and following a general scheme for a Magnetic Survey of the whole globe, and united efforts might considerably reduce the labour involved in so great an undertaking. It is very desirable that such a systematic and complete survey should be taken in hand, instead of giving particular attention to limited districts, and I solicit the help of those interested in the subject, in starting an undertaking in which we may be sure that all nations will gladly join.

(To be concluded in our next Number.)

IV.—ON THE SYSTEMATIC POSITION OF THE “DENDRODONT” FISHES.

By Dr. R. H. TRAQUAIR, F.R.S., F.G.S.

IN a short paper on the nomenclature of the Old Red Sandstone Fishes published in this MAGAZINE for November, 1888, I expressed the opinion “that the scattered teeth and fragments of jaws known as *Dendrodus* and *Lamnodus* belong to fishes at present known to us by their scales as species of *Holoptychius* and *Glyptolepis*.” The family terms “Holoptychiidæ” and “Dendrodontidæ” I consider absolutely synonymous. On the other hand, the Rhizodontidæ (*Gyroptychius*, *Tristichopterus*, *Rhizodus*, etc.) present a somewhat different form of tooth-structure, and one which is, in the main, identical with that which, in so many Stegocephalous Amphibia, is called “labyrinthodont.”

The reasons in support of this opinion are something considerably beyond the region of conjecture,—they amount to positive proof.

As far back as 1849, Hugh Miller¹ figured portions of jaws with teeth, as well as microscopic sections of teeth from Thurso, which are undoubtedly referable to Owen’s genus *Dendrodus*, both as regards external configuration and internal structure. Of this Miller was aware, though he refers them to *Asterolepis*, Eichwald, along with the large cranial shields and other remains of a great coccostean fish, *Homosteus* of Asmuss. Now nothing can be more certain than that these dendrodont teeth from Thurso belong to a large species of *Glyptolepis*, in more than one head of which, belonging to the Edinburgh Museum, they may be seen *in situ*. This *Glyptolepis* is also identical with Agassiz’s “*Platynathus*” *paucidens*.

As regards the *very* closely allied Upper Old Red genus *Holoptychius*, I have not obtained any microscopic sections of teeth found *in situ*; but, to judge from the external characters of these teeth, as seen through a good hand-lens, it is impossible to doubt their dendrodont nature. And finally the portions of jaws which occur displaying teeth of “*Dendrodus*” are undoubtedly Holoptychian in their configuration.

Now, the occurrence in the Holoptychiidæ of pectoral fins displaying the “archipterygeal” configuration clearly enough shows that there must be *some* genetic connection between this family and the Dipnoi. I was therefore interested to read in the introduction to a recent paper on this subject² by Dr. J. V. Rohon that the

¹ Footprints of the Creator, first edition, 1849, figs. 30, 31, 32 and 33.

² Die Dendrodonts des devonischen Systems in Russland, Mem. Acad. Imp. Sc. St. Petersburg (vii.) vol. xxxvi. No. 14, 1889.

“Dendrodonts” do not belong to the Ganoidei, but to the Dipnoi, as he had been able to prove the autostylic condition of the skull—“d.h. das mit dem Schädel unbeweglich verschmolzene Palatoquadratum und das verkümmerte Hyomandibulare.” On reading the paper, however, and examining the two very pretty plates by which it is illustrated, one is rather disappointed as to the evidence which Dr. Rohon has adduced to prove his position.

It is of course not always easy to identify every part of a fossil fish skull from drawings only, but there are a few points concerning the fossil figured by Dr. Rohon as the “skull” of *Dendrodus biporcatus* which are self-evident.

This “skull” (pl. i. fig. 1) is not the entire skull, with several body-vertebræ fused with it, as Dr. Rohon seems to imagine, but only the anterior part or snout broken off near the interorbital region. His “pterygo-palatine” bones are the two elements of the duplex vomer, each of which, as in the Rhizodonts and Saurodipterines, bears one or more large tusks. The skull being broken off quite anterior to the brain-cavity, it will hardly be appropriate to designate anything here displayed as “quadrate” or “hyomandibular,” the parts so lettered being in reality ante-orbital in position! What Dr. Rohon interprets as orbit (though indeed with a query) is a crevice apparently at the postero-external part of the premaxilla.

