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# TWO NEW DINOSAURIAN REPTILES FROM MONGOLIA WITH NOTES ON SOME FRAGMENTARY SPECIMENS[1]

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CONTENTS



## INTRODUCTION

The present paper gives the results of a study of the residue of the dinosaur collections made in Mongolia by various Asiatic expeditions of The American Museum of Natural History. All of the material is fragmentary, but diagnostic parts of two of the specimens are sufficiently preserved to be worthy of detailed description. One records the presence of a new genus and species of the Nodosauridae, the other a new genus and species of the Sauropoda. The remaining specimens, none of which permit of more than family identification, are of interest either in recording new localities for dinosaur remains or in constituting the sole evidence of their presence in certain formations.

I wish to express to Dr. Walter Granger my appreciation for the opportunity given me to study this interesting material, and also for his assistance in all matters pertaining to the work; to Mr. Sydney Prentice, I am grateful for his skill and patience in delineating these difficult subjects.

In the table to follow is set forth the geological distribution of the Dinosauria in Mongolia, compiled from all available sources. A striking approximation to their distribution in North America is shown.

[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 118.

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CHRONOLOGICAL DISTRIBUTION OF THE DINOSAURIA IN MONGOLIA

| Geologic Age | Formation | Approximate thickness in feet | Faunal List |
|---|---|---|---|
| Upper Cretaceous | Djadochta | 500′ | *Protoceratops andrewsi* Granger and Gregory<br>*Velociraptor mongoliensis* Osborn<br>*Oviraptor philoceratops* Osborn<br>*Saurornithoides mongoliensis* Osborn<br>Theropod (Deinodont?)<br>*Pinacosaurus grangeri* Gilmore |
| | Iren Dabasu | 80′ | *Ornithomimus asiaticus* Gilmore<br>*Alectrosaurus olseni* Gilmore<br>*Mandschurosaurus mongoliensis* Gilmore<br>*Bactrosaurus johnsoni* Gilmore<br>Nodosauridae, gen. and sp. indet. |
| | Nantienmen | 2500′+ | Theropod |
| | Dohoin Usu | 300′± | Hadrosauridae, gen. and sp. indet.<br>Theropod |
| Lower Cretaceous | Dubshih | 1000′± | |
| | Ochungchelo | 2000′± | Sauropod fragment |
| | Tairum Nor | 100′ | Ornithomimid? gen. and sp. indet.<br>Dinosaur indet. |
| | Baiying Bologai | 150′ | Ceratopsidae? gen. and sp. indet.<br>Hadrosauridae, gen. and sp. indet. |
| | Jasu Jergulung | 100′± | |
| | Go Yoto | 250′± | |
| | Shirigu | ? | Dinosaur fragments indet. |
| | Oshih | 2000′± | *Asiatosaurus mongoliensis* Osborn<br>*Prodeinodon mongoliense* Osborn<br>*Psittacosaurus mongoliensis* Osborn |
| | On Gong | 500′+ | *Mongolosaurus haplodon* Gilmore |
| | Ondai Sair | 500′+ | *Protiguanodon mongoliense* Osborn<br>Sauropod (rib) |

## DESCRIPTION OF GENERA AND SPECIES

### Order **ORTHOPODA**

### Family **NODOSAURIDAE**

The family Nodosauridae is represented in Mongolia by two specimens, an incomplete ilium from the Iren Dabasu formation, and a poorly preserved skull from the Djadochta formation about to be described as the type of a new genus and species. Attention has been called in a previous paper[1] to a third occurrence of this family in eastern Asia, a specimen from Shantung, China.

The specimen to be described is so badly crushed and broken that much of its detailed structure is obscured, but in view of its unique occurrence, it seems worthy of description, although I am fully aware of the meagerness of its characterization.

**Pinacosaurus grangeri,** new genus, new species

TYPE:—No. 6523, A. M. N. H., consists of a badly crushed skull and jaws and a few scattered dermal bones. Collected by Walter Granger, 1923.

LOCALITY:—Shabarakh Usu, Outer Mongolia.

HORIZON:—Djadochta formation, Upper Cretaceous.

GENERIC AND SPECIFIC CHARACTERS:—Skull covered with numerous small osseous scutes; large quadrate + quadratojugal dermal plates; skull relatively slender, longer than wide; beak regularly rounded and apparently devoid of osseous scutes; external nares small, opening laterally; orbits placed well posterior, ovate; palate divided longitudinally by a vertical median bony plate. Teeth extremely small; dentate.

The skull which forms the type of *Pinacosaurus grangeri* was found embedded in a reddish sand and after preparation displays the shattered appearance illustrated in Figures 1 and 2. Although badly crushed and checked in all directions, practically all parts of the skull and lower jaws are present. Viewed from above, the skull has the usual subtriangular shape of the nodosaurian crania. It is evident that, as in other members of this family, the entire top of the skull is covered with ossified dermal scutes which completely obscure the underlying cranial elements. In an unbroken specimen these ossifications may have been arranged in some definite pattern, but the precise character of this arrangement cannot now be determined. An area on the upper posterior median surface is smooth, but the grain of the bone radiates from a common center much as in *Dyoplosaurus.*[2] Approaching the lateral margins, especially in the direction of the nose, the scutal surfaces be-

[1]Gilmore, Charles W. 1933. Bull. Amer. Mus. Nat. Hist., LXVII, Art. 11, p. 75.
[2]Gilmore, Charles W. 1930. Proc. U. S. Nat. Mus., LXXVII, Pl. IX.

come progressively roughened, but no special pattern can be detected. Some of the scutes overlying the nasal portion have their centers somewhat raised, and it is quite probable these were set off by circumscribing grooves, as is faintly indicated in one or two instances. Above each orbit

