The Pondaung mammal fauna:

an analysis of a terrestrial mammal fauna in the latest middle Eocene of central Myanmar (Southeast Asia)

by

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ポンダウン化石哺乳類相
--ミャンマーにおける中期始新世末期の陸生哺乳類相の解析--

鍔本武久

要旨

ミャンマー中央部に分布する始新統ポンダウン層の陸生化石哺乳類相の解析を行い，その古環境の推定と，東アジアにおける始新世後半の哺乳類相の進化に関する考察を行った．また，同層のフィッショントラック年代を測定し，37.2±1.3Ma（中期始新世末期）という値を得た．中期始新世末期に相当するこの年代は，これまで哺乳類化石や有孔虫化石の解析から中期～後期始新世と推測していた説を支持する．

ポンダウン化石哺乳類相（ポンダウン相）には6目16科21属（霊長目4属，肉歯目2属，齧歯目1属，偶蹄目4属，奇蹄目9属，目未定（有蹄上目）1属）の哺乳類が含まれる．霊長類はすべて非常に原始的な初期真猿類と思われる．肉食性哺乳類では2種の肉歯類が発見されているのみである．小型の哺乳類は，小型霊長類一種と齧歯類一種が見つかっているだけで，標本数も少ない．圧倒的に種類・標本数が多く，繁栄していたと思われるのは奇蹄類と偶蹄類である．その比率は標本数は偶蹄類の方が多いが，科・属の数は奇蹄類の方が多い．

特に，アントラコテリウム科（偶蹄目）は最も数多く産出し，最も繁栄していたらしい．また，ポンダウン相から産出するアントラコテリウム科の分類は混乱しており，最大3属12種が存在していたが，これらを1属（アントラコテリウム属）4種にまとめた．アジアやヨーロッパから産出するこの属の他の種と比べると，ポンダウン相のアントラコテリウム属は比較的原始的で，時代的にもっとも古く，また大きな形態的変異が認められることから，この属の起源が中期始新世の東南アジア地域であった可能性が示唆される．

ポンダウン相の古環境は，海岸からあまり遠くない亜熱帯～熱帯湿潤性の森林部で，大きな河川の近くであったと思われる．その根拠は以下の通りである．1）植物食性哺乳類では，若葉や果実など柔らかい植物を好んで採食する低冠歯型動物（ブロントテリウム類など）が圧倒的に多く，硬い草などを食べる完全な高冠歯型哺乳類は発見されていない．2）樹上性と思われる複数の霊長類が存在する．3）水辺を好むアントラコテリウム科などが種類も標本数も多く存在する．4）ポンダウン層の下部は海成層が卓越しており，上位・下位の地層は完全な海成層である．5）ポンダウン相のセノグラムは現生の亜熱帯～熱帯湿潤性森林の動物相のものに類似する．

東アジアの古第三紀の陸生哺乳類生層序を，AEO 法（各々の動物相に含まれる属種の出現・消滅のシークエンスを決め，それによって各相を基本的に時間軸に沿って並べる方法）を用いて，定量的に再考察した．これまでポンダウン相は，そこに含まれる哺乳類の進化段階などから東アジアの陸生哺乳類生層序のシャラムルニアン期に対比されてきたが，AEO 解析の結果，このことが再確認された．

ポンダウン相はやや固有性が高いが，同時代の東南アジア各地の哺乳類相との類似性を示す．特に中国南部の那讀相とは５属及び４種が共通しており，両相の年代的・動物地理学的近縁性を示している．東アジアの中・北部の同時代の哺乳類相（シャラムルン相など）とはデペレテラ属などが共通するが，これらは始新世後半の東アジアに普遍的に存在するので，ポンダウン相との特別な類似性を示しているとは考えられない．また，始新世後半から漸新世の東アジアの哺乳類相は時代とともに奇蹄類が衰退し，それに対して齧歯類や偶蹄類が繁栄してくるという一般的傾向があるが，始新世後半の間においては，東アジア南部では偶蹄類の繁栄と奇蹄類の衰退が顕著にみられるが，東アジア北部では奇蹄類が繁栄したままである．これは，始新世後半から漸新世にかけての東アジアの動物相の変遷が南部から生じた可能性を示唆する．

