

河南浙川核桃园组的低等 四足类动物群

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关键词 河南浙川 中始新世 蜥蜴及鳄类

内 容 提 要

本文记述了我国中始新世的一低等四足类动物群。包括三属蜥蜴和三种鳄类。其中的浙川短齿蜥 (*Brevidensilacerta xichuanensis*) 和河南密齿蜥 (*Creberidentat henanensis*) 为新属种; 而响蜥 (*Tinosaurus*) 发现于同时代北美、欧洲、亚洲的十数个地点。

河南浙川为一始新世哺乳动物地点。1929年秉志 (Ping Chi) 首次记述了来自范庄的一龟化石, 浙川厚龟 (*Sinohadrianus sichuanensis*)。周明镇等 (1973) 在研究哺乳类化石时又记述了鳄类的四枚剑齿, 称之为 *Pristichampsus* aff. *P. rollinatti*。近年来, 随着哺乳类研究工作的深入开展, 爬行类的材料也逐渐积累。但大部分的化石保存情况不佳, 只有少数较为完整, 为鉴定和研究提供了条件。一些破碎的牙床和单个的牙齿, 只可作较高级分类单元的鉴定。它们共同构成了一个以蜥蜴和鳄类为主的低等四足类动物群。这一动物群的发现推动了我国始新世爬行类的研究, 为这一时代不同地区之间动物群的对比, 及探讨某些蜥蜴、鳄类分支的进化和迁徙打下了基础。

一、化石材料

有鳞目 Squamata

蜥蜴亚目 Lacertilia

庞然蜥下目¹⁾ Iguania

鬣蜥科 Agamidae

浙川短齿蜥(新属、新种) *Brevidensilacerta xichuanensis*

gen. et sp. nov.

释名 Brevidens-拉丁形容词, 短齿的; lacerta 拉丁词, 蜥蜴; xichuan 为化石产地。

正模 一不完整的右下颌支, 古脊椎所标本登记号 (V9587.1)。

副模 一不完整的右上颌骨 (V9587.2) 和一前颌骨 (V9587.3)。

1) Iguania 曾译为鬣蜥下目或飞蜥下目。前者与现生 *Agama* 的译名“鬣蜥”重复, 后者与现生 *Draco* 的译名“飞蜥”重复。iguana 西班牙语, 来自加勒比语 yuana = igoana, 为一种大蜥蜴。故此处将这一分类单元译为庞然蜥下目。

归入标本 5 块不完整的上颌骨 (V9587.4—8); 2 块近于完整的前颌骨 (V9587.9, 10); 一不完整的左下颌支 (V9587.11); 4 块不完整的颌骨 (V9587.12—15)。

产地及层位 河南淅川, 中始新统, 核桃园组。

属及模式种特征 前颌骨愈合。下颌高而粗壮。齿骨后延至喙状突之后。喙状突高。麦氏沟张开。异齿型齿列, 每侧 2—3 前颌骨齿, 10 个上颌骨齿和 14 个齿骨齿。前颌骨齿和前 4 个齿骨齿侧生型, 上下颊齿端生, 粗壮且稍侧扁。后部颊齿的磨面呈水平的透镜状。

标本记述 正模右下颌支 (V9587.1) 前部保存完好, 喙状突之后部分断失。保存长度 13 毫米, 自前端至喙状突的距离为 9.5 毫米。如果以现生 *Agama* 下颌的相应长度为例, 推测其下颌全长为 16 毫米左右。标本保存部分结构粗壮。纵轴平直地向后延伸, 除前端的缝合部外, 未见任何弯曲。

齿骨及喙状骨保存完好, 但二者之间的界线不清。齿骨宽大, 粗壮, 自前向后高度增大, 在喙状突部形成下颌的最大高度 6.5 毫米。齿骨后端大大超过喙状突一线, 且为一窄凹分为上下两支。齿骨的外侧为一凸出的弧形面, 在其最大厚度之下, 水平地排列着 5 个神经孔。内侧齿列之下有一水平的浅沟, 自前端延至第 6 个端生齿之下。齿骨的下缘平直, 麦氏沟张开。喙状骨的形态不清, 喙状突高耸, 侧视三角形。

下颌齿列由前端的侧生型齿和颊部的端生齿组成。两组牙齿之间有一明显的空缺。侧生齿 4 枚, 排列紧密, 齿干稍扁, 向舌面突出。齿冠短小而圆钝。端生齿数目为 10, 牙齿粗壮, 自前向后逐渐加大, 彼此紧密相接。前 4 个端生齿为稍侧扁的锥状。后部的牙齿为截锥状, 齿冠顶端被磨平, 磨蚀面透镜状。

V9587.11 为一左下颌支, 其形态、大小及保存情况均与正模十分相似。端生齿数目为 10, 与正模完全相同, 牙齿的形状, 大小, 磨损情况也一致。但令人困惑不解的是未见侧生型齿。下颌前端基本保存完整, 在侧生齿应该着生的部位齿骨极低, 且边缘菲薄。内侧表面光滑, 并不象是由牙齿脱落或断失所造成的, 但也无法用使用过度来解释这一现象。理由是按常规, 当动物将颌关闭时, 下颌应包于上颌之内, 下颌齿的唇侧与前上颌齿的舌侧相接触, 或是上下颌前部的牙齿互相交叉。只有在完全特殊的情况下, 上颌包于下颌之内, 下颌前端的牙齿才有可能被完全磨光。这块标本难道反映这种特例吗? 那它后部的端生齿并未见过度使用的现象, 又作何解释呢?

