Vol. VIII DECEMBER, 1897 No. 12

The National Geographic Magazine

AN ILLUSTRATED MONTHLY

CONTENTS

		PAGE
THE WASHINGTON AQUEDUCT AND CABIN JOHN BRIDGE. With illustrations	D. D. GAILLARD	337
GARDINER GREENE HUBBARD		345
POLLUTION OF THE POTOMAC RIVER	F. H. NEWELL	346
THE DELTA OF THE MISSISSIPPI RIVER	E. L. CORTHELL	351
THE ANNEXATION FEVER	HENRY GANNETT	354
SIR JOHN EVANS AND PROF. W J McGEE. With portraits		358
SOME RECENT GEOGRAPHIC EVENTS		359

Geographic Literature, p. 362; Proceedings of the National Geographic Society, p. 365; Geographic Notes, p. 367.

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THE

NATIONAL GEOGRAPHIC SOCIETY

SPECIAL ANNOUNCEMENT

To fill the vacancy in the presidency caused by the lamented death of Mr Gardiner G. Hubbard, General A. W. Greely, U. S. A., has been designated by the Board of Managers as Acting-President. At some personal inconvenience General Greely has acceded to the request of the Board, but has intimated that his official and other duties will render it impossible for him to serve the Society in this capacity for more than a short time.

The Board of Managers have accepted the resignation of Mr Everett Hayden as Recording Secretary, Mr Hayden still remaining a member of the Board. To fill this vacancy Mr F. H. Newell, a former secretary, has been designated, it being the intention of the Board to employ as Assistant Secretary some person who is qualified not only to perform the clerical duties of the position, but also to relieve the editors of the Magazine by acting as business manager of that publication.

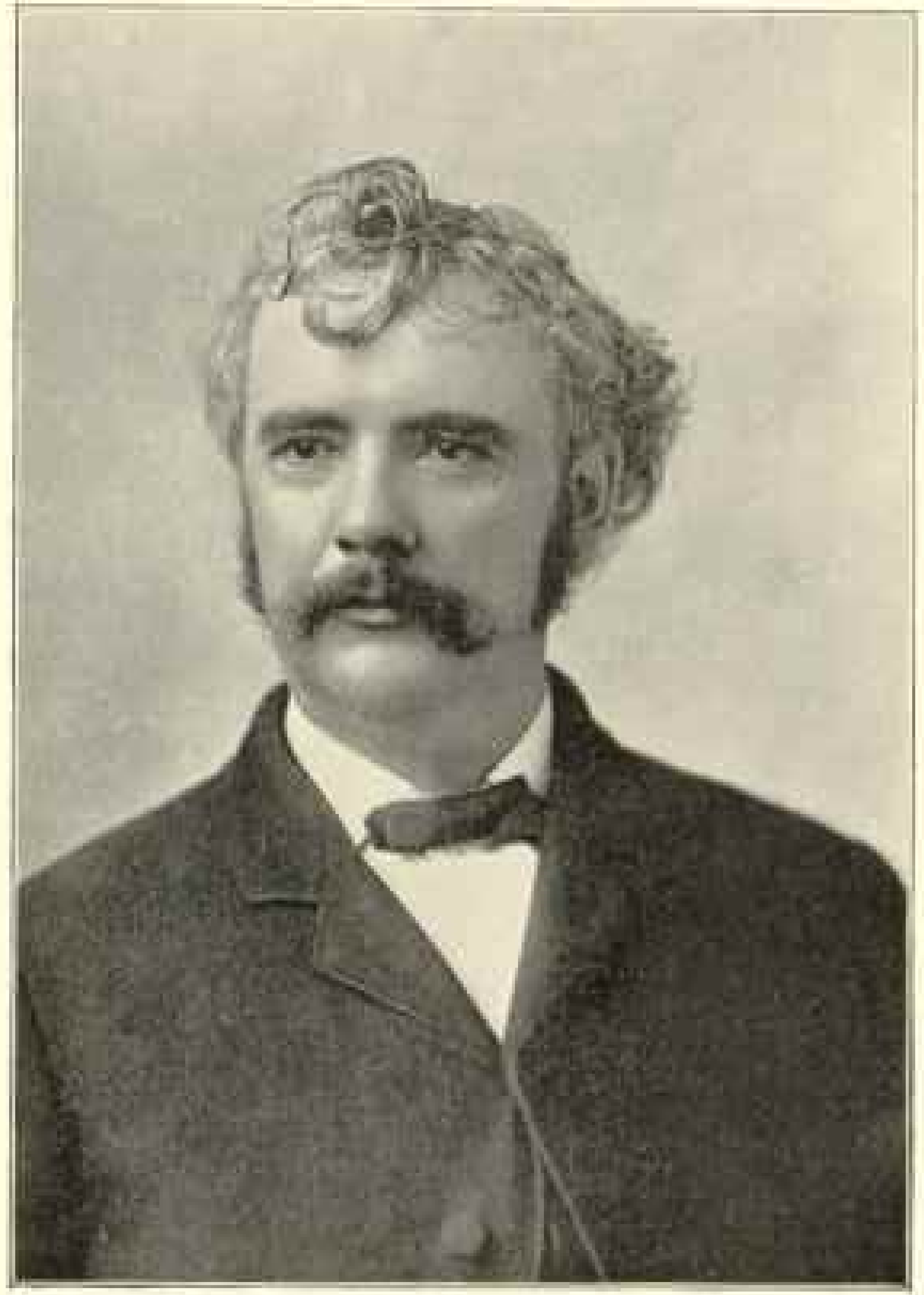
The Society's office has been removed to Room 55, Ohio National Bank Building, on the northwest corner of Twelfth and G Streets N.W. In these more commodious quarters it is expected to so arrange the Society's Library as to make it available to visiting members and their friends. The transaction of business will be facilitated by the addressing of mail to the undersigned at the above address.

F. H. NEWELL,

Secretary

SIR JOHN EVANS

President of the British Association for the Advancement of Science



PROF. W J McGEE

Acting-President of the American Association for the Advancement of Science

THE

National Geographic Magazine

Vol. VIII DECEMBER, 1897 No. 12

THE WASHINGTON AQUEDUCT AND CABIN JOHN BRIDGE*

By D. D. Gaillard,

Captain, Corps of Engineers, U. S. Army

The idea of supplying the city of Washington with water at some day was contemporaneous with the planning of the city, and numerous examinations and surveys were made by Major L'Enfant, the engineer and architect of the Government, under the direction of General Washington, of the Potomac river, the Eastern branch, Rock creek, and numerous springs and small streams, as possible sources of future supply.

The first definite plan to be found among the records of the Washington Aqueduct Office is given in a report made in January, 1851, by Brevet Lieut. Col. George W. Hughes, Corps of Topographical Engineers, to Colonel J. J. Abert, Chief of Topographical Engineers, in compliance with an act of Congress, approved September 30, 1850, appropriating $500 "to enable the War Department to make such examinations and surveys as may be necessary to determine the best and most available mode of supplying the city of Washington with pure water and to prepare a plan and estimate of the probable cost of the same, to be reported to Congress at its next session."

After an investigation of the subject Colonel Hughes proposed to obtain the necessary supply from Rock creek by damming the stream about six miles above the city and bringing the water into a receiving reservoir through a conduit of oval cross-section having an estimated capacity of 8,000,000 gallons in 24 hours.

* Read before the National Geographic Society, October 2, 1897.

It is interesting at this point to compare the estimate of the supply needed for the city in 1851 with that actually furnished in 1897—but 46 years later. The population of Washington and Georgetown was then about 48,000; now it is over 278,000; then 30 gallons was considered by Colonel Hughes a high estimate for the average daily per capita consumption; during the past month the average daily consumption for every inhabitant of the District of Columbia was 173 gallons; then the total estimated maximum consumption of water was 1,500,000 gallons per day; during the past month it actually exceeded 48,000,000 gallons per day.

No action appears to have been taken by Congress toward carrying out the plan proposed by Colonel Hughes, and the next step was one which eventually resulted in the construction of the present aqueduct system. The 32d Congress at its first session appropriated $5,000 to enable the President of the United States to cause to be made the necessary surveys, projects, and estimates for determining the best manner "of affording to the cities of Washington and Georgetown an unfailing and abundant supply of good and wholesome water." In accordance with this legislation the necessary surveys were made in the winter of 1852-'53 by Lieutenant (afterward General) Montgomery C. Meigs, U. S. Corps of Engineers, who, in his report of February 12, 1853, proposed three plans for obtaining the necessary water supply, submitted estimates of the cost of each, and entered into a broad and far-sighted discussion of the subject of supplying the cities with water.

In urging the necessity of a suitable supply he states that it was the general custom in Washington at that time to have all "the water for a family brought by the servant-maids from the street pump," a crude condition of affairs which the average Washingtonian of today will find it hard to believe existed but a little more than 40 years ago.

Briefly summed up, the three sources of supply proposed by General Meigs were as follows: (1) From Rock creek, by means of a dam and a conduit under natural flow. Estimated minimum daily supply, 9,860,000 gallons; estimated cost, $1,258,863. (2) From the Potomac at Little Falls, six miles above Georgetown, by means of a dam across the river, a canal and pumping machinery to raise the water to the reservoirs. Estimated minimum daily supply, 12,000,000 gallons; estimated cost, $1,662,215. (3) From the Potomac, just above the Great Falls, by means of a dam, a masonry conduit, two reservoirs, and the necessary bridges. Estimated daily supply, 36,015,400 gallons; estimated cost, $1,921,244.

This last estimate was based upon a conduit of seven feet in diameter and a bridge of a different design from that finally built over Cabin John creek. General Meigs recommended an increase in the diameter of the conduit to nine feet, which, with the changed plan of the bridge just mentioned, made the final estimated cost about $2,435,000 and increased the estimated capacity of the conduit to 67,596,400 gallons, a most fortunate change for the citizens of the District of Columbia, for, had the seven-foot conduit been built, the limit of its capacity would have been reached about six years ago.

In his report General Meigs urged the adoption of the third plan, calling attention to the fact that the waterworks of this country had been almost invariably designed on an inadequate scale, and that the history of all these works showed that the daily per capita consumption of water was increasing at a rate comparatively rapid. In consequence of this fact and of the rapid growth of population, many of these earlier works proved insufficient within a few years after construction.

Too much praise, then, cannot be given to the man who in 1853 planned a conduit with an ultimate daily capacity equal to one and one-half times the amount then furnished to the city of London, nearly four times that furnished to Paris, two and one-half times that furnished to New York, five times that furnished to Philadelphia, and one and one-half times that then furnished to Rome, although in A. D. 101 Rome had a daily supply of 377,000,000 gallons. Be it remembered that General Meigs did this when the combined population of Washington and Georgetown was but 58,000, which it was estimated would then require for all public and domestic purposes a total supply of but 5,220,000 gallons, about one-fifteenth of the ultimate capacity of the conduit.

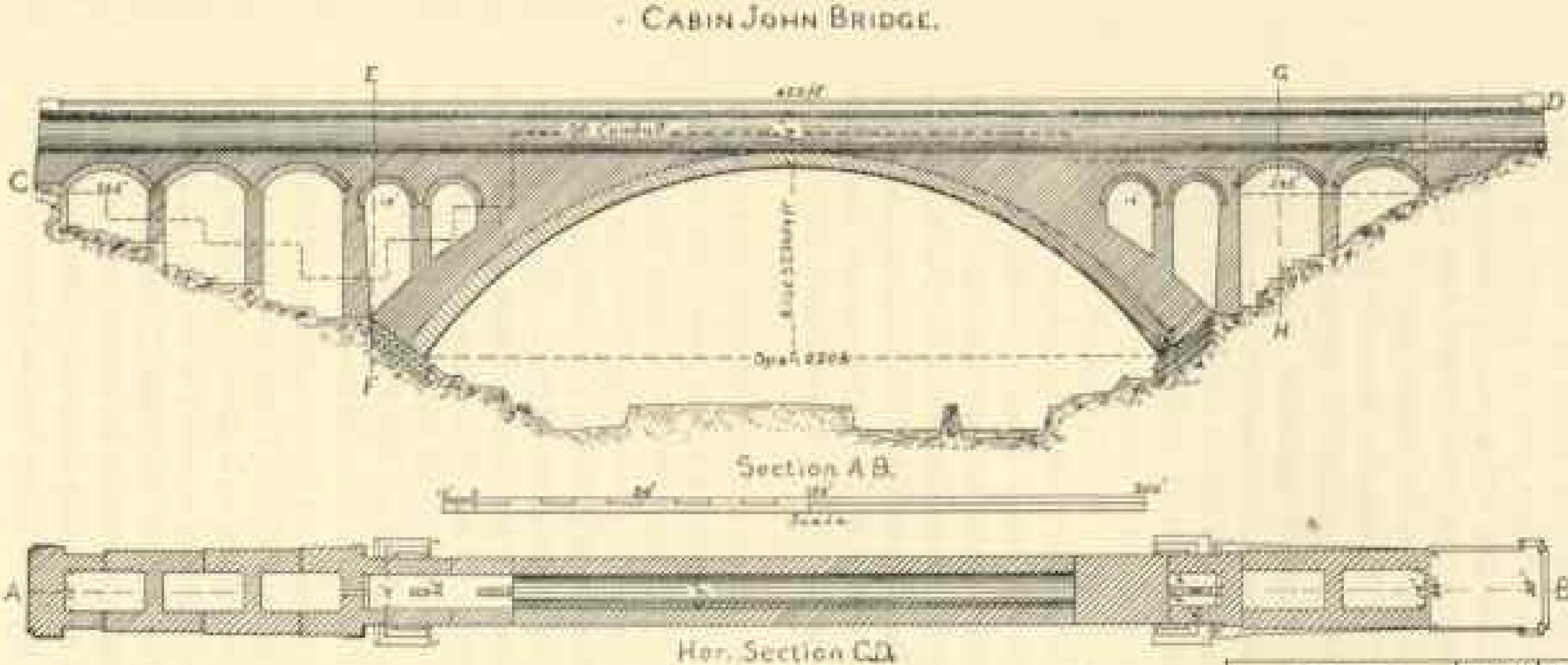
General Meigs' recommendation of the enlarged Great Falls plan and his reasons therefor carried such weight that they received the strong indorsement of General Joseph G. Totten, Chief of Engineers, when he forwarded the report to the Hon. C. M. Conrad, Secretary of War, who submitted it to President Fillmore without comment.

