34. *On a New Species of COCCODUS (C. LINDSTRÖMI, Davis).* By
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[PLATE XXII.]

WHILST on a visit to Stockholm last year my attention was drawn by Professor G. Lindström to a small fossil fish from the Hard Chalk of Hakel in Mount Lebanon, which had been presented to the Museum of the Academy by the Duke of Leuchtenberg. It is nearly related to *Coccodus armatus*, Pictet *, and exhibits for the first time an almost complete outline of the body of a member of this genus. It is smaller than the species described by Prof. Pictet, and presents several features which dissociate it specifically from *Coccodus armatus*.

The fish is 0·065 m. in length from the tip of the snout to the base of the tail; its height in front of the dorsal spine is 0·022 m., and rapidly diminishes to the peduncle of the tail; anteriorly the head, triangular in outline, terminates in a pointed snout. Nearly two-thirds of the anterior part of the body is covered with strong osseous plates, the remaining portion being devoid of protection. The impressions of about twenty vertebræ remain; they were probably cartilaginous, for neither in this specimen, nor in those found previously, is there evidence of bony centra. Strong osseous neural spines with *branching* neurapophyses extend from the vertebral column, and midway along the dorsal surface support nine interneural spines; the latter are thick towards the distal extremity and afford a broad base of attachment for the rays of the dorsal fin. The dorsal fin extends 0·006 m.; its anterior ray is 0·006 m. behind the spine, and its posterior ray is separated by a distance of 0·010 m. from the base of the caudal. The hæmal spines are similar in structure to the neural, and have attached to them strong inter-hæmals, apparently broader † than the interneurals, and which support the rays of the anal fin. The latter has its origin immediately behind the bony armature of the head and abdomen, and extends thence half the distance to the tail. The caudal fin is supported by articulated rays, of which ten can be counted supporting the lower half, and probably an equal number constituted the upper half. The rays are 0·01 m. in length. The termination of the vertebral column is dilated to a radiating flattened piece, with which the caudal fin-rays are connected. The median rays of the tail are longer than those above and below, presenting a uniformly convex posterior margin. The pectoral and ventral fins, if such existed, are not preserved.

* F. J. Pictet.—“Description de quelques Poissons fossiles du Mont Liban,” 1850, p. 51, pl. ix. fig. 9.

James W. Davis.—“The Fossil Fishes of the Chalk of Mount Lebanon, in Syria,” Trans. Roy. Dublin Soc. ser. 2, vol. iii. 1887, p. 546, pl. xxx. fig. 1.

† Rather too weak in the illustration.

The head and anterior part of the body are protected by osseous plates of considerable thickness and strength, surmounted at the occiput by a large and massive spine. The spine is situated near the middle of the back at a distance of 0.04 m. from the tip of the snout. It rises to a height of 0.015 m. from the dorsal surface, and is inclined at a very slight angle backwards. The anterior part of the base of the spine is connected with the osseous plates of the cranium by a broad expansion of its surface, which is overlapped by the cranial bones. The surface of the spine is ornamented by longitudinal striations, parallel with its anterior margin; the striæ on the posterior portion disappearing along that surface. The posterior margin of the spine is armed with a series of nine or ten denticles—long, pointed, and robust, equal in length to the diameter of the spine in its upper part. The denticles are all inclined upwards, at an angle with the spine of about 45 degrees.

The orbit (*Or.*) is medium-sized, situated very high, and at a distance of 0.023 m. from the extremity of the snout. The interorbital space is occupied by one or more osseous plates, extending from the base of the spine to a distance in advance of the orbit. Connected with this is a long plate terminating in a sharp-pointed snout, and probably overlapping the maxillary bone (*Mx.*). The surface of this bone, and also of those occupying the interorbital area, is covered with minute tubercles, arranged more or less in lines parallel with the longer axis of the plates. The under surface of the head is covered with a series of plates: the most anterior is probably the mandible (*Mn.*). It does not extend so far forward as the maxillary bone, and its posterior portion assumes a V-shaped form: the upper branch, extending parallel with the maxillæ, may be the dentary, whilst the lower and longer branch probably constitutes the articular bone. Between the orbit (*Or.*) and the operculum (*Op.*) is a series of bones, which in this specimen are somewhat indeterminate. The space between these and the lower jaw is not very well-preserved; but there are indications of a large, more or less triangular plate, whose under surface was covered by a series of lines radiating from above downwards, and covering the region occupied by the mandibular suspensorium. The gill-cover is large, and consists of preoperculum (*Pop.*), operculum (*Op.*), and probably suboperculum (*Sop.*). The anterior margin of the preoperculum (*Pop.*) is almost straight, and extends in an oblique line from the anterior base of the spine to the posterior extremity of the mandible. It is a long and narrow bone; attached to its posterior margin is the operculum (*Op.*), larger in size, and with a circular posterior margin extending forwards beneath the preoperculum. The surface of both is covered with minute tubercles arranged in lines. The space beneath the operculum may have been occupied by the suboperculum. Behind the operculum and extending to the abdominal aspect of the body is a large bony plate representing the clavicular portion of the scapular arch (*Sc.*). The posterior extremity of the bone forms a process extending considerably backwards; its upper portion is enveloped by the operculum; its surface is orna-

mented in a manner similar to that of the external bones already described.

