SECTION C—Geology

On the Laurentian Beds of Donegal and of other Parts of Ireland, by Prof. Edward Hull, LL.D., F.R.S., &c., Director of the Geological Survey of Ireland.—After a perusal of the writings of previous authors, and a personal examination made in the spring of 1881, in company with two of his colleagues of the Geological Survey, Mr. R. G. Symes, F.G.S., and Mr. S. B. Wilkinson, the author had arrived at the following conclusions:—1. That the Gneissose series of Donegal, sometimes called "Donegal granite," is unconformably overlaid by the metamorphosed quartzites, schists, and limestones which Prof. Harkness had shown to be the representatives of the Lower Silurian beds of Scotland (*Quart. Journ. Geol. Soc.*, vol. xvii. p. 256). This unconformity is especially noticeable in the district of Lough Salt near Glen. 2. That the Gneissose series is similar in character and identical in position and age with the "Fundamental Gneiss" (Murchison) of parts of Sutherlandshire and Ross-shire, and is therefore, like the latter, presumably of Laurentian age. That the formation is a metamorphosed series of sedimentary beds, has been shown by Dr. Haughton and Mr. R. H. Scott. 3. That the north-western boundary of the Donegal gneiss is a large fault between the Laurentian gneiss and the metamorphosed Lower Silurian beds, owing to which the older rocks have been elevated, and by denudation have been exposed at the surface. 4. That the Cambrian formation of Scotland is not represented in Donegal, and that the unconformity abve referred to represents a double hiatus, and is of the same character as that which occurs in Sutherlandshire, in the district of Fornaven and Ben Arkle, where the Lower Silurian beds rest directly on the Laurentian gneiss. 5. That Laurentian rocks may be recognised in other parts of Ireland, as in the Slieve Gamph and Ox Mountains of Mayo and Sligo, at Belmullet, and in West Galway, north of Galway Bay, where the rocks consist of red gneiss, horneblende rock, and schist, &c., similar to those in Donegal; also possibly in Co. Tyrone, as suggested by Mr. Kinahan.

Laurentian Rocks in Ireland, by G. H. Kinahan, M.R.I.A., &c.—The writer first mentioned that Cainozoic and Mesozoic rocks only occurred in the province of Ulster, while in the rest of the island there was a nearly continuous sequence of Palæozoic rocks, proved by the work of Griffith, Jukes, and their subordinates, from the Coal-Measures down to the Cambrian. He then pointed out that a recent attempt had been made to try and disturb their natural order, but that the new theory was solely founded on assertions that would not bear investigation. He proceeded to observe that the geologists of the pre-Cambrian school appeared to lay more weight on lithological evidence than that to which it was entitled, and in continuation he gave the localities for the oldest rocks in Ireland, with the reasons for and against the rocks being Laurentian. The localities are *Carngore*, or South-East Wexford, while it was shown that although the rocks were lithologically similar to the Laurentians, yet they contained Cambrian fossils—*Galway, South-East Mayo, Sligo, and Leitrim*—rocks that, from their lithological characters, were said to be Laurentian by Murchison, who recanted his statement when Harkness showed that stratigraphically this was an impossibility. These rocks occur on two zones, those on the highest being now said to be Laurentian—*Erris, North-West Mayo*—very old rocks, about which nothing can be positively said, except that they are older than the associated metamorphic rocks, also of uncertain age. *Donegal, Londonderry, and Tyrone*—the Laurentian age of some of these, years ago, was suggested by Jukes, while now it is positively asserted, but solely on lithological characters. The author pointed out that, although lithologically very like Laurentians, they were more like Huronians, Logan's description of the latter being very suitable for those of Donegal. He also pointed out that it was unnecessary to make vague assertions, as the stratigraphical position of the rocks ought to be easily worked out, either by starting from the Pomeroy fossiliferous rocks, or from the fossiliferous rocks found in Donegal by Dr. King; but that, at the same time, the work must be much better and more correctly done than that in the neighbourhood of Pomeroy, where the unaltered fossiliferous beds are classed with those they lie on, although the latter were extensively metamorphosed, contorted, upturned, and denuded, prior to the fossiliferous rocks being deposited on them. *North-East Antrim*-rocks, supposed to be of the same age as the older rocks near Pomeroy (*Upper Cambrians*).

On the Occurrence of Granite in situ about Twenty Miles South-West of Eddystone, by A. R. Hunt, M.A., F.G.S.—The author described and exhibited a fragment of granite brought up by a Brixham trawler twenty miles south-west of the Eddystone. He believed it to have been torn off a mass of granite *in situ*, and pointed out that in mineral composition it agreed with the gneisses of the Eddystone Reef and of the Shovel Reef in Plymouth Sound—all these rocks being composed of mica, quartz, and felspar, without hornblende or schorl. The author believed that the occurrence of gneiss in Plymouth Sound without altering the adjacent Devonian rocks was an indication that these Channel typical gneisses, and probably the typical granites too, were of pre-Devonian age.

