6. Notes on some Fish-remains from the Lower Trias of Spitzbergen.

By

A. Smith Woodward, LL. D., F. R. S.

of the British Museum.

(With Pl. XIV.)

The fish-remains collected in the Lower Trias of Spitzbergen by the Swedish expeditions of 1908 and 1909, belong to genera of which some are typically Triassic, while others occur more commonly in the latest Palæozoic formations. Several of the specimens are not sufficiently well preserved for exact determination; but after a careful comparison of the whole collection with the large series of Upper Palæozoic and Triassic fishes in the British Museum, I venture to recognise and name a few new species which are probably well founded.

1. Hybodont Selachian.

Three fragments of a large Selachian fin-spine, about 3 cm. in maximum width, were obtained from the *Daonella*-beds of Middelhook. It is longitudinally ribbed like the spines of *Hybodus* and *Acrodus,* but the hinder border cannot be seen.

2. **Coelacanthus guttatus** sp. nov. Pl. XIV, Figs. 1, 1 a, 1 b.

The remains of a Coelacanth fish from Sassen Bay (Fig. 1) comprise the operculum and scales, which show that the species is distinct from any hitherto discovered.

Description. — The head is represented only by fragments of the pterygoquadrate and mandible, with an imperfect gular plate beneath. The operculum (Fig. 1, OP.) is broken by crushing, and a little abraded; but it is clearly shown to be triangular in shape, with rounded angles, and some-

what deeper than broad. Its outer face is marked by sparsely arranged, coarse tubercles, which are sometimes elongated in directions radiating from the point of suspension. Indications of the ordinary Coelacanth axial skeleton are seen through the squamation; but the only remains of fins are the lobate base of one of the pectorals (P), part of the forked axonost of the posterior dorsal (D^2), and the foremost support of the lower lobe of the tail. The basal parts of the rays of the pectoral fin are, as usual, not articulated; and appearances suggest that their distal parts were not expanded. The thin scales are preserved in impression on the rock, often exhibiting their fine concentric lines of growth. Their external ornament consists of coarse tubercles (Fig. 1 *a*), which are never crowded but are especially sparse on the anterior part of the caudal region of the fish. These tubercles are often antero-posteriorly elongated, but they never converge towards the hinder angle of the scale. They do not vary much in coarseness, but some on the scales of the ventral border near the caudal fin (Fig. 1 *b*) are perhaps finer than the rest.

Determination. — On direct comparison of specimens it is evident, that the scale-ornament of the new Spitzbergen fossil agrees more closely with that of the later species of *Coelacanthus,* than with that of any other Coelacanth. It is especially similar to that of *C. gracilis,*[1] which is supposed to have been obtained from the Muschelkalk. It differs, however, in the sparseness of the coarse tubercles over a large part of the trunk, and may therefore be distinguished under the name of *C. guttatus.* The fish cannot be referred to either of the known Triassic genera *Graphiurus, Diplurus,* or *Heptanema,* differing from the first in the nature of the pectoral fin-rays, and from the others in the scale-ornament.

3. **Acrolepis arctica** sp. nov. Pl. XIV, Fig. 2.

A Palæoniscid fish from Sassen Bay is represented by several fragments, which apparently belong to one individual but are divided by veins of calcite. They exhibit numerous scales and portions of fins, with the pectoral arch and remains of the opercular bones, all in impression on the rock. Another specimen of the same species obtained by the Conway expedition in 1896, now in the British Museum, shows actual scales and some of the fin-rays.