一方，この頃のアジアはベーリング地峡を通じて北米と動物の交流があったが，同時代の北米の各地の哺乳類相とポンダウン相との間で基本的に共通の属はいない．ヨーロッパの後期始新世の哺乳類相とは，アントラコテリウム属が共通している．また，エジプトのファユム相（後期始新世～前期漸新世）とはフィオミス科齧歯類や原始的真猿類が共通しており注目される．特に，これまで西方（ヨーロッパ，アフリカ，西アジア）の動物相からしか見つかっていなかったフィオミス科齧歯類の発見は，この時期，東南アジアと西方との間で，浅海化していたトゥルガイ海峡・テチス海をわたって動物が移動していたことをより確実にした．

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Abstract

The mammal fauna from the Eocene Pondaung Formation in central Myanmar (the Pondaung mammal fauna) is reconstructed. The fission-track age of the Pondaung Formation calibrated from zircon grains is 37.2 ± 1.3 Ma, corresponding to the latest middle Eocene. The result is consistent with the geologic age, middle to late Eocene, suggested by previous studies.

The Pondaung fauna consists of six orders of mammals, including 16 families and 21 genera: Primates (four genera), Creodonta (two genera), Rodentia (one genus), Artiodactyla (four genera), Perissodactyla (nine genera), and order indeterminated (Ungulata) (one genus). Among these 21 genera, there are only two carnivorous (hyaenodontid creodonts) and two small (phiomyid rodent and eosimiid primate) mammals. All primates are considered to be primitive anthropoids. Both artiodactyls and perissodactyls are abundant in the Pondaung fauna, and the former is less diversified in familial and generic levels but more dominant in collection size than the latter.

In particular, anthracotheriid artiodactyls are the highest in specimen number, indicating its prosperity in the Pondaung fauna. The anthracotheres of the Pondaung fauna, which had been confusedly classified into many species among the three genera was reviewed, referring to one genus (*Anthracotherium*) and four species (*A. pangan*, *A. rubricum*, *A. birmanicus*, and *A. tenuis*). Compared with other *Anthracotherium* species discovered from localities of Asia and Europe, the Pondaung species are oldest in age and primitive in morphology, and show high degree of morphological variation, suggesting that the genus might have originated in Southeast Asia as early as the middle Eocene.

The paleoenvironment of the Pondaung fauna is estimated as subtropical/tropical forest with relatively large livers, located near the sea shore based on the following evidences: (1) there are many herbivorous mammals with brachyodont molars (e.g. brontotheres) but few species with hypsodont teeth, suggesting the existence of soft-leaves eaters rather than hard-grasses ones; (2) there are several primitive anthropoid primates, which are considered to be arboreal and frugivorous animals, indicating forest environment; (3) there are several species of anthracotheres and a metamynodontine amynodont which are considered to have lived in the riverside; (4) the lower part of the Pondaung Formation is dominated by marine deposits, and the formations below and above the Pondaung Formation are marine deposits; and (5) the result of the cenogram analysis suggested the similarity of the Pondaung fauna to Recent faunas in the tropical forested setting.

The Paleogene terrestrial mammal biostratigraphy was analyzed quantitatively by using the appearance event ordination (AEO) method. The results of the AEO analysis support that the Pondaung fauna is comparable to the Sharamurunian East Asian Land Mammal Age (EALMA), as was suggested by the previous researchers.

In the later Eocene, the faunas of the southern East Asia including the Pondaung fauna are characterized by the dominance of artiodactyls compared with perissodactyls, while, in contrast, in the northern East Asian faunas perissodactyls are still more dominant than artiodactyls both in the taxonomic and populational respects. Although the Pondaung fauna is relatively endemic, it is similar to some contemporaneous southern East Asian mammal faunas: particularly, it shares five genera and four species with the middle/late Eocene Naduo fauna, Yunnan Province, southern China, suggesting a close chronological/zoogeographical relationship between them. The Pondaung fauna also shares a few genera, such as *Deperetella* (Perissodactyla), with the contemporaneous faunas of northern East Asia, such as the Shara Murun fauna of Inner Mongolia, northern China. However, these genera are so widely known from the East Asian middle/late Eocene localities in East Asia that it may not be useful to determine any special relationships between the faunas.

