

A new species of sauropod, *Mamenchisaurus anyuensis* sp. nov.

by

Xinlu He, Suihua Yang, Kaiji Cai, Kui Li, and Zongwen Liu

Chengdu University of Technology

Papers on Geosciences
Contributed to the 30th International Geological Congress
1996
pp. 83-86

Translated By Will Downs
Bilby Research Center
Northern Arizona University
January, 2001

Introduction

The sauropod that is the subject of this study, *Mamenchisaurus anyuensis* sp. nov., was discovered in 1987 in the vicinity of town of Longchiaoxiang, Anyue Co., in the center of the Sichuan Basin. This locality is approximately 180 km southeast of the city of Chengdu and 70 km east northeast of the fossil locality of Dashanpu, Zigong Co. Specimens were excavated from two localities representing stratigraphic horizons in close proximity: the locality of Matisi is 2 km southeast of the administrative office of Longchiaoxiang where the lithology consists of a massive sandstone in the lower section of the Upper Jurassic Penglaizhen Fm. The second locality, Longjiawa, is approximately 1.7 km east of the administrative office of Longchiaoxiang and east northeast of Matisi where the specimens were collected from a sandstone lens in a predominantly purple-red mudstone unit at the top of the Suining Fm. extremely close to the contact with the overlying Penglaizhen Fm. (Table 1).

Excavations were initiated in 1987, resulting in a quarry surface area of approximately 120² m. Specimens were relatively abundant, the majority of which are represented by a single sauropod species which is newly erected in this text. Also collected were specimens representing Theropoda and Chelonia. The Longjiawa quarry was more productive than the Matisi quarry and it is estimated the bone bed extends much further than the excavation undertaken. No less than five to six individual sauropods were excavated from this quarry, including a juvenile, the theropod, and turtle. However, due to the proximity of the bone level to the surface, the specimens were submerged under water for a lengthy period of time, weathering them deeply. Consequently, completely preserved specimens at Longjiawa are not numerous. At Matisi, there are four individuals of the new species represented, one of which, specimen #AL001, is selected as the type for the species, representing two-thirds of an articulated skeleton.

**Table 1. Locality and stratigraphic position of
Mamenchisaurus anyuensis sp. nov.**

Stratigraphy		Locality	Taxa
Upper Jurassic	Penglaizhen Fm.	Matisi, Longchiaoxiang, Anyue Co.	Only <i>M. anyuensis</i>
	Suining Fm.	Longjiawa, Longchiaoxiang, Anyue Co.	Vastly dominated by <i>M. anyuensis</i> , Theropoda: <i>Yangchansaurus</i> Chelonia: gen. et sp. indet. (only a single piece)
	Shaximiao Upper		

Formerly, the vast majority of Jurassic dinosaurs from the Sichuan Basin were produced from the Shaximiao fms. and rock units underlying it. Fossils from the overlying Suining and Penglaizhen Fm. had been extremely rare. Thus, the discovery of these abundant specimens, from one aspect fills a stratigraphic vacancy in the Sichuan Basin and concurrently extends the range of *Mamenchisaurus* from the early Late Jurassic at least into the late Late Jurassic. Prior to the discovery of *M. anyuensis*, the most complete specimen representing the genus was

M. hochuanensis from the town of Taihezhen, Hechuan Co., Sichuan, although this specimen lacks cranial and dental material, pectoral girdle (including clavicle), a complete forelimb, and distal caudal vertebrae. *M. anyuensis* also lacks cranial material but fills the vacancies in *M. hochuanensis* with completely preserved postcrania. The buried populations of *Mamenchisaurus* in the Longchiaoxiang region are not the only occurrence of mass burials of the genus. Another mass burial occurs in the northern Sichuan county of Guangyuan but these specimens remain to be studied.

Description

Sauropoda Marsh 1878

Mamenchisauridae Young and Chao, 1972

Mamenchisaurus Young 1954

Mamenchisaurus anyuensis sp. nov

Material: Collections from both Longjiawa and Matisi near the town of Longchiaoxiang, Anyue Co., are estimated to include at least ten individuals. With the exception of cranial material, the rest of the skeleton is nearly completely represented. The specimens are considered conspecific due to their distinct consistency in size and morphology.

