Sauropterygian from Triassic of Guizhou, China

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Abstract A new sauropterygian, *Anshunsaurus huangguoshuensis*, is described on the basis of a well-preserved skull from the Late Triassic Wayao Member of Falang Formation, Guizhou Province, southwestern China. It is ascribed to Eusauropterygia because it possesses the following characters: the rostrum is mainly composed by the premaxillae; the nasals are small, paired and separated from one another by the premaxillae; the external nares are close to the orbits; and the frontals are fused. *Anshunsaurus* differs from other Triassic sauropterygians in its large size, long rostrum and the supratemporal fenestrae slightly smaller than orbits. It is further considered to be closely related to *Pistosaurus* on the basis of the nasals contact with the prefrontals; large pineal foramen, lain in the anterior part of the parietal table; the squamosals not in contact posterior to the supratemporal fenestra. The discovery of *Anshunsaurus* with the ichthyosaurs in the same locality indicates a new assemblage of Triassic marine tetrapods in China.

Keywords: Guizhou Province, Late Triassic, Sauropterygia.

MANY reptile fossils, such as *Keichousaurus*[1], *Nothosaurus* (*Shingyisaurus*)[2, 3], *Chinchenia*[2], *Sanchiaosaurus*[2] and *Mixosaurus*[4], have been found in the marine Triassic of Guizhou (Kweichou) Province, China. Unfortunately nearly all these taxa are poorly known from fragmentary materials except for *Keichousaurus*. Recently some well-preserved specimens of sauropterygians and ichthyosaurs were collected from the marine Wayao Member of Falang Formation (Carnian) in Guizhou Province. The fossils were found in a set of dark gray laminated calcilutite. Many bedding planes of the laminated calcilutite are densely covered with bivalves and ammonites, including the bedding plane that yields the reptilian skeletons.

Keichousaurus hui is from the lower part of the Zhuganpo Member of the Falang Formation (Ladinian)[5], not the Guanlin Formation in Anisian[1]. *Nothosaurus*, *Chinchenia*, *Sanchiaosaurus* and *Mixosaurus* are from the Middle Triassic[2,4]. The specimens of Anshun come from the Upper Triassic and represent a new marine tetrapod assemblage in China. According to the study, the specimen of sauropterygians represents a new eusauropterygian. In the present note the author intends to report this important discovery and to provide a brief description of the new sauropterygian.

1 Systematic paleontology

Order Sauropterygia Owen, 1860

Suborder Eusauropterygia Tschanz, 1989

Family *incertae sedis*

Genus *Anshunsaurus* gen. nov.

Etymology. The generic name is derived from Anshun, the name of the place where the specimen was collected.

Type species. *Anshunsaurus huangguoshuensis* sp. nov.

Diagnosis. As for the type and only species.

Anshunsaurus huangguoshuensis sp. nov.

Etymology. The specific name is referred to Huangguoshu, a famous touring place known for the waterfall, near which the fossil locality is located.

Holotype. Institue of Vertebrate Paleontology and Paleoanthropology specimen number: IVPP V11835, a nearly complete skull with lower jaw, the axial skeleton with the caudal vertebrae missing and the left forelimb (see figure 1).

Type locality and horizon. Huangtutan, Xinpu, Guanling County, Anshun area, Guizhou Province, southwestern China; Late Triassic Wayao Member of Falang Formation (Carnian).

Diagnosis. A medium-sized eusauropterygians (about 3 m) with neck only half long of the body; rostrum elongate, occiput concave; external nares small and approaching orbits; supratemporal fenestrae slightly smaller than orbits; pineal foramen large and posteriorly situated; premaxillae reaching frontals, separate nasals; frontals fused; parietal table broad but not forming crest along midline; squamosals not in contact behind supratemporal fenestrae; teeth pointed, curved, with longitudinal striae; about 18 cervical vertebrae and more than 20 dorsal vertebrae.

Description. The entire skeleton is exposed in dorsal view. The skull is 38.5 cm, the neck is about 51 cm, and the truck is about 100 cm in length. Conjecturing from these measurements, the overall size of this animal was probably 3 m long in life (table 1).

