quadrant, and being entirely on the upper right-hand side. He described the colour as being like the upper ground part of a kerosene lamp shade in the cabin to which he pointed. The sun looked watery. When he first saw it it was coming from behind scud. There was no sky which could be called blue. It was a whitey sky. Cooper's drawing was marked with radial lines extending across the outer annulus from the inner.

"The return voyage was begun at daylight on the morning of the 13th of December. The only lasting traces of the astronomers left on the island were the photographers' dark rooms and the brick foundations used for the instruments, in which were entombed two bottles containing coins and newspapers and some particulars of the expedition. A member of the party, animated by something of the spirit of Old Mortality in his desire to preserve from oblivion the mortuary memorials of the expedition, inscribed this touching record on the slab which formed the top of one of these pedestals :—'Sacred to the memory of the Australian Eclipse Expedition.'"

SOCIETIES AND ACADEMIES

LONDON

Royal Society, February 15.—"On the Induction of Electric Currents in an infinite plane sheet of uniformly conducting matter," by Prof. Clerk Maxwell, F.R.S.

The currents are supposed to be induced in the sheet by the variation in position or intensity of any system of magnets or electromagnets.

When any system of currents is excited in the sheet, and then left to itself, it gradually decays, on account of the resistance of the sheet. At any point on the positive side of the sheet, the electromagnetic action is precisely the same as if the sheet, with its currents, retaining their original intensity, had been carried away in the negative direction with a constant velocity R, where R is the value, in electromagnetic measure, of the resistance of a rectangular portion of the sheet, of length 1 and breadth 2π. This velocity, for a sheet of copper of best quality of one millimetre thickness, is about twenty-five metres per second, and is, therefore, in general comparable with the velocities attainable in experiments with rotating apparatus.

When an electromagnet is suddenly excited on the positive side of the sheet, a system of currents is induced in the sheet, the effect of which on any point on the negative side is, *at the first instant*, such as exactly to neutralise the effect of the magnet itself. The effect of the decay of this system of currents is therefore equivalent to that of an image of the magnet, equal and opposite to the real magnet, from the position of the real magnet, in the direction of the normal drawn away from the sheet, with the constant velocity R.

When any change occurs in an electromagnetic system, whether by its motion or by the variation of its intensity, we may conceive the change to take place by the superposition of an imaginary system upon the original system; the imaginary system being equivalent to the difference between the original and the final state of the system.

The currents excited in the sheet by this change will gradually decay, and their effect will be equivalent to that of the imaginary system carried away from the sheet with the constant velocity R.

When a magnet or electro-magnet moves or varies in any continuous manner, a succession of imaginary magnetic systems like those already described is formed, and each, as it is formed, begins to move away from the sheet with the constant velocity R. In this way a train or trail of images, is formed, moves off, parallel to itself, away from the sheet, as the smoke of a steamer ascends in still air from the moving funnel.

When the sheet itself is in motion, the currents, relatively to the sheet, are the same as if the sheet had been at rest, and the magnets had moved with the same relative velocity. The only difference is, that whereas when the sheet is at rest no difference of electric potential is produced in different parts of the sheet, differences of potential, which may be detected by fixed electrodes are produced in the moving sheet.

The problem of Arago's whirling disc has been investigated by MM. Felici and Jochmann. Neither of these writers, however, has solved the problem so as to take into account the mutual induction of the currents in the disc. This is the principal step made in this paper, and it is expressed in terms of the theory of images, by which Sir W. Thomson solved so many problems in Statical Electricity. In the case of the whirling disc, the trail of images has the form of a helix, moving away from the disc with velocity R, while it revolves about the axis along with the disc. Besides the dragging action which the disc exerts on the magnetic pole in the tangential direction, parallel to the motion of the disc, the theory also indicates a repulsive action directed away from the disc, and an attraction towards the axis of the disc, provided the pole is not placed very near the edge of the disc, a case not included in the investigation. These phenomena were observed experimentally by Arago, *Ann. de Chimie*, 1826.