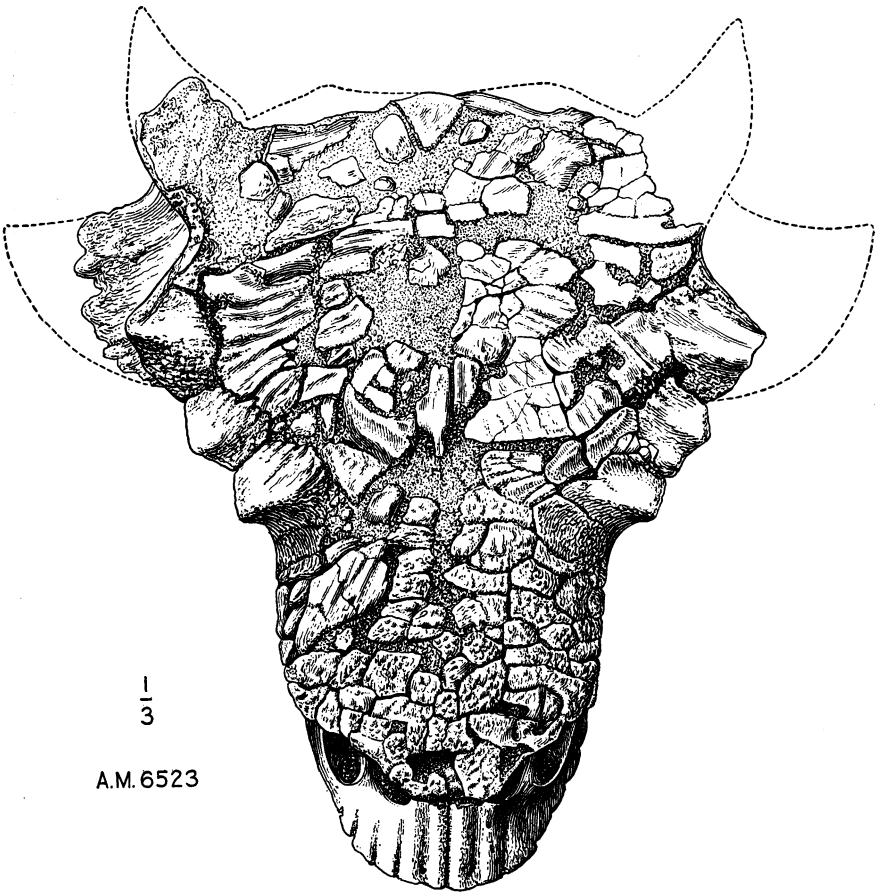


Fig. 1. Skull of *Pinacosaurus grangeri*. Type. No. 6523, A. M. N. H. Top view reconstructed from the badly disorganized original specimen. One-third natural size.

are two moderately large, ridged plates having a sharp edge, and these form ornamental borders that overhang the orbits. A third scute with a lower dorsal keel precedes the two mentioned above. This keel turns strongly inward toward the median line. Each posterior external angle

of the skull seems to have been ornamented by a large spine-like scute as in *Dyoplosaurus* and *Ankylosaurus*, but its precise form cannot be determined from this specimen. The left element is entirely missing and the right has been slightly displaced and so badly crushed and broken that its detailed characteristics are destroyed.

It is quite evident that much, if not all, of the sides of the skull was also covered by dermal bones, but their extent and arrangement cannot be determined. On the posterior inferior angles is a large plate that develops a flattened triangular process which extends strongly downward and outward as in *Dyoplosaurus* and *Euoplocephalus* and completely covers the quadrate and its articulation with the lower jaw. Its form is shown in figure 1. This scute is relatively thin as compared with the more robust element of the *Dyoplosaurus* skull.

The orbits are placed much as in *Dyoplosaurus* and *Euoplocephalus* and are suboval in outline.

The premaxillary region presents a most unusual condition in dinosaurian anatomy from the fact that the usual position of the external nares is occupied by two subovate, longitudinal openings of about equal size, placed one above the other and separated by a horizontal bar (see fig. 1). This condition, when allowance is made for post-mortem distortion, is the same in both premaxillaries. If both openings pertain to the nares, a condition is represented not before known in the Dinosauria. It is quite certain that the two inner openings represent the true narial orifices while the two outer may be homologous to small openings lateral to the nares and leading back into the buccal area in a skull (No. 11868, U. S. N. M.) of *Palaeoscincus*. Direct comparison of the two specimens, however, does not confirm this suggestion. The crushed and broken condition of the type skull makes it quite impossible to trace out the course of these openings, hence a determination of their function must await the discovery of a more perfect specimen. In any event the external nares open laterally. The upper margin of the inner opening was apparently bordered by dermal bone, but all of the premaxillary surfaces in front of these openings appear to have been free of dermal covering, as shown in figure 1.

PALATE:—The palatal side of the skull, although badly crushed and broken (see fig. 2), nevertheless shows much of its structure. Unfortunately, most of the sutures are obliterated, making it impossible to determine the full extent of many of the elements. In its main features, this specimen is in accord with the well preserved palate of *Palaeoscincus rugosidens*,[1] that is, the mouth is divided longitudinally by a vertical

[1]Gilmore, Charles W. 1930. Proc. U. S. Nat. Mus., LXXVII, Art. 16, fig. 2.

plate of bone extending from the median junction of the premaxillary bones to the pterygoids; there is a great fore and aft shortening of the pterygoids, and a wide overhang of the buccal area above the maxillary

