Meteor-Showers.

	R.A.	Decl.	
Near γ Persei	44	54 N.	Slow.
	103	33 N.	Swift; streaks.
	135	80 N.	Very swift.

GEOGRAPHICAL NOTES.

THE Hon. Secretary of the South Australian branch of the Geographical Society recently received the following telegraphic message from Mr. Tietkens, who is in command of an Expedition engaged in exploring the interior. The telegram came from Charlotte Waters, and is published by the *Colonies and India*. It says:—"The Expedition under my command arrived at Erldunda on July 22, the party being all well. The Expedition left Glen Edith on May 10. While there for four days and five nights almost incessant rain fell. Forty miles west of Glen Edith we discovered and named Cleland Hills and Gill's Creek, flowing south for twelve miles. The extent of good country is limited. We also discovered and named Beetson Hills, where there were three miles of running water, the extent of available country also being limited. In east longitude 128° 45′ and south latitude 23° 20′, we discovered and named the Kintore Range, the highest peaks of which are Mount Leister and Mount Strickland, 1500 feet above the plains. Here we experienced three days' heavy rains. In south latitude 23° 22′ and east longitude 128° 15′, we discovered and named Lake Macdonald, after the hon. secretary of the Victorian branch of the Society. It extends westerly to east longitude 127° 50′, the south shore being in latitude 23° 40′. South of the Kintore Range we visited and named Davenport Hill, and thence we travelled in a south-easterly direction to Blood's Range, the highest peaks of which were named Mount Harris and Mount Carruthers, being 1400 feet above the plains. Mount Unapproachable, in Long's Range, marks the west extremity to Lake Amadeus, its south shore, south of Mount Olga, being in latitude 24° 39′. At Lake Amadeus the camels partook of a poisonous plant, from the effects of which one died. At Mount Olga the other was unable to travel. After a week's rest the Expedition left there and visited Ayer's Rock. Mr. Goss's marked tree has been burnt down by the blacks. Near Mount Connor we discovered a small spring, and travelling northward from there discovered and named Basedow Range; from there travelled easterly over better country until we arrived here, receiving a most cordial and hospitable reception from Messrs. Warburton and Tomlin. To Mr. Warburton's kindness we are indebted for conveying this message to the telegraph line. The general character of the country passed over has been Spinifex, sand-hills, and plains, with extensive forests of Casuarina. Rock reservoirs, native wells, and a few clay-pans were the only descriptions of water met with."

ONE of the most important of recent exploring Expeditions has been that under Sir William Macgregor, the Administrator of British New Guinea, who has recently ascended and examined the Owen Stanley Range, over 13,000 feet above the sea. Several attempts have been made to reach the summit within the past few years; Sir William therefore deserves much credit, all the more that his natural history observations are very full and valuable. Sir William is an accomplished naturalist, so that any exploring work he may undertake is sure to be of scientific value. He left Port Moresby in May, accompanied by his secretary, and when the Expedition was finally made up there were about forty natives. Only five, however, went up to the top with Sir William, who spent three or four days examining the ridge. The summit was reached on June 11. The climate Sir William describes as foggy and unpleasant up to 8000 feet; but above that clear blue sky and beautiful climate, "one of the finest in the world." The party were ten days over 10,000 feet, and never had a cloud above them. The sea coast was visible on both sides, that on the north being the most distant. But the country is much smoother on that side, and the ascent of the mountain from the north apparently unobstructed and easy. From the point of Mount Victoria in the east to Mount Lilley in the west is a continuous, unbroken crest of thirty miles, which was traversed by Sir William, who spent three days and a half on the summit. His eyes were gladdened by the sight of daisies, buttercups, and forget-me-nots, and he brought away with him a quantity of white heath which reminded him of his native mountains. Big icicles amazed his native companions, who thought their mouths were burnt when they attempted to bite this, to them, novel product of Nature Larks were plentiful, similar in flight and song to those of the old country. Specimens of the flora were naturally collected by an enthusiastic naturalist like Sir William, and amongst them also probably several novelties will be found. There are no trees within 1000 feet of the top, which is bare rock or covered with grass. There are no snakes or other pests on the main range, but unfortunately game is very scarce also. The temperature ranged from freezing-point to 70° in the sun. The southern aspect of the range is drained exclusively by the Vanapa River, the head of which was crossed at an elevation of 10,130 feet. No natives live on the mountains above 4000 feet, although they hunt as high as 9700 feet. All those met with at the base were extremely friendly. Nothing, however, would induce any of them to accompany the party up the mountain. They grow tobacco, peas, beans, many kinds of potatoes, yams, and bananas, and of these they gave Sir William as much as he wanted. They are certainly Papuan. The party returned to Port Moresby on June 25. Sir William was in perfect health the whole time, though, as usual, the natives had their little complaints. Another account states that Sir William found the top of the crest very uneven, consisting of immense masses of rock separated by deep chasms. The long-tailed bird of paradise was shot at from 5000 to 9000 feet altitude. On the top of one of the mountains what is believed to be a new bird of paradise was obtained, golden yellow on the back, with a black velvet breast and belly. As to the botany, the variety was very small, but what there was was new.

M. YADRINTZEFF'S Expedition returned to Kiakhta on August 16, after having reached the sources of the Orkhon River, and determined the position of Kara-korum. It also discovered the ruins of two large cities (one of them having a circumference of thirteen miles), as well as of the palaces of the Khans of Mongolia, and their cemeteries, where numerous statues and important inscriptions were found.

THE BRITISH ASSOCIATION.

REPORTS.

