LOWER ORDOVICIAN FISH REMAINS FROM MISSOURI.

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ABSTRACT. A well preserved portion of a fish jaw, apparently a premaxilla, has been obtained from the Dutchtown formation of southeastern Missouri. It is the oldest certain evidence of fishes known, and it was found in association with a large and varied marine fauna, including conodonts.

ALMOST a decade ago Collison recorded the occurrence of fish remains in the Lower Ordovician Dutchtown formation of southeastern Missouri and documented his statements with illustrations and descriptions of two specimens. However, this discovery has not been accorded the consideration it seems to merit, and it is still generally stated that the oldest known fishes are from the Harding sandstone of Colorado, the Bighorn formation of Wyoming, and the Whitewood formation of South Dakota, all of which are Middle or Upper Ordovician in age. It should perhaps be mentioned in this connection that conodonts, which are regarded by many paleontologists as teeth of primitive fishes, are known to occur in such Lower Ordovician strata as the Jefferson City and Prairie du Chien groups of the Mississippi Valley, the Balticport of the Baltic region, and the Arenig of Scotland—all of these are almost certainly older than the Dutchtown. The oldest conodonts that have so far been described are believed to be those from the Oneota formation of the Prairie du Chien group.

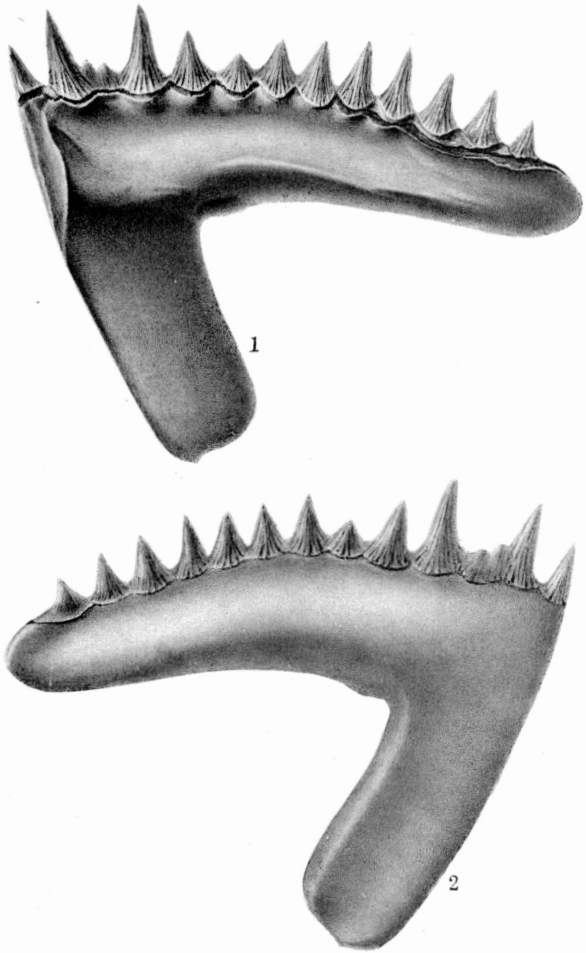
The better of the two fish fragments known from the Dutchtown is the holotype of *Archeognathus primus* Cullison, the type species of the genus. It consists of a more or less V-shaped structure, one bar of which is considerably shorter than the other. The longer bar, which is about 7½ mm. in length, is distinctly bowed laterally and arched orally—one of its convex sides was presumably oral in position for there is a series of denticles on it.

The two bars join at an angle of approximately 60 degrees. The maximum thickness of the specimen, estimated as some 2 mm., is attained at or near the junction of the bars, both of

which taper gradually from this place. In general, the shorter bar is elliptical in cross section, whereas the longer one, though subangular laterally, is more or less pyriform, with the denticles on the attenuate side. The inner lateral surface of the bars is very dark brown in color, whereas the outer, though locally stained red, is light bluish gray, as are many Paleozoic fish plates.

