

MURAENOSAURUS? REEDII, SP. NOV. AND TRI-
CLEIDUS? LARAMIENSIS KNIGHT, AMERICAN
JURASSIC PLESIOSAURS

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The material upon which this paper is based consists of the more or less fragmentary remains of two plesiosaurs from the Jurassic of Wyoming, furnished by Professor Wm. H. Reed, curator of vertebrate paleontology in the University of Wyoming. It is in honor of Professor Reed that the name *Muraenosaurus? reedii* is given to one of the species which proves to be new.

Muraenosaurus? reedii, sp. nov.

This specimen consists of a fairly complete right coracoid and a part of the left one, parts of the right and left pubes and ischia, numerous dorsal and caudal vertebrae, several ventral ribs, and a nearly complete left pectoral paddle. The species, judging from the remains at hand, is one of the most primitive found in America and in all probability belongs to a new genus. The material is hardly complete enough for a generic description, however, and the species is therefore provisionally placed with the English genus *Muraenosaurus* Seeley,¹ which it closely resembles in several respects. The primitive form of this species is shown in the relatively long humerus with its moderately expanded distal end, the long radius, and the relatively small degree of hyperphalangy. Although there is no way of determining the length of the neck, it must have been long, for the ischia are short and the association of these two things, long neck and short ischia, seems to be a rule that can usually be depended upon. The similarity of this species with *Muraenosaurus* will be seen in a comparison with the following partial diagnosis of that genus by Andrews:

In the shoulder-girdle there is a well-developed interclavicle, while the clavicles are generally greatly reduced, in some cases being mere films of bone

¹ Andrews, *Marine Reptiles of the Oxford Clay*, Part 1, p. 77.

adherent to the visceral face of the interclavicle; in some cases probably they are wanting entirely. Coracoids not greatly produced outward and backward into postero-lateral processes. Fore limb a little larger than the hind limb, to which it is very similar in form, the humerus not being greatly expanded at its distal and even in the adult.

The coracoids, shown in Fig. 3a, are strikingly short, and although the posterior border is missing, they are so thin at this point that nearly the entire bone is probably represented. The anterior border is considerably thickened and in the median line extends forward in a short, obtuse angle which apparently did not articulate with the scapulae. In general form they resemble *M. durobrivensis* Lydekker. They have a width of 310 mm. and are 260 mm. along their greatest length.

The pelvic girdle is represented by a part of the left pubic bone from the acetabulum to the median line, the lateral end of the right pubis, and the acetabular extremities of the ischia. From these the details of the girdle cannot be obtained, but the parts present resemble closely those of the above-mentioned species.

The ventral ribs (Figs. 3b, 3c, and 3d) are peculiar on account of their massiveness: they greatly exceed those of all other known American forms in size, so far as I can learn, and in that respect resemble those of the English forms *Muraenosaurus*, *Cryptocleidus* Seeley, and allied genera. The median ribs are not uniform in shape or size, those present ranging from 18 mm. to 30 mm. in thickness and from 30 mm. to 37 mm. in width. Some of them reach a length of at least 560 mm. The extremities are flattened for a considerable distance along the ventral surface for the articulation of a row of smaller lateral ones. The number and arrangement of these ventral ribs cannot be determined, but it was probably much the same as that in *Cryptocleidus* and *Muraenosaurus*, viz., a median and three overlapping lateral rows.

The vertebrae are somewhat crushed and badly weathered and cannot be described with a great deal of accuracy. There are thirteen dorsal vertebrae present, all of which have the spines missing as well as most of the arches. The centra are moderately biconcave. They are somewhat flattened on the ventral surface, the lateral surface, however, being rather deeply concave antero-

posteriorly. Not much can be said of the arch except that it is apparently low, the diapophyses arising just above the centrum. The diapophyses are rather stout, directed outward in a horizontal plane, and have an oval cross-section the greater diameter of which is directed in an antero-posterior direction. The centra vary between 33 mm. and 40 mm. in length and are but slightly wider than long. Of the fifteen caudal vertebrae present two are from the posterior region and are disklike, cylindrical, and flattened on the articular surfaces. The other thirteen caudals are more anterior in position, from round to oval with flattened ventral surface in cross-section, moderately biconcave, the lateral surface concave antero-posteriorly. The diapophyses arise low down on the centrum nearly on a plane with the ventral surface and directed out and downward. The lower articular borders are slightly beveled for the chevrons. In length the centra range between 21 mm. and 26 mm. and from 33 mm. to 36 mm. in width.

