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A NEW GENUS AND SPECIES OF A HOLOSTEAN BELONGING TO THE FAMILY OPHIOPSIDAE, *Teoichthys kallistos*, FROM THE CRETACEOUS, NEAR TEPEXI DE RODRÍGUEZ, PUEBLA

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ABSTRACT

A hitherto unknown fossil fish is described from the middle Cretaceous beds near the town of Tepexi de Rodríguez, State of Puebla. The new genus is related to *Ophiopsis* and *Macrepistius* and therefore is placed in the family Ophiopsidae. The fossil fish is from the Tlayua quarry and is known from two specimens.

Key words: holostean, *Teoichthys kallistos*, fishes, Cretaceous, Tepexi de Rodríguez, Puebla, Mexico.

RESUMEN

Se describe un pez fósil importante desconocido hasta ahora, procedente de capas de edad cretácica media cercanas al poblado de Tepexi de Rodríguez, Estado de Puebla. Este género está relacionado con *Ophiopsis* y *Macrepistius*, por lo que se coloca en la familia Ophiopsidae. El pez fósil proviene de la cantera Tlayua y se cuenta con dos especímenes.

Palabras clave: holósteos, *Teoichthys kallistos*, peces, Cretácico, Tepexi de Rodríguez, Puebla, México.

INTRODUCTION

Figure 1 shows the location of the Tlayua quarry, near Tepexi de Rodríguez; it is being worked for flagstone as well as for fossils. The beds are part of a sequence of folded middle Cretaceous limestone strata, which in the quarry shows no bioturbidation and consists of numerous fine layers. On the basis of the invertebrates, the fauna is thought to be of late Albian age.

The type specimen was discovered by Benjamín Aranguthy and was taken from Zone 2 of the Aranguthy quarry, IGM-locality 370, which is part of the Tlayua quarry (Applegate and Espinosa-Arrubarrena, 1982, and Applegate *et al.*, 1984). The specimen was collected in the fall of 1982. The type designation is IGM-3460. The paratype was collected from the Alacranes quarry in Zone F, from the coordinates 4E, 10S (arbitrary system, units in meters) and is catalogued as IGM-4126. This specimen was collected in the fall of 1985. The scientific name for this fossil fish is *Teoichthys kallistos* and it comes from the *Mexica* name meaning god: *teo*, combined with *ichthys* from the Greek for fish. The specific name *kallistos* means most beautiful in Greek. A rough translation could be: god's most beautiful fish. Both fossils are deposited in the type collection of the Paleontology Museum of the Instituto de Geología, Universidad Nacional Autónoma de Mexico, which abbreviation is IGM**.

Other fossils from this quarry are being studied by the staff of the Institute and other agencies both in Mexico and in the United States. Part of the aid for this work came from the National Geographic Society's grant Num. 2580. The other funds were furnished by the Institute of Geology of the National University of Mexico. Marjorie Jackson helped in editing the manuscript.

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** *The locality designation for the specimens is: IGM-3460, locality 370 and IGM-4126, locality 1970.*

TAXONOMY AND DIAGNOSIS

Subdivision Halecomorphi
Family Ophiopsidae
Genus *Teoichthys* gen. nov.
Genotype IGM-3460, *Teoichthys kallistos* sp. nov.

The specific diagnosis is the same as the generic.

Generic diagnosis of type. A fusiform moderately deep-bodied ophiopsid with an estimated length of 26 cm. A portion of the upper caudal lobe is missing. The compressed body depth below the anterior part of the first dorsal fin is 5.5 cm. Head length from the snout tip to the rear of the cleithrum is 5.7 cm. The depth of the head at the preopercular is 4.4 cm. These characters are shown in Figure 2.