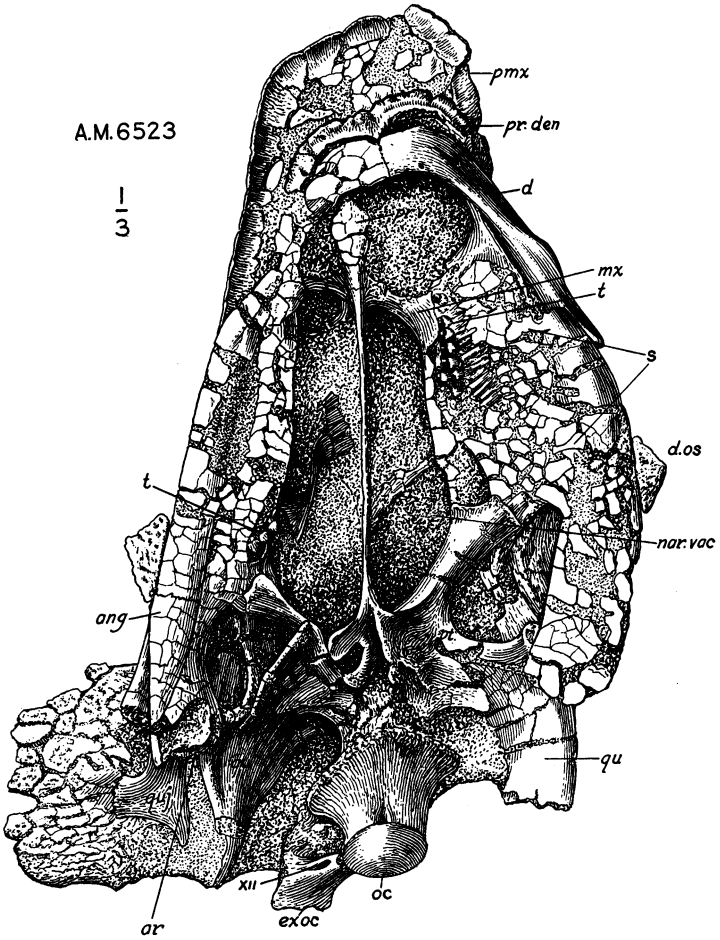


Fig. 2. Skull of *Pinacosaurus grangeri*. Type. No. 6523, A. M. N. H. Ventral view of the skull as it lay in the matrix, shattered and badly crushed. One-third natural size.

*Ang.*, angular; *ar.*, articular; *d.*, dentary; *d. os.*, dermal ossicle on the lower jaw; *exoc.*, exoccipital; *mx.*, maxillary; *nar. vac.*, posterior narial vacuity; *oc.*, occipital condyle; *pmx.*, premaxillary; *pr. den.*, predentary; *pr. v.*, prevomer; *pt.*, pterygoid; *qu.*, quadrate; *quj.*, quadrato-jugal; *s.*, splenial; *t.*, teeth in maxillary; XII, foramen for exit of the twelfth or hypoglossal nerve.

bones. The edentulous premaxillaries form a rounded but comparatively narrow muzzle. Their outer borders curve strongly downward, presenting a sharp cutting edge that in life was probably covered with chitinous

skin, thus forming a very efficient cutting beak. The maxillary bones are almost completely hidden by the lower jaws which are crushed down upon them. The occipital condyle is visible on the lower side (see fig. 2). It is somewhat flattened but relatively small, having a greatest transverse diameter of 33 mm. The basipterygoid region is so damaged that none of its details can be determined. The pterygoids, as in all of the armored dinosaurs, are extremely short antero-posteriorly. Each pterygoid may be described as consisting of three parts: a thin, wing-like process that extends backward and outward to articulate with the inner side of the quadrate; a heavier, but nearly vertical process that extends forward and outward to articulate with the ectopterygoids, if those elements are present; and a median portion that apparently forms the posterior boundary of the internal nares. The bone of this mid-portion of the pterygoid is too poorly preserved to be worthy of description. It is quite evident, as shown in figure 2, that the internal nares occupy the same posterior position in the palate as in *Palaeoscincus* and *Edmontonia*.

The measurements given below are only approximate, as the broken condition of the skull renders it impossible to obtain precise dimensions.

MEASUREMENTS OF SKULL

| | |
|---|---|
| Greatest length over all, about | 305 mm. |
| Greatest breadth, across tips of jugal processes, about | 340 |
| Greatest breadth, across posterior end | 245 |
| Greatest breadth, across center of orbits | 235 |
| Greatest breadth, across external nares | 105 |
| Distance between anterior border of orbit and anterior extremity of premaxillary at center | 225 |
| Greatest antero-posterior extent of orbit | 60 |
| Greatest transverse diameter of occipital condyle | 33 |

LOWER JAW:—The rami are preserved in nearly their proper relationship to the skull, as shown in figure 2, but both are so badly crushed and broken that most of their detailed structure is obscured. It is quite evident that they closely resemble the jaws of other armored dinosaurs of the family Nodosauridae in general shape and proportions. The postcoronoidal part of the jaw is short, the dentary forming the anterior two-thirds. In front, the ramus is much reduced in height, and it turns strongly inward to meet its fellow on the median line. There is a well developed splenial covering Meckel's groove, whose anterior termination appears to be considerably short of the symphysis. The outer surface of the anterior half of the ramus is devoid of dermal scutes, but the posterior half is much obscured by a triangular, obtusely edged plate

that projects downward and outward below the level of the lower border (see *d.os.*, fig. 2), forming a prominent protuberance at about its posterior third. The lower jaw has a greatest length of about 245 mm. in a straight line.

The predentary is present, but its anterior surface only is visible. It is relatively narrow dorso-ventrally, broadly rounded transversely. At the center on the ventral side there is a slight projection that was interposed between the cojoined rami. The upper anterior border is roughened by a row of node-like eminences.