Coccodus armatus, Pictet.—The specimen described by Prof. Pictet (*op. cit.* pl. ix. fig. 9) exhibited the under surface of the upper jaw, with the arrangement of the teeth; and the under surface of the shoulder-girdle, to which is attached a pectoral spine. The skeleton is regarded as being of a more fibrous than osseous structure; the vertebral column is deformed by fossilization; the osseous spines are large and solid, and probably held the fins. The pectoral arch recalled to the mind of the learned author the organization of the Rays. The upper jaw is armed with four ranges of flat teeth, which cover the entire surface of the palate; they are preceded by a number of small teeth at the extremity of the jaw. The teeth of the lower jaw are represented by a single row; they are smaller than those of the upper, and Pictet found on examination that they were attached to the jaw without roots, in a similar manner to those of Pyenodont fishes. The spines attached to the pectoral arch recall those of the *Pimelodus Clarias*, Geoff., a Siluroid fish found in the Nile, as does also the bone to which it is attached, extending along the side of the body. It also approaches the Sclerodermic *Ostracion* in the bony covering of the anterior portion of the body. In conclusion, Pictet considers that the fish most nearly approaches the Siluroids, with some Sclerodermic resemblances, but differs from both in the character of the teeth.

The second example of *C. armatus*, described in the Transactions of the Royal Dublin Society, is also imperfect, but exhibits a lateral presentment of the bones of the head, a part of the vertebral column, and the position of the dorsal fin. The fin referred to as the "ventral," which should be "anal," is shown by the specimen now described to be the base of the caudal. The anal fin is opposite to the dorsal, but is absent in that specimen. The arrangement of the teeth is exhibited, and is similar to that in the specimen figured by Pictet. The arrangement and character of the bones covering the posterior part of the head are shown. There is an expansion of the pectoral arch into three prominent, pointed, spinous processes. The first has its origin behind the median portion of the operculum, and from a broad base extends downwards, with a curvature ending in a more or less pointed apex. A second and smaller process extends in an outwardly diagonal direction from the body. The third extends backwards parallel with the abdominal surface of the body, becomes attenuated, and ends in a point. The surface of each is striated and their margins are denticulated.

Coccodus Lindstroemi, sp. nov.—The example now described, whilst possessing a sufficiently clear generic resemblance to *Coccodus*, as defined and described by Pictet, presents several peculiar features, which differ from the detailed characters of *C. armatus*, and renders necessary the institution of a separate species. The size of the body and the character and arrangement of the teeth are similar in all the specimens previously described; and the pectoral spine exhibited in Pictet's figure is probably represented by the lower one

figured in the Transactions of the Royal Dublin Society (1887, pl. xxx. fig. 1). In the species now described an equivalent of this spinous process does not appear, unless the posterior extension of the scapular arch could be so construed. The posterior basal extension of the dorsal spine is also very different in the two forms. The dentition of this specimen is not exposed, and the size of the body is only about one-third that of *Coccodus armatus*, Pictet. The dorsal fin in *C. armatus* is separated from the occipital region by a distance equal to the length of the head; but in this smaller specimen it is comparatively near, and was, compared with the size of the fish, a larger fin.

The imperfection of the specimen at the disposal of Professor Pictet led him to the conclusion that the fish presented the most marked analogy with some of the Siluroids, indicating more particularly *Synodontis*, locally termed "Schal," which is found in the Nile, and *Pimelodus*, also found in the Nile, but more abundantly in the rivers of South America. These fishes are protected by dermal coverings on the head, and possess pectoral and dorsal spines; but in *Synodontis* the mouth is small, and is armed only with weak, though long, pointed teeth; and the jaws of *Pimelodus* are edentulous. The arrangement of the fins, as shown in the specimen now described, is quite different from that of the Siluroids named above; in the latter the dorsal fin is attached to the spine; in *Coccodus* it is widely separated from it; and the anal is shorter and not of the form of that in *Coccodus*. The great resemblance of the teeth of *Coccodus* to those of the Pycnodonts, and the cartilaginous character of the vertebræ, indicate a relationship with the Ganoids; but its exact location in that group must still remain problematical.

I have pleasure in appending the name of my friend Professor G. Lindström, to whom I have been in many ways indebted, to designate specifically the fish now described.

EXPLANATION OF PLATE XXII.

Fig. 1. *Coccodus Lindströmi*, Davis. Outline; natural size.

2. The same; enlarged two diameters.

Or., orbit; *Mx.*, maxilla; *Pmx.*, premaxilla; *Mn.*, mandible; *Pop.*, preoperculum; *Op.*, operculum; *Sop.*, suboperculum; *Sc.*, scapular arch; *Fr.*, frontal.

Fig. 2. Magn. 2 diam.

Fig. 1. Nat. size.

COCODUS LINDSTREMI, Davis.