1872 and 1885, did not leave the immediate neighbourhood of the Biela comet earlier than 1841-45, and may be treated as having at that time orbits osculating that of the comet.—The ultra-violet spectrum of cadmium, by Louis Bell. The ultra-violet spectrum of cadmium having long served as a standard of reference in the measuring of other spectra, an attempt is here made to determine its principal wave-lengths more accurately than is possible by Cornu's ingenious process. By taking photographs on Stanley instantaneous dry plates, Mr. Bell believes the wave-lengths here determined will be found correct to probably within 1/50,000 part of their respective values. The total number of lines accurately determined in the entire spectrum was thirty, of which the wave-lengths are tabulated with the corresponding figures obtained by Hartley and Cornu. —Communications from the United States Geological Survey, Rocky Mountains Division. The present communication (No. vii.) deals with the occurrence of topaz and garnet in lithophyses of rhyolites, and is contributed by Mr. Whitman Cross, who had already described the occurrence of minute crystals of topaz in the small drusy cavities of a coarsely crystalline rhyolite from Chalk Mountain, by Fremont's Pass, Colorado. The present specimens of topaz and small dark red garnets are from the trachyte on the Arkansas River, opposite Nathrop, Chaffee County, Colorado. The mode of formation of the topaz and garnet in the lithophysal cavities of the rhyolite in this district is not fully determinable, but they are evidently not secondary, but primary products, produced by sublimation or crystallisation from presumably heated solutions contemporaneous, or nearly so, with the final consolidation of the rocks.—On the strain-effect of sudden cooling exhibited by glass and by steel, by C. Barus and V. Strouhal. The experiments here described confirmed the views already announced by the authors, that the annealing of steel, considered physically, is at once referable to the category of viscous phenomena; also that the existence of the characteristic strain in glass-hard steel is the cause of electrical effects so enormous, that any additional effects caused by any change of carburation may be disregarded, and the electrical and magnetic results interpreted as due to variations in the intensity of the said strain. The chief results here arrived at have since been substantiated by polariscope evidence and by the investigation of the density of the consecutive shells of the "Prince Rupert drop." An account of these results will be given in their next paper.—Upon the origin of the mica-schists and black mica-slates of the Penokee-Gogebic iron-bearing series, by C. R. Van Hise. The iron-bearing formation of this region extends for over 80 miles from Lake Numakagon in Wisconsin to Lake Gogebic in Michigan; and at Penokee Gap, Wisconsin, the series is 13,000 feet thick, the upper 11,000 feet being mica-schists and black slates. The Muscovitic and biotitic greywacke, biotite-schists, and other formations here described furnish a graded series from the slightly altered greywackes to the crystalline mica-schists.—On two masses of meteoric iron of unusual interest, by Wm. Earl Hidden. One of these specimens, found on July 2, 1885, on a height to the east of Batesville, Independence County, Arkansas, weighs 94 lbs., and belongs to the class holosiderite of Brezina. It is specially remarkable for a hole piercing it near the edge, and cone-shaped from both sides. Analysis yielded: iron, 91·22; phosphorus, 0·16; nickel and cobalt, 8·62 by difference. The other, found in 1857 in Laurens County, South Carolina, weighs only 4 lbs. 11 oz., but is noted for the perfection of the Widmanstätter lines and unusual abundance of nickel and cobalt. Analysis: iron, 85·33; nickel, 13·34; cobalt, 0·87; phosphorus, 0·16, with trace of sulphur.—Notice of a new genus of Lower Silurian Brachiopoda, by S. W. Ford. This nearly perfect specimen of the ventral valve of the species described by E. Billings under the name of *Obolella desiderata*, and now preserved in the collection of Walter R. Billings, Ottawa, may be taken as the type of a new genus, probably including several described Lower Silurian species. It differs from *Obolella* in the form and arrangement of its muscular impressions, in the possession of a thinner shell and in other respects. The author, therefore, proposes for it the new generic name of Billingsia in honour of Mr. E. Billings, the late eminent palæontologist of the Canadian Geological Survey.

Bulletin de l'Académie Royale de Belgique, April 3.—Determination of the remainder in Gauss's quadrature formula, by M. Mansion. By a definite integral the author completes this formula, which thus becomes applicable to non-parabolic curves. —On some remains of cetaceans from the foot of the Caucasus, by M. P. J. Van Beneden. These remains, comprising portion of a skull with some vertebræ from the district east of Vladikavkas, and an almost perfect vertebral column, with ribs, radius, and humerus from the bed of the Kuban River, all belong to the same species, the *Cetotherium rathkei*, Brandt. By their means the author is enabled to determine the true characteristics of the Cetotherium, which shows some affinity to the Pachyacanthæ of the basin of the Danube, but was quite distinct from the extinct species of the Antwerp basin.—On some rocks dredged off the Ostend coast, by M. A. F. Renard. These include granites, porphyries, diorites, &c., such as occur along the French seaboard and in the Channel Islands; also Jurassic and Chalk formations identical with those of Boulogne and the cliffs of Dover. There is nothing to show that any of these rocks have been transported either from the south or from the Scandinavian regions during the Glacial epoch.

