

NOTICES OF MEMOIRS.¹

I.—ON FAULTS AS A PREDISPOSING CAUSE FOR THE EXISTENCE OF POT-HOLES ON INGLEBOROUGH. By HAROLD BRODRICK.

INGLEBOROUGH Hill consists of a large plateau of Carboniferous Limestone about 500 feet in thickness and capped by a cone of Yoredale rocks with a summit of Millstone Grit. On this plateau there are a large number of pot-holes or vertical shafts in the limestone: there are upwards of thirty of these at present known to exist, and it is probable that there are many more still covered with the deposit of glacial drift. Within the last few years many facts have come to light which prove that many, if not all, of the deeper pot-holes owe their existence to faults. Rift Pot, a pot-hole on the south-east side of the hill, was recently explored and found to extend to a depth of over 300 feet: the first portion consists of a vertical shaft 114 feet deep, the lower portion of which consists of a chamber 130 feet long and 25 feet broad; from the south end of this the pot descends for a distance of about 200 feet with a series of platforms of jambed stones wedged between the walls of a vertical fissure, finally ending in a short passage which at the end is waterlogged. The pot-hole at the surface takes the form of a fissure 60 feet long and from one to seven feet wide. At the northern end of this fissure, within a few feet of the moor level, the east wall is slickensided, and in the main chamber at the foot of the first shaft the east wall is also slickensided, over an area 50 feet in length and at least 20 feet in height. At the surface the slickensides occur along successive master joints, while those in the main chamber occur along another master joint at a horizontal distance of about 15 feet. These slickensides are horizontal, showing that the fault was one of horizontal displacement, and as a careful examination shows that the beds of limestone on either side of the upper part of the pot correspond, it is clear that no vertical movement accompanied the faulting. The slickensides near the surface are coated with clear crystals of calcite, which when removed leave the slickensides very clearly marked.

Only one fault is marked on the maps of the Geological Survey: this is a fault which runs from near Horton to God's Bridge, in Chapel-le-Dale. Along the line of this fault are several pot-holes, all of which have their longer axes in the direction of the fault. Sulber Pot, which is about 59 feet deep, and Nick Pot, which receives an inflowing stream, and has recently been explored to a depth of about 80 feet, exhibit no direct evidences of faulting; but Mere Gill, on the other hand, does. Mere Gill consists of a fissure, about 80 yards long, which is bridged in three places by rock. As a rule this fissure is filled with water to within 30 feet of the surface; in times of normal rainfall the water escapes through a tunnel below the water-level, which leads in a southerly direction (away from the valley); it then makes two vertical descents of 80 feet each and turns northwards to emerge in the valley near God's Bridge in the direct line of the fault. On the limestone, which is usually covered

¹ Abstracts of six papers read before the British Association, Section C (Geology), York, 1906.

by the stream falling into the pot, are crystals of calcite. These are very much water-worn, but clearly indicate the existence of a fault.

Gaping Gill consists of a vertical shaft, 365 feet deep, into which the waters of Fell Beck fall. At a depth of about 190 feet is a ledge some 12 feet wide: at this point a fault is very clearly to be seen; the fault has a downthrow of six feet to the south. The shape of practically all the pot-holes is a further indication that they have been formed as the result of faults: they are all much longer than they are wide, and thin out at each end into a narrow crack. It is also a noticeable fact that they occur in groups and in such positions that it would have been impossible for a stream to form more than one out of several.

II.—JURASSIC PLANTS FROM THE ROCKS OF EAST YORKSHIRE. By A. C. SEWARD, M.A., F.R.S.

