own lectures and those of Prof. von Koenen, Professor of Geology.

From this it is evident, as Prof. Wagner concludes, "that there is no connection whatever (*gar kein Konnex*) between my lectures and those of the geologist."

Can any one doubt that the establishment of such a system of teaching geography and geology, side-by-side, as set forth in these two communications, would not be of the utmost benefit to our country and its education generally, if established in our Universities also? It will be impossible to obtain adequately trained teachers of physical geography until such courses of instruction are open; and until adequately trained teachers are produced for higher schools and training colleges, no real progress in the teaching of physical geography can be made throughout the country.

There can scarcely be a doubt that the establishment, at our Universities, of such a condition as that at the German ones, would be in every way to the advantage and advancement of geology, and to the increase of the numbers of its students; it would also advance the cause of all other branches of natural science, and all interested in the teaching of these subjects ought to support a movement in favour of its adoption warmly. No doubt the adoption of the system is merely a question of time,—England cannot lag behind in the study of geography for ever.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Mr. J. E. Marr, M.A., Fellow of St. John's College, has been appointed University Lecturer in Geology.

It is estimated that the ethnological collections now displayed in the Antiquarian Museum are worth at least 2000*l*., and with a little additional accommodation objects valued at 1000*l*. more can be displayed. These series are of inestimable value to the student of anthropology, and from the labours of Baron von Hügel in their arrangement the University is reaping a rich harvest. The baron contemplates illustrating them by a full series of maps and drawings.

The honorary degree of M.A. is to be conferred on Mr. C. Todd, Government Astronomer, Postmaster-General, and Director of Telegraphs in South Au-tralia.

The Open Entrance Scholarships for Natural Science to be competed for in the ensuing months include those of Peterhouse, Chemistry and Physics, October; Clare, Natural Science, March 24; Downing, Natural Science, June 1; Non-Collegiate Students, Physical Science, July.

Mathematical Scholarships will be given at each College mentioned above (except Downing), and at Trinity Hall, March 17; Corpus Christi, March 23; Queens', April 27; St. Catherine's, May 11; Magdalene, March 17. Further information will be given by the Tutors of each College.

AT the City and Guilds of London Institute, Central Institution, Exhibition Road, S.W., Prof. Ayrton, F.R.S., will give a course of six lectures on some of the industrial applications of electricity, from 5 p.m. to 6 p.m. Friday afternoons, March 12, 19, 26, April 2, 9, and 16. The lecture on March 12 will be on Electric Lighting; March 19, Electricity as a Motive Power; March 26, Electric Storage of Energy; April 2, Electric Transmission of Power; April 9, Electric Meters; April 16, Electric Locomotion.

AT Clifton College a Scholarship of the value of 30*l*. per annum, tenable for three years at the Central Institution of the City and Guilds of London Institute for the Advancement of Technical Education, is offered by the Committee of the Institute, and will be awarded, on the nomination of the headmaster, in July next. The candidate so nominated will be required to pass the Entrance Examination of the Institution, to be held in the following October. It is the intention of the Committee of the Institute to offer this Scholarship annually for six years, beginning with 1886. The object of the Central Institution is to provide advanced instruction in those kinds of knowledge which bear upon the different branches of industry, whether manufactures or arts.

It is intended that a subdivision of the Military and Engineering Department of Clifton College shall have its studies specially, though not exclusively, directed with a view to prepare for entrance to the Central Institution and similar Engineering and Technical Colleges.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, February 4.—"On the Polarisation of Light by Reflection from the Surface of a Crystal of Iceland Spar." By Sir John Conroy, Bart., M.A. of Keble College, Oxford. Communicated by Prof. G. G. Stokes, P.R.S.

In the year 1819 Sir David Brewster communicated to the Royal Society (*Phil. Trans.*, 1819, p. 145) an account of some experiments he had made on the polarisation of light by reflection from the surface of double-refracting substances, and showed that Malus's statement with regard to Iceland spar was incorrect.

Malus said that Iceland spar behaves towards the light it reflects like a common transparent body, and that its polarising angle is about 56° 30′, and that, whatever be the angle comprehended between the plane of incidence and the principal section of the crystal, the ray reflected by the first surface is always polarised in the same manner ("Théorie de la Double Refraction," pp. 240, 241).

Some years later Seebeck made a number of very accurate observations on the same subject, and in 1835 and 1837 Neumann published an account of further experiments that he had made on the reflection of light by Iceland spar.

