"Thus the limit given by Thomson, although so vastly below that afforded by the speculations of some geologists, would appear itself to demand a considerable additional reduction. And I cannot see how we can well suppose the sun in its present form to have radiated heat for more than twenty millions of years, while three or four millions would seem to be a far more probable estimate, unless the thermic laws be totally different in those exalted temperatures which we must suppose to have existed at some past epoch.

"The very great diversity of the limiting values for the specific heat seems to afford ample scope for every needful allowance on account of the natural action of the particles within the body of the sun, even conceding to this the immense effect (analogous to the increase of specific heat) which has been assigned to it by some investigators. Even did we conceive a primitive heat equal to 200,000,000 times the amount now yearly radiated, and a specific heat 10,000 times as great as is possessed by any known gaseous body excepting hydrogen, we could not deduce so long a period as 80,000,000 of years for the past duration of the sun's heat."

SCIENTIFIC SERIALS

THE *Geological Magazine* for May (No. 71, or Vol. vii., No. 5) commences with a biographical sketch of Mr. G. Poulett Scrope, whose investigations into the phenomena of vulcanicity certainly entitle him to a distinguished place among eminent living geologists. This article is illustrated with an admirable portrait. Mr. Jenkins communicates an article on the surface geology of Belgium, in explanation of his map, a reprint of which appeared in the April number of the magazine. Mr. Maw notices two sections on the borders of Shropshire and Cheshire, in which Rhætic beds with characteristic fossils are exposed. In a paper on the Lower Silurian rocks of Galashiels, of which only the first part, illustrated with a map, is here published, Mr. Lapworth furnishes an important contribution to the elucidation of this confused group of rocks. The article in this number which will be generally read with most interest is one by Mr. James Croll, upon the boulder clay of Caithness, which he maintains to be a product of the action of land ice. This paper also is incomplete. Professor Rupert Jones notices and figures the species of Entomostraca from the coal measures of South Wales; several of the species are described as new. Lastly, Mr. Judd's paper, on the use and application of the term Neocomian, contains a good discussion of a matter which, although it seems to be merely a question of terminology, is really, especially at the present moment, one of considerable importance to geologists. Besides the usual reviews, notices, &c., the present number contains a supplementary paper by Mr. Samuel Hyde, on deep-mining in the south-west of Ireland, which possesses much economical interest.

THE *Ibis*, a Quarterly Journal of Ornithology, New Series, No. 22, April 1870. (Van Voorst.)—This number contains :—(10) "Notes relating chiefly to the Birds of India," by Mr. Blyth—the results of an examination of the specimens in the Leyden Museum; (11) "Note on the Systematic Position of *Indicator*," by Mr. P. L. Sclater; (12) "Stray Notes on Ornithology in India," by Mr. Allan Hume; (13) "On New and Little-known Birds collected during the Voyage of the *Magenta*," by Drs. Giglioli and Salvadori; (14) "A List of the Birds of Turkey" (continued), by Capt. Elwes and Mr. T. E. Buckley; (15) "On Rare and Little-known *Limicolæ*," by Mr. J. E. Hasting, determining and discriminating two puzzling species of *Eudromias*, *E. asiaticus*, and *E. veredus*; (16) "On the *Oriolidæ* of the Ethiopian Region," by Mr. R. B. Sharpe—a very elaborate article; (17) "On the Ornithology of Hainan" (continued), by Consul Swinhoe; (18) "On existing Remains of *Alca impennis*," by Prof. Newton, showing that there remain to us of this supposed extinct bird 71 or 72 skins, 9 skeletons, detached bones of 38 or 41 individuals, and 65 eggs. (19) "Notices of Recent Ornithological Publications"—English, French, Dutch, German, Russian, and American, wherein more than twenty works are briefly reviewed; and (20) "Letters, &c.," from Messrs. Layard, Hume, Brooks, and R. Gray, Col. Tytler, Lord Walden, Mr. C. Horne, Capt. Fielden, Herr von Pelzeln, Dr. Salvadori, and Messrs. P. L. Sclater, Harvie Brown, Hawkins, H. Saunders, Elliot, Tristram, and Skeat—the last a communication which will interest others than ornithologists, for it explains the etymology of the name "Grey Lag Goose"—the goose that *lagged* behind the others bred in this country when its congeners had departed for their summer quarters. The number is illustrated by some woodcuts, and by five beautiful coloured plates, by Mr. Keulemans, representing eight species of birds, of which six have never been figured before, and the other two in imperfect plumage only.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 5.—The Bakerian Lecture, "On the Pre-Carboniferous Floras of North-Eastern America, with especial reference to that of the Erian (Devonian) Period." By J. W. Dawson, LL.D., F.R.S., &c., Principal and Vice-Chancellor of M'Gill University, Montreal.

The attention of the author was first directed to the Devonian as distinguished from the Carboniferous flora, by the discovery, on the part of Sir W. E. Logan, in 1843, of some remarkable remains of plants in the Sandstones of Gaspé, Canada. In 1859, after visiting Gaspé to study these plants *in situ*, descriptions of them, and more particularly of the two characteristic Lower Devonian genera *Prototaxites* and *Psilophyton*, were published in the Journal of the Geological Society. Subsequently additional material was obtained by personal investigation of the Devonian of Maine and New Brunswick, and through the kindness of Prof. James Hall, from that of New York. These additional plants were also published in the Journal of the Geological Society. Still more recently, a thorough re-examination of the Gaspé beds, the systematic exploration of the plant-bearing beds near St. John by Prof. Hastt, and fresh collections made by Prof. Hall, have enabled the author to prepare a catalogue of 121 species, and to attempt a thorough revision of the Erian flora, and an investigation of its conditions of growth and relations to the Carboniferous flora.

The term "Erian" is applied to the formations included between the top of the Upper Silurian and the base of the Carboniferous, on account of the uncertainties which have attended the subdivision and limitation of the Devonian of Europe, and also on account of the immense area occupied by these beds on the south and west of Lake Erie, and their admirable development with regard to subdivisions and fossils. The name "Erie Division" was also that originally applied to this typical series by the geologists of the Survey of New York.

