中国上白垩统窃蛋龙科—新属种
（兽脚类：窃蛋龙类）

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摘要：根据可能发现于江西赣州晚白垩世南雄组地层中一件标本报道了窃蛋龙科—新属种——斑鳍龙。新标本具有以下不同于其他窃蛋龙属种的特征：由前颌骨和鼻骨形成的脊冠具有阶梯状的后端，表面有两个纵向的沟槽和许多倾斜的条痕；外鼻孔延长，其后侧与眶骨相近；翼骨颚骨支持缘有深窝；齿骨后背缘有纵向沟槽；上隅翼前背缘有小结节。斑鳍龙腭部和下颌的一些特征不同于窃蛋龙科的其他属种，但近似于更原始的窃蛋龙类。这些特征表明斑鳍龙代表窃蛋龙科中相对原始的一个属种。这一系列发育假说得到了定量的系统发育分析的支持。斑鳍龙的发现不仅增加了晚白垩世窃蛋龙科的分异度，而且为这一类群的特征演化提供了重要信息。

关键词：中国；晚白垩世；窃蛋龙科，兽脚类
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A NEW OVIRAPTORID DINOSAUR (THEROPODA: OVIRAPTOROSAURIA) FROM THE UPPER CRETACEOUS OF CHINA

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Abstract Here we report a new oviraptorid taxon based on a specimen possibly collected from the Upper Cretaceous Nanxiong Formation of Ganzhou, Jiangxi, China. This new taxon is distinguishable from other species based on the following features; a crest formed by the premaxillae and nasals having a step-wise posterior end and bearing two longitudinal grooves and numerous oblique striations on each of its lateral surfaces, an extremely elongate external nares that is posteriorly situated and close to the orbit, a deep fossa on the dorsal surface of the palatal ramus of the pterygoid, several longitudinal grooves along the posterior part of the dorsal margin of the dentary, and several tubercles along the lateral shelf at the dorsal margin of the surangular. This new taxon possesses some palatal and mandibular features not seen in other oviraptorids but similar to those in more basal oviraptorosaurs, suggesting a relatively basal position for this taxon within the Oviraptoridae. This systematic hypothesis is supported by a numerical cladistic analysis. This discovery not only adds to the known diversity of Late Cretaceous oviraptorids, but provides significant new information on the evolution of some oviraptorid features.

Key words China; Late Cretaceous; Oviraptoridae, Theropoda

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1 Introduction

The oviraptorids are a theropod group in which the skull and mandible are highly modified. Oviraptorids are characterized by a short snout, the absence of teeth, a tall mandible, a long parietal, an enlarged tooth-like process on the palate, and a large, anteriorly located external mandibular fenestra (Osmólska et al., 2004). Ten oviraptorid taxa have been reported from Late Cretaceous deposits in Asia, including *Oviraptor philoceratops* from the Djadokhta Formation of Bayn Dzak, Mongolia (Osborn, 1924), *Ingenia yanshini* and *Conchoraptor gracilis* from the Barun Goyot Formation of Hermiin Tsav, Mongolia (Barsbold, 1981, 1986), *Rinchenia mongoliensis* from the Nemegt Formation of Hermiin Tsav (Barsbold, 1986, 1997; Osmólska et al., 2004), *Caiipati osmolskae* and *Khaan meckenait* from the Djadokhta Formation of Ukhaa Tolgod, Mongolia (Clark et al., 2001, 2002), *Heyuanxiao huangi* from the Dalangshan Formation of Guangdong Province, China (Lü, 2002, 2005), *Nemegtomaa barsboldi* from the Nemegt Formation of the Nemegt locality, Mongolia (Lü et al., 2004, 2005), *Shixinggial obilta* from the Pingling Formation of Shixing County, Guangdong Province, China (Lü and Zhang, 2005), and *Luoyangxia liudianensis* from the lower Upper Cretaceous “Mangchuan Formation”, Henan Province, China (Lü et al., 2009). Here we briefly describe a nearly complete skull and mandible possibly from the Upper Cretaceous Nanxiong Formation of the Hongcheng Basin near Ganzhou City, Jiangxi Province, which represents a new oviraptorid taxon. A specimen preserving an embryonic oviraptorid skeleton has been reported from the same basin (Cheng et al., 2008), but lacks informative cranial features that can be compared with our specimen.