He begins his second paper by a brief summary of the results obtained by Brewster and Seebeck. "Brewster found that the angle of complete polarisation for calc-spar depends on the position of the reflecting surface relatively to the axis, and upon the position of its principal section to the plane of reflection; he also found that when the reflecting surface is covered with a liquid the plane of polarisation of the completely polarised ray does not coincide with the plane of reflection, but makes a smaller or greater angle with this; when a cleavage-face of calc-spar is covered with oil of cassia this deviation may amount to 90°. The knowledge of these phenomena has only been further advanced in recent times. Dr. Seebeck has so followed out, by means of most accurate determinations, the influence of optically uniaxial crystals upon complete polarisation that the angle of incidence at which this occurs can be determined as accurately beforehand as it can by Brewster's law in the case of uncrystallised bodies. Seebeck also discovered that the deviation of the plane of polarisation from the plane of reflection, which Brewster had observed, also occurs when the ray of light falls directly from air on to the surface of the crystal."

Seebeck's observations having been mainly directed to the determination of the angle of polarisation, Neumann's object was to determine the azimuth of the plane of polarisation of the reflected light.

Seebeck and Neumann only repeated a portion of Brewster's experiments, and no one except Sir David Brewster appears to have made any determinations of the angles and azimuths of polarisation when the spar was in contact with media other than air.

Prof. Stokes very kindly called my attention to these experiments of Sir David Brewster, and pointed out that, as they had never been published in detail, and had not been repeated by any one else, it was desirable that further observations should be made on this subject. The experiments, the results of which I have the honour of submitting to the Royal Society, were undertaken at Prof. Stokes's suggestion, and in carrying them out I had the benefit of his advice.

The apparatus used was essentially the same as that employed by Seebeck; the divided circle of the goniometer was, however, horizontal, and not vertical, as in Seebeck's instrument, and the arrangement for keeping the reflected ray constantly in the axis of the observing-tube, whilst the angle of incidence was varied, differed from that employed by him.

The measurements were made by altering the angle of incidence and the azimuth of the observing Nicol until the light reflected by the Iceland spar was reduced to a minimum, the position of the crystal remaining fixed.

In order to obtain anything like accurate results with observations of this kind it is necessary to make a large number of determinations and take their mean: it was obvious that there were two ways in which any given number of observations might be grouped, either by making a good many separate determinations for a few positions of the crystal, or by making a few observations at a number of different azimuths; the latter alternative being the one adopted, two readings were made at seventy-two different azimuths of the crystal.

Two complete series of observations were made with cleavagefaces of Iceland spar in air, water, and tetrachloride of carbon, the water and tetrachloride of carbon being contained by a nearly cylindrical thin glass vessel (a chemical beaker), which stood on the horizontal stage of the goniometer, the tetrachloride being prevented from evaporating by a layer of water floating on its surface.

The position of the crystal in which the principal section was in the plane of incidence and the obtuse summit nearest the observer was considered the zero position; when the principal section was in the plane of incidence, and the obtuse summit towards the side from which the light was incident upon it, was therefore azimuth 180°. The crystal was rotated clockwise, and the same direction of rotation was considered the positive direction for the Nicol.

It had been intended to make similar measurements with artificial surfaces cut perpendicular and parallel to the axis of the crystal, and three pieces of Iceland spar cut respectively parallel to a natural face, and perpendicular and parallel to the axis, and all polished with "whiting" were obtained.

Seebeck states (*Pogg. Ann.*, vol. xxi. 290) that Iceland spar polished with rouge or putty powder differs in its optical properties from the natural substance, but that an artificial surface polished with chalk behaves very nearly, if not exactly, like a natural one.

Seebeck's measurements were all made with the crystal in air, and as the changes in the azimuth of the plane of polarisation, and in the value of the polarising angle, for different azimuths of the crystal, when such is the case, are small, it seemed desirable, before making any measurements with the artificial surfaces cut perpendicular and parallel to the axis, to make some determinations with an artificial surface parallel to a natural face of the crystal when the crystal was immersed in water; this was accordingly done.

These results differed considerably from those obtained previously with a natural face in water, and it therefore did not appear worth while to make any further experiments with artificial surfaces, as it seemed certain that the results would be untrustworthy.