Skull roof. The skull roof is shown in Figures 3 and 4. The exposed portions of the posterior head plates and post-cleithral scales have small evenly spaced tubercles and ridges. These ornaments are stronger on the posterior parts of the frontals, parietals, dermopterotics, supratemporal and post-temporal. The rostrum is displaced, smooth and small and bears the rostral commissure. The nasals meet in the midline but are very badly crushed. The antorbitals bear sensory canals. The frontals are long and the anterior part lacks ornamentation. The parietals meet in the midline and are of equal size and rectangular in shape. The dermopterotics are narrower than the parietals but are also rectangular. The dermosphenotic is quite small and bears a few ornaments. The sphenotic forms the posterior corner of the orbit, and is smaller and unornamented. The supratemporals meet in the midline. They would be more or less rectangular except for the fact that the outer edge is much longer than the inner. The post-temporals do not meet in the midline. The supra-temporals have a saw-like fringe on the posterior edge; lateral to the post-temporals is the supracleithrum.

Orbital series. The orbital series are shown in Figures 3, 4 and 5. The supraorbitals are broken and fragmentary. There is, however, a single large anterior plate. In Figures 4 and 5 is shown a double row of

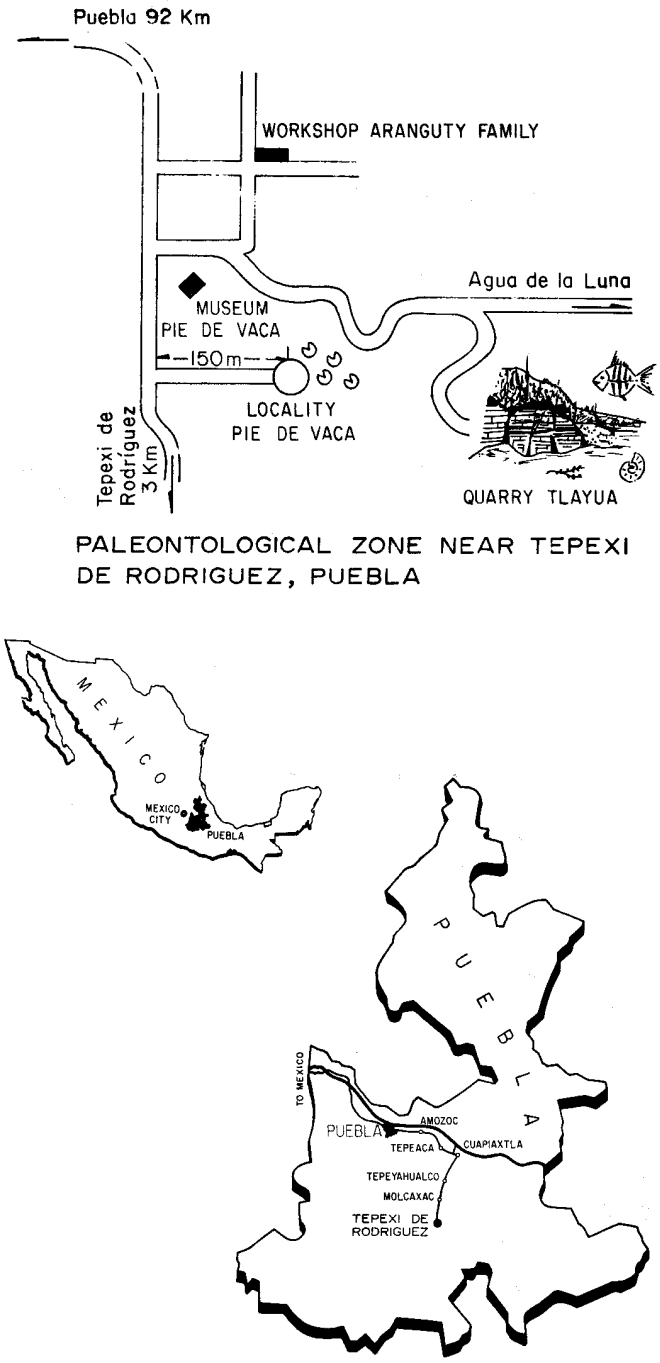

Figure 1.- Index map showing location of the Tlayua quarry.

three supraorbital bones making a total of seven supraorbitals.