The first appropriation for the construction of the aqueduct was made in March, 1853, and the actual work of breaking ground was commenced in November, 1853. In order that the city might receive a supply of water as soon as possible, work was pushed upon the receiving (Dalecarlia) reservoir and the conduit connecting it with the supply mains, and on January 3, 1859, water from the Dalecarlia reservoir was introduced into the pipes leading to the city. This was not Potomac water, however, but was supplied by the streams emptying into the Dalecarlia reservoir, which streams are now diverted therefrom by the admirable system of protection works completed in 1895 by Colonel George H. Elliot, U. S. Corps of Engineers, retired. This mode of supply continued until the conduit between Great Falls and the Dalecarlia reservoir was completed, in 1863, and on December 5, 1863, Potomac water was introduced into the Dalecarlia reservoir for the first time.

Conns island separates the Potomac at Great Falls into two parts, known as the Maryland and Virginia channels respectively. In order to divert water into the mouth of the conduit-feeder at Great Falls a temporary dam of stone and crib work was built across the Maryland channel, 1857 to 1864, which was replaced by a masonry dam completed in 1867. In 1883–'86 the masonry dam was extended across the Virginia channel. In times of very low water in the Potomac this dam, the crest of which was at an elevation of 148 feet above mean tide at the Washington navy yard, did not raise the water to a height sufficient to fill the mouth of the conduit at Great Falls, and in 1895–'96 the whole dam was raised 2½ feet, so that at low stages of the Potomac the mouth of the conduit is just filled.

The Washington aqueduct system as it exists today is, with but few modifications, that originally planned by General Meigs. The water supply is taken from the Potomac river at Great Falls, about 14 miles above the city. At this point a masonry dam eight feet in width on the top and 2,877 feet in length, completed in 1896, extends across the river from the Maryland to the Virginia shore. The water passes from the feeder, under the Chesapeake and Ohio canal, through the gatehouse and into the conduit, which is circular in cross-section, and for the greater part of its entire length is nine feet in diameter and composed either of rubble masonry plastered or of three rings of brick, but where the soil in which it was built was considered particularly good the inner ring of brick was omitted and the diameter was nine feet nine inches. Where the conduit passes as an unlined tunnel through rock the excavation was sufficient to contain an inscribed circle 11 feet in diameter.

CABIN JOHN BRIDGE.



Construction commenced 1857.
Construction completed 1864.
Parapet walls constructed 1872–73.
Cut stone arch – Quincy granite.
Rubble arch – Seneca sandstone.
Spandrils – Seneca sandstone.
Parapet walls – Seneca sandstone.
Abutments – Gneiss from Montgomery Co., Md.

LOCATION.	Masonry Cu. yds.	Concrete Cu. yds.	Brick work Cu. yds.
West Abutment	2573.18	413.48	
East Abutment	2085.19	439.18	
Granite Arch	973.63		
Rubble Arch	1889.19		
Load	3007.63		
Under Spring Line	178.76		
Parapet Walls	257.40		
Conduit Through Bridge			616.00
TOTAL	11914.18	852.66	616.00

AQUEDUCT BRIDGE OVER CABIN JOHN CREEK, NEAR WASHINGTON, D. C.

The total length of the conduit and the two by-conduits around the reservoirs is 12 miles, and its slope is nine inches in 5,000 feet. Constructed by General Meigs in connection with the aqueduct system are five bridges, two of which are unique among engineering structures and will be briefly described later.

At the distributing reservoir the water passes into four cast-iron mains—48 inches, 36 inches, 30 inches, and 12 inches in diameter respectively. The Dalecarlia reservoir has a storage capacity of about 150,000,000 gallons, is practically without paved slope-walls, and is perfectly protected against pollution from the drainage of the surrounding country. The distributing reservoir has a storage capacity of about 150,850,000 gallons and is divided by a puddled and paved wall (through which is a passageway) into two sections containing 97,600,000 and 53,250,000 gallons respectively. The Georgetown high-service reservoir has a capacity of about 1,500,000 gallons.

In addition to the three reservoirs already mentioned, which form a part of the aqueduct system, there is another reservoir, built and controlled by the Commissioners of the District of Columbia, called the Fort Reno reservoir, with a capacity of about 4,500,000 gallons, the reference of its water surface when the reservoir is full being about 420 feet above mean tide at the navy yard.

The Dalecarlia and distributing reservoirs supply the pumping station and that part of the District which lies below 100 feet above datum. The areas lying between the levels of 100 and 210 feet above datum are supplied by pumping from the U-street station directly into the distributing mains, the Georgetown high-service reservoir being held as a reserve supply. The areas having a greater elevation than 210 feet above datum are supplied from the Fort Reno reservoir. It will be observed, therefore, that the total present storage capacity of all reservoirs is a little less than 307,000,000 gallons, or about six days' supply.

In July, 1897, for the first time in its history the conduit was permitted to discharge its maximum flow, which by current meter observations was found to be 76,500,000 gallons per 24 hours. Today the average daily consumption is about 45,000,000 gallons, or about 60 per cent of the ultimate capacity of the conduit. Ten years ago it was but 35 per cent, or less than 27,000,000 gallons.

To avoid misapprehension it should be stated that while the conduit can supply the distributing reservoir with 76,500,000 gallons per day, yet the pipes leading from the reservoir to the city are already overtaxed in supplying the present rate of consumption, and no relief will be felt by consumers until some method is provided for bringing an increased quantity of water from the distributing reservoir into the city.

General Meigs was in charge of the work upon the Washington aqueduct from the time of the first survey until July, 1860, when he was relieved by Captain H. W. Benham, of the U. S. Corps of Engineers, who in turn was succeeded by Lieutenant James St. C. Morton, of the same corps. On February 22, 1861, after an absence of seven months, General Meigs was again placed in charge, and the work was practically completed by him. In June, 1862, owing to the overworked condition of the War Department, the charge of the Washington aqueduct was transferred from that department to the Department of the Interior, where it remained until April, 1867, when it again passed into the care of the War Department, and has remained there ever since.

In his report upon the proposed line of the conduit, General Meigs states that seven miles after leaving Great Falls the only serious obstacle in its whole course, the valley of Cabin John branch, is encountered. This valley, he says, might be crossed by pipes, but he states that in his project he has avoided them because "they always occasion a loss of head or else exceed in cost the bridges they replace." He therefore first proposed to cross the valley by a bridge 482 feet long and 20 feet wide, supported upon six semi-circular arches of 60 feet span, resting upon piers seven feet thick at the top and of various heights, the highest being 52½ feet. The estimated cost of this bridge was $72,409. This plan was afterward entirely changed and the present magnificent structure, the grandest stone arch in existence, was erected.

The total length of the bridge, including abutments, is 450 feet; its width is 20 feet 4 inches, and its height above the bottom of the creek 100 feet. The span of the arch is 220 feet and the rise 57.26 feet. It was begun in 1857 and completed, with the exception of the parapet walls, in 1864. These walls were built in 1872–73, vehicles having been prevented from getting off the bridge prior to that time by timber guards. All the original plans of the bridge are signed by General Meigs as chief engineer of the Washington aqueduct and by Alfred L. Rives, assistant engineer, Cabin John division. The entire bridge contains 13,283 cubic yards of stone masonry, concrete, and brick-work, and it cost, complete, about $254,000. The cut-stone arch is of Quincy

(Massachusetts) granite, the abutments are of Montgomery county gneiss, and the rubble arch, spandrils, and parapet are of Seneca sandstone.

Contrary to the general impression, the space between the spandril and abutment walls is not solid, but contains several arches, built, as shown in the drawing, to effect a saving in masonry. Materials were transported to the bridge by boat *via* the Chesapeake and Ohio canal and Cabin John creek, across which a dam was built near the canal, and the pool thus formed was connected with the latter by a lock.

On the south side of the west abutment of the bridge the following inscription is cut:

Washington Aqueduct,
Begun A. D. 1853. President of the U. S.
Franklin Pierce. Secretary of War.
—— ——. Building A. D. 1861.
President of the U. S., Abraham Lincoln.
Secretary of War, Simon Cameron.

This inscription originally contained the name of Jefferson Davis, which was cut out in the summer of 1862 by the contractor by order of the Secretary of the Interior, Hon. Caleb B. Smith, to whose department the aqueduct had been recently transferred. If forgetfulness of the bare historical fact as to who was Secretary of War at the time was the object sought by the erasure, the result has been a woeful failure, for the inherent curiosity of mankind is such that the erased name is more strongly impressed upon the memory of the visitor than would have been the case had it remained untouched.

In concluding the description of the Washington aqueduct and its special structures, it is proper to call attention to another of its bridges, the bridge over Rock creek on Pennsylvania avenue, as noted for its bold originality as is Cabin John bridge for its grand proportions.

This bridge is unique among the aqueduct bridges of the world, in that the two 48-inch mains, through which now flows about one-half of the water used by the city, themselves form the arched ribs which support the roadway overhead. The span of this bridge is 200 feet and its rise 20 feet. At the time it was built it was the only one of its kind in the world, and it enjoys, it is believed, this distinction at the present day. It was much commented upon by European engineers, and was illustrated in many of the foreign scientific and engineering journals of the time.

CABIN JOHN BRIDGE — WASHINGTON AQUEDUCT — THE LARGEST STONE ARCH IN THE WORLD

From a Photograph by Elliott P. Hough

GARDINER GREENE HUBBARD

It is with the most profound regret that we record the death of Mr Gardiner G. Hubbard, which occurred at his country house, Twin Oaks, near Washington, on Saturday, December 11.

While the Joint Commission of the Scientific Societies of Washington mourns the loss of a many-sided and broad-minded president, the Smithsonian Institution a most active and sagacious regent, the Columbian University a generous and indefatigable trustee, and other educational, patriotic, and benevolent institutions of the national capital a liberal benefactor, a wise counselor, or an earnest colaborer, it is in the National Geographic Society and its work that the most conspicuous gap has been created. The President of this Society from its foundation, Mr Hubbard was enabled by a combination of circumstances as exceptional as it was fortunate to sustain a relation to it that is probably without a parallel in the history of scientific societies. It is no new thing for such societies to enjoy the benefactions of wealthy and generous patrons and the inestimable advantage of the wise counsels of far-seeing and judicial-minded advisers concurrently with the inspiring influence of men of the broadest culture and the most progressive ideas. Rarely if ever before, however, have these qualities and functions been united in one individual, or has there been so singularly varied a capacity for usefulness as was given to Mr Hubbard and as he exercised to its fullest extent. The loss to the National Geographic Society is for this reason an irreparable one, and the ordinary expressions of regret seem cold and conventional.

It is impossible, in this number of the Magazine, to attempt a portrayal of Mr Hubbard's unique personality, or to do justice to the nobility of his character, or render adequate tribute to his unexampled services to the Society. We can only record his deeply lamented death, refer thus briefly to his untiring labors for the advancement of science, and announce that a more extended notice of his life and work will appear in the January number of this journal.

J. H.

POLLUTION OF THE POTOMAC RIVER.

By F. H. Newell,

Chief Hydrographer, U. S. Geological Survey

The facts concerning the pollution of the Potomac river are of peculiar concern to the residents of Washington because of the fact that the supply for domestic and municipal use is derived mainly from that stream, only a small portion being obtained from wells or springs. This water we know to be polluted, but opinions differ widely as to whether these pollutions are negligible or may be sources of ever-present danger to the community.

In order to discuss the subject intelligibly it is necessary to have clearly in mind the situation of the catchment basin of the river, as well as the relative position of the various tributaries and of the principal towns and political divisions. We of course know that the Potomac is one of the principal rivers of the Atlantic slope, receiving the drainage from an area which lies about midway of the eastern side of the United States. It rises in the Alleghany mountains, its drainage basin embracing portions of the states of Pennsylvania, Maryland, West Virginia, and Virginia. At this part of the system the mountains have a general trend a little north of northeast, the narrow valleys between the ridges are nearly parallel, and thus the streams coming from the mountain sides unite in creeks or rivers flowing either northeasterly or southwesterly. Taking the Potomac basin as a whole, by far the greater number of the tributaries flow toward the northeast, the streams coming from the northern part of the basin being relatively small. The main river itself, receiving from point to point the tributaries from each side, cuts directly across the mountains, having a southeasterly direction, although in detail its course is quite crooked.