Although the Pondaung fauna has some mammal taxa also known from the contemporaneous faunas of other continents, it is not likely indicate any close resemblances to these faunas. There is no clearly congeneric species between the Pondaung fauna and the North American faunas, although it has been indicated by many researchers that there were some faunal exchanges between East Asia and North America during the Eocene age. On the other hand, the Pondaung fauna shares *Anthracotherium* with the late Eocene mammal faunas of Europe. It is noteworthy that the Pondaung fauna shares primitive anthropoids and phiomyid rodent with the late Eocene/early Oligocene Fayum fauna in Egypt. In particular, the discovery of a phiomyid rodent, which has ever been reported only from Africa/Western Eurasia, assures that there used to be some faunal exchanging between East Asia and Africa/West Eurasia across the Turgai Straight and/or Tethys Sea during the middle to late Eocene.

Key words: biostratigraphy, East Asia, Eocene, mammal fauna, paleoenvironment estimation, Pondaung Formation

Contents

1. Introduction

The middle to late Eocene Pondaung mammal fauna located in central Myanmar, Southeast Asia, has been catching many researchers' attention because it has long been only one Eocene mammal fauna in Southeast Asia (except for southern China), yielding possible earliest anthropoid primates (= higher primates), which are morphologically more primitive and probably older in age than the primitive anthropoid primates fossils from the late Eocene/early Oligocene Fayum deposits in Egypt (e.g., Colbert, 1938; Ba Maw *et al.*, 1979; Ciochon *et al.*, 1985; Jaeger *et al.*, 1998, 1999).

There is no systematic review on the whole Pondaung mammal fauna since Colbert (1938), though many mammal fossils of the Pondaung fauna have been reported separately (e.g., Ba Maw *et al.*, 1979; Ciochon *et al.*, 1985; Holroyd and Ciochon, 1995, 2000; Jaeger *et al.*, 1998, 1999; Ducrocq *et al.*, 2000; Métais *et al.*, 2000).

The geologic age has been estimated by many researchers on the basis of the mammal fossils (Pilgrim and Cotter, 1916; Colbert, 1938) and some microfossils (e.g. Holroyd and Ciochon, 1995), but no radiometric dating has been tried yet because of the lack of the volcanic deposits in the Pondaung Formation. Furthermore, the mammal biostratigraphy of the East Asian Eocene has been based mainly on the northern East Asian faunas of higher latitude (e.g. Meng and McKenna, 1998), in contrast, the Pondaung fauna are located at southern East Asia of low latitude.

In this work, (1) the Pondaung mammal fauna is reviewed and reconstructed based on the fossil material described by earlier workers and newly discovered fossil material from the Pondaung Formation in 1997 by Myanmar researchers and in 1998 and 1999 by Myanmar-Japan joint team (Takai *et al.*, 2000; Tsubamoto *et al.*, 2000a; Egi and Tsubamoto, 2000), and particularly, the anthracotheres of the fauna are reexamined; (2) the fission-track zircon age of the tuff bed of the Pondaung Formation is calculated; (3) the paleoenvironment of the Pondaung fauna is inferred by analysing the mammal fossil assemblage and by the cenogram analysis of the estimated body weight of the fossil mammals (Legendre, 1986, 1989, Legendre and Hartenberger, 1992); (4) the East Asian Paleogene mammal faunas including the Pondaung fauna are analyzed using appearance event ordination (AEO) (Alroy, 1994, 1996, 1998c, 2000 = in press) to correlate with the contemporaneous other faunas; (5) the Pondaung fauna is compared with the contemporaneous other faunas not only of the East Asia but also of some North America and Africa/West Eurasia.

Abbreviations and taxonomic system

All new fossil material used in this work are stored in the National Museum of the Union of Myanmar, in Yangon, Myanmar. The new fossil material collected by Myanmar researchers and by Myanmar-Japan Joint Fossil Expedition Team are serially catalogued under NMMP-KU specimen numbers. "NMMP" means National Museum, Myanmar, Paleontology, and "KU" means Kyoto University (Japan).

The fossil material in many other institutions were observed as well. These museums store the fossil material collected from the Pondaung Formation in earlier days and the mammalian fossils compared with the Pondaung forms in this study. The abbreviations for these institution are: AMNH = American Museum of Natural History, in New York, USA; BMNH = The Natural Museum (former British Museum of Natural History), in London, United Kingdom; GSI = Geological Survey of India, in Calcutta, India; IVPP = Institute of Vertebrate Paleontology and Paleoanthropology, in Beijing, China; UCMP = Museum of Paleontology, University of California, in Berkeley, USA.

