

Article XXV. — ON THE STRUCTURE OF TWO IMPERFECTLY KNOWN DINICHTHYIDS.

By L. HUSSAKOF.

PLATES XV-XVII.

During the past year the American Museum secured a small but valuable assemblage of sharks and "placoderms" from the Devonian (Cleveland shale) of Ohio, brought together by the veteran Ohio collector, Rev. Dr. William Kepler. This collection came into my hands for examination and cataloguing; and in going over the specimens several facts were made out which throw additional light on the structure of the two Arthrodires, *Dinichthys curtus* and *D. clarki* (= *Gorgonichthys*). These facts are briefly presented in the present paper.

I may add that this material was placed at my disposal by the Honorary Curator of fishes, Professor Bashford Dean, and that I am further indebted to him for many helpful suggestions made during the course of my work.

***Dinichthys curtus* Newb.**

The structure of this species is still imperfectly known. Some of its principal elements, e.g., the dorso-median, "clavicular," postero-ventro-lateral, and ventro-medians have not yet been described; while of the plates already known, especially those of the cranial shield, a critical review is needed in the light of new material.

In the present collection the remains, still retained in a large concretion of shale, are evidently those of a single individual, and, while incomplete and rather poorly preserved, are valuable because of their association. I here describe only those features which contribute to our understanding of this form.

Cranial shield (Pl. XV, Fig. 1). — Only the impression of a fragment from the left side of the cranium is preserved, the bone itself being entirely weathered away. The fragment shows the sutures and the canal system, both of which are clearly brought out in a cast prepared from the impression. This portion of the head-shield, it is noticed, is too small to warrant an altogether accurate restoration of the entire cranium, but with major probability it substantiates Professor Newberry's statement on page 156 of his *Palæozoic Fishes* of

North America, that the cranial shield, both in size and in the arrangement of its elements, resembles most closely that of *D. intermedius*. The canals and sutures, which were not referred to in detail by Newberry, entirely agree, as far as the present fragment goes, with those of *D. intermedius*, but are, of course, relatively smaller.

Dorso-median (Fig. 1.). — This element in *D. curtus* does not

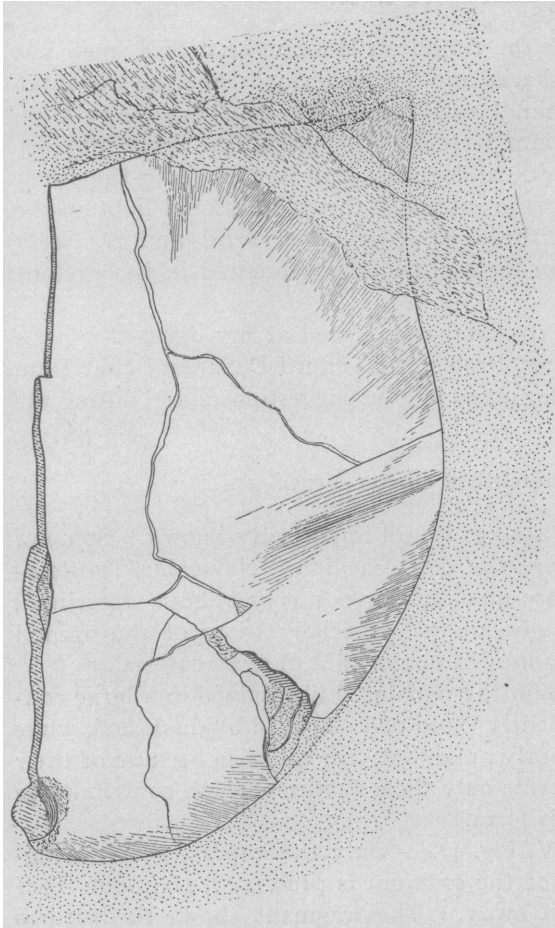


FIG. 1. *Dinichthys curtus* Newb. No. 7072. Left half of Dorso-median, internal aspect. Cleveland shale, Ohio. $\times \frac{1}{2}$.

appear to have been described. In the present specimen the left-hand half alone is preserved showing the ventral aspect. Both the keel and the posterior process are wanting. From the fragment it appears that the *curtus* dorso-median differs in no essential point from that in any other species of *Dinichthys*. The fragment clearly indicates an anterior emargination and somewhat acute antero-lateral angles.

Length (excluding process), $190 \pm$ mm.

Width (of fragment). 105 mm.

Estimated total width, 220 mm.

“*Clavicular.*” —

This element in *D. curtus* has hitherto not been described.

