The Dashanpu Dinosaur Fauna of Zigong Sichuan
Short Report V - Labyrinthodont Amphibia

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Vertebrata PalAsiatica
Volume XXIII, No. 4
October, 1985
pp. 301-305

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December, 1990

Abstract

A brief discussion is presented on the morphological characteristics and phylogenetic position of *Sinobrachyops placenticephalus* (gen. et sp. nov.). The specimen is derived from the well-known Middle Jurassic Dashanpu dinosaur quarries of Zigong County, Sichaun Province. *Sinobrachyops* is the youngest geological occurrence of a labyrinthodont amphibian known to date. Its discovery extends the upper geochronological limit for the Labyrinthodontia into the Middle Jurassic.

Introduction

The first fossils collected from Dashanpu, Zigong, in 1979, were a pair of rhachitomous vertebrae. This discovery created a sense of perplexity among the workers, for the morphology of these pleurocentra and intercentra suggested an assignment to the Labyrinthodontia. This group of amphibians, however, was traditionally believed to have become extinct in the Late Triassic, a traditional concept that must be abandoned if scientific investigation is to be advanced and left unfettered.

In 1983 the Institute of Vertebrate Paleontology, Paleoanthropology Academia Sinica launched a paleontological expedition in the Shishugou Formation (Middle-Late Jurassic) from the Kelameili region, northeast Jungar Basin, Xinjiang Autonomous Region, where several rhachitomous vertebrae were discovered. Later, a fragmentary skull of a labyrinthodont amphibian was collected, confirming that this group extended into the Middle Jurassic. The discovery from the Shishugou Formation convinced the workers that the rhachitomous vertebrae at Dashanpu belonged to the Labyrinthodontia.

On May 14, l984, a fossil specimen was collected by Shida Zhu of the Zigong Dinosaur Museum and Renyan Gao of the regional engineering division, who undertook a 1983-1984 joint investigation while constructing the foundation for the expansion of the dinosaur exhibit hall. Exposed in a piece of sandstone was an osteological plate ornamented with a reticular linear network that the author of this report diagnosed as possibly belonging to a labyrinthodont skull. The Zigong Dinosaur Museum agreed to relinquish the specimen to the Institute of Vertebrate Paleontology, Paleoanthropology in Peking. After two months of meticulous preparation by colleague Hong Zhang, an exceptionally complete labyrinthodont skull was revealed (Plate I). This discovery further necessitates the revision of the upper geochronologic limitation for the Labyrinthodontia, extending their temporal limit 12 million years later. This text presents a short report on this valuable cranial specimen to coincide with the opening of the Zigong Dinosaur Museum exhibit hall.

Fossil Description

Amphibia
Labyrinthodontia
Temnospondylia
Brachyopoidea
Brachyopidae
***Sinobrachyops* gen. nov.**
***Sinobrachyops placenticephalus* sp. nov.**

(Plate I)

Etymology: The type for the short-skulled labyrinthodont genus *Brachyops* is derived from the Indian subcontinent, where the genus *Austobrachyops* is derived from the Antarctic

continent. The Chinese specimen from Zigong approaches both these in morphology, permitting its inclusion in the Brachyopidae, but it is distinguished as a new Chinese genus, *Sinobrachyops.*

Diagnosis: A moderate-sized brachyopid, with reticulate cranial ornamentation attributable to the Labyrinthodontia. Remnant lateral line canals occur dorsal to the orbits; the anterior oral extremity is bluntly rounded; and nasal cavities are in tight association. Orbits are large, laterally positioned, and widely spaced. Interpterygoid vacuities are large. The cultriform process of the parasphenoid is gracile and long, extending anteriorly to the anterior margin of interpterygoid vacuities. Paired tusks occur on the palatine, vomer, and epipterygoid.

Specimen: A complete skull and pair of incomplete mandibles housed at the Zigong Dinosaur Museum. Specimen No. ZDM 1.

Locality and Age: Middle Jurassic Lower Shaximiao Formation, Zigong, Dashanpu County, Sichuan Province.

Description: Specimen ZDM 1 is preserved in a block of sandstone in which a small cavity was accidentally chiseled into the top of the cranium at the time of its exposure. All other features of the cranium are complete (Pl. I). At the time of its burial, the left mandible was laterally crushed beneath the skull. The anterior part of this element was also lost at the time of its exposure. The right mandible is preserved relatively completely. Deductions made from the condition of preservation suggest that after death the carcass underwent fluvial transportation, but was not transported far before burial. Hence, it is extremely possible that post-cranial elements remain within the sandstone unit that the skull was derived from, making the rock unit at this locality worthy of further post-excavation attention.

