

# 周口店“顶盖”层中的大灵猫化石

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## 内 容 提 要

本文对裴文中教授1939年记述的采自周口店“顶盖”层中的 *Viverridae* indet. 化石作了补充研究,发现它和印度及非洲的一些大灵猫化石十分接近,代表了我国一类特有的大灵猫化石,特定名为裴氏大灵猫 *Viverra peii*. 文中对它的系统关系,对“顶盖”层沉积的地质时代和古气候都进行了讨论。

1939年裴文中教授曾简短地报道过发现于周口店“顶盖”层中的几件未定属种的灵猫科化石。这几件化石,到目前为止,仍然是我国蓬蒂期以后和泥河湾期(狭意)以前这段时期中有关灵猫化石的唯一报道。关于它的性质,当时并不很清楚。裴只是提到:“它的大小和圆形的  $M^2$  表明它颇似鼬鬣狗 (*Ictitherium*), 但牙齿的主要特征却是典型的亚洲大灵猫式的……。”实际上,这几件标本中的上牙齿和 Bose 1879年记述的上西瓦利克的巴氏大灵猫 (*Viverra bakeri*) 十分相似。遗憾地是当时并没有和西瓦利克的标本进行对比,也没有确定属、种,而只是说:“它显然是中国过去未曾报道过的一类新的灵猫。”

最近十几年来,在非洲又不断发现了类似的灵猫化石。这就是 Petter 1963年所定的李氏大灵猫 (*Viverra leakeyi*)。Petter 在研究这些标本时注意到了它们和巴氏大灵猫很相似,但没有注意到周口店“顶盖”层的标本。其实,中国、印度和非洲这三类在时代和性质上都很接近。它们对研究大灵猫的起源和进化是很重要的材料。

目前我们对这些大灵猫化石了解还很少,主要是因为材料很少:印度的材料中没有下牙,非洲的全是零星的牙齿。相对而言,周口店“顶盖”层中的材料还较完整些;有属于同一齿列的上、下牙。上颌为一幼年个体,  $P^2, P^3$  大部尚在齿槽内,这次我们也把它们修理了出来,对齿槽的轮廓也予以修整,这使我们对这些牙齿有了更确切的了解。

本文拟对这些化石作进一步的描述、定种,并对有关的几个问题稍加讨论。

## *Viverra peii* sp. nov. (裴氏大灵猫)

**正型** 右上颌,幼年个体,带  $P^2-P^4$  和  $M^2, M^1$  齿槽部分保留。V6092 (原始编号, CP. 123)。

**其它材料** 左下颌水平支,带  $P_4-M_1$ 。V6093。(CP.124); 单个左  $M_1$ , 下前脊破碎。V6094 (CP.125?)。

**特征** 体型大,比亚洲大灵猫中大者大约  $1/4$ 。牙齿的基本形态和各齿间的比例与现生亚洲大灵猫者最接近,但  $M^2$  舌侧宽圆,冠面呈瘤状结构,与现生非洲大灵猫有些相

似。前臼齿常具小瘤状突起;上前臼齿内齿带发育,  $P^3$  具切割状“跟座”;下颌水平支高。

**描述** 颧弓前端横向宽,在眼眶的前下角最宽达 8mm, 颧骨在此处一半面向上,下半面向外。眶前缘位于  $P^4$  中线附近;眶前孔位置低,位于  $P^3$  后缘稍前,它与眶前缘之间的距离约为 13mm。

上齿列中  $P^2$  刚刚从齿槽中萌出,  $P^3$  主尖露出不足 5mm,  $P^4$  三个尖均已露出,但原尖露出很少。 $M^1$  生前脱落,  $M^2$  已全部露出。上述各牙均未磨蚀。

$P^2$  和  $P^3$  构造比较接近。主尖的前嵴仅于齿冠基部发育,稍稍偏向内方;后嵴都很发育,自顶端开始,在  $P^2$  上,后嵴在其下 1/3 处形成一小尖,此小尖的外后方为一不规则的小瘤状物。在  $P^3$  上,后嵴的下 1/3 倾斜显著变缓,形成一切割式的“跟座”,“跟座”与主尖间隔以小切口,切口的内外面延伸成沟。这两个牙齿的内齿带都很发育,在前嵴基部的后方形成小瘤,这在  $P^3$  中看得最清楚;前外齿带也清楚,主尖以后的外齿带很微弱。

