

point was somewhere within the sickle of Leo, but I am not sure as to its exact position. Most of the meteors shot westward along the ecliptic, through Gemini and Taurus, but others in all directions. The trains of light and the nuclei were generally white, with a slight tinge of green, but all the prismatic colours were seen. The time of duration of the flight was from the fraction of a second up to 6 seconds, and the longest trains about 40°. At one time gleams of light of various forms appeared in Leo. I had a small hand-spectroscope, but the times of duration were too short for using it."

SCIENTIFIC SERIALS

The *Moniteur Scientifique* for December 1 contains a translation of Dr. Williamson's memoir of the late Professor Graham, which appeared in the first number of NATURE, a review of contemporary physics and astronomy, a long notice of M. Paul Champion's work on the ancient and modern industry of China, and the usual accounts of new patents and meetings of scientific societies. The number for December 15 completes the volume for 1869, and gives elaborate tables of contents. The remaining space is devoted to reports of the proceedings of the Academy of Sciences, abstracts of papers, notices of new publications, and an account of the new development of the trade in false autographs.

The *Revue des Cours Scientifiques* for December 11 contains a translation of an essay by Helmholtz on Goethe as a naturalist and a physicist, an article on the boring of Mont Cenis by M. A. Cazin, and a translation of Professor Williamson's memoir of Graham, contributed to our first number. The greater portion of the number for December 18 is occupied by a translation of a paper on the Centenary of Humboldt, read before the Boston Natural History Society by Professor Agassiz. It also contains lectures on Paleontology by M. A. Gaudry, and an important paper on the Mortality of Women in Labour, by Professor Lorain.

In the *Philosophical Magazine* for this month, Mr. C. Tomlinson, F.R.S., gives an account of Van der Meusbrugge's important treatise on the Superficial Tension of Liquids, in which the movements of camphor on the surface of water are shown to form a particular case of a general theory. Mr. W. H. Preece contributes a proof of the Parallelogram of Forces, and Dr. Odling a note on Condensed Ammonia Compounds. Professor Kengott's Microscopical Investigation of the Knyahynia Meteorite, and M. Abich's paper on Hailstorms in Russian Georgia (both of which are accompanied by plates), are well deserving of attention.

In the *Chemical News* for December 17, Mr. Edwin Smith describes an interesting series of experiments on the Electrical Phenomena of Plants, suggested by a chapter in Becquerel's treatise. A paper read before the Glasgow Philosophical Society by Mr. R. R. Tatlock, F.C.S., on the Estimation of Iodine and Bromine, with special reference to the Analysis of Kelp, is reproduced. Mr. W. T. Suffolk, F.R.M.S., continues his useful articles on Microscopical Manipulation; and Mr. H. C. Sorby, F.R.S., describes the application of the Spectrum Microscope to the Valuation of Wines. In a paper on the Constitution of the Compounds of Sodium, Mr. J. A. Wanklyn, F.C.S., adduces new arguments in support of his opinion that the metal sodium had a polyvalent character. The books noticed in this number are Dr. Bence Jones's Memoir of Faraday, and a treatise on the Leclanché Battery. Correspondence from Dr. Mennier and Dr. J. H. Gladstone, and Chemical Notices from Foreign Journals, make up the rest of the number.

A Paper by M. Felix Plateau, on the Flight of the Coleoptera, read before the Physical and Natural History Society of Geneva, in September last, has just been published in the *Bibliothèque Universelle et Revue Suisse*. The conclusions arrived at are as follows:—(1), The difference of flexibility between the two edges of the wing are not sufficient to account completely for the phenomena of flight. (2), The wing makes a wide angle with the plane in which it moves. (3), It is deflected more rapidly than it is elevated. (4), The extent of surface of the wing is greater in the movement of deflection than in the movement of elevation. The influence of the elytra, their form and mode of action, as well as some other considerations, are reserved for a memoir which the author hopes to publish shortly.

ASTRONOMY

Oppolzer communicates to the *Astronomische Nachrichten* the following elements of Comet II., 1869:—

$$\begin{aligned} \tau &= \text{Oct. } 9^{\text{h}} 26^{\text{m}} \text{ Berlin mean time.} \\ \pi &= 139^{\circ} \ 1' \ 13'' \\ \Omega &= 311^{\circ} \ 27' \ 51'' \\ i &= 111^{\circ} \ 26' \ 40'' \\ \log. q &= 0.09014 \end{aligned} \left. \begin{array}{l} \\ \\ \\ \\ \end{array} \right\} \text{Mean Eq. 1869-70.}$$

Professor C. H. F. Peters, of Clinton, N.Y., has discovered still another new planet, 9.7 mag., the elements of which are as follows:—

$$\begin{aligned} \tau &= 1869, \text{ Oct. } 0^{\text{h}} 0^{\text{m}} \text{ Berlin mean time.} \\ M &= 338^{\circ} \ 1' \ 47.7'' \\ \pi &= 53^{\circ} \ 8' \ 20.8'' \\ \Omega &= 5^{\circ} \ 3' \ 52.2'' \\ i &= 8^{\circ} \ 9' \ 59.4'' \\ \phi &= 16^{\circ} \ 43' \ 30.2'' \\ \mu &= 808'' 32 \\ \log. a &= 0.428281 \end{aligned}$$