左右前颌骨愈合。在现有的三个材料 (V9587.3, 9, 10) 中, 背突均不完整。副模的前颌齿数为 5, 而另两个材料的齿数为 4。牙齿侧生型, 排列紧密, 形状与下颌前部牙齿相似。但仔细观察可以发现, 几个材料的牙齿形态存在细微的差异。如尺寸最小的 V9587.9 牙齿短小, 齿冠圆钝, 齿间有窄的间隔。中等大小的 V9587.3 牙齿排列密集, 齿干加粗, 向舌面膨胀。而大的 V9587.10 齿冠侧扁, 在舌面上形成一斜面, 似乎是使用的痕迹。这些微细的差别可能反映它们处于不同的生长发育阶段, 也可能是个体差异所造成的。

副模右上颌骨 (V9587.2) 保存不完整, 前端、后端和背部破损。外侧面在齿列之上, 上颌骨向外突出, 形成一明显的棱。由于破损无法确切地知道上颌骨的前颌骨突是否在中线相遇, 以隔开前颌骨与颞骨。上颌骨的后缘宽、平。目前也无法确知是否有颞骨延至此处将上颌骨与眼眶隔开。但象其它 *agamid* 一样, 上颌骨可以后延到眼眶之下。

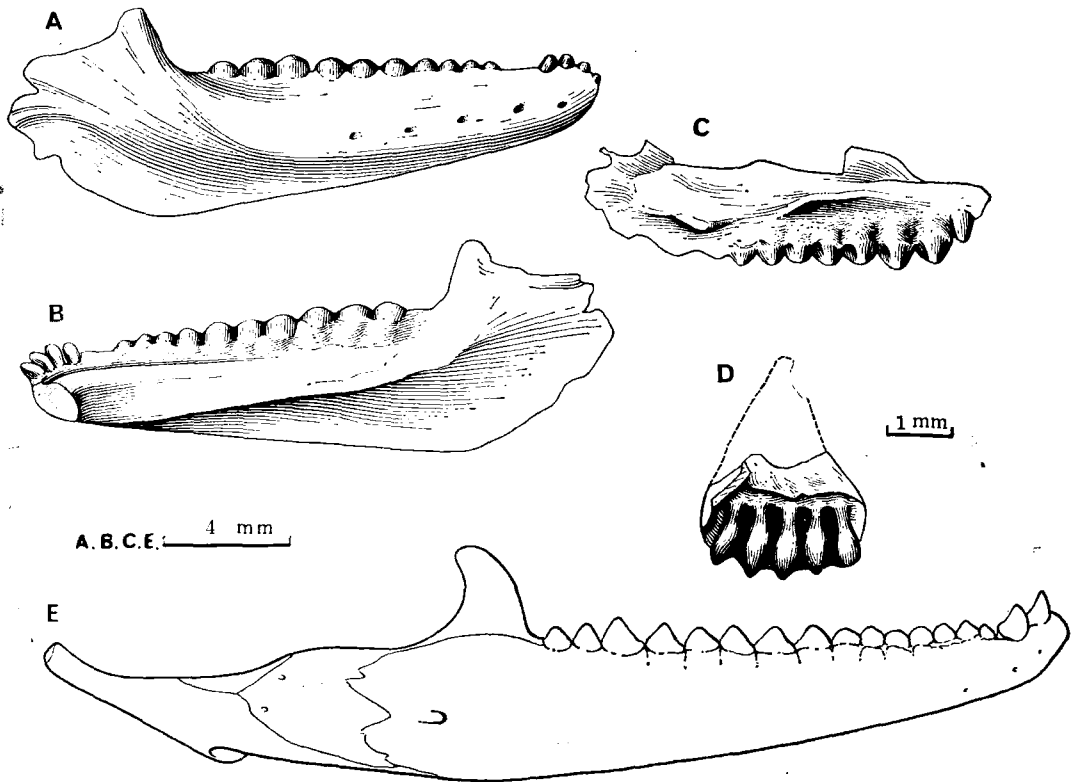


图 1 A—D 浙川短齿蜥(新属, 新种) A. 右下颌外侧视; B. 右下颌内侧视; C. 右上颌内侧视; D. 前颌骨内侧视; E. 现生鬣蜥右下颌外侧视

Fig. 1 A—D. *Brevidentilacerta xichuanensis* gen. et sp. nov. A. lateral view of right mandible (V 9587.1); B. interior view of right mandible (V 9587.1); C. interior view of right maxilla (V 9587.2); D. interior view of premaxilla (V 9587.3); E. lateral view of right mandible of living *Agama* sp.

V9587.2 齿列的前端破损, 保存有 2 个破损 8 个完好的端生齿。它们与下颌齿列十分相似, 前面的牙齿小而侧扁, 向后逐渐加大变粗, 顶端具水平透镜状的磨面。最后一个牙齿为小的钝锥状, 位置高于它前面的牙齿, 推测为尚未投入使用的新生齿。齿列后部牙齿的舌面上有一轻微的凹入区。牙齿的唇面为平整的弧形面。

比较与讨论 这一始新世蜥蜴虽然保存不够完整, 但依据其特征将它归入 Agamidae 科似乎是没有疑问的。它和这一科的其它成员一样都有愈合的前颌骨, 后伸至眼眶之下的上颌骨, 前部侧生, 后部端生的异齿型齿列。这一科的现生成员广泛地分布于旧大陆, 但化石材料相当稀少。