A large part of the paper was occupied with the revision of the Erian flora, including the description of twenty-three new species, and more ample descriptions of others previously known only in fragments. Large trunks of *Prototaxites*, from the base of the Lower Devonian, were described, and full details given of the form, structures, and fructification of two species of *Psilophyton*. The new genus *Ormoxylon* was described. The genus *Cyclostigma* was noticed, as represented by two species in America, and its foliage and fruit described for the first time. The genera of the Erian Ferns were examined and corrected, and several interesting trunks and stipes belonging to Tree-ferns were described. The fruits of the genus *Cardiocarpum* were illustrated with reference to their structure. The occurrence of *Lepidophloios*, *Calamodendron*, and other forms in the Middle Devonian was noticed for the first time.

The third part of the memoir was occupied with comparisons and general conclusions. At the close of the Upper Silurian period there was a great subsidence of the land in Eastern America, proved by the wide extent of the marine beds of the Lower Helderberg (Ludlow) group. It was on the small areas of Lower Silurian and Laurentian land, remaining after this subsidence, that the oldest land plants known in the region flourished. Re-elevation occurred early in the Devonian period, and the known flora receives considerable extension in the shallow-water beds of the Lower Erian. The subsidence indicated by the great Carboniferous limestone interrupted these conditions on the west side of the Appalachians, but not on their eastern side. At the close of this we find the rich Middle Devonian flora, which diminishes toward the close of the period; and after the physical disturbances which on the east side of the Appalachians terminated the Erian age, it is followed by the meagre and quite dissimilar flora of the Lower Carboniferous; and this, after the subsidence indicated by the Carboniferous limestone, is followed by the Coal-formation flora.

If we compare the Erian and Carboniferous floras, we find that the leading genera of the latter are represented in the

former, but, for the most part, under distinct specific forms; that the Erian possesses some genera of its own, and that many Carboniferous genera have not yet been recognised in the Erian. There is also great local diversity in the Erian flora, conveying the impression that the conditions affecting the growth of plants were more varied, and the facilities for migration of species less extensive than in the Carboniferous.

In comparing the Erian flora of America with the Devonian of Europe, we meet with the difficulty that little is known of the plants of the Lower and Middle Devonian in Europe. There are, however, specimens in the Museum of the Geological Survey which show, in connection with facts which can be gleaned from the works of continental writers, that *Psilophyton* occupied the same important place in Europe which it did in America; and in the Upper Devonian the generic forms are very similar, though the species are, for the most part, different.

In Eastern America no land flora is known below the Upper Silurian; and even in that series the plants found are confined to the genus *Psilophyton*. Independently, however, of the somewhat doubtful Lower Silurian plants stated to have been found in Europe, there are indications, in the Lower Erian flora, that it must have been the successor of a Silurian flora as yet almost unknown to us; and the line of separation between this old flora and that of the Devonian proper, seems to be at the base of the Middle Devonian.

In applying these facts and considerations to the questions relating to the introduction and extinction of species, and the actual relations of successive floras, it was proposed to compare what might be called specific types, that is, forms which in any given period could not be rationally supposed to be genetically related. Of these specific types, at least fifty may be reckoned in the Erian flora; of these, only three or four are represented in the Carboniferous by identical species, while about one half are represented by allied species. The remainder have no representatives.

A Table of specific types of the Erian was given, and its bearing shown on the questions above referred to; and the hope was expressed that by separating such types from doubtful species and varietal forms, some progress might be made towards understanding, at least, the times and conditions in which specific types were introduced and perished, and the range of varietal forms through which they passed.

Royal Institution, May 9.—Sir Henry Holland, Bart., F.R.S., president, in the chair.—T. W. Boord, F.S.A., Miss Eliza Bowman, Miss Margaret Graham, Rev. Brenchley Kingsford, M.A., H. F. Makins, R. Heber Prance, the Earl of Rosse, F.R.S., the Hon. Capt. R. Talbot, M.P., the Hon. P. S. Wyndham, M.P., were elected members of the Royal Institution. John Tyndall, LL.D., F.R.S., was re-elected as Professor of Natural Philosophy.

Geological Society, April 27.—R. A. C. Godwin-Austen, F.R.S., vice-president, in the chair. The following communications were read:—1. "On the species of rhinoceros whose remains were discovered in a fissure-cavern at Oreston in 1816." By George Busk, F.R.S., F.G.S. The object of this paper was to show that the rhinoceros whose remains were discovered by Mr. Whidbey in a fissure-cavern at Oreston, near Plymouth, in the year 1816, and described by Sir Everard Home in the "Philosophical Transactions" for 1817, belonged, not as has hitherto been supposed by every one except the late Dr. Falconer, to *Rhinoceros tichorhinus*, but to *Rh. leptorhinus*, Cuv. (*R. megarhinus*, Christol). The remains in question are in the Museum of the Royal College of Surgeons, and consist of between thirty and forty, more or less, broken portions of the teeth, and of numerous bones of the skeleton. The greater number being hardly in a condition to afford satisfactory diagnostic specific characters, the remarks in the paper were limited to the teeth and to a perfect metacarpal bone, which appeared amply sufficient for the purpose. The teeth mainly relied upon were the first or second upper molars (m^1 or m^2) of the right and left sides. Both the teeth were broken, but what was wanting in one was supplied by the other. The characters exhibited were shown to be unlike those of *R. tichorhinus*, and quite in accordance with those of *R. leptorhinus*. These were the thinness and smoothness of the enamel, the configuration of the dorsal surface, the form and size of the columns, and the disposition and relations of the "uncus" and "*pecten*" ("*crochet*" and "anterior combing-plate);" and the consequent absence of the characteristic "*tichorhine pit*" or *fossette*. The less strongly marked characters by which the teeth could be distinguished from those of *R. hemitæchus*, Falc., and *R. etruscus*, Falc., were also pointed out. The metacarpal bone selected for the illustration of the diagnosis is 9¼ inches long, and remarkable for the compression of the shaft and its comparative slenderness, as contrasted with the same bone in *R. tichorhinus*, specimens of which were exhibited on the table, and which, in no case within the author's knowledge, ever exceeds 7½ or 8 inches in length, and is proportionately much thicker than in *R. leptorhinus* or any other extinct species. The size and form of the bone also showed that the species could not be either *R. hemitæchus* or *R. etruscus*, for although the means of direct comparison with the third metacarpal of those species did not, to the author's knowledge, exist in London, its probable general dimensions and proportions could be deduced from those of the corresponding metatarsal, of which bone numerous specimens were available. It was further shown that the Oreston metacarpal exactly corresponded with those of *R. leptorhinus*, from Grays Thurrock, in the British Museum. The determination of the species appears to be of considerable interest, inasmuch as it affords an additional instance of the occurrence in England of the great southern Rhinoceros. This is also the only example of the discovery of that species, except in river or other deposits, either in this country or on the Continent. The Chairman remarked that at one time the Oreston *Rhinoceros* was referred to *R. tichorhinus*, but that Buckland, although mentioning the *Rhinoceros*, never gave it a specific name. The Chairman also said that the Oreston fissures were not caves, but mere fissures which had been filled in; an entire skeleton occurred at one spot, and the animal must have fallen in. Mr. Boyd Dawkins had been struck by the non-tichorhine character of the Oreston specimens some years since. He confirmed Prof. Busk's determination, and remarked that five British species of *Rhinoceros* are known, namely: 1. *R. Schleiermacheri*, from the Red Crag of Suffolk (in the Miocene at Darmstadt); 2. *R. etruscus*, from the Forest Bed = *R. Merckii* (Von Meyer); 3. *R. megarhinus* (Christol) = *leptorhinus* (Cuv.); but the latter name includes also *R. etruscus* and *R. hemitæchus*; so that the adoption of De Christol's name gets rid of a difficulty; 4. *R. hemitæchus*; and 5. *R. tichorhinus* = *R. antiquitatis* (Blum.). Prof. Busk, in reply, stated that Oreston was a fissure-cavern, and noticed the successive openings in 1816, 1821, and 1826. He did not agree with Mr. Boyd Dawkins in preferring the name *megarhinus* to Cuvier's *leptorhinus*. He did not know of the occurrence of two species of *Rhinoceros* at Oreston.