Some Observations on the Causes of Volcanic Action, by J. Prestwich, M.A., F.R.S., &c., Professor of Geology in the University of Oxford.—The hypothesis generally accepted in this country as to the cause of volcanic action is that of the late Mr. Poulett Scrope, who considered that "the rise of lava in a volcanic vent is occasioned by the expansion of volumes of high-pressure steam, generated in a mass of liquefied and heated matter within or beneath the eruptive orifice," and that the expulsion of the lava is effected solely by high-pressure steam generated at great depths, but at what depths is not mentioned, nor is it explained how the water is introduced, whether from the surface, or whether from water in original combination with the basic magma. The objections to this hypothesis are—1. That during the most powerful explosions, *i.e.*, when the discharge of steam is at its maximum, the escape of lava is frequently at its minimum. 2. That streams of lava often flow with little disengagement of steam, and are generally greatest after the force of the first violent explosion is expended. 3. That it is not a mere boiling over, in which case, after the escape of the active agent—the water—and the expulsion of such portion of the obstructing medium, the lava, as became entangled with it, the remaining lava would subside in the vent to a depth corresponding to the quantity of lava ejected; but the level of the lava, *cæteris paribsu*, remains the same during successive eruptions. Of the important part played by water in volcanic eruptions there can be no doubt, but instead of considering it as the primary, the author views it as secondary cause in volcanic eruptions. All agree in describing ordinary volcanic eruptions as generally accompanied or preceded by shocks or earthquakes of a minor or local character, to which succeed paroxysmal explosions, during which vast quantities of stones, scoriæ, and ashes, together with volumes of steam, are projected from the crater. The first paroxysms are the most violent, and they gradually decrease and then cease altogether. The flow of lava, on the other hand, which commences sooner or later after the first explosions, is continued and prolonged independently. Ultimately the volcano returns to a state of repose, which may last a few months or many years. Adopting the theory of an original igneous nucleus, the author considers a certain fluidity of the former, and mobility of the latter. The one and the other feebly represent conditions of which the phenomena of the rocks afford clearer and stronger evidence as we go back in geological time. Although thermometrical experiments, of the necessary accuracy and length of time, are yet wanting, it has been estimated that a small quantity of central heat still reaches the surface and is lost by radiation into space, and the escape of liquid lava and steam from volcanoes, and of hot springs from these and other sources, must bring, in however small a quantity, a certain increment of heat from the interior to the surface, where it is lost. This should lead to a certain contraction at depths, and of readjustment of the external crust, in consequence of which the fused masses of the interior will from time to time tend to be forced outwards, whenever tension became sufficient to overcome resistance. In this the author agrees with many other geologists. The further hypothesis respecting volcanic action, he now suggests, he has been mainly led to form by his researches on underground waters. A portion of the rain falling on the surface not only of permeable and fissured sedimentary strata, but also of fissured and creviced crystalline and other rocks, passes below ground, and is there transmitted as far down as the permeable rocks range, or as the fissures in the rocks extend, unless some counteracting causes intervene. Those causes are the occurrence of impermeable rocks, faults, and heat. The former two are exceptional, the latter constant. The increase of temperature with depth being 1° Fahr. for every 50 to 60 feet, the boiling point of water would be reached at a depth of about 10,000 feet, but owing to the pressure of the superincumbent rocks, it has been estimated that water will retain its liquidity and continue to circulate freely to far greater depths. Unfortunately, very little is known of the substrata of volcanoes. Etna and Hecla apparently stand on permeable Tertiary strata, Vesuvius on Tertiary and Cretaceous strata, while in South America some of the volcanoes are seemingly situated amongst palæozoic and crystalline rocks. Under ordinary circumstances all the permeable strata and all fissured rocks become charged with water up to the level of the lowest point of escape on the surface, or if there should be an escape in the sea-bed, then to that level, *plus* a difference caused by friction. The extreme porosity of lavas is well known. All the water falling on the surface of Etna and Vesuvius (except where the rocks are decomposed and a surface soil formed) disappears at once, passing into the fissures and cavities formed by the contraction of the lava in cooling. Not only are these fissures filled, but the water lodges in the main duct itself, and occasionally rises to a height to fill the crater. Beneath the mass of fragmentary and cavernous volcanic materials forming the volcano, lies the original compact mass of sedimentary strata, &c. Owing to the fortunate circumstance of an Artesian well having been sunk at Naples, we know the underlying sedimentary strata there to consist of alternating strata of marl, sands, and sandstones, some water-bearing, others impermeable. The water from the lowest spring reached in this boring rose at first 8 feet above the surface, and 81 feet above the sea-level. Where the strata crop out in the sea-bed, the same pressure of the column of inland water forces the fresh water outwards, so as to form a freshwater spring in the sea, as at Spezzia and elsewhere on the Mediterranean coast. It is this fundamental hydrostatic principle which keeps wells in islands, and in shores adjacent to the sea, free from salt water, as in the Isle of Thanet. Where, however, the head of inland waters is small or impeded, sea-water will enter the permeable strata, and spoil the springs, as in the case of the Lower Tertiary sands at Ostend, and the Lower Greensand at Calais and in the Somme, in which latter department the underground spring was found affected to a distance of about one mile from the sea, but pure at a distance of nine miles. Further, if where the head of inland water is sufficient to force back the sea-water under ordinary conditions, those ordinary conditions are disturbed by pumping to an extent that lowers the line of water-level to below that of the sea-level, then the sea-water will flow inwards until an equilibrium is established. The flow of water under a volcanic mountain may be also influenced by the quaquaversal dip, which there is some evidence that the underlying strata there take, owing probably to the removal of matter from below, and the weight of the mountain. If we are to assume that the volcanic ashes and tufas below Naples are subaërial, the original land-surface has sunk not less than 665 feet, and a dip of the underlying strata from the seaward, as well as from inland, has in all probability been caused. This Artesian well was carried to the depth of 1524 feet, and passed through three water-bearing beds—one in the volcanic ashes, the second in the sub-Apennine beds, and the third in the Cretaceous strata at the bottom. No eruption of lava can then take place without coming in contact with these underground waters. The first to be affected will be the water in the cavities of the mountain in and around the crater. As the pressure of the ascending column of lava splits the crust formed subsequently to the preceding eruption, the water finds its way to the heated surface, and leads to explosions more or less violent. When the fluid lava breaks more completely through the old crust, and the mountain is fissured by the force and pressure of the ascending column, the whole body of water stored in the mountain successively flows in upon the heated lava, and is at once flushed off into steam. Then take place those more violent detonations and explosions—those deluges of rain arising from the condensed steam—with which the great eruptions usually commence. In conclusion, the author conceives that the first cause of volcanic action is the welling up of the lava in consequence of pressure due to slight contraction of a portion of the earth's crust. Secondly, the fluid lava coming into contact with water stored in the crevices of the masses of lava and ashes forming the volcano, the water is at once flushed into steam, giving rise to powerful detonations and explosions. Thirdly follows an influx of water from the underlying sedimentary or other strata lying at greater depths into the ducts of the volcano; and, lastly, as these subterranean bodies of water are thus converted into steam and expelled, the exhausted strata then serve as a channel to an influx of sea-water into the volcano. A point is finally reached when, owing to the cessation of the powerful shocks and vibrations, and the excessive drainage of the strata, the flow of the lava is effected quietly, and so continues until another equilibrium is established and the lava ceases to escape.

