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BULLETIN

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AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XLI 1909. No. 2

THE ORIGIN OF THE ALPS.*

BY

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Geography is based on exploration and investigation. No less necessary than the work of the pioneer, who penetrates into unknown countries, is the work of the scientist who studies minutely a more limited region and tries to clear up certain scientific questions.

While in the interior of Africa and Asia and the Polar regions of both hemispheres international geographical explorations were going on, the Alps were the chief field of geographical research in Europe, and most new ideas on the origin of mountains have arisen there or have been proved there. Half a century ago it was believed that the Alps were formed by a vertical upheaval. It was imagined that the rocks which form the axis of the mountain range came as an eruptive rock from the interior of the earth and that they pressed together the layers deposited along the sides of that region where they were intruded. But later we learned that the Alps were formed by folding of the strata caused by lateral compression of the crust of a shrinking globe, which shrinking was believed to be the result of a loss of heat. Indeed, there are regions in the Alps where we can see a very clear crumpling of the strata. Every visitor to the Lake of Lucerne knows how the strata along the Axen-Strasse are folded and compressed, and every visitor to the Säntis Chain

* An Abstract of a Lecture before the American Geographical Society on Nov. 24, 1908.

knows the remarkable anticline which forms Mt. Säntis and has also seen the synclines of the neighbouring valleys.

One of the most eminent geologists of Switzerland, Arnold Escher von der Linth, pointed out this system of anticlines and synclines, which is, indeed, of astonishing perfection. We find here the layers of the lower, middle, and upper Cretaceous forming a system of folds, and these folds rise from a country in which are younger deposits of early Tertiary age. It was believed by Escher von der Linth that these Cretaceous layers were pressed up amid the older Tertiary deposits. A recent investigation of the chain, however, has convinced Albert Heim that these older layers are not pressed upward from beneath the younger ones, but that they are pushed over them, and that all those wonderful folds of the Säntis Chain are merely afloat on the younger rocks. This mountain chain has no roots in the crust of the earth. Its whole mass has been transported.

This new explanation is coincident with the new ideas on the formation of Alpine structure, and these ideas have been formed step by step. The first decided step was made by Albert Heim who showed us that in very extensive parts of the Glarnese Alps older strata are found above younger ones. He thought at first, as did his master, Escher von der Linth, that these phenomena must be explained by the assumption of a double fold of rocks, one pushed from the north and the other from the south, by which movement older strata were forced above younger ones. But Marcel Bertrand showed that there was another explanation possible, which assumes only one fold which was thrust over a region of considerable width. This idea of Marcel Bertrand did not attract much attention in the beginning, but later the researches of Hans Schardt in the region of the upper end of Lake Geneva, which were confirmed by those of Lugeon, have demonstrated that the conception of Bertrand on the structure of the western Alps was right, as it was always believed to be by Eduard Suess. In consequence, Heim adopted it for the Glarnese Alps.

Now we know that the chains of the Alps are only partly formed by material which is at present at the place where it was deposited and where it is pressed together as if in a vice. Only a part of the mountains is autochthonous; the whole border of the Swiss Alps from the Valley of the Rhine to the Valley of the Rhone is allochthonous. That is, the chains consist of layers which have been deposited farther south than the regions in which they are found.

We can distinguish in the border region of the Alps of Switzer-

land three different overthrust layers, lying one above the other and all upon an autochthonous substratum of older Tertiary deposits. We see at first material, which can be derived from the north side of the Swiss Alps, forming the so-called Helvetian thrust layer. Above this we find the thrust layer of the Klippen, the origin of which lies in the central zone of the Alps. Above that we meet with a third thrust layer, the material of which comes from the south side of the Alps, and that is the so-called East Alpine thrust layer.

Every thrust layer consists of a set of folds which are thickest and very much pressed together just at the outer edge of the layer, where they form enormous, flat-lying folds. Only in a few cases is it possible to trace back the overthrust layers to their roots. As a rule, this connection cannot be followed, and it is only by the position of the overthrust layers that we can judge as to the places of their probable derivation.

Such an arrangement is not consistent with the idea that the folds of the Alps were made directly by lateral pressure. This whole condition reminds one of material which has slid down, as, for example, the material of a landslide. Such material, indeed, forms an arrangement similar to a thrust layer. It is very much pressed together at its outer edge, and several writers have suggested that these thrust layers were moved under the influence of gravity which caused a downward movement of materials, which, for some reason—probably through strong lateral compression—became over-elevated so that they could not stand and consequently flowed down.

As a consequence of these ideas, we have to assume that, at those regions where we to-day find the thrust layers, formerly a depression existed into which the material could slide down, and that, instead of the high border ranges of the Alps from the Säntis over the Glärnisch to the Diablerets, a low ground extended into which the different thrust layers moved down and which later became elevated. Thus we become aware that the folding of the strata is not the direct cause of the present mountain range but that the latter came into existence later by elevation. Indeed, there are very extensive tracts in the Alps which are very high but which are not folded at all. We think here of the well-known Dolomite region of Southern Tyrol. Here we find horizontal layers of Permian and Triassic age forming mountains the height of which varies from 9,000 to 10,000 feet, and which are often covered with glaciers.

We have distinct proof in the structure of these mountain ranges that folding is not the necessary corollary of mountain-making even in the Alps and that the more elevated parts of the Alps owe their

height to a vertical movement of the earth's crust in the same way as the plateau of Colorado. Indeed, there is a remarkable similarity in the structure of the southeastern Alps and that plateau. The difference consists only in the amount of dissection. The Colorado plateau is only cut through by a river and the highland still stands nearly untouched. In the southeastern Alps, however, the plateau is almost totally destroyed and only pillars of material remain which indicate its former height.

Recent investigations have shown that the vertical movement which caused the elevation of the Alps is still going on and that it was very considerable even in the last geological period, that is, in the Quarternary or Pleistocene.* These proofs are given by the surface features of the mountains. We can trace in our deep Alpine valleys terraces of rock which indicate older valley floors. These valley floors do not have that slope which is characteristic of river valleys. This slope is rather slight in the interior of the mountains, and it becomes pretty steep at the edge of the Alps. This arrangement indicates a general upheaval of the Alps which was felt most strongly just at the border of the mountain chain.

A very important feature in the main valleys of the Alps proves the continuity of their elevation until very recent times. We find now and then deposits of former lakes which were ancestors of the lakes of to-day, but the deposits lie far higher than a lake could exist to-day. The repeated recurrence of these facts points to a general cause which we assume consists in an elevation of the Alps with the lake deposits in their valleys above the surrounding country.

The mountain region which had just been elevated had some other surface features than the Alps of to-day. The mountains were not so high; their forms were more rounded; their valleys were broader and not so deep as to-day. The whole surface of that mountain region was in a state of orographic maturity. At the northeast end of the Alps, especially in Styria, these mature surface features still exist. At other places they are dissected by very deep valleys. Thus, for example, in the southernmost parts of the Tyrol west of Lake Garda and southeast of Trient. Here the highlands have the soft rounded forms of a mature landscape. Those mountainous parts are separated from each other by valleys with very steep slopes. The slopes are evidently cut into the older formations. Even in the interior of the mountain chain we find remnants of its former maturity. We meet with very broad valleys and mountains, the

* A detailed description of the corresponding facts is given by the author and Ed. Brückner in: Die Alpen im Eisseitalter, Leipzig, 1909.

general outline of which is a rolling one. Even the chain of the Mont Blanc conserves features which indicate that the chain was formerly rounded.

We must expect, indeed, that a region which becomes elevated above the surrounding country will have a kind of rejuvenation of its forms. Its rivers must begin to erode deep channels into their former valleys. But the rejuvenation of the Alps is only partly due to river action. It is for the larger part caused by ice. During the great Ice Age the Alps were four times covered with a vast mantle of ice, and the very glaciers which filled up the valleys have left everywhere the traces of their former existence. They eroded the valleys in a very characteristic way, giving them U-shaped cross sections. The larger the glaciers, the deeper were the valleys eroded. The larger valleys became far deeper than the smaller ones. They are over-deepened; the smaller are hanging at their sides. We do not find in the Alps that regular joining of river floors which corresponds to the law of Playfair and which is so characteristic of valleys excavated by water. The law of Playfair, which applies to the formation of true river valleys, is not valid in the Alps with the exception of those parts which have not suffered from the glacial action; namely, those parts lying in the northeast corner of the mountain chain. Here we find numerous river joinings at grade and, as already mentioned, between them rounded mountain forms. Everywhere we have to deal here with true orographical maturity, in the words of William M. Davis.

Where the main Alpine valleys show the characteristic over-deepening and the lateral valleys are hanging along their sides, the lateral affluents of the main rivers either come down in waterfalls or in narrow gorges which they have excavated, just in the step which separates the floor of the over-deepened main valley from that of the hanging valley. In these gorges we find the finest display of river action one can imagine. The water rushes down, whirling out pot-holes, foaming over ledges. Here are the places where we can study water erosion. Water, however, does not erode in the over-deepened valleys, but deposits there the material it carries along with it in the form of enormous alluvial fans. Thus deposition occurs to-day where the glaciers have exercised their strongest erosion, and, on the other hand, the river action in the Alps is most conspicuous at places where glacial erosion has been least.

The over-deepening of the main valleys extends as far as the old glaciers reached. At the end of the glaciation the bottom of the over-deepened valley gently rises to the level of the pre-glacial valley

floor. Thus concave forms in the over-deepened valleys come into existence which are partly occupied by lakes and partly filled out by later river deposits. All large lakes in the Alps lie near the end of the old glaciers and most of them are surrounded by important terminal moraines of the old glaciers. A few, however, do not reach as far as the ice extended, and occupy regions where the over-deepening of the valleys by the glaciers ceased from other causes. All great Alpine lake-basins, however, have been eroded by the ice, though some of them are partly dammed up by the moraines just at their end.

It is also due to the existence of former glaciers that the mountains of the Alps have lost their rounded forms. Glaciers have gnawed into these mountains. They have excavated those interesting forms which are called "corries" in Scotland, or "cwmbs" in Wales, or cirques in North America. These are the "kare" of the Alps. These kare have been compared to armchairs. Their flat bottom is surrounded on three sides by steep walls and in several groups of the Alps we can still follow the original rounded surface between the kare, but in other ranges these kare become so large that the steep walls of neighbouring and opposite kare meet together, forming a sharp crest-like ridge. These ridges are the characteristic feature of the high parts of the Alps. In the very high parts they divide glaciers from each other which are still continuing the deepening of the kare. At those heights which have already lost their glaciers, they form the surroundings of little lakes which are found on the floor of old, small glaciers, as the big lakes on the floor of the larger glaciers. In many parts of the Alps neighbouring kare unite and their bottoms join together to form a terrace above the over-deepened part of the valley. At those places there is a regular succession of forms; the U-shaped bed of the main glacier, the steep slopes, and above those slopes a shoulder on which were lying the lateral affluents.

The Alps as they are to-day are only the ruin of what they formerly were. Their surface is not at all as it was once believed to be, a direct result of crustal movements which split asunder the mountains and formed the valleys as crevasses. The highest parts are not those which have been elevated highest, but they consist mostly of the hardest material which offered the greatest resistance to weathering. The valleys are, however, the work of rivers and are modified very much by ice. The elevation of the mountains is not the direct result of a folding of the strata, but of a recent uplift which occurred over a zone of central Europe which had only partly

a very complicated structure and which, on the other hand, had a very simple structure, and which before its elevation had rounded mountains and well-graded valleys.

The complicated structure, which is best seen along the north side of the Alps, can be regarded as a consequence of enormous fundamental folding by which one part of the Alps became very much elevated, probably as a result of compression, while the neighbouring part sank down. And, as in the over-deepened valleys of to-day, we now and then meet with considerable mountain-slides, those parts of the over-elevated fold seem to have slipped down into the sunken part of the fold. We now and then meet on the floor of the ocean forms which remind us of such fundamental folds. There are very deep troughs outside of islands, and between the islands and the troughs we encounter very steep slopes on which our telegraph cables are often torn asunder, a fact which has been repeatedly ascribed to local slides occurring here. There are, indeed, some reasons to believe that the folding of the strata of the Alps had something to do with the formation of a deep trough on the earth's crust. Their strata exhibit often far greater thickness than we see elsewhere, and their character differs pretty much from that of the surrounding layers. But the reconstruction of the geographical features of the unfolded region met with one difficulty; that is, layers which were formed under very different geographical conditions are found in the adjoining regions, a fact which is easily explained by the assumption of the very considerable overthrusts which occurred. These overthrusts could not have occurred at the surface of the earth, and, if we find the relics of thrust layers confined to small mountains, as, for example, Mythen near Lake Lucerne, then we become aware of the enormous amount of erosion which has lowered the Alps. But this erosion has been counteracted by a recent uplift.

Thus the origin of the Alps is a very complicated one, and, although much has been added to its history during recent years, still many problems remain to be solved.

CAMPING ON THE SOUFRIÈRE OF ST. VINCENT.*

BY

EDMUND OTIS HOVEY.

One hundred miles due south of the crater of Mt. Pelé, Martinique, lies its associate in eruption, the great crater of the Soufrière of St. Vincent. This was the second main object† of my expedition to the West Indies in the spring of 1908 in behalf of the American Museum of Natural History, and, after five weeks in Martinique, my wife and I sailed for St. Vincent by way of Barbados and Grenada. It is not easy to get around from one island to another in the West Indies, especially between the French and the English colonies, and one's routes are often circuitous. We reached Kingstown, the capital and chief town of the island, an hour after sunset on June 15, and the next afternoon took the picturesque ride of about fourteen miles in the mail canoe along the leeward coast to the village of Château Belair, about a mile south of the limit of the actual devastation caused by the eruptions of 1902 and 1903.

St. Vincent is less than 18 miles long and 8 miles broad, but it is extremely mountainous, there being comparatively little flat land on the whole island. A continuous line of volcanic mountains, varying from 2,700 to more than 4,000 feet in altitude, runs from south to north and sends out great spurs to either coast. Those along the west coast have been cut off abruptly by the sea and present many bold bluffs to view, rendering the canoe ride extremely interesting, with a succession of fertile valleys opening into the interior giving glimpses of cultivated fields and great expanses of dense forests. Here and there a little village stretches along the coast or a "great house," with its attendant factory and hamlet, nestles among the cane, arrowroot or cotton fields of its plantation.

Camden Park, two miles from Kingstown, is one of the village sites purchased by the Colonial Government from the relief fund contributed by sympathizing friends all over the world and built up with cabins for the use of the negroes who were rendered homeless by the eruption. Layou, three miles beyond, is a village at the mouth

*Published with the permission of the American Museum of Natural History. Expedition of 1908, aided by a grant from the Esther Hermann Research Fund of the New York Academy of Sciences.

† See BULLETIN, Nov., 1908, for account of the Martinique portion of the expedition.

of a valley that evidently was a favourite resort of the ancient Caribs, since many stone implements have been found here and a famous sacrificial stone covered with strange hieroglyphics is about a mile back from the coast. Three miles beyond Layou the canoe halts at the village of Barruali, quaintly placed on the coast at the base of a great cliff of columnar lava. The next stop is the end of the route, Château Belair, not a big place, but the most important town on the leeward coast. It lies upon an excellent harbour.

Although so near the devastated zone, I begrudged the two miles intervening between Château Belair and the nearest part of my work

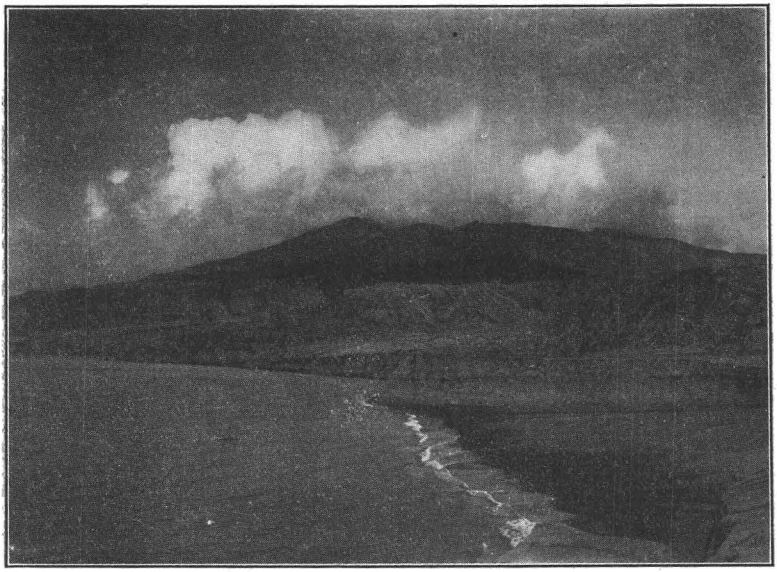

FIG. 1—THE SOUFRIÈRE OF ST. VINCENT.
MOUTH OF WALLIBOU RIVER IN FOREGROUND. MARCH, 1903.

on the Soufrière, hence, after two nights of camping out in the Government "rest room" in the police headquarters, we took our tents and other outfit in a canoe and established ourselves on a smooth little bench of new volcanic material beside the mouth of the Wallibou River at the base of the great Soufrière, not more than one hundred yards from a copious spring of delicious, pure water. It seemed an ideal place for a camp, but we had our periods of anxiety, since we were really too close to the bed of the Wallibou, a stream that is dry most of the time, but is subject to frequent floods, due to heavy rains on its mountain watershed, most of which is still practically barren of vegetation as a result of the eruptions.

