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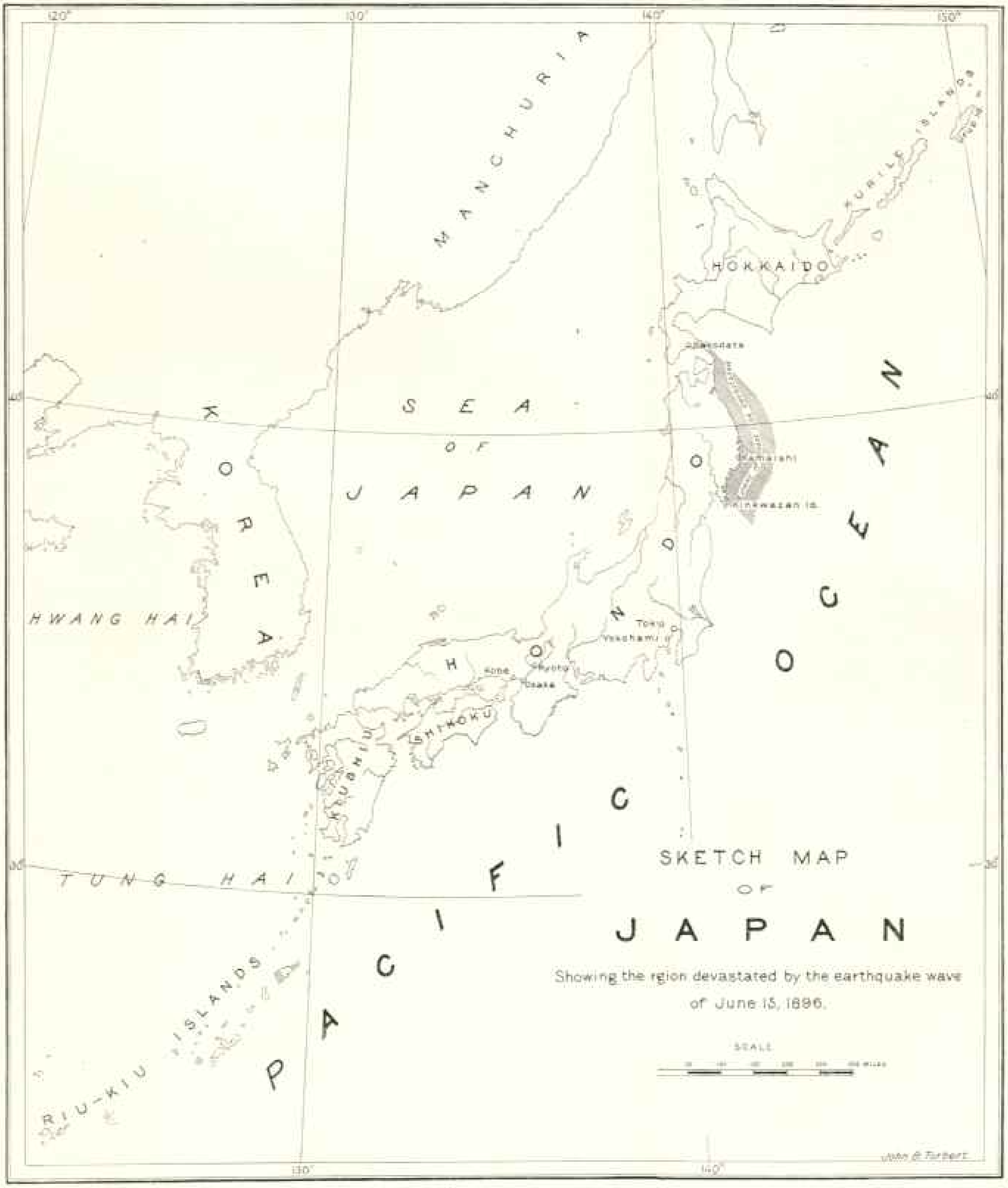
EFFECTS OF THE EARTHQUAKE WAVE AT KAMAISHI, JAPAN, JUNE 15, 1896