Description. — The operculum (Fig. 2, OP), suboperculum, and clavicular plates (CL) are covered with a close ornamentation of rounded vermiculating ridges, which pass at the hinder border into a finer crimping or serration. A few of the anterior flank-scales are somewhat deeper than broad, but the majority are not so deep as broad, while those near the ventral edge of the fish are often twice as broad as deep. Their over-

[1] L. AGASSIZ, Rech. Poiss. Foss. vol. ii. pt. ii (1884), p. 173; A. S. WOODWARD, Catalogue of Fossil Fishes in the British Museum, pt. ii (1891), p. 408.

lapped anterior border is relatively wide. Their outer face is ornamented by smooth, rounded ridges, which are slightly inclined downwards and backwards. At the anterior edge these ridges are most numerous, either by branching or by intercalation; in the hinder half of the scale they become wider and flatter, and are sometimes partly fused together; while at the hinder edge there are again short intercalated ridges, which help to form a comparatively fine and regular pectination. This characteristic ornament is as conspicuous on the ventral scales as on those of the flank. So far as preserved, the fin-rays have a long unjointed base, are then crossed by a few widely-separated articulations, and are finely subdivided distally. Some of the stout rays appear to have been ornamented with longitudinal ridges. In the British Museum specimen the pectoral fin is fringed with delicate fulcra, and its rays are crossed by distant articulations for at least their distal half.

Determination. — Though the generic position of the fish represented by these fragmentary remains is not certain, the species must probably be referred either to *Elonichthys*, *Acrolepis,* or *Gyrolepis*. The scales appear to be too deeply overlapping and the fins too small for *Elonichthys;* while the much-articulated pectoral fin-rays seem to exclude the fish from *Gyrolepis*. So far as preserved, however, it agrees well with *Acrolepis,* and it is merely distinguished from the known species of this genus by the nature of the scale-ornament. It may thus be named *Acrolepis arctica*.

4. Acrolepis (?) spp.

Some larger scales from Sassen Bay and other scales from the *Daonella*-beds of Middelhook, may also belong to species of *Acrolepis;* and a portion of a Palæoniscid tail from the *Daonella*-beds of Cape Svea, is probably referable to the same genus.

5. Myriolepis (?) sp.

A large elongated Palæoniscid fish coiled up in a nodule (no. 12) from Sassen Bay, is covered with very small scales which are ornamented as in *Myriolepis*.[1] The jaws also exhibit well-spaced large laniary teeth. The median fins, however, cannot be seen, and the generic position of the fish thus remains doubtful.

6. Belonorhynchus wimani sp. nov. Pl. XIV, Figs. 3—6.

A few imperfect skulls and jaws from Sassen Bay belong to a large species of *Belonorhynchus,* with the head about 25 cm. in length. Though

[1] A. S. WOODWARD, Ann. & Mag. Nat. Hist. [7] vol. xviii (1906), p. 418, pl. x. fig. 1 *a*; and Mem. Geol. Surv. N. S. Wales, Palæontology no. 10 (1908), p. 16, pl. iii, fig. 3.

fragmentary, the skulls are not much crushed, and they therefore exhibit some new features. One specimen (no. 9) is especially instructive, being broken longitudinally in two planes, which display both the outer bones (Fig. 5) and part of the cranium (Fig. 6). Another specimen (no. 15), showing also some anterior scutes and parts of the pectoral fins (Figs. 3, 4), is only disturbed by veins of calcite.