The mammal taxonomic system used in this paper is mainly based on Carroll (1988) and McKenna and Bell (1997).

Research history of the Pondaung fauna

Fossil mammals from the Pondaung Formation were firstly described by Pilgrim and Cotter (1916). They described three genera (*Anthracohyus*, *Anthracotherium* and *Anthracokeryx*) of the anthracotheriid artiodactyls, one genus (*Metamynodon*?) of the amynodontid perissodactyl, and one genus (*Telmatherium*?) of the brontotheriid (titanotheriid) perissodactyl. They decided the age of the Pondaung fauna as late Eocene based mainly on the stratigraphical evidence with marine index fossils from the formations lying above and below the Pondaung Formation. They also figured out the faunal age being late Eocene based on the comparisons of mammal evolutional stages between the species from the Pondaung fauna and those from the European and North American faunas. The anthracotheres were slightly less progressive than those of the European Oligocene forms. The amynodonts and brontotheres from the Pondaung fauna were less progressive than the North American Oligocene forms, and were similar in evolutional stage to the American late Eocene North forms.

However, the Eocene to Oligocene biostratigraphy and biochronology in East Asia were revised recently, correlating with the revised Land Mammal Zones (MP system) in Europe and Land Mammal Ages in North America (Berggren *et al.*, 1978; Berggren and Prothero, 1992; Prothero and Swisher, 1992; Ducrocq, 1993; Prothero, 1994; Holroyd and Ciochon, 1994): the Lutetian stage was referred to early middle Eocene, the Bartonian stage to late middle Eocene; the previous middle Oligocene mammal faunas to early Oligocene, the previous early Oligocene faunas to late Eocene, the previous late Eocene faunas to late middle Eocene, and the previous late middle to late Eocene faunas to middle middle Eocene.

The initial description of the Pondaung fauna in 1916 was followed by the subsequent studies by Pilgrim (1925, 1927, 1928). Pilgrim (1925) described and reviewed the Pondaung perissodactyls, recognizing five genera and eight species within three perissodactyl families: two genera (*Sivatitanops* and ?*Eotitanotherium*) of the Brontotheriidae; one genus (*Metamynodon*) of the Amynodontidae; and two genera (*Indolophus* and ?*Chasmotherium*) of the Tapiridae. Pilgrim (1927) reported *Pondaungia cotteri*, the first primate species from the Pondaung fauna. Pilgrim (1928) described and reviewed the Pondaung artiodactyls, recognizing four genera within two artiodactyl families: three genera (*Anthracohyus*, *Anthracothema* and *Anthracokeryx*) of the Anthracotheriidae; and one genus (*Indomeryx*) of the ?Tragulidae (Ruminantia). Based on the mammal evolutional stages of the fauna compared with those of European, North American, and northern East Asian faunas, he concluded that the age of the Pondaung

fauna was equivalent to the European Bartonian stage, which is now considered to be late middle Eocene (see above). In addition to the studies by Pilgrim, some Pondaung mammal fossil material were described by Matthew (1929) who revised the genus *Metamynodon* from the Pondaung fauna into the new genus *Paramynodon*. Colbert (1937) described *Amphipithecus mogaungensis*, the second primate species (which was dubiously thought to belong to Simiidae at that time) from the Pondaung fauna.

In 1938, Colbert reviewed the Pondaung mammal fauna, which included two primate, four artiodactyl, and five perissodactyl genera. Two primates, *Pondaungia cotteri* and *Amphipithecus mogaungensis*, were both questionably referred to the Simiidae (Anthropoidea). Artiodactyls included seven to nine anthracotheriid species within three genera (*Anthracohyus*, *Anthracothema* and *Anthracokeryx*) and one or two species of *Indomeryx* which was questionably referred to the Hypertragulidae. Perissodactyls consisted of five brontotheriid species within two genera(*Sivatitanops* and *?Metatelmatherium*), one or two species of *Paramynodon* (Amynodontidae), *Indolophus guptai* (Isectolophidae), and *Deperetella? birmanica* (Helaletidae). He concluded that the Pondaung fauna might be the latest Eocene. This conclusion is based on the similar mammal faunal comparisons as Pilgrim (1925, 1928). (As mentioned above, this conclusion on the age of the Pondaung fauna can be now revised and interpreted as the latest middle Eocene.)