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

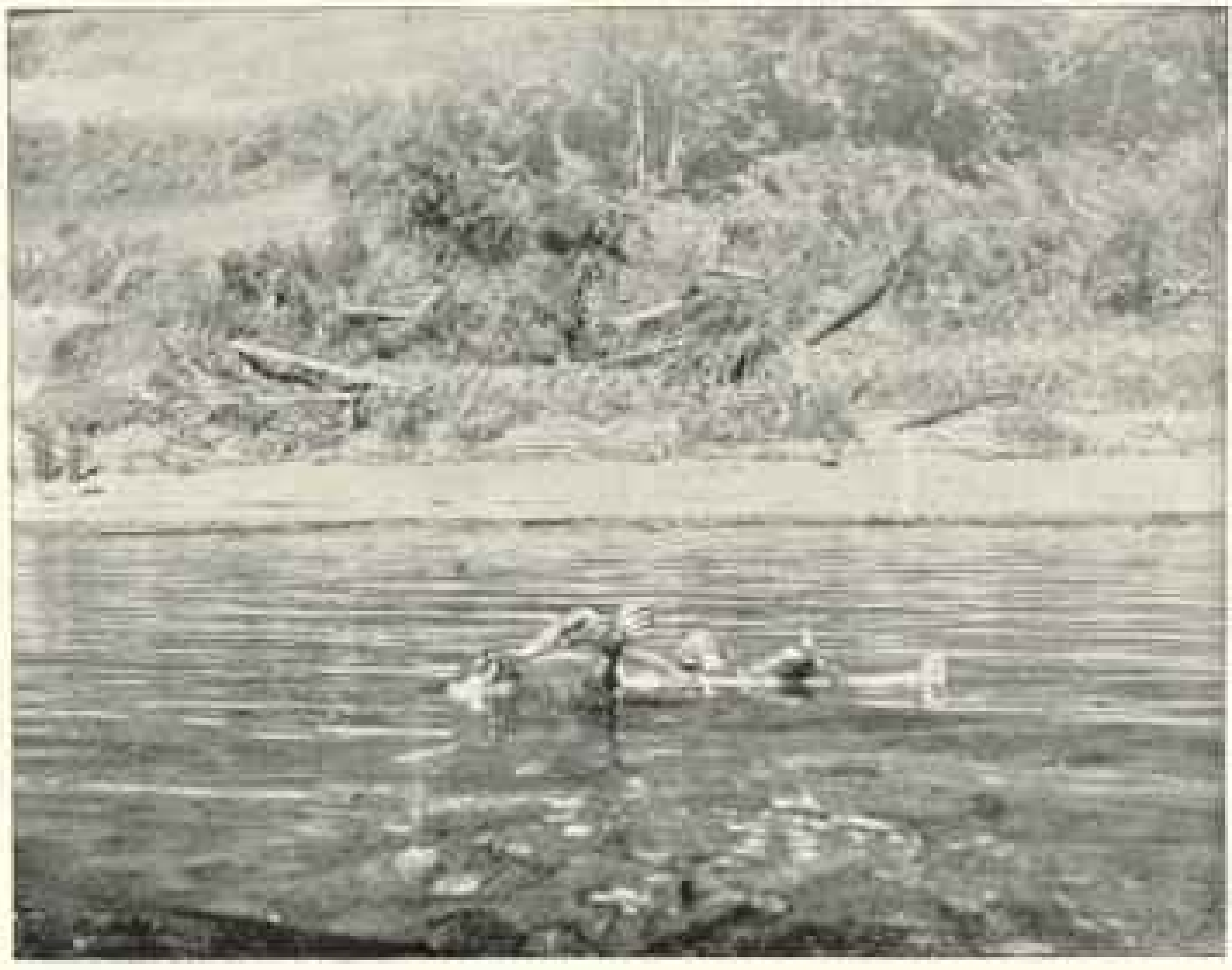
THE RECENT EARTHQUAKE WAVE ON THE COAST OF JAPAN

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,

United States Geological Survey

"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 María, 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 indeeply 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.

Cañoncito.—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 quebrados 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 important 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 29, 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,

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