

fully would require a plan and sectional elevation; but so much has already been laid before the geological public with regard to this particular junction that I refrain from the infliction.

The Cambrian rocks to the south of this junction strike across the harbour of Porth-clais nearly due east and west, and on the left or east bank the granite is directly in contact with the green Cambrian shales. The conglomerate is not to be seen. At a distance of about 30 feet north of this contact, and embedded in the granite, is a vein¹ of green shale about 18 inches across, and another about 10 feet nearer to the contact about 6 inches across. Both these veins of shale, but especially the thinner one, have a rudely columnar structure at right angles to their direction. Excepting that this shale is a little more indurated and more like slate in its constitution, it is similar to the Cambrian green shales that overlie the basal conglomerate. These veins are in my view undoubtedly part of the Cambrian shale entangled in the granite, so that the granite must be post-Cambrian.

I cannot see any way of escaping from this conclusion. I may add that the conglomerate in contact with the granite, as before described on the opposite side of the valley, is converted into an extraordinarily tough rock. Though I saw no veins of granite penetrating the adjoining rock, I have little difficulty in recognizing these alterations as ordinary contact phenomena.

In the face of this strong evidence to the contrary, it appears to me that the presence of "dirty quartz" in the conglomerate like that in the granite, a resemblance that may be accidental or fanciful, but is much insisted upon by Dr. Hicks, has no great weight in proving that the conglomerate is largely made up of materials from the granite, and that therefore the granite is pre-Cambrian.

NOTICES OF MEMOIRS.

I.—NOTE ON A FEW OF THE MANY REMARKABLE BOULDER-STONES TO BE FOUND ALONG THE EASTERN MARGIN OF THE WICKLOW MOUNTAINS. BY PROFESSOR EDWARD HULL, LL.D., F.R.S., DIRECTOR OF THE GEOLOGICAL SURVEY OF IRELAND.²

AMONGST the evidences of the former existence of an extensive sheet of ice descending from the Wicklow Mountains towards the shores of the Irish Sea is the occurrence of boulder-stones, chiefly formed of granite or granitoid gneiss, derived from the mountainous range to the westward, of a size seldom equalled—probably not surpassed—amongst the British Isles. As the Association includes in its labours the task of collecting details regarding erratic blocks, it may prove of interest, if I record a few cases which have come under my own notice.

1. *The Mottha Stone.*—This remarkable boulder is perched on the summit of Cronhane Hill, above Castle Howard, and is a conspicuous object from all directions. It consists of grey granite,

¹ I use the term "vein" because it best describes the form in which these remnants of the shale occur.

² Read before Section C. (Geology), British Association, Manchester, Sept. 1887.

and rests upon Lower Silurian slate. Its dimensions are nearly as follows:—length, 14 feet; height, 9 feet; breadth, 9 feet. It contains about 35 cubic yards of matter, and its weight would be about 70 tons. From the site of the Mottha Stone, at a level of 816 feet above the sea, the eye ranges westward along the magnificent valley of Glenmalure, to the flanks of Lugnaquilla, at a distance of about ten or twelve miles, whence, as we may suppose, the granite block started on its journey. In its course it must have crossed the deep hollow of the Avonmore valley, which extends just below the feet of the observer transversely to the path of this remarkable erratic block.

2. *Castle Kevin*.—In the valley between Castle Kevin and Moneystown, where large boulders are numerous, there lies a block of granite, partially imbedded, of which the dimensions are:—length, 15 feet; breadth, 10 feet; height, 9 feet (imbedded portion—probably 3 feet—is not included in above). This block contains about 50 cubic yards of matter, and is about 100 tons in weight. The birthplace of this boulder was probably the mountainous tract about Mullaghcleevann, 2783 feet in height, lying at the head of the valley in which is situated the deep waters of Lough Dan. and it probably travelled a distance of eight or nine miles in an E.S.E. direction.

