegate for William and Mary College, specified in its charter, was cut off.

In the state law for apportionment of members of Congress, 1892, the following names of cities are given separate from names of counties: First district, Fredericksburg; second, Norfolk, Portsmouth, and Williamsburg; third, Richmond and Manchester; fourth, Petersburg; fifth, Danville and the town of North Danville; sixth, Lynchburg, Radford, and Roanoke; seventh, Charlottesville and Winchester; eighth, Alexandria; ninth, Bristol; tenth, Staunton. To these are to be added Buena Vista, in the tenth district, chartered on the day of the approval of the apportionment bill, and Newport News, for which the bill was signed January 18, 1896. The conditions for the town of North Danville are in transition. It has been a town independent of Pittsylvania county, but judicially dependent on Danville. The name has recently been changed to Neapolis, and just too late for insertion here it will be determined by popular vote whether it shall be consolidated with Danville.*

In early days there was a disposition in certain other colonies to establish cities independent of counties. In New Jersey and in Maryland such early independencies as survived came under county control. In Pennsylvania the claims of Germantown to independence of the taxation of Philadelphia county were overruled by the governor. In Virginia, from the incorporation of James City (1639), it has been the steady policy to have the cities independent of the counties. It confuses some students

* By popular vote, on February 20, Neapolis is to become a part of Danville on July 1, 1896.

to find an occasional participation of urban residents and rural residents in local affairs, but on examination of charters it will be found that this extends only to subjects expressly named in any instance.

If one will examine the scheme of government for the city and county of St. Louis, Missouri (1876), he will find that *all* power of county officers was abrogated. The same act restored their power for the rural portion, now St. Louis county, leaving the city to be provided with a separate government in the same act. The situation in Virginia may be clearer if the legislature is deemed to have abolished all county authority in any city under consideration, and then to have restored by name such items of power as circumstances demanded.

The present cities of Virginia have the following characteristics:

The Code defines a city as a town having over 5,000 inhabitants and a hustings court, and defines a town as an incorporated town having less than 5,000 population.*

The cities have distinct courts. Their citizens do not pay county taxes on city property. They do not serve on county juries. Deeds and other papers affecting city property are recorded by city officers and not by county officers.

Generally, residents of cities do not participate in county elections. Exceptionally, they may hold county offices, more exceptionally, they may vote for county officers.

Generally, city police courts have jurisdiction one mile beyond corporate limits. Exceptionally, there is a limited concurrent jurisdiction of city and county courts, as over waters adjacent to the cities of Norfolk and Portsmouth and to Norfolk county.

Generally, the county and the city have each a set of public buildings within their respective borders. Exceptionally, authority is given to a county for buildings in a city, as when, at the chartering of the city of Manchester, Chesterfield county was authorized to continue to use its public buildings therein till other arrangements could be made. This authority sometimes embraces arrangement for joint occupancy, as when Norfolk county was authorized to arrange with the city of Portsmouth for the location and construction of a jail.

Generally, a county officer may not serve writs in a city. Exceptionally, he can serve writs in the city on residents of his

* The venerable city of Williamsburg has a smaller population, but its site is expressly set apart for a city.

county, as witnesses may be summoned for Campbell county in the city of Lynchburg.

Except for individually specified purposes, county and city are as distinct as two counties.

The city of Newport News, Virginia, was organized January 20, 1896, under a charter naming officers to serve till July. The charter contains the following paragraph:

"115. The city of Newport News, its real and personal property and other subjects of taxation, and its inhabitants shall be exempt from all assessments and levies in the way of taxes imposed by the authorities of Warwick county for any purpose whatever, except upon property owned in the said county by the inhabitants of said city, from and after the first day of January, eighteen hundred and ninety-six, nor shall said inhabitants be liable to serve upon juries or work upon roads in said county except in such cases as are provided for by the laws of the state."

This extract states an exemption of residents in cities from county taxes and from duty on county juries prevalent in the state.

The present facts regarding the cities of Virginia are little known beyond the state. The Congressional Directory is conspicuous as a public document out of the state that shows the cities separately. The Civil Service Commission has found it necessary to recognize the certificate of an officer of a city court of record for Baltimore, St. Louis, and the cities of Virginia where a certificate from a county court was contemplated. A list of cities in Virginia paying no county taxes occurs in the Report of the Tenth Census (1880), volume 7, page 117.

Ordinarily, in this country, a city is part of a county; it is set apart that a dense population may establish new values and impose new taxes to meet special demands for public welfare; it continues to pay county taxes.

The difficulty of harmonious action by sparse and dense populations upon subjects common to them has led to exceptional separation of cities from counties—Baltimore, Maryland, by successive steps, culminating in 1823, and St. Louis, Missouri, through popular vote in 1876.

These two instances are explained in the Johns Hopkins University studies in historical and political science—Local Institutions of Maryland, in volume 3, and City Government of St. Louis, in volume 5, the latter being most minute, and constituting a monograph in itself, and yet the existence of cities independent of county control and of county taxes is denied in certain histories and works on civil government used in high schools, colleges, and universities.

In many states the administration of the public schools is largely through municipalities charged with that work and superimposed upon areas occupied by other municipalities charged with other interests. There is a very general tendency to charter school districts independent of the town in the north or of the county at the south. In some states this method of enabling a community to do what the larger unit of which it has been part is not ready to do bids fair to increase. This form of legislation is more common in the west and south than in the northeast. The forms which these educational municipalities assume are numerous, and the complications produced are often intricate.

The complications are probably most intricate in those states formed of the public domain which have township organization, a modified form of the town government of New England. It will be most convenient to limit illustration to the organizations which possess taxing powers, disregarding subdivisions made simply for details of administration of a larger unit, like a voting precinct as a division of a county without taxing power. National, state, and county taxes bear upon property-owners throughout the country, with the exception of county taxes in St. Louis, Baltimore, and cities of Virginia, as already explained. The national taxes are so largely collected on goods in bulk before their distribution that most consumers either do not recognize them or persuade themselves that somebody else pays them.

Below the county tax come the multitudes of variations. The congressional township of the land survey, six miles square, in its simplest organization became a school township—a plan encouraged by the grant to the state of a section or of two sections or square miles in a township for school purposes. This school corporation is often subdivided into districts, each with its taxing power. There are instances of superimposed incorporation of the town as a high-school district with taxing power. Turning from school administration, we find the same area made a civil township, with care of roads, the poor, and other subjects. Within this township may grow up a compact body of population to be chartered as a village, a town, or a city, according to circumstances, with taxing power for police and other purposes. In some instances, like Springfield, Illinois, these units will assume the charge of schools; in others, like Aurora, Illinois, the city does not administer the schools, which remain under the districts into which the school township was divided.

A citizen may therefore find himself under three sets of taxes for schools—the township and the district for common schools and the high school township for its specialty. He may have in addition the civil township tax and the corporation tax. When the school district is given a charter making it independent of its town, the succession of taxes is modified. A volume would hardly suffice to instance all the variations and combinations of duties of the taxpayer in different states, or even in different parts of the same state, growing out of the separately chartered taxing powers and their limited independencies.

The cities of Washington, D. C., which has practically absorbed Washington county and become identified with the District of Columbia; Philadelphia, Pennsylvania; New York; Brooklyn (January 1, 1896), New York; New Orleans, Louisiana, coextensive with Philadelphia, New York, and Kings counties and Orleans parish respectively, but continuing to exercise some functions of counties, and San Francisco, California, identical with San Francisco county, represent simply a growth by which cities have filled county boundaries, and not an independence of counties.

GEOGRAPHIC LITERATURE

The receipt at a somewhat late hour of two important articles published in this number of the magazine has necessitated the holding over until April of the entire Department of Geographic Literature.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1895-'96.

Special Meeting, January 31, 1896.—Vice-President Greely in the chair. Mr Richard Villafranca, Commissioner General from Costa Rica to the Atlanta Exposition, read a paper, with lantern-slide illustrations, on The Geography, People, and Resources of Costa Rica.

Regular Meeting, February 7, 1896.—Vice-President Merriam in the chair. Mr W J McGee delivered an address, illustrated by lantern slides (mostly from original photographs), entitled "A Sojourn in Seriland: Explorations among Hostile Savages of the Gulf of California."

Special Meeting, February 14, 1896.—President Hubbard in the chair. Commander Z. L. Tanner, United States Navy, described his cruise in command of the United States Fish Commission steamer *Albatross* from the north Atlantic to the north Pacific, via the strait of Magellan and the Galapagos islands. Practical details of the scientific work and views of the various ports visited were given by means of lantern-slide illustrations.

Regular Meeting, February 21, 1896.—President Hubbard in the chair. Hon. George C. Perkins, United States Senator, read a paper, illustrated by lantern slides, on California: her Geography, Scenery, and Resources.

Elections.—New members have been elected as follows:

February 3.—John M. Comstock, Dr F. P. Dewey, Herbert Forsyth, Capt. D. D. Gaillard, U. S. A., Edward M. Kindle, Gen. Nelson A. Miles, U. S. A., R. A. Pearson, W. S. Post, W. P. Robinson, Wm. A. Taylor, Col. W. B. Thompson, Thos. L. Watson, Hon. Andrew D. White.

February 14.—Dr J. O. Adams, W. H. Baldwin, Jr., Miss Amy M. Bradley, Levi J. Bryant, Mrs M. L. Byington, Mrs J. A. Campbell, Col. H. W. Closson, U. S. A., J. Ashley Cooper, Gen. W. P. Craighill, U. S. A., Claas Denekas, Pay Inspector L. A. Frailey, U. S. N., Chief Justice Melville W. Fuller, Col. D. S. Gordon, U. S. A., Dr Ida J. Heiberger, F. J. Heiberger, James G. Jester, Lieut. W. Lacy Kenly, U. S. A., Mrs W. H. Kerr, T. A. Lambert, James B. Lambie, Noble D. Larner, Daniel W. Lord, Wm. G. Lown, Samuel Maddox, Chas. Addison Mann, Jr., Edward J. McQuade, Hon. John L. Mitchell, U. S. S., W. Henderson Moses, Owen Owen, A. S. Perham, August Peterson, Dr Chas. V. Petteys, Robert A. Phillips, Mr J. B. Pioda (Swiss Minister), Rev. Philip M. Prescott, J. M. Rieman, John W. Saville, Thos. W. Smith, Capt. J. A. Snyder, U. S. A., W. E. Speir, Pearce Thompson, Capt. R. Vance, U. S. A., W. H. Veerhoff, Dr John E. Walsh, John Sidney Webb, Oscar W. White, Ernest Wilkinson.

Obituary.—General John Gibbon, a distinguished officer and gallant soldier, died in Baltimore February 6. Graduating at the United States Military Academy in 1847, he rose to be a brigadier-general in the regular Army and a major-general of Volunteers. Alike against the Seminoles in Florida and the Nez Perces and Sioux in the northwest, in the Mexican war and in the war for the Union, he served with conspicuous gallantry, winning distinction whether he was in command of a regiment, a brigade, a division, or an army corps. The most desperate battles of the army of the Potomac found him at the front, and he was severely wounded both at Fredericksburg and Gettysburg. As a man, General Gibbon was greatly respected, and The National Geographic Society deplores in his death the loss of a valuable member, who in the course of 45 years of active service had gained a practical knowledge of the geography of the United States such as few men have the opportunity of acquiring.

No one unacquainted with Professor W. H. Dall's earlier work as an explorer would imagine from the reading of his modest article on pages 110 and 111 that he himself bore an important and honorable part in one of the expeditions to which he refers. To all, however, except the younger generation, this fact is well known, as is the further fact that Professor Dall's continued explorations and researches in Alaska and the North Pacific ocean for the long period of 30 years have led to his recognition as one of the best informed men of the time on all matters relating to that most interesting and increasingly important section of the globe. After the abandonment of the overland telegraph project in 1867, Mr Dall remained for some time in Russian America, witnessing its transformation into Alaska as the result of its purchase by the United States. On his return, he published numerous articles of great scientific value, and in 1870 appeared his well known work on Alaska and its Resources. As an assistant in the U. S. Coast Survey from 1871 to 1874, he devoted himself largely to Alaskan studies, making repeated visits to the far north and publishing from time to time the results of his investigations concerning it. In 1884 he joined the U. S. Geological Survey, of which he has since remained an officer. He is also closely identified with the Smithsonian Institution, of which he is an honorary curator.

The proposal to establish a permanent directorship-in-chief of scientific bureaus and investigations in the Department of Agriculture, to give coördination and continuity to the many-sided scientific work of the Department and to complete the good work done by the present Secretary in protecting the scientific force from the onslaught of the political spoilsman, has excited great interest in the scientific world and called forth a very notable expression of favorable opinion from a large number of eminent scientists and scientific educators. Within a brief period—in fact, since February 18, President Gilman and the faculty of Johns Hopkins, President Dwight and the scientific faculty of Yale, President Schurman of Cornell, President Low of Columbia, President Adams of Wisconsin, President Francis A. Walker of the Boston Institute of Technology, Dr Shaler, dean of the Lawrence Scientific School at Harvard; Dr John S. Billings, of New York; the Joint Commission of the Scientific Societies of Washington, and the presidents and other officers of various state universities and colleges have given the proposal the very strongest indorsement. While the recommendation is scarcely likely to be favorably acted upon at the present session of Congress, it is too obviously a step in the direction of a more effective and at the same time more economical administration—too manifestly in the interest of good government in general—for its adoption to be long delayed.

A preliminary announcement of the Mexican census of 1895 gives a total population of 12,542,057, as against 9,908,011 at the census of 1879, and 11,632,924 as officially estimated in 1889. The population of the principal cities is said to be as follows: City of Mexico, 339,935; Puebla, 91,917; Guadalajara, 83,870; San Luis Potosi, 69,676; Monterey, 56,835; Merida, 56,702; Pachuca, 52,188; Durango, 42,166, and Zacatecas, 40,026.

A GOLD MEDAL

WILL BE AWARDED BY

The National Geographic Society

to such **pupil in a public high school** in the United States as shall compose and submit by **October 15, 1896**, the **best original essay**, not exceeding 2,000 words in length, on the **Mountain Systems of the United States.**

A **Certificate of Proficiency** will also be awarded for the **best essay received from each State**, provided such essay is of sufficient merit to justify the award.

Essays will be received only from such public high schools as formally announce their intention to compete by **May 31.**

All competitors will be required to make a formal certification on honor that they have not received aid from any person in the composition of their essays.

The Adjudication Committee consists of General A. W. Greely, Chief Signal Officer, U. S. Army; Dr. T. C. Mendenhall, President of the Polytechnic Institute, Worcester, Mass., and Prof. W. B. Powell, Superintendent of Public Schools of the District of Columbia.

EVERETT HAYDEN,
WASHINGTON, 1515 H STREET N. W. *Secretary.*

THE APRIL NUMBER

— OF —

THE NATIONAL GEOGRAPHIC MAGAZINE

will contain several important, illustrated articles relating to

THE PACIFIC SLOPE,

TOGETHER WITH A

MAP OF SERILAND,

including TIBURON ISLAND, based upon recent geographic explorations and surveys;

— ALSO A MAP OF —

THE OLYMPIC COUNTRY

and new determinations of the elevation of several of the Principal Peaks of the Cascade Range.

JUDD & DETWEILER, PRINTERS, WASHINGTON, D. C.

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AN ILLUSTRATED MONTHLY

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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 over 1,300. 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 will be sent regularly to all members, both active and corresponding.

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

W. D. Johnson, Topographer

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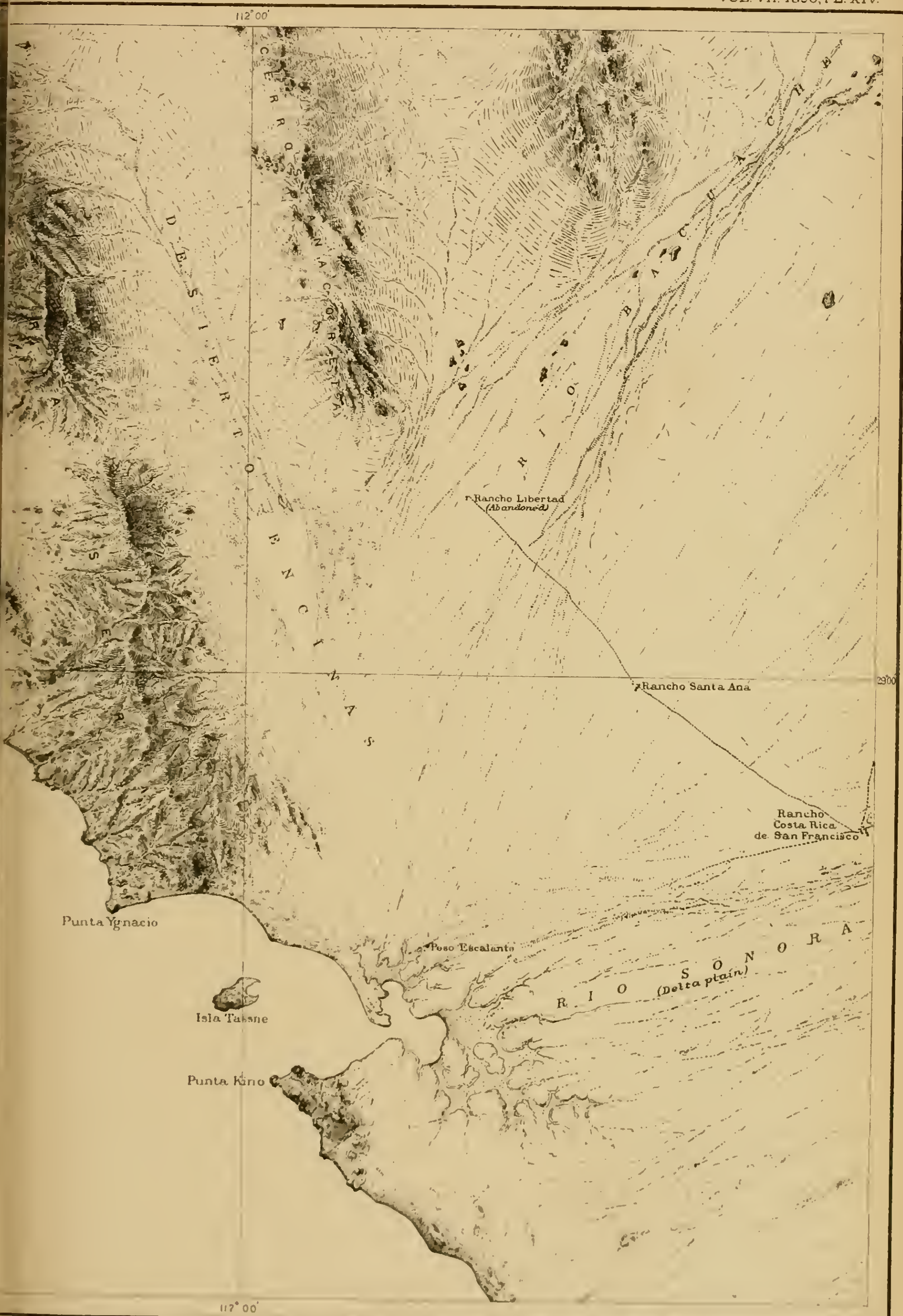

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W. D. Johnson, Topographer

W J McGee, Ethnologist in Charge

SERILAND

SONORA, MEXICO

From surveys Bureau American Ethnology Expedition, 1895

(Coast-line mainly from U.S. Hydrographic Surveys)

Scale: 7 miles to 1 inch

THE

National Geographic Magazine

Vol. VII APRIL, 1896 No. 4

SERILAND

By W J McGee and Willard D. Johnson

After three weeks of seasoning in the saddle, we pushed through the water-gap trenching the chief range of central Sonora and descended the sand-wash (commonly dry, locally wet) for a hard day to the adobe hamlet of Bacuache, and next morning one of us climbed a near-by butte to make a planetable station and incidentally to realize the peculiar isolation of the long-promised land of the Seri Indians, still fifty miles away. On the same afternoon of November 29, 1895, we left sand-wash for butte-dotted plain in time to see the setting sun shadow a jagged mountain crest far out on the broad barrier desert; and the grim fatherland of a fierce tribe, the terror of explorers since Coronado, the dread of Sonora today, the nightmare of the few local settlers, the cynosure of all eyes of the party, was spontaneously, and so unconsciously that no one could remember the sponsor, christened Seriland. Later, in traversing the hard desert and climbing the rugged Sierra Seri, and about the guarded camp fire on Isla Tiburon, alternative names for the territory were sought and temporarily used, but they soon slipped away, while the simple appellation clung.

So Seriland was named, and for present purposes, at least, the informal christening may be made formal.

The little party of the Bureau of American Ethnology pushed on from Bacuache, making stations by the way, to Rancho San Francisco de Costa Rica, where they were met by the owner, Señor Pascual Encinas, the now aged but always intrepid Seri fighter, with his good wife Doña Anita. There a small party was organized and a little boat was built, and the surveys were pushed into and eventually over the barrier desert and harsh mountains of Seriland, both continental and insular. The story of the work is not without interest, but must be left for other pages.

The instrumental outfit comprised a planetable with compass and alidade, but no means of hypsometric determination. The planetable triangulation was carried from the international boundary, and the scale is fixed by the boundary work in conjunction with the coastwise positions determined by the United States Hydrographic surveys of the *Narragansett* in 1873–'75. From Tiburon the survey was carried eastward beyond Hermosillo, and from this line the surveyed zone contracts somewhat northward to the boundary. The area covered is about 10,000 square miles; 47 stations were occupied for control, and a considerably larger number of additional points for sketching. The accompanying map of Seriland represents only the extreme southwestern portion of the area surveyed; within it 16 stations (including the culminating point in Sierra Seri) were occupied for control as well as for sketching. It should be noted that both control and sketching are hardly what might be desired on the western slopes of Tiburon island.

The district including Seriland may be likened unto a great roof-slope stretching from a lofty comb in the Sierra Madre to and under the gulf of California as into a huge eaves-trough; but the slope is diversified and the eaves-line interrupted by outlying ranges and buttes. The most aberrant part of roof-slope and eaves-line is Seriland; for here the outlying ranges are of exceptional magnitude and rise even beyond the general coastline to form the largest island in the gulf. In general the outline of the coast would not be greatly changed, but only shifted somewhat inland or offward, if the sloping plain of Sonora were to sink or rise a few hundred feet; but if Seriland were lifted only a hundred feet its strait would be drained and Tiburon island would join the continent, while if it were depressed two or three hundred feet the entire province would become two great islands, and even if Sonora were sunk 3,000 feet or more Seriland would persist as an archipelago far in the offing. Thus the land of the Seri stands forth conspicuously on the broad continental slope by reason of exceptional altitude.

Most of the vapor of the Pacific floats over the sun-parched plains and lower mountains along the coast and rolls far up the slope toward the Sierra Madre before it is condensed, and thus the region is arid. Streams rise in the high Sierra indeed, especially during the midwinter and midsummer rainy seasons, and rush down the strong slope toward the gulf in roaring torrents; but so dry are air and sand that even the largest floods are absorbed well up the incline—and between mountain-born Colorado and sierra-fed Yaki, 500 miles apart, no river ever reaches the sea. The precipitation is greater on the outlying ranges, especially the lofty masses of Seriland, than over the intervening plains; yet everywhere the rainfall is so slight that the region is semidesert, with broad belts of Saharan sands between the coastward ranges. The local configuration about Seriland appears to favor local winds (rising into nearly continuous gales during December, 1895), and the unstable air brings forth fogs which feed the flora of coast and foothills; but little moisture in rain, dew, or fog ever reaches that broadest of the desert plains of western Sonora, the natural boundary of Seriland, Desierto Encinas. So the aboriginal principality of Seriland is set apart, isolated, practically insulated so far as life is concerned, by a natural barrier. It is to this natural isolation, as well as to the ferocity of the natives, that the checking of exploration and evangelization at the Seri frontier is to be ascribed; yet at the same time the characteristics of the savages are in a measure due to their isolation (as shown elsewhere), and thus natural condition and artificial custom have coöperated cumulatively through the centuries to prevent earlier study of the stanch little dominion of the Seri.

The topography of Seriland is striking by reason of the ruggedness of the ranges which rise steeply from great apron-like expanses of foot-slope or plain. The abrupt transition from jagged cliffs above to smooth plains below conveys irresistibly the impression that the mountains are buried to their ears in vast torrential deposits which line the intervening valleys to profound depths; and the geologist is surprised and distrustful of observation until many times repeated when he finds that the intermontane expanses are simply planed rock strata with a scant veneer of torrent-spread alluvium. This topographic paradox, of which the whole of Seriland and much of adjacent Papagueria form a great example, is well illustrated in a section exposed in the shore between Puerta Infierno and Punta Ygnacio. A quarter of this 15-mile exposure is the current-built point, another quarter cuts butte or range of igneous rock or ancient granite, while the remaining half traverses typical intermontane plain in cliffs of 20 to 50 feet, and fully 5 out of the 7½ miles of the low cliff reveal the substratum of planed granite beneath a torrential veneer, while there is more of alluvium-free granite than of graniteless alluvium. The sharp contrast between mountain and plain is doubtless due to the character of the scant rainfall; but the relation need not be further pursued at present. Hardly less striking than this general topographic relation are the strong local features of the topography. Tiburon island is but 30 miles long and less than 20 wide, yet it contains several ranges, the dominant one (Sierra Kunkaak) of Alpine ruggedness throughout most of its 4,000 feet of altitude. Sierra Seri is an imposing assemblage of peaks, aretes, precipices, and profound gorges, cutting the azure at fully 5,000 feet, though the width of the range from strait to desert is but 10 miles. Even more impressive than the mountains, to the explorer on the ground, is Desierto Encinas—the broad waste of playas and sand dunes lying over against the Papago of old, the law-bound Sonora of today. Toward its broad basin-shape expanse storm freshets flow apparently from all directions, yet it is never filled and rarely wetted, and the scant water sometimes rising to the surface on its steeper western slope is saline; it is partly barred from the gulf and lined in its lower levels by a sheet of sediment charged with recent marine shells, which show that at no remote day it was an arm of the sea. Of interest, too, is the gale-swept strait El Infiernillo, for the foot-slopes on island and mainland are just such as sweep down and merge between the parallel ranges of the interior, and extend nearly or quite to the coastline where they are cut by wave-carved cliffs or pass into current-built sand-spits, making it manifest that the strait was originally a subaerial valley like those of the interior and only recently occupied and slightly modified by the sea. Isla Tassne, too, is a noteworthy feature; though but a fraction of a mile in any dimension and for the most part a wave-built bench, its nucleus is a 500-foot spire of rock, the half-submerged crest of a twinned peak. on which myriads of water fowl nest. The topographic detail of Seriland is that of water-carving or water-building, yet the aridity is such that the work must proceed at infinitesimal rate. The dearth of water is a burning question to the explorer, a vital element in prospective conquest of Seriland for the behoof of civilized man. In all the half dozen valleys, the hundred barrancas, and the thousand storm-cut gorges, there are probably less than a dozen nominally permanent, and but two or three actually permanent, sources of fresh water in the territory.

VIEW OF SERILAND

Camp at Seri Rancheria on Tiberon Island. Location, base of sand-spit looking eastward over Puerta Infierno toward southern part of Sierra Seri. Expedition boat *Anita* at anchor.

The geology of Seriland is worthy of study. The prevailing rocks of the principal ranges are rather ancient (probably Mesozoic or early Tertiary) lava sheets with associated tuffs and breccias, while in several localities, notably the western foot-slopes of Sierra Seri, there are large areas of still more ancient granite, often slightly schistose and intersected with dikes and veins. It is the current belief in Sonora (a belief based partly on the use of rare minerals as face-paint among the Seri) that rich deposits of ores and precious metals exist in Seriland, and certain portions of the area examined certainly appear worth prospecting; but no rich deposits were found, and most of the rocks examined are unpromising. The dominant geologic feature of the territory is that reflected in the topography—the abrupt transition from rugged mountain to smooth peneplain of similar rocks with a veneer of fragmental debris. Generally this debris is unconsolidated and fresh-looking, though sometimes it is cemented by siliceous or ferruginous matter, and toward the eastern side of Desierto Encinas even the superficial portions of the alluvium are somewhat indurated, as if by calçareous infiltration, into a mass known as caliche in western Mexico (the tepitate of eastern Mexico). No deposits postdating the extravasation of the lavas and the outlining of the mountain ranges were seen save the shell-charged sands of Encinas desert; these deposits and the shelf skirting Tassne island on north and east suggest relatively recent uplifting, while the configuration of shores, especially in Estrecho Infiernillo, demonstrates relatively recent subsidence, so that to one of us, at least, the combined records indicate local warping. To some extent in Seriland, as decidedly in contiguous Papagueria, the divides are migrating northeastwardly, and this widespread characteristic suggests a relatively recent tilting of the land southwestward, whereby the feeble streams flowing with the increasing slope are stimulated while those flowing against it are paralyzed.

The meager flora of Seriland is peculiar. The conspicuous forms are cacti, comprising the monstrous saguesa (a *Cereus* related to *giganteus* but still larger) and wide-branching pitahaya (*Cereus thurberi*) on the foot-slopes, with the cina (*Cereus schottii*) and cholla (a cylindropuntia) at lower levels and the water-bearing bisnaga (*Echinocactus*) here and there on the mainland, though few and far between on the island. The ghostly okatillo (*Fouquiera splendens*) is fairly abundant, and there are occasional yuccas and a variety of the more slender agaves. The prevailing trees, which are usually little more than shrubs, are mesquite, catclaw (*Acacia greggii*), and paloverde (*Parkinsonia microphylla*) on plain and foothill, and paloblanca, torote, and torotito among the mountains; the prevailing shrub is the creosote bush (*Larrea tridentata*), with a variety of small mimosas and other brambles, all scrubby and all beset with thorns or endowed with foul flavors and odors; and about the few permanent waters there are patches of bamboo-like reeds, which are used by the Seri in making balsas and sometimes in building bowers for habitation. It is not too much to say that there is no soil in Seriland, for the scant moisture and slow-growing plants do not produce humus; and the gray or ashen earth between the scattered plant-colonies glares starkly in the glowing sunlight, inflaming the eyes of the traveler as in snow-blindness. Two general features of the vegetal life of the region may be noted: Partly by reason of the absence of humus, the superficial deposits are comminuted mechanically but imperfectly reduced chemically, so that they vary from place to place with the variation in rocks and quantity of water, and thereby tend to produce local floras, or a provincial habit of the general flora; while it results from the dearth of water and strength of sun that the plants strive against the inorganic environment rather than against each other for continued existence, and are thereby brought into a curious coöperation, whereby nearly all plants (and animate organisms as well) gather into colonies for mutual support. These relations, though highly significant and attractive, need not be pursued here; it suffices to say that they profoundly affect the flora which, as even a casual traveler cannot fail to note, varies notably from place to place, and is generally gathered in close-set tufts or bunches, with broad bare spaces between. The flora on island and mainland is essentially the same; and the coasts, insular and continental, are skirted with a zone of pulpy-leaved shrubs and bushes apparently watered by fogs.

The fauna of Seriland includes the bighorn and bura (a large, sluggish deer) in the mountains, the antelope, peccary, and blacktail deer on the plains, with the jackrabbit and coyote everywhere; the jaguar is reputed common and the puma rarer—the assemblage of large game animals being rich enough to tempt the sportsman. The turkey is said to haunt the saguesa forests and the California quail may be seen hourly, and small birds are surprisingly numerous, while hawks, eagles, and burrowing owls abound. The rattlesnake, scorpion, centipede, and tarantula furnish spice for the fare of the traveler, while rainbow-hued swifts and somber, slow-moving lizards of alleged poisonous bite harbor numerously in the scattered plant colonies. Ground-squirrels and kangaroo-rats are common. On some portions of the island the squirrels abound exceedingly, so that the land is laid out in hexagons by their surface trails, while each third or fifth footfall of the pedestrian stops half knee-deep in subsurface burrows. There are ants galore, and myriads of black bugs that apparently fertilize the cacti, but mosquitoes, gnats, and other pernicious insects are apparently unknown. The coöperation of the vegetation extends unto the animate life of plain and mountain to the extent that all living things dwell together in singularly perfect harmony; but this feature of the life may be passed over. Along the coast the green turtle abounds and forms the chief fare of the Indians, and his shells shingle the more permanent house-bowers. Fish and crustaceans swarm, edible crabs and oysters and superb lobsters await gathering, and clams sprinkle the coastwise mud flats. The gray pelican breeds on Isla Tassne—the first-formed land of earth as built by the Ancient of Pelicans, in Seri myth,—and his flesh feeds, while his feathered skins clothe, the ever-warring holders of Seriland; and other water-fowl, from swan to snipe and from cormorant to curlew, chatter and scream and croak about the rocky islets and spurs, especially on the fowls' paradise of Isla Tassne. The seal creeps up on the rocks now and then, the shark scavengers the sea as the coyote the land, and the skeleton of a whale fully 80 feet long on the shores of Tiburon records a famous feast of the Seri when for weeks they found no need for hunting and fishing and for months gnawed gradually softening tendon and cartilage. The subdesert fauna of Seriland is meager and peculiar, but the maritime fauna of the coasts is rich and varied.

The fierce holders of desert-bound Seriland have protected their inheritance from time immemorial, and since the time of Coronado have written their history in blood. Three of their many interesting characteristics are especially notable: They are isolated in language, belief, custom, and sympathy as in habitat; they are dominated by a moral law under which intermarriage with other peoples is capital crime and under which they attain righteousness by slaying humans of alien blood with only greater avidity than beasts are slain, always save when deterred by fear; and they are of a stature, strength, and endurance befitting their hard and eventful lives.

The coast of Seriland has been surveyed, and long ago a pearl fishery was maintained for a time on its borders near Punta Tepopa. There is a tradition that Sergeant Escalante (he who later swam the Gila and saw Casa Grande) wandered into the bounding desert in the seventeenth century, and dug a shallow well which still yields a yellow nitrous water and is known sometimes as Poso Escalante, sometimes as Agua Amarillo; and there are vague rumors of prospectors and other parties landing on island and mainland, but soon retreating with loss of life from poisoned arrow or still more poignant thirst. It is known, too, from living witnesses that Sr Pascual Encinas pushed stock-raising well toward the desert and sometimes even across it to the saline waters at the eastern base of Sierra Seri, the Indians contenting themselves with a heavy impost of surreptitiously slaughtered stock, and that he twice or oftener visited Tiburon, once with a small party for a few hours, once with a larger party, including horses transported by a steam vessel, for two or three days; but until 1895 (when Encinas' trustiest assistants were added to our party and taken far beyond their previous knowledge) the interior, continental and insular, was never surveyed, most of it never seen by white men.

The previously published nomenclature is adopted so far as it goes, together with a part of the unpublished field nomenclature of the Hydrographic Office, save for a few trifling exceptions mostly made with the object of expressing the generic elements in the language of Mexico (articles being omitted for brevity). So far as practicable the specific elements, especially on the insular tract, are Seri, the accents being indicated here but not on the map. It has been sought to use names originally connotive yet of such character as readily to become denotive, due regard being given to euphony and brevity—qualities not easily found among the simple-minded savages. The names applied are as follows, those marked by asterisks being new and those marked by obelisks being recast:

*Seriland: Extra-vernacular name of tribe with English locative.

Mar de Cortez (Sea of Cortez = Gulf of California): Customary Spanish designation.

† Isla Tiburon (Shark island): Spanish.

† Isla San Esteban (Saint Stephen island): Spanish.

† Isla Tass′ne (Pelican island): Specific Seri (sometimes called Alcatraz = Pelican in Spanish).

Estrecho [or El] Infiernillo (Hellish strait): Spanish.

† Puerta Infierno (Infernal gate): Spanish.

† Punta Tepopa (Tepopa point): Generic Spanish, specific of long standing.

* Punta Ygnacio (Ygnacio point): Specific in honor of Ygnacio Lozania, a trusty aid who had previously visited this point.

* Punta Mashem′ (Mashem′ point): Specific in honor of sub-chief Mashem′ (sometimes called Francisco Estorga), who speaks Spanish and acted as interpreter in 1894.

† Punta Kino (Kino point): Specific (of long standing) in honor of the early missionary.

* Sierra Seri (Seri range): Generic Spanish, specific the extra-vernacular tribe name.

* Sierra Kunkaak′ (Kunkaak′ range): Specific the vernacular tribe name.

* Cerros Anacoreta (Anchorite hills): Spanish.

* Disierto Encinas (Encinas desert): Generic Spanish, specific in honor of the intrepid settler on the outskirts of the desert.

Poso Escalante (Escalante well): Generic Spanish, specific in honor of the early explorer.

Rancho San Francisco de Costa Rica: Spanish (elements transposed on map through error).

Rancho Santa Ana: Spanish.

Rancho Libertad: Spanish (now abandoned).

Rio Sonora: Spanish.

Rio Bacuache.

THE OLYMPIC COUNTRY

By the late S. C. Gilman, C. E.

[The following valuable article is based largely on the explorations of the writer in the comparatively unknown region he describes. A melancholy interest attaches to it, Mr Gilman having been suddenly cut off, at the early age of thirty-six and in the midst of an increasingly useful and promising career, only a few days after the transmission of the article for publication and before he could be made aware of its acceptance.]

The Olympic peninsula, in northwestern Washington, forms the extreme northwest corner of the United States proper. It lies west of Puget sound, Admiralty inlet, and Hood's canal, commonly spoken of collectively as Puget sound, and extends over 90 miles along the south side of the straits of Juan de Fuca. Its west coast borders for 100 miles on the Pacific ocean, while Gray's harbor and the Chehalis river furnish deep-water navigation for 30 miles along its southern border, leaving only a neck of 25 miles in width connecting its southeastern part with the mainland.

THE TOPOGRAPHY OF THE MOUNTAINOUS REGION OCCUPYING THE CENTRAL PORTION OF THIS MAP IS BASED ON THE EXPLORATIONS OF MR S. C. GILMAN, C. E., WHOSE ARTICLE, "THE OLYMPIC COUNTRY," APPEARS IN THIS NUMBER.

As the northern, eastern, and southern sides of the peninsula, bordering on Fuca straits, Puget sound, and the Chehalis river and Gray's harbor, are partially settled and comparatively well known for six to ten miles back from those waters, this article will have reference almost exclusively to the interior and western portions of the peninsula. The whole peninsula contains an area of about 5,700 square miles, of which probably 3,000 square miles are occupied by the Olympic mountains, from which the peninsula takes its name.

The main watershed of these mountains begins at cape Flattery and extends southeasterly almost parallel with the straits and about 12 miles therefrom until nearly south of Port Angeles, where an abrupt turn to the south is made for about 6 miles, passing by the east end of mount Olympus; thence southeast 20 miles to Pyramid peak; thence southwest and gradually swinging to the west for 30 miles to mount Frances at the head of Quinault lake; thence southwest for about 18 miles, rapidly decreasing in height until it reaches its termination. Such is the general course of the divide between the waters flowing westward to the Pacific ocean and those flowing to the north, east, and south into Fuca straits, Puget sound, and Gray's harbor. From the main divide, and in many places exceeding it in height, branch out in all directions spurs and ranges, they in their turn rebranching and branching again, until the complicated ramifications of mountain ridge and peak so completely cover the country with their rugged heights that there is hardly room for the gorges and canyons and ravines that lie between, and none at all for valley or plain. These mountains are a comparatively recent upheaval, and nature has not yet had time to round off their slopes or dull the jagged sharpness of their summits. She has, however, through the agency of an enormous rainfall, cut various gigantic sluices in the rocky face of the mountains, and through these a large amount of detritus is brought down.

Mount Olympus, the name peak, 8,150 feet high, is the highest and most conspicuous mountain in the range. It was first named La Sierra Santa Rosalia, by Perez, in 1774, but in 1788 Captain John Mears saw and described it under the name of mount Olympus. It is about twenty miles south of Freshwater bay on the straits of Fuca, and is southwest of the main divide, with which it connects by a short, sharp, high ridge. It is a cluster of sharp, jagged rock peaks projecting upward through an accumulation of ice which forms a cap two miles wide and four miles long to the main body of the mountain. It is difficult to estimate the thickness of this ice cap. At the close of summer, when it is thinnest, there are places where it has the appearance of being at least 500 feet thick. It is built up many additional feet in thickness by the storms of winter, to be correspondingly melted away again by the succeeding warm summer months. The Queets, Hoh, and Solduck rivers head in mount Olympus, and Higley and Tunnel creeks, branches of the Elwha, have their sources in an ice-field two miles long and three-fourths of a mile wide close to the northeast end of Olympus. Tunnel creek has formed a beautifully arched tunnel 20 feet high and 40 feet wide (in summer), through which it flows for two and one-half miles under an accumulation of ice that fills the gorge to a depth of 100 to 300 feet. These accumulations of ice are very numerous among the higher peaks all through the range.

As for scenery, perched on one of the numerous accessible peaks you are surrounded by towering, sky-piercing pinnacles and ragged, rocky ice-capped ridges that are plowed and harrowed by slides of rock and ice and chiseled and worn by ages of rushing water, mantled with snow and garlanded with great patches of roses and daisies and dainty mountain flowers and gowned with dense, dark evergreen forests, reaching far down into cavernous depths of canyon and ravine, across which on some opposite mountain side is rushing down from its icy fountain head a tumultuous mountain torrent which finally dashes over a lofty precipice and is lost in a veil of mist in the valley below. Away to the west is seen the ocean with its lazily rolling billows, the dark trail of a steamer's smoke, and the white sails of a ship just showing above the horizon. To the east lie Hood's canal and Puget sound, with their bays and arms and inlets spread out like silver leaf on a carpet of green. Beyond rise the dark, wooded slopes and snow-clad summits of the Cascades, with grand old Rainier standing guard to the southeast and the majestic Baker to the northeast.

Lakes Cushman, Crescent, and Quinault are all of considerable extent and great depth. At Quinault lake, nearly 20 miles from the ocean, the boom of the breakers on the beach is plainly heard during and after a storm, but the sound comes from the opposite direction to the ocean, being reflected from the slopes of mount Frances on the east. For 25 miles north from the mouth of Gray's harbor is a stretch of broad, smooth, hard, sand beach reaching to point Grenville. From point Grenville to cape

Flattery, bluffs 100 to 250 feet high border the ocean. Sometimes they stand a little back, leaving a narrow strip of loose sand, gravel, boulders, or slippery ledge between them and the sea. Sometimes they approach a little closer; the strip of sand or rock is correspondingly narrower and covered with water as the tide rises. Often they push boldly into the sea, which continually surges and dashes at their feet and leaps high up their face. About five miles southwest of the mouth of the Hoh river and four miles offshore is Destruction island, so called on account of the numerous wrecks that have occurred on its reefs and on the adjacent main shore. The island stands among many broad reefs, some of which are just visible at low tide, and over these the ocean swells foam and boil at high tide. It rises abruptly, with precipitous sides, 80 feet above the water, and then spreads out smooth and level about 60 acres in extent. The Hoh Indians have long cultivated several small potato patches on it and have also used it as a lookout station for whale, in the capture of which animal they have attained great proficiency. The United States Government has built on the island a lighthouse of the first order, 80 feet high, with a double fog-horn and the usual auxiliary buildings. It commands a fine view of the coast and mountains.

On the mountains, above 4,000 feet, the timber is very scrubby and infrequent, owing, probably, as much to the barrenness of the soil and the great depth of snowfall as to the elevation. At a lower altitude, among rocky crags, are thousands of acres of the finest grazing lands, well watered by innumerable rivulets and pools, fanned by the winds from the ocean, and free from flies, mosquitoes, and all other annoying insects. Of course, these grasslands would not be habitable during the winter, but they would be available from the first of June until December. Among the rocks at the edge of the grasslands, and just below the ice-fields, blueberries, huckleberries, and bearberries grow in profusion, and the season for them lasts from July to October, as they follow the snow up as it melts away, blossoming just below it and ripening a little lower down. These berries attract thither large numbers of black bear, and it is the exception when none are in sight among the peaks during the berry season. These open grasslands are also favorite ranges for large numbers of the elk that are common all over the peninsula and bands of fifty or more are often seen. From 4,000 feet down, the timber is good and thrifty. The Alaska cedar, from one and one-half to five feet in diameter and running up smooth and tall, is a very valuable variety of timber and is common down to 1,000 feet above sea level. The mountains and uplands of the peninsula generally are heavily timbered with hemlock, cedar, spruce, fir, balsam, pine, vine-maple, alder, cottonwood, yew, cherry, etc., prevalent in about the order named and of the usual Puget sound size and quality. The valleys and bottom lands are densely covered with alder, vine-maple, cottonwood, willow, boxelder, crab-apple, ash, dogwood, and occasional immense bottom-land spruces. There is frequently also a very heavy undergrowth of sallal or salmon-berry or of hazel or of mountain hemlock. It is also a great country for moss, which grows deep on the ground and down timber and on the trunks of standing trees and hangs in long streamers from the twigs and branches, and is always wet and slippery except in the dry season. Many beautiful varieties of small, delicate ferns grow among the forests. On the prairies, which are neither numerous nor large, and which are often gravelly, though sometimes containing a very rich soil, a large and coarse variety of fern grows four to ten feet high.

Between the mountains and the coast are about 1,300 square miles, or 830,000 acres, of comparatively level valley and bench lands. Of this about 225,000 acres are rich bottom lands along the various streams. The soil of these bottom lands cannot be surpassed anywhere on the coast. The uplands are generally rolling, but there are several quite extensive and comparatively level tracts. The fact of these lands not draining readily has encouraged the growth of fine bodies of large cedar, with, in some places, tall, smooth, large, white pines scattered among them. These cedar lands are in no sense swamps or bogs. The soil is a heavy clay, into which the sluggish streams have not cut very deep channels, and they are frequently clogged or turned by fallen timber, so that during the rains the streams overrun their banks and spread pretty much all over the country, keeping the ground well soaked all through the rainy season. There are, however, abundant facilities for drainage. The soil is excellent, and there are numerous small openings sufficiently large for nice farms. The soil of the rolling uplands is generally a rich, shot clay, but sometimes quite gravelly. The timber is generally very heavy and it will be many years before all the good land is under cultivation. There are, however, many open places and small creek bottoms and depressions among the hills that can be very easily cleared. In fact, there are few 160-acre tracts on which cannot be found ten or more acres of good land comparatively easy to clear, and the timber on all these lands will be valuable in a few years and be a help instead of a hindrance in establishing a home.

The principal streams draining this slope are the Quillyhute and its four branches, the Dickey, the Solduck, the Killawah, and the Bogachiel; the Hoh, Queets, Quinault, and Humptulips. They are all clear, cold, rapid streams, capable of floating logs and being canoed considerable distances. They teem with salmon and trout. The Quinault salmon, peculiar to that stream, is a short, thick fish, weighing from three to seven pounds and said to be the finest variety of salmon on this coast. Opportunities for developing good water-power at very small cost are numerous along these streams, and especially so in the mountains. Game is plentiful, and it would be a paradise for the hunter were it not so difficult of access. In addition to elk and bear, before mentioned, are deer, mountain goat, cougar, beaver, otter, fisher, wildcat, marmot, geese, ducks, grouse, partridge, quail, pelican, and many smaller or less desirable birds and animals. Off the beach from Gray's harbor to point Grenville is one of the few sea-otter ranges of the world. It still furnishes a few hides of that valuable fur to market each year.

The country rocks of the mountains are syenite, gneiss, quartzite, protogene, crystalline and chlorite schists, slate (hard black flinty to soft green talc) shale, sandstone, trap, and basalt. In the foothills on the west and along the coast the formation is principally shales, sandstone, cement gravel, conglomerate (in one place near Hoh Head, boulder conglomerate), clays and drift gravel and sand. Limestone much criss-crossed with small quartz seams is found in a few places. Clays are especially abundant and good-appearing, and, so far as tried, give very excellent analytic returns. Beds of partially formed lignite are abundant along the coast between the Quinault and Quillyhute rivers. In a bluff, a few miles south of the mouth of the Hoh river, four seams of such lignite, from 18 inches to 3 feet thick, show, lying horizontally one above the other, and separated by 4 to 12 feet of sand or clay or both. In this lignite the form of roots, trunks, and limbs of trees, also the grain of the wood, show very distinctly, and occasionally pieces of wood, but little changed, are found. Small seams of very good coal crop out in several places in sandstone and shale, but they are too small, so far as found, to be of any value. Between Pillar point and

Clallam bay, on the straits of Fuca, is the abandoned Thorndike coal mine. There are said to have been "six leads of coal, ranging in thickness from 1 to 3 feet, dip 10 degrees, distance between coal leads, 12 to 100 feet, formation sandstone." This is said to have been one of the best coals found in Washington. It was mined for some time, until it pinched out or was cut off by a fault and the vein was lost and work abandoned.

In the valley of the Solduck river, among the mountains, is a group of springs which discharge quite a volume of hot water of undetermined medicinal value. Fine springs heavily charged with iron or sulphur are very numerous. On the coast just south of the Queets river, in the bluff along the beach, are several small alum springs. The alum is present in very small quantities, and cannot be detected during the rainy season, when the natural flow of the springs is reinforced by the numerous rains; but during the dry season, when the springs are at their lowest ebb and when the water from them is evaporated very fast as it trickles down the cliffs exposed to the afternoon sun, the alum marks with white streaks the margin of the rivulets. There is also some borax present, and probably other chemicals might be found in measurable quantities.

Several varieties of iron ore are scattered promiscuously over the peninsula in limited quantities, and ocher and iron stains are numerous. Near Port Townsend is a deposit of limonite that has been worked for some time. On the headwaters of the Humptulips river is a vein of magnetite about one foot thick. On the coast south of Raft river is a bed of clay ironstone of very low grade and so badly mixed with sulphurets as in all probability to be worthless. The traces of iron are so abundant and widespread that it would seem that there must be somewhere in the peninsula extensive deposits of a pure and valuable ore.

Colors of gold are found in the beach sands and along several of the streams in the mountains, and in a few places fair wages have been made washing it. Low grade silver and copper ore are found in good-sized veins in the mountains. Comparatively little prospecting has been done, owing to the inaccessibility of the region; not enough to determine its value as a mineral country.

It does not seem reasonable to suppose that the great upheaval of these mountains has been accomplished without bringing within reach some valuable mineral deposits. The principal apparent wealth of the peninsula is in its immense forests of fine timber, of which the Alaska cedar of the mountains will soon be an important factor, and in the large area of fertile valley and benchland on its western slope.

The climate of the western slope of this peninsula is a little different from that of the rest of western Washington. Owing probably to its proximity to the ocean and its accessibility to the ocean breezes, there is more wind and much less foggy weather. The amount of rainfall on the average is in excess of that of the Sound country, but it comes in the shape of sharper showers and heavier storms, thus allowing a much greater proportion of fair weather. In the summer the nights are cool, but not cold, allowing tomatoes and corn to ripen perfectly and naturally, as they do not elsewhere west of the Cascades. Except in the mountains, ice or snow is seldom seen, and then only for a few hours at a time.

THE DISCOVERY OF GLACIER BAY, ALASKA

By Eliza Ruhamah Scidmore

(*The Century Dictionary*)

"Discover—4. To gain sight of, especially for the first time, or after a period of concealment; espy; as, land was *discovered* on the lee bow.

"Hence 5. To gain the first knowledge of, as something that was before entirely unknown, either to men in general, to the finder, or to persons concerned; as, Columbus *discovered* the new world; Newton *discovered* the law of gravitation; we often *discover* our mistakes when too late, &c.

"6. To explore; bring to light by examination."

(*Webster's International Dictionary, 1892*)

"Discover—2. To disclose; to lay open to view; to make visible; to reveal; to make known; to show (what has been secret, unseen, or unknown).

"3. To obtain for the first time sight or knowledge of, as of a thing existing already, but not perceived or known; to find out; to ascertain; to espy; to detect."

(*The Standard Dictionary*)

"Discover—To get first sight or knowledge of, as something previously unknown or unperceived; find out; ascertain; espy; detect; *specifically*, to find and *bring to the knowledge of the world;* as, to *discover* a comet, a principle, or plot."

"It is in the highest degree probable that Lief Ericsson and his friends made a few voyages to what we now know to have been the coast of America; but it is an abuse of language to say that they '*discovered*' America."

Fiske, "*Discovery of America*," vol. 1, ch. 2, p. 255.

In a recent communication to the Geographical Society of the Pacific, Rear-Admiral L. A. Beardslee has raised questions as to the discovery of Glacier bay, prompted thereto by an article by Professor John Muir, published in the *Century Magazine*, June, 1895. Admiral Beardslee very flatteringly refers to and quotes in proof certain published notes of my own—notes published in such condensed form for general and average tourist information that not all the details and facts relative to the discovery of and earliest visitors to the bay could be given.

Vancouver's description would dispel some of Admiral Beardslee's references to later visitors, since he very plainly noted the fact that there was a navigable bay with an entrance, and wrote:

"The shores of the continent form two large open bays, which were terminated (July 12, 1794) by compact, solid mountains of ice rising perpendicularly from the water's edge and bounded to the north by a continuation of the united, lofty, frozen mountains that extend eastward from mount Fairweather. In these bays also were great quantities of broken ice, which, having been put in motion by the springing up of a northerly wind, were drifted to the southward."

The Fairweather ice-sheet extended then some 40 miles south of its present limit in the bay. The Russian traders aptly named Icy straits into which the bay debouches, and as there were no Indian villages on its north shore, where currents and floating ice made navigation dangerous, they kept away, and their charts only repeated Vancouver's lines.

The first really known of the existence of this great bay of tide-water glaciers was in 1869, when Kloh-Kutz, the Chilkat chief, told Professor George Davidson of a bay full of breaking ice cliffs lying to the westward of the Davidson glacier in Lynn canal. It was distant only one day's journey on snow-shoes (30 miles), he stated, and Kloh-Kutz urged the astronomer to make the little excursion with him and see the hair-seal riding around on ice cakes and the ice rumbling down like landslides into the water. The visit of ex-Secretary Seward to the eclipse observatory and his waiting to convey Professor Davidson back to Sitka on his private steamer prevented the full discovery of the bay that season by that first and greatest of Pacific coast scientists whose name is so inseparably connected with all of geographic record on that side of our continent.

In 1877, when Lieutenant C. E. S. Wood, U. S. A., and Mr Charles Taylor were prevented from making their proposed exploration of the mount St. Elias region by the mutiny of their native boatmen, the old chief pointed to mount Fairweather and said: "One mountain is as good as another. There, is a very big one. Go, climb that, if you want to." The disappointed explorers were forced to turn back, and then visited the most westerly of Vancouver's great bays south of mount Fairweather, afterward named Taylor bay by Coast Survey officials. In that most interesting and beautifully illustrated article, "Among the Thlinkets," *Century Magazine*, July, 1882, Lieutenant Wood wrote:

"Mr Taylor decided to return home, and we accompanied him to Sitka. There I reëngaged Sam and Myers, and, obtaining a new crew, returned at once to a bay about twenty miles southeast of mount Fairweather. My purpose was to explore the bay, cross the Coast range, and strike the upper waters of Chilkaht."

From that bay he "went with a party of mountain-goat hunters up into the St. Elias Alps back of mount Fairweather—that is, to the northeast of that mountain." He found that great game, also the rare St. Elias silver-tipped bear, crossed the divide to sight of the bush country explored by Mr E. J. Glave in 1891, and returning to the bay spent several days in the seal-hunters' camp in Geikie inlet near the Wood glacier, as they were later named by Professor Reid. Lieutenant Wood had applied for a year's leave of absence, with the intention of making further independent exploration in the interior of Alaska, but it was denied him. His brief reference to the bay in a popular magazine article cannot be accepted as bringing it definitely to the knowledge of the world, since he did not specifically describe, sketch, map, or name any part of the region. In private letters and verbally, whenever the subject has been broached, Lieutenant Wood entirely disclaims being the discoverer of Glacier bay, and very modestly protested against Professor Reid's naming for him the glacier beside which he had camped. It was not vital to him at the time that the bay was not charted; he simply went along with the Hoonahs to the region where they promised great game—not going for glaciers nor glory, but only to shoot mountain goat and see the alpine region behind mount Fairweather.

In October, 1879, Professor John Muir, who for two seasons had been searching for and visiting the glaciers of the Alaska coast from the Stikine river northward, found this bay full of glaciers of which native seal-hunters had told him. He, with his companions, Rev. Hall Young and four Christian Indians from Fort Wrangell, canoed to the head of the bay, camped for a few days,

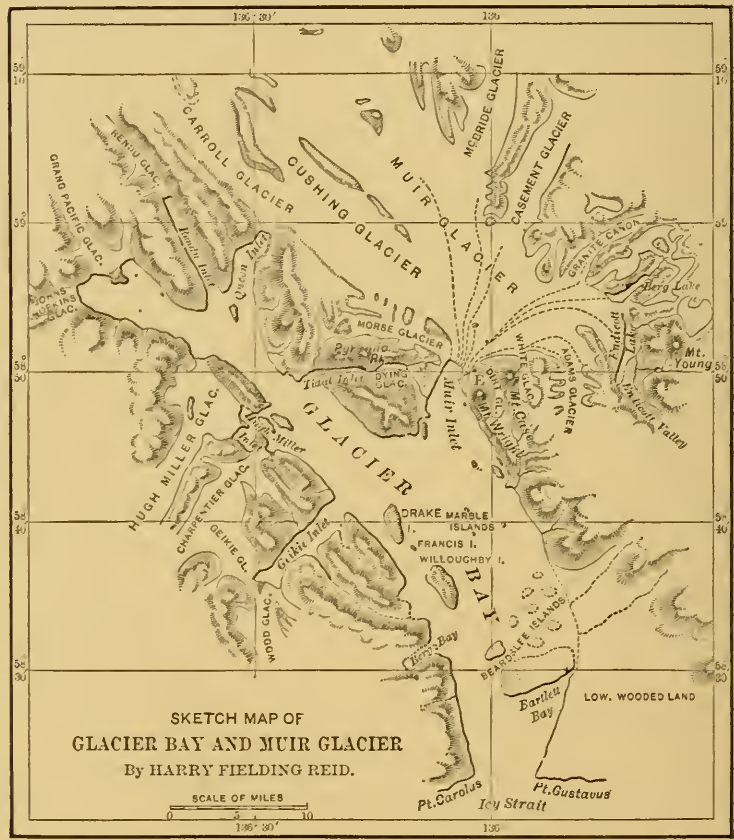
FRONT OF MUIR GLACIER FROM THE WEST MORAINE — MOUNT CASE IN THE BACKGROUND

and made the circuit of its shores. Having found these glaciers, he brought them to the knowledge of the world in the series of letters from Alaska published in the San Francisco *Evening Bulletin*, and described them in lectures illustrated by blackboard sketches of these remarkable "Fairweather glaciers."

In July, 1880, Captain Beardslee brought the steamer *Favorite* into the bay, up to that time unknown to the Russian pilot who accompanied him. They proceeded a little beyond the island then named for the trader, Willoughby, who was with them, and then turned back, fleeing from storm-clouds and fog that greatly alarmed the owners of the chartered steamer, who feared the loss of their insurance in the event of any disaster befalling them in those uncharted and dangerous waters. While Captain Beardslee held parley with the Indians in Berg bay, Ensign Hanus made a running survey of the lower end of the bay, the lines of its northern extension and indentations being drawn in roughly from the descriptions of the native seal-hunters. The Indians at the same time told of the two white men who had come the preceding year, and Captain Beardslee easily recognized Mr Muir from this description, the glacial prospector being well known on the coast. Mr Muir returned to the bay in September, 1880, and spent some weeks exploring the ice-fields. On his return that winter to San Francisco, he again wrote and lectured about the "Fairweather glaciers," the only designation he gave to these ice-streams.

Captain Beardslee described his visit in an official report (Forty-sixth Congress, Second Session, Senate Ex. Doc. No. 145), accompanied by his map of the bay, and also published an account in letters to *Forest and Stream*. By his own personal insistence and a determined stand made at the Coast Survey office, Captain Beardslee had his very apt name of Glacier bay retained on official charts, instead of giving to it the name of some inconsequent and now forgotten statesman whom it seemed officially desirable to flatter at the time. All Alaska tourists owe it to Captain Beardslee that this reserve of such unparalleled scenic grandeur is not vulgarized by some great misnomer.

Captain Beardslee gave a tracing of this chart and notes to Captain James Carroll, and Mr Muir assured that navigator that there was clear navigation beyond the Beardslee islands, and that if he followed the eastern shores he would find anchorage in a broad inlet into which one of the largest glaciers broke away. Captain Carroll took the steamship *Idaho* into the bay in July, 1883, found the inlet and glacier as described, and named them both for Mr Muir. Captain William George, pilot of the *Idaho*, sent a sketch map and notes, with record of the names they had bestowed, to the Coast Survey. It was my good fortune to be one of the *Idaho's* passengers on that voyage, and a pleasure later to inform Mr Muir at his Martinez ranch that the great glacier had been named for him. "Which one of the glaciers do they



From "Alaska Guide Book," *Copyright, 1893, by D. Appleton & Co.*

call mine?" was his amused question and only reply. Mr Muir did not bestow any names in the course of his first ice explorations in Alaska.

The bay has not yet been surveyed and charted by the government, although the Pacific Coast Steamship Company's vessels have regularly visited it since 1883 and landed thousands of enthusiastic passengers in Muir inlet. Through private enterprise the Muir glacier and all its tributaries have been explored and mapped, and the work of Professor Harry Fielding Reid and his assistants leaves nothing for the delinquent government to do in that quarter. Mr Muir canoed across the front of the Grand Pacific glacier and the shores of the bay's end in 1879; Professor Reid made a similar canoe cruise in 1892, and succeeding in it, accompanied Captain James Carroll, who took the large ocean steamer *Queen* around those upper reaches, found the unsuspected Johns Hopkins glacier, and, penetrating two deep inlets, discovered the hitherto unknown Rendu and Carroll glaciers, as then named by Professor Reid and published on the map accompanying Appleton's Guide to Alaska.

Mr Muir seems to be justly entitled to the honors as the discoverer of Glacier bay, since he first fulfilled the conditions of both finding and bringing its wonders to the knowledge of the world. Lieutenant Wood, as he himself says, did not surely know that the bay was waiting to be found; that it definitely needed a discoverer, and his scant geographic references in the *Century's* pages did not altogether bring it to the knowledge of the world or stimulate others to explore. He awards all the honor to Mr Muir. Lieutenant Wood was the Lief Ericsson, Mr Muir the Columbus, in this instance.

In five summer visits to Alaska, during one of which our party camped for several weeks in the cabin at the side of Muir glacier, I made every effort to learn of earlier visitors than Mr Muir and Lieutenant Wood and to meet those mythical miners who were said to have known the bay well for years before the great glacial geologist went there. The closest questioning of those residents making these statements resulted in vague and foggy generalities. "I guess so;" "I was told so;" "I supposed so." Not a fact, not a date, nor a definite statement, nor a particle of proof could be obtained from these free and easy talkers of steamer wharves on tourist days. The alleged miners had always "gone to the Yukon;" it was not known whether letters would reach them at Forty Mile creek or not; it was quite possible they had left the Yukon, etc. These ready dispensers of information did not know the full names or the real names of these miners; even "Slim Jim," of Juneau, could not help them there, but they were always sure that "a lot of miners" had prospected all around the bay at least one year before Mr Muir went there (1879), only, the miners never thought it worth while to say anything "until these tourists began making such a fuss over the glaciers." Not one of them, however, had ever heard of Lieutenant Wood's visit in 1877, two years before Mr Muir and one year before the mythical miners.

HYDROGRAPHY IN THE UNITED STATES

By Frederick H. Newell,

Chief Hydrographer, United States Geological Survey

Hydrography has been defined as that branch of the science of physical geography which pertains to the waters of the earth's surface. The river systems, the annual regimen of the streams and their function in sculpturing the land, the lakes with their fluctuations, and the oceans with their tides and currents, all come within the province of the hydrographer. In the United States explorations and discoveries in this branch of geography are being made largely through surveys carried on by the Federal Government through its various executive departments—as, for instance, the Coast and Geodetic Survey, a bureau of the Treasury Department; the Geological Survey, a part of the Department of the Interior, and others. In common use, especially among mariners, the term hydrography is understood as pertaining only to marine surveying and charting, but as employed in scientific usage it embraces far more than the knowledge of the coasts and includes all waters, without reference to navigation, thus covering the continents as well as the oceans.

In tracing the order in which these hydrographic surveys are being made by the various organizations or bureaus of the government, it may be well to begin with the waters as they first occur upon the land and trace them downward in their course to the ocean. First in this system comes the Weather Bureau, which measures and records the precipitation at various places. From these data certain general deductions can be made regarding the hydrography of the country, but the operations pertaining more directly to this subject are those incident to the prediction of floods along important streams. For this purpose the Weather Bureau maintains river gauges at various points, the observers reporting the height of water at certain intervals, and at times of threatened floods telegraphing the facts regarding the behavior of the stream, in order that the central office of the district or that at Washington may be informed in time to issue predictions or warnings as to impending disaster. The operations of this bureau, as far as they relate to the hydrography of the rivers and of the lake and seacoast navigation, are for the exclusive purpose of issuing prompt notices, which shall be of immediate value to the farmer or other resident upon the lowlands and to the sailor.

Coming next in the scheme of the study of the waters of the country is the work of the Geological Survey, which, taking the facts relating to precipitation and moisture given by the Weather Bureau and utilizing the data as to river heights as far as possible, expands these into a general study of the occurrence of water within the United States, tracing out the causes, especially those of topographic and geologic character, which lead to variations in distribution and fluctuations in supply, and in short bringing together material by which the water resources of the country may be known as thoroughly as its mineral wealth. From the time, therefore, that the rain reaches the ground the Geological Survey endeavors to trace its course on or below the surface and to ascertain the laws governing its circulation and its reappearance by seepage or through natural outlets in springs or in artificial openings, such as artesian or other wells.

This Survey, as incidental to the preparation of the great map of the United States, examines in detail the surface of the country, determines the age and character of the rocks, their structure and position with relation to each other, their permeability or imperviousness to water, and the probabilities of their being able to yield a supply at points not yet penetrated by the well-digger. As in all scientific work, the ultimate object is that of prediction, of revealing that which is now unknown or but partly understood. Such extension of knowledge rests upon a thorough examination and understanding of the history of the past and of the conditions in the present. Before questions can be answered as to what is the probable supply of water at this or that point, for power, for irrigation, or for municipal supply, it is necessary that long-continued and accurate work be done.

The work of the United States Geological Survey relating to water resources is carried on by the Division of Hydrography. The field operations of this division consist of the measurement at selected points of the flowing waters of springs, creeks, and rivers, the estimation of the discharge of artesian wells, and of the quantities of water which can be obtained by other means.

Permanent river stations are established at many points on important streams, usually near their headwaters, and daily records kept of the fluctuations. These fluctuations are in turn interpreted into quantities of discharge by means of measurements of area and velocity made at short intervals by the hydrographers. The quantities thus ascertained furnish the basis for comparisons day by day, month by month, and year by year, throwing light upon the relation between precipitation and discharge, and upon the modifying influences introduced by topography, geologic structure, and cultural conditions. The non-periodic fluctuation of waters, the questions of erosion, transportation, and sedimentation, the appearance and disappearance of surface streams and the minerals in solution are all matters connected more or less directly with this study of stream behavior.

The surveys of the surface streams, their slope as obtained by the topographers, their volume as measured by the hydrographers, and their composition as determined by the chemist, are, however, simple matters in comparison with those which relate to the waters immediately beneath the surface. In the first case the phenomena are visible and tangible; in the second, keen observation must be followed by correct reasoning from well-established facts and conclusions. The occurrence of underground water in quantities sufficient to be of value, its character as regards mineral contents, and the pressure under the influence of which it may rise toward the surface, are all details which vary with the geology of the particular area. To be able to predict that water can be found at a given place, at a certain depth, and in quantity, it is necessary to know thoroughly all the facts which can be ascertained concerning the geology of the region. Toward this end the Geological Survey is collecting and putting upon record all obtainable data concerning deep wells, whether successful or not, and is making examinations of the water-bearing rocks wherever they come to the surface or are penetrated by underground workings. In the course of the preparation of the systematic sheets, designed ultimately to cover the whole country, much of this work has been done, but in certain portions of the country, such as the subhumid, where information is needed in advance of the completion of these atlas sheets, the field examinations of the hydrographic division are being pushed forward for this one object. The investigations of this division are thus seen to touch very closely the work of the Weather Bureau in its records of precipitation and in its material for flood prediction, and to connect these intimately with the mapping of the topographer and the studies of the geologist.

Passing from the many small streams of the country to the larger, navigable rivers, the work of the Engineer Corps of the Army is reached. As far as this relates to hydrography, the surveys of the Engineer Corps consist of examinations of particular points with the object of obtaining information preliminary to construction for the benefit of navigation. A considerable number of river gauges have been maintained and readings continued in order to ascertain the periods of low and high water and to obtain other data essential to correct plans. A few measurements of volume have been made upon some of the larger streams. With the work of the Engineer Corps can be placed that of the Mississippi and Missouri River Commissions, these organizations having conducted series of observations throwing light upon the behavior of these great rivers. Nearly related to this has been the work of the Lake Survey, conducted by army engineers, who have prepared detailed maps of the shores, showing the harbors, passages, and depths of water at all the shallow places.

At the head of tide water begins the work of the United States Coast and Geodetic Survey. This, the oldest of the surveying organizations of the Government, maps the navigable tidal waters of the United States from the remotest waters to the shore line and from the shore line outward to the oceanic abyss, studying the currents and fluctuations of water surface and mapping in great detail the harbors, shoals, channels, and all other features of importance to mariners. The investigations of this Survey have been conducted with the utmost accuracy, and its charts and publications relating to hydrography have reached the highest point of scientific attainment. With the work of the Coast Survey may be considered that of the Light-house Board, also a bureau of the Treasury Department, which in a relatively more limited and less detailed way has made hydrographic surveys for the purpose of erecting danger signals or light-houses, and has thus contributed somewhat to the knowledge of the navigable waters.

Extending beyond the bounds of the United States, our knowledge of the hydrography of the great seas is being added to by the Hydrographic Office of the Navy, which brings together and publishes maps, charts, and everything of interest to mariners relating to foreign lands, and covering with perhaps less minuteness the shores of other countries in a manner similar to that with which the Coast Survey has mapped out the waters of the United States.

Historically the investigations set on foot by the Smithsonian Institution should be noticed, for from these has come, directly or indirectly, nearly all our information concerning hydrography in its broader aspect. The systematic study of precipitation was first begun under this institution, and after being well established was turned over to the Signal Office, the predecessor of the Weather Bureau. In other lines the Smithsonian Institution has in similar manner shown the way, and when feasible has entrusted the continuation of the investigations to other organizations, in order that it might concentrate its own energies on other original lines of research tending to "the increase and diffusion of knowledge."

RECENT TRIANGULATION IN THE CASCADES

By S. S. Gannett,

United States Geological Survey

During the field season of 1895, the United States Geological Survey extended triangulation over a portion of central Washington. An astronomical determination of Ellensburg having been made, a base was measured on the roadbed of the Northern Pacific railroad. From this base, triangulation was extended into the Cascade mountains. Horizontal angles were measured with an eight-inch theodolite, reading by micrometers to two seconds of arc. Vertical measures were also taken upon some of the more prominent peaks, angles being measured by a vertical circle four and one-half inches in diameter and reading by vernier to one minute of arc. Elevations are based upon the height of the Northern Pacific railroad at Ellensburg.

The preliminary computation gives the elevation of mount Aix, by reciprocal observations to and from stations in the base expansion, 28 miles distant, as 7,815 feet above sea level.

Mount Rainier, by foresights from mount Aix, 24 miles distant, is found to be 14,532 feet, mount Adams, likewise by foresights from mount Aix, 42 miles distant, 12,470 feet, and mount Stuart, by foresights from several stations in the base expansion 24 to 30 miles distant, 9,500 feet, above sea level.

THE ALTITUDE OF MOUNT ADAMS, WASHINGTON

By Edgar McClure

On July 10, 1895, in company with the heliograph party of the Mazamas,* I carried a mercurial barometer to the summit of mount Adams, a snow-capped peak in the Cascade range, in the southern part of the state of Washington.

We traveled from Eugene, Oregon, by rail to Portland, Oregon; thence by steamer down the Willamette river to its mouth, and thence up the Columbia river to White Salmon landing. From this last-mentioned point we traveled north by wagon road 27 miles to Trout lake, and thence by trail, still northward, 14 miles to the snow-line on the mountain side. This camp was called Mountain View camp, and is situated near the foot of the White Salmon glacier. From this point it is a continuous climb of four miles to the summit of the mountain.

The instrument used was barometer No. 1612, made by James Green, of Brooklyn, New York. It was compared with the Weather Bureau instrument at Portland, Oregon, and with the large standard barometer belonging to the State Weather Service at the University of Oregon, at Eugene, Oregon. Parallel observations were made by previous arrangement at Portland, Oregon, Eugene, Oregon, and Seattle, Washington.

Mountain View camp, at the snow-line, was left at 4:30 a. m. on July 10, and the summit of the mountain was reached about 11:00 a. m. The ascent was made over a large snow-field immediately west of a long lava ridge which runs southeastward from the summit of the mountain. The climb is long and hard, but it has no points of danger along the route. The summit was left for the return trip about 4:00 p. m. and camp was reached about 5:30 p. m.

Observations began on the summit at 12:30 p. m. and were continued until 3:30 p. m. The air thermometer having been accidentally broken on the evening before the climb, the air temperature on the summit was taken from the attached ther-

* The Mazamas is an association of mountain climbers, with headquarters at Portland, Oregon. The object of the organization is the collection of scientific data concerning the mountains of Oregon and Washington.

mometer by subtracting three degrees. Parallel readings, taken at Trout lake and Mountain View camp, of the attached thermometer and the air thermometer, before the latter was broken, gave readings of the latter 2° and 3° below the former. The belief that the reading on the summit of the mountain on the afternoon of the climb would have been in the same proportion is strengthened by the fact that the air temperature shown by the air thermometer used with the boiling-point apparatus closely corresponded with my air temperature obtained in the manner above stated.

OBSERVATIONS.

Portland, Oregon.

State Weather Bureau, July 10, 1895.

P. M.	*Barograph.*	*Thermograph.*
1:00	29.80	90 F.
2:00	29.79	92 "
3:00	29.77	93 "

Pressure figures corrected for temperature. Barometer 157 feet above sea level.

B. S. PAYNE,
Director.

Seattle, Washington.

Weather Bureau, July 10, 1895.

P. M.	*Barograph.*	*Thermograph.*
1:00	29.875	85 F.
2:00	29.865	86 "
3:00	29.850	87 "

Pressure figures corrected for temperature. Barometer 119.4 feet above sea level.

GEORGE N. SALISBURY,
Observer.

Eugene, Oregon.

University of Oregon, July 10, 1895.

P. M.	*Standard barometer.*	*Exp. thermometer.*
1:00	29.386	93.5
2:00	29.374	94.0
3:00	29.361	95.0

Pressure figures corrected for temperature. Barometer 485.7 feet above sea level.

S. H. MCALISTER,
Observer.

Summit of Mount Adams, Washington.

Mazama Expedition, July 10, 1895.

P. M.	*Barometer No. 1612.*	*Air temperature.*
1:00	19.256	38.0
2:00	19.272	38.5
3:00	19.281	43.0

Pressure figures corrected for temperature. Cistern of barometer 1.1 feet above the level of snow.

The calculations were made by two methods—by Major R. S. Williamson's tables, based on Plantamour's formula, and by Guyot's tables. In the former case, since no observations were taken to determine the humidity of the air, the temperature correction was calculated by the formula of La Place. Three estimates were made on each place as a base from observations taken at 1:00, 2:00, and 3:00 o'clock p. m. This gives nine estimates by each method, or a total of eighteen estimates on the elevation of the peak. The two results agree within 44.7 feet.

	P. M.	Williamson.		Guyot.	
Portland, Oregon	1:00	12,459.8		12,413.5	
	2:00	12,457.7		12,412.4	
	3:00	12,495.3		12,449.8	
Mean..............................			12,470.9		12,425.2
Seattle, Washington.......	1:00	12,427.8		12,382.6	
	2:00	12,414.4		12,369.2	
	3:00	12,458.1		12,411.8	
Mean..............................			12,433.4		12,387.9
Eugene, Oregon...........	1:00	12,436.6		12,393.8	
	2:00	12,414.0		12,371.1	
	3:00	12,455.7		12,412.6	
Mean..............................			12,435.4		12,392.5
Grand mean......................			12,446.6		12,401.9

The mean of these two estimates, 12,446.6 and 12,401.9, is 12,424.2.

Trout Lake and Mountain View Camp.—An estimate based on observations made before the climb gives the following elevations:

Trout lake (camp at Wagnitz place)................. 1,854 feet.
Mountain View camp (snow line, July 10, 1895)...... 5,714 feet.

GEOGRAPHIC LITERATURE

Archeological Studies among the Ancient Cities of Mexico. Part I: Monuments of Yucatan. By William H. Holmes. Pp. 137, with 18 plates. Chicago, 1895.

