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EOENTELODON—A NEW PRIMITIVE ENTELODONT FROM THE EOCENE OF LUNAN, YUNNAN

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Introduction

In the winter of 1956 Mr. C. C. Hu of the Geological Museum, Ministry of Geology, CPR, during a field trip for fossil collecting to the eastern part of Yunnan, procured a well preserved lower jaw fragment (with P_3—M_3) of a median-sized bunodont artiodactyle from an inhabitant of the village Shihopu, who had collected the specimen from the pink whitish marly beds (Lunan beds) of the Early Tertiary Lunan basin, Lunan District. The age of the Lunan beds according to the investigations of Bien (1939), Young and Bien (1939), and Chow (1957 a, b) is late Eocene. The mammalian fauna containing *Caenolophus, Amynodon, Deperetella,* etc. is considered to be a correlative of the Upper Eocene Irdin Manha of the Inner Mongolia region. However, recent discoveries made by Mr. Hu indicate that the Lunan beds may be divided into two groups, and from the upper part of the formation mammalian remains of *Bothriodon, Cadurcotherium,* etc. indicating a higher Oligocene level were collected. The remains of entelodont described in this paper are from the lower part of the Lunan beds according to Hu.

This lower jaw is of great paleontological interest because it belongs to a form of entelodont which is so primitive in the structure of dentition and mandible that serve well to represent the long sought for ancestor of the common Oligocene entelodont genera, such as *Entelodon, Archaeotherium*, etc., which have very wide distribution in Western Europe and North America and recently have been found probably also to have rather wide distribution in Asia (Trofimov, 1952, Young and Chow, 1956).

The writer is obliged to Mr. C. C. Kao, Director of the said Museum for entrusting him to have the privilege of studying this interesting specimens. The photos and illustrations accompanying the text were made by Messrs C. F. Wang and W. L. Shen respectively.

Family Entelodontidae Leidy

Genus *Eoentelodon* Chow, gen. nov.

Genotype.—Eoentelodon yunnanense, sp. nov.

Diagnoses.—A primitive entelodont much inferior in size than the smallest form of the genus *Archaeotherium* (such as *A. clavus*) linearly about one half with reference to lower cheek teeth; P_4 relatively large, M_3 with a hypoconulid as large as the entoconid.

Lower jaw deep and the bony tubercle beneath P_4 and M_1 only in an incipient stage of development.

Eoentelodon yunnanense, sp. nov.

Diagnoses.—As for the genus.

Type.—Right lower jaw with complete P_3—M_3. Cat. No. Geol. Mus. Vm 0051.

Referred material.—A complete unworn lower second molar, paratype (Vm 0037).

Horizon and Locality.—Upper Eocene, Lower part of Lunan formation. Shihopu village, Lunnan District, Yunnan.

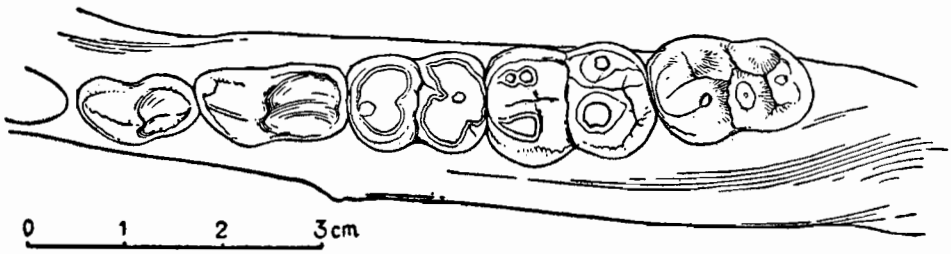

Fig. 1. *Eoentelodon yunnanense* Chow.
Type lower jaw: Geol. Mus., CPP, Vm 0051. Crown view.

