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by David Bardack

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Résumé

L'auteur décrit l'un des deux poissons à peu près complets trouvés dans la formation Oldman. Il s'agit d'un grand téléostéen, le *Paratarpon apogerontus.* Ses dimensions sont impressionnantes et sa ressemblance aux élopidés vivants *Megalops* et *Tarpon,* au dernier en particulier, le rendent extrêmement intéressant. La présence de ces deux poissons fossiles dans la formation Oldman suggère que, sur une certaine étendue au moins, il y aurait eu invasion maritime.

Summary

One of the only two fairly complete fishes found in the Oldman Formation, a large teleost termed *Paratarpon apogerontus*, is described. It is noteworthy for its size and its relationship to the living elopids *Tarpon* and *Megalops*, particularly the former. The presence of the two fossil fishes in the Oldman Formation indicates that one area, at least, of the formation was subjected to marine incursions.

Biographical Note

Dr. David Bardack, a native of New York, received his doctorate from the University of Kansas in 1963. Since then, he has worked often in Canada, collecting in Manitoba, Alberta, and the Northwest Territories. Dr. Bardack is recognized as an expert on fossil fishes and is particularly known for his work on marine fishes of the dinosaurian age. At present he is an Associate Professor in the Department of Biological Sciences, University of Illinois at Chicago Circle.

Introduction

A diverse assemblage of reptiles dominated by dinosaurs (Langston 1965; Russell 1967) has long been known from the Oldman Formation in Alberta. At a few localities, representatives of other vertebrate groups ranging from mammals to fishes have been discovered. Despite nearly 75 years of active collecting in this formation, only two intact and reasonably complete fishes have been recovered. Both were collected in 1937 by C.M. Sternberg. They were found within 11 miles of each other in southern exposures of the Oldman Formation that have yielded significantly fewer dinosaurian remains than those of the classic Steveville region. One of the specimens currently under study by Wann Langston Jr. is a ray represented by a partial skeleton but lacking the dentition. The other is a large teleost. Although the head of the latter is not preserved, it clearly represents a new fish noteworthy for its size and its similarity to the living elopids, *Tarpon* and *Megalops*. Both fossils indicate the presence of nearby marine and (or) brackish water environments.

Acknowledgments

I wish to thank Dr. D.A. Russell for permission to examine, prepare, and describe the teleost. Dr. C.M. Sternberg provided information on the fossil localities. During the summer of 1968, I examined exposures of the Oldman Formation in the area where both fossil fishes were discovered. We probably prospected the precise localities from which these fishes were obtained but found only isolated vertebrae and teeth.

Plate 1

Order Elopiformes
Family Elopidae Romer, 1966
Genus ***Paratarpon***, n.g.

Diagnosis Large, deep bodied elopid. Dorsal fin situated midway between top of cleithrum and base of caudal fin. Pelvic fin originating in front of dorsal. Length of longest pelvic ray equivalent to $\frac{1}{3}$ of distance from base of pectoral fin to start of anal fin. Caudal skeleton essentially as in *Tarpon* except for presence of only two uroneurals and two epurals. Generic name derived from *para* = near, and *Tarpon*, a living elopid.

Type species: *Paratarpon apogerontus.*

Paratarpon apogerontus, n.sp.
Plate 1, Figure 1

Diagnosis Same as for genus. Specific name combined from the Greek *apo* = from and *gerontos* = old man, in reference to the formation that yielded this fish.

Holotype NMC 8814. Intact fish lacking head but with body and fins preserved.

Horizon and locality Upper Cretaceous, Oldman Formation. SE1/4, sec. 31, T. 3N., R. 3 west of the 4th meridian. "In a shale bank about 15 feet below sandy shale and clay-sand band which apparently marks the top of the Pale Beds (Oldman Formation)," C.M. Sternberg, field notes, 1937. The site is in exposures developed along a tributary stream on the south side of Sage Creek.