February 22.—"On a New Hygrometer." By Mr. Wildman O. Whitehouse.

"On the Contact of Surfaces." By William Spottiswoode, M.A., Treas. R.S.

In a paper published in the "Philosophical Transactions" (1870, p. 289), I have considered the contact, at a point P, of two curves which are co-planar sections of two surfaces (U, V); and have examined somewhat in detail the case where one of the curves, viz., the section of V, is a conic. In the method there employed, the conditions that the point P should be sextatic, involved the azimuth of the plane of section measured about an axis passing through P; and consequently, regarded as an equation in the azimuth, it showed that the point would be sextatic for certain definite sections. It does not, however, follow, if conics having six-pointic contact with the surface U be drawn in the planes so determined, that a single quadric surface can be made to pass through them all. The investigation therefore of the memoir above quoted was not directly concerned with the contact of surfaces, although it may be considered as dealing with a problem intermediate to the contact of plane curves and that of surfaces.

In the present investigation I have considered a point P common to the two surfaces, U and V; an axis drawn arbitrarily through P; and a plane of section passing through the axis and capable of revolution about it. Proceeding as in the former memoir, and forming the equations for contact of various degrees, and finally by rendering them independent of the azimuth, we obtain the conditions for contact for all positions of the cutting plane about the axis. Such contact is called circumaxal; and in particular it is called uniaxal, biaxal, &c., according as it subsists for one, two, &c. axes. If it holds for all axes through the point it is called superficial contact; and in the memoir some theorems are established relating to the number of sections along which contact of a given degree must subsist in order to ensure uniaxal contact, as well as to the connection between uniaxal and multiaxal contact. At the conclusion of sec. 3 it is shown that the method of plane sections may, in the cases possessing most interest and importance, be replaced by the more general method of curved sections.

In the concluding section a few general considerations are given relating to the determination of surfaces having superficial contact of various degrees with given surfaces; and at the same time have indicated how very much the general theory is affected by the particular circumstances of each case. The question of a quadric having four-pointic superficial contact with a given surface is considered more in detail; and it is shown how in general such a quadric degenerates into the tangent plane taken twice. To this there is an apparently exceptional case, the condition for which is given and reduced to a comparatively simple form; but I must admit to having so left it, in the hope of giving a fuller discussion of it on a future occasion.

The subject of three-pointic superficial contact was considered by Dupin, "Développements de Géométrie," p. 12, and, as I have learnt since the memoir was written, a general theorem connecting superficial contact and contact along various branches of the curve of intersection of two surfaces (substantially the same as that given in the text) was enunciated by M. Moutard.*

In a corollary to this theorem, M. Moutard states that through every point of a surface there can be drawn twenty-seven conics, having six-pointic contact with the surface. This number is perhaps open to question; and I have even reason to think, from considerations stated to me by Mr. Clifford, that the number ten, given in my memoir above quoted, may be capable of reduction by unity to nine. But this question refers to the subject of that earlier memoir rather than to this.

Geological Society, February 7.—Mr. Prestwich, F.R.S., president, in the chair. 1. "Further Notes on the Geology of the neighbourhood of Malaga," by M. D. M. d'Orueta. In this paper, which is a continuation of a former note laid