The Connection between the Intrusion of Volcanic Action, by Prof. W. J. Sollas, M.A.—In a volcanic eruption there are concerned first the elevation of the lava column in the axial pipe of the volcano, and next the explosion by which the lava is ejected into the air. The author attempts to find a *vera causa* for the latter. Sorby's researches on included cavities prove that steam at a high tension must have been everywhere present throughout plutonic rocks when these were in a state of fusion, and the presence of steam in ejected lava is well known. He considers it probable that the axial pipe of a volcano is occupied by fused rocks permeated by steam, which is probably in a liquid state, and the tension of which will depend on the hydrostatic pressure due to the lava column above it. Any sudden diminution of this pressure will tend to a sudden expansion of the steam, and tend to produce a volcanic explosion. The mere elevation of the lava in the volcanic pipe cannot directly produce a diminution of pressure, though an overflow at the surface of the ground would, but this infers that the overflow of lava should precede an eruption, which is not the case; hence the author concludes that an overflow of lava from the sides of the pipe and other places underground, and the pressure on the lava column being reduced beneath the point of overflow, an eruption follows. The ascendant pressure of intruded sheets and dykes of igneous rock known to occur beneath volcanic cones thus stands in close connection with the production of volcanic explosions.

A Restoration of the Skeleton of Archæopteryx, with some Remarks on Differences between the Berlin and London Specimens.—Prof. H. G. Seeley, F.R.S., traced the forms of the bones from a photograph, and arranged the skeleton so as to represent a bird which stood about ten inches high. The head has a post-occipital process in the cormorants; the neck is curved forward; the tail reached almost to the ground; and the limbs were exactly as in birds.

On Simosaurus pusillus (Fraas), *a Step in the Evolution of the Plesiosauria.*—Prof. H. G. Seeley gave a detailed description of the skeleton of Simosaurus recently discovered in the Trias near Stuttgart, and briefly noticed and figured by Dr. Oscar Fraas. He then drew special attention to the difference from Plesiosaurus, especially in the form of the pectoral arch and in the characters of the fore and hind limbs. The hind limb was discussed, to show how it might assume like character with the fore limb. Prof. Seeley concluded that the Plesiosaurus were originally land animals, and that their ancestors and affinities must be sought in Simosaurus, Nottrosaurus, and allied types of amphibious Triassic reptiles.