2. "On two Gneissoid series in Nova Scotia and New Brunswick, supposed to be the equivalents of the Huronian (Cambrian) and Laurentian." By H. Youle Hind, M.A.

This paper described the relations of two gneissoid series in Nova Scotia and New Brunswick, which have hitherto been regarded as intrusive granites and syenites, and have been thus represented on the published geological maps of those provinces. The author considered that these gneisses were in the main of Laurentian age, the Huronian or Cambrian rocks occurring only in patches over a vast area of Laurentian porphyroid gneiss. The old gneiss was stated to be brought to the surface by three great undulations between the Atlantic coast of Nova Scotia and the Laurentian axis of America north of the St. Lawrence. These axes were rudely parallel to one another, and in the troughs which lay between them the Silurian, Devonian, and Carboniferous series occurred in regular sequence, the New Brunswick Coal-field occupying the central trough. On the line of section, in the troughs to the north-west and south-east, the Lower Carboniferous was stated to be the highest rock series which has escaped denudation. The gold-bearing rocks of Nova Scotia are of Lower Silurian age, and rest either on Huronian strata or, where these had been removed by denudation, on the old Laurentian gneiss. The gold is found chiefly in beds of auriferous quartz of contemporaneous age with the slates and quartzites composing the mass of the series, which, in Nova Scotia, is 12,000 feet thick; and the auriferous beds are worked, in one district or another, through a vertical space of 6,000 feet. Besides auriferous beds of quartz, intercalated beds and true veins are found to yield gold, and are worked. A series of sharp and well-defined anticlinals ridge the province of Nova Scotia from east to west, while another series of low broad anticlinals of much later date have a meridional course. At the intersection of these anticlinals the gold districts are situated, because there denudation has best exposed the upturned edges of the auriferous beds of quartz, and rendered them accessible, sometimes exposing also the underlying gneiss. Plans of Waverley and Sherbrooke gold districts were exhibited, showing the outcrop of the edges

of the slates and auriferous beds of quartz in semi-elliptical forms, with the gneiss at the base of the ellipse. On this ground it was suggested that a correct mapping of the gneisses of Nova Scotia would have an important influence on the development of the mineral resources of the province. A plan of some of the lodes in the Waverley gold district showed the result of operations in 1869, subsequently to the publication of a geological map and sections of the district furnished to the Department of Mines by the author in 1868. Citations were made from the annual reports just issued of the Chief Commissioner of Mines and of the Inspector of Mines, confirming the correctness of the author's plans exhibiting the geological structure of Waverley, which is a type of all the Nova Scotian gold districts. Principal Dawson spoke in confirmation of the fact that the Palæozoic rocks are underlain by Laurentian gneiss, &c., quite to the eastern coast of British North America, and stated that the same relation occurred in Newfoundland, and had been traced southwards into Massachussetts. He confirmed Mr. Hind's views generally, and stated that the Lower Silurian of Nova Scotia includes no great fossiliferous limestone, like that of the interior of North America. The supposed *Eozoon* discovered by Dr. Honeyman, was probably distinct from *E. canadense*, but was certainly a Foraminiferal organism allied to *Eozoon;* but as *Eozoon bohemicum* is of later date than *E. canadense*, the presence of *Eozoon* did not necessarily indicate Laurentian age. Prof. Ramsay suggested that other organisms besides *Eozoon* aided in building up these great calcareous masses. He inquired as to the mode of occurrence of gold, and suggested that the gold is obtained at the anticlinals merely because the exposure is better, and that it will be found to pervade the synclinals also. Mr. Henry Robinson had visited the Waverley district in company with Prof. Hind, in the winter of 1868, at which time the mining on the lodes referred to in the map before the society was at a standstill, the lodes having been lost by reason of a fault. He thought it was very satisfactory to find that the explorations of Prof. Hind, and the theoretical position which he assigned to the lodes, had been completely verified. Mr. Robinson also stated that gold is being mined in the synclinals by sinking shafts and driving cross-cuts. Mr. Hind remarked that all the Lower Silurian in Nova Scotia was auriferous, and that the gold was derived from the underlying Laurentian rocks. He stated that Sir W. E. Logan had indicated an auriferous zone in the Laurentian of Canada. Gold was finely distributed in the slates of Nova Scotia, as in Victoria, in the neighbourhood of lodes, according to Mr. R. Brough Smyth.