Bulletin de la Société des Naturalistes de Moscou, 1885, No. 1. —Revision of the numerical values of the repulsive force, by Prof. Th. Bredichin. In his preceding researches the author had determined it approximately by means of the rough formula of Bessel. Now, he corrects these results, either by direct evaluations by means of more exact formulæ, or indirectly by means of the isodynames constructed upon his rigorous formulæ. Taking 40 different comets (since 1472) M. Bredichin classifies them under three different types, and, on the former method, receives for the first type, $R = 14$, while the initial speed (due to the ejective force) varies between $g = 0{\cdot}1$ and $g = 0{\cdot}34$, the average being 0·22; for the second type, $R = 1{\cdot}1$, and $g = 0{\cdot}05$ (varies between 0·03 and 0·07); and for the third type, $R = 0{\cdot}2$, and $g = 0{\cdot}1$ to 0·2.—On the oscillation of the emissive of comets, by the same (with a plate). From a careful study of the comet 1862 III. the learned professor concludes that the oscillations of its emission ought to be considered beyond doubt, as they result not only from measurements, but also from all the *ensemble* of phenomena afforded by the head and tail of the comet.—Third report upon my herbarium, by Ed. Lindemann (in German).—Plantæ Raddeanæ Monopetalæ (continuation of Labiatæ), by Ferd. Herder.—Letters from Dr. A. Regel dated from Bokhara, Merv, &c., between May 1884 and April 1885. —Notice of a journey to Akhal-Tekke, by A. Becker, with a list of plants found at Kyzyl arvat.—On northern *Aucellæ*, by H. Trautschold.

No. 2.—Enumeration of the vascular plants of the Caucasus, by M. Smirnoff, continued from the preceding issue, and forming an introduction to the flora of the Caucasus.—Birds of the Transcaspian region, by M. Zaroudnoï.—Thirty-five years of observations on the earliest and latest times of blooming of wild and cultivated plants in the neighbourhood of Kishineff, by A. Dœngingk, followed by remarks on vegetable parasites and noxious insects. Four hundred plants are on the lists of the author.—Revision of the copulatric armatures of the males from the *Phileremide* tribe, by Gen. Radoszkowski (with two plates). —The appendix contains the third part of the systematic catalogue of the herbarium of Moscow University, published by Prof. Goroshankin.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 13.—"On the Structure of Mucous Salivary Glands." By J. N. Langley, M.A., F.R.S., Fellow and Lecturer of Trinity College, Cambridge.

The cells of mucous salivary glands I have previously described as consisting of a framework or network, containing in its spaces hyaline substance and granules. The granules of the mucous salivary glands are rendered very distinct by irrigating a mounted specimen of a fresh gland with moderately dilute solutions of neutral or alkaline salts. In these fluids the granules can scarcely be distinguished from small fat globules; those of the submaxillary gland of the dog have a diameter of 1 to 2 μ. In the resting gland the granules are fairly closely packed throughout the cell, in a line stretching from basement membrane to lumen; there are 8 to 12 granules. Both hyaline substance and granules give rise to mucin.

During secretion both the hyaline substance and the granules are turned out of the cells; after prolonged secretion the cells consist of an outer zone, chiefly of freshly-formed substance, and of an inner zone of network, hyaline substance, and granules, as in the resting state. When the saliva has a high percentage of

solids, both the hyaline substance and the granules can be seen in it. The hyaline substance is more soluble than are the granules, and is thus less commonly seen; it is partly dissolved, partly swollen up into a continuous mass; the less swollen parts appear as strings or blebs. The granules in saliva vary greatly in appearance; they may be very slightly swollen, and have fairly sharp outlines; or they may be more swollen and run together, forming pale masses of various size; occasionally in more dilute saliva they are just visible as pale spheres.

Although the mucous cells are able to turn out bodily their products, they do not disintegrate during secretion. As the decrease in the interfibrillar substance takes place, there is a fresh formation of substance in the outer part of the cells, *i.e.* as the cell secretes it also grows. In saliva there is no evidence of broken-down cells, nor are nuclei present except those in "salivary corpuscles," which, as stated by Pflüger, are leucocytes. Further, there is not any satisfactory proof that the demilune cells multiply during secretion, and give rise to mucous cells. During secretion there is no increase in the number of nuclei undergoing indirect division. As I have previously said, I hold the demilunes to be secreting cells of a different nature from that of the mucous cells. Glands with demilunes are simply glands in which the "albuminous" element is reduced to a minimum. The apparent increase in size of the demilunes, described by Lavdowsky as taking place in the first stage of secretory activity, I take to be due to the decrease in the size of the alveoli, so that the ordinarily flat demilunes become more spherical. Moreover, the demilune cells show signs of secretory activity. The "young" cells described by Heidenhain and by Lavdowsky are chiefly altered mucous cells.