Description

The fish (Pl. 1) is intact from the upper part of the pectoral girdle to the distal end of the caudal fin. Fins except for the pectoral are preserved in their entirety. From the dorsal border of the cleithrum to the base of the caudal fin the specimen measures 63 cm along the slightly curved vertebral column. Maximum body depth anterior to the dorsal fin is 27 cm. The dorsal margin of the body is straight. The ventral outline, determined by the projection of a line from the base of the anal fin to the base of the pectoral fin and taking into account a natural position of the pelvic basipterygium, must have been gently convex, as in *Megalops* or smaller specimens of *Tarpon.*

The vertebral column consists of at least 71 centra, of which 32 or 33 are caudal. A few additional centra probably were present between the cleithrum and basioccipital. The centra, all higher than long, are biconcave discs. Anteroposterior lengths of abdominal centra range from 7.0 to 7.5 mm. Caudal centra measure 7.5 to 9 mm in length except for the last 10, which gradually diminish in length. Central height increases from 1.1 cm anteriorly to 1.6 cm near the abdominal caudal junction. Caudal centra are all about 1.3 cm high. Dorsal pits for neural arches and ventral pits for hemal arches are present on caudal centra. Lateral surfaces are characterized by slender ridges, which extend across the length of the centrum.

A cross-section of a centrum from the middle of the caudal series shows an outer layer of lamellar bone 0.6 mm thick. The body of the centrum exhibits a series of about 150 slender, strut-like ridges of bone, which radiate from the imperforate centre. The ridges are crossed by numerous circumferential layers of bone. This combination of radial and circular layers produces a delicate lattice pattern with each bone-enclosed pocket approximately cubical in form. A similar pattern appears in a sectioned *Tarpon* centrum.

The caudal skeleton (Figure 1) resembles that of living elopids. The vertebral column gradually tapers in height with the last three centra turned gently dorsad. Two ossified ural centra are present (nomenclature of caudal skeleton follows Cavender 1966 and Nybelin 1963). There are seven hypurals. The first two hypurals are attached to the first ural centrum; the third, fourth, and fifth to the second ural centrum. The sixth and seventh hypurals lie free but probably were attached to a cartilaginous extension of the last ural centrum. Hypural 1 expands posteriorly to form a broad plate measuring 4.5 cm in length from its articulation to the distal end and 2.0 cm in height distally. Hypural 2, about 3.5 cm long and about 0.5 cm high distally, lies in a nearly horizontal position close to hypural 1 and separated by a space of about 1 cm from hypural 3. The latter is also a plate-like bone; its articular head is larger than that of the other hypurals. The remaining hypurals are flattened rectangular bones of progressively shorter length.

A pair of uroneurals extends along the upturned posterior end of the vertebral column and diverges over ural and preural centra. The first uroneural reaches the second preural centrum. At least two long epurals are present. Hemal spines are long, rectangular plates supporting ventral raylets of the caudal fin and probably a few principal caudal fin rays. Posterior neural spines are more rounded in outline than the hemal spines.