This is the eighth publication of the Field Columbian Museum and the first of the Anthropological series. It opens with an itinerary of the voyage of the yacht *Ituna* (the property of Mr Allison V. Armour), which sailed from New York December 16, 1894, and reached the coast of Yucatan a fortnight later, carrying a scientific party headed by Professor Holmes; and thereafter, for two months, the services of the vessel and the energies of the party were devoted to researches in the land of ancient cities. Ever since the conquest Yucatan has been noted for ruins of astonishing magnificence, and the names of the ancient cities, Palenque and Chichen-Itza and Uxmal, are hardly less known than those of present population centers. Stephens, Maudslay, Bandelier, Charnay, and other archeologists have drawn on the rich store of records of ancient culture afforded by these cities, and the Le Plongeons, husband and wife, have made voluminous collections and evolved curious speculations amid the ruins; and now a well-known archeologist and artist has traversed this singularly fertile field, and, with the aid of camera and pencil, has reproduced some of the most striking features of the ancient work. The photographs are excellent and remarkably well reproduced; the author's device of representing the ruins in panoramas, with the mantle of vegetation omitted, is quite effective, and the wealth of detail depicted in the minor drawings adds much to the value of the book. In this treatise and the succeeding part, which is promised soon to follow, a clear and faithful picture of the Yucatec ruins will be found; and the great Museum at Chicago is to be felicitated as the patron of the research and the depository of the collections growing out of it.

Geological History of the Chautauqua Grape Belt. Bulletin No. 109, Cornell University Agricultural Experiment Station, Ithaca, N. Y. By R. S. Tarr. Pp. 36, with maps and illustrations.

This is issued as the first specific attempt in this country on the part of an experiment station to analyze the physical geography of a fruit belt. Notwithstanding most excellent opportunities, very little has been attempted in the United States in the way of studying the conditions of soil and climate existing in what may be called type fruit regions. It is obvious that such studies, if properly carried on, would be of great practical value, for if once the conditions prevailing in the type regions for certain fruits were thoroughly understood it would be possible within given limits to determine the practicability of growing such fruits in other sections of the country. Work bearing on this subject has for several years been in progress by Professor Milton Whitney, of the United States Department of Agriculture, and as a result the geological and physical characteristics of the type soils for several important crops have been worked out. The work by Professor Tarr, although somewhat different in its character, has the same object in view, namely, that of ascertaining the natural conditions existing in a region famous for the excellence of one of its products, in this instance the grape. Professor Tarr has confined his studies largely to the geological side of the question, first discussing the topography and then following with a consideration of the bed rock. The different kinds of soils and their relative values are also discussed. Altogether the bulletin is very interesting, and is especially valuable as taking up a line of work that has been somewhat neglected.

Die Liparischen Inseln. In eight Parts, fully illustrated with excellent wood cuts of Sketches by Fredrich Hawránek. Prag. Heinr. Mercy, 1895.

This handsome work gives a complete picture of the present condition of these interesting historical islands and contains much information of value to the student and traveler. Each of the first seven parts is devoted to an elaborate illustration of one of the islands, with a brief description of its natural features and culture. One cannot but regret that the numerous illustrations of these remarkable volcanic islands are drawn wholly from sketches instead of from photographs, which have so much higher a value as a source of information. For example, in part 5, chapter III, the illustrations of the cavernous coast show no definite relation of the caverns and arches to the structure of the rock, as is well known to be the case along coasts of volcanic rocks. An excellent hachure-shaded contour map is given of each island, on a scale in some cases as large as 1 : 25000. The eighth part contains, besides a map of the whole group, brief descriptions of the climate, sea, anchorage, springs, flora, fauna, and population of the islands, as well as fuller accounts of the occupations of the people, their habits, customs, and commerce, with their means of intercommunication and accommodations for tourists.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1895-'96

Special Meeting, February 28, 1896.—Vice-President Greely in the chair. Mrs Fannie B. Ward read a narrative of Two Years' Travel in and about South America, illustrated by lantern-slides, mostly from original drawings and photographs.

Special Meeting, March 2, 1896.—First lecture of the course of seven illustrated Monday afternoon lectures descriptive of a trip to Alaska. President Hubbard in the chair. Mr W J McGee described the route from St. Paul, Minnesota, to Banff, Alberta, and Mr Bailey Willis an excursion to Mount Rainier, Washington. Both addresses were illustrated by lantern-slides.

Regular Meeting, March 6, 1896.—Vice-President Merriam in the chair. Mr F. V. Coville read a paper, illustrated by lantern-slides, on the Adaptations of Plants to Desert Environment. The paper was discussed by Mr W J McGee, Surgeon-General George M. Sternberg, U. S. A., Mr G. K. Gilbert, Dr C. Hart Merriam, and others.

Special Meeting, March 9, 1896.—Second Monday afternoon lecture. President Hubbard in the chair. Prof. Charles E. Fay, of Tufts College, Massachusetts, delivered an address on the Glaciers, Peaks, and Canyons of the Canadian Rockies, illustrated by lantern-slides.

Special Meeting, March 12, 1896.—Reception at the Arlington Hotel to the Venezuelan Boundary Commission. President Hubbard and a committee of ladies, headed by Mrs Richard Olney, received the Society's guests and presented to them upwards of 400 of the members of the Society and their friends.

Special Meeting, March 13, 1896.—President Hubbard in the chair. Mr C. E. Borchgrevink, of Norway, addressed the Society, giving a graphic description of his voyage to the Antarctic continent, and exhibiting a number of lantern-slide reproductions of photographs.

Special Meeting, March 16, 1896.—Third Monday afternoon lecture. President Hubbard in the chair. Mr James Fletcher, of Ottawa, Canada, described the trip from the Canadian National Park to the Pacific Coast, illustrating his address by means of lantern-slides and specimens of the flora and fauna of the region traversed.

Regular Meeting, March 20, 1896.—Vice-President Gannett in the chair. Mr N. H. Darton read a paper, illustrated by lantern-slides, on the Physiographic Development of the District of Columbia Region. He was followed by Major Gilbert Thompson, who spoke on the Use of Geodetic Control Lines in Geographic Work.

Special Meeting, March 23, 1896.—Fourth Monday afternoon lecture. President Hubbard in the chair. Lieut. A. P. Niblack, U. S. N., described the trip, "From Puget Sound to Sitka; Fiords, Islands, and Canals," with lantern-slide illustrations.

ELECTIONS.—New members have been elected as follows:

February 28.—Rev. Dr Alfred H. Ames, Edward Burgess, Prof. J. A. I. Cassedy, Rev. Ernst Drewitz, D. Wallace Duncan, O. J. Edwards, Miss Mary H. Elliott, James Fletcher, A. B. de Guerville, Dr Herbert Harlan, Chr. Heurich, Dr A. L. Howard, W. J. Lampton, Edmond S. Meany, Daniel Murray, Rev. Jos. B. North, Walter T. Paine, Col. Henry A. Pierce, Wm. H. Saunders, H. Jaudon Smith, Chas. C. Snow, Chas. M. Staley, W. P. Van Wickle, Wm. G. Webster, S. T. White, John W. Winder, Dr D. P. Wolhaupter, F. G. Würdemann.

March 20.—Perry Allen, Judge Victor Barringer, Miss Marie E. Byington, Henry A. Curtis, James A. Edgar, Dr R. Farnham, Henry F. Getz, Francis R. Hart, Mrs A. G. Hensley, Marshall H. Jewell, Prof. L. M. Keasbey, Chief Engineer Absalom Kirby, U. S. N., F. R. McCormick, Lieut. A. P. Niblack, U. S. N., Miss M. L. Nicholson, Frederick Law Olmsted, Jr., Leopoldo S. Pietra, D. M. Quackenbush, C. C. Randolph, W. L. Symons, Hon. G. P. Wetmore, U. S. S., Wm. Whelan, W. D. Wilcox.

MISCELLANEA

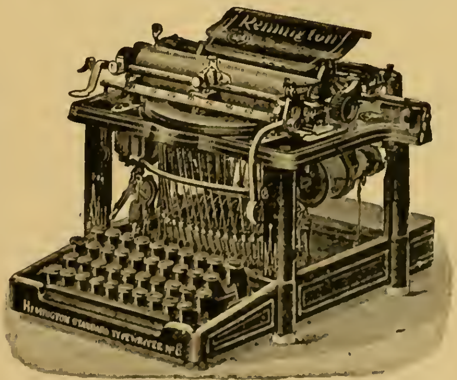
THE Congress of Chambers of Commerce at Bloemfontein, South Africa, has resolved to adhere to meridian 22° 30′ east as the standard time for South Africa.

THE total output of gold in the seven Australasian colonies in 1895 is officially announced as 2,350,562 ounces, an increase of 106,928 ounces over the production in 1894.

THE salmon pack of the Columbia river last year amounted to 655,410 cases, of the aggregate value of $3,342,928. The industry gave employment to 3,775 fishermen and to 1,574 cannery operatives.

THE population of the city of Melbourne at the end of 1895 is officially reported as 447,461, an increase during the year of 8,506. The estimated population of the seven Australasian colonies at the end of 1895 was 4,238,000, an increase of 11.25 per cent since the census of 1891.

UPWARDS of 100,000 bales of American and Egyptian cotton have been received at Manchester, via the ship canal, since September last. There has also been a very large increase in the receipts of lumber and other raw products, and much concern is again being felt in Liverpool as to the probable effect of this great enterprise upon the commerce of that city.



A GOLD MEDAL

WILL BE AWARDED BY

The National Geographic Society

to such **pupil in a public high school** in the United States as shall compose and submit by **October 15, 1896**, the **best original** essay, not exceeding 2,000 words in length, on the **Mountain Systems of the United States.**

A **Certificate of Proficiency** will also be awarded for the **best essay received from each State,** provided such essay is of sufficient merit to justify the award.

Essays will be received only from such public high schools as formally announce their intention to compete by **May 31.**

All competitors will be required to make a formal certification on honor that they have not received aid from any person in the composition of their essays.

The Adjudication Committee consists of General A. W. Greely, Chief Signal Officer, U. S. Army; Dr. T. C. Mendenhall, President of the Polytechnic Institute, Worcester, Mass., and Prof. W. B. Powell, Superintendent of Public Schools of the District of Columbia.

EVERETT HAYDEN,

WASHINGTON, 1515 H STREET N. W. *Secretary.*

THE MAY NUMBER

— OF —

THE NATIONAL GEOGRAPHIC MAGAZINE

will contain the

PRESIDENTIAL ADDRESS

— OF —

Hon. GARDINER G. HUBBARD, LL. D.

— TO THE —

NATIONAL GEOGRAPHIC SOCIETY,

— ON —

AFRICA

with special reference to the Transvaal and the Italian Possessions.

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For the purpose of making up complete sets of the Magazine, the National Geographic Society is prepared to purchase at reasonable prices the following back numbers :

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Address: EVERETT HAYDEN, *Secretary*,
1517 H STREET, WASHINGTON.

HON. GARDINER GREENE HUBBARD, LL. D.,
President of the National Geographic Society.

THE
National Geographic Magazine

Vol. VII MAY, 1896 No. 5

AFRICA SINCE 1888, WITH SPECIAL REFERENCE TO SOUTH AFRICA AND ABYSSINIA*

By Hon. Gardiner G. Hubbard, LL. D.,
President of the National Geographic Society

Eight years ago I selected Africa as the subject of my annual address before the National Geographic Society. Since then the nations of Europe, seeking new outlets for trade and possible homes for their surplus population, have taken possession of the larger part of the continent. They have developed Africa more rapidly than in any preceding age, and have greatly increased our knowledge of it.

Africa and America were discovered about the same time—the one by Portugal, the other by Spain. Soon afterward the slave trade was established between the two continents to supply the place of Indian labor, the natives of America, unable to stand the tasks imposed upon them by the Spaniards, having been exterminated. This trade proved so profitable that England soon took part in it, exchanging her products for slaves transported to the Spanish colonies in America. This continued for two hundred and fifty years, or until the early part of the nineteenth century, when the slave trade was abolished and the trade in intoxicating liquors substituted, which has been to the African a greater evil than the slave trade. A recent writer says that four million gallons of the most poisonous gin and rum are imported yearly into the Nagos and Niger coast protectorates.

*Annual presidential address, delivered April 24, 1896.

Nearly half a century ago two or three large mercantile firms of Hamburg and Bremen established trading stations on the west coast of Africa. Their profits were very large, as, in exchange for rum, trinkets, beads, and worthless arms, cocoanut oil, ivory, india-rubber, and other tropical products were obtained. This trade finally resulted in the starting of a regular line of steamers from Hamburg to the west coast, and also of one through the Suez canal to the east coast. Prince Bismarck realized that he had a most urgent problem to solve, either to restrain German emigration, or, failing in that, to keep it under the control of the empire. America was closed; Asia was all taken; his only opportunity was colonization in Africa. He ordered German ships of war to visit the African coast, and established consulates at different ports. Treaties were made with the natives for the purpose of acquiring colorable titles to large tracts of land, the German flag was raised, and the country declared to be under German protection. These settlements are merely stations, where two or three families of foreign merchants reside, and outstations of natives—middlemen, who carry on the trade between the natives of the interior and the foreigners on the coast. Germany also claims the hinterland or interior country behind the stations, although most of it had been regarded by the English as under their flag.

At the time of the uprising in Egypt against the rule of England and France, in 1882, France declined to act with England, but soon bitterly regretted her mistake, and to offset her loss in Egypt she extended her dominion in northwest Africa and on the Gold Coast and the upper Niger, although most of these regions had been claimed by English traders. About the same time the Kongo Free State was founded and claimed the whole of the Kongo valley. This was opposed by both France and Portugal, the one claiming the country north of the Kongo, the other that to the south. Thus in 1883 and 1884 it seemed that all the great nations of Europe might come into conflict regarding their different claims in Africa. For the purpose of settling these questions and defining the rights of each country, Germany, France, Belgium, Portugal, and England held a conference at Berlin in 1884, to which the United States was invited, the only conference between the great powers, relating to foreign affairs, in which it has participated. At this convention and by subsequent agreements made between 1885 and 1895 the European powers fixed the boundaries of their several African possessions.

It was determined that free navigation and free trade should be established for all nations within the regions watered by the Kongo and its affluents—a right subsequently annulled—and on the Zambesi to a point five miles above the mouth of the Shiré, and free trade for transit to regions on the Niger beyond British influence.

Under these agreements England and France each claim a little more than twenty-five per cent of the Continent; Portugal, Germany, and Belgium together claim about twenty-three per cent. The other European powers, with the Boers of the Transvaal and the sultan of Turkey, together hold about twelve per cent, leaving to the Africans the desert of Sahara and part of the Sudan, about fifteen per cent. This gives to the European powers, having no right but that of might, all those portions of Africa supposed to be habitable or valuable.

It has been the policy of Great Britain to allow her merchants to establish commercial relations with the natives by opening trading-stations, but not until the trade becomes profitable, and private enterprise and money have established the value of the trade, to raise her flag, claim them as British possessions, and exercise governmental control. The East Indian empire was the outgrowth of a trading-station. France and Germany reversed this policy, first taking possession of different parts of Africa, establishing territorial governments, and afterward offering inducements to mercantile companies to establish trading-stations and in addition guaranteeing protection from the natives. England as a result of her policy—the flag following the trade—has secured the most valuable parts of Africa.

France holds an immense territory on the Mediterranean, with Algiers as its capital, the country south of Algiers and west of Senegambia, and on the upper waters of the Niger, while England claims the Niger and Benue, the only navigable rivers in Africa. England formerly claimed Damaraland and Namaqualand, on the southwest coast of Africa, but yielded them to Germany, reserving a small tract of land near the center of the territory, Walfish bay, the only good harbor on the coast and the best means of access to the interior of the German possessions.

England allowed Germany to secure a vast region in East Africa over which she had claimed dominion, but claims for herself a large portion of South Africa, the Shiré and the upper waters of the Zambesi, the part of Africa best fitted for the occupation of Europeans. She retained Egypt, allowing France to acquire Tunis and the desert of Sahara. She yielded to Italy the southwest coast of the Red sea and south on the Indian ocean to the river Juba, including Massowah, the most unhealthy part of the Red sea, on condition that Italy should occupy Kassala and drive out the Mahdists, reserving also for herself the best harbors in the Italian territory on the Indian ocean.

The occupation of Africa has cost France $750,000,000 and Italy her reputation as one of the leading powers of Europe; Germany has failed in her colonization scheme, for, as a recent writer says, her colonists in Africa number less than 1,000 and cost about $2,750 a year each, while the only portions of Africa that have yielded large returns for investments made by colonists are the regions controlled by England on the Niger and in South Africa.

THE BRITISH SOUTH AFRICAN COMPANY.

The government of these vast tracts and colonies has generally been granted to companies chartered by the governments of Europe. One of these companies, the British South African Company, was founded in 1889 by Mr Cecil Rhodes. The son-in-law of the Prince of Wales and other members of the nobility were made directors and officers, receiving full-paid founders' shares. Dr Jameson was one of the subordinate officers. The par value of the stock, £1, soon rose in the market to £3 or £4, thus securing a handsome profit to the company's noble directors. The company was authorized "to acquire by any concession, grant, or treaty all or any rights, authorities, jurisdictions, and powers of any kind or nature whatever, including powers necessary for the purposes of government, comprised or referred to in the concessions and agreement made as aforesaid or affecting other territories, lands, or property in Africa or the inhabitants thereof." Among the privileges given to it are "the right to establish banking and other companies and associations; to make and maintain railroads, telegraphs, and lines of steamships; to carry on mining operations and license mining companies; to settle, cultivate, and improve the lands; to preserve peace and order in such ways and manner as it shall consider necessary, and for that object may establish and maintain a force of police and have its own flag."

The territory originally included in the charter of the company was many times larger than Great Britain, but Mr Rhodes and his associates, still unsatisfied, penetrated into Khama's country, Matabeleland and Mashonaland, defeated Lobengula, and added a large tract to that already under British protection. But still beyond lay richer lands, and in June, 1895, a territory called Northern Zambesia and Nyassaland, larger and more valuable than the original grant, was added to the South African Company. This was the land discovered by Dr Livingstone, settled by Scotchmen at his instance, and here on lake Bangweolo he died. The whole territory is now called Rhodesia, or Zambesia, and extends from Cape Colony north over two thousand miles past lake Nyassa, with lake Tanganyika as its northeastern boundary and the Kongo Free State its northwestern. The company now claim a territory of nearly one million square miles, an area larger than Europe exclusive of Russia.

The country is very thinly populated, and the valleys of the Limpopo and Zambesi are infested by the tsetse, a stinging fly unknown elsewhere; its bite is fatal to the horse and ox; it seems, however, to disappear with the advance of civilization. But notwithstanding this pest, Zambesia, with its great elevation, its fine climate, its fertile soil (much of it capable of cultivation by irrigation), and its great mineral deposits, may become one of the most wealthy and densely populated portions of Africa.

Within the territory of the South African Company are the richest diamond mines in the world, and just over its border, in the Transvaal, the richest gold mines.

DIAMONDS

India was formerly the only country in which diamonds were found to any great extent. They were afterward discovered in Brazil, and some of small size have been found in other places. The diamond fields of both India and Brazil appear to be nearly exhausted. The first diamond discovered in South Africa was found in 1868 near Kimberley, 620 miles north of Cape Town. Since 1870, when mines were opened, the production has rapidly increased, and in twenty-five years these mines have produced more and larger diamonds than all other countries, 98 per cent of the present production of the world coming from Kimberley.

These stones are found in a region about twelve miles in circumference, where four small hills or pipes, as they are called, rise from 60 to 80 feet above the ground, probably natural chimneys or extinct craters, lined with walls of basalt, broadening out below the surface to a great depth. These craters are filled with a blue diamantiferous formation, which has been forced to the surface of the ground by the pressure of the subterranean gases. In this formation the diamonds are imbedded, in a regular order known to miners. Formerly the earth was thrown out from the surface until several hundred feet in depth over a large area had been removed. This method of working was dangerous and expensive, and now shafts are sunk at a little distance from the craters and the blue earth is reached by underground galleries. The workings are inclosed by high walls, within which the workmen are confined during the time of their service. Each night they are stripped and their persons and clothing subjected to a most careful examination. The secretion of diamonds or their purchase from workmen is punished most severely; but with all these precautions diamonds to the value of probably a million dollars a year are secured by the miners. Instances like the following are not uncommon: A man escaping on horseback was carefully examined and released, no diamonds being found upon him, but on crossing the border he stopped, dismounted, shot his horse, and took from the animal a small bag of these precious stones.

There were originally so many different claims and rival companies that their consolidation seemed almost impossible. It was then that Mr Cecil Rhodes first appeared prominently before the world. Through his financial genius and marvelous management the companies were consolidated into one corporation, with a capital of $20,000,000. The net profits in 1895 are said to have been over $11,000,000 from the sale of the diamonds; $5,000,000, or 25 per cent, was divided and the balance carried to a reserve fund. The production is limited to the demand, so that the market may not be overstocked and the diamond decrease in value.

TRANSVAAL, OR SOUTH AFRICAN REPUBLIC

Not far from the diamond mines are the richest gold mines in the world. These are in the Transvaal, a country of from 110,000 to 120,000 square miles, 240 miles from north to south and 360 miles from east to west, and with a population of 700,000 to 750,000. Of these 75,000 are Boers.*

The ancestors of the Boers were Dutch and French Huguenots, who had with our own Pilgrim Fathers found in Holland a refuge from persecution for more than a generation. They left Holland about the same time that the Pilgrims and Dutch sailed for America—the one to an inhospitable climate and a

* Boer is the same word as the German Bauer and English boor, a peasant farmer.

life of hardship, privation, and intense activity, the other to a genial climate, where toil was unnecessary and where all the surroundings were favorable to life and a rapid increase of population. The one has steadily advanced, the other retrograded, a difference largely due to environment.

The southern coast of Africa for nearly eight hundred miles, is entirely destitute of navigable rivers; has neither harbors nor islands, has only one or two open roadsteads, and therefore offers no inducements to commerce. Nearly parallel with the coastline are three chains of mountains running from east to west, the first about fifty miles from the ocean and the others from fifty to one hundred miles apart, each succeeding range rising higher than the one in front of it. On the coast the soil is rich and fertile, producing excellent grapes, yielding more wine per acre than those of any other country, though of an inferior quality. There is an abundant rainfall and the crops are large, but the rain clouds passing over the mountains leave the plateau between them dry and barren. North of the third range is the valley of the Orange, various branches of which, rising to the north and south among the mountains, flow across Africa to the Atlantic. Its eastern watershed is well watered and can be easily irrigated, but until irrigated it is only adapted to grazing.

The railroad from the cape of Good Hope to Johannesburg runs almost through the middle of the country. The land west of the railroad is arid, and the Orange river grows shallower as it approaches the sea. Only a small portion of the country is suitable for agriculture, but a large part offers, with but little labor, good pasturage for cattle all the year round. The climate is delightful, the thermometer rarely rising to 90° Fah. or falling below the freezing point.

This country was formerly inhabited by the Hottentots, among the lowest in the scale of negro races. About the time the Boers landed in South Africa, the Bantus, the highest in the scale, were pushing their way to the south, along the eastern coast, forcing the Hottentots into the interior and thence to the west. After the advent of the Boers the increase in population was very slow, the total number of inhabitants being only about twenty thousand when the English took possession of Cape Colony in 1800. The English emigrants were better educated than the Boers, and the two races have rarely intermarried.

After the Crimean war in 1855, 2,000 to 3,000 Germans, volunteers in that war, were given homesteads in southeastern Africa by the English; these have in the main been absorbed by the Boers.

Between 1820 and 1830 slavery was abolished by Great Britain. The Dutch, who were engaged in trade and agriculture, freed their slaves and remained in Cape Colony, mingling more and more with the English; those engaged in the raising of cattle, dissatisfied with the compensation offered, moved northward, though still under British dominion.

The English and the Boers were engaged in continual conflict with the natives, but the home government was unwilling to defend the settlers. The Boers were therefore compelled to defend themselves, and thereby gradually became independent, roaming with their families and cattle, crushing out or enslaving the natives, until they reached the Orange river, in the country now called the Orange Free State. Between 1835 and 1838 they settled beyond the river Vaal, in the Transvaal. Here scattered over a vast area each family occupies as many acres as it desires. There is no means of intercommunication, save by ox wagons, traveling only twelve miles a day. The people are without near neighbors, and there are very few towns or villages. In such a community education is necessarily neglected. Intermingling with English, Germans, and Kaffirs they speak a dialect unlike either the pure Dutch or the Dutch spoken in Cape Town. They live in perfect social equality, with a strong sense of personal dignity—proud, independent, neither rich nor poor, but shrewd and self-willed. Mr Gladstone has described them as "Protestants in religion, Hollanders in origin, vigorous, obstinate, and tenacious in character, even as we are."

In time of drought they move with their families and cattle from place to place for pasturage, returning after the rains to their homes. The hunting of game is an absolute necessity, not only for the protection of the cattle from wild animals, but for food, clothing, and trade. In consequence, the elephant, lion, rhinoceros, ostrich, and zebra have been almost entirely driven to the north. When they are gone the Boer will probably lose his remarkable skill with the rifle.

When the Boers receive a summons to arms from the president they take their provisions, rifles, and ammunition, mount their horses, and are off, the best sharpshooters and guerillas in the world, as the English have frequently learned to their cost, especially in the battle of Majuba hill, where, though strongly entrenched, they were defeated with great loss.


SKETCH MAP OF AFRICA
SHOWING
PRINCIPAL POLITICAL DIVISIONS
0 100 200 300 400 500
English Statute Miles
0 100 200 300 400 500
Geographical Miles
Algiers
Tunis
ALGERIA
MOROCCO
Morocco
Canary Islands
TRIPOLI
SAHARA
Senegal
SENEGAMBIA
NIGER
SUD
Freetown
LIBERIA
ASHANTI
DAHOMEY
GOLD COAST
GERMAN KAMERUN
Victoria
Libreville
FRENCH KONGO
Franceville
Loango
Leopoldville
Boma
Banana
GULF OF GUINEA
ATLANTIC OCEAN
PORTUGUESE
Benguella
Walfish Bay
Cape Town

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

When the Boers were in Cape Colony, and for some time afterward during their nomad life, they were under English rule. They rebelled at times, but it was not until 1852 that they threw off the English yoke and became a free people. In 1882 Paul Kruger was elected president, and by the Convention of London in 1884 the Transvaal was recognized as a nation, England merely retaining the right to approve "all treaties made with any state or nation other than the Orange Free State, and with any native tribes outside the Transvaal." The Boers agreed that "all persons, with their families, should have full liberty to reside in any part of the Transvaal and to carrry on any kind of business, and such persons were to be subject to no higher taxation than is or may be imposed upon citizens;" also that no slavery was to be tolerated. If these privileges are conceded, England has no right to interfere in its internal affairs.

The government of the Transvaal is nominally administered by a parliament, but the power is in the hands of Paul Kruger, the president, the grandson of a German, a stolid Boer of great natural ability and shrewdness, with strong homely features and blue eyes showing keen watchfulness and great firmness of purpose. When parliament is not in session, he has power to issue proclamations, which can be enforced until its next meeting, and when it is in session he rules the members, it is said, by threatening to reduce their salaries.

In 1885 gold was discovered on a ridge about six thousand feet above sea-level, near the present city of Johannesburg. Immigrants immediately flocked in. Today Johannesburg is the center of a district, according to an informal but reliable census, of 120,850 Europeans and Americans, all of whom are engaged in mining. This discovery of gold has been most fortunate for the world. As the production of the mines of California fell off, the loss has been made up in the Transvaal. After the discovery of the California mines, the gold production of the world gradually increased until 1853, when it reached the maximum of $155,000,000; then it steadily diminished until 1883, when it was only $95,000,000; at this time the African mines began to supply the market. Since then production has rapidly increased, and it is believed that in 1896 it will be over $200,000,000, the largest amount ever mined, and one-half will come from the Transvaal. The veins have been carefully surveyed and traced for several hundred miles, and it is believed that they are more extensive than any other gold fields. In many places the remains of ancient surface workings, probably hundreds of years old, have been found, supposed by some to be the mines of King Solomon.

Beside the gold mines, the Transvaal is rich in all kinds of minerals, especially silver, copper, coal, and iron. The soil also is very rich, and with a proper system of irrigation is capable of yielding large returns; but the farms of the Boers are neglected and unproductive. The late Lord Randolph Churchill, who visited it in 1892, wrote of it that "it might be the most wealthy and prosperous spot on earth, but Providence has cursed it with the rule of fifty thousand Boers."

The foreigners, or Uitlanders, as they are called, desire representation in the government and claim rights and privileges to which as foreigners and unnaturalized citizens they are not entitled. They assert that taxes in Johannesburg, contrary to the convention of 1884, are ten times as high as in Pretoria, and that nine-tenths of all the taxes are paid by them; that they have no right to vote or to participate in the administration of the general or local governments; that they are compelled to sustain schools where all the instruction is in the Dutch language. In answer it is said that Pretoria is a town of poor farms; Johannesburg a bustling, growing, thriving mining city, with a large, unruly population, where taxes must be high; that the foreigners are absorbing the trade and carrying away the wealth of the country, and should therefore pay the larger part of the taxes; that the laws give the Uitlanders the right to vote after naturalization and to become members of the lower, though not of the higher, house; that the schools were established by the Boers for their own children, not for the English, and that naturally no provision has been made for instruction in a foreign language; that the Uitlanders came into the Transvaal a short time ago without invitation from the Boers, without any fixed determination to remain, solely for their own profit, and have therefore no right to complain of laws to which they have voluntarily submitted.

The Uitlanders looked to Mr Cecil Rhodes and his company for help and gladly promised to join any force that might be sent to their relief. In response to this appeal Dr Jameson collected the police force of the chartered company, crossed the boundary into the Transvaal in the last days of 1895 to restore the Transvaal to English rule; but he had underestimated the strategical skill, the strength, and ability of the Boers. General Joubert, the commander, showed on this, as on prior occasions, great military ability, and by his quick movements put down the incipient rebellion at Johannesburg, and defeated and captured the English forces. All South Africa would have rejoiced in the success of Dr Jameson, and England would have accepted the situation. Germany might have objected, though we cannot see what right she would have had, for the Transvaal is hundreds of miles from her possessions, and the new doctrine of "Sphere of Influence" could not have applied.

The Boers have shown great forbearance, wisdom, and good judgment in this emergency. In time of peace armed men invaded their country to overthrow the government. They could justly have been hanged, but, at the request of the British government, the president surrendered Dr Jameson and his men for trial according to the laws of Great Britain. We doubt if it would be easy to find in all history an instance of like forbearance and mercy. It should, however, be remembered that the fathers of the present Boers either drove the natives from the Transvaal or reduced them to slavery, the higher civilization driving out the lower.

This country, with its delightful climate, fertile soil, forests of valuable timber, mines of precious metals, and large deposits of coal, will continue to draw large numbers of emigrants from England. Further disturbance is therefore sure to arise unless the Boers give the Uitlanders the civil rights they claim, and these once secured, it is inevitable that the British flag will float over the Transvaal.

Other gold veins are worked in various places on the territory of the chartered company. Buluwayo, in November, 1893, the chief kraal of Lobengula, has now a population of 4,000, and is the center of one of the gold fields. None of these fields has thus far proved profitable, but there is every reason to believe that gold will be found in great abundance.

There are political movements which politicians do not initiate; revolutions accomplished without statesmen or captains. In these we look in vain for a master-mind, acting either alone or with others. Not the least significant are the changes effected by the discovery of gold. The middle of the century witnessed a wonderful development in the United States and Australia; its close promises to witness an even greater revolution in South Africa.

ABYSSINIA

We will now turn from the Transvaal to Abyssinia and the Italian possessions on the Red sea, where Italy is engaged in what may prove to be a life-and-death struggle.

Abyssinia, or Ethiopia, as it was formerly called, is the most elevated plateau of Africa. The coast of the Red sea is here low, dry, and utterly devoid of vegetation, consisting of great sand wastes, only relieved by alkali plains, salt marshes and salt lakes, hot, and most unhealthy. A traveler, writing of this region, says: "The country is a parched, desolate region; the climate an intensified, perpetual, torrid heat; the rainfall one or more terrific thunder-storms in the year; the occupation of the inhabitants tending scanty and wretched flocks and herds, watching the approach of enemies; their fears always alive for sudden death; their hopes for peace."

The ground rises abruptly to the height of nine or ten thousand feet, forming a steep mountain chain about six hundred miles long, at first parallel to the Red sea, but near Massowah the coast trends to the southeast, while the range continues its southerly course. Some of these mountains rise to the height of sixteen thousand feet. Far away on the west the country falls gradually to the Nile valley, and on the southwest to the great lakes. The only access to this plateau from the Red sea is up great gorges or canyons 1,000 to 3,000 feet in depth, each canyon varying in width from two or three feet to one hundred feet, with sudden turns shutting off the view beyond. Down these canyons in the wet season the water rushes with great violence, bringing masses of stone and rock; but the greater part of the year they are dry, and the traveler must often go from twenty to thirty miles without finding water. This plateau when reached is not a level plain, but is broken and tossed up by volcanic action, the mountains assuming wild fantastic forms, with abrupt, precipitous valleys, only accessible through deep passes. The plateaus, between six thousand and eight thousand feet above sea-level, are the temperate region, never either very hot or very cold. Some of the canyons are so deep that one can stand on the edge and, looking down, see at one glance the vegetation of the frigid, temperate, and torrid zones. The rivers flowing through these canyons act as barriers to communication, instead of facilitating it. In this region the Blue Nile rises and flows through deep canyons, falling about

4,000 feet in less than three hundred miles and cutting Abyssinia into Northern and Southern Ethiopia. The volume of this river is increased from 6,000 cubic feet per second in the dry season to 220,000 in the rainy season, and it carries down the earth from these high lands to Egypt, which owes its prodigious fertility to the Blue Nile.

From its elevation Abyssinia is healthy, and the climate is said to be as salubrious as any on the globe. The valleys on the western slope are fertile, producing abundant fruits and the vegetation of the temperate and tropical zones. Its lofty ranges are the home of Abyssinians, Copts, Arabs, and Jews of the Caucasian race—partially civilized tribes, once converted to Christianity, and still calling themselves Christians. The people are strong and active, but rude and barbarous. The different tribes are generally at war with each other, but at present they are all united under one ruler, who claims descent from the Queen of Sheba.

During the ages many attempts have been made to conquer the Abyssinians, but this has always been most difficult, as they can only be reached either from Egypt up the valley of the Nile or from the Red sea through one of the canyons. The latter has been the route most usually attempted, with results generally disastrous to the invader. The Abyssinians, hidden in the clefts of the mountains, behind the rocks and bushes, wait until the enemy has reached a difficult part of the canyon before attacking him. The most notable exception was in 1868, when the British, under Sir R. Napier, marched through one of these canyons, captured Magdala, and took prisoner King Theodore; but at that time Theodore had by his atrocities alienated the other chiefs and tribes, and through their aid the British passed up the canyon without opposition. It was in one of these canyons that the Abyssinians, under Menelek, the Negus Negus or King of Kings, as their emperor is called, lying in ambush, recently surprised and completely routed the Italians. It is said that the Abyssinian army of one hundred thousand men was supplied with the best repeating rifles by the French and Russians, and was aided by French officers.

The Russians have recently sent an embassy to Abyssinia and received an ambassador from that country, and negotiations are in progress to bring the Abyssinians into the Greek church.

About twenty years ago the Egyptians occupied the whole of the upper Nile, even to the Great Lakes and the valley of the Red sea. Abyssinia lay between these possessions, and the Khedive desired to conquer it. He sent two large armies, which marched up the eastern branches of the Nile to Abyssinia; both armies were defeated. The son of the Khedive, in command of the second army, was captured with a large number of men, but was subsequently ransomed.

A Mohammedan, born in Dongola, calling himself El Mahdi—*i. e.*, the leader, prophet, or guide—appeared in the Sudan about 1880, and raised the flag of the Prophet on a small island in the Nile near Khartum. Soon Arabs from the desert joined him, and later the Bedouins flocked from all parts of Egypt. About the same time Arabi Pasha, then an officer in the Egyptian army, conspired with El Mahdi and seized Cairo, the Khedive and English retiring to Alexandria. Sir Garnet Wolseley was sent to command the English and Indian armies, and at the battle of Tel-el-Kebir, September, 1882, Arabi was defeated and taken prisoner. He was subsequently sent to Ceylon, but the disaffection in the upper Nile continued to extend, and soon the whole population of the Sudan and upper Nile was gathered under the banner of the prophet El Mahdi. He defeated four expeditions, and in 1883 General Hicks Pasha, with an Anglo-Egyptian army of 10,000, was sent against him. They marched into the desert, and for months nothing was heard of the expedition, then slowly the news of its annihilation reached Cairo. In June El Mahdi captured Khartum, killing General Gordon a few days before General Wolseley with the English army came in sight of the city—too late. They returned without even attempting to avenge his death.

El Mahdi died a few months later, but his army was not dispersed. Osman Digna, the general of the Mahdists, overran the region east of the Nile, capturing and massacring Egyptian garrisons at different places and marching to the very gates of Suakin on the Red Sea, where the Mahdists desired to have a seaport for communication with Arabia, in order to obtain a good market for slaves from the interior of Africa. With these Mahdists the Italians have now to contend. Soon after their occupation of Massowah they acquired control of Tigre and Kassala, then held by the Mahdists and Dervishes. These fanatics, encouraged by the defeat of the Italians, are now said to be preparing to attack Kassala.

The English, for the purpose of aiding the Italians and recovering the valley of the upper Nile, wrested from Egypt by the Mahdists ten years ago, have sent a body of English troops, with an army of Sudanese and Egyptians, under English officers, from Cairo up the Nile to Dongola, between the fourth and fifth cataracts, in the expectation that the Mahdists and Dervishes will be drawn from Kassala to attack the English. If the latter are successful they will probably march up the valley to Khartum. If they are unsuccessful it is feared that the Mahdists will march down the valley to Cairo.

To an American it seems difficult to understand the reason that led Italy to attempt the acquisition of such a territory in Africa, and why Signor Crispi, under whose ministry it was undertaken, should assert that "colonial extension is a vital question—the advantage which it brings not being translatable into figures."

Unfortunately for Signor Crispi it has been translated into figures which show a large and serious deficit in Italian finances.

THE PHYSICAL FEATURES OF AFRICA AS THEY AFFECT ITS ECONOMIC VALUE, FUTURE OCCUPATION, AND CIVILIZATION.

The growth and prosperity of a country depend on its formation, including its mountains, temperature, and rainfall, its mineral and vegetable productions, and its facilities for intercommunication.

Africa is unlike the other continents, especially in the uniformity of its topography and in its temperature. It is a great peninsula, without islands, indentations, or harbors on its coast. This difference is especially exemplified by the Mediterranean coasts of Africa and Europe. The former is a long continued sand beach, without a break and with only one or two good harbors, while on the European side are the great peninsulas of Spain, Italy, and Greece, everywhere indented with island-studded seas and with bays and harbors.

Africa has a coastline of only 15,000 miles. If it was as long as that of Europe, in proportion to the size of the continent, it would be 57,000 miles long.

The relief of the land, instead of being centered in long and lofty mountain ranges, has been spread over the continent with wonderful equality, forming high plateaus, with terraces to the ocean, down which the water rushes in rapids or over high falls, which render the great rivers impossible of navigation. Notwithstanding this lack of long mountain ranges, its average altitude—about 2,000 feet—is higher than that of the other continents.

The country north of the equator presents a great similarity to the country south of it, though the features on the north are on a much larger scale. North of the equator is the greater lake Chad, south of it the smaller lake Ngami; north of lake Chad is the great desert of Sahara; south of lake Ngami is the small desert of Kalahari. North of Sahara, on the Mediterranean, and south of Kalahari, on the Indian ocean, are fertile tracts of limited extent, where the rainfall is abundant and vegetation flourishes.

The greater part of the territory between the Mediterranean and Sudan and between the Atlantic and the Red sea, and a considerable portion south of the Zambesi, comprising nearly one-half of Africa, is practically Sahara—that is, a waste or desert.

The Sahara is a plateau of diversified structure, with hills and numerous dried-up water-courses; regions of dunes or steppes, overgrown with alfa, alternating with sandy waste. At sunset the temperature falls quickly, causing a difference of one hundred degrees between day and night. Scattered through the desert are about four hundred oases, where the date palm flourishes. In many places wells have been dug, and great caravans follow the line of these oases and wells. The desert of Kalahari, in South Africa, is much smaller, has a more temperate climate, resembles our arid lands, and, like the latter region, is to a large extent suitable for the pasturing of cattle.

Although Africa is about five thousand miles long and four thousand five hundred miles wide in the broadest part, stretching over seventy degrees of latitude, about two-thirds of its area lies within the tropics, with a vertical sun twice a year, giving it the hottest climate in the world. The average temperature is eighty degrees, while north and south of the tropics the average temperature is only ten degrees less. In the tropics the climate is so enervating and unhealthy for Europeans that they cannot live there more than two or three years, while the same climate is most favorable to the negro.

The Germans occupied the Kamerun, in western Africa, near the equator, supposing that a great mountain rising fourteen thousand feet directly from the ocean would prove an excellent health resort; but the miasmatic vapors ascend the mountain slopes and render it an unfit habitation for the European. The rainfall in equatorial Africa is most abundant, from seventy to one hundred inches a year, causing a hot, moist atmosphere and a luxuriant vegetation. In this region the population is densest, from the abundance of fruits and the ease with which life is supported. There is also a heavy rainfall in the mountains of Abyssinia, on the northwest coast of the Mediterranean and on the southern and southeastern coasts, the rainfall diminishing toward the central and western parts of South Africa. As the rainfall diminishes, the native population decreases. All the other continents have great rivers, forming waterways to and from the interior. Africa has but one such river—the Niger. The Nile and Kongo are, however, among the most remarkable rivers in the world; the Nile, for its history and inundations; the Kongo, for the great number of its branches, navigable for small vessels for several thousand miles. On this river and its branches there are from forty to fifty stern-wheel steamers and about 100 stations, with from 600 to 800 white men in charge.

The whole trade of Africa, excepting that of Cape Colony and the Mediterranean, is monopolized by great companies, and where these do not exist, by smaller traders. This trade is most profitable to Europeans, consisting largely in the exchange of cheap cotton goods, beads, copper wire, in limited quantities, and of rum, brandy, old arms, and ammunition, in large quantities, for ivory, india-rubber, and other products.

The total amount of the annual exports and imports of Africa other than from the Mediterranean and exclusive of gold, silver, and diamonds is, however, scarcely equal to the annual foreign trade of one of the large ports of the United States.

From this résumé it appears that Africa produces abundantly in the equatorial provinces, where the white man cannot live; that there are not any good waterways from the interior to the coast and few good harbors when it is reached; that the only articles obtained from the natives are elephants' tusks and the fruits that grow spontaneously; that the only way of moving products to and from the sea is by caravans, a slow and expensive method, precluding any extensive commerce. From this it follows that the value of equatorial Africa is and must be for a long time very small It is possible to build railroads into the interior of equatorial Africa, for one or two are now in operation in Portuguese West Africa, one is in process of construction around the falls of the Kongo, and surveys are being made in eastern Africa, both by England and by Germany, and in northwestern Africa by France; but it is doubtful if there is now sufficient business to enable these roads to pay operating expenses, nor can the trade be materially increased until the natives acquire the habits and wants of civilized life and are willing to labor and raise the products that will grow in the tropics and exchange them for the goods and wares of Europe and America. This change is slowly taking place. The mercantile agencies must and do employ native traders and native labor. All the work in the tropics is performed by Africans; men whose fathers never saw or heard of white men are building railroads and telegraphs and carrying great loads from the interior to the coast; some are in superior positions, in charge of stores and telegraph-offices or steamboats; some receive regular wages; others are paid in clothing or spirits.

The European can probably live in the high plateaus of Abyssinia, in the Lake region, and in southern Africa, where, from the elevation, he would have a European or temperate climate. Southeastern and central South Africa have a temperate climate, are generally well watered, and the land is capable of cultivation by irrigation. In this region the mineral wealth is large, and it is connected with the Indian ocean and South Atlantic by railroads now in operation. There seems to be no physical cause to prevent these regions from becoming the homes of numbers of Europeans beside the present occupants.

In America the Indians or natives have invariably given place to the white man and have been generally exterminated. Will the negroes or natives of Africa retire before the European? Let us consider South Africa the portion of the continent most favorable to the white man. The slave trade and the constant wars between the natives have been stopped; the Kaffirs have exchanged the brutal rule of the savage for the beneficent government of the European, and have become freemen, endowed with an absolute title to their homes and to any property they may acquire. They cultivate the fields of the Boer: they work in the diamond and gold mines; they own large herds of cattle, and, compelled to give up their nomad life, they have commenced tilling the ground for themselves.

Instead of white day laborers, as in Europe and America, the English in South Africa employ the Kaffir. As a result the native population is increasing with accelerated rapidity. It is already many times more numerous than the European and the disparity is constantly and rapidly increasing. The Kaffir lives more cheaply and works for less wages than the white man. The only

Europeans required, or for whom there is room or occupation, are the owner and the overseer, the mechanic and the engineer. In another generation the Kaffir will fill most of these places, and there will be no work or position in the interior for the Englishman. The capitalist, the manufacturer, the merchant, and the trader will live in the cities.

First the Hottentots were expelled by the Bantus; then the Bantus were driven into the interior by the Boers; the Boer in his turn gives way to the Englishman only to be ejected by the Kaffir when he has learned to work.

What is true of the Kaffir holds good to a less extent of the Bantus and negro tribes in Equatorial Africa. The Arab slave dealer has been shorn of his power; the slave trade has been generally stopped, and with that the prime cause of the internecine wars. Wherever the European rule is established and peace assured, improvement soon appears in the habits and character of the people, with a very rapid increase of the population.

The Arab, Bantu, and negro must occupy the equatorial regions of Africa, because the white man cannot live there, and they will then, I believe, drive out the Europeans from the remainder of the continent and we shall see a race vastly superior to any Africans now there and in some respects superior to the white man.

FUNDAMENTAL GEOGRAPHIC RELATION OF THE THREE AMERICAS

By Robert T. Hill,

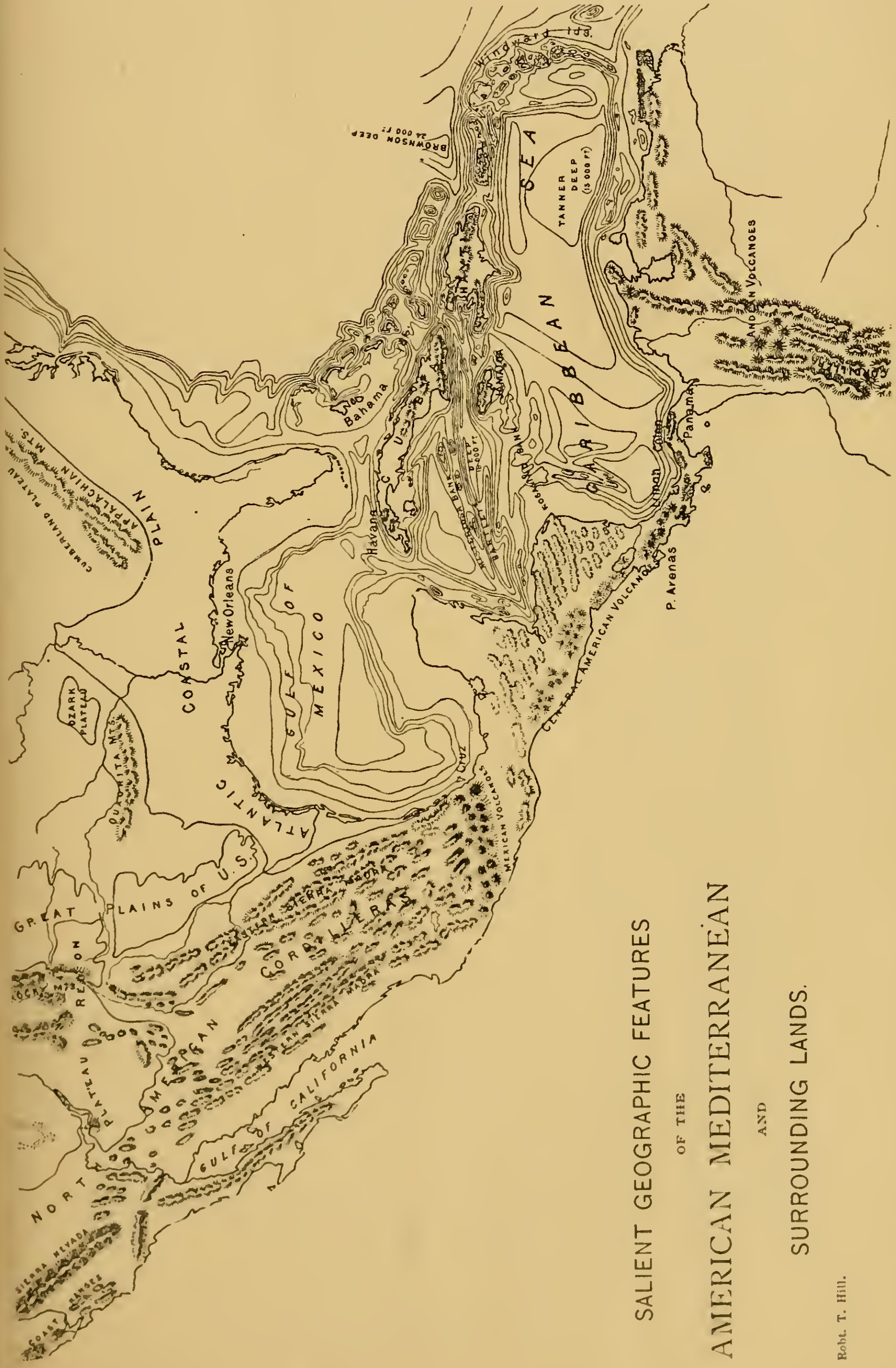
United States Geological Survey

The early geographers taught that the two American continents are practically dominated by a continuous cordilleran system, running like a backbone through South America, Central America, and North America, connecting the whole western border of the hemisphere into one great mountain system. Modern exploration shows that this teaching must be modified.

The Andean cordilleran belt dominating the western coast of South America trifurcates after crossing the equator, bends slightly eastward, and abruptly terminates in northern Colombia. Only one doubtful spur of the Andes touches the coast of the American Mediterranean, and this is the Sierra del Marta, lying between the gulf of Maracaibo and Rio Magdalena. This northern end of the Andes lies entirely west of the Isthmian region and is separated from it by Rio Atrato. Minute study shows that the Andean system has no genetic connection with the mountains of the northern coast of South America, much less with the mountains of Central America or the great Rocky Mountain region of Mexico and the United States; in fact, the deeply eroded valley of this stream nearly severs the Isthmian region and the Pacific coast of the Republic of Colombia from the South American continent.

The studies of many geographers, especially those recently conducted by Felix and Lenk, have shown that the main cordilleran system of Mexico, which is the southern continuation of the Rocky Mountain region of the United States, abruptly terminates with the great scarp or "abfall" of the so-called plateau a little south of the capital of the Republic, and that these mountains have no orographic features in common with those of the Central American region lying further southward. The axes of the two great North American and South American cordilleras, the Rocky mountains and the Andean system, if projected from their termini in Colombia and southern Mexico, respectively, would not connect through Central America, but would pass each other in parallel lines many hundred miles apart. The projected Andes would pass through Jamaica and eastern Cuba and continue east of the longitude of the whole Appalachian system in the direction of Nova Scotia; the southward continuation of the North American cordilleras would cross the equator in the Pacific, far west of Central America and the South American continent.

Between the widely separated termini of the main North American and South American cordilleras as above defined, and extending directly across their trend at right angles to them, lies another great orogenic system of folds, to which the term Antillean has been applied. Collectively they constitute a great orogenic system which has been of the utmost importance in giving to the Caribbean region its predominant outlines—a system composed of corrugations having an east-west trend, which has never been appreciated by the geologist or geographer owing to the overwhelming proportions of the adjacent mountains built up by volcanic ejecta. They extend along the Venezuelan and Colombian coast of South America, north of the Orinoco, the isthmus of Panama, Costa Rica, and the eastern



SALIENT GEOGRAPHIC FEATURES
OF THE
AMERICAN MEDITERRANEAN
AND
SURROUNDING LANDS.

Robt. T. Hill.

parts of Nicaragua, Guatemala, Honduras, Yucatan, Chiapas, and southern Oaxaca, and through the Great Antilles. These mountains are made up of granites, eruptives, and folded sedimentary rocks of Paleozoic, Mesozoic, and Cenozoic age in Guatemala and southern Mexico; of Mesozoic and Cenozoic age in the Antilles, Costa Rica, Venezuela, and Colombia; and of Cenozoic age in Panama.

The two elongated submarine ridges (the so-called Misterosa and Rosalind banks) stretching across the Caribbean from the Antilles to the Central American coast, between the Sierra Maestro of Cuba and the gulf of Honduras, and from Jamaica to cape Gracios a Dios respectively, separated by the submarine valley, 18,000 feet in depth, known as "Bartlett Deep," have a suggestive and remarkable resemblance to these east-west corrugations of the land; indeed Seebach long since suggested that these ridges directly connected the mountains of the Antilles with those of Guatemala and Honduras.

Thus the Caribbean sea is almost entirely surrounded by the east-west trending mountains and submarine ridges of the Antillean type; the Windward islands, marking the eastern inlet of the sea, are largely volcanic necks.

A distinct class of mountains, independent of great lines of folding of the earth-crust, are the volcanoes. These have grown by extrusion and accumulation; sometimes they are parasitic on the folded mother-systems, sometimes independent of them. They belong to the great area of igneous activity which, since at least as early as the beginning of Tertiary time, has marked the whole western half of the North American continent, the Caribbean, and the northern and western sides of the Andean region. Although they blend, the volcanic ejecta of this great belt may be classified for convenience in two distinct age categories, which may be called the quiescent and the active volcanic groups.

The active volcanic groups occur in four widely separated regions: 1. The Andean group of volcanoes of the equatorial region of western South America, rising above the corrugated folds of the northern termination of the predominant South American cordilleras. 2. The chain of some twenty-five great cinder cones which stretch east and west across the southern end of the Mexican plateau, protruding parasite-like upon the terminus of the North American cordilleras. 3. The Central American group, with its thirty-one active craters, growing diagonally across the western ends of the east-west folds of the Antillean corrugations, which fringes the Pacific side of Guatemala, San Salvador, and Costa Rica; this is separated from the Mexican group on the north by a large non-volcanic area (the isthmus of Tehuantepec), and from the Andean volcanoes on the south by an area (the isthmus of Panama) in which no living volcanoes are found. 4. The chain of volcanoes of the Windward islands, marking the eastern gate of the Caribbean sea and standing in a line directly across the eastern termini of the Antillean mountains of east-west trend, parallel to the Central American group similarly situated at the western termini of these mountains. In recent times all these giants of fire have built up vast piles of lava and cinder into lofty summits, which overwhelm in topographic grandeur the lesser but more significant orographic features of the region.

The quiescent volcanic regions, where activity was dominant chiefly in Tertiary time, but ceased long ago, are many. The isthmus of Panama, the Pacific coast of South America west of the Atrato, the northern coast of South America, and the old volcanic regions of northern Mexico and the United States are among these. There can be little doubt that the tremendous outbursts of igneous material in Tertiary time, which dominated western North America, extended in a great belt around the southern end of the North American cordilleras, crossing the Caribbean area to the Atlantic between the two continents.

The North American cordilleran region lying north of the isthmus of Tehuantepec is one of north-south folded sedimentaries, plus accumulations of volcanic intrusions and ejecta (chiefly Tertiary), and dominates a continental area.

The Andean region of the South American continent is one of north-south folded sedimentaries, plus accumulations of Tertiary volcanic intrusions and ejecta, and dominates a continental area.

The Caribbean region, including Central America, the Antilles and the Windward islands, and most of the Venezuelan and Colombian coast of South America, is one of east-west folded sedimentaries, plus accumulations of volcanic intrusions and ejecta, but, instead of dominating a continental region, *practically constitutes a mountainous perimeter surrounding the depressed basin of the Caribbean.* These mountains were mostly made about the close of Tertiary time, and hence are newer than the chief continental systems.

Upon this arrangement of the three systems of mountain folds are chiefly dependent the great physical differences between the lands bordering the gulf of Mexico and Caribbean sea; the former in its geognostic aspects and relations is North American, while the latter is distinctly Central American.

The gulf of Mexico, with the single exception of its extreme southwestern indentation of the coast of Mexico, is surrounded by gently tilted plains, composed of great sheets of subhorizontal sediment, largely deposited by its own waters when they occupied a larger area than at present.

The Central American region as above outlined—*i. e.*, that portion of the American hemisphere extending from the southern termination of the Rocky Mountain region to the northern termination of the South American Andes, including the southern border of Mexico, the Republics of Central America, and the isthmus of Panama proper—constitutes the western perimeter of the circle of mountains inclosing the Caribbean. As a whole it is called by some writers the American Isthmian region,* and can be genetically separated into two conspicuous regions: 1. The recent volcanic plateau lying nearer the Pacific coast from its commencement in Guatemala to its eastern termination in Costa Rica, which is composed of accumulated material extruded across the western termini of the Antillean trends. 2. The lower but nevertheless mountainous portions of the Caribbean side, composed of folded mountain-axes extending east-west in conformable direction with the Antillean uplifts, accompanied by old eruptive extrusions of past geologic time. The most conspicuous eminences are the grand volcanic peaks of Guatemala, San Salvador, and Costa Rica. These rise to an average height of 10,000 feet, in irregular masses standing nearer the Pacific coast than the Atlantic until reaching the borders of Costa Rica, when they sweep diagonally toward the Caribbean side, again assuming in the southern portion of that republic a central continental position. These great eminences are built up of accumulations of volcanic debris, which have buried and largely concealed a most interesting antecedent geologic structure that must be interpreted before the complete history of the region can be written. These mountains, being largely extrusions of volcanic material instead of regular folds or plications of stratified rock, produce irregularities of surface which defy the ordinary modes of classification.

* The conspicuous features of this greater Isthmian (Central American) region are its narrow, elongated outlines relative to the broadening areas of the adjacent continent and the completely mountainous character of its entire area, which is void of coastal plains.

The western termini of the east-west Antillean axes of the Caribbean half of Central America, which are buried in western Guatemala, Honduras, and Costa Rica by the overlying volcanic masses, are not so limited on the Pacific side, but continue across Panama. On entering this state from Costa Rica signs of recent volcanic activity cease, and the continuity of the chain of high Central American summits is succeeded by the still more broken and apparently inexplicable lower-lying Isthmian topography.

The isthmus of Panama can now be accurately defined as the stretch of land lying east of the southern end of the Central American region of active volcanoes (commonly called the Costa Rican volcanic plateau) and extending to the northern termination of the Andes. Its limit on the east is Rio Atrato, which flows northward from the equator along the valley marking the eastern flank of the Andes; on the west it is limited by the southern boundary of the republic of Costa Rica, extending from Burica Point to the island of Veraguas and thence between the meridians of 79° 15′ and 82° for a distance of 180 miles. The axial trend of the Isthmian region is east and west, or in a direction contrary to the north and south continental trends, and is conformable with the Antillean axes.

The Great Antilles lie along the line of east-west corrugations and apparently represent nodes of greater elevation whereby the surfaces of these islands were projected above the waters as islands, which have persisted without continental connection or union with each other since their origin.

[Note.—The foregoing article is published by permission of Professor Agassiz, under whose auspices the writer conducted his investigations in the region described.]

THE KANSAS RIVER

By Arthur P. Davis

United States Geological Survey

The Kansas river proper is formed by the junction of the Smoky Hill and Republican forks, at Fort Riley, in Davis county, Kansas, about 140 miles from where it empties into the Missouri. It is one of the best examples of a western stream whose drainage lies entirely in a plains region, with no mountain tributaries. Its basin extends from eastern Colorado to the Missouri river, a distance of 485 miles, with an extreme width of nearly 200 miles. The total area drained, as measured from the latest drainage maps of the General Land Office, is 61,440 square miles, of which 34,526 are in Kansas, 17,454 in Nebraska, and 9,459 in Colorado.

The altitude of the basin varies from 750 feet at Kansas City to over 5,000 feet in Colorado, the average being about 2,500 feet. The area is distributed with reference to elevation as follows:

Under 1,000 feet	1,250	square	miles.
Between 1,000 and 2,000 feet	26,200	"	"
" 2,000 and 3,000 feet	14,300	"	"
" 3,000 and 4,000 feet	12,560	"	"
" 4,000 and 5,000 feet	5,620	"	"
Over 5,000 feet	1,510	"	"

Gauge readings have been carried on for several years at the mill dam at Lawrence by the mill owner. Sufficient measurements have not yet been made to establish a mean annual flow. The minimum discharge is probably a little over 500 second-feet. The mean annual rainfall of this basin varies with approximate regularity from about ten inches at its western extremity to nearly forty inches at the Missouri river, averaging perhaps twenty inches. It will be seen, therefore, that this basin reverses the conditions of the typical western stream which rises in the mountains, where the precipitation is great, and carries its abundant waters into the arid plains, where the smaller tributaries can be used one by one, as they leave the mountains, to irrigate the plain.

Rising as they do, in the most arid portion of the basin, and draining a sandy country of gentle slope, the streams, except at the rainiest times, are almost insignificant in size until they reach the region where the precipitation is sufficient for the requirements of agriculture. They thus attain a considerable volume only in the eastern part of the State, where irrigation is not imperative, and where, moreover, nearly all the water is concentrated in one stream so large and with so gentle a slope that its diversion for commercial purposes is impracticable. If the rainfall conditions of the Kansas basin could be reversed, with a forty-inch precipitation in eastern Colorado, decreasing to one of ten inches at the Missouri, its irrigation possibilities would be increased many fold.

Three principal rivers flow directly into the Kansas: the Blue, from the north; the Republican, from the northwest, and the Smoky Hill, from the west. The Blue has a drainage of 9,490 square miles, of which 2,450 are in Kansas and 7,040 in Nebraska. In volume of water the Blue river is by far the most important of the tributaries of the Kansas. The discharge of this river is being measured by the Geological Survey at Rockyford, about five miles above its mouth, and the minimum has been found to be about 300 cubic feet per second.

The next stream in order, and also in amount of water delivered, is the Republican, draining an area of 25,837 square miles, and showing a minimum flow, as observed at Junction City, of about 200 cubic feet per second. It will be noticed that though draining over two and one-half times as large an area as the Blue, its discharge at low water is only two-thirds as great as that of the latter stream. This is due to the fact that the Blue drains the northern and eastern parts of the basin, where the rainfall is heaviest, while the Republican rises at the western extremity of the drainage area and flows for hundreds of miles through arid sand hills that yield very little run-off, except in times of excessive rainfall. No part of its basin receives a precipitation equal to the average of the basin of the Blue; so, although the basins adjoin each other and the rivers empty within twenty miles of each other, the ratio of run-off to area is over four times as great for the Blue as for the Republican.

The Smoky Hill river rises in eastern Colorado and drains an area of 20,428 square miles. It has two considerable tributaries, the Saline and the Solomon, draining respectively 3,311 and 6,882 square miles. Gauging stations have been established on all three of these streams. The station at Ellsworth, on the Smoky Hill, intercepts the drainage of 7,980 square miles, of which 6,447 are in Kansas and 1,533 in Colorado. A minimum discharge of only 10 cubic feet per second sometimes occurs at this point. At the gauge on the Saline river at Beverly the area drained is 2,730 square miles, and a low-water discharge of 20 second-feet is shown. The gauge on the Solomon is at Beloit. The area draining past this point is 5,539 square miles, and the low-water flow is 140 cubic feet per second.

There are many water-power developments in the Kansas basin, the most numerous and important occurring on the Solomon and Blue rivers. These developments are, however, in their infancy, only a small proportion of the favorable sites being improved. The following summary of the power in use in this basin, taken from the reports on the Water Power of the United States, published by the Tenth Census, vol. xvii. page 361, exhibits the importance of this river and its tributaries to the local industries rapidly being developed upon the Great Plains:

Stream.	Tributary to what.	State.	Number of mills.	Total fall used.	Horse-power of wheels.
Kansas	Missouri	Kansas	9	8	317
Delaware	Kansas	...do	7	64	377
Big Blue	...do	Kan. and Neb.	16	103	1,022
Little Blue	Big Blue	...do	13	103½	637
West Fork Blue	...do	Nebraska	8	80	340
North Fork Blue	...do	...do	4	35	242
Smoky Hill	Kansas	Kansas	7	59½	442
Solomon	Smoky Hill	...do	11	98½	657
North Fork Solomon.	Solomon	...do	8	104	298
South Fork Solomon.	...do	...do	2	17	114
Saline	Smoky Hill	...do	6	72	199
Republican	Kansas	Kan. and Neb.	7	43	356
Prairie Dog	Republican	...do	6	71	152
Sundry small streams.	Kansas and tributaries.	...do	41	486½	1,408
Total, Kansas river and all tributaries			145	1,345	6,561

GEOGRAPHIC LITERATURE

DE LAPPARENT'S LEÇONS DE GÉOGRAPHIE PHYSIQUE

Leçons de Géographie physique. By A. de Lapparent. Pp. 590, with many illustrations, maps, and diagrams. Paris: Masson et Cie. 1896.

M. A. de Lapparent, professor in the *Ecole libre de hautes études* in Paris and lately president of the French Geographical Society, lays us under many obligations by the preparation of this valuable work. An accomplished field geologist, as evinced, for example, in his monograph on the peculiar deformation in the Paris basin known as the Pays de Bray; author of a compendious treatise on geology, the leading work of its kind in the French language; a presiding officer as notable for his courteous tact as for his competence in his subject, he now discloses a close acquaintance with a line of study that as yet is hardly acclimated in Europe, namely, the American science of geomorphology, whose principles and name he adopts together. Although his references to American sources overweight the relative importance of contributions from certain quarters, he has clearly seized the essentials of the rational as against the empirical method of geographical description. The initial forms produced by uplift, deformation, or other genetic processes, the succeeding work of the agencies of erosion, the control of dissection by the effective baselevel, the gradual and systematic progress in dissection as determined by the advance in time through the geographical cycle, and the termination of the normal uninterrupted cycle of erosion in a plain or peneplain of subaerial denudation, all these and many other essential features of the American treatment are succinctly presented. Numerous illustrative examples, largely taken from European sources, are presented; these being of particular value to our students of the subject, who are naturally more familiar with American occurrences. Following the statement of general and special principles, there comes an account of Europe in particular and of the world in less detail, which is, I believe, the first serious attempt to treat areal geography in this fashion. Local geomorphological studies have been attempted elsewhere, but no one has hitherto undertaken to discuss the physical geography of the world on these new lines. It goes without saying that the treatment must be very unequal, for the physiography of many parts of the world is now as little known as the fauna and flora of the remoter regions were known a century ago.

It is manifest from an examination of this book, as well as from the study of various other sources, that the morphology of mountains is in a much less advanced state than that of simpler structures. Students of the subject will therefore do well to give particular attention to remedying this deficiency. At present we read frequently about the height and length of ranges, about the rocks of which they are composed, and about the influence of mountains on climate, both local and adjacent, as well as about their control of the character and distribution of plants and animals, but it is very seldom that any critical or detailed morphological account is given of the mountains themselves. Their forms are so various, so ungeometrical, that they have not yet been reduced to system and embodied in a satisfactory terminology, indicative of structure on the one hand and of stage of destructional development on the other. Thus de Lapparent's account of the concentric escarpments of the Paris basin is more systematically complete than his description of the Pyrenees; a clearer idea is given of the topography characterizing the simplified forms of the old mountains of the middle Rhine than of the complicated forms of the still vigorous Alps. This is not to be avoided in the present stage of the science, but nothing will aid more in carrying us past this stage than the preparation of sound general treatises like the one before us. Its perusal must turn many students toward further investigation, and new investigators are greatly needed.

In the matter of citations, the author has been sparing, but this is to be the less regretted on account of the exhaustive bibliographic treatment of geomorphology in Penck's recent *Morphologie der Erdoberfläche* (2 vols., Stuttgart, 1894). The latter book presents an exceptionally full account of the historical development of physical geography, while the former presents a concise account of its present advanced condition, and thus the two works complement each other very satisfactorily.

Whether in preparation for a trip abroad or for use in study and teaching at home, de Lapparent's *Leçons* must prove very acceptable to American geographers. W. M. Davis.

ANNUAL REPORT OF THE SUPERINTENDENT OF THE UNITED STATES COAST AND GEODETIC SURVEY

This report is still in the hands of the Public Printer, but by the courtesy of Gen. W. W. Duffield, Superintendent of the Survey, The National Geographic Magazine is permitted to present its readers with the following summary of its contents:

The report covers the fiscal year ending June 30, 1895. It gives the progress of the work in the field and office with the customary detail, and the necessary references to several boundary surveys and other special surveys of precision of the class usually assigned to this bureau.

Upwards of seventy-five parties were actively engaged in the various branches of the field operations. Work was carried on within the limits or on the coasts of sixteen states and territories along the seaboard and in nine states and territories in the interior. It included reconnaissance, base-line measures, triangulation, topography, hydrography, physical hydrography; time, latitude, longitude, and azimuth determinations; boundary-line surveys, geodetic leveling; magnetic declination, dip and intensity observations; laying out meridian lines, gravity determinations; tidal and current observations; oyster-bed surveys, etc.

Among the surveys of special importance are the completion of the topographic and hydrographic resurvey of Boston harbor and vicinity; the beginning of the resurvey of Buzzards bay; the continuation of the telegraphic longitude determinations in the southwest; the progress on the transcontinental triangulation in Colorado and the oblique arc in Alabama; points furnished in aid of state surveys in Tennessee, Kentucky, New Jersey and Minnesota; the completion of the reconnaissance of the Rio Grande from its mouth to El Paso; the completion of the resurvey of Pensacola bay and its tributaries; the surveys for the location of the boundary line between southeastern Alaska and British Columbia; the survey of the California oblique boundary line and the topographic and hydrographic resurvey of San Francisco bay and harbor.

The line of precise spirit-levels from tidewater was continued to Kansas City, and the usual progress was made in surveying those portions of the coasts not yet fully charted, including the channels of Washington sound, the strait of Fuca, and the hydrographic development of the intricate channels of the Alexander archipelago in southeast Alaska.

The report records the death of Lieut. F. H. Crosby and four men engaged in the prosecution of the field work, who were drowned while attempting to land through the surf on the coast of Washington. This is commented upon as the most serious casualty that has happened to any of the field parties of the Survey since the loss of the *Walker* in 1856.

In accordance with the provisions of law, one of the assistants has continued to serve as a member of the Mississippi River Commission, and another, by appointment of the President, is a member of the International Boundary Commission, organized for the location of that part of the United States and Mexican boundary line extending from El Paso to the Pacific. At the request of the Secretary of the Navy two assistants were temporarily detailed, one for special triangulation in connection with marking the speed trial course in Long Island sound, and the other for a survey on a large scale of the vicinity of the dry dock at Port Orchard, Puget sound. Assistants were detailed during the year at the request of the Governor of Virginia for surveys of the Virginia oyster beds, and a special survey of the Fox islands, Chesapeake bay, for the settlement of some questions of riparian rights, and at the request of the Commissioner of Fish and Fisheries to make further examination of the oyster beds in Mobile bay and vicinity. The detail of an assistant for the Massachusetts State town boundary survey also continued during the greater part of the year. The surveys for the location of the boundary between Alaska and British Columbia, that have been conducted by the Superintendent for several years past in his capacity as commissioner on the part of the United States, were continued during the season of available working weather, and the parties organized in the spring of 1895 completed all the work necessary for the compilation of the maps required. Under the head of special surveys, mention is also made of the act of Congress of August 1, 1894, requiring the Superintendent to lay out a circle around the new Naval Observatory for the deflection of the street extensions of the city; the work was duly completed and the results with maps showing location delivered to the Navy Department.

The report of operations in the office is given in great detail. The publications of the Survey relate essentially to the navigation of the coasts of the United States; but in the preparation of the tide tables for the new year a commendable departure seems to have been made by including predictions for the principal ports of the world. Seventy-five new charts were issued and one hundred and twenty-eight charts were revised and reissued. The new chart publications complete the series of the Atlantic and Gulf coasts on the uniform scale of 1 : 400,000, designed especially for the use of navigators, and the series on the coast of Maine on the large scale of 1 : 40,000, designed for the safe navigation of the intricate passages of that broken and rock-bound coast. The distribution of charts during the year is reported at 51,456 copies, more than half the number having been sold by the agents in the principal maritime cities. There were also distributed 114,000 copies of the monthly notices to mariners, describing the important hydrographic developments and changes in aids to navigation on the coasts of the United States.

The "Bureau of Standard Weights and Measures," which is also under the direction of the Superintendent of the Survey, reports that duplicate sets of standards had been furnished the states of North and South Dakota, besides the customary routine work. Reference is also made to the new Kilo balance of precision recently obtained by the Bureau. It is a duplicate of the balance of the International Bureau and is the second brought to this country. The other is in the Smithsonian Institution and was used by Professor Morley in the determination of atomic weights. The special features of these balances are auxiliary devices which enable the observer to note the oscillations of the beam from a distance and to interchange the weights upon the scale-pans without approaching the balance. The probable error of a single weighing with a load of one kilogramme is only $\pm$ $0^{mg}.0236$.

In presenting his estimates for the next year the Superintendent urges a moderate increase in the appropriation for field work as necessary to the rapid and economical prosecution of the surveys urgently demanded in the interests of commerce along our coasts, and for the advancement of other important field operations of the survey, which, he states, are found to be impracticable with the amount appropriated for the current year. The estimates contemplate resurveys of several important harbors on the Atlantic and Pacific coasts; also the commencement of a survey of the Aleutian islands and an examination of the mouths of the Yukon river in Alaska in addition to the work in progress.

Besides the publications referring to nautical matters, the survey issues bulletins at irregular intervals intended to impart advance information on new discoveries or other matter relating to the survey; and appendices to the report of the Superintendent giving scientific results and other developments incidental to the progress of the work. Four bulletins were issued during the year and the report has appendices on the following subjects: The Secular Variation in Direction and Intensity of the Earth's Magnetic Force in the United States and Some Adjacent Countries; Observations of the Transit of Mercury at Washington in 1894; Results of Latitude and Longitude Determinations in Alaska; Physical Hydrography, Nantucket, Mass.; Notes on the Specific Gravity of the Waters of the Gulf of Mexico and the Gulf Stream; A Graphic Method of Reducing Stars from Mean to Apparent Places; A Description of Improved Leveling Rods and a Report on the New Kilo Balance of Precision.

HERBERT G. OGDEN.

MISCELLANEA

In Santo Domingo important governmental concessions have been granted to an American corporation. From Puerto Plata, a seaport of 18,000 inhabitants, at which from 12 to 15 steamers enter monthly, a railroad is being constructed to Santiago and Mora.

American capitalists have purchased the entire street-railway system of the city of Mexico, comprising 100 miles of broad gauge and 60 miles of narrow gauge, over which seventeen and one-half millions of passengers were carried in 1895. Electric traction and other improvements are contemplated.

Two summer courses in physiography will be given by Professor W. M. Davis at Harvard University, beginning July 3 and lasting six weeks. The chief object of the elementary course is to promote the change in the method of teaching geography so generally advocated in recent years, and the lectures will be supplemented by laboratory work and excursions. The advanced course will be specially adapted to the needs of those already well grounded in the elements of physiography. The admirable library and laboratory resources of the university will be available for the use of students, and as the fee for either course is only $20, there should be a large attendance.

A GOLD MEDAL

WILL BE AWARDED BY

The National Geographic Society

to such **pupil in a public high school** in the United States as shall compose and submit by **October 15, 1896**, the **best original essay**, not exceeding 2,000 words in length, on the **Mountain Systems of the United States.**

A **Certificate of Proficiency** will also be awarded for the **best essay received from each State,** provided such essay is of sufficient merit to justify the award.

Essays will be received only from such public high schools as formally announce their intention to compete by **May 31.**

All competitors will be required to make a formal certification on honor that they have not received aid from any person in the composition of their essays.

The Adjudication Committee consists of General A. W. Greely, Chief Signal Officer, U. S. Army; Dr. T. C. Mendenhall, President of the Polytechnic Institute, Worcester, Mass., and Prof. W. B. Powell, Superintendent of Public Schools of the District of Columbia.

EVERETT HAYDEN,
WASHINGTON, 1515 H STREET N. W. *Secretary.*

THE JUNE NUMBER

OF

THE NATIONAL GEOGRAPHIC MAGAZINE

will contain among other important articles

THE SEINE, THE MEUSE,

AND

THE MOSELLE,

BY PROFESSOR WILLIAM M. DAVIS,
OF HARVARD UNIVERSITY;

AND

ACROSS THE GULF BY RAIL TO KEY WEST,

BY JEFFERSON B. BROWNE,
COLLECTOR OF CUSTOMS OF THE PORT OF KEY WEST;

ALSO A PORTRAIT OF

GENERAL A. W. GREELY, U. S. A.

JUDD & DETWEILER, PRINTERS, WASHINGTON, D. C.

Vol. VII JUNE, 1896 No. 6

The National Geographic Magazine

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(*Gold Medallist of the Royal Geographical Society, and of the Société de Géographie de Paris*)

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THE

National Geographic Magazine

Vol. VII JUNE, 1896 No. 6

THE SEINE, THE MEUSE, AND THE MOSELLE

By William M. Davis

Professor of Physical Geography in Harvard University

The three rivers.—The narrow basin of the Meuse lies between the widespreading branches of the Seine on the west and of the Moselle on the east. The slender trunk stream of the Meuse, with hardly a tributary on either side, is like one of those tall. close-trimmed poplars that the traveler often sees along the national roads of France, and the comparison is not altogether inapt, for there is good reason to think that the Meuse has really been trimmed of certain branches which have been diverted to the basins of its larger neighbors. Its basin is, indeed, like the

Figure 1.—The Arabic numbers on this figure show the different locations of the other figures used in this article. The Roman numbers show the location of the page plates.

dwindling territory of a petty prince between the encroaching kingdoms of powerful rulers on either side. The evidence of this will appear when we examine the characteristics of the three rivers.

