

II.—ON *XENACANTHUS* (*ORTHACANTHUS*) *DECHENII*, GOLDFUSS.

By Professor KNER, of Vienna.

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**A**MONG the many valuable papers by Professor Kner, on Recent and Fossil Fishes,<sup>1</sup> the one before us deserves the particular attention of palæontologists, as giving the first complete elucidation of a remarkable type of fossil fishes, which had been hitherto, to a great degree, misunderstood. Prof. Kner first gives an abstract of the history of his subject. The genera *Orthacanthus* and *Pleuracanthus* were founded 30 years ago (1837), on isolated "ichthyodolites" from the British Carboniferous System, by Agassiz, and were erroneously regarded as the first indications of the existence of Skates on our planet. They were found in various localities in Great Britain (Dudley, Leeds, North Wales, Carlisle, and Edinburgh); and subsequently three other species were described by Dr. Newberry, from the Carboniferous formation of Ohio. A singular form of teeth, considered as those of a peculiar genus of Sharks, *Diplodus*, Ag., was at the same time found in the Carboniferous slates of England (Stafford, Carlisle, Burdiehouse), and in Nova Scotia. Ten years later (1847), Goldfuss described and figured<sup>2</sup> a rather well preserved impression of the fish itself from Ruppelsdorf, in Bohemia, while Beyrich (1848), published an account of the counter-part of the same specimen,<sup>3</sup> but named it *Xenacanthus Dechenii*, and Dr. Jordan (1849) described some remains of the same type from Lebach, near Saarbück, as those of a fossil shark, called *Triodus sessilis*.<sup>4</sup> The identity of this last genus with *Xenacanthus* was pointed out by Mr. Schnur.<sup>5</sup>

Meanwhile Sir Philip de M. Grey Egerton, Bart., had pronounced the generic identity of *Pleuracanthus* and *Diplodus* (Brit. Assoc. Glasgow, 1855), and soon after (1857, *Annals*, vol. xx.), having examined several fine specimens from Klein-Neundorf, in Silesia, he was able to announce that the spines of *Xenacanthus* did not differ generically from these termed *Pleuracanthus*. Up to this time, how-

<sup>1</sup> Kner u. Heckel. Neue Beiträge zur Kenntniss der fossilen Fische, Oesterrische, 1861. (Denkschriften d. Wiener Akademie).

Kner u. Steindachner. Neue Beiträge z. K. d. f. F., O. 1863. (*ibid.*)

Kner. Ueber einige Fossile Fische aus den Kriede- und Tertiär schichten von Coman u. Podused. 1863. (Wiener Sitzungsberichte).

—— Kleinere Beiträge z. K. d. f. F., O. (*ibid.*) 1862.

—— Die Fossilen Fische der Asphaltschiefer von Seefeld in Tirol, 1866. (*ibid.*)

—— Die Fische der bituminösen Schiefer v. Raibl in Karnten. 1866. (*ibid.*)

—— Neuer Beiträge z. K. d. f. F. von Coman b. Gorg., 1867. (*ibid.*)

—— Nachtrag. zur der fossilen Fischen von Raibl. 1867. (*ibid.*)

—— Ueber *Orthacanthus Dechenii*, Goldf., oder *Xenacanthus Dechenii*, Beyr., 1867. (*ibid.*)

<sup>2</sup> Beiträge z. Fauna d. rheinischen Steinkohle.

<sup>3</sup> Monatsberichte d. Ak. d. W. Berlin.

<sup>4</sup> Leonhard u. Bronn. Jahrbuch, etc., p. 843.

<sup>5</sup> Zeitschrift d. deutschen Geologischen Gesellschaft, viii., 1856.

ever, the fish was principally known from Beyrich's description, and was commonly held to be a shark related to the recent *Squatina*.

In 1861 Dr. Geinitz gave a new description and a beautiful figure of it (natural size), in his excellent work on the "Dyas" (pp. 22, 23, f. 1). The discovery, that a remarkable disc-like body, often accompanying the fossil fish, was formed of the coalesced ventral fins, transformed into a sort of sucking-disc, induced this author to place it (with Reichenbach) in the vicinity of the *Discoboli* (Cyclopterines), rather than in that of the *Placoidei*.

Our author then proceeds to describe in detail the various specimens entrusted to his examination by the Museums of Dresden, Berlin, Breslau, and Vienna, and some private gentlemen (Dr. Weiss and Dr Jordan) at Saarbruck, forming together a much richer series of specimens for the investigation of this curious Permian genus, than any of its previous observers had before them. This descriptive portion of Professor Kner's memoir is accompanied by ten lithographic plates. It is hardly possible to give an abstract of it, nor is it necessary, as we may learn from the general sketch given below, of the whole organisation of the animal, in which the author has himself condensed all the most essential results of the preceding elaborate description. If I add that it is no easy task to follow the author through his detailed account of all the more or less fragmentary and often indistinct and dubious specimens, and that the figures do not always aid the understanding of the text, so well as might have been expected, this is not intended as a reproof; I fully understand how very difficult their interpretation and figuring in many instances must have been.