The network of the cell consists of two parts—one in the cell-membrane, the other stretching from this throughout the cell. The peripheral network consists of very delicate fibres; at some of the nodal points there are small spherical swellings. From lumen to basement membrane there are twelve to fifteen meshes. The internal network is connected with the peripheral network, but it appears to me to have much larger meshes. From basement membrane to lumen there are in the submaxillary gland of the dog four to six meshes, *i.e.* the number of meshes in a given direction in the cell is about half that of the number of granules.

May 27.—"A General Theorem in Electrostatic Induction." By John Buchanan, B.Sc.

Part I. of this paper deals with the effect of change of the specific inductive capacity of a dielectric which is placed in a field of electric force, and it is proved that in general, under these circumstances, the dielectric becomes electrified.

By translating the theorem into the language of magnetism a theorem in magnetic induction is obtained.

The mathematical proof leads to an expression of the form

$$h = -\left(\frac{d\pi}{dV} - V\frac{d^2\pi}{dV^2}\right),$$

where h denotes the rate of change of the apparent electrification of the dielectric with regard to the specific inductive capacity as independent variable; π denotes the rate of change of the work done against electrical forces with regard to the same independent variable; and V denotes the potential.

The conditions that there may be no electrification of the dielectric are next obtained. The result is arrived at that, in order to have no electrification, when the specific inductive capacity is altered, the whole field of force must be occupied by an electrically homogeneous dielectric. It is then pointed out that the equations obtained express the effect of heterogeneity in the constitution of the dielectric medium.

In Part II. the above theorem and some of the results obtained by Dr. Kerr in his experiments in "electro-optics," are applied to obtain a theory of electrification by friction.

The discussion leads to these conclusions:—

"Positive" liquids tend to become positively electrified by friction.
"Negative" ,, ,, negatively ,, ,,
"Positive" solids ,, negatively ,, ,,
"Negative" ,, ,, positively ,, ,,

All these conclusions are verified by the experimental results given in the paper.

June 10.—"Fluted Craterless Carbons for Arc Lighting." By Sir James N. Douglass.

On December 8, 1858, at the South Foreland High Light-house, and with the direct current magnetic machines of Holmes, the first important application of the electric arc light, as a rival to oil and gas for coast lighting, was carried out by the Trinity House, under the advice of Faraday.

The carbons then used, and for several years afterwards, were sawn from the residuum carbon of gas retorts; they were square in section, $6\frac{1}{4} \times 6\frac{1}{4}$ mm., and the mean intensity of the arc measured in the horizontal plane was 670 candle units, being 17 candle units per square millimetre of cross-sectional area of the carbon. The crater formed at the point of the upper carbon of the "Holmes" lamp was so small that no appreciable loss of light was found to occur, and the arc proved to be very perfect in affording an exceptionally large vertical angle of radiant light for application with the optical apparatus.

The most reliable and efficient machine that has yet been tried for lighthouse purposes is the large size alternate current magneto machines of De Meritens. The average results with these machines are as follows, viz.:—

	One machine	Two machines supplying current to one lamp
E.M.F.	38 volts	48 volts.
Mean current	206 amperes	372 amperes.
Carbons (cylindrical) ...	35 mm. diam. ...	50 mm. diam.
Diameter of crater in carbon	13 mm.	18 mm.
Mean intensity of arc measured in the horizontal plane (candle units) ..	15,000	30,000
Light per square millimetre of carbon section (candle units)	12	12

It will be observed from this statement that the intensity of the arc in the horizontal plane per square millimetre of sectional area of carbon is about 35 per cent. less than it was with the small square carbons used by "Holmes," although it might reasonably be expected that with the improvements since effected in the manufacture of carbons, the efficiency of the old carbons would at least be maintained. The relative inefficiency of the large carbons used with the powerful currents now available appears to be due (1) to the loss of a large portion of the most intense part of the arc which is confined within the crater of each carbon; and (2) to the fluctuations in the intensity of the arc caused by the current passing between various points of the end of each carbon.

For a new electric light installation about to be made by the Trinity House at St. Catharine's Lighthouse, Isle of Wight, it is intended to utilise the large De Meritens machines that were used at the recent South Foreland experiments for determining the relative merits of electricity, gas, and oil as lighthouse illuminants. The electric light at St. Catharine's is intended to be "single-flashing" at periods of 30 seconds. Each flash is to have a duration of $5\frac{1}{2}$ seconds, and to be followed by an eclipse of $24\frac{1}{2}$ seconds. It is intended to use one De Meritens machine during clear weather, and two machines whenever the atmosphere is found to be so impaired for the transmission of light that the flashes are not reaching their intended range.