Skull: Typically brachyopid, with a pair of large orbits positioned anterior to the transverse midline of the skull. The oral region is bluntly rounded with a pair of small apparently confluent external nares positioned at the oral extremity. From a palatal perspective, the paired internal nares communicate with the single external fossae. Consequently, it may be inferred that the external nares are actually paired fossae, and are divided by a thin internarial bar, although on the specimen itself this septum is unobservable.

The dorsal aspect of the skull maintains a network of radiating reticulate ornamentation typical of the labyrinthodont amphibians. The suture line relationships are not clearly observable due to this obscurity by the cranial ornamentation. However these sutures are visible from a palatal perspective, permitting a secondary reference to be made through the reticulate ornamentation for each dorsal cranial element. Figure 1 illustrates these inferred suture lines. Most obvious are the orbits, laterally situated and surrounded by the prefrontal, postfrontal, postorbital, and jugal. Grooves of the lateral line system are present on the prefrontals and postfrontals as basically symmetrical, long, and broad troughs. These grooves are remnants of the bifurcated supraorbital sensory system. Phylogenetically, the late-stage labyrinthodont family, the Brachyopidae, frequently lose this character or merely retain some remnants of it. The Labyrinthodontia generally possess a pineal eye, but on this specimen the fossa for such a feature is unobservable dorsally, and ventrally its location is concealed by the parasphenoid.

From an occipital perspective, specimen ZDM1 is rectangularly convex with sharp angles. Both an otic notch and tabular horn are absent in the supratemporal region. The occipital condyles project posteriorly, and extend laterally to intersect the posterior margin of the parietals at an oblique angle. A deep concavity occurs between the condyles, the base of which Watson (1956) identified as the basioccipital. Dorsally, this concavity broadens transversely to form the elliptical foramen magnum. The crania of the labyrinthodonts are not completely fused, displaying long stapedial fossae on the lateral sides of the occipital condyles. A stapes, however, is not preserved

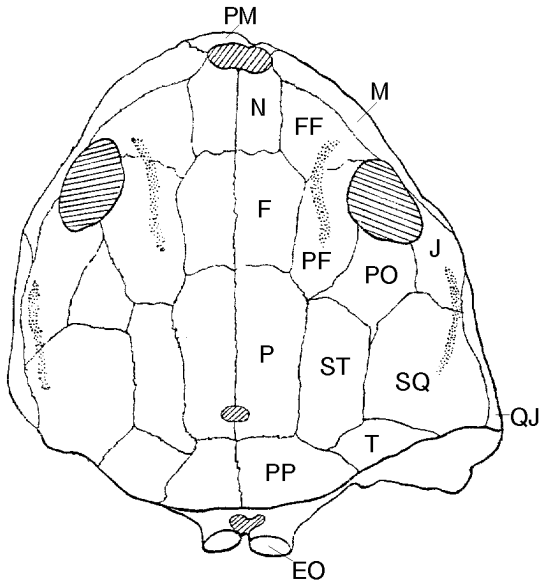

Figure 1. Conjectured cranial suture lines on the dorsal aspect of *Sinobrachyops placenticephalus* gen. et sp. nov.
PM premaxilla; M maxilla; N nasal; F frontal; FF Prefrontal; PF postfrontal; P Parietal; PP postparietal; PO postorbital; J jugal; ST supratemporal; T tabular; SQ squamosal; QJ quadratojugal.

here. At the posterolateral margin of the stapedial fossa is a small and shallow sulcus that Warren (1981) designated the substapedial fossa in her description of *Siderops*. This fossa is located at the junction of the quadrate ramus of the pterygoid and the squamosal. The squamosal is located at the posterior margin of the oral region where, anteromedially, it joins the tabular, anteriorly it contacts the postorbital, posteriorly meets the quadrate, and laterally joins the quadratojugal. There is a deep sulcus at the suture line between these elements interpreted as the paraquadrate foramen. The quadrate is located between the quadrate ramus of the pterygoid and the squamosal. The Zigong specimen displays a quadrate ramus of the pterygoid that is tightly fused to the quadrate dorsomedially, and shows the same wing-shaped configuration known in other brachyopids, and forms a robust suspended organ for facilitating the mandible. The body of this suspended organ is transversely broadened to form the condyle of the quadrate. Lateral to the quadrate is the quadratojugal, and medial is the quadrate ramus of the pterygoid. The protruding occipital condyles, or the posteriorly expanded angle between the occipital condyles and the condyle of the quadrate, is considered apomorphic for the Brachyopidae (Warren 1979).