SOCIETIES AND ACADEMIES

LONDON

Royal Astronomical Society, December 10. — Second Meeting of Session. Admiral Manners, president, in the chair during the early part of the meeting; afterwards (the president finding his health not sufficiently restored to enable him to remain), Mr. De la Rue, F.R.S., vice-president, took the chair. The minutes of the last meeting were read and confirmed, and thirty-two presents announced, including a magnificent representation of the solar spectrum from France (showing the part beyond the violet end), presented by Mr. Ladd. Mr. Williams, the assistant secretary, then read a series of extracts from an elaborate work on Chinese Astronomy, upon which he has been engaged during the last three years. He exhibited in a very complete and lucid manner the Chinese mode of reckoning time by cycles of sixty years, the several years of each cycle being indicated by certain characters called Kea Tsze. He then showed how any year in ordinary chronology, whether B.C. or A.D., can be represented in the proper cycle, and in its right place in that cycle. He described the division of the heavens into thirty-one parts; three, called "Yuen," of large size; the remainder, called "Suh," representing lunar houses, and very irregular in extent, both from east to west and from north to south. While one, for instance, extended north and south from Perseus to Canopus, another consisted mainly of a few stars in the head of Orion. Other extracts exhibited the correctness of the positions assigned by the Chinese to the equinoxes and the solstices, and the evidence their estimates give respecting the date at which their observations were made. He mentioned *inter alia* that the Metonic Cycle had been known to the Chinese astronomers 2,000 years before Meton's day. The occurrence of the names of our modern asterisms in Chinese records must not be held to indicate the antiquity of our constellation-figures, because it cannot be doubted that the Jesuits taught the Chinese these new names. In fact, the Chinese were led to remodel their system of astronomy according to the instructions of the Jesuits—a misfortune, perhaps, since, although the old system of astronomy had had the disadvantage of being inexact and scarcely intelligible, the change destroyed many of the clues by which we might have found clearer ideas as to what the Chinese astronomers really meant to record.—The Astronomer Royal indicated his high opinion of the value of such researches as those in which Mr. Williams had been engaged. Astronomy is the science which of all others brings most together the past, the present, and the future, and, therefore, all studies of long past eras, even though the astronomical observations then made were comparatively inexact, cannot but have a high value. Mr. Stone, F.R.S., called attention to the general value of the matter brought before the society's notice by Mr. Williams, but expressed his regret that the Chinese records named only the day on which any phenomenon was observed. Mr. De la Rue then mentioned that the greater part, if not all, of Mr. Williams's work, would be printed in the Society's Memoirs.—The Astronomer Royal described an arrangement for correcting atmospheric chromatic dispersion, even simpler than those he had before devised. It had occurred simultaneously to himself and to Mr. Simms, the

optician, and consists simply in giving the eye-glass of an eye-piece such a motion that while the face towards the field-glass presents an unchanged curvature, the other face (plane) is slightly inclined. This is clearly equivalent to the addition of a prism to the eye-glass, only there is no loss of light, as there would be were a separate prism added. The new eye-piece will serve also to correct errors in the centreing of an object-glass.—Professor Cayley discussed certain geometrical relations connected with the problem of determining the place of a body revolving round the sun, from three observations. He remarked that each observation shows that the body lies on a known line. If we take these three lines in space, what the problem really requires is, that we should determine the position of a plane passing through the sun, and intersecting these lines so that a conic through the points of intersection should have the sun in its focus, and the areas between vectorial radii to the points proportional to the two observed time-intervals. He then considered the locus of the orbit-pole, (1) for an assumed eccentricity, (2) for an assumed period, on a stereographic projection of a portion of the sphere—equal in extent to one half, but not actually a hemisphere. The loci for poles to real orbits—that is, orbits having all three points on one branch—exhibit a singular figure, the true locus having *points d'arrêt* on the bounding-lines of the half-sphere of projection. In answer to questions by the Astronomer Royal, Mr. De la Rue, and Mr. Stone, Professor Cayley indicated that his paper was intended rather as a contribution to the geometry of the problem than to its practical solution.—Dr. Balfour Stewart then read a paper on terrestrial magnetism. After referring to the views he has already published respecting the earth's magnetic character, he indicated his belief that the zodiacal light is a phenomenon of terrestrial magnetism, owing its existence to the magnetic effects produced by the upper air-currents (the counter-trades); these effects not being recognisable, of course, in ordinary observations. He suggested also that the motion of the tidal wave might account for the magnetic variations, whose period corresponds to the lunar diurnal motion. The Astronomer Royal remarked on the complexity of the whole problem of terrestrial magnetism, which he characterised as hardly belonging to the class of subjects usually dealt with by the Society.—Mr. Proctor gave a brief sketch of a new theory of the Milky Way. He regards the galaxy as neither a cloven disc, as Sir W. Herschel opined, nor a flat ring as Sir J. Herschel has suggested, but a spiral of a figure which he indicated as serving to explain all the most striking peculiarities of the Milky Way, as seen upon the heavens.—Another paper by Mr. Proctor, on Great Circle Sailing, and a letter from Lieut. Tupman about the November meteors as seen in Egypt, remained unread owing to the lateness of the hour.

Geological Society, December 8.—Professor T. H. Huxley, J.L.D., F.R.S., president, in the chair. The following communications were read:—1. "Notes on the Brachiopoda hitherto obtained from the Pebble-bed at Budleigh Salterton, near Exmouth, in Devonshire," by Thomas Davidson, Esq., F.R.S., F.G.S., &c. The author first described the general characters, and discussed the opinions that have been put forward as to the origin of the pebbles forming this bed. Nearly forty species of Brachiopoda have been obtained from them. The fossils contained in the pebbles have been regarded as of Lower Silurian age; the author considered the great majority of the Brachiopoda to be Devonian. The species identified with Silurian fossils are:—*Lingula Lesnouri* (Rouault), *L. Rouaulti* (Salter), and *L. Harvei* (Rouault). The species regarded by the author as undoubtedly Devonian (*i.e.* either previously described from Devonian deposits or associated with such species in the same pebble) are twelve in number, namely:—*Spirifer Verneuilii* (Murch), *S. macroptera* (Goldf.), *Athyris budleighensis* (sp. n.), *Athyra (reticularis?)*, *Rhynchonella inaurita* (Sandb.), *R. elliptica* (Schnurr.), *R. Vicaryi* (sp. n.), and two undetermined species of *Rhynchonella*, *Streptorhynchus cronistria* (Phil.) *Productus Vicaryi* (Salt.), and an undetermined *Chonetes*. Eight species occurring in the same rock, three of which have been doubtfully identified, are considered by the author to be probably Devonian. The species supposed to be determined are:—*Orthis redux* (Barr.) and *O. Berthosi* (Rouault), Silurian; and *Spirifer octoplicatus* (Sow.), Devonian and Carboniferous, but possibly identical with the Silurian *S. elevatus* (Dalm.) The others are two new species of *Orthis*, and a new *Rhynchonella* (?), and an undetermined species of *Terebratula* (?) and *Strophomena* (?). Finally, the author noticed fourteen species (all new, except

