SCIENTIFIC SERIALS

POLLI'S *Annali di Chimica applicati alla Medicina* (No. 1, 1870) has a long preface relating to *miasma palustre* and the use of febrifuges; these topics being discussed in view of the competition for which the Royal Institute of Lombardy has offered a prize in 1872. The competition is restricted to a discussion of the use of sulphites and hyposulphites in intermittent fevers. The editor adds to his preface a list of thirty-seven memoirs which have been published on these subjects between 1863 and 1869. Carlo Pavesi contributes a note on a speedy method of preparing mercurial ointment, in which the use of oil of turpentine as an ingredient is specially recommended. Belardi draws attention to the fact that pharmaceutical preparations of bismuth are liable to contain antimony. Pagano gives an illustration of the therapeutic value of magnesic sulphite; and Moretti records some clinical observations on the use of the same salt as well as sodic sulphite.

THE *Moniteur Scientifique* (January 15th) contains an unnecessarily tedious article on Sodic Bromide, by Casthélaz, which does not contain any original matter. M. E. Kopp contributes extracts from foreign journals (practical chemistry). M. J. Personne compares the process of Roussin for preparing hydrated chloral, which he condemns as imperfect, with that given in Dumas' *Traité de Chimie*, which he eulogises (it yields 185 per cent.) M. Jonglet reports ably on the progress of the sugar industry in France.

THE *Astronomische Nacrichten*, No. 1788, January 19, 1870, contains (1) Observations with the Reichenbach Circle at the Warsaw Observatory, by C. Deike, Second Assistant at the Observatory; (2) Observations of Comet III., 1869, by Argelander; (3) and (4) Elements and Ephemeris of the same Comet, by Bruhns and Von Littrow. Von Littrow states that the comet will hardly be visible after the end of January, as its brilliancy on 13th January only amounted to one-fifth the brilliancy at the time of its discovery. The fifth paper in the present number is by Peters, and gives Elements and Ephemeris of Felicitas (109) from January 30th to 22nd March. In the sixth and last paper Dr. Oppolzer communicates a definitive determination of the orbit of the planet (64) Angelina.

Annales de Chimie et de Physique, January.—M. Achille Cazin contributes a memoir on "internal work in gases." It contains a theoretical discussion and an experimental proof of such work, the latter being in principle a repetition of Joule's experiment, in which air is allowed to flow from a full into an exhausted receiver. M. Boussingault determines carbon in iron by mixing the filings with mercuric chloride and a little water, allowing the mixture to repose in contact with aqueous hydric chloride for about an hour, filtering and igniting the precipitate (carbon, mercurous chloride, &c.) in hydrogen. Successive ignitions in air and hydrogen then give the *combined* carbon; successive ignitions in oxygen and hydrogen next give the graphite. This number also contains an unfinished paper, by M. Vicaire, on the "temperature of flames and dissociation."

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 27.—The following papers were read: "Observations on the temperature of the strata taken during the sinking of the Rose Bridge Colliery, Wigan, Lancashire, 1868-69." By Edward Hull, M.A., F.R.S., Director of the Geological Survey of Ireland. The manager of the Rose Bridge Colliery, Mr. Bryham, sensible of the value of observations of the temperature of the strata in what is probably the deepest colliery in the world, certainly in Britain, made a series of observations with as much care as the circumstances of the sinking of the shaft would admit, and entrusted them to Mr. Hull for publication. The mode of taking the observations was as follows:—On a favourable stratum, such as shale, or even coal, having been reached, a hole was drilled with water in the solid strata to a depth of one yard from the bottom of the pit. A thermometer was then inserted for the space of thirty minutes, the hole having been sealed and made air-tight with clay. At the expiration of the half-hour the thermometer was taken up and the reading noted. While the temperatures of the strata were being measured, observations were carried on *pari passu* on those of the open pit during the descent. These are given in the Table annexed. By a comparison of the results in the two columns, it will be observed that, as the depth increased, the differences between the corresponding temperatures in the pit and the strata tended to augment; in other words, the temperature of the strata was found to augment more rapidly than that of the open pit. The effects of the high temperature and pressure on the strata at the depth of 2,425 feet are making themselves felt, and cause an increase in the expense both of labour and timber for props. This colliery, in fact, will be in a position to put to the test our views and speculations on the effects of high temperature and pressure on mining operations. In order to obtain the average rate of increase of heat, as shown by the experiments at Rose Bridge Colliery, we may assume (in the absence of direct observation) the position and temperature of the *invariable stratum* to be 50 feet from the surface and 50° F., which is probably nearly the mean temperature of the place. With these data, the increase is 1° F. for every 54·57 feet, which approximates to that obtained by Professor Phillips at Monkwearmouth of 1° F. for about every 60 feet. If, on the other hand, for the purpose of comparison, the measurements for the *invariable stratum* as obtained at Dukenfield be adopted, the rate of increase is found to be 1° F. for every 47·2 feet as against 1° F. for every 83·2 feet in the case of Dukenfield itself. So great a discordance in the results is remarkable, and is not, in the opinion of the author, attributable to inaccuracy of observation in making the experiments. On the other hand, he suggests that it is due, at least in some measure, to dissimilarity in the position and inclination of the strata in each case.

THERMOMETRICAL OBSERVATIONS AT ROSE BRIDGE COLLIERY.

Date.	Depth, in yards.	Strata.	Temperature in open pit.	Temperature in solid strata.
			F. °	F. °
July 1854	161	Blue shale	...	64·5
August 1854	188	Warrant earth	...	66
May 1858	550	Blue shale	...	78
July 1858	600	Warrant earth	...	80
May 18, 1868	630	"Raven" coal	73	83
July 24, 1868	665	Linn and wool	75	85
April 29, 1869	673	"Yard Coal" mine	76	86
November 18, 1868	700	Strong Blue Metal	76	87
February 22, 1869	736	Do.	76	88½
March 12, 1869	748	Shale	77	89
April 17, 1869	762	Linn and wool, or strong shale	78	90·5
May 3, 1869	774	Strong shale	80	91·5
May 19, 1869	782	Blue metal	79	92
July 8, 1869	801	Strong blue shale	79	93
July 16, 1869	808	Coal (Arley mine)	79	93½

Remarks.—All holes vertical in solid at bottom of pit drilled with water one yard deep, and thermometer remained thirty minutes in hole made air-tight with clay.