The defect here arose which is common to all electric flashing lights where a minimum and a maximum intensity of flash are adopted, viz. that the duration of the flashes of minimum and maximum intensity would vary in the ratio of the difference in the diameter of the carbons employed with one and two machines respectively, which in this case should be 50 mm. and 35 mm., this mean difference amounting to $36\frac{1}{2}$ per cent. nearly. It is evident that such a variation in the duration of flash would seriously impair the distinctive character of the signal.

It occurred to me, however, that, if carbons of a fluted cross-section were employed, the carbons for minimum and maximum intensity could be made of corresponding diameter, their sectional areas being proportioned to the minimum and maximum currents employed, and thus the flashes of minimum and maximum intensity would have exactly the same duration. As all carbons for electric arc lights are now made in moulds, I saw that such a form would not involve any more difficulty in manufacture than if made cylindrical, while there would be less liability of internal fracture occurring, as is often the case with large carbons in the process of drying and baking. Other advantages to be obtained with fluted carbons are: (1) a larger vertical angle of radiant light from the arc, and with a higher coefficient of in-

tensity in consequence of the unobstructed radiance through the fluting at the points of each carbon; and (2) a steadier light is obtained owing to the localising of the current at the central portion of each carbon.

The result of many experimental trials with fluted carbons 50 mm. diameter have entirely confirmed my expectations. No crater is formed in either of the carbon points, and their form is all that can be desired for utilising fully the maximum light of the radiant arc. My experiments have not been sufficient to determine accurately the additional intensity of light obtained from the arc of a pair of the fluted carbons as compared with that from the arc of a pair of cylindrical carbons, but I am of opinion that the gain with fluted carbons is not less than ten per cent.

Geological Society, June 9.—Prof. J. W. Judd, F.R.S., President, in the chair.—The following communications were read:—On the volcanic rocks of North-Eastern Fife, by James Durham, F.G.S., with an appendix by the President. After describing the general distribution of the volcanic rocks of Old Red Sandstone and Carboniferous age in the counties of Forfar and Fife, the author called attention to a fine section exhibited where the Ochil Hills terminate along the southern shore of the Firth of Tay. In immediate proximity to the Tay Bridge, a series of the later volcanic rocks, consisting of felstones, breccias, and ashy sandstones are found let down by faults in the midst of the older porphyrites (altered andesites) which cover so large an area in the district. The breccias contain enormous numbers of blocks of a red dacite (quartz-andesite), and inclosed in this rock angular fragments of a glassy rock, resembling a "pitchstone-porphyry," are found, everywhere, however, more or less converted into a white decomposition-product. The youngest igneous rocks of the district are the bosses and dykes of melaphyre (altered basalt and dolerite) which have been often so far removed by weathering as to leave open fissures. In the appendix three very interesting rocks were described in detail. The rock of the Northfield Quarry, which is shown to be the augite-andesite, has a large quantity of a glassy base with felted microlites, and contains large porphyritic crystals of a colourless augite. The rock of the Causewayhead Quarries is described as an enstatite-andesite; it has but little glassy base, being made up of lath-shaped felspar crystals (andesine), with prismatic crystals and grains of a slightly ferriferous enstatite; there are no porphyritic crystals, but the enstatite individuals are sometimes curiously aggregated. The red porphyritic rock from the breccias near the Tay Bridge was shown to be a mica-dacite, and the glassy rock associated with it to be the same material with a vitreous in place of a stony base. The glassy base exhibits very beautiful fluidal and perlitic structures. The crystals of first consolidation in this rock are oligoclase and biotite, often showing marks of injury in transport; those of the second consolidation appear to be orthoclase. In conclusion, the successive stages by which the andesitic rocks of the area were altered, so as to assume the characters distinctive of porphyrites, were fully discussed, as well as the change of the glassy rock into its white decomposition-product.—On some eruptive rocks from the neighbourhood of St. Minver, Cornwall, by Frank Rutley, F.G.S. The rocks described in this paper were derived from Cant Hill, opposite Padstow, and from a small quarry about half a mile from Cant Hill, near Carlion. At the former locality the volcanic rocks are much decomposed, but from their microscopic characters they may be regarded as altered glassy lavas of a more or less basic type. No unaltered pyroxene, amphibole, or olivine is to be detected in the specimens described, but there is a considerable amount of secondary matter which may include kaolin, serpentine, chlorite, palagonitic substances, &c. There is evidence of fluxion-structure in some of the sections; others are vesicular, and the vesicles are usually filled with siliceous or serpentinous matter. The relation of these lavas to the underlying Devonian slates was not ascertained. The rock occurring near Carlion contains numerous porphyritic crystals of augite in which the crystallisation is interrupted by the co-development of small felspar crystals, which appear, as a rule, to have been converted into felsitic matter. Ilmenite is also present in patches which indicate a similar interrupted crystallisation to that shown by the augite. The rock has the mineral constitution of an augite-andesite, but since it is a holocrystalline rock, exception would be taken by many petrologists to the employment of the term andesite. The lavas of Cant Hill were also probably of an andesitic character, so that, so far as original mineral constitution is concerned, there is some apparent justification for the mapping of both of these rocks as "greenstone" by the Geological Survey.—The Bagshot beds of the London Basin, by H. W. Monckton, F.G.S., and R. S. Herries, B.A., F.G.S. The authors stated that their object was to describe more fully the Lower Bagshot beds, and to disprove the view lately advanced by Mr. Irving that, in certain places, the Upper Bagshots overlap the Lower, and rest directly on the London Clay. They described or referred to a number of sections all round the main mass, beginning at St. Ann's Hill, Chertsey, where they considered that the mass of pebbles and associated greensands must be referred to the Middle Bagshot. The outliers near Bracknell and Wokingham were shown to consist of Lower and Middle Bagshot, which does not appear in the valley north of Wellington College. The Aldershot district was explained, and it was shown that the beds there resting on the London Clay were Lower and not Middle Bagshot, and the occurrence of fossils in the Upper Bagshot of that district was recorded. The conclusions that the authors came to were, that a well-marked pebble-bed was almost always present, marking the division between the Upper and Middle Bagshots, but that there were other pebble-beds of a less persistent character occurring both in the Middle and Lower Bagshots; that the Lower Bagshots generally consist of false-bedded sands with clay laminæ and no fossils except wood, whereas the Upper Bagshots are rarely false-bedded, and are characterised by the absence of clay bands and the presence of marine fossils; and that the Middle Bagshot is a well-marked series consisting of greensands and clays. They claimed, in conclusion, that there was no reason for disturbing the old reading of the district, and that there was no evidence of an overlap of the Lower Bagshots by the Upper.

