ART. XVIII.—*A New Species of Baptanodon from the Jurassic of Wyoming*; by CHARLES W. GILMORE.

DURING the summer of 1905 Mr. W. H. Reed, Curator of the University of Wyoming museum, found what appears to be the most complete skeleton of *Baptanodon* yet obtained from the marine Jurassic of this country.

Through the kindness of Mr. Reed the important parts of this specimen were submitted to the writer for study and description. Characters observed in the teeth and anterior extremities indicate a new species, for which the name *Baptanodon reedi* is proposed, in recognition of Mr. Reed's many discoveries in this formation.

Baptanodon reedi sp. nov.

Char. Specific: *Distal end of humerus broad and articulating completely with radius, ulna, and pisiform. Teeth of large size and extending the full length of the jaws. Sclerotic ring small in proportion to length of skull.*

The type specimen, designated as D.B. in the University of Wyoming collection, was found in the Dutton Creek Basin, Fremont Co., Wyoming. It occurred in the same horizon of the marine beds and only a few hundred feet distant from the place where the type specimen of *Megalneusaurus rex** was found. This horizon Knight considered the uppermost band of the Shirley† stage, and the stratigraphic position is quite in accord with the highly specialized features observed in the skeletal structure of this specimen.

The *type* of the present species consists of one-half of the skull (divided longitudinally), one hundred and fifty-three vertebræ in series beginning with the atlas, numerous ribs, proximal part of the left scapula, both humeri, and the proximal portion of the left pectoral extremity.

The writer has had no opportunity of examining more of the skull than the sclerotic ring of one orbit and the anterior portion of the rostrum, and only the parts studied will be considered in this paper. However, a photograph of the right side shows a general resemblance to the other *Baptanodon* skulls known.

The sclerotic ring is remarkably free from distortion and gives a clear conception of the arrangement of the bony plates, which constitute the protective covering of the eye. The ring

* W. C. Knight, this Journal, vol. v, May, 1898.

† W. C. Knight, Bulletin Geol. Soc., of America, vol. xi, May, 1900, p. 385.

AM. JOUR. SCI.—FOURTH SERIES, VOL. XXIII, No. 135.—MARCH, 1907.

appears to have the same number of segments (14) as found in the other members of this genus. It has been removed from the orbital cavity and as viewed antero-posteriorly it might be well described as the union of the bases of two truncated cones. This specimen fully confirms a previous suggestion of the writer* "that this covering extended well to the back of the eyeball as in some birds." The diameter of the internal opening equals that of the external pupillary opening. The ring is about 70^{mm} in thickness, and compared with the eye of *B. discus* is small in diameter, as is clearly indicated by the following measurements:

	Greatest length of skull.	Diameter of sclerotic ring.	Diameter of pupillary opening.
<i>B. discus</i> , No. 878, Carnegie Museum	1082 ^{mm}	202 ^{mm}	100 ^{mm}
<i>B. reedi</i> , D. B., University of Wyo.	1320 "	150 "†	85 "

That part of the *rostrum* studied by the writer measures 262^{mm} in length, and, as in the other *Baptanodon* skulls, the tip of the beak is wanting. The frail nature of the bone, together with the exceedingly refractory matrix, did not admit of the preparation of this part of the specimen, but a longitudinal fracture exposes the dental groove of one side, in which may be counted the bases of thirteen teeth.

These teeth are of a strong, robust nature with enlarged bases. The few teeth protruding from the matrix are subcircular in cross-section, their surfaces being covered with coarse longitudinal striæ which gradually subside before reaching the subacute apex, which is smooth. Mr. Reed informs me that large teeth are present in the grooves of the posterior portion of the rostrum. It would seem, therefore, from this evidence that *Baptanodon reedi* had a series of strong functional teeth extending from the back to the front of the jaws.

