

Labyrinthodont Batrachia, e. g. *Trematosaurus*, *Capitosaurus*, and *Labyrinthodon* proper. The evidence of this structure presented by the tubercles of carbonaceous matter that filled the depressions in the bone, is at the same time evidence of the pulpy or plastic state of the carbonaceous matter when it made the cast of the sculptured outer surface of the cranium, which surface it now shows in relief.

A small microscopic section of the osseous tissue, which Mr. Quekett has had the kindness to prepare, shows very distinct and well-defined bone-corpuscles or cells, of an elliptic or oval figure, scattered throughout the tissue, at distances of from one to two or three of their own long diameters: without any appearance, in the section prepared, of vascular canals. The size of these bone-cells is less than those in the Batrachian reptile discovered by Sir Charles Lyell and Mr. Dawson in the South Joggins coal-field of Nova Scotia\*, and corresponds with those in some of the larger Sauria, as e. g. the *Megalosaurus*. Neither Mr. Quekett nor I have yet met with any fish-bone recent or fossil, which shows a microscopic structure like that of the fossil in question from Pictou coal.

From the characters above specified, therefore, I conclude that this fossil is the fore-part of the skull of a Sauroid Batrachian, of the extinct family of the Labyrinthodonts. It agrees with them in the number, size, and disposition of the teeth; in the proportions and mode of connexion of the premaxillaries, maxillaries, nasals, prefrontals, and frontals; and in the resultant peculiarly broad and depressed character of the skull. The traces of the nostrils are less definite and satisfactory than the remains of the orbits; but the latter appear to me to be decisive against the piscine nature of the fossil. The fossil also presents the same well-marked external sculpturing as in the Labyrinthodonts; and amongst the genera that have been established in that family, the form of the end of the muzzle, or upper jaw, in the Pictou coal specimen best accords with that in the *Capitosaurus* and *Metopias* of Von Meyer and Burmeister. [The orbits have been evidently larger and of a different form than in the reptiles so called; and, for the convenience of distinction and reference, I propose to name the present fossil *Baphetes planiceps* (βάπτω, I dip or dive), in reference to the depth of its position, its probable diving habits, and the shape of its head.—Feb. 25, 1854.]

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4. *On the TRACKS of a CRUSTACEAN in the "LINGULA FLAGS."*  
By J. W. SALTER, F.G.S., A.L.S., of the Geological Survey of Great Britain.

WHILE investigating in the past autumn the fossil contents of the lowest fossiliferous zone in Wales—the "Lingula flags"—my atten-

\* See Quart. Journ. Geol. Soc. vol. ix. pl. 3. fig. 8.

tion was frequently directed to very numerous evidences of the existence of marine worms during the formation of these ancient deposits.

Nearly all the sandy and ripple-marked surfaces present worm-tracks, whether in the higher or lower division of these strata, and in all the localities visited : viz. the elevated country between Arenig and Ffestiniog, the vale of Ffestiniog itself, and the valley of Tremadoc in Caernarvonshire.

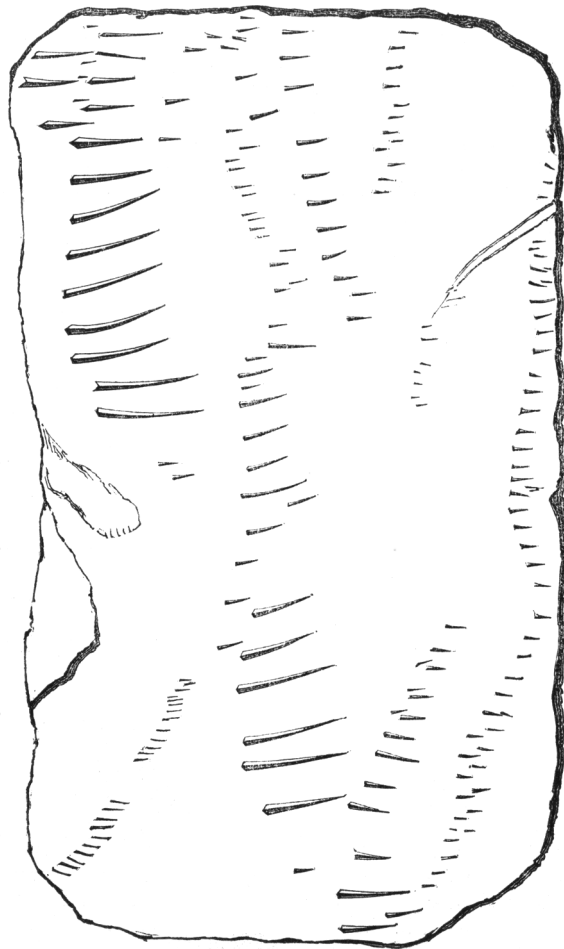
The latter locality, besides exhibiting a very complete section of the whole series of these ancient rocks, exposes particularly well the lower or lower middle portion, in which only the *Lingula Davisii* is found in any great abundance, but in which the *Hymenocaris vermicauda* also occurs. The latter fossil, a crustacean of the phyllopod tribe, was described by me in the 'Reports of the Sections of the British Association' for 1852. About a mile and a half west of Tremadoc, the *Lingula* beds are well exposed ; and along the road to Criccieth, and on the bye-roads near Penmorfa, they are loaded with the *Lingula* ;—just above Penmorfa church the beds are particularly rich in this fossil. At the village of Y-Felin-Newydd, the sandy surfaces are seen to be broadly ripple-marked ; and the beds, alternately of coarse and fine materials—many different layers often occurring in the space of an inch,—have quite the appearance of having been accumulated near shore, or at least in shallow water. The sandstone is highly micaceous in parts, often very fine-grained, generally flinty and of a flag-like character, and, though not at all cleaved, it exhibits everywhere proofs of movements which have compressed the beds laterally and plaited their surfaces in a remarkable manner. On one of the sandy surfaces, obscurely and broadly ripple-marked, were a number of short parallel linear impressions, arranged in several transverse curved series, and of such a uniform size and character that it was plain they were the marks made in succession by the same animal. (See figure, p. 210.)

