and $d'h't'$ respectively. Then, from any point S on the circumference of the circle, reproject the six points dht, $d'h't'$, upon the same circumference in the points similarly lettered.

By means of this double projection from the centres E and i the points DHT have been transferred in duplicate from the hyperbola to the circle, or from one conic to another of a different species; and it is proved in treatises on modern geometry that points so transferred lose none of their projective properties. Hence the points dht and $d'h't'$ on the circumference of the circle are allied projective systems. Therefore, in order to find the perspective line common to both systems, choose one point t of the first set as the centre of projection of the second system; and make t', the correlative point of the second set, the centre of projection of the system dht.

From t project the points d' and h' by rays td' and th', and from t' project the correlative points d and h by rays $t'd$ and $t'h$. Then the correlative rays td' and $t'd$ will intersect in a point d_0 on the required perspective line; and the correlative rays th' and $t'h$ will meet in h_0, a second point on the same line. This perspective line d_0h_0 will intersect the circumference in two points i_0 and g_0 which, being joined to S and produced, will determine the double points I and g common to the hyperbola and transversal Lz. The complete quadrangle EC'IC shows that the harmonic ratios CziN and gzIL are segments of the same harmonic pencil P.

The lines Ez and C'z are tangents to the curve at E and C' respectively; and z is the pole of the polar EC' with respect to the hyperbola. The proofs of these last two deductions may be found in any good text-book on geometry of position.

ROBERT H. GRAHAM.

Thought and Breathing.

PROF. MAX MÜLLER'S article on thought and breathing, in your issue of February 6 (p. 317) has just come into my hands. In it he states that the power of retaining the breath is practised largely by Hindus as a means towards a higher object, viz. the abstraction of the organs of the human body from their natural functions. The same custom prevails amongst a certain sect of Mahometans also—the so-called Softas.

In 1878, when in the Central Provinces of India, I came across a native Christian—Softa Ali, as he was called—who had a history. His father had been a Cazi—or religious judge—and a wealthy man, who through scruples of conscience fell into disgrace with a certain native ruler, lost his all, and was banished. His son was, or became, a Softa, and after some years embraced Christianity from conviction, and at great cost to himself—for his wife and children would no longer consort with him. When describing to me the practices formerly enjoined upon him by his religion, this man stated that a Softa is required to draw in and retain his breath and respire it again in various manners. He did not give full details as to how this should be effected, but said that the object of this procedure was to worship with every organ of one's body—heart, lungs, &c., in turn. He added that this practice was a fruitful source of heart-disease.

The following year, when staying at Futtehpore Sikri, near Agra, I saw and heard a Mahometan, unknown to himself, make his evening devotions near the tomb of Suleem Chisti in the way above described; his movements, and the sounds he uttered, were most peculiar.

It has been often related, from well-attested evidence, that in the case of those who have been recovered from drowning, or of those who have been hung and cut down before life was extinct, a kind of automatic consciousness seems to be extraordinarily active in them at the time of their peril. It would appear that, as regards Hindu and Mahometan devotees, and the drowning or partially hung man, a kind of asphyxia is the result, and that, when sensation is almost gone, the intelligence acquires increased activity. In our ordinary life, if our minds are intently fixed upon a subject, we instinctively and involuntarily retain the breath.

When in Rajputana, and again when on the frontier of Chinese Tibet, I saw in each place a man who, to all appearance, seemed to have attained the power of perfect abstraction. In the former case, the villagers asserted that the devotee rose only once a week from his most uncomfortable and constrained position; in the second instance, the man—a most singular-looking person—remained absolutely immovable the whole day. Both seemed to be in a kind of cataleptic trance.

HARRIET G. M. MURRAY-AYNSLEY.

Former Glacial Periods.

I HAVE long felt convinced that geologists are being misled in reference to former glacial epochs by failing to give due thought to a consideration referred to on former occasions,[1] viz. that when the present surface of the globe has been disintegrated, washed into the sea, and transformed into rock, there will undoubtedly then be about as little evidence that there had been a glacial epoch during post-Tertiary times as there is at present that there was one during Miocene, Eocene, Permian, and other periods.