Since Colbert's study in 1938, there have been many studies on the Pondaung primates by von Koenigswald (1965), Szalay (1970, 1972), Simons (1971), Ba Maw *et al.* (1979), Ciochon *et al.* (1985), Ciochon and Holroyd (1994), and others. Ba Maw *et al.* (1979) and Ciochon *et al.* (1985) described a new specimen of *Pondaungia* and *Amphipithecus*, respectively.

There are also work on the other fossil mammals of the Pondaung fauna: Holroyd and Ciochon (1995, 2000) described new taxa, *Pakkokuhyus lahirii* (Artiodactyla; Helohyidae) and *Bunobrontops savagei* and *Bunobrontops* sp. (Perissodactyla; Brontotheriidae), respectively.

A number of additional Pondaung fossils were discovered by Myanmar researchers in 1997 (Pondaung Fossil Expedition Team, 1997), by Myanmar-America Joint Fossil Expedition Team in 1997-1998, by Myanmar-France Joint Fossil Expedition Team in 1998 and 1999 (Jaeger *et al.*, 1998, 1999; Chaimanee *et al.*, 2000; Ducrocq *et al.*; 2000, and Métais *et al.*, 2000), and by Myanmar-Japan Joint Fossil Expedition Team in 1998 and 1999 (Takai *et al.*, 2000; Tsubamoto *et al.*, 2000a, b; Egi and Tsubamoto, 2000).

Jaeger *et al.* (1998) described new material of *Pondaungia* and *Amphipithecus*,

establishing a new species of *Pondaungia*, *Pondaungia minuta* which was considered to be a female of *P. cotteri* by Chaimanee *et al.* (2000). A new small primate species, *Bahinia pondaungensis* (Anthropoidea; Eosimiidae) from the Pondaung fauna was described by Jaeger *et al.* (1999). Ducrocq *et al.* (2000) described a new taxon, *Hsanotherium parvum* (?Tethytheria; Anthracobunidae). Métais *et al.* (2000) described a new taxa *Indomeryx "pilgrimi"* and *Indomeryx "minus"* (Artiodactyla; Pecora). Takai *et al.* (2000) reviewed the Pondaung primates. Tsubamoto *et al.* (2000a) made a preliminary report of the new mammal material from the Pondaung Formation. Egi and Tsubamoto (2000) made a preliminary description of the creodont material from the Pondaung Formation. Tsubamoto *et al.* (2000b) described new material of *Deperetella birmanica* (Perissodactyla; Deperetellidae) and reviewed its systematics.

2. Geological setting

2.1. General geology

The mammal fossil material studied here were collected from the Pondaung Formation in Myanmar. The geological structure of Myanmar can be divided into four main parts, each of which extends from north to south (Ba Than Haq, 1981). From east to west in order, those are: 1) the Shan-Tenasserim Massif, which consists of the Precambrian to Cretaceous rocks; 2) the Central Irrawaddy Lowland, which is mainly composed of the Cenozoic deposits; 3) the Naga-Arakan Mountain Belt (or Naga-Rakhine Mountain Belt), which consists of the Cretaceous to Miocene rocks; and 4) the Coastal Arakan Lowland (or Coastal Rakhine Lowland), which includes the Cretaceous to Recent deposits (Ba Than Haq, 1981). The Pondaung Formation locates in the central part of the Central Irrawaddy Lowland (Figure 1).

Figure 2 and 3 give the Eocene geological section and generalized schematic diagram of the stratigraphy in the Pondaung area. The Pondaung Formation overlies the Tabyin Formation and is overlain by the Yaw Formation. The Tabyin Formation (= Tabyin Clay) mainly consists of marine clay, yielding *Nummulites acutus*, an index fossil for the middle Eocene age (Bender, 1983). It gradually changes upwardly into the Pondaung Formation, and in part, these two formations interfinger with one another (Bender, 1983). The Yaw Formation (= Yaw Shale) conformably overlies the Pondaung Formation with a distinct lithological break (Bender, 1983; Aye Ko Aung, 1999). The Yaw Formation mainly consists of marine shale, containing the macroforaminifera (*Nummulites yawensis*, *Discocyclina sella*, *Operculina* sp. cf. *O. canalifera*) and rich molluscan faunas with Velates perversus of the late Eocene age (Bender, 1983; Aye Ko Aung, 1999).

