

some of the Calciferous Sandstone Series," as McCoy supposed, the Mansfield fishes are typically and essentially Carboniferous. "Of the six genera represented in the collection, one (*Eupleurognmus*) is too imperfectly known for discussion; four of the others (*Acanthodes*, *Ctenodus*, *Strepsodus*, and *Elonichthys*) have hitherto been discovered only in the Permian and Carboniferous of Europe and in the Carboniferous of North America; while the sixth (*Gyracanthides*) is related to an essentially Carboniferous fish in the northern hemisphere, and bears every mark of belonging to the same late Palæozoic period." *Gyracanthides*, which McCoy was correct in recognizing as a close ally of *Gyracanthus*, is regarded by Dr. Smith Woodward as a remarkable discovery. The new specimens prove *Gyracanthides* to be a typical Acanthodian belonging either to the Diplacanthidæ or to a distinct family marking the culmination of this series. The fins exhibit peculiarities indicating a high degree of specialization, which was analogous to that observable in later geological periods among Selachians and Teleosteans.

The Mansfield fishes are such as often occur in estuarine and fresh-water strata in the northern hemisphere, though all the genera are occasionally found in sediments of marine origin. Their association with the remains of land plants suggest estuarine conditions.

The systematic descriptions are illustrated by 11 lithographic (rock-colour tinted) plates, with three figures in the text, one of which is a restored drawing of the remarkable Acanthodian *Gyracanthides Murrayi*.

The following are the species described and figured:—

Gyracanthides Murrayi, sp. nov.
Acanthodes Australis, sp. nov.
Eupleurognmus Creswelli, McCoy.
Ctenodus breviceps, sp. nov.

Strepsodus decipiens, sp. nov.
Elonichthys Sweetii, sp. nov.
E. gibbus, sp. nov.

A. H. F.

CORRESPONDENCE.

THE MODE OF ACCUMULATION OF THE SOUTH DEVON RED SANDSTONES AND CONGLOMERATES.

SIR,—I am glad to see that Mr. Hobson¹ has attacked the perplexing problem of the mode of accumulation of the Devonshire red conglomerates. The remark of mine which he quotes was not intended to throw any doubt on the fact that water was the agent: the difficulty is to conceive any probable mode of action. The Torbay evidence is much as follows. In the English Channel, a few hundred yards south of Berry Head, is a rocky islet, and in its limestone there is apparently a pipe, or small swallow-hole, filled with red sandstone. In the eastern face of Berry Head there is, if I remember aright, a small fissure filled with sandstone. In the

¹ See GEOL. MAG., July, 1906, pp. 310-320 (Pl. XXIA).

Berry Head quarries there stood for long a large dyke of red rock left isolated by the quarrying of the limestone, This, I believe, was subsequently carried off to build a church with. All these I have only observed from the water. On the strand under the old Naval Hospital are the celebrated intersecting Permian dykes, and near the breakwater there is a massive dyke in the low cliff. There appears to be a mass of sandstone in the quarry between Brixham and Fishcombe Cove; and in the northern boundary limestone of the Fishcombe Valley and Cove there is a pipe filled with sandstone. Small dykes occur in the rocks between Elbury and Broadsands, and north of Broadsands there is an outlier of pure sandstone abutting on the limestone under the railway. All the foregoing are fine sandstones. But a few hundred yards further north, in Saltern Cove, we have the celebrated case of the stratified conglomerate lying on the planed edges of the Lower Devonian thin-bedded slates and grits.

Then on the south face of Roundham Head we have the section figured by Mr. Hobson,¹ but further east on the same face we find a much more intricate and incomprehensible example of the most complex false-bedding, with contemporaneous erosion and alternate beds of rough conglomerate. Then on the Paignton side of Roundham Head there is, or was, a cliff-face showing their bedding with one rippled surface; and I once noticed a slab on the beach with what I took for rain-pittings. Sun-cracks are occasionally discernible. Nearer Torquay, on the coast south of Livermead Head, I noticed a bed of fine sandstone which had been channelled and covered with a bed of conglomerate filling the channel. At Corbons Head, near the Torquay railway station, we have some Poikilitic sandstone. Lastly, at Labrador, north of Teignmouth, we have the volcanic breccia overlying the ordinary conglomerate; some of this breccia being of peculiar altered rocks with blue tourmaline, whose origin of derivation has never been positively located. Further on, beyond Teignmouth, we have the often described large masses and blocks, associated with the conglomerates. Now between placid lake shores and the most raging torrents any one of the above cases could be tentatively explained; but to account for every variety of water action, from sun-cracks and ripple-marks to torrential action over scores of miles in area, this is difficult.

Two or three details clash with authority, and at first sight with the laws of nature, especially of hydrostatics and mechanics. No alternate currents in opposite directions could produce the Roundham Head false bedding, and for a current to cover and fill up channels of fine sand with stones is contrary to the axiom that it takes a more rapid current to carry away stones than it does to remove sand,

In a paper privately printed some years ago I described an hour's experiments with currents and sand, and pointed out how there may be two and even three parallel streams at the same time rolling sand both to right and left and producing intricate overlapping

¹ See July Number, Pl. XXI, Fig. 1.

stratula of false bedding. Then, by varying the depth of water and the rate of current, one can secure almost any deposition, such as coarse over fine, and any contemporary erosion. But at Roundham Head the difficulty is that the variations in the conditions are so numerous and so extreme. Added to this there is the marvel throughout the Red Sandstones of an apparently inexhaustible supply of ready-made material. Hundreds of feet of deposition follow each other with apparently little denudation and erosion from lack of material. The millstones are rarely left to grind each other's faces for lack of meal.

It is clear that the fissures in the limestones were washed out clean before being quietly filled with fine Permian sand. But, *per contra*, the conglomerates seem to have planed at least one Devonian surface smooth, and then to have deposited themselves, horizontally bedded, upon it. That of itself is not a very intelligible operation.

With reference to the visit of the Geologists' Association to Devonshire in 1900, I have always felt that I owed an apology to the Association for accepting the office of a director both at Torquay and for the Dartmoor walk. I had never attended a meeting and did not understand the duties of the directors, and regarded myself solely as a local guide. It had never occurred to me that I should be expected to say anything on the geological problems encountered, but only to show the way on the moorland walk by devious paths, and to do the honours of Kent's Cavern at Torquay. My remarks on the conglomerates were only an expression of my own ignorance, and of satisfaction that Dr. Teall had a torrential hypothesis to suggest. The physics of the Devonshire Red Sandstones are at present most inscrutable.

A. R. HUNT.

TRIMMINGHAM CHALK.

SIR,—The coming Winter is possibly the last in which the 'North Bluff' will continue to exist, and in view of Professor Bonney's rejection of my observations as to the 'grey chalk' I hope that some geologist or geologists of recognised position will visit the locality this Autumn to test my accuracy as far as it is still possible. I shall be only too glad to meet anyone on the spot with this object. It is unfortunately no longer possible, owing to the ravages of the sea during the past year, to trace (as I have traced inch by inch and over and over again in the 70 odd visits I have made in the last six years) a continuous sheet of grey chalk from the most westerly point of Professor Bonney's block E to the most easterly point of the original bluff, but I think I can still show them enough to make it reasonable to accept as to such continuity the statement of a mere student of fossil polyzoa—if that is a fair description of me.

R. M. BRYDONE.

16, SOUTH AUDLEY STREET, W.
17th September, 1906.