$P^4$  前附尖低小,但很清楚,为嵴形,并以沟和前尖相分。它的外壁上也有一个小瘤状物。前尖(主尖)近锥状,并不特别后倾,后附尖近嵴状,也并不特别向外歪曲,两切叶之间的夹角较宽缓。原尖大,三角形,并不特别向前伸,因此齿前缘也不形成凹入。内齿带发育,自原尖顶端分别向前、后伸延,后者在切叶内侧为瘤状嵴,前者延伸成前齿带,前外齿带在前尖之前发育。

$M^1$  缺失。有两个齿根的槽保留较清楚。估计它的轮廓应比较短宽,而且前附尖比后附尖向外伸展较多。

$M^2$  近一外平内圆的长方形,宽稍大于长。外缘有三个小尖,中间者最小而尖锐,前者为向前外方弯曲的嵴形,后者则为锥形。原尖与前、后嵴形成一 U 形嵴:原尖嵴形,是 U 形嵴中最高的部分,前嵴较低,后嵴和原尖之间以沟相分,后嵴本身中部也以沟相分。U 形嵴和外缘三尖所包围的中央小面微凸,周围有一圆形槽,使  $M^2$  的冠面呈瘤状结构。在原尖和后嵴之间的沟的基部内面有一小瘤,是内齿带的代表。

下颌骨粗壮,  $M_1$  处骨体高达 23mm。后颞孔相当大,位于  $P_3$  前端。从齿槽看,  $P_2$  和  $P_3$  都相当粗壮。  $P_4$  前附尖低,但很明显,其内侧还有两个不规则的小瘤;后附尖高大,其内侧面稍前下方还有一单独的小瘤。后齿带,特别是内半段很发育,外齿带很微弱。

$M_1$  三角座宽大而高,下原尖最高,下后尖最低,但仍比跟座高。跟座比三角座稍窄,近一圆盆状,盆缘由嵴状尖组成:下次尖最高,下内尖次之,下次尖之前还有一小的下中尖(mesoconid),在 P. 125 标本上,下内尖之前也有一个小尖——下内小尖,但在 P. 124 标本上却没有这个小尖。下次小尖由分割不太明显的两个嵴形小尖组成。盆中央为一向舌侧倾斜的不规则面。 $M_2$  从齿槽看,还相当大。

上述标本中上颌和下颌显然不属同一个体,因为上颌所代表的个体更年幼。那个单独的  $M_1$  和下颌也不属同一个体,因为都是左侧的。 $M_1$  和上颌的关系很难判断。但把它们归入同一种大概没有什么疑问的。它们采自同一地点,大小恰相吻合,上、下牙在形态特征上也很一致,都是亚洲大灵猫型,但又有些非洲大灵猫的特点。

