A NEW PTEROSAURIAN REPTILE FROM THE MARINE CRETACEOUS OF OREGON

By Charles W. Gilmore

Curator of Vertebrate Paleontology, United States National Museum

Through the kindness of Prof. E. L. Packard, of the University of Oregon, I have recently received for study a fossil specimen found by him in the marine Cretaceous rocks of eastern Oregon. This specimen clearly belongs to the Pterosauria, and, as this reptilian group has not previously been known to occur in the Pacific coast region of North America, the discovery is of much scientific interest.

In North America pterosaurian remains have been found in the marine Niobrara Chalk of western Kansas and in the fresh-water Morrison deposits of Wyoming. Three genera are recognized—*Pteranodon* and *Nyctodactylus* from the Niobrara, and *Dermodactylus* from the Morrison formation. The first two mentioned genera are adequately defined from well-preserved specimens; but the latter, founded on a single incomplete and poorly preserved skeleton, is at this time inadequately characterized.

Well-preserved pterosaurian specimens are among the rarest of American reptilian fossils, and when this pterosaurian fauna is contrasted with those of Great Britain and Europe, with their great number of genera and species of wide geological range, the paucity of our rocks in pteryodactyle remains becomes strikingly apparent. This comparison serves also to accentuate the importance of this latest discovery, in greatly extending their known geographical range as well as furnishing a representative of the order that is intermediate in geological position between the earliest and latest known American members.

In regard to the geological occurrence of this specimen, Professor Packard, under date of September 19, 1927, writes me as follows: "These specimens were found in Cretaceous shales associated with a determinable ammonite fauna of Lower Chico, or possibly Upper Horsetown age." The specimens referred to in the above citation are the pterosaur and an ichthyosaur,[1] the first and only vertebrate remains so far found in this formation.

[1] Merriam, J. C., and Gilmore, C. W., Carnegie Instit. of Washington. Pub. No. 393, 1928, pp. 1–4.

The unique geographical occurrence of this Oregon fossil in conjunction with its intermediate geological position appears to justify its description as a new species, and the specific name *oregonensis* is proposed for its reception. As a matter of expediency awaiting the discovery of more diagnostic materials, this species is tentatively assigned to the genus *Pteranodon*. That it may pertain to a new genus is a fact fully recognized but one that can only be determined by the discovery of more complete specimens.

PTERANODON (?) OREGONENSIS, new species

Type.—Consists of a nearly complete left humerus, two coossified dorsal vertebrae and the articular end of an undetermined bone. Collected by E. L. Packard, 1927.

Type locality.—"Mitchell Quadrangle, Wheeler County, Oreg., S. E. ¼ sec. 36, T. 26 S., R. 21 E. About 200 feet above gorge of a small east gulley leading into Nelson Creek about ¼ mile above its mouth, not more than 200 feet from southward bend in Nelson Creek Road after it reaches the flat."

Geological occurrence.—Upper Chico, or Lower Horsetown, Cretaceous.

Description.—The few bones preserved of this specimen are remarkable on account of their uncrushed preservation, an unusual condition in flying reptiles. On account of the fragile hollow structure of the bones of the pterosaurs, and especially those from the Niobrara Chalk, they are usually much flattened, with their natural configuration so altered as to leave one in doubt as to their original form. Fortunately, these bones have not suffered in this respect, although important parts of certain of the processes have been lost either through erosional agencies before the specimen was discovered or have been destroyed by subsequent attempts at preparation.

When the humerus came into my hands it was in two pieces, and although the two broken surfaces appear to show contact at the middle of the shaft and the external contours seem to be in accord on all sides, a slight doubt exists as to their being properly united. Professor Packard, however, assures me that there can be no doubt of their belonging together.

A critical comparison of the humerus with the humeri of other American pterosaurs is rendered quite unsatisfactory due to the crushed and flattened condition of all of the Niobrara fossils. Eaton[2] has called attention to this flattening as follows:

> The vagaries of form assumed by the humerus [in *Pteranodon*] under pressure in the matrix are very surprising, the first result of this perplexing situation being that almost every humerus in the collection seems to represent a

[2] Eaton, G. F., Memoirs Conn. Acad. Arts and Sci., vol. 2, 1910, pp. 28–29.

distinct species. From an examination of 14 practically complete humeri of *Pteranodon* variously distorted, it appears that pressure in the vertical direction (the vertebral axis of the pteryodactyl being supposed to lie in the horizontal plane, with the wings outstretched latterly) usually crushes and shortens the radial crest, while pressure in the horizontal plane not only leaves the radial crest extended to its full length but also alters the head of the humerus in such a way that the radial crest appears to originate farther from the proximal condyle.