Agamidae 科最早的代表 *Mimeosaurus crasus*, *Priscagama gobiensis*, *Pleurodontagama aenigmatodes* 都发现于蒙古上白垩统。1984 年 Borsuck-Bialynicka 和 Moody 将这三个早期的属归入一新的亚科 Priscagaminae。浙川短齿蜥由于有缩小了的夹板骨和张开的麦氏沟而区别于 Priscagaminae 的成员。后者是以狭长的夹板骨, 封闭的麦氏沟及其上的 Posterior mylohyoid foramen 为特征的。

始新世似乎是 agamid 的第一个繁盛时期, 虽然迄今为止报道的材料均不完整, 但

它们的踪迹却散布于欧亚及北美大陆的十余个地点。1974年侯连海记述了安徽古新统 *Agama* 的一个种,命名为中国飞蜥 *A. sinensis*。依据的材料是一段带有牙齿的上颌骨。据 Estes (1983) 称,在 Moody (1980) 的学位论文中曾认为这一种更类似于蒙古晚白垩世的 *Mimeosaurus*。笔者无法读到 Moody 的原文,但对 *A. sinensis* 正模 (IVPP V 4454) 的观察发现,该种的特征需予以订正。这一上颌骨上的牙齿着生方式相同,为同型齿。虽然该动物具异齿型齿列的可能性是无法排除的,但在缺少前颌骨齿和下颌前端齿列的情况下,臆测它们为“异型齿”是缺乏依据的。原作者将这 5—6 个牙齿称为端生齿,也是不能被接受的。观察表明这几个牙齿虽然有别于典型的侧生型齿,但它们贴于上颌骨内侧,具侧生性质。事实上原作者的插图 7 清楚地显示了这点。据此,将这一种归入 *Agama* 是有疑问的。如果仅就着生方式而论,它似乎更接近于蒙古晚白垩世的 *Pleurodontagama*, 只是安徽标本上牙齿排列得更紧密而规整。

淮南安徽蜥 (*Anhuisaurus huainanensis*) 是侯连海(1974)订立的 Agamidae 科的另一属种。标本的个体小,齿列极短,从侧面看端生齿呈圆锥状,牙齿间有小的间隔。这些特征明显地有别于浙川短齿蜥。Estes (1983) 指出淮南安徽蜥与 Agamidae 科的特征不符。而它的短的齿列暗示出它可能是蚓蜥科 (Amphisbaenidae) 的成员。

化石 agamid 中分布最广,数量最多的当数响蜥 (*Tinosaurus*)。它最初见于北美的怀俄明,后在欧洲、蒙古、中国的河南及安徽均有发现。但该属的材料无一保存完整,以至到目前为止,仍不能较全面地确定属级特征,仅以主要分布于始新世地层的一些特殊的三尖状牙齿为依据确定这一动物的存在。浙川短齿蜥的牙齿明显不同于响蜥的三尖状齿。在同一地点经筛洗法获得的材料中也发现了响蜥带有牙齿的颌骨,该材料将在下文记述。浙川短齿蜥的牙齿短而粗壮,虽然没有前后小尖,但牙齿舌面上凹入区的存在似乎暗示它与响蜥有较近的亲缘关系。

Tinosaurus cf. *T. lushihensis*

材料 一段带有三个牙齿的颌骨,古脊椎所标本登记号 (V9588)。

讨论 化石材料破碎,但两个牙齿保存完整。牙齿端生型,齿冠侧扁,三尖状,中央主尖与前后小尖之间有浅沟相隔。牙齿不呈直线排列,前一个牙齿的后小尖与后一个牙齿的前小尖相互错开,并稍显重叠。单就牙齿的形态而言,这一材料与河南卢氏中始新统的卢氏响蜥 (*Tinosaurus lushihensis* Dong 1965) 非常相似。

卢氏响蜥的正模被记述为“同一个体的一块右上颌骨与一块右下颌骨中段 (V2899) (董枝明,1965)。化石细小,在收藏的过程中“下颌骨”前部的牙齿已破损。但进一步的修理显示这是一块不完整的左上颌骨,在齿列的内侧上颌骨的腭板水平延伸,其余各部形态与右上颌骨对应,它们确属同一个体。

(?) 蛇蜥下目 *Anguimorpha*

(?) 蛇蜥科 *Anguidae*

河南密齿蜥 *Creberidentat henanensis* gen. et sp. nov.

释名 *Creber*-拉丁形容词,密集的; *dentat* 拉丁词,牙齿; *henan* 为化石产地。

正模 一近于完整的左上颌骨,古脊椎所标本登记号 (V9589.1)。

副模 一不完整的右下颌支 (V9589.2)。

归入标本 2个近于完整的左上颌骨 (V9589.3, .4); 4个不完整的右下颌支 (V9589.5—8); 一左下颌支的后部 (V9589.9)。

产地及层位 河南淅川,中始新统,核桃园组。

特征 上颌骨前突指向上方。上颌骨17—19齿,下颌19齿。牙齿侧生型,排列紧密。齿干基部粗壮,齿冠侧扁,呈叶片状。齿骨及间下颌中隔后腹缘圆弧状,未形成腹后突。麦氏沟张开。

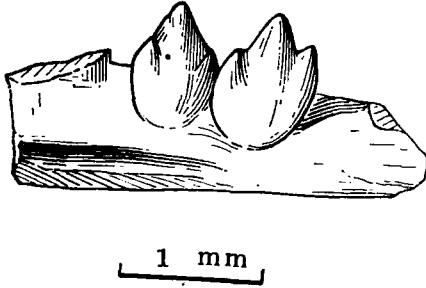


图2 似卢氏响蜥 (V 9588)
Fig. 2 *Tinosaurus* cf. *T. lushihensis*
(V 9588)

