

XVI.—“*Note on a Band of Fossiliferous Ironstone in the Cambrian Rocks of West Ross-shire.*” By J. HORNE, Geological Survey of Scotland.

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THE discovery of the *Olenellus* zone in the Cambrian rocks of the North-West Highlands has furnished a definite geological horizon from which to work out the succession of the strata above and below. The trilobites, recently described by my colleague, Mr Peach, F.R.S. (Q. J. Geol. Soc., vol. L., p. 661), plainly show that valuable additions could be made to our knowledge of the fauna of Lower Cambrian time in the North-West of Scotland, if favourable sections could be obtained for the exploration of this zone. Unfortunately, from the lithological character of the Fucoid shales, they frequently weather with a soft grassy feature. Hence for miles along the line of outcrop the fossiliferous bands of the *Olenellus* zone are concealed from view, save where a stream has cut a transverse section across the series. This feature is specially noticeable in the area lying to the west of the great terrestrial displacements in Sutherland and Ross. As it is only in the undisturbed region that any hope can be entertained of finding well preserved fossils, this phenomenon is a source of disappointment to those interested in the life-history of the older Palæozoic rocks of the North-West Highlands.

When searching the Fucoid shales on the slope of Meall Ghiubhais near Loch Maree, in 1893, Mr Macconochie observed a thin band of pisolitic ironstone about two inches thick. It there rests on the layer containing the splendidly preserved specimens of *Olenellus*, and is overlain by shales containing fragments and some complete specimens of trilobites. This thin seam of ironstone contained organisms like brachiopods, though at the time undeterminable. He further noted it in the disturbed area in Glen Cruchallie (Glen Logan), near Kinlochewe, where it is to be found near the top of the Fucoid beds, close to the outcrop of the Glen Logan Thrust plane.

In the course of my field work in the Achnashellach deer forest during 1894, evidence was obtained of the presence of this band of ironstone in the Allt nan Dearcaig, one of the sources of the Coulin river, at a point about two miles north of Achnashellach station. Here it is met with in the region affected by the dynamic movements. The lofty mountains lying to the

west furnish admirable examples of the repetition of the Torridon Sandstone and Cambrian rocks, partly by great reversed faults and a complicated system of folding. The extraordinary alternation of great slices of Torridon Sandstone and Cambrian rocks in that region was referred to and figured long ago by Sir A. Geikie in the conjoint memoir with Sir R. I. Murchison on the North-West Highlands. The recent detailed mapping of the area proves that the complicated structure can be unravelled with marvellous accuracy by means of the zonal method.

In Allt nan Dearcaig there is an excellent section of the Fucoid shales, as the burn flows for part of its course along the strike of the beds. Unfortunately the shales are much cleaved, and though from the nature of the bands one can recognise the *Olenellus* zone in its proper position underneath the Serpulite (*Salterella*) Grit, still it is almost hopeless to expect to find recognisable fragments of trilobites. On the hill slope on the east side of the stream the outcrop of the Coulin Thrust can be followed, bringing forward a slice of Lewisian gneiss and deformed Torridon Sandstone. Though the Fucoid shales are highly cleaved, the band of ironstone forms a conspicuous feature at one point in the bed of the stream, reaching a thickness from 18 inches to 2 feet. The cleavage has not affected the band of ironstone. It is abundantly charged with one or more organisms, conspicuous on the weathered surface of the rock. From a microscopic section examined by my colleague, Mr Teall, it appears that the organic remains show structures resembling those of echinoderms—a view which is shared by Dr Hinde and Mr E. T. Newton. These fragments have their original calcite replaced by ferric oxide, in the same way as specimens of Carboniferous Limestone from South Wales. The matrix of the Achnashellach ironstone and of the South Wales specimen referred to is calcite.

In a valuable paper by Mr C. D. Walcott on "Lower Cambrian Rocks in Eastern California," published in the *American Journal of Science*, February 1895, he makes the following reference to the fossils found in the limestone series:—"In places the lower portion of the upper limestone is almost a solid bed of *Archæocyathinae*. *Ethmophyllum Whitnei*, Meek, is very abundant, and the genera *Protopharetra*, *Coscinocyathus* and *Archæocyathus* occur. *Ethmophyllum* ranges throughout the limestone series into the base of the shales in Tollgate Canyon where it is associated with Cystidean plates and fragments of *Olenellus*."

It is not improbable that some of the organic remains in the Achnashellach ironstone may be Cystideans. Mr Peach, however, is of opinion that a Lower Cambrian brachiopod also occurs in the rock.