The absence of lakes, marshes, and broad valleys renders the tributary streams rapid in their delivery of precipitation upon the basin, the Potomac being subject to sudden floods, and the dry season discharge being very small. For this reason the river as a source of power is not so valuable as might be expected from the size of its drainage area. At the points where the river cuts through the successive mountain ridges the slope is rapid, but there are no falls of considerable magnitude until the stream has passed the Piedmont plateau and reached the border of the softer Cretaceous rocks. Here, at the fall line, it forms a succession of cataracts, a drop of 90 feet occurring within a short distance at the Great Falls. At about this locality the city of Washington has been placed, its situation being governed by the questions of navigation and of water-power. These have been the factors which have contributed largely to the growth and development of important cities along what is known as the Fall line, extending from New York to Georgia. Just before the river takes its plunge over the Great Falls a small portion of its water is diverted into an aqueduct, which, following along the north side of the river, delivers by gravity a supply of water to the reservoirs, which in turn feed the water system for the city.

One of the most notable features is that the river receives only a few short streams from the north, the greater portion of the water coming from the south and flowing northeasterly in the nearly parallel narrow valleys between the mountain ridges. The rivers meander through trough-like valleys, cut out mainly in limestone, the bounding ridges being of sandstone or other hard resisting rocks. These ridges rise to heights of 2,000 feet or more and are usually forestclad. The precipitation from these ridges, usually in the form of rain, is partly evaporated or taken up by vegetation, about 50 per cent or a little more flowing down the steep hillsides to the valleys.

This run-off water is pure and clear, but upon reaching the lowlands it mingles with the washings from the rich soils and cultivated fields, and becomes, in time of flood at least, turbid and yellow. The lowlands, especially of the wide valleys such as the Shenandoah, are notably rich, and prosperous farms are to be found their entire length. These have induced the growth of villages and towns, some of which, under the stimulus of small manufacturing industries, are rapidly growing. As a rule these are situated upon some stream, since their location has been primarily determined by a water-power mill or ford. The refuse from all these towns is, as a matter of course, discharged into the stream.

Potomac river, as the name is commonly applied, results from the union of the North branch, the stream above which Cumberland, Md., is located, with the South branch, at a point about 12 miles below this city. The North branch and the main stream into which it empties form the state boundary between Maryland and West Virginia. The South branch lies wholly within this latter state. At their headwaters these two branches flow in a general northeasterly direction, nearly parallel to each other, the North branch being to the west of the Alleghany front and the South branch to the east. The total drainage area of the North branch at Cumberland is 891 square miles, or about 8 per cent of the entire catchment area above the city of Washington. The total drainage area of the North branch at its mouth, or where it joins the South branch, is 1,365 square miles, being a trifle smaller than the area drained by the latter.

The waters of the North branch of the Potomac, even near its head, are naturally somewhat dark in color, and it is stated by the older inhabitants of the region that it has always been thus, owing probably to the presence of decaying vegetable matter from the forests. This is further increased by the effluents from the saw-mills, tanneries, and coal mines, so that at the old mill-dam near Keyser the polluted water agitated by the fall boils and foams, forming in the early morning a thick layer of whitish-brown froth.

In order to obtain a general conception of the amount of pollution, it is necessary to know how much water is carried by the river. This, of course, varies from day to day and even hour by hour. These minor fluctuations are slight, and by taking special care during time of flood it is possible to know how much water is delivered by the main stream and its principal tributaries. Without entering into a discussion of how this is accomplished, it is sufficient to state that the results are given in a table showing the average daily flow throughout the year in cubic feet per second.

The minimum flow of the river has been considered to be that obtained by Mr William R. Hutton in 1856, 1,063 cubic feet per second. It is probable that during the past fall (1897), owing to the protracted dry weather, the discharge sank to about this amount. At that time the water received into the conduit is stated to have been from 75 to 90 second-feet, or from 7 to 9 per cent of the total volume of the river.

It is evident that the quantity of water in the Potomac, especially at times of flood, is very considerable, and that sewage and waste material dumped into it from towns and manufacturing establishments must be greatly diluted, but in times of low water this must necessarily become less so. The quality of the water is therefore becoming more and more a matter of concern because of the fact that with the increase of population in the Potomac basin the artificial impurities will increase and the amount of water to be taken out at Washington will also be greater, while the natural flow of the stream is practically unaffected. As before stated, the impurities are of two kinds, natural and artificial. The natural impurities consist mainly of the finely divided soil washed from the agricultural lands of the valleys, this being for the most part the residual matter left by solution of limestones. It exists in such fine particles that while the water is in motion it is not deposited and may remain in suspension for days, even after the water sample has been put into a closed bottle.

The proportion of this mud varies from time to time, being greatest during floods and least during periods of low water, when the supply is received by percolation from underground sources. At such times the water is clear and entirely unobjectionable as far as casual observation is concerned, but the flow in the river is greatly diminished and the proportion of sewage must be notably increased.

While the natural impurities are usually so apparent and annoying to the eye through the dirty color and muddy sediment, the artificial impurities, on the other hand, are not so readily noted. The heavier particles of the waste from the towns and manufacturing establishments are washed down the stream slowly and are gradually burned up or oxidized or pass into solution in the form of various organic compounds. These, as a rule, do not notably discolor the water, and some of them may even aid in giving a bright, sparkling effect, so that very dilute sewage when exposed to light and air for a few hours may be unobjectionable to the eye, although carrying with it a great load of objectionable substances or minute animal or vegetable life.

The pollution of the Washington water supply would be very little if the headwaters of the Potomac could be cut off just below Cumberland, and while the water is very bad at that point, it should be remembered that it is there a comparatively small stream, with a minimum discharge of less than 60 feet per second, while the minimum discharge at Point of Rocks, so far as observed, is about 800 second-feet, and the Monocacy and a number of smaller tributaries reach the river between that point and the intake of the waterworks at Great Falls.

In times of low water, when, of course, these pollutions bear the largest ratio to the total supply, the Potomac at Cumberland probably contributes not more than six per cent of the water carried by the Potomac at Great Falls, and this small percentage traverses about 190 miles of broad river bed, agitated and broken by numerous shoals and diluted by fresh waters bearing more or less oxygen and sediment tending to its purification. While these influences contribute to ameliorate the quality of the water, it cannot be contended that the supply for this city is entirely as it should be.

Sufficient has been said to indicate that a considerable amount of filth of all kinds is habitually dumped into the river, and that this is steadily increasing. It is not desirable to describe or characterize this material under any stronger term than sewage, as the details are too disgusting to be given in a public address. It may properly be claimed, however, that no matter how bad the material is at the point where discharged, it becomes neutralized or destroyed before the water containing it reaches the Washington aqueduct. The self-purification of rivers is a phrase which has been made the excuse for much carelessness or indifference, but there is no doubt that streams do tend to rid themselves of much of their undesirable load.

The conditions along the Potomac are particularly favorable, for the water passes over many broad riffles where it is exposed to light and air, and many deleterious substances are unquestionably burned up, while others may possibly be dragged down by the finely divided sediment which is usually present. Thus the chemicals used in the pulp mills, tanneries, and other factories are greatly diluted, and by reaction upon each other and upon the small amount of lime carried in solution probably form harmless compounds.* The momentous question therefore is as to the behavior of the small micro-organisms, to which the modern students of disease attribute such potent influence on the human system. Take, for example, the typhoid bacillus, which is said to live even in ice for a hundred days or more and to develop in soil, retaining its vitality for a year and even increasing from a single cell to 16 million individuals in 24 hours. It may be questioned whether such an organism is rendered harmless in the journey of from two to four days or more from the sewers of towns up the river to the mouth of the aqueduct.

We are comforted by the assurance that harmful bacteria are rarely found in Potomac water; but still this may not set us wholly at rest, for negative evidence in such a case proves little. The discussion of the probable danger from sewage must be left to experts in other lines, for the work in hand pertains mainly to ascertaining the quantity of supply, its variations, and its use. The facts which have been put on record are those concerning the source and quantity of water in the river, the location and character of the polluting agencies, and inferentially the degree to which the sewage or waste is diluted by the annual flow of the stream.

Until state or national legislation can be secured to regulate such matters, the Potomac, as in the case of all interstate streams, must serve as a sort of sewer into which town and manufacturing establishments empty their refuse, and this fact must be borne in mind in all considerations of water supply. The improvement of water supplies from this source should begin at both ends—that is to say, pollution should be prevented as far as possible and the water supply for a city should be filtered. The state of Massachusetts has set the example in this respect, preventing the pollution of streams by gradually forcing towns to provide suitable sand filters for sewage before allowing it to discharge into certain rivers, and also by providing similar sand filtration for the water which is to be used for municipal purposes. The system of intermittent sand filtration has been found to be efficacious not only in taking out visible particles but in nitrifying and destroying the smaller organisms apparently so potent in matters of public health.

THE DELTA OF THE MISSISSIPPI RIVER*

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

The Mississippi delta proper extends over 100 miles by the course of the river above the city of New Orleans. The materials composing this great mass of sedimentary deposit have been partly disclosed by numerous artesian wells which have from time to time been driven for the purpose of obtaining, if possible, potable water. The most notable instance, and where probably the most careful observations were made, is the artesian well at Lafayette square, New Orleans. At a depth of 1,042 feet the tool was broken and the work ended, but driftwood was pumped up at the last foot.

*Abridgment of paper read before the Geographical Section of the British Association for the Advancement of Science, Toronto, August 24, 1897.

Many interesting facts bearing upon the question of the geological formation of the Mississippi delta were brought to attention two years ago through the investigations and discussions connected with an engineering question which arose between the executors of the late Mr James B. Eads and the War Department as to what is the legal plane of reference for ascertaining the depths and widths of channel which Mr Eads was required by the law of the Federal Congress to maintain between the deep water of the South Pass of the Mississippi river and the Gulf of Mexico.

On Belize bayou, which leads out to the Gulf from one of the now unused passes of the river, stands an old Spanish magazine, built over 200 years ago. At the time of building the jetties at the mouth of the South Pass this magazine was in a fair state of preservation. The exterior was intact and there were no cracks which would indicate settlement, the building standing perfectly level, but with the surface of the water stretching across the arch which crowned the entrance door, the sill of which must have been at least ten feet below the water. That was in the year 1877. Nineteen years later a part of the structure had been removed, but enough of the roof and arches remained to show that the subsidence had continued steadily during that period of nineteen years at about the same rate as during the preceding two hundred years. It may be stated that this rate, both from this instance and from other information, is, at the mouth of the Mississippi, about one-half of one-tenth of a foot per annum. Numerous illustrations going to prove the general subsidence of the delta lands might be stated. Not only are these lands unstable in a vertical direction, but they are often found to be so in a lateral direction. It is an interesting engineering as well as physical fact that an accurately measured base line exactly seven hundred feet in length was found, after a lapse of five years, to be 712 feet in length. It has been found impracticable to maintain with sufficient accuracy for reference purposes bench-marks, level heights, and tide gauges. This subject is quite fully discussed in the Report of the Mississippi River Commission for 1894, pages 2794–2797, where the following important statement is made: "Discrepancies in bench-marks and level heights and gauges could only be satisfactorily accounted for by the most plausible explanation of the subsidence of the whole delta, making gauges and bench-marks at the mouth of South Pass unreliable." This remark is made by Mr J. A. Ockerson, assistant engineer to the commission.

On page 2697 of the same report the commission itself confirms Mr Ockerson's statement by its own opinion, as follows: "The main object of this resurvey was to elicit some information bearing upon the question of the stability of the land about the mouth of the river. In the report of Assistant Engineer Ockerson, appended to the report of the secretary, a number of figures and comparisons are given, based upon this survey and prior ones, indicating a progressive depression of the alluvial delta near the mouth of the river." An interesting diagram, designed to show the changes referred to, assumes that either the tide gauge had gone down or the level of the Gulf had gone up over one foot in twenty years. Numerous pertinent facts might be brought forward to show, in addition to the above, that the lands had gone down and that the Gulf level had not changed. It is a fact well known to people living in the delta of the Mississippi that large tracts of land were long ago abandoned in consequence of overflow by Gulf waters, due to the sinking of the lands.

The conditions are very different now from those existing prior to the construction of levees. There are at present no annual accretions of sedimentary matters from the periodical overflows of the river. These accretions formerly were a little more than equal to the annual subsidence of the lands.

As to the question of the rising of the Gulf level, careful investigations and inquiries around the entire Gulf coast from Yucatan to Florida disclose no indications of any such elevations. The factors in forming the great hydraulic conditions of the Gulf operate so steadily from year to year and from cycle to cycle that we should naturally expect that, with the exception of small annual changes due to wind and tides, the mean surface of the Gulf would remain practically at the same level. The difference in precipitation, fluvial discharge into the Gulf, and evaporation is very slight as compared with the great current forces that make and maintain the Gulf level. From very careful observations, it may be stated that the mean precipitation, river discharge, and evaporation amount, all told, to a little over three cubic miles per day. This volume "sinks into utter insignificance when compared with that produced by the inflowing current of the Yucatan channel, which, according to a calculation from Lieutenant Pillsbury's current observations, hurls the enormous quantity of six hundred and fifty-two cubic miles of water per day into the Gulf." *

* See a paper by A. Lindenkohl, Assistant U. S. Coast and Geodetic Survey, in *Science*, N. S., Vol. III, No. 60, February 21, 1896.