Type: Specimen AL001 from Matisi is a relatively complete skeleton. With the exception of a small amount of postcranial elements being displaced, the remaining represents the majority of an articulated skeleton with an estimated 8 medial to posterior cervical vertebrae, a complete column of dorsal vertebrae, 5 sacrals, 8 anterior caudals, 15 articulated distal caudals, pectoral and pelvic girdles, nearly complete forelimb, hind limb with damaged tibia and fibula, and lacking a portion of the pes, which is due to taphonomic conditions.

Hypodigm: Specimens AL002, AL003, and AL101-106.

Species diagnosis: A large sauropod with a body length of approximately 21 m or more, approaching *M. hochuanensis* in size. Teeth are typically spoon-shaped, relatively small, maintain serrations only on the anterior margin, have conspicuous folding on the basal labial side, and a lingual medial crest is present. Cervicals exceed 17 in count, there are 12 dorsals, 5 sacrals, and an estimated 50 caudals. Presacral centra are opisthocoelous, centrum walls are extremely thin and interior centrum composition is highly pneumaticized. Cervical pleurocoels are not well developed and centra are relatively elongated, or generally similar to the condition on *M. hochuanensis*. Posterior cervical and anterior dorsal neural spines are extremely weakly bifid. Dorsals all have typically well developed pleurocoels. Sacral centra are fused but not conspicuously ventrally constricted and only the first sacral centrum has extremely weak pleurocoels. Anterior caudals are procoelous, neural spines are simple in morphology, and diapophyses are not excessively developed. Medial caudals have bifurcated haemal arches and on the most posterior caudals prezygapophyses and neural spines remain present. The anteroproximal margin of the scapula is appropriately dorsally oblique, there is a conspicuous process on the posterior margin dorsal to the glenoid fossa, the coracoid is semi-elliptical and is in contact with the scapula with a relatively straight suture line. The clavicle is arched with one end narrow and bifurcated and the other end broad and flat. The humerus is approximately three-quarters the length of the femur and the ulna is two-thirds the length of the humerus. The ilium resembles the basic morphology of *Omeisaurus* and *Mamenchisaurus*, the pubic peduncle is robust and situated at the midpoint of the ilium, an ischiac peduncle is indistinct, proximal ischium is distinctly broadened, the shaft is elongated, and the distal end is thin.

Etymology: With reference to the species' discovery in the County of Anyue.

Description: The Longjiawa site produced 14 isolated teeth that are equivalent in size and are distinctly thin and small compared to the adult postcrania. Their small size may be attributed to the abundant tooth count in the maxilla and mandible, as is found in *M. youngi* from the locality of Xinminxiang, Zigong Co. All the teeth are spoon-shaped with serrations on their anterior margins although some lack serrations entirely. Tooth crown/root index is approximately 1:2, crown breadth is 40-45% of the height. On all teeth there are extremely few but thick folds on the labial base of the crown. A lingual medial longitudinal crest is present on all teeth (Plate I, Figs. 1 and 2).

Eight posterior cervical vertebrae are preserved on the type specimen AL001, specimen AL102 preserves five articulated cervicals which undoubtedly represent the medial cervical series anterior to the eight on AL001. This is determined on the basis of morphology and the standard variation of their lengths. It is estimated that there are at least four to five more cervicals anterior to this column, and thus it is estimated there are at least 17-18 vertebrae in the cervical series. For convenience sake it is determined that the count is equivalent to *M. hochuanensis* at 19.

Cervical morphology is nearly identical to *M. hochuanensis*. The length of the cervical column is three times the length of the dorsal column. Cervical centra are strongly opisthocoelous with very poorly developed pleurocoels, neural spines that are represented are all extremely low, on the anterior series they are relatively elongated, and on the several most posterior they are extremely weakly bifid. *M. anyuensis* is quite distinct however in its extremely well developed buttressing and internal pneumatization of the several posterior cervicals, its smaller diapophyses that are broader than on *M. hochuanensis* and in lateral view are nearly isosceles triangle-shaped, and its cervical ribs are more slender, and are not fused to the centra on adult specimens.