It is therefore quite obvious that comparisons made with this material can not be relied upon. Fortunately, a few fragmentary humeri from the Cretaceous deposits of England have retained their natural configurations, and they offer a better basis of comparison with the Oregon humerus.

The humerus is gently sigmoid from end to end. The ends are widely expanded, the distal exceeding the proximal in its transverse diameter, and planes projected through the longer axes of these ends would bisect one another at nearly right angles. The head is elongate, roughly crescent shaped in outline, with the longer axis transverse. The articular face is convex anteroposteriorly and slightly concave or saddle-shaped transversely. Much of the deltoid crest is missing in this specimen, but its great development is clearly apparent.

This process springs from the outer border at some distance below the head, as clearly shown in Figure 1. Its broken base has a greatest longitudinal diameter of 35 millimeters. The ulnar crest is strongly developed, and it springs from the inner border, nearer but also below the level of the proximal end. Comparison with flattened *Pteranodon* humeri seems to indicate a more robust development of this process in the Oregon specimen, and its extension downward on the side of the shaft appears to be greater. These differences, however, may be more apparent than real, for there is so much variation in the Niobrara humeri that little reliance can be placed in observed characters. Between the deltoid and ulnar crests the ventral surface of the humerus is strongly concave but becomes convex immediately below the lower border of the deltoid crest. The shaft decreases in size until in the middle it has a least diameter of 17.5 millimeters; distally it gradually but rapidly expands to the distal extremity. The distal end has suffered the loss of its outer articular surface, and abrasion of the inner surfaces renders their exact interpretation uncertain. There is a large depression in the center of this end, but it is not at all comparable to the deep circular foramen found in the humerus of *Ornithodesmus*, as described by Hooley.[3]

[3] Quart. Jour. Geol. Soc. London, vol. 69, 1913, p. 386, pl. 39, fig. 3.

Measurements of humerus

	Millimeters
Greatest length	183.0
Greatest width of proximal end	42.0
Greatest width of distal end	57.5
Least diameter of shaft	17.5
Anteroposterior diameter of head	20.5
Anteroposterior diameter of distal end	28.0

Vertebrae.—The vertebral column is represented by two vertebrae that are fully coossified. These are uncrushed, and except for the loss of the tops of the neural spines and ends of the transverse

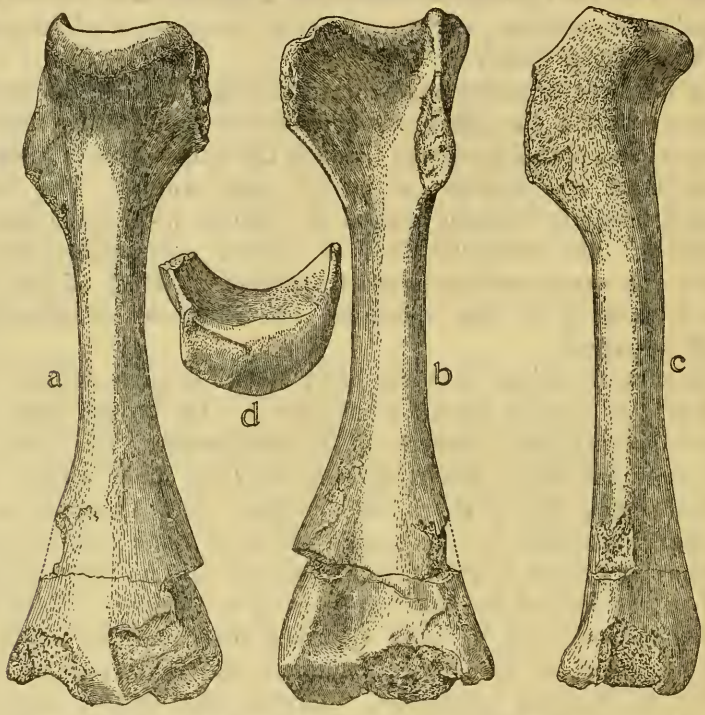

FIG. 1.—LEFT HUMERUS OF PTERANODON (?) OREGONENSIS. TYPE. *a*, POSTERIOR VIEW; *b*, ANTERIOR VIEW; *c*, EXTERNAL VIEW; *d*, PROXIMAL VIEW. ALL FIGURES ONE-HALF NATURAL SIZE

