

Article XIV. — TYRANNOSAURUS AND OTHER CRETACEOUS CARNIVOROUS DINOSAURS.

By HENRY FAIRFIELD OSBORN.

In 1902, the American Museum expedition in Montana, led by Mr. Barnum Brown, and accompanied by Professor R. S. Lull, secured considerable portions of the skeleton of one of the great Carnivorous Dinosaurs of Upper Cretaceous or Laramie age. Additional portions of this skeleton (Amer. Mus. No. 973) are now (1905) being taken out. I propose to make this animal the type of the new genus **Tyrannosaurus**, in reference to its size, which greatly exceeds that of any carnivorous land animal hitherto described.

I also briefly characterize as **Dynamosaurus** another carnivorous dinosaur, with dermal plates, found by Mr. Brown in 1900. The carnivorous group has hitherto been considered as belonging to the single genus *Dryptosaurus*, but it is probably little less diversified than its herbivorous contemporaries among the Iguanodontia and Ceratopsia. The generic distinctions which are herein indicated by partially studied remains will probably be intensified by future research. Geological, geographical, and morphological considerations render it *a priori* probable not only that the above genera as well as *Deinodon* are distinct from *Dryptosaurus* but that a fifth Cretaceous genus of somewhat more primitive character, which may be called **Albertosaurus**, is represented in the British Columbia skulls hitherto described as *Dryptosaurus*.

I. NOMENCLATURE.

A revision of the names which have been applied to the Carnivorous Dinosaurs of the Cretaceous appears to be necessary.

In 1856, *Deinodon horridus*, from the Judith River Beds of Montana, was securely¹ founded by Leidy² on Megalosaurian teeth, and those first mentioned and first figured in Leidy's original description and memoir (see citation below, p. 261) on the Judith River Vertebrates must be regarded as valid types.

In 1868, the genus *Aublysodon* Leidy was based (1) on large serrate incisor teeth, truncate posteriorly, which probably belong in

¹ It should be stated that both Professor Cope and Dr. Hay have advanced the contrary view very strongly that Leidy's type of *Deinodon* is indefinite and the name invalid.

² Proc. Acad. Nat. Sci. Phila., VIII, p. 72.

the anterior part¹ of the jaw of some species of *Deinodon*, (2) on smaller, non-serrate teeth, also truncate posteriorly, which probably do not belong with *Deinodon*. Since the teeth first mentioned (1) may belong to *Deinodon* the name *Aublysodon* is probably invalid.

In 1866 *Laelaps aquilunguis* Cope² from the Cretaceous Greensand of New Jersey, was distinguished from *Deinodon* Leidy by the characters of the teeth.

In 1877, Marsh³ pointed out that the name *Laelaps* was preoccupied by Koch, and proposed to replace it by *Dryptosaurus*.

The genus *Dryptosaurus* Marsh was therefore founded upon the type of *Dryptosaurus aquilunguis* (Cope) from the Cretaceous Greensand of New Jersey.

In 1876, Cope described the species *Laelaps incrassatus* from the Judith River Beds of Montana,⁴ and in the same communication the species *Aublysodon lateralis*, *Laelaps explanatus*, *Laelaps falculus*. He subsequently⁵ described from the same beds the additional species *Laelaps hazenianus*, *L. cristatus*, *L. laevifrons*.

In 1892,⁶ Cope described two skulls from the uppermost (true Laramie) beds of the Cretaceous system, Edmonton series, of Alberta, identifying them with *L. incrassatus*. These skulls have recently^{7, 8} been more fully described and figured by Lambe as *Dryptosaurus incrassatus*.

The geological distribution has a very important bearing on this matter of nomenclature. Since Hayden's original description (1857) the position of the Judith River Beds has been confirmed by Hatcher and Stanton as belonging to a *lower horizon* than the true Laramie Series, namely to the Ft. Pierre, and since all the Ceratopsia from the Judith River Beds belong to older and simpler forms than the Ceratopsia of the Laramie and Montana beds, it is highly probable that the reference by Cope and Lambe of the Edmonton Carnivore to a New Jersey Cretaceous genus, *Dryptosaurus*, and to a Judith River species (*D. incrassatus*), is incorrect.

It appears certain that the Edmonton and Laramie carnivores are generically distinct from those of the Judith River Beds.

¹ A complete jaw of *Allosaurus* in the American Museum shows that the front teeth are truncate posteriorly as in the type of *Aublysodon*.