Report (Eighteenth) of the Committee appointed for the purpose of investigating the Rate of Increase of Underground Temperature downwards in various Localities of Dry Land and under Water. Prof. Everett, Secretary.

Very important observations have been published (*Neues Jahrbuch für Mineralogie*, &c., 1889, Bd. 1) during the past year by Herr Dunker, whose observations in a very deep bore at Sperenberg were embodied in our Report for 1876. The new observations were taken at Schladebach, near Dürrenberg, in a bore of greater depth and smaller diameter than at Sperenberg, and with similar precautions against convection currents. The depth was 1748 metres, the bore passing through new red sandstone (Buntsandstein), magnesian limestone (Zechstein), Lower Permian sandstone (Rothliegendes), and coal measures (Steinkohlengebirge), to the Upper Devonian beds (Oberdevon).

It was tubed to the depth of 1240 metres. For the first 584 metres the diameter was 120 millimetres; for the next 104 m. it was 92 mm.; then for 393 m. it was 72 mm.; and for the next 159 m. it was 50 mm. From this point to the bottom the diameter gradually diminished to that of a man's little finger. The diamond borer was the instrument employed in sinking it.

India-rubber bags, such as were used at Sperenberg for preventing convection currents, being deemed unsuitable for such a narrow bore, a plugging of moist clay was employed, constructed as follows:—

On a cylindrical rod, which might be of tough wood for bores of moderate depth, but was of iron in the actual observations, are two wooden disks of such size that there is only just room for them to move in the bore. The lower disk is fixed, and the upper movable on the rod. The part of the rod below the fixed disk has a length equal to that of the water-column which it is desired to isolate. The maximum thermometer with which the temperatures are taken has its bulb half-way down this portion of the rod. It is fastened beside the rod if there is room for it; and when the bore is too narrow for this arrangement, the thermometer is placed in a metal box which may be described as forming part of the rod, the rod being divided into two portions screwed to the two ends of the box. The movable disk is removed to a measured distance from the fixed one, and the space between them is then filled with clay which has been made plastic by kneading it with water, so that it forms a cylinder with the two disks.

When the pole presses on the bottom of the bore, part of the weight of the boring rods is supported on the upper disk, thus squeezing the clay against the sides of the bore and forming a water-tight plug.

The above description applies especially to the taking of observations at the bottom of the bore. When it was desired to isolate a column of water at a considerable distance from the bottom, the apparatus employed consisted of two portions. The above description applies to the upper portion, and the lower portion was similar to it but inverted, resting upon rods which extended to the bottom. The two masses of clay in this case cut off a water-column between them.

Experiments with a model, in which the bore was represented by a cylindrical glass vessel 26 cm. high and 55 mm. wide, filled with water, showed that the isolation was very good, and that it remained so though the immersion lasted more than ten hours. In tearing away the clay from the vessel a portion of the clay fell into the water, but such an accident occurring in the bore would be of no consequence.

The construction of the isolating apparatus was intrusted to Bore-Inspector Köbrich, under whose management the observations were to be carried out.

Besides the thermometer in the isolated water-column, there was a second maximum thermometer in the open water just above the upper plug, for comparison, the height of its bulb above that of the principal thermometer being 2·8 m.

The thermometers were very similar to those employed at Sperenberg. They were overflow-thermometers, generally without scales, and were inclosed (for protection against pressure) in a hermetically sealed case of stout glass with an external diameter of 15 mm. To take the reading, the thermometer, after being drawn up, was put with a normal thermometer into a vessel of water at a temperature a little below that which was expected. Warm water was then gradually added, and the whole kept stirred till the mercury in the overflow-thermometer reached the open end. The temperature at this moment was then read by the other thermometer.

The first observations taken were in the untubed portion of the bore, which at that time extended from the depth of 1240 m. to 1376 m.; and as the bore was deepened to 1748 m. the observations were continued. In this way the last sixteen observations of Table I. were obtained, forming a series at intervals of 30 m. from 1266 m. to 1716 m. of depth.

A pause which subsequently occurred in the sinking of the bore, through having to wait for a new tube, was utilized for taking the observations which form the remainder of the table. We have thus a complete series of observations, at equal intervals of 30 m., from the depth of 6 m. to that of 1716 m.: 8°·3 R. at 6 m., and 45°·3 R. at 1716 m.

The table is arranged in five columns. The first column contains the natural numbers from one to fifty-eight, for convenience of reference to the observations at the fifty-eight different depths; the second column contains the depths in metres; and the third column, the temperatures observed at these depths in isolated water-columns. The fourth column contains the excess of the temperature so observed above the temperature observed by means of the secondary thermometer in the free water just above the plug. The fifth column contains the differences between the successive numbers in the third column—in other words, the increase of temperature for each 30 m. of depth.

The smallness of the effect of isolation, as shown in the fourth column of the table, is very noteworthy, its greatest value being 1° R., and its average value about ¼ of 1° R. At Sperenberg it amounted in several cases to about 3° R. The smallness of the effect in the present case is attributable to the narrowness of the bore, which tells in two ways: there is more frictional resistance to the movement of the water; and the thermal capacity of a given length of column is less in comparison with its surface of contact with the sides of the bore.

As a further experiment on the prevention of convection, a wooden plug was driven into the bore at the depth of 438 m., thick mud was introduced till it filled all the bore above this plug, and observations were taken with a maximum thermometer in the mud at depths from 426 m. to 126 m. A second plug was then driven in at the top of the tubing, which was 120 m. beneath the surface of the ground, and the observations were continued upwards from 118 m. to 6 m. The observations thus taken in the mud are given. They are rather higher than those previously obtained at the same depths, the greatest difference occurring at the depth of 276 m., where it amounts to 0°·9 R. Herr Dunker suggests that the difference may have arisen from insufficient time being allowed for the mud to take the permanent temperature.