Description

Mandibular bone.—The mandible is characteristically entelodont-like. But the horizontal ramus is relatively deeper than in the later forms; and the anterior of the ventral border tilts upward in stead of being nearly horizontal as the posterior with reference to the posterior mental tubercle which is only incipiently developed beneath P_4 and M_1. This character is here considered as primitive although it varies greatly within the genus *Archaeotherium* and may even be quite indistinct in the female individuals of some.

Lower premolars.—Only the third and fourth premolars are preserved. The presence of the first one which is a diagnostic character in distinguishing this group from archaenodonts is not indicated on the type, but it is presumed to be present as can be inferred from the structure of the mandible and lower teeth as a whole. The lower teeth as a whole are comparatively simple in structure. The second one which is only indicated by the alveolus is double rooted and much smaller than the third one. The last two lower premolars are well preserved. They are of typical entelodont type, not quite separated from each other and from the other teeth by diatesma and with simple, high and bluntly pointed conical cusp. The tip of the conical cusp turns slightly toward posterior, and the cingula are rather distinctly developed and nearly continuous on both teeth. The roots protrude highly above the alveolar border of the mandibular bone as in some of the anthracotheres and mesonychids.

The last lower premolar is much larger than the proceeding ones and its posterior outline is quite quadratic and without the accessory tuberosities seen in the genus *Entelodon*.

猪齒獸科的一新的原始屬

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摘 要

猪齒獸科或"巨猪科" (Entelodontidae) 是古脊椎動物學上富有興趣和有長久的研究歷史的一類絕滅的偶蹄類,在哺乳類系統分類上的位置如下:

目 偶蹄類

亞目 猪形類 (**Suiformes**)

附目 古齒獸類 (**Palaeodonta Matthew**)

總科 猪齒獸類 (**Entelodontoidae Colbert**)

科 猪齒獸科 (**Entelodontoidae Lydekker**)

這一科的動物與猪科 (Suidae) 在系統上並無直接關係,但在頭骨及牙齒的一般形態上和猪類相似,且身體一般都很大,故在古生物學文獻上常俗稱爲"巨猪" (giant pig)。頭部形態和猪類的主要區別是頰齒的構造,頭骨在顴弧外側、下顎接合部和第一臼齒下方各有一對長大的骨質突起。

根據過去的資料,這一科在地史上的分佈時代從漸新世初期中新世中後期。化石在歐洲及北美分別以 *Entelodon* 和 *Archaeotherium* 兩屬爲代表,大致在同一層位"突然地"出現。漸新世初期的種類在形態上已十分特化;個體也相當大,最小的也大於一般現代的猪類。它們的最早的來源以及它們與其他早期偶蹄類的關係(包括和本科最相近的、屬於同一總科的 archaenodontidae 的關係),由於沒有找到化石,始終不清楚。這些情況都說明猪齒獸類在漸新世以前,已經有一段相當長的發展過程。此外,這類動物的化石在歐洲和北美的漸新統地層中非常普遍,研究也相當詳盡,特別是最近數年來在亞洲北部相當的地層中續有發現 (Trofimov, 1953;楊、周,1956),它們和歐、美的種類也很近似。所以一般研究者都認爲這類動物的早期進化中心可能是在亞洲中部或北部,預料可以在亞洲的始新統地層中找到它們祖先的化石。

1957 年底,地質部地質陳列館胡承志同志在雲南路南上月牙溝石窩舖得到了一個較小的猪形類的下顎骨化石。標本採自該地路南層下部的上始新統地層中。這個化石無論從地層時代或所代表的動物的形態上看,都表示可以代表過去歐、亞、北美各地廣泛分佈的猪齒獸類的早一階段的祖先。原標本包括一個帶有第三前臼齒至第三臼齒的下顎及屬於另一個體的第二右下臼齒各一個,經筆者研究後定名爲"原始猪齒獸、雲南種" (新屬、新種) (*Eoentelodon yunnanense* Chow, gen. et sp. nov.)。其主要特徵是:"以下顎及下頰齒爲標準,大小僅爲最小的漸新世屬的一半左右,下前臼齒較小,下臼齒的下前尖 (pad) 和下後尖 (med) 分離,後下附尖 (hyld) 發達;下顎骨後頜突起僅有雛形。"