The geology of the delta of the Mississippi is an interesting local study. The effect of the withholding by the levees from the great areas of the delta of the annual contributions of sedimentary matters, and the steady, though slow, subsidence of these areas, is one which should be taken into account in deciding the important question of how to protect the people from the flood waters of the river. No doubt the great benefit to the present and two or three following generations accruing from a complete system of absolutely protective levees, excluding the flood waters entirely from the great areas of the lower delta country, far outweighs the disadvantages to future generations from the subsidence of the Gulf delta lands below the level of the sea and their gradual abandonment due to this cause. While it would be generally conceded that the present generation should not be selfish, yet it is safe to say that the development of the delta country during the twentieth century by a fully protective levee system, at whatever cost to the riparian states and the Federal Government, will be so remarkable that people of the whole United States can well afford, when the time comes, to build a protective levee against the Gulf waters, as the city of New Orleans has done on a small scale against the sea waters of Lake Pontchartrain, and as Holland has done for centuries and is now about to do on a still larger scale, in removing the sea waters themselves in the great projected reclamation of the lands submerged by the Zuyder Zee. Mr Eads once said, in an eloquent speech on the subject of the importance of the Mississippi river and its delta channels to the sea: "This giant stream, with its head shrouded in Arctic snows and embracing half a continent in the hundred thousand miles of its curious network, and coursing its majestic way to the southern Gulf through lands so fertile that human ingenuity is overtaxed to harvest their productiveness, has been given by its Immortal Architect into the jealous keeping of this Republic."

THE ANNEXATION FEVER

A curious and interesting example of the survival of inherited traits, on a large scale, is seen in the instinct for the acquisition of territory, which is manifested by all nations, savage or civilized, in greater or less degree.

In the olden time, when the earth was peopled by savages, the acquisition of territory by conquest involved not alone the extension over the conquered region of the jurisdiction of the conqueror, but possession in fee. The conquered territory was made as profitable as possible to the conqueror. It may have been looted for his benefit, or it may have been taxed for all it would bear. In whatever way it was done the conquered territory was made a source of profit to the victorious party.

That sort of thing passed out of vogue among civilized nations ages ago, and today among such people the acquisition of territory means simply a change of jurisdiction. The laws and the flag of one nation are substituted for those of another. The nation acquiring the territory collects taxes, and in turn assumes the duty of protecting the people of the acquired territory from one another and from foreign enemies. The nation is not enriched by the acquisition. It may or it may not be strengthened, according to the character of the acquisition.

But while the results of acquiring territory have thus become radically changed, the desire, the instinct for its acquisition remains apparently in full force. Without inquiring whether in any one case it will be an advantage or a disadvantage for a country to extend its limits, ninety-nine out of every hundred of its people urge its extension. In other words, the great mass of the people concerned act merely upon instinct, such instinct being simply the remains from the time when acquisition of territory meant an increase of property.

The question whether accessions of territory are desirable or not turns upon many considerations, among them being the character and resources of the proposed accession, its situation and distance, the condition of its people as regards civilization, and the character of the people and of the government of the annexing country.

The United States, of all nations, should go very slowly in this matter, first, because since it stands at the head of the nations in point of civilization, almost any addition of people to its numbers will reduce the average civilization, and consequently the strength and industrial capacity of its people. Second, because under its principle of home rule, annexed provinces will be called on to govern themselves in all local matters, while the general government will be held responsible by foreign governments for all hostile acts committed by such annexed states against their citizens; and, third, because all annexations involve responsibilities in case of war for which we are unprepared and show little disposition to prepare ourselves.

Viewed critically, our annexations of territory up to and including the Mexican cessions were wise and have justified the foresight of our statesmen. We needed Louisiana to control the Mississippi; the purchase of the Floridas settled a dispute of long standing, removed Spanish power from our midst, and gave us the entire Atlantic and Gulf coasts; the addition of Texas simplified our southern boundary, and the Mexican cessions rounded up our area of jurisdiction into compact form. But why we should have purchased Alaska is past finding out. A few of our citizens have profited by the fur and fish trade, but the government has been embarrassed and put to much expense on account of this region, and more embarrassment and more expense are certain in the future.

The majority of our people wish to annex the Hawaiian islands. For what reason it is difficult to see. Hawaii is 3,000 miles away from our nearest shore. While the governing class is largely made up of our own kin, the vast body of the population is Kanaka, Chinese, Japanese, and Portuguese—not by any means a desirable addition to our numbers. The annexation of these islands would greatly increase our responsibilities and correspondingly weaken us, without in any way adding to our well-being. It is said that they will furnish us a coaling station in the mid-Pacific. Under whatever jurisdiction these islands may be, our vessels can coal there freely in time of peace. In time of war our vessels will find occupation enough at home without wandering away from the coaling stations on our shores. We are not likely to take the offensive in a war with any first-class power, especially a naval power. It is certain that in case of war with such a power one of our first acts would be to give up all such outlying dependencies, since their defense would be utterly impracticable.

There is another side, however, to this Hawaiian matter. There is no doubt but that the ruling class in Hawaii would be better off under our jurisdiction than if isolated, or even under English jurisdiction. Shall we, for their good, ignore the manifest disadvantages to ourselves of this union? It may be doubted if we have reached this stage of altruism.

What has been written of Hawaii applies with much greater force to Cuba, whose annexation has been actively urged, even to the extent of offering to purchase the island from Spain. Why should we want Cuba? An island, separated from us by sea, sparsely populated by an alien, semi-civilized people speaking a different language, with no experience in self-government, with a history, traditions, and sympathies wholly different from ours: could we hope to make them one with us? Can we afford to dilute our national legislature with a score or more of Spanish Cubans? Can we afford to assume responsibility for the acts of such a home government as the Cubans are likely to set up?

As with Hawaii, there is no question about the advantage to Cuba of such annexation; but in this case even altruism would say nay; for, assuming for the moment that the mission of the United States is to better the condition of mankind, her efficiency for this mission would be too greatly impaired by such an act.

There is constantly more or less talk about the annexation of Canada. There is less objection to this than in the case of any other possible addition to our jurisdiction. It would practically eliminate Great Britain from North America, would add a population which on the whole is no less civilized than the average of our people, and a territory a part of which, at least, is of value as an agricultural region.

Having glanced at the merits and demerits of proposed additions to our area and population, it will be instructive to extend our view and glance at the history of other nations in this matter and the results of their acts. Of all nations, Great Britain has shown the greatest greed for land. Her jurisdiction is as wide as the earth. The little island in western Europe governs many millions of square miles, including Canada, Australia, India, Egypt, and South Africa, besides scores of smaller colonies. Wherever the cross of St George waves, good government and safety to persons and property are assured. To enforce her jurisdiction over all these dependencies she finds it necesary to maintain a large standing army and a navy which is by far the largest of all the nations; and yet, in spite of her large standing army and her immense navy, she is one of the weakest of nations, because her responsibilities have been increased in still greater proportion.

What has she gained by her policy of acquiring territory? In what way have her people gained more bread and cake? Has her commerce been increased materially? Her total foreign trade in 1894 was £624,000,000, of which her colonies contributed £166,000,000. The United States alone contributed £119,000,000. Have the annexed regions furnished homes for much of her swarming population? In all her colonies there are found some 9½ millions of people of English descent. In the United States alone are found not less than 40¼ millions of persons of British descent. Vastly more of her people have gone to the United States than to her colonies.

It is not to be supposed that Great Britain is doing all this work for pure philanthropy; still, in following her acquisitive instinct, she has been, on the whole, one of the greatest agencies for good, by the spread of civilization, that the world has known.

HENRY GANNETT.

SIR JOHN EVANS AND PROF. W J McGEE

Whether one of the ultimate results of that decided tendency to the specialization of knowledge and of all scientific investigation which constitutes so striking a characteristic of the present age will be to render it impossible for a man to become eminent in more than one department of intellectual activity remains to be seen. That that time has happily not yet arrived is perfectly clear, both the British and the American Associations for the Advancement of Science having this year been presided over by men who have attained the highest distinction in more than one department of science.

By occupation a civil engineer and paper manufacturer, and highly successful in both capacities, Sir John Evans has made so great an impress on the scientific work of his time as a geologist, an antiquary, and an anthropologist, as well as in numismatics and applied chemistry, that the leading British societies representing these different sciences have all successively honored him with their presidency, a circumstance almost unprecedented. Attaining at 74 years of age the chair rendered illustrious by the names of Herschel and Brewster, of Lyell and Murchison, of Huxley and Tyndall, he has only one more scientific distinction to look forward to—the presidency of the Royal Society.

Thirty years the junior of his eminent English compeer, Prof. W J McGee has likewise taken his place in the very front rank of anthropologists after attaining distinction as a geologist. His scientific career began with a detailed survey of an extensive area in Iowa at private cost, in the course of which important principles were developed. Later, as one of that splendid body of men who have made the United States Geological Survey the wonder and envy of all civilized nations, he spent a decade in solving the problems of the coastal plain and neighboring districts, in developing new principles for the classification of formations, and in compiling the standard geological maps of the United States and of the State of New York. He established the Potomac, Lafayette, and Columbia formations and traced them and other deposits throughout southeastern United States, his personal mapping of formations and systems covering an area of over 300,000 square miles. In his later work as Ethnologist in charge of the Bureau of American Ethnology he has made additions of the very greatest importance to our knowledge of the aboriginal races of the North American continent, and has greatly enriched anthropological literature, both by his official reports and his numerous contributions to the transactions of scientific societies. No worthier representative of American science could have been found to preside over the American Association during the year of the visit of the British Association to this continent than Prof. W J McGee. J. H.

SOME RECENT GEOGRAPHIC EVENTS

In the expectation that opportunity would be afforded to make them the subject of special articles, several recent occurrences of considerable geographic interest have so far been allowed to go without mention in this journal. The publication of the concluding number of the present volume, however, calls for at least a brief notice of them, if only as a matter of record.

These interesting events include the Andrée Balloon Expedition to the North Pole and the de Gerlache Expedition to the Antarctic, the return of the Jackson-Harmsworth Expedition from Franz Josef Land, of Lieutenant Peary from Greenland, and of Dr Sven Hedin from Central Asia; the successful ascent of Mount St Elias by Prince Luigi of Savoy, and the Mazama Expedition to the summit of Mount Rainier, with the lamented death of Professor Edgar McClure.

Herr S. A. Andrée, accompanied by Dr Strindberg and the engineer, Herr Fraenckell, ascended in his balloon, the *Eagle*, from Danes island, Spitzbergen, on the afternoon of Sunday, July 11, under favorable meteorological conditions. From that day to this nothing has been heard of the adventurous explorer and his two companions. Many eminent geographers have regarded the expedition as an impracticable if not absolutely foolhardy enterprise, but Herr Andrée's fellow-countrymen, at least, have not lost faith in his skill, courage, and endurance. Dr Nils Ekholm, who originally intended to accompany the expedition, but eventually declined to do so, in the belief that the impermeability of the balloon was not satisfactory, inclines to the opinion that Herr Andrée has descended somewhere between the Pole and Franz Josef Land; that he would endeavor to make his way to the provision depot that had been established in advance, and that

HERR S. A. ANDRÉE

no surprise need be felt in the event of no communication being received from him until next summer or fall. Mr Frederick G. Jackson, the leader of the Jackson-Harmsworth Expedition, says he sees nothing to prevent Andrée, with good luck, from accomplishing his purpose, but adds, significantly, that it is quite impossible for any one to say where he is likely to be.

For the Antarctic the *Belgica* sailed from Antwerp on August 16. The ship was fitted out in the best possible manner, and her crew, which consists largely of Norwegians, was most carefully selected. It is expected that the voyage will be completed within two years, but a three-years' supply of provisions has been taken. 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 is well equipped for scientific investigations as to marine specimens and submarine deposits.

The Jackson-Harmsworth Expedition to the North Polar Regions, which left England on July 11, 1894, in the steam-yacht *Windward*, arrived in the Thames on the 3d of September last, having left Franz Josef Land on August 6. This expedition has solved a most interesting geographical problem, having not only determined the northern coast line of Franz Josef Land, hitherto absolutely unknown, but proved, if not the non-existence of Gillis Land, at least the fact that it does not lie in the longitude that has been assigned it. The three years spent in the Polar Regions by this admirably equipped expedition (the entire cost of which was borne by Mr A. C. Harmsworth, who has since placed the *Windward* at the service of Lieutenant Peary) have resulted in many important additions, not merely to our knowledge of Arctic geography, but to various other sciences.

Lieutenant Peary's most recent expedition to Greenland is of note chiefly on account of the success that has attended his efforts to bring back with him the Cape York meteorite, 45 tons in weight. That this is a genuine meteorite has in certain quarters been called in question, but the consensus of opinion among the most eminent authorities leaves no room for doubt as to its extraterrestrial origin.

The return of Dr Sven Hedin from his four years' exploration of the less-known portions of Central Asia is a notable occurrence. Dr Hedin left Stockholm in October, 1893, returning to that city, his birthplace, on May 10 last. He made many important discoveries, among which were two ancient cities, now buried in the sands, whose paintings and sculptures bear witness to a high degree of civilization at a remote period of antiquity. Dr Hedin's explorations were made at the expense of the King of Sweden and Norway and a few private individuals.

The Duke of the Abruzzi (Prince Luigi of Savoy) and his companions reached the summit of Mount St Elias, without accident, on July 31. It took 38 days of hard traveling to reach the foot of the mountain from the point of debarkation, but the actual ascent, while exceedingly arduous, was made under most favorable conditions and many very fine photographs were secured.

The expedition of the Mazamas to the summit of Mount Rainier—so long looked forward to—was made in the last week of July, but of the large number of persons who started from Tacoma only a few reached the summit, and the lamentable death of Professor Edgar McClure, who fell over a precipice during the night of July 27-28, cast a gloom over the entire subsequent proceedings. Professor McClure, who occupied the chair of chemistry in the Oregon State University, was an experienced mountain-climber, having scaled all the principal peaks of the Cascade range. A valuable article from his pen on the Altitude of Mount Adams, Washington, appeared in the April, 1896, number of this magazine. J. H.