**比较** 这种动物的牙齿,在基本特征上,正如裴所指出的:“是典型的亚洲大灵猫式的”。

它们之间的共同特征是: 1. 上裂齿长大于宽,而且也大于  $M^1 + M^2$  的长; 2. 臼齿外

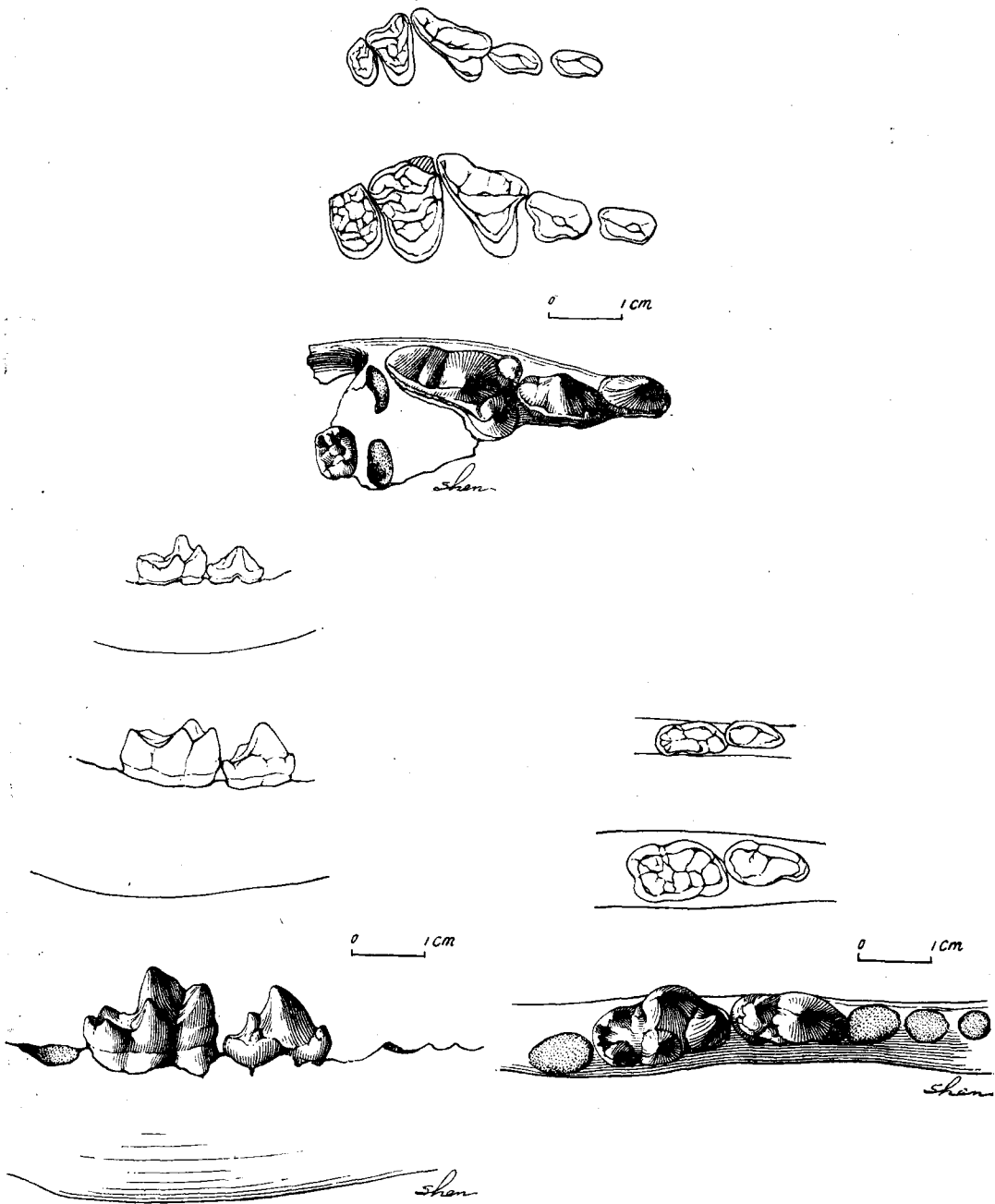


图 1. 三种大灵猫上、下颊齿的比较

Upper and lower cheek teeth of *Viverra tangalunga* IVPP. 189 (upper row), *Civettictis civetta* IVPP. 199 (middle row) and *Viverra peii* sp. nov. (lower row).

缘明显地斜向内后方，亦即：白齿和前白齿外缘连线之间的夹角较小；3. 前白齿扁长， $P^3$  没有明显的内侧隆起；4. 下裂齿三角座宽大而高，三个尖高度相差较大。上述几点其实也正是亚洲大灵猫和非洲大灵猫，(*Viverra* 和 *Civettictis*) 的不同之处。非洲大灵猫的上裂齿短宽，虽然长比宽稍大一点，但肯定比  $M^1 + M^2$  的长度小，白齿外缘向内后方倾斜

表 1. 上、下颊齿测量与比较

	P <sup>2</sup> (L×W)	P <sup>3</sup> (L×W)	P <sup>4</sup> (L×W)	M <sup>2</sup> (L×W)	P <sup>3</sup> + M <sup>2</sup> (L)	M <sup>1</sup> + M <sup>2</sup> (L)
<i>Viverra zibetha</i>	10.0×5.8	12.6×6.4	18.9×11.8	6.0×8.5	41.0	~13.0
<i>V. leakeyi</i> (measured from Petter, 1963 et 1977)		12.0×5.9	17.2×12.5	5.0×8.0		14.0
<i>V. bakerii</i> (calculated and measured from Lydekker, 1884)		10.1×5.8	15.7×10.0	5.8×10.1	36.0	14.2
<i>V. zibetha</i> (measured from Lydekker, 1884, fig. 12)	8.3×3.6	8.3×4.1	13.5×10.5	5.0×8.5	32.0	9.6
<i>Civettictis civetta</i> (IVPP. 199)	8.0×4.2	9.3×6.4	13.0×11.5	6.5×10.0	35.0	16.5