The first infraorbital bone is small and rectangular. The second infraorbital is larger and rectangular. The third is much narrower. The fourth is about equal in size to the second. It is convex on its anterior border. In the lower part of this plate, the infraorbital canal sends off at least six smaller canals, one of which enters the maxillary. Above the fourth infraorbital and below the frontal there is another element which was termed an X-bone by Shaeffer (1960). It takes part in the orbital ring and seems to lack a sensory canal. Though it abuts the antorbital, it is separate.

There are at least 10 suborbitals. The four forming an anterior row tend to be rectangular. The other six form the posterior border.

Opercular series and branchiostegals. The opercular series and branchiostegals are shown in Figure 5. The opercular is only slightly deeper than wide. It has a depth of 19.5 mm and a width of 14.5 mm. It is covered with a fine, smooth, tearshaped ornamentation. The subopercular is wider than it is deep with a width of 2.5 mm and a depth of 0.75 mm. There is a pointed anterior limb which is as long as the subopercular is deep. The interopercular, part of which is missing, is elongated and triangular. The height is 0.55 mm and the width is 0.58 mm. The preopercular is narrow and straight and there is no expansion of the lower posterior part. All these bones bear ornamentation similar to the opercular except that the preopercular is smooth. There are 16 or 17 branchiostegal rays. Our specimen shows at least eight rows of scales between the branchiostegal rays and the pectoral fin.

Upper and lower jaw. The upper and lower jaws are shown in Figures 3 and 5. The supermaxillary appears to be single although it is badly fragmented. It is smooth as opposed to the ornamented suborbitals. It is almost as long as the maxillary but it begins at about one-third of the length of the maxillary and extends about one-third of its length behind it. The maxillary is a thick elongated rectangular bone that has a sensory canal and bears 18 teeth. These teeth are smaller than those of the dentary and are narrowly triangular. The premaxillary is only slightly wider than it is deep. It bears five triangular teeth which appear to be a little larger and wider than those of the maxillary. In the lower jaw, the dentary has 15 teeth which are much larger than those of the upper jaw and bear a globular enamel cap which has a "tit-like" projection at its top. The lower part of the dentary bears the mandibular sensory canal. The surangular forms the coronoid process. The angular contains the sensory canal and it is badly broken so that its relationship with the articular cannot be distinguished.

Ceratohyal. The ceratohyal is shown in Figures 3 and 5. The end of the ceratohyal is at the middle of the dentary. In front of this, there are a few fragments of bone that could be part of the gular plate. There are also some scales similar to those found between the branchiostegal rays and the pectoral fin. These could have been displaced from that region.

Pectoral girdle. The pectoral girdle is shown in Figures 2, 3 and 5. It consists of a scapular which is only partially visible, a large cleithrum and a supracleithrum. The part of the supracleithrum above the lateral line which crosses this plate is ornamented. The part below is smooth. At the base of the cleithrum there is a small postcleithral scale. Above this, there is a large triangular scale. Posterior to the triangular scale, there are three postcleithral scales. The lowest is small and rounded. The second is almost rectangular. The next highest is the largest and it is about twice as deep as it is wide. This large scale is elongated triangular, posterior to the top of the cleithrum and the lower part of the supracleithrum.

Fins. Fins are shown in Figures 2 and 6. The pectoral fin has 16 rays, 11 or more fulcra occur on the anterior edge of this fin. There is a single dorsal fin which has approximately 65 fin rays. The ventral fin shows at least six rays and 10 fulcra. The dorsal fin has over 24 fulcra. Only three rays of the anal fin are present, but there is evidence to know that there were more. The anterior part of the dorsal fin is directly above the posterior one-third of the pectoral. The ventral is directly below the first one-third of the dorsal fin. The anal is directly below the two-thirds mark of the dorsal fin. The caudal fin has 35 rays. The top of the fin shows 11 fulcra. Since the tail is not complete, more fulcra were evidently present.

Vertebral column. The vertebral column is shown in Figure 7B. It is present but not well calcified; this is evident for it bears the impression of the overlying scales. It shows diplospondly with precentra and postcentra. The neural arch is attached, as is the haemal arch, though they alternate.

