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New Carnivorous Dinosaurs from the Upper Cretaceous of Mongolia

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(translated by F. J. Alcock)

The present article is a summary containing research investigations conducted on the new carnivorous dinosaurs of the family Deinodontidae whose remains were found by the Mongolian Paleontological Expedition of the Academy of Sciences USSR during 1948-1949, in the sites of Nemegt, Altan-Ula, and Tsagan-Ula. The aforementioned sites were described by I. A. Efremov.

Family Deinodontidae

Genus *Tarbosaurus* gen. nov.

Type of genus – *Tarbosaurus efremovi* sp. nov.

D i a g n o s i s o f g e n u s . The diagnosis was made on the basis of the study of the skull and the postcranial skeleton of *Tarbosaurus efremovi*. These were large carnivorous dinosaurs attaining the length of 10 to 12 m and from 4.2 to 5.0 m in height. The skull (Fig. 1) – large, massive, with 2 large premaxillary foramina and a third small foramen between the premaxilla and maxilla. The orbits – large, and pisolitic. Maxilla long, raised. and equipped with powerful saber-like teeth, slightly compressed and serrated marginally. In the transverse cross-section the teeth were oval, elongated, and the anteroposterior diameter surpasses the transverse one. All the teeth are dissimilar; each tooth differs slightly in the larger or smaller labial position of the serrated termini, and in the size of the crown. Premaxilla bears 4teeth, maxilla 12, dentary 15 teeth, and the largest tooth attains 112 mm. The interdental plates of the alveoli rise from 1.5 to 2 cm in the form of triangular plates.

The neck is short and consists of 8 to 9 vertebrae. The cervical vertebrae are opisthocoelous, short, and broad. The articulated surfaces of the centra are inclined, and the posterior surface is more slanted than the anterior. The dorsal vertebrae are amphicoelous or slightly procoelous, the centra

were tall and strongly laterally compressed. The thoracic ribs are long, strongly curved in the upper part, and slant convex medially. The ventral ribs [abdominal] were represented by a central rib and a whole series of lateral ribs. The forelimbs are reduced. Scapula long, narrow, the coracoid short, broad. Humerus very short and equipped with a strong deltopectoral crest; the proportion of the length of humerus to the length of the scapula 3:1. Radius and ulna thin, short; the proportion of ulna to humerus 3:1. Manus short with two digits (I, II). The digits terminated in strongly curved, sharp claws. The pelvis girdle developed very strongly and excels the dimensions of the skull. Ilium tall, long. Pubis massive. Pubic symphysis strongly elongate anteriorly and curved ventrally forming a powerful bony foot, suggesting an enormous pressing iron in shape. Ischia long, broad in proximal part, but tapering ventrally. Femur massive, long with well-developed head. The proportion of the femur length to the length of humerus 1:4. Tibia massive, strong. The proportion of the femur's length to tibia 1:1. Metatarsals massive, long. The proximal part of Mt3 extremely tapered and solidly compressed between lateral metatarsals. Pes massive. Only three digits are well developed (II, III, IV). The first digit developed rather poorly. The phalanges of the claws strong, sharp. Tail long, and consists of at least 35 to 45 vertebrae.

C o m p a r a t i v e N o t e s . According to the absolute measurements of *Tarbosaurus efremovi* it is smaller than *Tyrannosaurus rex* Osborn 1905, and *T. bataar* Maleev 1953.

Skull less massive and more elongated. Teeth more compressed laterally. Forelimbs shorter.

The Mongolian form differs from *Gorgosaurus libratus* Lambe 1914 and *G. sternbergi* Matthew and Brown 1922 by the huge size of the skull, the absence of the bony projection on the lacrimal, by the pisolitic orbit, and by the extremely reduced forelimbs (*Tarbosaurus*).

All of these characteristics compel us to regard the described form as a new genus of the family Deinodontidae, to be referred to as *Tarbosaurus* gen. nov. (*G. lancensis* Gilmore 1946, *G. lancinator* sp. nov., *G. novojilovi* sp. nov. differ greatly in the structure of their skull and are smaller in size than *Tarbosaurus efremovi*).

The complex of species of the genus *Tarbosaurus* consists of a single species, *T. efremovi* sp. nov. (The diagnosis of the species coincides with that of the genus *Tarbosaurus*).

T y p e o f s p e c i e s . Skull and postcranial skeleton. Collected by the Paleontological

Institute, Academy of Sciences USSR, #551-2.

L o c a l i t y . Nemegt, 350 km WSW of the center of Dalan-Dzadagad, Mongolian People's Republic.

P e r i o d . Upper Cretaceous.

M a t e r i a l . The excavation conducted in the years 1948-1949 in the main basin of Nemegt resulted in obtaining 4 almost complete skeletons and many miscellaneousbones. The bones were well preserved and white in color. Numerous remains were also found in the site of Tsagan-Ula, approximately 60 km west of Nemegt.

Genus *Gorgosaurus* Lambe 1917.

Species *Gorgosaurus lancinator* sp. nov.