JAMES CROLL.

Perth, March 6.

AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE formation of this Association, mainly by the efforts of Prof. Liversidge, of Sydney University, and its first meeting in Sydney in August 1888, were noticed at the time in NATURE (vol. xxxviii. pp. 437, 623). One of the chief rules of the Association is that it shall meet in turn in the capital cities of the various colonies; and Melbourne was agreed upon as the second meeting-place. It was found inconvenient, however, to hold the Melbourne meeting during 1889, as should have happened in due course, for it is only after Christmas that all the Universities are simultaneously in vacation; and accordingly it was commenced on the 7th of January in the present year, and was continued through the following week. Some anxiety was felt as to the result of this choice of date, for there is always a risk in January of such continuous heat as would hinder the work and destroy the pleasure of the meeting; but the Association proved to be specially favoured in the matter of weather.

The following are the names of the officers of the Association and of the Sections. With regard to the latter, the rule obtains that Presidents are chosen from other colonies, while Vice-Presidents and Secretaries are chosen from the colony in which the meeting is held.

President, Baron von Mueller, K.C.M.G., F.R.S.

Local Treasurer, R. L. J. Ellery, C.M.G., F.R.S.

General Secretaries: Prof. Archd. Liversidge, F.R.S., Permanent Hon. Secretary; Prof. W. Baldwin Spencer, Hon. Sec. for Victoria.

Assistant Secretary for Victoria, J. Steele Robertson.

Sectional Officers:—Section A (Astronomy, Mathematics, Physics, and Mechanics)—President, Prof. Threlfall, Sydney University. Vice-President, Prof. Lyle, Melbourne University. Secretaries: W. Sutherland, E. F. J. Love.

Section B (Chemistry and Mineralogy)—President, Prof. Rennie, Adelaide University. Vice-President, C. R. Blackett, Government Analyst, Melbourne. Secretary, Prof. Orme Masson, Melbourne University.

Section C (Geology and Palæontology—President, Prof. Hutton, Canterbury College, New Zealand. Vice-President, Prof. McCoy, C.M.G., F.R.S., Melbourne University. Secretary, James Sterling,

Section D (Biology)—President, Prof. A. P. Thomas, Auckland. Vice-Presidents: J. Bracebridge Wilson; P. H. MacGillivray. Secretaries: C. A. Topp, Arthur Dendy.

Section E (Geography)—President, W. H. Miskin, President of the Queensland Branch of the Royal Geographical Society of Australasia. Vice-Presidents: Commander Crawford Pasco, R.N.; A. C. Macdonald. Secretary, G. S. Griffiths.

Section F (Economic and Social Science and Statistics—President, R. M. Johnson, Registrar-General, Hobart. Vice-President, Prof. Elkington, Melbourne University. Secretaries: A. Sutherland, H. K. Rusden.

Section G (Anthropology)—President, Hon. J. Forrest, C.M.G., Commissioner for Crown Lands, Western

[1] Quart. Journ. Geol. Soc. for May 1889; "Climate and Time," p. 266.

Australia. Vice-President, A. W. Howitt, Secretary for Mines, Melbourne. Secretary, Rev. Lorimer Fison.

Section H (Sanitary Science and Hygiene)—President, Dr. J. Ashburton Thompson, Sydney. Vice-Presidents: A. P. Akehurst, President of the Central Board of Health, Melbourne; G. Gordon. Secretary, G. A. Syme.

Section I (Literature and Fine Arts)—President, Hon. J. W. Agnew, Hobart. Vice-Presidents: Prof. Tucker, Melbourne University (Literature Sub-Section); J. Hamilton Clarke (Music Sub-Section). Secretaries: Dr. Louis Henry (Music Sub-Section); Tennyson Smith (Literature Sub-Section).

Section J (Architecture and Engineering)—President, Prof. Warren, Sydney University. Vice-Presidents: A. Purchas, H. C. Mais. Secretary, A. O. Sachse.