Lateral line. The lateral line is shown in Figures 2 and 7A. It runs from the postcleithrum out to the ninth dorsal fin ray. The body contains 55 lateral line scales. The lateral line enters the articulae of the ninth fin ray. There are 17 scales above the lateral line and 15 below in the same scale row. This row is directly below the anterior edge of the dorsal fin. The lateral line enters the articulae at scale number 55 and can be traced into the seventh articulae (VII). This is a unique character for two other genera in the Ophiopsidae as discussed by Bartram (1975).

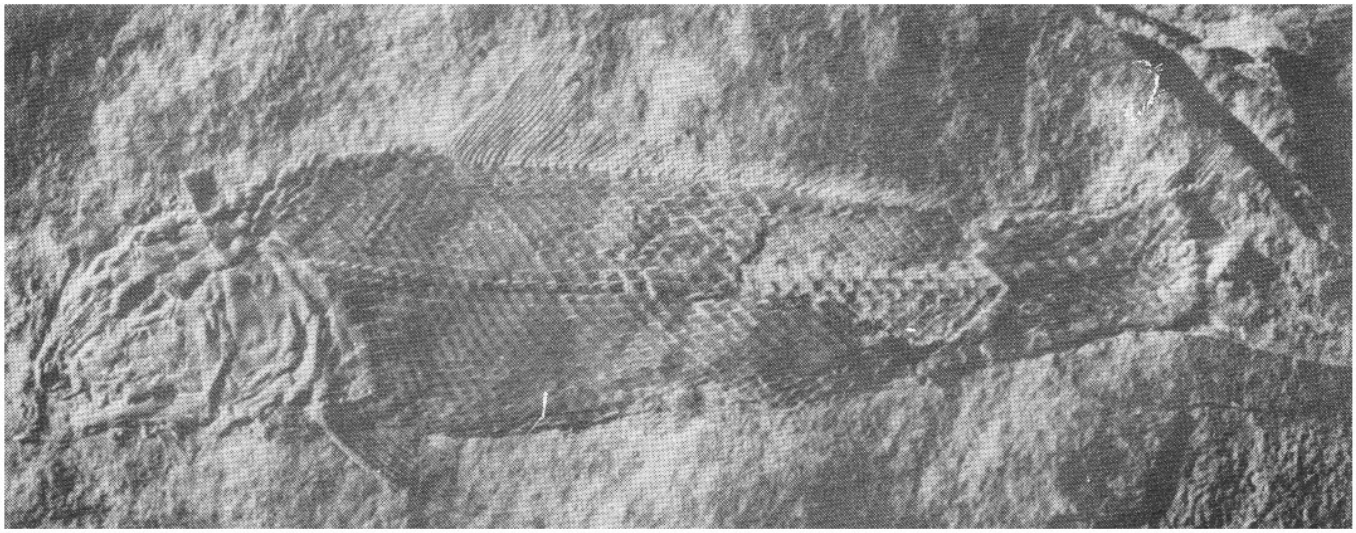

Figure 2.- Holotype IGM-3460, locality 370, of *Teoichthys kallistos*; slightly smaller than natural size.

Scales. The scales are rhomboid and show fine serrations on their posterior border. In the anterior part of the fish, the scales are deeper than wide. In the posterior part, they are wider than deep.