	P <sub>4</sub> (L×W)	M <sub>1</sub> (L×W)	下颌高 (H <sub>a</sub> + M <sub>1</sub> )
<i>Viverra zibetha</i>	15.5×7.0	19.0×10.0	23.0
<i>V. leakeyi</i> (measured from Petter, 1977)	13.0×6.7	16.3×9.0	
<i>Civettictis civetta</i> (IVPP. 199)	11.0×6.3	14.0×8.3	17.5

的也弱;前臼齿较短宽, P<sup>3</sup> 有明显的内隆;下裂齿三角座低小,三个尖几乎一样高。

但裴氏大灵猫也有某些与现生亚洲大灵猫并不相同,而和非洲大灵猫倒有点类似的地方。1. 它的体型较大。非洲大灵猫是目前最大的灵猫,所以在这一点上它和非洲大灵猫倒更接近;2. 牙齿的切割性弱,而近锥状:上、下前臼齿都有附加的瘤状构造, M<sup>2</sup> 不为三角形,舌侧宽圆,呈瘤状结构。

裴氏大灵猫也有一些自己的特点:1. 上前臼齿内齿带特别发育, P<sup>3</sup> 有切割式的“跟座”;2. M<sup>2</sup> 虽呈瘤状构造,但很弱,内齿带仅为一小瘤状物,而不是包围整个内缘;3. 下颌水平支骨体特别高,远高于任何已知种;4. 颧弓特别粗壮,其后端横向宽(这一点也可能和年幼有关?)。

综上所述,周口店的标本虽然有一些和非洲大灵猫相似的特征,也有一些自己的特征,但无疑仍应归入亚洲大灵猫属。

在该属已知的化石中,在大小和形态上和我们的标本比较接近的,实际上只有两个种:即巴氏和李氏大灵猫。

巴氏大灵猫仅发现于印度上西瓦利克,材料只有残破的头骨和 P<sup>3</sup>—M<sup>2</sup>。它确实和我们的标本十分相似,特别是在 P<sup>4</sup> 的形态和大小, P<sup>3</sup> 和 M<sup>2</sup> 比现生亚洲大灵猫都相对较大, M<sup>2</sup> 呈瘤状结构等方面。但它们之间也有明显的不同之处:1. 巴氏大灵猫体型较小(见表 1);2. 它的 P<sup>3</sup> 既没有强壮的内齿带,也没有切割式的“跟座”;3. 臼齿外缘向内后方倾斜程度较低,它和前臼齿外缘连线之间的夹角大约有 140°, M<sup>1</sup> 的前附尖大概也不很往外伸;4. P<sup>4</sup> 的原尖和前附尖相对较小,也没有瘤状的内齿带。

非洲的李氏大灵猫材料也很零散,至今仅知 C, P<sup>3</sup>—M<sup>2</sup>, P<sub>4</sub> 和 M<sub>1</sub>。它在大小上和我们的标本倒更接近,但在构造上却不如巴氏大灵猫与我们的标本那样接近。1. 它的 P<sup>3</sup> 也

和巴氏大灵猫的一样,没有明显的内齿带和切割式的“跟座”;2.李氏大灵猫的 $P^4$ 有两件标本,但这两件标本的构造不太一样:莱托利尔(Lactolil)的 $P^4$ 原尖缺失,但整个牙齿,特别是前附尖的部分,和我们的标本很接近;但奥莫(Omo)河谷的那件标本却没有前附尖,而且原尖很向前倾;3. $M^2$ 不呈瘤状结构,内齿带在整个舌侧发育;4.从插图看, $M_1$ 的跟座构造较简单:似乎没有下中尖,下次小尖大概也不一分为二;5. $P_4$ 主尖内侧后方也没有小瘤。