The vigorous meanders of the Seine.—The Seine, after gathering in its upper branches both above and below Paris, pursues a strongly meandering course to the sea. Its lower valley is sunk with rather steep sides in a comparatively even upland, which itself is a surface of denudation. Although without complete proof on this point, I am led to suppose that this gently rolling upland is an uplifted peneplain—that is, a denuded region that was once reduced to a surface of moderate relief close to its controlling baselevel, and then raised by some gentle process of elevation to its present altitude. During the development of the peneplain the Seine, the master river of the region, must have attained an extremely faint grade, and at the same time have taken on the habit of swinging from side to side in comparatively regular curves or meanders such as are characteristic of rivers with gentle slope. With the uplift of the region the meandering river would proceed to incise its channel beneath the uplifted surface, and thus Ramsay accounted for its peculiar intrenched meanders many years ago. They seem to be features of old age retained in youth of the present cycle of denudation as an inheritance from an advanced stage of a preceding cycle.

In the second cycle of denudation, now in progress, the belt of country inclosed by lines tangent to the outer meander curves of the Seine seems to have broadened to greater width than it possessed before the uplift of the region occurred. The evidence of this is seen in the long sloping descent of each tongue of land which enters one of the river curves and from which the river seems to have receded, while the outer side of the swinging current undercuts a bluff of steep descent from the upland, as if the river were pressing against it. If the meandering river had cut down its channel vertically the slopes on the two sides of its present course should be symmetrical.* The reason for the increased breadth of the meander belt appears to be in the increased velocity given to the river in consequence of the uplift of the region. Many similar cases might be mentioned, but none show more clearly than the Seine the special features of an invigorated river. The great curves around which it swings fit in nearly all cases close to the bluff on their outer side. It is an able-bodied river, a river of a robust habit of life.

* See note by A. Winslow in *Science*, 1893.

VALLEY OF THE SEINE, NEAR DUCLAIR

Sheet 31, Map of France, 1 : 80,000

The case of the Ste. Austreberte.—Not far below the city of Rouen and precisely at the small town of Duclair, on the north bank of the Seine, there is an interesting little occurrence strongly confirmatory of the invigorated habit of the swinging river. Duclair is situated on the outer side of a large north-turning meander. Into this north-turning meander descends a long sloping spur from the upland south of the river; east and west of Duclair similar long sloping spurs descend from the northern upland into the adjacent south-turning meanders. On looking closely at the map of the country or, still better, on looking over the region itself from the top of the bluff at the back of the town, it is seen that the western of the two northern spurs is obliquely cut across by a narrow, dry, flat-bottomed valley, which is just in continuation of the course of a little stream known as the Ste. Austreberte, coming from the northeast and mouthing in the Seine at Duclair. The dry valley was evidently at one time followed by the lower course of this stream, and it is still followed by the highway and the railway, for which it serves for a "short-cut" on their way down the Seine. (See Plate XXI.)

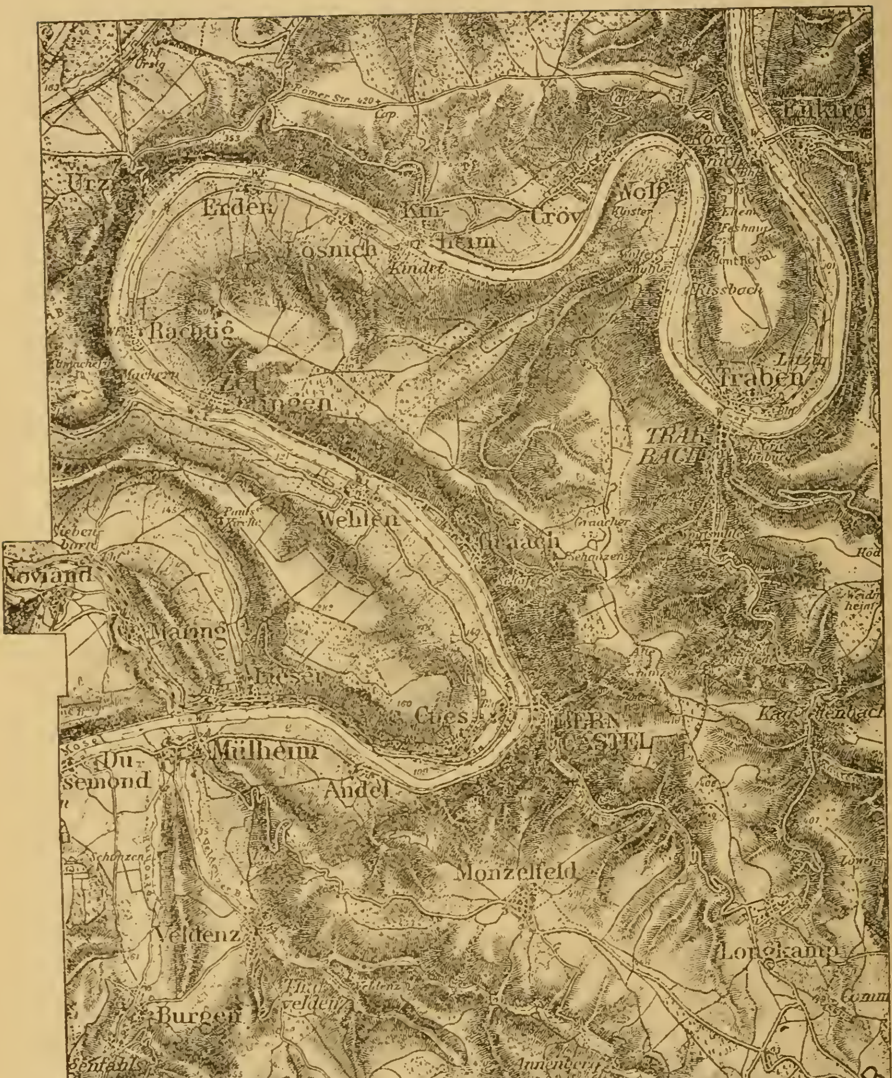
The question then arises, Why has the stream deserted so well prepared a path? The answer is not far to seek. The change evidently occurred because the Duclair meander of the Seine pushed its inclosing bluff further and further north until the river cut through the ridge that separated it from the Ste. Austreberte and thus tempted that stream to desert its lower course. This little fact, taken in connection with the slopes of the dovetailing spurs, fully justifies the opinion that the Seine is a most vigorous river, not only competent to swing around the curves of its former meanders, but demanding an increased radius for every curve, and thus widening its meander belt. Here and there, it is true, the swinging course of the river departs somewhat irregularly from the round curves of its valley, as if the river had shrunk somewhat away from the strong curves which it once followed. This may perhaps be explained as the result of the diminishing velocity of the river, now that it has cut its new valley deep below the adjacent upland and close to the controlling baselevel, but the irregularities are exceptional and they need not be further considered. As a whole, the river may be regarded as an able-bodied stream turning vigorously from curve to curve on its way to the sea.*

*An accident of the Ste. Austreberte type is found in the valley of the Marne a short distance below Meaux, where the Grand Morin now joins the Marne at Isles-les-Villenoy, abandoning a former lower course which led it to Precy.

The robust habit of the Moselle.—Let us next glance at the lower course of the Moselle. Passing below its upper branching course and following it below Trèves through the highlands to the Rhine, we find here again a most serpentine valley incised beneath the general upland of the region. Ascending from the valley bottom, which the traveler ordinarily follows, to the level of the inclosing upland, it is even more manifest here than in northwestern France that we have to do with an uplifted and well-dissected peneplain. The surrounding region is one in which the rocks are greatly deformed, possessing all the characteristics of mountain structure, but few of the characteristics of mountain height. Indeed, the upland between Trèves and the Rhine is one of the best examples of an uplifted peneplain that I have seen. The gently rolling surface shows little regard for the great diversity in the attitude of its rocks. Here and there it is still surmounted by low, linear eminences, such as the Idarwald and the Soonwald, following the strike of resistant quartzites. These I would call "monadnocks," taking the name from a typical residual mountain which surmounts the uplifted peneplain of New England in southwestern New Hampshire.

But how has the Moselle come to follow a meandering valley deeply incised in the peneplain? It is manifest, from what is now known concerning the geological development of land surfaces, that during the later stages of the denudation of the middle Rhine highlands the streams of the region must have flowed idly along meandering courses with gentle slope in channels little below the surrounding surface; but at present the streams, and especially the master rivers of the region, have deeply incised courses inclosed by steep-sided valleys. Clearly, then, the region has been uplifted since the denudation of the peneplain and is now well entered in a second cycle of denudation. The meanders developed in the later stages of the previous cycle of denudation are inherited in the early stage of the present cycle.

It is worth noting, however, that there seems to have been a pause during the general elevation of the region, for the valley of the Moselle may be described as a narrow, meandering trench cut in a wide-open, flat-bottomed trough, the trough being sunk well beneath the general surface of the adjacent upland. The same sequence of forms may be clearly recognized in the valley of the Rhine, particularly in the neighborhood of Bacharach, where the old river alluvium still lies on the floor of the uplifted trough, although the existing river trench is sunk several hun-



VALLEY OF THE MOSELLE, NEAR BERNCASTEL

Sheet 524, Map of the German Empire, 1 : 100,000 dred feet beneath it. It must therefore be concluded from the relation of the upland, the trough, and the trench that the uplift of the region to its present height was accomplished in two movements, and that a longer interval of comparative rest followed the first movement than has yet elapsed since the second; but it must also be understood that the time that has elapsed from the first of these movements to the present day is very short compared to the long cycle of denudation during which the ancient mountains of the region were worn down to the general surface of the peneplain.

The meanders which the Moselle now follows in its serpentine trench are therefore to be regarded as the inheritance of a meandering habit that it acquired on the floor of the trough; but here, as in the case of the Seine, the present width of the meander belt is somewhat greater than the width of the former belt, judging from the difference in the slopes of the interior spurs and the steep bluffs opposite them on the outer side of the river curves. The Moselle, like the Seine, swings around its curves with a robust, full-bodied action, nowhere hesitating to make the circuit with strong pressure on its outside bank.

The two cut-offs above Berncastel.—At several points the spurs from the upland have very narrow necks through which the valley railway passes in "short-cut" tunnels. Although I have not found any example of the diversion of a side stream by the lateral growth of the river meanders, yet such a change is imminent just above Pünderich, where the ridge between the Moselle and the Alfbach is reduced to a very narrow measure. But it does appear that just above Berncastel the Moselle has played upon itself the same trick that the Seine has played upon the Ste. Austreberte. The Moselle at this point has an exceptionally straight course, but to the right and left of it rise two isolated hills, inclosed by troughs of horseshoe shape whose outer slopes rise to the general uplands. From the study of the maps at home I had come to the opinion that these troughs represented former meanders of the river, now abandoned in favor of the more direct intermediate course, and an inspection of the district on the ground has confirmed this belief. I presume the fact is well known to students of river habits abroad.* (See Plate XXII.)

Nothing can be more satisfactory than the agreement shown between the features of these abandoned meanders and of the

*See, for example, H. Grebe, Ueber Thalbildung auf der linken Rheinseite, Jahrb. k. preuss. geol. Landesanst., 1885, 137.

meanders still occupied by the river farther down the trench. The radius of curvature is essentially the same in the several cases. The slopes on the outsides of the troughs have the characteristic, bluff-like descent from the upland. The isolated hills are the ends of interlocking spurs, now dissevered from the uplands by the cross-cut of the river; the ends of these hills that project into the horseshoe troughs have the comparatively gentle descent of the spurs that are elsewhere found projecting into the actual meanders. Not only so; the eastern branch of the southern horseshoe is just opposite and in line with the western branch of the northern horseshoe. There can be no doubt that the vigorous Moselle has here so earnestly swung against its outer bank that it has actually shortened its own course by cutting through the narrow necks of the intervening spurs. Perhaps I am giving too much emphasis to this occurrence. It is not a great rarity, for similarly abandoned river meanders are not infrequent in other plateaus. They are known in the plateau of Würtemberg, where it is trenched by the Neckar at Lauffen and just above, and in the plateau of western Pennsylvania, trenched by the Ohio and its branches. It is not, however, the mere occurrence of these cut-off meanders, but rather the lesson that they teach, that deserves emphasis. They all indicate strong river action. The Moselle must therefore be regarded as an able-bodied, vigorous river, like the Seine.

The staggering Meuse.—Let us now look at the Meuse. From some distance above Commercy, down stream as far as Verdun and beyond, this river, like the others, follows a well-defined meandering valley, incised beneath uplands on either side. As before, the slope of the bluffs on the outer side of the valley curves is comparatively steep, while the slope of the spurs on the inner side of the curves is relatively gentle. Just above Commercy, near Sarcy-sur-Meuse, one of the spurs is almost cut through and is now connected with its upland by a very narrow and low neck, which alone separates the flood-plain of the curving valley on either side. The railway and canal both save distance by cutting across the low neck. At Dun-sur-Meuse the neck of a former spur is entirely cut through. It now stands as an isolated hill surrounded on all sides by the flat valley floor.*

*The État-major map, 1:80,000, suggests three other abandoned meanders: one east of Liny-devant-Dun; another northeast of Letanne; the third southwest of Mouzon. The cutting of some of these meanders may have occurred early in the history of the valley. At Koeur-la-petite, below Commercy, the map shows the railway and canal running through a depression in the neck of a spur that extends toward Han-sur-Meuse, and I suppose that the Ste. Austreberte case is here paralleled.

VALLEY OF THE MEUSE, NEAR ST. MIHIEL

Sheet 52, Map of France, 1 : 80,000

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON D. C.

VALLEY OF THE MEUSE, NEAR DUN-SUR-MEUSE

Sheet 35, Map of France, 1 : 80,000

It is manifest, then, that this valley was excavated by a river hardly less vigorous than those that cut the valleys of the Seine and the Moselle, but the vigorous river that was once here is now nowhere to be found. The floor of the valley is at present occupied for the most part by broad, green meadows, instead of by a free-swinging current of water, and the only stream to be found is the little Meuse, wandering here and there on the broad meadows and staggering with most uncertain step around the valley curves. It wriggles from place to place, now touching this side of the valley, now that, swinging indifferently against the steep bluffs and gentle slopes of the spurs, sometimes even running for a short distance up the valley in its irregular path. Is it not then clear that since the time when this winding valley was made there has been a great diminution in the volume of water that follows it? No other conclusion seems admissible; and hence a reason for the loss of volume must be sought. (See Plates XXIII and XXIV.)

The loss of volume cannot be ascribed to any climatic change, for that should have affected the Seine and Moselle as well. May it then be ascribed to a change of the area drained, whereby the Seine and the Moselle gained the drainage area which the Meuse lost? If this were so, the Meuse would have become smaller and smaller, while the Seine and Moselle grew larger and larger. The dwindling Meuse would have lost the power of swinging boldly around its valley curves; it would have fallen into the present timid habit of staggering, after the fashion of other small streams, but at the same time the Seine and the Moselle would have been confirmed in their vigorous habit of swinging freely around the curves of their valleys. Is it possible, then, that the side branches of the Meuse have really been trimmed from the trunk river, and that the trimmed branches have been engrafted into the systems of the Seine and the Moselle?

The migration of river divides.—The question thus raised leads to a consideration of the general problem of the shifting or migration of river divides, a subject that is of particular interest to the student of physical geography. At first sight one would be inclined to think that the crest-line of a divide between adjacent river basins would merely waste lower and lower as it weathered away, without shifting laterally, and therefore without causing any change in the area of the adjacent drainage basins. It is probable, however, that this simple process is of very rare occurrence in nature. It is much more likely that the line of the divide will move more or less to one side or the other as it weathers away, on account of the unequal rate of wasting of its two slopes. The possible causes of unequal wasting are various. The declivity of the two slopes may differ, in which case the steep slope wastes faster than the other and the divide is very slowly pushed toward the flatter slope. The rocks underlying the two slopes may be of different resistance; then the weaker one will, as a rule, waste away the faster, and the divide will gradually migrate toward the more resistant rocks. Again, the agencies of erosion may be of different activities on the two slopes; one slope may have a greater rainfall than the other, or may suffer a greater number of alterations from freezing to melting. Although the last is generally a subordinate cause, it probably contributes in a small way to the solution of the problem as a whole.

The shifting of the divide as thus explained is generally accomplished by a slow migration. In some cases, however, when the divide is pushed to the very side of a stream whose basin it inclosed, then a little further change diverts all the upper drainage of this stream into the encroaching basin, and with this change the divide makes a sudden leap around the upper waters of the diverted river, after which the slow migration may be resumed. The movement of a divide may therefore be described as alternately creeping and leaping.

Whether this process is of very general importance or not can hardly be decided at the present time; but there are certain regions in which its application is most illuminating to the studies of the physical geographer. Philippson has brought the subject to general attention in his *Studien über Wasserscheiden*, where a full account of what others have done up to 1885 may be found. Oldham has told how certain headwaters of the Indian rivers are pushing their divides through the innermost of the Himalayan ranges, and thus acquiring drainage area that formerly belonged to the interior streams of the elevated Thibetan plateau. This example is one of the best in which the process depends chiefly on the unequal declivity of the slopes on the two sides of the divide. Heim has described the depredations of the Maira in beheading the upper course of the Inn, thus accounting in a most beautiful manner for the little lakes at the head of the Engadine valley, where this contest is going on. The special map of the Ober-Engadine, published in 1889, on a scale of 1 : 50,000, by the Swiss topographical bureau, gives fine illustration of the significant features of river interaction in this region.

A remarkable case of river diversion occurs in the shift of the course of the Vistula from its former path down the valley now occupied by the Netze to a more northward course, by which it flows directly to the Baltic sea, the point of change being at the town of Bromberg. This is well illustrated on the Prussian topographical maps, and has been described in a general way by various writers on the geography of North Germany. Whether it was caused by the spontaneous interaction of streams competing for drainage area or not, I shall not at this distance venture to say, but shall hope to find a full explanation of the change in a forthcoming essay by Berendt. Jukes-Brown has described an interesting case in England, where the Trent captured the headwaters of the Wytham, and in a recent volume of the *Geographical Journal* of London I have attempted a more general treatment of the same region. Readers who wish to follow the subject into examples of greater intricacy may find some problematic examples in the rivers of Pennsylvania and northern New Jersey.*

In the general discussion of this problem we should recognize two divisions. First, the processes by which it is accounted for, these having just been summarily described. Second, the topographical forms by which its occurrence may be recognized, distinction being made between examples occurring in the remote or the recent past and others likely to occur in the near or distant future. Illustration of the second division of the subject can best be given by describing the concrete case of the river Marne near Châlons, than which no better example has come to my notice anywhere in the world.

The case of the Marne below Châlons.—In the province of Champagne the Marne drains an extended interior lowland inclosed by a forested upland on the west. The lowland is the product of comparatively rapid erosion during late Tertiary time on weak upper Cretaceous strata. It is for the most part covered by extensive farms. The upland stands where the lower Tertiary strata have, during the same period of time, more successfully resisted erosion. As the dip of the strata is gently westward, the eastern margin of the upland is marked by a steep escarpment. The Marne gathers many branches from the lowland, and escapes on its way to the sea by a deep valley cut through the upland.

* The National Geographic Magazine, Washington, i, 1889; ii, 1890.

In this valley it receives two branches on the southern side, to which special attention should be given. The first is the Surmelin, whose head is found in the upland near its eastern precipitous margin; but, curiously enough, although this stream of course diminishes toward its source near Montmort, the valley that it occupies maintains an almost constant width some six miles farther, nearly to the escarpment of the upland. The second branch is the Petit Morin. This, like the Marne, heads in the lowland east of the upland, and also, like the Marne, escapes by a deep and narrow valley through the upland. The lowland area that it drains is, however, very small, and for about ten miles from its head there is an extended marsh, known as the Marais de St. Gond, lying partly on the lowlands and partly in the entrance to the narrow valley in the upland.

In searching for a reason for this arrangement of the Marne and its two branches, it is important to notice that if the branches were prolonged eastward they would both lead to streams, the Soude and the Somme,* flowing for some distance on the lowland toward the heads of the branches, but then turning northward and entering the Marne directly.

The beheading of the Surmelin and the Petit Morin.—In explanation of all these facts let it be supposed that the two pairs, Soude-Surmelin and Somme-Morin, were once actually continuous streams at a time before the lowland was eroded on the weak rocks east of the upland, and let the verity of the supposition be tested by the likelihood of a natural, spontaneous change from that condition to the present.

When the paired streams flowed westward, they, like the Marne, must have run in the direction of the dip of the strata; hence they may all be called *consequent* streams. They must all have passed from the weak Cretaceous strata to the resistant Tertiary strata. The Marne is much the largest of these three streams, and its valley must have been deepened rapidly, while the other valleys must have been deepened slowly. As the valleys were deepened they progressively widened, but the widening must have been much more rapid on the weak than on the resistant strata; and the deep valley of the Marne must have widened in the weaker strata much more rapidly than the neighboring shallow valleys of the Soude-Surmelin and the Somme-Morin. Now the question arises, will the divides between these three valleys shift in such a manner as to alter the assumed original

* Not to be confused with the river Somme in northwestern France.

arrangement to the actual arrangement? Undoubtedly they would, and for the following reasons.

The valley of the Marne being deeper than that of the Soude-Surmelin, the divide between the two would be pushed away from the larger and toward the smaller streams, and eventually the upper course of the Soude-Surmelin would be diverted by a growing side branch of the Marne (the lower part of the Soude), and thus led to join that vigorous river, while the lower course of the Soude-Surmelin (the Surmelin) would remain as a dimin-

FIGURE 2*a*.

ished, beheaded river. The side branch of the Marne, which causes the diversion, belongs to the class of streams called *subsequent*. Let us next look at the divide between the Soude-Surmelin and the Somme-Morin. At first, as these streams are of about equal volume, the divide between them would not be pushed significantly to one side or the other, but after the capture of the Soude by a branch of the Marne, the Soude would rapidly deepen its valley on the weak strata, and from that time forward the divide between the Soude and the Somme-Morin would be systematically pushed toward the latter. Eventually the upper waters of this stream would also be diverted to the Marne by the way of the lower Soude, leaving the lower waters (the Petit Morin) as another diminished, beheaded stream; but inasmuch as this second capture must occur at a much later date than the first, it is natural to expect that the beheaded Petit Morin will, at the time of capture, have cut a much deeper valley through the upland than was cut by the earlier beheaded stream, the Surmelin.

The elbow of capture.—Let us call the sharp turn that the diverted headwaters make where they join the diverting stream "the elbow of capture." After the capture the rearranged watercourse will cut a sharply intrenched valley above and below this elbow, for the diverted stream, of considerable volume, being turned into the head of the diverting stream, where the volume is zero, must immediately deepen its channel. As time passes the trench will disappear by widening, and hence the occurrence of such a trench may be taken as indication of recent rearrangement. Similarly the diminished, beheaded stream may be more or less obstructed by the detritus that is washed into its valley by small lateral branches; thus its flow may be delayed by swamps or it may be even held back in shallow lakes, as the Inn is held back in the lakes of Engadine, as described by Heim; but this is also a relatively short-lived condition, for as time passes the beheaded stream will adjust its grade to the work that its diminished volume has to do and its lakes and swamps will disappear.

In nearly all cases further shortening is enforced upon the beheaded stream below the elbow of capture. It deepens its valley slowly, while the reinforced subsequent diverter deepens its valley with relative rapidity; hence the divide will be pushed away from the elbow of capture and the beheaded stream will be progressively diminished. The distance of the source of the beheaded stream from the elbow of capture may therefore be generally taken as a measure of the remoteness of the time when the capture took place. It not infrequently happens that a small stream is developed, flowing into the elbow of capture from the neighborhood of the source of the beheaded stream, and progressively lengthening as the divide is pushed away and the beheaded stream is shortened. Let us call streams of this class, flowing against the dip of the strata, *obsequent*. They will manifestly be wanting at elbows of recent capture, but they may attain a length of several miles if the capture occurred long enough ago.

Now, look at the actual arrangement of the streams on the lowland west of Châlons and on the upland beyond the escarpment, while bearing these deductive criteria in mind. The Somme has lately been captured by the growth of a subsequent branch from near the elbow of the Soude; for, behold, at the little village of Ecury-le-Repos a sharp elbow in the course of this stream and a narrow trench for a moderate distance above and below the elbow. The Petit Morin is evidently the lower course of the Somme. On account of its diminished volume it is for the present unable to keep its valley clear of the detritus that is washed down from the steep valley sides in the upland, probably near Boissy and Le Thoult; hence the great marsh of St.

FIGURE 2*b*.

Gond and its extensive deposits of peat about the head of the stream. The marshy head of the Petit Morin is still close to the elbow of capture at Ecury-le-Repos, and no obsequent stream is yet developed in this case. The change is clearly of recent date.

Look next at the Soude-Surmelin system. Here the capture occurred long ago; there is no sign of a gorge at the elbow of capture. An obsequent stream, the Berle, about four miles in length, has grown toward the retreating escarpment of the upland, and the head of the beheaded stream is now ten miles away from where it stood at the time when the capture had just taken place. Having lost its head rather early in the history of the region, its valley through the upland is not cut to a great depth; it is much shallower than the valley of the Petit Morin, which was beheaded at a much later period, when it had become nearly as deep as that of the Marne itself.

It was while studying the French maps at home that I first came on this almost ideal example of migrating divides and adjustment of streams to structures, but it was not until an excursion abroad in 1894 that I was able to study it on the ground. I then had the gratification of confirming by direct observation, as far as the brief time at my disposal would allow, the expectations formed from study at a distance. The example of the Marne and its side branches therefore still serves me as a typical case of adjustments of this kind.

It is curious to note that another small stream, the upper Vaure, flows toward the marsh of St. Gond, but instead of being diverted northward by the Soude to the Marne, it is diverted southward by the Superbe, a subsequent branch of the Aube. It seems also probable that this subsequent branch has diverted the Maurienne at Pleurs, and thus cut it off from the Grand Morin, whose head is, like that of the Surmelin, on the upland west of the escarpment.

It is manifest that the terminology here employed will be of service in simplifying the description of other examples of shifting divides and river adjustment if they possess the same systematic features as are here so well exhibited. That such is the case I can confirm from the study of several examples near the escarpment of the Swabian Alp in Würtemberg, where the headwaters of the Neckar are actively pushing away the divide that separates them from the northern tributaries of the upper Danube. Although the arrangement of parts is not the same as in the example near Châlons, yet the homologies of the two regions can be clearly made out. The same may be said of the rivers of central England, which are as a rule well adjusted to the valleys between the uplands of the oölite and the chalk.

(*To be continued.*)

ACROSS THE GULF BY RAIL TO KEY WEST

By Jefferson B. Browne,

Collector of Customs of the Port of Key West

The traveler approaching Key West from the gulf of Mexico cannot but wonder that upward of twenty thousand people should have congregated on a spot so manifestly and completely isolated from the rest of the world. After landing and seeing how little man has done for the improvement of the island, or rather how nature has been marred by man's mistakes, the visitor's wonder changes to absolute amazement that so large a city could have grown up without railroad or even wagon-road connection with the state and country of which it politically forms a part. Unless, however, our visitor is an exceedingly superficial observer, he will soon begin to realize that it is not so much a matter of surprise that the city has attained its present growth as that, with the natural advantages it possesses, its development has not been still greater. He will learn that for fifty years Key West has held its supremacy as the most populous city of the state, and that it owes its prosperity not to any single industry, but to the diversity of its sources of revenue, the outgrowth mainly of its geographical location. Its fisheries, its sponge industry, its cigar manufactories, its importance as a coaling station and port of call for the commerce of the gulf, its superior advantages as a naval rendezvous and military station, all have contributed to the upbuilding of Key West on that broad foundation which is the secret of its continued prosperity. The shipbuilder, the sailor, and the sponger, the fisherman, the wrecker, and the stevedore, the cigarmaker and the machinist, the truck farmer and the fruit grower, all find employment in Key West and the adjacent islands, and no man with a technical knowledge of any branch of industry, with the single important exception of railroading, ever has to abandon his trade and seek a livelihood in another.

It is not too much to say that upon the completion of the Nicaragua canal, Key West will become the most important city in the South. Its harbor, land-locked by reefs and keys, in which can float the largest ships of the United States Navy, has four entrances. The southwest passage has 33 feet of water on the bar, the main ship channel 30 feet, the southeast 22 feet, and the northwest 14 feet. A vessel leaving the harbor of Key West by the southwest passage would have to sail but 10 miles before she could shape her course for her port of destination, and through the main ship channel she would have only five miles to run before she was at sea. Ships putting into Key West for stores or repairs need go out of their course but 10 miles, an advantage possessed by no other port in the United States. The Government is now engaged in deepening the northwest passage to 21 feet, and when this is completed ships trading in the gulf will pass through the harbor of Key West, coming in at one of the main channels and passing out over the northwest bar, thus saving 70 miles and avoiding the dangerous reefs around the Tortugas islands.

That Key West will within a short time be connected with the mainland by a railroad, no one who has noted the trend of railroad building in Florida can doubt. The ultimate object of all railroad construction in this state is obviously to reach deep water at an extreme southern point, and Key West meets these requirements to the fullest degree.

The first survey of a railroad route to Key West was made by Civil Engineer J. C. Bailey for the International Ocean Telegraph Company as long ago as 1866. General W. F. Smith, better known as " Baldy " Smith, at that time president of the company, obtained from the Spanish Government an exclusive landing for a cable on the coast of Cuba for forty years. The company had under consideration two plans for reaching Key West with its telegraph system. One contemplated a land line to Punta Rassa, Florida, and thence by cable to Key West; the other a continuous land line along the keys. It was proposed to drive iron piles into the coral rock in the waters separating the keys, and to socket them about 10 feet above high-water mark with wooden poles, and Mr Bailey was employed to make the survey. While engaged in this work he surveyed the route for a railroad to Key West, and embodied in his report to the company his opinion of its feasibility and cheapness as compared with the popular idea of what such a road would cost. When the Western Union Telegraph Company obtained control of the International Ocean Telegraph Company this report came into its possession, and it is still on file in its offices in New York.

The distance from Key West to the point where a railroad would connect with the mainland is about 120 miles, 100 miles of which would be on the keys. The construction of a railroad from Key West to Bahia Honda, an island 30 miles from the former point, presents no difficult problems of engineering and would be comparatively inexpensive. When cleared of a few inches of vegetable mold and loose stones, the surface of the islands is as level and smooth as a ballroom floor. From Key West to Bahia Honda the railroad would traverse Boca Chica, Saddle Bunch, Sugar Loaf, Cudjoe, Summerland, Torch, and Big Pine Key. Between these islands short trestles, ranging from one hundred yards to half a mile in length, would be necessary; but some of the passages could be filled with the loose rock which is found in immense quantities on all the keys, thus obviating the necessity of trestling and making a solid roadbed. Not more than seven feet of water has to be crossed until Bahia Honda channel is reached. This channel lies between West Summerland Key and Bahia Honda, and has an average depth of about 20 feet, the distance across it being a little over a quarter of a mile. Here it would be necessary to have a drawbridge, as the channel is used by the small vessels cruising along the coast.

The most difficult and expensive portion of the road would be from Bahia Honda to Knights Key. Between these two islands the distance is about eight miles, but dotted along the route are several small keys, surrounded by shallow bars, which extend a half-mile or more on all sides. Molasses Key lies directly on the route from Bahia Honda to Knights Key. Between Molasses Key and Knights Key the water is deep and bold, and if the road was carried in a straight line throughout it would cross about half a mile of water varying from 20 feet to 25 feet in depth; but by making a slight detour to the northward and trestling from Molasses Key to Pigeon Key, and from Pigeon Key to Knights Key, deep water would be avoided. Between the former islands lies the Moser channel, named after Lieut. Comdr. Jeff. F. Moser, U. S. N., who located it during his Coast Survey work in this vicinity several years ago, and four miles distant and to the westward of Knights Key is the channel which bears its name; over one or both of these channels there would be another drawbridge.

After reaching Knights Key there would be very little trestling for a distance of 30 miles, until the small keys to the eastward of

Grassy Key were reached. Thence there would be two and one-half miles of trestling to Conch Key and the same extent to Long Key. After traversing Long Key for four miles the train would run over a trestle three and one-half miles long—the water varying from 10 to 12 feet deep—to Lower Matecumbe, a fertile island four miles in length. The next island is Upper Matecumbe, to reach which would require a trestle two miles long and a drawbridge over one of the three channels separating these two keys. The water between Lower and Upper Matecumbe, except in these channels, is very shallow, the banks at low tide being above the surface of the water. The channels are exceedingly narrow, but the depth of water in them ranges from 12 feet to 15 feet. Upper Matecumbe, Umbrella Key, Plantation Key, and Key Largo are separated by very narrow channels, not over 100 yards in width. The last named island, the largest and most fertile of the entire chain, is 30 miles long, and connected on the north side with the mainland.

By a fortunate provision of nature there is situated about 30 miles from Key West a large island known as Big Pine Key, which is covered with a fine growth of pine suitable for railroad ties. All the islands over which the road would run are of coral formation. The piles used in the trestling and bridging would be of iron, which is easily driven into the soft coral rock. The lighthouses along the Florida reef are so constructed, and, standing on the edge of the gulf, exposed to the wind and sea, they have withstood the storms and cyclones of forty years. Over this road there would be no settling or washing of ties nor any sinking of trestles. Outside of the line of road and running parallel with it lies the Florida reef, forming a continuous breakwater from Fowey Rocks to Key West, and protecting the road from high seas even in the severest hurricanes. The channels between the reef and the keys are not over 12 feet deep, and the water in which the trestling would be built would be no rougher than that of any of our large rivers.

The keys are all below the frost line. The most delicate fruits and vegetables that were luxuriantly growing upon them during the two freezes of last winter were not affected in the slightest degree, and tomatoes, pineapples, eggplant, and tropical fruits were supplied from these islands after the fruit and vegetables in all other sections of the state had been destroyed. Owing to lack of transportation facilities, however, only a few of the keys are under cultivation; so the growth of the more delicate vegetables, which must find a daily market, is limited to the local demand. With rapid transportation the Florida keys would supply the country with fresh vegetables all winter.

Key West is destined to become the Newport of the South. Not since the exceptional year 1886 has the temperature risen above 92° F. or fallen below 44°; in fact, the mean annual maximum of the last nine years has been only 90.4°, while the mean annual minimum has been 50.5°. In 1891 the minimum was 53°, in 1892 53°, and in 1893 52°. Soft breezes from the ocean blow continuously over the island. The sun shines for 365 days in the year and is never obscured for more than a few hours at a time, except occasionally in the months of September and October, when a West India cyclone is passing up the gulf. There are no malaria-breeding pools or streams, and sooner or later the thousands of tourists who are restlessly seeking a milder and more equable winter climate than the mainland affords will find in Key West their ideal health resort.

The products of the West Indies and Caribbean sea will be ferried across from Cuba in five hours and taken by the railroad for distribution to all parts of the United States. Capital seeking investment will reap no handsomer return than from a dry dock at Key West, into which would come for repairs the trading-vessels of the gulf which now have to go hundreds of miles out of their way to Newport News, and with the completion of the Nicaragua canal Key West would be a port of call for supplies and repairs for no small part of the shipping of the world.

A railroad to Key West will assuredly be built. While the fact that it has no exact counterpart among the great achievements of modern engineering may make it, like all other great enterprises, a subject for a time of incredulity and distrust, it presents, as has been shown, no difficulties that are insurmountable. It is, however, a magnificent enterprise and one the execution of which will call for the exercise of qualities of the very highest order. Who will be its Cyrus W. Field? The hopes of the people of Key West are centered in Henry M. Flagler, whose financial genius and public spirit have opened up to the tourist and health-seeker 300 miles of the beautiful east coast of the state. The building of a railroad to Key West would be a fitting consummation of Mr. Flagler's remarkable career, and his name would be handed down to posterity linked to one of the grandest achievements of modern times.

A GEOGRAPHICAL DESCRIPTION OF THE BRITISH ISLANDS

The April number of the London *Geographical Journal* contains an important account by Dr H. R. Mill of his plan for a comprehensive Geographical Description of the British Islands. He proposes that a memoir shall be prepared for each sheet of the Ordnance one-inch maps, giving an index of places; the mean elevation of the sheet and of the areas included between successive contour lines; a hypsographical description; a physiographical explanation; the areas of woodlands, moorlands, and cultivated lands; a description of local political boundaries and of historical events; and, finally and chiefly, a geographical chapter, "showing the relation of the human inhabitants to all the foregoing conditions, especially with regard to the sites of towns and villages, the distribution of population, the utilization of natural resources, and historical development of industries." A few carefully selected photographs of typical scenery should accompany each memoir. Some sketch maps and diagrams may also be included. A bibliography would give the titles of all pertinent publications.

This plan was favorably received at a meeting devoted to its presentation, and it is to be hoped that the Royal Geographical Society will vigorously promote so admirable an undertaking. Hitherto concerned chiefly with the exploration of foreign lands, a share of its attention may well be turned towards its home islands; for, as was truly remarked at the opening of a recent Italian Geographical Congress, however great the glory of distant exploration may be, the study of the home country is a geographical duty.

It may, however, be questioned whether the method of issuing a memoir for each survey sheet is on the whole advisable for a work in which the physiographical and geographical chapters, the most important parts of all, ought to be limited by natural and not by arbitrary geometrical boundaries. Unity of treatment would be gained and much repetition would be avoided by considering each physiographical area as a whole and not in accidental fragments as it happens to be divided by the edges of the map sheets. The usefulness of the empirical measurement of altitudes on so detailed a scale as here proposed may also be questioned. Not contour-line areas, but physiographical areas, should be computed, for it is of little geographical value to include under a single arithmetical heading two surfaces of equal limiting altitudes, one a steep slope, the other a broad flat. Again, the seriousness of the undertaking is hardly recognized in the statement that "the physiographical explanation would, so far as the geology is concerned, be simply a restatement of the 'physical geography' section of the [local] geological survey memoir, with such modifications as the modern views of the cycle of development of a land surface suggest." This is as if one should say that a petrographical chapter in a new geological report should be merely a modification of a chapter on rocks that was written before the methods of modern petrography were invented.

It is stated that the geographical description "must be the work of a trained geographer, who, after studying the maps in the light of all the information referred to above, shall have made himself familiar with the ground." There are in Great Britain many travelers and explorers, but not many "trained geographers" in the sense contemplated by Dr Mill, and here seems to be a prime difficulty besetting this grand undertaking at its outset. But the difficulty may be in great part solved if to this crowning chapter we apply what Dr Mill says of a certain subordinate section: "It would be very suitable as an exercise and training for students if any institution existed in this country where students could be induced to study geography seriously." A work of this sort must necessarily be uneven in quality. It should exhibit a marked improvement from a fair beginning to a much better ending, and when the end comes a revision of the earlier parts may be fairly demanded. It is, therefore, to be hoped that Dr Mill will not adhere too closely to the philosophy that prohibits going into the water until after learning how to swim. Let a beginning of the work at least be made as a means of training up new geographers, and not merely as an occupation for geographers already trained. Let the Royal Geographical Society announce that it will publish in brochures chapters written according to an approved plan and reaching a standard satisfactory to a committee of editors. An actual beginning thus made, in the best form at present attainable, will give the strongest possible impulse to the serious study of geography in the colleges and universities of a country where its neglect is now so much deplored.

To all parts of the work might be applied the remark introduced by Dr Mill under "historical information." It should be "very stringently edited, so as to confine it strictly to those features and events of direct geographical importance." The varied standards of articles in the current geographical journals indicate so vague an idea of the essential quality of geographical discipline that this stringent editing will surely be needed in every chapter of the proposed memoirs. Care must be taken that the volumes do not become so many encyclopedias of subjects that have not a "direct geographical importance." Local floras and faunas, for example, which stand in the list of suggested topics, might easily depart entirely from geography and become pure biology. Mere lists of species have practically no geographical bearing. If treated with relation to distribution they gain a touch of geographical quality; but if their distribution is used to reinforce the appreciation of conditions of form, altitude, soil, and climate they become as fully geographical as any other means of enlightened description. So with the study of population. Numerical tables extracted from census reports omit the essential quality of relationship that characterizes geography proper. True geographical study is needed to bring out the meaning of numbers and their dependence on physiographical conditions. We believe that Dr Mill appreciates these principles very fully, but there is a possibility that others who will probably coöperate with him are not so fully impressed by them, and that a committee of editors as a whole might not see the importance of excluding mere tabulations of species, of population, and similar unrelated records from the memoirs, unless the principle of relationship is insisted on from the beginning.

There is no place in the world that is today so favorably situated for the undertaking of a work of this kind as are the British Islands. Well defined by insular position, a compact embodiment of greatly varied forms, a seat of vast power and wealth, the rest of the world may hope to have the model of geographical monographs there established. There is, on the whole, no society in the world better fitted to encourage and support such an undertaking than the Royal Geographical Society of London—established in the world's center of commerce, the resort of great numbers of explorers, travelers, and others of geographic sympathies, possessing vast resources in its library and its funds. Dr Mill, as a secretary of this society, is to be congratulated on the surroundings amid which his project takes form, and we wish him the greatest success in its execution.

W. M. DAVIS.

THE MEXICAN CENSUS

The population of Mexico, as ascertained by the census of October 20, 1895, is officially announced as 12,570,195. The population of the different states, with their respective capitals, is as follows:

STATES		CAPITAL CITIES	
Aguascalientes	103,645	Aguascalientes	31,619
Campeche	90,458	Campeche	16,631
Coahuila	235,638	Saltillo	19,654
Colima	55,677	Colima	19,305
Chiapas	313,678	Tuxtla Gutierrez	7,882
Chihuahua	266,831	Chihuahua	18,521
Durango	294,366	Durango	42,165
Guanajuato	1,047,238	Guanajuato	39,337
Guerrero	417,621	Chilpancingo	6,204
Hidalgo	548,039	Pachuca	52,189
Jalisco	1,107,863	Guadalajara	83,870
Mexico	838,737	Toluca	23,648
Michoacan	889,795	Morelia	32,287
Morelos	159,800	Cuernavaca	8,554
Nuevo Leon	309,607	Monterey	56,855
Oaxaca	882,529	Oaxaca	32,641
Puebla	979,723	Puebla	91,917
Queretaro	227,233	Queretaro	32,790
San Luis Potosi	570,814	San Luis Potosi	69,676
Sinaloa	256,414	Culiacan	14,205
Sonora	191,281	Hermosillo	8,376
Tabasco	134,794	San Juan Bautista	27,036
Tamaulipas	204,206	Ciudad Victoria	14,575
Tlaxcala	166,803	Tlaxcala	2,874
Veracruz	855,975	Jalapa	18,173
Yucatan	297,507	Merida	36,720
Zacatecas	452,720	Zacatecas	40,026
Federal District	484,608	Mexico	339,935
Territory of Tepic	144,308	Tepic	16,226
N. Dist. Lower Calif.	7,452	Ensenada de Todos Santos.	1,259
S. Dist. Lower Calif.	34,835	La Paz	4,737

GEOGRAPHIC LITERATURE

Handbook of Arctic Discoveries. Columbian Knowledge Series. By A. W. Greely, Brigadier-General, United States Army; Chief Signal Officer. Pp. xi + 257, with 11 maps. Boston: Roberts Bros. 1896. $1.00.

This work is a perfect storehouse of arctic facts and figures, from the time of brave old Barents and Willoughby down to the present. As the title indicates, it is a "handbook" and not a narrative of arctic discovery; but the little volume "represents more than 50,000 pages of original narrative, from which the author has faithfully endeavored to compile such data of accomplished results as may subserve the inquiries of a busy man who often wishes to know what, when, and where, rather than how." Beginning with a chapter on the scope and value of arctic exploration, fifteen succinct chapters are devoted to a description of the north polar regions and of the successive explorations by which they have been made known; each of these chapters is followed by a special bibliography, while a general bibliography forms a final chapter, and the volume ends with an excellent index. The little book is a model of condensation and logical arrangement; it cannot be other than a godsend to the student of arctic literature; it shows immense reading and study, with patience and perseverance beyond the average man; and its vivid and forceful style carries the writer back over years of arctic research and hundreds of volumes of arctic literature to his own voyages on icy seas. G. W. Melville.

Crater Lake Special Map. Klamath County, Oregon. United States Geological Survey. Washington, 1896.

Rand, McNally & Co.'s Indexed County and Railroad Pocket Map and Shippers' Guide. Massachusetts, Pennsylvania, Kentucky, Washington, and other states; Quebec, British Columbia, and other provinces of Canada. New edition. Chicago: Rand, McNally & Co. 1896. 25 cents.

Occupations of the Negroes. By Henry Gannett, of the United States Geological Survey. Pp. 16, with 12 diagrams. Baltimore: The Trustees of the John F. Slater Fund. Occasional Papers. No. 6. 1895. 25 cents.

The Foreign Commerce and Navigation of the United States for the Year ending June 30, 1895. Prepared by the Chief of the Bureau of Statistics, Treasury Department. Washington, 1896. Pp. xcix + 1106 + 83, with diagrams.

Statistical Abstract of the United States. 1895. Eighteenth number. Prepared by the Bureau of Statistics, under the direction of the Secretary of the Treasury. Pp. xii + 412. Washington, 1896.

A commendable departure recently made by the Geological Survey is well exemplified in the case of the topographic sheet devoted to Crater lake, Oregon, which contains three very instructive as well as attractive illustrations, together with an interesting description of the lake and its vicinity from the pen of Mr J. S. Diller, the accomplished geologist to whom the country is in no small measure indebted for its scientific knowledge of this great natural wonder.

The new edition of the Rand-McNally state pocket maps cannot fail to add to the well-deserved popularity they have so long enjoyed. The maps are clearer and handsomer than ever, and the geographical index by which they are accompanied is brought down to the date of publication, the population according to the state census of 1895 being substituted for that at the federal census of 1890 in all states in which an interdecennial census has been taken.

Nothing could be more admirable in its way than is Mr Gannett's presentation in the pamphlet recently published by the Trustees of the John F. Slater Fund of the facts brought to light by the Eleventh Census concerning the occupations of the negroes. The treatise is a model of lucid condensation, the brief compass of a dozen pages sufficing for a most satisfactory setting forth of the following important facts and conclusions, viz., that the negro is mainly engaged either in agriculture or personal service; that he has in a generation made little progress in manufactures, transportation, or trade; that males are in greater proportion engaged in agriculture and females in domestic service; that the negro has during this generation made good progress toward acquiring property, especially in the form of homes and farms, and that, in just so far as he has acquired possession of real estate, it is safe to say he has become more valuable as a citizen. The author's conclusion that the outlook for the Afro-American race is very favorable as agriculturists, but that there is little prospect that they will become an important factor in manufactures, transportation, or commerce seems to be fully warranted by the experience of the last thirty years.

With the possible exception of the Yearbook of the Department of Agriculture, of which 500,000 copies are printed annually, there is no publication of the United States Government that is consulted more frequently or for more important purposes than are the Annual Report on Commerce and Navigation, published by the Bureau of Statistics of the Treasury Department, and the Statistical Abstract, issued annually from the same office. These volumes contain the statistics of exports and imports, those of immigration and of the currency, and, for a large number of important commodities, those of total and per capita consumption and of market prices. They are continually being consulted and quoted by politicians of every party and economists and financiers of every school, and however conflicting the conclusions professedly drawn from them, the figures themselves are usually accepted without question. It is therefore much to be regretted that the value of the volumes for 1895 is so greatly impaired by the want of care with which the figures for the last fiscal year have been compiled. While many of the errors are not of sufficient magnitude to seriously affect totals or percentages, and are therefore of consequence only so far as they help to destroy the confidence of the reader in the contents of the volumes in general, this cannot be said of them all. In several cases they are of more or less far-reaching effect, while one by no means self-evident error of ten million dollars plays havoc in all its relations. The efficient and respected Chief of the Bureau, who has in so many different ways added to the scope and value of these publications, makes a strong appeal to Congress for additional clerical assistance, the number of persons employed in the Bureau not having been increased during a period of nearly thirty years. Although the compilation of so enormous a mass of figures involves an amount of labor of which the average Congressman has not the slightest conception, it is not too much to hope that more adequate provision will hereafter be made for the work of this most important Bureau. The perfect indifference with which statistical inaccuracies are regarded is truly deplorable. Our legislators themselves are constant and serious offenders, numerical statements in the daily press are rarely to be relied upon, and even our most pretentious works of reference are not free from errors that are absolutely inexcusable. In the article on agriculture, for example, in one of our best known cyclopedias, an eminent college professor is responsible for the statement, among others equally erroneous, that the United States contains nearly a billion horses, or over fifty times the number it actually does or ever did contain. It is useless to take refuge in the plea of non-infallibility. No publication, whether official or non-official, can afford to make misstatements that are more than mere elusive, typographical errors.

J. Hyde.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1895-'96

Special Meeting, March 27, 1896.—Vice-President Ogden in the chair. Hon. James H. Eckels, Comptroller of the Currency, addressed the Society on the Geographic History of Currency.

Special Meeting, March 30, 1896.—Fifth Monday afternoon lecture. Mr W J McGee in the chair. Prof. Harry Fielding Reid described and illustrated the Glaciers of Alaska, exhibiting many original views by means of the lantern.

Regular Meeting, April 3, 1896.—Vice-President Gannett in the chair. Mr Robert T. Hill read a paper on the Greer County Case.

Special Meeting, April 6, 1896.—Sixth Monday afternoon lecture. President Hubbard in the chair. The President announced that Prof. Wm. H. Dall, who was to have addressed the Society, was prevented from doing so by illness, and that Mr Marcus Baker had kindly consented to take his place. Mr Baker then described the voyage from Sitka westward to Attu island, with lantern-slide illustrations.

Special Meeting, April 10, 1896.—President Hubbard in the chair. Mr Wm. F. Mannix addressed the Society on Cuba as Seen by a War Correspondent, with lantern-slide illustrations.

Special Meeting, April 13, 1896.—Seventh Monday afternoon lecture. President Hubbard in the chair. Prof. I. C. Russell described his visit to the interior of Alaska, up the Yukon and Porcupine rivers, and across the Chilcat pass to Lynn canal, illustrating his address by means of a large map and numerous lantern slides. The President announced that this was the last of the special afternoon course, and that the subject of the Lenten course of 1897 would probably be an illustrated tour across the Atlantic and through the Mediterranean.

Regular Meeting, April 17, 1896.—President Hubbard in the chair. Hon. Fred. T. Dubois, U. S. S., read a paper, illustrated by lantern slides, on the Geography, Scenery, and Resources of Idaho.

The following amendments to the by-laws were offered in writing, to come up for action at the annual meeting:

By Vice-President Greely: Article V, Dues. Add after second paragraph: "Suitable rebates may be made, in the discretion of the Board of Managers, in the annual dues of members elected in February, March, April, and May."

By Secretary Hayden: Add the following new article: "Article IX. Seal. The seal of the Society shall consist of a polyconic projection of the western hemisphere, from 0° to 180° west from Greenwich, with the legend 'National Geographic Society' above and 'Incorporated A. D. 1888' below, as in the design herewith."

Special Meeting, April 24, 1896.—Hon. Gardiner G. Hubbard, President of the Society, delivered the annual address from the chair, taking for his subject the Progress of Africa since 1888, with special Reference to South Africa and Abyssinia. The address was accompanied by lantern-slide illustrations.

Special Meeting, May 8, 1896.—President Hubbard in the chair. Mr George F. Kunz read a paper, with lantern-slide illustrations, on Geography as Illustrated by Precious Stones.

Regular Meeting, May 15, 1896.—Eighth Annual Meeting of the Society. President Hubbard in the chair. The Secretary and Treasurer presented their annual reports. Pending amendments to the by-laws were considered and adopted as follows:

Article V, Dues. Add, after second paragraph, "Suitable rebates may be made, in the discretion of the Board of Managers, in the annual dues of members elected in April and May."

Add the following new article:

"Article IX, Seal. The seal of the Society shall consist of a polyconic projection of the western hemisphere, from 0° to 180° west from Greenwich, with the legend 'National Geographic Society' above and 'Incorporated A. D. 1888' below, as in the design herewith."

Mr Wm. A. De Caindry and Col. H. C. Rizer were appointed a committee to audit the Society's accounts.

The President announced that, in accordance with the resolution adopted by the Society at a meeting held December 27, 1895, the Board of Managers had classified its members in three groups of six members each, as follows: To retire in May, 1896, Mr C. J. Bell, Hon. C. W. Dabney, Jr., Mr G. K. Gilbert, Mr H. G. Ogden, Hon. J. R. Procter, and Miss E. R. Scidmore; in May, 1897, Mr Marcus Baker, Mr H. F. Blount, Lieut. E. Hayden, Dr C. Hart Merriam, Prof. W. B. Powell, and Mr J. B.

Wight; in May, 1898, Mr Hy. Gannett, Gen. A. W. Greely, Hon. Gardiner G. Hubbard, Mr J. Hyde, Mr W J McGee, and Mr F. H. Newell.

The Society then elected the following-named gentlemen members of the Board of Managers for a term of three years: Mr C. J. Bell, Hon. C. W. Dabney, Jr., Prof. Wm. H. Dall, Dr David T. Day, Mr G. K. Gilbert, and Mr H. G. Ogden.

Special Meeting, May 16, 1896.—Eighth Annual Excursion and Field Meeting. About 300 members and guests went by special train to Charlottesville, Va., and there visited Monticello (the home of Jefferson) and the University of Virginia. The meeting was held at Monticello, President Hubbard in the chair, and addresses were made by Mayor Patton, of Charlottesville; President Randolph, of the University; General A. W. Greely, Dr Randolph McKim, Prof. W J McGee, Dr G. Brown Goode, and other gentlemen. After lunch the party visited the University and were received by the faculty, returning to Washington the same evening.

Elections.—New members have been elected as follows:

April 3.—Edward Bailey, Maj. Geo. V. Boutelle, Mrs L. A. Bradley, Henry G. Bryant, Dr John P. Davis, Mrs James M. Foster, S. L. Lupton, Frank C. Miles, Thos. C. Noyes, Dr Heinrich Ries, Geo. F. Thompson.

April 17.—Dr S. W. Beyer, Lieut. W. V. Bronaugh, U. S. N., Lewis Clephane, Maj. H. L. Cranford, Miss S. B. Hale, Geo. W. Holdrege, Maj. James M. Morgan, Alex. R. Mullowny, T. W. Neill, Gen. Albert Ordway, Horace L. Piper, Miss Elizabeth Wright, Henry Xander.

May 4.—W. L. Atkin, E. B. Baldwin, Hiram E. Deats, Dr Johnson Eliot, Miss E. F. Fisher, J. C. Gifford, Chas. Hallock, Rev. P. M. McTeague, Chas. A. Perkins, Chas. S. Prosser.

May 15.—James O. Brooks, Dr Wm. D. Cabell, Miss Ella Loraine Dorsey, Gen. M. F. Force, W. F. Foster, Mrs H. D. Green, F. W. Perkins, Wm. E. Rogers, Lorin P. Smith, Hon. J. Randolph Tucker, W. A. Turk.

Obituary.—The Society has to deplore the deaths of three of its members—Mr Charles Addison Mann, Jr., who died March 12; Major William Holcomb Webster, the well known and much respected Chief Examiner of the Civil Service Commission, who expired suddenly on March 23, and Judge Victor C. Barringer, formerly and for many years a distinguished member of the International Court of Appeals at Alexandria, Egypt, whose death occurred May 27.

Officers for 1896–'97.—At a meeting of the Board of Managers, held June 5, 1896, the following were elected officers of the Society for the ensuing year: President, Hon. Gardiner G. Hubbard; Vice-Presidents, Mr Marcus Baker, U. S. Geological Survey; Prof. Wm. H. Dall, Smithsonian Institution; Mr G. K. Gilbert, U. S. Geological Survey; Gen. A. W. Greely, U.S.A., Chief Signal Officer; Dr C. Hart Merriam, U. S. Department of Agriculture, and Mr Herbert G. Ogden; Treasurer, Mr C. J. Bell, President of the American Security and Trust Company; Recording Secretary, Lieut. Everett Hayden, U.S.N.; Corresponding Secretary, Mr Henry Gannett, U. S. Geological Survey.

GEOGRAPHIC NOTES

NORTH AMERICA

Newfoundland. The Newfoundland seal fishery has ended in a total catch of 196,485 seals, weighing 4,637 tons and of the value of $268,000.

Mexico. The imports of British cottons into Mexico in 1895 were nearly double those of the preceding year, although the Mexican mills were favored by protection and also by the low price of silver.

Canada. The Royal Society of Canada has adopted a memorial to the governor-general praying his intervention with the imperial government in favor of the unification of nautical, civil, and astronomical time, the reform to come into effect on the first day of the new century.

The Canadian and British governments have come to an agreement relative to the subsidization of a fast steamship service between Liverpool, or some other English port, and Quebec in summer, and Halifax, Nova Scotia, in winter. The vessels are to be in every respect equal to the best steamers running into New York.

SOUTH AMERICA

British Guiana. About 20 miles have been completed of the railroad that is being constructed from Kartabo point, at the junction of the Mazaruni and Cuyuny rivers and opposite the mining town of Bartica, to the interior of the country. Another enterprise that will facilitate access to the interior is the line that is being built from Wismar, on the Demerara river, to a point on the Esequibo above the dangerous falls that interfere with the navigation of that stream. Two other lines, both in the Barima mining district, are being rapidly pushed to completion.

EUROPE

Austria. Large vessels can now sail right up the Danube to Vienna, and the construction of ship canals connecting the Danube, Oder, and Vistula, and also between Budapest and Fiume, is strongly advocated.

England. The total receipts of the Manchester Ship Canal for the first four months of the present year showed an increase of more than $55,000 on those for the corresponding period of 1895.

The president of the Royal Geographical Society, Mr C. R. Markham, received the honor of knighthood on the recent anniversary of Queen Victoria's birthday.

The Founders' medal of the Royal Geographical Society has been awarded to Sir W. Macgregor for his valuable geographical work in New Guinea; the Patrons' medal to Mr St. George R. Littledale for his expeditions in Central Asia; the Murchison award to Khan Bahadur Yusuf Sharif, native Indian surveyor; the Gill memorial to Mr A. P. Low for explorations in Labrador; the Black grant to Mr J. Burr Tyrrell for his expeditions to the Barren Grounds of northwest Canada, and the Cuthbert Peck grant to Mr Alfred Sharpe for his many journeys in British Central Africa.

FRANCE. According to the recent census, the population of Paris is now 2,511,955, an increase of 87,250 in five years.

The proposed ship canal between the bay of Biscay and the Mediterranean is pronounced impracticable as a private enterprise, and the commissioners further report that it offers no such strategic or other advantages as would justify its construction by the government.

The activity and influence of the Société de Géographie de Paris are indicated by the fifteen medals and prizes just awarded as follows: 1. *Great Gold Medal*, Prince Henri d'Orléans, Exploration from gulf of Tonkin to gulf of Bengal; 2. *Gold Medal*, Captain G. Toutée, Explorations through Dahomey and on the Niger; 3. *Logerot Medal*, Commander Decoeuer, The Niger Mission; 4. *Fournier Medal*, L. Rousselet, The New Dictionary of Universal Geography; 5. *Malte-Brun Medal*, E. Chantre, Ethnographical and archeological investigations in the Caucasus; 6. *Dewez Medal*, F.-J. Clozel, Explorations to the north of Upper Sangha; 7. *Herbert-Fournet Medal*, A. Pavie, Explorations in Indo-China and his efforts to extend the power of France in the far East; 8. *Bourbonnaud Medal*, L. Lapicque, Voyage in the Persian gulf and study of the Negritos; 9. *Duveyrier Medal*, Commander Decazes, Investigations of French Congo and surveys north of Abiras; 10. *Morot Medal*, J. Renaud and C. Rollet de L'Isle, Surveys in the Pai-tsi-long archipelago, Tonkin; 11. *Montherot Medal*, R. de Saint Arroman, Study of geographic enterprises of the Minister of Public Instruction; 12. *Grad Medal*, A.-M. Gochet, Works on geographic instruction; 13. *Huber Medal*, F.-A. Forel, Work on lake Léman and on glaciers; 14. *Janssen Medal*, F. Foureau, Physical observations and explorations in the Sahara; 15. *Jomard prize*, H. Froidevaux, Memoirs of travel in French Guyanne.

GERMANY. The final report of the census of the German Empire, taken December 2, 1895, shows a total population of 52,244,503, an increase of nearly three millions within five years.

The traffic receipts of the North Sea and Baltic Ship Canal have so far been very disappointing. A traffic of 7,500,000 tons and receipts of nearly 5,000,000 marks per annum had been counted on, whereas the first eight months' receipts amounted to only 605,050 marks and represented a traffic of only 976,478 tons.

ITALY. The population of Rome on December 31, 1895, is officially reported as 471,801, an increase of 35,621 since December 31, 1891. For some unexplained reason no enumeration was made of such of the inhabitants of the city as were without fixed abode, their number being assumed to be the same as at the census of 1891, viz., 28,765. The number having fixed abodes was 431,881 and the garrison 11,155.

ASIA

SIAM. The French authorities at Chentabun are making a road to Battambang and constructing a telegraph line.

Upper Burma. Active operations looking to the development of the mineral wealth of Upper Burma are about to be commenced. A promising gold reef has been discovered in the Wuntho district, and coal of excellent quality is reported from Lawksawk, in the Southern Shan country.

China. An imperial edict directs the construction of a railway from Shanghai to Soochow, 65 miles, at an estimated cost of 2,000,000 taels. Shares for one-half the amount are offered to the public at Shanghai. Only Chinese stockholders will be admitted, and the government will retain control. The government has sanctioned a large increase in the production of salt as an additional source of revenue for the repayment of the Russian loan.

Turkestan. The Russian government is said to have decided to take another step toward getting within striking distance of Herat. A broad-gauge railway is to be built from Merv to a point near the Afghan frontier, a distance of about 130 miles, and all necessary material is to be collected at the far end of the line for the rapid extension of the road to Herat, a further distance of only 94 miles, in the event of war. Authority has also been given to the Turkestan administration to begin the building of a railroad along the Oxus from Charjui, where the river is bridged, to Kerki, within a short distance of the Afghan frontier.

AFRICA

West Coast. An amicable settlement of the boundaries between Senegal and Gambia has been arrived at by the French and English commissioners.

East Coast. In the British Colony of Natal there are more than 51,000 Indian laborers, and the Europeans are clamoring for the prohibition of further immigration.

Professor Elliot's Expedition. Consul Masterson reports that Prof. D. G. Elliot and Messrs Akeley and Dodson arrived at Aden April 14, where they procured 70 Somalis, 80 camels, and 20 horses and mules. A week later they crossed to Berbera, on the Somali coast. An absence of 10 months is planned, during which they will cross Somali into Gallaland and pass to the south of Juba river. The main object of the journey is the collection of mammals, but no effort will be spared to make the zoölogical collection varied and complete.

Dr Smith's Expedition. Interest is added to Elliot's journey by the very successful expedition of Dr A. Donaldson Smith, of Philadelphia, who left Berbera July 10, 1894, and visited the unexplored country of Gallaland, between Shebeli river and lake Rudolf. This lake, to the northeast of Victoria Nyanza, was reached in July, 1895. After a journey of 4,000 miles, Dr Smith arrived at Lamu, on the east coast, north of Zanzibar, on October 25, 1895, having lost only six men in sixteen months. His most interesting discovery was a race of pigmies, the Dunne, very black, flat-nosed, large-lipped, woolly-haired, and averaging only five feet in height, the tallest being 5 feet 2 inches. The most valuable results of the expedition are the large and varied natural history collections, consisting of 75 mammals; 300 specimens of plants, 24 new; 700 specimens and 400 varieties of birds, 24 new; 375 specimens of reptiles, 22 new, and 7,000 specimens of butterflies, 50 new.

POLAR REGIONS

The *Windward*, of the Jackson-Harmsworth expedition, will leave for the Arctic regions early this month. She will carry letters for Dr Nansen, on the chance of falling in with him north of Franz Josef Land.

Prof. Y. Nielsen, of the University of Christiania, states that at the last moment Dr Nansen contemplated a change in his route. It was to follow the sea of Kara along the east coast of Nova Zembla and reach Franz Josef Land to the north of the 80th parallel, whence he would push to the north to seek polar currents. Nielsen believes that this course has been followed by Nansen, since he failed to call for the dogs and supplies collected for him at the mouth of the Olenek.

MISCELLANEA

Prof. R. S. Tarr will take a party of Cornell men to Greenland with Lieut. Peary this summer. The intention is to spend five or six weeks in studying the geology and natural history of a part of the coast north of Upernavik. The main object will be the study of glaciation, but the party will be so constituted that other subjects will receive full attention.

A Bronze Memorial Bust of Commodore G. W. Melville, Engineer-in-Chief of the United States Navy and Chief of the Bureau of Steam Engineering, has been presented to the Philadelphia Commandery of the Military Order of the Loyal Legion by a few of the friends and admirers of that distinguished engineer and arctic explorer. The bust, which is by Ellicott, is pronounced an excellent likeness.

Albert Perry Brigham has recently published a noteworthy article entitled "The New Geography" (*Popular Science Monthly*, April, 1896), in which some of the characteristics of scientific geography are appreciatively set forth. The geography of past generations related to earth-forms treated as changeless units; the geography of the present generation treats of earth-forms as landmarks in terrestrial evolution, and leads to the consideration of growth and decay, cause and effect, process and product, and finally of the agencies of earth-making; the old geography was mere description of dead forms, the new geographic description extends to history and cause. The contributions of Powell, Gilbert, Dutton, McGee, Davis, and other American students of the new science are recognized, Superintendent Powell's activity in disseminating sound method is commended, and the activity of the National Geographic Society in discovery and in inculcating modern ideas is noticed. The article is of interest as an indication of progress in the development and diffusion of scientific geography, and its appearance in a journal not given to the recognition of modern earth science is especially welcome.

The National Geographic Magazine,

NOW PUBLISHED MONTHLY,

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

Mr. Cyrus C. Adams, New York.
Dr. Cyrus Adler, Smithsonian Institution.
Mr. Marcus Baker, U. S. Geological Survey.
Capt. John R. Bartlett, U. S. N.
Dr. Francis Brown, Union Theol. Seminary.
Hon. Jefferson B. Browne, Collector of Customs at Key West.
Dr. E. L. Corthell, C. E., New York.
Dr. Elliott Coues.
Hon. William E. Curtis, ex-Director of the Bureau of the American Republics.
Mr. Frank Hamilton Cushing, Bureau of American Ethnology.
Dr. Charles W. Dabney, Jr., Assistant Secretary of Agriculture.
Dr. Wm. H. Dall, Smithsonian Institution.
Dr. George Davidson, President of the Geographical Society of the Pacific.
Mr. Arthur P. Davis, U. S. Geological Survey.
Mr. Wm. M. Davis, Professor of Physical Geography in Harvard University.
Dr. David T. Day, Chief of the Div. of Mining Statistics and Technology, U. S. Geol. Sur.
Mr. J. S. Diller, U. S. Geological Survey.
Hon. John W. Foster, ex-Secretary of State.
Mr. Henry Gannett, Chief Geographer, U. S. Geological Survey and 11th Census.
Mr. G. K. Gilbert, U. S. Geological Survey.
Gen. A. W. Greely, U. S. A., Chief Signal Officer, War Department.
Hon. Gardiner G. Hubbard, President of the National Geographic Society.
Dr. Mark W. Harrington, President of the University of the State of Washington.
Lieut. Everett Hayden, U. S. N., Secretary of the National Geographic Society.
Mr. Robert T. Hill, U. S. Geological Survey.
Mr. Wm. H. Holmes, Dir. of the Dept. of Anthropology, Field Colum. Museum, Chicago.
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Mr. John E. McGrath, U. S. Coast Survey.
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Dr. T. C. Mendenhall, President of the Polytechnic Institute, Worcester, Mass.
Dr. C. Hart Merriam, Ornithologist and Mammalogist, U. S. Department of Agriculture.
Hon. John H. Mitchell, U. S. S.
Prof. W. L. Moore, Chief of Weather Bureau.
Mr. Frederick H. Newell, Chief Hydrographer of the U. S. Geological Survey.
Mr. Herbert G. Ogden, U. S. Coast Survey.
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Mrs. Robert E. Peary.
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Mr. William H. Pickering, Professor of Astronomy in Harvard University.
Major John W. Powell, Director of the Bureau of American Ethnology.
Prof. W. B. Powell, Superintendent of Schools, District of Columbia.
Hon. John R. Procter, President of the U. S. Civil Service Commission.
Mr. Israel C. Russell, Professor of Geology in the University of Michigan.
Dr. N. S. Shaler, Professor of Geology in Harvard University.
Commander Charles D. Sigsbee, Hydrographer to the Bureau of Navigation, Navy Dept.
Miss Eliza Ruhamah Scidmore.
Commander Z. L. Tanner, U. S. N.
Mr. Frank Vincent, New York.
Hon. Charles D. Walcott, Director of the U. S. Geological Survey.
Mrs. Fannie B. Ward.
Mr. Bailey Willis, U. S. Geological Survey.

PRINCIPAL CONTENTS OF RECENT NUMBERS.

JANUARY.—Russia in Europe, with map, Hon. Gardiner G. Hubbard; The Arctic Cruise of the U. S. Revenue Cutter "Bear," with illustrations, Dr. Sheldon Jackson; The Scope and Value of Arctic Exploration, Gen. A. W. Greely, U. S. A.

FEBRUARY.—Venezuela: Her Government, People, and Boundary, with map and illustrations, William E. Curtis; The Panama Canal Route, with illustrations, Prof. Robert T. Hill; The Tehuantepec Ship Railway, with maps, E. L. Corthell, C. E., LL. D.; The Present State of the Nicaragua Canal, Gen. A. W. Greely; Explorations by the Bureau of American Ethnology, W J McGee. *Also map of the Orinoco valley, showing territory drained by that waterway and its bearing on the Venezuelan Boundary Question.*

MARCH.—The So-Called "Jeannette Relics," Prof. Wm. H. Dall; Nansen's Polar Expedition, Gen. A. W. Greely; The Submarine Cables of the World, Gustave Herrle; The Survey and Subdivision of Indian Territory, with map and illustration, Henry Gannett; "Free Burghs" in the United States, James H. Blodgett. *Also chart, 19 x 30 inches, showing Submarine Telegraph Cables of the World and Principal Land Lines. Full-page portraits of Dr. Nansen and Prof. Wm. H. Dall.*

APRIL.—Seriland, with map and illustration, W J McGee and Willard D. Johnson; The Olympic Country, with map, the late S. C. Gilman; The Discovery of Glacier Bay, Alaska, Eliza Ruhamah Scidmore; Hydrography in the United States, Frederick H. Newell; Recent Triangulation in the Cascades, S. S. Gannett; The Altitude of Mt. Adams, Washington, Edgar McClure.

MAY.—Africa since 1888, with special reference to South Africa and Abyssinia, with map, Hon. Gardiner G. Hubbard; Fundamental Geographic Relation of the Three Americas, with map, Prof. Robert T. Hill; The Kansas River, Arthur P. Davis. *Also portrait of Hon. Gardiner G. Hubbard, President of the National Geographic Society.*

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THE JULY NUMBER

— OF —

THE NATIONAL GEOGRAPHIC MAGAZINE

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By MARK B. KERR, C. E.;

GEOGRAPHIC NAMES,

By HENRY GANNETT,

Chief Geographer of the U. S. Geological Survey and President of the U. S. Board on Geographic Names;

and the conclusion of the article by

PROFESSOR W. M. DAVIS

— ON —

THE SEINE, THE MEUSE, AND THE MOSELLE.

JUDD & DETWEILER, PRINTERS, WASHINGTON, D. C.

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HANDIWORK OF THE CAYAPAS INDIANS, ECUADOR

From an Original Photograph by Mark B. Kerr, C. E.

See page 242.

THE

National Geographic Magazine

Vol. VII JULY, 1896 No. 7

THE WORK OF THE UNITED STATES BOARD ON GEOGRAPHIC NAMES

By Henry Gannett,

Chairman of the Board and Chief Geographer of the U. S. Geological Survey and of the Tenth and Eleventh Censuses

This board was originally constituted, in the early part of 1890, as a voluntary association of officers of various departments of the government for the purpose of securing uniformity in the official spelling of geographic names. It was the result, in the main, of the efforts of Dr T. C. Mendenhall, then Superintendent of the U. S. Coast and Geodetic Survey, who was chosen its first chairman. It was given standing and authority by an executive order of September 4, 1890, which reads as follows:

"As it is desirable that uniform usage in regard to geographic nomenclature and orthography obtain throughout the executive departments of the government, and particularly upon the maps and charts issued by the various departments and bureaus, I hereby constitute a Board on Geographic Names and designate the following persons, who have heretofore coöperated for a similar purpose under the authority of the several departments, bureaus, and institutions with which they are connected, as members of said board. . . . To this board shall be referred all unsettled questions concerning geographic names which arise in the departments, and the decisions of the board are to be accepted by these departments as the standard authority in such matters." . . .

The board now consists of representatives of the following departments and bureaus: State, War, and Navy departments, Light-House Board, Coast and Geodetic Survey, Geological Survey, General Land Office, Post Office Department, and Smithsonian Institution.

During the five years or more of its existence the board has held 48 meetings and has decided 2,835 cases. Its *modus operandi* is simple and direct. The cases of disputed nomenclature which reach it are referred at once to an executive committee consisting at present of the representatives of the Geological Survey, Navy Department, and Coast and Geodetic Survey. An investigation of each case is made by this executive committee, which reports it, with recommendations, to the board, which makes a final decision. For such decision a majority of the entire board is necessary. It not infrequently happens, therefore, that it is only by a unanimous vote of those present at a meeting that definite action can be taken.

Geographic names may be broadly distinguished into two classes: those which are established by usage, commonly local usage, and those which are not so established. In regard to the former class, the primary principle which controls the decisions of the board is that local usage ought to prevail. What the people call themselves and what they call the natural features lying within their jurisdiction should, unless there is good reason to the contrary, be the names thereof. That this is just and proper surely goes without saying. In general, every man has a right to insist that other people call him by the name which he selects and accept that spelling of his name which he chooses to adopt. The rights which a man has over his own name, a community has over its own name and over the names of all natural features lying within its jurisdiction. Lest it should appear that I am dwelling too much on this aspect of the case and arguing a self-evident proposition, let me quote from an article recently published in Justus Perthes' Geographische Mittheilungen, which will show that there are men, and men of eminence, too, who do not accept this principle.

"The practical Americans have had since 1890 a Bureau of Geographic Names. . . . The establishment of this Bureau on Geographic Names and its first decisions were referred to in our last report. We gave a hearty greeting to the new creation, and added to the greeting a few suggestions; but these have not been considered. Nay, more, the later decisions of the board, about 700 in number, relating to geographic names at home and abroad, correspond still less to the most reasonable expectations. We miss the principle that the original form of the name, the meaning and etymology of the name, the motive for naming, is to be considered, and considered *first and foremost*. We miss the scientific spirit, which, instead of cleaving to the form, unlocks the intrinsic meaning, and accordingly we miss in the works of a government board of names all evidence of acquaintance with toponymic literature."

Summarizing a discussion which took place before the National Geographic Society on the subject of geographic names, the same author says:

"Only the last named among the four speakers has a word to say in behalf of the original forms of the nomenclature introduced by discovery and explorers, or received from the Indians; but his championship is timid and surrounded by wide reservation. Nowhere do we find the principle laid down that the original forms of names, especially Indian names, which are so true to life, are to be preserved as much as possible. A board of names has no easy task. It has not merely to give 'decisions,' but also to base these decisions on thorough study, and to inform the public, so far as necessary, of the grounds on which they are made. We wish to know from what variations the form selected has been picked out; and this statement will serve to show the amount of knowledge of literature possessed and the scientific principle followed, and will itself win for the decision the confidence of the interested circles. Only this method turns out solid work; any other procedure merely replaces private caprice by official caprice. This official caprice is able to turn a 'Golfo Triste' (sad bay) into a 'Gulf of Triste,' thus manufacturing a personal name or place name, Triste, after which the bay must have been named. It is well known that this feature is the arm of the sea between the Orinoco and Trinidad, to which the Dragon's gorge forms the northern entrance, a passage which was deserted and feared even in the time of Columbus, because ships, driving with spread sails under brisk west wind against the mighty current of the Orinoco, are exposed to danger. The above-mentioned decision of the board of names has masked the physical fact and formally falsified an expressive geographic name."

With regard to this case, it may be stated that the board has made no decision whatever. It has not come before it.

"In the United States and elsewhere there are undoubtedly an infinity of names and places of obscure origin, and for which a decision has to be made without giving reasons. Be it so. We recognize the necessity where it exists; but just as positively must we demand that the decision be made on scientific grounds whenever possible."

Dr Egli, the writer of this article, is well known as one of the leading geographers of Europe and one who has given much attention to this subject of geographic names. It seems to me clear, however, and in that view I know that I share the opinion of the other members of the board, that he is radically wrong in the views he here presents. He states the exact fact when he says that "We miss the principle that the original form of the name, the meaning, the etymology of the name, the motive for naming, is to be considered, and considered *first* and *foremost*."