All arrangements for the meeting were made by the Local Committee, of which Mr. R. L. J. Ellery, the Government Astronomer, was chairman, and Prof. W. Baldwin Spencer secretary. The greater share of the work devolved on Prof. Spencer, and to his indefatigable energy is mainly due the undoubted success of the meeting. The buildings and grounds of the University were placed at the service of the Association, and nothing could have been better than the accommodation thus afforded. A lecture theatre was set apart for each of the ten Sections; and, as these theatres are situated in different parts of the grounds, and some distance apart, they were all connected by telephone, so that the advent of each paper in any Section could be signalled in every other. The large Wilson Hall was used as a reception-room; and a luncheon-hall, smoking-rooms, reading- and writing-rooms, a press-room, &c., were also provided, as also a special post- and telegraph-office. An official journal of the proceedings was published each morning, and every member was supplied with a copy of a special hand-book compiled for the occasion, and containing the following chapters:—

(1) "History of Victoria," by Alexander Sutherland.
(2) "Geology of Melbourne," by G. S. Griffiths.
(3) "Aborigines of Victoria," by Lorimer Fison.
(4) "Zoology, Vertebrata," by A. H. S. Lucas.
(5) "Zoology, Invertebrata," by A. Dendy.
(6) "Entomology," by C. French, Government Entomologist.
(7) "Botany," by C. A. Topp.
(8) "Commerce and Manufactures," by W. H. Thodey.
(9) "Climate," by R. L. J. Ellery, C.M.G., F.R.S., Government Astronomer.

Over six hundred members, representing all parts of Australasia, were in actual attendance, the total membership roll numbering more than a thousand. Some hundred and fifty papers in all were set down for reading in the various Sections. All these figures show a large increase since the first meeting, and give gratifying evidence of the growing interest taken in science throughout the colonies; further proofs of which are to be found in the facts that the Government of Victoria voted the liberal sum of £1000 towards defraying the expenses of the meeting, and that the entertainments provided by the hospitality of prominent citizens were numerous and on a most sumptuous scale. Many visits to places of scientific interest were also arranged for—short afternoon excursions for those who might not care for continuous Sectional work, and longer excursions at the conclusion of the meeting, under special leaders, to the Australian Alps, the Black Spur and Marysville, Gippsland Lakes, Ferntree Gully, Ballarat, and Sandhurst, all of which proved highly successful.

At the opening meeting in the Town Hall—presided over by His Excellency the Governor, the Earl of Hopetoun—the President, Baron Sir Ferdinand von Mueller, delivered his address, after being introduced by his predecessor in office, Mr. Russell, the Government Astronomer of New South Wales. Baron von Mueller undoubtedly stands at the head of the scientific workers in Australia. He has been a colonist since 1848, and since 1852 has held the position of Government Botanist in Victoria. His fame, which is based not only on the immense amount of work he has done in his special subject, the botany of Australia, but on his early achievements as an explorer, may be indicated in the words used by Mr. Russell:—"In 1861 he was made a Fellow of the Royal Society; he received from Her Majesty the Queen the Knight Companionship of St. Michael and St. George; was made a Commander of the Orders of St. Iago of Portugal, of Isabella of Spain, and of Philip of Hesse; was created hereditary Baron by the King of Würtemberg in 1871; and is honorary or corresponding member of a hundred and fifty learned societies." To this enumeration may be added what is, perhaps, the most honourable award of all—that of a Royal Medal by the Royal Society at the end of 1888. Throughout the colonies "the Baron" is known: a unique personality, not always wholly understood, but always recognized as a proud possession. His address, therefore, was listened to with peculiar interest, and perhaps all the more so that he did not confine himself to any special branch, but dealt generally with the past and future of Australasian science.