The denticles also are dark brown in color, though when viewed with transmitted light, they take on an amber hue. Altogether there are fourteen denticles on the specimen under consideration, but two of them are very small. In size these denticles vary greatly, but in general they constitute a gradational series, with the largest individuals being on the anterior portion of the bar. The surface of the denticles is marked by longitudinal striae that are fairly regular in their development. They are particularly prominent on the basal portions of the denticles and become very faint distally, possibly as a result of wear, which is more apparent on the specimen than our illustrations indicate. Although the bases of most of the denticles are closely appressed, they do not appear to be fused. Clearly these denticles have hollow bases, and they rest on the bar rather than being inserted into it. Insofar as size, shape, and manner of basal attachment are concerned, these denticles do not differ greatly from certain Ordovician conodonts, some of which also bear longitudinal striae. Furthermore, in such conodont genera as *Neocoleodus* Branson and Mehl, which is well represented in the Dutchtown formation, adjacent denticles are only slightly fused basally, and their individuality is readily apparent when they are viewed by means of transmitted light. It seems probable that isolated denticles from the specimen we are studying might readily be taken for primitive conodonts.

The general physiognomy of this specimen suggests that it is a premaxilla, which is one of the structural elements known to be present in the dermocranium of Paleozoic as well as modern fishes. However, Bobb Schaeffer has recently written us that he and W. K. Gregory, after reading our manuscript, believe that whereas "the single specimen of *Archeognathus primus* may very well be a Lower Ordovician vertebrate jaw element, its definite identification as a premaxillary might be open to question. The premaxillary is a membrane bone that covers part of the vertebrate primary upper jaw, and is first recognized in the primitive members of the Osteichthyes (bony



EXPLANATION OF PLATE 1

Plate 1. Inner and outer lateral views of the holotype of *Archeognathus primus* Cullison, from about six feet above the base of the middle member of the Dutchtown formation at the west end of the Sals Creek diversion channel half a mile west of Ancell, Scott County, Missouri, x 10.

fishes). It is not identified as such in the ostracoderms, placoderms or Chondrichthyes. The hollow cone-like teeth, except for the striations, are analogous to those found in the cyclostomes, although they may be quite different in origin and histology."

For the sake of completeness, it should be mentioned that a second specimen is known from the Dutchtown that may belong in the genus *Archeognathus*. It is the holotype of *A.? carinatus* Cullison. Although this specimen is fragmentary, it seems to resemble the genoholotype fairly closely, and it is corroborative evidence of the occurrence of fish remains in the formation. This specimen came from the base of the middle member of the Dutchtown formation in the Geiser quarry, 1.3 miles east of Dutchtown, Cape Girardeau County, Missouri. Both it and the genoholotype came from almost the same horizon in the Dutchtown at localities about 5½ miles apart.

Although the fish remains known from the Ordovician Harding, Bighorn, and Whitewood formations of western United States occur in association with marine fossils, it is generally contended that the animals they represent were probably inhabitants of fresh waters, which after death were washed to the littoral zone. However, when one takes into consideration the fact that the Dutchtown specimens also occur in association with undoubted marine fossils, for example, cephalopods, it seems more logical to conclude that all of the known Ordovician fishes were marine. The Dutchtown consists chiefly of thin-bedded limestones, dolomites, and shales, which are not indicative of deltaic conditions of deposition. The fish remains that the formation has yielded, though meager, seem to suggest that the creatures which they represent were not as far removed from modern forms as their age would have led us to suspect. That is, their similarity to the premaxillae of certain modern fishes is indeed striking, though it may of course be more apparent than real. Inasmuch as the Dutchtown fishes seem to be rather far advanced from the postulated ancestral vertebrates, a marine habitat for them would not necessarily conflict with the theory that the earliest vertebrates were of fresh water origin.

It should be stated that the illustrations which accompany this study are photographs retouched by Mr. Howard Webster of Iowa City. The Graduate College of The State University of Iowa made the preparation of this report financially possible.

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