It is true that the board attaches little importance to these matters. On the contrary, its fundamental principle, as before stated—a principle which has controlled many hundreds of its decisions—is that local usage, the prevalent usage of the people living in the neighborhood, should be followed. By this it is not meant that local usage has absolutely controlled in all cases. Departures have been made whenever, for other reasons, such a course seemed wise, but this principle has controlled the decisions of the board in nine cases out of ten. I have already touched on its validity. Concerning its expediency, I may say that unless the decisions of the board are adopted by the people and generally followed its work will be a failure. It was constituted not to restore corrupted forms to so-called pure forms, but to secure uniformity of usage. There is not force enough in any government, at least not enough in the government of the United States, to make the people do what they do not wish to do. To fly in the face of the community is like attempting to dam up a river and force it to flow up hill.

To adopt as the "first and foremost" principle the one formulated by Dr Egli, that the original forms of names be restored, would lead to some startling results, results which he surely does not fully appreciate. Geographic names in the United States have been modified, changed, distorted, corrupted, if you will, to an astonishing extent. To throw aside these corrupted but well established names and replace them by old and forgotten forms would involve wholesale changes, such as would find no following among the people of the United States. The name which was accepted fifty or a hundred years ago is not the name in use at present; today the people accept something else.

An example of corruption is seen in the name Bobruly, applied to a creek in Missouri. The original will, of course, be recognized as Bois Brulé. Again, Rum river, Wisconsin, was originally the St. Esprit, which, translated, became Spirit river, and thence, by some pundit, rendered in its present form. For a whole century Wisconsin was spelled Ouisconsing. Would there be any right or propriety in reverting to that spelling and requiring the citizens of the Badger State to adopt it in place of the present form? Shall we attempt to revive the name Illinois or Illinovacks in place of Michigan for one of the Great Lakes, Ouabash for Wabash, and apply it to the Ohio river, or call it La Belle Riviere? Should we substitute Kichi Gummi, Grand Lac, Tracy, Condé, or Algona for Lake Superior, and Ihankton for Yankton? Shall we call the Mississippi the St. Francis, the

Colbert, the Conception, or the St. Louis; shall we change Missouri into Missouries or St. Phillip, and Iowa into Ioway?

We might go on and quote thousands of names that have been changed to a greater or less extent, but these few will suffice to illustrate the matter. Examination of old maps of the United States shows that a majority of the geographic names now in use have been changed since they were first applied; consequently it would be utterly impracticable to ignore the forms to which the people are now accustomed, even if there were no impropriety in so doing. In short, it is impossible, even were it desirable, to restore the original forms of names.

The principle above enunciated is a far-reaching one, and it will be well, before entering upon a discussion of the exceptions which the board makes to it, to follow it and see to what it leads us. The names of many features in foreign countries have from time out of mind been known to English-speaking people by names other than those applied by their inhabitants. The Germans call their country Deutschland, the Italians call theirs Italia, the Spaniards España. The citizens of certain places in Italia call their cities Livorno, Roma, Venecia, but we call them by other names in a way that is utterly unwarranted. Every American resents having a Frenchman call our country Les Etats Unis, and properly, for it is not its name. There is no more sense in translating a geographic name than a person's name. A name is not a common noun, that it should be translated. The time is apparently not ripe for adopting the home names of all foreign geographic features, but, speaking for myself, I have no doubt that it will soon be feasible to institute this reform. Indeed, in almost every individual case of this sort that has been brought before the board the decision has been rendered in favor of the home name.

The universal adoption of this principle would, however, lead to many inconsistencies. For instance, in many cases what is plainly the same name appears in different parts of the United States as a designation of different features, with different spellings. In such cases should these different spellings be unified? The tendency of the board doubtless is in that direction, but in many cases they not only run against strong local usage but against legal authority as well. Wichita, Washita, and Ouachita are the same word; so with Wyandot, Wyandotte, and Guyandot. All are familiar with the name Allegheny, *hany*, *any*, applied to counties in New York, Pennsylvania, Virginia, West Virginia, and North Carolina, and to mountain ranges and a river. As a county name it is spelled in three different forms, each of which is fortified by legislative acts, legal documents, and no end of local usage. It is desirable to make the spelling uniform; but can it be done? In such a case the board is between the devil and the deep sea. Consistency in following local usage produces inconsistency in orthography. In some cases of this sort, where the board was of the opinion that local usage could be overcome, it has adopted a uniform spelling, but in other cases it has refrained from making decisions.

In the matter of geographic names, as in everything else, development is constantly going on; names are continually changing, being modified in some cases slightly, in other cases radically. Is it best that this development should be suffered to go on blindly, as development has proceeded throughout the world in times past, or will it be more economical and will the results be more satisfactory and be attained at less cost if it be guided intelligently? Surely no one will hesitate to admit that the latter is the better condition. Recognizing this course of development in geographic names, the board has studied it with a view to ascertaining its trend, of discovering what changes are going on, and what their result is likely to be in the future, and, acting upon the knowledge thus acquired, it has endeavored to guide the course of development into the best channels, so as to produce good results from it as speedily as practicable. The most marked direction in which development is proceeding is that of simplification. Useless letters are being dropped, hyphens are being omitted; appendages to names, such as the word city, town, court-house, cross-roads, etc., are one after another being dropped. The possessive form of names is being given up. Life is too short to expend it in writing these useless words and letters. Names consisting of more than one word are being run together into one word. In these and many other ways the course of development is toward simplification and abbreviation. Of these changes the board heartily approves and it is going as fast and as far in the direction of furthering them as it believes the public will support it. To go faster or to go further at the present time would be to discredit itself, and this the board prefers not to do. Another tendency in development is toward uniformity in spelling. Certain names ending in *burg* were formerly spelled *burgh*, others *burg*, necessitating constant reference to gazetteers in order to learn whether the name had a final *h* or not. The board at one stroke relieved the American public of this necessity by striking off the *h* in every case. The same thing was done with the termination *ugh* of *borough* and for the same purpose. Similarly the word *centre* is now uniformly spelled *center* wherever it appears as a part of a geographic name.

There is one other class of names to be considered, that is, names in remote, unsettled parts of the country, where there is no local usage. These are mainly of Indian origin, and they may be said to be still in an unsettled state, like the country in which they are found. How do we obtain Indian names? The spelling given to an Indian name represents the way in which some white man understood some Indian to pronounce it, and every one knows that in such a case there will be just as many different spellings of an Indian name as there are white men to hear it and Indians to pronounce it. From our Northwest we could, if space permitted, give hundreds of such names, each of them with a dozen or perhaps twenty different versions, and each version just as correct as any other. In such cases the board selects from among the different versions the one which seems to represent the sound the most clearly and most simply.

Early in the life of the board a long list of Alaskan names was submitted to it for decision. These names were referred by the board to some half-dozen gentlemen, all of whom were known as Alaskan geographers, and the subsequent decisions were based upon the weight of evidence submitted by these specialists. Of course, the decisions did not in all cases please all persons acquainted with Alaskan names.

In the matter of names in unsettled countries under foreign jurisdiction, the policy of the board has been to accept the spelling of the nation having jurisdiction there.

The work involved in making these decisions is in the main simple in character. Although much of it involves investigation, it is common every-day investigation, consisting mainly in finding out what people call themselves. The matters with which the board are concerned are not, as a rule, scientific matters. They are simply matters of fact or judgment. The board is often criticised for inconsistency in its decisions; with having decided one way in one case and a different way in another case which appears to be quite similar. I think the board is quite ready to plead guilty to the charge of inconsistency, but with extenuating circumstances, since consistency in certain matters involves inconsistency in others.

THE SEINE, THE MEUSE, AND THE MOSELLE

By William M. Davis

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II

Diversion of the upper Moselle from the Meuse.—After this long digression let us now return to the case of the Meuse and see whether indications can be found that any of its branches have been diverted to the basins of the Seine or of the Moselle. The first example to be mentioned is found in the neighborhood of Toul, and for simplicity of description I shall take the liberty of changing the names of the streams in this region in accordance with the adjoining diagram, the actual names being given in thin-lined letters, the assumed names in heavy-lined letters. The case may then be briefly stated as follows: The Toul (upper Moselle) once flowed through a meandering valley and joined the Meuse at the little village of Pagny-sur-Meuse. The meandering valley trenches an upland of middle oölite strata, but in the course of time the Pompey, a branch of the Moselle, pushed away the divide at its head, tapped the Toul where the city of that name now stands, and diverted it from the Meuse to the Moselle.*

The first fact to note is that the abandoned valley between Toul and Pagny swings on large curved meanders, after the

* My attention was first called to this example by my kind friend, M. Emm. de Margerie, who was so good as to refer me to the writings of several French authors by whom it had been described more or less fully and to whose essays I thereupon referred either in the original or in some citation. The earliest writer to make mention of this change in the course of the Toul seems to have been Boblaye, (1) who in 1829 reported that he found pebbles in the valley of the Meuse unlike the rocks of its upper basin, but like those of the upper valley of the Toul in the Vosges mountains. Buvignier (2) gave a fuller account of the same facts in 1852 and came to the same conclusion. Housson (3) wrote on the same subject in 1864, but I have not seen his article. The latest account of the case is by Godron (4) in 1876. All these authors recognize what may be called the geological evidence of the change, that is, the occurrence of pebbles from the Toul in the valley of the Meuse; but as far as I have read, they did not give particular care to the geographical features of the case. It is to these, therefore, that special attention is here called.

(1) Mem. sur la formation jurassique dans le nord de la France. Ann Sci. Nat., 1829.

(2) Statistique géol. et min. du department de la Meuse, Paris, 1852.

(3) Origine de l'espèce humaine dans les environs de Toul. Pont-a Monsson, 1864.

(4) Ann. Club Alpin français, xiii, 1876, 442–457.

fashion often assumed by the valleys of large rivers, but never imitated by valleys of small streams. It is true that the valleys of small streams may in the course of time become comparatively wide, but they can never develop systematically curving meanders of large radius with steep sloping bluffs on the outside of the curves and long sloping spurs on the inside of the curves. The form of the valley from Toul to Pagny, therefore, at once suggests not only that a stream once passed through it, but also that the stream was a large one.

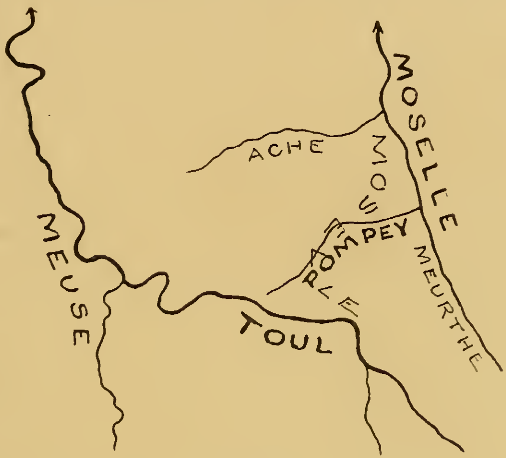


FIGURE 3.

In the second place, on looking more closely at the topographic details in the neighborhood of Toul, it is seen that we have here a well developed elbow of capture—a sharp bend in the river course, independent of local rock structure. The Toul makes a sharp turn from the direction of its upper course and swings off along the course of the Pompey to the Moselle. The Pompey was once merely one of many small branches of the Moselle, of which the neighboring Ache may be taken as the type; but in consequence of adding the large vol-

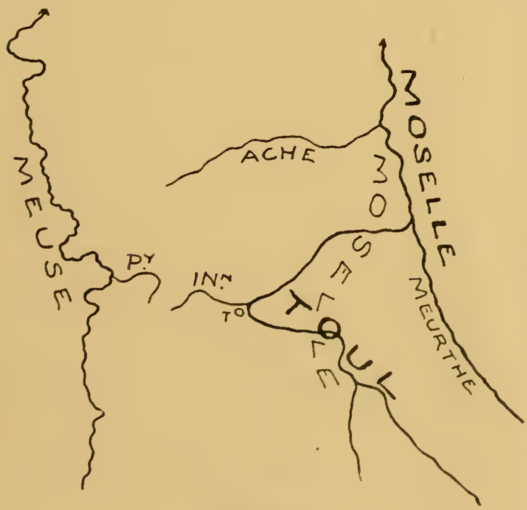


FIGURE 4.

ume of the Toul to the formerly small volume of the Pompey, the valley has been distinctly deepened both down and upstream from the elbow of capture below the former level of the streams and now exhibits the steep-sided trench characteristic of recent captures. Not only the diverted Toul but several of its branches above the elbow of capture have intrenched themselves beneath the general level of the open valley-plain of lower oölite strata on which they formerly flowed. On restoring the surface of this old valley floor by filling up the trenches which now dissect it, it may be seen to slope at such a grade as would lead it to the floor of the meandering valley on the way to the Meuse. Immediately after the division of the Toul we may imagine that only a small stream—the Pagny—fed by the drainage from the valley slopes, was left to follow the meandering valley to Meuse. This would be the diminished, beheaded stream of our terminology. But in consequence of the development of the deep trench at the elbow of capture and the accompanying growth of the obsequent stream—the Ingressin—the beheaded Pagny has been still further shortened and is now not more than two and one-half miles in length.*

The Pagny and the Ingressin.—Let me here turn a moment from the main subject to consider some special features of the meandering valley and its present occupants, the Pagny and the Ingressin. In the first place, midway in the valley, at the village of Foug, there is a little stream coming in from the Bois Romont on the north. The topographic details of the district give good reason for thinking that this little stream used to join the valley at Lay-St.-Remy on the next meander to the west, and thus we have here a repetition of an accident of the Ste. Austreberte type. When the vigorous Toul was running through this valley and widening its meander belt it must have pushed its swinging current so vigorously against the outer side of its curves that it cut through the ridge separating the Foug meander from the little stream on the north, and thus changed the mouth of its own tributary from a lower to an upper meander. This may be added to the evidence indicating the former passage of a large river through the meandering valley.

Next as to the obsequent Ingressin, whose head is at least six

* The following altitudes are significant:
Junction of the Meurthe and the Moselle at Pompey, about 190 m.
Elbow of capture at Toul, 204 m.
Old valley floor at elbow of capture, about 255 m.
Divide between Ingressin and Pagny, 265 m.
Junction of the Pagny and the Meuse, 245 m.

miles from the elbow. The comparative narrowness of the trench both above and below the elbow of capture by Toul would not lead us to expect an obsequent stream of much length, and I therefore suggest the following explanation of the rather surprising length of the Ingressin. A little southwest of Foug is the narrowest part of the old valley, its narrowness here being due to the greater resistance of the middle Oölite, which form the highland through which it is cut. From these steep slopes it appears that a significant amount of waste has crept down into the valley trough, obstructing it more or less and producing a swamp of small dimensions. The beheaded Pagny seems to have been unable to hold its course through this obstruction. It probably accumulated for a time in a shallow lake above the obstruction, until on overflowing into the gorge at the elbow this part of its course reversed its direction of flow, and thus gave rise to an obsequent stream of a somewhat aberrant type which is now called the Ingressin.

All this, however, only by way of suggestion. Further study of the geographical aspects of the country is necessary before this suggestion deserves acceptance. There need, however, be no doubt on the general problem concerning the diversion of the Toul from the Meuse to the Moselle, and to my mind the case would be perfectly satisfactory if no pebbles from the Vosges had ever been found in the valley of the Meuse below Pagny. The dimensions of the meandering valley, the systematic form of its bluffs and curves, the gorge above and below the elbow of capture at Toul, the relation of the old valley plain in which the gorge was cut to the floor of the meandering valley that leads through the upland, and the accident that happened to the little side stream at Foug, all combine into so systematic an arrangement of parts as to leave no doubt that an explanation which can account for them by a single and simple process is their true explanation.

The diminished Meuse.—Looking now again at the Meuse by Commercy we must recognize it as a river whose volume has been diminished by the diversion of an important tributary to another river system. Its volume having diminished, it is unable now to accommodate itself to the large curves of its valley and must instead advance in an uncertain course as it staggers along on the valley floor. Not only so; having lost volume, it seems unable to maintain so gentle a slope as it had assumed when its volume was larger, for its flood-plain now has every appearance of having filled up the former valley-trough to a moderate depth. It therefore gives us an illustration of a river which has changed its action from degrading its slope when its volume was large to aggrading its slope now that its volume is small.

What the Meuse has lost the Moselle has gained, and the considerable addition that the Toul has given to its volume has undoubtedly confirmed its habit of swinging boldly around the meanders of its lower valley, even to the point of cutting almost or quite through the necks of its meander spurs.

The Aire and the Bar.—Let us next look at the case of the Aire. This stream was once an affluent of the Meuse on the western side of its basin, but it has been diverted to swell the volume of the Seine. The elbow of capture in this case lies about two miles east of Grand Pré. The Aire coming from the southeast here makes a sharp turn westward through the ridge of lower Cretaceous strata that bears the forest of Argonne and thus joins the Aisne. In direct continuation of the course of the Aire an open valley leads to the Meuse a little below Sedan. The greater length of this valley is followed by a small stream—the Bar; but while the valley exhibits strong meanders of rather large radius, the Bar is nothing but a little brook that wriggles here and there, back and forth, on the valley floor. The slopes of the valley floor have the usual systematic arrangement—steeper slopes on the outside of the curves, gentler slopes on the inside. A spur that enters one of the meanders from the upland on the west, covered by the Bois la Queue near St Aignan, has so narrow a neck that the canal leading from the Meuse to the Seine system has cut a trench through the neck instead of going around the spur. (See Plate V.)

FIGURE 5.

The indications of the former greater volume of water in the stream that once swung boldly around the meanders of this valley are perfectly conclusive. But now the little Bar staggers about in the most random manner, quite unable to continue the widening of the meanders and the narrowing of the necks of the spurs by running systematically against the outer side of the valley curves. The meadow-like quality of the flat valley floor suggests that the Bar has aggraded its course since the greater volume of water was withdrawn at the Grand Pré elbow, thus repeating the features of the Meuse about Commercy. Following up the Bar, the breadth of the valley and the radius of its large meanders are slowly diminished for a long distance; but the little Bar winding through the meadow floor, rapidly diminishes, and near Buzancy the meadow is left without more drainage than is given by such ditches as the farmers have cut here and there for the better drying of their flat, marshy fields. Passing further to the southeast along the meandering valley, we soon find a small stream, successively called the Moulin, Briquenay, and Agron, flowing southward for seven miles in a trench cut along the valley-trough to the elbow of capture above Grand Pré. This is the back-handed stream by whose growth from the elbow of capture the beheaded Bar has been progressively more and more shortened.

Whether the divide at present existing between the obsequent Briquenay-Agron and the beheaded Bar has been determined in this case by the accumulation of detritus washed in from the valley slopes, as it apparently was in the case of the Pagny, I cannot surely say; but there does not appear to be much disparity between the time required for the amount of widening that the gorge of the Aire has received at the elbow of capture and for the headward growth of the back-handed Briquenay-Agron. As in the case of the Toul (upper Moselle), so with the Aire; its old valley floor, occupied at a time when it still ran down the valley now occupied by the Bar, is easily recognized in the flat, terrace-like benches in either direction from the elbow of capture; but these benches now overlook the widened trench of the diverted Aire and the narrower trench of the reversed Briquenay-Agron. A considerable depth is maintained by the trench of the Aire for some distance up the stream from the elbow of capture, and, of course, also through the former valley floor of the diverter on the way to Aisne; but on going up the reversed stream its trench rapidly decreases in depth, and near Buzancy it makes but a slight depression in the meadows.

One of the most interesting points of view for the appreciation of this example of river arrangement is on the flat fields of the old valley floor near the elbow of capture, just south of the village of Champigneules. Here all the different parts are easily recognized, as if on a model made expressly for the explanation of the problem. In some pits dug here and there by the roadside on the plain one may see the old river gravels laid down by the Aire while it was running at this high level on its way northward to the Meuse. Another point of view no less instructive is offered after surmounting the hill by which the national road southward from Sedan, on the Meuse, crosses over to the valley of the Bar at Chevenges. From the summit and along the southward descent one has a beautiful view of the broad valley as it swings around the narrow-necked spur of the Bois la Queue, but he looks in vain for the stream by which the valley was cut. He fails to see any stream at all until descending to the valley floor, when the only occupant of the great, boldly swinging valley is found to be a little meadow brook.

Here, as before, it should be remembered that it is not the width of the valley that is essentially discordant with the size of the brook that now drains it; for in the late maturity of the geographical development of a land surface even small streams have broad valleys. The discordance which proclaims that the valley is not the work of the existing stream is seen in the relative dimensions of their meanders. The valley swings regularly in curves of at least half a mile in radius, and maintains this habit of curvature with small diminution far up toward the elbow of capture and probably still further south. The stream turns and twists in curves whose radius may often be less than a hundred feet. *

In comparing the case of the Toul (upper Moselle) and Aire, we see that these rivers are the diverted upper portions of

* The following altitudes are instructive:

Junction of Bar and Meuse	153 m.
Divide in old valley-trough between the beheaded Bar and the reversed Briquenay-Agron on the meadows west of Buzancy	175 m.
Junction of the reversed Briquenay-Agron with the Aire at the elbow of capture	130 m.
Floor of old Aire valley at elbow of capture	182 m.
Junction of Aire and Aisne	113 m.
The advantage of depth thus gained by the Aire is about	50 m.

It is worth noticing that if the Aire had not been diverted at Grand Pré it would have soon been captured farther down its former valley at Brieulles-sur-Bar for here the Fournelle, a branch of the Aisne, has almost cut through the forested ridge of Argonne, as the following heights show:

Mouth of Fournelle in Aisne by Vouziers	100 m.
Divide between head of Fournelle and Bar near Noirval	174 m.
Bar at Brieulles	168 m.

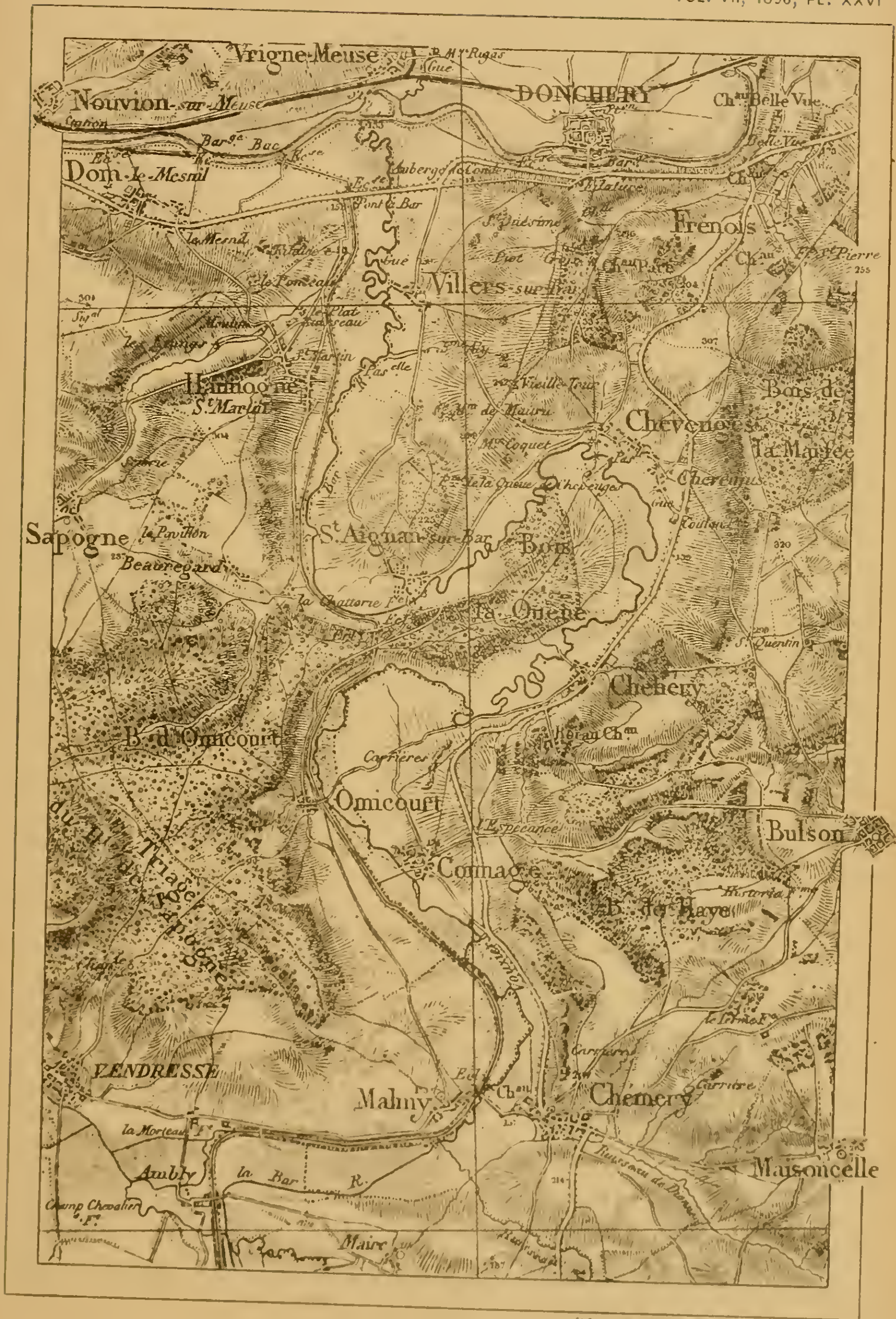
branches that once belonged to the Meuse. The diverters (by which the Toul was given over to the Moselle and the Aire to the Aisne) may be called the Pompey and the Grand Pré respectively, the latter ultimately delivering its prize through the Marne to the Seine. The beheaded streams of the two are the Pagny and the Bar. The former is so insignificant that I have had to invent a name for it, finding no name for the stream but only the "Marais de Pagny" entered on the Etat-major map of 1 : 80,000. The Bar is the best example that I have ever seen of a beheaded stream trying ineffectually to live up to the robust habits of its great predecessor.

The diminished Meuse again.—The loss suffered by the Meuse and the increase gained by the Seine through the diversion of the Aire are of no great moment, but as far as they go they serve to confirm each river in the habits that now characterize it—the Meuse in staggering with uncertain steps around its valley curves, the Seine and the Moselle in swinging boldly around their curves and undermining the inclosing bluffs. It should be noted, however, that when a large tributary is diverted from a point high up on the trunk of a main river, the loss of volume that the change produces may be a large fraction of the total volume that once belonged to the main river, and hence that the loss may greatly affect the ability of the main river still to follow the swinging valley that it cut out when its volume was greater. On the other hand, when a tributary of relatively small volume is diverted from some point near the middle of the main river, the loss thus occasioned will be a comparatively small fraction of the trunk volume, and the change of habit thus produced will be correspondingly small. It is for this reason that the staggering of the Meuse near Commercy is so much more marked than between Sedan and Mézières. The loss of the Toul (upper Moselle) was a much more serious affair for the Meuse than the loss of the Aire.

Supplementary problems.—There are certain aspects of this problem that remain to be considered briefly. First, are there any other examples of branches diverted from the system of the Meuse to those of its neighbors on the west and east? Although I have been unable to find any direct signs of them on the map, there still does seem to be indication that other diversions have occurred. On looking at the Meuse above Pagny, it is there almost as much out of proportion to its valley as it is below Pagny. It is possible, therefore, that other headwater branches higher up than the upper Moselle have been diverted. Looking at the Aire, it appears that the present radius of the meanders is much smaller than the radius of the swinging valley that is followed by the little Bar, and from this it may be inferred that not only the existing Aire but the drainage of a still larger basin once ran down the valley of the Bar. Perhaps the upper Ornain represents something of the additional volume that the Aire once possessed, but I cannot find direct indication that such is the fact. The maps on the scale of 1 : 80,000 seem hardly of sufficient detail to enable one to solve this phase of the problem by indoor study alone. The whole subject calls for extended study in the field, and a more interesting problem could hardly be selected for a summer's work.

Another subject to which no reference has yet been made is, nevertheless, of fundamental importance to the whole problem: Why is it that the Seine and the Moselle are waxing at the expense of the waning Meuse? Why do they possess an advantage while the intermediate stream is at a disadvantage? How could the Meuse ever have gained so large a drainage area as it once must have had, if at a later stage of its history it was to be so closely shorn of its branches? This is too large a problem to enter far upon now, but it contains two elements that may be briefly stated. One is that many ot the streams in the region of the Meuse are longitudinal streams—that is, they run chiefly along the strike of the weaker strata and their valleys have long ascending slopes on the eastern side and more abrupt slopes on the western side. The highlands reached by these slopes are determined by the outcrop of more resistant strata than those of the valleys which the streams have excavated. Longitudinal streams of this kind I have called "*subsequent*," believing that they cannot have originated in immediate consequence of the original slopes of the land surface when it first arose above the sea, but that their opportunity came later when the wasting of the weak strata allowed the headward growth of streams along their strike, after the manner explained in connection with the adjustments of the Marne and its branches near Châlons. The Meuse and at least some of the branches that it once had therefore seem themselves to have been the result of depredations committed on the territory of some still earlier river or rivers, and if this is true, the sympathy that the present impoverished condition of the Meuse excites is not deserved.

However this may be, why is it that the Meuse has lately



THE LOWER VALLEY OF THE BAR

Sheet 24, Map of France, 1 : 80,000

found so great difficulty in deepening its valley and thus saving its branches from capture by its neighbors? The chief cause of this difficulty must be looked for in the uplift of the Ardennes, across whose resistant rocks the lower Meuse has, during Tertiary time (perhaps only during later Tertiary time), been cutting its grand gorge. Like the highlands of the middle Rhine, the Ardennes consist of ancient and deformed rocks which have once been reduced to a peneplain of moderate relief drained by idle streams,* but across which the Meuse is now actively cutting a deep transverse valley in consequence of the strong uplift of the region. While the peneplain was yet a lowland the Meuse was comparatively safe from depredations, but during the elevation of the peneplain and thereafter, great difficulty must have been experienced in deepening the valley. The Moselle must also have had some difficulty in deepening its valley through the uplifted highlands of the middle Rhine, but the uplift there does not seem to have been so great as it was in the Ardennes, and thus the Seine and the Moselle seem to have gained an advantage over the unlucky river between their headwaters. It is, indeed, remarkable enough that the Meuse is still able to maintain its course across the uplifted Ardennes, and its success can only be explained by regarding it as an excellent example of an antecedent river. It has battled manfully to preserve its course, and in this it has been wonderfully successful, for the highlands

* This view of the history of the Ardennes is strongly presented in an essay by Professor de Lapparent, entitled "L'age des formes topographiques" (Rev. des questions scientifiques, October, 1894); but there is one conclusion that he announces from which, if I understand him correctly, I must differ. Professor de Lapparent states that at the beginning of Tertiary time, when the Ardennes were denuded close to the level of the sea, "the streams there circulated capriciously and almost with out slope on the surface of a region devoid of relief." The "capricious" arrangement of the streams seems to me very unlikely. Inasmuch as the present drainage of the Ardennes is for the most part accomplished by a rectangular system of streams, which follow longitudinal courses along the weaker strata and transverse courses across the stronger strata, it seems advisable to picture the peneplain to which the Ardennes were reduced as still possessing faint residuals of the many ridges that once rose above the peneplain, and to conceive the streams as exhibiting a well-adjusted relation to the structures, such as they would have slowly and laboriously acquired during the making of a peneplain from a once mountainous region of disorderly structure. The present rectangular streams would then be, not the readjusted successors of a capricious system of drainage on the peneplain, but the persistent successors of the laboriously adjusted streams of pre-Tertiary beginning. If some of the streams of the Ardennes now exhibit capricious courses, unrelated to the structure in which their valleys are incised, they may be the successors of late Tertiary streams that had lost the adjustment of maturity in the meandering of old age, or they may be inherited from courses that were assumed on a cover of unconformably superposed strata of late Cretaceous or early Tertiary date, now all stripped off; but, as far as I have seen the region and studied the maps, capricious streams of this kind do not prevail. The characteristic rectangular streams are well shown on sheets 48 and 51 of the Belgian topographical maps; scale, 1 : 40,000.

of the Ardennes through which its deep gorge is cut are now higher than the uplands in which its meandering valley is sunk for some distance above Mézières. Yet although successful in holding its way through the revived mountains of the Ardennes, it has had to pay dearly for this success by the loss of its side branches. The hard rocks of the uplifted Ardennes form a sill that holds the upper Meuse at a relatively high level and allows the head branches of the Seine and Moselle to undercut it on either side. Thus it is left as a waning river, still persevering bravely in its course, but much embarrassed by the diversion to its encroaching neighbors of certain tributaries from whom it had expected loyal assistance in its great task of cutting a way through all obstacles to the sea.

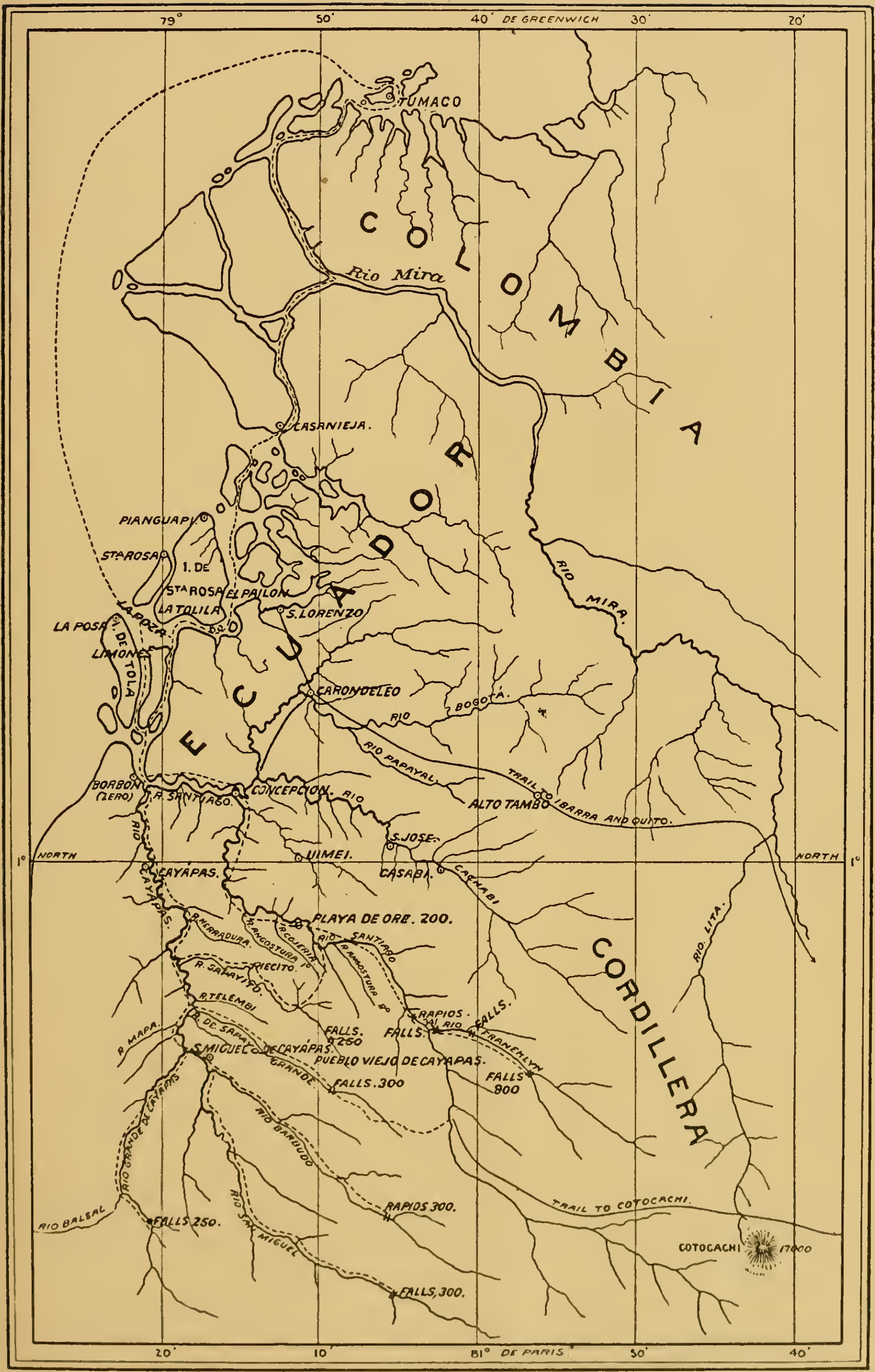
A JOURNEY IN ECUADOR

By Mark B. Kerr, C. E.

I left Panama on June 26, 1894, and two days later made my first stop at Buenaventura. Here a Californian, Mr J. L. Cherry, is building a railroad to the interior of Colombia, to penetrate Cauca valley, probably the richest district in quartz and placer gold mines in South America. The railroad here has been completed to Cordoba, some thirty or forty miles inland from this town. Transportation across the mountains is effected by packing.

On June 30 I arrived at Tumaco, on the borders of Colombia and Ecuador, at the mouth of Rio Mira. From this point inland *via* Patia river and Barbacoas another mule trail leads to the interior of Colombia, this and the one already noted being the only ways of reaching the interior from the Pacific. At Tumaco the fruit is delicious, mangoes, pineapples, oranges, and apricots being finer than at any other place I visited.

The next river southward (in Ecuador) is Rio Santiago. Between this river and the Mira there is at high water a deep and narrow interior channel or sound, which is generally traversed by canoe in preference to the rougher outside journey by sea. In this portion of Ecuador transportation is entirely by canoe, as the Andes rise abruptly from the Pacific, culminating in the immense peaks of Chimborazo (20,498 feet) and Cotopaxi (19,480 feet). The only regular route to the interior in Ecuador is the



DRAINAGE MAP OF NORTHWESTERN ECUADOR

From the Survey of Mark B. Kerr, Civil Engineer, and R. M. Arango, Assistant Engineer

Coast line and adjacent country from the Ecuador Government Survey, by courtesy of C. Van Eschott, Esq., of Guayaquil, Ecuador

Elevation above sea level shown in figures   Kerr's route ------------

rough road from Guayaquil to Quito, crossing the Andes at an elevation of 14,000 feet just south of Chimborazo.

On the journey from Tumaco I was accompanied by an Englishman named Nelson. The first day out we stopped for the night in this interior channel. The vegetation was dense and thick, and parasitic vines stretched completely across the waterway. Many different kinds of parrots combined with innumerable insects and lizards and a few monkeys to make night hideous; and when a sharp, curious noise like a dog-bark caused my friend to thrust his head from under his leafy canopy in the canoe to inquire, "What is that noise?" I answered "An equi snake." Nelson dropped back under his ranch, and when he ventured out in the morning remarked, "What an infernal country, when even the snakes bark!"

We followed the inland passage to the mouth of Rio Santiago and ascended this river 12 miles to Borbon. The passage was so narrow and the vegetation so thick as to give the impression of floating through a forest. At Borbon we found a warehouse which thereafter served as our base of supplies. The Spaniards knew of gold placers on the Santiago over two hundred years ago and brought in negro slaves to work them. The descendants of these slaves now people one branch of the river, numbering over 1,500. They crowded out the natives (the Cayapas Indians, about 1,000 in number), who retired to another fork of the same river. At Borbon the Santiago forks, the left (northern) and decidedly smaller branch retaining the name, while the right fork is called Cayapas, after the native tribe. The old semi-civilization of South America and Central America seems to have been confined to the elevated plateaus, particularly in Peru and Ecuador, and there only do we find ruins of the remarkable buildings constructed by the Incas, such as those of Quito, Cuzco, and Lake Titicaca. When Pizarro conquered this region in the earlier half of the sixteenth century many of these people fled before the conquistador and established new homes along the banks of these torrential rivers, which plunge into the Pacific after a limited course, usually 75 to 100 miles. These rivers would seem magnificent if they were not surpassed by the grandeur of their neighbors, the Orinoco and the Amazon. Santiago river and its branches rise in the snowy crest of the Andes, and the Cayapas Indians are probably descendants of the Chimec or Chibcha, who, conquered neither by Inca nor Spaniard, retired to remote districts and held themselves aloof from strangers.

RESIDENCE OF THE GOBERNADOR OF THE CAYAPAS INDIANS, ON THE RIO CAYAPAS, ECUADOR

From an Original Photograph by Mark B. Kerr, C. E.

Along most of the rivers descending from the Andes to the Pacific in Ecuador gold was found in small quantities by the Spaniards. In this eager search for the yellow metal the Indians were forced to give way, and now in their homes along the banks of the Cayapas they meet all strangers in an inhospitable and surly manner. The negroes have borrowed many customs and useful arts in weaving, house-building, etc., from the Cayapas Indians, and, having retained many old habits of their former African abode, combined with some of the worst traits of the inferior whites, may be summed up as being phlegmatic, ignorant, superstitious, without strong family ties or sense of gratitude. Their superstitions take the form of incantations to prevent accidents, and especial trouble is taken to prevent the devil from taking possession of infants. Some respect is felt for the priest who occasionally visits here, but with these negroes religion is only another word for superstition.

But to return to my journey On July 17 we left Borbon and proceeded by steam launch 28 miles up Rio Cayapas. Grasses, ferns, and bushes (mostly of the class Umbelliferæ) lined the banks and mingled with the cocoanut trees, the breadfruit, the splendid royal palm, and the mango with its spreading and symmetrical foliage. These magnificent trees with their large leaves strained imagination to the utmost and utterly deceived the eye in grasping proportions. While lost in silent admiration of such a wealth of vegetation, we turned a sharp bend of the river and over the thatched huts of the natives could be seen the overhanging feathery tufts of the bamboo, which softened as well as lightened up the intensely dark hue of vegetation in the background. This was the headquarters of Napo, the gobernador of the Cayapas. A judicious presentation of beads and buttons insured us a pleasant reception from the chief, and he detailed a guide for us on the upper river.

The house of the gobernador was on stilts (as is the case with most of these houses) and was built like a long rectangle, 100 by 60 feet. Two large fireplaces (wooden boxes elevated about three or four feet above the floor and filled with sand) and some large flat stones sufficed for cooking purposes, while four small extensions, two on each side of the house, like bay windows, served as sleeping apartments for the different members of the family. The men are well formed, of good stature, beardless, with glossy black hair, and splendid chest development, while the women, being forced to do all the work, are generally small, coarsely fat, and disfigured by black streaks across their faces arms, and breasts. They wear an embroidered cloth of their own manufacture tied around the waist and reaching to the knee, and the men wear a garment like swimming trunks, made of the same material.

Boiled plantain beaten into cakes between two flat stones constituted supper and breakfast. After supper the women engaged in weaving cloth from shreds of plantain fiber, and through this embroidered long pieces of cotton dyed by rolling cotton in natural blues and reds through the cloth like wax-ends. This cloth, all hand-made, was when completed extremely handsome, reminding one of the figures and coloring of German embroidery. The men amused themselves lolling in hammocks or playing on the marimba, an instrument made of upright pieces of bamboo with pieces of hard wood laid across them, in tone like a xylophone. Sometimes they played minor chords on another instrument like a harp. A fire of a sort of resinous wood served to light up the scene until night fell black and damp, and we were lulled to sleep by the crackling flight of large beetles and the occasional hoarse bark of a tree-frog or lizard.

Early the next morning we visited the trapiche or sugar-cane press of the chief. Here two huge wooden rollers set close together pressed the cane stalks and large metal vessels received the juice. Distilling pots were placed conveniently near. All the apparatus had apparently been in use for many years.

These natives make light and swift canoes and leaf-shape paddles, and are also skillful in weaving hats, fans, and hammocks from the many-colored rushes and grasses. From the "pita" they make fish nets and lines, and by whipping a small stream, diving, and keeping the net close to the bottom they inclose the fish in a small space, when men, women, and children have great sport in spearing them. Besides this, the men are skillful fishermen, and when the river is high an Indian can often be seen, with one hand holding his pole and the other propelling and guiding his canoe in a manner worthy of the most scientific sportsman. They also make a sort of vegetable cloth by beating off the outside covering of strips of Tanajaqua bark, which afterwards by repeated washings becomes pliable.

By some means of rapid signaling our progress up the river was anticipated, but thanks to the kind office of our friend, the gobernador, although not altogether hospitably received, we were still permitted to pass along without question. Along the whole course of this river we found different clans living in communal style in these large houses, similar to the house of the chief, skillful in weaving cloth and carving figures out of wood, without doubt arts from a higher civilization. The custom of removing the bones from the head of the dead and then drying and embalming the latter seems confined to the Serranos on the upper plateaus, but I saw one of these heads, about the size of an ordinary ball, with perfect hair and features. This tribe is entirely pure, and although most of them understand the Spanish of the country, they use their own language among themselves.

Reaching the head of steam navigation, we again took to our canoes. The river, swollen by recent rains, rushed down at a furious rate, and the native boatmen, clinging to roots and overhanging bushes, used vigorously both paddle and pole, shouting and babbling to each other louder even than the roar of the water. We encountered mostly sedimentary rocks until we reached the Sapayo. The bed-rock then was soft and contained fossil shells, some of them belonging to the Chico group. A short distance up this river the formation changes. Immediately above an altered sandstone and slate and then granite and quartz occur. In the Sapollite the quartz is gold-bearing, but above it is barren. Further above occur the diabase rocks and lavas to the crest of the mountains. Outside of the Sapollite and Sapayo Grande the rocks are base, gabbro-like, and carry no gold. The float of the Sapayo Grande shows crystals of quartz and Brazilian topaz, but none of the stones we saw were valuable.

Having reached the head of canoe navigation on Cayapas river and made an examination of the placers there, we built a hut after the native fashion and made our second base camp. My plan was to cross the cordillera and examine the rocks and topography of the country between the rivers Cayapas and Santiago.

We found here an old trail running into the interior across the Andes to the town of Cotocachi. No white man had ever gone so high up the river or attempted the interesting journey across the Andes. On account of the heavy rainfall (about 30 inches a month) it is very difficult to preserve negatives, and even clothing soon becomes mildewed. A great many of my exposures were ruined and most of the negatives were spotted by the dampness. Thus my photographs are few and imperfect.

Leaving all our miscellaneous equipage at this camp, we decided to cut our way along the old trail. Never before in all my experience had I encountered such a wealth of vegetable and insect life as here in the depth of the equatorial forest. Many-colored moths, butterflies, and humming-birds fluttered from plant to plant. and even snakes, toads, and lizards were clothed in prevailing bright hues. The snakes were generally about the size of the rattlesnake, with flat heads and large fangs, and many of them were venomous. The boa here does not reach so great a size as on the Amazon drainage, the largest we saw being eight feet long and three inches thick. On some of the smaller streams one species of reptile, light green in color, had an uncanny way of dropping unexpectedly from trees, once in awhile actually dropping into our canoe as we passed. Two large copper tanks were filled with different species of reptiles. One earthworm was found two feet long, a cockroach three inches, and a grasshopper three and one-half inches in length. Large fireflies, with two phosphorescent eyes, were plentiful; they made a crackling noise in flight. During the night we stuffed cotton in our ears, not alone to drown the droning and buzzing of the insects, but also to prevent the pests from crawling in while we slept.

Four or five natives in charge of an assistant were sent ahead with provisions, to put up ranches (a ranch here is a temporary camp) of cane and palm leaves, and with three others I brought up the rear. The vegetation changed somewhat and became semi-tropical in character, the red cedar predominating, and although there was not the same dense jungle as below, still the underbrush was luxuriant, and our machete men were kept busy in cutting out the large tangled roots and dense vegetation which obstructed our path up the ridges. As we ascended the stream we noticed many butterflies on the playas. Toward evening the number increased until for an hour they passed over our heads in perfect swarms like locusts.

We passed two falls by swimming and climbing along the edge of the rocky bank until it was too steep to even afford foothold. We then made a raft of light balsa wood and passed along the cliffs to the third fall. Wearied by our work, we pitched our tent along the edge of the cañon about thirty-five feet above the water. For the sake of convenience our Jamaican cook had pitched his camp under a shelving rock about twenty feet above the water. Shortly after dark we heard the distant thunder in the mountains, and in two hours, before we had even time to realize what had happened, the water came down in one solid sheet of white foam and washed our kitchen away, leaving us, however, the cook. The water rose thirty feet, and then gradually subsided, having just missed carrying away our entire camp.

After we left the river one high ridge was reached only to plunge again into a ravine on the other side, for the trail carried us across the many forks of the Sapayo Grande. We made only four or five miles a day. One day, having a particularly rough and difficult journey to make, we failed to reach our camp and remained all night upon the cordillera. The darkness fell rapidly. Suddenly a peal of thunder was heard, followed by a sound like a rushing, furious wind through the tree-tops, the signal of approaching rain. It came in torrents, wetting us through and through, and putting out our fire. The earth, like a sponge filled to repletion, received and gave off its additional moisture, making the air intensely humid. We sat up the rest of the night, clinging to the roots of the trees, hearing the whirr of innumerable birds, the buzz of countless insects, and the howling of wild cats, while large firebugs and a phosphorescent gleam from decayed vegetation spread a weird glow that only served to intensify the darkness.

On the fourth day we reached the main divide or cordillera overlooking Rio Santiago, 8,000 feet above the sea, and leading direct to the summit of Cotocachi. This peak is included in the scheme of triangulation and observation of Juan and Ulloa, Humboldt and Pissis. At this point the Andes begin to show their power; numerous streams fall in beautiful cascades over the cliffs and disappear in the vegetation below, while not far away looms up a snowy summit, 17,000 feet above sea level.

After extending our reconnaissance to the river we returned over our trail and down the Cayapas to the headquarters at Borbon. For some reason we were avoided by the natives, and even treated with open signs of enmity. However, we had accomplished all we wished in limiting the areas containing gold gravel and in making a rough but interesting trip in a very short time.

THE ABERRATION OF SOUND AS ILLUSTRATED BY THE BERKELEY POWDER EXPLOSION

By Robert H. Chapman,

United States Geological Survey

Dr Charles A. White* and Mr Arnold B. Johnson† have treated of the sounds given by fog-sirens. They have discovered areas close to the siren in which the sound is inaudible. In some cases this fact is accounted for by the intervention of an object, such as an island or mountain, but not infrequently there is no visible obstruction to the sound waves coming from the siren. It is my wish to present some facts that have come within my own observation and that show a direct relationship between sound waves and waves of motion generated by sharp explosions.

On Saturday, July 9, 1892, about 9.30 a. m., an explosion occurred at the giant-powder works at West Berkeley, California. The first explosion was in the "mixing-room," and about 1,000 pounds of nitro-glycerine were discharged. About five minutes later the three magazines blew up, the final explosion being the heaviest. The total amount of powder and nitro-glycerine exploded was about 250 tons. The shock of the last explosion was very severe, the column of smoke and flame rising to a height of at least 1,200 feet, and resembling a volcanic eruption. The damage in San Francisco, eight miles across the bay, was very great, plate-glass windows being broken, doors forced, and skylights shattered. Tne shock seemed to be a little heavier in the low-lying portion of the city, although farther from the scene of the explosion, than in the hilly quarter. It was distinctly felt by the engineer and passengers of a rapidly moving express train 12 miles north of the works. A train only five miles distant was partially protected by hills, and no shock was noticed. At Napa, 28 miles due north, the shock was distinctly noticeable.

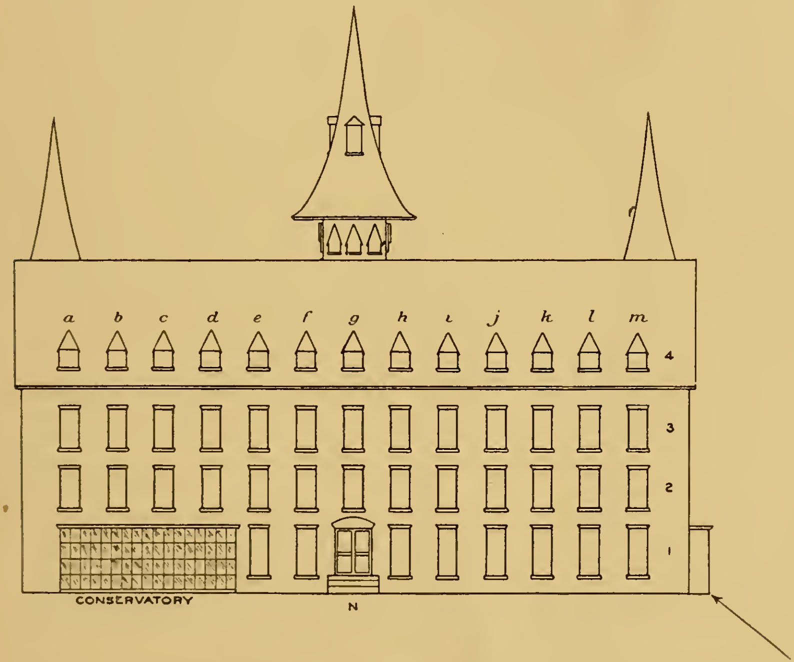
About one and one-half miles a little south of east of the works and at about 100 feet higher elevation is situated a large frame

* *Science*, vol. xxiii, pp. 59–62, The Relation of the Sounds of Fog Signals to other Sounds.

† *Science*, vol. xxiii, pp. 3–6, The Cruise of the *Clover*.

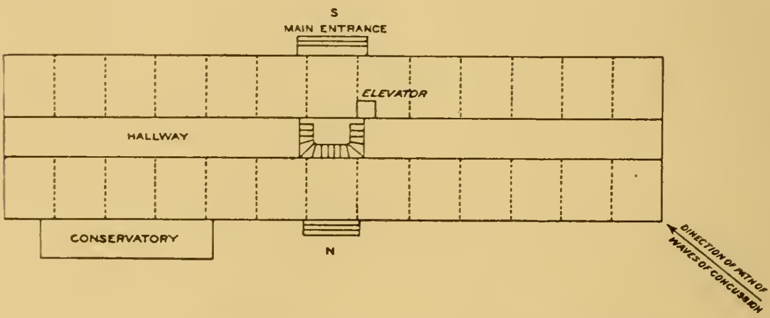
See also The Modern Light-house Service, pp. 74-91, A. B. Johnson, and Report upon Fog-signal Experiments (Report of the Light-house Board, 1894, Appendix No. V), pp. 289–304, W. R. Livermore.

building, built for hotel purposes, and having a great number of rooms and windows. It was used at that time as a young ladies' seminary, but the explosion occurred during vacation, and the president of the institution and his family were the only persons occupying it. Accordingly most of the rooms were vacant and the doors and windows closed. The dimensions of the building are about 200 feet in an east-west direction by 50 feet north and south, and it is several stories high. On the first floor are large dining-rooms, reception-rooms, etc, with a hallway in the middle



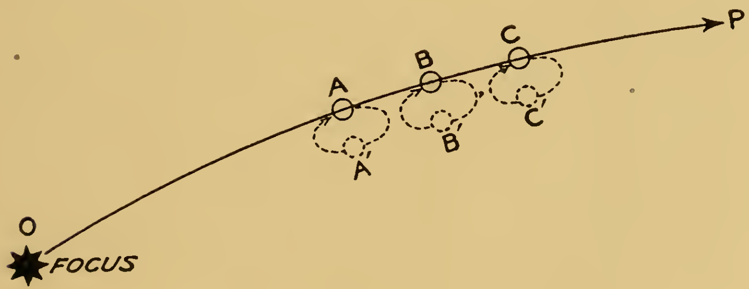
of the building. The upper stories have a hallway running east and west for the entire length of the building. doors opening to rooms on each side of the hall, and transoms over the doors, with elevator and stairways in the middle of the building, as shown in the accompanying ground plan and profile, which, however, are given as correct only as to their general features. For convenience, the windows shown in the sketch are numbered vertically from the bottom and lettered consecutively from the left.

The conservatory, on the north side of the building, was badly broken, both glass and framework, the latter being moved outward, or toward the focus of action. All the windows on the western end of the building were broken, while those on the eastern end were uninjured. The direction of the waves of motion was toward the northwest corner of the building. On examining the column marked *b*, I found window 2 blown in and its frame broken into small pieces. Window 3 was uninjured, while 4 was in a condition similar to 2, both glass and frame being broken. This skipping of alternate windows in the same vertical line was remarked in several instances, but the broken windows were not always in the same horizontal line. I remarked no systematic alternations in injuries to windows of the same story. In some cases the transom above the door of a room, the door and window being shut, was broken, glass and frame, the door blown in toward the room and broken from the hinges and



lock, the window remaining uninjured. Many windows on the south side of the building, the side unexposed to the direct force of the explosion, were broken and many doors on the south side of the hallway were broken and unhinged. The large doors at the entrance of the building on the south side were broken from hinges, lock, and floor-bolt; one was blown in and the other blown out. No damage was noted in the vicinity of the elevator shaft, where the air in the building was free to circulate. The general rule appeared to be that the doors were forced toward the room or hallway having the greater cubical contents. Looking at the north side of the building, one was impressed with the fact that it appeared to have been bombarded, the windows being broken in groups. This seems to bear out, to some extent at least, the assertion of Professor P. G. Tait, that "in the case of a disturbance in air due to a very sudden explosion, as of dynamite or as by the passage of a flash of lightning, it is probable that for some distance from the source the motion is of a projectile character." *

The breaking of the transoms over doors, while the window was uninjured, and the breaking of the windows unexposed to the direct force of the explosion are very interesting phenomena, and I wish to offer an explanation which I think will account for the facts observed. The path of the maximum of disturbance results largely from the unequal resistance of the air, and while at the actual center of explosion the pressure may be in "concentric shells," at a very short distance it becomes stellar. The changing pressure of the wind, as shown by Professor Langley's experiments, and the shape of the flame in an explosion (stellar) lead one to this conclusion. As the maximum wave moves from the focus, the air forming it is constantly changing, and the following sketch illustrates the path of an air particle as I believe it to be:



A, *B*, and *C* are air particles in the path of a maximum wave traveling along the line *O P*. The motion of each is first along the line of *O P*, away from the focus, a result of direct impact of other particles, then back to its original position, or near it, the track forming a closed curve. When the particle is in the position *A′*, *B′*, or *C′*, its motion is toward the focus of the explosion, and so any damage it might do would be evidenced by a breaking of objects unexposed to the force of the direct wave. In the case of the transoms mentioned above, the back thrust which broke the glass and frame was cushioned by the air in the room, and so the window was not injured.

* *Encyclopædia Britannica*, ninth edition, vol. xxiv, p. 418.

MINERAL PRODUCTION IN THE UNITED STATES

The mineral products of the United States in the calendar year 1895 had a total value, according to the statistics collected by the U. S. Geological Survey, of $611,795,290. This amount, although nearly one-sixth greater than that for the preceding year, was less than in 1890, 1891, or 1892. The quantities of the principal items were, however, greater than ever before, while the values were in many cases less, owing to the reduction in prices.

The most noteworthy increase in the list is in the case of pig iron, the quantity of which increased nearly 42 per cent, viz., from 6,657,388 long tons to 9,446,308 long tons, and the value nearly 62 per cent, viz., from $65,007,247 to $105,198,550. This production is the largest the country has ever seen and is probably not far from double that of the British islands. The decrease in silver production has continued, the amount produced being 47,000,000 ounces, or about 2½ million ounces less than the year before. The production of gold has greatly increased, being $47,000,000 against $39,500,000 in 1894. The product of the Transvaal was almost equal to that of this country. The production of copper has increased slightly, being 381,106,868 pounds. The production of lead also has increased, reaching 161,440 short tons. The output of coal consisted of 135,118,193 short tons of bituminous and 51,785,122 long tons of Pennsylvania anthracite. The output of coal, both bituminous and anthracite, is the largest on record. The production of petroleum was 52,983,526 barrels of 42 gallons each, the largest amount ever produced in a single year with the exception of 1891. The production of natural gas has slightly diminished.

The enormous increase in some of these items, especially those of pig iron and coal, illustrates in emphatic terms the promptness with which the supply of such products responds to an increased demand. For two years the railroads of the United States were economizing in the purchase of rails, with the result that at the end of that time an unusually large number of lines were needing new rails, and the different companies took advantage of the low price of steel to supply their necessities in this regard. The result was a large and sudden demand for steel rails, causing a great increase in price; mines and furnaces were reopened, and general activity prevailed in the trade, resulting, as before stated, in an increase in the iron output of nearly 42 per cent over the previous year. In the case of most of our mineral products the output is limited only by the market. The supply and the facilities for extraction are more than sufficient to meet any possible demand.

GEOGRAPHIC NOTES

EUROPE

England. Four additional wires, mainly for telephone purposes, are to be laid between London and Paris.

A census taken in March last found the population of London, exclusive of the outer suburbs, to be 4,411,271, an increase of 199,528 in five years.

ASIA

India. In 1895 new railways aggregating over 800 miles in length were opened, while nearly 3,800 miles were under construction or sanctioned. The net earnings of the Indian railways averaged 5.78 per cent.

China. The imports during 1895 amounted to 171,696,715 taels (the tael fluctuating between 65 and 74 cents), against 162,102,911 taels in 1894. The exports amounted to 143,293,211 taels, against 128,104,522 taels in 1894. Silk is now a more important export article than tea. Raw cotton, also, is an export that is increasing very rapidly. Of the total foreign trade of nearly 315 million taels, Great Britain had over 215 millions, Japan 32 millions, Continental Europe (excluding Russia) 29 millions, the United States 20½ millions, and the Russian empire 17 millions. Nearly 219 million taels of this trade had its center in the port of Shanghai. The total number of foreign residents in China last year was 10,091, the British and Americans leading all other nations, with 4,084 and 1,325 respectively. Of the 603 foreign firms in the empire, 361 were British and 91 German.

AFRICA

Uganda. About 100 miles of the new railway are expected to be constructed this year, at a cost of about £520,000. The total outlay will be not less than £3,000,000.

Ashanti. Major Donovan, a British officer, recently visited lake Busumakwe and is said to be the first white man to have penetrated that region. The area of the lake was found to be about 48 square miles, and there is no apparent outlet.

Dahomey-Lagos. The Anglo-French commission for the demarcation of the boundary between Dahomey and Lagos has completed its task to the satisfaction of all concerned. The French were found to have occupied several places in British territory and to have been receiving taxes therefrom, but the representatives of the French government promptly withdrew on this fact being established.

British Central Africa. Mr A. J. Swann, the British magistrate at Kotakota, lake Nyassa, who some time ago discovered some remarkable fresh-water medusæ, has recently found an immense bed of lime fossils and flint, and the Royal Society of London has sent out an expedition to examine and report upon the latter discovery, with a view to throwing light on the origin of the great African lakes.

NORTH AMERICA

British America. The government of Newfoundland is issuing bonds for the construction and equipment of a railway from a point on the Exploits river about 200 miles from Placentia Junction to Port-aux-Basques.

AUSTRALASIA

Australia. An expedition left Adelaide on May 22 to explore the interior of the island. Its return is not expected until late in 1897.

POLAR REGIONS

The steam-yacht *Windward* left London for Franz Josef Land on June 9 for the relief of the Jackson expedition. She carried a very large supply of provisions, a number of sledges, 5,000 tabloids of the essential properties of blood, and several thousand letters and packages. The *Windward* will call at Vardö to take on board coal, sheep, and reindeer, and she expects to communicate with the explorers at cape Flora, Franz Josef Land, on or about July 20. The return of the exploring party before 1897 is, however, very unlikely.

MISCELLANEA

The Suez Canal. The traffic through the Suez canal in 1895 comprised 3,434 ships, of 8,448,383 tons, with 216,938 passengers. Of the ships, 2,318 were British, 314 German, 278 French, 192 Dutch, 78 Italian, 72 Austrian, 57 Norwegian, 39 Russian, 36 Turkish, 33 Spanish, 5 American, 3 Portuguese, 2 Chinese, 2 Egyptian, 2 Japanese, 2 Swedish, and 1 Danish. Of the passengers, 118,639 were soldiers, 74,878 civilians, and 23,421 pilgrims and emigrants. The total receipts were 78,426,000 francs, an increase of 4,299,000 francs, gross, and of 3,172,000 francs, net, over those of 1894. The average duration of the transit was 16 hours 18 minutes, a reduction of 23 minutes from the average of the preceding year.

Deep-sea Soundings. The British Admiralty has just issued its report of the deep-sea soundings conducted by ships of the royal navy in 1895. Commander A. F. Balfour, in the *Penguin*, while surveying in the South Pacific, found very deep water to the eastward of a line drawn between the Friendly and Kermadec islands. Soundings of 5,147 and 5,155 fathoms were obtained in latitude 28° 44.4′ S., longitude 176° 04′ W., and latitude 30° 27.7′ S., longitude 176° 39′ W., respectively. The deepest sounding ever before obtained was 4,655 fathoms, to the northeast of Japan. The new soundings are therefore deeper by about 3,000 feet than anything before discovered. A remarkable fact in connection with the new soundings is that these extraordinary depths are not far from land.

The National Geographic Magazine,

NOW PUBLISHED MONTHLY,

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

Mr. Cyrus C. Adams, New York.
Dr. Cyrus Adler, Smithsonian Institution.
Mr. Marcus Baker, U. S. Geological Survey.
Capt. John R. Bartlett, U. S. N.
Dr. Francis Brown, Union Theol. Seminary.
Hon. Jefferson B. Browne, Collector of Customs at Key West.
Dr. E. L. Corthell, C. E., New York.
Dr. Elliott Coues.
Hon. William E. Curtis, ex-Director of the Bureau of the American Republics.
Mr. Frank Hamilton Cushing, Bureau of American Ethnology.
Dr. Charles W. Dabney, Jr., Assistant Secretary of Agriculture.
Dr. Wm. H. Dall, Smithsonian Institution.
Dr. George Davidson, President of the Geographical Society of the Pacific.
Mr. Arthur P. Davis, U. S. Geological Survey.
Mr. Wm. M. Davis, Professor of Physical Geography in Harvard University.
Dr. David T. Day, Chief of the Div. of Mining Statistics and Technology, U. S. Geol. Sur.
Mr. J. S. Diller, U. S. Geological Survey.
Hon. John W. Foster, ex-Secretary of State.
Mr. Henry Gannett, Chief Geographer, U. S. Geological Survey and 11th Census.
Mr. G. K. Gilbert, U. S. Geological Survey.
Gen. A. W. Greely, U. S. A., Chief Signal Officer, War Department.
Hon. Gardiner G. Hubbard, President of the National Geographic Society.
Dr. Mark W. Harrington, President of the University of the State of Washington.
Lieut. Everett Hayden, U. S. N., Secretary of the National Geographic Society.
Mr. Robert T. Hill, U. S. Geological Survey.
Mr. Wm. H. Holmes, Dir. of the Dept. of Anthropology, Field Colum. Museum, Chicago.
Dr. Emil Holub, Vienna, Austria.
Dr. Sheldon Jackson, U. S. Commissioner of Education for Alaska.
Mr. Willard D. Johnson, U. S. Geol. Survey.
Mr. Mark B. Kerr, C. E.
Mr. George Kennan.
Prof. William Libbey, Jr., Princeton Coll., N. J.
Prof. E. McClure, University of Oregon.
Prof. W J McGee, Bureau of American Ethnology.
Mr. John E. McGrath, U. S. Coast Survey.
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Dr. T. C. Mendenhall, President of the Polytechnic Institute, Worcester, Mass.
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Mrs. Robert E. Peary.
Hon. Geo. C. Perkins, U. S. S.
Mr. William H. Pickering, Professor of Astronomy in Harvard University.
Major John W. Powell, Director of the Bureau of American Ethnology.
Prof. W. B. Powell, Superintendent of Schools, District of Columbia.
Hon. John R. Procter, President of the U. S. Civil Service Commission.
Mr. Israel C. Russell, Professor of Geology in the University of Michigan.
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Commander Charles D. Sigsbee, Hydrographer to the Bureau of Navigation, Navy Dept.
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Hon. Charles D. Walcott, Director of the U. S. Geological Survey.
Mrs. Fannie B. Ward.
Mr. Bailey Willis, U. S. Geological Survey.

PRINCIPAL CONTENTS OF RECENT NUMBERS.

JANUARY.—Russia in Europe, with map, Hon. Gardiner G. Hubbard; The Arctic Cruise of the U. S. Revenue Cutter "Bear," with illustrations, Dr. Sheldon Jackson; The Scope and Value of Arctic Exploration, Gen. A. W. Greely, U. S. A.

FEBRUARY.—Venezuela: Her Government, People, and Boundary, with map and illustrations, William E. Curtis; The Panama Canal Route, with illustrations, Prof. Robert T. Hill; The Tehuantepec Ship Railway, with maps, E. L. Corthell, C. E., LL. D.; The Present State of the Nicaragua Canal, Gen. A. W. Greely; Explorations by the Bureau of American Ethnology, W J McGee. *Also map of the Orinoco valley, showing territory drained by that waterway and its bearing on the Venezuelan Boundary Question.*

MARCH.—The So-Called "Jeannette Relics," Prof. Wm. H. Dall; Nansen's Polar Expedition, Gen. A. W. Greely; The Submarine Cables of the World, Gustave Herrle; The Survey and Subdivision of Indian Territory, with map and illustration, Henry Gannett; "Free Burghs" in the United States, James H. Blodgett. *Also chart, 19 x 30 inches, showing Submarine Telegraph Cables of the World and Principal Land Lines. Full-page portraits of Dr. Nansen and Prof. Wm. H. Dall.*

APRIL.—Seriland, with map and illustration, W J McGee and Willard D. Johnson; The Olympic Country, with map, the late S. C. Gilman; The Discovery of Glacier Bay, Alaska, Eliza Ruhamah Scidmore; Hydrography in the United States, Frederick H. Newell; Recent Triangulation in the Cascades, S. S. Gannett; The Altitude of Mt. Adams, Washington, Edgar McClure.

MAY.—Africa since 1888, with special reference to South Africa and Abyssinia, with map, Hon. Gardiner G. Hubbard; Fundamental Geographic Relation of the Three Americas, with map, Prof. Robert T. Hill; The Kansas River, Arthur P. Davis. *Also portrait of Hon. Gardiner G. Hubbard, President of the National Geographic Society.*

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—— OF ——

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BY PROF. W J McGEE;

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AN ILLUSTRATED MONTHLY

Honorary Editor: JOHN HYDE

Honorary Associate Editors

A. W. GREELY W J McGEE ELIZA RUHAMAH SCIDMORE

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THE

National Geographic Magazine

Vol. VII AUGUST, 1896 No. 8

THE WORK OF THE NATIONAL GEOGRAPHIC SOCIETY*

THE CHARACTER OF THE SOCIETY

The National Geographic Society is a scientific organization. In common with most other scientific bodies, it is occupied in both creating and diffusing knowledge. By reason of its activity in the diffusion of knowledge it has become a popular society, especially in the national capital, where most of the addresses and technical papers prepared under its auspices are delivered; but the essential fact remains that it is a scientific society and that it is its function to create as well as to diffuse geographic knowledge.

THE DEVELOPMENT OF GEOGRAPHY

Ancient geography was a description of continents and seas, nations and cities, races and tribes, and perhaps of animals and plants; in the beginning the descriptions were oral, but with the invention of sketching, writing, and mapping a permanent geographic art was developed. Thus ancient geography was chiefly the description of terrestrial things in words and pictures, and included the art of describing earth-features with pen and brush and graver. In this stage geographic features were assumed to be permanent and were described in terms of form and position.

As time passed men observed that tribes and peoples came and went, that cities were founded and sometimes abandoned, that nations arose and passed away; and thus history came to be and a time element was gradually introduced into geography.

* Substance of remarks by W J McGee at a meeting of the Board of Managers of the Society on June 5, 1896, printed at the instance of the Board.

Still later it was observed that rivers are diverted, lakes filled up, and islands submerged through natural agencies; it was also found that many shore lines are shifting, that some lands are rising and others sinking, that all continents are wasting through the action of rain and rivers, and that the waste of the land is carried into the seas; thus geology grew up, and a time element was introduced even into that part of geography which deals with the more persistent earth-forms. In this stage geographic features were assumed to be changeable, and they were described not only in terms of form and position, but in terms of stage or sequence. This may be called transitional or medieval geography, though it comes down to the present in the books, and many geographers and some geographic societies have not yet risen above its plane.

Modern students of earth-forms have observed that rivers cut their own valleys in definite ways and at definite rates depending on known conditions, and that eventually the running waters carve the land into hill and dale, mountain and plain, in a definite way, albeit varying with altitude, structure, and other conditions. With recognition of the agencies and conditions of geographic change geographic history became definite, and it was found possible to interpret the record of ages of continent-growth from the geographic features, great and small, displayed by the continent. In this way a new science was developed; sometimes it is called the new geography, sometimes the new geology, sometimes geomorphology or geomorphy. It matters little what the science is called, but it is important to remember that through recognition of causes and conditions geography was raised to the plane of science. This is modern geography; and in this stage geographic features are regarded as definite products of known agency, and thus as definite records of determinate history, and description in terms of form and position is but a means to a nobler end, the reading of world-history from geographic features.

So three epochs in geographic development may be recognized, and their importance is none the less because some of their factors overlap—for the overlapping of factors is one of the characteristics of development. The first was the ancient or empiric epoch; the second was the transitional or scholastic epoch; the third is the modern or scientific epoch. In its first epoch geography was a meager body of description of features and a crude art of describing; in the second epoch it became a richer body of description of stages as well as features, and the art of describing was improved; and in so far as it has entered into the third epoch it has become a science of the earth in which the chaos of geographic features and historical stages is reduced to order, while the body of description is enriched in quantity and even more in quality, and the art of describing is greatly improved. So in modern geography each district, the continent, even the entire world is considered not simply as an assemblage of features. but as an expression of tangible forces and conditions, a record of the past, and an index to the future, and thus the dead features are imbued with living interest. Briefly stated, the ancient geography was static, the modern geography is essentially dynamic.

With the transformation of geography from art to science its method changed. In the ancient and transitional epochs, when description was the end and aim of geographic work, men sought unknown lands and waters, and through their zeal and courage the earth was explored save for small areas in the Americas, Asia, Africa, and Australia, and for larger but more forbidding areas in the Arctic and especially in the Antarctic. Modern geographers in like manner seek the unknown, but their eyes are fixed on agencies and conditions, or on causes and effects, rather than on material features, and their aim is the complete reading of terrestrial history rather than the complete mapping of the terrestrial surface. So, while the methods blend much as the stages overlap, it is just to say that the early method of geographic work was exploration, and that the modern method is research.

THE FUTURE OF GEOGRAPHY

The transformation of geography began with the introduction of history and culminated with the incorporation of the principles of geology. Much was taken also from biology, chiefly through the doctrine of evolution, which afforded a rational view of successional relations; but less was obtained from anthropology, despite the fact that this branch of knowledge was the original contributor of history. The poverty of anthropology as a donor of geographic knowledge is due partly to the fact that history was fettered by scholasticism almost from the beginning, partly to the fact that students hesitated long before applying the principles of evolution to human beings and institutions. Accordingly human geography is still in the transitional stage, so far at least as most of the geographers and geographic institutions of the world are concerned. It is indeed recognized that tribes and peoples come and go, that cities are founded and sometimes abandoned, that nations arise and pass away, and the statistician records the facts as the early geographer described forms and positions, while the historian records the successive stages as the medieval geographer noted stages in the wandering of an overloaded river; but the description, be it formal or historical, is description merely, and too rarely reaches the plane of science. The one thing needful in modern geography is suggested by the advance made through the new geology; it is *definite recognition of the causes and conditions by which human progress is shaped.* When this fundamental principle is grasped, dead statistics and musty history will be vivified, just as the dead earth-forms have been imbued with living interest, and human geography will rise to the plane of science. Now, the first requisite for improvement is recognition of need, and the common need of geography and anthropology is so keenly felt by a number of students as to suggest the future, and it may clearly be foreseen that future students will extend and apply our ever-increasing knowledge of cause and effect to human progress. Statistics and history recorded in monuments and letters, paintings and gravings furnish the requisite data of form and position and succession, and may be molded into attractive form, but nothing less than definite recognition of the forces by which the successive stages grew will infuse the breath of life into this body of knowledge.

So it may be predicted that the geography of the future will be devoted primarily to research concerning the forces of the earth, including those affecting peoples and institutions as well as those shaping land-forms and molding faunas and floras, and that industries, arts, commerce, laws, governments, religions, even civilization itself, will eventually fall within the domain of definitely organized science and become incorporated in geography. The prediction is easy and safe because the geography of the present is already on the higher plane with respect to the inorganic part of its object-matter, is well advanced toward this plane with respect to the evolution of organisms, and looks up to the same plane with respect to the courses and causes of human organization; the fulfillment of the prediction will be simply the consummation of present progress.

THE PURPOSES AND METHODS OF THE SOCIETY

It is the purpose of the National Geographic Society to increase and diffuse geographic knowledge growing out of research as well as exploration. The more tangible instrumentalities employed are (1) technical meetings, (2) popular addresses, and (3) a monthly magazine.

The technical meetings are devoted to the presentation and discussion of the results of geographic research, the announcement of discoveries made through research or exploration, the discussion of methods for exploration, survey, research, record, etc. These meetings are somewhat informal gatherings of a body of working geographers, bound together by common interest in geographic progress. Each contributes, either under a set title or in extempore discussion, to the common stock of knowledge; each is fresh from field or laboratory, and his ideas are developed by personal contact with the phenomena and forces of the earth; collectively, these active geographers form a hive of busy workers, constantly engaged in extending and improving the science of the earth, and their researches are stimulated by the encouragement and association found in the Society. The communications are illustrated, as required, by maps, sketches, stereopticon views, objects, apparatus, etc. The meetings are open to members and guests of the Society, but the participants are chiefly geographic workers and teachers. The working geographers who maintain the technical meetings are for the most part officers of the scientific bureaus and of the army and navy of the federal government; and in no other center in the world are there so many working geographers occupied in so extensive a field. Other contributors come from the universities and colleges and the normal and high schools of the national capital and neighboring cities; and still others are distinguished teachers, explorers, or investigators in geography from other parts of the country and from foreign lands. So far as the official surveys and other geographic operations of the federal government are concerned, the National Geographic Society is a scientific clearing-house in which the coin of knowledge and the securities of science are exchanged and distributed to mutual benefit.