标本记述 正模的部分牙齿断失,其余部分保存完好。上颌骨长12毫米,高7毫米。最大高度位于上颌骨的前三分之一处,接近外鼻孔的后缘。上颌骨的外表面光滑,未见具雕饰的膜质骨板,且在水平、垂直两个方向上都很平直,据其形态推测该蜥的头骨较高。上颌骨的前端与其它蜥不同,不是一个短小的前突,而是向上弯曲,形成一个小的上突。这样上颌骨就不仅从后方、下方,而且从前下方包围外鼻孔。上颌骨的后突长且粗壮,腭突为三角形。

上颌骨齿列侧生型,牙齿排列紧密,无间隙,齿干基部粗壮,而齿冠侧扁。紧密相连的牙齿顶部形成锯齿状的切割脊。齿冠超出上颌骨外侧缘 (parapet of maxilla) 的部分大于整个牙齿高度的二分之一。牙齿大小基本一致,只是最前面的2—3齿和最后的一齿略显粗大。上颌骨齿数17—19。正模18齿,除保存完整或不完整的17齿外,最前端破损处可能有一齿已断失。上颌骨中最大的V9589.3具19个牙齿,而稍短于正模的V9589.4具17个牙齿。三个上颌骨上齿数的变化恰恰证明了随个体加大牙齿数目增加。

保存的几个下颌支均不完整,除齿骨及喙状骨外,其余各骨缺失。齿骨粗壮,其下缘平直地向后腹侧倾斜。下颌内侧,齿列的后下方有一向后腹侧延伸的翼状骨片,标志着间下颌中隔 (intramandibular septum) 的存在。据Estes (1964) 所述,间下颌中隔起着隔离下颌血管、神经与麦氏软骨的作用。在河南密齿蜥中它似乎自齿列后部起一直延到喙状突之后,且与齿骨后部的形态一致,为圆弧状,并未形成腹后突。喙状骨与齿骨的骨缝无法分辨。完整的下颌齿列长10—11毫米,齿数19,牙齿形态与上颌齿相同。

对比与讨论 河南密齿蜥的材料不够完整,缺失了头骨顶部的全部骨片,给分类和对比带来困难。下颌上,间下颌中隔的存在似乎表明它是蛇蜥科 (Anguidae) 的一个成员。牙齿的着生方式和一些其它特征也支持这一判断。蛇蜥科包括四个亚科。河南密齿蜥不大可能属于Diploglossinae亚科和Gerrhonotinae亚科,前者几乎是一个南美和中美洲的现生类群,后者也仅分布于新大陆,化石记录最早出现于晚上新世。Glyptosaurinae亚科是一类头甲和体甲上都带有排列有序的瘤状小突的动物。河南密齿蜥的上颌骨和下颌前部都未见这种结构。同时它的麦氏沟是张开的,与glyptosaurus全封闭式的麦氏沟不同。因此,河南密齿蜥很可能属于蛇蜥亚科。这一归属并不是没有疑问的。受材料所限

蛇蜥亚科的许多特征无法在河南密齿蜥上得到证实,个别之处二者并不相符。如据 Meszoly (1970), Gauthier (1981) 所述,蛇蜥亚科的隅骨向前延伸要大大超过喙状骨。河南密齿蜥的这一部位未见骨缝,而基于齿骨圆滑和完整的后缘推测,似乎无论是上隅骨,还是隅骨的前端都并未超过喙状骨。

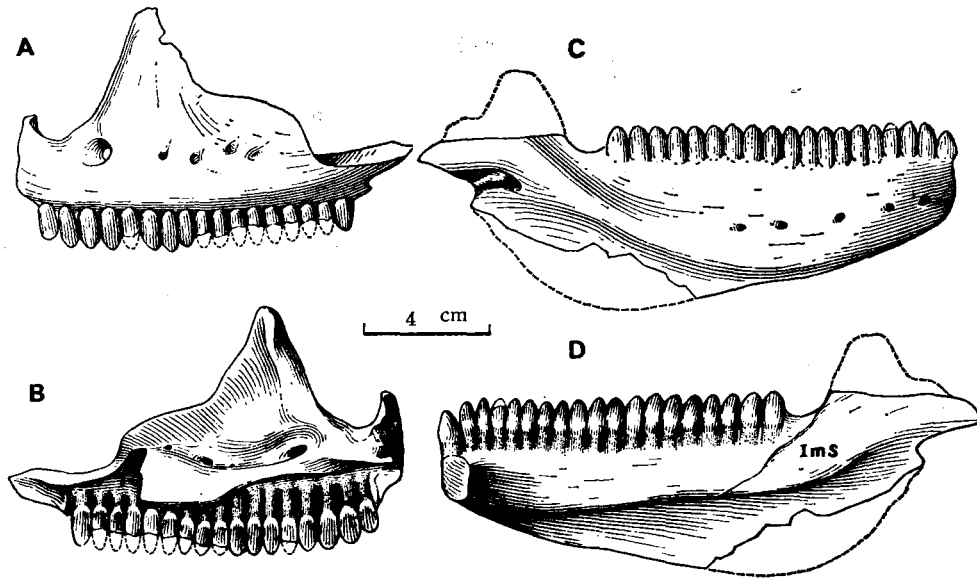


图3 河南密齿蜥(新属,新种) A.B. 左上颌骨外侧、内侧视; C.D. 右下颌支外侧、内侧视; ImS 间下颌中隔

Fig. 3 *Creberidentat henanensis* gen. et sp. nov. A.B. labial and lingual view of left maxilla (V 9589. 1); C.D. labial and lingual view of right mandible (V 9589.2); ImS Intramandibular septum