Influence of Barometric Pressure on the Discharge of Water from Springs, by Baldwin Latham, M.Inst.C.E.—The author of this paper mentioned that it was alleged, by some of the long-established millers on the chalk streams, that they were able to foretell the appearance of rainfall from a sensible increase in the volume of water flowing down the stream before the period of rainfall. He had, therefore, undertaken a series of observations to investigate the phenomena, and he found, in setting up gauges in the Bourne flow in the Caterham Valley, near Croydon, in the spring of this year (1881), and selecting periods when there was no rain to vitiate the results, that whenever there was a rapid fall in the barometer, there was a corresponding increase in the volume of water flowing, and with a rise of the barometer, there was a diminution in the flow. The gaugings of deep wells also confirmed these observations; for where there was a large amount of water held by capillarity in the strata above the water-line, at that period of the year when the wells became sensitive and the flow from the strata was sluggish, that a fall in the barometer coincided with a rise in the water-line, and that under conditions of high barometric pressure the water-line was lowered. Percolating gauges also gave similar evidence, for after percolation had ceased and the filter was apparently dry, a rapid fall of the barometer occurring, a small quantity of water passed from the percolating gauges. The conclusion arrived at was, that atmospheric pressure exercises a marked influence upon the escape of water from springs.

On Evaporation and Excentricity as Co-factors in the Causes of Glacial Epoch, by the Rev. E. Hill, M.A.

On some Points in the Morphology of the Rhabdophora, by John Hopkinson.—The author, after reviewing the characteristics of the group, concludes from his investigation into the morphology of this group that they are the Palæozoic representatives of the recent Hydroida.

The Glacial Deposits of West Cumberland, by J. D. Kendall, C.E., F.G.S.—The extent, form, and inner nature of these deposits is first described; a number of new and important facts being brought forward on the distribution of boulders both in the boulder clays and in other glacial deposits. The conclusions arrived at from the facts are (1) that the boulder-clays were formed in the sea, partly by glacier action and partly by icebergs. The occurrence of boulders from distant localities, often in very different directions, in a matrix partaking of the character of the underlying rocks, is explained in an entirely new way. 2. That the middle sands and gravels are the result of marine and river action combined. 3. That the mounds of sands and gravels occurring in the mouths of valleys were accumulated by floating ice from pre-existing deposits. A somewhat novel explanation is given of the occurrence of boulders on higher levels than the rocks from which they were derived.

On "Flots," by J. R. Dakyns, M.A., Geological Survey of England and Wales.—The word "flot" is a miner's term for ore lying between the beds, or at certain definite horizons in the strata. In text-books flots are generally called "flats" or "flattings." They are of two kinds: (1) those connected with "cross-veins"; (2) those connected with courses of dun limestone. Firstly, cross-veins are veins (generally mere spar veins on Greenhow Hill) which cross and intersect or shift the metal veins, but which often bear ore at their intersection with the metal veins. Where these cross-veins cut the flot planes, ore is found. Secondly, similarly with courses of dun limestone. Dun limestone, so-called from its colour, is a dolomitised form of ordinary limestone. The dun lime occurs in beds or irregular masses, or more frequently in dyke-like courses, running north-north-west and south-south-east. These courses are often several yards or even fathoms wide, and where the dun course crosses the flot plane ore is developed along the joints between the dun and the white limestones. Ore is not found along the flot plane except at its intersection with the cross-veins or with the courses of dun limestone.

On the Lower Cambrian of Anglesea, by J. McK. Hughes, Woodwardian Professor, Cambridge.—In this paper the author gives the results of further examination of the basement beds of the Cambrian, which he has now traced all along the north-west flank of the Archæan axis of Llanfaelog. The sequence he found almost invariably was in ascending order:—(A) Quartz conglomerate passing up into (B) grit, which in turn becomes finer, and passed into (C) sandstones weathering brown, which got split up in their upper part by thin slabby shales; (D) black shales with subordinate beds of black (D 2) breccia, and occasionally sandstone in the lower part.

On the Gnarled Series of Amloch and Holyhead in Anglesea, by T. McK. Hughes, Woodwardian Professor, Cambridge.—The author offers the results of his inquiries into the age of certain schists which form the main mass of the rocks of northern and Western Anglesea, leaving for the present the consideration of the masses of somewhat similar rock which occur south of the Llanfaelog gneissic axis in the central and south-east part of the island. The author believes these felspathic gnarled rocks must be either the marine equivalents of the Bala volcanic series, or the result of a later (probably Silurian) denudation of those beds. As Lower May Hill (= Birkhill) fossils only occur in the slates immediately south of the area in question, the latter supposition is the only one tenable in the present state of the evidence.