The popular meetings are devoted to (*a*) addresses by distinguished geographers on topics of current interest suggested either by research or exploration, and (*b*) series of lectures on important phases of geographic science by distinguished investigators or teachers. The popular lecturers are usually leading exponents of geographic thought in this and other countries. The addresses are illustrated usually by stereopticon views, sometimes by maps and sketches or objects in addition. The attendance at the popular meetings commonly ranges from 500 to 1,500, and comprises working geographers and teachers, as well as intelligent laypeople, and includes a considerable sprinkling of youth, mainly students in universities and schools. In choosing popular speakers on current topics, preference is given either to actual explorers or original investigators who are known to treat geography as a branch of science, and such speakers arrange and present their matter freely, save that the excessive use of picture and anecdote is discouraged—the object is to instruct as well as entertain. Still greater care is given to the selection of lecturers for the organized courses. The first requisite is that each speaker shall be a recognized authority; the second is that the treatment shall be scientific—that superficial description and pictorial illustration shall be subordinate to the exposition of relations and principles. The lecture courses of the last two years exemplify the methods of the Society. Nominally, they were descriptions and illustrations of transcontinental tours; the descriptions were presented by careful students of the several areas described, and the illustrations were the finest lantern slides obtainable, showing noted scenic features; yet the essential characteristic of the lectures was the interpretation of the geographic features in terms of agency and history in such manner that each gave a picture of geographic development, while the course yielded a living panorama of world-making. When Niagara was depicted in sun and word picture it was not simply as one of the world's wonders, but as a potent geographic agency and eloquent record of continent growth. To this character the success of the lecture courses must be ascribed. Other lecturers describe mountains and canyons and picturesque coasts as scenic features with indifferent success as measured by the interest developed; the Society's lecturers described mountain, glacier, plain, river, coast, and city as marking stages in a grand procession of events, and opened vistas through the ages with gratifying success as measured by the display of interest. Thus the popular addresses are not designed primarily for entertainment, for the display of eloquence or the revelation of pictorial art, or for minute accounts of geographic features; they are designed for diffusing interest and definite knowledge concerning geographic science.

The National Geographic Magazine is a medium of communication between geographers within and without the Society, and its aim is to convey new information and at the same time to reflect current opinion on geographic matters. In the selec-

MONTICELLO

MEETING OF THE NATIONAL GEOGRAPHIC SOCIETY, MAY 16, 1896 tion of articles, books for review, subjects of notes, etc, preference is given first to original records of personal work in exploration and research, and next to systematic writings tending to organize, and thereby to advance and improve, geographic knowledge.

Some of the most efficient instrumentalities employed by the Society in promoting geographic knowledge are more or less intangible. Through a large and widely scattered corresponding membership, interest in modern geography is diffused throughout the country; through the public, high, and normal school teachers, especially in the District of Columbia and Maryland, who are affiliated with the Society, a steadily increasing influence is exerted on elementary geographic education. All the leading American universities are represented in the Society, and through them its influence on more advanced education is large and constantly increasing; all the leading state and federal surveys, geographic and geologic, are also represented, and in this way the surveys are brought into closer harmony, their interests are promoted, their efficiency is increased, and the people are benefited. In this and other ways the National Geographic Society strives to contribute to the scientific progress and thus to the material welfare of all parts of the country; and there is evidence that its efforts are far from unsuccessful.

EIGHTH ANNUAL FIELD MEETING OF THE NATIONAL GEOGRAPHIC SOCIETY

The annual field meeting, held at Monticello, near Charlottesville, Virginia, on Saturday, May 16, was noteworthy as the first meeting of the National Geographic Society in the well-defined geographic province known as the Piedmont plateau.

A special train left Washington at 9.00 a. m., carrying about 300 members and guests of the Society. Reaching Charlottesville at noon, the visitors were conveyed in carriages to Monticello, the homestead of Thomas Jefferson. Here they were welcomed by Mayor John S. Patton, of Charlottesville, in a felicitous address. Responding, President Hubbard happily characterized Charlottesville as an intellectual center of the south, and, referring particularly to Monticello, eulogized Jefferson as statesman, citizen, geographer, educator, and man. "Jefferson," he said, "was a man of acts, not words. His name is better known and more revered today than when he died. No nobler epitaph was ever written on the tomb of any man than on that of Jefferson: 'The author of the Declaration of Independence and the founder of the University of Virginia.'" An address of welcome on the part of the University of Virginia by the Rector, Dr W. C. N. Randolph, was then presented, to which General Greely responded. Mr Rosewell Page, of Richmond, spoke gracefully on behalf of the Association for the Preservation of Virginia Antiquities, welcoming the National Geographic Society to Virginia, and describing the work of the Association in preserving Jamestown and other historic sites of geographic interest; and Mr Jefferson M. Levy, owner of Monticello, in a few well-chosen words, extended the hospitality of the historic mansion to the Society. As an alumnus of the University of Virginia and a member of the National Geographic Society, the Rev. Dr Randolph H. McKim delivered an entertaining address on "Jefferson at Home." He described the founding of the university under Jefferson's plans and tireless supervision, and explained the admirable principles by which the university is controlled—the high scholarship, the elective system, the personal-honor system of discipline, the principle of religious freedom—and showed by illustration and example that the breadth and soundness of education in this institution prove Jefferson to have been far in advance of his times as an educator. Addresses followed on the "Physiography of the Piedmont Plateau," on "Albemarle in Revolutionary Days," and on "Spottswood's Expedition of 1716;" these are appended. After a collation the visitors attended a most agreeable reception at the university.

The details of the meeting were arranged by a committee under the chairmanship of Dr David T. Day, including representatives from the municipality of Charlottesville and the University of Virginia, the Sons of the American Revolution, the Daughters of the American Revolution, the Association for the Preservation of Virginia Antiquities, and the Columbia Historical Society.

The addresses of special geographic interest follow.

GEOGRAPHIC HISTORY OF THE PIEDMONT PLATEAU

By W J McGee

Monticello is the northernmost knob of a low mountain range; it overlooks a fair and fertile plain, glorious in vernal verdure and the promise of a rich harvest of golden grain and purple grapes in autumn. The plain is not monotonously smooth; here it undulates in graceful swells, there it dips into rocky river gorges winding across its width, and elsewhere it rises into rugged ranges running parallel with the neighboring Blue Ridge. Such is the Piedmont plain within view of Monticello, and such is the province throughout its extent from New York to Alabama; everywhere it is bounded on the southeast by the coastward lowland and on the northwest by the Appalachian mountains, and everywhere it rises so high above the coastal plain that it is fitly called a plateau. This undulant upland, with its transverse riverways, its parallel ranges, and its fertile soil, is a record of unwritten history stretching far into the wordless past.

Consider the rivers and the tributaries by which they are fed: Rivanna river runs yellow with mud; sometimes it is clearer, but after the great storm or the vernal freshet it is still more heavily laden with earth matter washed in from the hills; thus the Rivanna with its tributaries, and all the neighboring rivers of the province are incessantly carrying the debris of the land to the sea. How much the Rivanna carries has not been measured, but the burdens borne by the Mississippi and Potomac and many other rivers have been weighed and a rate for river work has been fixed, and thus it is known that the Rivanna, with its tributary mill-streams and brooks and storm rills, robs the land on which its waters gather of a layer of soil a third of an inch in average thickness during each century. This is an initial point in the reading of geographic history. He who desires to comprehend the record of the ages must realize that the land is not an indestructible thing, that the hills are not eternal, that the streams work ever and in time accomplish much; he must understand that since Jamestown was founded an inch of soil or rock has been removed from every average acre about Rivanna river and elsewhere throughout the Piedmont province. So the brawling brooks and turbulent rivers declare that the Piedmont hills and valleys are slowly but incessantly wasting.

Consider the ways in which the waters run: Some rivers flow sluggishly in broad, flat-bottomed valleys flanked by gentle slopes, but the Rivanna and all its feeders and neighbors rush through narrow, rock-bound gorges, and on reaching the coastal plain cascade over huge bowlders and rugged ledges down nearly or quite to tide-level. Now, swift-flowing waters cut their channels quickly, and the fact that all the Piedmont rivers, large and small, are incessantly corrading their beds yet are unable to carve them down to tide-level, proves that the land is lifting. This is the second of the two starting points in the reading of geographic history; he who would learn how continents come to be must realize that the earth-crust is ever warping, that all lands are slowly rising or sinking in some of their parts, and that streams are living witnesses of the movement—for without this realization he must needs linger at the threshold of knowledge, where the forefathers unwittingly loitered before geography became science, and leave to others the joy of full understanding. The rate of land-lifting has not been measured, but since even the strongest streams are unable to cut their narrow channels down to tide-level, the rate must be many times the mean surface waste. Probably the Piedmont is rising about as rapidly as the adjacent lowland is sinking, and this has been reckoned at two feet per century in New Jersey, and may be one-third so much in Virginia. By reason of the land-lifting the modern Piedmont channels are carved sharply in the rock; these channels are but the bottoms of sharp-cut gorges 100 to 300 feet deep (the trenches of the recently defined Ozarkian epoch), and thus the gorges indicate that the lifting of the Piedmont is not the movement of a day or millenium merely, but has continued through ages. So the rushing rivers and rugged riverways of the Piedmont declare that the province is now, and long has been, rising more rapidly than the hills and valleys are wasting.

Consider next the parallel mountain ranges: Monticello and the rest of Carter mountain are but a ridge of hard rock scored by ravines and thinly mantled with soil, and Ragged mountain on the west, Southwest mountain on the north, and all the other ranges diversifying the plateau are its counterparts. The mountains are ribbed with silicious schists or quartzites or other rocks that resist well the work of the weather, the beating of storms, and the cutting of streams, while the rocks underlying the fertile fields of the plain are softer schists easily weathered and worn away. Now, the development of topographic forms is an evolution whose key-note is "the survival of the hardest"; hence the Piedmont ranges may be (and indeed must be, since no other rational explanation has ever been framed) regarded as remnants of an ancient plateau whose softer portions have been swept away by the storms and streams of the ages. These ranges rise 500 to 2,000 feet above the undulant plain by which they are flanked; it follows that not only the vertical furlongs required to raise the present plateau to the higher crests has been borne seaward, but so much more as the crests themselves may have lost; it follows, too, that the time required for the waste of these thousands of vertical feet of rock matter at the known rate of a third of an inch in a century must have been vast, too vast for ready realization. So the Piedmont ranges declare the antiquity of the province, and testify that the modern plateau is but the foundation of a greater one in ages gone.

Turn now to the structure of the rocks exposed in gorge and mountain side: Collectively these are known as the Piedmont schists; they are harder or softer, traversed by dikes, or cut by quartz veins, but everywhere they are highly tilted in a trend conforming to the extension of the province; yet the composition of the schists indicates that they were originally marine sediments such as are accumulated in nearly horizontal sheets on the sea bottom. Now, sedimentary rocks are tilted and altered only by profound movements in the earth-crust which at the same time produce great mountain ranges, and the structure of the Piedmont rocks indicates that they are the roots of a broad mountain range; such is the conclusion of modern geology. Under this interpretation, the undulant and mountain-embossed plateau of the Piedmont must be regarded as the basal portion of a vast mass of inclined rocks of which an unmeasured upper portion has been planed away; no trace of the original surface appears; the softer strata end in the soil and the harder strata crop out in the ranges, and both point mutely to an ancient surface far above; there is nothing to indicate that originally the mass may not have extended ten miles upward, and the structure cannot be interpreted by geology save by assuming that its summit was at least half a mile or a mile above the highest crests of today. While the height of the ancient mountain of which the present Piedmont is the foundation may not be measured in the province, it may be determined roughly from the neighboring Appalachian province, where the sedimentary strata are corrugated as by compression from southeast to northwest into long ranges trending parallel with the provinces, and where the rocks are so little altered that their thickness may be measured accurately. The two provinces are closely related, differing chiefly in the greater compression suffered by the Piedmont rocks; and frequently in the mountain province, as always in the Piedmont, the strata expose planed edges. Now the planed Appalachian strata are three miles or more in vertical thickness, demonstrating that so much of rock matter has been carried away; and while the Piedmont waste may have been somewhat greater or a trifle less, all authorities are agreed that at least one and probably three or more vertical miles of rock matter have gone into the sea. The evidence of the two provinces is corroborated by that of a third; for the coastal plain, to a width of some hundred miles and a depth of some thousand feet, is built of sediments demonstrably derived from the lost mountains. The time required for the paring down and bearing away of this immense mass of rock at the known rate of an inch in three centuries, or at any other conceivable rate, is vast, so vast as to tax the mind; yet he who falters at accepting the facts of mass or time only confesses failure to grasp this and other problems of modern geography. So the Piedmont rocks attest that the province is but the foundation of a range, say 75 miles wide and 3 miles high; and the rivers and the rocks declare with one voice that this vast volume has been swept into the sea to build another province. This story of the moving of mountains is striking: Colorado canyon is sometimes regarded as the world's most impressive example of the work of rain and river, yet the Piedmont is still more impressive; for the James and Potomac and Susquehanna must have traversed the ancient range in gorges no less profound than the Grand canyon, yet the storms and tributary streams stayed not when the canyons were cut, but continued consuming the canyon walls until they were gone, even until the mountains were not—the Colorado has cut a trench, the Piedmont rivers have carved a province.

Thus the fertile plain of the Piedmont, the transverse riverways, the parallel ranges, the subsoil rocks, teem with history which he who tarries a little may clearly read; they tell that the land is wasting into the sea at measured rate, yet that in the present epoch the land-mass is lifting still more rapidly; they tell that these processes wrought in the past (the long past whose hours are as millions of years) so persistently that they moved a mountain range and lined an ocean-side. The soil, too, tells of conquest over savages and beasts, of the blossoming of the wilderness at human behest, of the flowering of culture and the ripening of intellect, over all the fair and fertile plain wrought during the ages; but this story of man's dominion is writ clearer in the leaves of books than in the furrows of the fields.

SPOTTSWOOD'S EXPEDITION OF 1716

By Dr William M. Thornton,

Chairman of the Faculty of the University of Virginia

Nearly 180 years ago there was formed in the Old Dominion a prototype of the National Geographic Society. The governor of the colony, Alexander Spottswood—trained in Marlborough's legions and bearing honorable scars from Blenheim—was its head. Robert Beverly, the historian of Virginia; John Fontaine, the chronicler of their exploration, with Todd and Robinson and Taylor and Brooke and Mason, and other names famous in Virginian annals, were on the roll. The fortunate preservation of Fontaine's Journal, and its publication* in the Rev. Philip Slaughter's "History of St. Mark's Parish," makes it easy to attempt a reproduction of the story of this historic ride.

Ten of these Virginian gentlemen, with four Indian guides and two small companies of rangers, assembled on August 26, 1716, at Germanna, on the banks of the Rappahannock, and set out thence to explore the passes of what they called the "highest ridge of mountains." "For this expedition," says the Rev Hugh Jones, chaplain of the House of Burgesses, "they were obliged to provide a great quantity of horseshoes, things seldom used in the eastern part of Virginia, where there are no stones, upon which account the governor, upon his return, presented each of his companions with a golden horseshoe, with the inscription on one side—*Sic juvat transcendere montes.*" Such was the badge of this early society of explorers, now called in Virginian story the "Knights of the Golden Horseshoe."

One of these little golden memorials of that far-off time would

* Due acknowledgment is rendered to this valuable monograph.

be a highly prized treasure in our own day, when a lively interest in the history of our commonwealth renders precious every genuine relic of its heroic age; but all of them would seem to have perished. In that dismal effort to endow this charming story of Spottswood's ride with romantic and tragic interest, "The Knight of the Horse Shoe," by Dr Wm. A. Caruthers, is contained the following letter, which gives authentic evidence of the preservation of one of these ornaments to a late day. But even this Caruthers himself seemed unable to secure.

"St. Julien (near Fredericksburg), Va., *February 25, 1841.*

"*To Dr Wm. A. Caruthers.*

"My Dear Sir: I have received your letter of the 5th inst., and in reply to it I can only say, what I said some years past to my friend, George Summers, on the subject of your letter. I said to him that I had seen, in the possession of the eldest branch of my family, a golden horseshoe set with garnets, and having inscribed on it the motto, '*Sic jurat transcendere montes,*' which from tradition I always understood was presented by Governor Spottswood to my grandfather as one of many gentlemen who accompanied him across the mountains.

"With great respect, yours,

"Francis Brooke."

Horseshoes alone did not make up their outfit. There were saddle and pack horses in abundance, great store of provisions, guns and pistols and ammunition, that they might replenish their commissariat with game, and with true Virginian hospitality an "extraordinary variety of liquors," used with generous and patriotic fervor. There were red wine and white, whisky and brandy, two sorts of rum, champagne, canary, cider, shrub, "and so forth," says the exhausted chronicler, and they were dealt out with a liberal hand. On September 6, they ascended a peak of the Massanutten—fancying themselves at the summit of the continental ridge—and standing on this terminus of their journey they dedicated their discoveries to His Majesty King George the First. After a good dinner they got the men together, fired a volley, and drank the king's health in champagne; then came another volley, with the princess's health in Burgundy; then another, with the health of the royal family in claret; then a fourth, with the health of the governor, and so perhaps continuing till even the youngest knight of their roystering Round Table had been honored by his volley and his toast. Through all their expedition good fellowship and cheerful converse brightened the way. "We arrived at a large spring," said

Fontaine, "where we dined and drank a bowl of punch." And again, "We made large fires, pitched our tents, and cut boughs to lie on, had good liquor, and at ten we went to sleep."

And yet our convivial geographers did not shrink from hard riding and hard work. Their journey followed the course of the Rappahannock to its fork, and thence pursued the Rapidan to its sources, whence, passing into the valley of the headwaters of the James, they crossed the Blue Ridge at Swift Run gap, descended the western flank, forded the Shenandoah, "drank some healths," as by invariable custom, on the other side, ascended the Massanutten, and there celebrated the completion of their journey with joyous salvos and flowing goblets. The route was no easy one, as it wound its way through those primeval forests, untrodden save by the wild beast and the wilder Indian. An average day's journey was less than ten miles. "We had a rugged way," writes Fontaine, on the 2d of September. "We passed over a great many small runs of water, some of which were very deep and others very miry. Several of our company were dismounted, some were down with their horses. and some thrown off." On September 3 they "came to a thicket so tightly laced together that we had a great deal of trouble to get through. Our baggage was injured, our clothes torn all to rags, and the saddles and holsters also torn." The axmen were constantly in request. clearing away the vines and briars to make a bridle-path. But cheerful spirits and brave hearts carried them through every danger. Each night they would make large fires. pitch their tents, and after hearty feasting and cheerful talk fall asleep on their rough couches of green boughs, keeping always a sentry at the governor's door. All their troubles were lightly taken. "This was some hindrance," says Fontaine of one of them, "and did a little damage, but afforded a great deal of diversion."

Game and fish were naturally plentiful, and sport was thus added to the pleasures of their journey. From the beginning they had venison in abundance, which they roasted before their camp fires on wooden forks and washed down with generous draughts of wine. Bears were killed almost daily—often three in one day. On the western slope of the Blue Ridge they saw "the footing of elk and buffaloes and their beds." Turkeys abounded all along their way. When they chanced upon neither deer nor turkeys they "ate part of one of the bears, which tasted very well and would be good and might pass for veal if one did not know what it was." While they camped on the banks of the Shenandoah, writes Fontaine, "I got some grasshoppers and fished, another and I, and we catched a dish of fish, some perch and a kind of fish they called chub. The others went a-hunting and killed deer and turkeys." There were rattlesnakes, too, to be killed and hornets to be fought, and at least once the bear objected to the sacrificial rite, attacking the man who rode after him and narrowly missing him; "he tore the things that he had behind him from the horse and would have destroyed him had he not had immediate help from the other men and our dogs." So their expedition did not lack the spice of peril to season its hilarity. Two men fell sick with measles also and had to be left in camp with guards and taken up again on the homeward march, but all in the end went well, and after a ride of nine days out and four days back the gallant party reached Germanna once more.

The question has sometimes been raised whether Spottswood's was the first company to attempt the crossing of the Blue Ridge and the exploration of the regions beyond. John P. Hale, for example, in his "Transallegheny Pioneers," states that Colonel Abraham Wood, under a concession from the colonial governor (Richard Bennet) "to explore the country and open up trade with the Indians to the west," crossed the mountains in 1654, probably at Wood's gap—far to the south of Spottswood's line of march—and again that Governor Berkeley, in 1666, dispatched an exploring party under Captain Henry Batte, who followed the same route as Wood. Hale offers no documentary evidence to support these claims and the writer has been able to discover none. Until thus authenticated they must rest in the limbo of unverified traditions, and Spottswood must wear his rightful laurels as the first white man who with serious purpose led a company across this boundary of our colonial civilization, and set the example so promptly followed by the hardy pioneers, who faced the perils of the wilderness and built their homes in the fair valley of Virginia.

What, then, were the serious purposes of this earliest reconnaissance of the Blue Ridge? for, of course, the grave and sagacious Spottswood was not the man to prosecute such a journey merely that he might say at the end "we were very merry and diverted ourselves with our adventures." "The chief aim of my expedition," he writes in 1718 to the Board of Trade, "was to satisfy myself whether it was practicable to come at the lakes." What he did was to trace the Rappahannock to its source, to identify the springs of the James, to "find an easy passage over that great ridge of mountains (the Blue Ridge) hitherto deemed impassable," and then he fancied the problem solved, and believed himself within easy reach of the streams which fed lake Erie and her vast sisters. We know now that he was misled by the Indians and deceived himself; that the great valley of Virginia stretched before him untraversed; that beyond lay the unscaled heights of the Alleghanies, and then the broad prairies of the Northwest. It was far from being such an easy matter, as Spottswood thought, thus to gain possession of these lakes. But the daring and martial spirit which such wild-wood adventures fostered in Virginian breasts was the spirit which sixty years later reared on American soil an everlasting altar to freedom; which thrilled Virginia's great orator when he cried, "I know not what other men may do; but as for me, give me liberty or give me death;" which inspired Massachusetts' noble statesman, when he swore to abide by the Declaration of Independence, "sink or swim, live or die, survive or perish." To recall this spirit and all that aided to nurture and strengthen it seems not inappropriate here beneath the roof of the author of that declaration, in sight of his cradle at Shadwell, and with the birthplace of George Rogers Clarke, the hero of Kaskaskia and Vincennes, at our feet; for it was left for this hardy warrior to perfect in battle and in march the work which Spottswood's genial and jovial company had purposed peacefully to begin.

JEFFERSON AS A GEOGRAPHER

By General A. W. Greely,

Chief Signal Officer, United States Army

It is a forlorn hope that I am undertaking, to answer an undelivered speech, to speak but three minutes, and to say something of interest. I will at least say that the reasons which make Monticello one of America's shrines are too well known to need extended comment from me. As long as a love of liberty abides in American hearts, as long as a desire for knowledge stirs youthful minds, so long will the name of Thomas Jefferson be here cherished. He was a man worthy of honor, whether considered as an individual founding the University of Virginia, as a Virginian shedding luster on his native state, or as a citizen doing in that broader national field things of greater import for his country and for oppressed humanity everywhere. Trite may have been the truths he uttered, but he voiced so aptly and clearly the aspirations of the people that his words yet thrill mankind and will in centuries to come.

The National Geographic Society erred not in making Monticello the scene of its annual field day. Bear in mind that of all our Presidents Jefferson is the only one of whom we can say, "He was a geographer." We do not know how far he aided his father in the surveys or draughting that resulted in the famed Jefferson and Fry map of Virginia, published in London in 1775, under Jefferys, the royal geographer, but we can well imagine young Jefferson eagerly studying its western and scarcely known limits, then given over to the Indian and the Spaniard. Doubtless from such studies his comprehending mind, in a manner common to all men of genius, stored geographic facts and ideas that better fitted him for his life duties. Men of genius make all knowledge tributary to their particular interests and ambitions.

In the days of travail for this nation, when to Europe America was a land of savages and forests, then it was that Jefferson did his first geographical work, writing "Notes on Virginia," to make known to the statesmen of France the resources and possibilities of a struggling colony. We know that the book was timely and effective, and we believe that it broadened the mind of Jefferson. His greatest geographic measure was his extra-constitutional act of annexation by purchase of the great territory of Louisiana. He realized that the only natural southern boundary of the United States of his day was the gulf of Mexico. To the south and southwest the presence of Latin races meant constant irritation and misunderstandings between them and the Anglo-Saxons.

Louisiana acquired, Jefferson, like a good geographer, initiated a survey of its immense and unknown areas, sending Lewis and Clarke to the west, and Pike first to the north and then to the southwest. With unwonted wisdom and courage, even before the territory was formally transferred, he sent Lewis and Clarke on their long and perilous journey, the first as well as the most important of all American explorations. Their three years' journey taught the way to the Pacific overland, and their discovery of the upper valley of the Columbia, conjoined with Gray's entrance at the mouth of that noble waterway in 1792, insured the title of the United States to Oregon territory in 1845.

Without Jefferson's original action we might well have been without a foothold on the Pacific today.

Remember that he was also foremost, if not first, in formulating plans and methods whereby the public lands should not lie wild and fallow, but serve their purpose of developing the nation's power by passing systematically and easily into the hands of the settler and farmer, which has proved the basis of our phenomenal growth and prosperity.

While we pay tribute to Jefferson as an individual, as a citizen, as a lover of liberty, and as a President, let us not forget his special claim to recognition as one of the greatest of American geographers.

ALBEMARLE IN REVOLUTIONARY DAYS

By Dr G. Brown Goode,

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The key to the history of Virginia in colonial and revolutionary days is to be found in the study of its rivers. So numerous are these and so wide that in their lower portions they can be crossed only in boats, and so far do they extend into the interior that in early days the lines of travel were almost entirely along their courses.

The region of the mountains was reached by roads which were parallel to the rivers, and the currents of western migration passed through "gaps" or passes in the Blue Ridge which were traversed by the streams which form the headwaters.

Between the principal rivers are peninsulas which stretch forth toward the sea like the fingers of a great hand: Accomac, or the "Eastern Shore," between the Delaware and the Susquehanna; the Maryland peninsula, between the Susquehanna and the Potomac; the Northern Neck, the domain of Lord Fairfax, between the Potomac and the Rappahannock; the Gloucester peninsula, between the Rappahannock and the York; the Yorktown peninsula, between the York and the Potomac, and Southside Virginia, between the James and the Dan-Roanoke. The Shenandoah valley, bounded by mountains rather than river courses, was similarly isolated, though by different means. Each of these had a history of its own, to a certain extent distinct and peculiar. The people of these areas were isolated in early colonial days; intermarried chiefly with each other generation after generation, and formed permanent relationships which may be traced even now after the lapse of two centuries. At the time of the Revolution there were only two roads traversing Virginia from north to south. One passed from Philadelphia, by way of Newcastle, Del., Annapolis, Md., Alexandria, Fredericksburg, and Williamsburg, to the western settlements of North Carolina, crossing all rivers near the head of navigation except the James and the Roanoke. This road was serviceable only for passenger traffic, and for through travel was used almost exclusively by horsemen. The other was "The Great Waggon Road" from Philadelphia to the head of the Yadkin, in North Carolina. It followed the course of the ancient Indian road used for centuries before by the tribes of the east in their excursions from the Atlantic seaboard to the great hunting grounds in Kentucky and Tennessee, and as early as 1750 was the principal line of commerce between the Northern states and the Carolinas and Georgia. It traversed the entire length of the Shenandoah valley, crossing the Potomac some 20 miles above Harpers Ferry, near the mouth of the Conococheague creek. It was the position of the Conococheague upon this great highway which gave it such prominence in the days when the site of the national capital was being selected, and which almost led to the location of the capital here rather than where it now stands.

The main artery of Virginia was the James, and it was to the fact that the county of Albemarle was near its head and at that time almost upon the western frontier that its peculiar relation to the events of the Revolution was due.

Twenty-five miles east of Monticello is the great fork of the James river, which at that time was considered to be its head. Here two streams converge to form one greater one; the northernmost is the Rivanna, which rises on the eastern slopes of the Blue Ridge, then flows by Charlottesville and through the pass at Monticello; the southernmost the Fluvanna, rising far to the west in the midst of the Alleghanies, breaking through the Blue Ridge at Balcony falls (close to the Natural bridge), a hundred miles or more above its junction with the Rivanna. This, which is far the more important of the two, is now called the "Upper James."

The names of these streams are monuments to the loyalty of the early colonists. The James bears the name of the monarch who ruled over England when Virginia was planted, and Rivanna and Fluvanna were named for his granddaughter, Queen Anne, for whom also were named the Rapid Anne, which we crossed on our way hither, as well as the South Anna and the North Anna, which drain the region just to the eastward. Rivanna was compounded by some enthusiast from the two words "river" and "Anna." Fluvanna is precisely the same, except that he used the Latin equivalent for the word river.

The old county of Albemarle, much larger at the beginning of the Revolution than now, occupied the triangle formed by the Blue Ridge on the west, the Fluvanna on the south, and the northern divide of the Rivanna basin on the north. In the southeastern angle of the county (which in 1777 was set aside in the county of Fluvanna), was the place called "Point of Fork," an important military station in the Revolution, while twenty miles above, on the Fluvanna or James, was old Albemarle court-house, also a supply station.

Charlottesville in 1776 had only recently become the county seat. A court-house and a tavern had been built, and in 1779 a group of a dozen houses had grown up about them. A considerable number of families lived in the vicinity, recent arrivals from tidewater Virginia. These people lived in comfort, though in great simplicity, upon the vast plantations which they owned, this region being upon the very frontier. Thomas Jefferson's father was one of the earliest settlers here, and he himself was perhaps the first white child born in this region. At the time of his birth, in 1743, buffalo still abounded in the neighborhood. Ten years before a buffalo calf had been captured just across the Blue Ridge and taken as a gift to the governor at Williamsburg. The Huguenot colonists at Manikintown, fifty miles down the James, kept buffalo in domestication for milk and beef. A trail frequented by the buffalo herds crossed the Blue Ridge at Rockfish gap, twenty-four miles west of Charlottesville, passed the Shenandoah at a ford near Staunton, and afterward over the next range by a passage still known as "Buffalo Gap," into the beautiful valleys, then, as at present, called the "Cow Pasture" and the "Calf Pasture," doubtless because of the presence there of buffalo herds in the days when they were named.

The inhabitants were still collecting bounties in tobacco for the wolves which they killed with their guns or enticed into pitfalls. The stream called "Wolftrap branch," near Charlottesville, preserves by its name the memory of those times. I have myself seen in this locality pits partially filled up, which were used as wolf traps not half a century ago, and have talked with a man whose father had seen great herds of buffalo crossing the Roanoke river less than a hundred miles southeast of Charlottesville, at a point still called "Buffalo ford."

I mention these circumstances simply to give an idea of the solitude and seclusion of this region at the time of the Revolution. It was because of its very remoteness that Congress decided upon it, in 1779, as a place for the detention of the prisoners of war at that time quartered at Cambridge, in Massachusetts. These were the so-called "Convention troops," the captive army of Burgoyne, which had surrendered to Gates at Saratoga, October 12, 1777. This is not the place to discuss what seems to have been very bad faith upon the part of our government, which did not keep its pledges, but retained these captured troops for four years as prisoners of war, notwithstanding the agreement made by Gates and confirmed by Congress, that they should at once be sent to England on parole.

Two years after the Saratoga convention they were still confined in Massachusetts. They were marched in the dead of winter 700 miles, from Boston to Charlottesville. The number surrendered at Saratoga was 5,791, of whom 2,412 were Germans and Hessians. The number brought to Virginia was, of course, somewhat less, but how much there is no means of ascertaining. We know, however, that a year later their numbers had been reduced by death, desertion, and partial exchanges to about 2,100. They arrived in January at Charlottesville, where little preparation had been made to receive them.

One who was present at the time has left the following description:

> As to the men, the situation was truly horrible, after the hard shifts they had experienced in their march from the Potomack. They were, instead of comfortable barracks, conducted into a wood, where a few log huts were just begun to be built, the most part not covered over, and all of them full of snow; these the men were obliged to clear out and cover over, to secure themselves from the inclemency of the weather, as quick as they could, and in the course of two or three days rendered them a habitable, but by no means a comfortable retirement. What added greatly to the distresses of the men was the want of provisions, as none had as yet arrived for the troops, and for six days they subsisted on the meal of Indian corn made into cakes. The person who had the management of everything informed us that we were not expected till spring. Never was a country so destitute of every comfort; provisions were not to be purchased for ten days; the officers subsisted upon salt pork and Indian

corn made into cakes; not a drop of any kind of spirit; what little there had been was already consumed by the first and second brigades; many officers to comfort themselves put red pepper into water to drink by way of cordial.

On the arrival of the troops at Charlottesville the officers, what with vexation and to keep out the cold, drank rather freely of an abominable liquor called peach brandy, which, if drunk to excess, the fumes raise an absolute delirium, and in their cups several were guilty of deeds that would admit of no apology. The inhabitants must have actually thought us mad, for in the course of three or four days there were no less than six or seven duels fought.

The officers were allowed to go into the surrounding country in search of quarters; the Englishmen within a fixed circuit which extended beyond Richmond on the east; the Germans within a similar circuit, chiefly within the Shenandoah valley and including Staunton. Captain Auburey has left a most interesting account of his experiences in his book of travels published in London in 1789. In the Memoirs of the Baroness von Riedesel, who was with the German troops, may be found a narrative which is even more instructive. The barracks were about six miles north of Charlottesville, near Ivy creek, on a plantation now belonging to Mr Carr. Here the troops were detained until November, 1780, when the advance of the British through the Carolinas rendering their capture probable, they were marched northward. The British were moved to Maryland and thence to Connecticut; the Germans to Winchester, in the Shenandoah valley.

Some of the Germans, it is said, were quartered upon the estate of General Daniel Morgan, in what is now Clarke county, and were employed by him to build the great stone mansion, still standing, which he named "Saratoga" in memory of the place associated with his triumph and their defeat. In 1780 a considerable number of other prisoners captured at the Cowpens and in South Carolina were also brought to Albemarle. These men were liberated by the British at the time of Tarleton's raid. It is a curious fact that some who had married here while in captivity deserted from the British lines at Yorktown and returned here to live. It is said that some of their descendants still live in Albemarle. The position of Albemarle upon the frontier again gave it prominence in 1781, when the governor and legislature of Virginia having been driven from Richmond by the British invasion, Charlottesville became the temporary capital of the state.

It should be remembered that it was only the closing scenes of the war which took place upon the soil of Virginia. For the first five years all the battles were in the northern colonies. In 1780, however, Charleston, South Carolina, was captured, and the southern campaign began. The Virginia line was detached from the army of Washington, and with that of North Carolina went south to oppose the advance of Cornwallis. Other portions of the Continental Army followed. Notwithstanding the victories of the Americans at Eutaw Springs, Kings Mountain, and the Cowpens and the constant check to his progress which Greene and his militia auxiliaries interposed, Cornwallis (strongly reinforced by the tory partisans of Georgia and the Carolinas) slowly advanced toward Virginia. On May 20, 1781, he reached Petersburg by way of Wilmington. Another army, under Benedict Arnold, had five months before invaded the valley of the James, which they ascended to Petersburg and Richmond.

Virginia was at this time in a most helpless condition. All the able-bodied men were in the Continental Army. The militia were without arms, and Congress seemed unable to respond to their appeals for help. In those days putty had not been invented, and the glass in the windows of houses was held together by lead. So great was the need for bullets that the windows were destroyed to obtain them. Major John Pryor, commissary, stationed at Charlottesville, in June, 1778, wrote to Colonel Davies at Staunton that he had sent "by Expresses to every probable House within forty miles extent along the Southwest Mountains to collect what lead can be found in the windows and elsewhere."

All southern Virginia was ravaged by a motley horde armed with torch and sword, who traversed it under the leadership of Colonel Banastre Tarleton, a dashing officer of dragoons, who was followed by hundreds of tory partisans from the Carolinas. So shameless were their depredations that an officer in Cornwallis' army denounced them as a disgrace to civilization. Henry Clay, at that time a boy four years of age, living near Hanover court-house, remembered how the troopers desecrated the newly made grave of his father, who had died only a few days before, piercing it on every side with their sabers in search of hidden treasure.

The British having found little in the way of booty or resistance at Richmond slowly proceeded up the James. At the Point of Fork, already mentioned as being in old Albemarle and 25 miles to the east of Monticello, the Americans had an important military depot under the charge of Baron von Steuben, with a small body of troops. The British Colonel Simcoe, with his battalion of "Queen's Rangers," was sent to dislodge him, which he did in a manner at the time not considered creditable to the American commander.

Cornwallis also in June detached Tarleton with 180 troopers from his own legion, 70 mounted infantrymen, and a gang of Carolina tories to go to Charlottesville to capture Governor Jefferson and the legislature. Tarleton selected a secluded route up the valley of the South Anna by way of Louisa court-house, and on the morning of June 4, 1781, had approached to within ten miles of Charlottesville on the east. But for the courage of a man whose name is still remembered his plan would have been a perfect success. John Jouett, a scout and partisan, then 23 years of age, suspected the designs of the British, cut his way through the front of the column, and having a very fleet horse reached Charlottesville two hours in advance and gave warning to the legislature, and also got a messenger to Monticello to give warning to Mr Jefferson and to several members of the legislature who were residing at his house. This man was the grandfather of a citizen of Washington whom many of us personally know, Rear-Admiral James E. Jouett of the Navy.

The legislature adjourned with astonishing rapidity to Staunton, on the other side of the Blue Ridge, and only seven were captured. Shortly afterward they were again stampeded, and took to the mountains still farther west. The cause of their flight was somewhat curious. A company of Virginia troops marching northward approached Staunton, the colors flying and drums beating. The people of this region had never before seen soldiers in uniform and knew only the buckskin-clad rangers of their own region. The country people supposed the advancing column to be that of Cornwallis and gave a false alarm. When Tarleton's white-coated troopers reached the crest of Monticello, Governor Jefferson was not there; he was safe in the woods on Carter's mountain, the elevation next to Monticello on the south, and his family were at Enniscorthy, Colonel Carter's plantation, about six miles away.

Visitors to Monticello are often told that Mr Jefferson made his escape from the house by a sort of passage which connected it with outbuildings. In this story there is no truth. The circumstances of his flight are well remembered by his descendants, and there is an interesting memorandum in Mr Jefferson's own handwriting in the possession of his grandson, Dr W. C. N. Randolph, of Charlottesville. Jouett's first messenger arrived at Monticello at sunrise. Governor Jefferson and the members of the legislature who were with him quietly took breakfast, after which his guests departed for Charlottesville, and he, after ordering some servants to hide the household silver under the floor of the front porch, occupied himself in packing up his papers. About two hours after another messenger, a Mr Hudson, rode up to tell him that the British were about to ascend the mountain. He at once sent his family to Enniscorthy and ordered his saddle-horse, which was being newly shod at the blacksmith's shop on the plantation. Carrying his papers, sword, and field-glass, he made his way to a place on Carter's mountain, whence he could see Charlottesville and the surrounding country. After awhile, not being able to see any troops, he started back home, but finding that he had left his sword returned to get it. Looking again, he saw a large detachment of dragoons in the streets of Charlottesville, and then mounted his horse and proceeded to Enniscorthy. In the meantime a detachment of troops under the command of Captain MacLeod had ascended the mountain from the opposite side and were searching for him at Monticello; but for the loss of his sword he would doubtless have returned home and been captured. When the troops reached the house, the two negroes, Martin and Cæsar, were still packing away the valuables under the porch through an opening made by lifting some of the planks in the floor. When the soldiers came up, the planks were replaced, and one of the negroes was imprisoned for eighteen hours. It was afterward ascertained that Colonel Tarleton had given positive orders to have the governor captured, if possible, but that none of his property should be destroyed, and this order was strictly carried out.

After laying waste the surrounding region, Tarleton rejoined Cornwallis, who had now encamped upon a plantation called "Elk Hill," just below the Point of Fork, which belonged to Mr Jefferson. General Lafayette was at this time assembling his forces in the vicinity of Culpeper court-house, about fifty miles to the northward. He was reinforced by Wayne's army at Raccoon ford, on the Rapid Anne, very near to Cedar mountain. He traversed Louisa, the next county to the northeast of us, crossed the North Anna at Brock's bridge, opened a road through the woods, still known as the Marquis road, and passed on in rapid pursuit of Cornwallis, who had begun his retreat down the James. The boy-general soon drove his adversary to the end of the Yorktown peninsula, where Cornwallis hoped to get help from the British fleet. What happened there between the 30th of July and the 9th of October it is needless for me to relate.

Before closing, I must refer to some of the historic personages whose lives were passed in the region which surrounds us. It is to be regretted that Monticello is but a "little mountain" in fact as well as in name. If it were 1,500 feet higher and we were all provided with telescopes I could show you many things of interest.

Here and there along the banks of the James I might point out the homes of six of the seven Virginians who signed the Declaration of Independence. We might see the old court-house in Hanover, twenty miles to the east, where Patrick Henry, pleading in the famous Parsons cause in 1763, declared that the burgesses in Virginia were the only authority who could give force to the laws for the government of the colony. I could show you still closer, in Louisa, the home of Dabney Carr, who proposed in the House of Burgesses, in 1773, the plan for committees of correspondence (to be organized for mutual protection in the several colonies), which were so useful in the earliest days of the Revolution. We could also see old St. John's church in Richmond, where, in 1775, at the meeting of the House of Burgesses, Henry defied the British crown, crying, "Give me liberty or give me death," and the spot where he died, at "Red Hill," just beyond Willis mountain, to the southeast. We could see what we have already seen once today fifty miles to the northward, the region of Culpeper, whence the Minutemen marched in 1775 with their rattlesnake flag and the motto "Liberty or Death" upon their hunting shirts, to the defeat of Lord Dunmore at Great bridge, with John Marshall, afterward Chief Justice of the United States, in their ranks. In this quarter we could also see the ancestral home of Madison, the champion of the Constitution. Looking to the northwest, beyond the Blue Ridge, we might see the region of the lower Shenandoah, whence marched two regiments of buckskin-clad riflemen to Boston at the alarm of Lexington, and the passes through which Washington journeyed in his early expedition to the westward. Over the Blue Ridge, not many miles away, we might seek out the birthplace of General Arthur Campbell, the hero of Kings Mountain, and that of John Sevier, the founder of the state of Franklin, afterward Tennessee, the first commonwealth beyond the Alleghanies, and also the spot where Abram Linkhorn, grandfather of the President, married, lived, and was captain of a company of militia organized in 1776 for the defence of the western frontier. Still nearer, almost at the base of Monticello, the birthplace of General George Rogers Clarke, who by his victory over the British and Indians at Fort Vincennes in 1781 saved the northwest to the United States, a man the value of whose services to the nation at this time were second only to those of Washington, and away to the southward the spot where General Thomas Sumter was born. Our eyes, still turned to the west, would traverse the great frontier county of Augusta, whose western boundary extended, in accordance with the charter of 1609, to the Pacific, and whose actual limits, at that time undisputed, were upon the shores of the Mississippi.

After the surrender of Cornwallis, in this region were centered in large degree the future destinies of America. "The American states," writes Cooke, "were now either to set up as separate nations or to enter into a durable union; and the latter policy was strongly urged by Virginia. It is necessary to state this fact; the "states-right" record of the commonwealth has produced the impression that the sentiment of union was not strong in the people. The contrary is the fact. From the first the Virginians were the foremost advocates of union and made every sacrifice to effect it.

"To bring it about, Virginia began by surrendering a principality. The entire region beyond the Ohio, now the States of Ohio, Indiana, and Illinois, was a part of her domain under her charter. Her right to it rested upon as firm a basis as the right of any other commonwealth to her own domain, and if there was any question of the Virginia title by charter she could assert her right by conquest. The region had been wrested from the British by a Virginian commanding Virginian troops; the people had taken 'the oath of allegiance to the commonwealth of Virginia,' and her title to the entire territory was thus indisputable. The country north of the Ohio river was a part of Virginia under her original charter, remained a portion of her domain when in May, 1776, she declared herself an independent commonwealth before there was any union, and she herself succeeded to all the rights of the crown.

"These rights she now abandoned, and her action was the result of an enlarged patriotism and devotion to the cause of union. The articles of confederation had not been adopted by all the colonies; some of them still held back. They were unwilling to recognize the Virginia title, but would 'accede to the confederation provided Congress would fix the western limits of *the states claiming to extend to the Mississippi or the South sea.*' The issue was thus distinctly presented, the surrender of the territory and union, or its retention and disunion. Virginia decided for union, and (January, 1781) agreed to cede the country to the Federal Government. In 1783 Congress accepted her terms, and in 1787 passed an ordinance for the government of the territory." Nothing now remained to complete the activities of this period of the Revolution but the adoption of the Constitution and the election of Washington to the presidential chair.

GEOGRAPHIC NOTES

NORTH AMERICA

CANADA. At the annual meeting of the Hudson's Bay Company, held recently in London, it was stated that the surveys of the public lands in the northwest having been extended to the Rocky mountains it had become necessary to define the western boundary of the lands of the Hudson's Bay Company. The Dominion government had contended that the line should be placed at the limit of cultivable and grazing lands, which meant the base of the Rocky mountains. The government had, however, finally accepted the contention of the company that the latter's one-twentieth share of the lands available for settlement extends to the summit of the mountains.

Dr Robert Bell, of the Canadian Geological Survey, with Mr R. W. Brock and a small party of boatmen, has renewed his explorations to the eastward of James bay. Instead of following his route of 1895 by Gatineau river, he journeys this summer via Keepawa and Grand lakes, whence he crosses the divide into the watershed of the Noddawai river, which he intends to explore geologically, giving especial attention to the valley of Bell river. Dr Bell's explorations in 1895 proved that the main source of the Noddawai, which drains some 60,000 square miles to the southeast of James bay, is Mattagami lake, fed by two large streams, the Bell and Wasawampi. The Wasawampi, which enters the east end of the lake, is interrupted about 60 miles to the southeast by its enlargement into the lake of the same name, where it receives its most important tributary, called the O'Sullivan, from its original explorer in 1894. The most important feeder of Mattagami lake, Bell river, at its western extremity, was discovered in 1895 by Dr Bell. It is in the main a broad stream, from 20 to 40 feet deep, navigable long distances by steamboats. Bell reports that the watershed of this river has extensive regions suitable for grain raising, dairy farming, lumbering, and stock growing, and he believes that it will eventually be made accessible by railway and occupied by a large white population.

EUROPE.

GERMANY. During May 1,360 ships, aggregating 139,787 tons, passed through the Baltic canal, the tolls amounting to 78,206 marks. Both the traffic and the receipts continue to fall far short of original expectations.

SWITZERLAND. The foreign trade of Switzerland in 1895 showed a considerable increase upon that of the preceding year, the imports increasing from $165,000,000 to $183,000,000 and the exports from $124,000,000 to $132,500,000, in round numbers. The exports to the United States showed a large increase.

RUSSIA. The annual fair at Nijni Novgorod has been opened this year at an earlier date than usual, in order to secure visits from the foreigners who attended the czar's coronation at Moscow. The exhibition covers over 200 acres, and while still possessing those unique features which have made this great Russian fair so famous, it is this year demonstrating in a most striking manner the enormous strides the various mechanical industries are making in the Russian empire.

UNITED KINGDOM. During the year ending July 1, 1896, 23,695 vessels paid harbor dues at the port of Liverpool. While the number was 248 fewer than in the preceding year, the aggregate tonnage (11,046,459) showed an increase of 269,313.

The total output of coal in the United Kingdom in 1895 has just been officially announced as 189,661,362 tons, which exceeds by 1,383,837 tons the output of 1894, the highest previous record. The total recorded output of minerals was 201,738,351 tons, an increase of 2,287,000 tons over the previous year. The number of mines worked was 3,512 and the number of persons employed therein 700,284. The number of quarries worked was 8,062, the product, mostly stone, amounting to 29,813,734 tons. The number of employés in this branch of industry was 104,625, and the total number of persons employed in the entire mineral industry 838,282.

ASIA

CHINA. Russia is stated by the St. Petersburg *Novosti* to have obtained absolute freedom of trade in northern China.

TONKIN. Official notice is given that the English commissioner has handed over to the French authorities the district of Mongsin with the dependent territories as being on the left bank of the Mekong.

BURMA. A preliminary survey has been made for a railway from the Mu valley line to the Chindwin river, a distance of 70 miles. The route presents no serious engineering difficulties and the country to be traversed is densely populated.

AFGHANISTAN. The Amir has issued orders that none of his subjects shall be allowed to keep Kafirs as slaves, and strictly forbidding all slave dealing. The Kafirs, moreover, are not to be compelled to become Mohammedans against their will.

INDIA. The first consignment of Kashmir silk was recently sold in London. Kashmir possesses excellent water power, and attention is being called to the inducements it offers for the employment of capital.

The Nizam of Haidarabad, one of the feudatory princes of India, has recently consented to the acquisition of land in his dominions by Europeans. It is expected that cotton factories and other industrial enterprises will soon be established in the state.

JAPAN. A treaty of commerce has been concluded between Japan and Belgium.

The fishing industry of Japan is rapidly acquiring great importance. Last year Japanese fishermen caught on the Siberian coasts 600,000 salmon and 160,000 salmon trout. In the island of Saghalien the Japanese have leased 84 stations; 71 vessels were employed last year, and the catch was valued at $330,000. From the same island no less than 10,000 tons of edible seaweed were sent to China in 1894.

TURKESTAN. It is announced that a railway will be built as soon as possible from Tashkend to Orenburg, with the object of connecting the Trans-Caspian and Samarcand line with that of Siberia.

AFRICA

NATAL. The 400th anniversary of the discovery of Natal will occur in 1897, and it is proposed to celebrate the occasion by an exhibition.

ORANGE FREE STATE. To the development of the gold mines of this state is mainly due the increase in the net profits of the Orange Free State railway from £1,653 in 1891 to £523,926 in 1895.

SIERRA LEONE. The work of the Anglo-French Boundary Commission of the Sierra Leone and French Guinea frontier establishes as British territory a large extent of country and a number of populous towns which have hitherto been regarded as French. The British will also now occupy the extensive hinterland of Sierra Leone. Except on the coast, the climate of this region is said to be comparatively healthy, and the country is capable of producing rice, cotton, and tobacco in large quantities. There is also a considerable trade in ivory and rubber. The construction of roads to the interior will be commenced at once.

AUSTRALASIA

WESTERN AUSTRALIA. Since the beginning of 1894 the population of Western Australia has more than doubled. The extensive railway system now adopted, together with the harbor works in progress at Fremantle and other points on the coast, will facilitate and probably greatly expand the export of lumber, the supply of which is practically inexhaustible and the quality excellent.

MISCELLANEA

In connection with the recent loss of the *Drummond Castle* off cape Finisterre, attention has been called to the statement of the late Professor Tyndall that the electric light is not good for lighthouse purposes. There seems to be no satisfactory explanation of the fact that the powerful Ushant light was not visible at the time of the recent disaster.

Henry Gannett, Chief Geographer of the Geological Survey, Geographer of two censuses, President of the Board of Geographic Names, and author of several standard works, is a leading geographer of America. Born August 24, 1846, he this month rounds out a half-century of fruitful life.

A recent brochure of the "Bulletin, Department of Geology, University of California," is a description of the Great Valley of California, with a criticism of the theory of isostasy, by F. Leslie Ransome. As indicated by the initial paragraph, the memoir is primarily a critical discussion of the well-known geologic doctrine enunciated by Dutton—the doctrine that the earth-crust is in a state analogous to that of hydrostatic equilibrium, and that it is warped or deformed by transfer of load through the action of streams, as, for example, from the Rocky mountains into the gulf of Mexico. The author opposes this doctrine and appeals to the facts of the Californian valley for support. The memoir is scholarly and the critical remarks are gratifyingly courteous, and it is notable as a careful review of the literature pertaining to isostasy. No geographer concerned with the study of the greater terrestrial movements can fail to find it of use. The memoir forms pages 371–428 of volume I of a highly creditable series of publications emanating from the University of California "at irregular intervals in the form of separate papers * * * which embody the results of research by some competent investigator." Several of these memoirs, especially those by Professor Andrew C. Lawson, are noteworthy contributions to scientific geography.

In his letter to the National Geographic Society on the occasion of its recent field meeting at Charlottesville, Va., Dr W. C. N. Randolph, of the University of Virginia, called attention to the extraordinary productiveness of that region in respect of illustrious men. "Across the river in front of us," he said, "Jefferson was born; around its turn is the birthplace of General Rogers Clarke, who, through Virginia, gave to the Great Republic the Northwest. Over there, a short mile and a half away, lived Monroe; a mile west of the city lived William Wirt, the famous lawyer, orator, and author, while seven miles further west Meriwether Lewis, of the Lewis and Clarke expedition, was born. Down these "little mountains," as the old people love to call them, was born the game-cock of the Carolinas, General Sumter; further on dwelt James Madison and Zachary Taylor, the latter the hero of Buena Vista, and both of them Presidents of the United States. In the same county were born the Barbours, one of them one of the most honored of our representatives at the Court of St. James, the other a distinguished member of the Supreme Bench. Further on, in Fauquier county, was born John Marshall, the greatest of our Chief Justices. He took the frazelled threads of American jurisprudence and twisted them into a rope so strong that it has never been broken, so flexible that it has never been oppressive, so sound that at the end of nearly a hundred years it shows no evidence of decay." He thought he might be pardoned if he requested that, in making up the list of products of the beautiful Piedmont plateau, account might be taken of the many illustrious men to whom it has given birth.

EUGENE FIELD MEMORIAL FUND.

A beautiful souvenir volume, containing some of the late lamented author's choicest poems, with a fine portrait and many exquisite illustrations, will be sent to every contributor of One Dollar (with ten cents added for postage) to the Field Memorial Fund.

The publishers of Mr. Field's works have generously waived their copyright in the poems selected, thirty artists of the very highest talent have contributed the illustrations, and admirers of the gentle poet all over the country are uniting in doing honor to his memory.

The proceeds will be divided equally between Mr. Field's family and the fund for the erection of a monument.

The movement has the warm and generous support of the profession of which Mr. Field was so distinguished an ornament, and THE NATIONAL GEOGRAPHIC MAGAZINE offers its own sincere tribute to the exceeding worthiness of the object and the peculiar appropriateness of the means by which it is sought to be attained.

Send One Dollar and Ten Cents to Henry W. Tiernan and Albert L. Swift, Secretaries Field Memorial Fund, 180 Monroe Street, Chicago, Ill.

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JANUARY.—Russia in Europe, with map, Hon. Gardiner G. Hubbard; The Arctic Cruise of the U. S. Revenue Cutter "Bear," with illustrations, Dr. Sheldon Jackson; The Scope and Value of Arctic Exploration, Gen. A. W. Greely, U. S. A.

FEBRUARY.—Venezuela: Her Government, People, and Boundary, with map and illustrations, William E. Curtis; The Panama Canal Route, with illustrations, Prof. Robert T. Hill; The Tehuantepec Ship Railway, with maps, E. L. Corthell, C. E., LL. D.; The Present State of the Nicaragua Canal, Gen. A. W. Greely; Explorations by the Bureau of American Ethnology, W J McGee. *Also map of the Orinoco valley showing territory drained by that waterway and its bearing on the Venezuelan Boundary Question.*

MARCH.—The So-Called "Jeannette Relics," Prof. Wm. H. Dall; Nansen's Polar Expedition, Gen. A. W. Greely; The Submarine Cables of the World, Gustave Herrle; The Survey and Subdivision of Indian Territory, with map and illustration, Henry Gannett; "Free Burghs" in the United States, James H. Blodgett. *Also chart, 19 x 30 inches, showing Submarine Telegraph Cables of the World and Principal Land Lines. Full-page portraits of Dr. Nansen and Prof. Wm. H. Dall.*

APRIL.—Seriland, with map and illustration, W J McGee and Willard D. Johnson; The Olympic Country, with map, the late S. C. Gilman; The Discovery of Glacier Bay, Alaska, Eliza Ruhamah Scidmore; Hydrography in the United States, Frederick H. Newell; Recent Triangulation in the Cascades, S. S. Gannett; The Altitude of Mt. Adams, Washington, Edgar McClure.

MAY.—Africa since 1888, with special reference to South Africa and Abyssinia, with map, Hon. Gardiner G. Hubbard; Fundamental Geographic Relation of the Three Americas, with map, Prof. Robert T. Hill; The Kansas River, Arthur P. Davis. *Also portrait of Hon. Gardiner G. Hubbard, President of the National Geographic Society.*

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— OF —

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EFFECTS OF THE EARTHQUAKE WAVE AT


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SEA
OF
APAN
Yokoham
Kobe
Kyoto
Osaka
SHIKOKU
Showing the r

SKETCH MAP OF JAPAN

Showing the region devastated by the earthquake wave of June 15, 1896.

THE

National Geographic Magazine

Vol. VII SEPTEMBER, 1896 No. 9

THE RECENT EARTHQUAKE WAVE ON THE COAST OF JAPAN

By Eliza Ruhamah Scidmore

On the evening of June 15, 1896, the northeast coast of Hondo, the main island of Japan, was struck by a great earthquake wave (*tsunami*), which was more destructive of life and property than any earthquake convulsion of this century in that empire. The whole coastline of the San-Riku, the three provinces of Rikuzen, Rikuchu, and Rikuoku, from the island of Kinkwazan, 38° 20′ north, northward for 175 miles, was laid waste by a great wave moving from the east and south, that varied in recorded height from 10 to 50 feet. A few survivors, who saw it advancing in the darkness, report its height as 80 to 100 feet. With a difference of but thirty minutes in time between the southern and northern points, it struck the San-Riku coast and in a trice obliterated towns and villages, killed 26,975 people out of the original population, and grievously wounded the 5,390 survivors. It washed away and wrecked 9,313 houses, stranded some 300 larger craft—steamers, schooners, and junks—and crushed or carried away 10,000 fishing boats, destroying property to the value of six million yen. Thousands of acres of arable land were turned to wastes, projecting rocks offshore were broken, overturned, or moved hundreds of yards, shallows and bars were formed, and in some localities the entire shoreline was changed.

They were all seafaring communities along this coast strip and the fisheries were the chief industry. The shipment of sea products to the great ports was the main connection with the outer world. A high mountain range bars communication with the trunk railway line of the island, and this picturesque, fiord-cut coast is so remote and so isolated that only two foreigners had been seen in the region in ten years, with the exception of the French mission priest, Father Raspail, who lost his life in the flood. With telegraph offices, instruments, and operators carried away, word came slowly to Tokyo, and with 50 to 100 miles of mountain roads between the nearest railway station and the seacoast aid was long in reaching the wretched survivors. When adequate idea of the calamity reached the capital and the cities, men-of-war, soldiers, sappers, surgeons, and nurses were quickly dispatched, and public sympathy found expression in contributions through the different newspapers, amounting to more than 250,000 yen, for the relief of the injured. The Japanese journalist and photographer were quickly on their way, and the vernacular press soon fed the public full of horrors, yet the first to reach the scene of the disaster was an American missionary, the Rev. Rothesay Miller, who made the usual three days' trip over the mountains in less than a day and a half on his American bicycle.

There were old traditions of such earthquake waves on this coast, one of two centuries ago doing some damage, and a *tsunami* of forty years ago and a lesser one of 1892 flooding the streets of Kamaishi and driving people to upper floors and the roofs of their houses. The barometer gave no warning, no indication of any unusual conditions on June 15, and the occurrence of thirteen light earthquake shocks during the day excited no comment. Rain had fallen in the morning and afternoon, and with a temperature of 80° to 90° the damp atmosphere was very oppressive. The villagers on that remote coast adhered to the old calendar in observing their local fêtes and holidays, and on that fifth day of the fifth moon had been celebrating the Girls' Festival. Rain had driven them indoors with the darkness, and nearly all were in their houses at eight o'clock, when, with a rumbling as of heavy cannonading out at sea, a roar, and the crash and crackling of timbers, they were suddenly engulfed in the swirling waters. Only a few survivors on all that length of coast saw the advancing wave, one of them telling that the water first receded some 600 yards from ghastly white sands and then the Wave stood like a black wall 80 feet in height, with phosphorescent lights gleaming along its crest. Others, hearing a distant roar, saw a dark shadow seaward and ran to high ground, crying "*Tsunami! tsunami!*" Some who ran to the upper stories

SCENES ON THE COAST AT KAMAISHI, JAPAN, JUNE 15, 1896

of their houses for safety were drowned, crushed, or imprisoned there, only a few breaking through the roofs or escaping after the water subsided.

Shallow water and outlying islands broke the force of the wave in some places, and in long, narrow inlets or fiords the giant roller was broken into two, three, and even six waves, that crashed upon the shore in succession. Ships and junks were carried one and two miles inland, left on hilltops, treetops, and in the midst of fields uninjured or mixed up with the ruins of houses, the rest engulfed or swept seaward. Where the wave entered a fiord or bay it bore everything along to the head of the ravine or valley and left the mass of debris in a heap at the end. Where the coast was low and faced the open ocean the wave washed in and, retreating, carried everything back with it. Many survivors, swept away by the waters, were cast ashore on outlying islands, or seized bits of wreckage and kept afloat. On the open coast the wave came and withdrew within five minutes, while in long inlets the waters boiled and surged for nearly a half hour before subsiding. The best swimmers were helpless in the first swirl of water, and nearly all the bodies recovered were frightfully battered and mutilated, rolled over and driven against rocks, struck by and crushed between timbers. The force of the wave cut down groves of large pine trees to short stumps, snapped thick granite posts of temple gates and carried the stone cross-beams 300 yards away. Many people were lost through running back to save others or to save their valuables.

One loyal schoolmaster carried the emperor's portrait to a place of safety before seeking out his own family. A half-demented soldier, retired since the late war and continually brooding on a possible attack by the enemy, became convinced that the first cannonading sound was from a hostile fleet, and, seizing his sword, ran down to the beach to meet the foe. One village officer, mistaking the sound of crashing timbers for crackling flames, ran to high ground to see where the fire was, and thus saved his life. Another village officer, living on the edge of a hill, heard the crash and slid his screens open to look upon foaming waters nearly level with his veranda. In a moment the waters disappeared, leaving a black, empty level where the populous village had been a few minutes before. Four women clung to one man, seeking to escape to high ground, and their combined weight resisting the force of the receding wave they were all saved. The only survivors of another village were eight men who had been playing the game of "go" in a hillside temple. Eight children floated away and left on high ground were believed to be the only survivors of one village, until one hundred people were found who had been borne across and stranded on the opposite shores of their bay. One hundred and fifty people were found cast away on one island offshore. From two large villages on one bay only thirty young men survived, hardy, muscular young fishermen and powerful swimmers, yet in other places the strongest perished, and the aged and infirm, cripples, and tiny children were miraculously preserved. The wave flooded the cells of Okachi prison and the jailers broke the bolts and let the 195 convicts free. Only two convicts attempted to escape, the others waiting in good order until marched to the high ground by their keepers. The good Père Raspail had just reached Kamaishi from his all-day walk of 50 miles over the mountains and entered his inn, when his assistant called to him from the street. The priest came to the veranda, but in an instant the water was upon him. He was seen later, swimming, but evidently was struck by timbers or swept out to sea, as his body has not been recovered. Japanese men-of-war cruised for a week off Kamaishi, recovering bodies daily. The Japanese system of census enumeration is so complete and minute that the name of every person who lost his life was soon known, and the *Official Gazette* was able to state that out of a population of 6,529 at Kamaishi 4,985 were lost and 500 injured, while 953 dwellings and 867 warehouses and other structures were destroyed or carried away, and 176 ships carried inland or swept out and lost.

The survivors were so stunned with the appalling disaster that few could do anything for themselves or others. With houses, nets, and fishing-boats carried away and the fish retreating to further and deeper waters, starvation faced them, and, the great heat continuing while so many bodies were strewn along shore and imprisoned in ruins, the atmosphere fast became poisonous. The north-coast people are opposed to cremation and insisted on earth burial, which delayed the disposal of the dead and augmented the danger of pestilence. Disinfectants were sent in quantity, and the work of recovery and burial was so pressing that soldiers were put to it after all available coolies had been impressed. The Red Cross Society, with its hospitals and nurses, had difficulty in caring for all the wounded, the greater number of whom, besides requiring surgical aid, were suffering from pneumonia and internal inflammations consequent upon their

SCENE ON THE COAST OF THE ISLAND OF HONDO, JAPAN, AFTER THE EARTHQUAKE WAVE OF JUNE 15, 1896

long exposure in wet clothing without shelter and from the brine, fish oil, and sand breathed in and swallowed while in the first tumult of waters. Besides the generous relief fund subscribed by the people, the government has made large assignments from its available funds and sent stores of provisions, clothing, tools, etc., to the 60,000 homeless, ruined, bereaved, and starving people of the San-Riku coast.

The wave was plainly felt two hours later on the shores of the island of Yesso, 200 miles north of the center of disturbance on the San-Riku coast, the water advancing 80 feet beyond high-tide mark on the beach at Hakodate. Eight hours later there was a great disturbance of the waters on the shores of the Bonin islands, more than 700 miles southward, the water rising three or four feet and retreating violently. Six hours later, on the shores of Kaui, the most northern of the Hawaiian islands, distant 3,390 miles, the waters receded violently and washed on shore in a wave some inches above the normal height.

The plainest inference has been that the great wave was the result of an eruption, explosion, or other disturbance in the bed of the sea, 500 or 600 miles off the San-Riku coast. The most popular theory is that it resulted from the caving-in of some part of the wall or bed of the great "Tuscarora Deep," one of the greatest depressions of the ocean bed in the world, discovered in 1874 by the present Rear-Admiral Belknap, U. S. N., while in command of the U. S. S. *Tuscarora*, engaged in deep-sea surveys.

The "Tuscarora Deep" is nearly five and one-third statute miles in depth, being exceeded, so far as known, only by the still more profound depths discovered last year in the South Pacific by Commander A. F. Balfour, of the British Navy.*

That disturbances were taking place in this tremendous abyss was again suggested at six o'clock on the morning of July 4, when the Canadian Pacific Railway Company's mail steamer *Empress of Japan*, sailing directly over it in a smooth sea, was shaken as if a propeller blade had been lost or the ship had struck an obstruction. Every one was roused by the peculiar shock, but no visible explanation was furnished. The destructive wave and this incident together should stimulate further investigation of this dangerous, bottomless pit of the Pacific ocean, which owes its discovery to United States explorers by deep-sea soundings.

*See Nat. Geog. Mag., vol. vii, p. 252.

THE RETURN OF DR NANSEN

The National Geographic Magazine rejoices in the safe return and in the extensive geographic explorations of Dr F. Nansen, Captain O. N. Svendrup, and their companions in the *Fram*. Nansen entered the pack in September, 1893, in 78° 50′ north, 134° east, to the northwest of the New Siberian islands. This drift was in the same general direction as that of De Long in the *Jeannette*. The *Fram* barely escaped destruction by the action of the ice, but it reached by March, 1895, 83° 59′ north, 102° west. At this point Dr Nansen, with one companion, reached, April 7, 1895, by dogs and sledge over the frozen sea. 86° 14′ north and about 95° east, a point 2° 51′ farther north than was made by Lockwood and Brainard, of the Greely expedition. Nansen for some unexplained reason did not return to the *Fram*, which was left in command of Captain Svendrup, but started for Spitzbergen via Franz Josef land. He reached, August 6, 1895, in 81° 38′ north, 63° east, outlying ice-capped islands of the Franz Josef archipelago, and wintered in the vicinity. Subsisting on bear and walrus meat, he almost miraculously met the Jackson-Harmsworth party wintering on Franz Josef land and was brought safely by them to Vardö. Nansen's experiences were astounding in character, and his safe return results from a combination of courage, endurance, and self-helpfulness, supplemented by good fortune, unequaled in the annals of Arctic exploration.

Svendrup's return with the *Fram* happily ends the fears that were entertained for the safety of the vessel on Nansen's return. It would seem, in the absence of definite information, that the *Fram* drifted to the northward of Franz Josef land and Spitzbergen and came into open water to the northwest of the latter land. No land was discovered to the north of the eighty-second parallel, and the archipelago discovered by the Greely expedition remains the most northerly land known. The very deep water, 2,185 fathoms, found by Svendrup indicates an extension to the north and east of the great deep existent between Spitzbergen and Greenland, and renders it improbable that any extensive land lies to the north of Franz Josef land or Spitzbergen.

Thus by boldness and energy, rivaling those qualities of their Scandinavian ancestors, have Nansen and Svendrup rolled back for admiring mankind, to an extent unequaled in this age, the Ultima Thule of the North.

DESCRIPTIVE TOPOGRAPHIC TERMS OF SPANISH AMERICA*

By Robert T. Hill,

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"Did it ever occur to the reader how poverty-stricken the (I will not say English exactly, but) Anglo-American language is in sharp, crisp, definite topographic terms? English writers seem to have gathered up a moderate number of them, but they got most of them from Scotland within the past thirty or forty years. They are not a part of our legitimate inheritance from the mother country. In truth, we have in this country some three or four words which are available for duty in expressing several scores of topographic characteristics. Anything that is hollow we call a valley and anything that stands up above the surrounding land we call a hill or mountain; but the Spanish—or Mexican, if you prefer—is rich in topographic terms which are delightfully expressive and definite. There is scarcely a feature of the land which repeats itself with similar characteristics that has not a pat name; and these terms are euphonious as well as precise. They designate things objective as happily and concisely as the Saxon designates things subjective; therefore we use them."—Major C. E. Dutton, "Mount Taylor and the Zuñi Plateau," pp. 126-127, Sixth Annual Report, U. S. Geological Survey, 1884-'85.

An appropriate generic name should be provided for every possible form of the earth's surface, so that when referred to it may be as readily recognized as are the parts of a building in an architectural description. The nomenclature of geographic processes has far outstripped that of topographic forms, so that pages of literature are burdened with sentences descriptive of ordinary unnamed features of the landscape that should be expressed by simple designations. The English language is exceedingly sterile in topographic adjectives and substantives, and such words as we possess are ambiguously applied to many different specific forms.

All topographic forms may be reduced to four distinct generic categories—eminences (protuberances), plains, valleys, and declivities. Each of these has variations productive of a large number of specific forms, passing one into another.

* Prepared for a report to the Director of the U. S. Geological Survey on the geography of the Texas-New Mexican region of the United States.

The English pioneers gave to the topographic features of America only a few names. Eminences they described as mountains, hills, knobs, chains, ranges, lone mountains, and lost mountains. They called valleys lake valleys, basin valleys (a very ambiguous term), and river valleys. I cannot at present recall any established English words for varieties of plains. The words we use for these—plateaux, savannas, etc.—are all foreign terms. For declivities we have slope, bluff, terrace, escarpment, bank, etc. Possibly the paucity of descriptive words for plains is due to the fact that in England, where the English language developed, plains are not conspicuous topographic features.

In the portions of America settled or explored by the Spanish race there is a remarkable stock of appropriate descriptive topographic terms, as can be ascertained by studying and translating the names upon any of the maps of southwestern United States. Although unfamiliar to eastern ears, these words are as euphonious as some of those invented by modern geographers. They also bear the stamp of priority, for they were probably applied to the features they now adorn before the English settled on the North American continent, and they have since been in constant use by the people of the region. They appear also on published maps, and nearly every word used in this paper is taken from some printed map of New Mexico, of the adjacent border states of Mexico, or of Trans-Pecos Texas.

It should, perhaps, be stated that the present article is not written from the standpoint of a philologist, and may not even bear the close criticism of a linguist. It is an outgrowth of the writer's habit of looking up the meaning of names encountered in his travels in Spanish America. Finally, on taking stock of the words collected, he has found that they cover nearly every possible topographic form in the region. These terms, as applied in America, may not exactly coincide in meaning with Castilian usage, but they are now Americanized and in daily use. They are now submitted to the criticism of intelligent geographers. Many of them may seem unnecessary and even useless, but there are some admirable ones that will survive and that in their anglicized form must be adopted in any scheme of geographic nomenclature which would seek to have an appropriate general term for every possible topographic form.

NAMES APPLIED TO PROTUBERANCES (MOUNTAIN FORMS)

The following names of protuberances above adjacent regions, known to us as mountains and hills, are preserved in the cartographic literature of Spanish America:

Eminencia,	Picacho,	Tinaja,
Montaña,	Peña,	Sandia,
Cerro,	Candela,	Pelado,
Cerrillo,	Pelon,	Pico,
Loma,	Peloncilla,	Cumbre,
Lomita,	Teta,	Cuchilla,
Cordillera,	Tejon,	Chiquito.
Sierra,	Huerfano,	

Eminencia.—A generic term for any kind of mountainous or hilly protuberance.

Montaña.—A generic term for mountain, exactly synonymous with the English word mountain as used in distinction from hill.

Cerro.—A single eminence, somewhat intermediate between our conceptions of hill and mountain. It is an eminence of too great an altitude to be called a hill, but yet too low to be called a mountain.

Cerrillo.—The diminutive of cerro; printed cerrito on many maps.

Loma.—A hill; a rising ground in the midst of a plain.

Lomita.—A small loma.

Certain terms applied to mountains convey an idea of their arrangement:

Cordillera.—This term is used in a collective sense for a mass of mountains as distinguished from single mountain summits. For illustration, the Rocky mountain region of the North American continent, or, as called by others, the cordilleran region, is divisible into a number of areas where the crests are numerous and compactly crowded. These areas are separated from one another by intervals of a less mountainous character. The areas of multiple masses are cordilleras. For instance, the eastern front of the Rocky mountain region is composed of the Montaña, Colorado, Guadalupe, and Mexican (eastern Sierra Madre) cordilleras.

Sierra.—This name is used in the singular for a mountain mass, range, or block of elongated outline, usually with a serrated crest. A group of sierras, such as any Mexican Sierra Madre, may constitute a cordillera.

The following words are descriptive of the forms of single mountains or hills:

Picacho.—A peaked or pointed eminence.

Peña (the end of the mizzen-mast).—A needle-like eminence. Examples, Peña Oscura, New Mexico; Peña Colorado, Texas.

Candelas (candles).—A collection of peña summits. Example, Sierra Candela, of the state of Coahuila, Mexico.

Pelon.—A bare conical eminence, having the outline of a sugar loaf.

Peloncilla.—The diminutive of pelon. Example, Brackett sheet, Texas.

Teta.—A solitary, circular mountain having the form of a woman's breast. The French word *mamelon* is also used synonymously for teta in the isthmus of Panama, generally for a lower eminence, however. *Teton* is used in the United States and Canada.

Tejon (disk-shaped) and *huerfano* (orphan) are also used for circumscribed eminences. The latter is applied especially to solitary eminences standing far away from kindred masses.

Tinaja.—A solitary, hemispherical mountain, shaped somewhat like the inverted bottom of a Mexican olla. The term is more generally used, however, for water holes or natural bowls.

Sandia (watermelon).—An oblong, oval, or rounded eminence. Example, the Sandia range of New Mexico.

Pelado.—A barren, treeless mountain.

Other appropriate words describe the relative parts of a mountain or mountains:

Cumbre.—The highest elevation or highest peak of a sierra or cordillera.

Pico.—A summit point.

Cuchilla (knife).—A useful term for the salients or comb-like, secondary crests which project at right angles between the lateral drainage originating on the sides of a sierra. Example, the Cuchilla de Baracoa of Cuba. It is equivalent to the French *arête*.

The adjective *chiquito*, meaning little, is applied to minor secondary fringing elevations accompanying the base of a sierra or cordillera, such as "hogbacks."

NAMES APPLIED TO PLAINS

The arid region of North America is about equally divided into mountains and plains. The plains belong to four great topographic categories, which in the rich Spanish nomenclature of the region may be termed *mesas*, *bolsons*, *plazas*, and *cuestas* (including *bajadas*). *Mesas* are summit plains; *cuestas* and *bajadas* are inclined plains, which can also be classed as declivities; *plazas* and *bolsons* are valley plains or flat-bottomed valleys.

The term *mesa* means, literally, a table. It is a flat surface on the top of hills or mountains. In New Mexico it is applied not only to the table-lands of a circumscribed summit, but to extensive level benches abutting against higher eminences and bounded partially by escarpments called *cejas*. Extensive mesa regions are usually called by Americans plateaux.

Mesas of New Mexico and of the Trans-Pecos region of Texas are of three general types: plateau mesas, bench mesas, and cuesta mesas. The plateau mesa is a circumscribed summit whose continuity with other areas has been destroyed by erosion. The bench mesa is a bench or shoulder projecting against a region forming a higher background. Bench mesas may be classified by structure into bolson mesas, stream-terrace mesas, talus-fan mesas, and malpais mesas. A bolson mesa is a bench mesa forming the outer escarpment of a drainage valley which has been cut through a bolson. Example, the El Paso mesa. Stream-terrace, talus-fan, and malpais mesas are self-explanatory terms.

A *cuesta* is a structural plain, so tilted that it has a perceptibly sloping surface. The cuesta is, in a manner, a transitional feature between mesa and mountain. The Cuesta del Burro of the Marfa, Texas, sheet of the United States Geological Survey is an example.

*Bolson.**—The third type of plain is the bolson. Bolsons are basin valleys which have not, or originally had not, any outflowing drainage, and are lined with sedimentary debris derived from the surrounding country.