综合来看,如果河南密齿蜥确实是蛇蜥亚科的一个成员的话,它以下列一些特征区别于该科的其它属。河南密齿蜥上颌骨前端具小的上突,使该骨片从三个方向上包围外鼻孔;侧生型的牙齿排列紧密,无间隙,牙齿叶片状;齿数较多,下颌 19 齿,上颌齿列推测可达 21 齿(包括 2 个前上颌齿);齿骨及间下颌中隔的下缘圆滑,它们都不具腹后突。蛇蜥亚科中其它的化石属种,其材料也都不完整,只能作简单的形态对比。发现于欧洲中始新统的 *Ophisaurus hellensis* 每个齿列仅具 11 个牙齿,该属的现生种齿数为 5—17。 *Anguis* 产自欧洲的渐新世到更新世地层,牙齿为向后弯曲的锥状齿。 *Machaerosaurus* 是北美西部古新世和渐新世的属,它的上隅骨较喙状骨大大超前,牙齿圆锥状,齿尖稍向后弯曲,牙齿排列较为稀疏。

鳄目 Crocodylia

河南浙川的鳄类材料称得上丰富,但都很破碎,从野外收集到的大部分是单个的牙齿和头骨碎片。牙齿的大小形态分为三种,它们可能代表三种不同的鳄类。由于头骨材料的缺乏,无法作详细鉴定,但它们在这一点点的存在为确定其古环境及与同时代其它动物

群的对比提供了依据。

1. 剑齿 (Ziphodont teeth)

共有 11 个基本完整的牙齿, 它们是不同的时间分批采集的。其中 3 个牙齿极大, 显然来自同一个体 (V 9590.1—3); 6 个中等大小, 唇—舌面间厚度较大 (V9591.1—6);

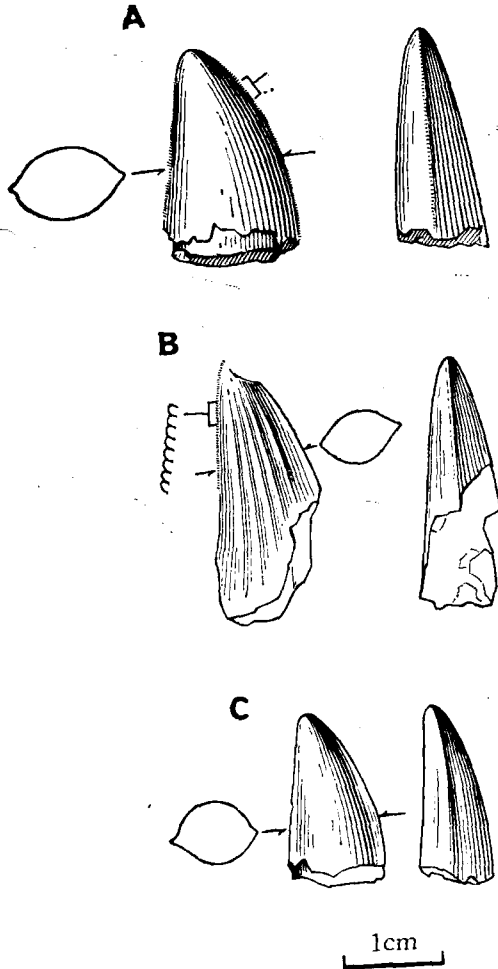


图 4 鳄类牙齿 A. 剑齿 (V 9591.1); B. 剑齿 (V 9592.1); C. 侧扁的牙齿 (V 9593.1)
Fig.4 Crocodilian teeth A. Ziphodont tooth (V9591.1); B. Ziphodont tooth (V 9592.1); C. Compressed tooth (V 9593.1)

余下的两个牙齿表面具极浅的纵棱 (V9592.1—2)。它们的共同特征是, 牙齿侧扁, 具明显的带有锯齿结构的前后棱; 牙齿前后不对称, 前边大于后边, 齿尖向后弯曲; 唇面与舌面也略显不对称, 唇面大于舌面。前后边缘上的小齿较粗大 (见表 1), 齿冠中部—顶部每毫米 3—4 齿, 而牙齿基部边缘小齿变小, 密度加大, 大约每毫米 4.5—5.5 齿。同一牙齿前后缘小齿的密度大致相等, 有时有小的差异, 可能是由材料不完整, 测量高度不同所造成的。测量表明小齿的密度似乎与牙齿的大小无关。

浙川标本与其它地区鳄类的剑齿比较, 差异是明显的。浙川的牙齿较大而粗壮, 边缘小齿的密度小。Langston (1956, 1975) 测量的 *Sebecus* 10 个牙齿中只有两个牙齿的情况与浙川材料相似, 边缘小齿的密度为每毫米 3—4 齿; 6 个牙齿的最大密度为 4—6; 2 个牙齿的最大密度为 6—8。欧洲 *Pristichampsus* 边缘小齿的密度更高, 测量的 3 个牙齿, 其最大密度均可达每毫米 7—8 齿。浙川大部分牙齿的表面是光滑的, V9592 虽有浅而疏的放射状棱, 但仍有别于某些 *Pristichampsus* 牙齿表面的结构。浙川材料与中国南方古新统平顶鳄 (*Planocrania*) 的牙齿形态相似, 但后者的边缘小齿结构不如浙川牙齿发育。

周明镇等 (1973) 记述了浙川的四个牙齿, 认为它们“与欧洲始新世的 *Pristichampsus rollinai* 基本相似”, 订其为 *Pristichampsus aff. P. rollinai*。这 4 个牙齿下落不明, 原文无附图, 无法进行实际比较。推测它们很可能与上面所描述的材料是一致的。

