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New eggysodontid (Mammalia, Perissodactyla) material from the Paleogene of the Guangnan Basin, Yunnan Province, China

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Key words Guangnan, Yunnan; Eocene; Yanshan Formation; Eggysodontidae; biostratigraphy

Summary

Rhinocerotoid fossils are relatively abundant in Paleogene deposits in South China. Many previous studies have investigated Paleogene rhinocerotoids from Yunnan Province (Russell and Zhai, 1987; Zong et al., 1996). Zhang (1981) briefly reported some fossils from Xiaoguangnan Village, Guangnan, Yunnan Province, within the Guangnan Basin. Recently, a new specimen comprising a fragmentary left mandible was recovered from the Paleogene of Xiaoguangnan. The new fossil is referable to the rhinocerotoid clade Eggysodontidae. Mainly based on its less molarized p3-p4, the new specimen is regarded as intermediate between the primitive Late Eocene taxon *Proeggysodon* and the derived Oligocene genera *Eggysodon* and *Allacerops*. Here we describe the new specimen and discuss the age of the Yanshan Formation. Terminology used to describe dental features follows Qiu and Wang (2007).

Order Perissodactyla Owen, 1758

Superfamily Rhinocerotoidea Gray, 1825

Family Eggysodontidae Breuning, 1923

***Guangnanodon* gen. nov.**

Type species *Guangnanodon youngi* gen. et sp. nov.

Included species Only the type species.

Diagnosis Same as for the type species.

Etymology From “Guangnan”, where the fossil site is located.

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Guangnanodon youngi gen. et sp. nov.

(Fig. 1)

Holotype GNV-001, fragmentary left mandible with p3-m3, housed in Nationalities Museum of Guangnan County.

Type locality and horizon Xiaoguangnan Village, Liancheng Town, Guangnan County, Yunnan Province, China; Yanshan Formation.

Etymology The specific name honors Prof. Yang Zhongjian (C. C. Young), the founder of vertebrate paleontology in China, who initiated the studies of Paleogene stratigraphy of Yunnan Province.

Diagnosis Small eggysodontid. Moderately molarized lower premolars with weak entoconids and relatively complete entolophids on p3-p4; hypolophids slightly anterolingually oblique on p4 and m2; trigonid of m3 nearly as V-shaped as that of m2. Cingulids distinct at anterior and posterior bases of m1-m3. Buccal cingulids weak and continuous on p3, but interrupted at bases of protoconids and hypoconids of p4-m3; lingual cingulids interrupted at bases of metaconids of p3-p4, and only present in valley between metaconid and entoconid on m1-m3.

Description The fragmentary left mandible belonged to an old individual, and retains p3-m3. The left mental foramen is situated below the anterior end of p3. The length of the lower molar series is 85.5 mm. Measurements of the cheek teeth are given in Table 1.

The p3 is trapezoidal in occlusal outline, widening posteriorly. The trigonid is elongated, having a conical paraconid and a short paralophid that is fused with the anterior cingulids. The protolophid extends anterolingually, forming an obtuse angle (about 100°) with the posterolingually oblique metalophid. The talonid is shorter and wider than the trigonid. The entoconid is low and small. The entolophid tapers lingually and joins the hypolophid at nearly a right angle. The buccal cingulid is weak but continuous. The lingual cingulid surrounds the trigonid and talonid but is interrupted at the base of the metaconid.

The p4 has a rounded rectangular outline in crown view. This tooth differs from p3 in being larger, and in having a longer paralophid, a more distinct hypoconid and entolophid, and an acute angle (about 75°) between the protolophid and metalophid. The hypolophid extends anterolingually, at the highest level in all teeth, and contacts the metalophid at a point about one third of the way from the buccal end of the metalophid to the lingual end. The cingulids are similar to those of p3, but the buccal cingulids are interrupted at the bases of the protoconid and the hypoconid.

The m1 is heavily worn, and its anterobuccal part is damaged. It is similar to p4 in morphology, but differs from p3-p4 in having a more strongly developed entoconid and entolophid, a transversely aligned metalophid and entolophid, and a weak lingual cingulid that is only present in the valleys of the talonid.

The m2 is larger than m1. The paralophid is short, and its lingual part is slightly damaged. The protolophid extends anterolingually from the protoconid to the midpoint of the anterior border of the tooth. The metalophid extends anterorbuccally and forms an acute angle (ca. 70°) with the protolophid. The hypolophid contacts the metalophid at a point about one quarter of the way from the buccal end of the metalophid to the lingual end. The cingulids are similar to those of m1.