Orchis pulvinata, Salt.) only known from these pebbles, but which were stated to possess a Devonian *facies*.—Mr. Etheridge agreed with Mr. Davidson as to his determination of the species. He had, however, examined the extensive collection of Mr. Vicary, and, from their general *facies*, he was inclined to assign them to the Middle Devonian and Carboniferous beds. The attribution of the fossils to Upper Llandovery beds was founded on the presence of *Lingula crumena*; but he thought he could give some clue to the locality from which the pebbles had been derived. It had first, from the lithological character of the pebbles, as well as from the fossils, been thought that they were of Lower Caradoc age. He himself assigned the position of the rocks from which the pebbles had been derived to the Hangman group of North Devon. At Anstis Cove, Mr. Tawney had found a series of the same class of fossils in a matrix exactly like that of the pebbles. He had examined the spot, and there recognised an extension of the sandstones of North Devon (the Hangman Grits) on the south coast, and certainly, so far as lithological character is concerned, the rocks are the same as the pebbles. It did not, however, follow that the pebbles came from that particular district, but probably from the denudation of the large tract of country of Devonian age to the north. There are, however, Silurian species in the pebbles, and these he would refer to the denudation of rocks in an area mainly to the south of what is now the Devon coast. The fauna at Budleigh Salterton is essentially British, and not French, though some few species are common to both areas. The bivalves, indeed, were hardly known in France. On the whole, he concluded that the fossils in the pebbles were Devonian, with a slight admixture of Silurian and probably Carboniferous forms, derived from rocks at no great distance from the spot where the pebbles are found.—Professor Ramsay pointed out that in conglomerates it might be expected to find pebbles of rocks of various ages. He commented on the difficulty palæontologists seemed to labour under in determining a fossil if it came out of a pebble instead of from a rock the position of which was definitely known. He adverted to the statement that the beds containing the pebbles had been deposited in the New Red Sandstone sea, whereas Mr. Godwin-Austen had regarded the New Red deposits as formed in large inland lakes; and the local character of the beds supported this latter view.—Mr. Prestwich was glad that some other source had been suggested for the quartzite pebbles. He had found somewhat similar quartzites between Lisieux and Cherbourg, in France.—The President observed that he would like to see the rise of a new race of palæontologists, relying simply on zoological characteristics, and not on geological position. A considerable simplification of our classification would probably result.—Mr. Etheridge briefly replied.

2. "On the relation of the Boulder-clay without Chalk of the North of England to the Great Chalky Boulder-clay of the South," by Searles V. Wood, jun., Esq., F.G.S. The author described the Yorkshire glacial clays as of two kinds—the lower, containing chalk debris, and belonging to the uppermost member of the glacial series in eastern and east-central England; the upper containing chalk sparingly in its lower part, and gradually losing this upwards. On the coast the latter occurs only north of Flambro'. He stated that, palæontologically, the lower and middle glacial deposits closely agree with the crag, and are quite distinct from the deposits at Bridlington, which he placed immediately above the "Great Chalky Clay." The absence of chalk debris in the deposit north of Flambro' has been regarded as evidence of a drift from north to south; but the author stated that the purple clay without chalk extends over much of the north-eastern part of the Wolds, from the sea-level to an elevation of 450 feet, and that outliers of it occur at intervals along the Holderness coast-section as far as Dimlington, forty-two miles south of the northern limit of the Wolds. In the direction of Flambro' and York the clay was said to be destitute of chalk, which would not be the case had the Wolds formed a sea-shore causing a drift from the north to pass either to south-east or south-west. The author described the characters of the great chalky boulder-clay in the eastern and central counties of England, and maintained that the chalk found in it (equal, according to him, to a layer of at least 200 feet over the entire Wold) could only have been detached by the agency of moving ice, which he believed to have covered nearly the whole Wold for a long period. The author stated that boulders of Shap Fell granite are confined to the deposit of clay without chalk; and discussed the means by which they could have been distributed. He ascribed their dispersion to the agency of floating ice during an adequate sub-

mergence of the district. He supposed them to have passed from Shap Fell by what is now the pass of Stainmoor. Thus he ascribed the formation of the "great chalky clay" to the extrusion from the sea-foot of a great sheet of ice, of materials abraded by the latter, the land being depressed 600 to 700 feet below its present level; and that of the clay without chalk and with boulders of Shap Fell granite to deposition during a period of much greater depression (about 1,500 feet), throughout which the sea bore much floating ice. He considered that the "great chalky clay" indicated a long period during which the land, with its enveloping ice, remained stationary, and that during this period, when intense cold prevailed, the arctic fauna of Bridlington became established. He thought that the recommencement of subsidence was indicated by the reddish-brown or brownish-purple sediments of Holderness, in which some chalk occurs. He then indicated the species of mollusca which have occurred in the purple clay without chalk about Scarbro' and Whitby, all of which were said to belong to existing forms, and thus be in accordance with the date assigned by him to that deposit. The molluscan fauna of Moël Tryfane was referred to by the author, who stated that he regarded it as belonging to the period of emergence from the deepest depression during which the clay without chalk was assumed to have been deposited, i.e., to the earliest part of the post-glacial period, to which the stratified drifts of Scotland are referred by Mr. A. Geikie. Mr. Gwyn Jeffreys had found the shells of Kelsea and elsewhere in Yorkshire to be mainly arctic; and Mr. Prestwich, in his paper on the boulder-clay near Hull, had first pointed out their glacial character. In the late dredgings in H.M.S. *Porcupine* several of the species before known as fossil at Bridlington, but not as existing in the British seas, had been discovered. In fact, he believed that the Bridlington species, with but few exceptions, had now been found in the British seas. Similar species had also been found in the boulder-clay in Scotland. Prof. Ramsay was pleased to find the author's views so closely correspond with his own published some years ago as to the glacial phenomena of North Wales, though based on another part of the country. He thought that shells might be found by careful search in the low-lying boulder-clay in other places than those enumerated, as they had been discovered in the western part of England. Mr. Prestwich, though inclined to accept the divisions of the boulder-clay in Yorkshire as suggested by the author, was not so clear as to his divisions in the south. He thought the presence of chalk in the clay might be traced to the contiguity of the outcrop of the chalk stratum. The shells being to a very great extent recent, the grouping might be due to accidental or local circumstances. The Chillesford clays, in his opinion, mark the commencement of the great glacial period. Mr. Etheridge suggested that *Nucula Cobboldia*, *Cardita similis*, and some other shells not found in the British seas, proved the arctic character of the Bridlington fauna. Sir Charles Lyell remarked that if the fauna of the lower and middle glacial really corresponded so closely with that of the crag, it afforded a strong argument against their being of the same age as the Bridlington beds. Perhaps, eventually, some palæontological connection might be traced throughout the series, and a chronological scale established. The President suggested a difficulty in the marine transport of ice from Shap Fell to Bridlington, not only from the wind blowing rarely in the necessary direction, but from the current caused by the great submerged ridge also tending to carry any bergs in another direction. He thought the transport by sheet-ice more probable. The Rev. J. L. Rome had traced the Shap granites over the valley of the Eden, across Stainmoor, to the Yorkshire side. There might have been difficulties in their transport, but there they are. Though they were found in Teesdale, yet the intervening ridge of millstone-grit, 2,000 feet, had prevented them finding their way into Swale Dale. Mr. Searles V. Wood, jun., stated that he had relied on Mr. Gwyn Jeffreys's works for his classification of the shells as being arctic or otherwise. He regarded the succession of the various members of the glacial series as well established, and as borne out also by the molluscan remains. He utterly repudiated the notion that the Chillesford, Bridlington, and Kelsea Hill beds were on the same horizon. He believed the whole of the Scotch beds to be newer than those of England. He quoted Professor Phillips as suggesting a change in the elevation around Shap Fell since the dispersion of the boulders, and offered as his own explanation of the hypothesis, that the passes by which the boulders travelled were those which, though at the higher levels, were the soonest freed from