2 Systematic paleontology

**Theropoda Marsh, 1881**

**Oviraptorosauria Barsbold, 1976**

**Oviraptoridae Barsbold, 1976**

*Banji long* gen. et sp. nov.

**Holotype** IVPP V 16896 (housed in the Institute of Vertebrate Paleontology and Paleoanthropology, Beijing), a nearly complete skull and mandible.

**Type locality and horizon** The specimen was acquired from an amateur collector who is not willing to reveal his identity. The only information concerning the provenance of the specimen provided by this collector is that the specimen was collected in the Hongcheng Basin near Ganzhou City, Jiangxi Province. The red beds exposed in the Hongcheng Basin are normally correlated with the Upper Cretaceous Nanxiong Formation (Sato et al., 2005).

**Etymology** Genus name from ‘ban’, speckle, but sometimes referring to stripes in Chinese, and ‘ji’, crest; refers to the animal’s bearing a crest with distinctive striations over the snout. The species name ‘long’ is a transliteration of the Chinese word for dragon.

**Diagnosis** An oviraptorid distinguishable from other species based on the following features: a crest formed by the premaxillae and nasals having a step-wise posterior end and bearing two longitudinal grooves and numerous oblique striations on each of its lateral surfaces, an extremely elongate external naris that is posteriorly situated and close to the orbit, a deep fossa on the dorsal surface of the palatal ramus of the pterygoid, several longitudinal grooves along the posterior part of the dorsal margin of the dentary, and several tubercles along the lateral shelf at the dorsal margin of the surangular.

3 Description and comparison

The specimen is small (about 65 mm in basal skull length) (Fig. 1), and the lack of ex-
Fig. 1  Photographs of the Banji long gen. et sp. nov., holotype, IVPP V 16896
Skull and mandible in left (A) and right (B) lateral views
Abbreviations; aof. antorbital fossa 隆前窝; an. angular 隆骨; cre. crest 骨脊; d. dentary 齿骨; ec. ectopterygoid 外翼骨; emf. external mandibular fenestra 外下颌孔; fp. fossa on pterygoid 翼骨上的小窝; fr. frontal 额骨; gpn. grooves on premaxilla and nasal 前颌骨和鼻骨上的沟槽; grd. grooves and ridges on dentary 齿骨上形成的沟槽和脊; gs. grooves on surangular 上隅骨上的沟槽; j. jugal 颧骨; l. lacrimal 泪骨; mxf. maxillary fenestra 上颌孔; n. nasal 鼻骨; nar. naris 鼻孔; p. parietal 顶骨; pm. premaxilla 前颌骨; po. postorbital 眶后骨; pt. pterygoid 翼骨; q. quadrate 方骨; sa. surangular 上隅骨; saf. surangular foramen 上隅骨孔; sifo. subnarial fossa 鼻下窝; sq. squamosal 鳞骨; ts. tubercles on surangular 上隅骨上的突起
pected fusions among some cranial and mandibular bones (the articular and basioccipital are separated from the surangular and exoccipital, respectively) suggests that it is probably a juvenile individual. However, the left and right nasals are fused to each other without any trace of a suture, as are the contralateral frontals, parietals, and probably dentaries. These fusions indicate that IVPP V 16896 had probably matured beyond an early juvenile ontogenetic stage.

_Banji_ has a typical oviraptorid skull profile — the skull is short and tall, with a short snout (Clark et al., 2002; Osmólska et al., 2004). The large external naris is high and posterior in position (posterior margin near the orbit), extremely elongate (long axis nearly three times length of short axis), and surrounded by several distinctive pneumatic fossae (Figs. 1, 2). The small antorbital fossa contains an anteroposteriorly narrow antorbital fenestra and a large sub-triangular maxillary fenestra (Figs. 1B; 2). As in other oviraptorids (Osmólska et al., 2004), a large infratemporal fenestra is present. The premaxillae and nasals form a crest with a stepwise posterior end. Each lateral surface of the crest bears two longitudinal grooves and numerous distinctive, oblique striations, in addition to several pneumatic fossae (Figs. 1B; 2).

