

# 云南中三叠世豆齿龙类 (爬行纲:楯齿龙目)一新属<sup>1)</sup>

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**摘要:**中国已知的楯齿龙目(Placodontia)化石仅见于贵州省西南部地区,其中豆齿龙亚目(Cyamodontoidea)产自关岭地区的法郎组瓦窑段,时代为晚三叠世卡尼期;楯齿龙亚目(Placodontia)产自盘县的关岭组II段,时代为中三叠世安尼期。本文记述的豆齿龙类新属种——康氏雕甲龟龙(*Glyphoderma kangi* gen. et sp. nov.)产于云南富源的法郎组竹杆坡段,属中三叠世拉丁期。

正型标本保存于浙江自然博物馆(编号:M 8729),其头骨高度愈合,代表一个完全成年之个体,根据以下特征明显区别于我国的*Psephochelys*和欧洲的*Psephoderma*: 1) 头骨枕部具3枚大型的锥状鳞; 2) 背甲甲片结构更为复杂,具明显的放射状沟/脊结构。到目前为止,康氏雕甲龟龙是龟龙科(Placochelyidae)中惟一的中三叠世属种,该科的其他成员全部发现于上三叠统。

**关键词:**云南富源,拉丁期,法郎组竹杆坡段,楯齿龙

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## A NEW ARMORED PLACODONT FROM THE MIDDLE TRIASSIC OF YUNNAN PROVINCE, SOUTHWESTERN CHINA

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**Abstract** A new cyamodontoid placodont, *Glyphoderma kangi* gen. et sp. nov., is established on the basis of an articulated skeleton from the Middle Triassic Zhuganpo Member of the Falang Formation, Yunnan, southwestern China. It differs from the geologically younger *Psephochelys polyosteoderma* (early Late

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Triassic) in having a more complicated carapace osteoderm structure, and 3 enlarged tubercular osteoderms fused to the posterior surface of the skull. *Glyphoderma* is the only Ladinian member of the family Placochelyidae, all other placochelyids being Late Triassic. Placodonts, including both armored and non-armored forms are distributed from the Anisian to the Carnian in China.

**Key words** Fuyuan, Yunnan; Ladinian; Zhuganpo Member of Falang Formation; cyamodontoid placodont

## 1 Introduction

Placodontia, the sister-group of all other sauropterygians (Rieppel, 2000) was believed to be restricted to the marine Triassic of the western Tethyan faunal province before being reported from Guizhou Province, southwestern China (Li, 2000; Li and Rieppel, 2002). The Chinese placodont record was limited to two taxa from the Carnian Wayao Member of the Falang Formation in Guizhou, *Sinocyamodus xinpuensis* Li, 2000 and *Psephochelys polyosteoderma* Li & Rieppel, 2002. Both genera are referable to the armored placodonts, Cyamodontoidea. Besides, some undescribed specimens that probably represent the non-armored genus *Placodus* sp. (materials kept in the Institute of Vertebrate Paleontology and Paleoanthropology) were known from the Anisian. Most recently, along with pistosauroids (Cheng et al., 2006) and protorosaurids (Li et al., 2007a, b), a new cyamodontoid placodont was excavated from the Ladinian limestone in Yunnan Province (adjacent to Guizhou). The fossil is preserved in a thick slab and only the dorsal aspect of the specimen could be readily prepared. The dorsal aspect is described here, and a further report dealing with the ventral aspect of the specimen will be published following more extensive preparation.

## 2 Systematic paleontology

### Order Placodontia Cope, 1871

#### Suborder Cyamodontoidea Nopcsa, 1923

#### Family Placochelyidae Romer, 1956

#### *Glyphoderma* gen. nov.

**Type and only species** *Glyphoderma kangi* gen. et sp. nov.

**Etymology** From Greek *Glyph*, sculpture, and *derma*, cutis. The genus name refers to the unique, delicately sculpted structure of the osteoderms that form the carapace.

**Diagnosis** As that of the type and only species.

#### *Glyphoderma kangi* gen. et sp. nov.

**Etymology** The species name is in honor of Mr. Kang Ximin, the director of the Zhejiang Museum of Natural History, China, for his contribution to the collection and conservation of Chinese marine reptile fossils.

**Holotype** ZMNH (Zhejiang Museum of Natural History) M 8729, a nearly complete skeleton.

**Locality and horizon** Fuyuan, Yunnan Province, southwestern China; Zhuganpo Member of the Falang Formation, Ladinian epoch of the Middle Triassic.