² Proc. Acad. Nat. Sci. Phila., Aug., 1866, p. 276.

³ "This name *Laelaps* is preoccupied, having been used by Koch in 1835, and again by Walker in 1843. It may, therefore, be replaced by *Dryptosaurus*. This genus is allied to *Megalosaurus*, and is represented in American Cretaceous strata by several species, among them *Dryptosaurus aquilunguis*" ('Notice of a New and Gigantic Dinosaur,' Amer. Jour. of Sci. and Arts, Vol. XIX, July, 1877, p. 88).

⁴ Proc. Acad. Nat. Sci. Phila., Oct., 1876, pp. 248-340.

⁵ Proc. Acad. Nat. Sci. Phila., 1876, p. 343.

⁶ Cope, Proc. Amer. Philos. Soc., Vol. XXX., 1892, p. 240

⁷ Ottawa Naturalist, Vol. XVII, pp. 133-139, Nov., 1903.

⁸ Contributions to Canadian Palæontology, Vol. III (quarto), Part III, pp. 1-27, pll. i-viii.

II. NEW OR PARTIALLY-KNOWN CARNIVOROUS DINOSAURS.

1. *From the Cretaceous of New Jersey.*Genus *Dryptosaurus* Marsh.

Including the *Laelaps* of Cope. Probably a different animal, but not as yet distinguished from the previously described *Deinodon*.

Type. — The type of this genus is also the type specimen of *Laelaps aquilunguis* Cope, consisting of portions of the jaws, teeth, and skeleton from the Cretaceous of New Jersey in the collection of the Academy of Natural Sciences at Philadelphia.

Dental characters. — Mandibular teeth compressed, recurved, crowns lenticular in section, serrate on both edges, fangs transversely oval.

2. *From the Ft. Pierre (Judith River) Beds of Montana and Belly River, Alberta.*Genus *Deinodon* Leidy.

Synonym: *Aublysodon* Leidy.

Type. — Twelve isolated and fragmentary teeth in the collection of the Philadelphia Academy.

Probable characters. — The anterior (premaxillary and premandibular) teeth large and truncate posteriorly. The posterior teeth recurved, of sharply defined lenticular section from crown to base, edges strongly serrate anteriorly and posteriorly. Number of teeth unknown, probably equalling or exceeding fifteen in each series.

Leidy's characterization of the type in his memoir (1859) is as follows, the insertions in square brackets indicating the present writer's references to the generic terms which Leidy had in mind:

"The specimens upon which the latter genus [*Deinodon*] is based, consist of fragments of about a dozen teeth, of which three-fourths [types of *Deinodon*] are nearly identical in form with those of *Megalosaurus*, while the others [types of *Aublysodon*] are more or less peculiar. The uniformity in shape of the teeth of *Megalosaurus* would appear to indicate that the three-fourths of the specimens alluded to, belonged to, at most, another species of the same genus [*Deinodon*], while the remaining specimens would typify a distinct genus [*Aublysodon*]. However, from the variety in form of the latter specimens, together with the fact that all the specimens present the same general appearance, as regards colour, texture, and constitution, I have been induced to regard them as belonging to a single animal [*Deinodon*], and feel that it must be left for further discovery to ascertain whether such a view is correct." Comparison with the teeth of *Allosaurus* convinces me that Leidy's last expressed view is correct.

3. *From the Laramie (Edmonton) of Montana, Wyoming, and Alberta.***Tyrannosaurus rex** gen. et sp. nov.

Type. — The larger portion of a skeleton from the true Laramie of Hell Creek, Dawson County, Montana, 220 feet above the Ft. Pierre, American Museum No. 973.

Characters. — Carnivorous Dinosaurs attaining very large size. Humerus believed to be of large size and elongate (Brown). No evidence of bony dermal plates (Brown).

