expediency of continuing the work of the Association, if it keep at all near to the standard of the York meeting. The German Society, founded nine years before our Association, and its prototype, still continues to meet annually; and scientific congresses are becoming more and more general every year in Europe.

Canada has been proposed as the place of meeting for 1885. The difficulties of time and place and expense are far less formidable than they appear at the outset. Great facilities would be put in our way by steamboat companies; and, once arrived, the Colony would receive us with open arms. Again, the Americans wish us to join their Association on some convenient occasion, and *àpropos* of this a practical American observed a few days since, "From the moment you set foot on American soil to the moment of departure, you should not put down a cent." One other fact remains to be noticed in regard to the York meeting. *Thirty-four* local societies and institutions were represented at the meeting by forty-nine delegates; and the Council have under consideration the conditions under which these delegates were present, and their object in attending. Cannot the Association do something for them? Cannot some organisation be introduced to influence the local societies through the Association, and cannot a committee of delegates be appointed to discuss matters connected with their respective institutions?

REPORTS

Report of the Committee, consisting of Dr. J. H. Gladstone, Dr. W. R. E. Hodgkinson, Mr. W. Carleton Williams, and Dr. P. P. Bedson (secretary), appointed for the purpose of investigating the Method of Determining the Specific Refraction of Solids from their Solutions.—Mr. P. P. Bedson, D.Sc., read the Report, and stated that the object of this report was to submit to further examination the method proposed some years ago by Messrs. Gladstone and Dale. According to this method the specific refraction of a solid may be deduced from that of a solution containing it, provided the specific refraction of the solvent is known, as also that of the solution and the composition of the solution. The experiments, of which an account is given in the report, appear to confirm this statement of the above-mentioned authors. The first case examined was that of liquid phenol. Its specific refraction for a ray of light of infinite wave-length was determined at 40° and 45°. The values obtained for the specific refraction of liquid phenol at 40° and 45°, viz., ·4850 and ·4848, are closely approximate to that obtained by Brühl (*Journ.* Chem. Soc., abst., 1880, p. 782) for phenol at 20°, viz., ·4862. Further, these results agree very well with the mean of the specific refractions obtained from the alcoholic and acetic acids solutions. The specific refraction of rock-salt in the solid state has also been determined and compared, with its specific refraction as deduced from its aqueous solutions; and it was found that the specific refraction obtained from the aqueous solution is substantially the same as that obtained from a prism of rock-salt. Further, the specific refractions of fused borax and boric acid have been determined, and in these cases also the specific refraction obtained from their aqueous solutions was found to be approximately the same as the specific refractions of fused borax and boric acid. The indices of fused borax and of fused boric acid were determined by means of prisms of these materials, which were cast in a mould of silver plates and afterwards ground and polished.

Report of Committee on Meteoric Dust, by Prof. Schuster.—This Committee was appointed for the double purpose of examining the observations hitherto recorded on the subject of meteoric dust and of discussing the possibility of future more systematic investigations. With regard to the first point we note that in a paper presented to the Royal Astronomical Society in 1879, Mr. Ranyard has given what appears to be a pretty complete account of the known observations as to the presence of meteoric dust in the atmosphere. It appears that in the year 1852 Prof. Andrews found native iron in the basalt of the Giant's Causeway. Nordenskjöld found particles of iron which in all probability had a cosmic origin in the snows of Finland and in the ice-fields of the Arctic regions. Dr. T. L. Phipson, and more recently Tissandier, found similar particles deposited by the winds on plates exposed in different localities. Finally, Mr. John Murray discovered magnetic particles raised from deposits at the bottom of the sea by H.M.S. *Challenger*. These particles were examined by Prof. Alexander Herschel, who agreed with Mr. Murray in ascribing a cosmic origin to them. For fuller details and all references we must refer to Mr. Ranyard's paper. There cannot be any doubt that magnetic dust, which in all probability derives its origin from meteors, has often been observed, and the question arises, in what way we can increase our knowledge on these points to an appreciable extent. A further series of occasional observations would in all probability lead to no result of great value, unless they were carried on for a great length of time in suitable places. Meteoric dust, we know, does fall, and observations ought if possible to be directed rather towards an approximate estimate of the quantity which falls within a given time. Difficulties very likely will be found in the determination of the locality in which the observations should be conducted. The place ought to be sheltered as much as possible against any ordinary dust not of meteoric origin. The lonely spots best fitted for these observations are generally accessible to occasional experiments only, and do not lend themselves easily to a regular series of observations. Nevertheless experiments continued for a few months at some elevated spot in the Alps might lead to valuable results. The Committee would like to draw attention to an instrument which is well fitted for such observations. It was devised by Dr. Pierre Miquel for the purpose of examining, not the meteoric particles, but organic and organised matters floating about in the air. A description, with illustrations, will be found in the *Annuaire de Montsouris* for 1879. Two forms of the instrument are given. In the first form, which is only adapted to permanent places of observations, an aspirator draws a quantity of air through a fine hole. The air impinges on a plate coated with glycerine, which retains all solid matter. By means of this instrument we may determine the quantity of solid particles within a given volume of air. The second, more portable, form does not allow such an accurate quantitative air analysis. The instrument is attached to a weathercock, and thus is always directed against the wind, which traverses it, and deposits, as in the other permanent form, its solid matter on a glycerine plate. An anemometer placed in the vicinity serves to give an approximate idea of the quantity of air which has passed through the apparatus. These instruments have been called aëroscopes by their inventor. It is likely that the second form given to the apparatus will be best fitted for the purpose which the Committee has in view.