The difference between the results obtained with this artificial surface and with a natural surface of the crystal is too great to be explained by supposing that the artificial surface was not cut absolutely parallel to the direction of the cleavage, and must therefore be attributed to some change produced by the polishing, possibly due to the pressure employed (conf. Seebeck, *Pogg. Ann.* vol. xx., 1830, 27).

Prof. Stokes pointed out to me that the experimental results which had been obtained were well suited for reduction by means of the harmonic analysis, and not only explained the method but himself reduced the first set of observations made with a cleavage-face in water. All the observations were accordingly reduced by this method.

Owing to the fact that the principal section of the crystal is a plane of symmetry, the periodic series for the development of the azimuths of the planes of polarisation can contain sines only, and that for the polarising angles cosines only, including the constant term; therefore the coefficients of the cosines in the former case, and of the sines in the latter, were not calculated, except with the observations made with the artificial surface; it seemed possible that the process of polishing might occasion some want of symmetry, and that therefore it was desirable to calculate the values of the coefficients in both sines and cosines.

Omitting the terms which we know from theoretical reasons ought not to appear, and which at any rate are extremely small, we obtain as the final result the following approximate expressions—

Azimuths of the Plane of Polarisation of Light Polarised by Reflection

Cleavage surface in air	$-\ 2^\circ\ 10' \sin\theta + 1^\circ 49' \sin 2\theta + 0^\circ\ 2' \sin 3\theta + 0^\circ\ 1' \sin 4\theta.$
Ditto, in water	$-\ 9^\circ\ 27' \sin\theta + 5^\circ 29' \sin 2\theta + 0^\circ 47' \sin 3\theta - 0^\circ 10' \sin 4\theta.$
Ditto, in tetrachloride of carbon	$-23^\circ 47' \sin\theta + 10^\circ 25' \sin 2\theta + 4^\circ 17' \sin 3\theta - 0^\circ 24' \sin 4\theta.$
Artificial surface in water	$-\ 3^\circ 52' \sin\theta + 5^\circ 11' \sin 2\theta + 0^\circ{\cdot}33' \sin 3\theta - 0^\circ 21' \sin 4\theta.$

Polarising Angles

Cleavage surface in air	$58^\circ 17' - 1^\circ 15' \cos 2\theta + 0^\circ\ 2' \cos 4\theta.$
Ditto, in water	$52^\circ\ 2' - 3^\circ 14' \cos 2\theta + 0^\circ 13' \cos 4\theta.$
Ditto, in tetrachloride of carbon	$53^\circ\ 9' - 8^\circ 54' \cos 2\theta + 1^\circ 12' \cos 4\theta.$
Artificial surface in water	$48^\circ 53' - 2^\circ\ 9' \cos 2\theta + 0^\circ\ 1' \cos 4\theta.$

From these expressions the values of the ordinates of the curves representing the phenomena were calculated, and the curves plotted from the values so obtained.

These curves correspond very closely with the smooth curves drawn from the points given by the observations, the values of the ordinates for those portions of the curve corresponding to azimuths 0°–40° and 320°–360°, being rather greater than the values given by the smooth eye-drawn curve. The curves for the artificial surface in water show clearly, when compared with the corresponding curves for the natural surface, how greatly these two surfaces differed in their optical behaviour.

Brewster, in his paper in the *Philosophical Transactions* for 1819, says:—"In any given surface when A and A'' are the maximum and minimum polarising angles, viz. in the azimuths of 0° and 90°, the polarising angle A' at any intermediate azimuth α may be found by the formula $A' = A + \sin^2\alpha(A'' - A)$."

This expression is the same as that given by the harmonic reduction of the observations set forth in this paper, if we assume that the smaller terms are due to errors of observation, as in that case the expression for the polarising angle in air (B) becomes $58^\circ\ 17' - 1^\circ\ 15' \cos 2\theta$.

Brewster's formula also appears to hold good for the case of Iceland spar in water, as the harmonic series for the value of the polarising angle (D) may be taken as $52^\circ\ 02' - 3^\circ\ 14' \cos 2\theta$. But with the spar in tetrachloride of carbon the agreement no longer holds, as the coefficient of $\cos 4\theta$ becomes too large to be neglected, being $1^\circ\ 12'$. The determinations made in this strongly refracting liquid were less satisfactory than the others, but there is hardly sufficient ground for assuming that the value of the coefficient of $\cos 4\theta$ is merely due to errors of observation.