Dr. Rohon seems to put great weight on the “einheitlichen Hautknochen” by which the “Schädeldecke” is represented. The fusion of the dermal plates of the snout with the premaxillæ into one piece is not, however, a very rare phenomenon in Devonian Crossopterygii, and is indeed well seen in a large skull of *Glyptolepis paucidens* in the Edinburgh Museum.

In fig. 3 Dr. Rohon represents a broken-off snout which he refers to a new species of *Cricodus* (*C. Wenjuckowi*). Here the supposed “orbits” have a most suspicious resemblance to nasal openings. The orbits in many old fossil fishes are anterior enough, it is true, but not quite situated upon the very front of the snout itself.

In fig. 10 Dr. Rohon has given a view of a dentigerous fragment from Thurso which he supposes to be a part of a skull of *Dendrodus* showing the cranial cavity. As the diameter of the supposed cranial cavity is not greater than that of the base of the large tooth attached to the specimen, this interpretation can hardly be correct.

Nor can I admit that the dentigerous fragment depicted in his fig. 11 represents the entire mandible either of *Dendrodus* or any other fish. I think also that Dr. Rohon is hardly entitled to explain the discrepancies between this fragment and the mandibles, figured by Pander, Trautschold and Agassiz, on the supposition that they belonged to fishes which, though “allied to the Dendrodonts in the structure of their teeth, were tolerably far removed from them as regards the constitution of the lower jaw, and probably also of the skull.”

At the end of the paper he gives an “attempt at a restoration” of *Dendrodus biporcatus*, Owen. Here the body and fins are formed as in *Gyrotychius*, and, if the author considers *Dendrodus* to be a

Dipnoan, it is certainly strange that he should represent it with the obtusely lobate pectorals of the Rhizodonts and Osteolepids instead of with the acutely lobate or unabbreviate archipterygeal members of *Ceratodus* or *Dipterus*. Except the mandible, no bones are marked off on the head, in accordance with the idea that the cranial roof is represented by a single dermal bone, while near the end of the snout are placed two minute orbits. It is to be hoped that no future compilers of geological or palæontological text-books will copy this extraordinary figure and insert it as a "restoration of *Dendrodus*."

As the result of his researches Dr. Rohon announces that the genera *Dendrodus*, Owen, and *Cricodus*, Agassiz, are not Ganoids, and considers that they should be reckoned as forming a peculiar order of Dipnoi. Of this supposed "order" he gives the following definition:—"Fishes with depressed head, whose surface-ornament consists of ridges and tubercles. The free margin of the snout is set with numerous small teeth, whose folded dentine encloses a spacious pulp-cavity. Two powerfully developed palatal teeth, which are intimately united with the pterygo-palatine, and within the folded dentine contain a spacious pulp-cavity; they are placed asymmetrically. The bony quadrate is fused with the skull. A styliform parasphenoid displays on its surface a tract of little tubercle-like teeth, and is the bearer of several fused vertebræ, drawn into the skull. Very small orbits (?) and two internal nasal openings are present. The skull-roof represents a simple dermal bone, whose histological structure corresponds to that of true osseous tissue."

Now as this definition is founded upon an entire misinterpretation of the specimens figured in the paper, I fear it can only be looked upon as a curiosity of scientific literature. Whatever relationship "*Dendrodus*" may have with the Dipnoi, it is certainly not in the manner indicated by Dr. Rohon, and I for one do not as yet see any reason for separating the Holoptychiidae, of which I consider "*Dendrodontidae*" to be a simple synonym, from the Crossopterygian Ganoids.

Again, I must refer to my paper on the nomenclature of the Old Red Sandstone fishes with regard to *Cricodus*, which Dr. Rohon also includes in his Dendrodont Dipnoi. If Pander's *Polyplocodus* be synonymous with Agassiz's *Cricodus*, then the latter is certainly not a Dendrodont or Holoptychian, but a Rhizodont.

V.—ON ZONAL STRUCTURE IN OLIVINE.

By J. SHEARSON HYLAND, Ph.D., M.A.,
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IN a recent paper on the volcanic rocks of Kilimandjaro I referred to the presence in the basaltic lavas of olivine crystals, which appeared to possess zonal structure. Although actual proof was wanting, still the symmetrical arrangement of the inclusions, as also the mode of alteration of the crystals, rendered the occurrence of such a structure highly probable. The olivines, being rich in iron, were altered into ferric oxide or ferric hydrate; and the line of