"On the Theory of Continuous Beams." By John Mortimer Heppel, Mem. Inst. C.E. Communicated by W. J. Macquorn Rankine, F.R.S. The chief object of this communication was to remedy some acknowledged defects in the theory of the above-mentioned subject. The principal steps by which it has reached its present state of development were also noticed, and may be briefly recapitulated as follows:—The great defect in the theory up to the present time has been that, in order to avoid an inextricable complexity, it has been necessary to consider the load in each span as uniformly distributed over it, and the moment of inertia of the section as uniform throughout each span. The method now given treats these conditions rigorously; and although the equations obtained are such as necessarily require some laborious computation to obtain numerical results, they are by no means inextricable.

"Remarks on Mr. Heppel's Theory of Continuous Beams." By W. J. Macquorn Rankine, C.E., LL.D., F.R.S. The author states that the advantages possessed by Mr. Heppel's method will probably cause it to be used both in practice and in scientific study. With a view to the instruction of students in engineering science, he proposes an abridged way of stating the theoretical principles of Mr. Heppel's method, considering at the same time that Mr. Heppel's more detailed investigation forms the best model for numerical calculation. He then uses Mr. Heppel's improved form of the "Theorem of the Three Moments" to test the accuracy of the formulæ which he obtained in another way, and published in "A Manual of Civil Engineering," for the case of an uniform continuous beam with an indefinite number of equal spans, the successive spans being loaded alternately with an uniform fixed load only, and with an uniform

travelling load in addition to the fixed load; and he finds the results of the two methods to agree in every respect.

"Remarks on the recent eclipse of the sun as observed in the United States," by J. N. Lockyer, F.R.S.

By the kindness of Professors Winlock, Morton, and Newton, I have been favoured with photographs, and as yet unpublished accounts, of the results of the recent total eclipse of the sun observed in America. I am anxious, therefore, to take the opportunity afforded by the subject being under discussion, to lay a few remarks thus early before the Royal Society.

The points which I hoped might be more especially elucidated by this eclipse were as follows:—

1. Is it possible to differentiate between the chromosphere and the corona?

2. What is the real photographic evidence of the structure of the base of the chromosphere in reference to Mr. W. De la Rue's enlarged photographs of the eclipse of 1860?

3. What is the amount of the obliterating effect of the illumination of our atmosphere on the spectrum of the chromosphere?

4. Is there any cooler hydrogen above the prominences?

5. Can the spectroscope settle the nature of the corona during eclipses?

With regard to 1, the evidence is conclusive. The chromosphere, including a "radiance," as it has been termed by Dr. Gould (the edge of the radiance as photographed being strangely like the edge of the chromosphere in places viewed with the open slit), is not to be confounded with the corona.

On this subject, in a letter to Professor Morton, Dr. B. A. Gould writes:—"An examination of the beautiful photographs made at Burlington and Ottumwa by the sections of your party in charge of Professors Mayer and Haines, and a comparison of them with my sketches of the corona, have led me to the conviction that the radiance around the moon in the pictures made during totality is not the corona at all, but is actually the image of what Lockyer has called the chromosphere.

"This interesting fact is indicated by many different considerations. The directions of maximum radiance do not coincide with those of the great beams of the corona; they remain constant, while the latter were variable. There is a diameter approximately corresponding to the solar axis, near the extremities of which the radiance upon the photographs is a minimum, whereas the coronal beams in these directions were especially marked during a great part of the total obscuration. The coronal beams stood in no apparent relation to the protuberances, whereas the aureole seen upon the photographs is most marked in their immediate vicinity; indeed the great protuberance, at 230° to 245°, seems to have formed a southern limit to the radiance on the western side, while a sharp northern limit is seen on all the photographs at about 350°, the intermediate are being thickly studded with protuberances which the moon displayed at the close of totality. The exquisite masses of flocculent light on the following limb are upon the two sides of that curious prominence at 93°, which at first resembled an ear of corn, as you have said, but which, in the later pictures, after it had been more occulted, and its southern branch thus rendered more conspicuous, was like a pair of antelope's horns, to which some observers compare it. Whatever of this aureole is shown upon the photographs was occulted or displayed by the lunar motion, precisely as the protuberances were. The variations in the form of the corona, on the other hand, did not seem to be dependent in any degree upon the moon's motion. The singular and elegant structural indication in the special aggregations of light on the eastern side may be of high value in guiding to a further knowledge of the chromosphere. They are manifest in all the photographs by your parties which I have seen, but are especially marked in those of shortest exposure, such as the first one at Ottumwa. In some of the later views they may be detected on the other side of the sun, though less distinct; but the very irregular and jagged outline of the chromosphere, as described by Janssen and Lockyer, is exhibited in perfection."

2. The second point is also referred to in the same letter. I think the American photographs afford evidence that certain appearances in parts of Mr. De la Rue's photographs, which represent the chromosphere as billowy on its under side, are really due to some action either of the moon's surface or of a possible rare lunar atmosphere, so that it is not desirable to confound these effects with others that might be due to a possible suspension of the chromosphere in transparent atmosphere, if only a *section* of the chromosphere were photographed.

Dr. Gould writes:—"You will observe that some of the brighter, petal-like flocculi of light have produced apparent indentations in the moon's limb at their base, like those at the bases of the protuberances. These indentations are evidently due to specular reflection from the moon's surface, as I stated to the American Association at Salem last month. Had any doubt existed in my mind previously, it would have been removed by an inspection of the photographs."

Where the chromosphere is so uniformly bright that the actinic effect on the plate is pretty nearly equal, the base of the chromosphere is absolutely continuous in the American photographs; but in the case of some of the larger prominences, notably those at + 146 (Young) and − 130 (Young), there are strong apparent indents on the moon's limb.