**Diagnosis** Elongated and narrow rostrum spatulate, edentulous; carapace comprises more than 400 osteoderms. Osteoderms hexagonal or pentagonal in shape, each with a convex surface ornamented by radial ridges (or grooves) and small pits; carapace with a central longitudinal depression and a vaulted zone on either side of it. Nuchal (anterior) concavity moderately excavated. Small tuberculiform osteoderms exist at the nuchal excavation of the carapace.

**Description and comparison** The specimen described here is a nearly complete and articulate skeleton (Fig. 1) with the total length of 873 mm. The measurements of the different parts of the specimen see Table 1.

**Table 1** Measurements of *Glyphoderma kangi* gen. et sp. nov. (ZMNH M 8729, holotype) (mm)

length of the skull	110.62
width of the skull	83.68
length of the orbit	25.88
length of the temporal fossa	37.33
length of the carapace	242.80
width of the carapace	262.00
length of the humerus	65.68
length of the ulna	39.51
length of the radius	40.83
length of the femur	59.00
length of the fibula	47.49
length of the tibia	49.45

As in *Psephochelys*, the skull has the outline of an isosceles triangle in dorsal view, with an elongate narrow rostrum and a deeply excavated occiput (Fig. 2). Three enlarged tubercular osteoderms on each side are fused to the posterior edge of the temporal arch, compared to the one fused osteoderm per side in *Psephochelys*. The suture between the maxilla and the jugal is located below the posterior third of the orbit. The posterior process of the premaxilla extends backward only to the posterior margin of the nares, while in *Placochelys*, this process reaches the anterior border of the orbit. Most of the other bones of the cranium are fused completely without any visible sutures. Two blunt teeth can be observed in the posterior part of the lower jaw, but the anterior narrow part of the dentary is edentulous as in other placochelyids.

The shape of the carapace is similar to that of *Psephochelys*. The carapaces of both taxa have a rounded contour, interrupted only by an anterior nuchal excavation and a biconcave posterior margin (Fig. 3). However, the nuchal excavation of *Glyphoderma* is less concave and much more open than that of *Psephochelys*. The carapace of *Glyphoderma* is formed by more than 400 hexagonal and pentagonal osteoderms tightly sutured with each other, but the contacts among the osteoderms are not as firm as those in *Psephochelys*, in which the carapace is a solid structure with the osteoderms fused completely. At the periphery of the carapace of *Glyphoderma*, the osteoderms (also including those from the lateral wall) are isolated from one another and have evidently shifted from their original positions. At the lateral margins of the nuchal excavation of the carapace, there are two slightly enlarged osteoderms, but they are less obvious



Fig. 1 *Glyphoderma kangi* gen. et sp. nov. (ZMNH M 8729, holotype), scale bar = 10 cm