ice. He thought that the direction of the current was influenced by other causes than the general trend of the rocky dividing ridge.

The following specimens were exhibited to the meeting:—Fossiliferous Pebbles from Budleigh Salterton, exhibited by Professor Tennant and R. Etheridge, Esq.

Zoological Society, December 9.—Dr. E. Hamilton, V.P., in the chair. The Secretary read a list of the more remarkable of the recent additions to the Society's menagerie, amongst which were particularly noticed two gibbons (*Hyllobates lar*), deposited by G. S. Roden, Esq. An extract was read from a letter addressed to the Secretary by Capt. G. E. Bulger, C.M.Z.S., correcting an error in a former paper by him on the birds observed at Wellington, in the Neigherry Hills, published in the Society's Proceedings. Professor W. H. Flower, F.R.S., gave some account of the external characters of the fin-whale, recently stranded in Langston Harbour, near Portsmouth, which he considered referable to the species usually called *Balanoptera musculus*. Mr. Flower concluded his remarks with a sketch of the species of the Balenoid, or whalebone-producing, whales, which occur in the British seas. These, according to our present knowledge of them, appear to be six in number, namely:—*Balæna biscayensis*, *Megaptera longimana*, and *Balanoptera musculus*, *Sibbaldii*, *laticeps*, and *rostrata*. A communication was read from Surgeon Francis Day, F.Z.S., on the fresh-water fishes of Burmah, being an account of the specimens of this class of animals obtained during a recent inspection of the fisheries of Pegu, and during a short visit paid to the capital of Upper Burmah. A second communication was read from Surgeon Francis Day containing the third part of his critical notes on the fishes of the Calcutta Museum. Mr. G. French Angas gave descriptions of twelve new species of land-shells belonging to different subdivisions of the family *Helicidae*, from the Western Pacific Islands. Mr. P. L. Sclater read a list of the birds that had bred in the Gardens of the Society during the past twenty years. The total number of species enumerated in this list was 108. Mr. R. B. Sharpe pointed out the characters of a new kingfisher belonging to the genus *Tanyptera*, which he proposed to call *T. Elliotti*. A communication was read from Mr. Harper Pease on the classification of the molluscs of the genus *Heliciter*. A paper was read by Messrs. P. L. Sclater and O. Salvin on birds collected by Mr. W. H. Hudson at Conchitas, near Buenos Ayres, being their third communication to the Society upon this subject. Mr. Sclater exhibited and pointed out the characters of two new species of birds of the sub-family *Synallaxis*, proposed to be called *Synallaxis curvata* and *Leptasthenura andicola*. A communication was read from Capt. G. E. Bulger, entitled Notes on Two Animals observed near Wind-Vogel-berg, South Africa. Mr. R. Swinhoe, F.Z.S., read a paper on the Cervine Animals of the Island of Hainan, Southern China, which he stated to be referable to three species, namely:—*Cervulus vaginalis*, *Cervus (Panolia) Eldi*, and a Rusine Deer allied to *Cervus hippelaphus*. A communication was read from Mr. W. T. Blanford on the species of *Hyrax* inhabiting Abyssinia and the neighbouring countries, which he believed to be four in number. Dr. J. E. Gray communicated the description of a new species of *Emys*, living in the Society's Gardens, which he proposed to call *E. flavipes*, from an unknown locality.

Mathematical Society, December 9.—Professor Cayley, president, in the chair. Professor H. J. S. Smith communicated a note on the Focal Properties of two Correlative Figures. This paper was an appendix to a former paper by the same author, on the Focal Properties of Homographic Figures. By the term "focal properties" are intended those properties which arise from considering the imaginary circular points at an infinite distance in either figure, and the points corresponding to them in the other figure. These properties appear to be much less varied in their character in the case of two correlative figures than in the case of two homographic figures; and the two following theorems (of which the first is well known) will suffice to give an idea of the general nature of the results:—1. In two correlative figures in space there are always two corresponding tetrahedra, such that three adjacent edges of each are rectangular; the three edges opposite to these being at an infinite distance, and the edges at a finite distance in either figure corresponding to the edges at an infinite distance in the other. 2. If we consider any point in either figure, and its correlative plane in the other, we have two definite planes passing through the point, and two corresponding points upon the plane, which may be called respectively the cyclic planes of the point