3. I next come to the obliterating effect of the illumination of our atmosphere on the spectrum of the chromosphere.

This is considerable; in fact, the evidences of it are very much stronger than one could have wished, but hardly more decided than I had anticipated. Professor Winlock's evidence on this point, in a letter to myself, is as follows:—"I examined the principal protuberances before, during, and after totality. I saw three lines (C, near D and F) before and after totality, and eleven during totality; *eight were instantly extinguished on the first appearance of sunlight.*"

This effect was observed with two flint prisms and seven inches aperture. Professor Young, with five prisms of 45° and four inches aperture, found the same result in the part of the spectrum he was examining at the end of the totality.

He writes:—"I had just completed the measurements of 2,602, when the totality ended. *This line disappeared instantly*, but 2,796 [the hydrogen line near G] was nearly a minute in resuming its usual faintness."

These observations I consider among the most important ones made during the eclipse; for they show most unmistakably that, as I have already reported to the secretary of the Government-Grant Committee, the new method to be employed under the best conditions must be used with large apertures and large dispersion.

On the 4th point the evidence is negative only, and therefore in favour of the view I have some time ago communicated to the Royal Society.

5. We next come to the question of the corona, a question which has been made more difficult than ever, in appearance only, I think, by the American observations.

I propose to discuss only the spectroscopic observations of Professors Young and Pickering in connection with Dr. Gould's before-quoted remarks.

[After this discussion, for which we have not space, the author continues:—]

I have first to do with the continuous spectrum, deduced from Professor Pickering's observations.

I think in such a method of observation, even if the corona were terrestrial and gave a dark line spectrum, the lines visible with such a dim light would in great part be obliterated by the corresponding bright lines given out by the long arc of chromosphere visible, to say nothing of the prominences, in which it would be strange if C, D, E, *b*, F, and many other lines were not reversed. This suggestion, I think, is strengthened by the statement that two bright lines were seen "near C" and "near E;" should we not rather read (for the "near" shows that we are only dealing with approximations) C and F, which is exactly what we might expect?

But even this is not all that may be hazarded on the subject of the continuous spectrum, which was also seen by Prof. Young under different conditions.

Assuming the corona to be an atmospheric effect merely, as I have before asserted it to be, in part at least, it seems to me that its spectrum should be continuous, or nearly so; for is it not as much due to the light of the prominences as to the light of the photosphere, which it may be said roughly are complementary to each other?

With regard to the aurora theory, I gather from Prof. Young's note that, if not already withdrawn, he is anxious to wait till the next eclipse for further facts. I consider the fact that I often see the line at 1,474, and often do not, is fatal to it, as it should be constantly visible on the proposed hypothesis. The observation of iron-vapour, as I hold it to be at this elevation, is of extreme value coupled with its simple spectrum, *seen during an eclipse*, as it entirely confirms my observations made at a lower level in the case, not only of iron but of magnesium.

