A NEW ICHTHYOSAUR FROM THE LATE CRETACEOUS, NORTHEAST WYOMING.

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ABSTRACT. Remains of an ichthyosaur, *Myopterygius petersoni,* n. sp., from near the base of the Belle Fourche shale of Wyoming, are described. The fossil material, consisting of parts of the skull and portions of the post-cranial skeleton, constitutes the second recorded discovery of specifically describable ichthyosaur material in the Cretaceous of North America.

INTRODUCTION.

THE ichthyosaur remains here described were discovered by Mr. R. G. Gose of Upton, Wyoming. The writer was notified of the find by Mr. Paul Peterson, also of Upton, in 1939, and is indebted to Professor S. H. Knight, Director of the Geological Survey of Wyoming at that time, for the privilege of collecting and describing the specimen for the Survey. Before the specimen was excavated souvenir hunters had broken and scattered parts of the rostral portion of the skull and had removed various pieces of bone—how much is not known. The remaining material has been pieced together and is sufficiently complete for specific description.

Genus *Myopterygius* von Huene, 1922

Myopterygius petersoni, n. sp.

Type specimen.—Holotype. Rostral part of skull from anterior tip backward to a position probably just in front of the nares; large fragment of an unidentified skull bone; stapes and paroccipital (?) bones; a number of teeth in place in the alveolar grooves of the rostrum; 2 complete anterior dorsal centra and 1 fragment of an anterior dorsal centrum, probably the 18th or 19th; 1 complete and 3 incomplete posterior dorsal centra; 2 anterior and 3 posterior caudal centra; 1 dorsal rib; various rib heads and fragments of rib shafts. Right scapula. Right femur. 26 miscellaneous phalangeal elements. University of Wyoming Geological Museum, No. VP-190.

Horizon and locality.—The specimen comes from 3 feet above the base of the Belle Fourche shale member of the Graneros formation; SW part of sec. 25, T. 48 N., R. 65 W., Weston County, Wyoming.

Name.—The specific name honors Mr. Paul Peterson, whose interest and enthusiasm are directly responsible for scientific notice of the present species, and of a previously described species from the Mowry shale (Nace, 8).

Preservation.—On the whole preservation of the specimen is rather poor. Prior to burial the skeleton was rolled and completely disarticulated on the sea-floor; the skull proper was detached from the rostrum and lost or reduced to fragments. The lower jaw is missing. After burial most of the individual bones became nuclei of septarian clay-ironstone concretions that are considerably harder than the bone itself and are traversed by interlacing seams of amber calcite. A few non-concretionized bones were encased in fibrous gypsum in layers about one-fourth inch thick. Some of the bone was impregnated with iron compounds that apparently expanded on weathering and reduced the bone to crumbly ferruginous masses embedded in the concretions. The bone of the snout is very dense and compact and it suffered less damage than did the more porous bone of other parts of the skeleton.

Specific characters.—Unique characters of the species are difficult to state because different species of *Myopterygius* have been based in some instances on different parts of the skeleton. Certain species cannot therefore be directly compared; others can be compared only in part. Significant characters of the present species, as contrasted with known material of other species, are as follows: Snout slender and extremely elongate; nasal bones short, slender, surficially extending anteriad only about one-third the length of the preserved part of the snout. Teeth, where preserved, moderately long and slender, with indistinct longitudinal flutings in the enamel; tooth roots expanded, club-like; posterior teeth somewhat thicker and more blunt than anterior teeth; alveolar grooves deep and narrow. Scapula robust, with very thick glenoid articular edge and nearly straight shaft. Femur with plane of trochanteric masses oblique to a plane transecting the tibial and fibular facets. Some phalangeal elements with marginal clefts or incisions on proximal and distal articular surfaces. Vertebrae, so far as known, essentially circular in outline, without conspicuous differences between vertical and transverse diameters.

Descriptive details.—Elongation and slenderness of the snout, characteristic of all described skull material of *Myopterygius*, are extreme in *M. petersoni* (Plate I, figs. 5, 6). The length of the preserved part of the rostrum is 93.3 centimeters, compared for example, to a pre-narial length of 63.7 centimeters in *Myopterygius* aff. *M. campylodon*, as figured by Kiprijanoff (4, Taf. 9, fig. 1), from the Lower Cretaceous (Neocomian) of

the Province of Kursk, Russia[1], though similar sizes of the femora and vertebral centra in the two species indicate animals of comparable sizes. The median and naso-premaxillary sutures of the rostrum of *M. petersoni* are very sharply defined. Poor preservation and missing fragments prevent positive identification of the maxillo-premaxillary suture, the position of which is regarded by von Huene (3, p. 99) as of diagnostic generic value: "Maxilla weit rückwärtz, aber wenig vor die Nasenöffnung reichend." The suture may be present in a slight groove on the postero-lateral part of the rostrum; on the other hand it may well be obsolescent, as in *Ophthalmosaurus discus* (Gilmore, 2, pl. 8).

