

中国颌兽(犬齿兽类爬行动物) 的补充研究

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关键词 山西武乡 三叠纪 犬齿兽类 中国颌兽

内 容 提 要

到目前为止,在我国陆相三叠纪地层里,完美中国颌兽是非三列齿类犬齿类的唯一代表,首次报道时曾被鉴定为犬鳄科(Cynosuchidae)。本文记载了该头骨的牙齿、颌关节等特征,证明应归宽齿犬齿兽类的 Trirachodontinae。

与哺乳动物关系紧密的非三列齿类犬齿类在二叠纪晚期和三叠纪早中期这段时期内曾极度繁荣过。然而在中国大陆上材料却很稀少,除了以一个头骨为代表的完美中国颌兽(*Sinognathus gracilis*)以外,其他的记录十分零星。代表原犬齿兽类黄河犬齿兽(*Hwanghocynodon*, 杨钟健, 1979)的三颗牙齿中,至少有一颗很可能为锯齿龙类的牙齿。河套兽(杨钟健, 1961)则被认为是包氏兽形类的成员(Sigog-Russell 和 Sun, 1981)。因此,需对完美中国颌兽头骨作进一步的认识,以解决其系统位置问题。

杨钟健在首次记述该标本时(1959),认为它和 *Thrinaxodon* 以及 *Sysphinctostoma* 比较接近,故将它归入 Huene (1956) 的 Cynosuchidae。同时也指出,其头骨后部的粗壮性质类似于阔齿兽科(Diademodontidae)的一些属,尤其是 *Gomphognathus*。因此,这一中国类型也有可能代表与杂食类型有着一些亲缘关系的早期犬齿兽类。由于当时未能将牙齿暴露出来,故原作者不能提出肯定意见。

Hopson 和 Kitching (1972) 在评论犬齿兽类的分类时对中国颌兽的分类位置提出了质疑。他们认为中国颌兽显然比盔兽类(galesaurid)更为进步,而且似乎应当具备阔齿兽类的臼齿型犬后齿。因此他们将中国颌兽订为 Trirachodontinae incertae sedis。

最近,我们将这一标本(古脊椎所编号 V 2339)作了进一步的修理。根据暴露出来的齿冠面构造,证明 Hopson 等的推测是正确的,中国颌兽确实应属于 Trirachodontinae。

该头骨全长 126mm, 颧弓处宽约 100mm。骨缝不甚清楚,大致情况见图 1, 2。

头骨形状类似于横齿兽(*Traversodon*), 但吻部显得更短。眼孔前的吻长仅为头骨全长之 1/3, 颧孔长度却占头骨全长之 1/2。眼孔较小, 眶后骨弓完全。现将补充诸点记述于后。

(一) 下颌和颌关节部位

下颌最大的特点是齿骨的冠突 (coronoid process) 十分发育。冠突的前缘以 45° 之倾角向后上方倾斜。后缘与之大体平衡。其背缘较长, 从眼眶处后伸, 一直到达头骨后端之鳞骨处, 几乎贯穿整个颞孔, 长度达 40mm。冠突之后角后伸程度几乎超过下颌关节末端。和 *Diademodon rhodesiensis* (Brink, 1963) 一样, 在齿骨与上隅骨相联结的地方有一个突起, 其位置在冠突和隅突之间。