Geological Society, January 26.—Professor Huxley, LL.D., F.R.S., president, in the chair. Thomas Daniel Bott, Esq., 20, Osborne Villas, Talfourd Road, Peckham; Edwin Buckland Kemp-Welch, Esq., 3, Beaumont Terrace, Bournemouth; James Parkinson, Esq., F.C.S., Sarum House, Church Road, Upper Norwood, S.; Henry Sewell, Esq., Villa del Valle, Mexico; and Thomas F. W. Walker, Esq., M.A., F.R.G.S., Athenæum Club, London, and 6, Brock Street, Bath, were elected Fellows of the society. The Rev. Dr. Oswald Heer, of Zurich, was elected a foreign member of the society. The following communication was read:—"On the crag of Norfolk and associated beds." By Joseph Prestwich, Esq., F.R.S., F.G.S. The author commenced by referring to his last paper, in which he divided the Red Crag into two divisions—a lower one, of variable oblique bedded strata, and an upper one of sands passing up into the clay known as the Chillesford clay. In 1849 he had alluded to the possibility of this clay being synchronous with the Norwich Crag. He has since traced this upper or Chillesford division of the Red Crag northwards, with a view to determine its relation to the Norwich Crag. He has found it at various places inland, but the best exhibition of it occurs in the Easton Bavant Cliffs. He there found in it a group of shells similar to those at Chillesford, and under it the well-known bed of mammaliferous or Norwich Crag, with the usual shells. The author also showed that in this cliff and the one nearer Lowestoft traces of the Forest-bed clearly set in upon the Chillesford clay. He next traced these beds at the base of Horton Cliff, and then passed on to the well-known cliffs of Happisburgh and Mundesley. He considered the Chillesford clay to pass beneath the Elephant bed, and to represent some part of the Forest-bed. The same clay may be traced to near Weybourne. The crag under these beds he referred to the Chillesford sands. Mention was then made of the sands and shingle above the Chillesford, to which the author proposed the names of "Southwold Sands and Shingle." These usually are very unfossiliferous, but at two or three places near Southwold the author found indications of an abundance of shells (*Mytilus*, &c.) and Foraminifera in some iron sandstones intercalated in this series. In the Norfolk cliffs these beds contain alternating seams of marine and freshwater shells. The inland range of the beds to Aldeby, Norwich, and Coltishall was next traced, and the Chillesford clay shown to be present in each section, and the sands beneath to be referable to the Chillesford sands, as already shown by other geologists on the evidence of the organic remains. Mr. Gwyn Jeffreys, who had carefully examined the shells of the Norwich Crag for the author, stated that a considerable number of Arctic species were found in the Norfolk Crag which did not occur in Suffolk. While, therefore, the Norwich Crag seems to be synchronous with a portion of the Suffolk Crag, that portion is the upper division, and, therefore, the triple arrangement proposed by Mr. Charlesworth and advocated by Sir C. Lyell, together with the fact of the setting in of a gradually more severe climate, pointed out by the late Dr. Woodward and by Sir C. Lyell, are confirmed. Mr. Prestwich then referred to the origin of the materials of the Southwold shingle, and showed that, with few exceptions, they came from the south. In it he had found a considerable number of worn fragments of chert and ragstone from the Lower Greensand of Kent. He considered this a convenient base-line for the Quaternary period; as then commenced the spread of the marine gravels over the south of England, and soon after commenced the great denudations which give the great features to the country. Mr. Gwyn Jeffreys observed that no littoral shells occur in the Coralline Crag, while in the Red Crag they abound. In the Norwich Crag there is also evidence of littoral conditions, but in certain places the shells exhibit a deep-water character. In the Norwich Crag, after eliminating as derivative or extraneous certain species (as had already been done by the late Dr. Woodward), he finds, exclusive of varieties, 140 species, of which 123 are living, and 17 are supposed to be extinct. Of these 123, 101 still live in the British Seas, 12 are Arctic and North American, 8 Mediterranean, and 2 Asiatic. The southern species were probably derived from the Coralline Crag. The two Asiatic species were the *Corbicula fluminalis* and *Paludina unicolor*. Twenty species in the Norwich Crag have not been found in the Red or Coralline Crag, and he therefore thought there was some difference in their geological age, the Norwich Crag being both more recent than the Red Crag, and its shells of an Arctic or more northern kind. *Tellina balthica* he regarded as significant of brackish water conditions. *Actæon Noæ*, a characteristic shell of the Red and Norwich Crag, had been found fossil by Prof. Steenstrup in Iceland. Sir Charles Lyell had been struck with the similarity of the beds at Chillesford and at Aldeby, in which also the shells, though 40 in one case and 70 in the other, were very similar in character; but in neither was *Tellina balthica* found, though common in the glacial beds. He called attention to the condition of the shells as they occurred at Aldeby, and suggested that where the two shells of a bivalve were found in contact, they would probably afford some evidence whether they were derivative or no. Mr. Searles V. Wood, jun., was inclined to differ to a large extent from the author, especially with regard to the beds above the Chillesford clay. The sands containing *Tellina solidula* he placed as the lowest member of the glacial series; the fauna they contain is different from that of the Chillesford bed. He regarded the sand-beds at Kessingland as above the lower boulder-clay and contorted drift of Cromer, and considered that it might be traced as occupying this position along a great part of the coast of Norfolk. He had, in company with Mr. Harmer, surveyed a great part of the Norfolk and Suffolk district, and they intended to place their maps and sections at the disposal of the Geological Society and the Survey. He recommended that any examination of the country should commence from the east rather than from the west. Mr. Boyd Dawkins, speaking of the fossil mammalia of the crag, mentioned that, at the base of the crag at Horstead, immediately on the chalk, was a bed exhibiting an old land-surface, and in this were found the principal perfect mammalian remains, whereas in the crag above they were water-worn. But though these bones occurred in the marine deposit, the animals had lived on the land, and there was no evidence but that they belonged to a much earlier period than that at which it was submerged. He thought that the facies of the Cervidæ found at Horstead was that of an early Pliocene age. The mammals of the London Clay had in some cases become confounded with those of the Suffolk Crag, but these he regarded also as belonging to an old Pliocene land-surface. He differed from the author in not regarding the Forest-bed as Quaternary, as the remains of *Rhinoceros etruscus*, *Ursus arvernensis*, and *Elephas meridionalis*, &c., had occurred in it, in many cases in fine condition. He could see no reason for splitting up the Cainozoic series into four divisions, as there was no break in the life between the Tertiary and Quarternary periods. Though there might be a break in England, the forms of life were continuous from the Miocene of Pikermi on the Continent. The President suggested that if we were to admit a Quaternary period we must go back to the Miocene, as the mammalian fauna of that period was the direct ancestor of that of the present day. Mr. Prestwich, in reply, remarked that he did not quite agree with Mr. Jeffreys as to the number of derivative species in the different members of the Crag. The fauna, however, required further investigation. With regard to the objections of Mr. Wood, he had not on this occasion intended going into details as to the beds above the Chillesford clays; his object had rather been to show that these latter extended over a large area, and contained in other places than Chillesford the same shells as those occurring there. He did not attach the same value to the presence of *Tellina balthica* as did Mr. Wood, it being a shell now living and found on the coast. He had not overlooked the importance of the mammalian remains, but, like Mr. Dawkins, he had felt the uncertainty which, in the case of the Crag, so often attached to their origin, and therefore had not much insisted on them. He thought the divisions of Miocene and Pliocene were well known and generally accepted; and though the division was arbitrary, he thought the setting in of the Glacial period a good epoch at which to commence the Quaternary period. If we were to go back to some break in the forms of life, we might go back indefinitely.

Ethnological Society, January 25.—Professor Huxley, president, in the chair. The following new members were announced at this and the preceding meeting:—The Earl of Dunraven and Mount-earl, K.P., Lord Rosehill; Messrs. J. W. Barnes, T. H. Baylis, D. Duncan, M.A., J. E. Edwards, J. F. McLennan, W. Morrison, M.P., and R. L. Nash. Dr. Hooker, C.B., exhibited a collection of figures in unbaked clay, modelled by a native Zulu; and Colonel Lane Fox exhibited some stone mullers used for pounding grain.—Mr. Borwick, F.R.G.S., read a paper on the origin of the Tasmanians geologically considered. The Tasmanians have now become almost extinct, an old woman being the only survivor of the race. They were related in manners and in general *physique* to

the neighbouring Australians, but were allied by black skin and woolly hair to the distant Africans, while they were assimilated by resemblance of language, customs, and habits of thought to many races scattered over vast areas. The author sought to explain this relation by constructing an ideal southern continent, whence all the dark-coloured races surrounding the Indian Ocean, and extending into the Pacific and Southern Oceans, may have radiated. He regards the Tasmanian as probably older than the Australian. Dr. Hooker, whose authority had frequently been quoted in the paper, pointed out the similarity and differences that obtain between the floras of Australia, Tasmania, New Zealand, South Africa, &c. It has recently been found that the flora of the Howe Islands is very unlike that of Australia, although so near to the coast. He protested, however, against the inference that the line of migration followed by plants is necessarily the same as that pursued by the higher animals. The President alluded to the great difference between the Australian and Tasmanian, especially in the character of the hair, and he regarded it as physically impossible that the Tasmanian could have come from Australia. He suggested that an interrupted communication, by a chain of islands, may have extended from New Caledonia to Tasmania, similar to that which now connects New Caledonia with New Guinea; and that by this means a low negrito type may have spread eastwards over this area.—Mr. Howorth's paper, "On a frontier-line of Ethnology and Geology," was then read. Siberia and North America form a well-defined province, botanically, zoologically, and ethnologically. North of the isothermal line forming the southern boundary of this province dwell the Ugrian races, whose conditions of existence were compared by the author with those of the prehistoric period. In Europe the isothermals have been gradually twisted to the north by the Gulf Stream; and the author believes that the gradual advent of the stream may be traced from no earlier period than about the twelfth century B.C.; Remarks on this paper were made by the President, Dr. Hyde Clarke, Dr. Richard King, and Colonel Lane Fox.—Mr. Atkinson read a "Note on the Nicobar Islands," and exhibited some grotesque figures carved in wood, taken from the Nicobars by Capt. Edge in 1867, and recently brought to this country by Capt. Mackenzie. These figures are to be placed in the Christy collection, and similar objects have been forwarded to the Museum in Edinburgh.