Mr. Reed furnishes the following information concerning the vertebral series:

"The vertebræ of this specimen number one hundred and fifty-three. There are four centra missing, namely, the atlas, axis, third and fourth cervicals, but their neural processes are retained in place, and these parts resemble the homologous elements of *Baptanodon marshi*. The diapophysial articular surface on the fifth centrum (counting from the skull) of the series is confluent with the neurapophysial articular surface, and this position holds until the eighteenth centrum is reached. On this vertebra the two surfaces are separated. From this point posteriorly the diapophyses and parapophyses gradually move down on the

* C. W. Gilmore, Memoirs Carnegie Museum, vol. ii, No. 9, p. 328.

† If flattened out like the sclerotic ring of No. 878 this dimension would be about 175^{mm}.

sides of the centra, at the same time constantly approaching one another. for example, on the anterior vertebræ these processes are 16^{mm} apart but on the thirty-eighth they are only 7^{mm}. On the fortieth centrum the dia- and parapophysis are united forming an oblique elongated process, 22^{mm} long and 12^{mm} wide, which occupies a position well down under the side of the centrum. The single process continues as far posteriorly as the sixtieth vertebra: here there is another change. In diameter the single processes on sixtieth to the sixty-sixth vertebræ (inclusive) are nearly double the size of those in front, but they do not project as far from their centra, and, moreover, their articular ends are deeply concave. These processes also occupy a higher position on the sides of the centra than either those that precede or follow.

The single process is found on the sixty-seventh vertebra, but the surfaces of the succeeding centra are so abraded that it is impossible to determine on what vertebra this process is last found.

Beginning with the eightieth vertebra there is a sudden reduction in the diameter of the centra, or from the eightieth to the eighty-fourth the reduction is more than one half the previous diameter of the centra. From this point the centra gradually decrease in size to the one hundred and fifty-third, which measures 5^{mm} in its vertical and 3^{mm} in its horizontal diameter. These smaller vertebræ are oval in outline and only slightly biconcave.

The fifth vertebra in the series measures 60^{mm} in both its vertical and horizontal diameter; the tenth is 90^{mm} in the vertical and 84^{mm} in the horizontal; and the fortieth is 109^{mm} in the vertical and 98^{mm} in the horizontal.

The total length of this specimen from the anterior portion of the snout to the end of the one hundred and fifty-third vertebra is 6270^{mm}."

The finding of such a complete series of vertebræ establishes definitely the points where the various epophysial changes occur, and the more important of these may be summed up as follows:

1. The diapophysial and neurapophysial articular surfaces confluent on the anterior vertebræ separate on the eighteenth centrum.

2. The dia- and parapophysis unite on the fortieth centrum to form a single process.

3. The greatly modified processes on the sixtieth to the sixty-sixth centra (inclusive) may, as Mr. Reed has suggested, represent the point of attachment for the pelvis.

4. The sudden decrease in diameter of the caudal centra begins with the eightieth vertebra.

It is now fairly well established that *Baptanodon*, as in *Ichthyosaurus*, had a downward deflection of the caudal verte-

bræ into the lower lobe of the caudal fin. In *Ichthyosaurus communis*, Owen determined that the downward trend of the vertebræ commenced with the eightieth centrum, and Mr. Reed informs the writer that as found in the ground this specimen showed such a bend beginning at the point where the caudals decrease in size so rapidly.

Anterior limb.—Figure 1 illustrates the left pectoral extremity as preserved with this specimen. All of the elements remaining were retained in the matrix, and thus afford a good opportunity to study their mutual relationships.

The robust *humerus* has a stout twisted shaft and expanded ends which are so turned as to cut each other at an angle of

1

FIG. 1. Left pectoral extremity of *Baptanodon reedi*, seen from below. One-fifth natural size. H, humerus; R, radius; U, ulna; P, pisiform; Ra, radiale; I, intermedium; Ul, ulnare. Type specimen in the University of Wyoming collection, Laramie, Wyoming.