從上述特徵和猪齒類的一般形態特性及其地層和地理分佈,可得出關於這類動物進化方面的幾點初步結論:

Lower molar.—The lower molar teeth are also characteristically entelodont-like. They are comparatively large, quadrate but more rounded in outline and the anterior cusps of each tooth are much higher than the posterior cusps. The separation of paraconid and metaconid is shown on M_2 and M_3, and most probably likewise so on M_1 which is unfortunately much worn. The hypoconulid is well developed on M_3 and of about same size as the entoconid. Unlike in the advanced genera of the entelodonts the first lower molar is much smaller than the second one. The cingula are best developed on nearly all sides in M_2, less so in M_1, and only weakly developed on the anterior of M_3.

In all the teeth, the enamel surface of the crown is highly wrinckled into fine dendroid pattern.

Beside the type lower jaw there is in the collection another molar tooth, a M_2 of the right side (paratype); the structure of which is essentially identical with the corresponding tooth of the type except being somewhat bigger in size. The tooth is only very slightly worn and better preserved to show the detail of the dental structure.

Measurements (in mm) of the type and paratype:

Width of horizontal ramus at M_2	9.8
Depth of horizontal ramus at P_2	25.0
Depth of horizontal ramus at M_2	30.0
Length of P_3	11.2
Width of P_3	6.1
Length of P_4	14.6
Width of P_4	7.5
Length of M_1	13.2
Width of M_1	9.6
Length of M_2	16.0
Width of M_2	11.3
Length of M_3	14.2
Width of M_3	10.2
Length of paratype M_2	17.3
Width of paratype M_2	12.0

Conclusions and Remarks on the Evolution of the Entelodonts

1. *Eoentelodon*, gen nov., is evidently a more primitive entelodont close to the ancestral type of the more advanced genera of this group found in the Eurasiatic and North American Oligocene and Miocene. The promitive characters of this genus are morphologically well illustrated by its unusual small size, deeper mandibular ramus with incipient posterior mental tubercles and many dental characters, such as the smaller size of the premolars, well developed hypoconulid on M_3, etc.. It is also stratigraphically indicated by the fact that the fossils are from the Upper Eocene beds.

2. In comparison with the better known Oligocene genera of this family, the new Chinese form is more close to the genus *Archaeotherium* than *Entelodon*, because as far as the mandible and lower cheek teeth are concerned, in the genus *Entelodon*,

such as *E. magnum*, the premolars are larger, the molars have more quardratic outline and more strongly developed cingula, the paraconid and metaconid completely united, and the hypoconulid entirely suppressed on the last lower molar. In all these respects, *Eoentelodon* is more close to certain members of the genus *Archaeotherium* (*s. l.*) from the North American Oligocene, which, as generally known, is more primitive than the genus *Entelodon* of the European Oligocene and the evidences had been well summarized by Peterson (1909), Troxell (1920), and Scott (1940).

3. The structure of *Eoentelodon* except for its unusual small size is fundamentally not much different from the more advanced later forms. In other words the group characters of the family Entelodontidae are well established in its essentials in *Eoentelodon* in Late Eocene time. Later evolution is mainly in the nature of further modification of the established characters and of a tendency toward giantism. Thus, on the one hand, the new discovery in Yunnan does show that all the known entelodont genera from the Oligocene and Miocene of Europe, Asia, and North America were the direct descendents of *Eoentelodon* or its near relative; on the other hand, little can be learned