Upon the whole it is clear that in this great bore the disturbing effect of convection is very small, and that, such as it is, it has been almost annihilated by the very efficient system of plugging adopted. The series of observations now before us, extending as it does by regular stages from the surface to a depth of 5630 feet, in a new bore where there has not been time for the original heat to be lost by exposure, forms undoubtedly the most valuable contribution ever made to the observation of underground temperature. The official to whose initiative the observations are due is Chief-Mining-Captain Huyssen, of Berlin. The expense of sinking the bore was £10,000 sterling, the time required for hauling up the boring rods was ten hours, and their united weight was 20 tons.

On plotting the temperatures so as to exhibit temperature as a function of depth, the curve obtained approximates very closely to a straight line. A straight line joining its two ends meets the curve several times in the part corresponding to the tubed portion of the bore, which is about three-fourths of the whole; while in the remaining fourth (forming the deepest portion of the bore) all the temperatures except the first and last lie above the straight line. In this statement it is to be understood that depth is represented by distance laid off horizontally, and temperature by distance laid off vertically upwards.

The question whether the curve on the whole bends upwards or downwards is of some interest, because it is equivalent to the question whether the rate of increase is accelerated or retarded as we go deeper. The evidence on this point is undecisive. The curve for the untubed portion, from 1266 m. to 1716 m., lies slightly above its chord; but the curve from either 6 m. or 36 m. to 1500 m. lies for the most part below its chord.

Taking the observation at 36 m. as the first which is free from atmospheric disturbance, and comparing it with the deepest observation of all, which is at 1716 m., we have an increase of 36°·5 R. in 1680 m. This is a difference of 82°·1 F. in 5512 feet, which is at the rate of 1° F. in 67·1 feet.

Herr Dunker, after an elaborate discussion of the question whether the curve on the whole bends upwards or downwards, arrives at the conclusion that it is best represented by a straight line. He applies the method of least squares to find the slope of this straight line, on the assumption that it passes accurately through the point determined by the observation at 36 m., and he thus obtains a mean rate of increase of 0·0224276 of a degree Réaumur per metre, which is equivalent to 1° F. for 65·0 feet.

The Secretary has been in correspondence with Mr. George Westinghouse, Jun., of Pittsburg, President of the Philadelphia Company, with the view of obtaining observations of temperature from some of the deep oil and gas wells belonging to the Company. Mr. Westinghouse has purchased three of the Committee's maximum thermometers, and has intrusted the taking of the observations to Mr. A. Cummins, the Company's Mining Engineer and Geologist. Some attempts have been made at observation, but owing to press of business they have not been thoroughly carried out. Mr. Cummins states that "there has been a constant strain to bring up the supply of gas to the requirement of the city's needs, and every hour of delay is watched very jealously."

The most successful attempt was made in a well at Homewood, in the city of Pittsburg, known as the Dilworth well, where the following results were obtained:—

Depth in feet.	Temperature F.	Air at surface.
3600	96°	70°
3710	89	76
3920	102	60
4002	108	62
4215	111	62
4295	114	62

The well was sunk to a depth of 4625 feet, but no observations were made except at the depths specified. The thermometer remained only from five to ten minutes during each test; and as there were only 40 feet of water in the well, the observations must have been taken in air. The diameter of the well was 6 inches. The rock was chiefly slate, and was bored by "jumping." The mean air temperature at Pittsburg is 52° F., and the height above sea-level about 900 feet. Comparison of the mean surface-temperature (taken as 52°) with the temperature 114° recorded at 4295 feet shows an increase of 62°, which is at the rate of 1° F. for 69·3 feet; but comparisons of the observations *inter se* would give a rate about twice as rapid as this; hence no safe conclusion can be drawn. After the hurry and worry of the gas business is over, Mr. Cummins hopes to get the temperature of some deep wells in a way that will be satisfactory.

We may mention, as a contribution to the literature of underground temperature, the recent publication of results obtained at the Old Observatory, Allahabad, with thermometers whose bulbs were at the depths 3 feet, 1 foot, and ½ inch respectively. Harmonic reduction has been applied to deduce both the annual and the diurnal variation, and from the former a fairly consistent determination of "diffusivity," or quotient of conductivity by capacity, has been obtained. Its value, 0·0054 C.G.S., is smaller than any values that have been found elsewhere. The soil is a sandy loam, which in dry weather becomes almost as hard as brick. The observations extend over six years, and similar observations are now being carried on at the New Observatory. The gentleman who is responsible for the reductions and the description of the observations is Mr. S. A. Hill, B.Sc., Meteorological Reporter to the Government for the North-West Provinces.

Report of the Committee appointed for the purpose of investigating the Best Methods of ascertaining and measuring Variations in the Value of the Monetary Standard. Prof. Edgeworth, Secretary.

This consists of a Supplementary Memorandum by the Secretary, designed as a supplement to the Memorandum appended to the First Report of the Committee. The object of that Memorandum was to distinguish the different definitions which the proposed problem might present; and to construct the formula appropriate to each phase of the investigation. The analysis of contents is as follows:—(1) Prof. Newcomb's method; (2) Prof. Foxwell's method; (3) Mr. Giffen's methods; (4) Mr. Bourne's method; (5) Sir Rawson Rawson's method; (6) Prof. Edgeworth's method; (7) Ricardo's method.