processes are in an excellent state of preservation. Comparisons made with the vertebral column of *Pteranodon* seems to indicate their position to be in the posterior dorsal region. The position of the transverse processes, which have their origin above the level of the neural canal, centra constricted at the middle with expanded ends, and steep inclination of the zygapophysial facets are all features indicative of their posterior thoracic position as shown in Figure 2. In *Pteranodon* the dorsal series consists of eight anterior coossified vertebrae, which is designated the notarium, and they are followed by either three or four free vertebrae which fill the interval between the notarium and the coossified series forming the sacrum.

From a review of all available evidence it is my conclusion that the two vertebrae now before me belong to this free series. The fact of their being coossified does not necessarily argue against this conclusion, for in living birds aged individuals often show ossification of ligaments as well as the coossification of the spinous, transverse, and zygapophysial processes of the vertebrae, and it does not seem unreasonable to believe that a somewhat similar condition might take place in the backbone of these extinct flying reptiles.

When compared with the free vertebrae of *Pteranodon* the greatest dissimilarity noted is in the more prominent development of the ball

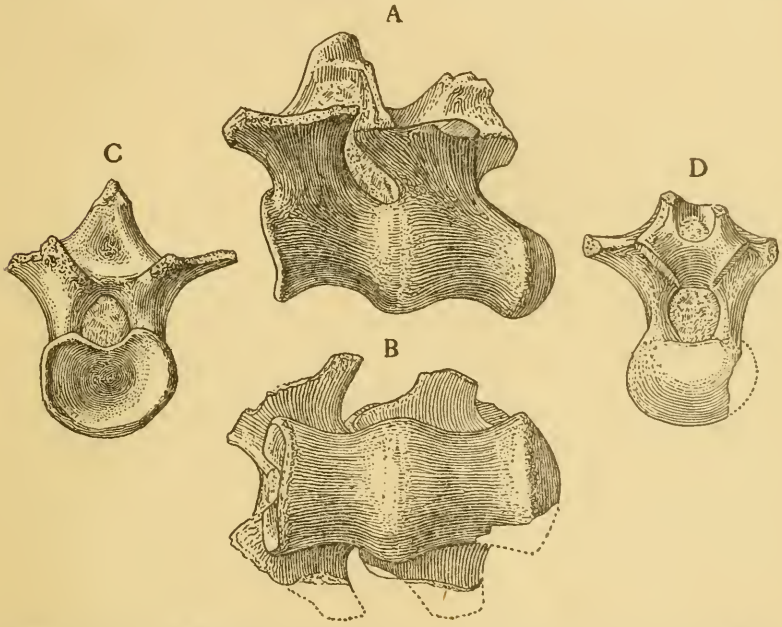

FIG. 2.—DORSAL VERTEBRAE OF PTERANODON (?) OREGONENSIS. TYPE. *a*, LATERAL VIEW FROM THE LEFT SIDE; *b*, VENTRAL VIEW; *c*, ANTERIOR VIEW; *d*, POSTERIOR VIEW. ALL FIGURES NATURAL SIZE

in the Oregon specimen, which gives the centrum a correspondingly increased length. The pedicels of the arches are also relatively wider anteroposteriorly. The transversely oval shape of the cup, the large size of the neural canal, the steep inclination of the zygapophysial facets are all features in close accord with the dorsals of *Pteranodon.*

Measurements of coossified vertebrae

	Millimeters
Greatest length of coossified centra	40
Greatest transverse diameter of anterior centrum	18.5
Greatest vertical diameter of anterior centrum	15.0
Greatest vertical diameter of posterior centrum	14.0
Width across anterior zygapophyses	18.5