The parts already discovered are, both jaws and portions of the skull, vertebræ, ribs, scapula, humerus, ilium, pubis, ischium, metapodials. The association of the very large humerus with this skel-

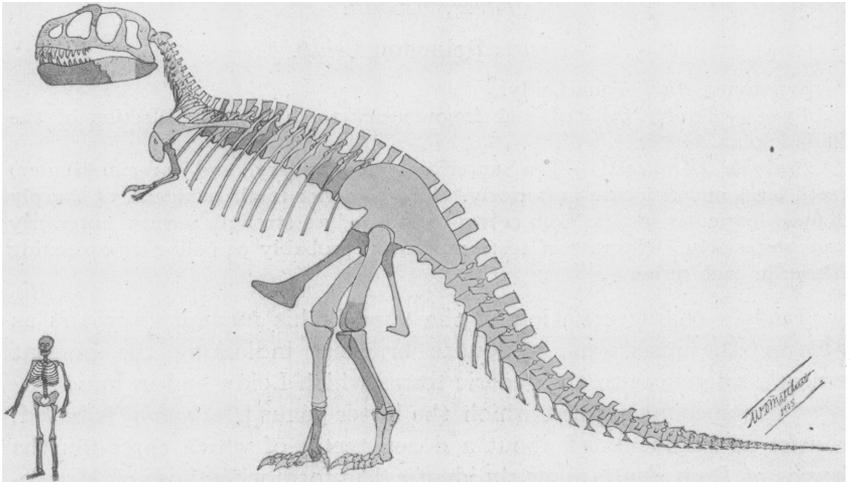


Fig. 1. Rough outline showing scale of size of *Tyrannosaurus rex*. By W. D. M. The association of the small forearm is probably incorrect.

eton is, according to Mr. Brown, almost certainly correct, and abundantly characterizes this animal; but in the writer's opinion final judgment must be suspended until the skeleton is fully worked out. The jaws and skull are not as yet prepared for description, so that comparison of these parts cannot be made at present with *Dinamosaurus* or *Albertosaurus*. No dermal plates whatever were found associated with this skeleton. Mr. Brown has devoted the entire past season (1905) to the very difficult work of completing the excavation of this skeleton from the hard sandstone.

The size of the chief portions of the skeleton at present prepared

from the quarry may be judged from the following table of measurements:

Pubes complete, length	1250 mm.
Pubes, free portion, length	470
Left tibia, length	1118
Mts. II of right leg, length	573

When placed together, as provisionally outlined by Dr. W. D. Matthew, the enormous proportions of this animal become very evident as compared with the skeleton of a man, the total length being estimated at thirty-nine feet, the height of the skull above the ground at nineteen feet.

Beside the parts above enumerated in the table, we have prepared the supraorbital portion of the frontal bone, extremely rugose, constituting a horn above the orbit very similar to that seen in *Allosaurus*. The jaw is represented by the dentary, angular, and articular.

Of the six dorso-lumbar vertebræ preserved, the largest, which probably belongs to the mid-dorsal region, exhibits a shallow amphicœlous centrum measuring 270 mm. transversely, 253 mm. vertically; the height of this vertebra to the top of the spine is 630 mm.

The pubes unite 470 mm. below the articular surfaces, forming a massive bar which terminates in the huge expanded pedicle. Portions of both femora have been recovered. These bones resemble the femora of *Allosaurus*. The preparation of this skeleton was very largely the work of Professor R. S. Lull.

***Dynamosaurus imperiosus* gen. et sp. nov.**

Type. — Numerous dermal plates and many parts of the skeleton. Collection of 1900, American Museum No. 5866, from Seven Mile Creek, six miles north of Cheyenne River, Weston County, Wyoming. The type of this skeleton was found by the American Museum expedition of 1900 under Mr. Barnum Brown, whose preliminary report was as follows: "It consists of lower jaws, having that large foramen characteristic of *Ceratopsaurus*, serrated teeth of uneven height joined by cartilage, not anchylosed. Concavo-concave and plano-concave vertebræ of lumbar-dorsal region are deeply excavated on sides and bottom rising to plane surface in region of canal; extremely hollow and as in *Morosaurus* not having spines and transverse processes united to centra. Sacral vertebræ 3? Post-sacral vertebræ, of which seven were embedded in stone matrix, show plano-plano surfaces. Transverse processes united to centra. Nature of cervical vertebræ not determined. Ribs large, not greatly curved in dorsal region, tapering gradually to those of cervical region. But few chevrons were found, those of extreme length in proportion to size of vertebræ."

Generic characters.—Carnivorous dinosaurs with twelve to fifteen mandibular teeth of rounded to flattened form. Anterior truncate teeth reduced or wanting. Irregular bony plates developed on the back or sides of the body. Alveolar partitions between the mandibular teeth extending upward into triangular plates on the inner sides of the jaws above the borders of dentaries.

Specific characters.—Twelve to thirteen mandibular teeth.