The Presidents of Sections also, in many cases, chose for their addresses subjects of particular interest in Australia. Prof. Rennie spoke of the work that has been done in the investigation of the chemistry of native plants and minerals, and made suggestions as to how this work may in future be encouraged and facilitated. Prof. Thomas discussed the problems here awaiting the biologist, and the local desiderata in scientific education. Mr. Miskin spoke principally of exploration in Australia and New Guinea, and of the importance to the colonies of Antarctic exploration; but he also discussed the chief geographical work now being done in other parts of the world. Mr. Forrest's address dealt with the present condition of the Australian aboriginal races. Dr. Ashburton Thompson discussed the sanitary organizations of Victoria and New South Wales, and the modes of obtaining and interpreting health statistics. Prof. Warren spoke of the education of engineers, with special reference to the local conditions and requirements. Dr. Agnew reviewed the literature and art of Australia. In the other Sections the Presidents chose subjects that do not owe their interest to local colour. Prof. Threlfall gave an account of the present state of electrical knowledge; Prof. Hutton's address was on the oscillations of the earth's surface; and Mr. Johnston spoke generally of current social and economic problems. A large proportion of the papers read by members in the various Sections were also Australian in their character. This was specially the case in the Sections of Geology and Anthropology; where, perhaps, the most valuable original work was communicated. As the Transactions will soon be published, the individual papers need not now be noticed; but reference may be made to the work done in the form of reports from Committees appointed at the previous meeting. The most bulky and perhaps the most valuable of these reports is that by a Committee which undertook, with Prof. Liversidge as its secretary, to prepare a census of the known minerals of the Australasian colonies. It disposes of New South Wales (only such information being given as was required to supplement Prof. Liversidge's published work), Queensland, and New Zealand. The portions dealing with Victoria and Tasmania are in process of completion; and, the Committee having been re-appointed, it is hoped that by next year the whole census will be complete. The publication will probably be delayed till then, and it will if possible take the form of a separate volume. A very important recommendation was made by another Committee (Prof. Haswell, of Sydney, secretary), which when

it is carried out will do much for biological research, viz. that steps be taken to establish and endow a central biological station at Port Jackson. Among the other reports may be mentioned one on the Polynesian races and Polynesian bibliography.

At the final meeting of the General Committee of the Association new special Committees were appointed to investigate and report on the following subjects: wheat rust, the manner of laying out towns, the preparation of geological maps, the arrangement of museums, the fertilization of the fig, Australian tides, and the present state of knowledge with regard to Australasian palæontology. A Committee was also appointed to formulate a scheme for obtaining practical assistance from the various Colonial Governments in the collection of material for research—chemical, geological, or biological. Other special Committees were appointed for the publication of the Transactions and for the revision of the laws of the Association.

The next meeting is to be held in Christchurch, New Zealand, probably in January 1891; and Sir James Hector has been elected President, and Prof. Hutton, Secretary. It has also been decided to hold the fourth meeting in Hobart, Tasmania, so that the Association will not again meet on the mainland for three years. To adventure so far as Christchurch is somewhat bold in so young an Association; but the success of the Melbourne meeting has demonstrated its usefulness and popularity, and warrants the belief that many will cross the water next year. There is even a strong hope felt by some that the occasion and the place may tempt a few of the members of the parent British Association to make the longer voyage from home, and see for themselves what is being done and what waits to be done for science at the antipodes.

ORME MASSON.

METEOROLOGICAL REPORT OF THE "CHALLENGER" EXPEDITION.[1]

PREVIOUS to 1872, discussions of the fundamental problems of meteorology relating to diurnal changes in atmospheric pressure, temperature, humidity, wind, and other phenomena, may be regarded as restricted to observations made on land. It had then, however, become evident that data from observations made on land only, which occupies about a fourth part of the earth's surface, were quite inadequate to a right conception and explanation of meteorologieal phenomena; and hence, when the *Challenger* Expedition was fitted out, arrangements were made for taking, during the cruise, hourly or two-hourly observations. These observations were published in detail in the "Narrative of the Cruise," Vol. II. pp. 305–74, and are still by far the most complete yet made on the meteorology of the ocean.