The pleural ribs are transversely flattened structures that do not reach the

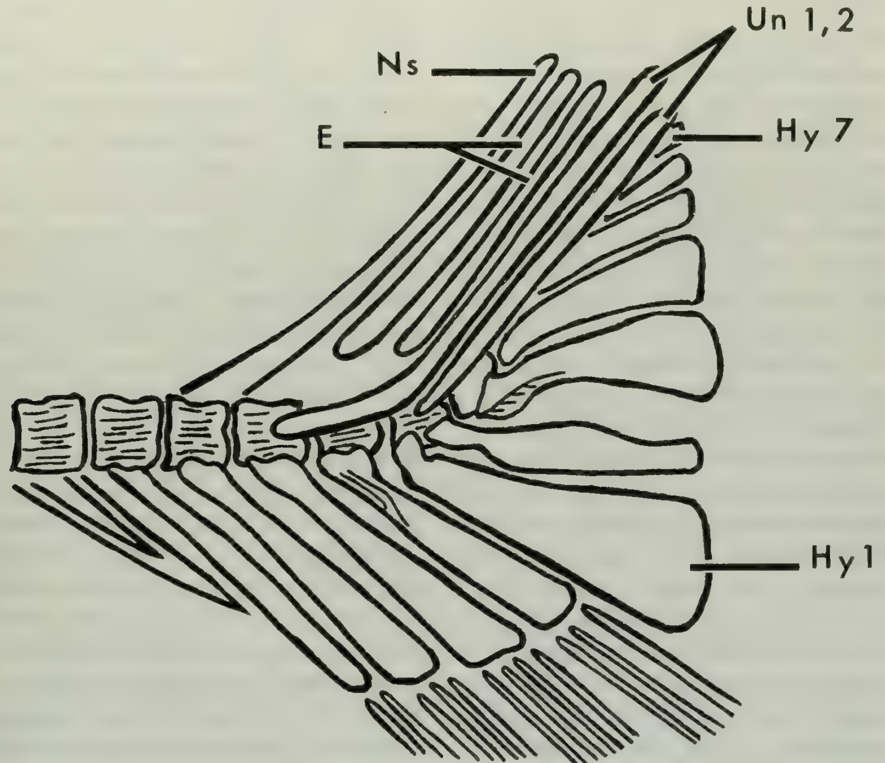

Figure 1

ventral margin of the body. Epineural ribs are present in the abdominal region. They lie close to the vertebral column and reach 18 cm in length. Fragments of ventral intramuscular bones are present in the caudal region. These bones are well developed in living elopids but may not have been fully ossified in this Cretaceous form.

The dorsal fin, which begins 30 cm behind the top of the supracleithrum, comprises 19 rays arising from a 9.1-cm long base. The fourth ray, measuring 10.5 cm, is the longest. The anal fin begins behind the dorsal and is composed of 29 rays arising from a 17-cm long base. Both dorsal and anal fins have a falcate outline with no indication that the last ray of either fin is elongated.

The pectoral fins are poorly preserved but appear to have been large; their length reaches ¾ of the body depth and is contained 2 ¾ times in the distance from the pectoral fin base to the start of the anal fin. The pelvic fins, which are much better preserved, are composed of 13 rays, the first of which attains 14 cm in length. This fin is inserted anterior to the origin of the dorsal fin and just behind the midway point between pectoral and anal fins. The basipterygium is a heavy plate, broadened posteriorly and narrowing anteriorly. It measures 9 cm in length. The caudal fin has 10 principal rays in the dorsal lobe and 9 anterior raylets. The ventral caudal ray count is less certain but appears to include 9 principal rays.

No scales were observed.

Remarks

Although the head is not preserved, sufficient information can be gathered from the rest of the fish to determine its relationships. Caudal structure, a prime clue, shows a pattern similar to that of elopids and *Tarpon atlanticus* (in particular *see* Figure 2 and Hollister, 1936; Nybelin 1963). The shape, articulation, and numbers of ural centra, hypurals, and uroneurals are essentially similar to *T. atlanticus. Paratarpon* shows two distinct uroneurals. Among living elopids, *Elops* has 4 and *Tarpon* 3. In *Tarpon* the third is a short, thin bone whose presence in the Oldman fossil may be represented by a similar element amid the bases of the upper rays of the caudal fin and dorsal hypurals. There are three epurals in the living elopids; only two are definitely recognizable in the fossil. The swollen base of the third hypural and the slight ventrally convex expansion of this element recall the shape of this bone in *Tarpon* rather than that of *Elops.* The elopid caudal skeleton was established in the Jurassic (Nybelin 1963) with the graceful *Elops* type. *Paratarpon* represents the first occurrence of the more robust *Tarpon* type.

The deep body with a short, broad caudal peduncle resembles that of *Tarpon* and *Megalops. Paratarpon* is the largest fossil elopid, judging from the dimensions of specimens cited by Woodward (1901). Among living elopids it resembles *Tarpon*, which commonly exceeds 150 cm in length, rather than *Megalops*, which rarely reaches 100 cm. The number of vertebrae in the fossil (71) exceeds that of *Tarpon* (53-57) and even *Megalops* (68). In this character, *Paratarpon* is at the upper end of the elopid range, as Woodward (1901) indicates that between 50 and approximately 70 centra are found in these fishes.