Notes on the Subsidences above the Permian Limestone between Hartlepool and Ripon, by A. G. Cameron, Geological Survey of England and Wales.—In this paper attention is drawn to the numerous forms of shrinkages of the land-surface, often extending to considerable depths into the rocks beneath, observable over the top of the Permian rocks betwixt Hartlepool and Ripon. As a general explanation of their origin, it is suggested that where the underground water, flowing over the limestone surface, reaches the margin of the sandstone, it receives a check whereby it accumulates, forming a chain of dams or pools along the line of junction of these rocks. As denudation proceeds, hollows form above, until ultimately the phenomena of the pits appear. This being so, "the water bubbling and frothing all over" is explained without calling in the aid of river-action. Allusion is made to the Home Farm Colliery accident at Hamilton, N.B., in February, 1877, through a subsidence in the gravelly alluvium of the Clyde; also to the recent subsidences at Blackheath, near London, and to the extensive caverns in the hematite districts of Furness.

The Great Plain of Northern India not an old Sea-Basin, by W. T. Blanford, F.R.S.—The author described the distribution of land in the Indian Peninsula and the intervention of a vast plain traversed by the Indus, Ganges, and Brahmaputra. This plain has constantly been considered, both by geological and lithological writers, as the basin of a great sea; but on examining the evidence, there does not appear to be a single fact in favour of the sea having at any geological period occupied the Gangetic or eastern position of the plain. The tract is evidently an area of depression filled up to above sea-level, through a long period of geological range of time.

The Gold-Fields and the Quartz Outcrops of Southern India, by William King, Deputy-Superintendent (for Madras), Geological Survey of India.—The paper is a *résumé* of the knowledge ascertained through the author's original survey of the Wainád gold-field in 1874 and by the later surveys and examinations of others; also in his examination of the Travancore and other areas in the beginning of the year. The geographical distribution of the gold areas is briefly treated of as being at Manyapet, on the Godávari River, near Dûmbal, in the South Mahratta country, near Kolár in Mysore, at Salem, in part of the Travancore State, and in the Nilgiri and Malabar country; and these are reduced to the more important fields of Malabar (including Wainád, and the Nilgiris) and Mysore. The reefs of Wainád are developed to a remarkable extent over a very large area of country; but their gold-bearing quality is only displaced over a portion of this, chiefly in the south east of Wainád and in the adjacent low country of Malabar, in a generally east and west belt, the reefs outside of this being fewer and only very locally auriferous. The "leaders" or offshoots of the reefs in this belt are strongly and numerously developed, and they and the "casing" are rich in gold. The author expects the gold-yield to be seven pennyweights to the ton. He does not think that a paying return can be obtained on less than three pennyweights of gold to the ton.

Geology of the Island of Cyprus, by R. Russell, C.E.—The author described the physical features of the island as consisting of two great mountain chains, the axes of which are mainly parallel to each other, distinct from each other in structure and in physical matter. The southern range, rounded in outline, rises to 6340 feet; the northern range rises up from hummocky ground, on both sides, as it were, in one great continuous wall-like cliff. The central area consists of flat-topped irregular hills rising abruptly from the low ground, and therefore show more prominently than they would otherwise. The rocks which occur may be classified as follows:—

Post-Tertiary.	Blown sand.	
	Alluvium (vent).	
	Kavara (solidified surface).	
	Raised beach.	
	Sand and gravel (old river deposits).	
	Calcareous tuff and travertine.	
Tertiary.	Pliocene	Kerynia rock.
		Nicosia beds.
	Miocene	Idalian beds.
Secondary	Upper Cretaceous.	Konnos.
	Jurassic	Mount Hilarion limestone.
	Igneous rocks.	

The last upheaval of the island took place in a comparatively recent period, and was not more than fifteen or twenty feet in vertical height.

On some Sections in the Lower Palæozoic Rocks of the Craven District, by J. E. Marr, B.A., F.G.S.—The author showed by means of a thin band containing *Phacops elegans*, Boeck and Sars, that a series of beds consisting of pale green shales, underlain by black shales, passing below into a conglomerate which rested unconformably upon the Bala beds (the whole exposed in Austisich Beck, near Settle), were the equivalents of the Stockdale shales of the Lake District, and of the May Hill beds of the Continent. The beds are lithologically similar to those of the Lake District, and, like them, are surmounted by blue flags containing *Monograptus priodon* and *M. vomerinus*.

Life in Irish and other Laurentian Rocks, by C. Moore, F.G.S.—The author drew attention to certain forms found by a microscopic examination of specimens of certain Laurentian and other Palæozoic limestone prepared by trituration, solution in acid, and washing. These forms were clearly those of organic structures, some apparently hairs and other feather barbs. The author considered that he had taken precautions to eliminate sources of error, through admixture of foreign materials, and he was led to think that the organisms belonged to the rocks.