COMMENTS ON THE SENSORY CANAL SYSTEM OF THE HEAD BONES

The main lateral line passes from the body into the supracleithrum (SCL), where it crosses this bone to the top anterior corner. There the canal enters into the lateral edge of the post-temporal (PTT). In our specimens the course of the canal is not clearly shown. Then the canal next enters the supratemporal (STT), where it runs close to the lateral edge. Near the middle of the bone (STT), the main cranial canal (indicated in Figure 5 with a dotted line) sends off the supratemporal commissure that meets its counterpart in the midline. The commissure is recognized by several pores on the bone. The main canal continues into the dermopterotic and then to the dermosphenotic. This bone is badly fragmented but the canal passes on to the first infraorbital, where it follows the posterior corner of the orbit. The canal then passes to the second infraorbital down and forward to its center. Here it takes an almost right angular bend and goes directly towards the snout. In the bend, the canal sends off two branches towards the suborbitals. The infraorbital continues through the third infraorbital on to the fourth bone. Here it sends branches that curve downward. One of these branches goes on to the maxillary (as shown by dashes in Figure 5). The maxillary pores of this canal are quite evident. The infraorbital canal passes on to the antorbital and down to the rostrum where it forms the rostral commissure. An upper branch might pass on to the supraorbital canal, but because of the displacement and crushing, it could not be followed. The supraorbital canal is present on the frontal and passes on to the parietal. The preopercular canal (shown by dashes in Figure 5) can be traced most of the length of the preopercular. It crosses over on to the mandible (shown by the pores in Figure 5), passing along the lower part of the angular into the dentary.

RELATIONSHIP OF *Teoicthys* TO THE FAMILIES CATURIDAE AND OPHIOPSIDAE

Bartram (1975) erected a new family, Ophiopsidae, in which he included the genera *Ophiopsis* and *Macrepistius*. In his paper, some of the strong affinities to *Heterolepidotus* were discussed, although this genus was not placed in the new family. I feel that many of the family characters would apply to *Heterolepidotus* although differences, such as a short dorsal fin, do exist. In the present investigation, it is apparent that the new genus *Teoichthys* belongs to the Ophiopsidae and with only slight changes in the family diagnosis one could also place the genus *Heterolepidotus* within the Ophiopsidae.

In considering the other caturids, it appears that only *Caturus, Furo* and *Osteorachis* might be placed in the Caturidae. Patterson (1973) thought that aside from these, some species of *Eurycormus* other than *Eurycormus grandis* might be placed in the family Caturidae. Patterson *(op. cit.)* also placed in this family a brain case that had been called "*Aspidorhynchus*". *Neorhombolepis lophiostomus* and *Otamitla* possibly do not belong to this family. The family Caturidae, in the restricted sense, is characterized by the following features.

FAMILY CATURIDAE

Large fish with the following characteristics: Length, from 10 cm to one meter; trunk fusiform; scales rhombic or rounded and thin; parietals small and irregular; frontal suture irregular; and nasals large and sometimes paired, meeting in the midline or separated by the dermoethnoid as in *Caturus*. There is a single infraorbital behind the orbital except in *Osteorachis* which has two of them (Gardiner, 1960). The rostrum is small and toothless. An X bone or "antorbital" is present. The

Figure 3.- Head plates of *Teoichthys kallistos*, left side; lateral view. The enlargement is X 9.

anterior infraorbitals are shallow except in *Osteorachis* which has moderately deep infraorbitals. There are three suborbitals and from two to three anterior infraorbitals. The preopercular is expanded posteriorly in *Caturus* and *Osteorachis*. The preopercular is short and not expanded in *Furo*. The subopercular is from one third to one half as deep as the opercular. The interopercular in *Caturus* and in *Furo* is elongated and narrow. The dermopterotic is large.

THE PLACEMENT OF *Otamitla*

Otamitla speciosa (Felix, 1891) shows the following similarities to *Amia*: Both have robust bones and acutely triangular teeth, the nasals and the last five infraorbitals have similar shapes, no antorbital is present, there is a large L-shaped preopercular in *Otamitla*; in *Amia*, the angle is less acute, the opercular and the subopercular are of a similar size and shape, though the subopercular is larger in *Amia*. Felix (*op. cit.*) illustrated a large element in front of the dermopterotic that could be either the dermosphenotic or a large superorbital.

I admit that *Otamitla* is a poorly known form, but the type figured by Felix (1891) seems to be sufficient to exclude *Otamitla* from the Caturidae and the Ophiopsidae. A recent search of the type locality for this genus failed to produce new material; so, for the present, I would place this genus tentatively within the Amiidae.