TEETH:—There are a considerable number of teeth present in both upper and lower jaws, but only a few are available for study, all of these being in the left maxillary; with Doctor Granger's permission, three of

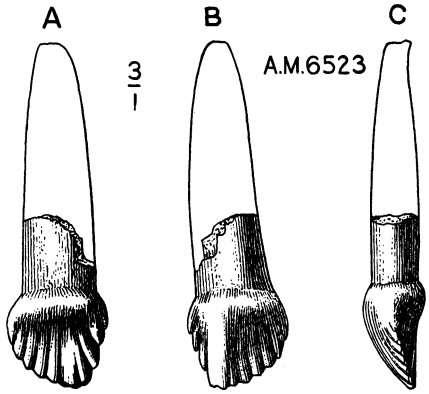


Fig. 3. Left maxillary tooth of *Pinacosaurus grangeri*. No. 6523, A. M. N. H. A, outer view; B, inner view; C, anterior view. All three times natural size.

these were removed in order to observe their details, and one is here illustrated in figure 3. The teeth, so far as they can be observed, are alike in form and size, being smaller than those of *Dyoplosaurus*,[1] which up to this time were the smallest nodosaurian teeth known. The functional teeth consist of a laterally compressed crown with a long cylindrical root. The crown of one well preserved tooth measures 4 mm. anteroposteriorly and 2.3 mm. transversely through the thickest part, and about 4 mm. in height. The outer side of the crown is more rugosely striated and flatter than the inner which is decidedly swollen at the base. The trenchant edge is denticulate, there being eleven denticles on each tooth, three posterior and seven anterior to the apical one which is decidedly

[1]Gilmore, Charles W. 1930, Proc. U. S. Nat. Mus., LXXVII, Art. 16, p. 35., fig. 18.

posterior to the center of the crown. On the outer side of the surface the crown is divided into eight principal columns by vertical fluting (see fig. 3A); on the inner side these grooves are much shorter and subside before reaching the swollen base. The large denticles are transversely flattened, the others presenting more or less rounded points. These teeth do not develop a cingulum as in the teeth of *Palaeoscincus* and *Dyoplosaurus*, but the base of the crown is evenly rounded to meet the fang, which is long, smooth-surfaced and subcylindrical in form.

Compared with the teeth of other Nodosauridae, these are nearest in size to those of *Dyoplosaurus acutosquameus* Parks, with which they have been directly compared. In form and great number of denticles they show a closer approach to those of *Edmontonia longiceps* Sternberg[1] but their much smaller size at once distinguishes them.

DERMAL ARMOR:—That the body of this animal was covered by dermal armor is strongly indicated by a few dermal plates remaining in the matrix posterior to the skull. These elements are so poorly preserved as to give little idea of their form, but they leave the impression of being much less massive than the neck plates of *Palaeoscincus*.

RELATIONSHIPS:—On the basis of the skull structure, the genus *Pinacosaurus* is a true member of the family Nodosauridae and it falls readily into the subfamily Ankylosaurinae as defined by Nopcsa[2] and emended by Gilmore[3].

In the arrangement of the dermal scuta of the skull, *Pinacosaurus grangeri* shows many resemblances to *Euoplocephalus* and *Dyoplosaurus*. The presence of large projecting dermal scutes on the postero-lateral angles, a row of ornate border ossifications above and overhanging the orbits, and the large triangular plate that extends downward and outward from the quadrato-jugal region are all features held in common. Likewise close resemblances are to be found in the form and denticulation of the teeth and in the structure of the palate and lower jaw.

## Order **SAURISCHIA**

The occurrence of saurischian Dinosauria in eastern Asia was first announced by Osborn[4] when he described *Asiatosaurus mongoliensis* from the Oshih formation. In addition to the type materials, mention is also made of a number of other occurrences in this same formation. In 1929, Wiman[5] described *Helopus zdanskyi*, a new genus and species founded on an excellent skeleton from Shantung, China.

[1]Sternberg, C. M. 1928. Trans. Roy. Soc. of Canada, XXII, pp. 102–104, Pl. III, figs. 2, 3, 4 and 5.
[2]Nopcsa, F. Baron. 1929. Dinosaurierresti Geologica Hungarica, Budapest, Pt. 5, p. 70.
[3]Gilmore, Charles W. 1930. Proc. U. S. Nat. Mus., LXXVII, Art. 16, p. 30.
[4]Osborn, H. F. 1924. Amer. Mus. Novitates, No. 128, p. 2.
[5]1929. Palaeontologia Sinica, Sec. C., VI, Pt. I, Geol. Survey of China, pp. 6–40, Pls. I to IV.

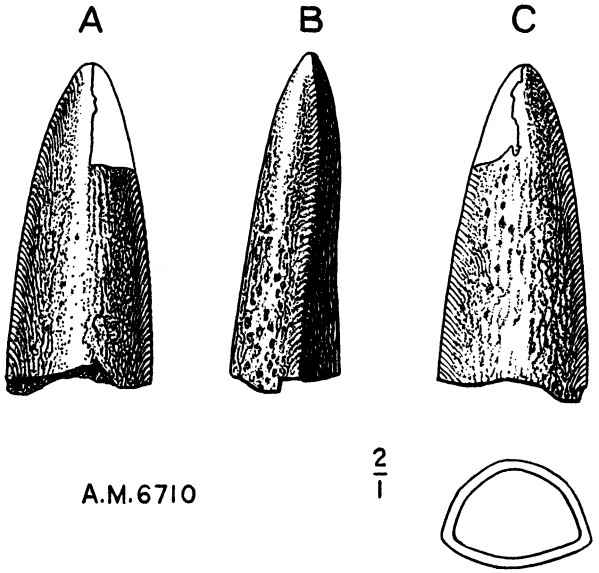


Fig. 4. Tooth crown of *Mongolosaurus haplodon*. Type. No. 6710, A. M. N. H. A, outer; B, edge, and C, inner views. Twice natural size.