The conclusion of the Memorandum runs as follows:—

It may be useful to enumerate and summarily characterize the principal definitions of the problem, or "standards,"[1] which have been discussed in this and the preceding Memorandum. An alphabetical order will be adopted, the order of merit being not only invidious, but also impossible in so far as different methods are the best for different purposes.

1. The *capital standard* takes for the measure of appreciation or depreciation the change in the monetary value of a certain set of articles. This set of articles consists of all purchasable things in existence in the community, either at the earlier epoch or at the later epoch, or some mean between those sets. This standard is due to Prof. Nicholson. It is stated by him (in terms a little less general than those here adopted) in his book on "Money." It is discussed in the sixth and the tenth sections of the former Memorandum.

2. The *consumption standard* takes for the measure of appreciation or depreciation the change in the monetary value on a certain set of articles. This set of articles consists of all the commodities consumed yearly by the community either at the earlier or the later epoch, or some mean between those two sets. This standard has been recommended by many eminent writers, in particular by Prof. Marshall in the *Contemporary Review* of 1887. It is proposed by the Committee as the principal standard. It is discussed in the second section of the former Memorandum.

3. The *currency standard* takes as the measure of appreciation or depreciation the change in the monetary value which changes hands in a certain set of sales. These sales comprise all the commodities bought and sold yearly at the earlier epoch or at the later epoch, or some mean between those quantities. This standard appears to be implicit in much that has been written on the subject, but to have been most clearly stated by Prof. Foxwell. It is discussed in the second section of this Memorandum.

[1] The methods discussed in connection with the names of Mr. Giffen, Mr. Bourne, and Sir Rawson Rawson are rather solutions than statements of the problem.

4. The *income standard* takes as the measure of the appreciation or depreciation the change in the monetary value of the average consumption, or in the income per head, of the community. This standard is proposed in the fourth and fifth sections of the former Memorandum.

5. The *indefinite standard* takes as the measure of appreciation or depreciation a simple unweighted average of the ratios formed by dividing the price of each commodity at the later period by the price of the same commodity at the earlier period. The average employed may be the arithmetic mean used by Soetbeer and many others, or the geometric mean used by Jevons, or the median recommended by Prof. Edgeworth. This standard is recommended by the practice of Jevons[1] and the theory of Cournot.[2] It is discussed in the eighth and ninth sections of the former Memorandum, and the fifth section of the present one.

6. The *production standard* is a designation which may be applied to a method which is related to the currency standard very nearly as the income standard is related to that based on consumption. The production standard takes as the measure of appreciation or depreciation the change in the monetary value *per head* of the total amount of things produced in the community yearly. This standard is proposed by Prof. Simon Newcomb in his "Political Economy." It is discussed in the first section of this Memorandum.

7. The *wages* (and *interest?*) *standard* takes as the measure of appreciation or depreciation the change in the pecuniary remuneration of a certain set of services—namely, all (or the principal) which are rendered in the course of production, throughout the community, during a year, either at the initial or the final epoch; or some expression intermediate between the two specified. The theoretical basis and practical construction of such a standard are indicated in Ricardo's "Principles of Political Economy" (ch. xx. and elsewhere), in Prof. Marshall's evidence before the Gold and Silver Commission ("Parliamentary Papers," 1888, C.), and in the papers contributed by Mr. Giffen to the second volume of the Bulletin of the International Statistical Institute. The standard is discussed in the last section of this Memorandum.

Report (Second) of the Committee appointed for the purpose of reporting on the present state of our knowledge of the Zoology and Botany of the West India Islands, and taking steps to investigate ascertained deficiencies in the Fauna and Flora. Mr. D. Morris, Secretary.

This Committee was first appointed in 1887, and re-appointed in 1888. At a meeting held on December 5, 1888, it was decided to invite the co-operation of Dr. Günther, F.R.S., a member of the sub-committee appointed for a similar purpose by the Government Grant Committee of the Royal Society, and Colonel

[1] Most of Jevons's celebrated calculations ("Currency and Finance," ii., iii., and iv.), and in particular his calculation of the probable error incident to his result (*ibid.* p. 157), involve this conception.

[2] Cournot has considered our problem in each of the five volumes in which he has treated of, or touched on, political economy ("Dictionary of Political Economy," Art. "Cournot"). It is sufficient here to refer to the first and the last of those works, the "Recherches" of 1838 and the "Revue Sommaire" of 1876—the Alpha and almost the Omega of economic wisdom. From these it is clear that variation in the "absolute" or "intrinsic" value of money, in Cournot's view, corresponds to the "indefinite standard" as defined in Section viii. of the predecessor to this Memorandum. Cournot illustrates the variation due to a change on the part of money, by that change in the position of the earth with respect to the stars, which is due to the motion of the earth. In this analogy the stars are treated as "points" ("Recherches," Art. 9). No account is taken of their mass. The context shows that Cournot contemplates a simple average of distances between the earth and each star; not a *weighted* average, or the distance between the earth and the *centre of gravity* of the stars. In his later works he expressly declares against, or at least thinks unbefitting highest place, the measure of what he calls the "power of money" ("Revue Sommaire," Sect. 3), that is, in our terms, the consumption standard; the analogy of which is the distance of the earth from the *centre of gravity* of the stars, or rather of certain select stars—say those which are nearest to our human sphere. The currency standard, of which the analogy is the distance of the earth from the *centre of gravity* of all stars whatever, does not seem to have been entertained by Cournot.