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表 1 (Table 1) 浙川剑齿测量 (Measurements of ziphodont teeth)

单位: 毫米 (in mm)

标本号 Number	齿冠高 Height of crown	齿基部宽 Fore and aft diame- ter at base of crown	齿基部厚 Transverse diameter at base of crown	每毫米锯齿数 Serrations in one millimeter			
				前缘 Leading edge		后缘 Trailing edge	
				齿冠中上部 At middle and upper part of crown	齿冠基部 At base of crown	齿冠中上部 At middle and upper part of crown	齿冠基部 At base of crown
V9590.1	40	25.6	14.6	3	—	—	—
V9590.2	39	21.5	13.2	4	—	3.8	—
V9590.3	27	13.9	8.5	3.8	—	3.6	—
V9591.1	32.9	11.7	9.9	3.6	5.5	4	—
V9591.2	31	17.2	13.7	3.4	—	—	—
V9591.3	23	11.2	9.3	3.8	4.6	3.6	4.4
V9591.4	22	12.8	8.7	4.0	—	4.0	4.4
V9591.5	17	13.3	8	3.8	5	—	—
V9591.6	12	8.6	5.6	4.2	—	5	—
V9592.1	25	14.0	6.6	—	—	3.8	—
V9592.2	13	6.9	4.4	4	4.2	4	—

2. 侧扁的牙齿 (Compressed teeth)

共 8 枚 (V9593)。其中之一齿冠短宽, 但极扁, 侧视三角形, 显然为齿列后部的牙齿。其余 7 齿的形态与上述剑齿相似, 只是齿尖向后倾的程度更小, 略向内侧弯曲。这些牙齿的前后边缘上有微细的皱折, 而没有发育完好的锯齿结构。它们很容易使人联想起大塘平顶鳄的牙齿。这些牙齿显然不同于一般鳄类的前后对称、齿尖弯向内侧的牙齿。从形态上看它介于普通鳄类的牙齿与剑齿之间, 但它与剑齿的同时存在又使人很难把它当作是一个中间发展阶段的代表。

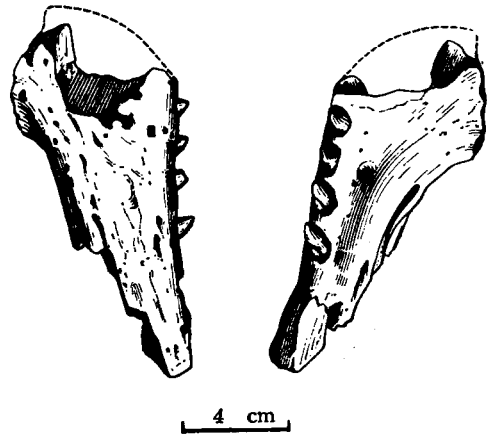


图 5 鳄类不完整的左下颌支 (V 9594)
Fig. 5 Incomplete left mandible (V 9594)

3. 真鳄类的牙齿

几十个牙齿及一左下颌支的前段 (V9594); 标志着一小型鳄类的存在。这些牙齿齿冠长度都不大于 3.5 毫米, 基部宽小于 2 毫米。齿冠前后对称, 齿尖弯向内侧, 表面结构光滑—有放射状的浅棱—纵纹清晰。

二、动物群的讨论

近年来中国始新世地层和哺乳动物群的研究取得了很大的进展, 已初步搞清了地层

层序和对比关系,并在 28 个盆地发现了一百余属哺乳类(童永生,1989)。相比之下,低等四足类的工作显得十分薄弱。几十年来仅有发现于内蒙、河南、湖南等地的个别属种被报道。此次记述的浙川爬行类化石,虽然保存得都不甚完整,但它是目前中国所发现的始新世最丰富的一个低等四足类动物群。必须声明的一点是,在浙川的采集品中,还有另外一些保存不好的蜥蜴牙床及脊椎。受材料所限,也受笔者的水平所限,对这些不同于上述各种的动物目前尚无法鉴定。随着新材料的发现及研究水平的提高,这一动物群定会更加丰富,也许面貌会有相应的改变。

动物群中的浙川厚龟、浙川短齿蜥及河南密齿蜥为地方属种,未见于其它始新世地层。只有 *Tinosaurus* 有着相当广泛的地理分布。它最早出现于古新世(安徽的痘姆响蜥, *T. doumuensis*),始新世时踪迹遍及北美、亚洲、欧洲各地。浙川的响蜥材料与河南卢氏组的卢氏响蜥非常相似。这一相似性与哺乳动物及地层研究工作的结果是相符的,核桃园组及卢氏组上部同为伊尔丁曼哈期(Irdingmanhan age)的沉积。

核桃园组的鳄类材料比蜥蜴保存得更差,仅凭目前掌握的一些单个牙齿能得出的结论是有限的。剑齿也发现于欧洲、非洲及北美的始新世,但它们分属于中鳄亚目和真鳄亚目的几个科。浙川材料不同于任何一已知属的牙齿,它大而粗壮,但边缘小齿的密度小,很可能代表一新的鳄类。第二类与大塘平顶鳄牙齿相似的侧扁牙齿,很可能标志着大塘平顶鳄后裔在核桃园组的存在。核桃园组中鳄类材料的丰富可能反映气候的温和及水域的广布。

笔者对提供化石材料的童永生同志深表谢意,感谢他深入细致的野外工作和在工作中付出的艰辛。同时感谢胡惠清同志,是她为这些化石绘制了精美的素描图。

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FOSSIL REPTILES FROM HETAOYUAN FORMATION, XICHUAN, HENAN

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Summary

Since 1920's, abundant fossil mammals have been collected from the Middle Eocene Hetaoyuan Formation, Xichuan, Henan Province. On the contrary, only two reptile remains from these continental deposits have been reported—a turtle, *Sinohadrianus sichuanensis* Ping, 1929, and a crocodile *Pristichampsus* aff. *P. rollinai* identified on the basis of several ziphodont teeth (Chow *et al.*, 1973).