The second day of our stay in camp we had a shower which can only be appreciated by those who have been in the tropics in the rainy season. For an hour or more the rain fell in sheets,—it simply seemed to come down solid water,—it poured. It was not long before the river appeared, coming down its bed in a roaring, sand- and boulder-laden wave, and in a very few minutes the sloping dry gravel plain, a fifth of a mile wide in front of our tent, was covered with a network of shallow channels which changed their locations with alarming frequency and quickness and threatened to undermine the little bluff on which our tent had been pitched. An extremely interesting feature of the flood was the way in which the water came down in waves or pulsations. During the most vigorous flow these

FIG. 2—BARRUALI MAIL CANOE "MIZPAH."

waves were two feet high and only a few seconds apart. Perhaps they corresponded to the squalls of heavy downpour characterizing the rain storm, for the denuded watershed cannot hold back the water falling upon it to make the run off uniform. Boulders a foot or more in diameter were rolled swiftly along in these sand-saturated waves and carried long distances on the road to their final resting place, the sea. The flood subsided, however, without doing us any damage and did not rise again during our stay in camp, so that we had no further trouble on that score. With Camp Wallibou as a centre, geological excursions were made in every direction, the most important of which, of course, were to the crater and the summit of the mountain.

The ascent of the Soufrière of St. Vincent is one of the best, if not the very best, excursion in all the Lesser Antilles. The trail from

the leeward is the most practicable route now. One follows the bed of the Trespé Dry River, close to the Wallibou, for three-quarters of a mile and then climbs sharply 300 feet upward to the north out of the river bed to gain the crest of the ridge which leads directly to the rim of the crater. Grass, bushes and young trees now cover the lower slopes of the mountain and render progress out of the valley somewhat uncomfortable, because the vegetation is tall enough to cut off the wind, but not tall enough to furnish any protection

FIG. 3—WALLIBOU CAMP.
WALLIBOU BLUFFS IN BACKGROUND.

against the vertical rays of the tropical sun. The crest of the ridge, however, is comparatively free from vegetation, and after gaining it one has little trouble from that source, except for the vines which throw their creepers treacherously across the trail and trip the unwary traveller.

The trail itself is safe enough, but there are several places where one needs a steady head, for the path is barely six inches wide and the sides slope off rapidly, soon becoming precipitous. Progress

is like walking the ridge-pole of a steeply pitched roof. About 1,500 feet above the sea the vegetation practically ceases, even grass being extremely scanty and small, and 200 feet higher the grass also fails except for widely scattered bunches The May, 1902, eruptions deposited enormous quantities of fine mud over the leeward side of the mountain, the coating being from three to six feet deep, even where no drifting took place. The October outbursts of the same year sifted sand and gravel over the mud. The loose stones remain on the surface between the altitudes of 1,000 and 2,000 feet,

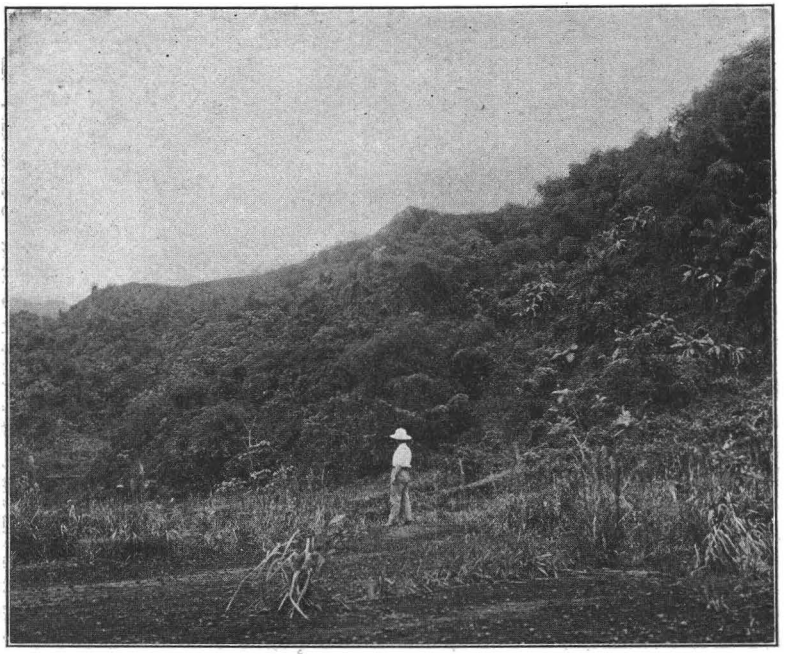

FIG. 4—BLUFF AT WALLIBOU CAMP.
SHOWS RENEWED VEGETATION ON A PROTECTED SLOPE.

and make one's steps rather uncertain, but above 2,000 feet the well-compacted mud gives good foothold.

Less than three hours after leaving the sea coast, on June 17, my wife and I stood on the rim of the crater at 3,013 feet above tide* and looked down into the wonderful open pit that forms the celebrated crater of the Soufrière. This is about nine-tenths of a mile in diameter from east to west and possibly 2,000 feet deep to the lake that occupies the bottom, estimating from the highest point of the

* British Admiralty chart of St. Vincent. Edition of 1890.

rim, which is opposite the point where the leeward trail arrives at the crater's edge. As one stands at the point where the trail reaches the rim, he has the lake more than a quarter of a mile below him, surrounded by vertical and nearly vertical walls which render the water inaccessible to anything without wings. The walls consist of alternating beds of columnar lava and solidified ash, indicating the changes that have taken place in the activity of the volcano and the consequent upbuilding of the mountain.

Prior to May, 1902, the Soufrière was noted for the beautiful lake of green water set like an emerald in the dark green of verdure-

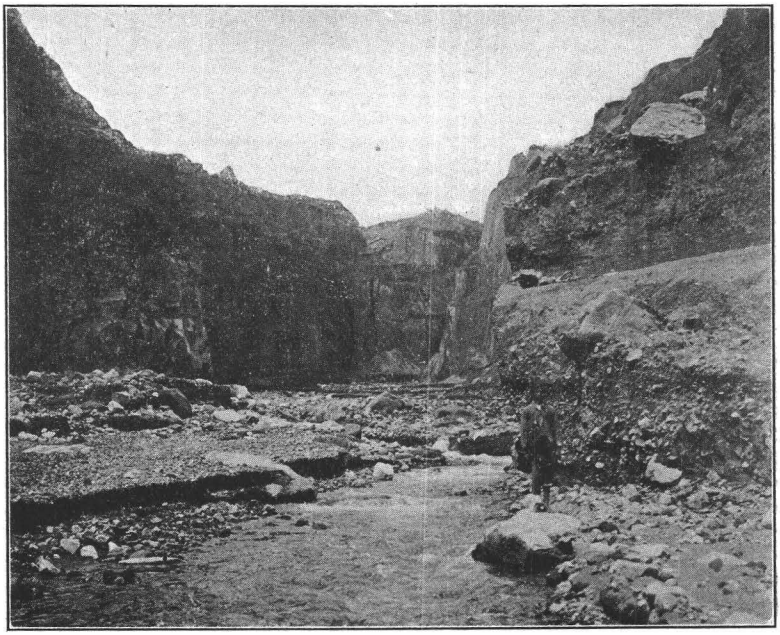

FIG. 5—WALLIBOU GORGE.
LOOKING UP STREAM TWO MILES FROM THE SEA.

covered crater walls. The 1890 edition of the British Admiralty chart of the Island of St. Vincent gives 1,930 feet as the altitude above tide of the surface of the lake. Mr. P. F. Huggins, a native resident of St. Vincent, states* that he took soundings on visits to the bottom of the crater in 1896, 1898, 1899, and 1900, and found the water to be 87½ fathoms (525 feet) deep in the middle of the lake. This deep lake was thrown out by the eruptions and its place taken at a much lower level by a shallow pool of

* An account of the Eruptions of the Saint Vincent Soufrière. 16mo, pp. 32, 2 pl. St. Vincent, 1902.

brown, muddy water, while the walls were completely denuded of vegetation. For about two years this pool was troubled with gentle puffs of steam or thrown out and destroyed by strong eruptions; but now the crater is perfectly quiet, not a wisp of steam being visible anywhere, and the lake has regained much of its former size and depth. The water is a beautiful yellowish green, varying in shade with the time of day and other accidents of light and shade. The walls give various tones of red, purple and gray, producing a marvellous setting to the green lake. A gale of wind was tearing over the mountain top at the rate of 60 to 75 miles an hour during our visit,

FIG. 6—THE "NEW" CRATER OF 1812.
NOW FILLED WITH ASH OF THE 1902 ERUPTIONS.

much to our discomfort. The wind whistled over the rim of the crater and swirled down to its depths, lashing the waters of the lake into white-capped waves, or scurrying across the water in vicious whirlwinds that threw spray high into the air.

It is hard to say exactly what changes have taken place in the crater, since no accurate survey of it on a large scale was made before the eruptions began, and none has been made since. The appearance of the rim makes it seem probable that there has been no great change in its contour. Along the southern and south-western portions, sections show that a layer of fine ash, probably not more than six feet thick, has been added to its height. The south-eastern crest has lost by erosion much of the layer of new ash. There

seems to be no indication of the thickness of the new material on the remainder of the rim. The interior of the crater has certainly been enlarged through widening due to the countless landslides resulting from the undermining action of the explosions and the stripping off of the old protective coat of vegetation. This widening has been most pronounced in the eastern half of the crater. The crater is thought also to have been deepened by the May, 1902, eruptions.

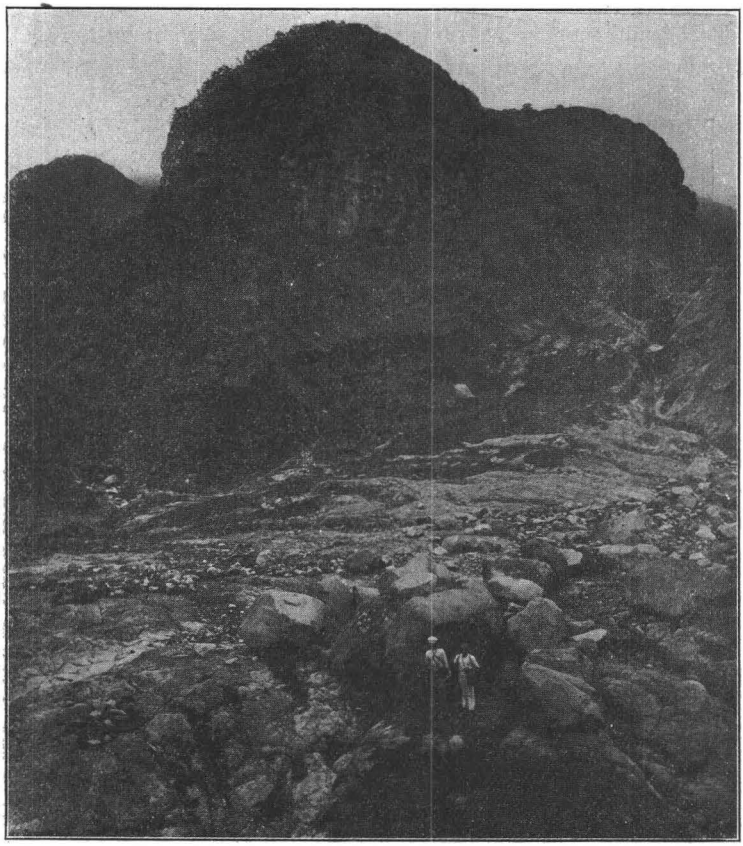

FIG. 7—WINDWARD TRAIL.
ROCK CROSSING AT 420 METERS, SHOWING BIG BOULDERS BROUGHT DOWN SINCE MARCH, 1903.

It was partly filled by the outbursts of October, 1902, but the débris was thrown out again by the more gentle activity of the succeeding months and the eruption of March, 1903, which was the latest great spasm, left it comparatively clean.

One of my desires was to see the windward or eastern side of the mountain and the island. I wanted to go over the top and down the

old trail into the Carib Country, as the region north of Georgetown is called, but several experienced negroes at Château Belair said it was impossible. Only one man had made the trip across the mountain since the Rev. Thomas Huckerby and I had gone over in March, 1903, and this man had come over, three years ago, from Georgetown. The trail to windward was reported washed away for much of its course and deeply ravined. Not to be discouraged easily, I sent for James Jarvis, the colored man who went across with Mr. Huckerby and me five years ago, and asked him what he thought of the enterprise. He told me that he had not been over since he went

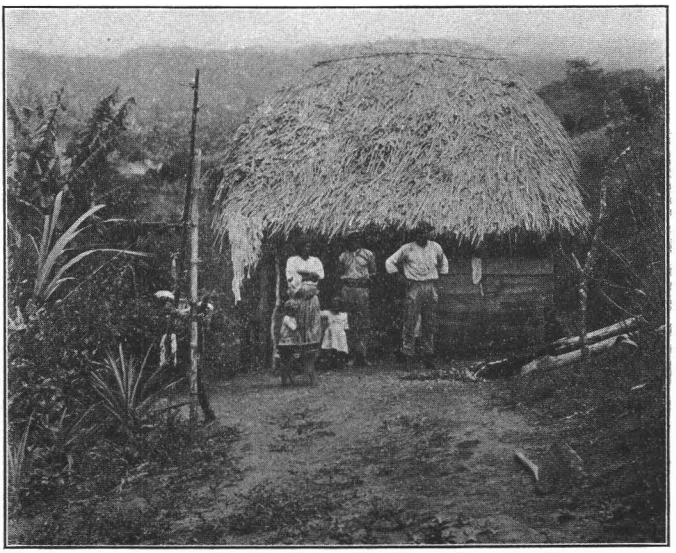

FIG. 8—NEGRO HUT.

with us, but that he was willing to make the attempt, since he thought the journey could be made.

The second porter was more difficult to find, and Jarvis approached five men before he was able to find one who was willing to accompany us, even at the more than triple wages I was ready to pay. One man had just hurt his foot, another did not see where he was going to get enough to eat, though I was responsible, of course, for their nourishment while on the expedition, and so on. The fact was that they were afraid to go, but I got my expedition organized in season and we left Château Belair at 6 o'clock on Wednesday morning, June 24, having broken camp the day before, since my work on the leeward side was finished.

The ascent from leeward was made without difficulty or incident, and when we reached the eastern side of the crater and had eaten our luncheon the clouds began to lift from the top of the mountain. Soon the whole summit was clear and I had a much-needed opportunity of examining the "new" crater, as it is called, which is the comparatively small vent that is said to have opened in the top of the mountain on the northeast side of the great crater during the eruption of 1812. The new crater has been two-thirds filled up with débris by the recent eruptions, and is now only about 50 feet deep below the lowest part of its rim. At 2:30 o'clock we began our descent to windward, and had to choose our way carefully, since no trace of the upper part of the trail remains. We found the right ridge directly and got along finely for the first thousand feet of descent, in spite of the loose stones and gravel covering the mountain side, which render footing uncertain.

About 2,000 feet above the sea the spur of our ridge, that we knew we ought to follow, dropped suddenly as a knife edge 250 feet into a great gorge. The ravine at the right proved to be impassable, ending at the same gorge in a precipice of 100 feet fall. The descent to the left looked almost as bad, on account of its steepness, but it was the only way, and down we started. This third attempt proved successful, projecting stones and convenient bushes, ferns and grasses enabling us to descend to the bed of the torrent across which the old trail went. My barometer gave the height of this almost vertical slope at 130 feet. Seeking to find an easier route than the farther side of the gorge offered, we descended the stream bed for some distance, only to find ourselves at the top of a sheer rock precipice at least 80 feet high.

Down or around this fall we could not go, hence we retraced our steps to a point near the place where we had succeeded in reaching the bottom of the gorge. Scaling the farther wall here, we found a few yards of the old trail along the side of the next ravine, but we could not follow its route on account of erosion, and we scrambled down to the stream bed. Here we got along very well and thought our difficulties conquered. Ten or fifteen minutes' walk showed us our error, for we came to the head of a series of precipices and gorges which were quite impassable. On the other side of the gorge we could see remnants of the old trail marked by a horizontal line of growing bamboos. We took courage then, for we were sure that there must be some way of reaching that path. Going back a quarter of a mile we plunged into a thicket of young trees, bushes and vines, now really dense and hard to penetrate, and

after some hard, sharp work succeeded in finding the obscure and broken path which we had seen from a distance. This was indeed the old trail, and we soon reached the head of the ridge leading directly to the ruined Lot Fourteen estate and thence to our destination, the Orange Hill estate in the midst of the Carib Country.

This, the windward side of the Soufrière, in contrast with the leeward side, received only coarse material, coarse sand, gravel, cinders and bombs from the eruptions, and, although a larger area was seriously affected, the damage seems less likely to prove lasting. The deposit is more porous in character, hence it has not caked like the dust of the western side, but it has allowed water to penetrate to the old soil below and has not prevented vegetation from coming up through a coat of moderate thickness. This porosity of the deposit and the greater rainfall of the windward side have combined to cause vegetation to advance more rapidly than it has to leeward and the general appearance of the lower slopes of the mountain is one of verdure. Even 2,200 feet above the sea we found abundant grass, bushes and ferns. The northern slopes of the ancient crater wall around the northern part of the present crater were not scorched so badly, and they have recovered their old appearance. Close inspection, however, shows the black, cinder-like ash nearly everywhere on the ridges, though the slopes have been washed nearly clean by the rains of six wet seasons, and enormous quantities of ash have been carried down to the sea by the rivers, particularly the Rabaka.

The day after crossing the mountain was devoted to an inspection of the estates that were "devastated" by the eruptions. There were seven of these, almost entirely devoted to sugar cane and arrowroot, comprising about 3,500 acres of tillable land. This region was covered with from nine inches to three feet of new ash. Five of the estates, including about 2,500 acres, have been put back again for the most part into cultivation. One estate has not been touched, for lack of labourers, and the Lot Fourteen estate is practically abandoned, at least for the present, on account of the thickness of the coat of ash over most of it.

