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Article XXXV.— *CORYTHOSAURUS CASUARIUS*, A NEW CRESTED DINOSAUR FROM THE BELLY RIVER CRETACEOUS, WITH PROVISIONAL CLASSIFICATION OF THE FAMILY TRACHODONTIDÆ.

By Barnum Brown.

Plate XLI.

The type of this genus and species is an unusually complete skeleton, No. 5240, secured by the American Museum Expedition of 1912.

Recently Mr. Lawrence M. Lambe has described and figured in the 'Ottawa Naturalist' (April, 1914) a skull and jaws of a Trachodont from the Belly River which he refers to his *Trachodon marginatus*, 1902, and removes that species from *Trachodon* as the type of a new genus, *Stephanosaurus*. It appears probable that this skull is congeneric with *Corythosaurus casuarius*, although clearly distinct as to species. That either is congeneric with the type of *T. marginatus* is improbable. Lambe states (1914) that *T. marginatus* was based upon "a ramus of the lower jaw and a maxilla and the remains of one individual." But reference to his original description (1902) shows clearly that the last named specimen (consisting of humerus, radius, ulna and some other parts named but not figured) was regarded as type at the time of description. It is first mentioned, and the describer goes on to say that "*the species is represented further by* disassociated femora, tibiæ, metacarpals and phalanges of the manus, *rami of the lower jaw and maxillæ*, dorsal and caudal vertebræ, a pubic bone, ischia, ilia, chevron bones and numerous teeth as well as other remains *probably referable to the same species*" (italics mine). Whether the upper and lower jaws described by Mr. Lambe belonged to one individual has never been stated. The remains of the associated individual are then described and measured, and the descriptions of the femur, tibia, jaws and other referred specimens follow.

While the upper and lower jaws referred to *T. marginatus* may rank as paratypes, if they are associated, the species obviously rests primarily upon the "remains of one individual." The other specimens referred are not cotypes, and the author is not at liberty to select any of them as a lectotype to the exclusion of his primary type. If the latter be indeterminate, valid generic characters may be drawn from the paratypes, and if they also are indeterminate, then from other specimens subsequently referred.

Whether valid generic characters can be found in either the type or para-

types of Lambe's species is at present an unsettled question. There are several genera of Trachodonts in the Belly River formation clearly distinct as to skull, but not at present distinguishable in the form of lower jaw, maxilla or teeth. Good generic characters may be found in these parts or in the proportions and characters of the fore limb bones, etc., of the type. Unfortunately our skeleton has only fragments of the fore limbs preserved, insufficient for comparison with the type of *T. marginatus*, the genotype of *Stephanosaurus*.

In the measurements given for the type of *T. marginatus* the humerus is longer than the radius, a character that agrees with the genus *Trachodon*.

The lower jaw is said to measure 630 millimeters in length and the figure shows that he refers to the dentary alone. If the data are correct this dentary is 130 millimeters longer than that of the new American Museum skull herein described and 155 millimeters longer than the new Ottawa skull. In size and general form it, as well as the maxilla, agrees with the genus *Trachodon* and Lambe's original reference to that genus was probably correct.

In view of the several uncertainties thus indicated it appears inadvisable to refer the species here described to *Stephanosaurus* unless some or all of the doubtful points can be settled by further study and comparison of more associated material from the Belly River formation.

[It is regrettable that Mr. Lambe did not base his new genus upon the new and complete specimens, and leave for later study the question whether its type species was or was not identical with *Trachodon marginatus*.]

Corythosaurus casuarius gen. et sp. nov.

Type of genus and species, No. 5240, a nearly complete skeleton with integument.

Horizon and locality. Belly River Beds, 300 feet below top of formation, near Steveville, Red Deer River, Alberta, Canada.

Generic and specific characters. Skull comparatively short with a high helmet-like crest formed by nasals, prefrontals and frontals. Nasals not separated in front by premaxillaries. Beak narrow, expanded part in front of nares elongate. Narial opening small.