FAMILY OPHIOPSIDAE (AMENDED DIAGNOSIS)

These are moderately sized fishes, up to 30 cm long, with fusiform or deep bodies. An elongated dorsal fin is present. The scales are deeper than wide in the anterior position of the body. Articulations for all fins are in the ultimate 2/3 or 1/2 of the fin. The lateral line goes into the caudal fin rays. A small rostrum is present. Nasals are large and meet in the midline. There is an antorbital canal with an ascending sensory canal on the outside of the nasals. An X bone is present. This is not, however, indicated in *Ophiopsis*. Frontals are elongated and lack ornamentation in their anterior 2/3. A sphenotic is visible in the skull roof. There is a dermosphenotic in front of the dermopterotic. The dermopterotic is the same size as the parietals. The supratemporals meet in the midline. The preopercular is crescent shaped and narrow. The opercular is rectangular and almost square. The anterior part of the subopercular is deeper, making the bone triangular. There is a pointed ascending process. The interopercular is also triangular

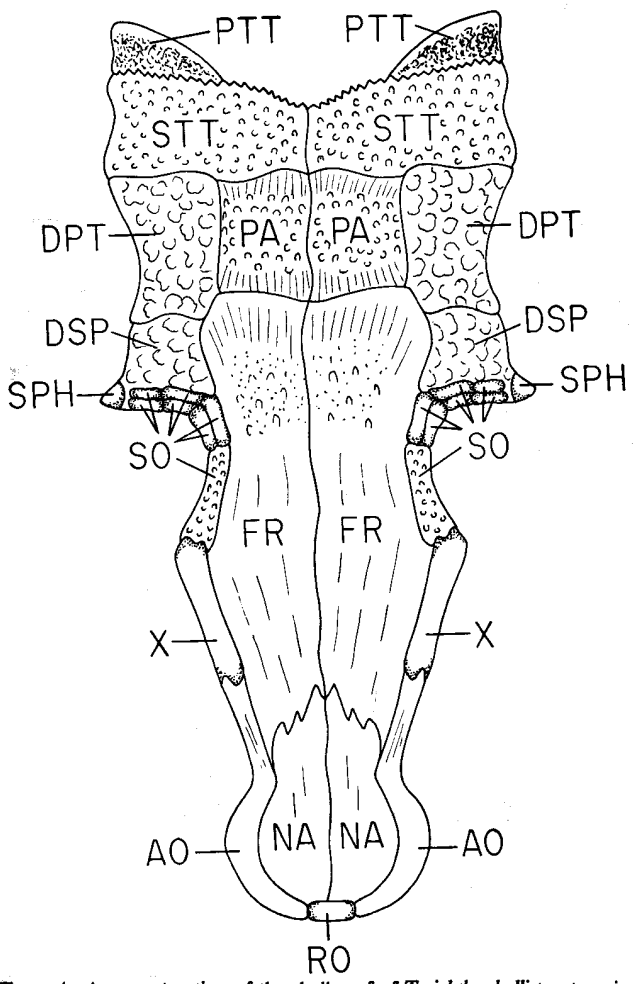

Figure 4.- A reconstruction of the skull roof of *Teoichthys kallistos*; top view. Angular = ANG; branchiostegal rays = BR; centra = CE; ceratohyal = CH; cleithrum = CL; dentary = DEN; dermopterotic = DPT; dermosphenotic = DSP; frontal = FR; haemal arch = HA; interorbital = IO; interoperculum = IOP; maxillary = MX; nasal = NA; neural arch = NAA; antorbital = OA; opercular = OP; parietal = PA; postcleithrum scales = PCLS; premaxillary = PMX; preoperculum = POP; post-temporal = PTT; rostrum = RO; surangular = SAN; supracleithrum = SCL; supramaxillary = SM; supraorbital = SO; suboperculum = SOP; supratemporal = STT; suborbital = SUO; X bone = X.