In St. Vincent the relief funds have been administered more judiciously than in Martinique and the planters have received some assistance in restoring their land to a productive condition. At the present writing (June, 1908) a canal is being constructed to bring water from Mt. Brisbane to five of the estates already mentioned for use in the sugar and arrowroot factories. The government has contributed $8,000 toward the cost of the undertaking, while the owner

is paying the remainder of the expense, which will be $10,000 or $12,000 more.

The return trip to Château Belair was accomplished without difficulty. It was rendered interesting by a heavy rain squall striking the great crater while I was on the rim. The strong trade wind was blowing a gale as usual, bringing up the clouds in banks from the east-south-east. These curled over the eastern rim of the crater, dived into its depths, concealed the lake for a moment and then swept up and out into the Larikai Valley that descends precipitously to the sea on the west. A black rain cloud came up from the Atlantic and spread its thick mantle over the midday sun, making the crater a dismal abyss and doubling its apparent depth. The rain then fell in torrents, and was driven in sheets against the crater's walls by the fierce wind. The lake was beaten into foam by the thickly falling drops, and cascades drew many snow-white lines down the surrounding precipices. It was a weird and beautiful sight, soon over, but long to be remembered.

At present there is no sign of activity about the Soufrière, not a bit of stream or a fumarole or even a warm spring remaining as a witness of the violent eruptions that occurred so recently. It is not safe to make predictions about volcanoes, but that of St. Vincent seems to be sleeping again and perhaps has entered upon another 90-year period of repose. At any rate, the inhabitants rightly feel warranted in reclaiming such land as was not completely ruined by the eruptions, and they are pushing their cultivation forward season by season in the old regions.

THE DECLINE OF THE LUNAR DISTANCE FOR THE DETERMINATION OF THE TIME AND LONGITUDE AT SEA.

BY

G. W. LITTLEHALES.

In the March number of volume 44 of *Gaea* (1908), there appears an article, under the title "Der gegenwärtige Streit über die beste Methode zur Bestimmung der geographischen Länge auf dem Meere," which is of interest at the present time when the governments of the United States, Great Britain, and France have decided upon the elimination of the lunar-distance tables from the Nautical Almanacs published for the use of navigators. This account im-

presses upon us the long course of years during which it was deemed necessary to furnish these tables, with the object of facilitating the determination of the time at sea, notwithstanding the uninterrupted growth of the employment by seamen of the marine chronometer for the same purpose.

Some years ago, the late Captain Lecky, one of the most widely known of the English authors upon the subject of navigation, declared, in his characteristic, jocular style, that "Lunars are as dead as Julius Cæsar"; and the last annual report of the Superintendent of the United States Naval Observatory at Washington contains the following passage:

> The tables of lunar distances will be omitted hereafter. Inquiries made in October, 1907, by the Chief of Bureau of Equipment, developed the fact that these tables are practically no longer used by the navigators of either the naval service or of the merchant marine, and authority has been given for their omission, beginning with the volume for 1912.

The lunar-distance tables were omitted from the *Connaissance des Temps* for the year 1905, after having retained their place in the French official ephemeris for 131 years; and from the British Nautical Almanac for 1907, after having been presented annually since the year 1767, when Maskelyne's tables were published.

Not long before the publication of the lunar-distance tables, the first marine chronometer was produced by John Harrison, and, as some years elapsed before this instrument was well known among navigators, the tables probably gained currency among seamen before the chronometer came into general use. Cook observed and calculated over 600 lunar distances to obtain the longitude of Strip Cove, New Zealand; and, in 1777, he observed 1,000 lunar distances to determine the longitude of Tonga-tabu; and all this with inferior instruments for the purpose. Dr. Bolte, observing with the improved instruments of the present day, obtained longitudes with a probable error of 22″ from 34 observations of lunar distances of the sun, and with a probable error of 31″ from observations of the lunar distances of stars.

At sea the observation of a lunar distance requires great accuracy and skill, especially if there be much vibration in the vessel; and it is found that hardly one navigator in two hundred has ever carried out the calculation of a longitude by the lunar-distance method in practice. Although this method can scarcely be said now to survive, it was a good service to have at the disposal of navigators for more than two hundred years the means for carrying it out, and it was a vast improvement upon antecedent methods for the astronomical determination of longitudes, chiefly because scarcely any of these earlier methods could be made available for use at sea.

The early astronomers made use of eclipses of the moon in determining differences of time, as in the instance when the longitude of Toledo from Bagdad was determined by the Arabian astronomer Arzachel; and, in the days of the great discoverers, navigators sometimes attempted to use this method for the purpose of finding the longitudes of distant stations with reference to places in Europe. By means of eclipses of the moon, Columbus found the longitude of a point in the New World to be 108¾° west of Cadiz, but this determination was 40° in error and it was not until long after the generation in which Columbus lived that the facilities for using the method became sufficient to reduce the errors of the longitudes determined in this manner to within 2 minutes of arc. No matter how precise and easy this method might have become, it could never be hoped that it would meet the daily demands for determinations of longitude, because eclipses are not frequent enough for this purpose.

It will be remembered that, during the generations when the minds of investigators were bent on formulating a practical method of determining longitude at sea, Gerhard Mercator proposed the use of the variation of the compass as a means of identifying geographical position, and it may be that this method would have attained a measure of success if it had not been for the successful advent of the chronometer. This is the same Gerhard Mercator who issued the first map or chart by the method of projection which to this day substantially helps in carrying on all the deep-sea commerce of the world.

After Galileo's observations of the moons of Jupiter, Domenico Cassini computed tables of their occultations; and by the aid of these tables Kepler calculated the difference of longitude between Löwen and Vienna within 6′, and Picard and Lahire deduced the longitudes of the most important places in France. As these tables are still somewhat uncertain, but little use is known to have been made of them in our own times beyond their employment by Nansen for finding the longitudes of islands in the Arctic regions.

Another method which was sometimes used by the early voyagers, but which could scarcely be hoped to be adequate to the requirements of navigation, on account of the infrequency of the phenomenon to be observed, was the method of conjunctions. For example, in 1499, on the coast of Venezuela, Amerigo Vespucci observed the moon to be 1° east of Mars at 7:30 o'clock in the evening and 5½° east at midnight. From which it was calculated that these two bodies must have been in conjunction at 6:30 o'clock. But, according to the tables of Regiomontanus (Johann Müller),

the same conjunction took place at Nuremberg at midnight, and so the longitude of the point of observation on the coast of Venezuela must have been 5½ hours, or 82½° west of Nuremberg.

It is interesting to look back over the course of progress in determining longitude at sea and review its effect as a contributive agency in advancing geography and benefiting commerce. We may muse upon the stage of the total inability of Columbus to find the time at sea by astronomical observations and see it giving place to the stage of rude approximation which prevailed in the fleets of Lord Nelson; and then meditate upon the advanced conditions of the present day, in which the local time at any meridian can be readily found almost without computation and be compared, for the purpose of finding longitude, with the time as given by chronometers regulated to the prime meridian and kept under perfect control by time-signals, which the observatories send broadcast over the oceans at fixed instants through the agency of wireless telegraphy.

THE DYING PEOPLE OF TAUU.

BY

WILLIAM CHURCHILL.

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For Tauu the hour has struck. The few remaining swings of the pendulum may register metronomically, they cannot defer, the extinction of this people. In the struggle for life a race of men has gone down in defeat.

This is human tragedy. It is the failure of men and women and children, our human kind with souls and hearts, people known by names and addressed in affectionate by-names, men who may once have had hopes and aspirations before despair came over them and they saw the struggle hopeless. Students in cloister seclusion have little chance to know, theirs is not the imagination to picture the bitterness of the fight out in the remote spots of elemental earth where the struggle for life is fiercest waged and where the fighters are men, bravely fighting, dying without complaint.

Of such sort is the story of Tauu, one battle of evolution which man has lost.

Scarcely to trained geographers are its name and position known, this petty islet in the Pacific where cynic Nature has with automatic cruelty borne down to defeat the aspirations of man. On the maps in the geography books one may note the Solomon Islands, the northern member of that chain of islands paralleling the eastern coast of the Australian continent a thousand miles off shore. Few charts have detail enough to show that as the Solomons parallel Australia, so are they themselves paralleled in the eastern offing by a chain of outliers, all tiny atolls of coral rock and glistening sand, yet homes of men. In their extension from the south to the north there lie in order Liueniua (Ongtong Java of the charts), Nukumanu, Tauu, Nuguria. Tauu lies in 157° east and 4° 50′ south, distant 120 nautical miles from Buka, the nearest of the Solomon Islands and itself the most northern of that archipelago. Its area cannot be as much as 500 acres, a mere reef-girt dot in the sea, yet

on that speck of land men have lived and loved uncounted generations until now defeat has come over them.

There are figures of population to tell the story. In 1884 when I visited their island the people of Tauu were lined up by families for the taking of a census and 64 of all ages were numbered. Their aged chief said that long ago his island had supported a much larger population. Evidence of the accuracy of that statement was not lacking in the pavements yet remaining where houses far beyond the needs of the population in that year had mouldered away. Still more positive confirmation was found in the canoe houses on the beach and the great canoes drawn up therein. These were not dugouts, they had keels and planks, they were 45 feet long and 5 feet deep. But there they lay, cracked apart and rotting, for the reason that the united strength of the population was unable to stir them from their props and shove them into the sea. This is clear proof that not many years before there had been men enough on Tauu to build and handle these canoes.

These canoes were last seen in 1885, when Parkinson visited the island. At that time he estimated the population at about 50. The year had taken its toll.

In 1896 Parkinson revisited the island and found the population still dwindling. There was then no need of a census, so few were left that it was possible to make the record by photography. A single plate has sufficed to preserve the tale of the total population of Tauu, 17 souls in all. The five children shown in the group were all boys. The men numbered six, fine upstanding fellows with the honour of many good scars. Of the six women four had evidently passed their prime. The sole dependence of the race lay then in two younger women, who had already borne children. Since that year the island has not been revisited. It is not known what change twelve years have brought about, but it cannot have been aught but marked decrease.

The extinction of the people of Tauu is an unmixed problem, there has been no contamination through external factors, for the island has been protected by its isolation. For generations the race has contended against the tyranny of its hard environment; at last it has silently given up the struggle and peacefully accepts defeat and the end. The people have lost the upspring which means life for the community and for the individual. They are inert of life, they are listless of death. Cut off from sources of blood renovation, they are expiring of racial anemia.

Tauu is an atoll island. It rises but a few feet above the sea.

As the seat of agricultural operations it possesses scarcely any advantage over its coral reef save that the island is no longer awash. It is covered with cocoanuts, for that tree grows best where it can dip its roots into salt water and is little exacting in the matter of soil. The breadfruit is with difficulty cultivated. The same is true of the root crops. How difficult the agriculture of Tauu is will appear in the fact that the island has no natural soil whatever. Such cultivation as is practiced at all is done in artificial humus. Pits have been broken out in the coral rock, natural depressions have been enlarged, and into these pits the people have for generations thrown dead leaves and the scanty garbage of their lives to rot and thereby form a soil for farming. There is no water, not a well nor a spring, far less a stream. The first line of dependence for a water supply is placed in the rains. Cisterns are dug and lined with mortar of sand and coral lime in order to preserve the catchment from seeping away through the porous rock. Into these cisterns the rain dripping from the trees or caught on mats is sedulously led and screened against evaporation. When the rain supply fails dependence is had on shallow holes dug in the beach sand above high-water mark, but reaching down below the tide level. The water which slowly fills these pits is roughly filtered in its passage through the sand. It is very brackish and repugnant to the palate of white men. The islanders relish it, but, in common with most peoples of the Pacific, they use sea water largely in their cooking and seem to be able to quench their thirst with it. It is certain that on their voyages they use sea water in quantities which would cause a white man to go mad with thirst.

The only flesh they have to eat is that of birds. The island is so small, the needs of its people are so great, that birds of food size do not find the chance to nest. The supply depends on stray comers which seek the island for a resting place in their cruising of the air.

The islanders' great mainstay is sea food. Whatever they can find in their lagoon, fish, shellfish, starfish, sea urchins, trepang, even less organized life of worms—not a thing goes to waste, they eat them all. When I visited them, they kept in their useless canoe houses carefully wrought hooks for the ruvettus fishery which had been handed down from their elders. These hooks were then useless, for the ruvettus must be caught in the open sea and the men were too weak to launch their remaining seagoing canoes and too few to handle them if they should be set afloat. Yet they remembered the art of the fishery and they regretted the fish, a great

delicacy to many Pacific islanders, although its flesh acts as a violent purge.

This exiguous record presents the tale of the environment against which the race has fought, from which it has conquered unknown generations of life, which in the end has conquered.

The Solomon Islands, all the islands of the great chain to the west, are crowded with life, rude but hearty. The Melanesians of that cordial environment are conquering and winning their way to a higher culture. But from Nuguria to Liueniua the tale is uniform of a race vastly superior, for they are of Polynesian stock and of the race that has peopled the broad eastern expanses of the Pacific from Hawaii to New Zealand, going down in defeat.

That they are Polynesians is proved by their colour, their commanding stature, by all the items of physical anthropometry. It is proved no less by their culture, the high development of their powers of ratiocination, by their speech. They are as much Polynesians as are the Samoan, the Maori, the Tahitian.

How it came to pass that they were left to colonize these remote and infertile islands must remain an unsolved problem. Speculation has been busy with its solution but with no satisfactory conclusions. In well-kept tradition there is some sort of record. Tauu is too sad to recall its past, the memory of people about to die has little interest in the time when it was a sturdy folk. But on Ongtong Java the record remains.

In the beginning of time Lolo lived at the bottom of the sea and busied himself in building the coral reef upward toward the surface. When the reef had reached the surface and had not yet gone above it a canoe came from afar and Siva was in it. He saw Lolo's head projecting from the sand and grasped it by the hair which was floating here and there upon the waves, and he pulled. Lolo called out to him to pull hard, and Siva drew him wholly to light. Then Lolo bade Siva sail away, for the island was not yet complete and, anyway, he wanted it for his own use and not for strangers. Whereupon Siva went away. Lolo built on industriously and brought the reef so high out of water that the waves could no longer dash over it. Then he proceeded to cover it with grass and herbs over its stones, then with shrubs and bushes, last of all with great trees.

When he had reached this stage of his work there came overseas another canoe carrying three men and a woman. Lolo, who had already associated with himself two companions, Keui and Puapua, was unwilling to let the newcomers land and bade them

keep off. But the strangers begged and pleaded and promised Lolo to teach him many new things which would enrich him and his island. In the end Lolo relaxed and gave them leave to come upon his island. The men in the canoe were named Amelelago, Sapu and Kau, the woman was Keruahine. Their home place was Makarama.

The newcomers fulfilled their promise. Kau taught the art of rubbing fire from two sticks, a thing hitherto unknown; likewise he showed how to cook food in the fire, which before that time had not been known. Sapu brought cocoanuts from his canoe and planted them on the island, thereby making the beginning of the present groves of that tree. Amelelago had brought taro plants and he and Keruahine made the first taro plantation. Keruahine introduced tattooing, Lolo stretched out on a mat and she tattooed him in the pattern in use to the present day. This tattooing is everywhere the same and is still done by the women. Amelelago likewise showed the art of the loom and the weaving of mats for the clothing of men and women. Weaving, therefore, is a task of men from that time to the present, only the highest chief and his kin are free from the weaver's beam.

So far the myth. The persons named therein have all become gods and to them prayers are made. The only thing that is clear in the tale is that a migration over seas brought the food staples and the arts to a land where they were till then unknown, but that an indigenous population was found there having a faint memory of a migration still earlier.

It is not easy to reconcile the several elements in the problem. In race and speech the people are Polynesian. Therefore it might be held that they have come from canoes which left the fleets coming out of the Malay seas, bound to the southeast to the settlement of Samoa and thence to wider oceanic distribution. The art of weaving, however, is not Polynesian; in the Pacific it is practised only by the Micronesians, and the nearest occurrence of the loom is in the distant Caroline Islands.

One does not often have the opportunity to look upon the struggle for life played out with human pawns. Commonly a new factor enters in the solidarity of mankind. The weak and the losers are protected in the lower societies by the beneficence of slavery. In the higher communities the same fostering of the dependent and defective is accomplished by organized charity. But in Tauu, this petty speck of infertile sand set remote from human help in the immensity of the Pacific, the battle has been fought out without the complication

of help. Nature has been pitiless and man has gone under, the struggle for life has been too great and environment has conquered soul.

ASPECTS OF THE COAST OF NORTHEAST GREENLAND.

On December 7 last Lieut. A. Trolle read a paper before the Royal Geographical Society on the Mylius-Erichsen Expedition to the Northeast coast of Greenland, giving a summary account of the work of the party whose purpose was to supply what was still lacking in our knowledge of the outlines of Greenland. The whole of the Northeast coast from 77° N. to the Independence Bay of Peary was practically unexplored, though the Duke of Orleans on the *Belgica,* in 1905, had gone as far north as 78° 30′ N., and from his ship had seen a part of the outer islands.

Lieut. Trolle referred only in general terms to the results of the scientific work, which are to be published later. The larger geographical results have already been noted in the BULLETIN (Sept., 1908, pp. 553-4; Jan., 1909, pp. 23-5). The speaker, however, gave interesting details of the new coast regions discovered, and his description is paraphrased here from his printed paper (*Geog. Jour.,* Jan., 1909, pp. 40-61).