Description. — The maximum depth of the head at the occiput seems to be contained between three and four times in its total length. As usual in *Belonorhynchus,* the cranial roof appears to extend directly backwards over the branchial region (no. 15). It is gently arched from side to side, but slightly flattened in the middle of the interorbital and postorbital regions, where the straight median suture between the frontal bones is conspicuous. These regions (as seen in no. 16) are covered with an ornament of close, relatively coarse ridges, which are mainly longitudinal in direction, but sometimes vermiculating, and sometimes partly subdivided into tubercles. Longitudinal ridges, much subdivided into elongated tubercles, are also seen (in no. 9) on the roof above and just in front of the narial openings. The extent of ossification in the cranial cartilage is uncertain; but cancellous bony tissue is seen (in nos. 9, 16) both in the postfrontal or sphenotic (Fig. 5, PTF) and prefrontal or ectethmoidal (Fig. 6, PRF) regions. Between the orbits there is a vertical thin ossified septum (seen in no. 9), but whether this is single or double cannot be determined. In the hinder part of the skull, a thin and narrow plate of bone (Fig. 6, X) extends backwards and upwards from the basicranial axis, perhaps an ascending process from the parasphenoid (PAS) over the otic region. The whole of the cheek behind the orbit (Fig. 5, ORB) is covered by a large bony plate (PO) directly continuous with the maxilla, which extends as a narrow bar below the eye. Its outer face is ornamented with closely arranged, coarse, flattened ridges, which are in general concentric with the margin in the postero-superior region, but appear to be nearly vertical or inclined downwards and forwards in other parts. As shown in cross-section below the orbit, a palatine plate extends inwards from its lower border.[1] Its straight oral margin bears a regular close series of small bluntly-pointed teeth as far back as the middle of the postorbital plate. Each tooth has an enamelled tip and a very finely striated base. The constitution of the face in front of the orbit is uncertain, but the maxilla seems to be produced as a tapering point for some distance forwards. Above this the bone of the face exhibits two narial openings (Figs. 3, 5, NA), both deeper than wide, and the hinder of the two comparatively small. The coarse ornament of its outer face is for the most part subdivided into closely-arranged flattened tubercles. The much extended premaxillary region (PMX) is ornamented at least in its hinder portion with the usual nearly vertical ridges, and its straight oral border

[1] A similar palatine plate on the maxilla of *Saurichthys* has been described by A. S. WOODWARD, Ann. & Mag. Nat. Hist. [6] vol. iii (1889), p. 301, pl. xiv. figs. 7, 8.

bears not only the small closely-arranged teeth, but also a very large conical tooth at distant intervals. Each of these teeth is of the form usual in *Saurichthys* and *Belonorhynchus,* with a small enamelled apex and a large vertically-striated base, which is especially wide and coarsely crimped where it is fused with the supporting bone. An enlarged tooth in the mandible appears just behind each enlarged tooth of the premaxilla. The articular end of the mandible (completely seen in Fig. 5, MD) is a little less deep than the postorbital plate; its hinder border inclines forwards and downwards, making an angle much greater than a right-angle with the lower border; and its outer face is ornamented by the usual coarse ridges which are directed downwards and forwards apparently in all parts, with only slight subdivision into flattened tubercles at the oral and lower margins. The thin hinder part of the splenial bone shows a few small tubercular teeth, very sparsely arranged. A long and narrow plate of bone within the hinder part of the maxilla, probably the ectopterygoid (Fig. 6, PT), is densely covered with tubercular teeth; and this passes forwards below the orbit into a smooth lamina of bone (probably palatine) which exhibits a single series of slightly larger tubercular teeth at its lower margin.

Of the trunk only an anterior fragment, with part of the pectoral fin, is shown in one specimen (Fig. 3), From the occiput a median dorsal series of overlapping scutes can be traced backwards, and two of the hindmost are sufficiently displaced to exhibit their outline. These (Figs. 3, 4, R) are almost trefoil-shaped, about as broad as long, with an angular cleft in front and very bluntly rounded margin behind. They are flattened in the fossil and their ornament is obscure, but they seem to be finely tuberculated. Immediately behind the occiput there are traces of a few series of deep and narrow rhombic scales, extending on either side of the ridge-scutes down the flanks to the lateral line, which is clearly marked by a series of relatively large and deep scutes. Each scute of the lateral line (Fig. 4, L) is about three times as deep as wide, the large opening for the slime-canal marking off the upper third which is slightly bent forwards, and the lower end being truncated. Here again the external ornament is of fine and closely arranged tubercles. The pectoral fin-rays (Figs. 3, 4, PCT) seem to have been subdivided distally.