The m3 is slightly longer than m2. The trigonid is very morphologically similar to that of m2. The tooth has a high paralophid and a deep valley. In the trigonid, the protolophid and metalophid form an angle that is only slightly acute (about 80°). The anterior end of the hypolophid reaches the metalophid, and the point of contact is low on the latter structure.

Comparison and discussion GNV-001 resembles previous described eggysodontids in having an anterolingually oblique protolophid, an acute angle (about 70°–80°) between the protolophid and the metalophid, a nearly V-shaped trigonid, the anteriorly subdued hypolophid contacting the metalophid at a low point on m3, and buccal cingulids that are interrupted at the bases of the protoconids and the hypoconids on the lower molars. These morphological features indicate that GNV-001 is referable to Eggysodontidae, which contains three previously described genera: *Proeggysodon*, *Eggysodon* and *Allacerops* (Bai and Wang, 2012).

Some intergeneric differences are known between *Eggysodon* and *Allacerops*. Four morphological differences have been postulated to distinguish *Eggysodon* from *Allacerops*: 1) *Allacerops* has three pairs of lower incisors while *Eggysodon* had two; 2) p1 is present in *Allacerops* but absent in *Eggysodon*; 3) the lower cheek teeth of *Eggysodon* are labiolingually narrower than those of *Allacerops*; 4) the lower cheek teeth have pronounced and continuous buccal cingulids in *Eggysodon*, but rarely in *Allacerops*. The first two purported differences were proposed by Reshetov et al. (1993), and the last two were added by Qiu and Wang (1999).

However, intrageneric variations affect all four suggested points of morphological difference between *Eggysodon* and *Allacerops*, and make the two genera less readily distinguishable from each other. Regarding the first point, Borsuk-Bialynicka (1968) erected *Allacerops minor*, which differs from the previously described species *A. turgaica* in having only two pairs of lower incisors. Furthermore, Antoine et al. (2011) reported that *E. gaudryi* from Moissac, southwest France, had three pairs of lower incisors. The fact that p1 is present in some *Eggysodon* specimens weakens the second point (de Bonis and Brunet, 1995). Data from *A. turgaica* specimens from Tort-Mola and Chelkar-Tenis (Reshetov et al., 1993) show the width/length ratios of the lower cheek teeth are more variable in *Allacerops* than in *Eggysodon* (Fig. 2). Regarding the last point, the buccal cingulids of the lower cheek teeth of *Eggysodon osborni* may be either weak and discontinuous (Uhlig, 1999), or distinct (de Bonis and Brunet, 1995), while in *Allacerops turgaica* the lower premolars have well developed buccal cingulids and the lower molars have moderately developed ones (Reshetov et al., 1993). However, all above variations happen only in a few cases and are probably at the intrageneric level. Here we consider both genera valid, and compare them separately with GNV-001.

The European Oligocene genus *Eggysodon* includes four species: *E. osborni*, *E. gaudryi*, *E. rechenaui* and *E. pomeli*. *Eggysodon* is more derived than GNV-001 in having more strongly developed entoconids and complete entolophids on p3-p4. In addition, the trigonid of m3 is V-shaped in GNV-001, resembling the trigonid of m2, but U-shaped in *Eggysodon*. Of the four species of *Eggysodon*, GNV-001 is most similar to *E. osborni*, resembling this species in size and in the presence of short paralophids and discontinuous buccal cingulids. However, *E. osborni* differs from GNV-001 in sharing the derived features of p3-p4 that are characteristic of *Eggysodon*. GNV-001 differs from *E. gaudryi* in being smaller and in having weaker, discontinuous buccal cingulids, shorter paralophids and V-shaped trigonids on m2-m3. *E. rechenaui* differs from GNV-001 in having remarkably long paralophids. Although the lower cheek teeth of *E. pomeli* are unknown, GNV-001 is markedly smaller than this species, which is the largest species of the genus *Eggysodon*. These comparisons suggest that GNV-001 represents an eggysodontid that is more primitive than the Oligocene *Eggysodon*.

Previously known Asian eggysodontids include the late Eocene *Proeggysodon* and the Oligocene *Allacerops*. GNV-001 is more derived than *Proeggysodon* in being larger and in having more extensively molarized lower premolars with relatively complete entolophids on p3-p4. In addition, GNV-001 can be readily distinguished from *Proeggysodon* based on the presence in m2-m3 of shorter paralophids, protolophids extending further lingually, more oblique entolophids, and distinct buccal cingulids at bases of the trigonids. *Allacerops* includes *A. turgaica* and *A. minor*. The lower cheek teeth of *Allacerops* are morphologically rather similar to those of *Eggysodon*, and p3-p4 appear more primitive in GNV-001 than in *Allacerops*. GNV-001 differs from a specimen of *A. turgaica* from Tort-Mola (Reshetov et al., 1993) in being smaller, in having shorter talonids on p3-p4, and in that m2 and m3 are subequal in size. GNV-001 differs from *A. minor* in being smaller, in having hypolophids that extend further lingually on p4 and m2, and in having more distinct buccal cingulids.