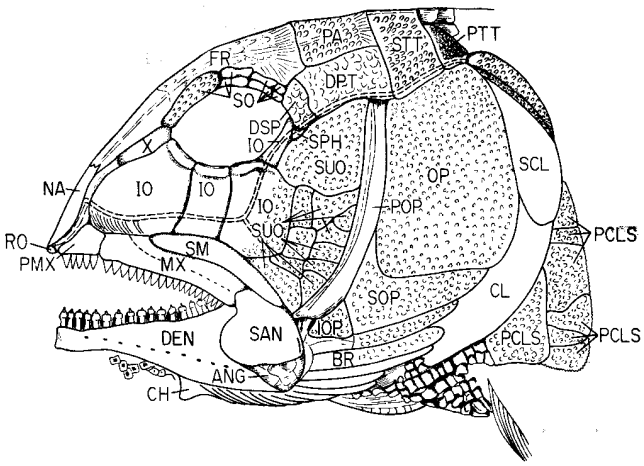

Figure 5.- Reconstruction of the head plates; lateral view of *Teoichthys kallistos*. See abbreviations for the names in the foot of Figure 4.

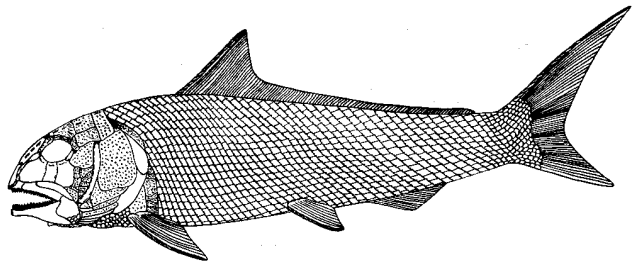

Figure 6.- Reconstruction of *Teoichthys kallistos*.

and excluded from the mandible. The first branchiostegal ray is enlarged and there are at least 13 or more branchiostegal rays. The cleithrum comes near the base of the opercular. The ceratohyal is positioned just below the middle of the mandibles. There are one or two rows of supraorbitals and four infraorbitals. The anterior three infraorbitals are very deep. The first infraorbital forms the posterior side of the orbital and the top is inclined towards the near one. The suborbitals consist of from three to 10 separate bones. A single supramaxillary is present. The maxillary is prominent and bears teeth most of its length. The teeth on both jaws are acutely triangular to globose and small. The premaxillary bears about six teeth.

CONCLUSIONS

As represented in this paper, the family Ophiopsidae includes *Ophiopsis, Teoichthys* and *Macrepistius*. *Heterolepidotus* might be considered a member of this family, but this would entail a reexamination of the European materials.

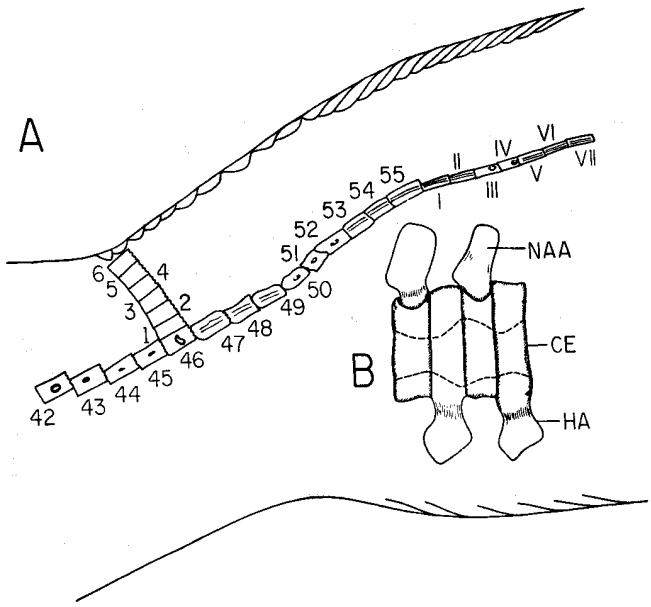

Figure 7.- A) An enlargement of the tail of *Teoichthys kallistos* showing the lateral line scales 42 to 55, and the articulars of the fin ray I through VII. B) Four caudal vertebrae of *Teoichthys kallistos*. See list of abbreviations in the foot of Figure 4.

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