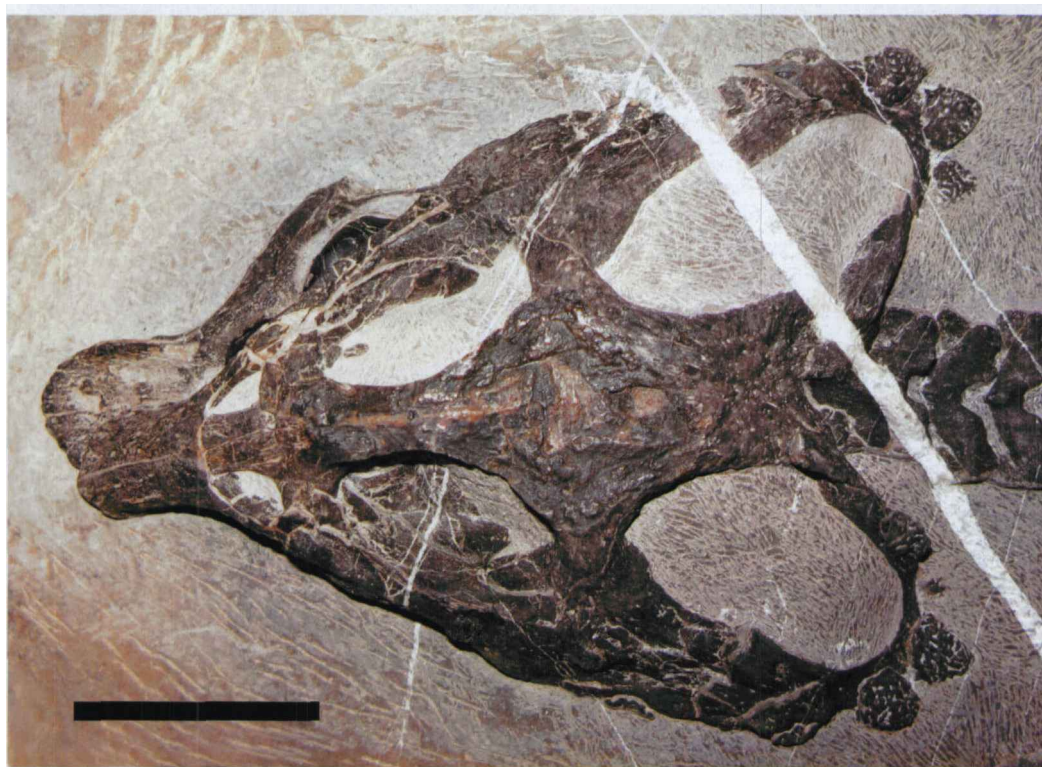


Fig. 2 Skull of *Glyphoderma kangi* gen. et sp. nov. (ZMNH M 8729, holotype) in dorsal view  
scale bar = 3 cm



Fig. 3 Capital comparison between the carapace of *Glyphoderma kangi* gen. et sp. nov. (left, ZMNH M 8729, holotype) and that of *Psephochelys polyosteoderma* (right, IVPP V 12442)  
The arrow shows the two enlarged (tuberculiform in *Psephochelys*) osteoderms that flank the nuchal excavation in each taxon; scale bars = 10 cm

than in *Psephochelys*. As in *Psephochelys*, the dorsal surface of the carapace is moderately convex with a shallow longitudinal groove along the midline. The structure of the osteoderms clearly

differs from that of *Psephochelys*, in which most of the osteoderms are smooth and only the two enlarged osteoderms planking the nuchal excavation are tuberculiform. All of the osteoderms in the carapace of *Glyphoderma* are convex and ornamented with radial ridges (or deep grooves) and tiny pits. This exquisite carapace structure also allows *Glyphoderma* to be easily distinguished from other taxa. In all types of carapace structure of cyamodontoid placodonts mentioned by Rieppel (2002), *Psephoderma* has the most similar characters including the size and the shape to our new material, but the ridges and the grooves on the osteoderms of *Glyphoderma* is clearly much deeper.

Excluding the atlas, there are five or six cervical vertebrae. They are short and wide, with very low neural spines. Only one dorsal vertebra, with a short rib, can be observed. As in *Sinocyamodus*, there are four sacral vertebrae in *Glyphoderma*. The pleurapophyses are expanded distally and overlap each other, enclosing a foramen between each adjacent pair. 34 caudal vertebrae, including four impressions, are preserved. Elongate transverse process exists on the three anteriormost caudals.

The pectoral girdle is mostly covered by the carapace, with only the distal end of the scapula exposed. The humeri are well preserved outside the carapace and fully exposed in dorsal view. The distal end of each humerus is greatly expanded. A flat triangular depression is visible on the dorsal surface of the distal end, and an open ectepicondylar groove exists at the anterior margin. The ulna and the radius are almost equal in length, but the radius is much more robust. Both the distal and proximal ends of the radius have a flat depression on their dorsal surfaces. The carpus comprises five ossifications. The other parts of the manus in M 8729 are incompletely preserved.

The femur is greatly expanded at both ends, with a relatively short shaft. The lateral surface of the tibia is deeply concave while the medial one is relatively straight. Thus the space between the tibia and the fibula is especially large compared with other Triassic sauropterygians. There are six ossified tarsals, all of which seem to be preserved in their natural positions. The large semilunar calcaneum and plate-shaped astragalus are located proximally and form an articular depression for the distal end of the tibia. The other four distal tarsals abutted to metatarsal I to IV. As in the manus, the phalangeal formula of the pes is difficult to determine because of the poor preservation. The last phalanx of each digit is nail-shaped.