总之,周口店的标本不同于任何已知种,为了纪念它的第一个描述者,命名为裴氏大灵猫。

### 讨论

#### 1. 关于裴氏大灵猫的地质时代。

1939年裴文中曾指出,周口店“顶盖”层的时代,根据共生的原鼯鼠(*Prosiphneus*)化石的原始性(齿根较长),肯定应早于维拉方期(这是指狭意的维拉方,即晚维拉方期,而且当时还放在上新世内),而根据大型鹿化石及模鼠(*Mimomys*)的存在,则一定晚于典型的蓬蒂。灵猫化石因系新类型,无法说明时代。

现在看来,大灵猫化石也能说明时代。在这方面,李氏大灵猫的资料,由于有同位素年龄的控制,比较有说服力。李氏大灵猫最初发现于东非坦桑尼亚的莱托利尔,其同位素年龄测定为3.5百万年。1977年在东非埃塞俄比亚的奥莫河谷的B—G层中又发现了这种化石,其同位素年龄测定为3—1.9百万年。这两个地点的时代,按照现在绝大多数新生代后期地层工作者的意见,相当于维拉方的早期。在更晚的地层中就再没有发现过李氏大灵猫。1974年Hendey曾报道过,在南非的Langebaanweg也发现过这种化石(标本描述未曾见到)。它的时代,根据动物群对比,大约为4—5百万年,最近Hendey又提出可能更早些,但无论如何也肯定晚于典型的蓬蒂期,亦即不会早于7百万年。印度的巴氏大灵猫没有确切的产地,只知产于上西瓦利克,Pilgrim曾推测它可能产于Pinjor层,但也不敢肯定。看来,也大体和非洲的时代相吻合。考虑到中国、印度和非洲这三个种是如此的相似,又和同期其它的灵猫类化石如此的不同,它们在时代上极可能也是大体一致的,也可能在纬度低的地区,由于气候变化较弱,残存的时代更晚一些。根据这种推测,周口店“顶盖”层产裴氏大灵猫的时代就很可能应该是维拉方早期或更早一些,其绝对年龄大概应为距今3—4百万年左右。

#### 2. 关于裴氏大灵猫的系统关系和分类地位。

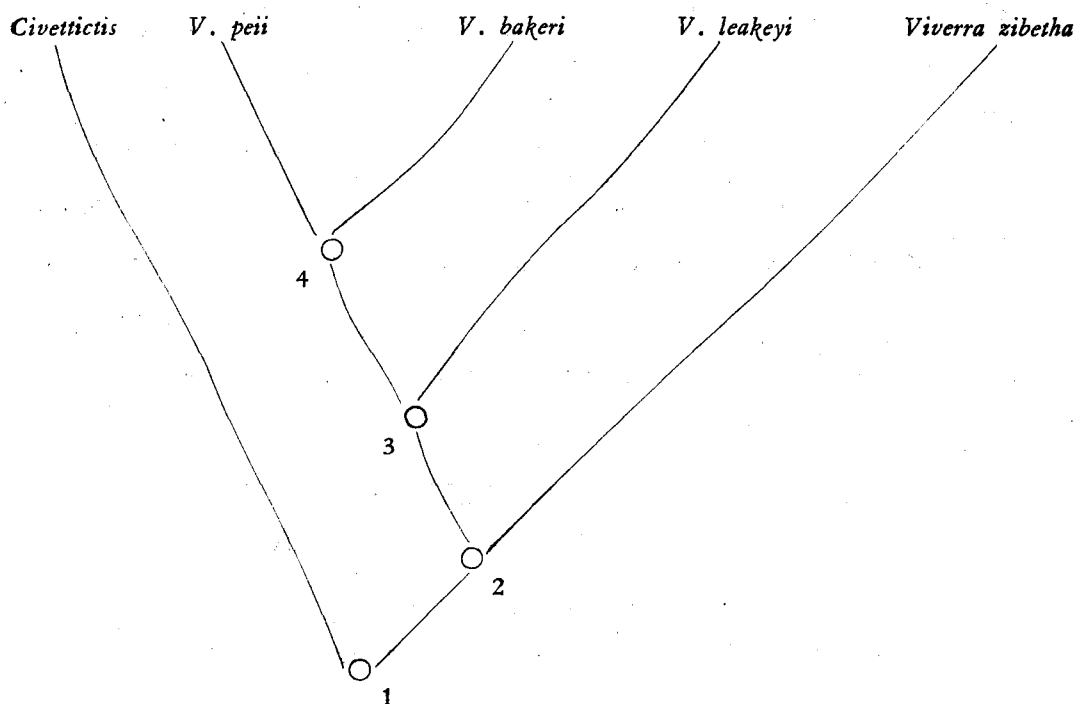
巴氏大灵猫的发现,由于它在特征上介于亚洲大灵猫(*Viverra*)和非洲大灵猫(*Civettictis*)之间,引起了人们对这两个现生属之间的系统关系的讨论。Lydekker(1884)认为裂齿小白齿大的非洲大灵猫代表了原始的类型,而裂齿大白齿小的亚洲大灵猫则是由巴氏大灵猫臼齿逐渐退化而产生的。Matthew(1929)则相反,认为非洲大灵猫是向杂食(臼齿研磨作用加强)方向适应的结果。Petter发现了李氏大灵猫后又详细讨论了这个问题。她分析了两方面的理由,觉得都有道理。不过她指出像亚洲大灵猫这样的切割型齿式早在中新世就已出现,而非洲大灵猫则很晚才出现,似乎更倾向于Matthew的意见。