T y p e o f s p e c i e s . Skull, dorsal and caudal vertebrae, metacarpal, and metatarsals. Collection of the Paleontological Institute, Academy of Sciences USSR, # 553-1.

D i a g n o s i s . Large carnivorous dinosaur attaining 9 m in length and from 3.5 to 5 m in height. Skull (Fig. 2) massive structure, elevated and less elongated than the case of *Tarbosaurus*. Orbit large and approximately ellipsoid. Maxilla elongated and slightly truncated anteriorly. The first antorbital fenestra very large, the maximum height 198 mm. Premaxilla bears 4 small teeth, maxilla – 12. The first maxillary tooth surpasses considerably in size the last premaxillary tooth. The anterior tooth of the dentary is smaller than the next following. The teeth are somewhat compressed laterally and are lenticular in transverse section. The dorsal vertebrae are amphicoelous, elevated, strongly compressed laterally. Manus short with two digits (I, II). Metatarsals long, the distal part of Mt3 more massive than the lateral metatarsals. Claws extremely strong, sharp.

C o m p a r a t i v e n o t e s . Skull of *Gorgosaurus lancinator* sp. nov. in its general proportions is similar to the skull of *Gorgosaurus libratus* Lambe 1917, although somewhat smaller in size, the maxilla less massive and the snout narrower. The Mongolian *Gorgosaurus* differs from *G. sternbergi* Matthew and Brown 1922 and *G. lancensis* Gilmore 1945 by the large size of the skull and by the absence of the bony lacrimal projection.

These distinctions compel us to classify the form described above as a new species of the

genus *Gorgosaurus lancinator* sp. nov.

L o c a l i t y . Nemegt Basin, Altan-Ula, Orliny Utes.

P e r i o d . Upper Cretaceous.

M a t e r i a l . Skull, dorsal and caudal vertebrae, metacarpals and metatarsals, and digital phalanges.

Gorgosaurus novojilovi sp. nov.

T y p e o f s p e c i e s . Skull and postcranial skeleton. Collection of the Paleontological Institute, Academy of Sciences USSR, #552-2.

D i a g n o s i s . Carnivorous dinosaur of medium size, attaining 5 to 6 m in length and 2.5 to 3 m in height. Skull (Fig. 3) proportionally small, maxilla less massive and snout narrower than in *G. libratus* and *G. lancinator*. Orbits large and round. First antorbital fenestra occupies almost _ the length of skull. Lower jaw low, elongate. Premaxilla bears 4 teeth, maxilla 12, dentary 15 teeth. Teeth tiny, strongly compressed laterally and serrated marginally, oval-elongate transversely. Interdental plates in shape of triangular plates. Neck somewhat longer than in the case of *Tyrannosaurus* and *Tarbosaurus*. Cervical vertebrae amphicoelous or slightly opisthocoelous; the articular surface of centra slanted. Dorsal vertebrae amphicoelous, centra tall and strongly compressed laterally. Scapula elongated. narrow; coracoid broad, short; humerus narrow, short. The proportion of the length of humerus to the length of scapula 2:1. Pelvic girdle massive, surpasses the dimensions of the skull. Ilium tall, long. Pubis massive; symphysis strongly elongated and forms a powerful bony expansion suggesting a pressing iron in shape. Ischium short, broad. Femur massive, considerably shorter than the foot. Dimensions of femur and tibia 0.9:1. Metatarsals long, well-proportioned, the proportional dimensions of Mt3 to length of femur 0.75:1. Pes strong. Tail long and consists of 40 to 45 vertebrae.

C o m p a r a t i v e n o t e s . *Gorgosaurus novojilovi* sp. nov. is similar to *Gorgosaurus sternbergi* Matthew and Brown 1922, although considerably smaller in size and more proportioned. The Mongolian form differs from *Gorgosaurus lancensis* Gilmore 1946 by the large skull and narrower snout.

S i t e . Tsagan-Ula, 30 to 70 km WSW of the south site of the Nemegt Basin. Numerous fragments also discovered at Nemegt.

P e r i o d . Upper Cretaceous.

M a t e r i a l . Skull and postcranial skeleton. Bone is white and well preserved.

The discovery of deinodonts in Mongolia indicates clearly the great diversity in the fauna of dinosaurs in Central Asia. The fauna included sauropods, trachodonts, ankylosaurs, and many carnosaurs, just as diverse as in the New World.

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Figure Captions

Figure 1. *Tarbosaurus efremovi* sp. nov. Lateral view of skull. D – dentary; Ju – jugal; La – lacrimal; Mx – maxilla; Na – nasal; Nr – external nares; Orb – orbit; ant_1 – antorbital fenestra; ant_2 – second antorbital fenestra; ant_3 – third antorbital fenestra; Jf – jugal foramen; lateral temoral fenestra; sq – squamosal; Ang – angular; Sa – surangular; Quju – quadratojugal.

Fig. 2. *Gorgosaurus lancinator* sp. nov. Lateral view of skull. Symbols as in Figure 1.

Fig. 3. *Gorgosaurus novojilovi* sp. nov. Lateral view of skull. Symbols as in Figure 1.