In recent years, with the progress of studying Eocene mammals, lower tetrapod collections have also been accumulated. The fossils described are all dissociated and fragmentary, and do not offer much of anatomical or phylogenetic interest; they are sufficient in most cases, however, to identify the group to which they belong; only a few remains preserved well enough for a detailed study. Three genera of lizard and three sorts of crocodylian teeth are described in the present paper. This is the first Eocene lower tetrapod assemblage reported from China. Among them, *Tinosaurus* is an agamid widely distributed in the Northern Hemisphere, while *Brevidensilacerta xichuanensis* and *Creberidentat henanensis* are new elements of Agamidae and Anguinae respectively.

The author is deeply indebted and thankful to Tong Yongsheng for turning these valuable materials and for allowing her to make the following description.

Squamota

Agamidae

Brevidensilacerta xichuanensis gen. et sp. nov.

Holotype An incomplete right lower jaw (IVPP V 9587.1).

Paratype An incomplete right maxilla (V 9587. 2), a premaxilla (V 9587.3).

Referred specimens 3 incomplete left maxillae (V 9587.4—6); 2 incomplete right maxillae (V 9587.7, 8); 2 premaxillae (V 9587.9, 10); an incomplete left lower jaw (V 9587.11); 4 broken jaw bones (V 9587.12—15).

Locality Xichuan, Henan Province.

Horizon Middle Eocene, Hetaoyuan Formation.

Diagnosis Mandibular deep and stout. Dentary extending backward to the level posterior to the high coronoid process. Meckel's groove widely open. Dentition consisting of 4—5 premaxillary (in total on both sides), 10 maxillary, 14 dentary teeth. Premaxillary and anterior 4 dentary teeth pleurodont, upper and lower cheek teeth acrodont, stout and slightly compressed, with wearing facets on top of posterior cheek teeth horizon and convex lens-shaped.

Description and discussion The type specimen (V 9587.1), only consists of dentary and coronoid, which can not be distinguished one from the other for the fusing tightly. The posterior end of the dentary, bearing some analogue to that of living *Agama*, is located far behind the level of the coronoid process, and separated by a narrow notch into two branches — the lower one is larger and has a smoothly curved lower margin. Like other agamids, *Brevidensilacerta* has a heterodont dentition, composed of 4 pleurodont teeth and 10 acrodont cheek teeth on the lower jaw. The cheek teeth are different from that of other agamids in having a stout crown, a horizontal wearing facet on the top of crown and a small depression on the anterior lingual surface of posterior teeth. On the lingual surface of the lower jaw a shallow groove below the dentition is present and closed at the 6th acrodont tooth.

Premaxillae are fused and bearing 4 (V 9587.9,.10) or 5 (V 9587.3) pleurodont teeth. All the specimens of maxillae (V 9587.2,.4—8) are incomplete, non of them can tell whether the premaxillary processes of maxilla meet at midline and separate the premaxilla from vomer or not. There are two broken and 8 complete acrodont teeth on maxilla, which show similarities to dentary teeth in size and in shape.

Brevidensilacerta xichuanensis agrees with the genera of Agamidae in having a fused premaxilla, heterodont dentition, a posterior extension of maxilla under orbit. The earliest representatives of the family, *Mimeosaurus*, *Priscagama* and *Pleurodonagama* were discovered from the Cretaceous of Mongolia (Borsuck-Bialynicka and Moody, 1984). They differ from *Brevidensilacerta* in having a closed Meckel's groove, a long and narrow splenial, and a posterior mylohyoid foramen. Eocene seems to be a flourished period for agamids and several genera have been found in northern Asia, Europe and North America. *Tinosaurus*, a widely distributed Eocene agamid, was erected on the basis of jaw bones with acrodont tricuspid teeth and opened Meckelian groove. The differences in tooth shape of *Brevidensilacerta* from *Tinosaurus* are distinct, but the depression on lingual surface of cheek teeth in *Brevidensilacerta* might suggest certain relations between the two genera. In fact, besides *Brevidensilacerta* several tinosaur tricuspid teeth were collected from the same locality, which will be mentioned below.

Hou (1974) has reported two agamids, *Anhuisaurus huainanensis* and *Agama sinensis*, from the paleocene Wanghudun Series of Anhui, China. It is reasonable for Estes (1983) to oppose assignment of the former to an agamid, but an amphishaenian, for the presence of a short acrodont dentition. The present author also fail to

find that the type specimen of the latter, a poorly preserved jaw bone without premaxilla and the anterior portion of mandible, was identical with a heterodont dentition as described by Hou. The pattern of the tooth plantation is not a typical acro-dont-type either.

Tinosaurus cf. *T. lushihensis*

A broken lizard jaw bone (V 9588), obtained along with the other lower vertebrates and mammalian fossils from Hetaoyuan Formation, Xichuan by screening projects, contains two complete teeth and the basal portion of a third. Their crowns are compressed and pointed with three cusps. The teeth as in the posterior cheek teeth of *T. lushihensis*, are not only closely spaced, but also slightly overlapped each other—the posterior cusp of anterior tooth is external to the anterior cusp of posterior tooth.