裴氏大灵猫的发现使我们相信,裴氏、巴氏和李氏这三种大灵猫虽然在特征上介于现生亚洲和非洲两类大灵猫,但它们不会是连结这两个现生属的中间环节。它们之间只会是

姊妹组的关系。裴氏、巴氏和李氏大灵猫的前臼齿已相对较大,但却不像非洲大灵猫那样横宽,臼齿在瘤状结构和齿带构造上也很不相同,这说明它们只是在适应杂食的方向上一致,而没有直接的系统关系。非洲大灵猫很可能是从更早一些的某种类型中产生的。裴氏、巴氏和李氏大灵猫也不可能是亚洲大灵猫的直接祖先。除了它们已特化之外,大约在同一时期,在欧洲的 Roussillon (Deperet, 1890) 和早维拉方 (Hürzeler, 1967) 发现的派氏大灵猫, *Viverra pepraxi* 显然和亚洲大灵猫更为接近得多。它作为亚洲大灵猫的祖先倒很合适。

现在看来,这个时期大概是大灵猫类辐射发展的一个重要时期。除了上述的化石外,和巴氏大灵猫一起发现的还有另一类特化的大型灵猫: *Vishnuictis durandi*。

上述系统关系可用下述分支图表示:



1. 非洲大灵猫与其它各种为姊妹组。前者向杂食方向发展,  $P^4 < M^1 + M^2$ ,  $M_1$  三角座低小; 后者  $P^4 > M^1 + M^2$ ,  $M_1$  三角座高大;

2. 亚洲大灵猫与其余各种为姊妹组。前者向切割方向发展,前臼齿、臼齿变小; 后者体型增大,前臼齿和臼齿与裂齿相比相对较大;

3. 李氏大灵猫与裴氏及巴氏大灵猫为姊妹组。后者  $M^2$  呈瘤状结构;

4. 裴氏与巴氏大灵猫为姊妹组。前者  $P^3$  发育切割式“跟座”。

上述分支图所表示的系统关系,在分类上则意味着: 1. 李氏、巴氏和裴氏大灵猫是性质相似、系统关系更接近的一组; 2. 它们与亚洲大灵猫为姊妹组,亦即有更晚近的系统关系; 3. 它们是早期特化而灭绝的一支。按照严格的分支分类学的观点,它们完全可以建立新属。不过为了避免分类的复杂化,我们还是赞成把它们放在亚洲大灵猫属内。如

果愿意,也可以建立一个亚属。*Megaviverra*也许是一个很合适的亚属名称。

### 3. 关于“顶盖”层沉积时期北京附近的古气候。

我们知道,现生亚洲大灵猫仅分布于我国秦岭以南的热带和亚热带地区,而现生非洲大灵猫则是一种典型的热带地区动物。裴氏大灵猫在食性的适应上更接近于非洲大灵猫,而不同于亚洲大灵猫。这会不会表明当时北京附近的气候比现在炎热得多,不仅仅是亚热带,而且可能是接近热带的气候呢?