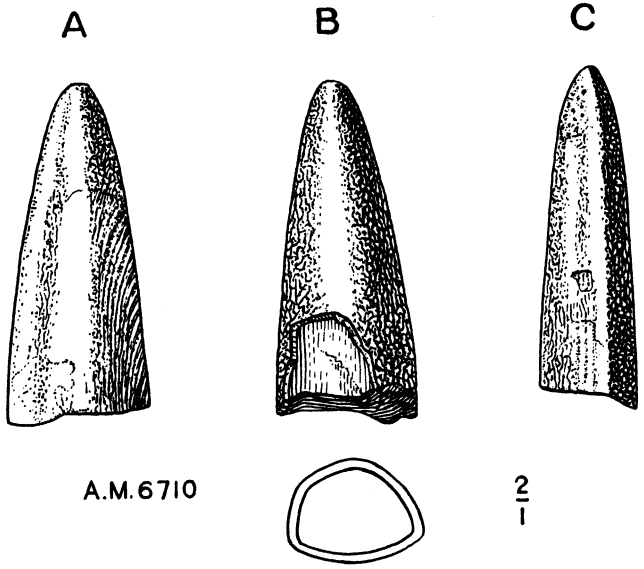


Fig. 5. Tooth crown of *Mongolosaurus haplodon*. Type. No. 6710, A. M. N. H. A, outer; B, inner, and C, edge views. Twice natural size.

The fragmentary specimen about to be described not only represents a new genus and species but is of further interest in being the only dinosaur known at this time from the On Gong formation.

Specimens observed in the field show the presence of saurischian dinosaurs in the Ondai Sair and Ochungchelo formations.

**Mongolosaurus haplodon**, new genus, new species

TYPE:—No. 6710, A. M. N. H., consists of the basioccipital, fragmentary teeth, atlas, fragmentary axis and third cervical vertebra. Collected by Walter Granger, June 3, 1928. Field No. 714.

LOCALITY:—Hu Khung Ulan, Inner Mongolia.

HORIZON:—On Gong, Lower Cretaceous.

Although fully recognizing the paucity of the type materials, the teeth found associated with the bones are so unlike those of any previously known sauropod that I consider it justifiable to propose the new genus and species **Mongolosaurus haplodon** for their reception.

It would seem that little question can be raised as to the proper association of these teeth, as they were found mingled with the bones, and also since this is the only dinosaur so far found in the On Gong formation.[1]

TEETH:—Among the tooth fragments preserved with this specimen are portions of five crowns and numerous fragments. All of these are tapering and obtusely pointed. Somewhat flattened, on what is regarded as the inner side, the outer is angularly rounded. On either side where these two surfaces meet, a low longitudinal ridge or carina is developed which extends to the apex of the crown. These carinae on one tooth are faintly serrate (see fig. 4); on another (see fig. 5) no trace of serration is found. The roots appear to have been cylindrical as in *Diplodocus*. The crowns are covered with a thin enamel, irregularly striated. The pulp cavity is continued to the top of the crown. One tooth shows wear on the tip of the crown. The largest and best preserved crown has a greatest diameter of 9 mm., a least diameter of 7 mm. These slender teeth have their nearest resemblances in those of *Diplodocus* and *Pleurocoelus*. The more pointed crown with faintly serrate borders, however, at once distinguishes them, as the teeth of both genera mentioned above are slightly spatulate without trace of serration. It is quite impossible to determine from these detached teeth whether they pertain to the upper or lower dental series.

BASIOCCIPITAL:—The detached basioccipital bone is all that is preserved of the skull of this individual. It comprises the large hemi-

[1]Andrews, R. C. 1932. Nat. Hist. of Central Asia, I, p. 378.

spherical condyle and heavy descending basioccipital processes. Its principal features are clearly shown in figure 6. The exoccipitals probably participate in the formation of the occipital condyle, but the sutures have so fully coalesced that no trace of their union is now visible. The condyle has a greatest transverse diameter of 54.5 mm., a greatest vertical diameter of 45 mm.

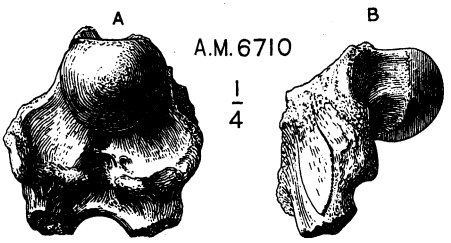


Fig. 6. Basioccipital of *Mongolosaurus haplodon*. Type. No. 6710, A. M. N. H. A, posterior view; B, lateral view. One-fourth natural size.

ATLAS:—The atlas consists of the usual four elements, the neurapophyses being firmly coössified with the intercentrum, and the odontoid with the anterior end of the axis. The intercentrum is relatively wider than the atlas of *Diplodocus*, more deeply excavated on the ventral

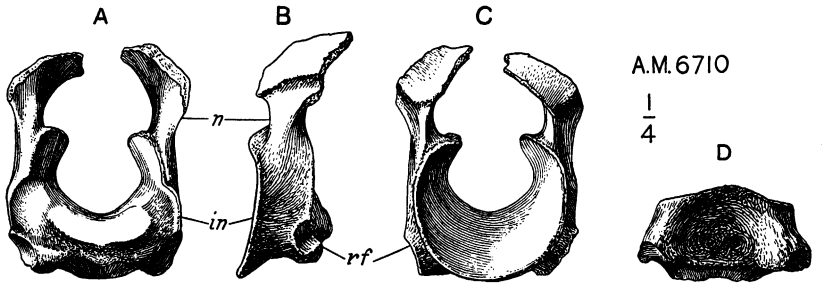


Fig. 7. Atlas of *Mongolosaurus haplodon*. Type. No. 6710, A. M. N. H. A, posterior view; B, lateral view; C, anterior view; D, ventral view. *In*, intercentrum; *n*, neurapophyses; *rf*, facets for cervical rib. All one-fourth natural size.

surface, and the neurapophyses are more constricted above the base than in that genus. The posteriorly directed portions of the neurapophyses or postzygapophyses are missing. The characters of the atlas are clearly shown in figure 7.