Determination. — The generic position of this fish is so obvious that it does not need discussion; and its specific characters are clearly distinct from those of any *Belonorhynchus* hitherto described. It differs from the known forms[1] especially in the shape and proportions of the dermal plates on the body, and I propose that it be named *B. wimani,* in honour of Dr. CARL WIMAN, who has contributed so much to our knowledge of the geology and fossils of Spitzbergen.

[1] A. S. WOODWARD, Catalogue of Fossil Fishes in the British Museum, pt. iii (1895), pp. 11—19; F. BASSANI, Palæontogr. Italica, vol. i (1895), pp. 183—186; G. DE ALESSANDRI, Mem. Soc. Ital. Sci. Nat. Milano, vol. vii (1910), pp. 52—66.

7. Semionotus (?) sp.

The greater part of the squamation, with the anal fin, of a small species of *Semionotus* or an allied genus, was obtained at a locality south of Cape Wijk.

8. **Colobodus altilepis** sp. nov. Pl. XIV, Figs. 7, 7 *a*—*c*.

There is one specimen of a Lepidotoid or Dapedioid fish from Sassen Bay, showing part of the head and trunk, but lacking the jaws and fins.

Description. — The head and opercular bones, the supraclavicle, supratemporals, and postclavicular plates are closely ornamented with large, flattened, enamelled tubercles, of irregular size and shape. The cranial roof is crushed upwards, and shows that the parietal bones (Fig. 7, PA) are equal in size, each about as broad as long. The squamosals must have been relatively small. The elongated frontal bones (FR) are excavated at the side for the orbit. The postorbital cheek-plates (PO), though very wide, are not so wide as the operculum; but all the cheek-plates are too much crushed and broken to exhibit their exact form and arrangement. The preoperculum, which is scarcely seen, must have been very narrow. The operculum (OP) is twice as deep as wide, and tapers a little towards the upper end. There is a single pair of supratemporal plates, which are transversely elongated, and taper to their point of meeting in the middle line, where they overlap the first dorsal ridge-scale. The supraclavicle and postclavicular plates are represented merely by fragments. All the scales are covered with smooth (sometimes slightly pitted) enamel, and more or less pectinated at the hinder border. They are united by very broad peg-and-socket articulations, which do not produce any thickened ridge on their inner face. Many of them are shown in broken section, displaying their concentric lines of growth. The dorsal region of the fish being crushed upwards, the median ridge-scales (R) are well seen. They are rhombic in shape, with a few pectinations at the hinder angle which is not produced to form any projecting point on the back. In each vertical row on the flank there are five nearly equilateral scales immediately below the ridge-scales, each with hinder pectinations in its lower half (Fig. 7 *b*). Then follow three or four larger and deeper scales (Figs. 7 *a*, 7 *c*) on the middle of the flank, which are completely pectinated at the hinder border. Two of these appear to be twice as deep as broad.

Determination. — The specimen thus described is excluded from the genus *Dapedius* by the structure of the cranial roof and the presence of only a single pair of supratemporal plates. Direct comparison, however, shows that it agrees very well with species of the allied genus *Colobodus*,

and its whole aspect is that of this typically Triassic and Rhætic fish. It differs from the known species of *Colobodus*[1] in the relatively great depth of the lower scales of the flank, and may be appropriately named *C. altilepis*.

Explanation of Figures Pl. XIV.