Chemical Society, May 5.—Prof. Williamson, F.R.S., President, in the chair. The following gentlemen were elected fellows: G. Matthey, T. Steel, T. Allen.—Mr. Brown read a paper on "Vapour densities," wherein he gave a historical review of the various methods employed for the determination of such densities.—Mr. Church communicated the analyses of two Cornish minerals. The one, Restormelite, may be regarded as a variety of kaolinite, standing nearest to the lithomarge group. The analysis gave the following figures:—

H_2O	11·68	per cent.
SiO_2	45·21	,,
Fe_2O_3	1·11	,,
Al_2O_3	35·10	,,
MgO	0·85	,,
K_2O	2·30	,,
Na_2O	4·12	,,

This corresponds pretty well with the formula of kaolinite, Al_2O_3, $2\,SiO_2 + 2$ aq., if we suppose a partial replacement of hydrogen by sodium or potassium, and of aluminium by iron. Restormelite may be considered as preserving in its alkalies more evident traces of its feldspathic origin than are usually found in such alteration products. The second of the above-mentioned minerals is Chalcophyllite. The recorded analyses of this mineral were so unsatisfactory that Mr. Church thought it worth his while to submit to a new investigation. The figures he obtained in his analysis led him to assign to chalcophyllite the formula $8\,CuO$, Al_2O_3, $As_2O_5 + 24$ aq. The mineral cannot be dried even in vacuo without an entire change in its appearance. The beautiful green and transparent crystals become of a more bluish tinge, and quite opaque. This change corresponds to a loss of 13·79 per cent. of water.—Messrs. Bolas and Gloves communicated a paper on their newly-discovered tetrabromide of carbon. This compound is obtained by heating bisulphide of carbon with bromide of iodine in a sealed tube to a temperature of 150° C for about forty-eight hours, adding afterwards caustic soda to the contents of the tube, and submitting the mixture to distillation, when the tetrabromide of carbon will distil over. Bromoform and bromopicrin, when treated with bromide of iodine, yield the same result. The bromide of iodine can be replaced by antimony terbromide. Tetrabromide of carbon is a white crystalline substance, melting at 91° C., insoluble in water, but readily soluble in ether, hot alcohol, benzol, American oil, bromoform, and chloroform. Sodium amalgam reduces it, first to bromoform, then to methylene dibromide. The authors propose to carry on their investigations of this interesting compound.

Anthropological Society of London, May 3.—Dr. R. S. Charnock, V.P., in the chair. Moore A. Cuffe, LL.D., 9, Camden Crescent, Bath, was elected a Fellow. A paper was read by Major W. Ross King, F.R.G.S., F.S.A.S., on the "Aboriginal Tribes of the Nilgiri Hills," namely, the Todas, Khotas, Erulas, and Kurumbas, especially noticing the former, as being the most singular and important. The author, who was three years among these tribes, described in turn the characteristic features and peculiarities of each, with detailed information as to their very curious social customs, and religious rites and ideas; showing the marked distinction existing in every point between tribes occupying one and the same area, and in constant communication with each other; pointing out the fact that each people retained its own language; and their remarkable isolation from the surrounding enormous population of the plains. The striking similarity between the rites, practices, and monuments of the Todas and those of the ancient Celts of Britain was shown; a passing allusion was made to the evidences of an early western migration as traceable through intervening countries in the existence of similar rites and customs; and the presence on the Nilgiri hills of Druidical circles, cromlechs, kistvaens, and tumuli was described, precisely similar to those so well-known in our own country. While commenting on the analogies thus apparent between the ancient Celts and some of these Hill Tribes, the author took occasion also to remark on their similarities in other respects to the Jews of old, to the Kaffirs, and to the ancient Romans, not as being likely to lead to any theory of origin in those quarters, but as possibly qualifying the reliance to be placed on every point of Celtic resemblance. In conclusion, the author, who illustrated his paper by the exhibition of several drawings, and of some interesting native ornaments, &c., summed up the various theories prevailing as to the probable origin of these tribes, of whose history we are still so ignorant, and recommended the subject to the Society as one worthy of their investigation.

Linnean Society, May 5.—The following foreign members were elected in the place of those who have died during the past year:—Prof. Spencer F. Baird, of Washington; Herr George Ritter von Frauenfeld, of Vienna; Dr. William Lilljeborg, Prof. of Zoology at Upsala; Dr. Charles Naudin, of Collioure, Pyrenees; and Sig. Roberto di Visiani, Prof. of Botany at Padua.—A letter was read from Dr. Ernst, of Caracas, on a peculiar plant belonging to that country known as "incense," a small tree forming a striking feature in the scenery. It was described by Humboldt and De Candolle under different names, its affinities not having been accurately determined. Dr. Ernst has established its right to form a distinct genus, to which he gives the name of *Libanothamnus*.—Dr. Hooker read a communication from Dr. Kirk, vice-consul at Zanzibar, on "Copals." One characteristic by which fossil copal is known from the recent resin, in addition to its greater transparency, is the so-called "goose-skin." Dr. Kirk has ascertained that the fossil copal shows no trace of this goose-skin when first dug out of the earth, but that it makes its appearance only after cleaning and brushing the outer surface. Specimens exhibited of both recent and fossil copal contained imprisoned flowers, leaves, and insects, in a beautiful state of preservation. Captain Grant states that the true copal gum-tree is a climber which climbs to a great height among the forest trees, and finally becomes completely detached from its original root, when the copal exudes from the extremities of these detached roots. Large pieces of the resin fetch a very high price even in that country.