The left pectoral paddle, with the exception of the ulna, a supernumerary mesopodial, a supernumerary epipodial, perhaps, and a few phalanges, is excellently preserved. A comparison of the paddle of this species with that of *Muraenosaurus leedsi* Seeley (Figs. 1a and 1b) shows the similarity of these two forms. *The humerus* is relatively long and slender, the shaft is oval in cross-section, tapering gradually from the distal expansion nearly to the proximal extremity. Here it expands sharply on the inner radial side into the head with a similar but less sharp expansion on the opposite side of the shaft. A broad shallow groove on the inner and outer sides of the shaft separates these two expansions into head and tuberosity which lie in a plane twisted at an angle of about forty degrees with that of the distal expansion. Along the upper third of the radial margin of the shaft there is a well-marked ridge, which loses its identity, however, in a short distance both proximally and distally. About 65 mm. below the head there is a strong ridge, for the attachment of muscles, running up and backward on the inner surface of the shaft. The distal end is moderately expanded and shows articular facets for the radius and ulna, the former measuring over half the width of the expansion, the latter a little less than one-third. Although there is no facet for the articulation

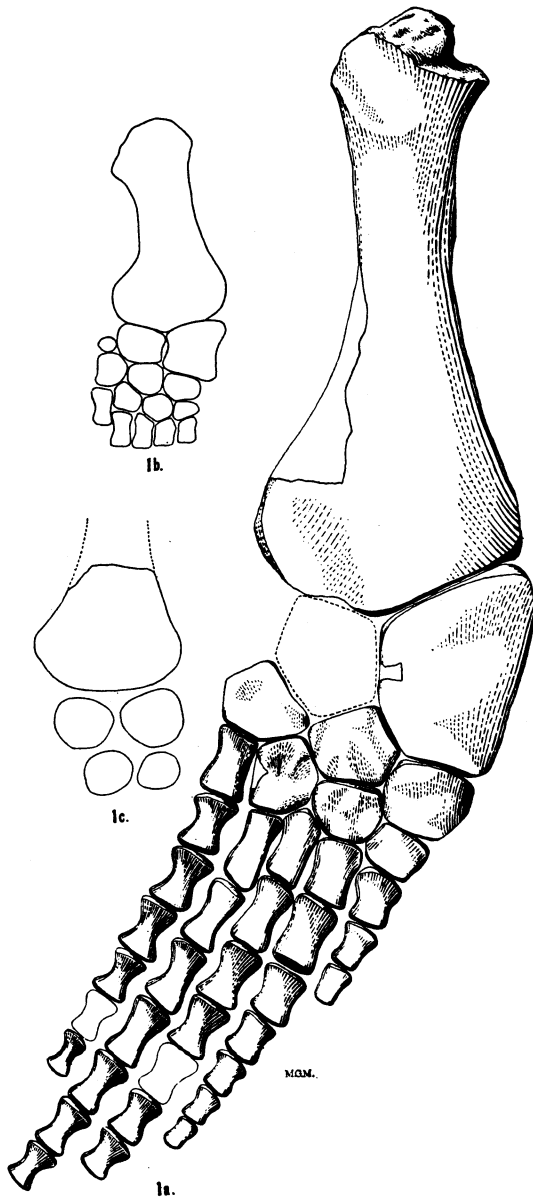


FIG. 1.—1a, left pectoral paddle of *Muraenosaurus reedii*, $\times \frac{1}{4}$. 1b, *M. leedsi* Seeley, pectoral paddle, $\times \frac{1}{16}$. 1c, pectoral paddle of *Pantosaurus striatus* Marsh (after a photograph by Williston), much reduced.

of a supernumerary epipodial, such a bone was probably present to fill out the remaining width of the humerus. *The radius* is remarkable for its length, being longer in comparison with its width than in any other known American form. Its greatest length is along its somewhat thinned outer margin. From here it gradually thickens toward the inner side and toward the extremities. The inner face is apparently unnotched and shows a close articulation with the ulna. *The ulna*, though not known, must have been pentagonal and considerably smaller than the radius. *The carpus* is represented by six bones, three in the proximal and three in the distal row. The ulnare has an articular facet on the outer upper surface, however, showing the presence of a fourth element in the proximal row. *The fingers* are not greatly elongate and are primitive in their relatively small degree of hyperphalangy. The arrangement of the bones is based partly on the determination of Professor Reed and partly on their relative size and shape. For this reason it cannot be said with certainty that the arrangement or number is correct. According to this determination there are, beyond the metacarpals, two phalanges in the first and six in the second finger, with a terminal phalanx missing in each, perhaps. There are five phalanges present in the third finger, with the fourth missing. In the fourth finger there are six and in the fifth five, with number five lacking. In each of the third, fourth, and fifth fingers there are probably two or three terminal phalanges missing.

A brief comparison with other American Jurassic forms will serve to bring out the distinctive characters of this species:

Comparison of the paddle with the outlines of that of *Pantosaurus striatus* Marsh (Fig. 1c), taken from a photograph of the type specimen made by Dr. Williston, shows a marked difference; the radius and ulna in this form are both short, and about equal in length and width.