and the foci of the plane. If we take any third point in the plane, the angles which its focal radii vectoroes make with the line joining the foci are equal to the angles which the traces of the corresponding planes upon the cyclic planes make with the line of intersection of those two planes. These theorems suppose only that in the two correlative figures the plane at an infinite distance in either figure answers to a point at a finite distance in the other. Mr. Tucker (Hon. Sec.) read a proof (by Mr. M. W. Crofton, F. R. S.) of Gauss' Theorems and Napier's Analogies. The proof, a purely geometrical one, was extremely neat and simple. The perpendicular bisector of the base is produced to meet the external bisector of the vertical angle, and from the point of intersection (P) arcs are drawn perpendicular to the sides containing the said vertical angle. This point (P) is also connected by arcs with the extremities of the base; and the results readily follow from the equality of certain triangles.—Mr. S. Roberts, M. A., gave an account of a short paper On the Order of the Discriminant of a Ternary Form. The main theorems, the author states, have been geometrically obtained by, and are due to, Professor Cremona (Mr. Roberts' paper contains an analytical proof of them), and relate to the influence of common multiple points on the number of double points of a pencil or involution of curves. The method employed was applied to the determination of the discriminant of a ternary form when certain of the terms are wanting, viz. the form $(x, y)^2 P(x, z)^2$. The communication also had reference to a paper on Discriminants, by Dr. Henrici, published in the Society's Proceedings, in which the result had been arrived at *indirectly*, and Mr. Roberts' aim was to clear up an apparent discrepancy in the results obtained by Professor Cremona and Dr. Henrici. The latter gentleman joined in a discussion on the subject.—The President gave an account of his investigations on the cen-ro-surface of an ellipsoid (locus of the centres of curvature of the ellipsoid). The surface has been studied by Dr. Salmon, and also by Professor Clebsch, but in particular the theory of the nodal curve on the surface admits of further development. The principal sections of the surface (as is known) consist each of them of an ellipse counting three times, and of an evolute of an ellipse: the evolute and ellipse have four contacts (twofold intersections) and four simple intersections, but the contacts and intersections respectively are in the different sections real or imaginary. The form of the principal sections then is: a real contact at P in the plane of xz , and a real intersection at Q in the plane of xy ; and thus there are an exterior and an interior sheet, but (instead of meeting in a conical point, as in the wave surface) these intersect in a nodal curve QP. The curve has a cusp at Q, and a node at P, thus extending beyond P, but from that point is acnodal, or without any real branch of the surface passing through it. Several simple relations were established, but the reductions were of some complexity.

Syro-Egyptian Society, December 7th.—W. H. Black, Esq. in the chair. Mr. Bonomi read a paper on the defacement of the name and figure of the god Amon on all Egyptian temples, obelisks, and statues, during the reign of the successor of Ammoph III., and the subsequent restoration of both during the reign of Rameses II. Mr. Bonomi conjectures that the amount of skilled labour and expenses of scaffolding necessary to effect these changes prove that they were considered of great importance in a religious point of view; and he stated that there was scarcely a public or private collection of Egyptian antiquities in Europe that could not furnish examples of it. The beautiful drawings and photographs exhibited by Mr. Bonomi, to illustrate the subject, enhanced the interest of his able paper.

Institution of Civil Engineers, December 14.—Mr. Chas. Hutton Gregory, president, in the chair. The paper on Ocean Steam Navigation, with a view to its future development, by Mr. John Grantham, M. Inst. C.E., partly read at the meeting on the 7th inst., was concluded; and a brief abstract of the whole is now given. The author contended that steam-ships could be employed more extensively on routes partially occupied by them, and on others where regular steam-lines had not yet been established. Rapid and regular voyages both for passengers and goods were now fully appreciated, while the greatly-increasing intercourse of all nations furnished freights which would support lines of expensive steam-vessels. He traced the rise of ocean steam navigation, and showed that the route from Liverpool to New York was the principal field on which it was first fully developed. He described the efforts made by the Americans to maintain by steam the prestige so long secured by their sailing

ships; gave the reason for the great change that had taken place; and stated that not one American steamer was now running between Europe and America. Some of the causes of this were to be found in the fact, that iron ships, worked by the screw propeller, could alone be employed successfully, and that such ships in America were too expensive, both in their construction and in their working, to enable them to compete with English vessels. The form of, and various improvements in, the boilers and the engines were described, showing that a much higher pressure of steam was now employed, that the expansive system and surface condensation were at present considered essential to success in economising fuel, and that the amount of coals consumed had in the best vessels been reduced to 2½lb. per indicated horse-power per hour, but it was anticipated that a reduction to 2lb. might soon be attained. A map on Mercator's projection was exhibited, indicating the principal ocean routes in connection with the trades between Great Britain and the rest of the world; and the improved system by great circle sailing, as recommended by Mr. Towson, of Liverpool, was described. A table was also exhibited of the relative distances between London and Liverpool, and the various ports shown on the map, both by long sea, and by the Suez Canal and the Pacific Railroad; from which it appeared that, as regarded the Northern Hemisphere, a great saving of distance and time would be effected. The number of ocean steam-ships now working in connection with this country was stated to be 364. The performances of the best ships of various companies were then alluded to, and the result showed that on the North American lines the highest average rate of speed was maintained, but by a large expenditure of fuel; that the Pacific and Colonial Companies' ships gave excellent results, as regarded economy of fuel; and that some new vessels, lately built for the Royal West India Mail Company, seemed to promise the best performances with respect to speed and economy combined. A table taken from the Board of Trade Returns for 1868 showed that, with North America, the tonnage of steam-ships nearly equalled that of sailing ships; but in the Mediterranean trade steam-ships largely exceeded sailing ships. On the other hand, in the regular trades with India, China, and Australia, steam tonnage, by long sea, comprised only about 1 per cent. of the whole. A calculation was then made to show what might be expected if the trade with the East was in future carried through the Suez Canal, and of the number of large steam-fleets which would be required to work it. Some facts were also recorded relative to the effect of the Pacific Railroad, and the probability of letters and passengers from China, Japan, and Western Australia going by that route. It was shown that several days' saving in time would be effected. The author considered that the voyage to Melbourne could be best performed by long sea, as there would be no saving either in distance or in time by way of Suez. The paper held out great prospects of advantage to England and to British ship-builders, from the immense changes that were apparently about to take place.