A *plaza* † may be defined as the sublevel floor of an extensive, wide, flat valley lying between the cejas of mesas. In conception it resembles a cañon in being limited by cliffs, but differs from a cañon in the element of narrowness, the floor of a plaza being an exceptionally wide valley plain. Example, Plaza Larga, the flat valley of a southern tributary of the Canadian, in New Mexico, near the Texas line. The valleys of the Pecos and Canadian rivers in eastern New Mexico are plazas of great magnitude.

Mesas and cuestas are structural plains, representing surfaces resulting from the survival of hard layers of rock.

The plaza is a degradational plain, lying between steep escarpments, and formed by the cutting away of the hard, rock floor of the mesas through the underlying unconsolidated beds, to still lower strata of harder rock beneath it.

The bolson is an aggradational plain, formed by the filling up of ancient structural and erosion valleys by the debris of the marginal country.

The edges of the rock-sheets composing mesas in some instances upturn into mountain structure. The mountain structure sometimes flattens out into mesa structure.

The cuesta is a transitional feature, and connecting step between the mountain, mesa, and bolson. When a cuesta slopes toward a mountain and has its ceja or escarpment on the side farthest from and subparallel to the mountain range, the valley

* Literally a large purse. Example, Bolson de Mapimi. Lake Bonneville is a bolson.

† Literally an open, level area, such as a public square, a market place, or a drill ground. Applied in topography to local stretches of level, scarp-bordered valleys, in a generally hilly region.

lying between this and the mountain may become a bolson, and the highest crest of the escarpment of the cuesta may represent a simple monoclinal summit of the type defined by Russell and Gilbert as "basin ranges." The escarpment of a cuesta is often produced by a fault running parallel with it, and still another bolson may be developed in the trough thus formed at its foot. This process, many times repeated, produces alternations of bolson plains and of basin ranges of the cuesta type.

Bolsons always lie in valleys between the mountains, mesas, or cuestas, and are of subsequent origin.

Mesas are remnants of plains, once more extensive, but now constantly diminishing in area by degradation. Plazas are plains cut out of mesas, representing areas from which the mesas have been removed, and, conversely to the mesa, are increasing in area. Bolsons are ancient valleys which have been and usually are still being filled up by degradation of the surrounding mountains, mesas, and cuestas. The mesa plains in general constitute the plateau regions bordering the lateral and terminal portions of cordilleras, and occur chiefly as the platform surrounding the eastern line of the Rocky mountain cordilleras.

The plazas lie mostly east of the true mountains, principally along the Pecos and Canadian valleys of New Mexico, but are especially developed in the plateau countries wherever the formation known as the Red Beds enters into the substructure.

The bolsons generally lie interiorward of the plateau (mesa) regions bordering the interior side of the easternmost ranges of the cordilleran front and usually increase in area westward.

The chief plaza countries of the Southwest are from 2,000 to 4,000 feet in altitude. The altitude of the mesa country varies with the continental slope, but around the Rocky mountain region has an average of more than 5,000 feet. The bolsons usually lie between 4,000 and 5,000 feet, although some of them are below sea level.

NAMES APPLIED TO DECLIVITIES

The terms applied to declivities are:

Ceja,	Puerto,	Escabrodura,
Cejita,	Bajada,	Balcones.

Ceja.—The late General Albert Pike wrote the first description of which I find mention of the great escarpment constituting the eastern breaks of that portion of the mesa (plateau) of the plains known as the Llano Estacado. I have been unable to find his book, but George Wilkins

Kendall, who wrote the "Narrative of the Texan Santa Fé Expedition," * refers to it in describing the breaks or escarpment near Red river as follows: "The Mexicans who started with Albert Pike in his journey across the prairie spoke of this steppe and gave the name of Las Cejas, or the Eyebrows, to the singular range.[†] Mr P. appears to have passed to the south of the steppe."

The word ceja literally means a fringe, selvage, or border, and in topography is used for the escarpment cliff of a mesa. I was agreeably surprised to find this word used in its literal sense as the escarpment or mesa in three widely separated localities on the United States Land Office maps of New Mexico—the Ceja de los Comancheros, the Cejas de Galisteo, the Cejitas Blanca. If there is any feature more conspicuous than others in the arid region of New Mexico it is these cejas, extending for miles and miles across the country as far as the eye can see.

Cejita is the diminutive of ceja and is a very appropriate word for lines of low escarpments which are frequently met with. These are usually a secondary accompaniment of the larger cejas. For instance, where a mesa has a compound escarpment the uppermost cliff constitutes the predominating ceja, while its lower slopes reveal smaller benches in terrace-like arrangement, the faces of which may appropriately be called cejitas.

Puerto.—In the account of the Texan Santa Fé expedition is found a description of how the party wandered for miles along the mesa edges trying to find a place where they could descend the cejas of the northern edge of the Llano Estacado. Such a place, made by the flattening of the gradient of the caletas forming the headwater drainage, was called a puerto, which may be defined as a drainage notch through a ceja or sierra.

Bajada.—The term bajada literally means a gradual descent. I find it used upon the maps of New Mexico and applied to a gradually descending slope as distinguished from a more vertical escarpment. Example, the Bajada de los Comancheros. I take the liberty of proposing to limit the use of this term to extensive slopes of degradational and aggradational origin.‡ Bajadas of the latter kind are composed of talus and often constitute extensive features, such as that shown west of the Rio Grande on the Santa Clara, New Mexico, sheet of the United States Geological Survey. This definition is made in order to distinguish between a bajada and a cuesta, the latter being a tilted structural plain.

Escabrodura.—Literally the place where a chicken has scratched. In Featherstone's account of the Santa Fé Expedition § he describes how the party became lost and entangled in the escabroduras lying eastward of the ceja of the Llano Estacado. These were nothing more than the in-deeply eroded regions we know as Bad Lands. The bases of nearly all the cejas grade into extensive regions of escabroduras.

Balcones (balcony).—This name has been specifically applied and is

* Narrative of the Texan Santa Fé Expedition, by George Wilkins Kendall. Vol. i, page 250. London, 1844.

† It will be well to remember that in all the old explorations the great escarpments of the mesas are called mountains or ranges.

‡ There should be a term for each of these kinds of slope.

§ Journal of the Royal Geographical Society, 1843.

still used for the line of hills forming the scarp of the plateau region of Texas, between Austin and the Rio Grande.

NAMES APPLIED TO STREAMS AND STREAM VALLEYS

The Spanish language, judging from the application of the terms, is exceedingly rich in appropriate names for both stream courses and the forms of the stream basins. The following are a few of the words applied to the streams proper:

Rio.—A flowing river; the arterial trunk of a drainage system.

Cala.—A creek, corresponding to the laterals of the main drainage.

Caleta (leading into).—This is a useful word for the ultimate and smallest headwater ramification of a cala or lateral. It is synonymous with the term "draw," used in the middle Plains region of the United States, the "coulee" of Montana, and "drain" as used in Colorado.

Arroyo.—A streamway, ordinarily dry, in which water occurs only immediately after a torrential rainfall.

There are also many terms describing certain characteristic aqueous conditions frequently met with in our arid region, such as ojo, agua, tinaja, cienega, ensenada, laguna, etc.

The Spanish language likewise presents a rich assortment of appropriate terms descriptive of the form of the stream valley or drainage basin.

Barranca.—A gorge of the first magnitude in a mountain region. The valley of the Arkansas through the Rockies is a barranca; the Royal gorge is a cañon in the lower portion of the barranca.

Cañon.—A generic term for a streamway having very steep walls and a narrow gorge. Its use conveys two ideas, verticality of wall and narrowness of the valley.

Cajon.—A cañon having vertical walls like the sides of a box.

Tijera.—A cañon with angular walls having the profile of a letter V.

Cañoncita.—A small cañon.

Cañada.—The smallest cañon.

Plaza.—The plaza described under the general head of plains belongs also under the head of drainage valleys. It resembles the cañon in that it is bordered by subvertical walls, but differs in that its bottom instead of being narrow is of great breadth.

Rincon.—Literally a corner; a short, wide arm of a plaza indenting a mesa, receiving drainage at its inner end, and opening into a plaza.

Quebrada.—This word literally means a ravine, and is extensively used in Guatemala and other Central American states.

Boca (mouth).—Where a streamway suddenly leaves a barranca, tijera, cañon, or other precipitous gorge, and debouches on a plain, the point is called a boca. The bocas of Spanish America are conspicuous and interesting features.

Foso (a ditch).—A streamway without conspicuous banks or bluffs.

Callejon.—A deep and narrow pass through a sierra.

Angostura.—A narrow pass through a ceja.

The foregoing words cover nearly all the characteristic topographic forms of the arid region of Spanish America for which we have no good English equivalents. There remain, however, two interesting unnamed forms of valleys in the arid region for which I have as yet found no appropriate Spanish words. One of these is the elongated headwater indentation of a streamway into a mesa, having cañon walls and a notable area of flat, wide bottom. This type of cañoned streamway is especially developed along the coastward side of the Great Plains south of the Arkansas, and particularly along the Llano Estacado and Edwards plateau, where the heads of all the principal drainage incise the plains in this manner. The wide, flat bottoms of the streamway have often been partially refilled by later aggradational material. This form of valley is to a certain extent an elongated rincon. It may also be conceived as a narrow plaza. The home of the Quohado * band of Comanche Indians was in a cañon of this character where the Red river indents the Llano Estacado. For the want of a better name, the term *quohado* could be provisionally used for this type of valley.

Nearly all the stream valleys described above are the result of normal drainage following the inclination of a sloping plain or mountain side. Occasionally, however, the seaward progress of a stream is opposed by an interior-facing escarpment which must be crossed. Without here stopping to describe the method by which this has been accomplished, it may be stated that there are usually great V-shape valleys indenting the escarpment at such places, constituting a feature resembling a rincon, but differing from it in that the apex of the V points down stream instead of toward the headwaters, and in that it receives the drainage at its wider end instead of discharging it therefrom. Although the Spanish language has failed to name this feature, the cowboys have called it the "Fry-pan valley." This form of topography is a conspicuous feature of the Texas region.

In conclusion, let us illustrate the appropriateness of some of these terms by direct application to the Rocky mountain and Great Plains region. This, as a whole, is composed of great masses of mountains, cordilleras, and single ranges called sierras. Besides these, there are many more or less small, isolated peaks—tetas, mamelons, sandias, cerros, etc. The principal cordilleras

* It was at one time suggested that the word Quohado was a corruption of Quebrada, but Mr James Mooney informs me that such is not the case, Quohado being a Comanche word signifying outside

are as follows, beginning at the north and east: The Montaña cordillera, the Colorado cordillera, the Guadalupe cordillera, and the cordillera of the eastern Sierra Madre. Each of these grades westward into a great mesa or plateau region. The Columbia plateau borders the Montaña cordillera. The Colorado plateau lies west, southwest, and southeast of the Colorado cordillera. The Guadalupe cordillera is bordered on the west by a relatively smaller, but nevertheless extensive, plateau, known as the Sierra Diablo, which appears as a diminutive feature on the map. The eastern Sierra Madre of Mexico likewise flattens out westward into an extensive plateau region, which, for the want of a better name, I call the Parras plateau. The plateaus become tilted in places into cuestas, and, by faulting, the latter grade into sierras of the basin-range type, separated by bolsons. Each of the plateau regions is thus bordered on the west and south by great regions of bolsons and basin ranges. The Colorado plateau is bordered on the west and southwest by the Great Basin region of Powell and Gilbert, and on the southeast by the Coahuilan bolson region.

There are also internodal areas of mesa-like topography between the ends of the cordillera masses of the Rocky mountain systems, such as that lying between the southern end of the Colorado cordillera and the northern end of the Guadalupe cordillera. The great cordillera in western Mexico known as the Sierra Madre passes at its northern end into the Colorado plateau (not into the California sierras, as often supposed), and constitutes a partial barrier between the Coahuilan bolson region of Mexico, Trans-Pecos Texas, and New Mexico, and the great bolson (basin) region of Utah and Nevada.

The plateaus of the plains lying east of the Rocky mountain region south of Arkansas river are collectively a series of mesas overlooking broad plazas and separated from them by escarpments. The conspicuous plaza regions are the Canadian and Pecos valleys of New Mexico. The great Central Denuded region of Texas, Oklahoma, and southern Kansas is also mostly a plaza region. On the east are Cretaceous prairies of Texas, which we have described as dip plains; these are incipient cuestas. The Central Denuded region lying between the westward-facing scarps of these prairies* on the east and the eastward-looking scarps of the plains on the west is collectively a great plaza country.

* The old border of Appalachia forms the eastern boundary of this region, north of the Ouachita mountain system of Indian Territory.

The escarpments bordering the mesas and surrounding the plaza countries can also be readily described in this nomenclature. Theoretically, the simplest scarp form may be merely a ceja or cliff, but in this region, where hard and soft layers alternate, the escarpments are nearly everywhere compound, consisting of a surmounting ceja cornice, leading down by slopes (bajadas) and cejitas to a lower pediment, usually made of escabroduras (bad lands).

Let us also see how these terms will apply to the description of what we commonly know as drainage basins.

East of the mountains the two through-flowing streams of major magnitude, the Pecos and Canadian, pass from mountains into mesa regions and thence to plazas. The streams of second magnitude, such as the Red, Brazos, and Colorado, originate on mesas and pass through rincons or quohados into plazas. The streams of both these classes leave the plaza countries through fry-pans. The fry-pan of the Pecos is the southern end of the Pecos plaza where this stream, near the thirty-first meridian, enters a cañon made by the gathering walls of the Stockton and Edwards plateau. The Colorado, west of Austin, finds its way across the western escarpment of the Grand Prairie by means of a similar fry-pan valley. The Brazos, Colorado, Trinity, and Red river all make similar fry-pan indentations into the western edge of the Grand Prairie escarpment.

The Canadian may be thus described: The caletas leading down from the cuchillas of the Snowy range in the mountainous portion of the stream quickly gather into tijeras. Reaching the Ocate and Las Vegas mesas, the streamway through them is a cañon. The boca of this cañon is where the stream enters the plaza region, between the thirty-fifth and thirty-sixth parallels. From the boca to the 102d meridian the streamway threads the plaza country of the Canadian, only limited on either side by the great cejas of the Llano Estacado on the south and of the Las Vegas mesa on the north. The plaza of the Canadian as a whole is subdivided by cejitas into numerous successive plazas. The stream leaves the plaza country through a fry-pan and traverses the eastern portion of the plateau of the Plains through a cañoncita. This cañoncita also has a boca near the 100th meridian, marking the entrance of the river into the still greater plaza of the Central Denuded region. Here the topography again changes, the center of the streamway becomes a sand plain, while its margins are denuded divides of the type called escabroduras or bad lands.

The Rio Grande, like the Canadian, has its caletas in the Rocky mountains, gathering into tijeras, but the remainder of its course is quite different. It soon enters the great bolson of San Luis valley and continues in a longitudinal direction through a chain of bolsons the entire distance across New Mexico and into Texas as far as Quitman mountains. Thence, until the Cordilleras are crossed, it flows through great barrancas. Leaving the mountains, its course through the Stockton plateau is a typical cañon, finally merging into the low country of the Rio Grande embayment.

THE WEATHER BUREAU RIVER AND FLOOD SYSTEM

By Professor WILLIS L. MOORE,

Chief of the Weather Bureau

The special work of the Weather Bureau in connection with the rivers of the country is to facilitate commerce on navigable streams by the daily publication of information as to water stages along the course of each river, and to issue timely warnings of floods, with a view to the saving of life and property.

On January 1, 1896, the Weather Bureau river and flood system consisted of 145 special river stations, equipped with standard river-gauges for measuring the vertical rise of the surface of the water, and in many cases with standard thermometers for measuring air temperature. These stations were manned by local observers, receiving from the Weather Bureau pay commensurate with their services. There were 42 rainfall stations, equipped with rain-gauges and manned by local-paid observers, and so distributed in the various catchment basins of the tributaries to important rivers as to give, in connection with the regular meteorological Weather Bureau stations, a fair approximation to the average rainfall throughout each watershed. There were 38 completely equipped meteorological stations of the Weather Bureau where river measurements were made, and 16 Weather Bureau stations which were centers from which flood warnings and forecasts of expected changes in river level were issued.

As yet the rules of flood forecasting are largely empirical. The official in charge of a river center is familiar with the main river and its tributaries, the area and topography of the catchment basin, the frequency, and especially the intensity, of the rainfall, the average time occupied in the passage of flood-crests from one station to another, and the history of past rises. The knowledge of low-water conditions, especially where bars and shoals exist, is perhaps of as great importance as the knowledge of high water. In fact, many statements are received at the central office in Washington from steamboat and navigation companies to the effect that low-water conditions continue longer and affect navigation more than those of high water. The people living in regions contiguous to navigable streams are materially affected in their industries by the conditions of navigation, but the destruction of life and property, as effected by the rivers, depends entirely upon flood conditions. The official in charge of a river center is expected, with the data at his command, to give information to those interested in navigation, even during low or medium stages of water, that is of great pecuniary value; but his chief and foremost duty is the dissemination of warnings when floods threaten.

Many data in regard to river stages have been published by the Weather Bureau, the Mississippi River commission, and the U. S. Signal Service. From the data thus collected and now covering many years at some stations and shorter periods at others, the following general relations have been deduced: The time it takes high water to pass from Pittsburg to Wheeling is one day; from Pittsburg to Parkersburg, two days; from Parkersburg to Cincinnati, three days; from Cincinnati to Cairo, six days; from Cairo to Vicksburg, seven days, and from Vicksburg to New Orleans, four days. From Pittsburg, therefore, to the Gulf requires 22 days. Similar general relations concerning the movements of other rivers have been determined. Since the time of travel is so great, it naturally follows that many interfering conditions arise tending to accelerate or retard the crest of the flood-wave. No simple time rules are therefore possible. The volume of water passing a station in a given time is known for only a few places, and varies, of course, with high and low water; nor can simple rules be based upon the rainfall, as the absorptive condition of the soil is not constant and the distribution of precipitation over the drainage area is not always determinable.

The principal rivers concerned in the Weather Bureau system are the Alleghany, Monongahela, Ohio, Kanawha, Wabash, Illinois, Tennessee, Cumberland, Mississippi, Missouri, Arkansas, and Red rivers of the central valleys; the Columbia, Sacramento, and San Joaquin of the Pacific coast, and the Hudson, Susquehanna, Potomac, Savannah, Chattahoochee, and Alabama of the Atlantic and east Gulf coast. Gauging stations are most numerous on the rivers of the central valleys, and rainfall stations are more numerous throughout the catchment basins of these rivers than they are on the combined rivers of the Atlantic and Pacific coasts.

The river-flood service of the Bureau was reorganized on July 3, 1893, and the duty of warning communities resident along the great rivers placed in the hands of local forecast officials at the principal river centers. Each forecaster in charge of a river center has a definite section of the river system of his district to watch and forecast for. He receives the necessary telegraphic reports of rainfall that has occurred over the tributaries in his river district. the daily telegraphic data as to gauge readings nearer the source of the main river than his own station, and also gauge readings on many of the tributary streams. Each forecaster is familiar with the area of the catchment basin from which his rainfall reports are received, the contour and configuration of the surface, and the permeability of the soil. A slowly falling rain of considerable volume on a nearly level and permeable soil may cause little rise, while a rapidly falling rain of the same amount on an impermeable and greatly inclined surface will gather quickly in the channels of tributaries and soon become a rushing torrent in the main stream. Local forecasters are furnished with all the data available relative to the history of previous floods, and are consequently equipped as completely as possible for the work before them. In view of this fact and of the ability and experience of the men employed on this importanty duty, it is believed that no disastrous rise can occur in the future without adequate warning of the same having been given to all concerned.

The territory assigned to each forecast district is as follows: New Orleans: Mississippi river from Vicksburg to its mouth and the Red and Ouachita rivers; Vicksburg: the river from Memphis to Vicksburg; Cairo: that section of the Ohio from Evansville to Cairo and of the Mississippi from St. Louis to Memphis; St. Louis: the Mississippi from Davenport to St. Louis and the Missouri east of Kansas City; Omaha: the Missouri from Kansas City northward; Cincinnati: the Ohio and its tributaries from Evansville to Marietta; Nashville: the Cumberland, Chattanooga, and Tennessee rivers; Montgomery: the rivers in Alabama; Little Rock: the Arkansas; St. Paul: the Mississippi above Davenport; Harrisburg: the Susquehanna; Augusta: the Savannah; Portland, Oregon: the Snake and Columbia; San Francisco: the Sacramento and San Joaquin.

A river bulletin-board has been placed on some of the principal steamboats leaving Cairo, so arranged that the river stages can be read by people on shore and on passing steamers. Thus pilots ascending or descending the river get the latest information as to the height of the water at the places to which they are bound.

The river-gauge is a graduated scale on which the height of the river is measured. The zero of the gauge is usually at or somewhere near the level of the lowest water known. A gauge is generally vertical, is usually fastened to a bridge, pier, or piling, and is of sufficient length to cover the greatest height of water likely to occur. When a river-gauge cannot be set vertically, it is laid on the bank according to the slope of the ground. The foot-marks on a gauge of this kind must be accurately located by means of a spirit-level, so as to agree with those on a vertical gauge. When a stage of water below the zero occurs, it is read as a minus stage. It is not desirable to change the zero point after readings made from that basis have continued for any length of time.

It may be of interest to know that on account of the narrowness of the valley and the precipitous shore line of the Ohio the water in this river must show a rise varying from 30 to 50 feet before the danger line is reached. At Cincinnati the danger line is 45 feet above the zero of the scale, and a height of 71 feet above zero has been recorded. On the upper Mississippi the danger line averages about 15 feet above zero, but from St. Louis southward to Vicksburg it averages about 35 feet, while at New Orleans, with its great system of levees, the danger limit is but 13 feet above zero.

In the early history of the river system the data received from the various river stations, though meager, were sufficient to permit useful warning of marked changes in the river levels. In the spring of 1874 this branch of the Bureau had its first experience with destructive floods. In that year floods devastated the valleys of the lower Mississippi, the Arkansas, White, Red, and other rivers, causing crevasses in the levees and inundating large areas of bottom lands in the Mississippi delta. The value of the special reports which were telegraphed at that time by the Weather Bureau (or Signal Service Office, as it then was) could scarcely be determined. They were the only reports sent directly to the people of the flooded districts, and showed daily the coming rise or fall of the water. A study of these floods showed the necessity of establishing for each of the rivers a certain depth of water above which the stages were dangerous to river interests. These points were designated as "danger levels" and "danger lines," and were established for the Mississippi, Missouri, and Ohio rivers during that year. In prosecuting this work, data from the best available authorities were collected and compiled for the construction of a chart of the basins and watersheds of the principal rivers. A river slate was designed, on which were outlined the average grades of the beds of the various rivers at different parts of their courses. The object in preparing this chart was to facilitate the tracing of flood-waves and their movement from one place to another. When an unusually heavy rain was noted in any watershed, it was known into what rivers it must flow and approximately the rise that would result. A knowledge of the rapidity with which the flood would travel and of the rivers it would pass made it possible not only to follow its course, but also to give timely warning of its approach.

Some idea of the vast destruction of property by floods may be gathered from the statement that the floods of the spring of 1881 and of 1882 caused a loss of not less than $15,000,000 to the property interests of the Ohio and Mississippi valleys. It may also be noted that the flood of the spring of 1882 caused a loss of 138 lives in the region from Cairo southward to New Orleans.

In forecasting stages of water during such flood periods as the two mentioned, it must be borne in mind that precipitation may be only an inconsiderable factor. In those cases vast quantities of snow, which had accumulated during the winter, overlay the northern states, and with the early rains of spring came abnormal heat, causing a very rapid melting of the snow lying over many of the watersheds. In these floods it is probable that the sudden coming of abnormally high temperatures was a more potent influence than the immediate precipitation.

The floods of 1884 began in the Ohio valley in February, when the river reached the highest stage on record. The Mississippi river from Cairo to the Gulf also reached a very high stage. Ample and timely warnings were telegraphed to all available points throughout the Ohio valley, and the resources of the Bureau were taxed to the utmost in the interests of the flooded districts. The damage caused in the Ohio valley by this flood could hardly be calculated. In the region about Cincinnati alone the loss of property was variously estimated at from $10,000,000 to $25,000,000.

From June, 1889, to July, 1893, the care and supervision of the flood service of the Bureau were entrusted to a single individual, and a considerable extension of the system was made in the way of establishing rainfall stations near the headwaters of the more important tributaries of the great rivers. In the early part of June, 1889, forecasts were made twelve to twenty-four hours in advance of the flood which reached the city of Washington, and the value of property saved in this city alone was many times greater than the annual appropriation for the entire flood service of the country. In the spring of 1890 the lower Mississippi valley was flooded for a distance of forty miles back from the river in the states of Missouri, Arkansas, Mississippi, and Louisiana. Special flood warnings, which were amply confirmed by the subsequent stages of water, were issued from Washington in advance of the flood, and in several instances far in advance of the flood-crest. Numerous illustrations might be adduced to show the vast utility, from a commercial standpoint, of a thoroughly equipped Government flood-warning system, notwithstanding the fact that the forecasts are based upon empirical reasoning, and are, therefore, subject to more or less error. The allotment from the annual appropriation for the support of the river and flood system of the Weather Bureau is not greater than the value of property that may be saved in the cellar of an ordinary commercial house.

In considering the relation of the Weather Bureau to the hydrography of the country it should not be forgotten that there are now about 2,000 standard rain-gauges uniformly distributed throughout the region east of the Rocky mountains from which daily measurements of precipitation are received at the central office. In the Rocky mountain region there are about 1,000 gauges, but, on account of the paucity of population, there are many important regions from which proper data are not being received. Measurements of snowfall on the high mountain ranges would be of great value in connection with irrigation, but the present distribution of observation stations is inadequate to the proper undertaking of this important work.

CHARLES FRANCIS HALL AND JONES SOUND

The accompanying letter—one of the last written by Hall, the distinguished Arctic explorer—is of marked interest, both personal and historic, and its publication, in view of the continued efforts of Mr Robert Stein to stimulate Arctic exploration from a safe base station on the shores of Jones sound, is peculiarly timely. The letter, addressed to Mr Henry Gannett, then of Harvard College observatory, was in connection with the position of astronomer to Hall's expedition, which Mr Gannett declined. It will be recalled that Hall's instructions of June 10, 1871, left his route open to his own choice. Admiral Davis, in his official narrative of the expedition, says that Hall wrote Brevoort and Grinnell, in January, 1870, that his route would be via Jones sound, but adds: "He found occasion to change this opinion before leaving the United States." As no possible information as to either route could have reached Hall, Davis' narrative has been held to indicate indecision on the part of Hall.

This letter, dated just one month before he left Washington, shows Hall setting forth in detail his plans for exploration via Jones sound, and confirms the belief, held by most Arctic men in this country, that his success via Smith sound was due to his good judgment in taking advantage of the ice conditions, which were found to be especially favorable toward Smith sound on his passing cape York.

It may be added that the discoveries made on the west coast of Grinnell Land by Nares' expedition in 1876 and Greely's in 1882–'83 prove that no success that Hall could possibly have attained via Jones sound would have equaled that resulting from his excellent judgment in availing himself of the open sea toward Smith sound, instead of attempting the distant and unknown ice of the route he originally proposed to take. A. W. G.

WASHINGTON, D. C., *May 10, 1871.*

. . . .

The *scientific corps* will be small—to consist of only two or three. Dr Emil Bessels, who has lately arrived from Heidelburg, Germany, is with me. He is engaged as naturalist and photographer, and will most likely be the surgeon. He comes strongly endorsed by Dr Peterman, of Gotha, Germany, the most distinguished geographer of the world.

The great object of the expedition now fitting out here at the navy yard is to make geographical discoveries from about latitude 80° north up to the

North Pole. In doing this I feel [wish ?] to contribute all I can in advancing the cause of science, especially of that branch relating to astronomy. For near four months now the vessel designed for the North Polar Expedition has been in hand at the Washington navy yard. She has been almost entirely built anew, and is now the best strengthened vessel for Arctic service that any country ever fitted out. The vessel is to be in waiting about the 1st of June, at which time I hope to take departure. Capt. S. V. Budington, of Groton, Conn., is the sailing master and ice-pilot; Hubbel C. Chester, of Noank, Conn., is the first mate. The former has been 30 years at sea and 20 years navigating, more or less, in Davis strait; the latter has been for 12 years in the Arctic sea. The second mate is William Morton, who was on the first Grinnell expedition, 1850–'1, and with Dr Kane on his remarkable expedition of 1853–'4 and '5. This Morton is the adventurer who, with the Esquimaux Hans, made the sledge journey northward from Kane's winter quarters, latitude 78° 37′ north, up to cape Constitution, where he discovered the renowned "Open Polar sea."

The Esquimaux family, Joe, Hannah, and their little daughter Punny, will accompany me back to the north. This family I brought to the States in the fall of 1869, when I returned from my five-year voyage and travels in the Arctic regions. The whole ship's company from the States will consist of about 27 souls. The vessel is about 400 tons—a top-sail schooner with auxiliary propeller. I think Government will send one of her vessels as a transport to one of the higher settlements of Greenland. By having this transport to convey provisions and stores, a great confidence can be reposed in the resources of the expedition. My proposed route is up along the west coast of Greenland to the latitude of 76° north; then I turn to the westward, striking into Jones sound. After a penetration of this water for about 150 miles discovery begins, when the prow of *Polaris* (the name of the vessel) will, if land and water will permit, be urged on to the north as far as practicable. It is quite probable that the vessel cannot safely be advanced farther than latitude 80°, which will leave a distance, of course, of 600 geographic miles to the Pole. The time of arriving at latitude 80° will be about September 1; then a winter harbor will be sought for and vessel placed in it. The following spring (of 1872) sledge parties will be organized and led on poleward. By sledging and by boating—just as nature's highway shall be found to be—the north extremity of the earth's axis must be finally reached by the undersigned and his party; then my mission will have been performed, and not till then. I expect to succeed in accomplishing the purposes of this U. S. North Polar Expedition within two and one-half years, yet it may take five years. Every man that goes on this expedition must understand that if he goes it is with this full understanding that he will be faithful and true to the expedition and to all that pertains to it to the end if it takes from two and a half to five years. I am confident, however, that the purpose of the expedition will be accomplished by the end of two and a half years from the 1st of June next.

You are undoubtedly acquainted with the work that Sontag, the astronomer of Dr Kane's expedition, performed. . . . Owing to the fact that Congress did not appropriate but half the money sum I desired for the expedition, the salaries of all are far less than they should be; but it is certain that if the objects of this expedition should be fully accomplished every soul of it that shall have been *energetic, faithful*, and *true* will on the return of the expedition be abundantly rewarded by our liberal country through her noble-minded, appreciative U. S. Senators and Representatives. *I have been thus assured by many of these Senators and Representatives.*

. . . .

Yours, C. F. HALL,
Commanding U. S. North Polar Expedition.

MINERAL PRODUCTION IN THE UNITED STATES

The United States Geological Survey has issued, under date of August 1, a statement of the mineral production of the United States in 1895 differing materially as to one or two important products from its recently published statement, quoted from and commented upon in the July number of the NATIONAL GEOGRAPHIC MAGAZINE, the corrections being rendered necessary by the issuance by the Director of the Mint of revised figures of the production of the precious metals. The production of silver is now given as 55,727,000 ounces instead of 47,000,000 ounces, as in the former statement, a supposed decrease of about two and one-half million ounces giving place to an actual increase of over 6,200,000 ounces. The production of gold is given as $46,610,000 instead of $47,000,000. The total production of minerals is valued at $622,230,723 instead of $611,795,290, as previously stated, the amount now found to have been produced during 1895 being nearly one-fifth greater than that of the preceding year and exceeded in value only in 1891 and 1892.

REPORTS OF SEALING SCHOONERS CRUISING IN THE NEIGHBORHOOD OF TUSCARORA DEEP IN MAY AND JUNE, 1896

A resident of Hakodate, whose business connections are largely with the sealing schooners that cross from British Columbia each spring to hunt along the Japanese coasts, has given me, informally, several hitherto unpublished notes which would definitely indicate a submarine volcanic explosion or eruption in Tuscarora deep, and show that unusual disturbances existed there just before the great wave of June 15, 1896, devastated the Japanese coast.

Throughout the month of May the sealers found unusual and most baffling currents and cross-currents prevailing in their hunting grounds, which are at that season one hundred to two hundred miles off the southeastern coast of the Kurile islands, that volcanic range of islands or half-submerged peaks whose name is literally "The Smokers." These hunting grounds lie directly over and in line with that great depression (4,655 fathoms) of the Pacific's bed sounded by Admiral Belknap, of the U. S. S. *Tuscarora*, in 1872, exceeded only by the recent soundings of H. B. M. S. *Penguin* of 5,155 fathoms in the southern Pacific. The seal-hunters in their small boats were separated from the schooners more frequently and for longer periods than usual by these unexpected currents, and if the pelagic sealers were not the most practical and fearless men they might well have been superstitious. One schooner, with all its sails reefed and its small boats out, set 72 miles to the southwest one calm, clear day. The following day it set 60 miles to the southeast, and the third day, still close-reefed, on a smooth sea it was borne 40 miles due north.

Another schooner, sending out its small boats to a herd of seals feeding among some tide rips, saw the boats cross the tide rips and, with oars resting, drift away to the northeast, while the waiting schooner was rapidly carried to the southeast. The masters of such vessels were puzzled by these currents, and dead reckoning was rarely verified by observations.

The temperature of the water is carefully watched by pelagic sealers, as the variation of a few degrees either way will preclude any chance of seals being found in a neighborhood, those animals keeping to one even-water climate in their migrations. Several schooners found the water of unusually high temperature in places, and one vessel reported taking temperatures from 48° to 218° Fahrenheit in the course of a few miles' sailing, this during the second week of June. The frightened sealer put about quickly, when, as he described it, the water was literally boiling all around him.

The schooner *Carlotta Cox*, which reached Hakodate June 25, ten days after the great wave had struck the San-Riku coast, reported that when 250 miles out and sailing along the line of the great trough of Tuscarora deep it had sailed for two days through floating pumice. Other schooners reported traces of pumice, and the gossip of the Victoria sealers, who visited

Hakodate at the close of their hunting season, was all about the unusual currents, the tide rips running like a wall, and the unusually high temperature of the water at different places along the line of the great trough in which Admiral Belknap plumbed Tuscarora deep.

As all these sealing schooners winter at Victoria, British Columbia, it should be easy for those interested in volcanic phenomena and deep-sea geography to personally gather the statements and inspect the log books of the masters of these vessels. The exact position of the floating pumice encountered by the *Carlotta Cox* would at least be an interesting item for future deep-sea surveyors to note.

Eliza Ruhamah Scidmore.

The foregoing important statement has been received from Miss Scidmore since her article on pages 285–289 of this number was printed, as has also the information that the great wave was from three to twelve and in places as much as thirty feet in height when it broke upon the shores of the Hawaiian islands. The wave also reached the California coast, and was five feet in height at Santa Cruz.

GEOGRAPHIC NOTES

NORTH AMERICA

Canada. Mining experts say that the Kootenai district of British Columbia promises to be the greatest gold-producing region in the world. The population of Rossland, the principal mining camp of the district, has increased during the last year from 300 to 5,000.

Newfoundland. The recent parliamentary elections in Canada and the change of administration they have involved are considered to have postponed the entrance of Newfoundland into the Dominion at least five years.

SOUTH AMERICA

Argentina. The total number of immigrants who arrived in Argentina in 1895 was 61,226, an increase of 6,506 on the preceding year. During the first six months of 1896 the number landed was 30,900, of whom 21,329 were Italians, 6,088 Spaniards, 1,196 French, 407 Austrians, and 434 Germans.

EUROPE

Cyprus. Severe shocks of earthquake were experienced at Larnaka and Limasol on June 29–30.

Russia. Extraordinary activity now prevails in Russian railway enterprises. A railway to the extreme north is expected to revive the ancient trade of Archangel and the White sea.

United Kingdom. The receipts of the Manchester ship canal continue to show a large increase on those of last year.

A movement has been inaugurated for celebrating at Bristol, in June, 1897, the 400th anniversary of the discovery of North America by John and Sebastian Cabot, who sailed from Bristol.

FRANCE. A monument to Lagrée, the explorer, was unveiled at Grenoble on August 16.

The population of France, according to the recent census, has been officially declared to be 38,228,969, an increase of only 133,819 in five years. The population is, in fact, practically stationary, there being but one birth in each year to 1,500 inhabitants.

GERMANY. In the hope of increasing the traffic through the Baltic canal, it has been decided to reduce the tolls, the change to come into effect September 1.

Four first-class ironclads, with a draught of 24 feet 7 inches, and thirty-five other ships of war, all belonging to the German navy, recently passed safely through the Baltic canal.

The foreign trade of the German empire is steadily increasing. The total imports during the half year ending June 30, 1896, were 16,175,232 tons and the total exports 11,957,563 tons, as compared with 14,096,330 tons and 10,930,648 tons, respectively, during the corresponding period of 1895. The values of both exports and imports likewise show a large increase.

ASIA

SIBERIA. The Russian government has finally decided to make Vladivostok a commercial port.

BURMA. The Burma State Railway system, with nearly 1,000 miles of line in operation, has been sold to a syndicate for £6,000,000.

CHINA. The four sections of the commercial mission sent to China last year by the Lyons Chamber of Commerce are expected to unite in Yunnan in November.

The coast at Hai-chau, in the northeast of the Chinese province of Kiang-su, was visited by an earthquake wave on July 26. Several villages were destroyed, and it is estimated that 4,000 of the inhabitants perished.

TURKESTAN. The Swedish traveler, M. Sven Hedin, reports the discovery of a whole group of hitherto unknown lakes, to the east of the Yarkand Tarim, at 40½° north latitude. Between the Khotan Daria and the Kiria Daria he discovered two ancient cities, and further north he met with large herds of wild camels. M. Hedin followed the Kiria Daria as far as the place where it loses itself in the sands.

AFRICA

The first rail of the Uganda railway has been laid at Kilindini with imposing ceremonies.

Work will begin immediately upon the construction of the third section of the Beira railway, establishing communication between Fort Salisbury and the east coast.

A journey in many respects remarkable, but in none more than in its rapidity, has just been completed by M. Versepuy, Baron de Romans, and M. Sporck, who left Zanzibar on July 6, 1895, crossed the Nile on January 19 following, and arrived on the west coast by the first week in August, having crossed the continent in the brief space of 13 months.

KONGO FREE STATE. The Kongo State railway has now reached Tumba, 187 kilometers from the starting point.

MOROCCO. Neither roads, canals, navigable rivers, nor railways exist in Morocco, nor are they thought of. Foot couriers constitute the fastest medium of communication.

ORANGE FREE STATE. Dr Emil Holub, the well-known explorer, now of Vienna, has received advices of the discovery of gold fields in the Orange Free State which it is anticipated will rival those of the Transvaal in productiveness.

MADAGASCAR. While there is no longer any open resistance to French rule, Madagascar is in a condition of anarchy from one end to the other, and only the towns occupied by troops are safe for Europeans.

ZANZIBAR. In a recent report of the British consul at Zanzibar attention is called to the decline in the imports from Great Britain. Unbleached cotton cloth is imported mainly from the United States, being admittedly of better quality than Manchester productions of the same price.

TRANSVAAL. The first count of a census of population within a radius of three miles of Johannesburg gives a total of 102,714, consisting of 51,225 whites, 44,396 kaffirs, and 7,093 half-breeds. Of the whites, 32,741 are males and 18,484 females.

EGYPT. An electric street railway has been opened in Cairo.

The number of pieces of mail matter dealt with by the Egyptian post-office in 1895 was 22.446,000, against 21,070,000 in 1894.

The annual overflow of the Nile is two weeks late and great anxiety is expressed with regard to the maize and rice crops.

At Kosheh, where a contingent of the Anglo-Egyptian army is awaiting the advent of cooler weather before continuing its advance into the interior, the mercury recently stood at 130° in the shade.

MAURITIUS. In a recent lecture on "Mauritius, Past and Present," Sir Hubert Jerningham, the governor of the island, stated that if English was the official and commercial language, French remained the language of the home, and if gratitude for the numerous benefits bestowed by England upon the community assured attachment to that country, the heart of the old colonists still beats in their descendants.

AUSTRALASIA

The annual financial statements of the different Australasian governments nearly all show increased revenues and substantial surpluses.

NEW SOUTH WALES. It is proposed by the colonial government that a great Australasian exposition shall be held at Sydney in 1899, the exhibits to be afterward sent to Paris.

TASMANIA. The yield of gold during the June quarter amounted to 17,000 ounces, being an increase of 10,000 ounces as compared with the corresponding period of last year.

Western Australia. The colonial government is promoting legislation authorizing a water supply for the gold fields, the extension of the railway system, and the improvement of docks and harbors. The premier estimates a gold production of £7,000,000 per annum.

THE AMERICAN ASSOCIATION AT BUFFALO

The forty-fifth meeting of the American Association for the Advancement of Science was held at Buffalo, August 22–29. The attendance was rather small, partly on account of limited local interest, only thirteen Buffalonians being registered; yet in the number of investigators and teachers of renown the meeting ranked well, and in general excellence of the papers and discussions it was above the average, so that, despite unfavorable business conditions and prospects, the meeting was successful.

Most of the contributions of interest to geographers were presented in Section E. One of these was an elaborate paper on the "Development of the Physiography of California," by J. Perrin Smith, in which successive stages in the growth of mountains and shaping of valleys along the Pacific slope were described and illustrated by landscapes and restorations. Todd presented "A Revision of the Moraines of Minnesota," in which these significant topographic features were interpreted; and I. C. White described and discussed the "Origin of the High Terrace Deposits of Monongahela River." Of value to geographers, too, were Hovey's papers on "The Making of Mammoth Cave" and "The Colossal Cavern." Under the title "Sheetflood Erosion," McGee defined the sheetflood as the logical correlative of the stream, produced under conditions of volume, declivity, and load tending to spread the flood over a wide belt instead of permitting it to converge, and explained the anomalous geographic features of southwestern United States and northwestern Mexico—rugged mountains rising sharply from smoothly-planed and lightly-veneered baselevels—as the product of sheetflood erosion, incidentally pointing out that the rounded summits and divides, as well as certain broad and shallow streamways in humid regions, represent similar agency. Collier Cobb's "Origin of Topographic Features in North Carolina," and Gulliver's "Post-Cretaceous Grade-Plains in Southern New England" dealt with the land-forms of the Piedmont province and its New England extension; Taylor's "Notes on the Glacial Succession in Eastern Michigan" was largely a study of land-forms, while Spencer's paper on "The Slopes of the Drowned Antillean Valleys" was a discussion of submarine topography.

Two features of the meeting were of special interest: One of the sessions of Section E was devoted to discussion of Niagara falls, with special reference to the origin of river and cataract, and to the reading of this most accurate of the geologic chronometers thus far known. To this session Gilbert contributed three remarkably clear and concise papers based on the season's operations; Holley, Taylor, and Upham also made communications on the subject, the first two resting on extended field studies. Then, after the adjournment Friday evening, a day was devoted by the Association to an excursion to and about the cataract; and the three ensuing days were spent by a group of working geologists in detailed examination and surveys in the vicinity under Mr Gilbert's guidance.

The second special feature was a celebration of the sixtieth anniversary of Professor James Hall's service as State Geologist of New York. Vice-President Emerson opened the session devoted to the occasion with an appropriate address on the part of the Association; Professor Le Conte followed, speaking on behalf of the Geological Society of America; McGee presented a formal address on "James Hall, Founder of American Stratigraphic Geology," and Professor John M. Clarke read an appreciative memoir entitled "Professor Hall and the Survey of the Fourth District." Stevenson, Hovey, Fairchild, and others spoke informally on the more personal side of Hall's connection with the State, while Hon. T. Guilford Smith fittingly addressed the meeting on behalf of the State, and especially of the Regents of the University of New York. The venerable geologist terminated a much-needed vacation and crossed the continent to attend the meeting arranged in his honor; and two days later he was in the field, with hammer and collecting-bag, guiding explorations for rock gas and oil in western New York.

DEATH OF G. BROWN GOODE

On September 6, Dr George Brown Goode, Assistant Secretary of the Smithsonian Institution and Director of the United States National Museum, an active member of the National Geographic Society, and author of an article in the August number of this Magazine, died of bronchial pneumonia at Lanier Heights, Washington, D. C. Dr Goode was one of the foremost biologists of his generation, his work in ichthyology being specially important, and he was the leading museum maker of the country, if not of the world. With the support of Baird at the outset and of Langley later, he was practically the creator of the National Museum. He contributed much, also, to the organization and success of the United States Fish Commission, of which he was for a time Superintendent. In addition to his strictly scientific and administrative work, he was a leading member of several patriotic and historical societies and did more probably than any other man of his generation toward elevating the aims of these societies and introducing scientific methods in their work. Although quiet and unobtrusive, he was possessed of exceeding energy and endurance, as his splendid accomplishments testify; at the same time his simplicity of manner and sweetness of disposition were such as to harmonize every circle into which he entered. As a leader and harmonizer he was perhaps the most influential man in the great scientific colony in the National Capital, and in every connection he served most successfully as a medium between specialists and the public. His untimely death, in his forty-sixth year, is a serious blow to the Smithsonian Institution and a heavy loss to American science—indeed, in view of his many connections with public interests, it may well be regarded as a national calamity.

W J M.

The National Geographic Magazine,

NOW PUBLISHED MONTHLY,

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

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UNITED STATES SENATOR;

— ALSO —

THE ECONOMIC ASPECTS OF SOIL EROSION,

BY DR N. S. SHALER,
PROFESSOR OF GEOLOGY IN HARVARD UNIVERSITY AND DEAN OF THE SCIENTIFIC SCHOOL;

— AND —

SOME RECENT NOTABLE EXPLORATIONS IN ASIA.

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THE

National Geographic Magazine

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CALIFORNIA

By the Hon. George C. Perkins,

United States Senator

The Californian is never at a loss for some good words for his state. If he is a pioneer he has wrought at the foundations and rejoices in the rise and progress of a commonwealth having now more than fourteen hundred thousand people. The Argonaut did not much concern himself with the geographical greatness of the future state. He did not even know that there would be a state. There was the great outlying territory of Alta California, stretching along for more than nine degrees of latitude and broadening inland to the crests of the Sierra 250 miles or more, an area that today contains 156,000 square miles, or more than 99,000,000 acres, constituting the second largest state in the Union. He knew little of the coastline, with its indentations a thousand miles in extent, as he sailed into that magnificent bay after his voyage around cape Horn, and he knew less if, after the long trail overland, he looked down from the top of the Sierra on the great valleys that lay between the mountains and the ocean.

The Spanish dominion, which lasted for 53 years, did not concern him much, since it left few vestiges of civilization. Mexican rule in Alta California was little more than a continuation of that of the mother country. The missions founded by the Catholic fathers constituted a chain of settlements from the bay of San Diego to the northern limit of the bay of San Francisco, each one making a little garden spot in the uncultivated waste. They founded no towns and built no cities. These missions in the height of their prosperity contained 24,000 Indian neophytes, possessing several hundred thousand cattle, 135,000 sheep, and 16,000 horses, and harvesting annually about 75,000 bushels of grain. Their decadence began when they were secularized by the act of the Mexican Congress, and that decline has not been arrested to this day. In the solitary places near where the fathers wrought there are now flourishing towns and cities, and the picturesque ruins of these old missions are among the treasures of the land.

The new era in the history of California began on July 7, 1846, when the American flag was hoisted at Monterey by Commodore Sloat. The discovery of gold followed on January 19, 1848, a month before the treaty of Guadalupe Hidalgo was signed and five months before Americans had acquired their title to California. Henceforth there were to be a new people, new laws, and new institutions. A few months after the discovery of gold 20,000 pioneers started on the long overland journey from the banks of the Missouri to California. Five thousand fell by the way through disease and hardships or were slaughtered by Indians. Scarcely less than 20,000 went by water, either around cape Horn or by way of the isthmus of Panama. In a few months 100,000 Argonauts were in California. Twenty-five years after that date $1,000,000,000 of gold had been taken out of the mines of the state. A stream of gold was poured into the Federal Treasury during the civil war, and there was another blessed outflow into the treasury of the sanitary commission for the relief of friend and foe alike, of the Gray as well as of the Blue.

For the first twenty years in the history of California the only mode of transportation after leaving the navigable rivers and the coast, aside from walking, was by stagecoach, wagon, pack-mules, and broncho horses. In Sacramento and Marysville, the two principal steamboat landings, it was a daily occurrence to have depart at break of day fifty or more stagecoaches and wagons loaded with passengers bound for the different mining towns and camps in the foothills and mountains. The return stages were so scheduled that they arrived back late in the afternoon or evening, and, with fresh exchange of horses, would be ready to leave again the following morning.

The early stage-driver in California was perhaps the most unique and was certainly one of the most important personages in the community. His social standing and influence were rated in about the following ratio: For a two-horse stage-driver to those of the sheriff; a four-horse stage-driver to a member of the legislature; a six-horse stage-driver to a mayor or governor while the driver of an eight-horse stagecoach upon a popular route through several flourishing mining camps would not have surrendered his place, with its influence and dignity, for a seat in either house of Congress. The teamster also was a very important personage, and the driver of an eight- or ten-bell mule team, with a single line, considered his position and importance quite equal to those of the superintendent of a railroad. I speak advisedly, for I have been honored with the experience.

Many of the richest mining camps could be reached only by long and circuitous routes, following up the forks and branches of rivers and creeks or over pathless hills and mountains. There being no roads or trails, the only manner in which supplies of provisions, clothing, and tools could be sent into the camp was upon pack-mules. These animals were loaded down with from 250 to 400 pounds of freight, which they carried upon their backs with apparent ease, crawling around steep points, over sliding earth and rock, where it seemed almost impossible for a man to walk. The pack-trains numbered from 50 to 100 mules in a train, each one in a single file, following the "bell leader," which was usually a broken-down, white horse that carried no load, and was directed by the owner of the pack-train, who also had a half-dozen or more Mexican vaqueros to assist in loading and unloading the mules; these brought up the rear of the caravan and saw that none of the train stopped by the way. Arrived at its destination, the cargo of freight was delivered at the mining camp, and the return train took back to the valley letters for the dear ones far away and gold dust to the merchants to pay for the merchandise and freight.

But no prosperous state was ever built over gold and silver mines. These were only a single element of future prosperity. The Argonaut had not come to build, but to find treasure for another and, as he thought, a better land; but these men were unconsciously making ready for the new commonwealth. Civilization could not survive without the state. There must be law and order, security for life and property. There must be organized society, or there would be chaos. Then the pioneers became builders. The bad element must be restrained and the good must have protection. There could be no permanent society without homes. California was no longer a barren land. Pioneers here and there had cultivated a few acres as a sort of heartsease. They had begun to make places beautiful as the garden of the gods. The land seemed to look up and smile when touched by the various implements of cultivation. There was verdure in the desert. Wheat was no longer brought from Chili for bread. The wheat-fields of California began to wave in the morning and evening breeze.

The discovery of the agricultural capabilities of California was greater than the discovery of gold. Men ceased to talk about a worthless country. The land was vital with the elements of hidden fertility. There came a day when six hundred ships were not enough to carry the surplus wheat crop of the state to foreign lands. The whole country from not producing sufficient to feed 100,000 Argonauts at home was now producing enough to feed more than a million people abroad, and the capacity of the state today is sufficient to sustain ten millions.

Nor has the mineral industry become obsolete. If the testimony of mining experts is to be taken, there is more gold in the placers and quartz mines of the state than all that has ever been taken out; but the products of agriculture, of which there was once no promise, have annually for more than ten years past exceeded in value one hundred million dollars, although they have as yet reached only the first stage of development, while the annual production of gold and silver amounts to less than twenty million dollars.

But these are not all the marvelous industrial changes that have been wrought. The Mission Fathers adopted a primitive system of agriculture. They selected stations near the ocean, where the moisture was greatest and where there were living streams for artificial irrigation. They cultivated no crops that they could not water when the rains had ceased. They brought the olive and the vine from Spain and naturalized them in their gardens. The orange from Seville also sometimes bloomed and fruited there, but there were no blossoming orchards beyond, and no vineyards ripened the grape under the long summer sun. The native Mexican cared for none of these things; he was content with his jerked beef and his tortillas. Fruit was reserved as the luxury of those who cultivated it in consecrated gardens. It has been recorded that many a pioneer was ready to exchange a silver dollar for an apple. The orchard and the vineyard became a necessity. What was good in the old homestead ought to be good about the new one. Seeds were sent in letters; cuttings and small fruit trees came as the most precious freight of the early steamers by way of the isthmus. Orchards began to blossom in the valleys, and the vine made many little patches of green on the hillsides. The wild vine was found climbing many a tree in the ravines and along the brooklets of the Coast range, and it could not be otherwise than that better ones would take kindly to the soil and give abundant fruitage. The best were brought from Spain and the wine districts of southern France. The mongrel and foxy grapes that suited eastern palates did not win any place in the viticulture of the state. The motto of the Californian everywhere is, "Get the best." After the vineyards of Spain and France had been laid under contribution, princely Tokays and mellow Muscats, with more than twenty other semitropical varieties, began to crowd the home markets. The wine grape climbed the hills and made the claret that was sold under a French label to thousands of eastern consumers. Eighteen million gallons of wine were the product of a single year. Grapes from these vineyards were shipped to every large city of the Union. More than 150,000 acres are now covered with vines in California, and the average product for an acre is nearly double the average product of the vineyards of France and Spain. For many large areas the average product is 12,000 pounds an acre, while in special instances the product reaches 20,000 pounds per acre. Beyond all other states of the Union, California is the land of the vine. More than two-thirds of the arable land of the state is suitable for viticulture and other fruit culture. There is more land in this one state suitable for the production of raisin grapes than there is adapted to that culture in Spain. When the Muscat began to hang in golden clusters and to turn into raisins on the vines, there was the first suggestion of the great raisin crop that could ultimately supply every market of this country. That the raisin product now falls short of this is because of the keen competition with the crop of Spain, that is produced for less than one-half the outlay for labor that the same production costs in California; but layer for layer and box for box, these domestic producers challenge for quality the best in the world. A small industry became a great one by beneficent protection. More is the pity that any part of it should have been withdrawn until these pioneers had fought out the battle for every home market in the land. The raisin product of the state last year was not less than 54,000,000 pounds. Not only is California golden-sandaled, but the very sun in the heavens turns her fruits into gold.

Such a miracle of transformation was wrought in southern California as had not been witnessed beyond her borders. The dry land that had become dust under the hoofs of famishing cattle took on perpetual verdure when the streams were trailed over it, and the orange blossomed and fruited under a semi-tropical sun. Towns sprang up and cities were built largely from the proceeds of this citrus industry. Water was impounded in the mountains or was recovered from sunken streams in the plains. The desert became more than a garden. A great citrus product soon to rival that of Florida was the promise of the future. How has it been fulfilled? More than 8,000 carloads of oranges were shipped overland as the product of the season of 1894–'95. Not less than 14,000 acres have been planted with lemon trees, with the certainty that when the maximum of this branch of citrus culture shall have been reached, this fruit will compete for the first place in all the leading home markets of the United States. Of deciduous fruits altogether 4,435 carloads were shipped overland in 1895.

The olive took kindly to the soil. There was, in fact, no product of Spain or of any other country about the Mediterranean that could not be duplicated in California. The fig ripens as it does about the borders of the Adriatic, while of prunes more than 32,000,000 pounds represent the annual production of the state. With wine to make his heart glad, oil to make his face to shine, and honey to sweeten his lips, the Californian may speak with enthusiasm of all this wealth of resources. Then there is $100,000,000 invested in the dairies of the state, and 40,000,000 pounds or more represents the beet-sugar product of the state for the season of 1894–'95—an amount larger than the aggregate production of all the rest of the country.

Passing from these details of production, it remains to be noted that California is the most picturesque state in the Union. This wealth of scenery can never be obscured. There is the great Sierra range stretching along the eastern boundary for 500 miles, having a width of 70 miles and summits ranging from 7,000 to more than 14,000 feet. Nineteen of these mountain peaks rise to the height of 10,000 feet, and seven of them rise still higher, until mount Whitney wears the crown, rising into the heavens to the height of 14,900 feet. Some of these summits are still warm with volcanic heat. There they stand, white-hooded, with glaciers moving and grinding along their flanks, as if a thousand years were but as yesterday, letting loose the mountain streams that go singing down to the sea. There is the divine sculpture of the rocks, the lakes that mirror these eternal ramparts, the great forests that sing in storm and sigh in the summer breeze, and the groups of sequoia overmatching in height and circumference any other conifers on the globe. There the clouds come down and kiss the mountains, and the lesson is renewed every day of eternal repose and majesty and strength. There is the fir tree with its balsam, clean and sanitary, inviting the invalid to come for his healing; there are the cedars more stately than those of Lebanon, and pines that were dropping their cones long before the first white man had set foot upon the continent.

How little of all this reserve of natural wealth can be set forth by inventory or speech! Hardly an impression has been made on these virgin forests. There is the great sanitary district, free from dust, with pure water flowing out of the granite, and an atmosphere as sweet as the breath of heaven. These mountains are not solitary, but are rich in floral and animal life. There butterflies flit, and birds sing, and huge grizzly bears come out of caves and caverns. There the mariposa lily unfolds its petals, and the snow plant, red as blood, springs in a day mysteriously out of the margin of the receding banks of snow. There the lakes repose in bowls with mountains for rims. There, 8,000 feet above the level of the sea, is lake Tahoe, more than 20 miles long and 1,500 feet deep, and more than five hundred lakelets mirror the frowning battlements that rise above them. Here are the great reservoirs that send their waters down to fertilize the hot valleys below. More than 4,000,000 acres of land are irrigated by these mountain streams, and made among the most productive in the state. Millions more will be watered from the great reservoirs that are held in check by these great forests, so that there is neither wasting flood nor withering drought.

In that great mountain range there is one of the seven wonders of the world. From the ends of the earth men come to see the awful grandeur of Yosemite, which no artist can paint and no pen can adequately describe. They will look up to the mighty fall which, in three leaps, descends 2,600 feet to the floor of the valley. They will see the great Vernal and Nevada falls pouring out their mighty floods into the valley below. Standing on the floor of this valley, 4,060 feet above the level of the sea, the tourist looks up to these granite walls, varying in height from 1,200 to 4,600 feet, hears the roar of the great cataracts, sees the awful battlements where in the winter the snow banners float from their tops; sees the Bridal Veil floating over a vertical wall and falling for nearly a thousand feet; watches the rainbows as they are set in this veil by the slant rays of the setting sun, and walks through this valley of wonderland six miles long, himself wondering whether by some mighty convulsion of nature the crust of the earth has fallen sheer down 4,000 feet, cleaving the granite on either side as it went, or whether the glaciers have plowed and eroded, planing and polishing the granite on either side, until Yosemite today is one of the sublime spectacles of the world. Cathedral spires and domes are there for his worship and the meadows are carpeted for his coming. Out of the valley a little way he will come upon groves of sequoia, the largest of which he will find by actual measurement to be 350 feet high and more than 30 feet in diameter. Away to the north in the same great Sierra range is mount Shasta, 14,442 feet high, wearing its eternal mantle of white as if set there as a great white throne for the coming judgment of the world.

Nor does this wealth of the picturesque end here. There is the Coast range that rims the great valleys on the ocean side, broken here and there, but extending parallel with the Sierra for hundreds of miles. For a part of the way there is an inner coast range inclosing such beautiful valleys as the Santa Clara, Sonoma, and Napa, presenting a series of landscapes that are unsurpassed on the Pacific coast for quiet picturesque effect. Here the apricot and the prune come to perfection, and the vineyards that creep up the mountains, in some places to their summits, produce the most luscious of all the table grapes that are sent late in the season to New York and other eastern markets.

It is in that part of the Coast range extending from Monterey bay to the northern border of Mendocino county (a distance of about 300 miles and averaging about 25 miles in breadth) and only there in the whole world that the redwood, *sequoia sempervirens*, is found, the first in commercial value of all the trees in California and, for the area covered, probably the most valuable timber tree in the United States. It belongs to the cedar family, lacking the pungent odor of the white cedar, but surpassing all others of this family in symmetry of form and in size, which, in some instances, is but little less than the related species, the *sequoia gigantea*, which is found nowhere else but on the western slope of the Sierra in isolated groves at elevations of from 3,000 to 5,000 feet. These redwood trees frequently attain an elevation of 200 feet and a diameter of from 10 to 12 feet. The average is something less. During the past season a redwood tree, yielding 48,000 feet of merchantable lumber, or a full cargo for a schooner of 125 tons, was cut by a lumberman in Mendocino county. One of the redwood trees, known as the Frémont tree, in the group near Santa Cruz, is 275 feet high and is 19 feet in diameter six feet above the ground. In the hollow of this tree a family some years ago found a comfortable residence for an entire winter. It was in or near this grove that Frémont encamped before the conquest of California had been fully made. This great timber district is within the humid belt of California, and all the picturesque valleys that extend along the base of these wooded mountains have a network of living streams that find their way to the sea. The valleys are dotted with beautiful towns and the landscape is a succession of vineyards and orchards. This redwood, besides its extensive use for the interior finish of houses, is everywhere admired for its natural color tones and is now in quest by Europeans for ornamental use. The pine and the fir tree, so common in California, are denizens of many countries, but the redwood makes here the one exclusive timber belt of its kind in the world.

The Sierra and the parallel Coast range inclose the great and continuous valley of the San Joaquin and the Sacramento, 350 miles long and with a breadth of about 40 miles, making an aggregate area of about 14,000 square miles. Forty-five years ago the greater part of the land in the San Joaquin valley could have been bought at $1.25 an acre. Thirty-five years ago there were thousands of acres which the Government had offered at the minimum price that found no buyers. The parched and desolate valley lay there at the base of the mighty Sierra, adown which the mountain streams descended, but made no fruitful fields. Today there are flourishing cities and towns, vineyards and orchards, and great wheatfields. From that valley enough raisins were produced this year to supply two-thirds of the consumption of the whole country. From this and the related valleys 9,000 carloads of oranges and 400,000 cases of lemons will this season go forward to Eastern markets. Add to this product not less than 4,000 tons of raisins, and we come to see the relation of all this wealth of production of the great mountain ranges which send their streams down to fertilize this great valley. From the hot plains men look up to these snow-clad mountains and know that the reservoirs will never fail, and that the winter gales that sing in the tops of the fir trees and smite the giant sequoia serve best to make eternal spring in the valley below. The San Joaquin from the south and the Sacramento from the north flow through the length of these valleys and enter the northern end of the great bay of San Francisco, an inland water 35 miles long and averaging 8 miles in breadth. There great navies ride at anchor, contending peacefully for some of the richest commerce of the world.

There is one other particular in which the natural wealth of California surpasses that of any other state. There are more than one hundred mineral springs, that together possess all the remedial qualities that are found in the most notable mineral springs of Europe. Hardly more than half of the whole number that are known to exist in the state have ever had any scientific description. All known minerals that have any healing qualities are held in solution in these waters. Some of these springs have more than local fame for their curative effects. Sulphur, iron, arsenic, and soda are sometimes found in a single group of springs, as at the geysers, where the waters boil and seethe and roar, sending up clouds of steam day and night, as if, after the spent volcanic forces, the bedevilment of nature was prolonged for the entertainment of tourist and stranger. Wherever one may go, in all the length and breadth of the state, the series of striking pictures never fails. Nothing is tame or insignificant; nothing, from the winter bloom of gardens, with all the affluence of color and perfume, to the mountains that are tipped with gold and purple as the sun sinks into the Pacific.

In one other particular California has greater natural wealth than any other state. Not elsewhere in all the Union are there so many climates. No non-resident ever quite gets to the bottom of this mystery. He will read of trains beleagured by snowdrifts in the mountains, and on the same page of almond and orange orchards in bloom; of ice that is cut out in solid blocks on mountain lakes, and of the mercury that marks 75 degrees of heat in some other place; of men in overcoats in San Francisco in July, and of the mercury that has gone up to 100 degrees in some of the interior valleys. The mean temperature of San Francisco for the whole year is 54 degrees, the means for the four seasons being 54, 57, 56, and 50 degrees, a difference of only seven degrees for the entire year. There is a coast climate, an interior valley climate, and a mountain climate, with a great number of subdivisions. Going north ten miles to the small town of San Rafael there is a difference in the summer climate of not less than 10 degrees. Riding for two hours by rail from the coast inland to the San Joaquin valley the difference will be not less than 35 degrees at midsummer. On the inland side of the Coast range, as in the Santa Clara valley, for instance, the heat of the summer is greater by several degrees than on the ocean side. The ocean, the Coast range, the great interior valleys, and the vast Sierra will account for many of these variations of climate. A well-known author has written a book about "Our Italy" in southern California. Where there are all the climates of Italy and Spain, the resident only encounters the perplexity of choice. There are also the same variations of moisture, ranging for a year from 8 inches of rainfall up to 60 inches, according to the geographical situation which one may choose, and these extremes within the limit of 200 miles.

And better than mountain and valley, and all that goes to make a picturesque state, is that system of public education which is giving instruction to more than two hundred thousand youth, and is crowned by two great universities with doors freely opened to every youth who is qualified to enter. California was admitted to the Union after a long and eventful struggle. Her constitution, framed by men from the North and the South, dedicated the land to freedom. The pioneers had staked their all for law and order as the very corner-stone of an enduring state. Isolated by nearly two thousand miles from the great family of states, the very Stars and Stripes that waved over them gave them a passionate longing for recognition. When the news of admission came, a tumultuous shout went up to the heavens amid jubilant songs and tears. The pioneers who embraced that day knew no country but the Union; nor have they known any other since that day. For forty-five years they have celebrated the anniversary of admission, accentuating it as no other state has done. They have stamped it as a legal holiday—the one day of jubilee wherein love of a particular state takes the higher interpretation of love for the Union. A generation born on the soil rejoices in the designation of "Native Sons" as the richest birthright and heritage that any land can give.

This is California, the Keystone state in the great Empire that is looming up on the Pacific.

THE ECONOMIC ASPECTS OF SOIL EROSION

By Dr N. S. Shaler,

Professor of Geology in Harvard University and Dean of the Lawrence Scientific School

The old view that the earth was firm set and that on it we could build "for aye" has gone the way of many ancient opinions. In every region which geologists have investigated they have had occasion to note many and profound alterations in the form of the surface which have taken place since man has occupied the earth. They have come to recognize the fact that man himself is, through his arts, particularly those of agriculture, one of the great agents of change, and that through these interferences with the course of nature the operation of many forces has been greatly increased in energy. This understanding has extended beyond the class of special students of earth phenomena. We find, indeed, the ablest essay as to the influence of man on terrestrial conditions written by one who approached the subject from the standpoint of the historian. So far as I am aware, no geologist has yet undertaken to consider this matter with reference at once to its scientific aspect and its economic importance. I therefore propose to take up the processes of land erosion from the point of view of the geologist, and to trace the influence of their actions upon the formation and preservation of the soil. In the treatment of this subject we shall be led into that important but as yet unrecognized branch of national economy which relates to the preservation of the tillage values of various countries.

In dealing with any group of geological features, it is well to consider at the outset the origin and mode of application of the energy that has served to give them shape. We may therefore begin our task with a brief account of the forces which operate in the process of erosion. So far as regards their origin, these forces are essentially simple. They all substantially depend upon solar radiation. Only secondarily and in a very unimportant way are they due to subterranean action or to the attractions of the sun and moon, which give rise to the tides. The average amount of heat received by a square foot of the earth's surface each year is sufficient to lift a pound of matter to a height of many thousand feet. If all this heat could be converted into dynamic energy and applied to rending rock, such as granite, into sand-like material, the effect would be to break up the rocks in a very rapid manner. It is likely that the process of destruction would go on at the rate of several feet a year. Fortunately for the earth, this work is so organized that only a small part of this energy actually enters into the processes which bring about wearing. By far the greater portion is fended off, in ways that we shall have to note, and sent upon other errands.

We shall now consider the ways in which excessive erosion is avoided, and thus be led to see how the remnant of the forces is applied to such work. When the tide of solar energy strikes our sphere, somewhere near one-half thereof is more or less directly intercepted by the atmosphere, and does not penetrate to the lower realm of rock and water, but goes away again into space. Of that which comes to what is commonly called the surface of the earth, again the greater part quickly flies away by radiation into the realms of space. If the air permitted the egress of heat as easily as it does the ingress of that form of motion the earth would never acquire the relatively high and tolerably stable temperatures which make it fit for organic life or for that work of erosion which, as we shall see hereafter, is intimately associated with the existence of all processes of development. If we trust the reckonings of certain eminent physicists, this sphere would under such conditions remain at the temperature of space, or some hundred degrees below zero on the Fahrenheit scale. Owing, however, to a nice adjustment of terrestrial conditions, the air, principally through the moisture it contains, hinders the outward motion of heat a little more than it does its incoming. It is in a small way a trap serving to retain the temperature. Thus the surface is in general maintained in a somewhat warmer state than that of the air. In this interesting condition of affairs we are now to find the origin of those processes which effect erosion.

Owing to the warmth which the sunshine gives alike to land and sea, the atmosphere next those surfaces becomes considerably heated and thereby expanded. This process leads to the formation of an ascending air current, which may be of a local nature, appearing as in dust-whirls, water-spouts, cyclones, or hurricanes, all exhibiting a spinning, upward movement of a temporary and migratory character; or the ascending movement may take the shape of the great tropical belt of ascending air—that vast, permanent, slit-like chimney which extends almost completely around the earth in the tropical zone. Whether these ascending currents have the character of the spinning storms or the great permanent tropical upcast, their effect is to put the air in motion. Through them volumes of the atmosphere are constantly set into currents of swaying movement, the result being that winds (variable so far as created by the cyclone groups or tolerably constant when due to the tropical upcast) are brought about. These winds, of sufficient energy to have distinct geological value in a direct or indirect way, appear to be constantly at work at all times and at all parts of the earth's surface, except during the long winter nights in the realm about either pole.

The simplest geological work of the winds is that which is brought about by their friction upon the water surfaces of the earth. For our purpose the important result of this friction is the formation of waves or undulations of water, in which are stored the energy which the winds expended in their making. In their greater form these waves may have a length of several miles, a width of a thousand feet or more, and a height from trough to crest of fifty or sixty feet. Such a wave may store more energy than can be applied at one time by the guns of the greatest warship. Gathering their power from a long-continued storm wind, these waves can roll on for hundreds of miles after they have passed beyond the field of air which set them in motion. So long as waves move over a deep sea they have no geological value. The greater part of them die out, generally converting the energy which they represent into heat, that is given to the water or to the air. When, however, the surges enter a part of the sea which is relatively shallow, they begin to do erosive work. In a depth of one thousand feet the higher waves drag a little on the bottom, brushing the sea floor lightly in a manner that may move the finer sediment. At a depth of two hundred and fifty feet the movement is strong enough to sweep small, coarse sand toward the shore, and with each further step in the shallowing the vigor of the scouring action increases until as the wave rises in the wall of the surf the rush has something like the fury of an avalanche, whirling before it everything that is not closely knit to the surface over which it is moving.

As the wave comes into shallow water, and in proportion to the dragging action which it exercises on the bottom, the surge becomes to a certain extent worn out; it shrinks in size, so that rarely, if ever, do the great waves of the wide ocean attain the continental shores. The decay of the wave is due to the application of its energy to the erosion work which it has done on the sea floor. The loss is shown not so much by the decrease in the height of the surge as in the shortening of its width and the slowing of its motion. A good share of its height is preserved in a peculiar manner: as the undulation comes over the shallowing floor of the sea the hindrance to its ongoing is proportionate to the diminution of the depth. The result is that the front of the wave, being in the least depth, is held back to a greater degree than the rear which is in deeper water. The two sides of the wave are thus crowded together, so that the crest of the arch is relatively uplifted. For all this, however, the wave when it overturns—that is, when the top, or part least held back by the friction on the bottom, shoots over the base and falls in the recurrent cataract of the surf—probably never exceeds twenty feet in height and the energy left in the surging water may be reckoned at less than one-tenth of that which is held by the greater waves of the open sea.

When the wave delivers its finishing stroke in the surf line and its splash front, the modes in which its energy is applied suddenly become changed. The falling mass of water strikes a powerful blow, which, coming upon firm-set rock or sand, has but little effect; but when, as is often the case, the beach is covered with loose stones, these fragments are driven about in a violent manner and strike heavy blows. When the wave overturns, the mass of water sweeps up the slope of the strand, urging before it all the rock fragments which it can drive onward. If the upper edge of the beach is bordered by cliffs, as is generally the case along rock-bound shores, the swash and secondary waves which gather inside the tumble of the surf send the boulders with each stroke to batter the base of the bluff. Although the waves have in all cases lost a large part of their energy before they are able to do this work of battering the shore cliffs they are still, when armed with rock fragments, competent to accomplish a great deal of erosion. Whenever the cliff is composed of ordinary hard rock, the battering at its base cuts a recess, causing the cliff to overhang. In time the weight of the mass which is thus unsupported brings it in ruins to the beach, where the fragments are ground into sand or mud by the action of the waves and removed to the deep sea or the distant reaches of the shore.

Whenever the level of sea and land remains for a considerable time constant and the shore is not protected by sand beaches, the sea cuts a distinct bench into the rocks. Even a few centuries will suffice to make this bench a noticeable feature in the sea front. A single geological period may serve to bring it to a width of one or many miles. In general, however, the frequent, we may say the incessant, changes of level place the shoreline now here and now there on the land surface and so distribute the effect of the marine benching over an area the width of which varies with the steepness of the slope from the interior to the ocean.

It is not as yet possible for us to estimate the value of this erosive work of the waves. Geologists and geographers have of late been disposed to give it less importance than they did in the earlier stages of the science. In my opinion they have seriously underestimated its importance. That it is of much value is clearly shown by the work that has been accomplished along the shores in very recent times. To limit ourselves to coasts that are at the moment steadfast and to areas within the limits of the United States, we may instance the southern borders of the islands of eastern Massachusetts, which since the settlement of the country have been encroached upon by the sea at a very rapid rate. On the south side of Nantucket the waste in certain years has amounted to five or six feet. On the corresponding shore of Martha's Vineyard the recession during the last forty years (as has been shown by the surveys of Assistant H. L. Whiting, of the U. S. Coast Survey) has been at an average rate of three feet per annum. It is probable that the gain of the sea on this part of the coast during the three centuries since the land was first seen by Europeans has amounted to nearly a mile.

On ordinary rock shores the rate of wearing is relatively slow and exceedingly variable in amount, but where the waves have a fair chance to assault the land it is always considerable. Allowing the minimum results obtained in numerous observations, we must reckon the gain of the sea at a mean of two feet per century. Computing at ten thousand years, the time that has elapsed since the ice-sheet of the last glacial period passed from these shores, the total amount of this coast erosion should average two hundred feet. During a period of one hundred thousand years—a very brief age in the history of the world—the sea should have worked its way in more than a third of a mile. Since the beginning of Tertiary time, which cannot well be reckoned at less than two to three millions of years ago, the recession of the shore, due to the action of the waves, may safely be estimated at several miles. Taking all the coastline on the eastern border of the United States into consideration, we see that the sand beaches, owing to their singular endurance of wave-action (a feature I have discussed elsewhere). have an important restraining effect on the process of marine erosion. Making allowance for this protective work, it remains clear that the effect of ocean waves is to wear back the shorelines into the land, and this at a rate which in a geological sense may be termed rapid.

As geologists find but few shores bordered by distinct benches cut in the hard rocks, they have generally underestimated the value of wave-work, but in forming their opinion they have neglected the important fact that the continents are continually changing their positions in relation to the sea level. Every step in the advancement of our knowledge of the problem shows that the shore lands are ceaselessly and at times suddenly moving upward or downward. Even those coasts which now appear to be steadfast have in very recent times changed their positions by sinking or rising. The result of these perpetual swayings of the coastlines is to distribute the benching action of the waves over a wide zone, extending along the most of the great lands from a level much below that of the present shores to a position far higher than that which they now occupy. In some instances, where the sea has chanced to remain for a long time in contact with the land on one horizontal plane, we note the existence of broad shelves of rock extending outward from the sea-cliffs, sometimes to the distance of a mile or more. Thus, on the coast of Yorkshire, from Whitby southward, a sea-cut bench, with its surface just above low tide, stretches seaward from the foot of the towering cliffs for an average distance of more than a mile, attesting in the plainest possible manner the cutting power of the sea. In general, we may say of the eastern coasts of North America that indications of marine work are visible to a height of several hundred feet above the plane of the ocean, and that there is good reason to believe that such cutting work has been done on much of the slope which now lies below the sea. When by the uplifting of the land ancient sea bases are carried above the limits of wave-action they are quickly worn away by the processes of erosion which are proper to the land. When such benches are lowered beneath the ocean they are soon covered by sediments, and thus brought into positions where even subsequent uprising of the continent would not cause them to be revealed.

Along the eastern face of North America, from South Carolina to Newfoundland, there exists a series of old mountain ranges, to which we may give the name of the Lost Appalachians, that have been worn down to their roots by some process of erosion. West of these deeply wasted mountains in the section from Pennsylvania southward we have the yet older ranges of the Blue Ridge or Central Appalachians, which on their eastern face have been worn away, though their western parts retain a considerable relief. Still further to the west, behind the wall of the Middle Appalachians, lie the West Appalachians or Cumberland and Alleghany ranges. These last-named elevations retain their original reliefs much more perfectly than the seaward mountains; they are relatively little degraded. They are recognized as mountains in common speech, while those along the Atlantic coast, though of younger age, have lost to the common eye their mountainous character and are known to the geologist only by the altitudes of their rocks.