London Mathematical Society, January 13.—Prof. Cayley, president, in the chair. Mr. Walker gave an account of a paper "On the Equations of Centres and Foci of, and Conditions for, certain Involutions." In this communication it is shown that the three points corresponding to one having an assigned distance (x') from the origin, in one of three involutions determined by a quartic, and found from the equation—

$(abcd\,\text{H}\,x', 1)^3$, $(bcde\,\text{H}\,x', 1)^3$, $(cdef\,\text{H}\,x', 1)^3$, $(defg\,\text{H}\,x', 1)^3$, $(x, 1)^3 = 0$,

the sextic covariant of the quartic being written $(a\,b\,c\,d\,e\,f\,g\,\text{H}\,x\,y)^6$, This form has been arrived at in carrying out a suggestion of the president, Prof. Cayley. It contains the equations giving the three centres of the involutions determined by the quartic, as well as that giving the six double points (the geometrical significance of which latter equation has been already pointed out by Dr. Salmon), by making x' infinitely great, and equal to x, successively. The case of the quartic breaking up into two quadratics is next discussed, when the roots of one correspond respectively to those of the other. The condition for two cubics $(u\,v)$ determining an involution, of such a kind that the three roots of one correspond each to a root of the other, is investigated. This has (since the meeting) been identified by the author with $\Delta\,\Theta'^2 - \Delta'\Theta^2 = 0$, Δ, Δ', being discriminants of u and v, while $\Theta\,\Theta'$ are the co-efficients of λ and λ^3 respectively in the discriminant of $u + \lambda v$. The equations for determining the centre and double points—or, more generally, that determining the point corresponding to an assigned one—in the involution determined by two cubics, satisfying the above condition, are also investigated. Dr. Henrici, Prof. Hirst, Mr. Clifford, and the President took part in a discussion on the paper. The President then made a statement of some results he had arrived at with reference to quartic surfaces. Mr. Roberts exhibited and explained diagrams of the pedals of conic sections which he had constructed by the methods described in his paper read before the society, January 14th, 1869.

Quekett Microscopical Club, January 28.—P. Le Neve Foster, Esq., president, in the chair.—A paper was read by Dr. Robert Braithwaite on the geographical distribution of mosses. The paper gave an abstract of the arrangement proposed by Prof. Schimper, who divides the whole of Europe into three areas in latitude—viz. (1), a northern zone, comprising N. Russia, Scandinavia, and N. Scotland; (2), a middle zone, extending south of this to the foot of the Alps, and including all central Europe; (3), a southern zone, reaching from the last to the Mediterranean. More important than these is their distribution in altitude, or height above the sea level, and for this five regions are indicated, each characterised by certain predominant species, and marked out by lines gradually falling in altitude as we pass northward to the pole, where the extreme limits, or that of the sea level and the line of perpetual snow, become coincident. Commencing at the sea level, the dimensions in altitude are—(1), the Campestral region, or that of the cultivated field and fruit trees, embracing the greatest varieties of soil and conditions of surface; (2), the Montane, or lower mountain region, marked at its upper limit by the disappearance of the beech; (3), the Sub-Alpine region, extending from the upper limit of the beech to the upper limit of the spruce fir; (4), the Alpine region, embraced between the commencement and termination of growth of the dwarf pine, and marked by the presence of dwarf birch; (5), the Supra-Alpine region, reaching above the limit of the trees named to the line of perpetual snow. A brief sketch was then given of the various *habitats* affected by mosses, and lists of the characteristic species given; these embraced the dwellers on walls, roofs, trees, heaths, bogs, and rocks. They were illustrated by a fine series of specimens of mosses and their associated flowering plants, prepared by the late Mr. N. B. Ward, who thus ingeniously attempted to work out the idea of representing the whole flora of a locality at one glance. Conspicuous among these were the sheets from Ben Lawers, Ben Voirlich, Heidelberg, Killarney, and Eridge Rocks.

Anthropological Society, January 18.—Annual General Meeting.—John Beddoe, Esq., M.D., president, in the chair. The report of the auditors showed the income of the society in 1869 to have been 1,091*l.* 9*s.* 5*d.*, the expenditure 964*l.* 9*s.* 8*d.*, and the balance in hand on the 31st December 126*l.* 19*s.* 9*d.* The report of the council was read and adopted. The president then delivered the annual address, including a full obituary notice of Dr. James Hunt, founder of the society. The ballot for the election of officers and council to serve in 1870 was taken with the following result:—President, John Beddoe, M.D.; vice-presidents, H. Beigel, M.D., Captain R. F. Burton, Dr. Charnock, J. Barnard Davis, M.D., F.R.S., Captain Bedford Pim, R.N., Dr. Berthold Seemann; director, Thos. Bendyshe, M.A.; treasurer, Rev. Dunbar I. Heath, M.A.; council, J. Gould Avery, J. Burford Carlill, M.D., S. E. Collingwood, Walter C. Dendy, George Harris, Jonathan Hutchinson, W. B. Kesteven, Kelburne King, M.D., Richard King, M.D., A. L. Lewis, St. George J. Mivart, F.R.S., Major S. R. I. Owen, Edward Peacock, F.S.A., J. Spence Ramskill, M.D., C. Robert Des Ruffières, John Thurnam, M.D., W. S. W. Vaux, F.R.S., C. Staniland Wake, Alfred Wiltshire, M.D., E. Villin.