Cournot, alluding to Jevons's treatment of the problem in "Money," not unjustly takes him to task for not having distinguished "assez nettement" variations in the "intrinsic value of money" (of which the measure is our indefinite standard) from variations in the "power of money" (of which the measure is our consumption standard) ("Revue Sommaire," p. 121). Referring to Jevons's proposal to construct a *tabular standard of value*, Cournot expresses his approbation in words which may fittingly conclude the present study:—"Ce sont là des idées qu'il faut laisser mûrir. Quand le moment sera venu de construire effectivement *l'étalon monétaire*, les géomètres pourront y trouver une application intéressante de leur *théorie de moyennes*, telles qu'ils l'ont déjà construite pour les besoins de l'astronomie et de la physique."

Feilden, of the Army Pay Department, at that time acting as Local Secretary to the Committee at Barbados.

The services of Mr. G. A. Ramage were retained as collector at Dominica and St. Lucia, and several collections were received from him during the past year. Owing to ill-health Mr. Ramage returned to this country in June last, and he has now retired from the post of collector to the Committee. Mr. F. Du Cane Godman has generously assisted the work of the Committee by sending out, at his own expense, the well-known naturalist and collector, Mr. H. H. Smith, to the Island of St. Vincent, to make collections in as many branches as possible of natural history. These collections have not yet reached this country, but it is anticipated that they will prove of considerable value.

Colonel Feilden obtained numerous botanical and zoological specimens in Barbados and the neighbouring islands. He has published a paper on the reptiles, and another on birds; papers on the Mammalia and land Mollusca will follow. He also obtained a living specimen of the green monkey of Western Africa, which has become feral in Barbados (*Cercopithecus callitrichus*). This was presented by the Committee to the Zoological Society of London.

Dr. H. A. Alford Nicholls, Local Secretary to the Committee at Dominica, has rendered valuable assistance, and he will be engaged for six weeks this autumn in exploring Montserrat and the isolated rock called Redonda, which is a dependency of Antigua.

The particulars of the collections received during the past year are as follows:—

Zoology.—The zoological specimens obtained by the Committee up to June 1889, including those collected by Mr. Ramage in Dominica and St. Lucia, have been placed in the hands of specialists for examination and determination. Mr. Oldfield Thomas has determined the Mammalia, Dr. Sclater the birds; Dr. Günther has published a paper on the reptiles, Mr. E. A. Smith three papers on the Mollusca, Mr. R. I. Pocock two on the Myriopoda and Crustacea, and Mr. Kirby one on the Phasmidæ.

Botany.—The botanical specimens collected by Mr. Ramage in Dominica and St. Lucia, up to May 1889, have been determined at Kew; the flowering plants by Mr. R. A. Rolfe, the ferns by Mr. J. G. Baker, and the cellular cryptogams by Dr. Cooke and Mr. C. H. Wright.

From Dominica about 394 species were received, of which (excluding the cryptogams) about 40 could only be provisionally determined; and of these a few, perhaps about half, are probably undescribed. The great majority belong to already well-known species, most of which were previously known from the island.

From St. Lucia about 189 species have been sent, of which (excluding the cryptogams, as before) over 30 were not determined, and possibly about half of these may prove to be undescribed. This island was less completely known than Dominica, and several additions to our knowledge of its flora have been made by Mr. Ramage. During the working up of the collections a strong affinity with Dominica, and perhaps still more so with Martinique, has become apparent. From the latter island large collections are well represented at Kew, though the materials have never been thoroughly worked up.

The specimens which it was not found possible to determine belong for the most part to large genera of woody plants, as Guttiferæ, Leguminosæ, Myrtaceæ, Myrsineæ, Laurineæ, and a few others, which renders it the more probable that a fair proportion of them may prove undescribed.

The number of novelties is perhaps not so great as was originally expected, and this may arise either from the ground having been worked over before, or, what is perhaps more probable, from the fact that a considerable uniformity prevails in the flora of this chain of islands, with a corresponding paucity in endemic types.

The Committee would draw particular attention to the botanical and zoological bibliography of the Lesser Antilles prepared under its direction, and published as an appendix to the Report for 1888. This bibliography has been widely distributed in the West Indies and in Europe, and has proved of considerable service in carrying out the objects for which the Committee was appointed.

Report (Fifth) of the Committee appointed for the purpose of considering the best means of Comparing and Reducing Magnetic Observations. Prof. W. Grylls Adams, Secretary.—The Committee report the establishment of regular magnetic observatories, where continuous photographic records of the magnetic elements are taken, at the United States Naval Observatory at Washington, and also at Los Angeles in California. The instruments used are of the Kew pattern, with the same time-scale, and the scale-coefficients for horizontal and vertical force instruments at Washington are very nearly those recommended by the Committee in their Third Report (1887), and which are in very near agreement with those at Vienna, St. Petersburg, and some other observatories. The Committee report, further, that the plan proposed by them in their Third Report for the Comparison and Reduction of Magnetic Observations, has been adopted at the United States Naval Observatory at Washington, which is now prepared to take part in the general scheme of co-operation proposed by the Committee. Copies of the photographic registers of the three elements for April 21–30, May 1–31, and for June 1–30 have been forwarded to the Committee from Washington, with tables of scale and temperature coefficients. There are also forwarded two prints showing the reduction of the declination for the year 1888, by means of a graphic composite curve, made by tracing over one another with a pantograph the daily curves of the month, and then drawing a curve through them to show the monthly means. There are also forwarded from Washington a set of prints showing the comparison of the disturbances of declination and horizontal force at Washington for ninety-nine days of 1888, and another set of prints showing the comparison of disturbances of declination on certain selected days at Washington, Los Angelos, and Toronto, all reduced to the same time-scale of 30·6 mm. for two hours, *i.e.* the time-scale of instruments of the Kew pattern. The Committee are more than ever of the opinion expressed in their Third Report, "that the establishment of regular magnetic observatories at the Cape of Good Hope and in South America would materially contribute to our knowledge of terrestrial magnetism." The Committee consider that it would be desirable to publish annually in a collected form for certain selected days the curves of the three magnetic elements, *i.e.* declination, horizontal force, and vertical force, taken at the different English and Colonial Magnetic Observatories, choosing for selection in 1888 the days for which the curves are published in the "Greenwich Observations."