Historical.—The work of Young and Bird, entitled "A Geological Survey of the Yorkshire Coast," was published at Whitby in 1822. William Bean, John Williamson, and William Crawford Williamson rendered excellent service in the early days of the geological exploration of the Yorkshire coast. Several specimens collected by local naturalists were sent to Adolphe Brongniart, and described by him in his "Histoire des Végétaux Fossiles," published in 1828. The publication in 1829 of "Illustrations of the Geology of Yorkshire," by J. Phillips, placed the geology of East Yorkshire on a sound scientific basis. Numerous species of Jurassic plants from the Yorkshire coast were figured and described in the "Fossil Flora of Great Britain," by Lindley and Hutton, which appeared in parts between 1831 and 1837. Important additions have been made to the knowledge of Yorkshire Jurassic plants by W. C. Williamson, Bunbury, Leckenby, Carruthers, Nathorst, and other writers.

Geological.—The East Yorkshire rocks of Lower Oolitic age may be said to consist of three important estuarine series, separated from one another by thin bands containing marine fossils. The majority of the plants have been obtained from the Lower Estuarine Series, which includes the famous plant-bed of Gristhorpe Bay.

Botanical.—I, **EQUISETALES**: *Equisetites columnaris* is one of the commonest and most characteristic plants of the Yorkshire flora. II, **FILICES**: the Ferns are represented by numerous species, including examples referred to the Cyatheaceæ, Osmundaceæ, Schizæaceæ, Dipteridinæ, and Matonineæ. III, **GINKGOALES**: the genera *Ginkgo* and *Baiera* are both represented by several forms. IV, **CYCADALES**: *Williamsonia*, *Nilssonia*, and *Otozamites* are the most conspicuous examples of this dominant class. V, **CONIFERÆ**: the conifers are less abundant than either the Cycads or Ferns, but the Araucariæ appear to have occupied a prominent position in the vegetation.

The author next gives an account of the composition of the Yorkshire Jurassic vegetation as compared with that of the floras of the same geological age in other parts of the world, and makes suggestions for future work.

III.—EXHIBITION OF A REMARKABLE FORM OF SODALITE FROM
RAJPUTANA. By T. H. HOLLAND, F.R.S.

NEARLY every discovery in the interesting family of nepheline syenites shows some feature of unusual interest amongst igneous rocks. The latest discovered occurrence of these rocks in India is remarkable for the presence of a form of sodalite which has the property, apparently unique amongst minerals, of rapidly changing colour in bright daylight from carmine to pale grey or colourless, and of slowly recovering its carmine colour when kept in the dark. The mineral with these peculiar properties was discovered by Mr. E. Vredenburg as a constituent of the pegmatitic veins in a nepheline syenite intruded into the Aravalli schist series of Kishengarh in Rajputana. Along the same belt the sodalite, intergrown with nepheline in the pegmatite veins, is of the common blue variety, and nothing unusual is shown by chemical analysis of either variety. The carmine colour disappears as rapidly on exposure to light in a moist atmosphere as in dry air, in the cold weather as rapidly as at higher temperatures, and under bright electric light as in daylight. The mineral has apparently no effect on a photographic plate, and is not noticeably radio-active. The reappearance of the carmine tint takes place in a few weeks in some specimens, but requires some months' concealment in the dark in others. No explanation has been offered so far to account for this remarkable phenomenon, and the specimens are now exhibited with the hope of obtaining suggestions for a systematic investigation of the mineral.

IV.—ON THE ORIGIN OF THE TRIAS. By Professor T. G. BONNEY,
Sc.D., LL.D., F.R.S.

THE three subdivisions of the Bunter, whether east or west of the Pennine Range, apparently unite to the south of it, and thin out as they approach the southern parts of Warwickshire, Staffordshire, and Leicestershire. Their equivalents are fairly well developed in Devonshire, but apparently thin out in a similar wedge-like manner towards the north and north-east, not reaching the Bristol Channel. The upper and lower members in the northern area are sandstones, generally red, often conspicuously current-bedded, but without pebbles, the grains being frequently wind-worn. The pebble-bed reaches a thickness of 1,000 feet near Liverpool—where, however, sand dominates over pebbles—is about 300 feet thick in the northern part of Staffordshire, and rather overlaps the Lower Bunter sand. The writer describes the lithological characters of the pebbles, and discusses the reasons for and against deriving them either from a southern or south-western source, like those in the Devon area, or from any region, either exposed or buried, in their more immediate neighbourhood, maintaining a northern origin to be the more probable. The Keuper group, both sandstones and marls, extended without interruption (except for the sea) from Devonshire to Yorkshire on the one hand, and Antrim on the other.