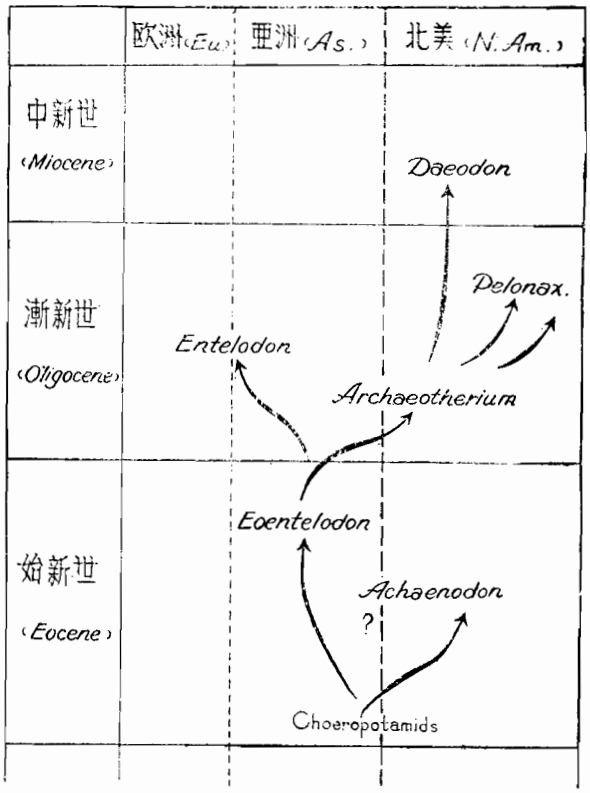

Table 1. The phylogeny (much simplified) and distribution of the entelodontoids.

from the known structure of *Eoentelodon* regarding the earlier ancestor of the group and their relationship with the archaeodonts, such as its relationship with the dichobunids (Gazin, 1955). In connection with this it seems reasonable to infer that *Eoentelodon* was a late Eocene genus, and we have to look for in the middle or lower Eocene of Eastern Asia the more primitive ancestor of this group to solve these problems.

4. In conclusion we can summarize that the group entelodontoids were derived from certain group of early dichobunoid artiodactyles, such as choeropotamids (Colbert, 1938) in early Eocene. Eastern Asia is the most probable center of early evolution of this group. They were probably separated from the archaenodonts in Early Middle Eocene and represented in Late Eocene time by the Genus *Eoentelodon* from which the genera *Archaeotherium* and *Entelodon* were derived and spread into North America and Europe at the beginning of Oligocene. The accompanying Table I shows diagrammatically the phylogeny and distribution of the entelodontoids.

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1). 雲南新發現的 *Eoentelodon* 屬是猪齒獸科中一個原始的新屬，是所有漸新世及中新世各已知屬的祖先。和各已知的屬比較，在基本形態上，除大小外，與中亞及北美新世的 *Archaeotherium* 屬最爲接近。

2). *Eoentelodon* 屬的構造，雖然具有許多原始性質，時代也較早(始新世晚期)，但是它的猪齒獸科的性質已經很清楚。換言之，這一科動物的基本特徵在始新世晚期的 *Eoentelodon* 屬中已經定型，後來的進化主要限於在已有基礎上的稍有修改，向"巨型化"發展，和擴大分佈區域。因此，*Eoentelodon* 的發現，一方面果然使我們找到了這一科動物的較早的共同祖先，但是，另一方面，並不能從它的構造上，了解到這一科動物的最早的來源以及它們與 Archaenodonts 的關係。

3). 根據現有的資料，關於這一科的進化史，我們大致可以得到的一些初步結論如下：猪齒獸科起源於始新世初期的某一類原始的錐齒型偶蹄類，例如雙錐齒類 (Dichobunoiade) 的 Chaeropotamids; 它們在下始新世末或中始新世初期時和 Archaeodontidae 分離。東亞大陸無疑是這一科動物發生和輻射的中心地區。*Eoentelodon* 是這一科中接近於發展主幹上的始新世晚期的代表屬，這一屬在漸新世開始時，進化到 *Archaeotherium* 屬，並且通過白令海峽陸橋進入北美洲。在亞洲同時還發生了另外的一支，以較進步的 *Entelodon* 屬爲代表，向西進入歐洲。其系統發生關係和分佈可用圖表簡單表示(參看圖表 I)。