The Subject-matter of Geology and its Classification.—Prof. W. J. Sollas, M.A., stated his object was to remove certain prevailing misconceptions as to the aim and scope of geology. The accepted definition of geology as "the history of the earth's crust and the fossils it contains," was considered to be both too wide and too narrow; the former since it includes palæontology, which, so far as it is a study of forms of life, belongs to biology; and too narrow, since the science of the whole, necessarily embraces much more than a study of its crust. Geology is one of the group of concrete sciences which include astronomy, geology, and biology. The scope of geology, or the science of the earth, is so wide, that a fresh classification of its subject-matter is required, and the author proposes *Morphological Geology*:—embracing geography, petrology, lithology, and mineralogy corresponding to anatomy and histology in biology; minerals, rocks, rock masses, constituting the earth's crust as cells, tissues, organs constituting living organisms, while palæontology is a study of successive morphological states, corresponding to embryology or development. *Physiological Geology*, considering the movement of the earth as a whole, and of all activities produced upon it, by extrinsic and intrinsic forces, acting singly or in combination; it rightly includes meteorology, hydro-geology, as well as the physiology of the earth's crust. *Distributional Geology* seeks to determine the distribution of the earth in time and space, and *Otiological Geology* corresponds roughly to what is known as cosmogony.

Exploration of a Fissure in the Mountain Limestone at Raygill, by James W. Davis, F.G.S.—Attention was first called to this fissure by Mr. Tiddeman about eight years ago. It occurs in a quarry in Lothersdale, about five miles from Skipton. The mouth of the cavern is blocked with glacial drift; under this occurs a finely laminated clay, beneath which is a brown sandy clay with well-worn boulders. The fissure, when excavated, proved to be forty feet in length, horizontal, with a second branch, both of which are abraded and smoothened by the action of running water. Contains bones of *Elephas*, teeth of *Hippopotamus*, *Rhinoceros leptorhinus*, remains of the roebuck and hyæna, and one or two teeth of lion, and a single tooth of bear.

On the Zoological Position of the Genus Petalo-rhynchus, Ag., *a Fossil Fish from the Mountain Limestone*, by J. W. Davis.—The species described resemble genera *Janassa*, Munst., and with it appear to occupy an intermediate position between the genera *Myliobatis* and *Cestraciontes*.

On Diodontopsodus, Davis, *a New Genus of Fossil Fishes from the Mountain Limestone at Richmond in Yorkshire*, by James W. Davis, F.G.S.—These teeth resemble those of the modern fish Diodon.

Preliminary Remarks on the Microscopic Structure of Coal from East Scotland and South Wales, by Prof. Williamson, F.R.S., Owens College.—This subject will not be worked out until ten years, but he described layers of vascular tissue which can be separated layer by layer, while in other cases the charcoal layer on the surface of the coal and the organic structure is not capable of separation, and he stated that charcoal contains a tubular structure, like tissues of ordinary bark. The association of tissues resembles that of Cycadian plants; and referred to the genus *Cordaites* having been proved to belong to this group by M. Renault; the author has made nearly a thousand distinct observations on the structure of coal. Separates ordinary coal with large quantities of mineral charcoal, with macrospores of Lepidendroid plants filled up with myriads of microspores which were certainly not floated to the spots, from the *paraffine coals* which do not contain these large macrospores. He divides coals into "Iso-sporous" coals and "Heterosporous" coals; both abound in *Cordaites*, which form the mineral charcoal.

On an International Scale of Colours for Geological Maps, by W. Topley, Geological Survey of England.—The author described the objects of the International Geological Congress which is to meet at Bologna this month. Three main subjects are there to be discussed, (*a*) colours and signs for geological maps, (*b*) nomenclature of rocks and formations, (*c*) nomenclature of species. This paper is concerned only with the first of these questions, and especially with the resolutions passed by the English Map Committee, of which Prof. Ramsay is president, and the author secretary. At present all countries and many map-makers in each country have different systems of colouring maps, and it is necessary carefully to study the index, or scale of colours used, before the map can be at all understood. The Congress proposes to frame some scheme of colouring which can be used and readily understood by all nations. It may not be possible, at least for some time to come, to obtain any alteration in national surveys in progress. But it is to be hoped that in new small-scale maps the scheme to be decided on will be adopted. One important point which the Congress proposes is the preparation and publication of a general map or atlas of Europe, compiled under the authority of the Congress, from the various national surveys and the work, of independent observers. The scheme of colouring proposed is one based on the order of colours in the solar spectrum, violet denoting the older rocks. Bright reds are reserved for igneous rocks; metamorphic rocks will be shown by dark bands of colour over the colour denoting the age; to these will be added bands of colour showing the period at which metamorphism has taken place, when such fact is clearly established: thus, Silurian rocks metamorphosed in Cretaceous time would be shown by violet striped with alternate lines of dark violet and green. The sub-divisions of a formation will be shown by shades of the body colour, the darkest shade denoting the oldest subdivision. The letter denoting the formation will be the capital initial letter of the name of the formation; with very small arrangements one system of lettering can be made to apply to all countries. It has been found impossible to adhere strictly to the order of colours of the spectrum, and an interpolation has been made of browns and greys for the series of beds between the Silurian and the Lias. Examples of maps and tables of strata coloured according to the plan adopted were exhibited, as were also a series of Indexes of Colours issued at various dates by the Geological Survey, commencing with one in MS. by Sir H. de la Bêche in the year 1832. The author also drew attention to a proposal made by Mr. J. W. Salter before this Association in 1847, and again at the International Exhibition in 1862, to colour geological maps in the order of colours of the solar spectrum. The plan recommended by the English committee differs considerably in detail from that of Mr. Salter.