Physical Society, June 12.—Dr. J. H. Gladstone, Vice-President, in the chair.—Dr. Samuel Rideal and Mr. E. C. Wellington were elected Members of the Society.—The following communications were read:—On an electric-light fire-damp indicator, by Messrs. Walter Emmott and William Ackroyd. The Royal Commission on Accidents in Mines point out in their recently-issued report, as a serious objection to the use of the electric light in mines, notwithstanding its many great advantages, that the light of an incandescent lamp, being produced within a vacuum, cannot admit of any device for the indication of fire-damp such as is given by the Davy, for example. The present apparatus is the outcome of an attempt to overcome this difficulty. It consists of two incandescent lamps, one with colourless and the other with red glass, and the circuit is so arranged that in an ordinary atmosphere the colourless lamp alone shines, but in fire-damp this goes out, and the red one is illuminated. This is effected in a simple manner by the motion of a mercury contact occupying the lower part of a curved tube, one end of which is open, and the other connected with a porous pot of unglazed porcelain, the motion of the mercury being due to the increased pressure in the porous pot occasioned by diffusion.—On a method of distinguishing rays of solar from those of terrestrial origin, by Prof. Cornu. It has been shown by M. Fizeau that, owing to the rotation of the sun upon its axis, there is a displacement of the spectral lines produced by solar absorption towards the red or towards the violet, according as to whether the light examined emanates from those parts of the sun which are receding from or approaching us. If, however, the lines are the result of absorption by the earth's atmosphere no such displacement should occur. It has been the aim of the author to make this principle the basis of a simple and instantaneous method of determining the origin of any given line. The displacement is very minute, amounting to about 1/150 of the distance between the D lines for rays in that part of the spectrum when the light is from the extremity of the solar equator, but it has been found quite sufficient. Observations have been made with a Rowland grating, the mean distance of the lines being ·00176 mm. An image of the sun is formed upon the slit of the spectroscope by a lens. By a slight oscillatory motion given to the lens by a lever from the hand, any part of the sun's image can be brought upon the slit. A heliostat sends the rays always in the same direction, and by a prism the image has its equator horizontal. To distinguish between a line of solar and one of terrestrial origin the line is brought near the vertical wire of the eye-piece, or, better still, one of those inevitable grains of dust which are always seen on the horizontal wire. The lever connected to the lens is then oscillated so as to bring alternately the two ends of the solar equator tangentially upon the slit. If the ray is of terrestrial origin it remains abso-