The skeleton is articulated and complete with exception of about two feet of the end of the tail, and the fore limbs. Both scapulæ and coracoids are in position but the rest of the fore limbs have weathered out and are represented by phalanges and pieces of humeri, ulnæ and radii, apparently incomplete.

The impression of the integument covers over the greater part of the skeleton outlining the form of the body. On the left or under side, this skin is preserved in carbonaceous clay difficult to prepare, so the work of

preparation has been slow and is not yet far enough advanced to warrant a description of the complete skeleton.

Skull. No dermal impressions were preserved on the skull and it has been entirely freed of matrix. It is compressed laterally so that the transverse width is approximately two-thirds of normal and the facial outline has been changed slightly where the nasals are pressed down upon the premaxillaries closing the nares. Otherwise the contour appears to be normal.

In proportion to the size of the skeleton the skull is much smaller and shorter than in *Trachodon, Kritosaurus* or *Saurolophus,* but on account of the enormous crest its superficial area is nearly as great.

The extraordinary crest rises above the brain-case like a Corinthian helmet or the crest of a cassowary which it resembles. It is developed from the nasals, prefrontals and frontals as in *Saurolophus* but instead of projecting backward as a heavy spine rises to the highest point in front and above the orbit. Throughout its extent the two lateral halves are separated by a median suture. In front of the orbit where it is formed by nasals and prefrontals the crest is arched in cross-section and the bone is fairly thick. Above this point the two sides approach very close, forming a vertical plate and the overlapping nasal and frontal bones are as thin as paper.

The nasal enters chiefly into the formation of the crest, extending from the tip of the beak to the highest part of the crest back of which it is overlapped by the frontal. The nasals meet in the center throughout their extent and are not separated in front by ascending premaxillary processes as in known skulls of other described genera.

The prefrontal is roughly triangular in form and is not as extensive as in the specimen described by Lambe under the name of *Stephanosaurus marginatus.* The union with the frontal is not well defined but apparently it forms no part of the orbital border.

The frontal forms the outer surface of the entire upper and posterior part of the crest overlapping the nasal for a considerable distance and extending as far forward as the anterior border of the prefrontal; posteriorly the free, thick, lower border extends above and parallel to the parietal, terminating back of the squamosals in a short, hooked process.

The mouth is comparatively narrow and the nares are small. The expanded portion of the premaxillary in front of the narial opening is elongate as in *Saurolophus* and *Trachodon,* whereas in *Kritosaurus* the nares extend far forward and the bill is short. Apparently there is no superior process of the premaxillary as in known skulls of other genera, and the nasals unite with each other to the end of the bill. In all other known skulls the nasals are separated in front by a superior process of the premaxillary. The inferior process of the premaxillary is shorter than in *Trachodon, Kritosaurus* or *Saurolophus* and does not unite with the lachrymal as in those genera.

The exact number of rows of teeth or the character of the enamel surface cannot be determined in this specimen; there are 34 rows visible in the dentary and 36 in the maxillary. The maxilla and the dentary are both short and the anterior end of the dentary is deflected as in *Kritosaurus*. The dentary of *Stephanosaurus* figured by Lambe appears to be straight as in *Trachodon*, but the form has probably been changed by crushing.

The other visible elements composing the sides and back of the skull have the same relative form and proportion but are comparatively smaller than in *Trachodon*.