On the Rhætics of Notts, by E. Wilson, F.G.S.—The author gave a summarised account of the Rhætic series in Nottinghamshire. The Rhætic sections of this district already known to geologists comprise those at Gainsboro', Newark, and Elton. The author described several additional new sections in the Rhætics of the county—viz. at Cotham and Kilvington between Newark and Bottesford; at Barnstone, between Bingham and Stahern; the boring for coal at Owthorpe, near Colston Bassett; and the section at Stanton-on-the-Wolds, between Nottingham and Melton Mowbray. A list of the Rhætic fossils of Notts was given, and the presence of bone-beds noticed. The author could not agree with certain geologists that the green marls which are found beneath the Paper shales in Notts (nor probably also the "Tea-green marls" of the West of England) belong to the Rhætic series, but took them to be Upper Keuper marls, once red in colour, which had become discoloured by some deoxidising agent, probably carbonic acid evolved during the decomposition of the organic matters of the fossils of the Paper shales. For, in lithological character the green marls agreed with underlying beds in the Keuper, but differed markedly from the overlying Rhætics; then there was every appearance of a passage between the green marls and the underlying red and green marls of the Keuper; and, lastly, the green marls, like the rest of the Keuper marls, were practically unfossiliferous, while with the commencement of the Paper shales we get the remains of an abundant and distinctly marine fauna, in part Liassic.

Notes on the Cheshire Salt-Field, by C. E. De Rance, F.G.S., of H.M.'s Geological Survey.—The author described the brine-springs of the Keuper marls in Cheshire and part of Shropshire as having been derived from rainfall absorbed at the line of the original outcrop of the beds of thick rock-salt, which is represented by a porous bed. These waters flow out by pressure in various natural springs, and are bored into by the wells or artesian shafts of the brine-pumpers. The natural solution of the rock-salt has caused the characteristic subsidences that occur in the district. Northwich subsidences, however, have been chiefly caused by bad mining.

On the Strata between the Chillesford Beds and the Lower Boulder Clay. "*The Mundesley and Westleton Beds,*" by J. Prestwich, M.A., F.R.S., Professor of Geology in the University of Oxford.—The beds between the Chillesford Clay and the Lower

Boulder Clay present such a series. Its exhibition on the coast of Norfolk, although very limited, is accompanied by special palæontological features that have caused it to be divided into the number of local beds which have been described by Trimmer, Green, Gunn, Wood, and Harmer, the author, Reid, Blake, and others. It includes the "Laminated Clays" of Gunn, the "Bure Valley Crag" of Searles-Wood, the "Westleton Shingle" of the author, and the "Rootlet-bed" and "Norwich Series" of Blake. Without reverting at present to the exact correlation of the several beds in the Norfolk area, respecting which there is still some difference of opinion, the author suggests that they should be included under a general term founded on the localities where, on the one hand, their varied palæontological characters are exhibited, and on the other where their peculiar petrological characters are well marked—characters which the author proposes to show, in another paper, have a very wide range, and serve to mark an important geological horizon in some interesting questions of local physical geology. The Mundesley beds were described by the author in 1860, and consist of alternating beds of clay, sands, and shingle, some containing freshwater and others marine mollusca, with a forest-growth and mammalian remains at their base; and again in 1871, including them in his Westleton group (No. 5 in the author's sections), which he showed to consist entirely of great masses of well-rounded shingle, with intercalated seams containing traces only of marine shells. Seeing the inconvenience of attaching the same term to the two very distinct series of beds, and that it may conflict with other local terms, the author now proposes to group this series under the term of "The Mundesley and Westleton Beds," indicative of their stratigraphical position in Norfolk, and of characters in Suffolk which serve to trace them in their range westward and inland to considerable distances beyond the Crag area, to which alone these beds have hitherto been restricted. At the same time it may be convenient, for brevity, to use one term only in speaking of typical cases.