Zoological Society, April 28.—John Gould, F.R.S., V.P., in the chair. The Secretary read some notes on the principal additions to the Society's Menagerie during the month of March,

and called particular attention to four Burrowing Owls presented by G. Wilks, Esq., C.M.Z.S, and to a wood-loving antelope (*Cephalophus sylvicultrix*), obtained by purchase.—Mr. J. E. Harting, F.Z.S., exhibited an unusually fine specimen of the Dusky Redshank (*Totanus fuscus*) in summer plumage, recently killed near London.—The Rev. H. B. Tristram exhibited two skins of *Salicaria melanopogon*—a rare European warbler, obtained near Ettawah, north of Agra, being the first recorded occurrence of this species in Central India.—Dr. E. Hamilton communicated an extract from a letter addressed to him by his nephew, Capt. Hamilton, lately commanding detachment at Port Blair, concerning the true locality of the so-called "Andaman Monkey," now in the Society's Gardens, which was stated to have been imported into the Andaman Islands from Burmah.—A letter was read from Dr. John Anderson, F.Z.S., of the Indian Museum, Calcutta, announcing that he had obtained a specimen of the dolphin of the Irrawaddi, which turned out to be a species of the genus *Globiocephalus*.—Mr. St. George Mivart read a memoir on the axial skeleton of the tailed batrachians, containing observations on the development and mode of formation of the spinal column of these animals.—A communication was read from Mr. Gerard Krefft, C.M.Z.S., containing the description of a new and very remarkable animal, allied to *Lepidosiren*, recently discovered in the fresh-waters of Queensland. Mr. Krefft considered this animal to be an Amphibian, and referred it to the genus *Ceratodus* of Agassiz, proposing to call it *Ceratodus Forsteri*, after Mr. Wm. Forster, its discoverer.—Mr. R. Swinhoe, F.Z.S., read a paper on the Mammals of Hainan, as observed during his recent visit to that island. The number of species enumerated was 21, amongst which was a hare, believed to be undescribed, and proposed to be called *Lepus hainanus*.—A second communication was read by Mr. Swinhoe, being a list of reptiles and batrachians found in the same island, with notes on their habits. The species had been determined by Dr. Günther.—Mr. D. G. Elliot, F.Z.S., read a paper on some new genera and species of birds belonging to the families *Formicariidæ*, *Pachycephalidæ*, and *Sylviidæ*. These were proposed to be called *Xenorhynchus pachycephaloides* (from New Caledonia), *Clytoctantes alixii* (from Ecuador), and *Calamoherpe subflavescens* (from Dahouria).—Messrs. Sharpe and Dresser read a paper "On some new or little-known points in the economy of the common swallow" (*Hirundo rustica*). The authors drew special attention to the changes of plumage through which this species passed during its residence in Southern Africa.—Mr. G. B. Sowerby communicated descriptions of 48 new species of shells from various localities.

CARDIFF

Naturalists' Society, April 5.—A paper was read on "Water in its different forms," by Mr. Vivian. A large number of very interesting objects contained in various descriptions of water were shown under the microscope, among which the most interesting were the contents of two vials, both from a shallow, muddy-looking bog on Splottland Moor, which furnished a puzzle for the members of the Society, and a satisfactory solution of which is still a desideratum. One of these was filled with the yellow gelatinous substance which deposits the famous bog iron, consisting chiefly of a very minutely twisted conferva, which Sir C. Lyell, after Ehrenberg, called *Gallionella*, but which is now more commonly named with Griffith *Didymohelix ferruginea*. Within this yellow substance was an innumerable swarm of bluish-green animalcules (*Stentor polymorphus*), with several specimens of two other kinds of Vorticellineæ—viz., *Urocentrum turbo* and *Cænomorpha medusula*. This is a very funny living parasol, worth seeing. The other vial, except the yellow stuff, which was eliminated on purpose, had the same trumpeters (*S. polymorphus*), which, wonderful to say, on being corked disappeared, collapsing all at once, and leaving nothing behind but a milky, bluish-green water, which still keeps its colour after several days. We shall wait to see if any living creature will ever come out of it by spontaneous or hemigerminal generation. From another vial a good harvest of phytozoa (*Euglenæ*) was expected, all the water looking deep yellow green; but this water, too, never settled as it does when living *Euglenæ* are collected, a clear proof that here also the animals come to grief—when and how?—that is the question the members of the Cardiff Naturalists' Society wish to have solved by some of our readers. In reference to the contents of a single drop of water, Prof. Gagliardi remarked:—It was in the same gathering that an extremely minute protoplasmic bit of living matter was seen. Under a magnifying power of 500 diameters this floating atom looked like a little comma, scarcely half the size of the *Surirella minutæ* that was living with it. Another unusually large specimen of *Amœba* came out of a gathering in a pond in Cathays; it looked somewhat like a streaming worm. I have no doubt that it was but a stronger variety of the *Amœba princeps*; yet, seeing how steadily it kept to the vernicular form, with very slight changes now and then, I should call it rather *A. vermicularis*.

GLASGOW

Geological Society, April 14.—Professor John Young, President, in the chair.—Mr. James Geikie, Vice-President, read a letter from Mr. Croll, of the Geological Survey of Scotland, referring to a paper contributed by him to the transactions of the Edinburgh Geological Society, on "Ancient River Channels buried under Drift," and on which Mr. John Young had made some remarks at a previous meeting. An animated discussion ensued on the points referred to in the letter.—Mr. D. Bell read a paper entitled "Aspects of Clydesdale during the Glacial Period." He gave a sketch of the succession of events which had been made out from the dawn of the glacial epoch, down to a comparatively recent geological time—beginning with the period of land-ice, and ending with the "last elevation" of the land. As to the period of land-ice, he thought the first point which they had to fix in their minds and try to get some adequate notion of, was the great thickness and mass which the ice attained. He did not know where they could get a better or more impressive idea of this than by ascending Ben Lomond. He described the marks of the ice, the grooved and polished surfaces, that may be traced from the shore at Rowardennan to a great height on Ben Lomond, observing that the ice evidently did not come *down* the mountain, but moved *along* or *across* it. He also referred to similar markings on the neighbouring hills, and the conclusion these all led to was, that the entire hollow in which Loch Lomond now lies was at one time filled from side to side with a mass of ice which only the higher mountains overtopped, and from which Ben Lomond itself only rose as a little rocky islet. Having shown that this was quite in harmony with what had been observed in other parts of the country, among the mountains of Perthshire, Aberdeenshire, and Argyleshire, he said he had no doubt the great depth of Loch Lomond in its upper part, where it is not less than 100 fathoms, was due mainly to the action of the ice, which was there compressed and imprisoned, forcing its way between the hills. In the lower part it got spread out more, so that although it had softer rocks to deal with, it produced comparatively a less effect. He then alluded to similar proofs of glacial action in the neighbouring parts of the Firth of Clyde—at Garelochhead and along the shores of that loch, of Lochlong, Lochgoil, and the Holy Loch—on the hills behind Gourock, Greenock, and Port-Glasgow—on Dumbarton Castle rock—on the flanks of the Kilpatrick hills—on the opposite side of the river near Bishopton, and all over the lower grounds from the Gleniffer and Cathkin braes on the one side, to the Campsie hills on the other. The persistency and uniformity of direction of these markings, alike in the valley and over the neighbouring hills, sufficiently proved the great volume the ice must have attained. He then proceeded to consider the formation of the boulder clay, holding that the lower till or clay was the product of this great sheet of land ice, and that the upper boulder clay was more probably due to sea ice during the period which followed, when the land was submerged to a depth of several hundred feet beneath its present level. He referred to the beds of sand found interspersed throughout the boulder clay, and thought that whether the theory of land or sea ice were adopted, these might be explained without supposing, as some did, that there had been so many distinct "breaks" in the glacial period. He pointed out the narrowness of the basis on which such conclusions rested, only a very few of the borings which had been adduced showing more than one or two beds of sand; and maintained that the one "break" of which we seemed to have evidence, between the first and second depression of the land, was sufficient, if we considered and gave due weight to the gradual advance and retreat of the ice in each case, and the accumulations of water that must have been caused thereby, to account for all the beds of sand that had been described. Coming to the "shell-beds" which had been found at various heights in the Clyde valley, from Airdrie, at 510 feet, down to Paisley, and from that to the present sea margin, he was of