Report (Fourth) of the Committee appointed for the purpose of promoting Tidal Observations in Canada. Prof. A. Johnson, Secretary.—The Committee refer to a previous Report, in which it was announced that the then Minister of Marine (the Hon. G. Foster) had directed that some preliminary investigations should be made by Lieut. Gordon, R.N., who was to put himself in communication with Prof. Darwin. The Minister, however, said that the existing expenditure on hydrographic surveys made it necessary to postpone for the time the consideration of further steps concerning tidal observations. The Committee was re-appointed last year to keep the subject before the notice of the Government, in the hope that this systematic tidal work would be begun this year. In May last an interview was obtained with the Hon. C. Tupper, the present Minister of Marine, at which Sir Wm. Dawson was present. The Minister expressed himself as entirely favourable to the institution of the proposed tidal observations, but said that the financial position as regards the expenditure on hydrographic surveys was the same as last year, and that therefore no further steps could be taken as yet in the matter. It is believed that since the interview some of the expenditure in hydrographic surveys has ceased, and as there is reason to believe that other Cabinet Ministers are in favour of the proposed measure, the Committee deem the prospects of carrying it into execution very satisfactory. There is no doubt about the anxiety of shipmasters to have the tidal investigations set on foot immediately, and the Royal Society of Canada deem the matter of such great practical importance, that at their last meeting they appointed a special Committee to give energetic support to the action of this Committee.

Report of the Committee appointed for the purpose of continuing the Inquiries relating to the Teaching of Science in Elementary Schools. Prof. Armstrong, Secretary.—This year has been one of continued depression in regard to the teaching of science in elementary schools, and of disappointment in regard to legislative action. The return of the Education Department for this year shows again a diminution in the teaching of the science subjects. The statistics of the class subjects for six years are given, and show an actual decrease in elementary science, and a comparative decrease in geography. The return of scholars individually examined in the scientific specific subjects shows an actual or relative falling off in every subject except mechanics and chemistry. The rapid and serious decrease of attention paid to these science subjects is shown by the percentage of children who have taken them, as compared with the number of scholars that might have taken these subjects, viz:—In 1882-83, 29·0 per cent.; in 1883-84, 26·0 per cent.; in 1884-85, 22·6 per cent.; in 1885-86, 19·9 per cent.; in 1886-87, 18·1 per cent.; in 1887-88, 16·9 per cent.; and it must be remembered that children who have taken two of these subjects count twice over. The Government laid upon the table of the House a new Code, which would have had a slightly beneficial effect upon the teaching of science; but it has been entirely withdrawn. The Government has introduced no Technical Instruction Bill this year—except just at the last moment—and that does not apply to "scholars receiving instruction in an elementary school in the obligatory or standard subjects prescribed by the minutes of the Education Department." It was hurried through the Committee and final stages during the last week of the session. Sir Henry E. Roscoe, however, reintroduced his Bill with some modifications, and it passed the second reading at a comparatively early period of the session; but the Government would only give facilities for its progress through the House on the understanding that very serious changes were to be made in it. As he could not accept these, it has not passed the Committee stage; and it was ultimately withdrawn. Mr. Samuel Smith has again brought in a Continuation Schools Bill; but there has been no opportunity of discussing it since the first reading, and it was therefore withdrawn. The subject has, however, grown in the estimation of the public; and the whole question of the teaching of science in State-aided schools requires to be pressed more and more upon the Legislature.

Report of the Committee on Electrical Standards. R. T. Glazebrook, F.R.S., Secretary. (Slightly abridged.)

The Committee report that the work of testing resistance coils has been continued at the Cavendish Laboratory. A table of the values found for the various coils is given. Further steps have been taken towards the construction of an air condenser. As stated in the last Report, Dr. Alexander Muirhead kindly placed at the disposal of the Committee, for the purpose of experiment, three such condensers which he had constructed. A series of tests of these condensers was carried out by the Secretary and laid before a meeting of the Committee in London on April 15. It was then decided to adopt Dr. Muirhead's form of condenser for the new instruments of the Committee, and two instruments, each having a capacity of 0·01 microfarad, have been ordered from the Cambridge Scientific Instrument Company. They are not yet finished; a detailed description of their design is therefore left to the next Report.

A second subject of investigation has been the specific resistance of copper. During the year Mr. T. C. Fitzpatrick has made a large series of experients to determine this, and the Committee desire to thank cordially those manufacturers and others who have given their assistance in this research. Before publishing his results, Mr. Fitzpatrick is desirous of experimenting on some copper which is being prepared for him by chemical means—all which has been used hitherto has been electrically deposited—and of attempting still further to purify some of the copper already in his possession. Two members of the Committee, Sir W. Thomson and Mr. Preece, were present at the recent Electrical Congress in Paris. As an English equivalent of the resolutions there passed, the Committee have adopted the following resolutions, which they hope will meet with general acceptance:—

(1) The name of the practical unit of work shall be the joule.

The joule is equivalent to 10^7 C.G.S. units of work. It is the energy expended during 1 second by a current of 1 ampere when traversing a resistance of 1 ohm.

(2) The name of the practical unit of power shall be the watt.