Table 1 Measurements of skull (in mm)

Skull length (from tip of rostrum to posterior end of parietal skull table)	355
Skull length (from tip of rostrum to squamosal)	385
Distance from tip of rostrum to anterior margin of external nares	180
Distance from tip of rostrum to anterior margin of orbit	230
Distance from tip of rostrum to anterior margin of supratemporal fenestra	300
Maximum skull breadth	160
Longitudinal diameter of external nares	20
Longitudinal diameter of orbit	63
Longitudinal diameter of supratemporal fenestra	52
Longitudinal diameter of pineal foramen	25
Width of frontals between orbits	37
Width of parietal bar between supratemporal fenestrae	50

Skull. The skull is elongate, with long rostrum which is longer than half length of the skull. The occiput is deeply concave. The outstanding features of the skull are those: the large orbits, greater than supratemporal fenestrae; the large pineal foramen; and the small external nares.

The premaxillae form the most dorsal part of rostrum together with the maxillae. The premaxillae extend posteriorly to contact with the frontals, the sutures level with the anterior edge of orbits. The external

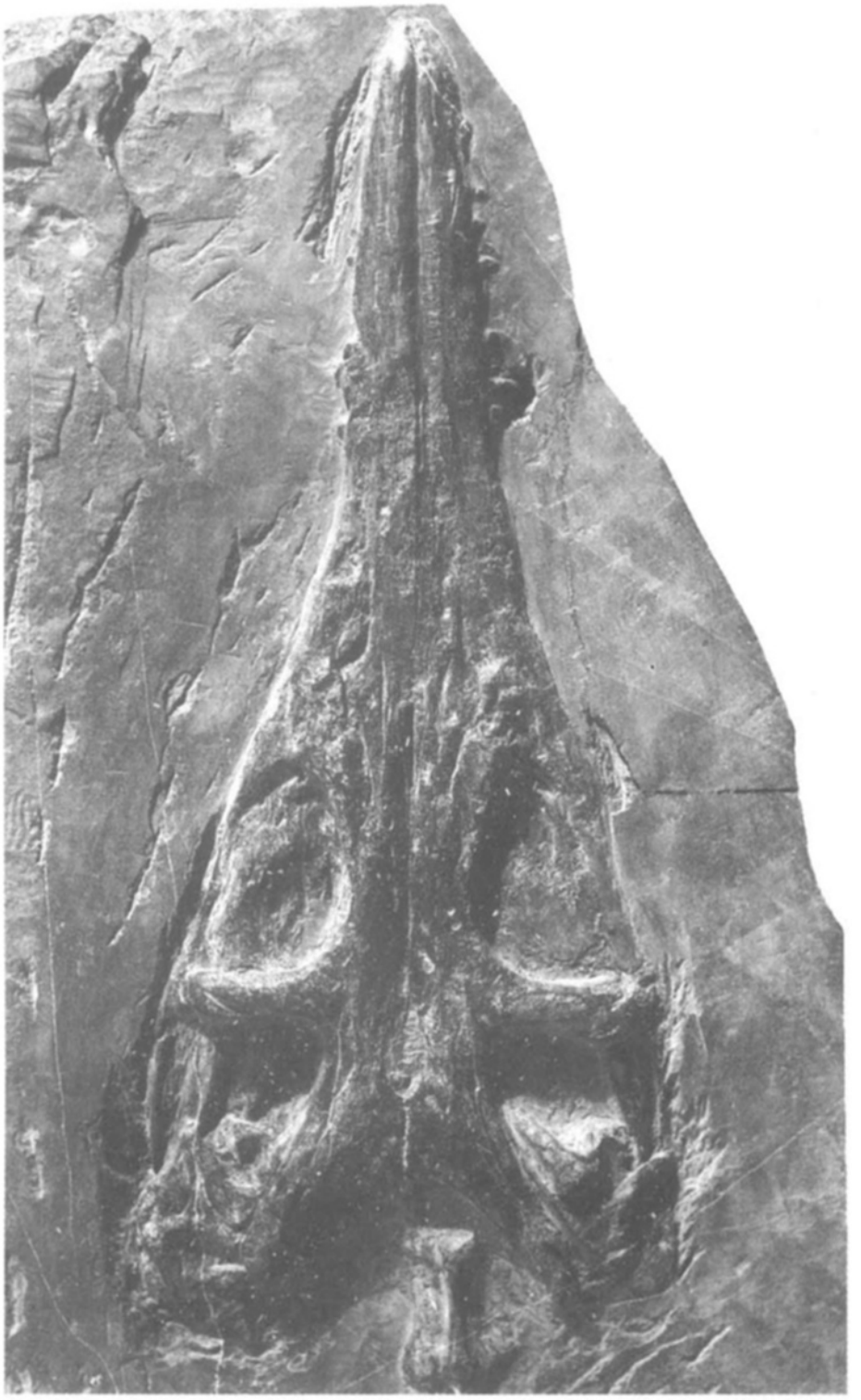

Fig. 1. *Anshunsaurus huangguoshuensis* Liu gen. et sp. nov. (IVPP V11835, holotype) × 0.5 photograph of the skull in dorsal view.

nares are located near the orbits. The former are small and oval, with the long axis anteriorly-posteriorly oriented. The external nares are bordered by the maxillae laterally and the nasals medially. The premaxillae approach, but not join to border the external nares.

The nasals are separated from one another by the premaxillae and extend posteriorly to join the formation of the anterior part of the interorbital bar. The nasals contact with the prefrontals in a way just as in *Pistosaurus longaevus*[6]. It is difficult to determine whether the lacrimals are present. The maxillae, if the lacrimals are absent, form the anterior and anterolateral rims of the orbits.

The prefrontals form the anterodorsal borders of the orbit. The frontals, forming the dorsal borders of the orbits, are fused. The exact shape of the postfrontal is difficult to discern. The postorbital bar is formed by the postorbital and the postfrontal. The postorbitals extend posteriorly to contact the squamosal and, together with the latter form the lateral borders of the supratemporal fenestrae.

The parietals form the skull table which is dorsally flat, and do not form a sagittal crest. The pineal foramen is positioned relatively posteriorly but still in the anterior part of the interfenestral region. The squamosals are not in contact posterior to the supratemporal fenestrae. The latter are subcircular and smaller than the orbits in size.