opinion that the theory of "unequal elevations," which had been proposed to account for these beds being found at so many different levels, was quite untenable, being a most objectionable and unphilosophical theory in every respect. He believed the true explanation was to be sought, not by supposing the beds to have been strictly *contemporaneous*, or formed at the same level, and afterwards "unequally elevated," but by considering them to have been *successive*, formed at different levels during the gradual sinking or rising of the land, as the depth of the sea, its freedom from ice, and other conditions, became favourable to the various forms of marine life, whose remains are found in the beds referred to.—Mr. John Young then exhibited some specimens of finely-laminated clay from the excavations in the College grounds, pointing out the traces of organisms which they presented, some of which were supposed to be of Annelides, others of Crustacea. Arrangements for the society's excursions during the summer months were afterwards announced, and the proceedings terminated.

PARIS

Academy of Sciences, May 2.—M. Le Verrier communicated a note by M. Aoust on roulettes in general.—The following papers on physical subjects were read :—A memoir by M. Becquerel on the cause of the electrical effects produced by the contact of metals with distilled water, in which the author, after discussing the opinions of previous writers on the subject, and describing his experiments, comes to the conclusion that these effects are due to the reaction of the water upon the gases absorbed by the inoxidisable metals, whilst those furnished by oxidisable metals arise from the presence of a slight coat of oxide upon their surface, which renders them positive relatively to metals not so protected. By M. J. Jamin and M. Cornu, notes in opposition to the results obtained by M. Croullebois with regard to the index of refraction of water; and a reply by M. Jamin to the recent note by M. Renou on the latent heat of ice. A memoir by M. Lecoq de Boisbaudran on the constitution of luminous spectra, containing a comparison of the spectra of chloride, bromide, and iodide of barium, showing that an augmentation of mean wave-length in some degree proportional to the augmentation of molecular weight, is caused by the substitution of one halogen for another, as well as by the substitution of one metal for another. A continuation of M. P. Desains' researches upon calorific spectra. A note by M. E. Bouchotte, communicated by M. E. Becquerel, on the estimation of the relation existing between the dynamic work expended and the quantity of electricity produced in Holtz's machine, in continuation of a note upon the same subject presented in February last; and a note by M. Limouzin, presented by M. Bussy, relating to a communication by M. Duclaux on the formation of liquid drops, and remarking that the author, more than a year ago, presented to the School of Pharmacy an alcoholometric apparatus constructed upon the principle indicated by M. Duclaux.—A note by M. Lacoine, on the effects produced by the Aurora of the 5th April on the Turkish Telegraphic lines, was presented by M. Leverrier. The author observed a complete stoppage of transmission in the line from Pera to Semlin, the line being traversed by a strong current in the opposite direction, indicating a terrestrial current from north to south.—M. Descloizeaux presented a note on the crystalline form and optical properties of a compound of protochloride of platinum and triethylophosphine analogous to Magnus's salt.—The following strictly chemical papers were also read :—A note by M. Morren to the president on the combustibility of the diamond, and the effects produced upon it by high temperatures. The author stated that when heated by means of common coal, or brought to a white heat in a current of coal gas, diamonds become blackened on the surface, but without change of weight; with pure hydrogen no alteration is produced; with carbonic acid they lose lustre and weight. He added that diamonds burn readily when exposed to the blow-pipe flame of a glass-blower's lamp upon a piece of platinum, and that the whole substance does not burn with equal readiness, so that if the operation is interrupted, the surface of the residue shows numerous small equilaterally triangular faces belonging to minute octahedra.—A note on the solubility of chloride, bromide, and iodide of silver in salts of mercury, by M. H. Debray.—A memoir on a new process for the volumetric determination of copper, by M. F. Weil, communicated by M. Dumas. This process depends on the facts that in presence of an excess of free hydrochloric acid, and at a boiling temperature, the least trace of bichloride of copper gives a distinct greenish yellow tinge to its solution, and that under these circumstances protochloride of tin instantly converts the salts of binoxide of copper into colourless proto-salts. The termination of the reaction is determined by means of bichloride of mercury, which produces the characteristic white precipitate of calomel with the slightest excess of chloride of tin.—A paper on the products of the fermentation of pyrotartaric acid and its homologues, by M. A. Béchamp. The author stated that as succinate of lime by fermentation furnishes butyric acid, with evolution of hydrogen and carbonic acids, its homologue, pyrotartaric acid, might also be expected to produce butyric acid, but that at the close of the operation the apparatus contains only carbonate of lime, whilst the gases evolved are carbonic acid and marsh gas. He also noticed the behaviour of several organic acids when fermented by means of chalk in presence of a small portion of flesh.—A note by the same author on the preparation of pyrotartaric acid. He operates upon anhydrous tartaric acid mixed with pumice, and obtains about 20 per cent. of pyrotartaric acid.—A note by M. F. Pisani on the minerals obtained in the copper mine of Cap Garonne (Var) was communicated by M. Descloiseaux. These minerals are Adamine (of which the author gives analyses), Chalcophyllite, Lettsomite, Brochantite, Olivenite, Mimetese, Azurite, Malachite, and Barytine.—M. Prunières forwarded some specimens of charcoal and carbonised wood, collected in the Lozère from a sedimentary deposit between granite and basalt, at a depth of 40 metres. Some of them bore remarkable notches, "which will have to be studied from another point of view."—M. Duméril communicated some observations by M. E. Moreau, on the structure of the *chorda dorsalis* in *Amphioxus lanceolatus*. Appended to the *chorda dorsalis* in this fish, the author finds neurapophyses and hæmapophyses; he also describes the sustaining pieces of the fins, especially the dorsal, which he regards as representing fin-rays amalgamated with interspinous pieces.—M. Brongriart communicated a memoir by M. A. Gris, containing anatomical and physiological observations on the pith in ligneous plants. The author distinguishes three medullary elements, namely, *active*, *inert*, and *crystalligenous* cells. When the first and third of these are present, he calls the pith *homogeneous medulla*; the first and second constitute a *heterogeneous medulla*. From the presence of starch in the active cells of the pith in large branches and trunks showing from eighteen to twenty-eight circles of growth, the author concludes that the supposed inertia of the medulla is by no means certain. He regards it as an organ of reserve.