From a palatal aspect, the most conspicuous feature on the Zigong specimen is the pair of enormous interpterygoid vacuities (Fig. 2) which constitute two-thirds of the palatal surface. As previously stated, the relationship of each cranial suture line on the dorsal side of the skull may be observed through these interpterygoid vacuities. The tabular does not unite with the parietal, but the structure of the parasphenoid and pteryoid is typical of the brachyopids (Fig. 2). The anterior end of the palate displays two small elliptical vacuities, or choanae, the anterior margins of which consist of the premaxilla and the lateral margins the maxillae. Posterior to the choanae are a pair of anterior palatal vacuities. The vomer composes the posterior margin of these round vacuities, and carries a transverse row of teeth. A concavity is present at the fused midline of the two vomers, which may be interpreted as the vomerine foramen. In his description of *Batrachasuchus browni,* Chernin (1977) suggested the vomerine foramen was a round perforation penetrating the anterior region of the vomer. Posterior to the vomers are large subrounded interpterygoid vacuities. In the

temporal region of the maxillae lie a pair of long vacuities, or the subtemporal fossae. The location, arrangement, and morphology of each of the palatal vacuities on the Zigong specimen are fundamentally consistent with those of *Siderops* and *Brachyops;* however, it differs by the larger interpterygoid vacuities and exceptionally small, tightly appressed internal nares.

The arrangement of the basicranial elements as well as the morphology of the ossified sutures in palatal perspective, are typical of the Brachyopidae. The cultriform process of the parasphenoid is long and gracile, and extends anteriorly to reach the anterior margin of the interpterygoid vacuities and meets with the posterior margin of the vomer. The suture line of this fusion has a "W" configuration, consistent with that observed on *Siderops*. The parasphenoid constitutes a major portion of the basicranium; it is butterfly shaped with the blade-like cultriform process extending anteriorly. Laterally it fuses with the pterygoid and posteriorly attaches to the occiput (Fig. 2). The large parasphenoid has undergone posterior compression causing it to conceal other basicranial elements beneath it. The pterygoid is the second-most-extensive cranial element on the palate, lying on both sides of the basicranium with a well-developed quadrate ramus of the pterygoid at its lateral side. This ramus extends to the posterior section of the quadrate, where it then turns ventrally to fuse tightly with the main body of the quadrate. The epipterygoid lies anterior to the anterior arm of the pterygoid, where it is situated between the subtemporal fossa and interpterygoid vacuities. The lateral margin of the subtemporal fossa is composed of the quadratojugal.

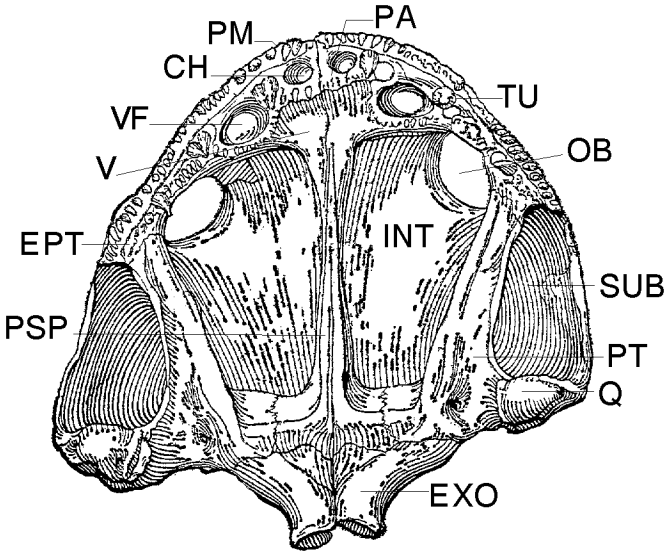

Figure 2. Palatal view of *Sinobrachyops placenticephalus* gen. et sp. nov. X $\frac{1}{2}$