Although only a few detailed cranial structures can be distinguished in *Glyphoderma kangi*, the obvious elongated rostrum and the edentulous anterior tip of dentary in M 8729 is quite similar to that of *Placochelys* and *Psephoderma*, indicating that *Glyphoderma* belongs to Placochelyiidae Romer, 1956. Thus, *Glyphoderma* is the only Middle Triassic member of this group, all other members of which are known from the Late Triassic (Rieppel, 2002 and see discussion below). *Glyphoderma* differs from other placochelyiids mostly in its unique osteoderm structure in which delicate grooves or ridges radiate from the center of the convex surface of each osteoderm. A notable taphonomic difference between placodont fossils from western and eastern Tethyan faunal provinces is that numerous isolated teeth and armor fragments are known from the former, while in China nearly all of the known specimens are complete skeletons.

### 3 Discussion

**Chinese placodonts** Placodonts had been never recorded outside the western Tethyan fauna province before being found in Guizhou, southwestern China (Li, 2000). The known Chinese placodonts include both armored (Cyamodontoidea) and non-armored (Placodontoidea) taxa, ranging stratigraphically from the Anisian to the Carnian (Fig. 4). During the field season of 2005, a three-dimensional preserved skull was excavated from the Anisian limestone (Member II of the Guanling Formation) of Panxian, Guizhou Province. This specimen has been provisionally identified as a full adult of *Placodus* sp., and is still being prepared in

the IVPP (V 14996). *Glyphoderma* was collected in the Zhuganpo Member of the Falang Formation in Fuyuan, Yunnan Province. The age of this horizon has long been controversial (see the brief introduction below), but the vertebrate fauna suggests that it is Ladinian (Li et al., 2002; Li, 2007a,b). *Sinocyamodus* and *Psephochelys* are known from the Carnian (the Wayao Member of the Falang Formation) of Guanling, Guizhou Province. *Sinocyamodus* initially seemed to represent a juvenile cyamodontoid (Li et al., 2002), but so far all known specimens of this taxon are of a similar size. *Psephochelys* shows a unique combination of characters observed in *Psephoderma* and *Placochelys*, and the distinctive cranial pattern needs to be confirmed by additional materials. Yin et al. (2000) tentatively erected a new species "*Placochelys ? minutes*" from the same locality and horizon. However, the specimen was a private collection and was poorly preserved, so this taxon is a *nomen dubium*.

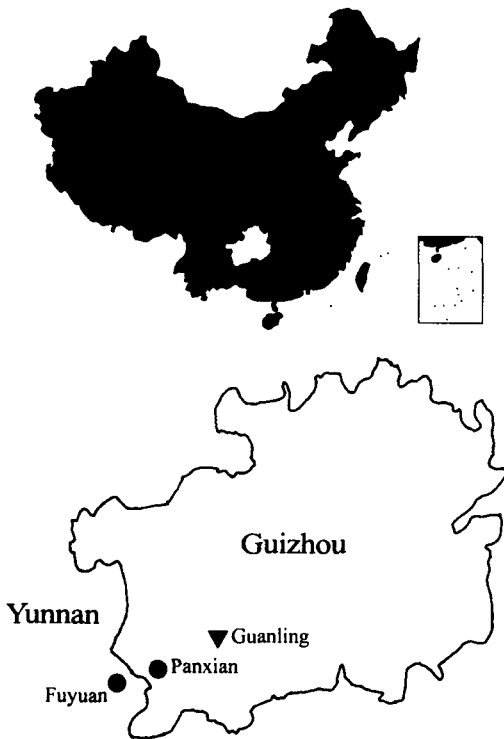


Fig. 4 The geographical and geological distribution of placodonts in China

- the Middle Triassic locality;
- ▼ the Upper Triassic locality

*saurus* (Li et al., 2002), *Tanystropheus* (Li, 2007a) and the askeptosaurid *Anshunsaurus* (Rieppel et al., 2006). A large undescribed ichthyosaur is also known. The locality in Yunnan Province where *Glyphoderma kangi* was collected has yielded not only marine reptiles such as pistosaurid *Yunguisaurus* (Cheng et al., 2006) and all of the taxa mentioned above, but also the terrestrial protorosaurid *Macrocnemus* (Li, 2007b). Thus the Xingyi Fauna clearly shows faunal affinities with both the western Tethyan and the eastern Pacific, although the correspondences to the former are stronger.