GEOGRAPHIC LITERATURE

The Founders of Geology. By Sir Archibald Geikie. Pp. x + 297. London and New York: Macmillan and Company. 1897. $2.00.

"Had the study of the earth begun in the New World instead of the Old, geology would unquestionably have made a more rapid advance than it has done. The future progress of the science may be expected to be largely directed and quickened by discoveries made in America, and by deductions from the clear evidence presented on that continent." Thus writes Sir Archibald Geikie, easily the foremost geologist of Great Britain if not of Europe, in his preface; and American geographers and geologists cannot fail to be gratified by this appreciative expression concerning their opportunities and their work. In the half dozen succeeding chapters or "lectures," the kindly promise of the preface is fulfilled, but with little further reference to the western hemisphere. It is singular that although geology is next to the youngest among the sciences, no competent student has sought hitherto to write the record of its growth; Lyell, indeed, made some essay in this direction, and our own Marsh has taken up one aspect of the subject, but neither of these masters professed to make his work both comprehensive and exhaustive. Now comes Sir Archibald, with unprecedented facilities, with the commendable desire of tracing without prejudice those efforts which contributed most materially to the making of the science, and with a disposition to assign due meed of credit to every "founder." The task is delicate and difficult, involving large reading, firm grasp of the science, warm sympathy for pioneering even when of the crudest, and judicial ability of a high order; yet it is done with such signal skill, with such boldness and fairness, that the little book at once takes rank among the classics of science. Beginning with the cosmogonists, Sir Archibald soon passes to the naturalists; and his review is specially noteworthy in bringing out clearly the important contributions to earth-science made by one whose name has seldom been heard in this generation—Jean Étienne Guettard, author of "a new application of geography" and of the earliest known geologic map, one of the first to describe appreciatively the work of rain and rivers in modifying geographic features and to accurately note the geographic distribution of fossils, first discoverer of the volcanic origin of the extinct craters of central France. Passing thence to Werner and to Hutton (and his interpreter, Playfair) with their rival "theories of the earth," he proceeds to parcel credit duly to d'Archiac, Barrande, von Buch, Buckland, Cuvier, Darwin, De la Beche, Sir James Hall, Lyell, Murchison, de Saussure, Sedgwick, William Smith, and a score of less known makers of the science; his treatment being the more satisfactory to geographers by reason of his own full appreciation of modern physical geography—the New Geology. American readers may find the work incomplete at first blush by reason of the omission of such names as those of our own Hall, the principal author of the "New York system," of Hilgard, the prophet of southern geology, and of Powell, the discoverer of the baselevel and thus the founder of physiography; but further reading will reveal the author's policy of avoiding characterization of the work of living leaders. Sir Archibald's style is simple and clear and the book-making is admirable; so the treatise is easy reading, while its substance is made accessible by a full index.

W J M.

Java, the Garden of the East. By Eliza Ruhamah Scidmore, Author of Jinrikisha Days in Japan. Pp. 339, with illustrations. New York: The Century Company. 1897. $1.50.

Fastidious readers are indebted to the Century Company for some three hundred and fifty pages of as artistic book-making as the year has seen—artistic in typography and paper, artistic in illustration, and still more artistic (though this is but the publishers' good fortune) in literary form and content—and the book is no less instructive than artistic. Toward the end of the fifteenth century the spirit of conquest awoke from its long sleep of the dark ages, and first Iberia and then Netherland entered on careers of exploration and colonization. All men took note of the Spanish conquests, partly because they included a New World; but somehow the less brilliant moves of the Dutch on the world's checkerboard have not been followed with equal attention—at least by English-speaking peoples. So Batavia has long been half recognized through the mists of a provincial language as some sort of contributor toward the solid wealth of Amsterdam and 's Gravenhage (reduced by us, in self-defense, to The Hague), while Java was still more vaguely glimpsed as the coffee plantation of the Dutch East India Company. True, there is a rich literature grown out of the Dutch conquest and colonization, in which Java and its capital city are faithfully pictured in all their stages of growth since the first vessels from Holland reached them about 1590; true, special students of geography and of trade interests are familiar with these records in the language of the Lowlands; yet to the mass of intelligent people the scant information gleaned through the alien literature was but the dry and dusty bones of dead knowledge. So Miss Scidmore's book comes as a fragrant breath direct from the lush nursery of the Orient—and a breath so redolent of the mystical potency of eastern legend (and western, too) as to regenerate the skeleton in full flesh and vigorous vitality. The author spent months in the country; she saw with occidental eyes, indeed, yet all the more clearly because without the curious oriental haze which distorts the vision, sometimes little, often much; her pen pictures and sun pictures alike bear inherent evidence of fidelity; and the general presentment of "The Garden of the East" is done in vigorous lines and strong colors. As time passes, literature changes; of old, the writer devoted a lifetime to a book (writ perchance for a single reader), which was often a heaviness to the spirit; of late, a more fanciful yet more vigorous style has grown up under the pressure of magazine editors compelled to meet, more promptly than the bookmakers, the demands of modern readers; and now this literary quality—which is represented by the best writings of two score authors, chiefly American—is going into the books. In this style Miss Scidmore writes; each sentence is filled with idea and every paragraph throbs with vitality and brims over with good humor, while the light of delicate fancy and solid culture shines out between the lines—each chapter is a gem, and the whole a chaplet of brilliants. The first chapter is "Singapore and the Equator;" the second "In 'Java Major';" the third "'Batavia, Queen of the East';" next "The Kampongs;" then "To the Hills;" the sixth "A Dutch Sans Souci;" the seventh "In a Tropical Garden;" the eighth and ninth "The 'Culture System';" the tenth "Sinagar;" the eleventh "Plantation Life;" the twelfth "Across the Preanger Regencies;" the thirteenth "'To Tissak Malaya';" then "Prisoners of State at Boro Boedor," followed by "Boro Boedor" and "Boro Boedor and Mendoet;" the seventeenth is "Brambanam;" the eighteenth "Solo: the City of the Susunhan;" next is "The Land of Kris and Sarong;" then comes "Djokjakarta," followed by "Pakoe Alam: The 'Axis of the Universe';" the twenty-second is "'Tjilatjap,' 'Chalachap,' 'Chelachap';" then follows "Garoet and Papandayang," and lastly (save a rather too condensed index) follows "'Salamat'," the soft farewell of the land of the Malay. It is impossible to epitomize these chapters, already condensed to the utmost; suffice it that apparently every appropriate subject is treated or at least touched lightly—the myth of the coco-de-mer is rectified and that of the "deadly upas" punctured skillfully; the coffee plantations are described, and the vile product of the local chef duly anathematized; the tea industry receives attention, and the unconventional hotel customs are not neglected; even Krakatoa, that world's volcano which happened to erupt so near to Java, comes in for a share of space. The book hardly professes to be scientific, and may be unworthy of entombment alongside the musty tomes of the Dutch societies; but it can be commended as a thoroughly readable and fully fin de siecle contribution to that semi-scientific literature which is neither so heavy as to sink straightway into the depths of desuetude nor so light as to drift into oblivion.

W J M.

Natural Elementary Geography. By Jacques W. Redway, F. R. G. S. Pp. 144, with maps and illustrations. New York, Cincinnati, Chicago: American Book Company. 1897. 60 cents.

For many years teachers have realized that geographical text-books were unsatisfactory, and that the teaching of geography was as a consequence equally so, but without being able to better them.

Geography, as it has been heretofore taught in the schools, is not a science. It is little more than a mere mass of unconnected facts relating to the earth's surface. Teachers and pupils are but beginning to understand that geography is in the truest sense a science, in that all phenomena of the earth proceed from cause to effect, and that geography is the fundamental science upon whose broad back rest nearly all other sciences.

The birth of the new science of physiography, the study of the relief of the earth, gave a decided direction to geography teaching. The "Committee of Ten," appointed by the National Educational Association in 1892, in its report made this the leading feature of geography. It was a step in the right direction, but at the same time it limited the scope of geography to a study of the surface features of the earth. Later, the "Committee of Fifteen" took a great step in advance, presenting the science of geography in its full breadth and scope, not only as embracing the surface features of the earth, but their influence upon man and his industries, which is the ultimate end of all geography.

The above book is the first of a series of school geographies now being issued by the American Book Company. In scope it is fully in accord with the Report of the Committee of Fifteen, as it teaches not only the origin of the surface features of the earth, but their relations to man, his life, and his activities. It also embodies the most approved pedagogical methods, leading the child from the known to the unknown, from those things which he can see and appreciate through his senses to those which he must realize by the aid of his imagination. It is admirably illustrated, both as to cuts and maps, and the illustrations are used for the purpose of assisting the text, not merely to make a pretty book.

Without disparaging other recent text-books on geography, it is safe to say that in scope and method of treatment this book is far the most successful that has yet appeared. H. G.

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

Excursion and Field Meeting, October 2, 1897.—Saturday afternoon excursion to Cabin John bridge by electric cars. Field meeting in the pavilion. Attendance about 250. After introductory remarks by President Hubbard, short addresses were delivered by Mr W J McGee on the Development of the Geography of the Region and by Mr Arthur P. Davis on the Pollution of Potomac Water. A paper prepared by Capt. D. D. Gaillard, U. S. Corps of Engineers, on Cabin John Bridge and the Washington Aqueduct was then read by Mr E. B. Hay, and the meeting adjourned to inspect the bridge and explore the surrounding country.

Special Meeting, October 22, 1897.—President Hubbard in the chair. Afternoon lecture by Prince Kropotkin on Russia and Siberia.

Reception to Dr Nansen, October 26, 1897.—Evening reception to Dr Fridtjof Nansen by the National Geographic Society at the Arlington hotel. President Hubbard, with members of the honorary reception committee, received the guests and presented them to Dr Nansen. About 1,600 persons were present. Later the President made a short address of welcome, and after remarks by Vice-President Greely and Engineer-in-Chief Melville, U.S.N., Dr Nansen addressed the Society, expressing his cordial appreciation of the hearty welcome and his indebtedness to American explorers, especially those of the *Jeannette* expedition, for the idea of his own voyage in the *Fram*.

Special Meeting, October 29, 1897.—Mr W J McGee in the chair. Vice-President Greely addressed the Society on Recent Geographic Progress.

Regular Meeting, November 5, 1897.—Vice-President Gilbert in the chair. Mr Robert T. Hill gave an illustrated lecture on the Geography of Jamaica and its Relation to Antillean Development.

Excursion and Field Meeting, November 6, 1897.—Saturday afternoon excursion to High island by electric cars for Brookmont, whence the party, consisting of about 350 members and guests, walked to the north end of the island. The field meeting was called to order by Mr McGee, and Mr Frederick V. Coville delivered a short address on the Coloration and Fall of Autumn Leaves. Later, at a meeting on the east side of the island, Mr Coville spoke of Adaptations for the Natural Distribution of Seeds, with practical illustrations.

ELECTIONS.—New members have been elected as follows:

September 16.—Lieut. Chas. P. Elliott, U.S.A., Miss Grace G. Isaacs, R. E. Redway.

October 6.—Mrs Mary O. Agnew, Rev. C. M. Bart, Major R. G. Batten, Mrs Julia P. Beckwith, H. M. Brayton, L. A. Conner, Jos. Dague, Miss Ellen C. Dyer, L. O. Garrett, Mrs Thos. Hovenden, Edwin A. Hill, Mrs Nora Hoegelsberger, Edgar Janney, M.D., Miss Virginia Kersey, Mrs J. B. Kendall, Henry Krogstad, M.D., Capt. F. Michler, U.S.A., W. E. Nalley, Miss Louisa G. Nash, Wilfred H. Osgood, Miss Mary B. O'Toole, A. Patten, M.D., Miss C. Augusta Pope, Hon. L. A. Pradt, G. W. Prewitt, M.D., J. W. Reisner, Wm. J. Rhees, Chief-Engineer C. R. Roelker, U.S.N., Jared G. Smith, Dr G. L. Spencer, O. H. Tittmann, Miss Mary E. C. Walker, Miss Helen I. Walsh, Edwd. C. Wilson, Miss Emma E. Woodard, Miss Hallie L. Wright.

October 22.—Miss Amelia R. Amos, Miss Jennie P. Andrews, Dr Frank Baker, F. L. J. Boettcher, Henry T. Burr, Eugene Byrnes, Miss Eliz. Carss, Robert S. Chilton, Thos. H. Clark, Major P. E. Dye, Saml. E. Fouts, W. J. Elstun, M.D., C. G. Gould, Miss Etta Griffin, F. P. Hackney, Mrs Wm. Hayden, Archibald Hopkins, F. M. Hosier, Dr L. O.

Howard, Miss Ida Howgate, D. S. Jackman, Mr N. J. Knagenhjelm (Chargé d'Affaires, &c., &c., Legation of Sweden and Norway), Chas. A. Keffer, Miss Mary Leet, Edwin R. Lewis, M.D., Frank B. Littell, Prof. Lee D. Lodge, Walter S. Logan, Miss Annie E. Loomis, Chief-Engineer H. Main, U.S.N., Mrs M. E. Martin, Miss N. E. S. McLean, Geo. Mason, Miss Frances M. Moore, John D. Morgan, Miss Susie P. Morris, Geo. L. Morton, Mrs Mary H. Myers, Rev. E. M. Paddock, Mrs Delia C. Perham, Edwd. T. Peters, Gifford Pinchot, Geo. H. Plant, Jr., Frank Playter, Fred. W. Pratt, Rev. Wallace Radcliffe, D.D., F. J. Randolph, Miss S. A. Reilly, T. B. Sanders, H. M. Schooley, D.D.S., Hon. H. W. Seymour, N. H. Shea, Miss E. J. Shively, Paul Simpson, Thos. J. Sullivan, Dr J. M. Sterrett, Miss Ida Thompson, Mrs Thos. L. Tulloch, Judge W. Vandevanter, Hon. F. A. Vanderlip, Surg.-Gen. W. K. Van Reypen, U.S.N., Miss Margaret S. Vidal, Major A. L. Wagner, U.S.A., H. Randall Webb, Henry W. Wheeler, Jas. L. White, Gen. E. Whittlesey, R. E. L. Wiltberger, D.D.S., W. F. Willoughby, Miss C. McL. Wright.