The land of King Frederick VIII (Map, BULL., Jan., 1909) is a beautiful mountainous country, in many places very much like Norway—the same picturesque valleys, the same deep fiords, with steep mountains, as high as 2,000 feet on both sides, which inspired the two painters of the expedition, Fries and Berthelsen; numerous islets and rock masses intersected with Sounds. Everywhere there were traces of glaciers from the Ice Period, but still earlier the country must have had a milder climate. The geologist, Jarner, found animal and plant fossils from this period in the sandstone of the Malemuk Mountain, Koldewey Island, and Hochstetter Foreland, and brought a fine collection home.

The country, bare of ice cap, is not very wide. At 77° lat. the head of the interior fiords may be reached about 40 to 60 miles from the coast, and here generally a glacier is seen coming down from the inland ice. Further north, at Jökel Bay, however, the inland ice comes down to the sea, and the coast-line here consists of two ranges of islets. At the Malemuk Mountain there is some more free land,

but it is narrower, and becomes lower and lower, until it finally disappears, and the inland ice extends straight into the sea. Denmark fiord is a big, mountainous indentation, 80 miles deep. Peary Land (so-called by Erichsen, north of Greenland) is not covered with inland ice; its southern coast is very low, and in the interior there are mountains to a height of 2,000 feet. All this coast-line up to Cape Bridgman and most of the edge of the inland ice was mapped by the cartographic staff, under Captain Koch, by theodolite measurements, in a very exact manner. The country in the neighbourhood of Denmark Harbour (where the vessel of the expedition wintered) was mapped topographically, and the triangulation there was connected with the German triangulation of 1870.

The most interesting geographical feature of the whole coast is the large peninsula extending eastward to 12° W. Long., so that the outlet between Greenland and Spitzbergen, of the great Polar Basin, thus becomes rather narrow. In this connection the speaker mentioned that Dr. Nansen, from his hydrographical observations in the Polar Sea, conjectured the existence of a sub-oceanic ridge between Greenland and Spitzbergen; and as the northeast coast of Greenland along the peninsular shores is low and flat, the probability is that such a ridge really exists.

The edge of the inland ice is in some places quite steep, in other places one might mount the inland ice without knowing it. The glaciers are few and not very productive; still the fiords are sometimes quite filled with icebergs stranded on barriers at their mouths.

In the interior, about 40 miles from the edge of the inland ice, the explorers found and mapped some nunalands (also called nunataks, land projecting above the ice cap) quite surrounded by the inland ice. On these highlands above the ice, the explorers saw flowers and tracks of foxes; also, in some places, coal. During the winter the ice-free land was covered with snow, with only here and there some bare wind-swept spots. In the spring this snow partly evaporated, even at a temperature of 20° Fahr. Then the water began to melt in the ravines, and, running under the glaciers, it formed the most fantastic ice-grottoes, where the light was dissolved into the prismatic colours by the crystal icicles.

Of the larger animals, the party found bears, musk-oxen, wolves and foxes on land, and walruses and seals at sea. Bears are rather plentiful; ninety were shot, but musk-oxen and wolves were scarce. The five wolves secured were very thin, and looked as if they had had nothing to eat for a long time. Snow-hares, which were found in great numbers, were very tame in April and May, and the men

could then get quite close to them. In the sea, the ponds and the glacial streams, animal life was not abundant. Some polar cod and inferior fish were usually the results of net-fishing. In one of the lakes, however, salmon was plentiful.

The expedition spent two years in Greenland, and the weather in one year differed much from that of the other. The winter of 1906-7 was cold and calm, the winter of 1907-8 milder and more windy. The ice in the first winter was 6 feet thick and broke up very late; in the second, it was only 4 feet thick. In the middle of February the sun returned, and May and June were a period of fogs and faint sea breezes. Otherwise, the wind was constantly from the northwest, due to the high air pressure over the inland ice. The climate was very healthful, and there were no diseases among the men. The only time the physician, Dr. Lindhard, acted in his professional capacity was once when poisoning resulted from eating a bear's liver.

No living Eskimo were found, but everywhere along the coast up to Denmark Fiord their tent stones, meat caches, and in some places even winter dwellings, were discovered. From their kayaks and oomiaks they had hunted the sea animals now found there, and also whales and reindeer, which the explorers did not find. The ethnologist, Thostrup, made a very interesting collection of their various tools, etc.

Lieut. Trolle said, with regard to the motor car in polar work, that he believed a stronger car than they took north would do good service where the surface is hard as on the inland ice. On the snow the motor car is too heavy and sinks in too deeply.

DR. STEIN'S TWO YEARS OF EXPLORATION.

Dr. M. A. Stein, Inspector-General of Education and Archæological Surveyor in the Northwest Frontier Province of India and Baluchistan, has completed his second series of explorations in Central Asia, which he undertook in 1906. The work has added largely to the brilliant archæological and geographical results which he attained in Eastern Turkestan in 1900-1. It will be remembered that, through this earlier work, Dr. Stein revealed the full extent to which Indian influence had established itself in Eastern Turkestan from a very early period, not merely through the spread of the Buddhist religion, but also in respect of languages, material culture and art. His investigations demonstrated, further, that the influence

of the classical West had penetrated even that distant part of Central Asia during the early centuries of the Christian era.

Dr. Stein's work was so rich in results that in 1905 the British Museum voted a grant of $10,000 towards the expenses of the expedition now concluded. His enterprise also had the substantial aid of the Indian Government, and the Survey of India gave him again the services of the native surveyor Rai Ram Singh, who, on the first expedition, helped Dr. Stein to add much to our knowledge of the magnificent mountain region in the western section of the Kwen-Lun Range. He took with him also survey instruments which enhanced the value of his geographical studies.

The progress of Dr. Stein has, from time to time, been reported in the London *Times* and the *Geographical Journal.* The following outline of the chief features of the work he has completed is condensed from the *Scottish Geographical Magazine,* which, from 1906 to January of this year, has printed a series of articles on the expedition.

Dr. Stein reached Kashgar, the capital of Eastern or Chinese Turkestan, in June, 1906, and left that city with his caravan at the end of the month. At Khotan, to the southeast, in August, his archæological labours began and interesting finds were made there. In his letters he emphasized the fact that cultivation was spreading in the Khotan region, on the southern edge of the great desert, to large areas that were covered by sand on his previous visit. They were now being reclaimed and water in the Khotan Oasis was abundant. He believes that irrigation on a large scale may successfully be carried out there.

Then Dr. Stein travelled 600 miles eastward to the northwest part of the Chinese province of Kansu. His route through the intervening desert was the same as Marco Polo followed, and Dr. Stein found that this famous explorer's description of the route was thoroughly accurate in all its topographical details. More than one-third of the route skirted the shores of a vast salt-covered lake, indicating the extent of the Lop-nor marshes at a period that was probably not very remote. The detailed survey by Rai Ram Singh showed clearly that the well-marked depressions between the slopes of the Kuruk-tagh to the north, and the Altyn-tagh to the south of Lop-nor, along which the expedition marched, had once served for the passage of the waters of the Su-lei-ho and Tun-hoang rivers far to the northeast, down to Lop-nor.

About the middle of June, 1907, Dr. Stein began his geographical work in the western and central Nan-shan Mts., Kansu Province.

His first move led towards the great snowy range south, which forms the watershed between the Su-lei-ho and Tun-hoang rivers. On the lowest of a succession of barren plateaus built up by parallel outer ranges he discovered a large ruined site near the village of Chiao-tzu. These ruins of an important town, abandoned about the twelfth or thirteenth centuries A. D., afford interesting proofs of the processes of desiccation and wind erosion which have greatly altered the physical and economic conditions of the outer hill region.

An instrumental survey was made of the great chain of glacier-crowned peaks, which overlook the barren outer ranges and detritus plateaus of the Nan-shan, west of the Su-lei-ho and Dr. Stein and his party then made their way over hitherto unexplored ground to the foot of the mountains near the famous Chia-yü-Kwan gate of the "Great Wall." The imposing line of this wall, which bends around the westernmost part of the Su-chou Oasis and extends to the very foot of the Nan-shan, has always been represented as the end of the ancient "Great Wall" guarding the northern border of Kansu. But careful examination disclosed to Dr. Stein the junction of two lines of frontier defense near Chia-yü-Kwan. One line is a crumbling wall of stamped clay which runs along the whole northern border of the Su-chou and Kan-chou districts and dates from the second century B. C. Its purpose was evidently to safeguard the narrow belt of oases along the north foot of the Nan-shan which was needed as a passage into Eastern Turkestan when Chinese political and commercial expansion towards the "Western regions" began under the first Han dynasty. The second line meets this ancient wall at right angles and probably dates no further back than the 15th-16th century A. D. It was built for the very different purpose of closing the great route towards Central Asia and the west at a time when China had once more resumed her traditional attitude of seclusion.

Su-chou, the first town within the wall, served as base for Dr. Stein's expedition into the Central Nan-shan. During August, 1907, the party crossed and surveyed in detail the three northernmost ranges of the Central Nan-shan, all rising to peaks of 18,000 and 19,000 feet between the longitudes of Su-chou and Kan-chou. All the rivers descending to these oases, as well as the Su-lei-ho, were explored to their glacier-fed sources. The magnificent ice-crowned range which divides the headwaters of the Su-lei-ho from the Koko-nor and Khara-nor drainage was also surveyed along the whole length of its north face. Its height exceeds that of the northern ranges. It was curious to meet in the wide mountain-girt basin, 13,000 feet above the sea, where the Su-lei-ho gathers its main sources, the same

combination of marshes and drift sand areas that marks the desert depression where the river dies away between Tun-huang and Lop-nor. From this region Dr. Stein made his way over difficult bog-covered uplands into the unexplored Alpine tract where the Ta-tung River, the most northern large tributary of the Hwang-ho, rises. After this short visit to the edge of the Pacific drainage he regained the broad valley of the upper Huei-ho or Kan-chou River.

Excellent work was done in this almost unknown mountain area. The plane table survey on a scale of 4 miles to an inch between An-shi and Kan-chou was about 24,000 square miles. The position of many stations was fixed astronomically by theodolite observations, and reliable height measurements were secured for all important peaks and passes by means of mercurial barometer and clinometer readings. A large series of photographic panoramas was taken by Dr. Stein, illustrating the characteristic features of the great ranges as they presented themselves from commanding positions.

From Kan-chou, Dr. Stein began early in September, 1907, the long journey westward back to the Tarim Basin. The journey was made by the caravan route, through Hami and Turfan, in the mountain region of northern Chinese Turkestan, and much survey work was done along the way.

In the winter of 1907-8 Dr. Stein began his explorations at Kara-shahr, in the extreme northeast of the Tarim Basin. He traced the sites of ancient towns at several points of the great plain, now a waste, covered with scrub and jungle, which encircles the Bagrash Lake on the north. Subsoil water, impregnated with salts and the effects of a climate less dry than in other parts of this Turkestan depression, had completely destroyed the structures that once stood within the still extant clay ramparts. A better field for excavations was offered by the numerous ruins of Buddhist shrines which occupy low rock terraces near the Kara-shahr River, where sculptures, paintings and other objects were unearthed. This wide plain of scrub and sand might to-day be easily brought under irrigation by canals from the Kara-shahr River. The supply of water in the river far exceeds the needs of the narrow strip of land actually cultivated by the Tungans and semi-nomad Mongols.

Dr. Stein then struck across the broad belt of waterless desert to the northwest and north of the oases of Domoko, and his excavations resulted in finds of well-preserved manuscripts in Indian scripts, Buddhist paintings on wood, etc. March and early April were spent in these archæological labours along the desert belt adjoining the oases from Domoko to Khotan. He found the remains of a large

Buddhist temple, decorated with elaborate frescoes, now completely buried by high dunes in the desert strip between Yurung-kash and the Karakash rivers. The temple proved to belong to the early centuries of our era.

Meanwhile, Rai Ram Singh completed a detailed survey of unmapped ground to the northwest and north of the Khotan oases, and then the party set out through the desert along the Khotan River bed. Six marches below the oases, Dr. Stein discovered the ruins of a fortified watch station once guarding the river route. The fort had been destroyed by fire, but on the steep rock slope, below big masses of refuse that the occupants had thrown out, Dr. Stein recovered a great collection of documents on wood and paper in a variety of scripts, mainly Indian, Chinese and Tibetan, and none apparently later than the eighth and ninth centuries A. D.

In May last the expedition reached Aksu, in northwestern Chinese Turkestan, and while the surveyor made a continuous survey along the outer Tian Shan Range westward as far as the passes above Kashgar, Dr. Stein travelled up the Uch-Turfan Valley and thence across a barren but remarkably picturesque mountain range to the oases of Kalpin. In the Kalpin region he secured sufficient evidence to conclude that this tract was occupied down to the eighth century A. D. by large settlements to which canals still traceable in part carried water from the Kashgar River. Dr. Stein was back in Khotan by the middle of June.

Rai Ram Singh, after carrying his plane-table survey along the foot of the Tian Shan from Aksu to Kashgar, succeeded in mapping the large portions of unknown country on the southern slopes of the Kwen-lun Range west of Khotan. He then rejoined Dr. Stein at Khotan, and on August 1 last the explorer despatched 50 camel loads of antiques, including 30 cases of ancient manuscripts and other records, to the foot of the Karakorum, where it was to await him while he and his surveyor started on their long-planned expedition to the sources of the Khotan River.

This journey was of much geographical importance. Dr. Stein established survey stations close under the crest line of the main Kwen-lun Range, about 20,000 feet above the sea, and mapped with theodolite, plane-table and photographic panoramas the greater part of the wild mountain region containing the Khotan headwaters. On the south for over 60 miles they proved to be flanked by a magnificent range of snowy peaks, rising to over 23,000 feet and clad with glaciers more extensive than any Dr. Stein had so far seen in the Kwen-lun. By crossing side spurs over passes 17,000 to 18,000 feet

high, they succeeded in tracing the great river to its ice-bound head in a basin 16,000 feet above the sea.

Dr. Stein then followed the great snowy range which he had found flanking the Khotan headwaters on the southeast and south to its end in the uppermost valley of the Keriya River, and then began the exploration of the hitherto unsurveyed ground westward.

This area figures on most maps as a high plain called the Aksai-chin Desert. It proved to be of a different character. High snow-covered spurs, with broad valleys between them, descend here from the great range flanking the Khotan. The streams brought down by these valleys rarely reach the large lakes and marshes at the foot of these spurs, but in most cases lose themselves in vast alluvial fans of detritus above the depressions which connect the lakes and marshes. The direction of these depressions, all of which bear signs of having been ancient lake beds running from east to west, greatly facilitated progress, but vegetation almost completely disappeared, and soon fresh water ceased to be obtainable except by digging wells in dry water courses, and the result was that nearly one-third of the pack animals were lost.

On the last day of his long labours, Dr. Stein found himself completely disabled by severely frostbitten feet. He was carried on a litter to Leh, on the edge of civilization, where an operation was performed, and it is hoped that the unfortunate accident will lead to no permanent inconvenience. His heavy caravan of antiques safely arrived at the foot of the Karakorum. Rai Ram Singh had succeeded in mapping no less than 17,000 square miles of mountainous ground. It is expected that, early this year, Dr. Stein will be seen again in Europe.

GEOGRAPHICAL RECORD.

AMERICA.

DRIFTWOOD NEAR THE MACKENZIE DELTA.—Mr. Alfred H. Harrison, in his recent book "In Search of a Polar Continent," says that the shore of the Arctic Ocean, from Herschel Island to Cape Brown, is piled many feet high with drift wood which has floated down the Mackenzie River. Whole trees, bared of their bark and branches, but otherwise intact as when they stood in their native forest, lie spread, root and bole, along this shore. Some of them measure 100 ft. in length, and trunks which are long enough for spars or masts are plentifully strewn around. There are likewise many knotty pieces that the whale-fishers convert into useful furniture, which, when polished, are even more glossy and handsome than oak. When the ships get out of fuel, gangs of men are sent to the coast to cut cords of wood for their whaling cruises.

DEVILS LAKE, N. D.—The U. S. A. Bureau of Fisheries (No. 634) prints a study of Devils Lake, N. D., in which the lake is said to be still in process of drying up and now has neither inlet nor outlet except after rain or floods. Desiccation has been especially well marked during the last twenty-five years. The lake formerly received a large tributary which drained a series of lakes whose waters were remarkably fresh as compared with those of Devils Lake. During the years 1884-87, when the lake was high, this tributary flowed throughout the year. Formerly also, the lake was remarkable for its wealth in pickerel, which supplied an extensive trade in fish and was the cause of various settlements in the vicinity of the lake. Specially abundant in the years 1884-87, the fish suddenly decreased thereafter, the last being caught in 1889. Since that date Devils Lake has yielded no food fish, though an attempt is now being made to restock it. It is believed that the drying up of the large tributary was chiefly the cause of the disappearance of the fish. They were apparently unable to spawn in the alkaline water of Devils Lake, and the disappearance of the tributary deprived them of the power of migrating to the other and fresher lakes of the chain for spawning purposes. This instance affords a definite example of the sudden disappearance of an important food supply, a circumstance that under primitive conditions of life would be likely to bring about a series of related changes.

RED TILL IN WISCONSIN.—In a preliminary publication, Dr. W. C. Alden has described a small part of the area of 8,600 square miles in southeastern Wisconsin, where he has been mapping the glacial geology in detail. (Milwaukee Special Folio, Wisconsin, Geologic Atlas of the United States, No. 140, 1906.) The conditions in this quadrangle are typical of those over an extended area, and the red till which forms part of the glacial drift is of especial interest.

The red till is an extremely fine silt, beautifully laminated in its lower portions and massive above. Through it are scattered small, angular, striated, foreign glacial pebbles. Its surface form is that of long billowy ridges, with the higher and steeper side toward Lake Michigan. It overlies older till, and is practicably unweathered.