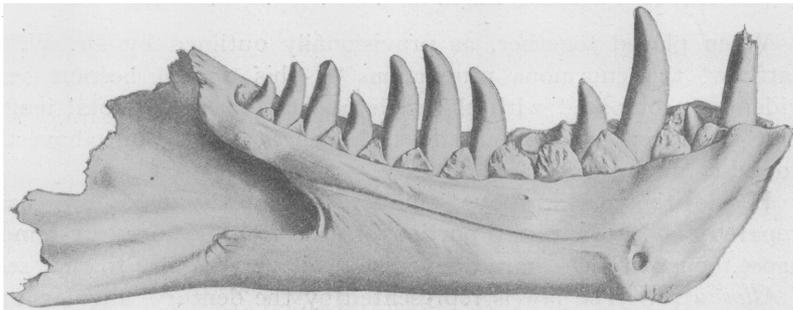


Fig. 2. Inner surface of the left lower jaw of the type specimen of *Dynamosaurus imperiosus*. $\frac{1}{4}$ nat. size.

This animal is distinguished by the presence of superficial bony dermal plates which extended either along the dorsal or side lines of the body, by the reduction of the number of teeth, by the apparent absence of truncated anterior teeth, by the rounded rather than lenticular form of the teeth, by the presence of a row of triangular upgrowths of the dental alveoli on the inner sides of the jaws. In *Deinodon* there will probably be found a larger number of teeth, and some of the anterior teeth of the jaw will be found to be truncated and serrate posteriorly as in *Allosaurus*.

Dentition.—The species *D. imperiosus* appears to be distinguished by the presence of from twelve to thirteen mandibular teeth. The inner view of the mandibular ramus (Fig. 1) exhibits a small anterior alveolus for a vestigial tooth followed by twelve fully functional teeth, behind which there is another partially closed alveolus; thus there appear to have been two reduced and twelve functional teeth. The dentition is not homodont, every tooth differing slightly in its section and in the position of the serrate edges, also in size. The third functional tooth from the front is apparently the largest, the measurements of the crown being a. p. 43, tr. 33, vert. 82 mm. The last functional tooth is decidedly smaller, the crown measuring a. p. 19, tr. 11, vert. 15 mm.

Jaws.—Between the teeth are a series of triangular osseous plates, which appear to be upward continuations of the alveolar walls which separate at the base from the edge of the dentary.

Albertosaurus sarcophagus gen. et sp. nov.

Type.—A skull in the Ottawa Museum from the Edmonton series, from Knee Hills Creek of the Red Deer River, Alberta. Described by Cope (*op. cit.*, p. 240) in 1892, by Lambe in 1904 (*op. cit.*, pp. 1-27, pll. iv, v). Cotype, a smaller skull, Red Deer River, found in 1889, described by Cope in 1892, by Lambe in 1903, 1904 (*op. cit.*, pll. i-iv).

The generic name is assigned in reference to the Province of Alberta, Dominion of Canada, in which these types were found. This animal is more specialized than *Deinodon* in the reduction of the truncated anterior teeth, and more primitive than *Dynamosaurus* in the presence of a larger number of teeth and in the less specialized form of the teeth.

Generic characters.—Reduced alveolar partitions between the mandibular teeth; . . . principal alveolar grooves apparently formed on the inner surface of the outer dentary wall with little or no development of grooves on the alveolar plate (Lambe, *op. cit.*, p. 16).'' The mandibular ramus is devoid of the triangular osseous plates between the teeth. The anterior truncate teeth are reduced to a single small pair.

Specific characters.—Fifteen mandibular teeth, including one small anterior tooth truncated posteriorly.

Some of the other characters given in Lambe's very full and clear descriptions are as follows: Skull with two preorbital openings; lower jaw with a distinct presplenial. Metatarsal of cotype long and slender. The teeth are laterally compressed, lenticular in section, in the upper portion of a more rounded oval form, nearer the bases recurved, serrate on both borders. These teeth are thus apparently intermediate in number and structure between those of *Dynamosaurus* and *Deinodon*. Lambe determines fifteen mandibular teeth, fourteen of full size, one, the anterior tooth, of smaller size, not successional, truncated posteriorly, as in *Deinodon*. He determines twelve maxillary teeth and presumes there were three in the premaxillaries.

This review relates only to the large carnivorous dinosaurs and omits reference to the Ornithomimidæ.

