A new carnosaur from Yongchuan County, Sichuan Province

by

Dong Zhiming
Institute of Vertebrate Palaeontology and Palaeoanthropology, Academia Sinica

Zhang Yihong, Li Xuanmin, and Zhou Shiwu
Chongqing City Museum

Ke Xue Tong Bao [Science Newsletter]
Vol. 23, n. 5, p. 302-304 (ending on p. 290)
1975

Translated by Jisuo Jin

Introduction

Carnosaurian fossils have been found in the Late Triassic-Late Cretaceous rocks of Inner Mongolia, Xinjiang, Guangxi, Ningxia, Gansu, Heilonjiang, Liaoning, Shandong, Shanxi, Henan, Hunan, Jiangxi, Sichuan, and Yunnan provinces and regions [1]. Up until now, twelve genera have been recorded in China:

Sinosaurus (Late Triassic)
Szechuanosaurus (Late Jurassic)
Chienkosaurus (Late Jurassic)
Prodinodon (Early Cretaceous);
Kelmayisaurus (Early Cretaceous)
Chilantaisaurus (Early Cretaceous)
Tarbosaurus (Late Cretaceous)
Shanshanosaurus (Late Cretaceous);

and so on. *Chilantaisaurus* and *Shanshanosaurus* are represented by relatively well-preserved specimens [1, 2], and the rest of the genera are based mostly on isolated teeth and bones.

In the June of 1977, a fairly complete carnosaur skeleton was discovered in the construction site of a reservoir dam in Yongchuan County, Sichuan Province. The specimen came from the dark-red sandy mudstones in the middle-upper Shaximiao Formation of the Chongqing Group (Jurassic). The skeleton is nearly complete except for the forelimbs and some posterior caudal vertebrae that are missing.

The skull is perfectly preserved (Text-fig. 1). It is the first nearly complete dinosaur skeleton found in China.

[Text-fig. 1. Left side view of the skull of *Yangchuanosaurus shangyouensis*.]
[Text-fig. 2. Skeleton of *Yangchuanosaurus shangyouensis* at the excavation site.]

The specimen of the Yongchuan carnosaur enables us to fully describe its morphology, to reconstruct precisely its live conditions, to analyze its functional morphology, to rearrange the carnosaur genera and species previously reported, to determine its systematic position in the evolution of carnosaurs, and to determine its age.

Text-figure 2 shows *Yangchuanosaurus* at the excavation site. It gives a vivid picture of the animal, with head tilted backward, tail curved upward, and the entire skeleton in articulation without any dislocation. This indicates that the animal was preserved *in situ*, without much subaerial exposure or any transportation before burial.

Its side-lying posture suggests that this highland-dwelling animal was probably pursuing prey when it got trapped in the mud by a lake and died.

Characteristics of *Yangchuanosaurus*

Preliminary preparation reveals that *Yangchuanosaurus* is a large carnosaur. It has a total length of 8 m, skull length of 82 cm, and skull height of 50 cm. The skull bears six pairs of fenestrae: nasal nares, orbits, temporal fenestrae, and two pairs of antorbital fenestrae. The first pair of antorbital fenestrae are very large and triangular (upside down). The second pair are small and triangular. A maxillary depression is located behind the nasal naris. There are no gaps between the parietal, parietal process, and frontal bones. The angular bone slopes slightly toward the posterior, thus elongating the mandibular lobe. A large mandibular foramen is present in the posterior portion of the mandible. Upper and lower teeth are laterally flattened and curved posteriorly, with serrated anterior and posterior ridges (12 denticles per 5 mm). Dental formula: Pm4M14-15/D14-15.

Vertebral column. 10 cervical, 13 dorsal, and 5 sacral vertebrae. The cervical vertebrae have concave posterior ends and sloping ventral sides. The dorsal vertebrae are flat on both ends. All five sacral vertebrae are fused together, and the anterior four neural spines are united to form a plate.

Pelvic girdles. The ilium is low and elongated in the anterior-posterior direction. The pubis is fused to the distal end of the ischium. The pubic foramen is evident, and the pubic foot is poorly developed. The femur is a little longer than the tibia. The astragalus and calcaneum are fused together. The ascending process of the astragalus is poorly formed.

The characteristics cited above indicate that *Yangchuanosaurus* is a typical carnosaur [4]. It should belong to the Megalosauridae [5] on the basis of its large and heavy skull, well-developed skull fenestrae, slightly tilting angular, long mandibular lobe, slender postorbital bone, and low ilium.