A detailed description of the skeleton will be published as soon as the specimen is prepared; for the present this species may be distinguished from the skull referred to *Stephanosaurus marginatus* by the less developed prefrontal and the character of the epidermis. Lambe, in 'The Ottawa Naturalist,' Vol. XXVII, pp. 133–134, Jan., 1914, describes the skin of (*Stephanosaurus*) *marginatus* as follows: "It is with one of these specimens of last summer's collection that the skin impressions are preserved. These impressions are from the side in the trunk region, and along the tail. In the former, depressed conical plates or scales, having an oval basal outline, occur at intervals with much smaller, polygonal, tubercle-like, non-imbricating plates filling the inter-spaces. The conical plates strongly resemble limpets in shape, and are about twice their diameter apart. They reach a size of about one and a half inches in length and one and a quarter inches in breadth, with a height of about five-sixteenths of an inch. The comparatively small, intervening plates resemble the smaller sized plates of *Protorosaurus belli*, and of *Trachodon annectens*, Marsh, as described by Osborn.[1] They range in diameter from about one-eighth up to two-eighths of an inch, an increase in size occurring toward the conical plates round which the largest ones form a ring. A marked feature of the conical scales is a radial crinkling which is most pronounced at the basal circumference and extends about half way up the sloping surface."

"In the tail the same scale pattern is continued but in a less striking manner, its component parts being reduced in size. The conical plates are more nearly circular in basal outline, with a diameter of about half an inch, and a proportionately lower relief. They are relatively farther apart than those of the trunk, being about four to six times their diameter distant from each other. The polygonal ones have an average diameter of about three-sixteenths of an inch, and, as in the trunk, a slight increase in size is observed in those near the conical plates. Along the side of the body the conical plates have their long diameter in a fore and aft direction."

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[1] Memoirs of Amer. Mus. Nat. Hist., new series, Vol. I, pl. ii; integument of the Iguanodont dinosaur *Trachodon*, pls. vi and vii.

In *Corythosaurus casuarius* the tail and sides of the body are covered by polygonal tuberculate scales that vary in size in different sections, and conical limpet-like scales are not present excepting on a fold of skin back of the distal end of the tibia, which is probably a section from the belly.

Measurements.

	mm.
Complete length of lower jaw	669
Depth of lower jaw in center to alveolus	100
Complete length of skull between vertical lines	812
" " " " beak to terminal end of crest	837
Height of skull	708
Length of squamosal	300

Classification of the Trachodontidæ.

The Trachodonts seem to have been more numerous in individuals, probably also in genera and species, than any other family of Cretaceous dinosaurs, and the zenith of their development appears to have been in the Judith (Belly) River times. Their habitat was evidently in and near water and chiefly on that account skeletons are more often found intact than among shore forms.

Number of more or less complete skeletons are preserved in museums and in several specimens the epidermis is preserved with the skeleton. No doubt eventually genera and species may be determined as accurately on skeleton and skin characters as in living animals.

Many species and several genera have been proposed on insufficient and inadequate material through a lack of information as to what constitutes valid specific and generic characters. Specific characters have frequently been assigned on what is now known to be individual variation of bones or variation due to distortion of parts during fossilization. On account of the complexity of the dental apparatus, characters founded on teeth alone are quite as misleading and at present not definable without skull or associated skeletal material. The full dental series in a complete skull with jaws comprises more than two thousand teeth. The maxillary are very different from the dentary teeth and those from the end rows of upper or lower jaw are much smaller than those from the center rows and sometimes variable in form.

Our knowledge of the family has advanced so far that certain characters can be fixed as of subfamily and generic rank but the limitation of species and sexual characters is as yet problematical.

Throughout the family there is a remarkable uniformity in the shape and

muscular attachments of vertebræ, ribs and limb bones, and, excepting in a few cases, certain generic identification of separate bones is impossible. The proportionate length of limb bones appears to be constant within genera. But the critical points of distinction are the sacrum, the pelvis and the skull. The skull is of course most important and those known show a considerable variety of shapes, but here again there is a great uniformity in the form and relation of the elements composing the jaws, the side and the back of the skull. The primary type of skull appears to be that of *Trachodon*, and the various departures from this type have been brought about chiefly by modification of those elements composing the facial region.

The relationship of the Trachodonts found in New Jersey and the eastern States is not clear. The bones known are unfortunately not the most critical parts of the skeleton for definite characterization, but they do differ considerably from the well defined western genera.