Fig. 1. *Coelacanthus guttatus* sp. nov., side view of fish, nat. size. D.[2] basal bone of posterior dorsal fin; OP. operculum; P. lobe of pectoral fin.
» 1 *a*.} Two scales of same specimen, twice nat. size.
» 1 *b*.}
» 2. *Acrolepis arctica* sp. nov.; fragment of anterior part of trunk, nat. size. CL. clavicle; OP. operculum; PCT. pectoral fin-rays.
» 3. *Belonorhynchus wimani* sp. nov.; head and anterior part of trunk of type specimen, two-thirds nat. size. L. dermal scute of lateral line; MD. mandible; NA. narial openings; PCT. pectoral fin; PMX. premaxilla; R. dermal scute of dorsal ridge.
» 4. Ditto; anterior part of trunk of same specimen, nat. size. Lettering as in Fig. 3.
» 5. Ditto; right side-view of head, nat. size. MD. mandible; NA. narial openings; ORB. orbit; PMX. premaxilla; PO. postorbital plate; PTF. postfrontal (sphenotic) bone.
» 6. Ditto; median longitudinal section of same skull, nat. size. PAS. parasphenoid; PRF. prefrontal (ectethmoid) bone; PT. pterygoid; X. ascending process of parasphenoid; other letters as in Fig. 5.
» 8. *Colobodus altilepis* sp. nov.; left side-view of head and part of trunk, distorted, nat. size. FR. frontal; OP. operculum; PA. parietal; PO. postorbital plates; R. dorsal ridge-scale; SOP. suboperculum.
» 7 *b*. Dorsal-lateral scale of same specimen, twice nat. size.
» 7 *a*, *c*. Two deepened flank-scales of same specimen, twice nat. size.

[1] A. S. Woodward, Catalogue of Fossil Fishes in the British Museum, pt. iii (1895), pp. 68—77; F. Bassani, Palæontogr. Italica, vol. i (1895), pp. 186—196; G de Alessandri, Mem. Soc. Ital. Sci. Nat. Milano, vol vii (1910), pp. 73—86.

