(Fig. 1, No. X.), sparkling like the scales of a fish, also excited much curiosity among the natives.

The siliceous ironstone is very difficult to fuse in crucible experiments with the usual proportion of limestone fluxes, even in the intense heat of a puddling furnace; but I found the blue Lias Clay an excellent flux, deducting of course the iron it contains (about four per cent.) from the result. Fossils were very scarce, and only the usual Inferior Oolite specimens, with a few small phosphatic nodules being occasionally met with of about an inch in length by half an inch in diameter, in the Northampton Ironstone bed.

Several chalybeate springs find their way into the valley, and form thin patches of re-deposited iron ore. The dead leaves and twigs at the bottom of ditches being sometimes covered with crystalline feathers of peroxide of iron, as bushes and trees are occasionally decorated with hoar frost in winter.

IV.—GEOLOGY OF THE ISLE OF MAN.

By HENRY H. HOWORTH, Esq.

IN a recent visit to the Isle of Man, I spent three long days in examining the deposits of the very interesting district in the south of the island, and I wish to draw the attention of your readers to some facts which are, I think, important. Not being an experienced geologist, I hope I shall do so with becoming modesty, and I should feel very gratified if some more practised geologist would verify my statements, which are, however, not rashly made, as I have sifted the question with care and patience.

Mr. Cumming has written the most elaborate account of the geology of the Isle of Man, and his work on the island is an admirable specimen of what such a work ought to be. He is the authority for the opinion now generally received, that the Mountain Limestone which occurs under very interesting circumstances in the bays of Derbyhaven, Castletown, and Poolvash, is separated from the underlying schists by deposits of the Devonian or Old Red Sandstone period. This conclusion, if true, would be very interesting in view of the recent discussions as to the relations of the Old Red Sandstone to the Carboniferous formation, since it is admitted by Mr. Cumming that the fossils contained in these red rocks are identical with those contained in the limestone.

I believe the view of Mr. Cumming on this subject to be entirely erroneous, and that the red rocks in question do not belong to the Old Red formation, nor are they older than the limestone, but that they in fact overlie that formation. There are four ways in which the age of the deposit may be tested, and the result in every case is conclusive that it is not Devonian.

First, the palæontological evidence. Into this I shall not enter. Mr. Cumming admits that the fossils found in the red deposit are the same as those found in the limestone, and this fact is assuredly *à priori* almost conclusive that the red rocks are not Devonian.

Secondly, the petrological evidence. The rocks in question consist

of a conglomerate, and occasional pockets and layers of consolidated fine red mud. The whole thickness is not more than twenty feet at any point. The conglomerate consists of a very closely packed series of boulders, some of them rounded and some with their edges sharp, imbedded in a matrix of consolidated red mud, similar to that just mentioned.

The boulders just referred to are of various sizes, from a foot and a foot and a half in diameter to small pebbles, and, so far as a careful and prolonged examination could discover, consist almost entirely of pieces of limestone and quartz, the limestone forming about $\frac{1}{10}$ of the whole. These limestone boulders are some of them of the natural colour of the limestone, and others are deeply coloured with iron. These boulders are most clearly of Mountain Limestone, and of the same character as the bedded limestone close by, and but for the colour of a number of them, there would never have been any doubt that they were formed out of the disintegrated limestone. Again, the muddy matrix in which the boulders are imbedded, as well as the intercalated pockets, consists of a paste made up largely of pulverized limestone.

These facts seem to admit of but one conclusion. A conglomerate consisting almost entirely of limestone boulders, imbedded in a matrix of pulverized limestone, lying immediately in contact with beds of limestone, cannot well by any process of reasoning be made into an "Old Red Conglomerate." Unless there be some reason of a very marked kind to the contrary, the conclusion is inevitable that it has been formed of the disintegrated beds of Mountain Limestone, and is posterior in date to them.

Thirdly, as to the position of these beds. Mr. Cumming says they underlie the limestone which rests conformably upon them. I have searched carefully the various points where they appear at Langness, on the banks of the river Santon, at Cushnahavin, and in Derbyhaven bay, and nowhere can I find evidence to support this statement. The sections exposed are nearly all on the coast, and are much obscured by the overgrowth of sea-weed, and by discolouration, etc., etc. There was only one place where the sequence of the beds seemed to me unmistakable, and that was in the beds lying almost horizontally between high and low water mark in Derbyhaven bay, and there, certainly, as far as I could make out, the grey and dark coloured limestone was overlain by beds of an ochreous colour, still unmistakable limestone, and in every respect bedded like the grey limestone just mentioned; above this red-coloured limestone again lay the beds of red conglomerate. Nowhere, as I have said, could I see any evidences that the conglomerate was overlain by the limestone, nor do I believe, after having tested the position carefully, that such a succession of the beds can be seen anywhere in this part of the island. On the contrary, north of the Santon brook, where, by the violence of the great discharge of trap, the beds are torn and twisted in an extraordinary fashion, a bed of limestone has been thrown up on end, and its lower surface has been bared, and we can examine very easily both its upper and lower

surface. The latter rests immediately on the schist, and I have a number of specimens broken off from the very point of contact, where unmistakable schist is immediately in contact with unmistakable limestone, and nothing intervenes between them, the beds at the same time resting apparently conformably one upon the other. This may be seen at Cushnahavin, a few yards north of the estuary of the Santon brook; a few yards to the south, as I have said, the purple schists may be also seen in immediate contact with the limestone, showing that no Devonian beds intervened.