In this specimen large portions of both elements are present though poorly preserved.

Except for a difference in size they are entirely like those of *D. intermedius* (Pl. XVI, Fig. 2).

Gnathal elements. — Nearly the complete dentition of the indi-



FIG. 1. *Dinichthys curtus* Newb. Cranial plates in the matrix. $\times \frac{1}{4}$. Cleveland shale, Ohio. No. 7071. *CRAN.*, impression of left half of cranium; *Mx.*, "maxillary"; *S. O.*, suborbital.

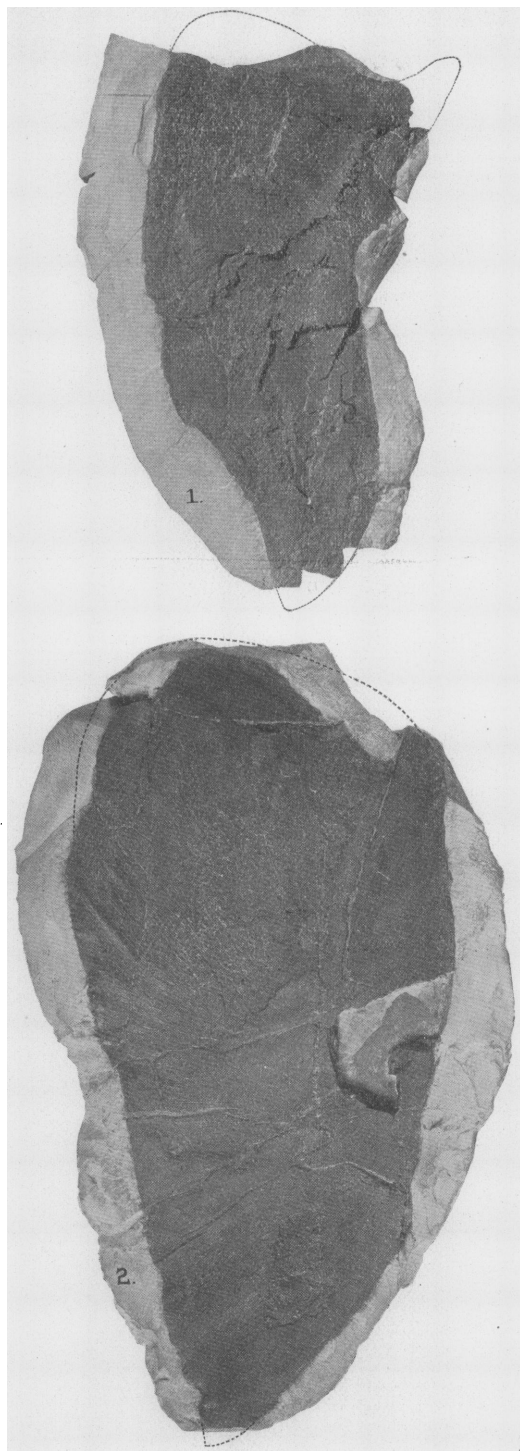
FIG. 2. *Dinichthys clarki* Claypole. Antero-dorso-lateral, visceral aspect. $\times \frac{1}{4}$. Cleveland shale, Ohio. No. 7039.



DINICHTHYS CURTUS NEWB. VENTRAL PLATES IN THE MATRIX. CLEVELAND SHALE, OHIO.

FIG. 1. Left antero-ventro-lateral, visceral aspect. $\times \frac{1}{4}$. No. 7048.

FIG. 2. Postero-ventro-laterals, visceral aspect. CL, portion of the clavicular. $\times \frac{1}{4}$. No. 7047.



DINICHTHYS CLARKI CLAYPOLE. VENTRAL PLATES IN THE MATRIX. CLEVELAND SHALE, OHIO.

FIG. 1. Right antero-ventro-lateral in visceral aspect. $\times \frac{1}{8}$. No. 7038.

FIG. 2. Right postero-ventro-lateral in visceral aspect. $\times \frac{1}{8}$. No. 7041.

vidual is preserved, the right "maxillary" alone, missing. The elements have been fully described by Professor Newberry¹ and by Dr. Eastman² and no description of them is here deemed necessary. It need only be pointed out that the specific character of the "mandible" as consisting in the presence of *two* cusps on the cutting edge following the main upturned "tooth," needs further examination. A careful comparison of several "mandibles" in this and in other species convinces the writer that the additional cusp — the more anterior of the two — is due to individual variation in the cutting action of the jaw, the condition in *D. curtus* being approximated in some specimens of *D. intermedius*. Again, this cusp is not strengthened by a vertical bar of bone as is the other cusp. Were it, then, a question of jaws only, *D. curtus* might reasonably be regarded as but a variety of *intermedius*.