One of the stapes (Pl. 1, fig. 13) was found associated with vertebral centra, ribs and miscellaneous bone fragments. It is a short, stout, massive bone with a cylindrical shaft, rounded lateral end and expanded medial end. Its total length is 8.6 centimeters. Another bone element (figs. 11, 12), found associated with a badly weathered occipital condyle, probably is the paroccipital; its identity cannot be proved without other material for comparison, however, and detailed description is therefore omitted.

The teeth have the usual campylodont form with long, club-like roots that bear a thick external layer of cement.

Vertebral centra in the collection are not pronouncedly different from those of *M. americanus* except in their much larger size and greater general uniformity of shape throughout the column. Since no cervical vertebrae were recovered, presence or absence of a cervical hypophyseal keel cannot be determined. An anterior dorsal centrum (fig. 14) is slightly higher than wide, a character not shown by any centra of *M. americanus* in front of the caudal flexure (Nace, 8, p. 677). A comparative tabulation of absolute sizes and of ratios of length to height to width (LHW ratio) in the centra of three species is given in Table 1.

[1] Kiprijanoff assigned his specimen to *Ichthyosaurus campylodon* Carter. It has often been mentioned and figured as such in the literature (see Lydekker, 7, p. 15 and fig. 10), and is perhaps better publicized than the original type, named by Carter and re-described by Owen (9). Koken (5, p. 759), Broili (1, p. 428) and von Huene (3, p. 94) agree that the Russian specimen is not identical with the original English species. *Ichthyosaurus campylodon* Carter was designated by von Huene (3, p. 98) as the type of his new genus *Myopterygius*. A specific name has not been proposed for Kiprijanoff's specimen.

Table 1. *Comparative Tabulation of Measurements and Ratios of Bone Elements in Three Species of* Myopterygius.

	aff. *M. campylodon*[a]	*americanus*	*petersoni*
Anterior dorsal centrum			
Length	44 mm.	27 mm.	37 mm.
Height	92	56	87
Width	94	56	84
LHW ratio[b]	100:209:214	100:207:207	100:235:227
Posterior dorsal centrum			
Length	38 mm.	25 mm.	40 mm.
Height	108	61	90
Width	110	65	94
LHW ratio	100:284:289	100:244:260	100:255:235
Anterior caudal centrum			
Length	34 mm.	17 mm.	26 mm.
Height	96	50	75
Width	94	51	79
LHW ratio	100:282:276	100:294:300	100:288:304
Femur			
Length	94 mm.	66 mm.	95 mm.
Greatest dorso-ventral depth (across trochanters)	82	46	75
Ratio of depth to length[c] ..	100:115	100:143	100:127
Scapula	(unknown)		
Length	———	173 mm.	267 mm.
Antero-posterior width of articular end	———	108	128
Ratio of width to length[d] ...	———	100:160	100:208[e]

[a] Measurements scaled from Kiprijanoff's figures (4, Taf. XI, figs. 2B, 4A, 5; Taf. XV, fig. 1B.

[b] Length taken as 100. [c] Depth taken as 100. [d] Width taken as 100.

[e] The ratio of width to length in the scapula of *M. petersoni* is slightly exaggerated by crushing, with constriction of width, of the proximal expansion (see Pl. 1, fig. 4).

In the Russian species, *Myopterygius* aff. *M. campylodon*, the anterior dorsal centrum is wider than high; the reverse condition exists in *M. petersoni;* in *M. americanus* height and width are equal. The excess of width over height disappears backward in the vertebral column of Kiprijanoff's specimen, but concurrently the posterior dorsals and anterior caudals become pronouncedly pyriform. A posterior dorsal of *M. petersoni* (Pl. I, fig. 16) is nearly circular, though slightly wider than high. Posterior dorsals of *M. americanus* are intermediate in form between the two extremes. There is thus considerably more regional shape differentiation in the centra of the Russian species than in either of the American species.

A nearly complete rib of *M. petersoni* (Pl. I, fig. 3) has no apparent distinctive characters.

The scapula (Pl. I, figs. 1, 2, 4) contrasts with that of

M. americanus in that it is much larger and more robustly constructed, the glenoid portion of the articular edge is proportionately thicker, and the axis of the shaft is essentially straight, without the continuous longitudinal curvature seen in *M. americanus*. Both the anterior and posterior outlines of the scapula are concave in general, but for a considerable distance the two margins of the shaft are essentially parallel. The distal (free) blade of the scapula, when collected, was embedded in a concretion and the peripheral area was weathered to a mass of crumbly ferruginous material that could not be preserved. In the illustrations the blade of the shaft is shown restored in accordance with the outline preserved in the concretion.