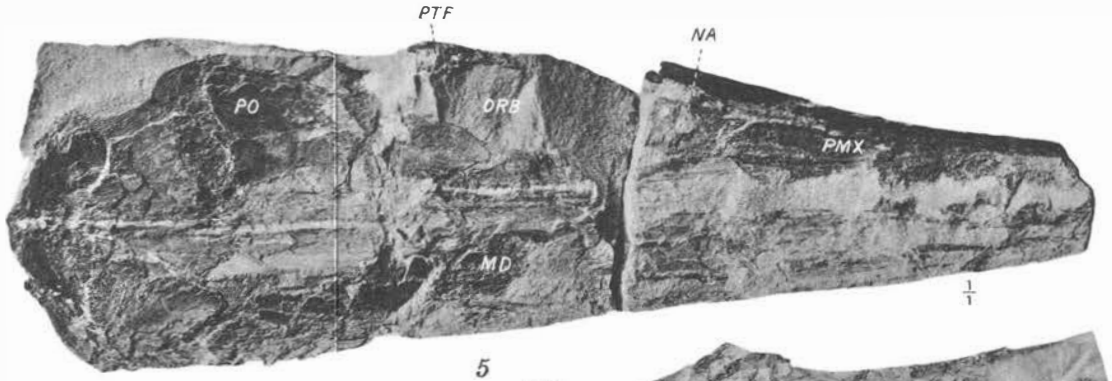
Gedruckt 15/4 *1912.*

1

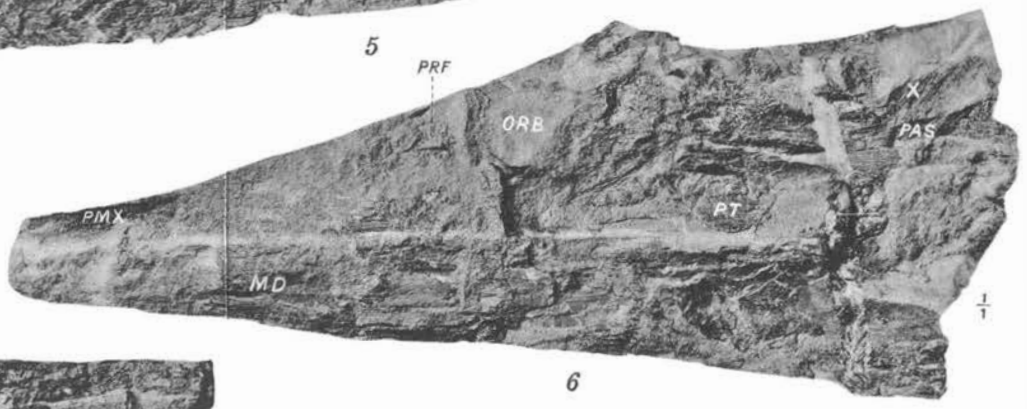
1a 1b

7a

7b 7c

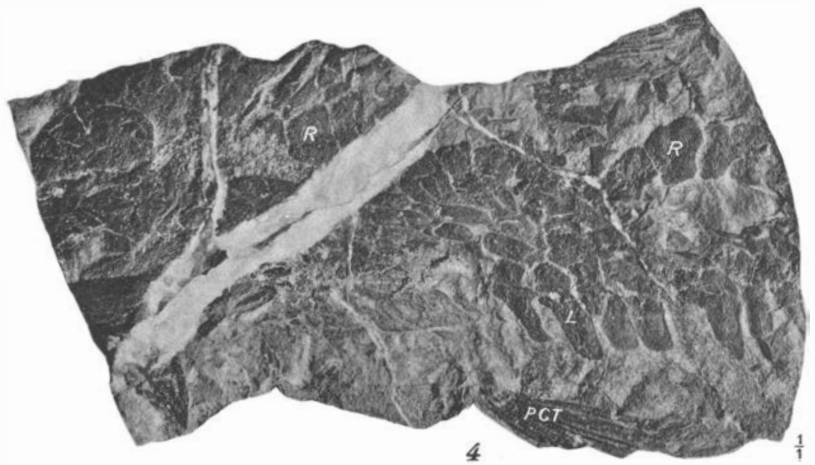


5



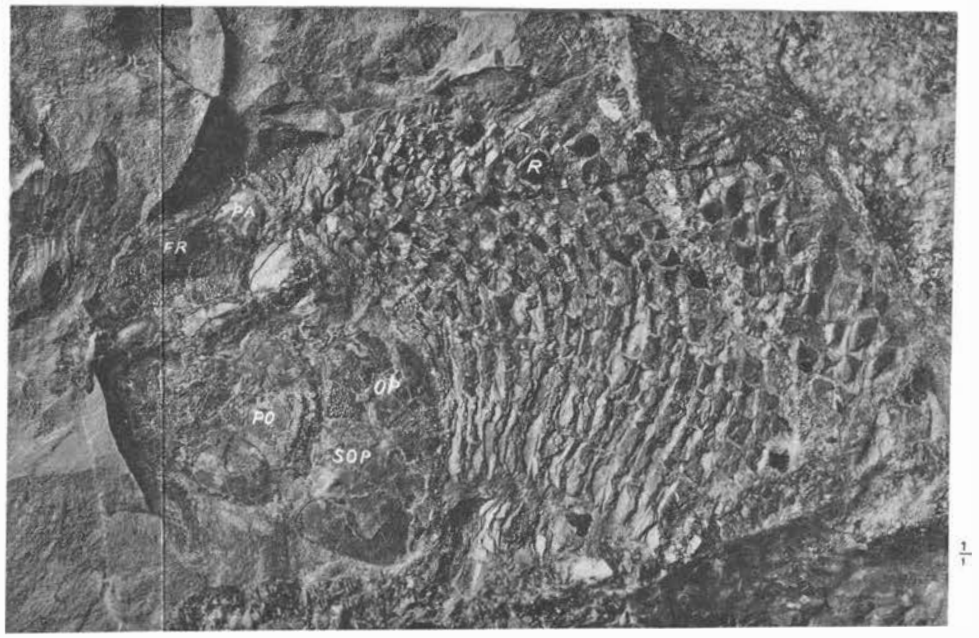
6

3



4

2



7

Ljustr. A. B. Lagrelius & Westphal, Stockholm