The experiments, of which an account had been given, confirm the accuracy of Brewster's observations made with a surface of Iceland spar in contact with media other than air, and show moreover that, as Seebeck pointed out, the change in the value of the azimuth of the plane of polarisation of the reflected light also occurs, though to a far less extent, when the crystal is in air, and further, as the refractive index of the medium increases, the change in both these values is greatly augmented.

The harmonic analysis affords a means of expressing approximately at least both these changes as functions of the azimuth of the principal section of the crystal, and further shows that, when the crystal is in air or water, Brewster's formula for the angle of polarisation expresses the facts of the case.

Linnean Society, February 18.—Dr. St. George Mivart, F.R.S., in the chair.—Prof. H. Macaulay Posnett, N.Z., was elected a Fellow of the Society.—Mr. W. Joshua exhibited over 130 species of Lichens from Jamaica, collected by Mr. J. Hart in the Blue Mountains near Gordon Town, and afterwards determined by Dr. J. Müller (Arg.) of Geneva; many of these were of great interest.—Mr. T. Christy exhibited some flowers preserved by a new chemical process; he also called attention to a hitherto unknown Cinchona bark from South Africa; and besides showed a living plant of *Erythoxylon coca* in fruit.—Mr. H. Goss made remarks on specimens of the Wild Parsnip (*Pastinaca sativa*) gathered by him on the Thames side, Moulsey, Surrey.—Mr. A. D. Michael read a paper on Acari of the genus *Glyciphagus*, discovered in moles'-nests. In *G. platygaster* the male, although slightly differing from the female, as is usual in the genus, still can easily be recognised as of the same species; but in *G. dispar*, while the female closely resembles that of *G. platygaster*, the male, on the contrary, is totally unlike in size, form, markings of body, and arrangement of the legs, &c. *G. dispar* also affords evidence of the retro-anal position of the bursa copulatrix, and its being the posterior median projection characteristic of the females of the genus. Mr. Michael speculates wherefore the above divergence of the male form of *G. dispar*, seeing that its habitat and other conditions are the same as its female, and the closely-allied species.—Mr. John Ball gave a communication on the botany of Western South America. He introduced the subject with reflections on the climatal relations of the western seaboard, which have such a remarkable influence on the development of vegetable life. He then describes his collection of plants from Buena Ventura in Columbia, from Payta in Northern Peru, from Caldera in Northern Chili, and Lota in Chili, from the neighbourhood of the Channels of Western Patagonia, and Straits of Magellan, throughout interspersing reflections and brief summaries of the peculiarities of the floras in each of the districts in question. He infers that the vast region including the warm and moist parts of South and Central America should be regarded as a single botanical province, in which the same generic types are represented by species of which a large proportion are endemic, and confined to comparatively small areas. Along with these we find, in various parts of the same region, a few forms so distinct as to be ranked as separate genera, mostly represented by one, or very few, species, and nearly allied to types of wide distribution. He assumes that, in a broad sense, the most natural divisions of the vegetation of the earth are wide areas of low country, over which, with more or less modification, a limited number of types have extended, with islands of high land, which are the original homes of special types that form the characteristic features of different regions.

Zoological Society, March 2.—Dr. St. George Mivart, F.R.S., Vice-President, in the chair.—Mr. J. G. Millais, F.Z.S., exhibited an adult specimen of the Ivory Gull, shot by himself near Thurso, in December 1885; also a young example of the same species, obtained in Scotland in 1879.—Mr. T. D. A. Cockerell exhibited a living Slug of the genus *Parmacella*, obtained at Tangier, and probably referable to *P. valenciennesi.*—A communication was read from Prof. R. Collett, C.M.Z.S., containing an account of a new Pediculate fish from the sea off Madeira, belonging to the family Ceratiidæ, which the author proposed to call *Linophryne lucifer.*—Mr. P. L. Sclater read a note on the external characters of the head of *Rhinoceros simus* as compared with those of *R. bicornis.*—Mr. F. E. Beddard read a note on the air-sacs of the Cassowary.—A second paper by Mr. Beddard treated of the syrinx and some other points in the anatomy of certain forms of Caprimulgidæ.