"The general form of the body was elongated, the head broad, rather depressed, the snout broadly rounded, the mandible somewhat prominent, the mouth closely beset with rows of pointed teeth on the inter-, supra-, and infra-maxillaries, the palatine and pharyngeal bones. Most of the teeth were three-pointed, with a short median point and two longer diverging lateral ones that arose from the posterior border of the base, and during repose were laid down in such a manner that only this basilar portion stood forward. They were hollow from the base towards the points, and therefore easily broken; some had a smooth, others a furrowed surface. In the lateral parts of the jaws they were arranged in 28-29 rows of 6-8 in each transversely; on the inter-maxillary they formed 4 rows of 6-8 in each. Beside the tricuspidate teeth, there were perhaps some with one point only,—we suspect that on the pharyngeal bones there were also others with two and four points, or even five and six! The osseous palatine arch appears to have formed, as in sharks, a simple maxillary suspensorium connected with the mandible. The existence and position of the eyes cannot be fully stated, but it is certain that four or five branchial arches were present, armed with a few long rake-shaped teeth: and in the front of these arches numerous thin branchiostegal rays were attached to the distal end of two large bones, answering to the cornua hyoidea. The connexion between the branchial apparatus and the shoulder-

girdle is similar to that in the sharks; the scapular arch is not attached to the occiput, but lies further back, as in *Chondropteri* and eels, without any immediate connexion with the vertebræ,—the neuropophyses of eight vertebræ lying between it and the head. There is no vestige of an opercular apparatus. The scapular arch is formed of at least three separate portions,—supra-scapula, scapula, and clavícula. The inferior triangular pharyngeal bone is single, and like the two superior separate ones they are closely covered with teeth of the same kind as those of the jaws; its posterior end lies directly before the scapular arch. From the occiput arises a straight-pointed occipital spine, without any basal articulation, somewhat depressed at the base, rounded towards the point, and serrated on both its lateral margins. The simple-rayed dorsal fin begins before the point of this spine (which is always laid down in a backward direction), and not only runs along the whole back to the point of the long compressed, and rather attenuated tail, but is also continued on the ventral side of the body towards the few-rayed anal fin. The pectorals are inserted at the angles of the scapular arch, and begin with some rather long, broad, bony plates, and a long multi-articulate carpal bone, to which were affixed several oblique, thin, long rays, continued by filamentous fibres, thus recalling the pectorals of the sharks but not specially those of *Squatina*. The anal fin is also distinguished by a strong dichotomous carpal ray. The ventral fins are always situated at, or behind, the centre of the body, and supported by triangular pelvic bones. In some specimens they are coalesced into a ventral disc, and provided inside and behind with tubiform (or half-tubiform) clasping appendages, others are without these, and are separate from each other. The vertebral column runs in a straight line to its extremity, and is composed of numerous vertebral elements, superior and inferior arches with spinous processes, and bearing thin ribs on the anterior arches; the dorsal fin is supported by a double (superior and inferior) row of hollow interspinous and dichotomous accessory interspinal bones (syropophyses, Ag.) articulating with each other, and with the fin-rays by true articulations. The vertebral bodies were nowhere truly developed, and failed in the caudal region altogether. The skeleton was probably mostly cartilaginous, as demonstrated by the distinct impression of the outer mosaic-shaped (tessellated) bony crust, quite similar to that of the living *Chondropteri*. The dermal covering in other examples consisted of a granular shagreen, composed of very small enamelled scales."

For several reasons (especially the difference of the teeth, which are smooth in some, furrowed in others, the different length, shape, and armature of the occipital spine, the dermal covering, etc.), the author is inclined to assume the existence of more than one species under the collective name of *X. Decheni*, (the species from Lebach might perhaps be distinct from that of Rakowitz).

The difference in the structure of the ventral fins, Professor Kner most ingeniously interprets (and herein I heartily agree with him), as a *sexual difference*, the ventral disc with its clasping appendages

not being a true sucking-disc, as in the *Cyclopteri*, but a male copulative organ. That the *Xenacanthi* fed upon their weaker contemporaries the *Acanthodes*, is evidenced by the discovery of spines and other remains of this genus within the body of the former. As to its geological position, it is characteristic of the "Rothliegende" of the Permian system, and our author thinks that the strata in England and North America containing teeth of *Diplodus* and spines of *Pleuracanthus*, ought, perhaps, on closer examination, also to be referred to the same system, and not to the Carboniferous.