Entomological Society, January 24.—Annual General Meeting, Mr. Frederick Smith, vice-president, in the chair. The Report of the Council for 1869, and an address by Mr. H. W. Bates, the retiring president, were read. The following thirteen members were chosen to form the council for 1870, viz: Messrs. Bates, Dallas, Dunning, Fry, Grut, M'Lachlan, Parry, Pascoe, Saunders, Stevens, Wallace, and Wormald. Mr. Alfred Russell Wallace was elected president for 1870; and the following officers were re-elected:—Mr. Stevens, treasurer; Messrs. Dunning and M'Lachlan, secretaries; Mr. Janson, librarian. The thanks of the society were voted to the officers and members of the council for their services during the previous year.

GLASGOW

Philosophical Society of Glasgow, January 12.—Dr. Francis H. Thomson, vice-president, in the chair. The president, Dr. James Bryce, F.G.S., gave an account of the "Geological Structure of Skye and the West Highlands." The difficulty and danger of thoroughly studying the peculiar geological structure of Skye were so great that no geologist, in the author's opinion, should undertake it without the company of an associate; and as he considered that no such person should ascend the mountains for the first time unaccompanied, the author specially recommended Angus Nicholson as a reliable guide. Dr. Bryce dwelt at some length upon the wonderful peculiarities in the structure of the Cuchullin mountains, which

form such a characteristic feature of the island in the vicinity of Glen Sligachan. They rise to a height of about 3,300 feet, the last 400 feet being absolutely inaccessible, owing to the peaked, spiry, or pinnacled structure. Thoroughly skilled Alpine climbers had been quite baffled by the Cuchullin mountains, unless they had gone to the ignominious extremity of using ladders to aid them in making the ascent. That structure was entirely due to the great abundance of one single mineral, a variety of augite known as *hypersthene*, the intense hardness of which was owing to the presence of large quantities of oxide of iron and oxide of manganese (*query*, silicate of iron and silicate of *magnesia ?*). While referring to the rock-features of Skye, Dr. Bryce remarked that of late geologists have been too much led away by the attractiveness of palæontology as a means of geological research, overlooking the superior claims of mineralogy. He considered that in Skye there were two chains of mountains—one black, in which the hypersthene prevails, and the other red, owing to the presence of syenite—and that they had come up in two, if not even in four eruptions, through a liassic basin, the thickness of which is probably not less than 1,500 feet. Besides the lias, he found gneiss, sandstone, quartzite, marble, numerous whin dykes, and crystalline slates from 10,000 to 20,000 feet in depth. When the country was examined closely two syenites were found, one intrusive, the other disruptive. The granites and syenites of Skye were very closely approximated to each other, each rock shading off into the other. On the coasts there were beds of oölite and traps, but they were difficult of examination, and indeed there were many points in the geology of the island yet to be explored. Dr. Bryce referred to the separate examinations of Skye made by Sir Roderick Murchison and the late Prof. Edward Forbes, but he differed in opinion from some of the conclusions of those geologists on the geology of the West Coast, and he expressed himself inclined to support the crystalline schist view of Prof. Nicol, of Aberdeen, rather than the Silurian theory which Sir Roderick Murchison and Mr. Geikie had promulgated, although the latter was the popular theory. Dr. Young said he could not agree with Dr. Bryce in his remarks regarding the relative claims of mineralogy and palæontology in geological inquiries. He dissented from some of the conclusions arrived at by Dr. Bryce, and on other points he confessed and regretted his inability to understand him. Dr. Bryce briefly replied.

Chemical Section, January 17.—Alexander Whitelaw, Esq., vice-president, in the chair. Two papers were read,—the first by Mr. J. Wallace Young, on "Artificial Alizarine," recently obtained from anthracene, one of the coal-tar products. In reference to the question of price, a member having much experience, said that manufacturers felt quite satisfied that they could supply artificial alizarine in large quantities, in half tons if it was wanted, and at a price much under that of natural alizarine as extracted from madder.—The other paper read was, "On the estimation of iodine and bromine in the mother liquors from saltpetre and in kelp." By Dr. John Clark.

Berlin

German Chemical Society, January 24.—F. Rüdorff showed a simple experiment to prove the expansion of water when freezing. Cylindrical bombs cast in iron, of half an inch in thickness, and measuring three inches in length, and one in diameter, were entirely filled with water, previously freed from air by boiling, and then closed by a tightly fitting screw. They were then covered by a mixture of pounded ice and common salt. In from ten to twenty minutes' time they exploded with a loud report like that of a pistol, breaking in different directions.—Mr. Holbein exhibited animals, from mussels up to small mammalia, which had been preserved in a solution of creosote in water (one of creosote to twenty parts of water). This process appeared particularly suited to the preservation of fishes.—A. Baeyer spoke on a third isomeric form of hydromellithic acid, adding interesting considerations on the transformation of isomeric bodies one into the other, which will not bear abbreviation.—A. Horstmann reported on the vapour density of acetic acid, which he found to be normal at low temperatures, when the acid vapour was diluted with air.—Prof. Lieben (of Turin) sent in a paper published conjointly with Rossi on normal butylic alcohol produced by the reduction of butyric acid.—Prof. Rose reported on the first diamond found in Europe. A small diamond, recognised as such by Schafarik in Prague, has lately been discovered in an alluvial formation in Bohemia, in which garnets, hyacinths, and sapphires have been found for years.