On the Upper Bagshot Sands of Hordwell Cliff, Hampshire, by E. B. Tawney, M.A., F.G.S.—The descriptions of former writers having been cited, it was found that there were two main views regarding the affinities of these sands, which occur in the cliff between Long Mead End and Beacon Bunny. The view formulated by the distinguished foreign geologists, D'Archiac, Dumont, Prof. Hebert, and Prof. C. Mayer, is that they are parallel to the upper sands of the Beauchamp (= Barton) period, and allied, therefore, to the marine Barton beds. This view is much the same as that of E. Forbes, and the Geological Survey, who called them the Upper Bagshot Sands. Latterly Prof. Judd has sought to revive the term Headon-Hill Sands for them, presuming them to be most nearly connected with the Headon series, and extending the bounds of that series to receive them. The author now gives a list of twenty-eight species obtained from the bed at Long Mead End; of these 35 per cent. are common to the sand and the Barton beds, but do not occur in the Headon series; while only 21·4 per cent. are common to the sand and Headon series, but do not occur in Barton beds. It is shown that this sand belongs to the zone of *Cerithium pleurotomoïdes*, Lam., and is exactly parallel to the sands of Mortefontaine, which belong to the same horizon, constituting the upper portion of the Beauchamp deposits. This is altogether below the *C. concavum* zone. From these sands being intimately connected with the Barton beds in both areas, it is held that the term Upper Bagshot is the most fitting designation that has been proposed for them.

NOTES

THE Emperor of Germany has, by Imperial Decree dated June 1, 1881, awarded the Gold Medal of Merit for Agriculture to Mr. Lawes and Dr. Gilbert jointly, in recognition of their services for the development of scientific and practical agriculture.

THE death is announced, at the age of sixty-two years, of Mr. Frederick Currey, F.R.S., F.L.S. Mr. Currey was well known as a botanist, and was secretary to the Linnean Society from 1860 to 1880. It is stated that Mr. Currey has left his valuable collections of fungi to Kew.

THE honour of knighthood has been conferred upon Dr. G. C. M. Birdwood, C.S.I., of the India Office; and also upon Dr. John Kirk, H.M. Political Agent and Consul-General at Zanzibar, well known as the friend of Livingstone, and naturalist to his second exploring expedition, and as having done so much to promote African exploration.

THE Sedgwick Memorial Fund (Cambridge) now amounts from subscriptions and interest to more than 14,000*l*., but this sum is not sufficient to build the new geological museum which it has been decided to erect in honour of the late professor. As, however, the present museum was built partly by subscriptions collected mainly through the exertions of Prof. Sedgwick, with a view to the erection of a geological museum, as well as of the library and other University buildings, the value of the portion occupied by the present museum should be taken into account in estimating the sum available for the new memorial building. An architect has been consulted as to the possibility of erecting a new geological museum and a chemical laboratory on the vacant space in front of the new museums and lecture-rooms facing Pembroke Street, but after examination of his plans and report it was found that the proposal could not be carried out, and it has consequently been decided to await the result of further negotiations for the purchase of the contiguous property. The recent acquisition by the University of some adjoining land will, it is hoped, diminish the difficulties now existing in the way of finding a suitable site for the erection of the new geological museum.

A LONG and interesting article in the *Daily News* of Tuesday describes the progress which has been made in carrying out the scheme of Mr. Holloway for the erection of a college for the education of young ladies. Mr. Holloway's endowment is of the amplest liberality; the building is all that could be desired, and is in a fair way of being completed; there is no danger of the institution becoming one for the benefit of the teachers and not of the students; the programme of education is meant to place science on a footing of absolute equality with learning. "The governing body will consist of twenty-one persons, to be appointed partly by the University of London, and partly by the Corporation of London, and it is stipulated that a certain portion shall always be women. Religious opinions are not in any way to affect the qualification for a governor. It is the founder's desire that power by Act of Parliament, Royal charter, or otherwise, should be eventually sought to enable the college to confer degrees after due examination; and that until such power is obtained the students shall qualify themselves to pass the Women's Examination of the London University, or any examination of a similar or higher character which may be open to women at any of the existing universities of the United Kingdom. The curriculum will not be restricted to subjects enjoined by any existing university. Instead of being regulated by the traditions and methods of former ages, the system of education will be mainly founded on studies and sciences which the experience of modern times has shown to be most valuable, and as best adapted for the intellectual and social requirements of students. The governors will therefore be empowered to provide instruction in any subject or branch of knowledge which shall appear to them, from time to time, most suitable for the education of women; and the curriculum of the college will not discourage students who may desire a liberal education apart from the Latin and Greek languages." All this is admirable, and we trust the spirit of the founder's wishes will be faithfully carried out. This building and the Sanatorium are not far from Virginia Water, and the total cost, with endowments, will probably amount to close upon a million.

IN connection with the Smoke Abatement Committee, an International Exhibition and trials of smoke-preventing appliances will be held in the East and West Arcades, and in buildings adjoining the Royal Albert Hall, at South Kensingto