Admitting *Hadrosaurus foulkii* Leidy of New Jersey as distinct, seven genera are recognized. They form two well defined subfamilies for which the names Trachodontinæ and Saurolophinæ are proposed. *Hadrosaurus*, if a valid genus, comes within the definition of the Trachodontinæ as determined by the ischium. The position of *Claosaurus* is doubtful; provisionally I have placed it in the same subfamily.

TRACHODONTIDÆ.

Subfamily TRACHODONTINÆ. Skull without crest. Ischium terminating in blunt rounded point.

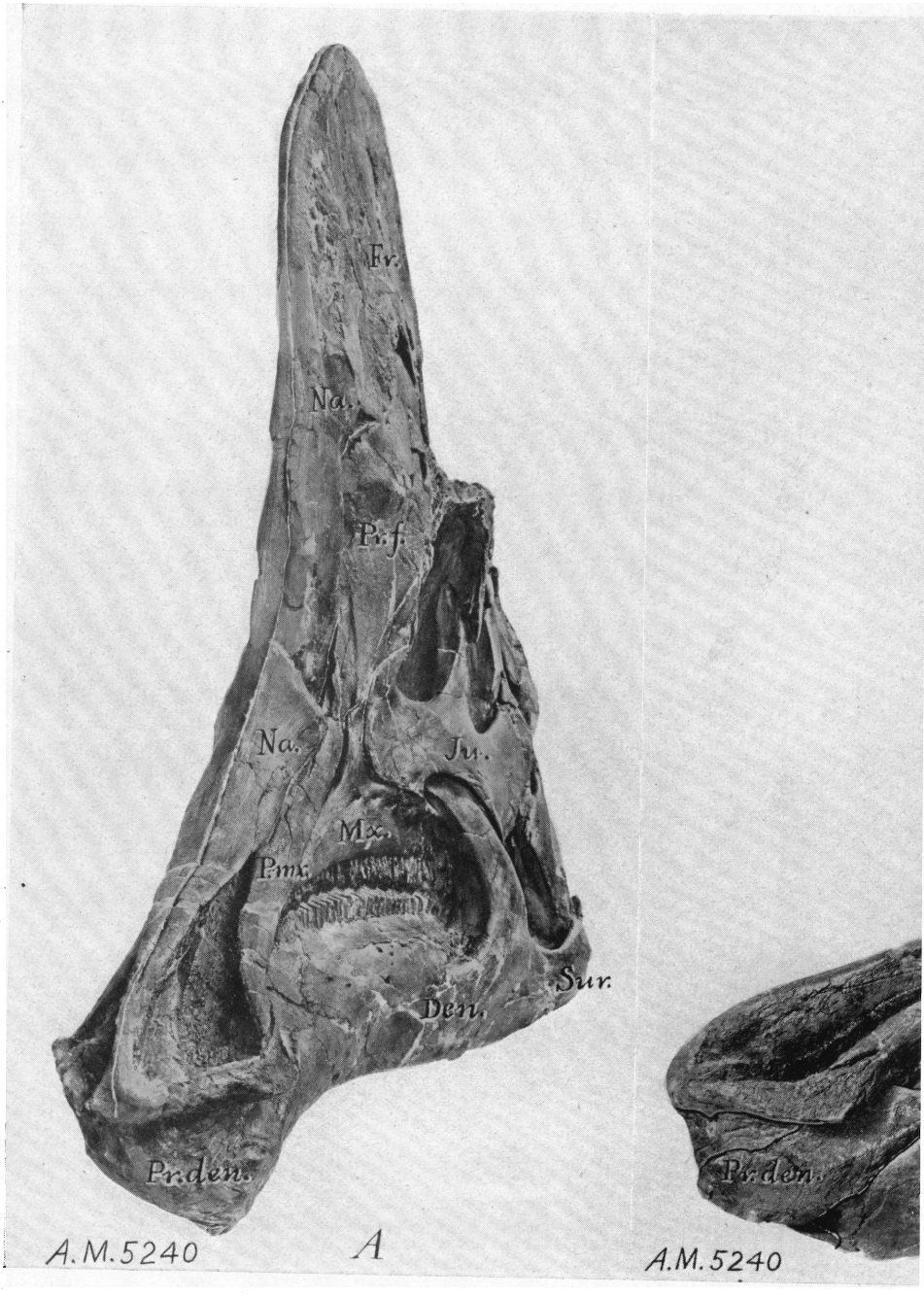
Trachodon. Skull long; mouth widely expanded; superior premaxillary processes terminating above middle of nares. Mandibular rami not strongly decurved; edentulous portion long. Radius shorter than humerus; metacarpals extremely long. Sacrum with nine coössified vertebræ; ilium elongate, not markedly curved; pubis with long expanded blade. Femur much longer than tibia.