![Fig. 2 A reconstruction of Banji long gen. et sp. nov. in lateral view, based on the holotype IVPP V 16896 Abbreviations; afe. antorbital fenestra; p. dentary tooth; gpn. grooves on the premaxillae and nasals; pnf. pneumatic fossae; n. maxillary fenestra; or. orbit; or. orbital fossa; pm. premaxillae; p. parietal; pm. pneumatic fossae; or. infratemporal fenestra; or. postorbital; pm. surangular fenestra; saf. subnarial fossa; s. tubercles on surangular; ts. tubercles on premaxilla.](image)

The large premaxilla borders most of the external naris, apart from the posteroventral end, and also borders the anterior and anterodorsal margins of the antorbital fossa. A large distinctive
subnarial fossa is present on the lateral surface of the premaxilla. As in other oviraptorids (Clark et al., 2002; Lu et al., 2004; Osmólska et al., 2004) (Figs. 1B; 2), the frontal is anteroposteriorly short, whereas the parietal is long (Fig. 1A). There is a shallow longitudinal groove rather than a sagittal crest along the midline of the fused parietals. The descending process of the pneumatic lacrimal has strongly convex anterior and lateral surfaces (Figs. 1A; 2). The suborbital ramus of the jugal is slender and slightly flattened mediolaterally. As in Citipati (Clark et al., 2002), it is perpendicular to the postorbital process, which is strongly upturned (Fig. 1A). The quadrato is very robust, and terminates ventrally in two large condyles separated by an oblique groove (Fig. 1A). The occiput faces posterodorsally. Both the nuchal transverse crest and the supraoccipital crest are weak. The paroccipital process is short and ventrally pendant. The palate exhibits several features intermediate in condition between basal oviraptorosaurs and other oviraptorids. The pterygoid has an anteroposteriorly long palatal ramus in comparison to other oviraptorids (Osmólska et al., 2004), amounting to about one-third of the basal skull length. There is a longitudinal trough along the dorsal surface of the palatal ramus, the lateral border of which is formed by the pterygoid-ectopterygoid bar (Fig. 1B). Other oviraptorids lack this feature, although they possess a trough along the ventral surface of the palatal ramus (Osmólska et al., 2004). A deep fossa is present on the medial wall of the dorsal trough of Banji, a feature unknown in any other oviraptorosaur (Osmólska et al., 2004) (Fig. 1B). The long ectopterygoid lies anterolaterally to the pterygoid, a condition intermediate between typical non-avian theropods and other oviraptorids (Figs. 1B; 2). The maxillary process of the ectopterygoid extends anteriorly and lacks a strong dorsal extension as in other oviraptorids (Osmólska et al., 2004). This feature is consistent with the position of the vomer, which lies at about the same level as most of the other palatal elements.

The mandible is massive, with an extremely anteriorly located mandibular fenestra, the anterior border of which even extends beyond the anteroventral corner of the dentary when the ventral edge of this bone is horizontally oriented (Figs. 1, 2). The symphyseal portion of the dentary is downturned in lateral view and U-shaped in ventral view. The dentary has a highly convex dorsal margin, in contrast to the gentler convexity seen in more basal oviraptorosaurs such as Incisivosaurus (Xu et al., 2002) and in therizinosaurs (Clark et al., 2004). In most other oviraptorids, the dentary has a concave anterodorsal margin in lateral view (Osmólska et al., 2004). A few sharp ridges and grooves are present on the posteriormost part of the dorsal margin of the dentary, and posterior to the coronoid process are several small but distinct tubercles along the lateral shelf at the dorsal margin of the surangular (Figs. 1B; 2). These features have not been reported in any other oviraptorosaur. Immediately posterior to the mandibular fenestra is a prominent, well-defined fossa, which contains several large foramina. Above the fossa is a distinct groove along the dorsal margin of the surangular (Fig. 1A). A similar groove is also known in Incisivosaurus (IVPP V 13326) and some maniraptorans, but in oviraptorids the dorsal edge of the surangular in this region is relatively narrow and rounded.

4 Discussion

Several discernible cranial features of IVPP V 16896 distinguish this specimen from other known oviraptorid taxa. At least some of these distinctive features, such as the unique morphology of the crest, the deep fossa on the dorsal surface of the pterygoid palatal ramus, and the deep groove along the dorsal margin of the surangular, are unlikely to be related to ontogeny. Consequently we erect a new taxon to reflect this unique combination of cranial morphological features, though future discoveries may demonstrate that the specimen belongs to an established taxon currently known only from postcranial material.