* Poncelet, "Applications d'Analyse à la Géométrie," 1864, tom. ii. p. 363

before the society (*see* Q. J. G. S. xxvii., p. 109), the author commenced by stating that his former opinion as to the Jurassic age of the rocks of Antequera is fully borne out by later researches upon their fossils. They apparently belong to the Portlandian series. The author made considerable additions to his description of the Torcal, near the foot of which he has found a sandstone containing abundance of *Gryphæa virgula* and *Ostrea deltoidea*. This he regards as equivalent to the Kimmeridge clay. In the Torcal he has also found a soft, white, calcareous deposit, overlying the limestones of supposed Portlandian age, and containing a fossil which he identifies with the Tithonian *Terebratula diphya*. The author discussed the peculiar forms assumed by the rocks of the Torcal under denudation, which he supposed to be due originally to the upheaval caused by the rising of a great mass of greenstone, portions of which are visible at the surface on both sides of the range. 2. "On the River-courses of England and Wales," by Prof. A. C. Ramsay, F.R.S., The author commenced by describing the changes in the physical conformation of Britain during the Jurassic and Cretaceous periods, and the relations which the deposits found during those periods bore to the Palæozoic rocks of Wales and the north-west of England. He stated that the Miocene period of Europe was essentially a continental one, and that it was closed by important disturbances of strata in central Europe, one effect of which would be to give the secondary formations of France and Britain a slight tilt towards the north-west. To this he ascribed the north-westerly direction of many of the rivers of France; and he surmised that at this period the rivers of the middle and south of England also took a westerly course. The westerly slope of the cretaceous strata of England was also, he considered, the cause of the southern flow of the Severn, between the hilly land of Wales and the long slope of chalk rising towards the east. The Severn would thus establish the commencement of the escarpment of the chalk, which has since receded far eastward. The author believed that after the Severn had cut out its valley the cretaceous and other strata were gradually tilted eastwards, causing the easterly course of the Thames and other rivers of southern and eastern England. In these and other cases adduced by the author, the sources of these rivers were originally upon the chalk near its escarpment; and it is by the recession of the latter (which was followed by the formation of the oolitic escarpment) that its present relation to the river-courses has been brought about. The author also referred to the courses followed by the rivers of the more northern part of England, and indicated their relations to the general dip of the strata.