PM premaxilla; PA palatine; CH internal nares; VF vomarine foramen; V vomer; OB orbit; TU conical tusk; INT interpalatal vacuities; EPT epipterygoid; PSP parasphenoid; SUB subtemporal fossa; PT pterygoid; EXO exoccipital; Q quadrate

Dentition: In spite of the large morphological variety in brachyopid dentitions, two morphological types may be distinguished from their eruptive position. One constitutes lateral margin dentition erupting predominantly from the premaxilla and maxilla. The other constitutes palatal dentition, erupting from the palatine, vomer, and epipterygoid. The former mode lies in tight alignment on the Zigong specimen. The teeth curve lingually, with broadened crowns and

subrounded roots. The premaxillary teeth are large and maxillary teeth smaller. Disregarding size, the dentition in this sequence is basically morphologically similar. Two forms of dentition are present on the palatal surface, one similar to the small dentition on the maxilla, and the second as large conical tusks. These tusks differ by their eruption in pairs upon the palatine, vomer, and epipterygoid. Among the tusks, the pair on the palatine is the largest, while those on the epipterygoid are smallest. Each pair is situated tightly together and is morphologically consistent, typical of the Labyrinthodontia, and is similar to the conical teeth of the ancestral Crossopterygii.

Mandible: Both are preserved, with the right side relatively complete and structurally similar to *Brachyops* and *Dvinosaurus.* The curvature of the mandible appropriately matches the curvature of the skull. A well-developed retroarticular process is present posteriorly. The dentition is similar to that on the maxilla.

Diagnosis: Characters suggesting the Zigong specimen is a labyrinthodont amphibian include the reticulate cranial ornamentation, labyrinthodont dentition, and the characteristic paired occipital condyles. The subclass Labyrinthodontia may generally be subdivided into three orders (Romer 1966): I. The Ichthyostegalia is the oldest labyrinthodont family, but as they did not differentiate greatly from the Crossopterygii they display numerous plesiomorphic characters, including a relatively high skull, the presence of a cranial articulation, and the presence of a lateral line system on the skull. These amphibians are principally derived from the Carboniferous. II. The Anthracosauria, derived principally from the Carboniferous or Permian, display a skull that has begun to become flattened. Several taxa still possess a features suggesting cranial kinesis, and the tabular and parietal are in direct contact. A majority of the geologically longer labyrinthodont taxa belong to the third order, the Temnospondyli, inhabiting the time range of the Permian to the Middle Jurassic. This is a rather derived group of labyrinthodonts with their skulls flattened, the cranial articulation lost, and the tabular separated from the parietal and shifted posteriorly. As the Zigong specimen displays a flattened cranium, a tabular separated from the parietal and lying in the temporal region, it is undoubtedly a member of the Temnospondyli.

Watson (1956), Warren (1977, 1978), Cosgriff (1976, 1984) and Carroll and Winer (1977) have all advanced taxonomic studies of the Temnospondylia. In spite of taxonomic discrepancies between them, these workers have mainly established phylogenetic characters for the Labyrinthodontia in the vertebrae and crania. Principal cranial characters include length of skull, position of orbits, structure of the otic region, morphology of the occipital condyles, and structure of the palate. According to the phylogenetic principles of Cosgriff (1984), who divided the Temnospondylia into six superfamilies, the Zigong specimen may be referred to the family Brachyopoidae based upon its short and flattened skull, the orbits situated in the anterior half of the skull, the wide sutures between the pterygoid and parasphenoid, the separation of the pterygoid from the palatine and vomer, and the transverse condyle of the quadrate situated anterior to the occipital condyles. Warren (1981) recognized only two families within this superfamily; those possessing tabular horns and otic notches are the Chigutisauridae; and those lacking tabular horns and otic notches, the Brachyopidae. The absence of tabular horns and otic notches on the Zigong specimen refers it to the latter family. Additionally, Warren (1981) conducted conclusive studies on the Brachyopidae, and recognized ten species within seven genera using cladistic analysis of 22 synapomorphic characters to further advance ancestral-descendant relationships among the seven genera.

The Zigong specimen may be clearly distinguished from several genera within the brachyopids by its confluent external nares, well-developed paired sharply conical palatal tusks, and its expansive interpalatal vacuities. Hence, the erection of the new taxon *Sinoplacenticephalus placenticephalus* gen. et sp. nov. is warranted.

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