The teeth are circular in cross section, recurved, crown surfaces ornamented with longitudinal striations. Dentition is isodont. The length of a single tooth is about 10 mm above the alveoli.

Postcranial skeleton. There are about 18 cervical vertebrae and more than 20 dorsal vertebrae. The caudal vertebrae are not preserved. Only left forelimb is preserved. This part of specimen is still in matrix, so no further description of the postcranial skeleton can be made at present.

2 Discussion

Recent studies have made progress in the phylogenenetic relationship of sauropterygians[7—10]. However, the interrelationships among sauropterygians need to be clarified with more precision[11]. Any new material is helpful to meeting this goal.

Anshunsaurus is distinguishable from other Triassic sauropterygians mainly in its large size, elongate rostrum, and the supratemporal fenestrae slightly smaller than the orbits. The new taxon is clearly much larger than *Chinchenia*. Its rostrum is longer than that of *Sanchiaosaurus*; and its supratemporal fenestra is very short when compared to that of *Nothosaurus*. *Anshunsaurus* is assigned to Eusauropterigia on the basis of the following features: the frontals are in contact with the premaxilla, the frontals fused[9]. The nasals of *Anshunsaurus* contact the prefrontals, only being seen in *Pistosaurus* and *Lariosaurus* of Eusauropterigia. *Aushunsaurus* differs greatly from *Lariosaurus* in its large size, long rostrum and small external nares. Other characters shared by *Anshunsaurus* and *Pistosaurus* include: the rostrum is long; the external nares are small; the pineal foramen is large and lies in the anterior part of the parietal table; the squamosals are not in contact posterior to the supratemporal fenestra. All these suggest that *Anshunsaurus* has a close relationship with *Pistosaurus*. In *Anshunsaurus*, the nasals enter the margin of the external nares, this is a plesiomorphy compared with that character in *Pistosaurus*[7]. The supratemporal fenestrae of *Anshunsaurus* are subcircular, and nearly as long as the orbits, a situation seen in some plesiosaurs such as *Plesiosaurus dolichodeirus*[12] and *Thalassiodracon hawkinsi*[13], but not in *Pistosaurus*. *Pistosaurus* is considered as the sister-taxon to the crown-groups including plesiosaurs and pliosaurs[7,8,14]. It is difficult to determine interrelations among *Anshunsaurus*, *Pistosaurus*, and crown-groups at the present stage. We now temporarily consider *Anshunsaurus* as family *incertae sedis* before further information become available.

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