The lower molars of GNV-001 are evidently characteristic of Eggysodontidae in their overall morphology. However, GNV-001 differs from all three reliably established genera in the family in having moderately molarized lower premolars (p3-p4). GNV-001 appears to be an eggysodontid of intermediate evolutionary grade, more derived than *Proeggysodon* and more primitive than *Eggysodon* and *Allacerops*. Therefore, we erect a new genus and species (*Guangnanodon youngi* gen. et sp. nov.) for GNV-001.

The age of *Guangnanodon* and the Yanshan Formation The moderately molarized lower premolars of *Guangnanodon* suggest that this taxon is probably intermediate in age between *Proeggysodon* on the one hand and *Eggysodon* and *Allacerops* on the other. In Asia, *Proeggysodon* was unearthed in Upper Eocene sediments (Bai and Wang, 2012), while *Allacerops* is from the Lower Oligocene (Daxner-Höck et al., 2010). The oldest specimens of *Eggysodon* are from the lowermost Oligocene (MP1) of Europe (Uhlig, 1999). Accordingly, *Guangnanodon* is probably latest Eocene in age, although more evidence will be needed to confirm this.

Zhang (1981) mentioned several fossils from the Yanshan Formation of the Guangnan Basin, *Urtinotherium* cf. *U. intermedium* unearthed from Lianfeng, and *Prohyracodon* sp. and

Caenolophus sp. unearthed from Xiaoguangnan Village. The bed containing *Urtinotherium* cf. *U. intermedium* probably correlates with a level within the Middle to Upper Eocene Caijiachong Formation, which yielded the *Urtinotherium intermedium* (= *Indricotherium intermedium*) material described by Chiu (1962)(Tong et al., 1995; Wang, 1997; Qiu and Wang, 2007). *Prohyracodon* is one of the diagnostic taxa of the Middle Eocene Sharamurunian Land Mammal Age (Tong et al., 1995), while the type of *Caenolophus* is from the Shara Murun Formation of North China (Radinsky, 1967). GNV-001 is probably latest Eocene in age, making it younger than the other specimens from the Guangnan Basin. Accordingly, the Yanshan Formation, at least, contains sediments of ages that range from late middle Eocene to latest Eocene.

云南广南古近纪紧齿犀类新材料

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摘要：记述了云南广南盆地古近纪砚山组紧齿犀科(Eggysodontidae)一新属种：杨氏广南犀*Guangnanodon youngi* gen. et sp. nov., 标本为一破损的带p3-m3的左下颌骨。新属种的特征为下前臼齿的臼齿化程度低，p3-p4的下内脊弱，向内收缩呈尖叶状，p4和m2的下次脊略偏向内侧倾斜，m3的下跟座与m2的相近，接近V形，p4-m3外齿带在下原尖和下次尖基部消失。这些特征表明广南犀明显比晚始新世的*Proeggysodon*进步，而比渐新世的其他紧齿犀类原始，其时代很可能为晚始新世最晚期。新标本的发现结合以前报道过的哺乳动物化石材料表明，广南盆地砚山组包含了中始新世晚期至晚始新世晚期的沉积。

关键词：云南广南，始新世，砚山组，紧齿犀科，地层时代

中图法分类号：Q915.877 **文献标识码**：A **文章编号**：1000-3118(2013)04-0305-16

1 研究历史

犀类是古近纪陆生哺乳动物中较为繁盛的一个类群，在中国南方古近系中有不少化石记录。自20世纪50年代起，以周明镇先生为代表的古生物学家对云南古近纪哺乳动物化石的研究取得了较为丰富的成果。研究区域以滇东地区(石林和曲靖等地)为主，还包括横断山区的丽江等地。