Dr. Alden explains this deposit as a glacial-lake silt ridged up by a subsequent glacial advance, an explanation quite different from the earlier one of Chamberlin. Later studies further northward in 1907 and 1908 show the red till moraines obliquely to overlie an earlier morainic system and to be present in the Green Bay-Lake Winnebago Valley, amply supporting Alden's explanation of the origin of this deposit as seen in the Milwaukee area. L. M.

AFRICA.

MR. CHURCHILL'S MISTAKE.—Mr. Winston Churchill, of England, in his new book, "My African Journey," gives a graphic account of Speke's discovery of the Nile as it issues from Speke Gulf, Victoria Nyanza. The author refers to "the luck which led Speke to his thrilling discovery of the source of the Nile." He goes on to say:

> There are 500 gulfs and inlets on the northern shore of Lake Victoria and nothing distinguishes this one [*i. e.*, the gulf from which the Nile issues] from the rest. . . . The explorer might have searched for a year without finding this spot. Instead of which he drifted and paddled gently along until all of a sudden the murmur of a distant cataract and the slight acceleration in the pace of his canoe drew him to the long-sought birthplace of the most wonderful river in the world.

The demerit of this description is its absolute inaccuracy. A reference to Speke's "Journal of the Discovery of the Source of the Nile" would have shown Mr. Churchill that the discovery was not brought about in so haphazard a manner. The truth is, that Speke did not make the journey to the source of the Nile by water, but on foot. From the capital of Uganda he was guided eastward over the land by subjects of King Mtesa as far as the Nile and then ascended the left bank of the river until he reached Ripon Falls, where the lake has its outlet and the great river begins.

THE PLOW FOR AFRICAN NEGROES.—According to the *Koloniale Zeitschrift* (No. 27, 1908), a movement is on foot in the colonies of Togo and German East Africa to substitute the plow for hoe cultivation among the natives. In the annual *Report* on German East Africa (1906-7) the question was discussed and the view expressed that the introduction of the plow is very important and may be brought about by gradually providing yokes of oxen and plows and giving the essential training. The cost would be considerable, but the outlay would in time be repaid through the ability of the natives to raise a larger amount of products available for export. It is said that a native farmer, with the hoe, cannot till more than an acre of land, while the efficient use of the plow would enable him to take care of several acres.

The Colonial Industrial Committee intends to introduce plow culture both in Togo and East Africa. The first experiment will be made in Togo, in the northern part of the region, where cattle can thrive, because it is free from the tsetse fly. It is proposed to establish a number of dépôts where plows may be kept for distribution, and to send Mr. J. W. Robinson, with assistants, to introduce the plow in this cotton-growing region and train the natives in the management of oxen and the way of plowing. The interest of the natives will be stimulated by premiums given to those who become proficient. After the movement has been well started it is thought that it will be spread by the natives themselves.

BOYD ALEXANDER RETURNS TO AFRICA.—Lieut. Boyd Alexander left England on Dec. 12 last, to explore the islands of São Thomé, Principe and Annobon, chiefly from a zoological point of view. He will have the assistance of his old collector, José Lopes, who was with him while on his last journey through Africa. In 1901 Lieut. Alexander studied the zoology of Fernando Po, the largest of the row of islands in the Gulf of Guinea, and showed that it possessed a rich and varied fauna, closely allied to that of the mainland, of which it, therefore, seems to have once formed part. He hopes by his work on the other islands to throw some light on their possible past relations with the continent. After four months in these islands the expedition will cross over to Victoria in the Cameroons, with the object of making a thorough zoological exploration of Cameroons Mountain, where Lieut. Alexander thinks it possible that he may meet with forms closely allied to those of the Ruwenzori Range. He hopes to examine also the interesting Manenguba Range, further in the interior, which rises to a height of some 10,000 feet. Ethnology and photography will also be features of the work during the twelve months which the party will probably spend in Africa. (*Geog. Jour.*, Jan., 1909.)

ASIA.

DR. ELLSWORTH HUNTINGTON RETURNS TO ASIA,—Dr. Huntington, Instructor in Geography at Yale University, wrote to the Society that he expected to sail on Feb. 10 for Southampton, and then go *via* Constantinople to Palestine. He will spend some time there in studying the Dead Sea with special reference to its fluctuations, both in the Glacial Period and in historic times, if any such have taken place. For this work he intends to take a folding canvas boat, for there are practically no boats on the Dead Sea. After leaving the Dead Sea, he will devote some time to getting a general idea of the geography of Palestine and to studying the ruins along the border of the Syrian Desert, to see what they may indicate as to the time when changes of climate have occurred.

On leaving Palestine he hopes to go up through the Syrian Desert to Aleppo and then to the lake region of central Asia Minor. There he will make the same kind of investigations as at the Dead Sea, using his folding boat to study the shores. In connection with the lakes he will examine the numerous ruins of the country. The entire summer will be spent among the lakes, in all probability. He expects to take with him an assistant, Mr. C. F. Graham, who has just finished his studies at Yale. They will return at the end of September.

LONGSTAFF'S NEW EXPEDITION TO THE HIMALAYAS.—Dr. T. Longstaff announces (*Geog. Jour.*, Jan., '09, p. 88) that next summer he will go to the Saltoro Glacier System in the Karakoram Range, and try to cross the long-closed Saltoro Pass to the headwaters of the Oprang River, an affluent of the upper Yarkand. There is no record of any crossing of the main Karakoram Range between the Mustagh and Karakoram passes, and we have no knowledge of the mountains northeast of K2, where, as has been pointed out by Col. Burrard, the great undiscovered peaks are most likely to exist. While Dr. Longstaff will try to climb any promising peak that offers, he attaches larger importance to the acquisition of some knowledge of the country across the main range. He will be accompanied by Lieut. Morris Slingsby.

CAPTAIN D'OLLONE'S JOURNEY IN EASTERN TIBET.—A communication from Captain d'Ollone's Expedition on the Chinese-Tibet frontier, printed in *La Géographie* (Nov., 1908), tells of an interesting journey across a wide tract between Sun-Pan-ting and Lan-Chou, where the leader avoided the routes of previous travellers as far as possible and secured some valuable results. He was able, by following down the valley of the Eul-tao Hwang-ho (Second Hwang-ho) to its junction with the main river, to fix the position of that point and also to throw further light on the remarkable bend of the Hwang-ho, which was in part laid down by Dr. Tafel. Marching along its valley for some days in a northwesterly direction, where the Hwang-ho was on its return course to the west after having passed the meridian of 102° on its easterly course, Captain d'Ollone then struck northeast for Lan-Chou and found a group of Mongols living among the Tibetans. He found that this region abounds with monasteries, subordinate to the great lamasery of Labrang, although the people in general display an independent and warlike bearing. He says the physical character of this region differs entirely from the more typical parts of Tibet. It lies at an altitude of 13,000 feet and forms a plain traversed by mountainous swells of no great height covered by grass and everywhere passable by horses. The inhabitants

are a pastoral people living on horseback, and approaching the Aryan type. The Chinese call them Sifan, since they are neither Tibetans nor Mongols. The traveller and his companions encountered hostilities which nearly resulted in disaster to the expedition. The party, however, finally reached the Labrang Monastery, which they describe as much surpassing the famous one at Kumbum.

AUSTRALIA.

CAPITAL OF THE COMMONWEALTH OF AUSTRALIA.—The House of Representatives of the Commonwealth of Australia has voted to place the future capital in the district Yass-Canberra, in southeastern New South Wales. As the conflicting interests of New South Wales and Victoria have defeated earlier decisions as to the site of the capital, it is expected that the present proposal also will meet with opposition.

The federal capital, according to the Constitution, is to be in New South Wales not less than 100 miles from Sydney. Its territory is to contain at least 100 square miles, and the Crown lands in the area selected for the capital are to be given by New South Wales without payment. The capital *pro tem* is in Melbourne, and will remain there until its situation is finally decided upon and the building is ready for occupancy.

A commission to report upon the most suitable site was appointed in 1901. The commissioners recommended Tumut, which has a fine situation and climate, excellent water supply and adequate rail communications. It is also removed from the coast, and, therefore, safe from naval attack. The House of Representatives in October, 1903, recommended Tumut, but the Senate substituted Bombala, probably because the proximity of this situation to the coast would enable it to have independent access to the sea through Twofold Bay. When the matter again came up in 1904, both Houses selected Dalgety, on the Snowy River, near Bombala. Objections, however, were made to this proposal and nothing further has been done until the House lately announced Yass-Canberra as its choice.

EUROPE.

THE ITALIAN EARTHQUAKES.—Mr. R. D. Oldham, formerly superintendent of the Geological Survey of India, in an article on the great calamity in Calabria and Sicily (*Nature,* No. 2045, p. 287), compares it with the earlier great earthquakes in the same region, particularly with the terrible cataclysm of 1783, and concludes that as the earthquake of that year "was followed by sixty years' respite from destructive earthquake and the lesser one of 1638 by twenty-one years' respite, so the disaster of 1908, though it will be followed by a series of after shocks, some of which probably will be severe, may reasonably be expected to inaugurate a long era of comparative repose during which the population will have time to recover." Mr. Oldham adds that so long as the people prefer to huddle together in towns and villages which are villainously built and designed in defiance of every precaution which should be taken in an earthquake country, so long will every severe shock result in loss of human life and property.

An extended account in the BULLETIN of the recent calamity will be deferred until authentic data and scientific study supply the material for an authoritative record.

POLAR.

ANOTHER MELVILLE-BRYANT DRIFT CASK FOUND.—A cable despatch to the American press from Captain Roald Amundsen, Christiana, reports that a drift cask picked up on Nov. 3 on the island of Soro, Norway, has been identified as one of the Melville-Bryant polar casks liberated in the Arctic Ocean north of Alaska in 1899, 1900 and 1901. The cask contained a letter saying that it had been launched at Cape Bathurst, some ways east of the Mackenzie River Delta. In a letter to the Philadelphia *Press* Mr. Henry G. Bryant, through whose generosity this attempt to learn more about the currents of the north polar area became possible, writes that the cask referred to, No. 26, was launched by Captain R. J. Cumiskey of the steam whaler *Narwhal,* in 71° N., 128° 5′ W., off Cape Bathurst, on July 2, 1900. In his opinion, although only the terminal points of its voyage are known with certainty, it is more than probable that its drift carried it north and east past Prince Patrick Island and Grant Land and thence around or across the polar area, and eventually into the sea between Greenland and Spitzbergen, thus reaching the North Atlantic and Norway. Assuming that it travelled the most direct route, the distance traversed in the 8 years, 3 months and 10 days that have elapsed was approximately 2,400 nautical miles. If, however, it followed a more circuitous route, similar to those of the *Jeanette* and *Fram,* the mileage would be much greater. All of the casks thus far recovered have been picked up within the Arctic Circle.

Only four of the drift casks have thus far been reported in the seven or eight years since they were placed on the ice north of Alaska and Western Canada. One of them drifted from a point west-northwest of Point Barrow, Alaska, where it was placed in 1889, over a 2,500 mile course across the north polar area to the most northern point in Iceland. The journey of this cask did much to strengthen the belief in the existence of a central drift current across the unknown polar area. Two of the casks that failed to enter this drift were found ashore on points on the Siberian coast.

CLIMATOLOGY.

PNEUMONIA AND WEATHER.—The relation between the prevalence of pneumonia and weather conditions is a subject which has been much studied. Most writers have considered changes of temperature of great importance in predisposing persons to pneumonia. The disease is found almost everywhere, in the tropics probably quite as commonly as in colder latitudes, and at high altitudes as well as at sea-level. A greater frequency of pneumonia generally follows cold, damp weather, with marked changes of temperature, which lower the vitality and are conducive to chills. Hence, the disease is most prevalent in the colder months. Severe cold spells have often been noted as being followed by an increase of pneumonia, especially among elderly persons and children. One of the most recent investigations along the lines of medical climatology in relation to pneumonia is that of Dr. C. M. Richter, of San Francisco ("The Relation of Anticyclonic Weather to the Prevalence of La Grippe and Pneumonia on the Northern Hemisphere," *Journ. Amer. Med. Assoc.,* Aug. 22, 1908, Vol. LI, pp. 660-663). The author made a study of the pneumonia epidemics of Chicago and San Francisco for the five years, 1899-1904, in their relation principally to air pressure. He finds that pneumonia is not merely a concomitant of the cold-weather season, but that its prevalence depends on anticyclonic weather, summer and winter, and

not on low temperature. Dr. Richter thinks that this relation to high pressure depends upon the quality of the air in anticyclones, which changes in conformity with changes in the activity of the sun, the prevalence of grip and pneumonia being subject to a specific quality of this air. Dr. Richter suggests several possible conditions of anticyclonic air which may be of importance in this connection: *e. g.,* the higher levels of the atmosphere are more directly affected by the sun's energy than the lower levels, and in anticyclones the air is descending from aloft; radio-activity, which varies according to pressure conditions; atmospheric electricity, and other factors may be concerned in the problem. R. DEC. W.

OCEANOGRAPHY.

INTERNATIONAL EXPLORATION OF THE ATLANTIC OCEAN.—At the Ninth International Geographical Congress, held in Geneva last summer, Sec. VI. was devoted to Oceanography, and among the papers read before this section were those of Prof. S. O. Pettersson of Stockholm and Prof. Schott of Hamburg, each relating to the need of inaugurating an exploration of the Atlantic on an international basis in respect of its physical and biological conditions. The substance of their suggestions is indicated below:

All deep-sea expeditions of later years have occupied themselves chiefly with the eastern half of the South Atlantic. No systematic deep sea research with modern instruments and by modern methods has been made in the western half of the North Atlantic since the *Challenger* Expedition, excepting some work by the U. S. vessel *Albatross*. Very little is known about the magnitude and laws of the variations of Atlantic currents in respect of strength or temperature. The non-periodic changes in the temperature of these currents, particularly in the Gulf Stream, must be looked for in that Stream itself. A study of the primary causes of these changes is of both scientific and great practical interest, for it is probable that they have a far-reaching influence upon the weather and vegetation of Europe.

The investigation of the physical conditions of the higher strata of air above the ocean is the work before oceanographical expeditions on the Atlantic. The highways of barometric depressions between the forties and fifties of latitude are especially important for Europe, because it is mainly the direction and frequency of these great atmospheric whirls which decide the character of European weather.

Fishery investigations, extended to the open Atlantic, may supply many surprises. The young eels of Northern Europe, for example, hitherto unknown as to form, have at last been found to the west of Ireland in depths of 500 fathoms; Mr. Hjort's investigations also have proved that other fish in its young stage are found at great depths far away from land. Furthermore, a careful study of changes in Atlantic plankton, with regard to sea food and place, is of great importance, because plankton, being the original food of the sea, influences the wanderings of all fish.

The writers recommend the following parts of the Atlantic Ocean for the earliest investigations:

A straight line from Fair Isle or the Pentland Firth to the Strait of Belle Isle across the Labrador Current.

The highway between the English Channel and the east coast of the United States in the forties and fifties of latitude. The ships are constantly traversing

this region, it is scientifically one of the least-known parts of the oceans. Though cable steamers have sounded the bottom everywhere, with the relief of the bottom our knowledge is nearly at its end.

A line between a point on the coast of Morocco and one on the coast of the United States, say Cape Hatteras. It appears that on this line important dynamical factors are at work greatly influencing the oceanic circulation. Soundings along this line would cut the "Cold Wall," the Gulf Stream, the northern part of the Sargasso Sea and the cold water on the coast of Africa which rises to the surface there from greater depths under the influence of the off-shore winds.

Corresponding series of soundings in a north-south direction or north-east-south-west towards Pará, cutting the Guinea Current, if possible, would complete the picture of the North Atlantic circulation and offer material for representing and calculating quantitatively the hydro-dynamic fields existing in this part of the ocean.

The writers remind the reader that, in the South Atlantic, the Argentine Republic and Cape Colony are now active in the investigation of the neighbouring seas, and these factors must be taken into account when an international combination is formed. The interests of the governments of the Atlantic states of Europe, Africa and America should be first solicited; also, the interest and cooperation of private persons, polar expeditions, owners of good-sized steam yachts and the great steamship companies, the latter being especially able to render important assistance.

The Congress adopted a resolution declaring that "the physical and biological investigation of the Atlantic Ocean is one of the most pressing problems in oceanography." The resolution goes on to say that the civilized nations of Europe, Africa and America should attack this problem in the great interests of the Atlantic shipping, of fisheries and of meteorology. The chairman of the Section Oceanography was authorized to form a "Committee for exploring the Atlantic Ocean," on which various nationalities shall be represented.

THE PHYTO-PLANKTON OF THE SEA.—In the *Revue Générale des Sciences* for August 30, Professor Mangin publishes an interesting general article on what he picturesquely calls the floating pastures of the sea, that is to say, the minute free-living plants often so extraordinarily abundant in the surface-water of the sea. It is, of course, these minute plants which colour the water at certain seasons black, red, green, or ochre-coloured, and have thus given rise to the names of some of the seas and oceans of the globe. For example, a red alga, known as *Trichodesmium erythraeum,* communicates its characteristic reddish tint to the Red Sea. The great interest of these minute forms of life is, of course, that ultimately they form the basis of the food of fishes, and as they change in position or in character according to the latitude and the seasons, they are of great importance in connection with the scientific study of fisheries. Just as on land the large carnivora are necessarily attached to the great natural or artificial areas of herbage on which feed their natural prey, the herbivora, so the fish follow the migrations of the phyto-plankton. (*Scot. Geog. Mag.,* Vol. 25, No. 1, 1909.)

PHYSICAL GEOGRAPHY.