Anthropological Society, December 14.—Dr. Charnock, V.P., in the chair. Mr. Wake read a paper on the Race Affinities of the Madecasses. The agreement of the *Hovas* with the other inhabitants of Madagascar in language and customs forbids us to refer the former to a Malayan origin. Moreover, the division into dark and light tribes is found in the Malayan Archipelago, and also in South Africa. Comparison of physical and mental characters, and of customs and superstitions, shows that the dark Madecasses, the Kafirs, and the Papuans, all belong to the same race. By a similar comparison, an analogous affinity between the *Hovas*, the Hottentots, and the Malays (as representative of whom the paper took the Siamese), can be established. The South African relationship of the Madecasses is supported by the verbal and grammatical affinity of the Malagasy to the Kafir and Hottentot dialects, which are shown to be related between themselves, and also to the Polynesian dialects. The arrangement of peoples on the African area is opposed to the idea of a continental origin of the Madecasses, while their numerous African affinities prevent their being traced to a Malayan source. The Madecasses are more really *autochthonous* than any other race except the aborigines of Australia, and probably Madagascar was connected with both the African Continent and the Malay Archipelago when it was first inhabited by man. The inhabitants of Madagascar possess the domestic ox, sheep, and fowl, and are skilled in the smelting and working of iron. This island was probably (according to the author) the seat of man's primitive civilisation.

DUBLIN

Royal Irish Academy, December 13.—The Rev. Professor Jellett, president, in the chair. Professor Sullivan, Ph.D., read a paper on the Beds of Thenardite of the Valley of Jarama, in connection with climatal effects supposed to be due to the variation of the eccentricity of the earth's orbit, according to the calculations of Messrs. Croll and Moore. The author remarked that M. Adhémar endeavoured to account for change of climate in geological time by the precession of the equinoxes, and the change of position of perihelion. These effects are modified by another astronomical movement—the change in the eccentricity of the earth's orbit. At the instance of Sir C. Lyell, Mr. Stone made some calculations to determine the eccentricity of the orbit in former periods, which Mr. Croll, by the aid of Leverrier's formula, has completed for one million years before 1800 in parts of a unit equal to the mean distance of the earth from the sun. These calculations are given by Sir C. Lyell in the last edition of his "Geology," with the addition of some calculations made by Mr. John Carrick Moore, of the mean temperature of the hottest and coldest months in the latitude of London, supposing other causes which may influence the distribution of heat to remain the same as at present. According to these tables, several periods of extreme temperature should have occurred within the million of years. The most marked of them should occur at 200,000, 210,000, and 750,000 years before 1800, when the mean temperature of the hottest month should be 113° Fahr., and of the coldest 1°·9, 0°·7, and 0°·6 respectively. Professor Tyndall has well pointed out that glaciers require heat as well as cold to produce them, so that extreme temperatures appear to represent the conditions required. These views appear to receive an unexpected support from a phenomenon which, being purely physical, gives more definite results than can in general be obtained from biological ones. In the Valley of the Jarama, a branch of the Tagus which receives the waters of the Manzanares, which flows through Madrid, occurs a series of beds,—thenardite, glauberite, gypsum, and clay,—having a variable thickness of from 16 to 19 metres. Through this the alluvial plain of the river has been cut. The formation of anhydrous sulphate of soda requires that the solution from which the salt separates should be above 35° Cent. or 95° Fahr. This is a temperature which even a shallow lake could only attain if the temperature of the air were considerably above that point. On the other hand, the conditions under which the sulphate of soda could be formed in the first instance requires a low temperature. So that, like glaciers, these beds require great heat and cold, the limits of which are, however, fixed in this case. If the temperature of the hottest month in the latitude of London were 113°, it would be still higher on the plain of Madrid, where even 120° Fahr. in the shade is sometimes even now attained in the locality of these beds. The circumstance which should exist at either of the glacial periods indicated by Mr. Croll's and Mr. Carrick Moore's calculations, would be sufficient to account for those beds; it would be difficult to account for them on the supposition of a period of intense cold. These beds were fully described in a paper by Professors Sullivan and O'Reilly, published in 1863 in Vol. iv. of the *Atlantis*, and afterwards in "Notes on the Geology and Mineralogy of the Spanish Provinces of Santander and Madrid." (London: Williams and Norgate. 1863.) Professors Apjohn and Hennessy took part in the discussion of the paper. J. R. Garstin, A.M., was elected a member of council in the room of Professor Jellett.

PARIS

Academy of Sciences, December 13.—M. H. Sainte-Claire Deville brought under the notice of the Academy a siderostat constructed by the late M. Léon Foucault, and communicated a note upon it by M. C. Wolf. Its action depends upon the production of a perfectly plane mirror, the mode of obtaining which was described in a posthumous paper by M. Léon Foucault, read to the Academy at a recent meeting (see NATURE, p. 177), and its object is to furnish the observer with a perfectly reflected image of any sidereal body for examination by the telescope. A figure of the instrument, which is provided with a clockwork movement, is given in illustration of M. Wolf's note.—M. Laugier remarked upon the employment of the plane mirror, and noticed that Arago had called attention twenty years ago to the advantages which might be derived from it. M. P. A. Favre presented some remarks upon the electric explorer described by M. Trouvé (see NATURE, p. 177), for the detection of metallic substances in wounds, and claimed for himself the