The author considers the Bunter to be fluviatile rather than lacustrine deposits, chiefly formed by large rivers. Two of these flowed from a mountain region, of which Scotland and the extreme north of Ireland are fragments, and a third from a similar region to the south-west of Britain. Deposits comparable with the Bunter, and especially the pebble-bed, may be found on the border of the Alps, and these rivers probably traversed (at any rate, early and late in the Bunter epoch) arid lowlands, from which, if not absorbed, they may have escaped by some channel now buried under south-eastern England. The Keuper sandstones, as he shows, indicate the setting in of inland sea conditions, the Red Marls being generally regarded as deposited in a great salt lake. These, like the clays of the Jurassic system, were probably derived from the mountain ranges, which had previously supplied sand and pebbles.

In fact, the physical and climatal conditions of the Trias—and the same perhaps may also be said of the Permian—were probably to some extent comparable with those now existing in certain of the more central parts of Asia, such as Persia or Turkestan.

V.—NOTES ON THE SPEETON AMMONITES. By C. G. DANFORD.

A RESIDENCE of several years in the neighbourhood of Speeton has enabled the author to collect many fossils from the clays and shales underlying the Chalk. With regard to the Ammonitidæ, his results confirm the general succession given by Pavlow and Lamplugh, and add some further information.

The lowest portion of the Kimmeridge Clay which the author has been able to examine in exposures on the shore contains numbers of ill-preserved ammonites of the square-backed *Hoplites* group; while the higher part contains forms of a different type, belonging to the round-backed *Perisphinctes* and allied genera.

In the lower part of the zone of *Belemnites lateralis* Ammonites are extremely rare, and the author has no fresh information to offer; but in the upper part they become plentiful. The very globose forms of *Olcostephanus* (*O. gravesiformis*, *Keyserlingi*, etc.) occur mainly in the bed D 3 of Mr. Lamplugh's classification, but are usually in bad preservation. The overlying bed, D 2, is perhaps the most interesting of the whole series; at its base both the *Olcostephani* and the *Hoplites* are very numerous, the former being often in the condition of imperfect phosphatic casts. Above this band the round-backed Ammonites entirely disappear, though *Belemnites lateralis* continues to be fairly abundant up to D 1.

It therefore appears that the southern *Hoplites* obtained full possession of the area earlier than their associated southern *Belemnites* of the *jaculum* type, although rare examples of these *Belemnites* occur in the clays below D 2.

The lower part of the zone of *Belemnites jaculum*, besides yielding many *Hoplites*, contains occasional Ammonites pertaining to the genera *Holcodiscus* and *Astieria* (of the *Olcostephani*), and also to other genera. The higher beds are occupied by *Olcostephani* of the

genus *Simbirskites*, but these beds have of late years been so poorly exposed that no further information can be given regarding the distribution of these forms.

In the zone of *Belemnites brunsvicensis* Ammonites only occur at the extreme base, where there are a few examples of one of the *Simbirskites*, and in its uppermost beds, where the genus *Hoplites*, represented by *H. Deshayesi*, reappears associated with forms of the genus *Oppelia*, the whole of the intervening deposits being apparently devoid of these fossils.

In the beds with *Belemnites Ewaldi*, which may prove to be a distinct zone between the *brunsvicensis* and *minus* zones, no Ammonites have as yet been detected, but in the *minus* zone *H. interruptus*, Brug., has been found.

The Criocerata have been found to exist in most, if not all, the deposits from the uppermost part of the *Belemnites lateralis* zone to the top of the *Belemnites brunsvicensis* zone, and are especially numerous about the middle of the *Belemnites jaculum* zone. They are, however, difficult to determine, being both fragmentary and ill-preserved.