Seventh Report of the Committee on Underground Water Supply, consisting of Prof. E. Hull, the Rev. H. W. Crosskey, Capt. Douglas Galton, C.B., Mr. James Glaisher, F.R.S., Prof. G. A. Lebour, Mr. W. Molyneux, Mr. G. H. Morton, Mr. W. Pengelly, Prof. J. Prestwich, Mr. James Plant, Mr. James Parker, Mr. T. Roberts, Mr. S. Stooke, Mr. G. J. Symons, Mr. W. Whitaker, was read by Mr. C. E. de Rance, of H.M.'s Geological Survey, the Secretary.—The Committee was appointed in 1874 at the Belfast Meeting of the Association, with Prof. Hull, LL.D., F.R.S., as Chairman, and Mr. De Rance, F.G.S., as Secretary and Reporter; its six published reports occupy 125 pages of the Society's *Proceedings*, and the results of the investigations of the Committee show that the Permian, Triassic, and Jurassic formations of England and Wales are capable of absorbing from five to ten inches of annual rainfall, giving a daily average yield of from 200,000 to 400,000 gallons per square mile per day. The area occupied by these formations is, in round numbers, Permian and Trias, 8600 square miles, and Oolites, 6600 square miles, capable of yielding 1720 millions and 1320 million gallons respectively, at the lowest rate of absorption, or, united, a supply for 100 million people, at thirty gallons a head. Mr. De Rance then described the water-bearing condition of the Yorkshire area, and stated that the investigation would now be extended to all the porous rocks of South Britain.

Report on the Earthquakes of Japan, by Prof. John Milne.—The author arrives at the following conclusions:—1. That the actual back and forth motion of the ground is seldom more than a few millimetres (usually not equal to 1 m.m.), even though chimneys have fallen. 2. The motion usually commences gently, but is very irregular. 3. The number of vibrations per second usually vary between three and six. 4. During one shock *its direction* of motion may be irregular. 5. East and west vibrations, as recorded in Yedo, have in some cases been shown by time observations to have travelled up from the south. 6. Many of the shocks which visit Yedo appear to have come

from the district which is faulted, and which shows distinct evidence of *very recent* elevation.

Second Report of the Committee consisting of Prof. P. M. Duncan and Mr. G. R. Vine, appointed for the purpose of reporting on Fossil Polyzoa; drawn up by Mr. Vine.—The order is divided into three subdivisions :—

1. *Cheilostoma*, Bark. = *Celleporina*, Ehrenberg.
2. *Cyclostomata*, ,, = *Tabuliporina*, Milne-Ed., Hagenow, Johnston.
3. *Ctenostomata*, ,,

The following terms are used in this Report in describing the genera :—

ZOARIUM.—"The composite structure formed by repeated gemmation" = Polyzoarium and Polypidom of authors.

ZOŒCIUM or cell.—"The chamber in which the Polypide is lodged."

CŒNŒCIUM.—"The common dermal system of a colony." Applicable alike to the "Frond," or "Polyzoary," of Fenestella, Polypora, Phyllopora, or Synocladia: or to the associated Zoœcia and their connecting "interstitial tubuli," of Ceriopora, Hyphasmapora, and Archæopora, or species allied to these.

FENESTRULES.—The square, oblong, or partially rounded openings in the zoarium—*connected by non-cellular dissepiments*—of Fenestella, Polypora, and species allied to these.

FENESTRÆ applied to similar openings, whenever connected by the general substance of the zoarium—as in Phyllopora, Clathropora, and the Permian Synocladia.

BRANCHES.—The CELL-bearing portions of the zoarium of Glauconome, Fenestella, Polypora, or Synocladia; or the offshoots from the main stem of any species.

GONÆCIUM.—"A modified zoœcium or cell, set apart for the purposes of reproduction."

GONOCYST.—"An inflation of the surface of the zoarium in which the embryos are developed." Modern terms from the Rev. Thos. Hincks.