A complete series of 12 dorsal vertebrae articulates with the most posterior cervical and anterior sacral on the type specimen. This series represents the most thoroughly studied specimens with principle characters including a neural spine that becomes gradually thicker and larger posteriorly along the column as does the entire height of the vertebrae. All centra have equally well developed opisthocoelous morphology, elliptical pleurocoels are all extremely well developed and located dorsomedially, centrum walls are extremely thin, the interior composition is highly pneumaticized, and the anterior six dorsals are extremely weakly bifid.

There are five sacral vertebrae on the type in articulation with the most posterior dorsal and anterior caudal. The four anterior centra are fused but their suture lines are still discernible. The first vertebra is in transition between dorsal and sacral morphology with characteristics predominantly resembling the dorsals, the centrum is very slightly convex anteriorly, and its pleurocoels are very weakly developed, but on the remaining sacrals they are absent. The fifth sacral is posteriorly convex and should thus be procoelous, resembling the condition of the caudals. Centra are very weakly constricted laterally and ventrally. Consequently, the ventral surface is united to form a single linear column.

Abundant caudals are represented although not as a complete articulated column. Eight anterior caudals are represented on the type but due to its extensive damage Cd8 is not figured in the plates. The seven anterior caudals are strongly procoelous with a semi-spherical posterior articular surface. Distal caudals are represented on both the type and specimen AL103 by 15 articulated vertebrae. Prezygapophyses reach or approach the anterodorsal portion of the vertebrae, postzygapophyses are inconspicuous, neural spines are distinctly oblique posteriorly, and on the terminal vertebrae extend nearly parallel to the centrum. In the midseries of these 15 vertebrae there are six contiguous bifurcated haemal arches that run parallel to the centra due to their bifurcations reaching 180° angles.