3. The last boulder-stone that I shall mention is the largest I have met with in co. Wicklow—perhaps in the British Islands. It stands behind a cottage by the roadside, near Roundwood Church, and is quite as large as the cottage itself, to which it forms a good protection from the storms descending from the mountains behind. This boulder consists of granitoid gneiss, resting on Lower Silurian slate and grit. Its dimensions are (q. p.):—length, 21 feet; breadth, 14 feet; height, 12 feet. Its form is somewhat oval, and it contains about 120 cubic yards of matter, and is about 240 tons in weight. The source of this block, which lies at an elevation of about 800 feet above the sea, was probably in the same locality with that of the Castle Kevin boulder, and the distance travelled was about six or seven miles.

The blocks above noticed, with many others of smaller size, do not belong to any of the local glaciers which once filled the valleys towards the close of the glacial epoch, and which have left numerous well-formed moraines in nearly all the principal valleys descending from the Wicklow range. They are to be referred, in all probability, to the earlier stage of intense glaciation, in which the whole district was covered with perennial snows and ice, moving eastward into the hollow now occupied by the waters of the Irish Sea.

II.—ON THE REPUTED CLAVICLES AND INTERCLAVICLES OF *IGUANODON*.
By Professor H. G. SEELEY, F.R.S.¹

THE author showed, by superimposing a figure of the reputed clavicle upon the bone figured by Mr. Hulke as clavicle and interclavicle of *Iguanodon* (Quart. Journ. Geol. Soc. vol. xli. pl. xiv.),

¹ Abstract of a paper read before the British Association, Manchester, Sept. 1887.

that the supposed sutures are fractures, and that the supposed interclavicle has no existence, except as an ossification posterior to the reputed clavicles. Then it was urged that these bones are unparalleled by any vertebrate clavicles, while the reputed pubes of Crocodiles and pre-pubes of other animals offer a more probable analogy.

The ossification in front of the pubis in *Ornithosaurus* is of similar form in several genera. And in Crocodiles the ossification of the fibrous extension which connects the reputed pubes with the sternal ribs would produce a bone like the supposed interclavicle of *Iguanodon*. Hence it was urged that these bones in *Iguanodon* are pre-pelvic, and the author identified them with the pre-pubic bones.

III.—THE CLASSIFICATION OF THE DINOSAURIA. By Professor H. G. SEELEY, F.R.S.¹

THE author discussed the structure of the animals named *Dinosauria*, and concluded that the group had no existence, the constituent animals belonging to two orders which have no affinity; they are named *Omosauria* and *Cetiosauria*, the former with a sub-avian pubis and ischium; the latter with those bones sub-lacertilian.

The *Omosauria* is defined as having the ventral border of the pubic bone notched out so that one limb is directed backward parallel to the ischium, while the other limb is directed forward. The ilium has a slender prolongation in front of the acetabulum.

The *Cetiosauria* is defined by having the pubes directed forward with a median symphysis, but with no posterior limb to the bone. The anterior prolongation of the ilium has a vertical expansion.

IV.—ON THE MODE OF DEVELOPMENT OF THE YOUNG IN *PLESIOSAURUS*. By Professor H. G. SEELEY, F.R.S.¹

THIS paper was descriptive of a specimen submitted to the author by J. F. Walker, Esq., F.G.S. It is a phosphatized nodule from the Lias of Whitby, measuring about 10 cm. by 7, by 5. On its surface are four more or less complete specimens regarded as foetal *Plesiosaurs*, together with fragments of at least three others. They are remarkable for having the flesh mineralized with phosphate of lime, and still show many characters of the external form of the body, but slightly distorted by decomposition. Only one individual has the head preserved, its extreme length is about 14 mm. The nares are terminal, like those of an emydid chelonian. The superior aspect of the head behind the frontal bone is occupied by muscular substance. The skull rests on one side against the matrix, so that its transverse width is not clearly shown, but it was wider than the neck, and narrows in front of the orbit towards the nares, which curve a little downward. The eyes look obliquely upward and outward, and have a diameter of two millimetres. The neck has a length of 4.5 centim. Behind the head it is about 4 millim. deep, and as wide; it widens to a centim. where the expansion takes place at the shoulders, and there the depth is about 8 mm. A sharp median ridge down