Two points about *T. lushihensis* are worth mentioning here. Reexamination of the referred specimen (V 2899, Dong 1965) indicates that it is a left maxilla rather than a right dentary. The teeth are compressed laterally as in the other species of *Tinosaurus*, instead of compressed transversely as described by Dong (1965).

(?) *Anguidae*

Creberidentat henanensis gen. et sp. nov.

Holotype A left maxilla (IVPP V 9589.1).

Paratype An incomplete right ramus of lower jaw (V 9589.2).

Referred specimens Two left maxillae (V 9589.3, 4); 4 incomplete right mandibles (V 9589.5–8); a posterior portion of left mandible (V 9589.9).

Locality Xichuan, Henan Province.

Horizon Middle Eocene Hetaoyuan Formation.

Diagnosis Skull medium. Maxilla with an anterior process turning upwards. Teeth pleurodont, closely spaced. Crown laterally compressed and leaf-like. 17–19 maxillary, 19 dentary teeth. Postero-ventral margins of dentary and intramandibular septum arc-like, without postero-ventral process. Meckel's groove open.

Description and discussion The type specimen is 12 mm long and 7 mm high. The surface is smooth and straight on both vertical and horizontal directions. The anterior end of the maxilla does not form a process pointed anteriorly, but a process turning upwards. As a result, the maxilla surrounds the external naris from three sides, anterior, underneath and posterior.

Except the well preserved dentary and coronoid, the other bones of lower jaw are lost completely in all mandible fragments (V 9589.2, 5–9). Below the posterior dentition, a thin sheet of bone with a free ventral border indicates the presence of an intramandibular septum. In identical to that of dentary, the postero-ventral border of intramandibular septum is smooth and arc-like, without any projection as in other anguids.

The upper and lower dentitions are isodont and pleurodont. The teeth have a stout stem and a leaf-like, laterally compressed crown. They are closely spaced and generally projecting about one-half their height above the parapet of the jaw. There are 17—19 teeth on the maxilla and 19 on the dentary. The lower dentition is 11 mm long.

The *Creberidentat henanensis* is of lacertilian, but its systematic position is debatable. The feature of the intramandibular septum, the pleurodont teeth and the opened Meckel's groove, may suggest that *Creberidentat* is of a member of Anguinae, Anguillidae. The inadequate fossil material in this subfamily makes the comparison unreliable. *Ophisaurus hellensis* from the Middle Eocene of Europe has relatively short dentition with only 11 teeth. *Anguis*, an Oligocene to Pleistocene genus of Europe, differs from *Creberidentat* in bearing recurved fanglike teeth. *Machaerosaurus* from the Oligocene and Pliocene of western North America, is distinguished from *Creberidentat* in having a widely spaced dentition, recurved conical teeth and a subangular extending anteriorly well in advance of coronoid.

Crocodylia

Fossil crocodiles are common in the Hetaoyuan reptile fauna. The materials, including many isolated teeth and several pieces of skull bone are exclusively too fragmentary to determine its generic or family affinities with any assurance, but the evidence of the tooth morphologies implies that more than three types of crocodiles seem to exist together during the Middle Eocene.

1. Ziphodont teeth

Eleven laterally compressed teeth with serrations on their fore and aft carinae were collected in different expeditions. Among them, three teeth (IVPP V 9590. 1—.3) are quite large and supposed from an individual; six teeth (V 9591. 1—.6) are medium in size, their cross section near the bone has a greater transverse diameter and are more oval in outline; the other two teeth (V 9592.1,2) develop slight fluting on the crowns. The serrations in the material mentioned above are almost regular—3—4 per millimeter at middle to upper carinae and 4.5—5.5 per millimeter at crown base, which are of larger relative size than serrations of other ziphodont teeth of comparable proportions (see table 1 and Longston 1956 table 1).

The ziphodont teeth of Hetaoyuan Formation were first described and assigned to *Pristichampsus* aff. *rollinai* in 1973 (Chow *et al.*). Possibly, they have no difference from the specimens at my disposal. Unfortunately, the reexamination and comparison can not be done for the lost of Chow's specimens. *Pristichampsus rollinai* is distinguished from Xichuan remains by the denser serrations, 5.5—9.9 per millimeter (Langston, 1956).

2. Compressed crocodylian teeth

Eight teeth (V 9593. 1—.8) are similar to the ziphodont teeth in shape, but different from them in lacking serrations on anterior and posterior edges. Their crowns are laterally compressed and curved slightly on both directions, lingual and poste-

rior. They are reminiscent of the teeth of *Planocrania*. From the point of view of morphology, the teeth stand on an intermediate stage between normal crocodilian teeth and ziphodont teeth.

3. Normal crocodilian teeth

Several dozen teeth (V 9594) and some broken skull bones indicate that there exist a small-sized crocodilian in the fauna. The teeth crown with normal crocodilian shape are either smooth or fluting. They are less than 3.5 mm long and 2 mm wide at crown base.

The Xichuan herpetofauna is by far the richest assemblage of fossil reptiles from the Eocene of China, both in terms of quantity of material and taxonomic diversity. Of the species a turtle *Sinohadrianus sichuanensis* and two lizards, *Brevidensilacerta xichuanensis* and *Creberidentat henanensis*, are endemic taxa. Only the agamid *Tinosaurus* had a wide geographic and stratigraphic distribution, which occurs also at a number of Paleocene and Eocene sites in North America, Europe and China. The Xichuan crocodilian remains are rich, but bearing no significance in determining generic or family affinities for the poor preservation. The abundance of fossil crocodilians may imply a warm climate and widely spreaded water area in Eocene.