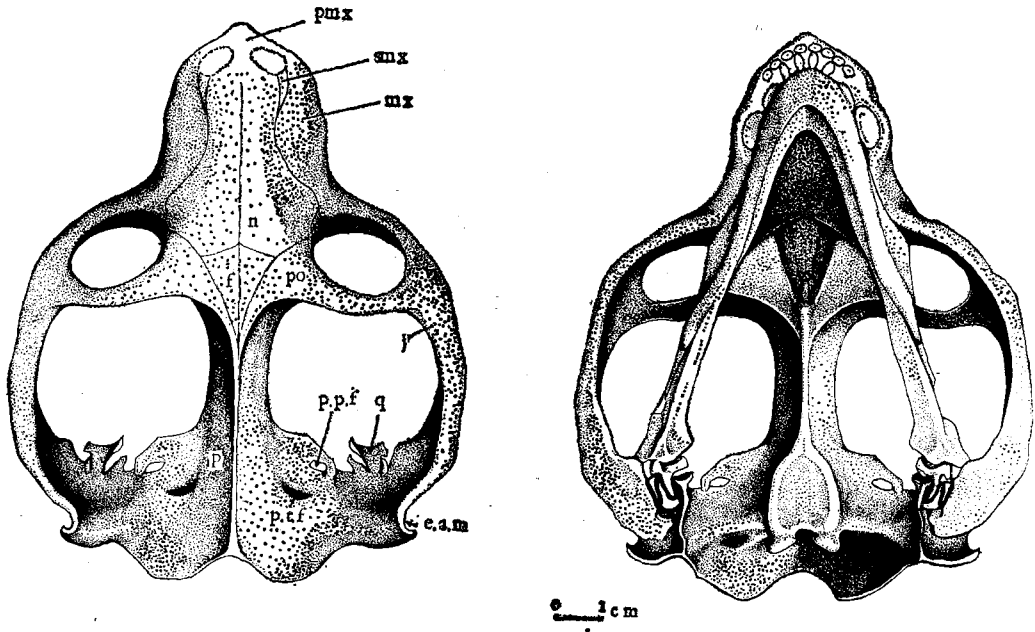


图 1 完美中国颌兽头骨背、腹面复原图, 简字说明见 178 页

Fig. 1 *Sinognathus gracilis*, dorsal and ventral views of the skull, reconstructed.
Abbreviations see page 178

下颌腹缘比较平直, 到齿列前部开始起翘。连结部较短。

齿骨并未到达下颌的最后端, 中止于离后端 1cm 处。后部腹缘向两侧膨起, 形成内棱和外棱。但外棱不象在 *Cynognathus* 中那样明显前伸。由辅助下颌骨(非齿骨成份)组成的骨棒即嵌入此两棱间的齿骨槽内。

上隅骨主要出露于下颌外侧, 一直向后伸至下颌外侧的最后端, 且向外翻转, 该处加厚成一明显的关节突 (sq. pr. sur) 与鳞骨相接。与隅骨之间的界线很清楚。在下颌内侧, 上隅骨只露出一细条, 被夹在齿骨和前关节骨之间。

前关节骨是下颌内侧的主要组成部分。它的后端也到达下颌后端, 其间有无关节骨之成分还难于肯定。因为在其前方, 尚有一扁圆形的骨骼坐落在上隅骨和前关节骨相交的三角形空间内, 或许此骨片应解释为退缩了的关节骨, 从下颌末端移落至此(图 3, 左)。