The description and figure of *Megalneusaurus* Knight, of which *M. rex*¹ is the type, shows the difference between these two forms. In *M. rex* the ulnar articular facet of the humerus is convex, the radius and ulna are short and of about the same dimensions, a radio-ulnar opening is present, and there are but three bones in the proximal row of the carpus.

¹ *Am. Jour. Sci.*, V, 378, Fig. 1.

It is improbable that the Jurassic plesiosaur *Plesiosaurus shirleyensis* Knight¹ belongs to the genus *Plesiosaurus*.² The vertebrae,

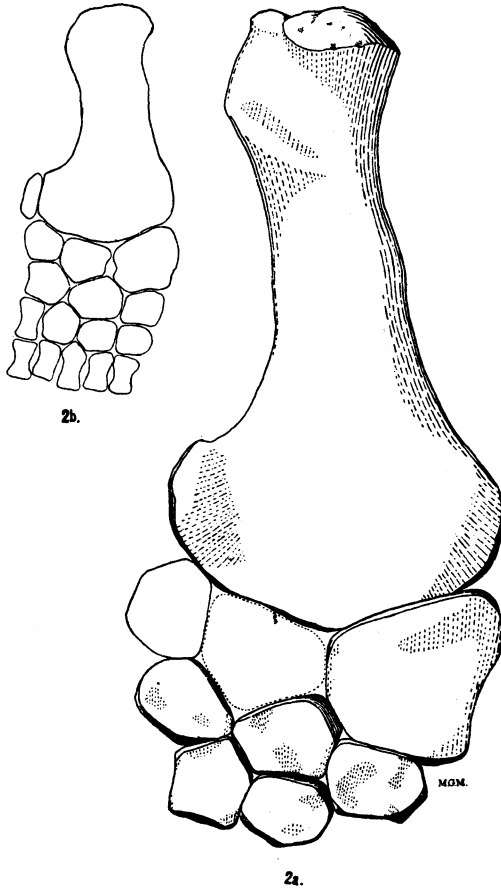


FIG. 2.—*Tricleidus* Andrews. 2a, left paddle of *T. laramiense* Knight, $\times \frac{1}{2}$. 2b, pectoral paddle of *T. seeleyi* Andrews, $\times \frac{1}{8}$.

however, seem to separate *M. reedii* from this form. Quoting from Professor Knight's description of *P. shirleyensis*:

The vertebrae are slightly biconcave, and all wider than long; but in the dorsals and posterior cervicals the length and breadth are nearly equal. . . . On the anterior caudals the neural spines are of considerable height. Nothing

¹ Knight, *Am. Jour. Sci.*, IV, 115.

² S. W. Williston, *North American Plesiosaurs*, Pub. Field Columbian Mus., Geol. Series, II, No. 1, p. 7.

of importance is known of the dorsal vertebrae, excepting that they are slightly biconcave and circular in transverse sections. Anterior caudals are flattened beneath and have two large circular facets for the articulation of the chevrons; neural arches firmly attached to centra.

The type material of *P. shirleyensis* is so fragmental that one cannot be certain of the distinguishing features.

Tricleidus? laramiensis Knight

The following description is based on a part of the original specimen described by Knight as *Cimoliosaurus laramiensis*.¹ In the past *Cimoliosaurus* Leidy has been made a sort of catch-all for the remains of imperfectly known plesiosaurs. The genus, however, was described from vertebrae alone² and, therefore, till it is better known, a species can be referred to it with certainty only on evidences furnished by the vertebrae. In Leidy's description of the type, *C. magnus*,³ he figured what he took to be two dorsal and eleven lumbar vertebrae. I believe that Dr. Williston was right, however, when he referred Figs. 13-19, Pl. 5, in Leidy's description, to the cervical region, Figs. 1-5, Pl. 6, to the dorsal, and Figs. 6-19, Pl. 6, to the cervical region.⁴ The caudals of *Discosaurus* Leidy, described in the same work, along with *Cimoliosaurus* and later shown by Cope to be identical with that genus, have a pair of ridges extending antero-posteriorly along the ventral surface. The vertebrae of *Cimoliosaurus*, then, have certain generic characteristics, but none of these is mentioned by Professor Knight in his description of *C. laramiensis*. In fact, the only characteristics mentioned are "the forward overhanging" of the dorsal centra and the large angular chevron facets of the caudal vertebrae and neither of these is noted in the type specimen. Furthermore, *Cimoliosaurus* is typically an Upper Cretaceous form. The species here described is, therefore, provisionally placed with the English genus *Tricleidus* Andrews,⁵ the pectoral paddle of which is very

¹ *Am. Jour. Sci.*, IV, X, 117.

² *Proc. Nat. Acad. Sci. Phila.*, 1851, 325; 1854, 72; pl. 2; figs. 4, 5, 6.