lutely fixed, if it is solar it oscillates with the lever.—On a hyperbolagraph, by Mr. H. H. Cunnynghame. It is not an unfrequent want to be able to find a rectangle of greatest or least area contained between a curve and rectangular co-ordinate axes. In several problems connected with motion and pressure in steam-engines this is useful, and even in political economy the graphic representation of monopoly curves depends on maxima and minima of this nature. For the solution of such problems it is often very useful to be able to describe rectangular hyperbolas, and the author has devised a machine to effect this. It depends on a mathematical property of the rectangular hyperbola, which he believes to be new, and which is as follows: From a fixed point let any line be drawn to meet a fixed line, and from the point of meeting draw the line perpendicular to the fixed line, and equal in length to the first line. The locus of the extremity of the second line is a rectangular hyperbola, or if from a fixed point O a line OP be drawn to meet a fixed line in a point P, and PQ be taken perpendicular to the fixed line, so that $OP + OQ$ be constant, then again the locus of Q is a rectangular hyperbola. In the machine the latter construction is mechanically and continuously carried out. A pencil, whose point corresponds in position to the point Q, slides along a rule which is carried across the paper always perpendicularly to the fixed line. A fine steel wire attached to the pencil passes over round a roller at P, and is then carried to and coiled round a similar one at O. The use of a steel wire is a special feature of the apparatus, and has a great advantage over string, which, owing to the facility with which it stretches, cannot give good results. The finest wire should be used: it unrolls from the one roller as much as it laps over the other, and its use may be extended to nearly all curve-drawing machines.—A voltaic cell with a solid electrolyte was exhibited by Mr. Shelford Bidwell. Its construction is as follows: upon a plate of copper is spread a layer of quite dry precipitated sulphide of copper; if on this a clean plate of silver is placed, and the cell joined up to a galvanometer, a slight deflection is observed due to the unavoidable presence of moisture. If, however, the silver plate be covered with a slight film of sulphide of silver, by pouring on it a solution of sulphur in bisulphide of carbon and evaporating the free sulphur by heat, and then placed with the prepared side down as before, a deflection is obtained far greater than, and in the opposite direction to, the former. The resistance of the cell was very great, but was enormously reduced by compression; the E.M.F. was about ·07 volt.

Mineralogical Society, May 21.—Prof. M. F. Heddle, M.D., F.R.S.E., in the chair.—The following papers were read:—On the nomenclature of the hydrocarbon compounds, with a suggestion of a new classification, by Andrew Taylor, F.C.S.—On new localities for diatomite, by Prof. W. Ivison Macadam.—On new localities for the mineral agalmatolite, with notes on its composition, by W. Hamilton Bell.—On a new locality for agalmatolite, with analysis, by Prof. W. Ivison Macadam.—The metallic ores of Chilé, by John F. Kerr, illustrated by a splendid collection of specimens.—On the chemical composition of the mineral found by Mr. Wallace at Loch Bhruithaich, Ross-shire, by Prof. W. Ivison Macadam.—Note on serpentine from Creag Mhòr Thollie, Loch Maree, by Prof. W. Ivison Macadam.—Notice of mica trap from Farley, near Beauly, by T. D. Wallace.—An excursion was made in the afternoon to the Spindle and Buddo Rocks, under the guidance of Prof. Heddle.

Edinburgh

Royal Society, June 21.—Sheriff Forbes Irvine, Vice-President, in the chair.—Mr. Omond, of Ben Nevis Observatory, read a paper on the diurnal variation in the direction of the summer winds on Ben Nevis. These varying winds seem to be entirely local, and are caused by the heating of the one side of the mountain by the sun, while the other is cooled by radiation. The air consequently passes over the mountain from the hot to the cold side.—Mr. A. Buchan read a paper on the meteorology of Ben Nevis. He referred chiefly to three points:—(1) temperature-variation; (2) variation of barometric pressure; (3) wind-speed. As regards temperature, there is the usual morning minimum and afternoon maximum, which tend to be obliterated in the winter months. The barometer reads below average in the early morning, and above average in the afternoon. There is an afternoon minimum, which tends to disappear in summer. The wind-speed is below average during the night, and above average in the afternoon. The barometer reads low when the wind is high at the top of the mountain. Mr. Buchan pointed out that the great advantage of the Observatory is that simultaneous observations are made at the top of the mountain and at the foot, the station at the foot being on an incline sloping down to sea-level. If this latter condition is not satisfied, no reliance can be placed upon deductions from the results obtained as to the rate of diminution of temperature with height. The Observatory at Hong Kong is so conditioned, and the rate of diminution, as deduced from results obtained there, is 1° F. per 281 feet. From the Ben Nevis observations Mr. Buchan finds it to be 1° F. per 270 feet.—Mr. G. W. W. Barclay described some algoid lake-balls found in South Uist.—Dr. W. Hunter read a paper on the duration of life of the red blood-corpuscles, as ascertained by transfusion. Three weeks is the average period given by his experiments. When there is no devitalising action in the corpuscles by the method of observation employed, it is probably from three to four weeks.