Report of the Committee on Erratic Blocks, drawn up by the Rev. B. W. Crosskey.—Many additional instances of the occurrence of erratic blocks were recorded. Particulars were given respecting granite and sandstone boulders found while excavating for the new dock at Maryport, Cumberland. The granite specimens vary in size from small pebbles to a ton in weight, and are rounded. The New Red Sandstone boulders vary from half a ton to two tons or more, and have sharp angles. The nearest granite occurs in the Kirkudbrightshire Hills, on the other side of the Solway, fifteen or twenty miles distant; the New Red Sandstone is the stone of the district. A boulder of Shap granite found near Filey has been removed to the University Museum, Oxford. It rested on Oolitic strata at a height of about 150 feet above the sea. The nearest place where a granite of the same character is found is 108 miles distant, bearing west-north-west from Filey. The attention of the committee was drawn by Prof. T. McK. Hughes to a boulder of porphyritic hornblende diabase, near the centre of Anglesea. It is chiefly interesting as having been considered an inscribed stone, but the supposed characters are entirely due to rock structure. A detailed description of the great erratic called the "Holy Stone," at Humberstone, Leicestershire, was given. Its weight is about twenty-one tons. It rests on a denuded surface of the Rhætic formation. The height from which it travelled is about 400 feet above the sea, and is situated six miles north-west. The present height at which the block now rests is about 240 feet above the sea, and there is a river valley between these two points, running at right angles to the line of transit of the block, which is only 110 feet above the level of the sea. Various groups of boulders in Leicestershire were also described, some containing millstone grit blocks derived from Derbyshire, which must have travelled about thirty-five miles. A catalogue of 191 blocks in the parish of Ashwell, County of Hertford, was given. None of these blocks are local. Their general derivation is from the Oolites of the Midlands and from the Carboniferous and other rocks of more northern districts. The report concluded with an appeal to local observers to give assistance in cataloguing the rapidly-disappearing erratic blocks of the country.

Report on Thermal Conductivity of Certain Rocks, showing especially the Geological Aspects of the Investigations, by Prof. A. S. Herschel and Prof. Lebour.—This is the seventh and final Report of the Committee, and comprises a *résumé* of the results given in the preceding ones, with numerous additions and corrections. A bibliographical list of all papers on the subject, by Mr. J. T. Dunn, B.Sc., is given as an appendix. The apparatus and specimens employed during the investigations of the Committee are preserved in the museum of the College of Physical Science at Newcastle-on-Tyne.

SECTION A—MATHEMATICAL AND PHYSICAL

On the Possibility of the Existence of Intra-Mercurial Planets, by Balfour Stewart, LL.D., F.R.S.—It is a somewhat frequent speculation amongst those who are engaged in sun-spot research to regard the state of the solar surface as influenced in some way by the positions of the planets.

In order to verify this hypothesis observers have tried whether there appear to be solar periods exactly coinciding with certain well-known planetary periods. This method has been adopted by the Kew observers (Messrs. De La Rue, Stewart, and Loewy), who had an unusually large mass of material at their disposal, and they have obtained from it the following results :—

1. An apparent maximum and minimum of spotted area approximately corresponding in time to the perihelion and aphelion of Mercury.
2. An apparent maximum and minimum of spotted area approximately corresponding in time to the conjunction and opposition of Mercury and Jupiter.
3. An apparent maximum and minimum of spotted area approximately corresponding in time to the conjunction and opposition of Venus and Jupiter.
4. An apparent maximum and minimum of spotted area approximately corresponding in time to the conjunction and opposition of Venus and Mercury.

The Kew observers make the following remarks upon these results :—

"There appears to be a certain amount of likeness between the march of the numbers in the four periods which we have investigated, but we desire to record this rather as a result brought out by a certain specified method of treating the material at our disposal than as a fact from which we are at present prepared to draw conclusions. As the investigation of these and similar phenomena proceeds, it may be hoped that much light will be thrown upon the causes of sun-spot periodicity."

The Kew observers have likewise produced evidence of a different kind in favour of the planetary hypothesis, for they have detected a periodicity in the behaviour of sun-spots with regard to increase and diminution apparently depending upon the positions of the two nearer planets, Mercury and Venus. The law seems to be that as a portion of the sun's surface is carried by rotation nearer to one of these two influential planets, there is a tendency for spots to become less and disappear, while on the other hand, when it is carried away from the neighbourhood of one of these planets, there is a tendency for spots to break out and increase.

But whatever truth may be in these conclusions, it appears to be quite certain that periodical relations between the various *known* planets will not account for *all* the sun-spot inequalities with which we are acquainted. They may account for some, but certainly not for all. For there are solar inequalities of short duration which, presuming them to be real, can only be accounted for on the planetary hypothesis by supposing the existence of several unknown intra-Mercurial planets.

Indeed these short-period inequalities in sun-spots and the allied phenomena of terrestrial magnetism and meteorology have so augmented in number of late years as to make some observers inclined to question their reality; while others again resort to the above-mentioned hypothesis, and attribute them to intra-Mercurial planetary agency.

The method to be pursued in detecting the existence of inequalities will be easily understood by an illustration. Suppose that we had in our possession extensive records of the temperature of the earth's atmosphere at some one place in middle latitudes, and that, independently of astronomical knowledge, we were to make use of these for the purpose of investigating the natural inequalities of terrestrial temperature. We should begin by grouping the observations according to various periods taken, say, at small but definite time-intervals from each other. Now if our series of observations were sufficiently extensive, and if some one of our various groupings together of this series