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## VIVERRA PEII, A NEW SPECIES FROM THE 'CAP' TRAVERTINE OF ZHOUKOUDIEN

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### Abstract

In 1939, in a report on fossil materials and artifacts collected from the Zhoukoudien region during the years 1937 to 1939, Prof. Pei mentioned some viverrid specimens under the title of 'Viverridae gen. indet.' In describing the specimens Pei wrote: 'The size of the fossil and the rounded shape of the M<sup>2</sup> would rather suggest its being an *Ichitherium*. But the main dental characters are typically those of a *Viverra*.' and concluded: 'This is evidently a new type of viverrid not reported so far in China.' Unfortunately, neither Prof. Pei himself, nor anyone else, has had the opportunity to return to this rather puzzling viverrid so far, and the specimens remain still generically and specifically undetermined now.

In spite of scarcity of the material and vague determination, the above-mention-

ed specimens represent the only reported viverrid collected from the postpontian and pre-nihowanian deposits of China.

In the present paper the author intends to give a more detailed description and some remarks on its systematic position based on cladistic analysis.

*Viverra peii* sp. nov.

**TYPE** Right maxilla of a young individual, with  $P^2$ — $P^4$  and  $M^2$ , V6092 (original No. CP 123).

**OTHER MATERIAL:** horizontal ramus of left lower jaw, with  $P_4$  and  $M_1$ , V 6093 (original No. CP 124) and an isolated left  $M_1$ , V 6094 (orig. No. CP 125?).

**BRIEF DESCRIPTION:** Zygomatic arch strongly built, forming a wide shelf of the orbit. The anterior border of the orbit lies above the middle of the  $P_4$ , while the preorbital foramen lies above the posterior border of  $P_3$ . The distance between the orbit and the foramen is 13mm. All the upper premolars are not yet fully erupted, so we had to remove some parts of the maxillar bone to expose the covered parts of the crowns.

$P^2$  elliptical in shape. Anterior ridge developed only in the lower 1/3 and situated a little lingually, while the posterior ridge developed fully, with a small denticle at the junction between its upper 2/3 and its lower 1/3. Cingulum well developed, interrupted merely at the middle of the labial side. The lingual cingulum is especially prominent, forming a tubercle behind the base of the anterior ridge.

$P^3$  considerably larger than  $P^2$ . Its anterior ridge extends upwards almost to the summit of the main cusp. The lower 1/3 of the posterior ridge forms a trenchant 'talon', which is separated from its upper 2/3 by a small notch, and a groove on its labial side. Cingulum as in the  $P^2$ , but comparatively stronger.

$P^4$  having its longitudinal diameter more than its transverse diameter, and even a little more than the combined length of  $M^1 + M^2$  measured from the outside. Parastyle small, with a vague and irregular tubercle on its outer side. Paracone conical, nearly vertical, the angle between the paracone and the metastyle lobes opens widely. Protocone does not reach the anterior margin of the tooth. The inner and the antero-external cingula are well developed, the inner cingulum behind the protocone is faintly granulated.

Judging from the preserved alveoli,  $M$  must be much broader than long.

$M^2$  rounded in shape, but its longitudinal diameter is a little less than its transverse diameter. Externally there are three 'cones', the middle being the smallest, but the most acute one. Around the anterior, internal and posterior borders of the tooth there is a U-formed crest consisting of tubercles. Cingulum is represented by merely a minute tubercle in the interno-posterior corner.

Lower jaw strongly built. Height at the  $M_1$  about 23mm. Posterior mental foramen lies beneath the anterior border of  $P_3$ .

$P_4$  having the anterior accessory cusp well shown. In addition there are two irregular tubercles on its inner side. The posterior accessory cusp is much more prominent than the anterior one. At the place of the metaconid there is a small tubercle. 'Talonid' wide, with a granulated posterior cingulum.

$M_1$  having the trigonid larger and higher than talonid. Protoconid is the highest and the most robust conid, while the metaconid is the smallest and the lowest in the



trigonid. Talonid low, but large and wide. Hypoconid large, endoconid a little smaller and hypoconulid bicuspid. There is also a 'mesoconid' in front of the hypoconid.