The watt is the rate of working of a machine performing 1 joule per second. The power of a machine could naturally be expressed in kilowatts instead of in horse-power.

(3) The name of the practical unit of light intensity shall be the candle.

The candle is equal to the twentieth part of the absolute standard of light as defined by the International Conference of 1884.

(4) The name of the practical unit of induction shall be the "quadrant." 1 quadrant is equal to 10^9 cm.

(5) The "period" of an alternating current is the duration of a complete oscillation.

(6) The "frequency" of an alternating current is the number of complete oscillations per second.

(7) The "mean current" through a circuit is the time average of the current, and is defined by

$$\text{mean current} = \frac{1}{T}\int_0^T i\,dt,$$

i being the current at each instant of the time T.

(8) The effective current is the square root of the time average of the square of the current. Thus

$$\text{effective current} = \sqrt{\left\{\frac{1}{T}\int_0^T i^2 dt\right\}}.$$

(9) The effective electromotive force is the square root of the time average of the square of the electromotive force. Thus

$$\text{effective electromotive force} = \sqrt{\left\{\frac{1}{T}\int_0^T e^2 dt\right\}},$$

e being the actual electromotive force at each instant of the time T.

(10) The impedance is the factor by which the effective current must be multiplied to give the effective electromotive force. Thus, in the case of a circuit of resistance R ohms, and self-induction L quadrants in which a simple harmonic electromotive force of frequency $\frac{n}{2\pi}$ is acting, impedance $= \sqrt{R^2 + L^2 n^2}$.

(11) In an accumulator the positive pole is that which is connected with the positive pole of the machine when charging, and from which the current passes into the external circuit when discharging.

The Committee are of opinion that they should be reappointed with the addition of the name of Prof. J. Viriamu Jones.

Report on the Present State of our Knowledge in Electrolysis and Electro-chemistry. By Mr. W. N. Shaw.

The following is an abstract:—

I. General electrolytic phenomena.

For a typical specimen we cannot suppose an electrolytic liquid otherwise than a mixture of solutions of chemical compounds, though the amount of all but one constituent of the mixture may be so small as to be regarded merely as impurities which it would not even be possible to detect by ordinary chemical means; thus von Helmholtz said in his Faraday lecture he has detected the polarization corresponding to the decomposition of a quantity of water of the order 1×10^{-11} gramme, and Gore (Proc. Roy. Soc., June 14, 1888) has shown the effect of chlorine upon the E.M.F. of a zinc platinum voltaic couple in distilled water is such that the presence of one part of chlorine in 1000 million parts of water could be detected thereby. Pure water, since Kohlrausch's experiments, is now looked upon as probably not conducting at all. Ratio of conductivity to that of mercury $= 0·71 \times 10^{-10}$ at 21°·5 C., and its sensitiveness to small quantities of impurity approximated to that of the sense of smell, since, when exposed in a room containing tobacco smoke, its conductivity doubled in three hours.

II. Laws and principles generally accepted.

(*a*) The electro-magnetic action of the current passing through an electrolyte is the same as if the electrolyte were replaced by a metallic conductor of the same size and shape and of such resistance that it could be substituted for the electrolyte without altering the current in the rest of the circuit.

(*b*) There are electrolytes in which the conduction of electricity from the electrode to the electrolyte, and again from the electrolyte to the electrode is entirely "convective" in the sense that no electricity can pass into an electrolyte or out of it again without causing a deposit of a certain number of constituent ions at the anode and the opposite ions at the kathode, *i.e.* in certain electrolytes no conduction takes place without chemical decomposition. This holds for a large number of electrolytes, possibly for all. It is not yet substantiated that it is true for all electrolytes, but the evidence is continually accumulating in that direction.

(*c*) The conduction of electric currents through electrolytes follows Ohm's law. Reference is made to Chrystal's experiments on metallic conduction, and Fitzgerald and Trouton's on electrolytic conduction.

One point is the experimental evidence for the deduction from Maxwell's theory of light, that electrolytes being transparent should behave as dielectrics for rapidly alternating electromotive forces. There are two ways of approaching the question—

(1) To find the length of light wave for which electrolytes are opaque.

(2) To find the rapidity of electrical vibration for which the electrolytes cease to conduct.

With reference to (2), Prof. J. J. Thomson says electrolytes still conduct when the rapidity of alternation is 300 millions per second.

(*d*) The only immediate effect of the passage of the current upon the body of a homogeneous electrolyte is to alter the temperature, and the alteration of temperature takes place in accordance with Joule's law.

Full references to the literature of the subject are given in the Report.

Report of the Committee appointed to make a digest of the Observations on Migration of Birds at Lighthouses and Light-vessels which have been carried on during the past nine years by the Migrations Committee of the British Association. Mr. John Cordeaux, Secretary.—The Committee have to report that one of their number, Mr. W. Eagle Clarke, of the Museum of Science and Art at Edinburgh, has, with the approbation of the Committee, undertaken to prepare the digest of the observations; and all the materials for making the same, including 1500 skeleton maps of the British Islands, provided for the purpose, have accordingly been placed in his hands. The labour of reducing the observations, to show in a concise form and on strictly scientific lines the results of the investigation which was carried on from 1879 to 1887 inclusive, will be easily understood to be enormous; and when it is borne in mind that this heavy work can only be carried on after official hours, your Committee feel that no apology is necessary for the non-completion of the digest this year.