October 29.—Mrs Alta C. Baldwin, Miss C. R. Barnett, Major H. von Bayer, Wm. T. Biehl, Gen. Z. R. Bliss, U.S.A., Col. G. B. Brackett, Miss Sara G. Browne, Miss Susan W. Carson, Mrs J. D. B. Chany, Miss May S. Clark, Miss Florence Conger, Señor Don Luis F. Corea, Dr S. L. Crissey, Mrs Nellie H. Crocker, Rev. Dr G. S. Duncan, Miss Isabella Erwin, Miss M. E. Etheridge, Louis T. Farabee, Lawrence C. Forman, Miss L. M. Fox, Hon. James A. Gary, Miss Mary C. Guion, Mrs Mary J. Hedges, Robt. T. Hill, Col. A. L. Hough, U.S.A., Miss F. S. Knobloch, Rev. E. B. Leavitt, Chas. A. Leith, Wm. W. Lesh, J. B. Mann, Frank B. Martin, S. S. McClure, Mrs Donald McLean, Col. Wm. H. Michael, Wm. Moore, M.D., Fred. A. Ober, J. A. Ockerson, C.E., Jesse L. Parker, Miss Mollie V. Paxton, Miss Eva H. Quinn, Prof. Geo. L. Raymond, Miss J. E. Richards, Geo. A. Ross, Miss Mary I. Sedgley, Mrs S. H. Shields, Rev. C. A. Smith, Robt. A. Smith, Chas. McG. Sweitzer, Gen. N. B. Sweitzer, U.S.A., Miss H. R. Talcott, Geo. Totten, Jr., Rev. John Van Ness, Dr Geo. B. Welch, Geo. Westinghouse, Jr., E. S. Whitney, Miss G. H. Williams, J. B. Wimer, Simon Wolf, Mr Alexander Zelenoy (Russian Legation), Miss Lillie L. Zimmerman.

GEOGRAPHIC NOTES

EUROPE

GREAT BRITAIN. The report of the ordnance survey of Great Britain states that the area revised during the year ending March 31, 1897, was 4,623 square miles. The sale of maps realized £17,715.

ICELAND. The Althing, or Icelandic parliament, has resolved to grant an annual subsidy of 35,000 kroner for 20 years to a company which has undertaken to lay a submarine cable from Iceland to Scotland *via* the Faröe isles. The Danish government also has promised financial aid, and it is expected that the cable will be laid early next summer.

GERMANY. The annual production of lumber in Germany is estimated at 8,300,000 tons. The imports have risen from 2,800,000 tons in 1891 to 3,200,000 tons in 1896, but according to Mr T. E. Moore, United States commercial agent at Weimar, there is not the slightest disposition to relax the stringent forest regulations which have so long been in force. Mr Moore adds that at the rate at which the devastation of forests is now going on in Russia, Sweden, and Galicia, those countries will soon have the same experience as Spain, which has been deprived of a part of her natural riches by the shortsighted policy of past generations.

ASIA

KOREA. Korea is becoming to a large extent the rice granary of Japan and Japanese manufactures are driving the products of other countries out of the Korean market simply by virtue of their cheapness.

HONG-KONG. The total tonnage entering and leaving the port of Hong-Kong in 1896 amounted to 16½ millions. Of this about 7½ millions represented the tonnage of junks and river steamers, leaving about nine million tons engaged in foreign trade, of which more than one-half was British.

SIBERIA. Railway communication has now been established between Khabarovka and Vladivostok, and the line will be opened for traffic at an early date. The Russian government has purchased ten tons of choice seed grain from the Canadian experiment stations for distribution among the Siberian farmers.

NORTH AMERICA

CANADA. The mineral output of British Columbia in 1896 amounted to $7,146,425, as compared with a total of $2,668,608 in 1890.

MEXICO. The Mexican government has officially promulgated a concession for a railroad from Chihuahua to the Pacific coast. The length of the line will be 372.8 miles, and to aid in its construction the government agrees to pay the promoters a subsidy of $4,600,000. It has also granted a concession, without subsidy, for the construction of a railroad from Presidio del Norte, on the Rio Grande, state of Chihuahua, west, *via* Chihuahua city, to a point on the Pacific coast in the state of Sinaloa. U. S. Consul R. M. Burke states that the mineral wealth of the region through which these roads must pass is beyond calculation.

AUSTRALASIA

The Australasian gold yield during 1896 amounted to 2,375,948 ounces, an increase of 16,704 ounces on the preceding year.

The forests of the colony of Western Australia cover an estimated area of 20,400,000 acres and contain marketable timber to the value of £124,000,000.

Queensland has at last agreed to join in the Australasian federation movement, and the Federal Convention has adjourned until January, 1898, when Queensland will be represented.

INDEX

Page
Abbe, Cleveland, cited on meteorology ... 67
Abbot, Philip S., Reference to work of ... 26
Abnaki Indians, Description of ... 18
Acoma, Pueblo of ... 273
Aconcagua, Attempted ascent of ... 28
Adams, F. D., Reference to work of ... 250
Africa, Civil cartography of ... 155
—, Description of western ... 1
—, Exploration in ... 34
—, Notes on ... 27, 61, 96, 204
—, Primitive people of ... 163
— (Recent explorations in equatorial); Ernest de Sasseville ... 88
—, Unexplored regions in ... 255
Alaska, Meteorology of ... 327
—, Rivers of ... 322
Allen, W. H., Reference to work of ... 326
Alvey, Richard H., Account of work of ... 106
Alvord, Henry E., Record of address by ... 63
Amendments to By-laws, Proposed ... 192
Andrée, S. A., Account of balloon ascension by ... 159
—, Portrait of ... 160
Annexation fever (The); Henry Gannett ... 354
— of Canada, Advantages of ... 357
— — Cuba, Reasons for and against ... 356
Antarctica, Exploration of ... 264
Applegate, O. C., Discovery of Crater lake by ... 33
Aqueduct, Description of Washington ... 340
—, Laws relative to Washington ... 338
Archeology of New Mexico ... 280
Arctic (A summer voyage to the); G. R. Putnam ... 97
— regions, Exploration of ... 263
Areas (The great unmapped) on the earth's surface awaiting the explorer and geographer; J. Scott Keltie ... 251
Argentina, Acknowledgment to officials in ... 219
—, Population of ... 26
Arid region, Lands of ... 55
Arizona (Forests and deserts of); Bernhard E. Fernow ... 203
Ashanti, Description of ... 1
Asia, Primitive people of ... 163
—, Unexplored areas in ... 252
Australia, Unexplored areas in ... 262

Bailey, F., Reference to work of ... 248
Bailey, Vernon, Reference to work of ... 59
Baker, Marcus, Book review by ... 230
—; Geographical research in the United States ... 285
—, Reference to work of ... 198, 249
—; The Venezuelan Boundary Commission and its work ... 105
Baldwin, M. R., quoted on St Louis river ... 117
Balloo, —, cited on Siberian railway ... 124
Bartlett, John, Reference to work of ... 97
Battenberg, Prince Henry of, Death of ... 13
Begg, Alexander, Reference to work of ... 23
Belgica, Voyage of the ... 260
Bell, Robert, Reference to work of ... 259
Bendire, Charles E., Record of death of ... 160
Bent, Theodore, Reference to discoveries by ... 253
Best, Emory F.; Utilization of the vacant public lands ... 49
Blount, Wm. T., Reference to work of ... 238
Boas, Franz, Reference to work of ... 26

Page
Branner, J. C., Reference to work of ... 250
Brazil, Rubber from ... 83
Brewer, David J., Account of work of ... 106
Bridge, Cabin John ... 337
British Association, Meeting of the ... 247
Broadhead, James O., Notice of work by ... 160
Brown, Bolton Coit, Reference to work of ... 62
Burr, George L., Account of work of ... 106
Burton, A. E., Photographs by ... 110
—, Reference to work of ... 97
Buys-Ballot, —, cited on meteorology ... 67

Cabin John bridge, Description of ... 343
— —, Views of ... 341, 344
Calvo, Don Joaquin B., Photographs by ... 121
Campbell, M. R., Record of address by ... 192
Carrew, —, cited on rubber industry ... 87
Carpenter, Frank G., Review of book by ... 222
Census (The Russian) of 1897; A. W. Greely ... 335
Central America, Notes on ... 204
— —, Unexplored areas in ... 261
Chicago, Change of lake level at ... 246
Civilization, Development of ... 161
—, Effect of environment on ... 29
Clephane, Lewis, Record of death of ... 95
Cleveland, President, Extracts from message of ... 104
Climate of Africa ... 257
— — Alaska ... 327
— — the United States ... 301
Coal, Indian ... 27
Coast and Geodetic Survey (A brief account of the geographic work of the U. S.); T. C. Mendenhall and Otto H. Tittmann ... 294
— — — —, Work of the ... 247
Coffee, growth of, in Costa Rica ... 147
—, Mexican ... 26
Commerce of Costa Rica ... 148
Compass (The) in modern navigation; G. W. Littlehales ... 266
Condon, Thomas, Reference to work of ... 59
Cornish, Vaughn, Reference to work of ... 249
Corthell, E. L., Reference to work of ... 249
—; The delta of the Mississippi river ... 351
Cotton, growth of, in Costa Rica ... 144
Coudert, Frederick R., Account of work of ... 106
Coville, F. V., Record of address by ... 308
—, Reference to work of ... 59
—, Review by ... 91
Crater lake, Oregon; J. S. Diller ... 33
Crawford, J., cited on rubber industry ... 85
Cunningham, J. M., Record of death of ... 95
Curtis, Wm. E., Reference to work of ... 63
Cushing, Frank Hamilton, Record of address by ... 94

Darwin, Charles, quoted on Fuegians ... 168
—, Reference to work of ... 91, 134
Davidson, Thomas, Record of address by ... 128
—, Reference to address by ... 31
Davis, Arthur P., Record of address by ... 128, 305
Davis, W. M., Reference to work of ... 250
Dawson, George, Reference to work of ... 259
De Grain, E. F., Reference to work of ... 111
Delta (The) of the Mississippi river; E. L. Corthell ... 351
Denison, F. Napier, Reference to work of ... 260
Deserts, Discoveries concerning ... 253

Page
Deserts of Arizona ... 263
Dickey, W. A.; The Sushitna river, Alaska 322
Dickinson, Sidney, Record of address by ... 63
Dick, ——, Reference to journeys of ... 89
Diller, J. S.; Crater lake, Oregon ... 33
—, Record of address by ... 63
—; The Mazamas ... 18
Dixon, R. B., Reference to work of ... 249
Dodge, Richard E., Reference to work of ... 248
Dryer, Charles R., Notice of work of ... 95
—, Review of book by ... 232
Duluth, Enterprises of ... 117
Dutton, C. E., cited on Crater lake ... 34
—, quoted on the Grand Cañon ... 225
—, Reference to work of ... 92

Eads, James B., cited on Mississippi delta ... 354
Earth movement, Geographic effects of ... 225
Elliot, George H., Reference to work of ... 340
Elliott, Charles P.; Mount St Helens ... 226
Engineer Corps, Work of the ... 288
[Environment, Effect of, in development of civilization]; Gardiner G. Hubbard ... 29
— (The effects of geographic) in the development of civilization in primitive man; Gardiner G. Hubbard ... 161
Erie, Lake, Development of ... 234
Escobar, Pedro, Discoveries by ... 3
Eskimo, Characteristics of ... 101
Ethnology of Africa ... 164
— — Costa Rica ... 145
— — Maine ... 16
— — Patagonia ... 138
— — western Africa ... 3
—, Work of Prof. W J McGee in ... 359
Europe, Primitive people of ... 160
Evans (Sir John) and Prof. W J McGee; John Hyde ... 358
—, Portrait of ... 357
Evermann, B. W., Reference to work of ... 59
—, Temperature observations by ... 48

Farnum, J. Edward, Reference to work of ... 41
Fauna of Patagonia ... 317
Fernow, Bernhard E., Record of address by ... 63
—, Reference to work of ... 90
—; The forests and deserts of Arizona ... 203
Fitzgerald, E. A., Reference to work of ... 28
Flora of Arizona ... 207
— — Costa Rica ... 143
— — Patagonia ... 316
Forbes, H. O., Reference to work of ... 259
Ford, Worthington C., Notice of work by ... 157
Forest reserves (The National); Frederick H. Newell ... 177
Forests of Arizona ... 203
Foster, John W., Record of address by ... 128
Franklin, Benjamin, cited on meteorology ... 66, 300
French, George K.; The Gold Coast, Ashanti, and Kumassi ... 1