Prague

National Museum of Bohemia, December 18, 1869.—Prof. Krejci continued his account of the Permian formation of the N.E. of Bohemia, and discussed the section of Stepanitz, near Paka, at Bělohrad. Three deposits are there distinguished. The lowest is schistose and rich in fossil fish; the next is composed of glauconitic grit, and contains trunks of auracaria *in situ;* the upper is calcareous, finely laminated, full of beautiful concretions of polished stones, of chalcedony and agate, often arranged in rows parallel to the stratification. This is the original deposit of the celebrated Psaronites (silicified trunks of *Marattiaceæ arborescentes*. M. Krejci calls this stratum the Kalva beds. This simple arrangement is disturbed by numerous faults and discolorations, united apparently by melaphyr. M. Krejci believes that all the numerous portions of melaphyr in this neighbourhood exhibited originally only a single level; he insists on the fact that in the sections frequently exposed of late in the course of railway operations; the melaphyr is intercalated conformably between the sedimentary deposits; thus leading to the supposition of a metamorphic change of schist or phyllite into melaphyr. He allows, moreover, that the mountain, Grand Levin, near Horka (Falgendorf) arose apparently through a cleft only one to two metres wide. As regards the band of melaphyr and red porphyry, which, at the southern foot of the superb basaltic mass of Mount Kozakov, rests against the very sloping beds of the cretaceous series, and extends towards Mount Jeschken for a distance of at least ten kilometres, M. Krejci prefers to the idea of an irruption, that of a fault into which the beds of porphyry and melaphyr have slid on the one side to reappear on the other.

January 17.—M. Schafarik announced the discovery of the diamond in Bohemia. A note on the subject will be found in another page. We may add here that the Dlaschkowitz diamond has been presented by Count Schönborn to the National Museum of Prague.—The Royal Society of Bohemia held no public meetings during the month of December.

Boston

Society of Natural History, November 17.—The president in the chair. Prof. N. S. Shaler read a note on the occurrence of the remains of *Tarandus rangifer* Gray, at Big Bone Lick, in Kentucky. At a previous meeting was presented the evidence in support of the conclusion that one of the large mammals of North America, the buffalo, had recently changed its limits, and had only ranged in the Ohio valley within the past few centuries. The same locality supplies us with evidence that the caribou existed in abundance in this river basin at a time anterior to the coming of the buffalo, and probably not very long after the disappearance of the *Elephas primigenius*. Since the coming of civilised man into America, the caribou has been confined to a narrow area in the north-east part of the continent; it is questionable whether it has ever ranged during this time south of the southern limit of the State of Maine. The position in which these remains were found leaves the precise relationship in time of this species to the mammoths and mastodons a little questionable. There is, however, little doubt in my mind that, if not in existence during the later part of the time of these pachyderms, it came immediately after them. Its bones are always found below the line of the buffalo and the Virginia deer. The remains of this latter species are found only among the most recent deposits of the swamp. The disappearance from this region of this eminently boreal animal immediately after the passing away of the ancient elephants from the Mississippi valley, goes to confirm the conclusion that the climatic change which closed the period of the mammoths was from cold to warmth, and not an alteration of the opposite character.

Section of Entomology, November 24.—Mr. Edward Burgess in the chair. The following paper was presented:—"American Lepidoptera. II. *Phalænidæ* Latr," by Charles S. Minot. At the June meeting of the section, I presented a paper entitled "American Lepidoptera, No. I." which contained descriptions of four new Geometridæ (*Phalænidæ* Latr.), and was published without further introduction. I should now like to say a few words on the intended purport of the series. I propose that it shall contain any papers of a miscellaneous nature which may aid in completing our knowledge of the natural history of the Lepidoptera; such as descriptions of new species, or of the metamorphoses and lists of insects found in particular localities or States, with their times of appearance, and perhaps ultimately anatomical communications. The descriptions of new species will, for

the present, be principally, if not entirely, confined to the Phalænidæ. Mr. W. H. Dall remarked that while passing over the Portage to the Yukon River, in Alaska, when the temperature was below zero of Fahrenheit, he shot a Canada jay, which had in its mouth the caterpillar of an Arctian; afterwards, when the thermometer was sixteen degrees below zero, he found one of the same caterpillars crawling upon the snow. On the middle of the frozen river, whenever the sun shone for a short time upon the crust, he saw upon the snow a species of *Lepisma* or *Podura* in great abundance, although the cold was intense. The caterpillar of *Vanessa Antiopa* was twice noticed alive during the winter, and the perfect insect was seen at Nulato, May 20th, when the nightly temperature was below freezing.

December 3.—The president in the chair. Dr. C. T. Jackson presented, in the name of Mr. Daniel McCain, specimens of native carbonate of magnesia from Greece, California, Maryland, and Kansas. These minerals are used by the Union Stone Company in making calcined magnesia, which is one of the ingredients of their artificial stone, serving, when combined with chloride of magnesium, as the binding material. Dr. Jackson gave a detailed account of the method of making the artificial stones, and of casting bas-reliefs, busts, and ornamental mouldings. He said the processes had been so improved that now artificial grindstones made of quartz-sand and of emery had been constructed, which were as solid and durable as any natural stone. The emery wheels made of these materials are vastly better than those made with a paste of vulcanised indiarubber, since they do not glaze, but wear away in such a manner as to always expose fresh particles of emery. He regarded this new manufacture as of great value for architecture and the mechanic arts, and as showing the importance of the mineral native carbonate of magnesia, which had been before used only for the manufacture of Epsom salts, of which a limited supply only is wanted. Professor N. S. Shaler offered some remarks on the relation of the rocks in the vicinity of Boston.

PHILADELPHIA

American Philosophical Society, January 7.—Mr. Pliny E. Chase made some observations on the comparison of different mechanical equivalents. He stated that recent determinations, by the different methods of Thomson and Farmer, fix the mechanical equivalent of light, in a wax candle burning 126½ grains per hour, at 13·1 foot-pounds per minute, the equivalent of one grain being 6·213 foot-pounds. According to Dubourg, the heat evolved during the combustion of one grain of olive oil in oxygen is sufficient to heat 9682 grains of water 1° C. According to Favre and Silbermann, one grain of oil of turpentine, burnt in oxygen, would heat 10,852 grains of water 1° C. It may therefore be presumed that the total heat given out by the combustion of one grain of wax is about sufficient to raise 10,000 grains of water 1° C., or 18,000 grains 1° F. This represents a mechanical equivalence of (18,000 × 772 ÷ 7,000 =) 1985·143 foot-pounds, which is 319·5 times as great as the corresponding equivalent of the light given out during the combustion. Tyndall, in his lecture on Radiation, states that the visible rays of the electric light contain about one-tenth of the total radiated heat. The relative luminous intensity of an electric lamp would, therefore, appear to be about 31·95 times as great as that of a wax candle. This ratio resembles that of solar to terrestrial superficial attraction, and the connection of electric and magnetic currents with solar radiation is so evident, that additional experiments, to furnish materials for a great variety of similar comparisons, seem desirable. While it is possible that the resemblance in the present instance may be accidental, the numerous harmonies which exist between the manifestations of cosmical and molecular forces render it at least equally possible that it may have a weighty significance.