**COMPARISON:** The above described specimens seem not too diverging from the genus *Viverra* to be erected as a new genus as suggested by Pei in 1939. In fact, the basic structure of the teeth is quite the same as that of *Viverra*. The features shared by the genus *Viverra* and the described specimens are: 1.  $P^4$  with the longitudinal diameter greater than its transverse one and greater than the combined length of  $M^1 M^2$ , too; 2. The external borders of  $M^1$  and  $M^2$  extend interno-posteriorly, thus forming an angle between the molar and the premolar external border-lines; 3. Premolars elongated,  $P^3$  without inner protuberance, and 4. The trigonid of  $M_1$  much larger and higher than talonid, the three conids of the trigonid are different in size and in height. It is mainly by these characters that the genus *Viverra* may be distinguished from the morphologically similar and phylogenetically closely related genus *Civettictis*. And this is the reason why we prefer to refer the described specimens as a member of the genus *Viverra*.

Among *Viverra* species only two species: *V. bakeri*, erected by Bose in 1879, and *V. leakeyi*, discovered by Dr. Petter in 1963, are more closely related to our 'Cap' specimens. They share the following characters: Size larger. Judging from the preserved parts, they must be larger than all other known species of *Viverra*, but approximate in size to *Civettictis*, the largest living form among Viverridae. All the teeth of the three forms show some degrees of tendencies toward omnivorous or frugivorous habits. This is shown either by their robust premolars, or by the enlarged and complicated  $M^3$  and the talonids of the lower carnassials.

However, the described specimens can be easily separated from the two species 1. by the upper premolars having more prominent inner cingulum, and  $P^3$  with a trenchant 'talon'; 2. by rudimentary inner cingulum on  $M^3$  and 3. by strongly built zygomatic arch and horizontal ramus of lower jaw. In the shape and structure of the  $M^2$ , our specimens seem to be more similar to *V. bakeri* rather than to *V. leakeyi*.

Based on the foregoing description and comparison we are inclined to establish a new species for the 'Cap' material, *V. peii*, the specific name is dedicated to its first describer, Prof. Pei. The new species may be diagnosed as: size large, zygomatic and lower jaw strong, premolars with additional tubercles,  $P^3$  with a trenchant 'talon',  $M^3$  widened lingually and covered with tubercles, talonid of  $M_1$  large and wide.

**DISCUSSION:** Since the discovery of *V. bakeri* in 1879, which is morphologically intermediate between *Viverra* and *Civettictis*, there have been two points of view about the phylogenetic relationship between the two genera. Lydekker considered *Civettictis* as the more primitive form from which *Viverra* evolved, while Matthew thought quite the opposite.

In my opinion, the phylogenetic relationship between the two genera could be, perhaps, more easily understood by means of cladistic analysis. In this way, 1, *Civettictis* may be the sister-group of *Viverra*, the former is adapted to frugivorous or omnivorous diet, with  $P^4 < M^1 + M^2$  and very large talonid of  $M_1$ , while the latter with  $P^4 > M^1 + M^2$  and large and high trigonid of  $M_1$ ; 2. The living species of *Viverra* (*V. zibetha*) may be the sister-group of *V. peii-V. bakeri-V. leakeyi* group. The latter group evolved along the direction to some extent parallel to *Civettictis*; 3. *V. leakeyi* may be the sister-group of *V. peii* and *V. bakeri*, the latter with  $M^2$  more rounded and

covered with tubercles; 4. *V. peii* and *V. bakeri* may be a pair of sister-groups, the latter with prominent inner cingulum on the premolars and a trenchant 'talon' on P<sup>3</sup>.

From the foregoing analysis it seems reasonable to assemble *V. peii*, *V. bakeri* and *V. leakeyi* into one separate group, if necessary, a subgenus, for which *Megaviverra* may be a suitable name.

The deposits yielding *V. leakeyi* fossils have been dated radiometrically. Their age ranges from about 5 million years to 1.9 million years before present. This is well accorded with the proposed geological age of the 'Cap' travertine of Zhoukoudien. The presence of *V. peii* also indicates that the 'Cap' travertine might be accumulated under a much warmer climatic condition than that of today.