The space on the slab which these impressions occupy is more than a foot in length ; and there are five or six distinct sets of indentations, each set 3 or 4 inches in extent, and with a curved outline, the broadest end of each impression being towards the outer side of the curve. The indentations themselves are more than half an inch long, and half a line wide ; abrupt and broad at their anterior end, and tapering backwards to a point. They are almost always a little curved, and are distant from one another a quarter of an inch,—in some cases rather less, in others more. Intermixed with these, which seem to have been the successive tracks of one larger animal, are numerous similar series of much smaller size, and also many single indents not placed in the regular transverse curves before noticed.

That these are not the tracks of marine worms is at once evident from their arrangement in regular series, and from their each tapering backwards, as well as lying parallel to each other. The section of each indent is subtriangular, so that it was probably made by some sharp instrument ; and their shape tapering backwards and position in parallel series indicate a rapid movement, such as would be given

by the spinous feet or abdomen of some crustaceous animal. As there is every reason to believe that Trilobites had soft feet, they could not have made such indentations with these instruments, and as the only species known in these beds—the *Olenus micrurus*—had an obtuse rounded tail, it could not have made the marks with that. We must look then to the possibility of their having been made by

Tracks of a small Crustacean animal (*Hymenocaris vermicauda*?) on a ripple-marked surface of the "Lingula-flags" of North Wales. (Nat. size.)



the *Hymenocaris*, a shrimp-like animal, whose abdomen does possess the requisite sharp prongs at its extremity, having in particular one large spine which seems to be exactly the instrument fitted for the purpose. It is well known, that, when in rapid or violent movement, the crustacea can strike vigorously with the abdomen, and so gain the

impetus necessary for advancing or retreating. And there is so much resemblance between these indented tracks, and those produced by the common Shrimp at ebb-tides, that the observer cannot help suspecting them to have been produced by this\*,—perhaps, the oldest of crustaceans, in its movements along the bottom, or (what is more probable) over the sand at the extreme edge of the waves.

The smaller marks were of course made by younger individuals of the species, whatever that may have been. But why should the indentations be parallel and arranged in transverse curved lines?

This question leads to the consideration of the circumstances under which these beds were accumulated, because, if under a sufficient depth of water to be out of reach of the tide, there seems no reason why the *Hymenocaris* should not have advanced in a straight direction; or, if agitated, why there should be any regularity in the indentations. I have already said, that the alternating coarse and fine materials of the sandy and micaceous beds indicate shallow water, a conclusion which is, I think, borne out by the occurrence of patches of drifted sand and broken shells on the strata in some neighbouring localities (for instance, in the quarry at the entrance to Y-wern). I would now go further, and suggest that we have here probable evidence of a flat shore, and of an ebbing tide against which the creature was striving to advance, and by keeping along the water's edge as the wave retired, it would necessarily produce a series of parallel indents along the curved edge. Such an explanation would account for the accurate preservation of all these minute impressions in their original sharpness; because the surface would be dried before it was again covered by fresh sand. I may remark that these indentations are common in the neighbourhood on similar surfaces, and with annelide tracks accompanying them. But I only met with this instance of their regular arrangement.

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JANUARY 4, 1854.

Charles Moore, Esq., Robert Hunt, Esq., R. Hall, Esq., Dr. J. Hobbins, and E. S. Jackson, Esq., A.M., were elected Fellows.

The following communications were read:—

1. *On the SUPERIOR LIMITS of the GLACIAL DEPOSITS in the ISLE OF MAN.* By the REV. J. G. CUMMING, M.A., F.G.S., Vice-Principal of King William College, Isle of Man.

IN a paper, read before this Society on the 4th of February, 1846, on the Tertiary Formations of the Isle of Man†, I detailed the position and relations to each other of certain pleistocene accumulations, which

\* This is rendered still more probable by the fact, that the *Hymenocaris* is found at Tremadoc, but the *Olenus* has not yet been discovered there.

† Quart. Journ. Geol. Soc. vol. ii. p. 317; with maps and sections.