In summing up the characters of this peculiar palæichthyic type with the view of determining its zoological affinities and systematic position, we should, with Dr Kner, distinguish between those which it has in common with modern Chondropteros (Placoid) fishes; for instance, the mosaic or tessellated covering of the skeleton, the absence of opercular bones, the position of the shoulder-girdle, the single undivided suspensorium of the jaw, the articulation of the upper jaw on the lower, the dermal covering, etc., all which of course would indicate the necessity of an arrangement, by which the *Pleuracanthi* would be placed among the *Chondropteri*, in the vicinity of the sharks. On the other hand, there are characters which contradict this position, and which remind us rather of the true osseous fishes; for instance, the dorsal fin-rays, the double row of interspinal bones, the toothed inter-maxillary, palatine, pharyngeal, and branchial arches, the tripartite shoulder-girdle and the branchiostegal rays. Professor Kner thinks these latter arguments so heavy that the balance inclines towards the *Teleostei*, especially the *Siluri*, rather than towards the *Chondropteri*, but that *Xenacanthus* was nevertheless an intermediate form partaking of the characters of each. We must confess, however, that the analogies with the "Sheet"-fishes (Flat-fishes) pointed out by the author; as for instance, the lengthened body, the broad terminal mouth, the shagreen covering of the head, recalling the "helm" of *Bagrus*, the straight and toothed dorsal spine (compressed, however, and serrated before and behind in the "Sheet"-fishes, depressed and serrated laterally in *Xenacanthus*, as pointed out by the author himself, the long many-rayed dorsal fin, continued to or around the long attenuated tail; the appendages of the ventral fins in the males (recalling, however, much more those of the sharks,) appear to us to be only vague analogies rather than evidences of affinity. Even if *Xenacanthus* differed from the *Chondropteri* in all the above-named parts of its organisation, and for some of them we must entirely rely on the sagacity and accuracy of the author, (his figures not always giving convincing proof or the means of checking his evidence,) while others, for instance the branchiostegal rays may be found in Chimæroids. I should think that *Xenacanthus* differed after all not much more from the typical *Chondropteri* (viz., the *Plagiostomi* (Skates and Sharks), though in a different manner and in another direction, than does e. g. the *Chimæra*, which is nevertheless commonly and duly regarded as a true Placoid, closely related to Sharks. Might we, perhaps, not come nearest to the truth by establishing in the order of *Chondropteri* a peculiar tribe or sub-order for

the reception of the *Pleuracanthini*, equivalent to the *Chimerini*, *Squatini*, *Raiini*, and *Acanthodini*. There are, perhaps, also some points of relationship between the last-named tribe and another type, verging on the *Teleostei* [*Ganoidei*], but as Professor Huxley has argued, perhaps they are best arranged with the *Chondropteri* and the *Pleuracanthini*. At least I would not advise other naturalists of the Darwinian school, to which Professor Kner evidently belongs, to build too many developmental hypotheses on this somewhat doubtful "*Proto-Silurus*." I fear there is not strength enough in its back to support them! Whichever opinion as to its systematic position be ultimately adopted, the author's merits are not thereby diminished; he has certainly filled up a hitherto very long-felt vacancy, and Palæichthyology has made a positive advance in the publication of Professor Kner's paper on *Xenacanthus Decheni*, not on any account to be underrated, and we heartily recommend it to the attention of Zoologists, Palæontologists, and Geologists.

III.—LEONHARD UND GEINITZ'S "NEUES JAHRBUCH FÜR MINERALOGIE, GEOLOGIE, UND PALÆONTOLOGIE." Jahrgang, 1867. Hefte I-V.

THIS excellent monthly periodical of Geology and Mineralogy well supports the reputation it has long possessed as Leonhard and Bronn's Jahrbuch. The original articles are well selected, always of considerable interest and often of great value; the letters to the Editors, with news of fresh discoveries in fossils, minerals, and geological research, are always worth looking at; the catalogue of new books, with a notice of the geological contents of periodicals, is an important bibliographic feature; and the numerous concise and careful abstracts of books, pamphlets, and papers, classified under Mineralogy, Geology, and Palæontology are always acceptable to those who wish to know what is being thought, written, and done in these branches of science.

The five Numbers for the earlier portion of 1867, now before us, supply a fair sample of the result of researches carried on by our German brethren. For Mineralogy, we have *Kenngott* treating of Natrolite (p. 77), and on the alkaline reaction of several minerals (pp. 302-313 and 429-441): zeolites, talc, felspars, augite, mica, spinel, olivine, celestine, chlorite, tourmaline, epidote, etc.; *G. Werner* on the significance of the contours of crystal faces, and their reference to the relations of symmetry in the crystallographic systems (p. 129); at p. 159 *Liebe* gives the particulars of a metallic mineral from Atacama, consisting chiefly of iodine and lead. This "Jodblei" gave, on analysis,—

Antimony .....	0.77	Iodine .....	17.01
Carbonic Acid .....	0.31	Lead .....	73.01
Sulphate of Lead.....	5.51		—
Chlorine .....	2.91		99.52

Its origin is suggested as having been due, first to the oxidization of galena, followed by decomposition and rearrangement, arising from the action of alkaline mineral waters carrying iodine. To those