Integument composed of non-imbricating tuberculate scales uniformly large over tail and back, differentiated into rosette-like pattern on belly.

Kritosaurus. Skull deep and massive; mouth narrow; nasals highly arched posteriorly; superior premaxillary processes extending beyond middle of nares; frontals short, orbital portion reduced barely coming to orbit. Mandibular rami massive and decurved anteriorly, edentulous portion short. Spines of anterior dorsal vertebræ high.

Integument with tuberculate scales of uniform size.

Hadrosaurus? Borders of mandibular teeth rounded, with feeble transverse ridges resolved into minute tubercles. Radius shorter than humerus. Femur longer than tibia. Metatarsals II and IV proportionately longer than in *Trachodon*, *Saurolophus* or *Claosaurus*. Ilium deep and strongly arched, anterior process long, pointed and triangular. Ischium not expanded distally.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Claosaurus. Mandibular teeth half as wide as high, lateral borders with transverse denticulate ridges resolved into 3 or 4 tubercles. Sacrum with seven coössified vertebræ. Ilium deep, anterior process strongly curved and triangular.

Subfamily SAUROLOPHINÆ. Skull with crest. Ischium terminating in expanded foot-like end.

Saurolophus. Skull large with long spike-like crest formed by nasals, prefrontals and frontals; mouth expanded and elongate; superior premaxillary process extending to posterior border of nares; lachrymal long. Radius and humerus of equal length. Sacrum composed of eight coössified vertebræ. Ilium strongly arched; pubis with short anteriorly expanded blade. Phalanges of digits II and IV short.

Hypacrosaurus. Cervical vertebræ strongly opisthocoelus, spines reduced or absent, ribs stout. Dorsal vertebræ with centra reduced in size, spines high and massive, five to seven times the height of respective centra. Scapula long and very broad. Radius much longer than humerus; metacarpals comparatively shorter than in *Trachodon.* Sacrum with eight vertebræ. Ilium deep and strongly arched. Ischium long with large foot-like terminal end. Pubis with anterior blade short and broadly expanded. Femur, tibia and fibula of nearly equal length. Pes long and massive.

Integument known not differentiated in pattern, tubercules small and elevated.

Corythosaurus.— Skull short with high anterior, helmet-like crest formed by nasals, prefrontals and frontals; nasals not separated in front by premaxillaries; mouth narrow, expanded part in front of nares elongate; narial opening small.

Integument composed of low polygonal non-imbricating tuberculate scales on sides, back and tail; rows of conical limpet-like scales on belly.

DESCRIPTION OF PLATE.

Plate XLI. *Corythosaurus casuarius.* *A*, oblique front view of skull, focal point at *Mx.* Nose slightly enlarged, posterior end foreshortened. *B*, side view nearly one-fourth natural size. Den., dentary; Ex.o., ex-occipital; Fr., frontal; Ju., jugal; La. lacrymal; Mx., maxillary; Na., nasal; Po.f., postfrontal; Pr., prefrontal; Pr. den., predentary; P.mx., premaxillary, Qu.; quadrate; Qu.j., quadrato-jugal; Sur., surangular; Sq., squamosal.