MEASUREMENTS OF ATLAS

| | |
|---|---|
| Greatest length of intercentrum | 43 mm. |
| Greatest width of intercentrum | 89 |
| Greatest height over all | 125 |

AXIS:—The centrum is all that is preserved of the axis. It is cupped posteriorly with a slight indication of a ball on the anterior end, in all probability the coalesced odontoid of the atlas complex. The anterior end is widely expanded, due to the development on either side of heavy parapophysial processes. These processes placed on the mid-height of the centrum project outward and backward and have a flattened articular

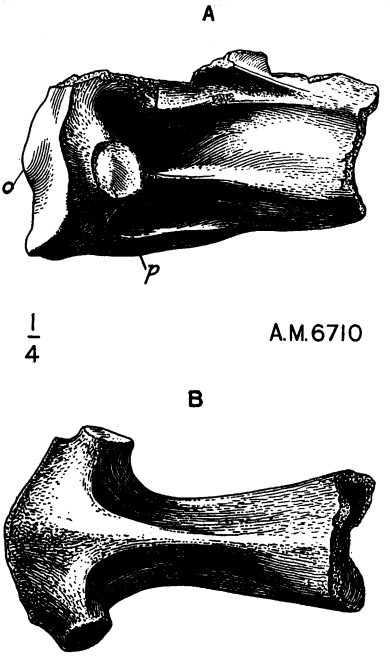


Fig. 8. Axis of *Mongolosaurus haplodon*. Type. No. 6710, A. M. N. H. A, lateral, B, ventral views. *O*, odontoid of atlas; *p*, parapophysial facet for cervical rib. One-fourth natural size.

end. Immediately posterior to this process, the side of the centrum is deeply excavated by cavities, one above the other. The upper is separated from the lower by a horizontal plate or lamina that anteriorly gives support to the parapophysial process. There is no evidence of a true pleurocentral cavity in the centrum such as occurs in *Camarasaurus* and *Diplodocus*.

From below, the centrum presents a transversely rounded surface at either end, connected by a thin keel which gradually widens toward the anterior end. The principal characters of the axis are shown in figure 8.

MEASUREMENTS OF AXIS

| | |
|---|---|
| Greatest length of centrum | 180 mm. |
| Greatest width of anterior end | 117 |
| Greatest width of posterior end | 72 |

THIRD CERVICAL:—The third cervical is strongly opisthocoelous. It is essentially complete and but little distorted. The anterior as well as the posterior zygapophyses are widely expanded and the former strongly overhangs the ball of the centrum. Near the anterior end on either side of the centrum, a strong process springs from the inferior lateral border.

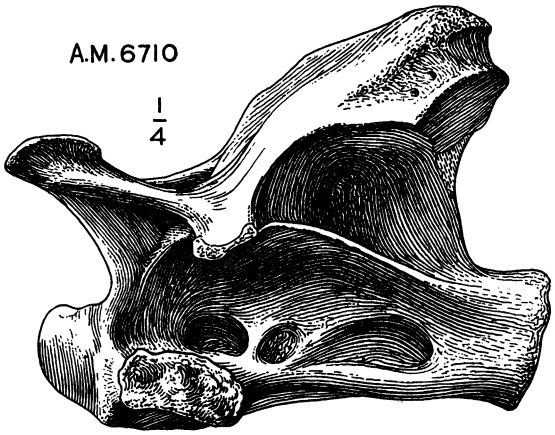


Fig. 9. Third cervical vertebra of *Mongolosaurus haplodon*. Type. No. 6710, A. M. N. H. Viewed from left side. One-fourth natural size.

The extremity of this process expands into a capitular facet for the articulation of the capitulum of the cervical rib. In this vertebra the lower surfaces of these processes are on a level with the bottom of the centrum, whereas in *Diplodocus*, *Helopus* and especially in *Haplocanthosaurus* they are produced far below the inferior side of the centrum. The presence in the cervical region of bifid spinous processes is apparently indicated by incipient parallel ridges that appear on either side of the median dorsal surface and that terminate posteriorly as two bluntly rounded projections that overhang the posterior border between the

zygapophyses. In this respect the third cervical differs from those of *Diplodocus*, *Helopus* and *Camarasaurus*, which have well indicated spines on the third cervical. There are no true pleurocentral cavities, thus resembling *Helopus*. On the side toward the anterior end of the centrum above the base of the capitular processes, cavities lead in toward the ball,

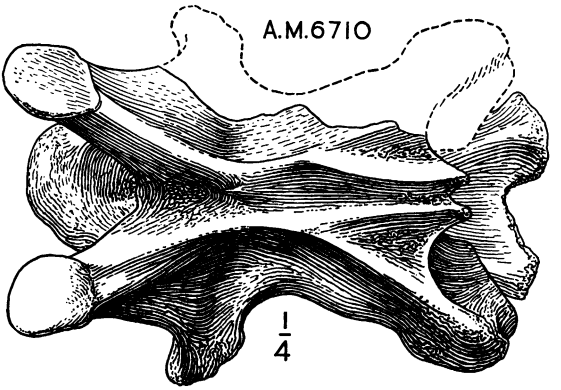


Fig. 10. Third cervical vertebra of *Mongolosaurus haplodon*. Type. No. 6710, A. M. N. H. Viewed from above. One-fourth natural size.