BERLIN

Royal Prussian Academy of Sciences, January 6.—The following scientific paper was read :—On the theory of the newest Electrophorous machines and on supernumerary conductor. By M. Riess.

January 17.—Professor W. Peters read a memoir on the Ductus pneumaticus of the lower jaw in the crocodile.

February 10.—Professor W. Peters read a memoir on the African monitors and their geographical distribution, in which he indicated the synonymy and distribution of the following species :—*Monitor niloticus*, Hasselqu.; *M. saurus*, Laur.; *M. albogularis*, Daud.; *M. ocellatus*, Rüpp.; *M. exanthematicus*, Bosc; and *M. griseus*, Daud. He adopts the Cuvierian name for the genus, as it is three years earlier than Merrem's *Varanus*. Prof. Peters also read a contribution to the knowledge of the herpetology of South Africa, including a list of a few species of lizards, snakes, and batrachia, chiefly from Hantam, in the Calvinia district. A new species of gecko, *Chondrodactylus angulifer*, is described and figured by the author; it is the type of a new genus, allied to *Stenodactylus*, but destitute of claws. The author also remarks upon the characters and synonymy of *Agama hispida*, Linn.; *A. atra*, Daud.; *Eremias capensis*, Smith; and *Euprepes vittatus*, Oliv.; and figures two small species of tree frogs, namely, *Arthroleptis Wahlbergii*, Smith; and *Hyperolius tuberilinguis*, Sundevall. He proposes to change the name of his *Hemidactylus variegatus* to *H. picturatus*.—A memoir by M. Kostka, on the determination of the ellipsoidal figure of equilibrium of a homogeneous mass of fluid rotating round a fixed axis, when its density and period of rotation are known, was presented by M. Weierstrass.

February 14.—Professor Dove read a note on the compensation of the cold observed in Europe in January of the present year, by an unusual elevation of the temperature in America.—Professor Ehrenberg made a preliminary communication on the beds

of Bacillariæ in the high lands of California, in which he noticed the occurrence of great beds consisting wholly of Diatomaceæ in various parts of the Californian territory.—M. Weierstrass presented a memoir by M. Ketteler on the influence of ponderable molecules upon the dispersion of light, and upon the import of the constants of the dispersion formulæ.

February 17.—The papers read at this meeting were chiefly of historical or antiquarian interest, but they included an important contribution to the history of algebra in Germany, by Prof. Gerhardt, of Eisleben.

February 24.—Prof. A. W. Hofmann read a paper on the preparation of the ethylamines on the large scale. The author finds that the most volatile of the subsidiary products of the manufacture of chloral, if condensed and digested at 212° F. with a strong alcoholic solution of ammonia, furnishes, by a simple subsequent treatment described by him, a considerable proportion of hydrochlorates of the amine bases, which may be isolated by the addition of concentrated solution of soda. Professor Hofmann also read some supplementary remarks upon the products of the desulphurisation of diphenylosulphocarbamide.

German Chemical Society, April 11.—Two papers by L. Carius were communicated. The first describes a new method of preparing dibrominated acetic ether, by the action of bromine on acetic ether. The second announced new syntheses of maleic and phenaconic acids, by the use of disodic acetic ether, $C\ H\ Na_2\ C\ O\ O\ C_2\ H_5$ on bibromoacetic ether, and on bibromosuccinic ether.—Messrs. Schneider and Erlenmeyer have investigated normal iodopropionic acid. Treated with acetate of silver, this acid yields acetoxypropionic acid.—L. Fleury publishes researches on new derivations of allyle, viz.: $C_3\ H_5\ Cl_2\ N\ O_2$, $C_3\ H_5\ I\ Cl_2$ and $C_3\ H_5\ O\ H\ H\ Cl\ O$.—A. Ladenburg has discovered a distannic ethide, $Sn_2\ (C_2\ H_5)_6$. The vapour density serving to establish the formula of this compound was taken by Hofmann's method, the constant temperature being produced by distillation of oil of cloves. Chlorine and iodine separate the molecule producing