THE FORMATION OF NIEVES PENITENTES.—Dr. William Hunter Workman has written a paper on the formations known as "Nieves Penitentes," which have

heretofore been described chiefly by explorers of the Andes and were long regarded as peculiar to the South American mountains from the equator to 35° 40′ S. Later, however, Hans Meyer and C. Uhlig found them on Kilimanjaro in Africa, and while Mrs. Bullock Workman and Dr. Workman were exploring the Nun Kun Mountain group in Suru, Cashmere, during the summer of 1906, they found large portions of the névé-covered surface of the Shafat glacier, at altitudes of from 16,000 to 18,500 ft., above the line of freezing at night, thickly covered with these formations. He is not aware that they are found in any other part of the Himalayas.

In his paper published in the *Alpine Journal,* May, 1908, he says that the "Nieves Penitentes," as he saw them in the Himalayas, varied in height from 8 inches to 3 feet and had the shape of wedges or pyramids flattened at the sides with curling, fluted crests all turned in the same direction. They were arranged in parallel lines on the glacier and diagonally to its axis, and were composed of granular snow, hard frozen in the morning, but softening more or less under the heat of the sun. No ice was found in them.

After presenting the information he collected, Dr. Workman gives his conclusions as to their formation, which seems to depend on two conditions—(1) the existence of a strong wind blowing constantly from the same direction, driving the snow into wavelets and ridges usually parallel to one another and condensing it into compact masses at foci a little removed from one another; and (2) a prolonged period of fine weather following, during which the softer portions are melted away by the sun's heat, both direct and reflected, leaving the denser parts standing in the well-known shapes. In stormy seasons the ridges, after being formed, are protected from the sun's action by new snow under which they are buried and no nieves are developed.

Seismic Sea Waves.—The Pilot Chart of the North Pacific Ocean for Feb., 1909, discusses seismic sea waves such as accentuated the recent great earthquake calamity in Calabria and Sicily. According to the descriptions of this disturbance, the sea, after the earthquake shock, at first receded for some distance from the shores and then a great wave, about 32 feet high, advanced upon the shore with appalling power and destructiveness.

"There are two general classes of seismic sea waves. The first is due to the sinking of the sea bottom and is marked by a withdrawal of the water after the earthquake, followed later by the return of great waves. The second is due to the uplift of the bottom and is characterized by a sudden rise of the sea without any previous withdrawal from the shore. Most of the historical inundations of the sea have been due to waves of the first class.

"The phenomena usually noted are: First, An earthquake; second, after a short interval, the sea is observed to be draining away, laying bare the bottom where it is ordinarily deep enough for ships to enter; third, after an interval of an hour or so, the sea is seen to be turning as a mighty wave, washing everything before it and thus carrying ships shoreward and stranding them; fourth, having once swept to shore, the sea again withdraws and lays bare the harbour as before and after about the same interval again returns as a second great wave. This periodic movement of the sea may be kept up for some time and quiet may not be restored for a day or two.

"Among the well-known historical sea waves of the first class, we shall cite only a few typical cases: As that which overwhelmed Helike in 373 B. C.; the

waves at Callao in 1724 and 1746; the wave following the Lisbon earthquake in 1755; the waves of Arica in 1868, and Iquique in 1877; the wave on the Japanese coast in 1896. In all these cases the water first withdrew from the shore—not suddenly, but slowly, as in the draining away of a tide, though somewhat more rapidly. This, of course, indicated that the sea bottom had sunk, and the water was draining away to fill up the depression in the level caused by the falling of the bottom. When the currents meet at the centre an elevation is produced by their mutual impact, and when this collapses under gravity the first great wave comes ashore. The elevation then subsides into a depression as at first, and the currents again flow in and force up the level a second time; and, with the second collapse, another wave is sent ashore; and so the oscillation of the sea continues, sometimes for a day or two, before it finally quiets down.

"Seismic sea waves of the second class are produced by the uplift of the sea bottom into ridges or submarine plateaus and islands. In such cases the water rises suddenly without previously withdrawing from the shore.

"The most disastrous in its effects of any of the examples of the first class is that which occurred in connection with the Lisbon earthquake of 1755. The seismic disturbance to which this wave was due occurred under the sea off the coast of Portugal in lat. 30° N. and long. 11° W. The water drained out from the land to such an extent that the bed of the river Tagus was left dry, and, half an hour after the most severe shocks were over, a series of waves 30 to 60 feet in height broke on the shore, and, sweeping over the land, caused the death of about 100,000 persons and enormous destruction of property. These waves extended along the coast, engulfing the villages for several miles to the south and reaching as far as Morocco. The shock was felt at Oporto, Cadiz, Madrid, and Funchal, and waves were propagated throughout the Atlantic to the coasts of America. At Cadiz the waves rose to 60 feet, at Madeira to 12 feet, and the sea was so disturbed 120 miles west of St. Vincent that vessels were violently shaken and men standing on deck were thrown down."

After the great earthquake at Lima on Oct. 28, 1724, the water withdrew from the coast and was followed by a wave about 80 feet high, which swept over Callao.

VARIOUS.

MR. J. G. BARTHOLOMEW, head of the Geographical Institute, the famous map house of Edinburgh, has been recently appointed an honourary Corresponding Member of the Société de Géographie of Paris.

THE UNITED STATES GEOGRAPHIC BOARD has just issued, in a pamphlet of 38 pp., all the decisions with regard to geographical names which it rendered from July 1st, 1906, to July 1st, 1908.

ANNUAL MEETING OF THE AMERICAN GEOGRAPHICAL SOCIETY.

The Annual Meeting of the Society was held at the Engineering Societies' Building, No. 29 West Thirty-ninth Street, on Tuesday, January 26th, 1909, at 8:30 o'clock P.M.

President Archer M. Huntington in the chair.

In opening the meeting President Huntington made the following remarks:

"It is my reluctant duty to recall to you to-night for the last time the name of

George C. Hurlbut. But if it be not my privilege to bring that name to your memories hereafter, I know well that it will not pass and be soon forgotten. A friend has left us, an old and well-tried friend, kind and gentle and faithful to all his trusts, who worked ever with that brave silence which is the gift of modesty founded upon ability and love of truth. Of the wealth, which is so-called, he had little; but of that wealth which the soul stores up out of the essential goodness of the world through patient living, he had a store untold. And of that glorious wealth he gave us much. So in his departure we are poorer, but the love for our friend has grown more deep."

The following persons, recommended by the Council, were elected Fellows:

W. Kirkpatrick Brice, William F. Keyes,
Charles G. Goddard, Francis Trevelyan Miller,
Edward A. Le Roy, Jr.

The Annual Report of the Council was presented and read by the Secretary, Mr. Levi Holbrook:

January 26th, 1909.

To the American Geographical Society:

The Council respectfully submit the following report for the year 1908:

An appalling disaster has befallen the Society of which appropriate notice is taken elsewhere. Here it may simply be stated that on Christmas Day the librarian, George C. Hurlbut, was killed, and the assistant librarian, Ilione Hurlbut, most severely maimed and disabled in an automobile accident.

The number of Fellows on the 1st of January was 1,319. The additions during the year were 28. The losses by death, resignation, etc., were 109, and the total Fellowship on the 31st of December was 1,238, of which number 351 were Life Fellows.

The additions to the Library number 3,983; Periodicals and Pamphlets, 3,220; Books, 568; Maps and Charts, 194, and 1 Atlas.

Six regular meetings of the Society were held at which addresses were made by

Frederick Monsen, Homer B. Hurlbert,
John Barrett, Prof. Albrecht Penck,
Rowland Dwight Grant, William Elliot Griffis.

There have been published in the BULLETIN, besides the Record, the Map Notes and the Book Reviews, forty original papers.

An exhibition of school maps and other appliances used in schools by teachers of geography was opened in the Society's house on December 21st and is still open to teachers and the public.

The Society has received $30,000, bequeathed to it by Madame de Vaugrigneuse, in memory of our late Vice-President, Francis Aquila Stout, which, in accordance with the terms of the will, has been invested as the "Francis A. Stout Memorial Fund."

For the condition of the finances, reference is respectfully made to the report of the Treasurer, herewith presented.

All of which is respectfully submitted.

CHANDLER ROBBINS,
Chairman.

L. HOLBROOK,
Secretary.

The report of the Treasurer, Mr. Henry Parish, Jr., for the year 1908, was then read:

GENERAL ACCOUNT.

The Treasurer respectfully reports:

On January 1st there was a credit balance of		$3,968.85
During the year there have been received for Fellowship Dues, Sales of Publications, Interest on Investments, &c	$24,123.87	
Legacies and Donations	33,500.00	57,623.87
		$61,592.72
There have been expended for Salaries, Meetings, Library, Publications, House Expenses, Insurance, Postage, &c	$23,790.52	
Invested in guaranteed mortgages	33,200.00	56,990.52
Credit balance December 31st, 1908		$4,602.20

Respectfully submitted,

HENRY PARISH, JR.,
Treasurer.

The reports were approved and ordered on file.

The report of the Committee charged with the duty of selecting candidates for the offices to be filled was presented and read:

NEW YORK, December 17th, 1908.

The Committee appointed November 19th, 1908, to nominate and recommend suitable persons to be elected in January, 1909, to fill vacancies then existing in its offices, respectfully report that they recommend the election of the following-named persons to the offices designated:

		Term to expire in
President	ARCHER M. HUNTINGTON,	1910
Vice-President	ANTON A. RAVEN,	1912
Treasurer	HENRY PARISH, JR.,	1910
Foreign Corresponding Secretary	WILLIAM LIBBEY,	1912
Recording Secretary	HAMILTON F. KEAN,	1910
Councillors	FRANCIS M. BACON,	
	J. HAMPDEN ROBB,	
	CHANDLER ROBBINS,	1912
	BANYER CLARKSON,	
	GEORGE W. FOLSOM,	

Respectfully submitted,

ARCHIBALD D. RUSSELL,
JOHN GREENOUGH,
PAUL TUCKERMAN,
Committee.

The vote of the Society was unanimously in favour of the persons recommended by the Council, and they were declared duly elected.

The President then introduced the speaker of the evening, Mr. Herman Montagu Donner, who addressed the Society on "Finland, the Lake Country of Scandinavia." Stereopticon views were shown.

On motion, the Society adjourned.

NEW MAPS

AMERICA.

United States Geological Survey Maps.

Alaska.—(*a*) Topographic Reconnaissance Map of York Tin Region, Seward Pen. Scale, 1:250,000. Contour inter., 200 ft. In colours. (*b*) Geologic Sketch Map of the Seward Pen. Tin Region. Scale, 16 miles to an inch. Black and white.

Illustrate *Bull.* 358, "Geology of the Seward Pen. Tin Deposits, Alaska." By Adolph Knopf.

California.—(*a*) Topography and Geology of Area covered by Indian Valley Map. Scale, 1:65,500. Contour inter., 100 ft. 40°-10′ N.; 120°40′-121° W. In Colours. (*b*) Topography and Geology of the Southern Half of Honey Lake Quadrangle. Scale, 1:250,000. Contour inter., 200 ft. 40°- 30′ N.; 120° W. In Colours. (*c*) General Geologic Map of Adjoining Portions of the Sierra Nevada and Cascade and Klamath Mountains. Scale, 1.9 miles to an inch. Black and white.

Illustrate *Bull.* 353, "Geology of the Taylorsville Region, Cal." By J. S. Diller.

Kentucky, Ohio and West Virginia.—Economic and Structural Map of the Kenova Quadrangle.—Scale, 125,000, or 1.9 statute miles to an inch. Contour interval, 100 ft.

This quadrangle includes parts of the above-named States. The map illustrates *Bull.* 349, dealing with the geological and economic features of the region which is noted for its deposits of coal and fire clay. The map shows the distribution of these deposits and of the coal mines, iron furnaces, sandstone quarries, etc.

Massachusetts, New Hampshire and Rhode Island.—Two black maps: (*a*) Map of Milford, Mass. Scale, 1 in. to a mile. Contour interval 20 ft. Showing location of granite quarries. (*b*) Map of part of New England; scale, 40 miles to an inch. Showing seven granite mining centres in New Hampshire, Massachusetts and Rhode Island.

The maps illustrate *Bull.* 354, "The Chief Commercial Granites of Massachusetts, New Hampshire and Rhode Island." By T Nelson Dale, 1908.

North Dakota and Montana.—(*a*) Map of the Sentinel Butte lignite field, N. D. and Mont.; scale, 5 miles to an inch; shows coal outcrops and mines; vertical section; (*b*) map of the Miles City coal field, Mont.; scale, 3.6 statute miles to an inch; shows mines, prospects and outcrops of workable and unworkable coal; vertical section. (*c*) Southwestern Part of the Bull Mountain coal field, Mont.; scale, 1 mile to an inch; differentiates coal areas according to thickness of beds; vertical section. (*d*) Outcrop of Eagle sandstone near Crazy Mts., Mont.; scale, 5 miles to an inch; shows coal openings, outcrops and mines, with horizontal sections. (*e*) Map and sections of the Red Lodge coal fields, Mont.; scale, 1 mile to an inch; shows coal outcrops and mines and shades areas under-

laid by coal. (*f*) Lewistown coal fields, Mont.; scale, 4 miles to an inch; shows 37 mines; also, prospects, outcrops, and areas probably underlaid by workable coal.

The maps illustrate *Bull.* 341 A, "Investigations of the Coal Fields of North Dakota and Montana in 1907."

HYDROGRAPHIC OFFICE CHARTS.

Pilot Charts of the North Atlantic Ocean, January and February, 1909.

DEPARTMENT OF AGRICULTURE MAPS.

SOIL SURVEYS.—Robinson County, Tex.; Sumner County, S. C. Scale, 1 mile to an inch.

Distribution of soils shown by tints; soil profiles on margin; descriptive letter press.

CANADA.—The following maps are in "North American Fauna," No. 27, U. S. Depart. of Agri., Bur. of Biolog. Sur., "A Biological Investigation of the Athabaska-Mackenzie Region": (*a*) Map of the Athabaska-Mackenzie Region. Scale, 180 miles to an inch, frontispiece; (*b*) Distribution of Barren Ground Caribou, p. 138. Showing their range in winter and summer; (*c*) Life Zones of Hudson Bay and Mackenzie Regions. Showing in colours the Arctic zone, the Hudsonian zone and the Canadian zone, p. 50; (*d*) Former Distribution of Elk, p. 129; (*e*) Distribution of Moose, p. 131; (*f*) Former Distribution of Bison, p. 144; (*g*) Distribution of Musk Ox, p. 151.

WYOMING.—(*a*) Geologic Map of South-Central Wyoming. Scale, 20 miles to an inch. (*b*) Geologic Map of Part of Central Wyoming. Scale, 16 miles to an inch. Black and white. By N. H. Darton.

Illustrates a paper by Mr. Darton in *Bull.* Geol. Soc. of Amer., Vol. 19, New York, 1908.

UNITED STATES AND MEXICO.—Relief Map of the Lower Colorado River, showing irrigable lands in the United States and Mexico. Scale, about 20 miles to an inch. Annual *Report* Smithson. Inst., Washington, 1907.

The map, with relief effect, illustrates a paper on "The Salton Sea," by F. H. Newell.

CANADA.—The Timber Belt of the North. Scale, 1:2,217,600, or 35 miles to an inch. By R. E. Young, Sup't of Railway Lands, Department of Interior, Ottawa, 1908.

Illustrates a paper by B. E. Fernow, "An Analysis of Canada's Timber Wealth," in the *Forestry Quarterly* (Vol. 6, No. 4). Detailed map of Canada's widespread forest areas; 6 tints are used to show the distribution of sparsely timbered lands, those that are fairly or thickly wooded, the prairie lands and the treeless areas. The map includes that part of Canada west of Hudson Bay.

NEW BRUNSWICK.—Map showing Principal Mineral Occurrences in New Brunswick. Scale, 1:1,013,750, or 16 statute miles to an inch. Accompanies report by R. W. Ells, "The Geology and Mineral Resources of New Brunswick," Ottawa, 1907.

Symbols show the location of metals, building stone, etc.

ARGENTINA.—River Paraná and Its Watershed. Scale, 1:10,000,000, or 158 statute miles to an inch. By W. S. Barclay. *Geog. Jour.*, London, Jan., 1909.

Illustrates Mr. Barclay's article, "The River Paraná: An Economic Survey." 6 brown tints show differences of elevation from sea-level to over 15,000 ft. The limits of the great plain, averaging 300 miles wide, through which the upper Paraguay and lower Paraná flow, are distinctly brought out.

ARGENTINA.—The Evolution of Falls on the Alto Paraná. Scale, 1:40,000, or 0.63 statute mile to an inch. *Geog Jour.*, London, Jan., 1909.

Accompanies Mr. Barclay's paper. Three small coloured maps: (*a*) Guayra Falls, (*b*) Iguazu Falls, (*c*) Uberatonga Falls.

BRAZIL.—(*a*) Mappa da antiga distribuição dos indios no Brazil meridional. 20°-40° S.; 20°-43° W. (*b*) Mappa da actual distribuição dos indios no Brazil meridional. *Revista* do Museu Paulista, Vol. 7. S. Paulo, 1907.

These maps show the former area occupied by the Indians of Southern Brazil and the greatly decreased area they now inhabit.

AFRICA.

AFRICA.—Die Verbreitung des sandflohs in Afrika. Von D. Kürchhoff. Scale, 1:40,000,000, or 631.3 miles to an inch. Accompanies "Der Sandfloh in Afrika," *Geog. Anzeig.*, Vol. 9, No. 11, Gotha, 1908.

This insect (*Pulex penetrans*) is said to have been introduced into Africa from South America by the English ship *Thomas Mitchell* in 1872. Its rapid spread along the west coast from Senegambia to German Southwest Africa and across Africa from the mouth of the Congo River to the Zambezi Delta is shown in red.

ABYSSINIA.—Les Frontières de L'Éthiopie (1908). Scale, 217 statute miles to an inch. *Bull.* Comité L'Afrique Française, No. 11, 1908.