Geological Society, February 16.—Mr. Joseph Prestwich, F.R.S., president, in the chair.—The Secretary read the reports of the council, of the Library and Museum Committee, and of the auditors. The general position of the society was described as satisfactory, although, owing to the number of deaths which had taken place among the Fellows during the year 1871, the society did not show the same increase which has characterised former years. In presenting the Wollaston gold medal to the Secretary, Mr. David Forbes, for transmission to Prof. Dana, of Yale College, Connecticut, the President said:—"I have the pleasure to announce that the Wollaston Medal has been conferred on Prof, Dana, of Yale College, Newhaven, U.S.; and in handing it to you for transmission to our Foreign Member, I beg to express the great gratification it affords me that the award of the Council has fallen on so distinguished and veteran a geologist. Prof. Dana's works have a world-wide reputation. Few branches of geology but have received his attention. An able naturalist and a skilful mineralogist, he has studied our science with advantages of which few of us can boast. His contributions to our science embrace cosmical questions of primary importance—palæontological questions of special interest—recent phenomena in their bearings on geology, and mineralogical investigations so essential to the right study of rocks, especially of volcanic phenomena. The wide range of knowledge he brought to bear in the production of his excellent treatise on Geology, one of the best of our class books, embracing the elements as well as the principles of geology. His treatise on Mineralogy exhibits a like skill in arrangement and knowledge in selection. In conveying this testimonial of the high estimation in which we hold his researches to Prof. Dana, may I beg also that it may be accompanied by an expression how strongly we feel that the bonds of friendship and brotherhood are connected amongst all civilised nations of the world by the one common, the one universal, and the one kindred pursuit of truth in the various branches of science."—Mr. David Forbes, in reply, said that it was to him a great pleasure to have, in the name of Prof. Dana, to return thanks to the society for their highest honour, and for this mark of the appreciation in which his labours are held in England. It had rarely if ever occurred in the history of the society that the Wollaston medal had been awarded to any geologist who had made himself so well known in such widely different departments of the science, for not only was Prof. Dana pre-eminent as a mineralogist, but his numerous memoirs on the Crustaceans, Zoophytes, coral islands, volcanic formations, and other allied subjects, as well as his admirable treatise on general Geology, fully testify to the extensive range and great depth of his scientific researches.—The President then presented the balance of the proceeds of the Wollaston donation fund to Prof. Ramsay, F.R.S., for transmission to Mr. James Croll, and addressed him as follows:—"The Wollaston fund has been awarded to Mr. James Croll, of Edinburgh, for his many valuable researches on the glacial phenomena of Scotland, and to aid in the prosecution of the same. Mr. Croll is also well known to all of us by his investigation of oceanic currents and their bearings on geological questions, and of many questions of great theoretical interest connected with some of the great problems in Geology. Will you, Prof. Ramsay, in handing this token of the interest with which we follow his researches, inform Mr. Croll of the additional value his labours have in our estimation, from the difficulties under which they have been pursued, and the limited time and opportunities he has had at his command."—Prof. Ramsay thanked the president and council in the name of Mr. Croll for the honour bestowed on him. He remarked that Mr. Croll's merits as an original thinker are of a very high kind, and that he is all the more deserving of this honour from the circumstance that he has risen to have a well-recognised place among men of science without any of the advantages of early scientific training; and the position he now occupies has been won by his own unassisted exertions. The President then proceeded to read his Anniversary Address, in which he discussed the bearings upon theoretical Geology of the results obtained by the Royal Commission on Water-Supply and the Royal Coal Commission. The Address was prefaced by biographical notices of deceased Fellows, including Sir Roderick I. Murchison, Mr. William Lonsdale, Sir Thomas Acland, Sir John Herschel, Mr. George Grote, Mr. Robert Chambers, and M. Lartet.—The ballot for the Council and Officers was taken, and the following were duly elected for the ensuing year:—President—The Duke of Argyll, K.T., F.R.S. Vice-Presidents—Prof. P. Martin Duncan, F.R.S., Prof. A. C. Ramsay, F.R.S., Warington W. Smyth, F.R.S., Prof. John Morris. Secretaries—John Evans, F.R.S., David Forbes, F.R.S. Foreign Secretary, Prof. T. D. Ansted, F.R.S. Treasurer—J. Gwyn Jeffreys, F.R.S. Council—Prof. T. D. Ansted, F.R.S., the Duke of Argyll, F.R.S., W. Carruthers, F.R.S., W. Boyd Dawkins, F.R.S., Prof. P. Martin Duncan, F.R.S., R. Etheridge, F.R.S., John Evans, F.R.S., James Fergusson, F.R.S., J. Wickham Flower, David Forbes, F.R.S., Capt. Douglas Galton, C.B., F.R.S., Rev. John Gunn, M.A., J. Whitaker Hulke, F.R.S., J. Gwyn Jeffreys, F.R.S., Sir Charles Lyell, Bart., F.R.S., C. J. Meyer, Prof. John Morris, Joseph Prestwich, F.R.S., Prof. A. C. Ramsay, F.R.S., R. H. Scott, F.R.S., W. W. Smyth, F.R.S., Prof. J. Tennant, Henry Woodward.

Zoological Society, February 20, Prof. Flower, F.R.S., in the chair.—The secretary read a report on the additions that had been made to the society's menagerie during the month of January, 1872, and called particular attention to a young king penguin (*Apterodytes pennanti*), presented by Mr. F. P. Cobb, of Port Stanley, Falkland Islands, and to a collection of African land tortoises, transmitted by Dr. Grey of Cradock, Cape Colony.—The secretary also called attention to the female Sumatran rhinoceros (*Rhinoceros sumatrensis*) just added to the society's menagerie.—A paper was read by Mr. J. W. Clark, on the visceral anatomy of the hippopotamus, as observed in the young specimen of this animal which had died in the society's gardens on the 10th January, 1872. After giving an account of the morbid appearances noticed, Mr. Clark described in detail the stomach of this specimen, which appeared to differ in some points from those examined by previous authorities.—A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the second part of his "Contributions to a General History of the Spongiadæ," in which was contained a full account of two species of the genus *Geodia*.—A paper by the

Rev. O. P. Cambridge was read, "On the Spiders of Palestine and Syria," in which was given a general list of the Araneidea of those countries, together with descriptions of numerous new species, and the characters of two new genera.—A communication was read from Dr. John Anderson, containing descriptions of some Persian, Himalayan, and other reptiles, either new or little known to science. A second paper by Dr. Anderson contained some further remarks on the external characters of the new Burmese macaque, which he had recently described under the name *Macacus brunneus*.—A communication was read from Count Thomaso Salvadori, containing a note on a specimen of Lidth's jay (*Garrulus lidthii*), in the collection of the King of Italy, which had originally been received alive from Japan. Mr. D. G. Elliot read a note on a Cat described by Dr. Gray in the Proceedings of the Zoological Society for 1867, as *Felis pardinoides* from India, which Mr. Elliot considered to be identical with *Felis Geoffroyii* of S. America.