The dorsal fin with 19 rays exceeds that of *Tarpon atlanticus* (12-15) (Hildebrand 1963) and approaches that of the closely related *Megalops cyprinoides* (19-21). Unlike *Megalops* and *Tarpon, Paratarpon* does not show a prolonged last ray of the dorsal fin. A prime difference between *Tarpon* and *Megalops* is the position of the pelvic fin with respect to the dorsal fin. In *Tarpon* and *Paratarpon*, this fin originates anterior to the start of the dorsal fin rather than under the dorsal as in *Megalops.*

Between the Late Cretaceous and Recent only one partial skeleton of a *Tarpon*-like fish is known from North America. *? Megalops vigilax* (Jordan), represented by an incomplete vertebral column of some 47 centra and a dorsal fin with about 14-15 rays, comes from the Miocene of California. According to David (1943) this species is similar to *Tarpon*. In the London Clay (Eocene) of England (Casier 1966) two species each of *Megalops* and *Promegalops* are recorded. Each is represented by cranial elements only. Other Cretaceous elopids are known from Europe, Western Asia and South America. In most cases only cranial elements are preserved. In those cases where the body is known it is relatively longer and shallower than that of *Paratarpon.*

In summary, *Paratarpon* is most similar in structure to *Tarpon* among living elopids and represents the earliest record of this type of modern elopid in North America.

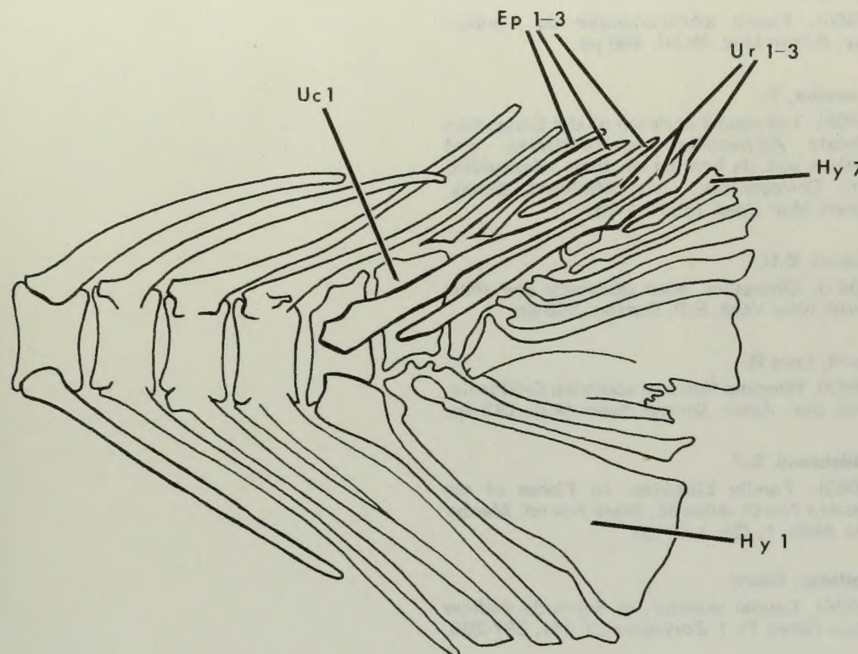

Figure 2

Discussion

It is generally assumed (Colbert 1961) that rocks of the Oldman Formation were deposited on a broad, well-forested lowland extending into a coastal plain. The upper part of the formation, including the horizon in which *Paratarpon* was obtained, contains beds of marine molluscs, indicating that in part, at least, the formation was subjected to periodic marine incursions. In themselves the teleost and the ray that will be described by Langston permit only general comment on the palaeoecology of the Oldman Formation. The rarity of intact fish specimens and the relatively low incidence of isolated fish elements in this southern part of the Oldman Formation suggest that occurrence of such fish was seasonal and perhaps uncommon in the environment represented by these beds.

Tarpon today is a coastal fish but is noted for making frequent entry into brackish and fresh water. Young as well as adult individuals are known from Lake Nicaragua, and they may even spawn there (Hildebrand 1963), but breeding usually occurs in marine or brackish waters along the coast. The occurrence of a large fish such as *Paratarpon* implies the presence of broad drainage channels of moderate depth suitable for the fish as well as for the numerous semiaquatic duckbill dinosaurs.

The head was lost probably shortly after death—a not uncommon phenomenon in the course of fish decay. This suggestion is also supported by the lack of a pronounced dorsad twist of the body. The body was then subjected to a gentle current of water, which resulted in the downturn of the caudal peduncle prior to complete burial.

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