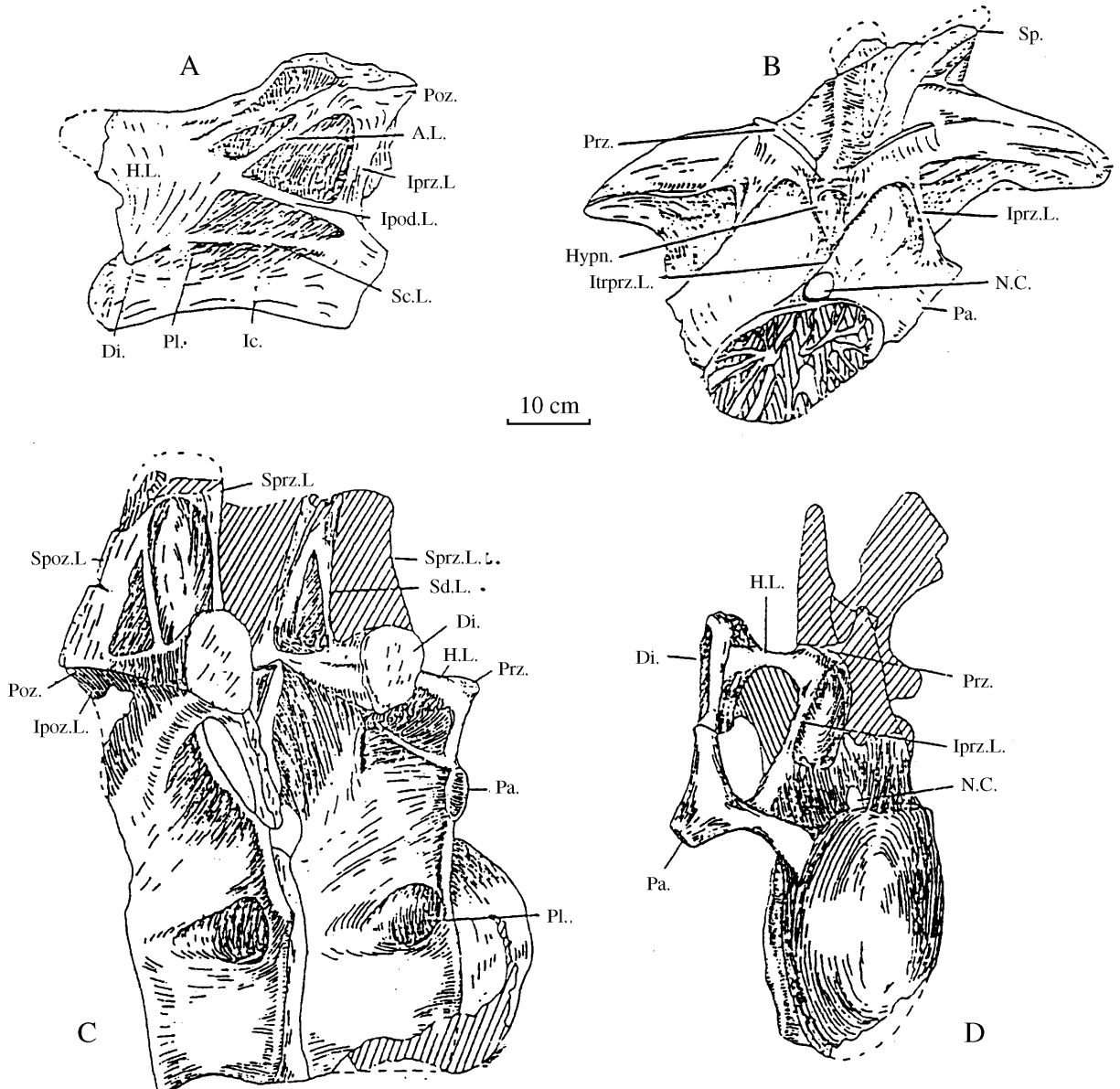


Figure 1. Vertebrae of *Mamenchisaurus anyuensis* sp. nov.

A. Left lateral view of specimen AL001 sixteenth (?) cervical exhibiting the extremely well developed buttressing; B. Anterolateral view of AL001 third dorsal vertebra with damaged anterior end exhibiting the well developed internal pneumatisation and bifid neural spine; C. Right lateral view of AL001 tenth and eleventh dorsal vertebrae exhibiting the location of the parapophyses and condition of the pleurocoels; D. anterior view of AL001 twelfth dorsal vertebra.

Scapula, coracoid, and clavicle are all well preserved. With the exception of the incomplete digits, the forelimb is completely preserved and represented by more than one individual with elements including humerus, ulna, radius, carpals, and metacarpals. Limitations on the length of this manuscript prohibits further description.

On the type, the pelvic girdle is basically complete with an ilium, ischium, and pubis. The ilium resembles the other species of *Mamenchisaurus* and *Omeisaurus* with an exceptionally

pronounced pubic peduncle that is located at the midpoint of the ilium and an indistinct ischiac peduncle.

With the exception of incomplete digits on the pes, the remaining hind limb elements are all completely represented, including an adult femur with a length of 152 to 162 cm, slightly longer than the femur on *M. hochuanensis*.

M. anyuensis is extremely close in size and morphology to *M. hochuanensis* but differs primarily in its more thinly walled and pneumaticized internal structure of the presacral vertebrae, more well developed buttressing on posterior cervicals, adult cervical ribs are not fused with the centra, pleurocoels on dorsal vertebrae are more well developed, and neural spines on the anterior caudal vertebrae are more simplified.

Acknowledgements

The authors express their appreciation to the administrative authorities of Anyue Co. and the town administration of Longchiaoxiang for their support. Appreciation is also expressed to the provincial administration of Sichuan, members of the Sichuan Provincial Academy, and all the department chairpersons in the Chengdu Academy of Geology for their solicitude and assistance.

Bibliography omitted