A black map showing the present boundaries of Abyssinia, according to her treaties with Great Britain in 1907, Italy in 1908 and France in 1897.

BELGIAN TERRITORY OF THE CONGO.—Congo State. Levels along the lines of projected railways from the Upper Congo to Albert Nyanza and Tanganyika. Scale, 1:2,000,000, or 31.56 statute miles to an inch. With insets showing levels along the line of projected railways between Dufile and Rejaf. Scale, 1:250,000, or 3.94 statute miles to an inch. *Geog. Jour.*, Vol. 32, No. 5, London, 1908.

A large number of elevations in feet are given, the result of levelling operations and affording more precise data as to elevations of the lakes and other surface features of this part of equatorial Africa.

EGYPT.—The Nile Basin. Scale, 1:7,500,000, or 118 miles to an inch. Accompanies "Some Geographical Aspects of the Nile," by Captain H. G. Lyons. *Geog. Jour.*, Vol. 32, No. 5, London, 1908.

Five tints to show elevations from sea-level to above 6,560 ft. Gives a good delineation of the drainage tributary to Victoria Nyanza.

FRENCH CONGO.—Trois itinérairies entre la haute Sanga, le haut Logone et Laï. Scale, 1:2,000,000, or 31.56 miles to an inch. Black and white. *Renseigne. Col.* No. 1, 1908, Paris.

These itineraries were chiefly through the almost unknown region along the water parting between the Sanga and Logone Rivers. The map gives the first tracing of the courses of a number of tributary streams. Large nomenclature.

FRENCH WEST AFRICA.—Carte Générale de L'Afrique Occidentale Française. Scale, 23 miles to an inch. Black and white. *Bull.* Soc. de Géog. Com. de Paris, Vol. 30, No. 12, Paris, 1908.

Illustrates a monograph by M. Dechesne-Fournet, "L'Afrique Occidentale Française." Shows railroads in operation, in construction, and projected.

MADAGASCAR.—Le Canal des Pangalanes et le Chemin de fer de Madagascar. (No scale or map net.) *Bull.* Comité L'Afrique Française. Black and white. No. 11, 1908.

Shows the coastal canal between the port of Tamatava and the Iaroka R. where the canal joins the railroad to Tananarivo, capital of the colony; also, gives the completed and uncompleted parts of this railroad. In April, 1908, 114.7 miles of the tortuous line through the mountains were in operation and 50 miles were yet to be built. The completion of the railroad is now announced.

NATAL.—Übersichtskarte der Missions-Orte des Klosters der reformiert. Cistercienser (Trappisten) von Mariannhill in Natal, Kap-kolonie, Mashonaland und Deutsch Ost-Afrika, 1907. Scale, 21 statute miles to an inch. In "Das Trappisten-Missions Kloster Mariannhill." Herder, Freiburg im Breisgau, 1907.

Shows in red the wide distribution of the Trappist Missions in Northern Cape Colony and Natal and the stations also established in German and Portuguese East Africa.

SAHARA.—Aïr. Scale, 18.6 miles to an inch. By Lieut. C. Jean. *Bull.* Comité de L'Afrique Française, No. 11, 1908.

Accompanies an article by Lieut. Jean, "L'Aïr et Les Touareg du Sud-Est." A mother map giving new details of this region. The surveys are based upon the astronomical positions of Iferuane and Tanciamane as determined by Foureau. Mountain features are outlined with considerable detail and caravan routes are shown. An inset gives a plan of Agades and its surroundings.

TUNIS.—Höhenschichten-Karte von Tunesien. Scale, 1:1,000,000, or 15.79 statute miles to an inch. 33°30′-37°30′ N.; 8°-11°30′ E. *Jahresber.* des Frankfurter Vereins für Geog. u. Stat., 1906-1908, Frankfurt am M., 1908.

Tints show contours of sea depths and land elevations. Two cross sections on margin show relief of Tunis.

ASIA.

CHINA.—Map of the Lungchow Customs District. No scale or map net. *China Trade Reports,* 1907, Shanghai, 1908.

Shows rivers, rapids, ferries, customs' stations, telegraph and post-offices, and, in red, the distribution of the agricultural products raised in the district.

CHINA.—Sketch map of Szemao District. *China Trade Reports,* 1907, Shanghai, 1908.

Information similar to that on map of Lungchow District.

CHINA.—Provincia de Macau. Scale, 1:165,000, or 2.6 miles to an inch. Black and white. *Revista Portugueza,* No. 12, 1908.

Showing the Portuguese Colony of Macao. Illustrates a paper "Questão de Macau."

EUROPE.

BALKAN STATES.—(*a*) Prof. J. Cvijic: Forschungsreisen in Altservien u. Mazedonien. Prof. Cvijic's routes shown in red; (*b*) J. Cvijic: Geologische Karte von Altserbien und Mazedonien. Scale, 1:750,000, or 11.84 statute miles to an inch. Geological sketch of Olympia region in inset on scale, 1:500,000. These maps accompany Erganzungsheft No. 162 to *Pet. Mitt.*, "Grundlinien der Geographie und Geologie Mazedonien und Altserbien."

POLAR.

GREENLAND.—Northeast Greenland. Sketch Map showing the Surveys of the Danish Expedition, 1906-8. Scale, 1:4,000,000, or 63.12 miles to an inch. In colours. *Geog. Jour.*, Vol. 33, No. 1, London, 1909.

A map, based upon the surveys of the Mylius-Erichsen expedition, of the newly explored east coast, with the ice limits in 1906 and 1908, the track of the vessel and details of the coast.

WORLD.

WORLD.—Soil Map of the World. Mercator Projection. By K. D. Glinka. Geol. Mineralog. *Ann.* of Russia, Nos. 3-4 St. Petersburg, 1908. (In Russian.)

Colours are used to show the distribution of 19 of the most important varieties of soils throughout the world. Illustrates an article by Mr. Glinka.

CURRENT GEOGRAPHICAL PAPERS.

NORTH AMERICA.

CALIFORNIA.—Stratigraphy and Palæontology of the San Pablo Formation in Middle California. By Charles E. Weaver. *Bull.* Dep't. Geol., Univ. of Cal., Vol. 5, No. 16, 1908, pp. 243-269.

NEW YORK STATE.—Geology of the Remsen Quadrangle, including Trenton Falls and Vicinity in Oneida and Herkimer Cos. By W. J. Miller. N. Y. State Museum, *Bull.* 126, Feb. 1, 1909. Maps and half-tones.

NORTH AMERICA, WEST COAST OF.—Über Kalifornische Meeresströmung. By H. Thorade. *Annal. der Hydrog. u. Maritimen Meteorol.* Nos. 1, 2, 1909, pp. 17-34. Temperature diagrams. Surface temperatures and currents.

UNITED STATES.—Shore Line Studies on Lakes Ontario and Erie. By A. W. G. Wilson. *Bull.* Geol. Soc. of Amer., Vol. 19, 1908, pp. 471-500.

YELLOWSTONE NATIONAL PARK.—La "Terre des Merveilles." By J. Leclercq. *Revue Gén.*, Jan., 1909, pp. 9. Based on "Changes in the Yellowstone Park," by R. D. Grant, *Bull.* Amer. Geog. Soc., May, 1908.

SOUTH AMERICA.

ARGENTINA.—The River Paraná: An Economic Study. By W. S. Barclay. *Geog. Jour.*, Jan., 1909, pp. 1-40. Illustrations and maps.

BRAZIL.—Dans Les Hervaes (Yerba Maté). By P. Walle. *Bull.* Soc. Géog. Com. de Paris, 1908, No. 12, pp. 721-44.

BRAZIL.—Rio de Janeiro. *Bull.* Bur. Amer. Reps., Jan., 1909, pp. 30-51.

GUIANA, FRENCH.—La Guyane Française. By Mgr. Marcel. *Les Miss. Cath.*, Jan. 1, 8, and 15, 1909. Illustrations.

SOUTH AMERICA.—Japan in Südamerika. *Export*, No. 3, 1909, pp. 38-42.

URUGUAY.—Kolonisation in Uruguay. *Export*, No. 2, 1909, pp. 23-4.

AFRICA.

ABYSSINIA.—A Etiopia Commerciale. By Prof. G. Jaja. *Boll.* della Soc. Geog. Ital., 1909. No. 1, pp. 13-36.

ALGERIA AND TUNIS.—Travaux scientifiques allemands en Algérie et en Tunis. By Paul Lemoine. *La Géog.*, Vol. 18, No. 6, 1908, pp. 399-402.

CONGO, Belgian Colony of the. Dans la Région minière du Katanga. *Le Mouve. Géog.*, No. 51, 1908.

CONGO, Belgian Colony of the. Le Chemin de Fer national vers le Katanga. By A. J. Wauters. *Le Mouve. Géog.*, No. 52, 1908. Sketch Map.

CONGO, Belgian Colony of the. Congo Belge: Les Missions Catholiques. *Revue Française*, Jan., 1909, pp. 29-33.

ERITREA.—I Confini e l'Area dell' Africa Italiana. By Attilio Mori. *Rivista* Geog. Ital., Nos. 7, 8 and 10, 1908. Historical surveys and maps.

FRENCH CONGO.—Les projets de Chemins de Fer au Congo Français. By A. J. Wauters. *Le Mouve. Géog.*, No. 50, 1908. Sketch Map.

FRENCH WEST AFRICA.—L'Afrique occidentale Française. Ses Voies Commerciales, Ses Produits. By Duchesne-Fournet. *Bull.* Soc. Géog. Com. de Paris, 1908, No. 12, pp. 785-864.

GERMAN SOUTH-WEST AFRICA.—Reisestudien in Gross-Namaland. By Dr. Paul Range. *Zeitsch.* der Gesells. f. Erdkunde zu Berlin, 1908, No. 10, pp. 664-687.

SAHARA.—Le Détournement de l'Oued Saoura au Foum-el-Kreneg (Algérie du Sud.). *La Géog.*, Vol. 18, No. 6, 1908, pp. 375-378. Sketch Map.

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MINERVA.—Jahrbuch der Gelehrten Welt. Begründet von Dr. K. Trübner, XVIII, 1908-1909. Mit dem Bildnis von Dr. Theodor Kocher. Strassburg, Karl J. Trübner. 1909. 8vo.

STEVENS, HENRY N.—Ptolemy's Geography. A Brief Account of all the Printed Editions down to 1730. With notes, etc., etc. 2nd Edition. London, Henry Stevens, Son & Stiles. 1908. pr. 8vo.

Nautical Charts. By G. R. Putnam. viii. and 162 pp., 50 Maps and other Illustrations, Index and Bibliography, John Wiley & Sons, New York, 1908. (Pr. $2.)

Mr. Putnam was Director of our Coast Surveys in the Philippine Islands from 1900 to 1906. His book should be especially welcome and useful in the United States where the literature relating to charts and maps is small. Any good work in English treating of map-making should have a helpful influence towards the improvement of maps produced by commercial publishers and stimulate appreciation of good maps. Over 1,000,000 copies of nautical charts are now issued annually by civilized countries, but though such map products are often mentioned or discussed in publications, there has been no book covering the general subject of their origin, construction and use. This work supplies the deficiency, and, though the topic is technical, the author has succeeded in treating it so clearly that all of the information will be readily understood by intelligent readers.

He treats of the development of chart and map-making, tells how information is collected and prepared for charts, notes the processes of their publication and correction, gives two interesting chapters on the reading and use of charts and indicates the publications which supplement them. The numerous black and white maps very helpfully illustrate the text.

The author says that only a comparatively small proportion of the coasts of the world are as yet completely surveyed and even such regions require much additional revision. The more thoroughly surveyed coasts include the Atlantic and most of the Pacific Coasts of the U. S., Porto Rico, nearly all the coasts of Europe, Algeria and portions of the coast of Japan, the Philippine Islands and India. A large extent of coasts has been surveyed incompletely, but well enough to permit the publication of navigation charts, as in southeastern Alaska, British Columbia, most of Mexico, Central America, the West Indies, Brazil and parts of Chile, the Hawaiian Islands, China, Malay Peninsula, Siam, the Dutch East Indies, Australia, New Zealand, Persia, Arabia, most of Africa, Iceland, Northern Scandinavia and Finland. A considerable part of the coasts has not been surveyed but is covered by explorations embodied in charts of varied degrees of incompleteness, such as the north coast and parts of the south and west coasts of Alaska, the Aleutian Islands, Siberia, most of the Pacific Oceanic groups, the northern coasts of Europe and North America, Greenland, the west coast of South America, Venezuela and Argentina. Coasts that are still entirely unexplored are confined to the polar regions.

The Indian in Relation to the White Population of the United States. By Fayette Avery McKenzie. 117 pp. Published by the author, Columbus, O., 1908.

A thesis presented to the Graduate School of the University of Pennsylvania, giving a sociological interpretation of the Indian problem with a discussion of his legal status and of the political, educational, religious and social policies realized or advisable in his behalf. An able and painstaking discussion of the

whole Indian problem, whose solution, as far as the national government is concerned, requires chiefly, in the author's opinion, the abolition of the reservation, the complete and final allotment of lands and trust funds, the granting of full citizenship, the withdrawal of special privileges and the enforcement of the Indian's equal rights in the courts of the land.

The Alps in Nature and History. By W. A. B. Coolidge. xx and 440 pp. Illustrations, Maps, Bibliography and Index. E. P. Dutton & Co., New York, 1908. Price, $2.50 net.

There is some question on as to the propriety of the title of this volume, inasmuch as the author takes early occasion to assure us that the Alps are "taken as they exist . . . . . and treated as practically unchangeable." He gives us little description even of the valley and mountain forms as they are, which is somewhat disappointing after the emphatic disclaimer concerning the physical evolution of the region. Changes go on so rapidly, one might say so boisterously, in the Alps, that one with physiographic leanings finds it difficult to seize precisely the author's point of view.

The illustrations, admirably rendered, are all of high mountain views, snow fields, glaciers, rock slopes and summits, but there is nothing exhibiting the forests, streams, agriculture or homes of the mountain slopes and valleys. A chapter on the "Snowy Region of the Alps" contains some interesting notes on the early investigations of glaciers, and truthful comments on their appearance and behaviour, marred somewhat by ascribing to scientific men the view that "in the Ice Age, the whole of Europe was really an unbroken sea of ice." It is not easy to see how this error could hold possession of an author who knows the Alps in the fullness of detail due to the studies and wanderings of more than forty years. This chapter refers to some interesting legal queries raised as to glaciers, such as the ownership of land uncovered by their recession, the right to grant concessions for the harvest and sale of ice, and whether the glaciers belong to commune or canton. The author's inclination to rather recondite matters of linguistics and political history is seen on pages 27 and 30 in the notice of the variety of sectional or national names given to glaciers and avalanches. The extended chapter on the "Political History of the Alps," an encyclopedia of detailed facts, might without much injustice be called a syllabus, in which one event follows another with bewildering swiftness. It would be easy to find on almost any single page from one to two dozen dates of minor events. There is no perspective, no descrimination between the trivial and the important. It need hardly be said that while such Alpine history shows much learning, and patient thoroughness, it has little interest or instruction for the average reader, for whom the volume would seem to be intended.

The account of the Great Historical Passes is open to the same criticism. The title raises expectation of an illuminating story of great lines of movement. Indeed, the author proposes to offer criteria for distinguishing between great and minor passes; but soon we are required to accept eight great historical passes in the western Alps alone, and when we have finished the chapter we have seen in swift review nearly 100 passes and have remembered quite too little concerning any of them. The maps of the passes are but flat sketch maps of small regions and give no general relations. It would seem better to have offered a general map showing the principal reliefs and delineating a small number of the really famous passes as they actually link northern Italy to France, Germany and

Austria. The general map of the Alps is quite apart from this criticism and is executed by Bartholomew.

The volume is at its very best in the three short chapters in which Mr. Coolidge writes of "Modern Mountaineering," of "Alpine Guides" and of "A Year's Round in the Alps." Here he expresses his own deepest feeling and experience, and we see the heart and the memories of an Alpine climber who has perhaps an unrivalled number of peaks to his credit and who is wedded to the air and the scenery of his beloved mountains.

Particularly fresh and good are his observations on guideless climbing, with the sorrows and discredit which have followed. So do the enthusiasm and intense loyalty of the Alpine devotee come to light in the preference of veterans for rock peaks rather than snow mountains.

The short half dozen pages of "A Year's Round in the Alps" are the gem of the volume, closest to the author's feeling, and assuring the summer visitant that his knowledge is only partial, that the mountains and valleys are at their best in the snows and peasant ways of the other nine months of the year. The coming of the cattle from the upper pastures, the genial sun of October, the preparations for winter, the brilliant atmosphere of the high places, the awaking of the spring,—such are the pictures that tell the summer traveller of delights to him unknown.

The appendixes give full lists of passes, peaks and dates of conquest, the recorded passes numbering nearly 500 and the peaks almost 1,000. There is a short bibliography and a full index. The volume is accurate in its scholarship and attractive in appearance, but is, for the greater part, more suited for reference than for general reading. A. P. B.

In Viking Land. Norway, its People, its Fjords and its Fjelds. By W. S. Monroe. xxiv and 332 pp., Illustrations, Bibliography and Index. L. C. Page & Co., Boston, 1908. Price, $3.

This is a serious geographical work, based, as is frankly stated, on two vacation trips and much reading of the literature of the country. It will not disappoint the reader who seeks within compact limits the most central and important features of Norway and its people. The author proposes, without neglecting the physical features, to give more heed than is usual to the people and their institutions.