The Megalosauridae is known as a "garbage bag" within the infraorder Carnosauria. The family includes some medium-sized Jurassic carnosaurs and some problematic Cretaceous carnosaurs. The group is characterized by a medium to large and robust body, a bipedal posture, a large and moderately high skull with a mobile gap between the parietal and frontal bones, a down-sloping lower lobe of the squamosal, a slender postorbital bone, an angular bone tilting slightly posteriorly, a long mandibular

lobe, presence of a mandibular foramen, and large, flattened teeth. The neck is shortened (9-10 cervical vertebrae), corresponding to skull enlargement. The body is also short (13-14 dorsal vertebrae). The five sacral vertebrae are commonly fused. The ilium is low; the pubis is long and slender with distal pubic foot commonly developed. Digits I and V become obliterated. The forelimbs are shorter than the hind limbs.

Megalosaurid materials have been found in Mesozoic rocks of nearly every continent, except for Antarctica. Well-preserved specimens, however, are confined to the North American *Antrodemus* (*Allosaurus*) and *Ceratosaurus*. Both genera have well-preserved skulls. Compared to *Yangchuanosaurus*, *Antrodemus* has a high skull, with dental formula Pm3M15-17/D15-16, and a mobile gap between the parietal and frontal. *Ceratosaurus* differs from *Yangchuanosaurus* in having a horn-like process on the nasal bone and a dental formula of Pm3M15/D15. *Yangchuanosaurus* closely resembles *Megalosaurus*, which occurs mainly in Upper Jurassic rocks of Europe and East Africa and is represented by fragmentary materials. In *Megalosaurus*, the maxilla bears a depression and the dental formula is the same as that of *Yangchuanosaurus*, but it differs from *Yangchuanosaurus* in having only one pair of antorbital fenestrae and a small mandibular foramen. Although there have been several megalosaurids found in Asia, most are based on isolated pieces of bones. *Szechuanosaurus, Chienkosaurus*, and *Chingkankousaurus*, for example, are all based on isolated teeth. *Chilantaisaurus* is represented by a broken skull, and its frontal and parietal bones are connected by ligament. Thus it is difficult to make a comparison.

Morphological features of the Yongchuan specimen make us believe that it is an unknown genus and species. It is named as a new genus and new species after its type locality: *Yangchuanosaurus shangyouensis* n. gen. and n. sp. Its taxonomic position is as follows:

Order Saurischia
Suborder Theropoda
Infraorder Carnosauria Huene, 1920
Family Megalosauridae Huxley, 1869
Genus ***Yangchuanosaurus*** n. gen.
Yangchuanosaurus shangyouensis n. sp.

The Age of *Yangchuanosaurus*

The exact age of the Mesozoic red bed deposits in the Sichuan Basin has been one of the most controversial subjects among geologists and paleontologists. Lateral facies changes make it difficult to correlate these deposits from northern Sichuan to southeastern Sichuan. Most elements of various fossil assemblages are long-ranging, and paleontologists tend to use their own specialized fossil groups for correlation. This has caused further confusion.

With the accumulation of data and more detailed geological and paleontological works, and especially with measuring and tracing sections in the field during the last few years, an agreement on the sequence of the red beds has been achieved. But there is still debate on the age of the red beds, particularly on the age of the Chongqing Group. The Upper Shaximiao Formation of the Chongqing Group contains abundant dinosaur fossils. Two dinosaur faunas have been identified. The Wujiaba (Zigong) dinosaur fauna occurs 10-15 m above the Conchostracan Shale marker bed. The fauna consists of

Sauropoda

Zigongosaurus fuxiensis n. gen. and n. sp.

Omeisaurus changshouensis Young

Omeisaurus junghsiensis Young

Theropoda

Szechuanosaurus yandonensis n. sp.

Coelurosauridae indet.

Stegosauria

Tuojiangosaurus multispinus n. gen. and n. sp.

In composition, the fauna has a Late Jurassic character. *Tuojiangosaurus* shows similarities to *Kentrosaurus* from the Tendaguru Formation of Tanzania [6]. It can also be compared to *Lexovisaurus* from the Late Jurassic of Europe in the shape of its dorsal dermal plates.

The other fauna occurs in the dark-red sandy mudstones of the middle-upper Shaximiao formation, including:

Sauropoda

Mamenchisaurus hochuanensis Young

Theropoda

Yangchuanosaurus shangyouensis n. gen. and n. sp.

Ornithopoda

Stegosauridae indet.

The fauna commonly contains turtles of the Plesiochelyidae and fish (*Ceratodus*). The dinosaurs are generally large in size, showing a Late Jurassic character. This fauna

can be compared to that in the Tendaguru Formation of Tanzania in terms of the faunal composition and the morphology of the elements.

Yangchuanosaurus shows typical characters of Late Jurassic megalosaurids. We therefore regard the Chongqing Group to be Late Jurassic in age. This age is at least correct for the Upper Shaximiao Formation.