MANCHESTER

Literary and Philosophical Society, February 6.—E. W. Binney, F.R.S., president, in the chair. Dr. Joule, F.R.S., called attention to the very extraordinary magnetic disturbances on the afternoon of the 4th instant, and from which he anticipated the aurora which afterwards took place. The horizontally suspended needle was pretty steady in the forenoon of that day, but about 4 P.M. the north end was deflected strongly to the east of the magnetic meridian, and afterwards still more strongly to the west. The following were the observations made :—

Time	Deflection from the Magnetic Meridian.	Time	Deflection from the Magnetic Meridian.
4.0 P.M.	0 50 E.	6.10 P.M.	1 24 W.
4.30 ,,	0 47 W.	6.12 ,,	1 8 ,,
4.55 ,,	2 22 ,,	7.41 ,,	0 10 ,,
4.58 ,,	3 0 ,,	7.43 ,,	0 0 ,,
5.9 ,,	3 45 ,,	8.9 ,,	0 42 ,,
5.12 ,,	0 52 ,,	8.31 ,,	0 10 ,,
5.23 ,,	5 36 ,,	8.54 ,,	1 18 ,,
5.24 ,,	2 28 ,,	8.58 ,,	0 52 ,,
5.35 ,,	0 52 ,,	11.3 ,,	0 5 ,,
5.55 ,,	0 52 ,,		

Mr. Sidebotham states that he also expected the magnificent aurora on account of the violent disturbance of the needle at Bowdon, amounting to at least 3°. Observation with the spectroscope by Dr. Joule showed a bright and almost colourless line near the yellow part of the spectrum. This line appeared in whatever part of the heavens the instrument was directed, and could be plainly seen when the sky was covered with clouds and rain was falling. When looking at the most brilliant red light of the aurora a faint red light was seen at the red end of the spectrum, and beyond the bright white line, towards the violet end, two broad bands of faint white light. Mr. Thomas Harrison stated that he saw the aurora on last Sunday evening from $6^h\ 15^m$ to $9^h\ 30^m$ and took spectroscopic observations thereon from various parts of the sky. In each case, however, he discovered only one bright yellow line, situated between D and E, being on Kirchhoff's scale about 1255 to 1260. He is not acquainted with any known substance that gives a corresponding line. The line throughout was very clear and decided, both in the narrow and wide slit; but he failed to discover any continuous spectrum. The line was also very perceptible by reflection from those parts of the sky in which no trace of aurora was visible; and although the streaks were both red and white, the spectroscope appeared to give the aurora as a monochromatic light.

KILKENNY

Royal Historical and Archæological Association of Ireland, January 17.—The Mayor of Kilkenny in the chair. Rev. J. Graves (hon. sec.) read the report for 1871. The following members were elected :—Earl of Dunraven, Rev. W. H. Fraser, L. Daniel, J. Lloyd, G. Reade, W. Irvine, J. Martin, W. J. Lemon, A. Gibb, A Menzies, F. Barton, and W. Moore; the Rev. Dean Watson and B. Delanny, were raised to Fellows.—"Historical Documents of 1644" were exhibited by the hon. sec., one of which contained a key to the cipher used in the correspondence between Ormonde and the confederate leaders at the time. The following papers were read: "On a recent discovery of Coins at Mullaboden, Ballymore Eustace, co. Kildare," by Rev. J. F. Shearman; "On Kilkenny, past and present," by P. Watters; "On some Unrecorded Antiquities in Yar-Connaught," by G. H. Kinahan; "On some Antiquities of Oak at Bellisle, co. Fermanagh," by W. F. Wakeman.