Considering from the point of view of economic interests the erosion or land destruction which is accomplished by the sea, we note that even in historic times it has wrought changes of considerable moment to mankind. Wherever the shores are bordered by very hard rocks or walled-in by sand beaches, the processes by which the land is stripped away and its debris carried into the sea are slow; the destruction is distributed over a long period, and there is no distinct effect in the interest of men. Where, however, the coasts are of soft rocks, the waste is often so rapid that it may dispossess communities of their inheritance. Thus, at the rate of marine invasion which is now going on on the southern shores of Nantucket, that island is likely to disappear in the course of two or three thousand years, being in the end reduced to the condition of a shoal such as we now find in the shallows which stretch far to the southeastward of that island, shallows which seem to mark the position of ancient lands that have been swept away by the waves. George's shoals and other shoals extending along the coast to the northern end of the banks of Newfoundland can best be explained by supposing that they mark the sites of islands that have been planed down by the sea.

The recorded history of this country is too brief to afford any very important instances of marine erosion. In the Old World, however, these abound. Perhaps the most noteworthy is that of the politically important island of Heligoland in the North sea, which is wasting with such rapidity that it is not likely to endure for more than two or three centuries to come. The eastern and southern coasts of England, bordered as they are by soft stratified rocks, are also the seat of a rapid though locally variable marine erosion, which within the limits of recorded history has sensibly diminished the areas of many parishes. Accurate data for determining the number of square miles thus lost to the service of man are lacking, but from a careful inspection of the English coast I am of the opinion that during the Christian era the total loss of area in that portion of the most important island in the world has probably been not less than one hundred square miles. As the land thus destroyed was of average fertility, the loss of food-giving capacity has been sufficient to diminish in a noteworthy way the population-sustaining value of the country.

Against the invasions of the sea, whether they arise from the direct assaults of the waves and the currents which the winds produce or by a combination of subsidence and wave-action, there seems to be no effective means of protection. The skill of the engineer, applied at great cost, may arrest or delay the loss at points where the safety of harbors or towns is involved, but there is no reason to suppose that it will ever be found economical to protect the sea margin from wasting where the defenses are merely to save agricultural land. Our own coasts, particularly that of New Jersey, are strewn with wrecks which mark the failure of ill-directed efforts to ward off the persistent assaults of the waves. At certain points in eastern Massachusetts I have found it worth while to advise the owners of houses on the seashore where their ground was endangered by the inwashing of the shoreline to heap the sea front with large boulders drawn from the neighboring fields. In somewhat protected positions the waves breaking on this artificial beach are fended from the cliffs. Thus by giving the sea-dogs a bone they could for a time be kept from their ravages. Where the waves do not attain the coastline with a height of more than five feet, this inexpensive barrier appears to be very serviceable, but on the more open shores any boulder that could without great cost be placed on the shore would be tossed about and rapidly worn to small bits. For the maintenance of the precious land, that seat of all the higher life of the world, against the assaults of the waves or the more rapid destruction which is brought about by the down-sinking of the shore lands, we must look to those natural forces which are ever, though not uniformly, at work uplifting the continental arches above the plane of the seas. At present we seem to be in a period where the great lands recently in a state of very general depression as regards the sea level have come to a prevailingly steadfast state. The next step may be toward a general gain of the continental areas on the fields of the oceans.

We turn now from the work of erosion which goes on upon the shores, and which, as we have seen, is due to the action of solar heat working through the movements that it enforces on the atmosphere, to another effect of the sun's energy, that due to the evaporation and precipitation of water. We have noted the fact that the radiation of heat is hindered by the atmosphere, one consequence of which is the warming of the air next the earth's surface, an effect which is noticeable in a diminishing rate for a great height above the surface. To this action is also attributable the establishment of conditions which bring about the system of the rains. It fortunately happens that the adjustment of temperatures next the earth's surface makes it possible for the process of evaporation to lift a large amount of water into the air. The quantity thus borne upward is not as yet definitely ascertained, but it probably amounts to not far from an average of five feet per annum over the surface of the seas. The greater part of this water after ascending to a height of perhaps a mile or more, on an average, is condensed and falls back to the ocean as rain or snow. In making this circuit work is done, but it is of no geological value. Following the dynamic history of a pound of water in its up and down journey, we see that it takes five thousand foot-pounds of energy expressed in heat to lift it for the mile or so of its ascent, and that this energy is reconverted into heat by the friction which the water encounters in falling or by the blow which it strikes when it attains the surface. Owing to the conditions, the energy of position which the water had when at its highest point (an amount sufficient to lift one ton to the height of two and one-half feet) has, when it falls back to the sea, done no work of lasting importance. It is, as we shall see, quite otherwise when in the downward movement the water falls upon a land surface.

The winds—those movements of the atmosphere which create the waves and thus bring about marine erosion—transport the watery vapor from its main source, the seas, so that a share of it, perhaps near one-half of all that is formed, is brought over the surface of the lands. There, owing to the fact that the air is more or less uplifted, the precipitation of the water vapor is more favored, and the proportion of rainfall is usually greater than it is upon the surface of the ocean. Falling upon the land, the condensed moisture comes down in one or another of three forms—as dew, as rain, or as snow. The dew, though it has much geological importance because of its relation to plant life, has only indirect value in the problem of land erosion. It serves to diminish this wearing by favoring in the dry seasons the development of a mat of vegetation which in the period of rains protects the earth in a very effective way from the temporary streams which gather during heavy showers. The importance of this form of precipitation is great, but it is so limited that we may, with this brief statement, dismiss it.

The normal form of falling water is rain. In this mode of precipitation we usually find the fluid descending from a considerable height in the form of drops of varied bulk, averaging perhaps rather more than one-twentieth of an inch in diameter. They are generally large enough to acquire a considerable velocity on their way to the earth, though their momentum is much diminished by the friction they encounter in passing through the air. Striking the earth, they apply to it what energy they have by virtue of their velocity. If we observe what takes place on recently tilled earth, we readily note certain important consequences arising from this immediate assault of the rain. As soon as the soil is moistened, each stroke acts to break up the clods, bringing the material into the condition of mud, in which it is readily borne away by the rills which, if the shower be heavy, quickly form in such numbers as to interlace the surface. In a few moments these little streams, at first obscure, gather into distinct rills, which, with quickly swinging curves, carve out a model of a new drainage system. In the course of an hour of very rapid downfall a bare, plowed field, on a declivity of not more than five feet in the hundred, or less than the average slope of land, may have an average of one-third of an inch of its surface soil removed to the channels of the streams which drain it. It may, after such a time of rain, be noted on a field which has been plowed and rolled that here and there a small flat stone or a potsherd lies on top of a little earthen column. We see at once that the natural roof has protected the earth beneath and caused it to be left behind in the process of erosion which has overtaken the soil of the neighboring surface.

A brief comparison of the effect of a heavy rainfall on a newly tilled surface bare of vegetation and on a like area which is protected by the natural covering of living and dead plants will show the peculiar influence of the vegetable shield on the history of soils. On wood and grass lands the rainfall has practically no erosive action whatever. In the forests the mat of decayed vegetation is in most cases able to take in three or four inches of water, which it yields up so slowly as to distribute the flow over weeks and in such a manner that it removes not a bit of the soil. On the meadows the outgoing of the water is more rapid; it may, indeed, pass to the permanent streams quite as rapidly as from the plowed ground, but it is kept from contact with the soil by the closely set and entangled stems through which it cannot break, even when gathered into considerable streams. Unless field mice or moles have made burrows leading up and down the slopes and thereby providing a way in which the water is able to work below the grass, a rainfall of two inches an hour, a rate which may be called torrential, may be carried from a large field of well grassed land having a slope of twelve feet in a hundred without notably eroding the soil.

If I were an extreme selectionist I should probably not hesitate to attribute to their own agency, as developed by survival of the fittest, the admirable system by which the plants preserve the soil on which they depend from the rapid degradation to which it would be subjected but for this defense. The protective work which is here accomplished is indeed more perfect than elsewhere. It may be conceived that the plants have prospered in proportion to the efficiency of the shield which they afford to the soil on which their life depends. Interesting as is this question, it lies apart from our inquiry, and we must turn our attention to the further history of the rainwater.

(To be continued.)

THE NANSEN POLAR EXPEDITION*

Special Report of the Hon. Ernest A. Man,

United States Consul at Bergen

On the 17th day of June, 1896, as some of the men of the English Jackson and Harmsworth expedition, in Franz Josef land, were looking out over the ice they discovered a weird figure advancing towards them, with long straggling hair and beard and garments covered with grease and blood stains, who proved to be none other than Dr Fridhjof Nansen, who fifteen months previous had left his ship, the *Fram*, at 83° 59′ north latitude and 102° 27′ east longitude in order to push on with sleds, boats, and dogs towards the Pole. In a shelter some distance off was Dr Nansen's companion, Lieutenant Johansen.

A few weeks later the *Fram* arrived safely at Skjervö, Norway, some days after Nansen's return home. While Nansen did not reach the hoped-for goal, the results of the expedition promise to be of value to the scientific world and of inestimable assistance to future efforts in the same direction.

The *Fram*, with a company of thirteen men, left Vardö, Norway, the 21st of July, 1893, and proceeded eastward through the Kara sea, rounded cape Chelyuskin, and on the 15th of September was off the mouth of the Olenek river. There they expected to go in to obtain additional dogs, but, finding that owing to the shoals and rocks and lateness of the season they would probably get locked in the ice and thus be delayed a year, they at once took a northerly course into the open Arctic ocean until September 22, when at 78° 50′ north latitude and 133° 37′ east longitude they made the vessel fast to an ice-field. From this point they began drifting with the ice in a northerly and northwesterly direction, according to the plan laid out by Nansen, and by which he hoped to drift near or over the Pole, as was supposed to have been the process by which the effects of the *Jeannette* expedition reached the eastern coast of Greenland.

As had been anticipated, the drift was most rapid in the winter and spring. During the summer months they were hindered

* This report, transmitted from Bergen September 4, has been courteously placed at the disposal of the National Geographic Society by the Hon. W. W. Rockhill, Acting Secretary of State.

by the prevailing north winds. They continued drifting with the ice in this manner for nearly eighteen months, when, having reached on March 3, 1895, 84° 4′ north latitude, and finding they were drifting to the southward again, Nansen determined that the time had come in which to leave the ship and make the attempt to reach the highest possible north by other methods—a decision in which he was perfectly justified, as the *Fram* was even then at a more northerly point than had been attained by any previous expedition.

Having given the command of the *Fram* over to Sverdrup, who had been his companion on his Greenland expedition, and accepted the offer of Lieutenant Johansen, who volunteered to accompany him—though warned by Dr Nansen that it was at the risk of his life to do so—the two men, on the 14th of March, 1895, at 83° 59′ north latitude and 102° 27′ east longitude, left the ship. They took with them 28 dogs, 3 sleds, 2 kayaks or canvas-covered canoes, food for the dogs for thirty days, and provisions for themselves for three months. From the 14th of March until the 7th of April they struggled onward, making their way on snowshoes or drifting on ice-floes, either northerly or southerly, with loose ice driving up around them into formidable heights over which it was wellnigh impossible to transport the boats and sleds, and with the thermometer almost steadily at 40° below zero, Fahrenheit.

On April 7 the odds against which they were laboring became decisive; there was no prospect of scaling the ice-barriers around them. They were then at 86° 14′ north latitude. Dr Nansen put on his snowshoes and took a last reconnoitering tour to the northward. As far as the eye could reach lay great bodies of ice driving before the wind, with no land or any indication of the same perceptible. It was apparent to Nansen that under these circumstances, and with the number of their dogs already decreasing, they had proceeded as far as it was practicable, and he therefore decided that they would start upon their return journey, taking a southerly course toward Franz Josef land, intending to proceed from there to Spitzbergen, where he knew they would be sure to find a ship which would carry them home.

They set forth on the 8th day of April, 1895, and on the 12th their watches stopped, which of course threw them out of their longitudinal reckoning somewhat, but they bravely went on, overcoming the most discouraging obstacles, sometimes gaining long distances on their snowshoes, and again drifting with the ice several miles back to the northward. Toward the last of June they concluded to make a sort of camp and wait for the ice to break up somewhat. Their food was giving out and they had but two dogs left, so they began to depend on walrus and bear meat for their sustenance. It was a month of hardships, but on the 23d of July they pushed on again, with health unbroken, toward land, which they sighted the next day, July 24, at about 82° north latitude.

At that time of the year the ice was considerably broken up, and, as it was unsafe in the boats, they were obliged to travel over the floating ice, leaping from one ice-field to another, and in this difficult and dangerous way proceeded towards the land they had sighted, and which was reached the 6th day of August, at 81° 38′ north latitude and about 63° east longitude, and proved to be three snow-covered islands, to the west of which they found open water, and through this they made their way in a westerly and southwesterly direction until August 26th, at 81° 12′ north latitude and about 56° east longitude, when they set foot upon land—Franz Josef land—where Dr Nansen considered it advisable to prepare themselves for spending the dark winter months, as it was too late to continue the journey to Spitzbergen. Thus they had been more than five months wandering over the Arctic ice-fields and in the Polar sea without a roof to cover them, even without furs, which they had left in order to limit their impedimenta to the strictest necessities.

The hut they put up was constructed of stone and turf, covered with walrus skins, and was twelve feet long and six feet wide, with a door made of bear skin. Here they spent nine dreary months, depending upon their own efforts for food, as their last dog had been killed before they reached land. They had started with twenty-eight dogs, but as soon as the provisions for them gave out they had to kill the weakest, one after another, in order to feed the remaining pack.

During this terrible winter bear meat was their main dependence—in fact, these two men shot nineteen bears during their adventurous fifteen months. The fat was used both as fuel and light, a lamp having been constructed out of the metal work of the sleds. They were also obliged to make themselves sleeping bags and winter clothing of furs.

On the 19th of May, 1896, the days having become sufficiently bright, and with a supply of bear meat and the hope of finding some game on the way and making a speedy journey homeward, they set out for Spitzbergen. On May 23d they came to open water, at 81° 5′ north latitude, but were delayed by a heavy gale until the 3d of June. They saw a large body of land in the west, with open water spreading out to the north and west of it, but they concluded to go over the ice to the southward, into a broad unknown strait. When they reached the southern end of this strait they found the open sea to the westward. It was while struggling over the ice off the coast of this land that they came upon the Jackson-Harmsworth expedition, which happened on the morning of the 17th of June, 1896. It was Nansen's turn to cook that day, and he had risen early to get breakfast, while Johansen lay in under the shelter they had constructed of the two kayaks and the sails of their sleds. Suddenly Nansen called out, "I hear the barking of dogs; there must be people near." Johansen sprang up, but could hear nothing. In the meantime they decided to finish their meal, and then Nansen went forth to search for the source of the sounds he had heard. He had not been gone long when Johansen distinctly heard the barking of dogs himself, and not long thereafter a party of men from the Jackson expedition made their appearance. They prepared at once to take Johansen and the camping effects with them to the Jackson headquarters, where Nansen had preceded them. Among the articles they took with them were the kayaks, or flat-bottomed canvas boats, which had carried the two men for so many days. They were made of a frame of bamboo, covered with sailcloth. One boat had been made by Nansen and the other by Mogstad, the carpenter on the *Fram*. They weighed some twenty pounds each, and were about twenty feet long, completely decked over, with a hole in the middle for the rower, and in each end a smaller opening through which to get at the provisions and anything else stowed under the bows and stern. These boats were now perfectly black with the grease and oil which had been smeared over them continually to keep them water-tight. Besides the boats, there were the sleeping-bags, old and ragged, their snowshoes, paddles, guns, bear-skin traces for dragging the sleds, etc. Their only cooking utensil was exceedingly primitive, and in the bottom of it were left the remains of the last meal cooked in it, a sort of soup, made of salt water, the meat of a young walrus, and a little corn meal. It is said that it would be impossible for the civilized world to picture to itself the appearance of Nansen and Johansen as they stood before the English explorers, their beards long and unkempt, their hair hanging in wild disorder upon their shoulders, and their clothing stiff and dark with the accumulated grease and blood of the animals they had slaughtered and cooked during fifteen months of unexampled existence.

On August 13, 1896, the Jackson expedition's ship, the *Windward*, landed them at Vardö, Norway, and on the 20th of the same month the *Fram* came steaming into Skjervö, near Hammerfest, and thus the whole expedition was once more on its native shores, every man alive and hearty, and the *Fram* itself without a timber injured.

After Nansen left the *Fram* in Captain Sverdrup's charge it continued its, on the whole, northwesterly drift, sometimes veering a little to the southward, and then gaining something in the wished-for direction northward, and again lying cradled in ice, from which it was several times freed by charges of powder, sometimes as large a charge as 110 pounds being exploded in the ice.

On the 16th of October, 1895, seven months after Nansen left them, the *Fram* reached her highest latitude, viz., 85° 57′ north latitude, in longitude 66° east. After this the drift was to the southward again, and when the ice broke up this summer of 1896 the most energetic efforts were made to free the *Fram* and get her through the vast fields of ice out to open water. This was finally successful, and on the 13th of August, the very day of Nansen's arrival at Vardö, the *Fram* reached the open sea, with no more obstacles between her and a home port. No one had been ill or injured during the voyage and not a case of scurvy had occurred. Cheerfulness reigned, and the amusements with which the long, dark winters were beguiled were only disturbed now and then by a feeling of anxiety caused by the crunching and grinding of the masses of ice crowding against the ship's sides. The electric light, with its windmill and accumulators, was a great success. When the wind failed, the men were ready and willing to take needed exercise by turning the capstan, and thus supplying the deficiency. No land was seen above the 82° of latitude. During the *Fram's* voyage soundings from the north of the New Siberian islands to north of Spitzbergen showed the minimum depth to be 1,600 fathoms and maximum 2,000 fathoms, which upsets all theories as to a shallow Polar basin in the European Arctic ocean. One peculiar feature of this Polar sea is that the upper space of water to a depth of about 100 fathoms is ice cold, while below it there is a stratum of water showing a half degree of warmth (Celsius) and reaching to a depth of about

380 fathoms, below which it is again cold. This may, possibly, be owing to the Gulf stream. There was a great dearth of organic life, none whatever being found in the greater ocean depths, and no signs of animal life in the higher latitudes, excepting an occasional migratory bird, so that the idea of organic life prevailing in the upper regions about the Pole is erroneous.

While many contend that Nansen's theory of a Polar current flowing across the Pole on to the east coast of Greenland seems to have been correct, there are strong arguments against it, and Sverdrup, who was in command of the *Fram* when she made her most northerly record, seems to think that there is no regular current, but that the movements of the ice masses are mainly governed by the winds. On the other hand, from a look at the chart showing the entire drift of the *Fram*, there would seem to be a reasonable probability that if the *Fram* had taken the course originally intended by Nansen, viz., had gone farther to the eastward and entered the ice-fields to the northeast of the New Siberian islands instead of the northwest, she might have drifted farther north, if not over the Pole itself. However that may be, it is said that Dr Nansen himself has stated that should he undertake another expedition in that direction it would not be by means of a ship, but with sleds, kayaks, and dogs, with Franz Josef land as a starting-point, and depending mainly on the resources of the regions about him for subsistence.

Whatever may be thought of the wisdom and usefulness of such expeditions, all must admire the superior courage of these two Norwegians, and especially Dr Nansen, who, fully appreciating the full extent of the deadly perils they were to encounter, had also the sagacity and ability to foresee and prepare for almost the minutest details of their undertaking. The fact of these men, after having passed through the terrible rigors of two Arctic winters, stepping over the side of their sheltering ship into the unknown wastes of this high latitude, with no expectation of rejoining her there, and marching with their dogs straight into the terrible north, required an amount of splendid courage impossible to excel; and that they were able to live through fifteen months of these conditions shows a physical superiority as great as their daring, in which, no doubt, their well-known abilities as sportsmen and athletes was a very important factor.

ICE-CLIFFS ON THE KOWAK RIVER

By Lieut. J. C. Cantwell,

United States Revenue-Cutter Service

The Kowak river rises in the northwestern part of Alaska, and after a tortuous easterly course of about 550 miles, the greater portion of which is within the Arctic circle, it flows into Hotham inlet, a large body of fresh water opening into Kotzebue sound. During the summers of 1884–'85 it was my good fortune to visit this region and to make a reconnaissance of the stream from its mouth to its headwaters. Among the many novel and interesting features of the region, which had never previously been visited by white men, none were more striking than a remarkable series of ice-cliffs observed along the banks of the river about 80 miles from its mouth. These deposits of ice were first seen in some of the low silt banks of the delta, and it was supposed that they were the result of the spring freshets in the river forcing large masses of ice into the soft, yielding soil of the banks. But when on our emerging from the delta and reaching the higher land of the interior we still found these ice deposits in the form of cliffs, from 80 to 150 feet high, the theory of current formation had to be abandoned. The banks of the stream in the region where the ice-cliffs are found are not all filled with ice, and the water-marks on those which are composed only of soil and rock show beyond question that the water has never reached a sufficiently high stage to have transported the ice to its present position.

At two points the cliffs attain an altitude of over 150 feet, and one cliff measured by sextant angles showed 185 feet. The tops of all the cliffs were superposed by a layer of black, silt-like soil from 6 to 8 feet thick, and from this springs a luxuriant growth of mosses, grass, and the characteristic Arctic shrubbery, consisting for the most part of willow, alder, and berry bushes, and a dense forest of spruce trees from 50 to 80 feet high and from 4 to 8 inches in diameter.

Where the face of the cliffs was towards the south the upper portion of the formation would be found undergoing the process of destruction under the melting action of the sun's rays, while in other situations the erosion of the river current was constantly undermining the cliffs. Both of these destructive agents caused great masses of soil and tree-laden ice to become detached and fall into the stream. Where the retreating waters of spring had left these masses of detached ice stranded on the adjacent beaches or bars, piles of soft dust almost entirely free from any gritty substance would be left as a monument to mark the spot where the ice had been melted by the summer sun. These small dust heaps are a characteristic feature of the region where the ice-cliffs are found and are entirely different in appearance from the gravel and sand heaps deposited in the same way by ice floated down from the upper river.

An examination of the tops of the ice-cliffs was very difficult on account of the dense undergrowth and the thick carpet of moss, but on one we discovered a lake about a mile in diameter and situated some 500 yards from the face of the cliff. The water in this lake was fresh and clear, but upon being disturbed became exceedingly turbid, owing to the presence of a large quantity of fine, decayed vegetable matter on the bottom. A piece of the ice melted showed a residuum of fine, impalpable dust, which under a lens proved to be composed mainly of vegetable matter and, while fresh, emitted a very pungent, disagreeable odor.

The country in this region is mostly rolling tundra plains, with innumerable small lakes and streams, all of which are tributary to the larger river. There is no evidence of glacial action whatever, and it is not until the first mountain range is reached, a hundred miles further upstream, that any rocks *in situ* are seen. Here and further inland more plainly are to be found beds of trap, which an examination shows to be a pronounced olivine diabase, with such minerals as hornblende, mica, feldspar, augite, etc. present. Other rock forms show unmistakable evidence of the eruptive agencies that have been at work in the formation of the upper river region. The formation of the remarkable ice-cliffs in the lower country is, however, a geological nut which the writer admits his inability to crack.

General A. W. Greely discusses the Nansen Polar Expedition at considerable length in Harper's Weekly of September 19, eulogizing Dr Nansen's courage and self-reliance, but taking strong exception to his leaving the *Fram*.

RECENT HYDROGRAPHIC WORK

The work of the Division of Hydrography in the United States Geological Survey has been greatly extended, owing to the increased appropriation made by Congress last spring. The reports covering the first quarter of the present fiscal year—July to September, 1896, inclusive—show that a large amount of data of more or less value to geographers is being accumulated. This relates principally to the rivers of the Rocky Mountain region, of the Pacific coast, and of the Atlantic slope. The underground waters also are being systematically studied, the problems being largely geologic in character. In particular, the work of Mr Willard D. Johnson upon the underground waters of western Kansas should be noted. Mr Johnson has been carrying on his examination mainly in the vicinity of Garden City, Kansas, where he has put down a number of test-wells for observing the fluctuations of the ground waters. By causing the large steam-pumps of the city water works to be operated at various rates of speed the ground water has been drawn upon, and he has been able to make valuable observations upon the rate of flow and general behavior of these percolating waters. The lack of uniformity in the data shows clearly that the problem of the movement of ground water is by no means so simple as it appeared, and that a large amount of detailed work is necessary. The importance of a correct knowledge of this subject can best be appreciated when it is considered that the utilization of a large part of the most fertile lands of the west is dependent upon the practicability of pumping water from under ground for irrigation.

The investigations above mentioned are, however, but a part of those of the Division of Hydrography. In eastern Washington and adjacent portions of Idaho and Oregon Professor Israel C. Russell has carried on a reconnaissance of the artesian conditions; in North Dakota Professor Earle J. Babcock has been making examination of the water supply derived from wells and springs; in Nebraska Mr N. H. Darton has been making a systematic study of the areal geology of the vicinities of Lincoln and Grand Island for the purpose of obtaining detailed information regarding the underground waters, and Professor Erwin H. Barbour has been carrying on a broad study of the wells of the state; in Kansas Professor Erasmus Haworth has been giving particular attention to the artesian conditions in the vicinity of the Meade County flowing wells, and in the Ohio valley Mr Frank Leverett has been continuing his study of water supply in connection with the examination of the glaciated area. About twenty-five short papers are now in preparation relating to the water supply in various parts of the United States or to the utilization of this in irrigation or for power or domestic purposes.

F. H. N.

MISCELLANEA

The September number of the United States Consular Reports, to which admirable publication of the Department of State The National Geographic Magazine is frequently indebted, contains valuable geographic articles on the Kongo Free State, Hangchow, and the Production of Coffee in Mexico.

The library of the National Geographic Society has again been enriched through the munificence of the Hon. Gardiner G. Hubbard, president of the Society, who has presented to it an unbroken set of Nouvelles Annales des Voyages from its commencement in 1819 to 1865, inclusive. These 184 volumes cover the world's explorations for nearly half a century and constitute the most valuable geographic serial extant.

The various subsidies granted by Congress for special fast mail service are of advantage to the public not merely in the acceleration of the mails, but also in the increased facilities the different railroad companies are enabled to offer in the transportation of passengers. Especially is this the case with the Southern railway, the subsidized mail trains of which system, running 100 miles or more without a stop, now reach the principal points in the South in several hours' less time than has ever before been practicable.

It is proposed to erect in London a terrestrial globe having a diameter of 84 feet and showing the earth's surface on a scale of about eight miles to the inch. Every geographical feature of importance will be shown and named. The United States, from east to west, will measure about 30 feet, and India, from east to west, about 23 feet, while London, drawn to scale, will cover a space rather larger than that of a silver half-dollar. Rarely has a project called forth a more remarkable manifestation of interest and approval than this has evoked. Among the 350 men eminent in art, science, and literature who have given it their hearty support are Markham, Stanley, Geikie, Lockyer, Bryce, Lecky, Wallace, Flower, Crookes, Keltie, and many others equally well known on both sides of the Atlantic. The project should prove of the greatest educational value and it cannot be too highly commended.

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THE WITWATERSRAND AND THE REVOLT OF THE UITLANDERS*

By George F. Becker,

United States Geological Survey

The South African Republic, or, as it is more often called, The Transvaal, lies in southeastern Africa, between the Limpopo or Crocodile river on the north and the Vaal river on the south. Portuguese and British possessions shut it off from the Indian ocean on the east, and the country to the north and west of the republic is also British. The Vaal river is tributary to the Orange, which flows into the Atlantic, while the Limpopo empties into the Indian ocean. The watershed between these rivers is the Witwatersrand, or white-water-range, which trends nearly east and west about south latitude 26°, and is therefore only 150 geographical miles from the tropic of Capricorn.

The Transvaal may be roughly described as an elevated plateau, most of which lies between 4,000 and 6,000 feet above sea level. To the north of the Witwatersrand the general level is not much over 4,000 feet. Immediately to the south of this watershed, near Johannesburg, the elevation is about 6,000 feet. gradually diminishing toward the Vaal. The general aspect of the country reminds one of the Laramie plains, but the rainfall averages about 30 inches, and the climate is mild and equable. The soil is only moderately fertile, and 15 years ago the country was considered fit for nothing but pastoral occupation.

The Witwatersrand, in the neighborhood of Johannesburg, consists of upturned edges of a thick mass of quartzites, shales, and conglomerates, known as the Lower Cape formation. These

* Paper read before the National Geographic Society, October 16, 1896.

rocks are of Paleozoic age, but carry no fossils. The conglomerates of this group almost all contain more or less gold. The most famous mines of the Transvaal are opened upon a certain set of these conglomerate beds known as the Main Reef series. Resting unconformably on the Lower Cape is another group known as the Upper Cape and containing one bed of conglomerate, the Black Reef, which has been profitably worked for gold at some points. An extensive sheet of dolomite forms one member of the Upper Cape. Unconformably on the Upper Cape lies the Triassic, carrying very extensive beds of coal, one of the treasures of the Transvaal of which little is heard outside of South Africa. As the country is also rich in iron ores, one may expect to hear more in the future than in the past of these coal fields. Meantime they supply the gold-mining industry with good and cheap fuel. The Lower Cape formation, with the Main Reef series, is exposed only to a limited extent. Within less than 20 miles of Johannesburg, both to the east and west, the Upper Cape and the Triassic beds flood the country, and for a long distance only an occasional glimpse is to be had of the Lower Cape with its auriferous conglomerate. It is said by various engineers to reappear occasionally for hundreds of miles from Johannesburg—as, for instance, in Zululand—and to be more or less auriferous wherever found. It need hardly be remarked that the search for the Main Reef beneath the Trias is most arduous. That it will eventually be traced far beyond the surface exposures of the district is quite certain.

In this paper the Witwatersrand district alone is of especial interest, but in conveying a general notion of the Transvaal it must be remarked that this is by no means the only auriferous district in the republic. There are four other districts, containing in all ten mines, which yield at the rate of over $100,000 each annually. Of these the Klerksdorp district carries gold in conglomerates. In the three other districts the gold is found in ordinary veins. The Sheba mine, in the De Kaap district, has yielded over $5,000,000. Four of the important mines lie in the Lydenburg district, and one, the Sutherland, in the Zoutpansburg district. The total gold product of the Transvaal for 1895, outside of the Witwatersrand, was $3,581,000, while the Rand alone yielded $38,110,000.* Statistics show that the yield of the outside mines is increasing about as rapidly as that of the Rand.

* For comparison it may be noted that the United States produced in 1895 $46,610,000 worth of gold, or about $4,900,000 more than the Transvaal.

The great gold deposits of the Rand are beds of conglomerate, known in South Africa as "banket" or "reef." They crop out for some 27 miles at a distance of from one to two miles from the crest of the Witwatersrand, and usually dip near the surface at an angle of 45° or more. When followed downward the dip diminishes somewhat rapidly to 25° or less. None of the mines are yet very deep; none in fact reach 2,000 feet, but the reefs have been found by the diamond drill to a depth of 2,500 feet. The structure of the country seems to show that below the 2,000-foot level the reefs will continue for a long distance at a moderate angle. How deep mining can be carried on may be more or less questionable, but the mining engineers on the Rand confidently believe that they can get down 5,000 feet, and I agree with them. The ore of the Rand is phenomenally uniform for an auriferous deposit. While it is locally patchy, considerable areas show only moderate fluctuations from a general average. The quantity of gold can be computed with something like the same confidence that the amount of coal in a coal seam can be calculated. Such a computation is in the nature of things only a first approximation, but within certain limits it has a value. Estimates of this kind for the whole area or portions of it have been made by various experts, among whom may be mentioned Mr Hamilton Smith, Bergrath Schmeisser, of the Prussian mining service, Mr John Hays Hammond, Messrs Hatch and Chalmers, and Professor De Launay, of the Paris School of Mines. These estimates accord fairly well. The latest is Professor De Launay's, who, after a review of the other estimates, calculates by a method of his own that to a depth of 1,000 meters (2,381 feet) and for a length of outcrop of 25 miles the amount of gold accessible is 13 or 14 milliards of francs, or from 2,600 to 2,800 million dollars. This would give down to the 5,000-foot level from 3,962 to 4,267 million dollars. Other of the estimates, similarly treated, would give still larger values. Hatch and Chalmers, on the other hand, estimate that the Rand proper, together with outlying portions of the district (all within about 20 miles of Johannesburg), will yield down to the 5,000-foot level about 3,500 million dollars. I have not been able to find any grounds for regarding this as an overestimate, and I know of no one familiar with the deposits who thinks it exaggerated.

The sketch of the character and resources of the Transvaal just given contains nothing new. It has been outlined in order to indicate how it happens that a community has suddenly sprung up at Johannesburg, composed of enterprising, highly intelligent, and perhaps somewhat impatient men, hailing from many different lands—men as different as possible from the pastoral pioneers who compose the South African Republic. The Boers and the foreigners, or "Uitlanders," as they are called in Dutch, were not congenial and the great mining camp has all along constituted a menace to the peace of the Republic. As every one now knows, the threatened danger was not averted.

The dramatic incidents which have taken place in the Transvaal during the past ten months have drawn the attention of the whole world to that country. The interest in these events felt in the United States has been little less intense than that in Great Britain. This is entirely natural, for many of the leading men in Johannesburg are Americans; indeed, the mining industry is chiefly under the guidance of American engineers, and the United States was represented on the reform committee by seven members. It really behooves the American public therefore to know how prominent American representatives of an important profession have behaved themselves under trying circumstances. While there is a natural sympathy in the United States for Anglo-Saxons taking up arms for their rights, we, as Republicans, also sympathize with the South African Republic in the endeavor to maintain its independence. This fellow-feeling makes it all the more interesting and important to examine carefully and, if haply such a thing is possible, impartially as well as carefully, into the causes and conduct of the revolt.

I wish this inquiry had fallen into other hands than mine, but I happened to visit the country in April for a stay of some months; several of the condemned men are old friends of mine as well as colleagues, it naturally fell to my part to make such efforts in their behalf as I could, and still in spite of these personal relations it is clear to me that there is much to be said on the Boer side of the questions at issue. So far as opportunities go, therefore, I am perhaps in as good a position as any one can be to review the circumstances without prejudice. The great difficulty in this, as in any inquiry of an historical nature, is to ascertain the facts, for these are differently represented by different though seemingly well-informed persons. I trust it will be found that I have measurably succeeded.

It would be impossible to understand the conditions which led to the grievances of the Uitlanders without considering some of the influences which have made the Dutch colonists or Boers what they are. The Boers are most closely related to us ethnologically, but their political and industrial history has been so different that jealousies and antagonisms have arisen which, though highly regrettable, are by no means without excuse.

The Boers, like the English, are in the main of Teutonic blood, with a relatively small infusion of French stock. Like the English, they are stubborn, self-reliant, fond of the chase, and admirably adapted to cope with the difficulties incident to colonization in a country occupied by savage beasts and still more savage men. The Boer ideal seems to be life on a large estate, with plenty of sport and the occupation of not too exigent stockbreeding and farming. So far their tastes do not differ greatly from those of many Englishmen, but they are for the most part ignorant of the refinements of life so dear to advanced Anglo-Saxons, and perhaps on this account they are almost devoid of the commercial instincts through which such tastes might be gratified. They are, it is said, usually able to read print, but for the most part their reading is confined to the Bible. They are highly religious, and the Bible appeals to them as to few other peoples, because the scenery and material conditions of the Book are so similar to those by which they are surrounded. The very animals are the same. Their religion is somber and puritanical; it is that of the Old Testament, with little sweetness or mercy in it. Under normal conditions the Boers are generously hospitable and they are brave. It is true that Englishmen have sometimes reviled them as cowardly, but their whole history, and particularly the battles of Boomplaats and Majuba Hill, shows the contrary. The accusation seems to be due in part to the fact that like all continental Europeans they are greatly averse to fisticuffs, and partly to the fact that in fighting with rifles they avail themselves of cover whenever they can. Taking advantage of cover I understand to be a well-established principle of all modern tactics.

Many of them are said to be untruthful, at least in matters of business. This is not strange, for it was long ago observed that financial responsibilities do more than the most stringent religion or than amiability and bravery to foster a high standard of truthfulness. The Boers are sometimes spoken of as a degenerate race, but this is certainly a slander. They usually possess an excellent physique, and it is perfectly well known that one or two generations of education put the Dutch colonist on a par with men of any nationality. The struggle for existence and for freedom has saved them from mental stagnation. That they are backward as a race, according to our standards, is true. Much of the seventeenth century still clings to them, but they have lost none of the capacity for advance.* The most important of all the characteristics of the Transvaal Boer is his passion for freedom or, what in his case is tantamount to the same thing, his horror of British domination. In 1880 the women of the Transvaal urged their sons and husbands to arms, bidding them die like patriots, if need were. This passionate horror of English rule is an historical development. The Boers have had little opportunity to observe how mild and beneficent English rule can be under certain circumstances.

Cape Colony passed into the possession of the British Crown by force of arms in 1806, and was formally ceded by the Prince of Orange in 1814. The white population of the Cape at that time consisted of the descendants of Dutch colonists and French Huguenots. The latter had found their way to Africa through Holland after the revocation of the Edict of Nantes in 1685. At no time did the Huguenots exceed one-sixth of the colonists, or, if the Dutch East India Company's servants are counted, one-eighth of the total European population. The colonists had little intercourse with Europe during the 18th century. Like other colonists of the time, they owned slaves, their lives were pastoral and agricultural, and, except for the Bible, their studies were confined to woodcraft. The petty impositions of the Dutch East India Company had made them unscrupulous so far as transactions with the government were concerned; the incorrigible carelessness of Hottentot servants had weakened the habits of cleanliness which they had brought from Holland, and the possession of slaves had produced its usual deleterious effects.

* Mr John Nixon, in his Story of the Transvaal, 1885, which certainly cannot be accused of partiality to the Dutch colonists, says: "I have the pleasure of numbering many intelligent and educated Boers among my acquaintance, and I desire to put on record my opinion that a 'good' Boer is quite equal to a good Englishman. Nay, in one respect he is better, for he adds to the virtues of an Englishman an unbounded and generous hospitality. . . . The educated Boer is a splendid stock. . . . No one can deny that on that day [Majuba] the Boers fought bravely and well."

The Uitlanders commonly form an extremely unfavorable opinion of the Boer. They do not desire Boer hospitality and they see nothing of his qualities as a pioneer, while in business they find him suspicious, untrustworthy, and behind the age; but it would not be fair to judge of a people like the Boers entirely from a commercial standpoint. The Boer, on the other hand, is not without justification for suspecting English designs on his independence, and he can point to many promises of the British government which have not been fulfilled; but it is not fair to judge a people like the English entirely from a political standpoint.

Thus, except in the resources appropriate to pioneers, they had been left behind in the march of civilization.

The British colonial policy in the early decades of this century had not yet developed into its modern phase of mildness in any part of the world. In 1815 took place a little disturbance which has been designated by the exaggerated name of the "rebellion" of Slachter's Nek.* Two of the insurgent Boers and one Hottentot British soldier only were killed, yet the British punished the revolt by hanging five men, none of whom had shed a drop of blood, while thirty-two others were condemned to banishment, imprisonment, or fines. This cruel sentence, followed by no commutation, has never been forgotten by the Boers, and small is the wonder. The use of the Dutch language was forbidden in the courts of Cape Colony in 1827, and for a short time those who did not understand English were even disqualified from jury duty. In 1834 the slaves were emancipated suddenly by act of Parliament. The compensation proposed was only one-third of the appraised value, and the conditions of obtaining this fraction were so onerous that the colonists in many cases realized only a fifth or a sixth of the actual value, and sometimes nothing at all. Many families were reduced to want, and great misery was caused by the injudicious execution of a measure the principle of which was laudable. The emancipated negroes were placed on a political equality with their recent masters, and the government refused to pass vagrant laws to control the blacks. This was a period when philanthropists were very enthusiastic on the subject of the universal brotherhood of man, and it was supposed by many well-meaning people that Kaffir tribes were intrinsically on a par with white communities. The Boers knew better. Their refusal to acknowledge the equality of white and black drew down on them the wrath of the missionaries, who were extremely influential both in London and Cape Town. There seems to be no doubt that the Dutch were represented as far more cruel to the natives than they really were, while the blacks were painted as far less barbarous than they are known to have been.† Thus the mutual antagonism of the Boers and the English was fomented by the apostles of peace.

*The origin of this affair was the refusal of a Boer named Bezuidenhout to comply with a summons to answer a charge of having ill-treated a colored servant. There seems to have been no politics in it.

†That some terrible cruelties have been perpetrated by the Boers on the blacks during periods of hostility is not to be doubted. It must be remembered that white prisoners taken by the blacks were and are tortured with indignities sickening to hear of and quite indescribable in print.

The various grievances briefly indicated above led to the first great "Trek," or emigration of the Boers, from Cape Colony in 1836–'37. Taking only their herds and such movables as they could load on their wagons, thousands left the country. The emigrants themselves maintained that they left the colony not to avoid law, but lawlessness, and they made it evident that their chief motive was to escape the severe yet inefficient English domination. In a manifesto by one of their principal men, Peter Retief, written in 1837 it is asserted, "We quit this colony under the full assurance that the English government has nothing more to require of us and will allow us to govern ourselves without its interference in the future." Vain hope!

In migrating into the wilderness, the Boers naturally came into contact with the natives, not the negroes of the United States, who came from the West Coast of Africa, nor the Hottentots of the Cape, but the great Bantu or Kaffir race, which includes the Zulus, Matabili, Basutos, etc. These people are of a dark bronze hue, and have good athletic figures. They possess some excellent traits, but are horribly cruel when once they have smelled blood. The Bantus appear to have reached the cape about the same time as the Europeans, killing out Hottentots and Bushmen as they advanced, and waging furious inter-tribal wars. Again and again a Bantu tribe, effectively organized under some able chief, has swept a great region clear of human beings. When their witch-finding ceremonies are considered as supplementing the unsparing slaughter of war, it is remarkable that any considerable number of Bantu remained. Nothing but the phenomenal fecundity of the race has kept up its numbers.

The trekking Boers thus met tribes who held their territories only by the right of recent and bloody conquest and to whom battle was the object of life. If the Boers had small compunction in taking land from them, it is perhaps not to be wondered at. The Boers paid for it, like the Bantus, with blood. The history of the conflicts between the Boers and Zulus is wildly romantic. It has been written and cannot be repeated here.

The greater part of the territory occupied by the South African Republic and by the Orange Free State was absolutely depopulated by the Matabili (or rebel Zulus) under Moselekatse in 1817. Twenty years later this chief and his followers fled to the north of the Limpopo river, as the result of independent defeats by the Zulu subjects of Dingaan and by the Boers.

When they left Cape Colony a portion of the Boers settled in

ZULU BRIDE AND BRIDEGROOM

Natal, after the loss of a great part of their number, treacherously slaughtered by the Zulu chief, Dingaan. The English had repeatedly refused to annex Natal, but after the Boers had been settled there for five years and had set up a republic, the British took possession, and to escape them most of the Boers trekked again to the north of the Orange river, where many of their kinsfolk had preceded them in 1836–'37. Repeated official declarations had been made that the British dominion would not be extended to the northward of this river. Nevertheless, in 1848, British sovereignty was proclaimed over the region between the Orange river on the south and the Vaal on the north, practically the area now occupied by the Orange Free State. The Boers resisted the annexation; two of their number were hanged and the property of other recalcitrants was confiscated. As early as 1842 many Boers had entered the Transvaal. After the annexation of the country to the south, many more crossed the Vaal. In 1852 the population amounted to about 5,000 white families, and the independence of the Transvaal was acknowledged by England in the Sand River Convention.

In 1877 the Transvaal was annexed by England on the plea that the weakness of the state was a menace to English interests.* But the unwillingness of the Boers to be British subjects had not diminished, nor were they without grave reasons for dissatisfaction. It is acknowledged by men of all parties that the promises made by the English at the time of the annexation were not kept.† Late in 1880 the republican flag was again hoisted; war and the battle of Majuba hill followed, and in 1881 the Transvaal was again acknowledged independent,‡ though with the reservation of British suzerainty. In 1884 the relation of the two countries was further modified by a convention, which is still in force. In this document the only substantial right reserved to Great Britain is that of ratifying treaties between the republic and foreign powers.

An attempt has been made in the foregoing paragraphs to show the origin of the hostility and distrust with which the Boers regard the English, but it is not to be inferred that the

* Proclamation of annexation and address of Sir T. Shepstone. The annexation was nominally provisional. In 1879 Sir Garnet Wolseley announced that it should continue "forever."

† Mr Nixon writes: "Nor were any of the other promises which were expressed or implied at the time of the annexation carried out."

‡ The greater part of the above historical notes are taken from Mr G. McC. Theal's History of South Africa, 4 vols. Mr Theal is generally acknowledged to be a trustworthy and impartial historian.

British policy in South Africa has been one of consistent and deliberate oppression. Vacillating it has been, through changes in party government, through ignorance in the colonial office of conditions in South Africa, and through the idiosyncrasies of arbitrary or doctrinaire commissioners. Many of the British governors have lost reputation and have been recalled in consequence of their mistakes, but South Africa has gained little by the penalties meted out to her rulers. In public affairs enlightened wisdom is more useful than virtue; for wrongs, though unintentionally committed, can seldom be righted or even fully atoned for.*

Gold had been discovered in the Transvaal in the Lydenburg district as early as 1867, and prior to 1881 it had been found at other points as well, but none of these discoveries were of a very sensational character. The marvelous deposits of the Witwatersrand were detected in 1885.

The Witwatersrand as a gold-producing district has no parallel in history. It is now producing from an area no larger than the District of Columbia at the rate of more than $40,000,000 worth of gold annually, and, as has been mentioned, there are good reasons for believing that the ultimate total production will be approximately $3,500,000,000, or about ten times the total value of the product of the Comstock lode.† Production did not begin till 1887. Of course, Johannesburg, the chief town of the district, grew with the utmost rapidity.

A census of the district within three miles of Market square was taken in July last. It showed 51,225 whites and 51,849 colored people. Doubtless the enumerators missed some residents, but probably no large proportion of them.

The sudden development of this vast industry naturally produced a profound effect upon the financial circumstances of the Transvaal, although the Burghers did not take part in the exploitation of gold. The Boers sold land at enormous valuations, furnished transportation at high rates, sold produce at famine prices, and levied most profitable taxes. How greatly they bene-

*The loyalty of many Englishmen is so extreme that they esteem it a blessing for any people to come under English domination, whether willingly or otherwise. They cannot understand how people can prefer independence to the British rule. This fact explains many instances of aggression which to an American seem without excuse.

†As estimated by the Mint Bureau of the United States, the Comstock produced up to January 1, 1896, about $149,000,000 worth of gold. If silver is reckoned at the coining value, or $1.2929 per fine ounce, the total product of the lode is estimated at $357,472,626.85. The gold is about 42 per cent of the total value. Last year the production of this great lode fell below a million dollars.

fited by the mining industry from a pecuniary point of view is illustrated by the fact that the public revenue in 1894 was six times that in 1886. The Boers did not foster the foreign community on the Rand, in spite of its beneficial influence upon their finances. On the contrary, they held aloof, and actually threw many obstacles in the way of the progress of the industry. They evidently regarded the immigration as a new and insidious form of British invasion. The independence which they had achieved by remarkable efforts and sacrifices was jeopardized by a peaceful inroad, and they were in danger of losing their freedom by a process of absorption into a larger community growing in their own midst.

That they should resist this new form of conquest by every means available to them was inevitable. Indeed, any other course would have belied their entire history. The most evident means of retaining control of their own destiny was to render the acquirement of the franchise difficult if not impossible, and this perhaps indispensable measure was promptly taken.

So far as I can learn, both the liberal or progressive party and the conservative or Dopper party of the republic are in accord as to the policy of practically denying the franchise to foreigners. On other points they differ. The conservatives, who are represented by the present administration, do not include among their members a sufficient number of educated and professional men to fill the offices rendered needful by the new order of things. They cannot draw largely on the opposition to fill these places, and few of the Cape Boers, being British subjects, are available for the execution of the anti-English policy.* Hence it is to Holland that President Kruger is almost forced to turn for educated men of Dutch speech to carry out the Dopper program. The railway, too, from Delagoa bay to Johannesburg and other points in the Transvaal is in the hands of the Netherlands Railway Company,† a fact which tends greatly to increase the influence of the Dutch in the Transvaal. It would also seem to be a deliberate plan with the conservative party to offset and minimize English influence as far as possible by that of the Netherlands, from which the republic has nothing to fear.

* According to Mr Wessels, in a lecture delivered in 1891, the fear of betrayal to England is frankly stated as a sufficient reason for not appointing Cape Boers to office in the Transvaal.

† The concession for this road was originally conferred under President Burgers in 1875, but the road was only completed so as to connect with the Cape system in 1891. It is said to be the most profitable railway in the world. The republic has the right to take possession of it.

The Dutch, or, as they are called in South Africa, the "Hollanders," are not popular with the progressive party, which could fill many of the offices with its own members. Neither is it the policy of this party to foster the influence of the Netherlands in the republic. The liberal party, as I gather, holds that so long as the control of the country is retained to the Burghers by limiting the franchise, any undue influence of the English can be obviated with little aid from Europe.* The mining community detests the Hollanders, for it is through them that nearly all the obstructive policy of the government is carried out. It is charged that the Hollander officials are very corrupt, and that some of them are so is certain. It is not, however, to be supposed that all of these members of an honorable nation are bad,† and that many of them are able is beyond question. Dr Leyds has shown himself a statesman of a very high order. Among the assistants he has chosen there must be many intelligent enough to appreciate the expediency of honesty. That bribery exists, however, and that mining companies bribe on a large scale is certain. Bribes are said to be indispensable.

It may be suspected that a large part of the Hollanders are in Africa to make their fortunes, with the intention of returning to Europe when this end is accomplished. If so, they are most undesirable officials or even burghers. No man of ordinary virtue who does not identify himself with the country in which he lives, to whom that country is not "home," will use official power or the franchise consistently for the best interests of a community from which he longs to be gone.

The Uitlanders of the Rand were, and are, extremely discontented under the Dopper policy of exclusion, obstruction, and repression. They considered themselves superior to the Burghers and a benefit to the country, and they were indignant at the favor shown to the Hollanders. They desired to manage local affairs in their own way, and above all to be unobstructed in the accumulation of wealth and in the development of the mining industry. The way to attain these desires which most naturally suggested itself to the Anglo-Saxon mind was to obtain the franchise on terms similar to those exacted in English colonies and in the United States. It is not clear that any large portion of

* At the last presidential election, in 1893, Mr Kruger was elected by a majority of only 843 over General Joubert, the progressive candidate and now Vice-President, in a total vote of 14,944.

† Mr Wessels says that among the Hollanders you will find "worthy descendants of a race that can boast of Egmont and Horn, of Hugo de Groot and Olden Barneveld."

CROSSING THE UMBELOSI RIVER, SWAZIELAND

the English and American residents were attached to the Transvaal in the sense of regarding it as a permanent home. Most of them meant or hoped to return to Europe or America, and it is probable that even had the full franchise been obtainable after five years' residence, few Anglo-Saxons would have abjured allegiance to England or the United States.* It was for business purposes that they desired a voice in public affairs, and few of them realized that, to the Boers, granting the franchise seemed equivalent to self-destruction.

So far as I can learn, the great mistake of the Boers was in giving the Uitlanders grave cause for desiring to control the legislation affecting them and the industry they had built up. The Uitlanders could have been quieted by judicious consideration for their convenience, without the franchise and without danger to the independence or the national character of the republic. A prosperous community like that of the Rand would bear extremely heavy taxation with little murmuring; but a prosperous and energetic community is the very last to submit patiently to discomfort, favoritism, and maladministration beyond its own control.

The grievances of the Uitlanders have been very real indeed, and the foreigner on the Rand has not been allowed to forget for an hour at a time that he was a member of an ill-governed community. A few facts will illustrate this condition. The town of Johannesburg, though containing over 50,000 white inhabitants, has no perfected system of lighting, no system of drainage, and no general water supply. There is abundance of water in the neighborhood, but the law of riparian rights, being framed for a purely agricultural population, is such that no water rights can be acquired if a single affected landowner objects. The town has no general municipal government, though there is a board of health. The state has refused until lately to aid education, except when conducted in Dutch. Public meetings of more than six persons may be dispersed at the discretion of the police. The charges of the Netherlands Railway Company are entirely uncontrolled by law, and on a portion of its line its tariff reaches the utterly exorbitant rate of six cents per ton per mile on coal. The company makes profits of 100 per cent, and yet it is not taken over by the state, which has the legal right to assume its ownership. No dynamite is made in the Transvaal, yet a mo-

* It is probable that a considerable number of Africanders would naturalize if the conditions were not too onerous. The Burghers, however, dread the influence of the "English-minded" Africander.

nopoly of its sale has been granted to a company which pays the government something over five shillings per case and charges the miners 85 shillings, of which about 36 shillings is profit. Other concessions of a like character have been threatened, though not carried out as yet. Until August, 1896, the government insisted upon allowing grog-shops accessible to the blacks to be kept open in the immediate neighborhood of the mines and mills, with lamentable results. There is no commission or any body of officials charged with the general administration of the district to whom appeals can be addressed or from whom assistance can be obtained. Taxation is so arranged as to fall almost exclusively on the Uitlanders, and it has not been reduced, although the treasury has a large surplus and although there are no industries to be protected. Many of the officials with whom the Uitlanders come in contact are open to bribery and, it is alleged, will not act except when paid to do so.

It is easy to imagine how very seriously business was and is hampered by these abuses. No fair-minded person can avoid sympathizing with the exasperation of capitalists or mine managers at the needless difficulties thrown in their way and the unjust exactions laid upon them. Enterprising and determined men could not be expected to submit tamely to such conditions, and it is not wonderful that resentment should have carried them beyond the limits of prudence or moderation. In considering the grievances, however, it will be apparent that they bear as a whole much more heavily on capitalists and business men than on employés. White miners, machinists, and mining engineers have almost without exception received higher pay and also made more money on the Rand during the last few years than ever before or in any other region. The direct personal discomforts to which they have been subjected have not been greater than they would have undergone in the mining camps of the United States or of Australia, all of which are much smaller than this. Thus it cannot be denied that the direct and tangible grievances are mainly capitalists' grievances and that the revolt is a capitalist revolt. The employés in joining the movement were influenced by a sense of irritation due to needless deprivation and discomfort and the knowledge that the source of their prosperity was endangered by oppressive exactions.

It is quite obvious that these causes of complaint could be removed by the exercise of a little of the good judgment with which the executive is abundantly supplied. The problem is vastly less difficult than those with which President Kruger and Dr Leyds have successfully grappled during the past few months. This district might be governed by commissioners and a judiciary appointed by the president of the republic, almost precisely as the District of Columbia is administered. The efficiency of such an administration would depend only on securing able and honest men, and it is absurd to doubt that the Transvaal can secure the services of such. The present tyrannical oppression of the Rand disgraces a people to whom no sacrifices were too great for the attainment of their own freedom. They should be the first to appreciate the hardships under which the Uitlanders are suffering, and to show the value they themselves put on liberty by imposing no unjust restraints upon others.

The Uitlanders made repeated efforts, by passing resolutions and presenting petitions, to obtain the franchise and the redress of grievances. These efforts extended over several years, but they met with no success. During the closing months of 1895 the agitation for reform was accentuated. The discontent of the Uitlanders was at this stage fomented under the guise of sympathy by residents of other portions of South Africa with a view to creating disturbances in the republic for ulterior ends. The idea was broached of making an armed demonstration, which it was hoped might impress the Boers sufficiently to bring about the desired changes. This seemed possible, because the Uitlanders are supposed to number about 50,000 men and the Boers only about 25,000* adult males.

The plan of threatening the government with force of arms was unfortunate from its very inception. Many of the Uitlanders felt that while the grievances were sore, they were not great enough to justify armed revolt, and these men withdrew from the movement. The seceders were chiefly those least susceptible to the influence of the purely English element in South Africa, viz., the Germans and a few Frenchmen. The bad feeling and even alienation arising from this defection is not yet allayed. The split in the Chamber of Mines, which is now unfavorably affecting business, was one of its results. While the Boers were fully equipped, the foreigners were almost unarmed, and the importation of arms is under legal restrictions, originating in the necessity of limiting or suppressing the sale of guns to the blacks. To procure arms in any quantity, therefore, it was necessary to

* This is Mr Charles Leonard's estimate. The Boers on that basis must count a total population of something like 125,000. The Uitlanders in the republic are very largely bachelors and probably number something like 75,000 men, women, and children.

smuggle them. A few thousand were brought in secreted under coke. A portion of these arms was forwarded by members of the British South Africa Company, better known as the Chartered Company. An arrangement was also made with Dr Jameson, and it has been alleged at his suggestion, that if matters were to go wrong at Johannesburg and the Boers should attack it the Chartered Company's administrator should come to the rescue with a body of men who as a matter of fact were chiefly policemen of the company.

The National Union had formed no plot against the independence of the republic, their idea being either to frighten the administration into granting redress of grievances or at most to substitute forcibly a more liberal administration for the present one. Such an administration would treat commerce more generously and stimulate trade with Cape Colony. This, in the opinion of the Uitlanders, would sufficiently repay Dr Jameson, if, indeed, he required reward for coming to the rescue of his countrymen and countrywomen in case of need.

The union issued a manifesto, defining its demands, on December 26, 1895. On the 30th news was received that Dr Jameson had crossed the border, contrary to agreement and in spite of requests on the part of the leaders of the union to remain beyond the boundary. The same day the reform committee was formed expressly because, as the notice to members states, Jameson's crossing the border "renders it necessary to take active steps for the defense of Johannesburg and the preservation of order." Before dawn on the morning of the 31st the leaders received information that on Jameson's arrival the British flag would be hoisted. This was portentous news for all parties. Without any consent on their own part, the reformers were made partners in an attempt at conquest instead of reformation. For the Americans the situation was particularly grave. For an American to assist in overthrowing a republic in order to aggrandize a monarchy would be to forfeit all respect from his countrymen. There is not the slightest evidence that any one of the seven Americans on the committee either contemplated such a crime or welcomed the situation thrust upon them. Mr John Hays Hammond, the only American among the leaders, took the appropriate step as soon as possible after daylight. He hoisted the Transvaal flag and he both demanded and obtained an oath of allegiance to it from the members of the reform committee, some eighty in all; but for this fortunate action the trial of the reformers in April

FLYING THE TRANSVAAL FLAG ON THE OFFICES OF THE REFORM COMMITTEE, JOHANNESBURG, DECEMBER 31, 1895

would have had more serious consequences. I am not aware that any member, either American or English, demurred to the oath.

The reform committee was a direct and inevitable consequence of the arming of the Uitlanders, coupled with Jameson's invasion. The Boers could not be expected to understand on the spur of the moment that Jameson had invaded the country in contravention of a distinct agreement. The Uitlanders were therefore from the Boer point of view engaged in an attempt to conquer the country; they were public enemies and subject to attack. Knowing this, and not knowing whether the Boers would exercise any forbearance, it seemed needful to the Uitlanders to organize themselves for self-defense.

In the rank and file of the reform committee there were six Americans. Messrs T. Mein, Joseph Story Curtis, and Victor Clement are well known, both in the United States and in Africa, as mining experts and managers; Mr Charles Butters is a metallurgist who has had remarkable success in improving the chemical treatment of gold ores; Mr H. J. King is a partner in the mine-owning firm of S. Neumann & Co., London, and Mr F. R. Lingham is a timber merchant. These men joined the committee very rashly, it is true. They did not know to what extent the Uitlander party had become implicated in treasonable procedures, nor did they stop to inquire. They assumed that nothing further was involved than organization for self-defense, and signed their names without adopting any of the precautions which they would have exercised in putting their signatures to any business documents of relatively trifling import. Of carelessness they certainly cannot be acquitted, but I have not been able to ascertain, either from Uitlanders or Burghers, that there is the slightest shadow of implication in real treason resting on any one of these Americans. Many of the Englishmen associated with them were equally guiltless. It is now easy for the dullest to see that the Americans would have been wiser to take no part in the Uitlanders' revolt. In those December days, on the other hand, it was very difficult to steer an even course over the boiling tide of events, avoiding the headland of Rashness and the maelstrom of Pusillanimity. If some of our men went ashore, they have taken their mishap like men; there has been no attempt to shift the blame and no whining over the issue. Their conduct, at any rate, has been such as we expect, and have a right to expect of Americans.

Every one knows that the revolt ended in a dismal fiasco. The

Transvaal government was evidently prepared for the invasion. Jameson and his troopers were captured with all their documents and even the key to their cipher dispatches. The Johannesburgers laid down their arms, and most of the reform committee were arrested. At their trial, in April, four of the leaders,* including Mr Hammond, pleaded guilty, on advice of counsel, to high treason, and the remainder pleaded guilty to lese majesté,† excepting Mr Curtis, who was detained by illness in Cape Town. His trial was postponed. The leaders were condemned to death on April 28, but the next day their sentence was reduced to fifteen years' imprisonment. The rank and file of the reform committee were given terms of imprisonment ranging from a few months to a couple of years. For some weeks no further mitigation of sentence was announced, and during this interval the government took occasion to publish telegrams and maps captured from Jameson's party, showing how deliberate had been the plot to deprive the republic of its independence. Such of the mass of the reformers as signed a petition for mercy were then discharged, on payment of a fine of £2,000 each. Two of them only, both Englishmen, refused to sign any appeal for clemency, and these gentlemen, whose attitude seems to most people a mistaken one, still remain in jail, so far as I am informed. Early in June the leaders also were released, on payment of the heavy fine of £25,000 each. They were given permission to remain in the Transvaal on condition of signing a pledge not to meddle in the affairs of the republic. This Colonel Frank Rhodes refused to do, and he was promptly escorted to the border. Mr Curtis, when sufficiently recovered from a very dangerous illness, presented himself in July for trial, but refused to plead guilty. The government, however, declined to proceed against him under plea of not guilty, evidently because it was loath to reopen the whole disagreeable question. I understand that Mr Curtis has contributed £2,000, the amount his comrades were fined, to the charities of the Transvaal, not caring to take pecuniary advantage of his exceptional position.

The surrender of Dr Jameson and his officers to the British

* Mr Charles Leonard, one of the five leaders, left the country before the arrest of the reform committee. The other leaders were Messrs George Farrar, Lionel Phillips, and Frank Rhodes.

† The prisoners understood that there was an understanding between their counsel and the prosecution that the plea of guilty would be followed by a mild sentence. This arrangement is wholly denied by the prosecution and, according to Reuter, by counsel for the defense. I have not been able to ascertain the origin of the misunderstanding. A trial would have resulted in much ill-feeling, and it is as well that it was avoided.

authorities by the government of the Transvaal and their subsequent trial in London need not be dwelt upon. The leader was condemned to fifteen months in prison, without special privileges, but he was shortly afterward granted the status of a first-class misdemeanant as an act of clemency. So far as I could learn, the sentences passed on the raiders were regarded in the Transvaal as adequate but not excessive. The share of Mr Cecil Rhodes and of the Chartered Company in responsibility for the raid is still to be investigated.

Quiet once more reigns in the Transvaal. The Uitlanders are again pressing for reforms, but there is no thought of revolt. The Burghers are now alive to the need of reforms, and as they seem anything but vindictive, I believe they will gradually concede what a sense of justice demands.

The Reformers, though very able men in their own professions, have been mere puppets in the hands of men whose designs were much larger and more dubious than the correction of the Uitlanders' grievances. The honest soreness of the foreigners over their wrongs was taken advantage of to excite them to a rebellion not justified by the provocation. The Transvaal government showed little business ability in giving or tolerating even a shadow of excuse for rebellion, but in the active contest which followed it displayed an astuteness for which the ability of its enemies was no match. The union of South Africa under British hegemony, for which Mr Rhodes has labored so persistently, seems further off than ever. The Transvaal burghers are substantially Dutch; so are the citizens of the Free State; so, too, are four-fifths of the Cape Colonists. The bond of sympathy between the Boers throughout South Africa has been drawn much closer during the past few months. The Africander League in Cape Colony, which aims at "Africa for the Africanders", *i. e.*, practically for the Boers, is much stronger than it was, and the whole race now sees in the Transvaal, which is arming to the teeth, an intellectual ability to cope with the larger questions of politics which has not hitherto been available. It seems today as if the position of the South African Republic in this region were very much like that of Prussia in the divided Germany of forty-one years ago. The whole country is in a state of tension, and a blundering policy on the part of the Paramount Power might have unusually serious consequences. Thus South Africa will probably command a larger measure of interest and attention from the world henceforth than hitherto.

THE ECONOMIC ASPECTS OF SOIL EROSION

By Dr N. S. Shaler,

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II

As the scattered drops of a shower gather into streams the water begins to act in an erosive way. If this gathering takes place at the height of five thousand feet above the sea, each pound of the fluid has a store of energy of position, which we term five thousand foot-pounds, which it is to expend on its path to the sea. When the rain comes down on highlands, the first stage of its journey to the sea is commonly made at high speed in torrents. In the torrential division of a river system we always find the surface cast into steep-sloped valleys. Generally the whole surface is composed of inclines ranging in declivity from five to thirty degrees or more, on which surfaces the soil, if it be present, is always moving down the incline at a variable rate. At times (especially when softened by the frosts of winter and filled with water) the earth on these steep hillsides slips in the manner of a landslide down to the bed of the stream. There it for a short time blocks the way of the torrent, but it is swiftly carried down to the river channels. Commonly the movements of these earth masses is in the manner of a glacier, slow, but steadfast, amounting to a few lines or a few inches a year; rarely to a foot or two in that length of time. So general is this movement that although not readily noted without precise observations it may by accurate observations be determined on nearly all steep slopes which are covered with a thick layer of soil. During the movement the expansion of the earth water in times of frost, the enlargement of the roots which penetrate the soil, and in a measure the process of wetting and drying the detritus operate to thrust the mass, the movement being in all cases in the direction in which gravity inclines it to go. Arriving at the margin of the torrent, the procession of the detritus is cut away by the swiftly moving waters and sent on its way to the sea.

As above indicated, this process of erosion by the slipping of the soil toward the torrent beds is characteristic of all steeply turned fields. So long as the earth is covered by the normal forest growth the strong roots are likely to pass through the soil and fix themselves in the crevices of the underlying rocks and clamp, so to speak, the loose materials in their place. In this way it comes about that one of the effects of deforesting a country, even where the lesser vegetation is allowed to develop, is to increase the rate at which the soil goes away to the streams. As yet this country has not been long enough exposed to the destructive effects of tillage to afford striking instances of the effect of the reckless war which is waged upon the woods by the savages who play that they are the agents of civilization. In Europe examples of the irreparable damage which may thus be wrought abound. Perhaps the most striking are to be found in the Apenines, near Florence, where it is possible to walk for miles on mountain slopes without setting foot on anything but bare rock fields, which a century or so ago bore heavy forests nurtured in a fertile, if not deep, soil. The last of the Medicis who held these woods as crown lands cut the timber without any provision for the replacement of the trees, with the result that the fine soil, before it had time to obtain protection from plants, was swept away. In this manner a great area has been doomed to age-long sterility and a region made desolate which might with proper management have continued to be helpful to man for an unlimited period.

The mountainous countries of the Old World, with their vast reaches of bare rock slopes, which down to recent centuries were forest-clad, show the destructive effects of man's heedless assault on the earth. In this country there has not been time for this process of destruction by the axman to manifest itself in a very serious way, yet in the Appalachians we can see the evil in rapid progress. South of Pennsylvania there is, according to my reckoning, based on observations in every state in that upland country, an aggregate area of not less than three thousand square miles where the soil has been destroyed by the complete removal of the woods and the consequent passage of the earthy matter to the lowlands and to the sea. At the rate at which this process is now going on, the loss in arable or forestable land may safely be reckoned at not less than one hundred square miles per annum; in other words, we are each year losing to the uses of man, through unnecessary destruction, a productive capacity which may be estimated as sufficient to sustain a population of a thousand people.

In considering the destruction which the elemental conditions bring upon a country which is subjected to the tax of civilization, the most important fields to be noted are those of the highland districts, for the reason that there the slopes are, on the average, steepest, the rainfall is greatest, and the action of frost is most considerable. There the process of erosion is the most rapid and the results are the most irremediable. There are, however, no lands in this country or in any other where the waste due to tillage is not noteworthy. Even in the prairies, where the average declivity of the surface is not more than one or two degrees, the effect of that baring of the earth which is the necessary first step of tillage is to send a share of the earthy matter from the fields to the streams and thence to the seas. The close observer who will walk for a day during a time of protracted rain along the banks of a main stream is likely to find that some of the tributaries carry water which is nearly clear while others discharge a very muddy flow. Examining the cause of the difference he will note that the relatively clear brooks come from fields that are not tilled, being either in forest or grass, while those which are very muddy have a large proportion of their area under plow culture. While the destruction of a plowed field in a given time is greater in proportion to the steepness of its slope, there are practically no fields, however slight their declivity, which are not exposed in the same considerable measure to this kind of wasting. In a degree it is the inevitable accompaniment of tillage, which rests on the plan of expelling the natural growth of a soil that place may be made for artificially imposed vegetation. However carefully the work may be done and whatever the nature of the crop, the earth is for the time bared to the assaults of rain and wind.

The question may well be asked whether, if this loss by erosion is a necessary element of tillage, it is not certain that in time all the soils will go on their way to the sea, and the earth thus be made unfit for the uses of man. The answer to this is that the natural regimen of the soil provides a way by which a certain amount of waste in its mass may be in almost all cases made good through the decay of the underlying rocks. This is accomplished by the action of that part of the rain-water which does not flow over the surface but finds its way into the soil and is slowly yielded to the streams in the form of distinct springs, or more commonly in the broad sheet of water which flows down along the bed-rock or the hard-pan until it enters the drainage channel of the area. This underground water, except in the rare places where caverns abound, moves very slowly and has no erosive effect. What material it takes away—a relatively small amount—is removed in solution. Penetrating to the bed-rock, this water, charged with carbonic dioxide and other compounds which add to its decay-bringing effects, attacks the bed-rocks, breaks them up, and with the assistance of the roots of the sturdier plants brings the hard stones into the state of soil. In this way the natural waste derived from the solutions effected by the underground water, the cutting along the streams, and the slight wearing of the general surface by water action is compensated for by the steadfast reproduction of the soil at its base.

In the state of nature the rate of degradation of the earth's surface over a region such as the Mississippi valley appears by the studies of Humphries and Abbot to be not far from one foot in five thousand years. At this rate of erosion, we may from the field evidence presume that the underground decay will keep somewhat ahead of the wearing actions, and so the soil rather gain than lose in depth. Under complete tillage, such as is now applied, the rate of downwearing will probably become as great as that which exists in the valley of the Po, where the surface descends at the rate of about one foot in a thousand years. Under these conditions we may be sure that the underground replacement of the soil cannot compensate for the wearing, and that consequently the fertile layer will gradually disappear, as it has done over large areas in the Old World and is now doing in other fields of this country.

Before proceeding to questions of a distinctly economic nature —those which concern the steps which should be taken to arrest the wasting of our soils—it will be well for us to consider the processes and rates of erosion on two of the many varieties of soils which plentifully exist in this country, namely, those of our glaciated districts and those found in the alluvial plains beside the true rivers. The first of these classes constitute about one-third of the possible agricultural and forest lands of this country; the second is of much smaller aggregate area, but on account of its exceeding fertility is of almost equal tillage value.

In glaciated districts experience shows that the risks of destructive erosion are relatively small. This is owing to the fact that the drift covering, which in its superficial modification constitutes the soil of those regions, is almost always composed of debris so deep and so loosely aggregated that the greater part of the rain-water enters into the earth and thus is preserved from doing erosive work. The result is that even in times of flood the streams draining from these fields covered by glacial debris are never very muddy; they have no important alluvial plains and characteristically lack the deltas or detritic cones which are such a prominent feature of the streams which flow from non-glaciated regions. In such fields soil erosion is so slight that it may give us no concern, except on the steeper mountain slopes, where the slipping of the deposited soils into the torrents may occasionally expose the bare rocks.

On the alluvial plains—at least so long as the down-cutting of the stream bed does not leave them above the level of the floods—the annual inundations constantly bring down layers of fertilizing sediment, and this at a rate which is pretty sure to compensate for any waste which the most reckless agriculture can bring about. Such soils, unlike those of our ordinary fields, grow by accessions on the surface and not by the decay of the bed-rocks. It is to this constant superficial gain in fertile materials that they owe their peculiar value to man. Alluvial lands are, however, subjected to a peculiar kind of erosion—that brought about by the lateral swinging of the river channels to and fro in their flood-plains. These peculiar, pendulum-like movements of the great rivers through their delta accumulations are important for the reason that they are not easily controlled and are often disastrous to the interests of men who dwell upon their banks. The movements are often made in a very rapid manner: moreover, where the streams change their courses in one portion of the alluvial plains the regimen of the currents is so altered that the curves thence downward to the mouth are subject to rapid modifications. In this manner the Mississippi has been endlessly wandering over the flood-plains between Cairo and the sea.

The natural check to the divagations of a river is found in the protective action due to the growth of trees upon its banks. There are many species which have habits of growth that permit them to flourish in places where their roots and stems are bathed by the floods for a considerable part of the year. These forms have fine roots which entangle the sediments deposited at high water, and they have a habit of growing in close order, so that their thick-set stems arrest the current and cause a plentiful deposition of sediment on the gravel which they occupy. If such a forest develops on one side of a river while the banks on the opposite border are not thus protected, the result usually is that the wooded shore advances while that which is defenseless is worn away. Many of the stream-swingings are readily explained by alternations in the development of the water-loving trees. Thus, while the oscillations of rivers cannot be altogether controlled by the planting of these trees, these changes can be considerably reduced by the proper use of such defenses.

From a large economic point of view, it will readily be seen that the changes in the courses of the great rivers are not very serious, and this for the reason that the area removed on the one side of the channel is in a manner compensated for by a growth on the other side. It is otherwise with the smaller streams which have slight alluvial plains, and which often have their channels pressed in against either bank. In these cases the water cuts away the base of the declivity and brings about the rapid movement of the soil down the slope. The loss of tillage area due to this action is considerable; from certain studies which I have made in the country in the basin of the Ohio river, especially in that part of it which lies to the south of the main stream, it may be reckoned that since the general removal of the forests an area of not less than 150 square miles, outside of the torrent section of this river system, has partly or completely lost its soil through this action.

We have now glanced at the several modes in which the solar energy, operating through the instrumentality of the winds, the waves, and the rain, tends to remove the detrital covering of the earth on which the substance of all land life depends. We may note in summing-up the matter that the attack of the waves is practically irresistible, but that its effect is gradually to diminish the area of the lands, the process going on so slowly that the immediate effect on human interests is very small. Moreover, as one part of the lands is worn away, compensation is generally made by the uplifting of other areas above the ocean level. The work of the winds in blowing away the friable earth coating is slight, and that for the reason that the surface is well protected by the coating of vegetation. It is when we come to consider the action of the rain that we find ourselves face to face with the really important economic problems of erosion. We have seen that in the state of nature the lands are provided against the destruction of the soil which the rainfall would otherwise cause by the admirably contrived protection afforded by the vegetal coating. If man occupied the earth under the same conditions as the other creatures of the land, he would not disturb the ancient and beautiful relations of the earth and its living mantle. In this case the wasting of the soil would go on, but at a rate no greater than it would be replaced by the decay of the upper part of the bed-rocks. The continents would gradually be lowered by the leaching out of the mineral matters in their superficial debris, and in some measure by the direct wearing action of the streams, but the life-giving covering would descend from stage to stage, affording at each step such fertility as the rocks on which it lay might determine.

The primitive man disturbed the conditions of the soil no more than did the lower animals. He made avail of the natural products of forest, field, and stream, never stirring the earth except. it might be, to bury his dead; but in the first step upward he began his manly career as a devastator. He became a soil-tiller, and with the invention of this art began the greatest revolution in the economics of the earth that has ever been instituted by a living being. Each extension of civilization has widened the field of destruction, until nearly one-half of all the land is subject to its ravages. It is now a question whether human culture, which rests upon the use of the soil, can devise and enforce ways of dealing with the earth which will preserve this source of life so that it may support the men of the ages to come. If this cannot be done, we must look forward to the time—remote it may be, yet clearly discernible—when our kind, having wasted its great inheritance, will fade from the earth because of the ruin it has accomplished. It should be the province of science to point the way to the remedy for this ill.

It seems to me to be the point of first importance to make clear to the people the conditions under which the earth can be made to yield its fruits without destructive tax upon its resources. To attain this end they need, in the first place, to know that the rainfall which flows over the surface is that which does the work of soil destruction; so far as this surface water acts on the soil its influence is evil. The share of the rain which enters the earth does not, until it emerges in the temporary springs, do any erosion work whatever. In a variable measure it removes the soil materials in the state of complete solution, to appear as the mineral matter of the springs; but this very limited destructive effect is on all naturally protected soils more than compensated for by the action of the ground water in promoting the decay of the bed-rocks, a process by which the soil is deepened and enriched. In the state of nature all the rainfall is indirectly led underground and made to do its appropriate work. In the condition of our ill-organized tillage so large a share of the precipitation is sent in its destructive superficial way that the lower soil often lacks the share of moisture which is necessary for the work of decay in the underlying rock, and which would be most useful to the crops in time of drought.