Entomological Society, March 3.—Mr. Robert McLachlan, F.R.S., President, in the chair.—Mr. J. M. C. Johnston was elected a Fellow, and Cavaliere Piero Bargagli, of Florence, was elected a Foreign Member.—Mr. Pascoe exhibited a curious larva, probably of a *Papilio*, from Pará; and also a pupa-case of *Anosia plexippus* (*Danais archippus*), from the same locality.—Mr. W. J. Williams exhibited, on behalf of Mr. C. Bartlett, a gigantic hairy and spiny larva, perhaps allied to *Gastropacha*, from Madagascar.—Mr. C. O. Waterhouse exhibited *Rutela rufipennis*, *Doryphora haroldi*, and some other (undescribed) species of *Coleoptera*, from Colombia.—Mr. Billups exhibited a specimen of *Cholus forbesei*, found alive in a horticultural sale-room in London.—Mr. Eland-Shaw referred to the exhibition at the last meeting of *Tettix australis* from New South Wales, and called attention to the fact that the aquatic habits of certain species of the genus *Tettix* in India had been previously recorded.—Dr. Fritz Müller communicated a paper on fig insects from Itajahy, South America; and Prof. Meldola exhibited, on behalf of Dr. Fritz Müller, a number of specimens of the insects described in the paper.—Mr. E. B. Poulton read further notes upon lepidopterous larvæ and pupæ, including an account of the loss of weight in the freshly formed pupa.

Dublin

University Experimental Science Association, January 27.—Prof. Cathcart in the chair.—Prof. Fitzgerald showed his new galvanometer. This instrument was constructed, and exhibited in the Inventions Exhibition last year, by the Cambridge Scientific Instrument Company. Its peculiarities are (1) the arrangement by which the coils can be measured in their place, which is an advantage when practical classes are working, and should measure their instruments; (2) the arrangement by which the circle is read with a microscope by reflection-mirrors attached to the magnet, when the instrument is used either as a sine or tangent galvanometer; (3) an arrangement by which a spot of light reads the tangents of deflection. The first advantage is secured by having the two pairs of short and long coils wound in grooves closed in, outside, by a glass plate through which they can be seen, and the external and internal diameter of each layer of wire measured; the transverse diameter, by seeing through small holes left in the ring that covers the coils outside. The reading is effected by viewing a scale engraved on the inside of a horizontal ring surrounding the needle by reflection in two right-angled prisms attached to the needle which reflect opposite sides of the scale. The corresponding lines in the two maps, which differ by exactly 180°, is the line at right angles to the line of intersection of the reflecting planes of the prism. The exact position of that line can be read by means of a micrometer in the eye-piece of the microscope. The horizontal graduated ring is attached through the vertical axis on which the coils, &c., turn to the base of the instrument, and so the same circle does for reading when the instrument is used as a sine galvanometer. By means of a small mirror attached to the needle at 45° to the line of suspension, a spot of light can be reflected through the glass side of the instrument to a scale, and then a uniform scale represents the tangents of the deflections.—Mr. J. Joly, B.E., gave an account of a method of finding the specific gravity of small heavy bodies. The substance, whose specific gravity is required, which may only be a few milligrammes in weight, is melted into a small dish of paraffin of known specific gravity. The paraffin and substance is then floated in a specific gravity solution, and from the formula

$$S = \frac{W}{\frac{w_1}{s_1} - \frac{w_2}{s_2}}$$

the required specific gravity of the body can be obtained. In the above equation W is the weight of the solid, w_2 that of the paraffin, w_1 the sum of these weights; s_2 is the specific gravity of paraffin, s_1 the specific gravity of paraffin and substance together. This method is extremely useful in dealing with porous bodies, owing to the capability of paraffin, when in a molten state, of entering the pores and expelling air. Mr. Joly gave details of a number of experiments which show excellent results.—The next paper was read by Mr. Gerald Stoney, on the dynamics of bicycling. He described experiments made by him, in conjunction with his father, Dr. G. Johnstone Stoney, F.R.S., by which the energy required to propel a bicycle was obtained. They found that it required, when the velocity was 9 miles per hour, about 5500 foot-pounds per minute, and that it often rose higher than 10,000 foot-pounds per minute, which was the highest the apparatus used was capable of recording. Their results were higher than those of other experimenters on the power a man can exert. This shows that the bicycle or tricycle is probably the most economical way of using human muscles. The experiments were made by attaching an indicator-diagram-apparatus to the lever of the safety-bicycle, known as the "Extraordinary," and also by observing the reduction in speed due to friction, when the bicycle was running free. The experiments also showed that the resistance varied almost as the velocity, and that the pressure on the pedal was not constant, but was at a maximum at the centre of the stroke.