The measurements of the gnathal elements are as follows:

Left "mandible,"	length, 236 mm.
" "	height, at tooth, $72 \pm$ mm.
Left "premaxillary,"	height (from tip of tooth to upper margin), 70 mm.
" "	width at process, 40 mm.
Left "maxillary,"	length, 90 mm.
" "	width just in front of process, 40 mm.

Ventral armor. — The ventral plates in this dinichthyid are similar in plan, and differ only in detail from those in the other species familiar to the writer. An almost perfect antero-ventro-lateral and both postero-ventro-laterals with their counterparts are represented.

The antero-ventro-lateral belongs to the left side and here exhibits its visceral face (Pl. XVI, Fig. 1). It agrees in proportions with that³ figured in external view by Newberry. As pointed out by Newberry, this element is relatively narrower in proportion to its length than the antero-ventro-lateral in any other species of *Dinichthys*.

Length, 245 mm.; about 2 mm. missing at posterior end.

Width, at about middle, 60 mm.

The postero-ventro-laterals in *D. curtus* are here described for the first time. A reference to the figure (Pl. XVI, Fig. 2) gives their form and proportions. They are exhibited in ventral aspect.

Measurements of the right-hand plate:

Length of preserved portion, 280 mm.

Estimated length, 290 mm.

Width at middle, 103 mm.

¹ Paleozoic Fishes of North America, p. 157.

² Dentition of Some Devonian Fishes. Journ. Geology, Vol. VIII, 1900, pp. 32-41.

³ Loc. cit., Plate L, fig. 2. Newb. Coll., No. 227.

A restoration of the ventral armor is suggested in the text, Fig. 2.

Sub-orbital (Pl. XV, Fig. 1.). — The left element is preserved. It is in shape like its homologue in other species.

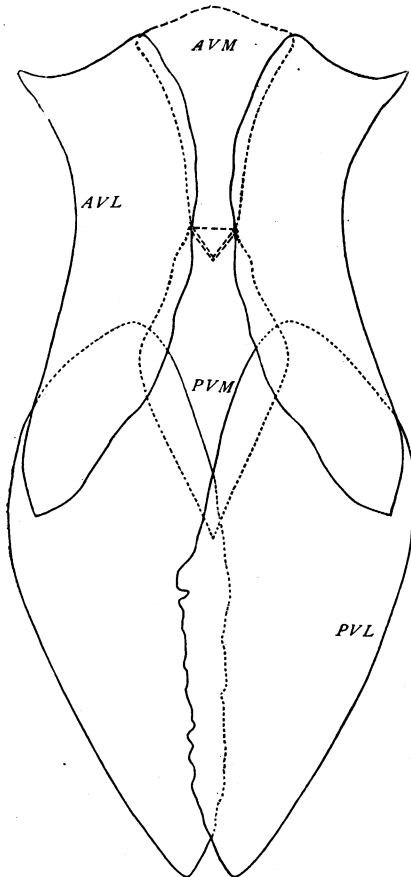


Fig. 2. *Dinichthys curtus* Newb. Restoration of ventral armor. $\times 4$. AVM, antero-ventro-medial; AVL, antero-ventro-lateral; PVM, postero-ventro-medial; PVL, postero-ventro-lateral.

Conclusion. — We are now in a position to define the specific characters of *D. curtus* Newberry. In general, this species most strongly resembles *D. intermedius*, though only about two-thirds its size. Professor Newberry has pointed out the agreement with that species in cranium, "maxillary"¹ and "mandible." My material extends this similarity to the dorso-median, the sub-orbital, and the "clavicular." The distinctive characters of the species, then, must be sought in other plates: in the antero-dorso-lateral, which Professor Newberry declares is "relatively broader than in any other species known"; in the antero-ventro-lateral, which is narrower in proportion to its length than that in any other species; in the characteristic outline of the postero-ventro-lateral; and, to a lesser degree, in the "mandible."

Dinichthys clarki Claypole

In 1892 Claypole described a huge toothed mandible from the Cleveland shale of Ohio to which he gave the name *Gorgonichthys*

clarki.² In 1900, Dr. C. R. Eastman maintained the generic identity of this genus with *Dinichthys*, pointing out that "the mandible displays an interesting stage of modification between denticled forms like *D. herzeri*, *D. halmodeus*, etc., on the one hand, and those with a

¹ *Loc. cit.*, p. 136.