invention, in 1862, of an electrical sound for the same purpose.—Marshal Vaillant announced that M. Pasteur was engaged at Trieste in completing a work upon sericulture, and in organising a silk-worm cultivation on a large scale, to be carried on in accordance with his system.—M. Haton de la Goupillière presented a memoir on the system of metallic floodgates which require the minimum of attraction.—A memoir on the dispersion of light, by M. M. Ricour, was communicated by M. Combes. General Morin presented a note by M. H. Morton, on the origin of the luminous band which is observed in contact with the margin of the moon's disc in the photographic pictures of various eclipses. In preparing negative photographs of eclipses, a slight band surrounds the border of the moon's shadow, in which the deposit of silver is more dense than elsewhere, producing a light band in that positive. The author has produced a similar effect by substituting a disc of dark paper for the moon's shadow, and he comes to the conclusion that the phenomenon is simply chemical, and due to the extension, during the development of the plate, of the nitrate of silver from the part protected by the shadow; to a short distance beyond the latter.—A note by M. Hugo Schiff, on the constitution of amygdaline and phloridzine, was communicated by M. Wurtz. The author describes and formulates these substances and their derivatives.—M. E. J. Mau-mené communicated another memoir on inverted sugar, in reply to M. Dubrunfant, in which he states that none of the latter's assertions are in accordance with experiment. He says that inverted sugar, properly prepared, is a mixture of three optically neutral bodies, which are neither glucose, nor levulose, nor any of the sugars possessing a rotatory power. The fermentation of inverted sugar is accompanied by no elective phenomena.—M. Dubrunfant presented a communication on spectrum analysis applied to the investigation of simple gases, and of their mixtures, in which he described the phenomena presented by various gases and gaseous mixtures under different conditions of pressure, and indicated that the supposed multiple spectra of certain gases are probably due to admixture. Thus it appears to be impossible to obtain hydrogen free from nitrogen, and under a low pressure the spectrum of the latter alone appears.—M. Jos. Boussingault communicated an analysis of the "morallon" emeralds from the mines of Muso, in New Granada.—A memoir was presented by M. Martin de Brettes on the determination of one or more of the following quantities, the others being given: The diameter of an oblong projectile, its weight, its initial velocity, the curve of its trajectory, and the weight of the gun from which it is fired. He gives the formulæ for working out these questions, and indicates their applications to artillery and small arms.—Of two zoological papers, one, by M. Lacaze Duthiers, calls the attention of naturalists to the Harbour of Roscoff, on the north coast of France, as a locality where the so-called *Pentacrinus europæus*, the young form of *Antedon rosaceus*, is to be found in abundance. From his description, the Bay of Roscoff is a paradise for the student of marine zoology.—The second memoir, by M. F. Lenormant, discusses the question of the antiquity of the ass and the horse as domestic animals in Syria and Egypt; and the author states, in opposition to Professor Owen, that the ass is represented very frequently upon the earliest known monuments. The horse, on the contrary, remained unknown in the countries south-west of the Euphrates until the time of the shepherd kings, or about the nineteenth century B.C. M. Milne-Edwards remarked upon this communication that it agreed with the conclusions of zoologists as to the distribution of the species of the genus *Equus*; the ass is to be regarded as an essentially African species, whilst the horse is a native of central Asia and part of Europe. He added that if the shepherd peoples introduced the horse into Egypt, this might throw some light upon their origin. M. Elie de Beaumont remarked that these facts were favourable to the opinion that the existing state of things on the surface of the globe was not of very ancient date.—M. J. Rebox communicated the results of some Prehistoric Archaeological researches upon the quaternary beds of Paris, in which he indicated the character of numerous worked flints obtained by him from these beds (from a depth of twelve metres upwards), and gave a long list of animals, the remains of which were found intermixed with the flints.—M. Guérin-Méneville remarked upon the conditions of production of truffles.—A note was presented from M. Namias, describing his employment of hydrate of chloral with beneficial effects at the Hospital of Venice; and another from M. Thuau on a process for the instantaneous lighting and extinction of gas-lamps by means of electricity.

BRUSSELS

Royal Academy of Sciences, November 6.—Various meteorological reports were presented to the Academy, namely: On the Aurora Borealis of the 6th of October, 1869, by MM. A. Quételet and F. Terby; and on storms observed in various parts of Belgium, by MM. A. Quételet, Brauch, Malaise, Dewalque, and Leclercq, the last giving an account of the storm phenomena of the neighbourhood of Liège for the year 1869.—M. C. Montigny communicated a note on the phenomena of coloration of the edges of the sun's disc when near the horizon, in which he referred especially to the appearance of rose-coloured undulations upon the blue arch of the upper margin of the sun, remarked upon certain facts which seem to indicate that these are not produced by atmospheric dispersion or interference, and suggested that they may be due to the protuberances of the chromosphere.—M. E. Morren presented a paper on the contagion of the variegation of plants by means of grafting, both from the stock to the graft, and from the graft to the stock. His observations relate to *Abutilon Thompsoni*, and other species of the same genus.—A note on the wax of straw, by Dr. B. Radziszewski, was communicated by M. L. Henry. This substance, which is analogous to the wax obtained from the sugarcane, was first observed in a paper-factory at Willebroeck; it is solid, white, insoluble in water, soluble in alcohol and ether, and crystallises from its alcoholic solution in small nacreous scales.—An important memoir, by M. E. Van Beneden, on a new and very large species of *Gregarina* was read; to this we shall revert elsewhere.

BERLIN

German Chemical Society, December 11.—On this date there was a general meeting for the purpose of electing its officers for the year 1870. The following gentlemen were elected:—President: Professor Rammelsberg, with 34 votes against 25 given to Professor Baeyer. Vice-presidents: Professors Baeyer, Hoffmann, Magnus, and Rose. Secretaries and Vice-Secretaries: Dr. Eichermann, Dr. Martius, Dr. Oppenheim, and Dr. Wichelhaus. Treasurer: Mr. Scherinn. Librarian: Dr. Scheibler. Resident Committee: Professor Finkener, Dr. Jacobser, Dr. Kunheim, Dr. Schultzen, and Dr. Vogel. Non-resident Committee: Professors Illasiwetz of Vienna, Hoppe-Scyler of Tuebingen, Kékulé of Bonn, Wislicenus in Zurich, and Wagner in Wurtzburg. Obituary notices of the late honorary member, Professor Graham, and the late member Mr. Beyrick in Berlin, were then read by the President.