The paper concludes with a list of the species of *Crioceras*, including those described in "Argiles de Speeton" and those met with by the author, and determined chiefly by Dr. A. von Koenen. This short list might, doubtless, be greatly extended by anyone conversant with the forms of this group.

VI.—NOTES ON THE GLACIATION OF THE USK AND WYE VALLEYS.

By the Rev. W. LOWER CARTER, M.A.

DURING a recent holiday the author was able to study the glacial deposits of the district to the north of the South Wales Coalfield. The gravelly deposits of Old Red Sandstone material which are characteristic of the valley of the Usk between Brecon and Abergavenny (see "Geological Survey Memoir") have been traced for some distance to the north-east of Brecon and up the valley of the Usk as far as Trecastle. Here the river breaks away from the old 'through' valley, which is continuous to Llandovery and rises in the Carmarthen Fans to the south. On the top of this red drift were found large numbers of erratics of volcanic ash and breccia, which the author supposes to have been derived from Ordovician outcrops to the west or north-west of the area in question. These blocks, which run up to two tons or more in weight, are found all down the Usk Valley below Trecastle, and over the col towards Llandovery, in the Gwyddrig Valley, as far down as 'Halfway.' The author has traced them on the flanks of the Brecon Beacon as high as Newadd (886 feet) and down to Talybont, where a large one was found close to the canal tunnel (400 feet). At Llangorse they form part of a moraine which dams back the drainage to form Llangorse Lake. They are found in large numbers at Talgarth, and were

traced up Cwm Pwll-y-wrach as high as the 800 foot contour. Numbers of smaller boulders were found mixed with Old Red Sandstone material in gravel deposits near Three Cocks Junction, a little stream revealing good sections in mounds of rearranged and roughly bedded drift deposits. No trace of these foreigners was found in the valley of the Wye from Builth Wells to Three Cocks, nor were any found in fine sections of Boulder-clay examined at Llandrindod Wells.

The author hopes to continue the investigation of these deposits, but believes that sufficient evidence has been collected to point to a local glacier at first in each of the valleys of the Usk and the Wye. The Usk glacier was fed from the Carmarthen and Brecon Fans, but appears to have been overridden subsequently by a stream of foreign ice from the direction of Llandovery, bringing the brecciated erratics and pressing down the valley to Llangorse, Talgarth, and Three Cocks. It is to the pressure of this foreign ice that he would attribute the overflow of the Old Red Sandstone drift by the Cray Valley, on to the Carboniferous rocks of Penwyllt, and up Dyffryn Crawnon and through the faulted gap of Nant Trefil into the Rhymney and Sirhowy valleys (as reported by the Geological Survey). Among the erratics of the Wye Valley were tough green grits, which were subsequently found quarried at Builth, but marked on the geological map as 'Greenstone.' Several interesting stream diversions, owing to accumulations of morainic material, were observed. Amongst the more important were the diversion of the Usk from a wide valley to a narrow gorge at Aberyscir by a moraine at Cradog; of the Honddu at 'The Forge,' Brecon, to the glacial gorge which runs below the Priory Church; and the reversal of the drainage of the Afon Honddu and Olchon Brook at Llanvihangel and Pandy by the morainic gravels which block the wide valley between Bryn-aro and Skirrid-fawr, down which these streams no doubt flowed in pre-Glacial times to join the Usk at Abergavenny, whereas now they have been diverted into the Monnow, and so reach the Wye at Monmouth.

Only one case of a dry valley which had been a glacier-lake overflow was noted, and that was the little gorge called Cwm Coed-y-cerig, by which the drainage of Orwyne Fawr appears to have been carried off when the lower part of its present valley was obstructed by a lobe of ice from Crickhowell, but it was not cut deeply enough to continue to take the stream when the lobe was withdrawn.

R E V I E W S.

I.—SMITHSONIAN INSTITUTION : UNITED STATES NATIONAL MUSEUM.

I. The United States National Museum: an Account of the Buildings occupied by the National Collections. By RICHARD RATHBURN, Assistant Secretary of the Smithsonian Institution.