¹ Abstracts of papers read before the British Association, Manchester, Sept. 1887.

the middle of the neck divides its superior aspect into two oblique moderately convex surfaces. Other individuals show that this ridge was prolonged down the back and tail, but less elevated. The body is about as long as the neck. On the right side it has suffered some abrasion and injury in cleaning, and is not quite symmetrical, being a little larger on the left side. It is about 2·4 centim. wide, convex from side to side, and less convex in length. The expansion from the neck is rapid, and attenuation posteriorly is marked so that the body has a long egg shape. The tail appears to be short and conical, and curves rapidly downward in every specimen. The height of the body was not more than half its width. The limbs are imperfectly preserved. The distance between them on the left side is 2·4 centim. The anterior limb appears to be the larger. The entire length of the specimen is 12·5 centim.

This individual lies over the neck of another specimen which was larger, and appears to have measured 15 centim. without the head. It shows the fore limbs to have been very wide relatively to their length, and to have measured in the antero-posterior direction 1·1 centim. at the junction with the shoulder on the right side; it is flattened, extended horizontally, imperfect distally, and curved somewhat backward, but evidently short as compared with the adult. The hind limbs of this specimen are not seen.

Other individuals are smaller, and have the body only about half as wide. They are very narrow in the anterior part of the body, and there appears to be only a slight budding of the fore limbs.

Hence, I regard this specimen as showing that the *Plesiosaurus* was viviparous, and that in one species from the Lias many were produced at one birth. The species was probably a long-necked one, and may have been *P. homalospondylus*, since the head in young animals is relatively large, and here it is $\frac{1}{3}$ of the total length of the animal.

V.—UPON A SIMPLE METHOD OF PROJECTING UPON THE SCREEN
MICROSCOPIC ROCK SECTIONS BOTH BY ORDINARY AND BY POLARIZED
LIGHT. By E. P. QUAIN.¹

KNOWING the difficulty experienced in pointing out to students any particular crystal in a rock-section when viewed with the microscope direct, I attempted to project the images on the screen, and by the aid of comparatively simple apparatus met with very gratifying success, both with ordinary and with polarized light.

The tube of the microscope was screwed out and replaced with a cork, through which a hole had been cut to carry the ordinary one-inch micro-objective and behind it the analyser of the microscope. The polariscope and rock-section occupied their usual position, as when used with the microscope in the ordinary way. The microscope stand being inclined into the horizontal position was placed in front of the object-lens of the lime-light lantern. The object-lens of a lantern usually consists of a combination of two lenses. If so, the back lens is taken out, and the front lens only

¹ Abstract of a paper read before the British Association, Manchester, Sept. 1887.

used, acting as an extra condenser, concentrating the light upon the rock-section, and causing it to pass through the polariser and the analyser. A little adjustment of the light was required to get it well through both polariser and analyser, but this with a little care was soon done, and a bright picture several feet in diameter was projected upon the screen, showing the crystals well defined, and exhibiting very strikingly the changes of colour, etc., characteristic of the crystals when viewed by polarised light, and in such a manner as to be well seen by a number of people at once, and also allowing the lecturer to readily point out any particular crystal or crystals to which he desires to draw the attention of his audience.

As the optical axes of the lantern and microscope did not coincide, the lantern was placed on a board provided with four levelling screws with which the necessary adjustments were readily made.

Much better effect may be got if the "Joblowsky" form of prisms made by Zeiss are used instead of the usual Nicols prisms, on account of their greater aperture and shorter length.