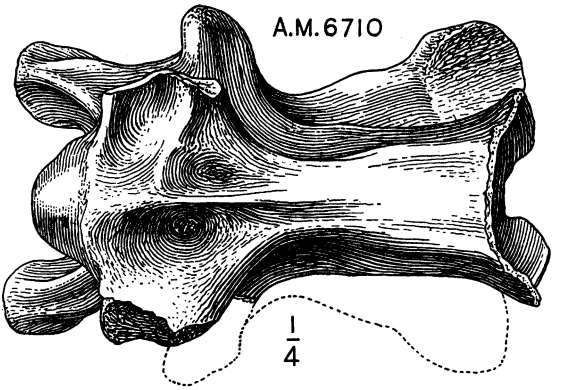


Fig. 11. Third cervical vertebra of *Mongolosaurus haplodon*. Type. No. 6710, A. M. N. H. Viewed from below. One-fourth natural size.

a feature apparently present in all sauropod cervicals. On the left side is a small subcircular cavity separated from the cavity described above by a slender vertical bar of bone. There is no evidence of a similar opening on the right side. Viewed from below, the anterior end appears broadly expanded with a low median keel on the anterior third, on either

side of which the surface is shallowly excavated. The ventral surface of the posterior portion is flattened, slightly constricted transversely at the center and expanded at the posterior end to form the cup. The left diapophysis is slender and lacks its articular end. It is supported by the usual laminae. The principal characters of this cervical are clearly shown in figures 9, 10 and 11.

MEASUREMENTS OF THIRD CERVICAL

| | |
|---|---|
| Greatest length of centrum | 263 mm. |
| Greatest height of vertebra | 208 |
| Greatest width of anterior end | 140 |
| Greatest width of posterior end | 100 |
| Greatest spread of anterior zygapophyses | 140 |

RELATIONSHIPS:—Little can now be said of the relationships of *Mongolosaurus haplodon*. That it is a true member of the Sauropoda is abundantly indicated by the few bones of the type specimen preserved, all of which are typical of that group. At the present time it is on the tooth characters that we must largely rely for distinguishing this from the previously described members of the order, since the lack of homologous parts renders proper comparison of the bones with those of many of the described genera out of the question.

The teeth, however, are so unlike any of the previously known spatulate sauropod teeth that the generic distinction of this form appears obvious.

The family relationships of *Mongolosaurus* must await the evidence afforded by more perfect material.

## NOTES ON OTHER DINOSAURIAN OCCURRENCES IN MONGOLIA

### Family **DEINODONTIDAE**

The presence in the Djadochta formation of a large member of the theropodous Dinosauria is indicated by a fragmentary portion of a right ilium (No. 6522, A. M. N. H.). This bone, consisting of the lower third of the anterior part of the blade and much of the acetabulum, lacking the greater peduncle, indicates an animal the size of *Gorgosaurus* of the American Upper Cretaceous, and it might very well pertain to the family Deinodontidae, but the fragmentary condition of the material precludes a positive confirmation of that suggestion. As recording the presence of a large member of the Theropoda in the Djadochta formation, this specimen is at least of interest.

A fragmentary specimen, No. 6592, A. M. N. H., collected by G. B.

Barbour from a bone bed on the Wanchuan Trail, above Kalgan, is clearly recognizable as pertaining to the Theropoda. This specimen is evidently the one referred to in Granger's letter[1] to me of Jan. 18, 1930, as "some fragments of small dinosaurs from Barbour's 'Nantienmen' Cretaceous beds of the Kalgan area, North China."

Among the fragments the following elements are recognized: An incomplete crown of a compressed tooth having a serrate posterior border, tip portion of an ungual phalanx, proximal end of ulna, half of a cervical vertebra, parts of several phalanges, and shaft portions of both pubes. These portions of the skeleton indicate an individual of about the stature of *Ornithomimus asiaticus*, but the presence of a tooth apparently indicates its distinctness from that form. The chief interest of the present specimen is that it records a new locality for carnivorous dinosaurs in North China, and in all probability an undescribed member of the Theropoda.

A second specimen, No. 2906, A. M. N. H., field No. 107, consisting of an incomplete sacrum, fragmentary portions of the ilia, pubes, ischia, parts of dorsal and caudal vertebrae, proximal end of radius, and many fragments, was collected 17 miles N.W. of Kalgan on the road to Wanchuan Hsien Pass by Morris and Barbour, October 11, 1925. Under date of Nov. 30, 1932, Granger wrote me: "The Barbour specimen came from the same locality and horizon and may even be a part of the same individual, although it was collected two or three years later."

The two specimens are essentially of the same size, and I find no duplication of parts. The character of fossilization is identical, so that they might very well, as Granger has suggested, pertain to the same individual.

### Family ORNITHOMIMIDAE

A fragmentary specimen, No. 6593, A. M. N. H., consisting of the proximal third of Mt. IV, a dorsal centrum, parts of two caudal centra and two phalanges of the hind foot, records a new locality for the Ornithomimidae in Mongolia. The specimen, field No. 804, was collected by Horwath, July 26, 1928, in Tairum Nor Basin on the south side of Tairum Nor Lake. The bones were associated and presumably pertain to a single individual; although one cannot be positive on such fragmentary evidence, they appear to be referable to the family Ornithomimidae, and the close resemblance of these bones to homologous

[1]Gilmore, Charles W. 1931. 'Fossil Turtles of Mongolia.' Bull. Amer. Mus. Nat. Hist., LIX, p. 248.

elements of the *Ornithomimus asiaticus* skeleton strongly implies their being congeneric. On the other hand, they might, if homologous elements were available for comparison, with equal propriety pertain to the genus *Oviraptor*. Since the family Ornithomimidae is not known to occur outside of the Upper Cretaceous, assumption would be that the beds from which this specimen came are of that age and furthermore equivalent to either the Iren Dabasu or Djadochta, although as Doctor Granger informs me the nearest known outcrops of those formations are 75 miles distant.