² *Amer. Geologist*, Vol. X, 1892, pp. 1-4.

sharp cutting edge like *D. terrelli* on the other," and proposed to change the name to *D. clarki*.¹ This view is adopted in this paper, especially in consideration of certain facts concerning the body plates, presently to be described. In what follows, therefore, the term *D. clarki* is employed.

The species is represented in the collection by several large fragments, which when carefully put together and studied proved to be (1) a "mandible" and (2) three body plates. None of the latter class of elements in this species have hitherto been described, although a large postero-ventro-lateral preserved in the Ohio State Museum and thought by Eastman to belong to *D. herzeri*, is regarded by the writer, for reasons to be given later, as probably of this species.²

"*Mandible*." — There came with the Kepler Collection the posterior two-thirds of a right "mandible" embedded with its visceral face in matrix. It possessed three denticles. It was carefully removed from the matrix and compared with a "mandible" of *D. clarki*, and it looked so much like the latter, that no hesitation was felt in labelling it as such. Subsequently it was discovered that the element could very well stand as the type of what was figured by Clappole as a new species and named by him *D. kepleri*.³ There is no doubt that the "mandible" in question is Clappole's type specimen. He speaks of it as remaining in the possession of Dr. Kepler; of being broken across at the middle; and on comparing it with his figure and measuring by his scale, all doubt is removed. The specimen is somewhat smaller than either of two splendid "mandibles" of *D. clarki* in the Museum collections, and it belongs probably to an immature individual. Dr. Eastman at one time, arguing presumably from Clappole's description, regarded this specimen as belonging to *D. herzeri*; and upon this evidence, as well as upon a huge postero-ventro-lateral some 75 cm. long which he regarded as also belonging to this species, he urged the presence of *D. herzeri* in the Cleveland shale. But the writer's interpretation of this same "mandible" as that of *D. clarki*, and his conviction that the postero-ventro-lateral, to be mentioned, also belongs to the latter species, since it differs both in size and proportions from that of *D. herzeri* (see table, p. 414), proves the absence of *D. herzeri* from the Cleveland shale and its restriction to the Huron.

Antero-dorso-lateral (Pl. XV, Fig. 2). — The plate preserved is from the right-hand side and exhibits its visceral surface. In general

¹ *Loc. cit.*, p. 35.

² Professor Dean informs the writer that an almost complete specimen of this species is preserved in the British Museum in the Clark Collection.

³ A new *Dinichthys* — *Dinichthys kepleri*. Amer. Geologist, Vol. XIX, 1897, pp. 322-324, pl. 24.

form, it resembles the antero-dorso-lateral in other species. A break in the bone in the middle line shows in the matrix, a long narrow ridge, the cast of the lateral line of the dorsal side. This has the same direction as in all similar plates. A slight excavation in the posterior margin near one side, characteristic of most species, is here also present. The articulating process is crushed into the plate, and its anterior portion is entirely broken away.

Greatest width, 450 mm.

Length at the lateral line, 270 mm.

Antero-ventro-lateral.—The plate figured (Pl. XVII, Fig. 1) is the right-hand one, and it exposes the external (ventral) surface. Its counterpart is also in the collection and supplies some portions of the outline not brought out in the original. It is noted that the plate, like the others here described, differs, outside of size, only in minor details from those in *D. terrelli*—which confirms Dr. Eastman's view that this form is only another species of *Dinichthys* and not a different genus.

Length, 500 mm.

Width at middle, 170 mm.

Postero-ventro-lateral.—This plate is identical in form with that in *D. terrelli* but much larger (see table below). The right-hand plate is preserved in the collection, on its visceral surface (Pl. XVII, Fig. 2). Its dimensions are as follows:

Length, 750 mm.

Greatest width, 300 mm.

In the table which follows are given, for comparison, the proportions of the postero-ventro-laterals of *D. herzeri* and *D. terrelli* with those of the present species. The measurements are taken from specimens in the Newberry Collection, those of *D. herzeri* being from the type plate. This comparison, it seems to the writer, justifies the conclusion that the element here described is neither that of *D. terrelli* nor of *D. herzeri*.

MEASUREMENTS OF THE POSTERO-VENTRO-LATERALS.

Species.	Length.	Width (greatest).	Ratio of Width to Length.
<i>D. herzeri</i>	64 cm.	33 cm.	.51
<i>terrelli</i>	61	27	.44
<i>clarki</i>	75	30	.40

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