

**A pachycephalosaur from the Wangshi Fm. of Laiyang Co., Shandong
Province, *Micropachycephalosaurus hongtuyanensis* gen. et sp. nov.**

by

Zhiming Dong

Vertebrata Palasiatica
Volume 16, Number 4
October, 1977
pp. 225-228

Translated By Will Downs
Department of Geology
Northern Arizona University
July, 2002

Abstract

A small specimen belonging to the Pachycephalosauria has been collected from the Wangshi Fm. in Laiyang Co., Shandong Province, erected here as *Micropachycephalosaurus hongtuyanensis* gen. et sp. nov. Two morphs of cranial morphology may be recognized in this infraorder: dome-headed and flat-headed. These morphs are not due to sexual dimorphism and may be thus regarded as phylogenetic characters. Two families are hereby recognized based upon these characters: the Pachycephalosauridae and the Homalocephaleridae fam. nov.

Introduction

The Wangshi Fm. in Laiyang Co., Shandong Province is typical for Chinese Late Cretaceous sediments and is globally renowned for its abundant dinosaurs that were comprehensively studied by Young (1958). The specimen described in this text was collected in the summer of 1972 during the study of a stratigraphic section in a cliff southwest of the Laiyang train station. The specimen is a small member of the Pachycephalosauria and supplements the already abundant dinosaur fauna documented from the Wangshi Fm.

Description

Pachycephalosauria Maryanska and Osmolska 1974

Homalocephaleridae fam. nov.

Micropachycephalosaurus gen. nov.

Genus diagnosis: As for species.

Micropachycephalosaurus hongtuyanensis gen. et sp. nov.

Species diagnosis: A small member of the Pachycephalosauria with an approximate length of 50-60 cm, parietal-squamosal crest is thickly inflated but relatively flat and undomed, the supratemporal fenestra is present, but conspicuous cranial ornamentation is absent. The mandible is relatively high, and the dentition is gracile and uniserial with a lateral median crest and symmetrical denticles anteriorly and posteriorly. The six fused sacral centra are platycoelous, the second sacral is inflated, and the diapophyses are fused to the sacral ribs making them robust. The dorsal sacral ribs lie on the sacral region.

Locality and stratigraphic position: Late Cretaceous Wangshi Fm. from a cliff southwest of the county capital of Laiyang, Shandong Province.

Material: A damaged parietal, incomplete squamosal, and quadrate; a single right mandible; a string of caudal vertebrae, a portion of the sacral girdle, and hind limb. IVPP V5542.

Description: The parietal is damaged with only the posterior portion preserved, being approximately 1.2 cm thick, and maintaining a projected crest on its posterior margin. The squamosal and quadrate have been subjected to compressional distortion, shifting them posteriorly. The quadrate maintains the typical morphology for the Ornithischia. The occipital condyle is preserved completely, is square in morphology, and its articular surface lacks any angularity.

Of the mandible, only a right dentary is preserved which is high and thin with small nutrient foramina laterally. Nine alveolae are present within which are seven complete gracile teeth. The dentition is uniserial and relatively densely packed. The tooth bases (roots) are

elliptical, the crown margins are nearly symmetrically denticulated, there is a median crest, and enamel covers the entire lingual side. The dental morphology resembles that of *Thescelosaurus* but in size it resembles *Wannanosaurus*.

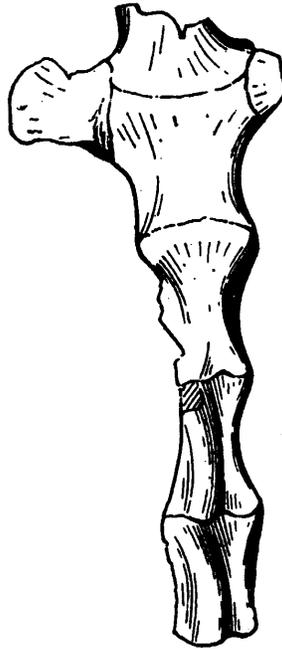


Figure 1. Ventral view of sacral vertebrae of *Micropachycephalosaurus hongtuyanensis* (x 1).