VI.—THE PERMIAN FAUNA OF BOHEMIA. By Prof. Dr. ANTON FRITSCH, Director of the Royal Bohemian Museum in Prague.¹

PROF. Dr. Anton Fritsch, of Prague, Bohemia, read a paper on the Permian Fauna of Bohemia. After having mentioned the 73 species of *Labyrinthodonts*, of which he has given figures in his work "Fauna der Gaskohle," and of which he exhibited the electro-types and restored models in the galleries of the Owens College, he communicated the discovery of a very peculiar genus *Naosaurus* (Cope). He then explained some unpublished plates of *Ctenodus*, *Orthacanthus*, *Hexacanthus*, and a new Ganoid Fish, *Trissolepis* with three kinds of scales. He proved *Acanthodes* to be very near to Selachians, and lastly he drew attention to the gigantic fish (*Amblypterus*) 113 cm. long exhibited in the galleries.

VII.—REPORT ON THE FOSSIL PLANTS OF THE TERTIARY AND SECONDARY BEDS OF THE UNITED KINGDOM. By J. S. GARDNER, F.L.S., F.G.S.¹

THE small balance carried forward from last meeting has been expended in visiting the localities in which fossil plants have previously been met with. The beds near the Pier at Bournemouth seem more than usually inaccessible, but a fall from the cliff has brought down some of the dark clays, and in these were parts of a large feather Palm and other leaves. I was fortunate enough, however, to secure at the west end of the cliffs a new species of *Acer* and a fine leaf of *Dryandra acutiloba*, really a *Myrica*, a rare leaf at Bournemouth, and one of the few that extend upward from the Lower Bagshot into the Bournemouth horizon.

I have again visited Alum Bay, but the pipe-clay on the shore has become still more diminished, and there is no hope that any more fossil plant-remains will be obtained there in our time. No distinct plant-remains are obtainable from the same horizon at

¹ Abstracts of papers read before the British Association, Manchester, Sept. 1887.

Whitecliff Bay, though I had some hope that this might be the case. The drought was unfavourable to collecting at Barton and Hordwell, where most interesting fruits are washed out during heavy rains, and I procured no plants during my visits there this year; but it favoured, on the contrary, collecting at Lough Neagh, by lowering the level of the lake; and I am able to add a new *Pteris*, an exquisitely preserved fruit, and many Dicotyledons to the Flora, and a *Paludina* to the Fauna.

No plant-remains are obtainable this year at Reading, nor do any of the other brick-pits in which plant-remains have occurred seem in exactly a favourable state, at the moment, for collecting, so that it appears undesirable to ask for further grants for this purpose at present. The Lower Eocene Floras are, however, still insufficiently known, and excavations at Bromley or elsewhere in the Woolwich horizon would, I anticipate, yield especially important results. In the mean time, an enormous mass of material has now been accumulated, which will require years of patient research to digest. Advantage has been taken of the presence of that distinguished Palæobotanist, the Marquis de Saporta, at our meeting, to go through the drawings, numbering more than a thousand, that I have already made of the plants so far collected. He is completely astonished at the richness of our Eocenes, and considers them to be unrivalled. The Reading and Bournemouth horizons contain plants which do not appear in Europe until much later Tertiary times, seeming to have passed very slowly across Europe towards Eastern Asia, which may be considered their present home, their chief affinities being with floras indigenous to that part of the globe, rather than with those of America and Australia, as hitherto supposed.

In conclusion, it may be mentioned, that although, owing to the drought and other causes, already referred to, the results of this year's labours have been but small, when contrasted with the magnificent collections obtained in former years; yet, notwithstanding these adverse circumstances, several important additions have been made by me to the palæophytological collections in the British Museum which will doubtless prove of good service in elucidating the Eocene flora of Britain.

R E V I E W S.

LES EAUX SOUTERRAINES AUX ÉPOQUES ANCIENNES. Par A. DAUBRÉE, etc. One Vol. pp. 443, with numerous Illustrations. (Vve. Ch. Dunod, Éditeur, Paris, 1887.)

THIS work treats of the part which underground waters have played in the origin and modification of the substance of the Earth's crust. In the preface Mons. Daubrée alludes to the ideas of Bernard Palissy and others as to the analogy which exists between what we should call organic and inorganic bodies, and to the belief that the latter possess a sort of quasi-vitality. Questions bearing on this subject have lately attracted the attention both of the President of the Geological Society and the Editor of this MAGAZINE. It is