Banji long is clearly an oviraptorid because it shares with other oviraptorids many unique
features, such as a tall, short snout, robust toothless jaws, a long parietal, and a large, anteri- orly located external mandibular fenestra. Among known oviraptorids, several features of the palate and mandible indicate that *Banji long* is probably relatively basal. Oviraptorids have a peculiar palate unique among dinosaurs. Although *Banji long* has a palate very similar to that of other oviraptorids, several palatal features are in an intermediate condition between more basal oviraptorosaurs and typical oviraptorids. Relative to other oviraptorids, *Banji long* has a proportionally longer palatal ramus of the pterygoid, and a less anteriorly located ectopterygoid that lacks a strong dorsal extension. The vomer is also at about same horizontal level as the other palatal elements, again in contrast to other oviraptorids. *Banji long* also resembles more basal oviraptorosaurs in several mandibular features, such as the convex dorsal margin of the dentary and the presence of a groove along the dorsal margin of the surangular. It is likely that some of these features are ontogeny-related given the juvenile status of the only known *Banji long* specimen, but currently there are no available data to indicate which features this is most likely to apply to.

![Phylogenetic tree](image)

**Herrerasaurus ischigualastensis**
**Velociraptor mongoliensis**
**Archaeopteryx lithographica**
**Incisivosaurus gauthieri**
**Caudipteryx zoui**
**Avimimus portentosus**
**Chirostenotes pergracilis**
**Gigantoraptor erlianensis**
**Banji long**
**Nemegtosaurus barsboldi**
**Citipati osmolskae**
**Rinchenia mongoliensis**
**Ingenia yanshini**
**Conchoraptor gracilis**
**Khaan mckennai**

Fig. 3 A phylogeny of oviraptorosaurs showing the systematic position of *Banji long* gen. et sp. nov. The analysis resulted in 2 most parsimonious trees, each with a length of 299 steps (CI = 0.64 and RI = 0.70); values above nodes represent bootstrap proportions (%); values beneath nodes represent Bremer support, and values of +1 or less are not shown.

In order to confirm this phylogenetic hypothesis, we further investigated the systematic position of *Banji long* using a dataset (Appendix 1) revised from a recently published one (Xu et al., 2007, which was in turn based on the analysis by Osmólska et al., 2004). Because ontogenetic variation is poorly understood in oviraptorids, we tentatively scored all features visible in IVPP V 16896. However, it is possible that some of these scorings were influenced by ontogeny and thus had a spurious effect on the results of the analysis. The data matrix was analyzed using the NONA (ver 2.0) software package (Goloboff, 1993), and formatting and character exploration were performed in WinClada (Nixon, 1999). The analysis protocol consisted of 1000 Tree Bisection and Regrafting tree searches followed by branch swapping. Settings included collapsing unsupported branches and counting all states in polymorphic codings. Other settings, including character ordering, follow Osmólska et al. (2004). The analysis resulted in 2 most parsimonious trees, the strict consensus of which is shown in Fig. 3. The relatively basal posi-
tion of Banjí long is confirmed by our analysis, which shows that Banjí long is the most basal oviraptorid apart from Gigantoraptor.

As a relatively basal oviraptorid from the Late Cretaceous of southern China, Banjí long represents an important addition to the known diversity of Late Cretaceous oviraptorids. Its discovery provides significant new information concerning the morphological evolution of the group and demonstrates the evolutionary sequence of some important oviraptorid features. A more detailed morphological description, accompanied by a discussion of the possible implications for understanding oviraptorid ontogeny (Norell et al., 2001), will be presented elsewhere.

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Appendix 1
1. Modified and newly added characters;
Character 61 of Osmólska et al., 2004:
Ectopterygoid position; lateral to (0), anterolateral to (1), or anterior to the pterygoid (2).
Character 162 (newly added). Surangular, distinct groove on dorsal surface; present (0) or absent (1).
Character 163 (newly added). Vomer, position; level with (0) or ventral to (1) other palatal elements.
2. Character scorings for Banji long gen. et sp. nov. based on IVPP V 16896 and Nemegtomaia barsboldi

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