方骨相当发育, 具一伸展的背翼。背翼后侧隆起成后背棱, 因而从枕面看, 方骨呈一

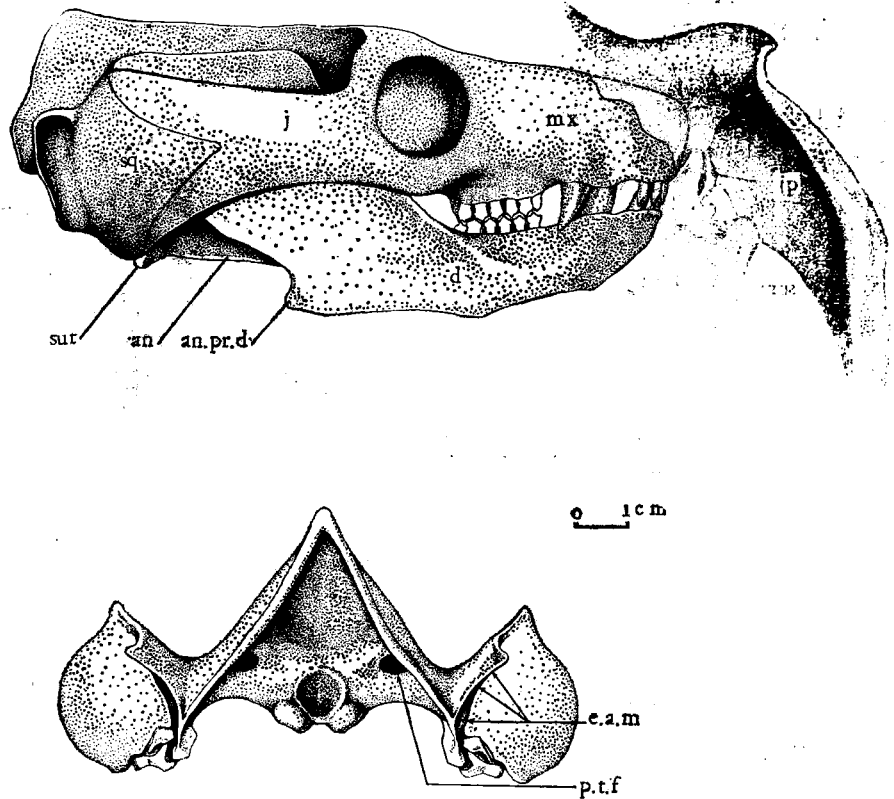


图2 完美中国颌兽头骨侧面和枕面复原图,简字说明见178页
 Fig. 2 *Sinognathus gracilis*, lateral and occipital views of the skull, reconstructed. Abbreviations see page 178

“山”字形构造。宽大的关节面形成底座,与下颌之关节窝相对。内、外关节突均很发育。内关节突扁平,其背面延伸上去,即贴在鳞骨前方之片状背翼。

方颞骨不甚发育,呈棒状,被夹在鳞骨的方颞骨凹内。方颞骨的末端已脱离开关节区,高高地悬挂在方骨外关节突之上(图3)。

颌关节部位的鳞骨有三个向下延伸的突起。鳞骨的外侧翼腹部隆起成鳞骨上隅骨翼(sur. fl. sq)与上隅骨相接,已如上述,该处加厚膨大。方骨凹和方颞骨凹均很清楚。居中的突起十分窄长,将方骨背翼和方颞骨分隔开。此突起与上面的鳞骨之间有一断裂,但无疑应是鳞骨之一部分。内侧的突起具一斜向的关节面,与方骨后背棱内侧之内关节突相对。在这个头骨上,鳞骨、方骨与关节骨之间均未紧密相接,彼此保持有约2mm的距离。

总的说来,中国颌兽的颌关节为典型的犬齿兽类结构。除了方骨—关节骨这一组关节以外,上隅骨和鳞骨亦参与了颌关节的组成。与 *Trirachodon* 相比,中国颌兽的方骨后背棱要发育得多,但是方骨关节面的内侧一端并未超过背面鳞骨的内边缘。从后面看,也没有被鳞骨的下伸支所覆盖。更没有见到 *Trirachodon* 那样在鳞骨内侧的凹坑,说明颞骨—鳞骨之接触在这里是不存在的。