石林(原名路南)地区是云南古近纪哺乳动物化石发现较多、研究程度较高的地区之

一，犀类化石丰富，其中两栖犀类的属种相对较多，还包括貘犀类、蹄齿犀类、巨犀类以及柯氏犀类。化石主要产自中始新世路美邑组，已经发表的奇蹄类属种包括：两栖犀类*Caenolophus medius*, *Caenolophus* sp., *Amynodon lunanensis*, *A. altidens*, cf. *Paramynodon* sp., *Teilhardia pretiosa*, ?*Teilhardia* sp., ?*Paracadurcodon* sp. (Chow, 1957; 周明镇等，1964; 徐余瑄，1966; 郑家坚等，1978; Russell and Zhai, 1987); 貘犀类*Hyrachyus lunanensis*, *H. minor* (黄学诗、齐陶，1982); 蹄齿犀类(当时归入真犀类) *Prohyracodon meridionale*, *P. progressa*, *Ilianodon lunanensis* (周明镇、徐余瑄，1961); 巨犀类*Juxia* sp., *Urtinotherium parvum* (= *Indricotherium parvum*)(周明镇，1958; 徐余瑄、邱占祥，1962; 郑家坚等，1978); 柯氏犀类*Forstercooperia shiwopuensis* (周明镇等，1974)。晚始新世小屯组产奇蹄类化石Hyracodontidae indet., cf. *Gigantamynodon giganteus* (Russell and Zhai, 1987)。曲靖地区古近纪哺乳动物化石也较丰富，犀类化石包括：*Urtinotherium intermedium*, *U. parvum*, *Cadurcodon ardynensis*, *Cadurcodon* sp., *Gigantamynodon* sp., *G. giganteus*, cf. *Metamynodon* sp., Amynodontidae indet.以及*Prohyracodon* sp. (徐余瑄，1961; 邱占祥，1962; 汤英俊，1978; 张玉萍等，1978; 郑家坚等，1978; 王伴月、张玉萍，1983; Russell and Zhai, 1987)。在滇西北丽江盆地和格木寺盆地，发现的古近纪犀类化石有*Sianodon* sp., Amynodontidae gen. et sp. indet., *Prohyracodon major*, *P. meridionale*, *Caenolophus proficiens*, *Lijiangia zhangi* (宗冠福等，1996)。此外，张兴永(1981)以消息的形式记录了广南地区古近纪的犀类化石，包括：*Urtinotherium* cf. *U. intermedium* (= *Indricotherium* cf. *I. intermedium*), *Prohyracodon* sp., *Caenolophus* sp.。丰富的化石记录为云南地区的古近纪生物地层研究提供了较好的材料基础。

20世纪80年代在云南广南县小广南古近纪地层(砚山组)中发现了一段不完整的紧齿犀类下颌，现收藏于云南省广南县博物馆。这是在广南盆地发现的为数不多的哺乳动物化石之一，同时也是中国南方首次发现的紧齿犀类材料。本文对该标本进行描记报道，犀超科的分类以及牙齿描述所用术语依邱占祥、王伴月(2007)。

2 系统古生物学

奇蹄目 Perissodactyla Owen, 1758

犀超科 Rhinocerotoidea Gray, 1825

紧齿犀科 Eggysodontidae Breuning, 1923

广南犀(新属) *Guangnanodon* gen. nov.

属型种 杨氏广南犀(*Guangnanodon youngi* gen. et sp. nov.)。

包括种 仅属型种。

特征 同属型种的特征。

属名来源 属名源自化石发现地点所在县——广南(Guangnan)。

杨氏广南犀(新属新种) *Guangnanodon youngi* gen. et sp. nov.

(图1)

正型标本 左下颌具p3-m3, m1的颊侧前端部分破损，冠面磨蚀严重。云南省广南

县博物馆标本编号：GNV-001。

产地及时代 云南广南县莲城镇小广南村，砚山组。

特征 小型紧齿犀类。下前臼齿臼齿化程度低，p3-p4的下内尖低于下次尖，二者连成弱的下内脊；p4和m2的下次脊向前内侧延伸；m3下三角座与m2的相近，接近V形。齿带中等发育，前、后侧齿带明显，p3的外齿带弱而连续；p4-m3的外齿带在下原尖和下次尖基部消失；p3-p4内齿带在下后尖基部消失，下臼齿内齿带仅在下跟座开口处有微弱分布。

种名来源 种本名献给最早开展云南古近纪地层研究的杨钟健院士，以纪念他对云南地区古近纪生物地层学研究所做的贡献。

标本描述 标本为一件保存了p3-m3的破损下颌，p3前缘下方可见一颏孔。GNV-001的下臼齿列长度为85.5 mm, 颊齿测量数据见表1。

图1 杨氏广南犀(新属新种)左下颌骨(GNV-001)

Fig. 1 Fragmentary left mandible of *Guangnanodon youngi* gen. et sp. nov. (GNV-001)

A. 颊侧视 buccal view; B. 冠面视 crown view; C. 舌侧视 lingual view