BOOKS RECEIVED

ENGLISH.—Principles of Geology, 11th edition, Vol. i.: Sir C. Lyell (J. Murray).—Scottish Meteorology, 1855-1871. Edinburgh Observatory.—A Treatise on the Theory of Friction: J. H. Jellett (Macmillan).—The Climate of Uckfield: C. L. Prince (Churchill).

AMERICA.—Transactions of the Albany Institute, Vols. 1-6.—Transactions of the Society for the Promotion of Useful Arts in the State of New York, Vol. iv., Part II.—Annals of the Dudley Institute, Vols. i. and ii.—Annual Address before the Albany Institute: O. Meads.—The Advice of a Father to his Son: N. François.

DIARY

THURSDAY, FEBRUARY 29.

ROYAL SOCIETY, at 8.30.—On the relative Power of 34 Substances to Prevent the Development of Protoplasmic and Fungus Life, and in Arresting Putrefaction: Prof. Crace-Calvert, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.—Further Facts in the History of the Early Discovery of Australia: R. H. Major, F.S.A.

FRIDAY, MARCH 1.

ROYAL INSTITUTION, at 9.—Measuring Temperature by Electricity: C. W. Siemens.

GEOLOGISTS' ASSOCIATION, at 8.—On the Geology of Hampstead, Middlesex: C. Evans, F.G.S.—Note on a recently exposed Section at Battersea: J. A. Coombs.

ARCHÆOLOGICAL INSTITUTE, at 4.

SATURDAY, MARCH 2.

ROYAL INSTITUTION, at 3.—Demonology: M. Conway.

SUNDAY, MARCH 3.

SUNDAY LECTURE SOCIETY, at 4.—On the Icelandic Language and its similarity to English. The Literature of Iceland, Old and Modern: Jon A. Hjaltalin.

MONDAY, MARCH 4.

ENTOMOLOGICAL SOCIETY, at 7.

ANTHROPOLOGICAL INSTITUTE, at 8.—Anthropological Collections from the Holy Land, No. III.: Capt. R. F. Burton and Dr. C. Carter Blake.—Race Characteristics as related to Civilisation: J. Gould Avery.

LONDON INSTITUTION, at 4.—Elementary Chemistry: Prof. Odling, F.R.S.

ROYAL INSTITUTION, at 2.—General Monthly Meeting.

TUESDAY, MARCH 5.

ZOOLOGICAL SOCIETY, at 9.—Notes on an Ostrich, recently living in the Society's collection; A. H. Garrod.—Catalogue of the Birds found in Ceylon, with some remarks on their habits and local distribution, and descriptions of two new species peculiar to the Island: E. W. H. Holdsworth.

SOCIETY OF BIBLICAL ARCHÆOLOGY, at 8.30.

ROYAL INSTITUTION, at 3.—On the Circulatory and Nervous Systems: Dr. Rutherford.

WEDNESDAY, MARCH 6.

GEOLOGICAL SOCIETY, at 8.—On *Prognathus Güntheri* (Egerton), a new genus of Fossil Fish from the Lias of Lyme Regis; On two Specimens of Ischyodus from the Lias of Lyme Regis: Sir P. de M. Grey-Egerton, Bart., M.P., F.R.S.—How the Parallel Roads of Glen Roy were formed: Prof. James Nichol, F.G.S.—Notes on Atolls or Lagoon Islands: S. J. Whitnell.

SOCIETY OF ARTS, at 8.—On the *Goliath* Training Ship: Capt. Bourchier.

MICROSCOPICAL SOCIETY, at 8.

PHARMACEUTICAL SOCIETY, at 8.

THURSDAY, MARCH 7.

ROYAL SOCIETY, at 8.30.

SOCIETY OF ANTIQUARIES, at 8.30.

ROYAL INSTITUTION, at 3.—On the Chemistry of Alkalies and Alka Manufacture; Prof Odling, F.R.S.

LINNEAN SOCIETY, at 8.

CHEMICAL SOCIETY, at 8.

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