Elaborate observations were likewise made on deep-sea temperatures, which were at once recognized as leading to results of the first importance in terrestrial physics, and opening for discussion the broad question of oceanic circulation, on a sound basis of authentic facts. Preliminary, however, to any such inquiry, a full discussion of atmospheric phenomena was essential, requiring for its proper handling maps showing the mean temperature, mean pressure, and prevailing winds of the globe for each month of the year, with tables giving the data from which the maps are constructed. In other words, what was required was an exhaustive revision and ratification of Dove's isothermals, 1852; Buchan's isobars and prevailing winds, 1869; and Coffin's winds of the globe, 1875.

[1] "Report of the Scientific Results of the Voyage of H.M.S. *Challenger* during the Years 1873–76." Prepared under the superintendence of John Murray, LL.D. "Physics and Chemistry," Vol. II., Part V. "Report on Atmospheric Circulation." By Alexander Buchan, M.A., LL.D.

The work was entrusted to Mr. Buchan, of the Scottish Meteorological Society, in 1883, and was published in the beginning of this year. In addition to the tables of the appendices, giving the results of the *Challenger* observations, the more important are those giving the mean diurnal variation of atmospheric pressure at 147 stations in all parts of the world; the mean monthly and annual pressure at 1366 stations; a similar table of temperatures at 1620 stations; and the mean monthly and annual direction of the wind at 746 stations. It is believed that these tables include all the information at present existing that is required in the discussion of the broad questions raised in the Report, which includes, with the exception of the rainfall, all the important elements of the climates of the globe.

The Report itself is divided into two parts, the first dealing with diurnal, and the second with monthly, annual, and recurring phenomena. This is the first attempt yet made to deal with the diurnal phenomena of meteorology over the ocean—the temperature, pressure, and movements of the atmosphere, together with such phenomena as squalls, precipitation, lightning, and thunderstorms.

In equatorial and subtropical regions, the mean temperature of the surface of the sea falls to the daily minimum from 4 to 6 a.m., and rises to the maximum from 2 to 4 p.m., the amount of the diurnal variation being only 0°·9 F. In the higher latitudes of the Antarctic Ocean, the diurnal variation was only 0°·2. Of the four great oceans, the greatest variation was 1°·0 in the North Pacific, and the least 0°·8 in the Atlantic. This small daily variation of the temperature of the surface of the sea, shown by the *Challenger* observations, is an important contribution to physical science, being in fact one of the prime factors in meteorology, particularly in its bearings on the daily variations of atmospheric pressure and winds. The diurnal phases of the temperature of the air over the open sea occur at the same times as those of the temperature of the surface, but the amount of the variation is about 3°·0, and when near land the amount rises to 4°·4. The greater variation of the temperature of the air, as compared with that of the surface of the sea on which it rests, is a point of much interest from the important bearings of the subject on the relations of the air, and its aqueous vapour in its gaseous, liquid, and solid states, and the particles of dust everywhere present, to solar and terrestrial radiation. Thus the air rises daily to a higher and falls to a lower temperature than does the surface of the sea on which it rests.

The diurnal variation in the elastic force of vapour in the air is seen in its amplest form over the open sea, the results giving a curve closely coincident with the diurnal curve of temperature. But near land, the elastic force instead of rising towards, and to, the daily maximum at noon and 2 p.m., shows a well-marked depression at these hours, and indicates no longer merely a single, but a double maxima and minima. In other words, the curve now assumes the characteristics of this vapour curve as observed at all land stations, or where during the warmest hours of the day ascending currents rise from the earth's surface, and down-currents of drier air take their place. An important point specially to be noted here is that over the open sea, hygrometric observations disprove the existence of any ascending current from the surface of the sea during the hours when temperature is highest. On the other hand, the curve of relative humidity is simply inverse to that of the temperature, falling to the minimum at 2 p.m. and rising to the maximum early in the morning.

As regards the diurnal variation of the barometer, it is shown that the special forms of the monthly curves are, in their relations to the sun, direct and not cumulative as is the case with most of the monthly mean results of