Paris

Academy of Sciences, March 1.—M. Jurien de la Gravière, President, in the chair.—Results of the application of the new method for preventing rabies after the bite of a mad dog, by M. Louis Pasteur. Since October 26, 1885, when his process was first announced to the Academy, 350 patients of all ages and both sexes have been treated with perfect success in every case except one. The eminent biologist considers his prophylactic method established, and expresses a hope that a hospital may now be founded for the regular treatment of patients by this process of inoculation. This suggestion met with general approval, and a Commission was appointed to give it effect, including the names of MM. Vulpian, Marey, P. Bert, Jurien de la Gravière, Bertrand, and De Freycinet.—Direct formulas for calculating the momenta of flexion in continuous girders of constant or variable section, by M. Maurice Lévy.—Note on the comparative results of direct astronomical observation with those obtained by MM. Henry's photographic process, by M. Wolf. Discrepancies are pointed out between the photographs of the Pleiades and the author's observations of that constellation in 1874. He adds: "The chart of the heavens now obtained by photography is different from that drawn from direct observation, and it also differs from that which will be obtained twenty years hence by the photography of the future, whose processes will certainly be different from ours. The human eye, on the contrary, is an organ which is always the same; consequently its observations are always capable of being compared together. . . . Celestial photography must work hand in hand with the observer's eye, which it can never replace."—Reply to M. Lalanne's note of February 22, on the mechanical effects of tornadoes, by M. Faye. M. Lalanne's facts are not questioned, but they are shown to be perfectly in accordance with M. Faye's well-known theory.—Remarks on the various theories of tornadoes, by M. Lecoq de Boisbaudran. While admitting the descending movement as the general law, the author suggests that a secondary movement in the opposite direction may perhaps occasionally be produced, which would serve to explain many phenomena difficult to account for on any one theory.—On the equivalent of the terbenes; explanatory note, by M. Lecoq de Boisbaudran.—On the employment of the azimuthal co-ordinates in geodetic surveys, by M. Hatt.—Communication on the approaching centenary of Arago, by M. Mouchez. It was announced, on behalf of the Committee, that the intended banquet in the Hôtel de Ville has been abandoned, and that it has been decided to erect a more lasting monument to the memory of the illustrious astronomer, to take the form of a colossal statue to be raised by national subscription on the Boulevard bearing his name.—Remarks on the *Year-book* of the Imperial Observatory of Rio de Janeiro, presented to the Academy on behalf of the Emperor of Brazil, by M. Faye.—Position of telescopic stars in the constellation of the Pleiades, by M. G. Rayet. A complete list is given of 143 stars observed with the 14-inch equatorial of the Bordeaux Observatory during the winters of the years 1884–85 and 1885–86.—Observations on Fabry's comet made at the Observatory of Algiers with the 0·50 m. telescope, by M. Ch. Trépied.—Orbit and ephemeris of the same comet, by M. Lebeuf. From the observations taken at Algiers, Hamburg, Nice, and Paris, the elements of the new orbit have been determined as under:—

$$T = 1886 \text{ April } 5{\cdot}9580 \text{ Paris Mean Time}$$

$$\left.\begin{aligned} \omega &= 126^\circ\ 36'\ 6''{\cdot}7 \\ \Omega &= 36\ \ 22\ \ 32{\cdot}0 \\ i &= 82\ \ 36\ \ 34{\cdot}9 \end{aligned}\right\} \text{Equinox } 1886{\cdot}0.$$