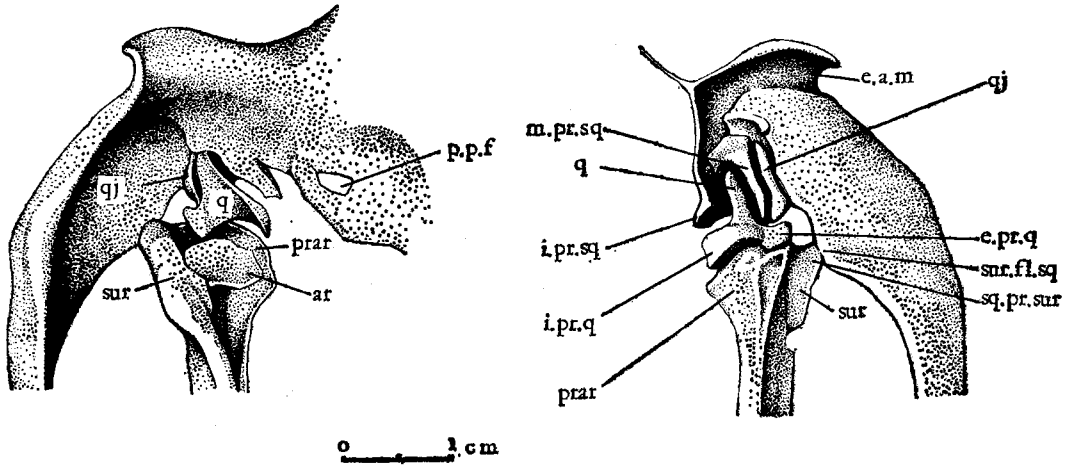


图3 完美中国颌兽之右侧颌关节,左,背视;右,腹视。简字说明见 178 页
 Fig. 3 *Sinognathus gracilis*, dorsal and ventral views of jaw joint.
 Abbreviations see page 178

(二) 齿 系

虽然作了试图将上下颌分开的努力,但没有成功。宽齿型的牙齿使上下牙齿之间相互接触的面积太大。加之,从下颌上也找不出合适的可断开之处。诚然,从右下颌内侧清理出来的大部分上颊齿齿冠,使我们能对中国颌兽的颊齿结构得到一个基本的了解(图4)。

在左侧,上门齿共有4枚。其中, I¹ 齿冠已断去, I² 和 I⁴ 保存完整, I³ 则处于生长过程中。各门齿大小相若,齿根处直径为2.6mm,略小于颊齿之长度。门齿高6.2mm。

上犬齿仅保存有残根,从左犬齿测得基部宽度为3mm,长5mm,呈侧扁状。上下牙齿咬合时上犬齿位于下犬齿之后方。

左右上颊齿齿列彼此呈八字形排列,内凹现象不甚明显。

上颊齿共6枚。Pc⁴ 和 Pc⁵ 发育最佳, Pc² 和 Pc³ 稍小些。从外侧看, Pc¹ 和其他

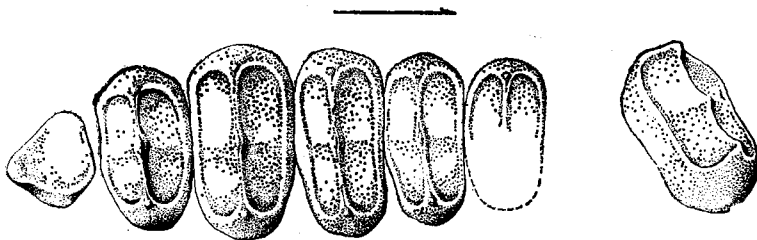


图4 中国颌兽之上齿列,嚼面观。右侧单独的牙齿为后侧面观。全为复原图,不按比例,箭头指向前方

Fig. 4 *Sinognathus gracilis*, crown view of the upper dentition, reconstructed. Right isolated tooth represents the posterolateral view of the cheek tooth. Arrow points anteriorly. Not to scale

各颊齿排列一致,但从内侧却见不到它咬合以外的齿冠面。一种可能性是该齿并未加宽,犹如阔齿兽的前颊齿那样呈扇形,故咬合时被下颊齿全部覆盖起来。另一种可能则为保存不全,内侧部分残缺。因该牙齿处于齿骨连结部的隅角,修理针很难触及。

Pc^2-Pc^5 均为宽齿型颊齿,估计宽度为 6mm 左右。颊齿略呈椭圆形,长宽之比约为 1:2。舌、唇侧各有一枚齿尖,其间以横脊相连。从第二和第三颊齿上可以见到横脊中央还有一中央齿尖。颊齿之前、后缘各有一条微弱的小脊,与横脊相平行,但未观察到任何小瘤构造的存在。

与 Pc^1 一样,从内侧见不到 Pc^6 的齿冠面。从齿列舌面看, Pc^6 显然向内缩进。因它是最后一枚颊齿,故从后面见到一个与下颊齿相咬合的齿尖。由此可以判定,这最后一枚上颊齿又恢复到非宽齿型。