³ *Smithsonian Contributions to Knowledge*, XIV, 25-29; pl. 5; figs. 13-19, and pl. 6; figs. 1-19.

⁴ *Am. Jour. Sci.*, XXI, 222.

⁵ Andrews, *Marine Reptiles of the Oxford Clay*, Part 1, p. 149.

similar. A comparison with the description of the following salient features of *T. seeleyi* Andrews will show the similarity of these two forms.

The fore limb is peculiar in several respects and differs considerably from that of *Cryptocleidus* and *Muraenosaurus*; its most striking characteristic

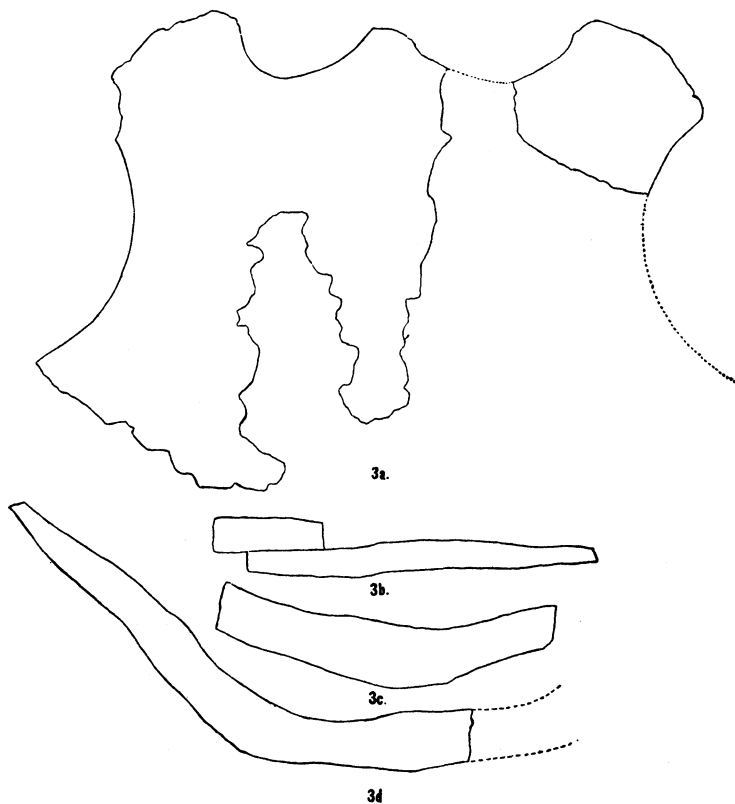


FIG. 3.—*Muraenosaurus reedii*. 3a, coracoids, 3b, lateral ventral ribs, 3c and 3d, median ventral ribs, all $\times \frac{1}{4}$.

is that the humerus articulates distally with four bones—three, the radius, ulna, and pisiform, being large, the fourth a small postaxial accessory ossicle. *The humerus* is short and stout; the head is round in outline and convex; at its upper anterior border it is continuous with the surface of the strongly developed tuberosity. This is bounded both in front and behind by strong ridges, which extend down a little on the shaft; its upper surface is flattened, and a little below its upper border there is a well-marked rugosity for the

attachment of muscle. The stout shaft is oval in section; its anterior border bears a roughened ridge, and the upper part of its ventral and ventral-posterior surface is roughened for muscle attachments. Distally the bone is expanded and compressed from above downward. The facet for the radius is the largest, that for the pisiform the smallest; the surface of the accessory ossicle is situated entirely on the postaxial border nearly parallel with the long axis of the bone.

The material at hand consists of the left humerus, the radius, five carpals, and a sixth bone which is probably a supernumerary epipodial. To the description of the humerus by Professor Knight it might be added that the plane of the distal expansion forms an angle of about fifty-five degrees with that of the head and tuberosity and that there is an articular face on the posterior distal end for the articulation of a third bone and perhaps a fourth facet on the posterior face of the expansion. The arrangement of the carpal bones is quite certain, there being three in the proximal row and two in the distal row, with a third, the first distal carpal, missing. A sixth bone, the position of which is uncertain, is represented in the figure by an unshaded outline as articulating with the humerus and the third carpal in the proximal row. There seems to be a distinct facet on the humerus and carpal at these points and in all probability the bone represents a supernumerary epipodial.

One of the most striking resemblances between the two forms is seen in the posterior border of the humerus; in each the distal expansion is recurved posteriorly, and although the fourth bone found articulated with the humerus of *T. seeleyi* is absent in *T. laramiense*, the posterior border of the humerus suggests that such a bone was originally present though perhaps not thoroughly ossified. A comparison of Figs. 2a and 2b shows this likeness.

I take this opportunity to acknowledge the kindness of Professor Reed in granting me the privilege of studying this material and also to thank Dr. Williston for suggestions in the preparation of this paper.