Only vertebrae from the sacral region are preserved. There are six fused platycoelus centra with neural spines that are fused into a single plate; between sacrals 1 and 2 the ribs are fused, and the centra are inflated. On sacrals 4-6 there is a ventral longitudinal groove. Dorsal to the sacral vertebrae are additional supporting dorsosacral ribs. The anterior caudal centra are amphicoelous, the neural spines are plate-shaped, the neural arches are low, and the diapophyses are well-developed laterally. These characters resemble those for Homalocephaleridae from Mongolia.

Only a fragment of a left ilium is preserved but together with the impression left in the matrix it allows the reconstruction illustrated in Figure 2. The ilium is low with a narrow and elongate preacetabular process, a morphology resembling both *Psittacosaurus* and *Homalocephale*.



Figure 2. Restoration of ilium of *Micropachycephalosaurus hongtuyanensis* (x 1).

A complete left femur is preserved with a length of 12.4 cm. It is anteroposteriorly curved, the head is dorsally projected but there is no conspicuous neck, the lesser trochanter is undeveloped, there is a flattened crest on the anterior margin that is consistent with the arc of the shaft, the fourth trochanter is a well-developed crest located rather proximally, and the distal condyles are undeveloped. A tibia that was collected has a morphology resembling *Psittacosaurus*.

Because this small animal has a thickened cranium and the posterior margin has a crest, there is no doubt that it represents a member of the Pachycephalosauria.

Diagnosis and discussion

The Pachycephalosauria is a rather rare and autapomorphic infraorder of the Ornithischia. The first description was conducted by Leidy (1856) who erected *Troödon formosus* based upon a single tooth, and because of the depauperate data, was unable to conduct a more advanced discussion. Subsequently, Gilmore (1924) described specimens from Alberta, Canada, and erected the family Troödonidae, after which Brown and Schlaikjer (1943) summarized the North American data and assigned pachycephalosaurs to the Ornithischia. At that time, pachycephalosaurs were principally known from the Late Cretaceous of North America. Sternberg (1945) erected the family Pachycephalosauridae, which was accepted by the vast majority of paleontologists.

The first documentation of this family in Asia was made by Bohlin (1953), who described the new species *Stegoceras bexelli*, based upon fragmentary specimens collected from the Hexizoulang Corridor, Gansu Province. Subsequently Maryanska and Osmolska (1974) described several relatively complete specimens collected by the Mongolian Paleontological Survey in the Nemegt and Khulsan basins of Mongolia, on which they erected the new infraorder Pachycephalosauria based upon pelvic characters.

Currently, the Pachycephalosauria contains 7 genera and 13 species, among which two morphologies may be generally recognized: the dome-headed morph, which has a closed supratemporal fenestra and ossified cranial tuberosities, includes the genera *Pachycephalosaurus*, *Stegoceras*, *Tylocephale*, and *Prenocephale*. The second morph also has a thickened cranium but it is tabular and the supratemporal fenestra remains present. This includes *Yaverlandia*, *Homalocephale*, and *Wannanosaurus*. Because the cranial specimen from Laiyang is relatively tabular, it is assigned to the latter morph.

Yaverlandia is a Wealden-Stage genus from Europe that is characterized by a V-shaped groove on its parietal that is quite distinct from the Shandong specimen. The cranium of *Homalocephale* is distinct from the Shandong specimen in being more massive, ornamented with osseous tuberosities, and larger. *Wannanosaurus* is a small individual with dental morphology nearly equivalent to the Shandong specimen and nearly equivalent in size. However, it differs in the densely packed osseous tuberosities ornamenting the skull and the parietal-squamosal not being posteriorly projected. Thus the specimen at hand is considered distinct from the other genera due to its small size and is erected as *Micropachycephalosaurus*. The species etymology *hongtuyanensis* indicates that the locality consists of a red clay (hongtuyan).