总的说来,中国颌兽的上颊齿结构比较接近于 *Trirachodon*, 而与 *Cricodon* 相去较远,区别在于前后齿脊上没有瘤状构造。

下门齿只有两枚,其大小和上门齿相仿,只是更高些。下犬齿和上犬齿同样粗壮,插入上颌内。左侧牙床露出其强大的齿根。

下颊齿共 7 枚。与上颊齿对比起来,它们应是接近圆形,从舌面和唇面都可以见到一个齿尖,两齿尖均指向上方而非指向中间。因此,下颊齿仍具两枚齿尖,相互之间的距离当然要小得多,而且也无法得知有无横脊构造。

左侧牙床破裂面表明,无论是上颊齿还是下颊齿均为单根。

中国颌兽的颊齿构造说明属宽齿犬齿兽类无疑。齿列前(?)、后端出现的扇形颊齿,以及结构并不十分复杂的上颊齿,证明它应归入 *Trirachodontinae* (Hopson and Kitching, 1972)。

(三) 其他补充

中国颌兽的腭面没有全部修出,翼骨以后之部位保存很不好。可以记述的是其次生腭只到达 Pc^4 和 Pc^5 处,并未到达齿列末端。在腭骨中间,锄骨有很好的出露。翼骨侧翼 (pterygoid flange) 仍相当发育。颅基部已遭风化。

同某些宽齿犬齿兽类相比,中国颌兽的颧弓虽然已增高,但和三列齿类一样,在颧骨的前端基部没有下伸突起。

枕部相当完整。为典型的宽齿犬齿兽类类型,“山”字形形状十分明显,枕平面和颧弓连接处十分低下,也仅为很窄的骨桥。枕髁已完全分隔,右枕髁有移位。一对圆圆的后颧孔十分醒目。方骨上方,鳞骨上的外耳道尤其清晰。顶骨和鳞骨组成的人字脊 (λ ridge) 十分发育,犹如宽宽的屋檐遮盖在枕平面上。

基于上面的补充记述,完美中国颌兽的种属特征可以修正为:

中等大小的犬齿兽类。吻短,为头骨长度之 $1/3$ 。颧孔宽大,长度为头骨之 $1/2$ 。顶脊长而锐。颧弓适度发育,前腹缘平滑,无隆起。齿骨冠突发育,背缘长而平直。齿式: $I \frac{4}{2}$,

$c \frac{1}{1}$, $Pc \frac{6}{7}$ 。颊齿横脊位于中部。前后脊不甚发育, 亦无小瘤构造。下颊齿明显窄于上颊齿。

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简 字 说 明

an	隅骨	angular
an. pr. d	齿骨隅突	angular process of dentary
ar	关节骨	articular
d	齿骨	dentary
d. fl. q	方骨背翼	dorsal flange of quadrate
e. a. m	外耳道	external auditory meatus
e. pr. q	方骨外关节突	external articular process of quadrate
f	额骨	frontal
i. pr. q	方骨内关节突	internal articular process of quadrate
i. pr. sq	鳞骨内突	internal process of squamosal
j	颧骨	jugal
mx	上颌骨	maxillary
m. pr. sq	鳞骨中突	medial process of squamosal
n	鼻骨	nasal
p	顶骨	parietal
po	后眶骨	postorbital
pmx	前颌骨	premaxillary
p. p. f	翼骨-副枕骨孔	pterygo-paroccipital foramen
prar	前关节骨	prearticular
p. t. f	后颞孔	post-temporal fossa
q	方骨	quadrate
qj	方颧骨	quadratojugal
smx	间颌骨	septomaxillary
sq	鳞骨	squamosal
sq. pr. sur	上隅骨鳞骨突	squamosal process of surangular
sur	上隅骨	surangular
sur. fl. sq	鳞骨上隅骨翼	surangular flange of squamosal

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ADDITIONAL STUDY ON *SINOGNATHUS GRACILIS* (CYNODONTIA; REPTILIA)

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Key words Wuxiang, Shanxi; Triassic; Cynodont; *Sinognathus*

Summary

Although the non-tritylodont cynodonts had been fully flourished in Permian and Triassic age, yet *Sinognathus gracilis* was the sole representative so far in China.