Gaillard, D. D., Record of paper by ... 365
—; The Washington aqueduct and Cabin John bridge ... 337
Gannett, Henry, Book reviews by ... 60, 61, 230, 232, 365
—, Notes by ... 92, 127, 157, 160, 190
—, Record of paper by ... 159
—, Reference to work of ... 20, 230
—; The annexation fever ... 354
Gatschet, Albert S.; All around the Bay of Passamaquoddy ... 16
Geikie, Sir Archibald, Reference to work of ... 91
—, Review of book by ... 362
Geographic events (Some recent); John Hyde ... 339
Geological Survey, Work of the ... 289
Geology of Patagonia ... 313
— — the delta of the Mississippi river ... 354
Gerlache (The de) expedition to the Antarctic, Record of ... 350
Gilbert, G. K.; Modification of the Great Lakes by earth movement ... 233
—, Reference to work of ... 206, 289
Gilman, Daniel C., Account of work of ... 186
Glaciation at Crater lake ... 39
Glaciers, Review of book on ... 128
Glenn, L. C.; Applied physiography in South Carolina ... 152
Gold Coast (The), Ashanti, and Kumassi; George K. French ... 1
Goodyear, William H., Record of address by ... 32, 160
Gore, J. Howard, Notice of work by ... 157
Grand Cañon, View of ... 103
Great Britain, Results of acquisition of territory by ... 357
Great Lakes (Modification of the) by earth movement; G. K. Gilbert ... 233
Greely, A. W.; George W. Melville ... 187
—, Note by ... 64
—, Record of address by ... 306
—, Reference to work of ... 249
—; Rubber forests of Nicaragua and Sierra Leone ... 83
—; The Russian census of 1897 ... 339
—; The Siberian Transcontinental railroad ... 121
Greenland, Voyage to ... 97
Gregory, J. W., Reference to work of ... 256
Grosvenor, Charles H., Record of address by ... 192
Grosvenor, Edwin A., Reference to address by ... 32, 160
Gulf of Mexico, Absence of indications of rise of level of ... 353

Haliburton, R., Reference to work of ... 256
Hamilton, Alexander, Land policy of ... 50
Hammond, John Hays, Reference to work of ... 64
Hassler, F. R., Founding of Coast Survey by ... 285
Hatcher, J. B.; Patagonia ... 305
Hatcher's work in Patagonia; W J McGee ... 319
Hawaii, Proposed annexation of ... 354
Hayden, Everett, cited on Crater lake ... 34
Hayden, F. V., Reference to work of ... 289
Hatt, H. C., Account of work of ... 273
Hazeltine, M. M., Photograph by ... 39
Hazen, H. A., Reference to work of ... 28
Hedin, Sven, Explorations by ... 254, 261
—, Record of return of, from central Asia ... 359
Henry, Joseph, Reference to work of ... 66
Henry of Orleans, Prince, Discoveries by ... 253
Hill, David J., Record of address by ... 160
Hill, Robert T., Record of address by ... 300
History of public lands ... 49
Hodge, F. W.; The Enchanted Mesa ... 273
Hollerith, Herman, Reference to device of ... 336
Hopkinson, John, Reference to work of ... 256
Hotchkiss, Jed, Record of paper by ... 191
Hough, Elliott P., Photograph by ... 344
Hourst Niger expedition (Return of the); Ernest de Sasserville ... 24
Howarth, O. H., Reference to work of ... 249
Howell, Thomas, Reference to work of ... 58
Hubbard, Gardiner Greene; [Effect of environment in the development of civilization] ... 29
—; Geographical research in the United States ... 285
—; John Hyde ... 145

Page

Hubbard, Gardiner Greene, Record of address by ... 30, 94
—, Reference to work of ... 249
—; The effects of geographic environment in the development of civilization in primitive man ... 161
Hughes, Geo. W., Outline of plan by for Washington city's water supply ... 337
Huron, Lake, Development of ... 236
Hurricanes, Origin of ... 301
Hutton, William R., Reference to work of ... 348
Hyde, John; Admiral R. W. Meade, U. S. N. ... 142
—, Book notices by ... 157
—; Electric street railways ... 264
—; Gardiner Greene Hubbard ... 245
—; Mineral production in the United States ... 291
—, Notes by ... 64, 95, 128, 156, 304
— on African orthography ... 88
—; Sir John Evans and Prof. W J McGee ... 358
—; Some recent geographic events ... 350
—; The Toronto meeting of the British Association for the Advancement of Science ... 247
Hydrographic office, Work of the ... 290
Hydrography, Work of the Weather Bureau in ... 72

Icebergs, Characteristics of ... 98
India, Note on ... 96
—, Production of coal in ... 27
Indian geographic names ... 71
— tradition, verification of ... 282
Indians of Arizona ... 220
— — Patagonia ... 306

Jackson-Harmsworth expedition, Record of return of, from Franz Josef Land ... 359
— — —, Work of ... 361
Jameson, J. F., Reference to work of ... 108
Japan, Note on ... 96
Java, Review of book on ... 363
Johnson, Alexander, Reference to work of ... 250
Jordan, David Starr, Record of Address by ... 28

Kabel, John, quoted on Russian population ... 316
Keltie, J. Scott, Reference to work of ... 248
—; The great unmapped areas on the earth's surface awaiting the explorer and geographer ... 251
Kennan, George, Record of address by ... 94
Kerbey, J. O., cited on rubber industry ... 83
Kerr, Mark B., Reference to work of ... 34
Kites, Use of, in meteorology ... 302
Klondike region, Winter weather in ... 327
Klotz, Otto J., Reference to work of ... 249
Knapp, Martin A., Record of address by ... 160
Kohen, John, Notice of work by ... 157
Kropotkin, Prince, Record of address by ... 366
—, Reference to work of ... 250
Kumassi, Description of ... 1

Lakes, Development of the Laurentian ... 236
Lands, Public ... 162
— (The utilization of the vacant public); Emory F. Best ... 49
Lapham, Increase A., cited on meteorology ... 67
Laws relating to public lands ... 54
— — Washington aqueduct ... 338
Leland, Charles G., Reference to work of ... 19
Lendenfeld, A., Reference to paper by ... 353
L'Enfant, Charles Pierre, Examinations of Potomac by ... 337
Levees in the lower delta country ... 254

Page

Lhasa, Exploration near ... 253
Littlehales, G. W., Record of address by ... 160
—; The compass in modern navigation ... 266
Libbey, William, reference to work of ... 274
Lindgren, Waldemar, Reference to work of ... 63
Logan, Sir William, Reference to work of ... 250
Lubbock, Sir John, Reference to work of ... 91
Luigi (Prince) of Savoy, Record of ascent of Mount St Elias by ... 359

McClure, Edgar, Biographic sketch of ... 362
—, Record of death of ... 359
—, Reference to work of ... 58
Macfarland, Joseph, Record of death of ... 95
McGee, W J, Biographic sketch of ... 358
—, Book reviews by ... 59, 90, 91, 124, 126, 362, 363
—; Hatcher's work in Patagonia ... 319
—, Portrait of ... 357
—, Record of address by ... 365
— — — paper by ... 194
—, Reference to work by ... 60, 251
Mackay-Smith, Alex., Record of address by ... 159
—, Reference to lecture by ... 31
McQuesten, L. N., Work of ... 327
Magellan (Straits of), A winter voyage through the; R. W. Meade ... 129
Maine coast, Description of ... 16
Mallet-Prevost, Severo, Account of work of ... 196
Man, Development of primitive ... 161
Mapless areas ... 251
Mayer glacier, View of ... 305
— river, Discovery of ... 329
Mayne, ——, quoted on Patagonians ... 136
Mazama, Mount ... 45
Mazamas expedition, Record of ... 359, 362
— (The); J. S. Diller ... 58
—, Work of the ... 34
Meade, R. W. (Admiral), U. S. N.; John Hyde ... 142
—; A winter voyage through the Straits of Magellan ... 129
—, Portrait of ... 130
—, Record of address by ... 28
— — —, Death of ... 160
Meigs, Montgomery C., Outline of plans by, for Washington city's water supply ... 338
Melville (George W.); A. W. Greely ... 187
—, Portrait of ... 161
Mendenhall, T. C.; A brief account of the geographic work of the U. S. Coast and Geodetic Survey ... 204
—, Record of address by ... 160
—, Reference to work of ... 249
Merriam, C. Hart, Record of address by ... 159
—, Reference to work of ... 59, 310
Merrill, Geo. P., Review of book by ... 126
Mesa (The Enchanted); F. W. Hodge ... 273
Mesopotamia, Development of civilization in ... 172
Meteorology ... 65
— of Alaska ... 327
— — the United States ... 299
Mexico, Productions of ... 26
Michigan, Lake, Development of ... 236
Mill, Hugh Robert, Reference to work of ... 248
Milne, John, Reference to work of ... 249
Mineral production in the United States; John Hyde ... 291
Mines of Costa Rica ... 151
Mississippi, Surveys of the ... 292
Moore, ——, Reference to work of, in Africa ... 250
Moore, Willis L., Reference to work of ... 249
—; Storms and weather forecasts ... 65
—; United States daily atmospheric survey ... 299

Page
MORGAN, E. DELMAR, Reference to work of .. 248
MOUNT ST HELENS; Charles F. Elliott .. 228
MURRAY, R. P., Record of exhibition by .. 160
MYER, ALBERT J., Reference to work of .. 67
MYERS, J. T., Reference to work of .. 240
MYTHOLOGY, African .. 6

NAMES, Indian geographic .. 23
NANSEN, FRIDTJOF, Account of reception to .. 360
—, Reference to work of .. 27, 254
NARBOROUGH, SIR JOHN, cited on Tierra del Fuego .. 149
NAVIGATION, Use of the compass in .. 289
NAVY DEPARTMENT, Work of the .. 290
NELSON, E. W.; A winter weather record from the Klondike region .. 327
NEWELL, F. H.; Pollution of the Potomac river .. 346
—, Record of address by .. 94
—, Reference to work of .. 249
—; The National forest reserves .. 177
NEW MEXICO, Mesas in .. 273
NEW ZEALAND, Unexplored areas in .. 263
NICARAGUA, Note on .. 95
—, Rubber forests of .. 83
NIGER EXPEDITION, Return of the .. 24
NOBLE, JOHN W., Reference to work of .. 185
NORTH AMERICA, Unexplored areas of .. 259

OCEANOGRAPHY, Progress in .. 265
OCKERSON, J. A., cited on subsidence of Mississippi delta .. 351
O'HARA, THOMAS, Reference to report by .. 304
O'LEARY, T. S., Record of address by .. 63
ONTARIO, Lake, Development of .. 252
OREGON, Map of part of .. 35

PAINE, HALBERT E., Reference to work of .. 62
PAMPAS, View of the .. 317
PASSAMAQUODDY (All around the bay of); Albert S. Gatschet .. 10
PATAGONIA, Coast of .. 129
—; J. B. Hatcher .. 305
PATAGONIANS, Characteristics of .. 136, 168, 306
PEARY, ROBERT E., Greenland expedition of .. 361
—, Record of return of, from Greenland .. 330
—, Reference to work of .. 97, 264
PECK, ANNIE S., Record of address by .. 94
PENCK, ALBRECHT, Reference to work of .. 249
PETERSON, O. A., Account of work by .. 312
PHILLIPS, P. LEE, Review of book by .. 61
PHYSIOGRAPHY (Applied) in South Carolina; L. C. Glenn .. 152
— of Patagonia .. 319
PLEASANTON, ALFRED, Record of death of .. 95
POPULATION, Increase of .. 258
— of Argentina .. 26
— — Costa Rica .. 145
— — Patagonia .. 320
— — Russia .. 235
— — Washington city, Increase of .. 338
PORTUGUESE discoveries in Africa .. 2
POTOMAC RIVER, Amount of water carried by .. 348
— —, Description of .. 346
— — (Pollution of the); F. H. Newell .. 346
— — water, Suggestions for improvement of .. 351
POWELL, J. W., Reference to work of .. 290
PRATT, GEORGE H., Account of work of .. 225
PREBLE, EDWARD A., Reference to work of .. 38
PRESTON, E. D., Record of exhibition by .. 128
PREVOST, SERVERO MALLET, Account of work of .. 196
PRJEVALSKY, ——, Discoveries by .. 253
PROCEEDINGS of the National Geographic Society .. 28, 63, 94, 128, 159, 365

PUTNAM, G. H.; A summer voyage to the Arctic .. 37
—, Reference to work of .. 101, 254

RAILROADS, The Transcontinental .. 121
RAILWAY SURVEYS, Importance of .. 292
RAILWAYS (Electric street); John Hyde .. 284
—, Street, notice of work on .. 159
REDWAY, JACQUES W., Review of book by .. 365
REID, HARRY FIELDING, Reference to work of .. 63
RELICS on the Enchanted Mesa .. 282
RESEARCH (Geographical) in the United States; Gardiner G. Hubbard and Marcus Baker .. 285
RESERVES, Forest .. 177
RICHEBUCKER, EUGENE, Reference to work of .. 34
RIJCKEVORSEL, —— VAN, Reference to work of .. 250
RIVER, Discovery of a new .. 330
RIVERS tributary to Lake Superior .. 115
ROBERTSON, SIR GEORGE SCOTT, Reference to work of .. 248
ROCKHILL, W. WOODVILLE, Discoveries by .. 251
ROMERO, MATIAS, Reference to work of .. 62
RUBBER forests of Nicaragua and Sierra Leone; A. W. Greely .. 83
RUSSELL, I. C., Reference to work of .. 26
—, Review of book by .. 128
RUSSIA, Notes on .. 95
—, Population of .. 235
—, Work of, on Transcontinental railroad .. 123