The aforementioned distinctions in the pachycephalosaur cranium were interpreted by Brown and Schlaikjer (1943) as being the result of sexual dimorphism, the dome-headed crania representing the male form and the tabular crania the female. Galton (1971) supported this interpretation and further suggested that the male condition was a result of head-butting for acquisition to females, resembling the condition of several extant bovids.

The more recent descriptions of Mongolian specimens by Maryanska and Osmolska (1974) indicate that the distinctions between the flat-headed *Homalocephale* and its contemporaneous dome-headed *Tylocephale* and *Prenocephale* lie not only in cranial morphology but also in a large discrepancy of the postcrania. Although the concept of sexual dimorphism cannot be completely rejected, it does not sufficiently explain the complete distinction of postcranial morphology. Moreover, generally speaking, the interspecific sexual dimorphic condition within gregarious herbivores is frequently expressed by females outnumbering the males.

As stated above, the Pachycephalosauria are interpreted to be gregarious herbivores that are sexually dimorphic (Brown and Schlaikjer, 1943; Galton, 1971) and should thus conform to the gregarious population dynamics as mentioned above. However, the data from Mongolia indicate that the dome-headed “males” outnumber the flat-headed “females” (Maryanska and Osmolska, 1974), and consequently it is believed here that the suborder Pachycephalosauria actually includes two families:

The dome-headed crania with the parietal and squamosal radically inflated, supratemporal fenestra sealed, and quadrate strongly anteriorly inflected is hereby recognized as the family Pachycephalosauridae Sternberg, 1945.

The crania that are not domed, maintain an open supratemporal fenestra, and a weakly anteriorly inflected quadrate is recognized as Homalocephaleridae fam. nov. This family contains the four taxa *Yaverlandia*, *Homalocephale*, *Wannanosaurus*, and *Micropachycephalosaurus* gen. nov.

Bibliography

- Bohlin, B., 1953; Fossil reptiles from Mongolia and Kansu. *The Sino-Swedish Exped. Publ.* 37, Stockholm
- Brown, B. and Schlaikjer, E.M., 1943; A study of the troödont dinosaurs with the description of a new genus and four new species. *Am. Mus. Nat. Hist. Bull.*, **82**, pp 115-150.
- Gilmore, C.W., 1924; On *Troödon validus*, an ornithopodous dinosaur from the Belly River Cretaceous of Alberta, Canada. *Bull. Alberta Univ.* **1**, pp. 1-43.
- Hou, L.H., 1977; A primitive pachycephalosaur from the Cretaceous of Anwei Province. *Vert. PalAs.* **15**(3), pp. 198-202.
- Leidy, J., 1856; Notices of remains of extinct reptiles and fishes, discovered by Dr. F.V. Hayden in the badlands of the Judith River, *Nebraska Terr. Proc. of the Acad. Nat. Sci. Phil.*, pp.72-73.
- Maryanska, T. and Osmolska, H., 1974; Pachycephalosauria, a new suborder of ornithischian dinosaurs. *Palaeon. Polonica*. Part 5, pp. 45-101.
- Steel, R., 1969; Ornithischia. In Kuhn, O., ed., *Hanbuch der Paläoherpetologie*, pp. 1-81, Stuttgart.
- Sternberg, C.M., 1945; Pachycephalosauridae proposed for dome-headed dinosaurs, *Stegoceras lambei*, n. sp. described. *Jour. Pal.* **19**, pp. 534-538.
- Young, C.C., 1958; Dinosaurian remains of Laiyang, Shandong Province. *Palaeontol. Sin., New Ser. C*, (16), 138 pp (in English with Chinese summary).



Micropachycephalosaurus hungtuyanensis gen. et sp. nov.

1. Mandible with dentition and quadrate above (x2); 2. Five fused sacral vertebrae (x 1);
3. Three articulated caudal vertebrae (x 1); 4. Femur and Tibia (x 1).