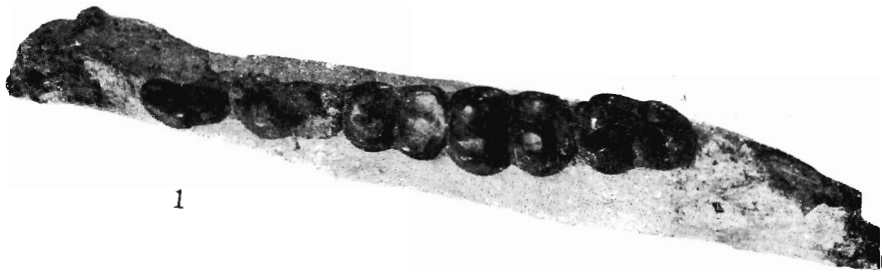
Explanation of plate I

***Eoentelodon yunanense* Chow, gen. et sp. nov.**

1—1b. Type left lower jaw. Crown view (1); external view (1a); internal view (1b).

2—2c. Paratype right M_3. Crown view (2); same (2a); internal (2b) and external (2c) view.

All figs. are natural size except 2a (×2).



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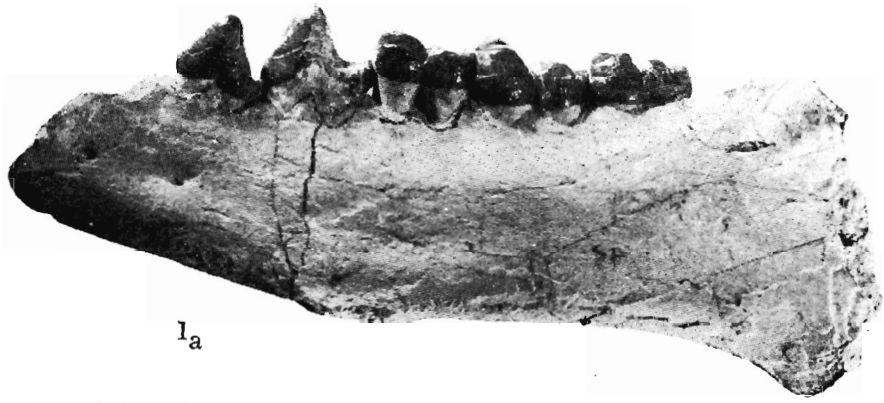
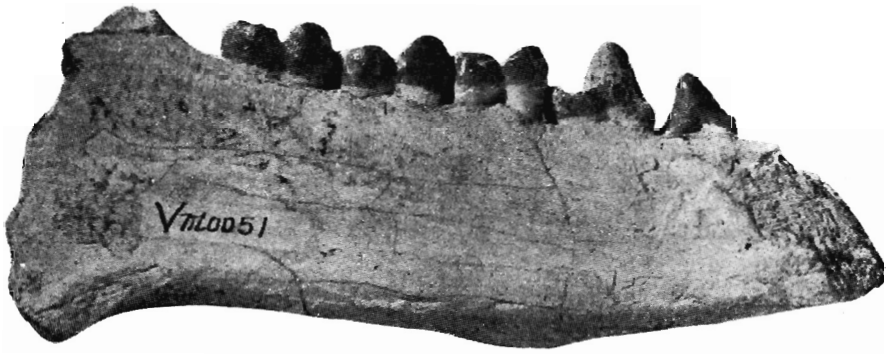


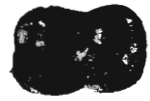
1_a



1_b

2_c

2_b



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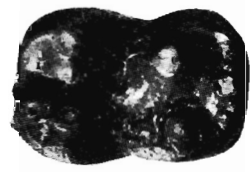

2_a