Paris

Academy of Sciences, June 21.—M. Jurien de la Gravière, President, in the chair.—Improvement of the bar at the mouth of the Senegal River, by M. Bouquet de la Grye. Having studied the question on the spot during the year 1885, the author proposes some simple measures by which the dangerous effects of the bar might be obviated and the navigation of the Senegal waters greatly improved.—On some double phosphates of thorium and potassium or of zirconium and potassium, by MM. L. Troost and L. Ouvrard. By preparing a certain number of phosphates of thorium and the corresponding compounds of zirconium by the dry process, the authors have endeavoured to verify the analogy pointed out by several observers between thorine and zircon. They find that the metaphosphate and the pyrophosphate of potassa yield with thorine and zircon double phosphates which have analogous compositions, but are not isomorphous. The orthophosphate of potassa gives double phosphates which have different compositions; nor is there any isomorphism between thorine and zircon obtained by calcination of the double phosphates at very high temperatures.—On the ammonia present in the ground, by MM. Berthelot and André. In reply to M. Schlœsing's last paper the authors claim to have made good their original statement that the ammonia present in the ground should be analysed without any dessication or previous treatment. They also join issue on various incidental points raised by M. Schlœsing himself during the controversy.—On the extension to a class of analogous forms of the theorem relative to a number of asyzygetic invariants of a given type, by Prof. Sylvester.—On the discovery of a new metal, austrium, announced by M. Ed. Linnemann in the *Monatshefte für Chemie* for April 1886, by M. Lecoq de Boisbaudran. From the description given of its chemical properties, its electric spectrum, and the process of its extraction from the orthite of Arendal, the author thinks that this substance is very probably gallium, a small quantity of which might easily be contained in orthite. The two rays of austrium approximately measured by M Linnemann are $\lambda = 403{\cdot}0$ and $416{\cdot}5$, those of gallium being $403{\cdot}2$ and $417{\cdot}05$. For both the ray 417 is the strongest.—Remarks accompanying the presentation of three volumes of the *Annales du Bureau central météorologique* for 1884, by M. Mascart. Attention is drawn especially to M. Fron's paper on the distribution of thunderstorms in France during the year 1883; to M. Moureaux' memoirs on the methods employed at the Parc Saint Maur Observatory for the study of terrestrial magnetism; and to M. Teisserenc de Bort's paper on the distribution of cloudiness over the surface of the globe.—Observations of Brooks's Comet III. (*c*, 1886), made at the Observatory of Algiers (0·50m. telescope), by M. Ch. Trépied.—Developments in trigonometrical series of certain functions verifying the equation of the potential $\Delta F = 0$, by M. Appell.—Note on some new groups of surfaces of two dimensions in spaces of n-dimensions, by M. Giovanni Bordiga.—Observations on M. Ledieu's note relative to the roll of vessels at sea, by M. de Bussy.—On the vapours emitted by a mixture of volatile substances, by M. P. Duhem. It is shown that the partial pressure of the vapour emitted by each of the two fluids mixed together is less than the tension of saturated vapour of the same fluid taken in the pure state.—Dynamics of the molecule of water: velocity of the propagation of sound; compressibility; heat of fusion of ice; specific heat of ice, by M. M. Langlois.—Calorimetric study of iron at high temperatures, by M. Pionchon. A detailed exami-

nation is made of the characteristic modifications experienced by iron at a temperature of about 700° through the extremely rapid absorption of heat in a comparatively slight interval of temperatures.—Conditions under which is realised the maximum of useful work in an electric distribution, by M. Vaschy.—Note on atmospheric refraction, by MM. J. Chappuis and Ch. Rivière. This phenomenon is here studied by a method based on the employment of Jamin's interferential refractometer.—New facts bearing on the phenomenon of the apparent oscillation of the stars, by M. Aug. Charpentier. Several observations are made, tending to show that the phenomenon is of a purely subjective character, due especially to the unequal fatigue of the muscles of the eye, or rather to their innervation.—On the presence of a new element in samarskite, by Mr. W. Crookes. The already described abnormal orange band $\lambda = 609 = \frac{1}{\lambda^2} 2693$, which the author supposed due to a mixture of the two earths yttrium and samarium, he now finds cannot be due to either of these, the only probable alternative being that it belongs to some new element. Until it can be separated from the asssociated substances and its chief properties determined, he proposes to name it Sa, the initial letter S indicating its samarskite origin.—On the dissociation of the hydrates of the sulphate of copper, by M. H. Lescœur.—Action of the acids and bases on emetic solutions, by M. Guntz.—Action of water and of ammonia on the chloride of methylene, by M. G. André.—Some new properties of cyanated camphor, by M. Alb. Haller.—A contribution to the study of the alkaloids, by M. Œchsner de Coninck. The author applies the method of MM. Hoogewerf and Van Dorp to the treatment of some iodides of pyridic ammonium—isomethylate of pyridine, C_5H_5N,CH_3I, and iodethylate of pyridine, C_5H_5N,C_2H_5I.—On the normal dinitriles