Fourthly, as to the red colour of the beds. This is undoubted, but, as I believe, it has nothing to do with the beds being Devonian. At the mouth of the Santon brook may be seen a sight which Mr. Cumming rightly considers as one of the most interesting which a geologist can see anywhere. The twisted and contorted schists gradually change colour, and from being of a blue, and grey colour, become striped with red bands, which are occasionally a foot and a foot and a half in width, and eventually the whole rock, without changing its character, assumes a beautiful purple colour. The brook passes right through these purple schists; some ten or fifteen yards to the south of the brook the schists lie directly against and in contact with the great beds of Mountain Limestone. At the point of contact, and some distance beyond, the limestone is coloured of a russet colour by iron. There are no interposed beds of red conglomerate, but the schists and the limestone are both of them stained red with iron for some distance from the point of junction. Further, I was told by a neighbouring farmer that a shaft had been pierced into the limestone at the point of contact in search of iron-ore, which had been found there.

Where the schists and the limestone are in contact at Port St. Mary, a similar excavation for iron has been made, and the limestone beds are stained of a russet colour.

The same thing occurred in Castletown bay on the peninsula of Langness, where the deep blue slate may be studied in its normal condition, both at the extremity of the headland and at a recently sunk shaft made in search of copper about 500 yards from the extremity of the headland. The schist between the two points just named gradually changes colour and becomes highly charged with iron, while the beds of limestone which lie in the bay go through a similar change of colour. This shows that where the schist and the limestone came into close contact, there has been a discharge of iron which has discoloured the rocks on either side. This discharge probably proceeded from one of the numerous trap veins which have dislocated the rocks in a very extraordinary manner, and whose meandering lines are very clearly marked against the differently coloured rocks close by. It is this discharge of iron at this critical line of junction between the limestone and the schist which may possibly have led to the idea of there having been a series of Devonian beds between the schists and limestones in the south of the Isle of Man, but I am confident that no such Devonian rocks exist in that part of the island. I do not say a word about the red sandstones of

Peel, which I have not seen, and my arguments only apply to the beds in the south of the island. Having shown that the red beds are not Devonian, I hope in another communication to show what they really are.

REVIEWS.

I.—A CATALOGUE OF BRITISH FOSSIL CRUSTACEA, WITH THEIR SYNONYMS AND THE RANGE IN TIME OF EACH GENUS AND ORDER. By HENRY WOODWARD, F.R.S., F.G.S., of the Department of Geology, British Museum. 8vo. pp. 168. (London: Printed by order of the Trustees, April, 1877.)

THE want of a Catalogue of British Fossil Crustacea, in which all the synonyms should be given, has long been felt. The present task was commenced some years since; but, owing to the unsatisfactory state of one group, the Bivalved Entomostraca, which greatly needed revision, the work was for some time laid aside by its author for other and more pressing occupations.

Thanks to the labours of Messrs. Brady, Crosskey, and Robertson, whose Monograph on the British Fossil Post-Tertiary Entomostraca forms quite a volume of itself in the Monographs of the Palæontographical Society for 1874, this portion of the work has now been very carefully worked out, and when combined with the long labours of Prof. T. Rupert Jones, F.R.S., amongst the older forms, leaves little more to be desired in the completion of this group.

Some idea may be formed of the progress of palæontological work in this country from the fact that when Prof. Morris's Catalogue of British Fossils was published in 1854, he recorded 81 genera and 306 species of Fossil Crustacea only.

The present Catalogue contains a record of 197 genera, and 1051 species and varieties found fossil in Britain; so that, since 1854, 116 new genera, and 745 new species and varieties of Fossil Crustacea have been figured and described in Britain.

With the exception of one doubtful organism (the *Eozoon Canadense*) not met with in the oldest known British Sedimentary rocks, the fossil representatives of the class CRUSTACEA take rank in antiquity amongst the earliest known organic remains.

From the recently discovered Pre-Cambrian rocks of St. David's, Pembrokeshire (the "Dimetian" and "Pebidian" formations), no organic remains of any kind have been obtained; the Lower Cambrian series, however, have yielded to the labours of Mr. Henry Hicks, F.G.S., and others, remains of MOLLUSCOIDA, ANNELIDA, and CRUSTACEA.

Of the thirteen Orders enumerated in the subjoined Table (p. 416), *two only* (printed in *Italics*) are extinct, namely the TRILOBITA and EURYPTERIDA, and three are not represented in a fossil state, viz. the CLADOCERA, the COPEPODA, and the RHIZOCEPHALA.

The small Table is intended to show at a glance the earliest