45°. The proximal end is subrectangular in outline and very rugose. It is slightly convex both vertically and horizontally. Vertically this end has an average thickness of about 80^{mm}. The distal end is much compressed, being about 50^{mm} in thickness, but broadly expanded in the other diameter. This end presents two distinct faces for articulation with the elements of the epipodal row. The facet for the radius has a markedly concave border instead of the straight face observed in the other species. The facet opposed to the ulna and pisiform meets the facet for the radius at an obtuse angle and from there extends straight out to the edge of the humerus. It is quite probable that these facets are concave vertically as found on the humerus of *B. marshi*, but to determine this point it would be necessary to separate these elements, and their closely applied surfaces rendered this procedure inadvisable.

The main projection of the proximal end beyond the plane of the distal end is toward the upper side, thus forming a very

strong trochanteric ridge which is wholly confined to the proximal half of the shaft.

The *radius* and *ulna*, particularly the former, are closely articulated with the humerus. In general form and size they resemble very closely the corresponding bones of *B. marshi*.

The *pisiform* in *B. reedi* is more elongate than circular in form and articulates completely with the humerus. In these respects it approaches the conditions found in the paddle of the closely allied form *Ophthalmosaurus icenicus*,* although

2

FIG. 2. Right pectoral extremity of *Ophthalmosaurus icenicus* Seeley, seen from above. One-fourth natural size. H, humerus; R, radius; U, ulna; P, pisiform. Paratype. (After Seeley.)

a comparison of figures 1 and 2 shows the elements in the latter genus to be more angular in their general outlines.

The *ulnare* appears more elongated than in *B. marshi*, and the *intermedium* more angular than those observed in other specimens.

The other elements of the paddle are more or less rounded disks and a description of them would hardly add anything to our understanding of this form.

The writer considers the paddle of *B. reedi* as the most highly specialized limb yet found among the American Ichthyosaurs. This is shown by the broadly expanded humerus, which articulates closely and completely with the radius, ulna and pisiform.

* H. G. Seeley, Quart. Jour. Geol. Soc. of London, vol. xxx, pp. 696-707, 1874.

The following comparative measurements are interesting as showing the similarity in proportions between the humeri of the American and English members of the Baptanodontidæ.

	Greatest length of humerus.	Greatest width of proximal end.	Greatest width of distal end.
Type of <i>B. reedi</i> , Univ. of Wyoming coll.	210 ^{mm}	140 ^{mm}	165 ^{mm}
Type of <i>B. marshi</i> , " " " "	190 "	127 "	130 "
Paratype of <i>O. icenicus</i> , Leed's collection	164 "	115 "	152 "

Judged from the limb structure alone, the pectoral extremity of *B. marshi* presents the most generalized features of this genus, while, on the other hand, the anterior paddle of *B. reedi* exhibits the most specialized characters. This deduction is based upon the comparative breadth of the distal ends of the humeri and the manner by which they articulate with the epipodal elements. In the former species, as Knight has pointed out, the facet for the pisiform is rudimentary, but in *B. reedi* the humerus has widened sufficiently to admit of the complete articulation of this bone. In the manner of the articulation of these elements the extremity* of *B. discus* figured by Marsh appears to be intermediate in form. The limbs, at least, suggest a direct line of development, and if the geological position of *B. reedi* is correctly determined as the uppermost part of the marine Jurassic, it would be quite in accord with the structural changes observed in these specimens, as the other species are known to have come from lower layers of these marine strata.

In *Baptanodon*, as in other Ichthyosaurians, the evidence furnished by limb structure is most valuable for working out their relationships, although, as Dr. Merriam has suggested in discussing the limbs of the Triassic Ichthyosaurs, "they hardly furnish the whole foundation for a definite classification."

A study of the coalesced atlas and axis of *B. natans*, *B. discus*, *B. marshi*, and *B. robustus* show differences of structure which would indicate that other characters that will serve for specific separation will probably come to light when the detailed structure of these several species is better known. Unfortunately the missing centra of the anterior cervicals of this specimen renders it impossible to compare these vertebrae with the homologous parts of the other species.

U. S. National Museum, Dec. 17, 1906.

*As suggested in a previous paper, the paddle identified by Professor Marsh as a pelvic limb is undoubtedly a pectoral extremity, and it is so considered here.