Although it is very difficult to make a newly overturned soil safe from the assaults of the rain, I believe that with a careful and in a large way economical system of tillage it can be done, at least provided the inventors can help us over certain mechanical difficulties. In the first place it should be noted that the plow, which has been much vaunted as a noble contrivance, is as ordinarily used an instrument which most effectively serves to compact the earth, so that when the few inches of ground tilled become soaked with water the fluid cannot penetrate into the deeper part of the earth. The reason for this injurious action can readily be understood. The pressure of the foot of the plow, due to the counter-thrust of the force used in dragging it forward through the earth as well as to the weight of the instrument, serves in a very effective way to compact and smear the surface over which it passes. When the frost penetrates deeply, the heaving action which it effects operates in a measure to overcome this effect of the plow, but in almost all fields, especially those of the southern part of this country, the artificial hard-pan is to the skilled eye most evident. It needs but a comparison of a bit of land which has been long under the plow with a like area still in virgin forest to show the true measure of this action. The one is for a few inches in depth moderately open, but at a lower level is so hard that water can penetrate it only in a slow way ; the other is open-textured to so great a depth that the rain and roots can penetrate in most cases to the rock which has not yet been broken up.

There is needed an instrument which will turn the soil in the manner of the spade, a tool which does not pack the under earth, but leaves it in a position very favorable to the downward movement of the water. As my friends who know the nature of mechanics tell me that it will be difficult to make such a contrivance, we may have to content ourselves for a considerable time to come with the ancient, but to my mind by no means venerable, utensil which has already sent the substance of millions of men to the sea. There are ways of using the plow by which its evils may be minimized. In the first place, the tilth should be made as deep as it well can be. The void spaces in the ground which is overturned to the depth of ten inches will if the earth be ordinarily dry take in a rainfall of an inch or perhaps an inch and one-half in depth falling in, say, two hours, without any surface flow; while if the depth of the tillage be but five inches half the water would have to pass over the surface. The well-known, but unhappily little used, process of subsoil plowing if discreetly used is also a valuable means of effecting the penetration and storage of water; underdraining also tends to the same end. In certain parts of the southern states of this country, where the evil effects of the surface flow have forced themselves upon the attention of the people, the farmers have begun to guard against the destructive action of this agent by forming temporary benches in the sloping fields. In the Old World the system of benching the hillsides is carried much farther than it is in any part of this country. In Germany, France, and Italy the greater part of the land that lies on steep declivities which have not been brought to ruin in the earlier and less conservative agriculture is now protected from destruction. Although we may expect a constant gain in the application of this conservative treatment of our fields, we cannot look to it alone for their safeguarding. Another class of precaution demanded by the elemental conditions of this country must be taken, and that we will now note.

Owing to the fact that in North America generally the rainfall is apt to have a torrential character (the precipitation taking place at a rate which is not common in Europe) and to the fact that these downpourings are likely to occur on ground which has been loosened by the frost, our soils are exposed to a measure of danger much greater than that which menaces the fields of the Old World. There appears to be but one way by which we may meet this danger—this is by limiting the work of the plow to those fields which have a degree of slope so slight that with proper tillage they may not be exposed to scouring action. Although this classification has to be made for each district and species of soil, it may in general be said that no field which has a greater slope than five feet vertical in one hundred feet of length should in any country be exposed to the danger which ordinary cropping inflicts. Areas from this measure of inclination upward to thrice this rate of slope, or to a maximum of fifteen feet in the hundred, may reasonably be plowed in order to bring them into the state of grass lands, but should not be tilled more than is necessary to retain them in this state. All areas having a slope of more than fifteen feet in one hundred should, by the rules which the conservator of the soils is disposed to lay down, be devoted to forests, which afford the only crop that can be harvested from such ground without a swift and irremediable loss of fertility.

It may be asked how these rules can be enforced. After much consideration of the matter, I am satisfied that our only reliance is on an education which will bear in upon our people the duty they owe to the soil and the ways in which they may discharge this great obligation. Our folk are dutiful; at every step in their advance they have striven, not for the moment's profit, but for the good of generations to come. If this admirable motive be impressed by knowledge, we can trust to it for the remedy. The scarred and unfertile fields of this country, which, to the extent of millions of acres, mark the results of a few generations' life upon areas which nature fitted for the unending support of man, are not evidences of lack of care on the part of the people who brought this ruin. They were of the breed which willingly lays down life for an idea, for a belief in creed or state. Teach them what the soil means to their kind, instruct them in the arts by which it may be cared for, and we may trust, as we needs must, to the fruit of this knowledge.

It is much to be deplored that there is not in our schools a single book to tell the youth what every one should know concerning the foundations of life in the soil or the conditions under which the generation to which he belongs may pass on the precious heritage to those who are to come after. Such instruction can alone be enforced through the exertions of those who have been brought to see the truth and who are willing to labor for its diffusion.

A CRITICAL PERIOD IN SOUTH AFRICAN HISTORY

The years 1876–'77, of which it was beside the purpose of Mr George F. Becker to treat in his long and interesting article on the Witwatersrand and the Revolt of the Uitlanders, constituted one of the most critical periods in South African history. The story of the successive crushing defeats inflicted upon the Boers by the Kaffirs, of the bankruptcy of the Boer national treasury, of the demoralization of the Boers themselves, of the state of anarchy into which the republic drifted, of the danger of a general uprising of the natives throughout the whole of South Africa, of the appeal made to the British government by a portion of the Boer nation, and of the strenuous efforts of the president of the republic to arouse the nation at large to a sense of its "impending dissolution" and to induce it to enter a confederation with the British colonies on the model of the Dominion of Canada is all impartially related in the volumes of Appletons' Annual Cyclopædia covering the period in question.*

All writers are agreed that at this time the Boers were utterly unable to defend themselves against the natives; their forces in the field had been overwhelmingly defeated and protection for their families and property could be secured only by the payment of blackmail to the native chiefs. To add to the demoralization created by the success of the Kaffirs in the north the Zulu king threatened invasion from the south, and the Boers were declared by their own president to be without any proper conception of their obligations as a civilized government. Emboldened by their success against the republic the natives everywhere assumed a menacing attitude, and a conflagration that would have overspread the whole of South Africa seemed on the verge of breaking out. Whether the Boers had at that time any idea of reasserting their independence after the subjugation of their enemies by the British there is no evidence to show, but it is an indisputable fact that they exchanged their independent sovereignty, such as it was, for British protection, if not with an enthusiasm at variance with their stolid character, at least with undisguised satisfaction and a manifest sense of relief.

Two years or a little more after the annexation of the Transvaal the British, after sustaining several serious reverses, completely broke the Zulu power and captured its warlike king, Cetewayo. Three months later Secocoeni, the Kaffir chieftain to whose military skill the complete overthrow of the Boers had been largely due, surrendered to British authority. This subjugation of the natives paved the way to that reëstablishment of the Boer republic which took place the following year.

While the two cases are not in every respect analogous, the encroachments of the British on the dominions of the Boers are not unlike those of our own frontiersmen on the treaty reserva-

*See Appletons' Annual Cyclopædia, New Series, Vols. I–II, 1876–'77, Articles, "Africa," "Cape Colony," and "Transvaal Republic." See also the Book of Facts, Harper Brothers, New York, 1895, p. 807.

tions of the Indians. It is not the national government that is primarily at fault in either case, but the miner, the trader, the stock-grower, the land-grabber. In both cases those occupying the country are either too ignorant or too shiftless to develop its resources for themselves, and the temptation to take possession is too great to be resisted by those restless, dauntless, and ofttimes ungovernable spirits who have been impelled by some mysterious centrifugal force to the periphery of civilization. J. H.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1896-'97

Special Meeting, October 9, 1896.—President Hubbard in the chair. Vice-President Greely delivered an address on Recent Geographic Progress, with Special Reference to Explorations in the Arctic Regions and Africa.

Special Meeting, October 16, 1896.—President Hubbard in the chair. Mr Geo. F. Becker read a paper, with lantern-slide illustrations, on The Witwatersrand and the Uitlanders' Revolt.

Special Meeting, October 23, 1896.—President Hubbard in the chair. Rev. John N. MacGonigle, of St. Augustine, Fla., addressed the Society on The Geography of the Southern Peninsula of the United States, illustrating his address with lantern slides.

Elections.—New members have been elected as follows:

October 9.—W. H. Beal, Hon. John B. Cotton, Wm. H. Darlington, Miss E. B. Eakle, Geo. K. French, Maj. Clément de Grandprey (French Embassy), Mrs M. B. Hitz, Chas. W. Little, Mrs Rosa McCabe, James A. Mitchell, C. H. Sholes, Prof. J. F. Sims, W. G. Steele, Mrs P. M. Stocking, Chas. W. Thompson, W. M. Van Dyke, Fred. C. Warman, Fletcher White, Rev. Earl M. Wilbur, Dr James Woodrow, W. Redin Woodward, Miss M. Zimmerman.

Obituary.—The Society has to deplore the deaths of the following members: Mr Edward Kübel, an old and much respected citizen of the District of Columbia, for many years connected with the U. S. Geological Survey; Mr Philip S. Abbot, a man of remarkable abilities and one of the most skillful and intrepid of mountain climbers, who lost his life by falling down the great precipice of Mt. Lefroy, Alberta, when engaged in the exploration of that almost inaccessible mountain, in company with other well-known members of the Appalachian Mountain Club; and the Hon. Edwin Willits, Ph. D., successively Member of Congress, President of the Michigan State Agricultural College, Assistant Secretary of Agriculture, and President of the U. S. Commission for the World's Columbian Exposition; also a member from 1892 to 1895 of the Board of Managers of the National Geographic Society; an able and conscientious executive officer, a wise counsellor, and a faithful friend. J. H.

GEOGRAPHIC NOTES

ASIA

India. The total length of the railways of India on March 31, 1896, was 19,677 miles, an increase of 822 miles during the year. In addition, there were 6,789 miles the construction of which was sanctioned, but which were not yet in operation. The proportion of passengers killed was one in nineteen millions, and the total number either killed or injured from railway accidents of all kinds was only 1 in 518,051.

Tibet. An important addition to geographic knowledge is expected to result from the journey across Tibet recently undertaken by Captain H. H. P. Deasy, an officer of the British Army. Captain Deasy will throw into the different streams he may encounter water-tight cans containing the request, in English and French, that an accurate statement as to where they are found may be forwarded without delay to the Royal Geographical Society, London. It is hoped that some of them may be found in the Brahmaputra, Salween, and Mekong, and thus help to solve the problem of the origin and connections of these rivers.

China. Of the two ports to be opened to foreign commerce under the treaty with Japan, that of Hangchow is the more important. A city of 800,000 inhabitants, and the richest and perhaps the finest in the empire, it is the capital of Chêkiang, a province containing the most extensive silk and tea district in the world. It is believed that the opening of this port will revolutionize the tea trade of middle China, and divert considerable commerce from Shanghai to Ningpo, the natural seaport of Hangchow. Chêkiang, a state of 35,000,000 inhabitants, produces two-thirds of all the silk exported from China, and is also the largest cotton-producing province. Other exports of special importance are straw goods, wine, alum, hemp, indigo, fans, and vegetable tallow from the tallow tree.

The thanks of all interested in geography are due to Messrs J. Scott Keltie and Hugh Robert Mill for the painstaking care with which they have edited the Report of the Sixth International Geographical Congress, held in London, 1895. This handsome volume of 1,116 pages is a worthy supplemental outcome of those personal labors, marked by tact, courtesy, and ability, by which its editors, in their capacity as secretaries, contributed so greatly to the success of the Congress. Among the more important papers of professional interest may be mentioned those of Buchanan on Oceanography, Chapman on the Mapping of Africa, Levasseur on the Teaching of Geography in Schools and Universities, Neumayer on South Polar Explorations, and Walker on the Geodetic Survey of India. Ravenstein's appended Catalogue of the Exhibition is of permanent value.

A. W. G.

Among the Contents of Forthcoming Numbers of

THE NATIONAL GEOGRAPHIC MAGAZINE

WILL BE THE FOLLOWING:

A Winter Voyage through the Straits of Magellan,

By ADMIRAL R. W. MEADE, U. S. N.;

Egypt and the Recent Expedition to Dongola,

By COLONEL CHARLES CHAILLÉ-LONG,

Late of the General Staff of the Egyptian Army;

The Negro Republic of Africa and its Homes,

FROM PERSONAL OBSERVATION,

By MR GEORGE K. FRENCH;

The Physical Features of Lake Superior,

By DR MARK W. HARRINGTON,

President of the University of the State of Washington;

——AND——

The Utilization of the Vacant Public Lands,

By JUDGE EMORY F. BEST,

Assistant Commissioner of the General Land Office.

JUDD & DETWEILER, PRINTERS, WASHINGTON, D. C

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AN ILLUSTRATED MONTHLY

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PHOSPHATE MINING ON THE WEST COAST OF FLORIDA

THE

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THE GEOGRAPHY OF THE SOUTHERN PENINSULA OF THE UNITED STATES

By The Rev. John N. MacGonigle

The study of the geography of the southern peninsula of the United States began about 400 years ago. Although the Great Admiral had not found the mainland of the Western Hemisphere, he had planted the standard of Spain on its adjacent islands, and his reports had kindled the spirit of adventure and awakened the hope of greater discoveries. In 1498 an expedition led by Pinzon and Solis entered the gulf of Mexico and made the harbor of Tampico, sailing thence around the whole of the Gulf coast, circumnavigating the southern peninsula, and journeying northward as far perhaps as the capes of Chesapeake bay. Of this successful voyage Ledesma and Americus Vespucius were the pilots, and it was doubtless from their charts that the first map of the peninsula was made. This map was made in Portugal, by some one unknown, for Alberto Cantino, who carried it to Italy to the Duke of Ferrara in the autumn of 1502. The original may now be seen in Modena, where it has been since 1886. One recognizes at a glance its singular correctness, at least as to its general outlines. It shows the deep indentations of the west coast and hints at the characteristic lagoon on the east. Without much difficulty and with reasonable certainty we can make some identifications. The River of the Palms is the Apalachicola, the Cape of the End of April is the southern point of the peninsula, the River of the Canoes is the Matanzas, and the River of the Alligators the St. Johns. Both this and the *Tabula Terre Nove* of 1508 were supposed to exhibit the new world, and therefore to include in Florida the whole of North America. How widely they were published we do not know, but they doubtless aided greatly in the conduct of subsequent expeditions.

Added to the other impulses toward discovery which marked the twilight of the fifteenth century, the love of life contributed its strong motives. In a book which might have been dedicated to Ananias, John Mandeville told of a fountain in eastern Asia of which he and his fellow-travelers had drunk freely, and ever since had known new life, instinct with the strength and joy of youth. To find this fountain of youth became a new quest of the voyager. From Porto Rico, in the island of Hispaniola, Juan Ponce de Leon set sail in March, 1512. From the folklore of the natives of Hispaniola he had learned that the fabled fountain would be found in Bimini, a little island of the Bahama group. He had authority from the king to conquer Bimini. His course, however, led him too far to the westward, and on March 27 the white sands of the southern peninsula came in sight. It was Pascua Florida, or Easter Sunday, and the new land was named Florida. Terra Florida it has been ever since, not only because Ponce de Leon reached it on Pascua Florida, but because it is a land of flowers. On April 2 Ponce de Leon landed at about 30° N., but sailed away again immediately, making his way around the peninsula to latitude 27° 30′, whence he sailed home. In 1521 he returned to colonize his territory. The Indians met him with savage resistance, and instead of the fountain of perpetual youth he found defeat, receiving an arrow wound which resulted in a lingering illness and his death in Cuba.

The portion of the state of Florida to be considered in this article lies between longitude 3° and 6° 30′ west of Washington and between 24° 30′ and 30° N. latitude. It has the Atlantic ocean on the east, the gulf of Mexico on the west, and the strait of Florida on the south. Close to its eastern shore is the Gulf stream, in many places not more than two miles distant.

The geology of Florida presents no grave or complicated problems. Lying immediately beneath the surface is a limestone which persists through the entire length of the state. This doubtless belongs to the Eocene system. The limestone, which forms the crest of a fold known as "the ridge," is very permeable by water. It is characterized by enormous sink-holes and subterranean streams. It forms the beds of the middle rivers and of the countless lakes. Lying to the west of this limestone ridge are those marvelous deposits of phosphates which are found along the west coast of the peninsula. East of the ridge, and more especially where it approaches the Atlantic, we find the coquina beds of sand and shells, which, with varying structure, form the barrier between the sea and the great coastal lagoon.

The peninsula naturally separates into three divisions; the middle portion, which comprises the beautiful lake region; the west coast, which slopes away from the high ridge to the gulf of Mexico, and the east coast, whose sandy levels are protected from the Atlantic by the great coquina atoll, extending from the mouth of the St. Johns river to the shores of lake Worth. Each of these divisions differs wholly from the others, presenting conditions and characteristics peculiar to itself.

Middle Florida is a broad ridge which reaches at places an elevation of nearly 250 feet. The soil is for the most part sandy, but like that of the state in general, it contains a sufficient quantity of phosphate to render it fertile. Forests of pine are everywhere. Here and there a cypress swamp varies the scene, and now and then a palmetto hammock suggests the approach of the tropics. It is in this division the lake region is found. Dotting the landscape like jewels of crystal in a field of green are numberless lakes, varying in size from a gem-like lakelet to the broad expanse of Okeechobee. Within a radius of 5 miles from Winter Haven 100 have been counted, and within 7 miles of Orlando there are known to be 150. With Gainesville as its northern limit and including lake Okeechobee on the south, this region contains at a conservative estimate at least 30,000 of these lakes and lakelets. They are not, as many imagine, the result of surface drainage or the reservoirs of sluggish streams. Many of them find their chief supply in the hidden sources of the great limestone which forms their beds, and some of them are connected by subterranean channels. It has frequently been observed that the fall of one means the rise of another. In some cases the water has disappeared entirely for a long period, only to return again, sometimes quite unexpectedly. Their waters are pure and they abound in fish. Clustered around them are the homes of thousands of people who have been driven south by diseases of the throat and lungs. The pine forests, the dry soil, the elevation above the not distant coast, the soft air and the healing sunshine insure almost entire immunity from pulmonary affections.

It is in this region that many of the great springs of Florida are found. The famous Silver spring lies just on the edge of the middle belt. De Leon spring, fabled as youth's fountain, and the strange Blue spring, with its ultramarine waters, are the most notable of these whims of nature.

The west coast region slopes gently away from the middle ridge until it touches the Gulf. It is traversed by rivers whose beauty it is impossible to describe. Rising in swamps and morasses, they make their way by countless windings to the Gulf. Overhead the trees twine their branches into one unbroken canopy, shutting out the sunlight. On the banks are lands of great fertility, devoted in some cases to grazing and in others to gardens, whose early products reach the north while that region is still enveloped in ice and snow. The far-famed Suwanee river rises in the edge of the Okefenokee swamp in Georgia, and after a course of 240 miles empties into the Gulf. The Withlacoochee takes its rise just west of Kissimmee, and after almost losing itself in the spread of its waters, eventually reaches the Gulf in Withlacoochee bay. The Caloosahatchee has its headwaters in the secret recesses of the Okaloocoochee slough, and as it approaches the coast it widens into a majestic stream. Through the drainage canal of the Disston Company it is connected with lake Flirt, lake Hicpochee, and lake Okeechobee. A voyage, unique in every circumstance, may be made by steamer from Punta Rassa, following the river, the lakes, or the canal as far inland as Kissimmee, where one sees the spreading cane fields redeemed by drainage at St. Cloud.

Along the brinks and in the beds of these streams are found one of Florida's chief sources of wealth, the great phosphate deposits. These deposits furnish the purest form of phosphate of lime found in nature, a fact especially significant of the manner in which the minerals of the west coast have in general been deposited. Hundreds of thousands of tons are taken annually to Tampa, Punta Gorda, and Fernandina to be forwarded to foreign ports or American manufactories for conversion into commercial fertilizers. There are also here enormous bodies of sedimentary limestone, fuller's-earth, and kaolin, all of unusual purity, due to the peculiar conditions of their deposition.

The Gulf coast is indented by many bays. These bays, from Suwanee to Sanibel, are dotted with tropical islands, and are bounded on the one side by coasts of unfailing verdure and on the other by the blue waters of the Gulf. Chief of these are Tampa bay and Charlotte harbor, the terminals of two great railway systems. Here one may take steamer for the West

ON THE ST. JOHNS RIVER

FALLS OF THE MIAMI RIVER

Indies or South America, or, choosing smaller craft, find endless summer. He may go with the sponger, who plies his trade on the great sponge reef in the Gulf; may ply the open waters for the silver king of the sea, the tarpon, or may find in the interior whatever his heart desires in the chase for deer and bear, or in that supreme idleness to which the climate induces.

Dividing the middle region of the lakes from the east coast is the St. Johns river. This river enters the Atlantic at Mayport, in a broad, open sweep of water. Running parallel with the Atlantic coast, it is navigable southward as far as Sanford. At some points narrow and crooked, it elsewhere widens into sheets like lake George, 5 miles wide and 15 miles long. Never more than 30 miles from the ocean, its headwaters are not 10 miles from the great lagoon in Halpatiokee swamp, a saw-grass region not unlike the Everglades. The scenery of this great river changes continually. Banks that are green with cypress and fragrant with magnolia and honeysuckle give place to orange groves and gardens, or widen out into a prairie fringed with low palmettos, over whose tops high pines appear. The chief tributary of the St. Johns is the Oklawaha, whose windings through intricate masses of vegetation, by floating islands and bayous haunted by alligators, afford a voyage of rare beauty.

The east coast proper is formed by the coquina ledge, which is found all the way from Anastasia island to the southern limit of Palm beach. This ledge for varying distance along its western border incloses the great lagoon. This lagoon is known by various names; in its extreme northern development it is the North river, then the Matanzas. Here the ledge shuts off the sea until it reaches Smiths and Mala Compra creeks. Beyond this the estuary has its own way, forming the Hillsboro, Halifax, Banana, Indian, and Jupiter rivers and lake Worth. The southern end of the lagoon is in lake Worth, unless it should hereafter be discovered that the coquina ledge continues to cape Florida, in which case Boca Raton, New River inlet, and Dumbfoundling bay will be included. The lagoon is sometimes a broad, deep stream, sometimes a shallow bayou or lake of brackish water. It is flanked on either side by the characteristic belts of the coast. First comes the white sand beach, which is succeeded by sand-dunes covered with beach grass, sea oats, wild morning-glory, and saw-palmetto, changing to red bays and cedars. This is often succeeded by a half-hammock of tall trees and vines. Inside the lagoon is the very fertile belt of the high hammock, composed mostly of oyster shells and fringed on its western end with pine. Following this is the low hammock of deep, black, exhaustless soil, the growths of which are picturesque and tropical, and last the yellow pine or flat woods where the negro and the cracker find their homes. Between the arms of the lagoon a channel 60 feet wide and 6 feet deep has recently been dredged, with the result that one will be able this winter to enter the lagoon at St. Augustine in a naphtha launch or house-boat and sail all the way to bay Biscayne. Leaving St. Augustine, with its old Spanish streets and frowning fortress of San Marco, the voyage lies

"Thro' leafey alleys of verdurous valleys"

to Ormond on the Halifax. Further south lie Daytona and New Smyrna, the site of old indigo and cane fields, English failure and Minorcan misfortune; next come Canaveral light and at length the broad pineapple fields of the Indian river; then the narrows of the Indian and Jupiter rivers to Jupiter light. A canal passes into lake Worth, where nature and art have combined to produce tropical conditions. Thence it extends to New river and by succeeding reach of river and creek and canal into bay Biscayne; thence south through bay Biscayne inside the keys, or outside the keys through Hawk channel to Key West.

The products of the peninsula are so well known that I give them but a passing notice. The orange was for many years the chief object of labor and culture. In 1893–'94 the crop reached the enormous output of 5,500,000 boxes. Then frost killed to the roots 90 per cent of the trees. Sixty per cent of these grew again from the roots and some will bear this year. Three years hence the crop will probably aggregate 5,000,000 boxes. A country of one crop, however, is, like a man with a pet virtue, of doubtful character, and Florida has learned the lesson of the freeze to good effect. Next to the orange is the pineapple, of which this year probably 80,000 crates have been shipped. Added to these, everything in the nature of fruit or vegetable that the temperate zone produces may be found ripening in our gardens for shipment to the north while the farms and gardens and orchards of that region are yet deep in the sleep of winter.

The climate of the peninsula presents so many phases that only an exhaustive study can do it justice. The chief interest, however, centers in its winter conditions. The disposition to escape from the rigors of the northern winter is gradually increasing, and the number of people able to do so is likewise on the increase. Such meager details as it is practicable to introduce into this article but poorly express the actual experience. At Tampa during December, 1895, and January and February, 1896, the following observations were made: Maximum, for the period observed, 80°; minimum, 32°; mean, 59°; greatest daily range, 32°; average number of clear days per month, 12; of partly cloudy, 12; of cloudy, 6. At Jacksonville for the same period: Maximum, 80°; minimum, 24°; mean, 55°; greatest daily range, 41°; clear days, 15; partly cloudy, 9; cloudy, 6. At Jupiter for the same period: Maximum, 83°; minimum, 37°; mean, 63°; greatest daily range, 24°; clear days, 8; partly cloudy, 13, and cloudy, 9. These figures show that the climate becomes more equable as you go southward. This is equally true of the coasts and of the interior, the winter climate of the lake region being of great equability.

For all varieties of pulmonary disease the middle region is a genial sanitarium. The east coast particularly affords relief for all forms of what is called "americanitis" or nerve exhaustion. That the climate is eminently suited either for rest or for increased mental activity and labor I can bear personal testimony. It is the climate *par excellence* for the student.

In March, 1892, Mr James E. Ingraham conceived the idea of, and at once proceeded to organize, an expedition for the exploration of the Everglades. The expedition experienced the greatest hardships, but its object was accomplished, and it is chiefly to its records that I am indebted for the following description.

The Everglades consist of two great basins lying between lake Okeechobee and the extreme southern point of the peninsula. The floor and rim of these basins are formed of a limestone which is doubtless a continuation of the rock composing the central ridge or backbone of the state. On the edges or rim where the rock is exposed it presents a very singular appearance. Here it is weathered and water-worn into the peculiar shapes which gave rise to the early opinion that Florida was of coraline formation. The pressure of the floods of water pouring over the sides or through the edges of this rim has worn away the softer portions of the rock, leaving the harder substance to present a somewhat coral-like structure. The color varies from cream to dark brown, owing to the black water, so called, which issues from the glades. This rock not only persists throughout the glades, so far as explored, but seems also to be present in the river beds to the south, through which the water of the glades finds an outlet.

To the north the water empties into lake Okeechobee; to the west, south, and east it flows through various rivers into the Atlantic and the Gulf. The evident elevation of the area above the east, west, and south coasts precludes the idea of drainage from surrounding areas, and we must look elsewhere for the sources of the water. These, I think, are found in part in precipitation, and, in part, in subterranean streams or springs. The rainfall over this vast area of three million acres must be very great. But when we remember that all the creeks and rivers lead out of and not into the glades, the rainfall, which possibly approximates an average of ten inches per month during the months of June, July, and August, is not sufficient. From what we know as to the subterranean relations between the lakes in the lake region, from the well-known conditions of Silver, Blue, and De Leon springs, as well as from data acquired by drilling for artesian water, it is reasonable to infer that the volume of water due to precipitation is materially increased by an underground supply. As some justification of this assumption, I may mention a spring which has its issue from the rocky rim just below the falls of the Miami river. Over the rocky ledge the dark brown water of the glade pours itself in a turbulent flood into the rapids of the Miami. But only a little distance below the falls, and exposed to view during the period of low water in the glade, the clear and uncolored volume of a huge spring gives itself up to the sunshine. The quality of the water is entirely different from that of the glades, and, as far as I have been able to observe, is unsurpassed in purity.

Approaching the glades from either east or west, the water gradually deepens, the rock forming the floor of the basin receding toward the middle at the rate of about 8.6 inches to the mile. In the valley thus formed, running north and south, the rock is about 15 feet below the surface. It is traceable directly across the glade, leaving no manner of doubt as to its persistence. Immediately over the rock is deposited the result of ages of decayed vegetation, forming a soft peat or muck, the depth of which varies from a few inches to five feet. It is everywhere present over the floor of the great basins, and if ever drained will afford a soil of incalculable richness and fertility.

For miles east and west from the valley of the basin and north

ON THE CALOOSAHATCHEE RIVER

and south through its length there stretches an almost impassable prairie of saw-grass. This saw-grass, rooted in the muck, grows to enormous size, and in many instances resembles a bamboo pole, of the size of an ordinary fishing-rod, with a continuous barbed-wire covering. On three sides of the grass grow teeth of singular sharpness, sometimes an inch in length. Through this prairie of saw-grass clear waterways are found here and there. Their direction is generally southward, and any attempt to cross the glades from west to east, as was the case with Mr Ingraham's expedition, is attended with great hardship and difficulty. Owing to the southerly trend of the glades proper, it sometimes became necessary for the members of the expedition, while carrying on their shoulders the camp outfit, to cling to the boats to prevent permanent bogging and an awful death in the sticky peat and ooze of the bottom. For the white man the passage of the glades means wading, poling, and portage, not infrequently through the densest of the grass, through which he sometimes has to blaze his way. The Indian, who has time on his hands, accommodates himself to the provisions of nature; he follows the path of the open waters and, through years of experience, has learned the apparently trackless way to his homestead or to the outside world. Frequently during Mr Ingraham's expedition the entire distance covered by a day of most arduous toil would not exceed 2½ or 3 miles. When night came on, nothing but saw-grass was in sight, and camp was made on the spot, the making of camp consisting merely in cutting away the saw-grass tops to a level, spreading out upon them the rubber blankets, and over these the clothing for protection and the cheese-cloth netting as a safeguard from sandflies and mosquitos. This somewhat uncomfortable mode of camping gave the party opportunities for observing and repeatedly verifying the marvelous growth of the everglade bamboo. It was frequently noted that the inner part of the cut grasses grew fully three-fourths of an inch during a single night.

Mosquitos are plentiful enough and sandflies exist in large numbers, but the greatest pest is the alligator-flea. This creature lives in the glade water, and has all the characteristics of his two namesakes. He is as strong as the alligator, as active as the *Pulex irritans* and his sudden sting has all the directness and keenness of that of the hornet. He is an oblong insect, brown in color, spongy in substance, and about three sixteenths of an inch in length.

For 8 or 10 miles on either edge of the glades the conditions change materially. Thousands of islands, varying in size from one-eighth of an acre to several acres, greet the eye. On these islands the soil is phenomenally rich, and giant ferns, the fronds of which measure 12 feet in length, grow upon their edges. The virgin forest is composed of the wild lemon, wild cucumber, and wild orange, the dogwood, the custard-apple, the prickly ash, and hundreds of other varieties. Overhead the myrtle and the morning-glory mingle in tangled masses with countless varieties of tropical vines.

In the early summer, after the annual overflow, the entry of the eastern region by the Miami river is singularly beautiful. Where a few weeks before the flood covered everything, is now a green prairie, and through the green gleam the delicate yellow and pink of numberless orchids. The emerald-hued islands are vocal with the songs of birds, and one can walk the now dry pathway of the waters, keeping time perchance to the diapason of some aged alligator bellowing away in a creek near by, unappreciated and undisturbed.

The great volume of water in the glades finds many courses to the sea. The northern basin empties its surplus into lake Okeechobee, from which it passes by the Disston drainage canal through lake Hicpochee and lake Flirt into the Caloosahatchee river and thence into the Gulf. In exceptionally wet seasons the northern basin overflows its southern rim, and contributes to the volume of the greater southern glade. These southern waters pour out through east, south, and southwest channels. Some portion of the volume doubtless furnishes the supply for the Big Cypress swamp. The remainder finds outlet through Gullivans, the Chokaluskee, the Fahkahnatchee, the Chatham, the Rogers, the Shark, the Harney, the Ingraham, and numerous smaller rivers and creeks. To the south there has not been sufficient exploration to furnish reliable data, but the Seminole tells of a southern outlet which is doubtless "Chi's Cut," and which furnishes the peculiar color of Black Water bay. On the east the outlets are numerous. Beginning with the Hillsboro river on the north, the great flood finds its way into the Atlantic through the Middle river, Cypress creek, New river, Snake river, Arch creek, Little river, and the Miami.

The islands in the Everglades have long been inhabited by the Seminole. His cypress dug-out follows the path of the waters from the outside world to his homestead. He lives in comparative civilization. Choosing some specially high and fertile island, he clears away enough of the dense growth to make a garden. Here he grows bananas, sweet potatoes, and other vegetables. He is reasonably industrious and does his own work, leaving it only to hunt or to attend the symbolic dances of the tribe. For many years his chief support was derived from the sale of bird pelts and the growing of coontie, the arrowroot of Florida. But the one has been rendered illegal and the other unprofitable. His home is usually a somewhat crude hut, made of rough boards riven from the log, and covered with a thatch of palmetto. The women of the Seminole are treated as women, the rearing of the children and the cares of the household being their only labor. As the tribe is gradually diminishing in numbers, an abundant game supply is found in the water-bound reservation and in the Big Cypress swamp. Deer, bear, and the wild turkey are found in fair quantity, and countless herons and ducks have their perpetual home on the islands. The wild-cat and the panther also are found in moderate numbers, while the alligator is always in evidence, with now and then a crocodile. The fine array of venomous snakes of the early geographies is not to be found in the eastern glades, an occasional moccasin only appearing.

The average distance from the rim of the glades to the coast is: on the south and southwest about 15 miles, on the east about 6 miles, and on the west about 50 miles. West of the glades lie the Okaloocoochee slough and the Big Cypress swamp.

Southwest of the Big Cypress and south of the Everglades exploration is fraught with so many difficulties that the country remains to a large extent unknown. Along the greater rivers, such as the Fahkahnatchee, Harney, Rogers, and Ingraham, the land lies very low, a little higher usually on the south bank than the north. These banks are subject to overflow, continuing through a considerable period, during the spring. This makes the region practically unavailable for settlement. The banks of many of these rivers are covered with a growth of black and red mangrove, which grow here to the giant sizes, comparatively speaking, of 50 to 75 feet in height and 24 to 30 inches in diameter. When the mangrove is not present there is a dense hammock growth springing from a soil of wonderful richness, composed of muck with an underlying green marl, below which the ever-present limestone is found. Inside the hammock and next the rim of the glades is the usual prairie fringe. On the south coast of the peninsula there is almost no shore-line. The dense forests of mangrove have reached out so far into the bays that the shore-line is merely an impenetrable tangle of roots. The weight of a man's body is enough to impart a swaying motion to three or four acres of this floating forest. Off the coast and extending to the northwest for many miles are countless islands or keys. These keys are covered with a dense growth of mangrove on the edges, while further in the sea-grape, wild fig, pawpaw, and buttonwood abound. On many of them there have been observed for years what appeared to be shell mounds, not differing in general appearance from other shell mounds. Through the narrow sun-kissed channels of these ten thousand islands the sponger, "the Conch," and the smuggler sailed for years; the settler in search of lands and the sportsman looking for a camp passed them by in contempt; but under the mangrove roots and the tangle of vines there slept the civilization of past centuries. These keys with their strange shell heaps are cities of the dead, and the magic touch of Mr Frank Hamilton Cushing has brought them into life. At Key Marco he has brought to light evidences of a culture belonging to the Stone age, yet surpassing it amazingly in beauty. Here dwelt a strange people who built sea-walls of shells and made themselves water-courts and temples on the gulf shore, working amazing results, in pottery and copper, with shark's teeth and fish-bones. How much more of this early civilization awaits research it is impossible to tell; but Mr Cushing's work has made the southwestern coast of the peninsula a shrine for the student and a mine of wealth for the worker in archeology.

It would hardly be possible to imagine in coast conditions a greater contrast than exists between these southern and southwestern coasts of Florida and the coast lying to the east of the Everglades. As one crosses the rim of the glades basin, the inevitable prairie is first met with. This is of varying width, but of remarkable fertility. Passing eastward it is succeeded by the pine-land belt, which in turn gives place to a hammock growth that is of its own kind. This new hammock fringes the inner shore of bay Biscayne, which, including Cards sound, has a shore-line of nearly 60 miles. To the utter surprise of the student of Floridian scenery and geology this shore-line is a rocky bluff. It is composed of a limestone yet unidentified, which, when first exposed, is soft and friable. It gives evidence of a slow, still-water bedding. Here and there it contains quantities of small shells; exposed, it weathers to a rich gray and hardens sufficiently to make excellent building-stone. In many localities inland for a mile the rock is on the surface, but for the most part it is covered with rich vegetable mold. The hammock surpasses all others of Florida in the variety of its woods. The familiar wild mulberry, red bay, and liveoak are here. With them grow the wild fig or rubber tree, the gumbo-limbo, ironwood, mastic, naked wood, crabwood, and many others. Scattered along the rocky bluff, washed by the crystal blue water of Biscayne, are great numbers of wild lemons, limes, and oranges, and over them all from tree to tree climbs the vivid green of a giant vining cactus. It is here, too, that the cocoanut palm sends up its giant plume-like fronds. The bamboo transplanted makes itself at home. The century-plant, reckless of weather, bears its giant bloom, and the queen of all the trees, the royal palm, graceful beyond description, adds her luxuriance to the tropical beauty of the scene.

The rocky front of the inshore of bay Biscayne is broken by the Miami and other rivers flowing out of the Everglades. A little north of the bay, into New River inlet, empties New river. Both of these glade rivers are singularly beautiful. Their waters, clear and limpid, are fringed on either shore by all the wild growths of the hammock, until they make their way through pine and prairie, reflecting every change of scene like mirrors. Through these rivers the Indians come to the frontier to sell their skins and venison. The distance from the coast to the glades is from 6 to 8 miles, under the overlocking branches of trees that are always green. The fall of the Miami river as it leaves the glade is about 10 feet in 900. Its mouth fringed with lordly cocoanuts, the Miami empties into the bay almost due west of cape Florida. The southern extremity of key Biscayne forms cape Florida, not far from which is the northern end of the Great Florida reef.

South of cape Florida, here clustered and there widely separated by the opal waters of the Southern ocean, lies the great system of the Florida keys, beginning with Sands key, passing Cards sound, Barnes sound, and the bay of Florida, until in the extreme south Key West sits in her isolation, a city of over 20,000 inhabitants, cut off from her sister cities and compelled to be content with a mail twice a week. These keys are a study in themselves. They vary in size from a point of land to key Largo, which is 25 miles long and from one-eighth of a mile to 2 miles in width.

This fringe of the continent forms a safe barrier against the sea, and in land-locked waters the voyage from Miami to Key

West, whether in midwinter or midsummer, is full of comfort, charm, and beauty. The keys are not barren sand-wastes, as was at first supposed, but seem to be formed of the same rock as the bluff of Biscayne bay. They are tropical in plant life, genial in climate, and fertile almost beyond belief. The waters of this summer country are beautiful beyond everything that language or color can express. They are for the most part shallow, but in their greatest depths one sees through their crystal blue the underlying floor of bay or sound or strait. This floor is covered by sea-weeds in picturesque tangles and sponges of grotesque form, through and above which myriads of fish flit like flashes of electric light. Close by the shores the lazy shark glides along indifferent to your presence. The modest manatee, the strange sea-cow, hurries away to deeper water. From the opalescent surface the tarpon springs for his prey, the pompano for his pleasure. Overhead the sun shines brilliantly, but even at midsummer the trade winds blow so surely but so soothingly that there is no sense of heat and certainly none of oppression at any season of the year.

The fertility of the southeastern coast region is really beyond description. It presents a variety of soils and lands unequaled. Anything known to the north temperate zone, except wheat, will grow. The vegetables of the ordinary garden mature and ripen at any period of the year. Planting and gathering run side by side winter and summer. It is the natural home for all the citrus family, such as lemons, limes, oranges, citrons, grape fruit, and shaddock. The pineapple grows and yields almost without attention. Mangos, guava, the alligator pear, the sapodilla, the sugar apple, the Japan plum and persimmon, with numerous other tropical fruits, thrive and yield amazingly. The culture of vanilla, camphor, kola, cinchona, cinnamon, and coffee has begun with great promise of success. The eastern edge of the southern Everglade furnishes every condition of soil and climate necessary to the culture of the india-rubber tree, and, whether the glades are ever drained or not, the islands of their eastern edge will furnish the rubber of future commerce.

In this favored region frost is entirely unknown. In addition to its southern latitude, it has two potent protectors. Close to its eastern shore courses that nursing mother of the sea, the great Gulf stream. Westward the warm waters of the glades hang a mist veil for 50 miles. In the eastern islands of the glades the habit of growth shown by the trees proves that frost has never fallen.

THE SAGE PLAINS OF OREGON

By Frederick V. Coville,

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The states of Washington and Oregon are cut in half from north to south by a great mountain range known as the Cascades. By this climatic barrier the eastern portions of these two states are transformed into a great arid plain centering about the valley of the Columbia river. The eastern limit of the plain is the western base of the Bitterroot mountains toward the north and of other ranges belonging to the Rocky mountain system further south. Thus is formed a great wedge-shaped area, its base toward the south, where the plains are continuous with those of Nevada, and its apex toward the north, where the plain is finally shut in by the boreal forest-belt which connects the northern end of the Bitterroots with the northern end of the Cascades. Near the center of this triangle, in northeastern Oregon, rises a great, irregular mass of rock known as the Blue mountains, which projecting into the plain from the eastward almost divides it into two portions, the resultant plains area being roughly of the shape of a dumb-bell, the upper half lying in Washington, the lower half in Oregon, and the two connected by a narrow neck in the mid-northern portion of the latter state. The area is drained largely by the Columbia river, which has cut its way through the Cascades to the Pacific. In the southern portion of Oregon the streams in many places find no outlet to oceanic waters, but flow into alkaline lakes and marshy sinks, from which their water either percolates into the soil to find an outlet elsewhere or is evaporated into the dry atmosphere. In altitude the plains range from less than 500 feet along the Columbia river valley to 4,000 and even 5,000 feet in the more distant portions. From north to south in a direct line the extreme length of the plains is about 450 miles, from east to west in the northern portion about 150 and in the southern portion about 250 miles, the relatively narrow neck connecting the two being constricted in its narrowest part to not more than 15 miles.

The first white men to penetrate this region were those belonging to the expedition of Lewis and Clarke, who crossed the

Bitterroot mountains from the east in the summer of 1805 and traveled laboriously across the plains and then down the valley of the Columbia to the ocean. The subsequent history of eastern Oregon may be divided into the period of occupation by the Hudson's Bay Company and other fur-dealing organizations, then the period of gold-mining excitement, and finally the period of agricultural settlement, beginning with the Grand Ronde and stretching out to other less attractive localities.

Two decades ago the plains of eastern Oregon, south of the Blue mountains, were practically an unsettled region. It was then generally recognized that the country was capable of producing a good quality of beef in enormous amounts, and the available land was rapidly taken up, chiefly under homestead entries, so that now there remains little land worth entering. The country, however, is still very sparsely settled. Perhaps the most suggestive fact about the whole region is that no point in the United States lies further from a railroad than the center of this plain. Even the great desert from Death valley eastward across southern Nevada and Utah is more deeply penetrated by railroad lines than is this great wilderness of eastern Oregon. Traveling southward from the Dalles to the southern part of the state and then eastward into Idaho one can go more than a thousand miles without crossing a railroad track, although no point is more than about 160 miles in a direct line from some railroad connection.

In the year 1893 the Division of Botany in the Department of Agriculture began to make a comprehensive examination of the vegetation of these plains, beginning with the Columbia plains proper, in the state of Washington. In 1894 this work was continued southward across the Columbia through the neck of the dumb-bell and down nearly to the southern boundary of the state of Oregon. In 1895 the work was interrupted for more urgent explorations in the Cœur d'Alène mountains, but in 1896 it was again taken up and the remainder of the Oregon plains was covered. The collections made in these three years, though not confined entirely to the plains region, but including also some of the adjacent forested mountain country, contained not far from 1,800 species, and it is probable that the plains themselves, as distinguished from the forests upon the surrounding mountains, contain not less than 1,000.

This year the route followed was from the town of Ontario, on the Snake river, westward to Harney, from which place a side trip was made northward in the Blue mountains. The expedition then traveled south from Harney to Steins mountain, then westward across the plains, winding back and forth between the north and south mountain ranges to Fort Klamath, and finally over the Cascades to the railroad.

The whole country appears to have been covered at some not very remote geological period by a great sheet of lava, which has since been cracked, uplifted, and depressed in various portions. Almost every plateau ends in an escarpment of naked basalt, known throughout the region as rim-rock, perhaps geologically the most characteristic surface feature of the country. Nearly every valley is inclosed by such a formation.

The vegetation of the country consists primarily of sage brush, the well-known *Artemisia tridentata* of botanists, a shrub three to six feet high, closely related to the wormwood of Europe, and having in common with that plant a light gray color and a strongly aromatic odor. Away from stream beds and sinks and the shores of lakes, sage brush covers the whole country like a gray mantle and constitutes probably nine-tenths of the total vegetation. It is a plant the herbage of which is eaten by but few animals and by those only in starvation times, one that will grow with little moisture and will stand the widest range of temperature. Sage brush gives to the country its character. A level stretch is known as a sage plain; the grouse which live there are known as sage hens; the fuel of the region is sage brush; the odor upon the atmosphere is that of sage brush.

After a season's lack of rain the sage brush turns to a blackish gray and everything has a dead, burned-out look, suggestive of thirst, of hot rocks, and parching winds. But after a soaking spring rain the sage brush puts on a new coloration, a delicate pale bluish green, soft and very pleasing to the eye. Occasionally in some far-off lava-covered basin of the plains, where there has been no rain for months, a stream bed stretching down from a mountain brings to the thirsty plain the water that has fallen in a summer thunder-storm upon some high peak, and as a consequence the dark gray blanket of sage brush is lighted up by a line of soft pea green. If the stream bed is one that still continues to carry water, the sage hens gather along it from miles back in the plains, and every morning and evening come down to drink. Sometimes the teal and other ducks, if the mountain is high enough to produce a perennial stream, bring up their broods of young in the tall grass along its margin. In one day's journey of about 20 miles along such a stream we passed, by actual count, 389 sage hens and brood after brood of ducks, while at one point we started up, at a distance of half a mile, a herd of 20 antelope, which lined-up like Indians and trotted away from their drinking place over the rim of the plateau. They were doubtless on their way back to their grazing grounds, where even at the present stage of civilization no hunter ever disturbs them.

Regret is sometimes expressed that sage brush, abundant as it is, does not furnish a succulent, palatable herbage suited to the appetites of cattle and horses. If it did, what an inexhaustible supply of forage these arid plains would support. But those who suggest such a resourceful condition of affairs have forgotten that the cause of its abundance and wide distribution is undoubtedly the protection against the ravages of grazing animals afforded by its disagreeable taste, so that it can grow, produce its seed, and spread almost unchecked. Had it been a grazing plant, suited to the appetite of antelope and deer, and later to that of sheep, horses, and cattle, it would long since have been exhausted and the Oregon plains have become as bare of sage brush as some of the Wyoming plains are bare of grass.

A few other shrubs form an inconsiderable part of the woody vegetation, but these and the sage brush make up by no means all the plant life of the country. As the snow melts away in the spring, the well moistened soil between the Artemisia bushes becomes covered with the seedlings of innumerable annuals. For a few weeks the ground is carpeted with these plants, which flower in the greatest profusion, but after about two months they ripen their seeds, dry up, die, and disappear. Growing with these annuals is another type of plants, tuberous-rooted perennials, which have stored up during the preceding year's growth a large amount of nourishment. They therefore bloom at the first break of spring, go through a brief period of rapid growth, lasting usually a little longer than that of the annuals, and then the newly formed bulbs, well protected by impervious coats against the desiccating influences of a long, dry summer, carry over a full supply of plant food for the next spring's blooming.

At some points in the higher altitudes of the sage plains, in level or slightly depressed areas which catch and retain for a time some of the water from the melting snows in spring, a dense meadow of fine grasses, interspersed with the greatest profusion of brilliantly colored flowers, is formed, and as one of the most abundant is the blue-flowered hyacinth-like camas, *Camassia esculenta*, these formations are known as camas meadows. They cover from a few acres to many hundreds. By the middle of summer these meadows, drained by some creek or rivulet, are dried out, the fine black soil, extremely sticky when moist, gaping open in deep, ragged cracks and becoming so hard that an ordinary spade makes scarcely any impression upon it. A lump of it broken off with a pick and cut with a knife shows a smooth, shining surface very similar to that of pipe-clay. When the soil of a camas meadow reaches this stage of dryness, the vegetation ripens, the seeds and dormant bulbous underground parts carrying the plants over the remaining period of drought.

As one descends from the open plains into the valley bottoms and approaches a lake or the sink of a stream, the soil becomes alkaline and the vegetation changes, the sage brush being followed by a somewhat similar hard-wood spiny shrub known as greasewood, *Sarcobatus vermiculatus*, and this, in turn, in case the alkaline valley bottom is dry, is succeeded by a hard-baked soil, absolutely devoid of vegetation. If the valley bottom is moist, the greasewood may be succeeded by a green carpet of salt grass, and this in turn by an incrustation of salt, often with a thin covering of briny water or oozy alkaline mud in the center of it. If, as frequently happens, the water in one of these valley bottoms is nearly fresh, it supports a more luxuriant vegetation, and the dense line of salt grass may be followed by taller succulent marsh grasses, the area covering hundreds and sometimes even thousands of acres and furnishing an almost inexhaustible supply of forage. In still wetter soil and surrounding the open water grows a line of tule, as it is called, a species of tall bulrush, known to botanists as *Scirpus lacustris occidentalis*.

At the western base of Steins mountain, in a great groove formed on the east by the sloping mountain base and on the west by an abruptly ended uplift of the lava crust, lie a long succession of marshes or slews, as they are called, connected by a flowing stream and covering probably a hundred thousand acres. This land constitutes the principal part of an immense ranch, consisting of 180,000 acres of fenced land, for the most part well watered. Indeed it covers all the available water supply of the region and controls a several times greater area of arid grazing land belonging to the government. In the spring the cattle are driven out into the open sage brush, where they graze for several weeks upon the abundant spring vegetation. Later, as the dry summer begins and this transient forage supply is exhausted, the stock is driven higher upon the plateaus or the mountain slopes, where they find an abundance of bunch grass. Then, as the cold weather of autumn sets in and the snows begin, the cattle are brought down again to the marsh lands, and when the swamps are frozen over and the ice is sufficiently thick they are driven out upon it and there eat the air-dried sugar grass and cane grass and tules. Finally, forewarned of the opening spring by a warm chinook from the southwest, the Mexican vaqueros, or buccaroos, as they are more commonly called in the language of the Oregonians, clear the cattle off the ice before it finally breaks up. Every summer an immense amount of hay is secured from these great meadows, about three thousand tons being annually cut and stacked for winter use on this particular ranch. During the storms of winter the cattle on the ranch are, as far as possible, fed and sheltered, but heavy losses from freezing and starvation frequently occur.

In 1889–'90 occurred one of those long, hard winters which are expected in eastern Oregon perhaps once in ten years. Snow began to fall earlier than usual and continued almost incessantly throughout the winter. The stock caught out upon the range were wholly inaccessible and could not be brought into the corrals. The cattle that were under shelter at the time the conditions became serious were fed as long as the supply of hay lasted, and then, the spring not breaking at its accustomed season, the animals slowly starved. The loss by starvation in the entire region varied from 30 to 70 and even 90 per cent. Those stock-raisers who were well prepared for such an emergency escaped with a set-back of a year or two in profits, but those who were taken in the worst condition were in many cases ruined.

The Indians who once lived upon these plains found, through centuries of slowly-gathered experience, not only that they could exist, but that they could live in comfort, building themselves shelters of tules and of juniper brush, and easily obtaining an abundant supply of game and rich, nutritious food with all the articles necessary to the manufacture of their various implements, their clothing, their cooking utensils, and in fact all the other necessaries of an out-door existence and the luxuries of savage life.

Perhaps no Indians in the far northwest have been guided by better councils from their chiefs, have shown a greater desire to assume the conditions of civilized life, or have proved themselves more capable of development under those conditions than the Klamath Indians of Oregon. They are now gathered together upon a reservation, about 40 miles by 60 in extent, in the southwestern part of the Oregon plains, in a country partly forested and partly covered with sage brush. The land they occupy is a part of that upon which their ancestors lived, and thus, not having been removed from the conditions under which they developed, they furnish an excellent opportunity for observing an intelligent Indian tribe, in process of civilization, still retaining the best and most deeply rooted of their old customs and habits and substituting for the less useful ones the improvements of civilization, yet not giving up in a generation the old tendencies of centuries. These Indians graze cattle and horses, cut hay for winter use, and raise a small quantity of grain and occasionally a few vegetables. They build fences around their separate farms and are now building houses of sawed lumber, their blacksmiths, carpenters, shoemakers, and other artisans being educated at the agency schools.

At least a hundred species of the native plants of the region are still used by the Klamaths in one way or another. One of their staple farinaceous foods is the seed of the great yellow water-lily of the northwest, *Nymphaea polysepala*, which grows in inexhaustible quantities in the marshes of the reservation. The bulbs of the camas plant, of which enormous amounts are pried out of the ground in spring with a camas stick or digger, furnish another excellent and favorite food. The most important of their fleshy fruits is a huckleberry, *Vaccinium myrtilloides*, which covers the mountain slopes in some parts of the neighboring Cascades. The best of their fibers is a perennial blue-flowered flax, *Linum lewisii*, which grows without irrigation in the open sage brush at higher altitudes. They get a beautiful lemon-yellow permanent dye from a yellow lichen, *Evernia vulpina*, which grows abundantly on the trunks of trees in the pine forests. Some of these plants and others equally useful may well attract the attention of agricultural experimenters.

In view of the present agricultural depression, which appears to be especially severe in the plains of eastern Oregon, the question naturally arises what the future promises in the way of relief; whether the agricultural capacities of the region are such as to offer a fair prospect of relief by some modification of the prevailing system or whether the result must be the gradual abandonment of present settlements. This is notably one of those regions in which money is made out of only one product, in this case, forage. The forage crop is not immediately exchanged for money, but is used to fatten cattle for beef, to raise horses for farm and other purposes, and to grow sheep for wool. At present the low price of wool has practically put an end to sheep grazing. The low price of horses, as draft animals, has resulted in the inability of the ranchers to market their stock, horses fresh from the range being now worth in some parts of Oregon no more than five dollars per head. The actual products of the region, therefore, are essentially limited to one, namely, beef cattle, and the price of these is so low that the income is barely sufficient to pay the expenses of managing the ranch.

One practical modification of the present system is clearly apparent to the traveler. Ranchers have been accustomed under the high prices of former years to neglect the ordinary processes of farming and to purchase their entire food supply from the outside, paying not merely the first cost of the food in eastern markets, but the cost of railroad transportation and of a long wagon haul besides. The ranchers of the plains have assumed rather than proved by experience that the country is incapable of producing the ordinary farm crops, such as are necessary for family use. There is no question that a proper use for gardens and field crops of some of the water which now either goes to waste or is turned upon grazing lands would be a most important step toward bettering the present agricultural conditions. This lesson, indeed, is now being learned practically from force of necessity, and in many places where it has been assumed from the occasional early or late frosts that certain crops could not be grown it is now found that with proper foresight and care excellent crops are produced.

Another lesson to be drawn from the fact that the native races obtained an abundant subsistence from these same plains in which a civilized race now finds it hard to subsist is that it is impossible to carry on with success in an arid region an agriculture developed in a humid region, unless important modifications are introduced. This lesson has already been learned in some other parts of the country, as, for example, in western Kansas, in Indian territory, and in northern Texas, where after years of largely unsuccessful trials it was found impossible to depend upon the typical American stock feed, Indian corn, but it was found possible to grow a cereal of the old world, now commonly known as Kafir corn. This has been found to flourish under conditions too arid for Indian corn, to produce heavy crops, and to have about the same nutritive qualities as that product for feeding farm stock of all kinds or for human food. There is a great subarid belt in that region in which Kafir corn has now become the staple crop, and while there is no great demand for it in the markets of the world, and it is not, therefore, directly convertible into money, yet, when transformed into pork, beef, or draft animals, it brings quite as good a price as Indian corn. Though this particular crop is probably not suited to the plains of Oregon, it suggests strongly that there may be equally valuable plants well adapted to that region. The observations we have just made on the native plants demonstrate the fact that there are many food-producing species which stand the climate well, and there is a reasonable probability that some of them might by careful cultivation and selection be turned into useful agricultural products. The bringing about of such a result, however, can be the outcome only of long and laborious experimentation and it offers no immediate solution of the present problem.

There is one phase of wastefulness of the natural resources of the United States which a trip across the plains of Oregon particularly impresses upon the traveler, namely, the careless destruction of our great natural wealth of forage. It is doubtless to this that the local aggravation of the present agricultural depression is in some parts of the country due. After an educational campaign of twenty years the government has recently appointed a commission to report a practical plan of dealing with the forestry problem of the United States. From the condition of our great grazing areas in the west it seems probable that the time will come when a similar popular demand will be made upon the government for some means of preventing the exhaustion of the forage supply on the public lands. Continued over-grazing year after year, if sufficiently excessive, unquestionably kills out the native forage plants, which are then replaced largely by introduced weeds. The original nutritious grasses never regain their former luxuriance and sometimes are almost exterminated. Under moderate grazing the native species produce yearly a good crop, or if even slightly over-grazed will after a few years of rest regain their former abundance.

Only a comparatively small percentage of the arid grazing lands of the west are under private ownership. Most of the grazing is done upon the public lands. When the price of beef or other product of grazing was high, as it was, for example, ten years ago, it was to the immediate interest of every cattle owner to fatten the largest number of stock in the briefest possible time, regardless of the effect of so doing upon the future productiveness of forage. Not only is the system a bad one theoretically, but its practical effects are manifest in the actual conditions of many portions of our grazing regions today, and if the prices of the products of grazing continue high enough to make grazing a profitable industry, the condition of affairs is bound to become gradually worse, and we shall ultimately, in section after section, ruin our grazing lands.

The correction of the evil may be brought about, it seems to me, by one of three methods. First, by a system of licenses which shall regulate the number of cattle to be grazed on a given area. A similar system has been proposed for our forest lands, and some plan of the kind seems likely to be adopted. The principal objection to licenses in the case of grazing lands is that the responsibility of the government would be great and the administration of such a law would add enormously to the machinery of the executive.

A second and perhaps preferable method is the private ownership of land. It is evident that it is to the advantage of an owner to maintain his land at its greatest continued productiveness, and he would not, therefore, seriously over-graze it. As a matter of fact, the great cattle ranges, which are either owned by individuals or corporations, or are essentially theirs through the control of the available water supply, are in far better condition today than the public lands, which are common grazing grounds, and many of the areas thus controlled are in just as good condition as they ever were.

A third method of securing responsible management of grazing lands is a long-term lease from the government. The principal objection of cattlemen to private ownership of land is the necessity of paying taxes. This difficulty would be obviated by a lease of the land from the government, and, even though the amount paid were small, the advantage of an interested management would prove of the highest benefit to the general public, while the government would still retain its title to the land and after the expiration of the lease could make new terms, based on longer experience and changed conditions.

THE UNITED STATES DEPARTMENT OF AGRICULTURE AND ITS BIOLOGICAL SURVEY

Probably no investigations now being carried on in connection with the many-sided scientific work of the U. S. Department of Agriculture will be more productive of beneficial results than those which are being conducted in the Division of Biological Survey, under the direction of Dr C. Hart Merriam. Six years ago Congress authorized the Department to institute a comprehensive investigation of the geographical distribution of plants and animals, but it made no change in the official designation of the division—that of Ornithology and Mammalogy—to which this important work was to be assigned. At the last session of Congress. however, this omission was made good, and now the study of the distribution of life in the United States with reference to the adaptation of different sections of the country to different agricultural and horticultural products will no longer be even nominally subordinated to those less important though most useful investigations in which Dr Merriam and his collaborators have hitherto been mainly engaged.

During the last half-dozen years American agriculture has been passing through a period of transition, consequent in part upon a sudden shifting of the agricultural center of gravity and in part upon an unusually prolonged era of low prices. It has been a time of change and experimentation, and millions of dollars have unquestionably been wasted through ignorance of the complex relations of the different products of the soil to the conditions under which their growth to maturity can most effectually be promoted. Although, with the exception of the cotton plant and the West India sugar cane, all the principal agricultural products of the United States have come, through the adaptation, either natural or artificial, of one or another of their varieties to local conditions, to have a range of successful cultivation almost as far-extending as the country itself, there is not one of them, nor a single variety of one of them, that has not an area within which its yield is more certain, more perfect, and more abundant than it is anywhere else, and this area is as definitely ascertainable as is the geographic distribution of the humming-bird or the long-leaved pine. To discover these regions of ideal conditions—of perfect adaptations—and so to understand their essential relations, each to its particular product, that the result of the slightest departure therefrom can be accurately foretold constitutes one of the principal duties of the new division.

The distribution of cultivated products cannot, however, be restricted to the localities in which the conditions of growth are exclusively favorable, and it may be presumed therefore that we shall see not merely a definite localization of the various regions of perfect development, but also an exact graduation of the manifold conditions of all reasonably successful cultivation.

A natural complement of these important investigations will be the introduction of new species of economic plants from abroad and their allocation to congenial climates and suitable soils, a procedure that will open up enormous possibilities of usefulness in a country possessing so great a diversity of soil and climate as does the United States.

All this, however, will call for the exercise of scientific attainments of the highest order, and its accomplishment will be a work of years. It is to be hoped that neither changes of administration nor mutations of congressional majorities will interfere with it, but that its maintenance will be as liberal and uninterrupted as befits an investigation of such vast economic importance.

J. H.

STATISTICS OF RAILWAYS IN THE UNITED STATES

From an advance copy of *Statistics of Railways in the United States*, from the report of the Interstate Commerce Commission for the year ending June 30, 1895, it appears that the total railway mileage of the country at that date was 180,657 miles, an increase during the year of 1,949 miles, or 1.09 per cent. This is the smallest annual increase for nearly a generation. It is, however, very generally distributed over the country, being participated in by nearly every state. As to railroad equipment, the number of locomotives has been increased by 207; the number of passenger cars also shows a slight increase, but the number of freight cars in use has been reduced by 9,050. The number of railroad employés was 785,034. This is a trifle larger than in 1894, but is a great reduction from the preceding year, when high-water mark in railroad transportation was reached. The reduction is quite uniformly distributed among all the different classes of employés. It is a notable fact that while the pay of the officers and clerks of railway corporations has been materially reduced during the recent depression, that of other employés remains practically the same as at its commencement. The total amount of railway stock stands at nearly 5,000 million dollars, and the total indebtedness is 4,641 millions, both showing a slight increase over the preceding year. As to public service in transportation, the total number of passengers carried was 507 millions, or, to put the figures in another form, the number of passengers carried one mile was 12,188 millions. This is a decrease from the preceding year of 1,200 millions, showing the extent to which the depression in business has affected the migrations of the people. On an average, every man, woman, and child in the country traveled by rail a distance of 175 miles during the year. The number of tons of freight moved was 697 millions, the number moved one mile being 85,227 millions, an increase of 4,892 millions over the preceding year. The gross income of the railroads was 1,075 million dollars, an increase of two millions, and the net income 350 millions, an increase of 7.7 millions. The dividends declared during the year amounted to 56 millions, or about 1.1 per cent on the capital stock. H. G.

GEOGRAPHIC WORK IN PERU

In several of the South American republics there are flourishing geographic societies. There, as in Russia and a few other countries, the geographic organization is a nucleus of general scientific activity, and geography becomes the foster-mother of various sciences, including geology, mineralogy, meteorology, botany, zoölogy, archeology, ethnology, etc. This is eminently true of the "Sociedad Geográfica de Lima," the leading scientific society of Peru. Its active membership is large, vigorous, and widely distributed, including many of the best known professional men and civil and military officers of the country. The *ex officio* president is the President of the Republic, and the *ex officio* vice-president is the Minister of Foreign Affairs; the present president of the council is Dr D. Luis Carranza, F.R.S., a widely known publicist, and the secretary is Dr D. Federico Elguera, kinsman of a diplomatic official favorably known in Washington. The honorary membership includes several active members of the National Geographic Society. The society issues a "boletin" of which the third trimester of the fifth volume has recently appeared; its contents indicate the breadth of the field occupied by the society. The opening article is the itinerary of Raimondi—"El inmortal Raimondi, creador de la Geografía Peruana," as he is styled by a leading Peruvian geographer—among the mountains of Huancayo in 1866; the second article is an exposition of a graphic method of determining latitudes and meridians; the third is the report of the delegate to the sixth International Geographic Congress in London; then follows a list of the common and systematic names of Peruvian plants. Sixteen pages are devoted to a description of Peruvian hydrography, and there is a classic contribution to the knowledge of aboriginal linguistics occupying forty-two of the large octavo pages. A brief account of the Victoria regia, "la reina del Amazonas" follows, and the fascicle closes with a series of elaborate meteorologic records, including the official tables prepared by the National Academy of Medicine.

GEOGRAPHIC LITERATURE

The Scenery of Switzerland and the Causes to which it is due. By Sir John Lubbock. New York: Macmillan & Co. 1896.

Two critics of this one book have said: "Had not this volume borne a well-known name we should have guessed it to be the production of one or more geological students who had read too many German text-books, and mixed their notes with . . . brief and simple extracts from the diary of a Swiss tour" (London *Athenæum*, Aug. 1, 1896); and "This admirable book shows how thoroughly a sagacious amateur may follow, appreciate, and transmit to a large circle of readers the best physiographic results gained by geologists and geographers of Switzerland" (*Science*, Aug. 7, 1896). As the latter opinion is my own, I naturally prefer it to that of the London writer, who seems to me a carping critic, unsympathetic and unappreciative. He gloats over misprints, he dwells on mistakes of *de* for *du*, he magnifies other trifling inaccuracies, and thus fails to present to his readers a clear idea of the intention of the book and of its essentially successful accomplishment. As it seems to me, the real point of the book is this: instead of contenting himself, after the fashion of the typical Alpine clubman, with a merely athletic ascent of a mountain peak, in itself truly a fine and invigorating exercise, Lubbock has done much more, for he has studied as well as climbed, and the book is an effort to share with others the intellectual entertainment thus gained. As he says: "My attention was from the first directed to the interesting problems presented by the physical geography of the country. I longed to know what forces had raised the mountains, had hollowed out the lakes, and directed the rivers. During all my holidays these questions have occupied my thoughts, and I have read much of what has been written about them." Speaking of the plan of his book, he adds: "I urged Tyndall and several others far better qualified than I am myself to give us such a volume, feeling sure that it would be welcome to our countrymen, and add both to the pleasure and to the interest of their Swiss trips. They were all, however, otherwise occupied, but they encouraged me to attempt it, promising me their valuable assistance, and this must be my excuse for undertaking the task, perhaps prematurely."

The book is a very welcome contribution to popular scientific literature, and the more so because it is upon a subject that has called forth singularly little writing of this class, in spite of the rich variety of its materials. It gives a brief account of the geology of the Alps, of the origin of mountains in general, and of the structural features of the mountains of Switzerland in particular; then follow chapters on ice and glaciers, on rivers, valleys, and lakes, and on the influence of the strata on scenery. Nearly two hundred pages ensue on special districts of the Alps, such as the Jura, the central plain, Mt Blanc, the Bernese Oberland, the Rhine, the Reuss, and the Engadine. Nowhere else can the intelligent reader or observant traveler so readily gain a general view of the results attained by specialists. One may amusedly regret that snow is spoken of as having eight-sided crystals (p. 56), and at the same time enjoy the account of avalanches and of moraines, which will surely edify many an inquiring traveler. Perhaps two names, *Sallanches* and *Salanfe*, are confused; but where else shall we go for a simple and accessible English rendering of such studies as Heim's on the former course of the Rhine or the beheading of the Inn? As a consequence of the latter accident, four little lakes have been formed on the valley floor, barred by alluvial fans thrown out by the lateral streams. Here is the best example that can now be quoted of this peculiar species of lakes; yet the *Athenæum* critic will have it that they are not caused "by dams formed by lateral streams, but by the rocky barriers above and below the lake of St Moritz. Lateral streams have only divided in two places the upper lake." Having a particular interest in lakes of this class, I wrote to Professor Heim, of Zurich, for fuller particulars, it being from his original study that Lubbock took his account. In reply, Heim gives details confirming his original statement and justifying Lubbock's abstract of it. A valuable list of works and authors referred to is given in an appendix. An index is unfortunately wanting.

One of the chief values of Lubbock's book lies in its being so manifestly the work of one who has enjoyed the study and observation required in its preparation. The author may still spell *Chamonix* "*Chamouni;*" perhaps, as a very busy man, he may leave proof-reading to others (we hope he gives his own time to higher pursuits), but he certainly shows himself a generous man in taking the pains to make so accessible to many others the beauties of nature that he has himself appreciated so well.

W. M. Davis.

Frye's Home and School Atlas. Boston: Ginn & Co. 1896. $1.15 by mail.

This is a by-product of the Frye series of school geographies. It contains 24 geographic maps, 9 of which are devoted to the United States and 10 to other parts of the world, the remainder being historical and commercial. These are well indexed and are convenient for ordinary use, although upon very small scales. There is also a series of relief maps of the continents and principal countries, and the work concludes with climatic and industrial maps of the United States, with descriptive text, tables, etc.

Lakes of North America: A Reading Lesson for Students of Geography and Geology. By Israel C. Russell, Professor of Geology in the University of Michigan. Pp. xi + 125, with 32 illustrations. Boston: Ginn & Co. 1895.

This little book is a treatise on lakes, in the light of the new geography. It classifies lakes by the origin of their basins, as those due to atmospheric, aqueous, glacial, volcanic, and other agencies. It treats of the movements of lake waters, as tides, waves, and currents, the effect of lakes upon climate, and the flow of streams. It describes the characteristic topography of lake shores, as cliffs, terraces, banks, deltas, etc.; the characteristics of fresh waters and saline lakes are given, life histories of lakes are detailed, and the book closes with studies of certain lakes, living and extinct, including the Laurentian lakes, lakes Agassiz, Bonneville, and La Hontan. The book is an exceptionally fine contribution to the science of physiography. It is delightfully written and the illustrations are in keeping with the matter of the work.

PROCEEDINGS OF THE NATIONAL GEOGRAPHIC SOCIETY, SESSION 1896-'97

Special Meeting, October 30, 1896.—Vice-President Merriam in the chair. Mr Frederick V. Coville read a paper on the Sage Plains of Oregon, illustrated with botanical specimens and lantern-slide views.

Special Meeting, November 6, 1896.—President Hubbard in the chair. Hon. Willis L. Moore addressed the Society on Weather Forecasts and Storm Warnings. Typical weather maps were distributed among the audience.

Regular Meeting, November 13, 1896.—President Hubbard in the chair. Mr George K. French lectured on the Gold Coast Colony: a Visit to Ashanti and Kumassi, illustrating his address with lantern slides.

Special Meeting, November 20, 1896.—President Hubbard in the chair. Col. Charles Chaillé-Long, late of the General Staff of the Egyptian Army and Chief of Staff to Gen. Gordon Pasha, Governor General of Egyptian Sudan, delivered an address on Egypt and her Lost Provinces, with an Account of the Recent British Expedition to Dongola and Khartum. A large map of Africa and a number of lantern slides were exhibited.

Regular Meeting, November 27, 1896.—Vice-President Merriam in the chair. Judge Emory F. Best, Assistant Commissioner of the General Land Office, read a paper on the Utilization of the Vacant Public Lands, illustrated by maps and diagrams.

ELECTIONS.—New members have been elected as follows:

October 30.—F. N. Barber, P. A. Eng'r F. C. Bieg, U. S. N., L. C. Brown, Chief Eng'r A. B. Canaga, U. S. N., Miss M. C. D. Chenoweth, Hon. E. S. Converse, Mrs Mary R. Davis, Mrs George M. Davison, George Doolittle, Miss Laura L. Dorsey, Miss Frances S. Fairley, Miss C. L. Garrison, Rev. Alfred Harding, Wm. C. Hobbs, Rev. J. N. MacGonigle, Miss Jeannette McWilliams, H. C. Oberholser, Edward A. Preble, Miss E. G. Reveley, Mrs M. J. Seymour, Dr Z. T. Sowers, Mrs E. A. Sutphen, Philip A. Tracy.

November 13.—Peter Bisset, G. I. Bouton, Miss Grace Calkins, Capt. H. M. Kendall, U. S. A., Frank B. King, Adam R. Magraw, F. E. Mitchell, D. P. Nicholson, Mrs Albert M. Patterson, Dr Paul J. Robert, B. D. Stallings, E. J. Todd, Edward White, George B. Williams, Miss Hattie P. Wood, Prof. Albert A. Wright.

GEOGRAPHIC NOTES

ASIA

JAPAN. Arrangements are being made for a direct line of steamers to run between Japan and the Black sea ports.

SIBERIA. The West Siberian Railway has been brought into direct communication with the principal railway systems of Europe.

The expedition sent out by the Russian Geographical Society for the exploration of the Irkutsk region will be absent three years.

AFRICA

TRANSVAAL. The final count makes the population of Johannesburg, according to the recent census, 102,078. Of the 50,907 whites, only 6,205 were born in the Transvaal.

EGYPT. The reëmbarkation of the Indian troops for Bombay disposes of the statement that the Anglo-Egyptian army would soon continue its march southward beyond Dongola.

Up to the end of 1895 900 miles of agricultural roads were completed. The construction of a system of light railways for the transportation of agricultural produce has also been authorized.

NATAL. The revenue for the fiscal year 1894–'95 was £1,169,780, and the expenditures £1,148,093. In a recent lecture at the London Imperial Institute, Professor Crookes stated that the colony of Natal contains more coal than existed in Great Britain before a single ton was raised.

TUNIS. After fourteen years of French occupation Tunis contains only 3,000 French inhabitants, as compared with 7,000 Maltese and 8,000 Italians. The colonizing efforts of the government have been attended with but little success, but French rule is regarded as being in the main beneficial.

AUSTRALASIA

NEW SOUTH WALES. During the recent session of parliament some slight amendments were made in the land laws, with a view to further facilitating the settlement of the colony, which is said to be making remarkable progress.

VICTORIA. During the last three years the city of Melbourne has lost 40,000 of its population, the prosperity of the agricultural industry of the colony affording superior attractions to the pursuits of the capital city.

The colony of Victoria has shown remarkable energy in opening up an extensive export trade with Great Britain. The colonial government has practically assumed control of the trade, and its contracts with two of the principal lines of steamers enable shipments to be made at extraordinarily low rates, the charge for butter, cheese, and meat being only 1½ cents per pound for the voyage from Melbourne to London in cold storage. The butter shipments to London from this single colony last year were close on to 26,000,000 pounds, valued at $5,406,215.

West Australia. Intelligence has been received of the arrival at Fitzroy river, in the northern part of West Australia, on November 6, of the expedition which left Adelaide in May last for the exploration of the interior of southern and western Australia. Two members of the party are missing and the survivors suffered great hardships and had to abandon their effects and scientific collection.

POLAR REGIONS

Antarctic. July 15, 1897, is the day fixed for the starting of the Belgian Antarctic expedition. The voyage is expected to be completed within two years, but a three-years' supply of provisions will be taken. The steamer, *The Belgica*, will go first to the east of Grahams Land in George IV sea, and then winter in Australia. The second year will be devoted to Victoria Land. The steamer will be well equipped for scientific investigations as to marine specimens and submarine deposits.

MISCELLANEA

The resources and attractions of the far west could hardly be more interestingly and at the same time more fairly set forth than is done in *The Corn Belt*, an illustrated monthly publication of the Chicago, Burlington and Quincy Railroad.

The heated term from July 28 to August 17 last is stated by Prof. H. A. Hazen in the *Monthly Weather Review* for August to have covered a larger region and given abnormal heat on a greater number of consecutive days than ever before recorded.

Always full of good things, thoroughly up to date, and for the most part admirably illustrated, *Knowledge*, published monthly in London, deserves to be better known in the United States than is indicated by its somewhat rare appearance in our libraries and newsrooms.

Boletin del Instituto Geológico de México, number 3, by Dr Carlos Sapper, is devoted to the geology and physical geography of Yucatan. It includes chapters on the agricultural and mineral production of the peninsula, and a valuable supplement containing meteorological tables and the elevation of 363 principal points in the province described.

Four hundred Illinois teachers attended the course of lectures on Physical Geography recently delivered at the University of Chicago by Professor Albert Perry Brigham, of Colgate University. The lectures were practically limited to the illustrative study of land forms, but the audience was led from definitions and elementary principles to the relation of physical geography to history and to industrial development in a manner that must have proved as delightful as it was instructive.

INDEX

ERRATA

On page 87, the paragraph relating to Franz Josef Land should be under separate sub-caption "Polar Regions."

On page 152, for 'B. S. Payne' (Director, Oregon State Weather Bureau), read 'B. S. Pague.'

On page 181, article "The Kansas River," line 2, for 'Davis county,' read 'Geary county.'

On page 232, line 39, for 'Plate V,' read 'Plate XXVI.'

On page 238, article "A Journey in Ecuador," line 15, for 'apricots,' read 'aguacates (alligator-pears).'

On page 290, lines 3, 14, 24, 32, and 37, for 'Svendrup,' read 'Sverdrup.'

On page 345, line 2, for 'easterly,' read 'westerly.'

CHICAGO
GREAT
WESTERN
RAILWAY
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