$$\log q = 9{\cdot}807626$$

—On the angle of the line of depression below the horizon at sea, by M. E. Perrin. The observations of depression here published were taken in 1884–85 on board the *Galissonnière* in the Chinese seas by means of a Lorieux reflection circle furnished with Daussy's additional small mirror. The mean value of apparent depression was determined at 5′ 31″·5. The corresponding geometric depression being 5′ 46″·8 for an altitude of 9 metres, about 1/23 was fixed for the coefficient of geodetic refraction at sea.—Calculation of mechanical regulators; the proper course to follow in practice in order to establish a regulating apparatus with indirect action, by M. H. Léauté.—Note on the articulated hyperboloid and the application of its properties to the demonstration of De Sparre's theorem, by M. A. Mannheim.—On Deprez d'Arsonval's aperiodic galvanometer employed as a ballistic galvanometer, by M. Ledeboer.—On the spectrum of erbine, by Prof. W. Crookes. The phosphorescent spectrum of this earth, of which a comparatively pure specimen has recently been obtained by the author, showed four green bands coinciding with none of those of the spectra of yttrium and samarium.—On the crystallisation of the paratartrate of soda and ammonia, by M. J. Joubert.—On the relations existing between the variations of terrestrial magnetism and the protuberances and other phenomena observed on the sun, by M. H. Wild. As far as the question has hitherto been studied the author considers it well-nigh established that the great movements of the solar atmosphere are revealed on the globe by corresponding disturbances of the magnetic needle.—Actinometric observations made at Montpellier during the year 1885, by M. A. Crova.—On the hygroscopic properties of tobacco, by M. Th. Schlœsing, jun.—On the isomeric states of the sesquichloride of chromium, green sesquichloride, by M. A. Recoura.—On some immediate principles of the peel of the bitter orange, by M. Tanret.—On the respiratory centres of the spinal marrow, by M. E. Wertheimer. Numerous experiments made on dogs show that in the spine there exist nervous centres, some determining inspiration, others expiration.—On the character of an anomalous rock in the Aspe Valley, Lower Pyrenees, by MM. E. Jacquot and A. Michel Lévy. This rock, by Charpentier called *compact feldspar*, is interstratified at the base of the Carboniferous formations, its age coinciding with the end of the granulite and beginning of the microgranulite eruptions. Although soft and oily to the touch, like the steatites, its dust scratches glass. Chief constituents: silica, 76·33 per cent.; alumina, 14·30; potassa, 3·33; lime, 0·90.—On the stratigraphic relations existing between the miliolite limestones and the *Micraster tercensis* formation in the department of the Haute-Garonne and the canton of Sainte-Croix (Ariège), by M. J. Roussel. The new acts determined by the author show that in the Pyrenees the relations of the Chalk and Tertiary formations are sometimes o an extremely complicated character. But in his remarks on this paper M. Hébert was unable to accept the view that the *Micraster tercensis* of the Pyrenees, essentially a Cretaceous rock, was contemporary with the Tertiary formations containing *Cerithium ladevezi*, *Ostrea uncifera*, and similar fossils.

STOCKHOLM

Royal Academy of Sciences, February 10.—On Binuclearia, a new genus of Confervacea, by Prof. V. B. Wittrock.—On the biology of some Arctic plants, by Prof. E. Warming.—Contributions to the anatomy of the cotyledons of the monocotyledonous plants, by Miss M. Lewin.—On the amount of the rainfall on bare and wooded ridges in the North of Halland, by Dr. H. Hamberg.—Insects collected in the Cameroon Mountain, by G. Waldau and H. Knutson: I. Coleoptera, Cetoniidæ, described by Prof. Chr. Aurivilius.

BOOKS AND PAMPHLETS RECEIVED

"Across the Jordan," by G. Schumacher (Bentley).—"Marvels of Animal Life," by C. F. Holder (Low).—"Japanese Homes," by E. S. Morse (Low)—"Highlands of Cantabria," by Ross and Cooper (Low).—"The Rain-Band," by J. R. Capron (Stanford).—"Lessons in Elementary Chemistry," new edition, by Sir H. E. Roscoe (Macmillan).—"Rotifera," part 2, by Hudson and Gosse (Longmans).—"Bees and Bee-keeping," part 7, by F. R Cheshire (Gill).—"The Western Pacific and New Guinea," by H. H. Romilly (Murray).—"British Petrography," part 2, by J. J. H. Teall (Watson, Birmingham).—"Indian Meteorological Memoirs," vol. ii. part 5 (Calcutta).—"Report on the Administration of the Meteorological Department of the Government of India in 1884-85."—"The Monthly Weather Report," Oct. and Nov., 1885.—"Proceedings of the Linnean Society of New South Wales," vol. x. part 3 (Cunninghame, Sydney).—PAMPHLETS:—"La Sensibilité et la Motilité des Végétaux," by E. Morren (Hayez, Bruxelles).—"Une Expérience sur l'Ascension de la Sexe chez les Plantes," by L. Errera.—"Fremdländische Zierfische, mit Abbildungen," by B. Dürigen (P. Matte, Berlin).—"The Fixed Idea of Astronomical Theory," by A. Tischner (Fock, Leipzig).—"Report on the Action of the Sheffield Water on the Lead Communication Pipes," by S. White.

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