### Family HADROSAURIDAE

A specimen, No. 6594, A. M. N. H., field No. 565, consisting of a mid-portion of a dentary, fragment of a surangular, a phalangeal bone of the pes and portions of three anterior caudal vertebrae, is regarded as pertaining to a member of the Hadrosauridae. Of its predentate affinities there is no doubt; the piece of a dentary showing grooves for the rows of teeth is sufficient evidence in itself. This conclusion is further substantiated by the fragment of the surangular and the foot bone. The caudal centra are large, subround in outline and have a close resemblance in length and form to those of *Hypacrosaurus*[1] figured by Brown. It appears that all of these bones may very well pertain to a single individual, and fragmentary as the evidence may be, it points to hadrosaurian relationships.

This specimen was collected by Walter Granger, July 27, 1929, about 75 miles northeast of Shabarakh Usu, Outer Mongolia, from the Dohoin Usu formation, and is of interest as recording the most ancient occurrence of hadrosaurian dinosaurs yet found in Mongolia.

A caudal centrum and two incomplete ribs, No. 6595, A. M. N. H., field No. 508, are identified as pertaining to a hadrosaurian dinosaur. These specimens were collected at Baiying Bologai by George Olsen, May 5, 1925. In a recent letter, Granger sends me the following extracts from his field notes concerning them.

"The centrum was one of several dinosaur bones found in at least four places—a femur four feet long without either end, a fragment of a presacral vertebra and one or two unrecognizable bones. Found in coarse red sandstone. A few additional bones taken on return journey, August."

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[1]Brown, Barnum. 1913. Bull. Amer. Mus. Nat. Hist., XXXII, Art. XX, fig. 3, p. 400.

The centrum, which appears to be an anterior caudal, pertains to a very large hadrosaurian. These specimens are of interest as being the only record of dinosaurian specimens known from the Baiying Bologai formation of the Lower Cretaceous.

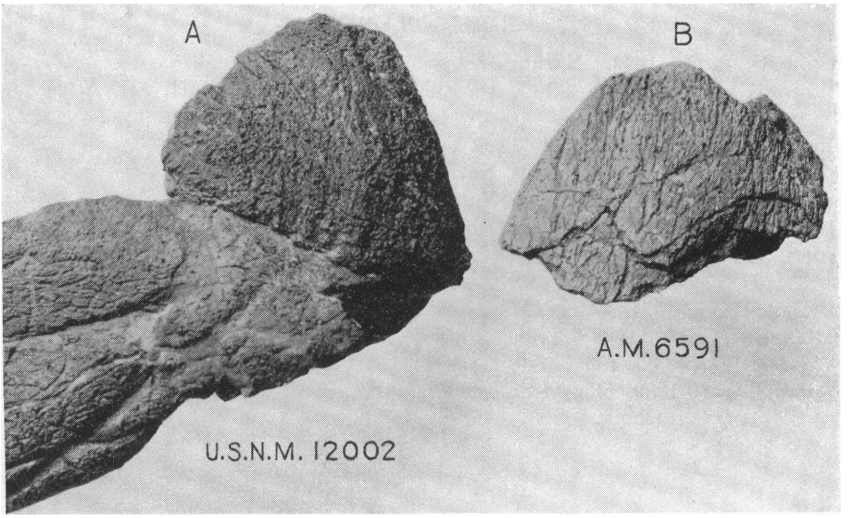


Fig. 12. Epoccipital bones compared. A, *Pentaceratops*, No. 12002, U. S. N. M.; B, Mongolian specimen, No. 6591, A. M. N. H. Both about one-third natural size.

## Family CERATOPSIDAE

A single incomplete bone, No. 6591, A. M. N. H., which came to me associated with field No. 508, is regarded as pertaining to a member of the horned Dinosauria. The close resemblance of this bone in form and surface sculpture to an epoccipital (No. 12002, U. S. N. M.), provisionally referred to the genus *Pentaceratops*, leaves little doubt of its ceratopsian affinities. The specimen was collected by George Olsen, at Baiying Bologai, Mongolia, May 5, 1925.

It is a compressed bone with a bluntly sharpened edge. One side, probably the lower, is flattened, the opposite side being slightly convex antero-posteriorly. Both surfaces are sculptured by the characteristic pits and grooves of a bone that in life was covered by a horny skin. The base is incomplete, this entire border presenting a broken surface, and owing to the lack of this surface a positive identification of the bone is not possible.

If, however, the bone is correctly referred to the horned Dinosauria, it is of much interest as being the first indication of the presence in Mongolia of a large member of the Ceratopsia, as previously the relatively small *Protoceratops* was the only form recognized.

## BIBLIOGRAPHY

ANDREWS, R. C. 1932. Natural History of Central Asia, I, p. 378.

BROWN, BARNUM. 1913. Bull. Amer. Mus. Nat. Hist., XXXII, Art. 20, fig. 3, p. 400.

GILMORE, CHARLES W. 1930. Proc. U. S. Nat. Mus., LXXVII.

1931. Bull. Amer. Mus. Nat. Hist., LIX, Art. IV, p. 248.

1933. Bull. Amer. Mus. Nat. Hist., LXVII, Art. II, p. 75.

HUENE, F. v. 1932. Monog. zur Geologie und Palaeontologie, Leipzig, Ser. 1, IV.

NOPCSA, F. BARON. 1929. Dinosaurierresti Geologica Hungarica, Budapest, Pt. 5, p. 70.

OSBORN, H. F. 1924. Amer. Mus. Novitates, No. 128.

STERNBERG, C. M. 1928. Trans. Roy. Soc. of Canada, XXII, Sec. IV, pp. 93–106, Pls. I–III.

WIMAN, CARL. 1929. Palaeontologia Sinica, Ser. C, VI, Pt. I, Geological Survey of China.