SAHARA, Explorations in .. 252
SALISBURY, R. D., Reference to work of .. 61
SAMBUC, ——, Reference to work of .. 258
SAN FRANCISCO MOUNTAINS, Description of .. 236
SANTAREM, JOAN DE, Discoveries by .. 2
SAPPER, CARLOS, Reference to work of .. 61
SASSEVILLE, ERNEST DE; Recent explorations in equatorial Africa .. 44
—; Return of the Hourst Niger expedition .. 24
—; Sheik Said .. 152
SCHERMERHORN, L. Y., cited on Great Lakes .. 112
SCIDMORE, ELIZA RUHAMAH, Review of book by .. 365
SCOTT, SIR FRANCIS, Conquest by .. 12
SCOTT, W. B., Review of book by .. 61
SELOUS, F. C., Reference to work of .. 249
SELWYN, SIR ALFRED, Reference to work of .. 259
SETCHELL, WILLIAM A., Review of book by .. 31
SHAHAN, THOMAS J., Record of address by .. 128
—, Reference to address by .. 30
SHEIK SAID; Ernest de Sasseville .. 155
SHORES, C. H., Work of .. 56
SIBERIA, Notes on .. 93
SIBERIAN (The) Transcontinental railroad; A. W. Greely .. 121
SIERRA LEONE, Rubber forests of .. 83
SMITH, ALEX. MACKAY, Record of address by .. 159
SMITH, B. LEIGH, Reference to work of .. 180
SMITH, HOKE, Reference to work of .. 180
SMITH, L. P., Record of death of .. 95
SMITH, SIR DONALD A., Reference to work of .. 63, 190
SOILS, Review of book on .. 126
SOUTH AMERICA, Notes on .. 304
—, Unexplored areas in .. 261
SOUTH CAROLINA, Physiography of .. 152
SPEIRS, FREDERIC W., Notice of work by .. 159
SPENCER, J. W., Reference to work of .. 277
SPORCK, ——, Reference to work of .. 80
SPURR, J. E., Record of address by .. 94
STANLEY, HENRY M., Discoveries by .. 14
—, Reference to work of .. 88
STEEL, W. G., cited on Crater lake .. 33
—, Work of .. 58

Page

Sternberg, Geo. M., Record of address by.
Storms and weather forecasts; Willis L. Moore 65
Stuntz, G. R., Reference to work of 245
Stupart, R., Reference to work of 290
S[illegible], W. N., Reference to work of 58
Sulte, B., Reference to work of 251
Superior (Lake), Area and drainage basin of; Mark W. Harrington 111
— —, Development of 238
Surveys, Atmospheric 290
—, Coast and Geodetic 294
Susitna river (The), Alaska; W. A. Dickey 322
Syria, Notes on 96

Tarr, Ralph S., Review of book by 59
Taylor, F. B., Reference to work of 235
Territory, Universal instinct for acquisition of 255
Tittmann, Otto H.: A brief account of the geographic work of the U. S. Coast and Geodetic Survey 294
—, Reference to work of 240
Toronto (The) meeting of the British Association for the Advancement of Science; John Hyde 247
Traditions, Verification of Indian 292
Treaty, Venezuelan 299
Trotter, J. K., Reference to work of 27
Tucker, J. Randolph, Record of death of 16
Tyrrell, J. B., Reference to work of 240

United States daily atmospheric survey; Willis L. Moore 290
— —, Reasons for and against annexing territory to 255
— —, Surveys of 294

Venezuelan (The) Boundary Commission and its work; Marcus Baker 100
Victor, Frances Fuller, cited on Crater lake 34
Villafranca, Ricardo; Costa Rica 161
Volcanoes of Patagonia 312
Vroman, A. C., Account of work of 275

Walcott, Charles D., Reference to work of 240
Ward, W. Hayes, Record of address by 94
Washington aqueduct (The) and Cabin John bridge; D. D. Gaillard 307
Weather (A winter record from the Klondike region); E. W. Nelson 327
— Bureau, Work of the 28, 291
— forecasts 65
West India, Hurricanes from 60
Wheeler, Benj. Ide, Record of address by 150
—, Reference to address by 31
Wheeler, George M., Reference to work of 289
White, Andrew D., Account of work of 196
White, T. Brook, Work of 58
White, W. J., Reference to work of 240
Whitney, J. D., Reference to work of 61
Wilbur, Earl M., Work of 58
Wilcox, Walter Dwight, Record of paper by 131
Williams, Talcott, Reference to lecture by 30
Wilson, H. M., Record of paper by 150
Wilson, William L., Record of address by 63
Windward, Voyage of the 301
Winsor, Justin, Reference to work of 198
Winston, Isaac, Record of paper by 150
Wolseley, Sir Garnet, Expedition by 8

Yucatan channel, Inflowing current of 333

Zeballos, Estanislao, Acknowledgment to 320

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CONTENTS

	Page
The Gold Coast, Ashanti, and Kumassi; by George K. French	1
All around the Bay of Passamaquoddy; by Albert S. Gatschet	16
Return of the Hourst Niger Expedition; by Ernest de Sasseville	24
Geographic Serials; [Henry Gannett]	25
Geographic Notes	26
Miscellanea	27
Proceedings of the National Geographic Society	28
The National Geographic Society: Synopsis of a course of lectures on the effects of geographic environment in developing the civilization of the world; Gardiner G. Hubbard	29
Crater Lake, Oregon; by J. S. Diller	33
The Utilization of the vacant Public Lands; by Emory F. Best	49
The Mazamas; J. S. Diller	58
Geographic Literature (Elementary Geology, Tarr; The Lessons of Erosion Due to Forest Destruction; Preliminary Report on the Income Account of Railways in the United States; Virginia Cartography, Phillips)	59
Geographic Serials; [Henry Gannett]	61
Proceedings of the National Geographic Society	63
Miscellanea	64
Storms and Weather Forecasts; by Willis L. Moore	65
Rubber Forests of Nicaragua and Sierra Leone; by A. W. Greely	83
Recent Explorations in Equatorial Africa; Ernest de Sasseville	88
Geographic Literature (Laboratory Practice for Beginners in Botany, Setchell; An Introduction to Geology, Scott)	91
Geographic Serials; [Henry Gannett]	92
Proceedings of the National Geographic Society	94
Geographic Notes	95
A Summer Voyage to the Arctic; by G. R. Putnam	97
Area and Drainage Basin of Lake Superior; by Mark W. Harrington	111
The Siberian Transcontinental Railroad; A. W. Greely	121
Geographic Literature (Glaciers of North America, Russell; A Treatise on Rocks, Rock Weathering, and Soils, Merrill)	124
Geographic Serials; [Henry Gannett]	127
Proceedings of the National Geographic Society	128
A Winter Voyage through the Straits of Magellan; by R. W. Meade	129
Admiral R. W. Meade, U. S. N.; [John Hyde]	142
Costa Rica; by Ricardo Villafranca	143
Applied Physiography in South Carolina; by L. C. Glenn	152
Sheik Said; Ernest de Sasseville	155
Geographic Literature; [John Hyde]	156
Geographic Serials; [Henry Gannett]	157
Proceedings of the National Geographic Society	159

Page

Miscellanea 160
The Effects of Geographic Environment in the Development of Civilization in Primitive Man; by GARDINER G. HUBBARD 161
The National Forest Reserves; by FREDERICK H. NEWELL 177
George W. Melville, Engineer-in-chief U. S. N.; [A. W. GREELY] 187
Geographic Serials; [HENRY GANNETT] 190
Proceedings of the National Geographic Society 191
The Venezuelan Boundary Commission and its Work; by MARCUS BAKER 193
Mineral Production in the United States; [JOHN HYDE] 201
The Forests and Deserts of Arizona; by BERNHARD E. FERNOW 203
Mount St. Helens; by CHARLES P. ELLIOTT 226
Geographic Literature (Magnetic Declination in the United States, Gannett; Carpenter's Geographical Reader; Studies in Indiana Geography, Dryer) 230
Modification of the Great Lakes by Earth Movement; by G. K. GILBERT 233
The Toronto Meeting of the British Association for the Advancement of Science; [JOHN HYDE] 247
The Great Unmapped Areas on the Earth's Surface Awaiting the Explorer and Geographer; by J. SCOTT KELTIE 251
The Compass in Modern Navigation; by G. W. LITTLEHALES 266
The Enchanted Mesa; by F. W. HODGE 273
Electric Street Railways; [JOHN HYDE] 284
Geographical Research in the United States; by GARDINER G. HUBBARD and MARCUS BAKER 285
A Brief Account of the Geographic Work of the U. S. Coast and Geodetic Survey; by T. C. MENDENHALL and OTTO H. TITTMANN 294
United States Daily Atmospheric Survey; by WILLIS L. MOORE 299
Geographic Notes 304
Patagonia; by J. B. HATCHER 305
Hatcher's Work in Patagonia; [W J MCGEE] 319
The Sushitna River, Alaska; by W. A. DICKEY 322
A Winter Weather Record from the Klondike Region; by E. W. NELSON 327
The Russian Census of 1897; [A. W. GREELY] 335
The Washington Aqueduct and Cabin John Bridge; by D. D. GAILLARD 338
Gardiner Greene Hubbard; [JOHN HYDE] 345
Pollution of the Potomac River; by F. H. NEWELL 346
The Delta of the Mississippi River; by E. L. CORTHELL 351
The Annexation Fever; HENRY GANNETT 354
Sir John Evans and Prof. W J McGee; [JOHN HYDE] 358
Some Recent Geographic Events; [JOHN HYDE] 359
Geographic Literature 362
Proceedings of the National Geographic Society 365
Geographic Notes 367
Index; [W J MCGEE] 369

ILLUSTRATIONS

	Page
One of the huts of King Prempeh's palace	1
Military road from Cape Coast Castle to Kumassi	3
The king of Elmina and his court	7
Ashanti women	10
Ashanti children	11
A royal progress in west Africa	12
Domestic architecture of Kumassi	13
A slayer of thirty thousand	14
The king of Beckwai and his court	15
Crater lake, Oregon (pl. 1)	33
Map showing routes to Crater lake	35
Rim of Crater lake	36
Map of Crater lake	38
Glaciated rim of Crater lake	39
Southern shore of Crater lake	43
Section of Crater lake and Mount Mazama	45
Snowdrift on Wizard island	47
River stations (pl. 2)	72
Winter storm, 1893 (pl. 3)	73
Winter storm, 1893 (pl. 4)	74
Winter storm, 1893 (pl. 5)	74
Hot wave, 1896 (pl. 6)	74
Cold wave, 1886 (pl. 7)	76
Cold wave, 1886 (pl. 8)	77
Cold wave, 1886 (pl. 9)	77
Cold wave, 1886 (pl. 10)	77
Cold wave, 1886 (pl. 11)	77
Cold wave, 1886 (pl. 12)	77
Cold wave, 1886 (pl. 13)	77
Cold wave, 1886 (pl. 14)	77
Tornado at Louisville (pl. 15)	78
Tornado at St Louis (pl. 16)	78
West India hurricane (pl. 17)	80
Change in air pressure (pl. 18)	80
West India hurricane (pl. 19)	80
Change in air pressure (pl. 20)	80
West India hurricane (pl. 21)	80
Change in air pressure (pl. 22)	80
West India hurricane (pl. 23)	80
Change in air pressure (pl. 24)	80
West India hurricane (pl. 25)	80
Change in air pressure (pl. 26)	80
Route of the *Hope*	90
A settlement on Umanak fiord	102

Page
A Greenland family 104
Kayaker in Umanak fiord 105
Face of Itivdliarsuk glacier 107
The *Hope* in the ice off Cape Mercy 108
Cumberland Sound Eskimos 109
Portrait of Admiral R. W. Meade, U. S. N. (pl. 27) 129
Map of the straits of Magellan 131
Limon, Costa Rica 144
The cathedral at San José, Costa Rica 146
A street in San José, Costa Rica 147
In Talamanca, Costa Rica 150
Portrait of Engineer-in-chief Geo. W. Melville (pl. 28) 161
Forestry diagram 181
Classified land diagram 183
Typical view of the Grand Cañon (pl. 29) 193
Petrified stump, Arizona 207
Petrified logs, Arizona 209
San Francisco mountains (pl. 30) 215
The Cañon country 224
Map of Mount St Helens (pl. 31) 228
Ancient and modern outlines of Lake Erie 234
Ancient and modern outlines of Lake Ontario 235
The Nipissing Great Lake 236
Oscillations of the surface of Lake Michigan 240
Annual oscillations of the surfaces of the Laurentian lakes 241
Lake surface as used for measuring earth movements 241
Map of the Great Lakes, showing gauging stations, etc 243
The Enchanted Mesa (pl. 32) 273
The great sandstone cleft of the mesa (pl. 33) 274
Enchanted Mesa from the south 277
The flattest part of the mesa (pl. 34) 279
An artificial monument on the summit of the mesa 280
Enchanted Mesa from the southeast 281
Map of the mesa summit 283
Mayer glacier, Patagonia (pl. 35) 305
Tehuelche boy 307
Tehuelche family and toldo 309
Map of Patagonia 311
Sierra Ventana, Patagonia (pl. 36) 313
Mount Leviathan, Tierra del Fuego 315
Typical view of the Pampas, Patagonia (pl. 37) 317
Map of Sushitna river, Alaska 323
Portraits of Sir John Evans and W J McGee (pl. 38) 337
Aqueduct bridge over Cabin John creek, near Washington, D. C. 341
Cabin John bridge, Washington aqueduct, the largest stone arch in the world (pl. 39) 344
S. A. Andrée 360

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