The femur differs from that of *M.* aff. *M. campylodon* most conspicuously in general outline, and from that of *M. americanus* both in outline and size. The ratio of length to dorso-ventral depth across the trochanteric expansions is different in all three species (Table 1). The plane of the trochanteric expansion is oblique to a plane bisecting the tibial and fibular facets; in *M.* aff. *M. campylodon* the two planes have only a slight mutual obliquity, and in *M. americanus* they are essentially at right angles. There is a ridge that extends proximad from the distal end of the anterior surface of the femur, but is only slightly developed, whereas in *M. americanus* the ridge is very strongly developed (Nace, 8, p. 681, Pl. II, fig. 1). The dorsal and ventral trochanters occupy almost the whole length of the femur (fig. 7). There is thus no distinct shaft or neck between the trochanter masses and the somewhat expanded distal end.

Phalangeal elements have the polygonal and sub-rectangular outlines characteristic of latipinnate genera (Pl. I, figs. 9, 10). An unusual feature of some of these is the presence of marginal indentations or incisions on the distal and proximal articular surfaces.

Remarks and conclusions.—Ichthyosaur remains are rather common in the upper Mowry and lower Belle Fourche shales of northeast Wyoming, but good specimens are extremely rare.

Explanation of Pl. 1. *Myopterygius petersoni*, n. sp. Figs. 5, 6, X ca. 1/8; all others, X 1/3. Figs. 1, 2, 4, Posterior, lateral and articular aspects of right scapula. Fig. 3. A dorsal rib. Figs. 5, 6. Left lateral and dorsal aspects of rostrum. Fig. 7. Posterior view of right femur. Fig. 8. Posterior caudal centrum. Figs. 9, 10. Phalanges. Figs. 11, 12. Two views of paroccipital (?) bone. Fig. 13. Stapes. Fig. 14. Anterior dorsal centrum. Fig. 15. Anterior caudal centrum. Fig. 16. Posterior dorsal centrum.

Fish and chelonian remains are commonly associated. Plesiosaur bones occur at some localities, and a specimen consisting of most of the limb bones, parts of the girdles, and various vertebrae, was recently collected by Mr. Peterson from the upper Mowry and sent to the writer. It is tentatively referred to *Trinacromerum*, but merits further study.

Since the skull and paddles of *Myopterygius* are very imperfectly known, the writer hopes that future exploration will yield more complete remains. The enormous development of the trochanters on the femur of *M. petersoni* results in a remarkable similarity of the outline to that of the *humerus* of *M. americanus* (Nace, 8, Pl. II, fig. 8). Homoplastic convergence of form of the femora and humeri of advanced ichthyosaurs has been remarked by various writers. *M. petersoni* appears to furnish an extreme example of the process.

The incisions on the articular surfaces of phalangeal elements, previously noted, possibly indicate incipient hyperdactylic splitting of the elements; on the other hand it seems quite possible that they are merely sites of origin or insertion of paddle tendons. Probably only an assembled paddle will permit determination of their true nature. It is of interest that a pair of phalangeal bones from *Myopterygius* aff. *M. campylodon*, as figured by Kiprijanoff (4, Taf. 14, figs. 8, 9), have similar but less pronounced indentations. Likewise, isolated phalanges from England in the Peabody Museum collection at Yale University, labelled *Ichthyosaurus campylodon*, have faint marginal indentations. Possibly the identations will be found to be a generic character.

As is well known, *Myopterygius* belongs to the family Ichthyosauridae. The writer previously (8, p. 674), by a curious and unexplained inadvertence, referred it to the Stenopterygidae.

Measurements	mm.
Rostrum (snout)	
Total length preserved	933
Distal tip to distal end of nasal bones	570
Depth at posterior end of preserved part	78
Depth at middle part of preserved portion	51
Width at rear of preserved part	137
Width at middle of preserved part	64
Length of preserved part of nasals	300
An anterior dorsal centrum	
Length through center	3
Length at margin	37
Height	87
Width	84

A posterior dorsal centrum	
Length through center	3
Length at margin	40
Height	90
Width	94
An anterior caudal centrum	
Length through center	4
Length at margin	26
Height	75
Width	79
A posterior caudal centrum	
Length through center	5
Length at margin	17
Height	45
Width	48
Right scapula	
Length	267
Antero-posterior width of articular end	128
" " " " free end (blade)	72
Median diameter of shaft	40
Thickness of glenoid part of articular end	33
Thickness of coracoid part of articular end	10
Right femur	
Length (probable: see restored outline, fig. 7)	95
Greatest antero-posterior width, proximal end (probable)	22
Greatest antero-posterior width, distal end	59
Greatest dorso-ventral depth (across trochanters)	75
Width of tibial facet	39
Width of fibular facet	28

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