$$CN—(CH_2)_n—CN,$$

by M. L. Henry.—Chemical researches on the products of the eruption of Mount Etna during the months of May and June 1886, by M. L. Ricciardi. The sands collected at Cibali were of a blackish colour, consisting mostly of amorphous detritus mixed with crystalline fragments of labradorite, olivine, and pyroxene readily affected by the magnet. The ashes ejected on May 28–29 present similar characteristics with a larger quantity of salts soluble in water.—Volumetric analysis of the sulphur in the sulphides decomposable by hydrochloric or sulphuric acid, by M. Fr. Weil.—Researches on the growth of beetroot, by M. Aimé Girard. This paper deals especially with the stalk, which during growth consists of a tissue, in the elementary organs of which water and sugar, forming a constant quantity, are mutually replaced according to the circumstances.—Researches on the structure of the scorpion's brain, by M. G. Saint-Remy.—On the structure of the germ vesicle in *Siphonostoma diplochætos*, Otto, by M. Et. Jourdan.—On the post-embryonic evolution of the vitelline sac in birds, by MM. Charbonnel-Salle and Phisalix.—On the vascular system of *Spatangus purpureus*, by M. H. Prouho.—On the glands of insects: a pretended "new type of elastic tissue," by M. J. Gazagnaire. The paper deals especially with the unicellular glands first described by Meckel in 1846, and afterwards studied by Stein, Sirodot, Leydig, and others. To these are referable M. H. Viallanes' pretended "elastic cellules."—On some histological peculiarities of the digestive tube in the simple Ascidians, and especially the Cynthiæ, by M. L. Roule.—On the geological constitution of the Pyrenees: the Triassic system, by M. E. Jacquot. The author's investigations lead to the conclusion that along the French slope, from the banks of the Nive to the Teck valley, the Triassic formation presents a uniform composition, recalling that of the ranges in Franche-Comté, Provence, and Lorraine.

BERLIN

Physical Society, May 21.—Dr. König spoke on the modern attempts towards laying down an unexceptionable basis of mechanics. Among the axioms of mechanics the law of inertia set up by Newton was the most important, but neither the conceptions of time, which lay at the basis of the idea of uniformity, nor the conception of the straight line, were precisely definable without further assumptions. A whole series of attempts had been made to fix these fundamental conceptions, attempts which the speaker briefly sketched. He came to the conclusion that as standard of time not the movement of translation, which could never be absolutely measured, but the movement of rotation must be recognised. The movement of rotation was perceptible in itself, namely, through the oblateness of the rotating ball. With regard to the straight line, that is with regard to our co-ordinate system in space, the speaker accepted the ideas set forth last year by Herr Lange of Leipzig, who started with a notion developed by Prof. James Thomson of Glasgow. Dr. König gave a graphic representation of the idea which had been only mathematically developed and established. According to this representation it was possible, when three points described in a particular space any paths whatsoever, to follow with a co-ordinate system these movements in such a manner that all three points moved rectilinearly. Experience taught that when three points described straight lines to such a co-ordinate system, each fourth, fifth, and so on, did it as well. Thus in the movements of rotation, and in the mobile co-ordinate system, unexceptionable bases of mechanics might be found whereupon to raise a superstructure, just as mathematics was built up on its axioms.

BOOKS AND PAMPHLETS RECEIVED

"Official Guide to the Museums of Economic Botany, Kew," No. 1, "Dicotyledons and Gymnosperms," 2nd edition (Eyre and Spottiswoode).—"Quarterly Journal of Microscopical Science," June (Churchill).—"*Challenger* Reports," vol. xiv. "Zoology."—"Hygiene of the Vocal Organs," by Dr. M. Mackenzie (Macmillan).—"Disorders of Digestion; their Consequences and Treatment," by Dr. T. L. Brunton (Macmillan).—"Photo-Micrography," by I. J. Jennings (Piper and Carter).—"Birds on the British List," by Rev. G. Smart (R. H. Porter).—"Proceedings of the Linnean Society of New South Wales," vol. x. part 4 (Cunninghame, Sydney).—"Proceedings of the Physical Society of Moscow," tome viii. No. 2.—"Bourne's Handy Assurance Directory, 1886" (Bourne, Liverpool).—"Journal of Anatomy and Physiology," July (Williams and Norgate).—"General Index to the Year-Book of Pharmacy for the Years 1864 to 1885" (Churchill).—"The Great and Growing Question of Vaccination" (E. W. Allen).—"Studies from the Biological Laboratory, Johns Hopkins University," vol. iii. No. 7.

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