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#### The Ladinian marine reptilian fauna of China

The Zhuganpo Member of the Falang Formation has yielded abundant Triassic marine reptile fossils since the middle of the last century (Young, 1958). Although conodont data strongly suggests the fossil bearing horizon is Carnian in age (Wang et al., 1998; Chen and Wang, 2002), the vertebrate fauna here corresponds closely to the Middle Triassic (Ladinian) marine biota in the western Tethyan fauna province. *Glyphoderma* is the only exception to this horizontal correspondence so far, for all other placochelyids were known from the Upper Triassic. The Zhuganpo Member is broadly distributed in the boundary region between Guizhou and Yunnan provinces, southwestern China. The vertebrate paleofauna of this area is traditionally called the "Xingyi Fauna" after the largest city in the vicinity. Till recently the marine reptile fossils were exclusively found on the Guizhou side, and before 2000, the pachypleurosaurid *Keichousaurus hui* was the only valid taxa recorded from this area. Other marine reptile fossils recently described from the Zhuganpo Member of Guizhou include *Nothosaurus* (Li and Rieppel, 2004), *Lario-*

## References

- Chen L D (陈立德), Wang C Y (王成源), 2002. Triassic conodonts from Zhuganpo and "Wayao" formations of Guanling, southwest China. *Acta Palaeont Sin (古生物学报)*, **41**(3): 349–360 (in Chinese with English summary)
- Cheng Y N, Sato T, Wu X C et al., 2006. First complete pistosauroid from the Triassic of China. *J Vert Paleont*, **26**(2): 501–504
- Li C (李淳), 2000. Placodont (Reptilia: Placodontia) from Upper Triassic of Guizhou, southwest China. *Vert Palasiat (古脊椎动物学报)*, **38**(4): 314–317 (in Chinese with English summary)
- Li C (李淳), 2007a. A juvenile *Tanystropheus* sp. (Protosauria: Tanystropheidae) from the Middle Triassic of Guizhou, China. *Vert Palasiat (古脊椎动物学报)*, **45**(1): 37–42 (in Chinese with English summary)
- Li C, 2007b. A new species of *Macrocnemus* (Reptilia: Protosauria) from the Middle Triassic of southwestern China and its palaeogeographical implication. *Sci China, Ser D*, **50**(11): 1601–1605
- Li C, Rieppel O, 2002. A new cyamodontoid placodont from Triassic of Guizhou, China. *Chinese Sci Bull*, **47**(5): 403–407
- Li J L (李锦玲), Liu J (刘俊), Rieppel O, 2002. A new species of *Lariosaurus* (Sauropterygia: Nothosauridae) from Triassic of Guizhou, southwest China. *Vert Palasiat (古脊椎动物学报)*, **40**(2): 114–126 (in Chinese with English summary)
- Li J L (李锦玲), Rieppel O, 2004. A new nothosaur from Middle Triassic of Guizhou, China. *Vert Palasiat (古脊椎动物学报)*, **42**(1): 1–12 (in Chinese and English)
- Rieppel O, 2000. Sauropterygia I. In: Wellnhofer P ed. *Encyclopedia Paleoherpology*, part 12A. München: Verlag Dr. Friedrich Pfeil. 1–134
- Rieppel O, 2002. The dermal armor of the cyamodontoid placodonts (Reptilia: Sauropterygia): morphology and systematic value. *Fieldiana Geol, New Ser*, **46**: 1–41
- Rieppel O, Liu J (刘俊), Li C (李淳), 2006. A new species of the thalattosaur genus *Anshunsaurus* (Reptilia: Thalattosauria) from the Middle Triassic of Guizhou Province, southwestern China. *Vert Palasiat (古脊椎动物学报)*, **44**(4): 285–296
- Wang C Y (王成源), Kang P Q (康沛泉), Wang Z H (王志浩), 1998. Conodont-based age of the *Kueichousaurus hui* Young, 1958. *Acta Micropalaeont Sin (微体古生物学报)*, **15**(2): 196–198 (in Chinese with English abstract)
- Yin G Z (尹恭正), Zhou X G (周修高), Cao Z T (曹泽田) et al., 2000. A preliminary study on the early Late Triassic marine reptiles from Guanling, Guizhou, China. *Geol Geochem (地质地球化学)*, **28**(3): 1–23 (in Chinese with English abstract)
- Young C C, 1958. On the new *Pachypleurosauroidea* from Keichow, southwest China. *Vert Palasiat (古脊椎动物学报)*, **2**(2–3): 69–81