December 13.—The following papers were read:—Riebermann and Gräbe on Anturacene-monocarbonic Acid. Baeyer and Emmerling: Synthesis of Indole. Ascher: The Transformation of Angelic into Valerianic Acid. Hofmann and Gentz on Brominated Derivatives of Xylidine and on Dixylyle-guanidine or Meloxylidine. Hofmann on an Isomeric diphenylated Guanidine; and on Sulphocyanate of Xylyle. Hobbreller on the Action of Sulphuret of Carbon on Sulphuretted Urea. Naumann: The Law of Avogadro considered as a consequence of the laws by which the movement of gases are regulated. Bel-Trederi on a Third Monochlorinated Phenolo-sulphurous Acid. Cossa on the Constitution of Native Carbonates. Thomsen on the Inaccuracy caused by the use of Favre and Silbermann's Mercury-calorimeter. Rathke on Molecular Combinations. Ladenburg on the Molecular Weight of certain Protoxides and Protochlorides. Fleury on the Action of Pentachloride of Phosphorus on Phenolic Ethers.

VIENNA

Imperial Academy of Sciences, December 2.—Professor Zepharovich presented a fourth instalment of his mineralogical communications, in which he referred to crystals of ullmanite and pyrite, and to the fine twin-crystals of sphene which were found in 1863 on the Rothenkopf. A telegram was communicated from M. Tempel announcing the discovery of a comet at Marseilles on the 27th November. This comet was, in consequence, observed at Vienna by Professor Weiss on the 29th November, and subsequently by Dr. Theodor Oppolzer, who communicated the elements of its orbit and its ephemeris up to the 6th January, 1870, deduced from the observations at Marseilles, Vienna, Leipzig, and Carlsruhe. A memoir entitled "Development of the tetrasymmetrical division of the hexagonal crystal-system, with remarks upon the occurrence of circular polarisation," by M. Aristides Brezina, was communicated by Professor Lang.—Professor von Hochstetter communicated a third paper on the earthquake-wave in the Pacific Ocean, in August 1868, con-

taining observations made in Australia.—M. Schrauf presented the first part of his investigations of Labradorite, containing a description of the mineral and a microscopical examination of its enclosures, and an account of the phenomenon of avanturinisation as presented by it.

DUBLIN

Royal Dublin Society, December 20.—G. J. Stoney, A.M., F.R.S., in the chair. Mr. John Adair read a paper on the Acclimatisation of Plants as a help to the advance of civilisation. The author treated this interesting subject from a practical point of view, leaning rather to the possibility of plants being acclimatised—at least sufficiently so to bear the ordinary winter climate of this country. Dr. Moore, Professor E. Perceval Wright, and others, took part in the discussion of the paper. Mr. A. G. More exhibited from the museum of the society three fine specimens, probably the only three known, of the Blue Mountain Duck of Jamaica (*Pterodroma Caribbaea* Carte) also a large specimen of the Grey Seal (*Halichærus griseus* Nils), which he had shot during the last summer on the coast of Galway. Dr. Emerson Reynolds exhibited a collection of flint arrowheads found in Ireland, and a photograph of a portion of the Giant's Causeway. He mentioned having obtained for the museum a series of the Causeway basaltic columns, consisting of a central column and six encircling ones.

[This abstract reached us too late to be inserted in its proper place.—Ed.]

DIARY

THURSDAY, DECEMBER 23.

SOCIETY OF ANTIQUARIES, at 8.30.—Confessionals in the Middle Ages: Abbé Cochet.

THURSDAY, DECEMBER 30.

ROYAL INSTITUTION, at 3—Light: Prof. Tyndall, F.R.S. (Juvenile Lectures.)

BOOKS RECEIVED

ENGLISH.—Catechism of the Decimal, Albert, and Metric Systems: A.W. Bonn (published by the author).—Madam How and Lady Why: Rev. C. Kingsley (Bell and Daldy).—Reptiles and Birds: L. Figuier, edited and adapted by Parker Gillmore (Chapman and Hall).—The Sun: Amédée Guillemin, translated from the French by Dr. Phipson (Bentley).—The Snakes of Australia: Gerard Krefft (Sydney: T. Richards).—Meteorological and Magnetical Observations made at Flagstaff Observatory, Melbourne; Geo. Neumayer. (Through Trübner & Co.)

AMERICAN.—The Trapper's Guide: S. Newhouse.—The New West: Charles Loring Brace.—Agricultural, Qualitative, and Quantitative Analysis: G. C. Caldwell.—Sorghum and its Products: F. L. Stewart.—Elements of Astronomy: C. J. White.—Annual of Scientific Discovery: Dr. J. Knueland.—The Mines of the West: Rossiter W. Raymond.—Report on the Machinery and Processes of the Industrial Arts, &c., at the Paris Exposition of 1867: F. A. B. Barnard.—The Myths of the New World: Dr. Daniel G. Brinton. (Through Trübner and Co.)—An Abstract of Measurements and Examinations of the Solar Eclipse of August 7, 1869. Lecture Notes on Physics. The Total Eclipse of August 7, 1869: all by Prof. Alfred M. Mayer, Ph.D. (From the author.)

FOREIGN.—De la Fécondation Artificielle: Jules Gautar (published by the author).—De l'Abus des Boissons Alcooliques: L. F. E. Bergent.—Die Spectralanalyse: Dr. H. Schellen.—Rapport sur le Progrès de la Chimie Organique pure: L. Micé.—Dictionnaire Botanique: E. G. de St. Pierre.—Die Physiologie: Dr. J. W. Czermak.—Stellung des Menschen: Ludwig Büchner. (Through Williams and Norgate.)

CONTENTS

	PAGE
TOWN SEWAGE. By Dr. BENJAMIN H. PAUL, F.C.S.	207
SCIENCE FOR CHILDREN. By CHARLES W. QUIN, F.C.S.	209
THE GOLD FIELDS OF VICTORIA. I. By A. GEIKIE, F.R.S.	210
OUR BOOK SHELF	212
SENSATION AND PERCEPTION. I. By Prof. H. C. BASTIAN, F.R.S.	213
MISTLETOE	214
THE MIDNIGHT SKY. (With Illustrations.)	215
LETTERS TO THE EDITOR:—	
Variety and Species.—F.	218
Cuckow's Eggs.—H. E. DRESSER.	218
Physical Meteorology.—Dr. HUDSON.	218
A Cyclone in England.—F.R.A.S.	219
Lectures to Ladies.—M. T. G.	219
NOTES	219
SCIENTIFIC SERIALS	221
ASTRONOMY	221
SOCIETIES AND ACADEMIES	221
DIARY. BOOKS RECEIVED	226