Academy of Natural Sciences, August 3, 1869.—Professor Cope called attention to a thin slab of shale containing foot impressions of vertebrate animals found some time ago by Professor Gabb, from the subcarboniferous slate in Schuylkill County. The position of the slab was about 300 feet above the conglomerate. The impressions found by Dr. Isaac Lea some years back were from a position about 700 feet below the conglomerate, and, therefore, more ancient. Professor Cope thought that the impressions found by Dr. Lea were neither reptiles nor fishes, but air-breathing vertebrates—*Batrachians*. But these tracks were different from most *Batrachia*, showing slender digits and long tarsus. The fore-feet are smaller than the hind. They are probably referable to a Salamandroid animal.

DIARY

THURSDAY, FEBRUARY 3.

ROYAL SOCIETY, at 8.30.—On the Fossil Mammals of Australia. Part III. Diprotodon Australis Ow.: Prof. Owen, F.R.S.—Note on an Extension of the Comparison of Magnetic Disturbances with Magnetic Effects, inferred from Observed Terrestrial Galvanic Currents, and Discussion of the Magnetic Effects Inferred from Galvanic Currents on Days of Tranquil Magnetism: The Astronomer Royal, F.R.S.

LINNEAN SOCIETY, at 8.—Revision of the genera and species of capsular gamophyllous *Liliaceæ*: J. G. Baker, F.L.S.—On a new form of Cephalopodous Ova: Dr. Collingwood, F.L.S.

ANTIQUARIES, at 8.30.—On some Ancient Oaken Coffins discovered in Northumberland: T. W. Snagge, Esq.

CHEMICAL SOCIETY, at 8.

FRIDAY, FEBRUARY 4.

PHILOLOGICAL SOCIETY, at 8.15.

ROYAL INSTITUTION, at 8.—Verona and its Rivers: Prof. Ruskin.

ARCHÆOLOGICAL INSTITUTE, at 8.

GEOLOGISTS' ASSOCIATION, at 8.

MONDAY, FEBRUARY 7

ROYAL INSTITUTION, at 2.—General Monthly Meeting.

ENTOMOLOGICAL SOCIETY, at 7.

MEDICAL SOCIETY, at 8.

LONDON INSTITUTION, at 4.

TUESDAY, FEBRUARY 8.

ROYAL INSTITUTION, at 3.—On the Architecture of the Human Body: Prof. Humphry.

ROYAL MEDICAL AND CHIRURGICAL SOCIETY, at 8.30.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Discussion upon Mr. Harrison's Paper "On Railway Statistics and Expenditure."

PHOTOGRAPHICAL SOCIETY, at 8.—Anniversary Meeting.

ETHNOLOGICAL SOCIETY, at 8.—On the discovery of Flint Flakes under a Submerged Forest in West Somerset: W. Boyd Dawkins, F.R.S.—On Remains of Pre-historic man in the neighbourhood of the Crinan Canal, Argyleshire: Rev. R. J. Mapleton.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Anniversary Meeting.

ARCHÆOLOGICAL ASSOCIATION, at 8.

WEDNESDAY, FEBRUARY 9.

GEOLOGICAL SOCIETY, at 8.—The Fossil Corals of the South-Australian Tertiaries. Prof. P. Martin Duncan, F.R.S., Sec. G.S.—Note on a very large undescribed Wealden Vertebra: J. W. Hulke, F.R.S.—Additional Observations on the Neocomian Strata of Yorkshire and Lincolnshire, with Notes on their Relations to the Beds of the same Age throughout Northern Europe: J. W. Judd.

SOCIETY OF ARTS, at 8.—On Loss of Life at Sea: Mr. J. W. Wood.

THURSDAY, FEBRUARY 10.

MATHEMATICAL SOCIETY, at 8.—Quartic Surfaces: Prof. Cayley.

ZOOLOGICAL SOCIETY, at 8.30.—On a new Cervine Animal from the Yang-tze-Kiang: R. Swinhoe.—On the Size of the Red Corpuscles of the Blood of *Moschus*, *Tragulus*, *Orycteropus*, *Ailurus*, and some other mammalia, with historical notices: G. Gulliver.

BOOKS RECEIVED

ENGLISH.—The Body and its Health: E. D. Mapother (Falconer, Dublin).—Our Domestic Fireplaces: F. Edwards (Longmans).—Handbook of Ferns: K. M. Lyell (Murray).—Transactions of the New Zealand Institute, 1868 (Trübner).

FOREIGN.—29 Monographie du Genre Ostrea Terrain Cretage Atlas: Coquand (Williams and Norgate).—Fortschritte der Physik im Jahre, 1866: Quincke Schwalbe and Wangern (Williams and Norgate).—Anthropolgie der Natur völker T. Waik (Williams and Norgate).—Physiologie des Menschen: E. Larisch (Williams and Norgate).—Einleitung in die Physik: Karsten, Harms, and Weyer (Williams and Norgate).—Histoire Generale de Paris. Planches: E. Belegrand.—Gebirgsschichten aus mikroskop. Bacillarien unter und bei der Stadt Mexiko: C. G. Ehrenberg.—Ueber die Macula Lutea des Menschen, &c: Fr. Mukel.—Anatomisch. System. Beschreibung der Alcyonarien: A. Kölliker.—Recherches sur la Faune de Madagascar: P. L. Polle, D. C. Van Dan.—Des Mollusques fossiles de la craie de Lemberg: E. Favre.—Recherches sur les Animaux Vertebr. vivant et fossiles: P. Gervais.

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