The opening chapter has to do with the general geography, other chapters on special features having a later place in the volume. One is surprised to read the rather assured statement that we must go back several hundred thousand years to reach the Ice Age in that land. Several chapters of an historical nature follow, a treatment sufficient to accompany a general geographic description. Thus the chapter on Haakon VII gives a short but good outline of the Norwegian system of government. The people of Norway, their physical and mental traits and some of their social customs, are described in Chapter VI. As the author is a teacher of experience, we find, as we should expect, a careful account of education, including some reference to the literature and influence of the press.

The physical and industrial relations of the land and the people receive attention under the heads, "Highways, Railways and Waterways"; "Farm Life and Agriculture"; and "Forests, Fisheries and Commerce." All of these topics have peculiar interest for any who have visited the Viking country and admired the perfection of its roads, the industry and thrift that mark tillage, or the extent and

glory of the Norwegian forests. Likewise, the fishing and general trade are essential to the life of the nation, and our author gives us a well-balanced story of these central elements of Norwegian geography.

Two physical chapters describe the "Fjords of the West Coast" and the "Fjelds and Mountain Valleys." Although the author concedes the pre-existence of river valleys in his references to the origin of the fjords, the general reader would gain an exaggerated impression of glacial erosion, as almost an exclusive agency in their making. The waters, lofty walls, the wealth of waterfalls, the lakes, farmsteads, hamlets and towns of the great fjords are truly and vividly described, accompanied, as are all the chapters, by very typical and satisfactory views. The general map of southern Norway, however, is unworthy of the volume, and should speedily be replaced by a good product of modern cartography.

In the account of Trondhjem Cathedral, the absence of any view of this great architectural monument of Norway marks an unfortunate omission. Other titles are,—"Bergen and the Hanseatic League," "Christiania," "Norse Letters and Henrik Ibsen," "Folk Music and Edvard Grieg"; and, "Painting, Sculpture and Architecture." Portraits are included of Haakon VII, Ibsen, Grieg, Nansen, Sinding, and of Mrs. Backer-Gröndahl. There is an appendix of suggestions to travellers, a bibliography and an index. A. P. B.

Worlds in the Making. The Evolution of the Universe. By Svante Arrhenius. Translated by Dr. H. Borns. xiv and 230 pp., and 60 illustrations. Harper & Bros., New York, 1908.

Dr. Arrhenius, director of the Physico-chemical Nobel Institute, Stockholm, is one of the greatest of physicists and chemists. In 1903, when he was 44 years old, he received the Nobel prize in the chemistry section and he had been Professor of Physics at Stockholm since his 36th year. His writings, on the scientific specialties he has made his own, command the serious attention of all workers in these fields. He published his "Lehrbuch der kosmischen Physik" (Treatise of Cosmic Physics) in 1903, and the explanations he tentatively offered of some cosmic phenomena involving great difficulties were very favourably received by his fellow students. This fact encouraged Dr. Arrhenius to submit his views to a wider circle of readers, and the present book is the successful result of this ambition. The volume is intended for popular reading and it will be welcomed by all intelligent readers who are interested in cosmical problems.

The book has to do with the evolution of the universe, and it differs much from many earlier works on this weighty problem because, in the past generation, the ascertained facts of chemistry as well as of astronomy have begun to be largely utilized in the study of the subject. Dr. Arrhenius assembles these facts, discusses them in relation to numerous phenomena and has happily brought recondite phases of his topic within the grasp of a large circle of readers.

He begins with what is nearest to us—some of the physical phenomena observable on our globe, and describes many of the phases of volcanic eruptions and earthquakes which have given us some knowledge of the interior of the earth. He concludes that "the solid earth crust cannot be very thick and that the core of the earth is probably gaseous." He thinks that the study of seismograms may help us to learn more about the central portions of the earth which, at first sight, appear to be absolutely inaccessible to scientific research.

In the second chapter, the author treats of celestial bodies as abodes of organisms. In this brief *résumé* of his book, it is impossible even to mention the group-

ings of many facts and their discussion. Allusion to some of the author's deductions is all that can be attempted. He thinks the assumption is plausible that organic life may thrive on Mars and also on a considerable part of the surface of Venus, particularly in the districts around the poles. "It is, however, rather sanguine to jump at the conclusion that the so-called canals of Mars prove its being inhabited by intelligent beings." Nevertheless, he does not think that Lowell's photographs warrant the opinion expressed by many persons, that the "canals" are optical illusions. The moons of Jupiter and Saturn may have, or have had, conditions suitable for the development of life. The author gives a most interesting account of the significance of carbon dioxide in the atmosphere; and though we lament the great waste of our coal resources and are terrified by the awful destruction of life and property by volcanic eruptions, there is comfort mixed with the evil:

> By the influence of the increasing percentage of carbonic acid in the atmosphere, we may hope to enjoy ages with more equable and better climates, especially as regards the colder regions of the earth, ages when the earth will bring forth much more abundant crops than at present, for the benefit of rapidly propagating mankind.

Much attention is naturally given to the radiation and constitution of the sun. The author concludes that we have every reason to presume that the sun's chemical energy will be sufficient to sustain the solar heat during many thousand millions, and possibly billions, of years to come. Several chapters are devoted to the stellar and nebular states of matter in the universe, including solar dust in the atmosphere and the non-luminous bodies that are probably diffused through space; also the polar lights and terrestrial magnetism. The concluding section, dealing with the way in which it is thought probable that life is spread through the universe is certain to interest every reader. The author summarizes earlier speculations on this subject, tells why there is good reason for dissenting from them, and asserts that recent discoveries of the effects of radiation and the universal acceptance of the theory of evolution have placed the question in a new and more favourable light.

The author agrees with Richter that organic life has always existed in the universe and has always propagated itself in the shape of living organisms from cells and from individuals composed of cells. It is probable that germs of the lowest organisms are continually being carried away, by electrical currents, against the force of gravity, from the earth and from other planets upon which they exist; and while most of them doubtless meet death in the cold of infinite space, yet a small number of the spores will fall on favourable soil in some other world and may there be able to spread life. According to this theory, "all organic beings in the whole universe should be related to one another and should consist of cells which are built up of carbon, hydrogen, oxygen and nitrogen."

The illustrations are instructive and the translation by Dr. Borns is beyond criticism.

São Paulo du Brésil. Notes d'un Colon Français. Par Louis Casabona. iv and 233 pp. and Illustrations. E. Guilmoto, Paris, 1908. Price, 3 frs.

The book is intended for Frenchmen who think of emigrating to São Paulo to engage in agriculture. It purports to be the notes of a French farmer, Léon Valade, who sold his little holding at home and emigrated with his family to São Paulo. The Immigration Bureau of the State gave him advice and material aid

in establishing himself on the allotment of land where he began life anew. Father Étienne, a French priest, helped him to put his notes in form for publication, and they were sent to Mr. Casabona, who had met the farmer in São Paulo and had asked him to compile the story of his experiences, in which the visitor was greatly interested. Mr. Casabona edited the manuscript and added copious notes on the geography, communications, commercial and other statistics, etc. The result is a consecutive and well-written story of the fortunes of a French family from the time they left home till the new hearth was reared and they could see that a degree of prosperity was attainable in this prosperous State to which many peasant farmers in France are strangers.

All information required by the French colonists on farm lands, climate, schools, government encouragement, crops, farm methods, and other matters, is given in much detail. The book in no way suggests the colonization pamphlet, but the account it gives of this remarkable State, which raises one-half of the world's coffee crop and offers great opportunity also for other agricultural industries and stock-raising, will interest and edify all readers. The full-page illustrations from photographs are instructive.

The Italians of To-day. From the French by René Bazin. Translated by William Marchant. 246 pp. and Index. Henry Holt & Co., New York, 1908.

A study of Italian life from the Lombard plain to Calabria and Sicily. The author sees the meaning of small as well as of large things and deals with those aspects which throw most light upon actual conditions in town and country and upon the life of all classes of Italians. It was written in the days of the late King Humbert, and the following extract from the author's description of the king, as he saw him at the inauguration of an Institute for the Blind in Milan, is a fair sample of a style that is both interesting and analytical:

> The King arrives first from Monza in a very ordinary two-horse landau. He wears a frock-coat and silk hat. The presentations being made, every one resumes his hat by the royal command, and the King begins to chat with the Milanese authorities and the managers of the new Institute, remaining in the vestibule, where the cold outdoor air circulates freely. I remark no excessive attention on the part of those who surround him. He talks to each in very short sentences, speaking low, with a frequent lifting of the chin. His attitude is altogether military; and it is easy to see that he likes to talk standing, his chest well thrown out, taking a step or two, now and then, a habit which he maintains in court receptions. His moustache is formidable, less so than on the coins, however. But his glance, a little singular in its fixedness, has nothing severe. King Humbert's popularity increased much after the cholera at Naples and he is aware of this fact.

Mr. Bazin's clean-cut word pictures take in many sides of Italy, from its literature and authors and its high society, to the Campania, which he loves, and the slums of Naples. The only chapter of considerable geographical interest is that on Etna in eruption.

Applied Geography. A Preliminary Sketch. By J. Scott Keltie. vii and 199 pp. and 10 Maps. Geo. Philip & Son, Ltd., London, 1908. Price, 2s. 6d.

In this book Dr. Keltie shows how, in many ways, knowledge of geography may be applied in the interests of commerce. It is eighteen years since the first edition was published, and the second is partly rewritten and thoroughly revised. A new chapter has been added, "The Unstaked Globe," in which he sums up the results of the recent scramble of leading Western nations and Japan for new

territory, which has finally placed all the continents and their islands, excepting Asia, in the hands of Europe or of peoples of European origin. These vast acquired areas have not, as yet, all been "effectively occupied or even completely explored, far less developed, as to their resources." Dr. Keltie especially illustrates the practical purposes to which geography may be applied by chapters on the geography of Africa and the British Empire, with deductions as to the bearings of the geography of these regions upon their development. Brought up to date, the book renews its usefulness as a series of suggestions and examples relating to the practical side of geography, of much value to teachers and which all intelligent readers may peruse with profit.

Peerless Alaska. Our Cache Near the Pole. By Charles Hallock. 324 pp., Illustrations by George G. Cantwell and 3 Appendices. Broadway Publishing Company, New York, 1908. Price, $1.25.

The amount of reading matter is almost doubled by "single leads" between the lines. The information on all phases of Alaska is readably presented and based partly upon the author's own observations over twenty years ago and his selection of much more recent data secured chiefly by government explorers. Alaska is treated in its geography, economic aspects, opportunities for agricultural development, mineral wealth, commercial fisheries, fur and game animals, glacier fields, climatic phases, attractions for tourists, missionary enterprise, and present stage of development. The author shares the confidence of many writers that the timber resources will become a large source of wealth, and that hundreds of thousands of acres, tucked away in the folds of Alaskan mountains, will yet be turned into the richest of grain, hay, and grazing lands. The book is instructive but without map or index.

In Search of a Polar Continent (1905–1907). By Alfred H. Harrison. xx and 292 pp., Illustrations, Map and Index. Edward Arnold, London, 1908; Longmans, Green & Co., New York, American Agents. Price, $3.50 net.

Mr. Harrison prefaced his sojourn in arctic America, here described, by two hunting trips in the Rocky Mountains and another sporting expedition in Canada that took him as far north as Great Slave Lake. The objects of the expedition to which this book is given were to visit the extreme north of Canada, make Herschel Island a base, and discover, if possible, whether unknown land exists in Beaufort Sea and the Arctic Ocean to the west of the archipelago, north of this continent. In the very bad ice year of 1906 he attempted to reach Banks Land on a whaler, which carried all his equipment, but the goal from which he expected to sledge north over the land and then west over the sea ice in search of new lands was almost unattainable on account of the ice; and, finally, the whalers were unable to give him the two-years' supplies of provisions they had promised. He was, therefore, compelled to give up the main purpose of his mission.

The work he accomplished, however, in his journey down the Mackenzie and during the two years he spent on the northern edge of the continent was most creditable. His book is both entertaining and instructive. He has written one of the best accounts of the Mackenzie that has been published. Well equipped for accurate surveying, he has made the best map of the eastern part of the Mackenzie Delta and the neighbouring regions, including the Baillie Islands and Herschel Island, that has yet been produced. He lived among both the Kogmolik and the

Nunatama Eskimo and gives a careful description of their characteristics and all phases of their lives. He travelled hundreds of miles along the coastal regions, which he describes in considerable detail. His account of the activities and life of the whalers in that region is informing, and the interest in his own adventures is enhanced by the fact that some unusual hardships were his lot and at times he was on the verge of starvation. His many photographic reproductions are admirable and his book was well worth writing.

Mr. Harrison wishes to utilize the experience he has gained by renewing his attempt to reach the far north in this region. He aspires to nothing less than to take soundings across the frozen ocean from Prince Patrick Island to Spitzbergen, passing over the Pole, the distance being about 1,500 miles. He desires to start from Prince Patrick Island in October, making the journey in winter, when there is less danger of meeting with open channels, and to have with him, 11 Eskimo, 18 sledges, 162 dogs and supplies for 260 days. He gives his reasons for believing that the journey can be made. His scheme is certainly original, and if he can raise $25,000 he intends to put it to the test.

L'Océanographie. Par Dr. J. Richard. vi and 398 pp., 339 Illustrations and Bibliography. Vuibert & Nony, Paris, 1907. Pr. 10 frs.

The author of this work is Dr. Jules Richard, Director of the Museum of Oceanography in Monaco. The chief predecessors of the volume in France are two works on oceanography by M. Thoulet and the section of de Lapparent's Traité de Géologie devoted to that subject. The present purpose is to offer a popular treatment which shall at the same time be highly scientific, omitting or only summarizing questions which are difficult, unattractive or still in debate. The work is dedicated, by his permission, to the Prince of Monaco as the fruit of many years of participation in the scientific cruises of that eminent patron and student of the science of the ocean.

The sixteen chapters may be considered as falling into four or five groups: first, those discussing larger and general features such as depth, limits, relations to the lands, and the sea bottom; second, the waters, including floating ice; third, movements; fourth, the life of the sea (six chapters), and a final chapter on the history of investigation. The work is amply illustrated with 339 maps, drawings and photographs. The quarto page allows these to be closely associated with the appropriate parts of the text, thus considerably enhancing the interest and instructional value of the treatise.

No less than thirty means of ascertaining depth are described, from simple devices to the elaborate machinery used on modern cruises of investigation. The various instruments determine depth by direct measurement, by recording the pressure of the water, through the propagation of sound and by means of variations of weight. Chapter 2 is chiefly occupied with an historical and descriptive account of bathymetric maps, particularly the series following upon the deliberations of the Wiesbaden commission and prepared through the munificence of the Prince of Monaco. A group photograph of the commission at work is included, showing the Prince of Monaco presiding, and Professors Krümmel, Thoulet, Supan, Pettersson and Mill. Maps of the several oceans are reproduced, and also of some special areas as the Ravin de Puerto Rico, the Fosse de l'Hirondelle and the Ravins des Carolines et des Mariannes. The accompanying text gives a most useful summary of the chief topographic features of the several ocean basins.

In like manner, the existing data as to the deposits of the ocean bottom are

summarized not only in a manner acceptable to the general reader, but convenient for geologists and geographers whose special studies lie in other fields, but who desire to know, or to have conveniently accessible, the results of this comparatively new branch of earth science. A similar comment, indeed, may well be made with reference to Dr. Richard's entire volume. The waters of the sea offer many problems, and we find here a variety of topics such as the measurement of temperature, its distribution and variations; the gathering of water samples at various depths, for which some seventeen devices receive notice; pressure and compressibility; specific gravity and density; transparency and coloration; chemical composition, dissolved gases and organic matter in solution.

An interesting passage discusses the "dead water" often reported by Norwegian sailors and encountered by Nansen off the Siberian coast, retarding the course of ships, but, until explained by recent researches, regarded as a product of the imagination. It has been shown that the phenomenon occurs only where salt waters are covered by a suitable stratum of fresh or brackish water, a condition likely to be found in the fiords of Norway or at other points of discharge of fresh waters. Cases are cited from the seas about Vancouver Island and in the Greek Archipelago. Pliny gives a similar example from an ancient voyage of Caligula, and M. Ekman attributes to this cause an experience of the 17th century reported in the "Nautica Mediterranea" of Bartolomeo Cresciento Romano.

Under the head of movements we find waves, tides, seiches, currents and the general circulation in the oceans. The Gulf Stream is described as the best-known and most important movement of ocean waters on the globe. "For us Europeans it plays a capital *rôle*. Its influence upon the climate of the shores of Europe is preponderating. It acts directly by the neighbourhood of its warm waters, or by the heat which it communicates to the winds which reach us." The stream is traced from its equatorial origin, and its variations of direction, width, depth, temperature and velocity are recorded. The course of this current in the vicinity of western Europe was shown by the researches of Hatreux, Bénard and the Prince of Monaco, the last having put out 510 floating objects along the 20th meridian between the latitudes of Cape Finisterre and the south of England. Of these 57 were recovered, from the shores of Brittany to the north of Spain, thus demonstrating one of the various ramifications of the Gulf Stream.

Chapter 10 discusses biological oceanography in general, outlining with ample illustrations the apparatus and methods used. Marine plants follow and a full review of the principal animal forms. The closing chapter is devoted to modern oceanography, the more important expeditions, the Permanent International Council for the Exploration of the Sea, oceanography in France, and, as is most proper, the contribution of the Prince of Monaco and the splendid Museum of Oceanography, of which he is the founder and patron. This institution was established in 1898, not only to gather and preserve the collections made by the Prince, but to exhibit everything that illustrates the science of the ocean. Two cuts show the façades of this imposing building, one of which rises loftily from the rocky shore-line of the Mediterranean. It is unfortunate that a volume so admirable and useful should not contain an alphabetic index.

A. P. B.

CONTENTS—FEBRUARY.

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