$$Sn\ (C_2\ H_5)_3\ Cl, \text{ or } Sn\ (C_2\ H_5)_3\ I.$$

C. Liebermann reported on an easier method patented by himself, in conjunction with Messrs. Graebe and Caro, for preparing artificial alizarine. Instead of brominating anthracene they treat it with sulphuric acid. According to the quantities employed, either one, two, or three atoms of hydrogen are replaced by the group HSO_4. $C_{14}\ H_8\ (SO_3H)_2$ fused with potash yields $C_{14}\ H_8\ (OH)_2$, and this is oxydised into alizarine $C_{14}\ H_6\ (HO)_2\ O_2$. Or they transform anthracene $C_{14}\ H_{10}$ first into anthrachinone $C_{14}\ H_8\ O_2$, and treat this substance with sulphuric acid. The compound $C_{14}\ H_6O_2\ (HSO_4)_2$ may then be transformed by fusion with potash into $C_{14}\ H_6O_2\ (OH)_2$. The compound $C_{14}\ H_5\ O_2\ (HSO_4)_3$ is transformed by this process into purpurine. A process lately patented by Bronner and Gubzkow for preparing alizarine was then severely criticised by Mr. Liebermann; this process, consisting in fusing anthrachinone with potash, yields only a trace of a blue colouring matter, but no alizarine. He intends to return to this subject.—Professor Rammelsberg reported on the action of periodic acid on the oxides of thallium. Protoxide of thallium treated with periodic acid is partly converted into the iodate, and partly into peroxide of thallium. Sesquioxide of thallium, on the contrary, combines with periodic acid.—V. Meyer has continued his researches on the synthesis of organic acids, by treating sulpho-salts with formiates. Sulphonaphthalate of potassium, when fused with formiate of sodium, produces acid sulphite of potassium and naphtalinecarbonate of sodium. Chlorosalylate of potassium treated in the same way, however, yields chloride of potassium and benzoate of sodium.

April 25.—Messrs. Krämer and Pinner have continued their researches on aldehyde by submitting it to the action of chlorine-gas. Conducted in this way, the reaction takes place in a different manner from that described by Wurtz, who, pouring an excess of aldehyde into large vessels filled with chlorine, obtained chloride of acetyle and its compound with aldehyde. Neither of these substances has been obtained by Messrs. Krämer and Pinner. Nor is ordinary chloral obtained by this reaction, the aldehyde being entirely converted into the chloral of the condensed aldehyde, C_4H_6O, known as crotonic aldehyde. Crotonic chloral is a liquid, boiling at 165°, and forming with water, but not with alcohol, a crystalline compound. By oxydation it forms trichlorocrotonic acid. Caustic potash transforms it into the corresponding chloroform $C_3\ H_3Cl_3$ and its derivative $C_3\ H_2\ Cl_2$ (bichlorinated allylene?) boiling at 78°.—C. Martius has studied the combinations of chloral with alcohols. Amylic alcohol forms with it a beautifully crystallised compound. Mercaptans also combine with chloral.—F. Rüdorff communicated a method of determining with great exactness the quantities of pure glacial contained in acetic acid of different degrees of concentration. It is founded on the melting-points of pure acetic acid (16°·7 C.) and its mixtures with water. Commercial glacial acetic acid contains often as much as 10 per cent. of water, and then melts at 10°·3 C., or even 15 per cent., and then melts at—0°·2.

DIARY

THURSDAY, MAY 12.

ROYAL SOCIETY, at 8.30.—On the Results of the method of investigating the Nervous System, more especially as applied to the elucidation of the Functions of the Pneumogastric and Sympathetic Nerves in Man: Dr. A. Waller (Croonian Lecture).

SOCIETY OF ANTIQUARIES, at 8.30.—On recent Discoveries at Rome: J. H Parker.

MATHEMATICAL SOCIETY, at 8.—Mechanical description of a nodal bicircular Quartic: Prof. Cayley.

ZOOLOGICAL SOCIETY, at 8.30.—Notes on some points in the Anatomy of certain Kingfishers: Dr. Cunningham.—On the taxonomic characters afforded by the muscular sheath of the œsophagus in Sauropsida and other Vertebrates: Mr. George Gulliver.—Notes on the myology of *Platydactylus Japonicus*: Mr. Alfred Sanders.—On the Hirundinidæ of the Ethiopian region: Mr. R. B. Sharpe.

ROYAL INSTITUTION, at 3.—Electricity: Prof. Tyndall.

FRIDAY, MAY 13.

ROYAL INSTITUTION, at 8.—Descent of Glaciers: Rev. Canon Moseley.

ROYAL ASTRONOMICAL SOCIETY, at 8.

QUEKETT MICROSCOPICAL SOCIETY, at 8.

SATURDAY, MAY 14.

ROYAL INSTITUTION, at 3.—Comets: Prof. Grant.

MONDAY, MAY 16.

LONDON INSTITUTION, at 4.—Botany: Prof. Bentley.

TUESDAY, MAY 17.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Discussion upon Mr. Briggs paper on Rotary Fans.—On Recent Improvements in Regenerative Hot Blast Stoves for Blast Furnaces: Mr. E. A. Cowper.

ROYAL INSTITUTION, at 3.—Moral Philosophy: Prof. Blackie.

ANTHROPOLOGICAL SOCIETY, at 8.—Music considered as a Racial Characteristic: Mr. H. F. Chorley.

STATISTICAL SOCIETY, at 8.—On the incidence of Local Taxation in the United Kingdom: Prof. Thorold Rogers.

THURSDAY, MAY 19.

ROYAL SOCIETY, at 8.30.

SOCIETY OF ANTIQUARIES, at 8.30.

ROYAL INSTITUTION, at 3.—Electricity: Prof. Tyndall.

CHEMICAL SOCIETY, at 8.—On some Bromine Derivatives of Coumarine: W. H. Perkins, F.R.S.

BOOKS RECEIVED

ENGLISH.—Other Worlds than ours: R. A. Proctor (Longmans.)—A New Manual of Logarithms; Dr. Bruhns (Williams and Norgate.)—Donkin's Acoustics (Macmillan.)—Thorell on European Spiders, Part 1 (Williams and Norgate.)

FOREIGN (through Williams and Norgate).—Baron Von der Decken's Reisen in Ost-Afrika; 4ter Band, Die Vögel Ost-Afrikas.—Beiträge zur vergleichenden Anatomie und Histologie der Ohrtrompete: Prof. Ridinger.—Die Reinigung und Erwässerung der Stadt Heidelberg: Prof. Friedreich.—Deutsche Vierteljahrsschrift für offentliche Gesundheitspflege; 2er Band, 1tes Heft.—Baillon's Histoire des plantes, Papilionacées: Zeitschrift für Parasitenkunde, Vol. 1.—Untersuchungen aus dem Institute für Physiologie und Histologie in Graz: A. Rollett.—Etude préhistorique sur la Savoie: A. Perrin.—Die Fische Deutschlands und Schweiz: J. C. Weber.—Grundriss der Physiologie des Menchen: Dr. L. Hermann.—Annalen der Oenologie 1er Band 2tes und 3tes Heft.—Beiträge zur Anatomie und Physiologie: C. Eckkard.

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