Report of the Committee appointed to arrange an Investigation of the Seasonal Variations of Temperature in Lakes, Rivers, and Estuaries in various parts of the United Kingdom in co-operation with the Local Societies represented on the Association. Dr. H. R. Mills, Secretary.—It is inadvisable to attempt at present to summarize the results of observations made, as although more than a year's observations are available on some rivers, it is only a few months since the work has been begun on others. At the end of another year it is expected that sufficient data will be found to justify a comprehensive report on the subject. Several members of the Committee have taken much trouble in collecting observations. Dr. Sorby has been good enough to collect and discuss a great mass of temperature observations which he had made from his yacht *Glimpse*, in the estuaries of the south-east of England during the summer months of five successive years. This will be published separately. Prof. Fitzgerald took charge of the observations in Ireland, where he induced a number of observers to take up the work. Mr. Willis Bund had already inaugurated similar researches on the Severn. Rev. C. J. Steward and Mr. Isaac Roberts rendered important services in their districts. A circular was sent to all the Corresponding Societies in connection with the Association, requesting their co-operation, and favourable replies were received from several, intimating that observations had been commenced. The instructions issued to observers are given as an appendix to the present Report.

Report of the Committee on Solar Radiation.—The actinometer devised by the late Prof. Balfour Stewart, for the continuous measurement of solar radiation which was described in the Report of the Association for 1887, is now ready for preliminary trials, the internal thermometer with a flat bulb of green glass having been made since the date of that Report. The construction of this thermometer occasioned a good deal more trouble than had been anticipated. No attempt has at present been made to render the instrument self-recording, as it would obviously be unwise to incur the outlay which any construction for this purpose would involve, until the result of preliminary trials was such as to encourage a hope that the instrument might really be useful if rendered self-recording.

Report of the Committee appointed for the purpose of taking steps for the Investigation of the Natural History of the Friendly Islands, or other Groups in the Pacific visited by H.M.S. "Egeria." Mr. S. F. Harmer, Secretary.—The Committee have not yet received information which puts them in a position to give any detailed report of the work which is being done in connection with the above subject. The grant has been paid to Mr. J. J. Lister, who reached Tonga on March 19. After devoting two months to the investigation of the natural history of that group, Mr. Lister joined H.M.S. *Egeria*, on her arrival at Tonga, with the intention of visiting Samoa, where, by the latest accounts, he was carrying on his researches.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE thirty-eighth annual meeting of this body was held in the fourth week of August at Toronto, Canada. This is the third time in the history of its existence that the meeting-place selected has been on British territory—the first and second being at Montreal in the years 1857 and 1882.

The arrangements for the entertainment of the visitors were all of that free, open-handed, generous character peculiar to New-World hospitality. A large and representative Local Committee was appointed, and through their instrumentality many facilities for comfort and pleasure were obtained; such, for example, as reduced railway fares, the withdrawal of all Customs duties on instruments, specimens, &c., for use at the meetings, a daily luncheon given gratis at the place of meeting, excursions at reduced rates to Niagara, to the Muskoka Lakes, to the Huronian district, and even across the continent to the Pacific coast. There were also the usual number, or perhaps even more than the usual number, of garden parties, evening entertainments, and small excursions to outlying localities of geological, entomological, or botanical interest. Two public lectures were also given, the subject of the first being the evolution of music, of the second, the geological history of Niagara.

Among those present who took an active part in the proceedings were Prof. James D. Dana; Sir Daniel Wilson, the President of University College, in the Convocation Hall and Lecture Rooms of which the majority of the Sections met; Sir William Dawson, of Montreal; Dr. Charles C. Abbott; Prof. N. H. Winchell, of Minneapolis; Major J. W. Powell, of Washington, the retiring President; T. C. Mendenhall, of Washington, the President for this year; Messrs. Carpmael, Ramsay, Wright, and London, of University College; Profs. Hall and Newberry, who, with Prof. Dana, were the first three Presidents of the Association; Mr. Macoun; Dr. T. Sterry Hunt; Prof. Alexander Winchell, author of "World Life"; Prof. Heilprin, author of "The Geographical and Geological Distribution of Animals," &c.; Messrs. Minot, Morse, Newton, and many others of note. Nor must be omitted the names of Mr. F. W. Putnam, the permanent Secretary; and the following Vice-Presidents of the Association: R. S. Woodward, H. S. Carhart, W. L. Dudley, J. E. Denton, C. A. White, G. L. Goodale, Colonel G. Mallery, and C. S. Hill.

Many sincerely regretted the absence of the learned and genial Professor E. J. Chapman, of University College.

Not much time was wasted at the first meeting in the inevitable speeches and addresses of welcome, and within a couple of hours of the time when the general session was called to order by the venerable Professor Dana, on Wednesday morning, August 28, the various Sections met to organize, preparatory for the delivering in the afternoon of the Vice-Presidential addresses—the Vice-Presidents of the Association being chosen from, and acting as Presidents of, the several Sections.

The majority of these addresses were of a general or historical character. Mr. Carhart, in the Section of Physics, reviewed the theories of electrical action; Mr. Goodale, in the Biological Section, spoke of protoplasm; in the Department of Anthropology, Colonel Mallery dealt with the somewhat curious and little heard of, though not novel, theory of the Hebrew origin of the Indians of North America, discussing the arguments in behalf of that theory, especially the very problematical ground that the plane of civilization and thought of the Indians of to-day was parallel to that of the Israelites of the Old Testament.

Section of Anthropology.

A very large number of the papers read in the Section of Anthropology quite naturally referred to the Indians of the American continent. The following is a list of the more important of these:—

The Huron-Iroquois, by Sir Daniel Wilson.

Evidences of the Successors of Palæolithic Man in the Delaware River Valley, by Dr. Charles C. Abbott.