In Young's first description (1959), *Sinognathus* was assigned to Cynosuchidae and was compared with those forms as *Thrinaxodon* and *Sysphinctostoma*. Young had also noticed the robustness of the posterior part of the skull, which makes it much similar to the genera of Diademodontidae, especially *Gomphognathus*. 'It would be not impossible that the Chinese form represents one of the earliest cynodonts from which may bear some relationship with such omnivorous forms,' he said, 'Unfortunately the structure of the teeth of our form is not clearly shown, so that it is premature to make a definite conclusion.'

Hopson and Kitching (1972) questioned the systematic position of *Sinognathus* when discussing the classification of cynodonts. They considered that it seems *Sinognathus* should have the molariform postcanines as that in diademodontids. Therefore, they classified *Sinognathus* as Trirachodontinae incertae sedis.

Recently, the specimen was reprepared and partly exposed the upper dentition. It confirms that *Sinognathus* was a member of Trirachodontinae, with a close relationship to *Trirachodon*. An additional description is given below.

The skull has a total length of 121 mm. The snout is quite short, only one third of the skull length, while the temporal fossa occupies half of the skull length. The postorbital arches are complete.

The dentary has a much developed coronoid process. Its dorsal border is long and straight, running through the whole temporal fossa and ends almost at the end of the skull. There is a prominent articular process at the place where the dentary stops on the postdentary bones.

As in trirachodontids, the jaw consists of two sets of articulations. In addition to the quadrate-articular joint, the squamosal turns down and sends a ventral flange to meet the

swollen process of surangular. The quadrate is quite strong and sitting straightly upon the broad articular surface of the lower jaw. Both external and internal articular processes are well distinguished. The median upright dorsal process is triangular in cross section, with a flat, heart-shaped anterior flange which fits on the anterior surface of the squamosal and a posterior ridge.

A splint of bone situates laterally, which may represents the quadratojugal. It is much smaller, stretching within the quadratojugal fossa of squamosal and resting upon the external articular process of quadrate. A long median projection separates the dorsal process of quadrate and quadratojugal. This projection is again separated from the squamosal proper, but most likely, resulted from a fracture. This represents the median downward process of the squamosal.

Both the surangular and prearticular have a extremely backward extension. There is a small pierce of bone lying within the space where both the surangular and prearticular angularly meet. This bone is better to be interpreted as an articular which was dropped from the vicinity of the lower jaw.

In general, the structure of the jaw articular region of *Sinognathus* is typical of gomphodont cynodonts and could be easily compared to that of *Trirachodon*.

Although the attempt of separating the upper and lower jaws failed, yet most of the upper cheek teeth crowns have been revealed.

The upper jaw is equipped with 4 incisors, 1 canine and 6 postcanines.

Pc²—Pc⁵ are ovale elongated, with a length to width proportion of 1:2. Two cusps located at the labial and lingual side respectively, connected by a transverse ridge which lies almost at the middle of the tooth. A third cusp situates at the center of this ridge. Along the anterior and posterior edges of the crown, there is a faint ridge lying parallel to the middle one, but without any cuspule is seen.

Both the Pc¹ and Pc⁶ are not in the same size as the others. It is not yet certain whether the lingual part of Pc¹ has been broken off, or the tooth is not widened at all. However, Pc⁶ shows definitely the sectorial feature, usually seen at the posterior end of the other diademodontids. View from the posterior end, it has only one cusp.

The lower dentition consists of 2 incisors, 1 canine and 7 postcanines. None of the postcanine crowns is shown. All we know from the preservation is that they are much narrower than those uppers, and each has two cusps.

Either the upper or the lower postcanine has only one root.

From the palatal surface, the secondary palate of *Sinognathus* does not reach the end of the dentition, it stops at the level of Pc⁴ and Pc⁵. The pterygoids are extensive with the large lateral flanges.

The jugal arch is deepened, but has no downward projection at the anterior base of the arch.

The structure of the occiput is typical of the gomphodonts, that is, a triangular central portion is connected to the lateral part by a narrow and low bridge (Fig. 2). The occipital condyle has completely divided into two. A distinct external auditory meatus lies by the squamosal ridge, it begins from the top of the quadrate, runs upwardly and curves outwardly. The lambdoid ridge is prominently developed.