The Pondaung Formation (= Pondaung Sandstones) is about 2,000 m thick at the type section (Aye Ko Aung, 1999), and the thickness decreases toward the south (Stamp, 1922). It consists of alternation of mudstone, sandstone and conglomerate, and is subdivided to "Lower" and "Upper" members (Aye Ko Aung, 1999). The "Lower Member" is about 1,500 m thick at the type section (Aye Ko Aung, 1999), and is dominated by greenish sandstone and conglomerate, containing marine molluscs occasionally, indicating the brackish to marine deposits (Bender, 1983). On the other hand, the "Upper Member" is about 500 m thick in the type section (Aye Ko Aung, 1999), and is dominated by variegated clay. It contains many mammalian and other vertebrate fossils, indicating freshwater lagoon environment (Colbert, 1938; Bender, 1983; Aye Ko

Aung, 1999; Aung Naing Soe, 1999). Unlike the Tabyin and Yaw formations, no marine index fossil has been found from the Pondaung Formation.

The fossil materials treated in this paper were discovered from the middle part of the "Upper Member" of the Pondaung Formation. The age of the Pondaung Formation has been considered as middle to late Eocene on the basis of the ages of the underlying Tabyin Formation and the overlying Yaw Formation, and the correlation of the terrestrial mammal fossils (Colbert, 1938; Bender, 1983).

2.2. Fossil localities

The currently known fossil sites for the Pondaung mammal fauna distribute narrowly, extending about 50 km from northwest to southeast. There are three main areas of the fossil localities: Bahin, Pangan, and Mogaung areas (Figures 1, 4-7; Table 1). Bahin area (Figures 1, 4, 5; Table 1) and Pangan area (Figures 1, 4, 6) are located about 25 - 30 km northwest and about 5-20 km north from Myaing town, respectively. Mogaung area (Figures 1, 4, 7) is located about 35-40 km west from Palé town. These three main areas bearing fossil localities roughly correlate to the middle part of the "Upper Member" of the Pondaung Formation, although the exact stratigraphic relationships are unclear (Figures 4-7; Table 1). There are several fossil localities in each area (Figures 4-7). Localities investigated in 1998 and 1999 are listed in Table 1. Localities were named based on the nearby villages. Localities investigated in 1998 and 1999 are listed in Table 1. Among the fossil localities in Bahin area, Bh1 locality (Plate 1-A) which is also called Yashe Kyitchaung is one of the most fossiliferous locality.

2.3. Fission-track zircon age

During the 1999 field season, a fine tuffaceous bed was found at Pk1 locality, where is also called "Humerus Site" (Figure 8; Table 1; Plate 1-B). This fine tuff bed corresponds to the middle part of the "Upper Member" of the Pondaung Formation, and the fission-track dating was attempted on the zircon grains sampled from the bed by the Kyoto Fission-Track Co. Ltd., Kyoto (Danhara *et al.*, 1999).

A sufficient amount of euhedral zircons suitable for fission-track analysis were separated from a sample of the fine tuff at Pk1, using the conventional heavy liquid and magnetic separation techniques. Fission-track age was determined by the external detector method (ED1) (Danhara *et al.*, 1991; Iwano and Danhara, 1998). The sample was etched with KOH:NaOH eutectic etchant at 225°C for 30 hr, and packed for irradiation between NBS-SRM612 glass + mica dosimeters. Fission-track age was calibrated by the zeta calibration method (Hurford and Green, 1983) factor of 370 ± 4.

Table 2 presents the analytical result: the fission-track zircon age was determined as 37.2 ± 1.3 (1 sigma) Ma, suggesting latest middle Eocene for the middle part of the "Upper Member" of the Pondaung Formation (Woodburne and Swisher, 1995). The result is consistent with the geologic age, middle to late Eocene, suggested by previous studies (Pilgrim and Cotter, 1916; Pilgrim, 1925, 1928; Colbert, 1938; Holroyd and Ciochon, 1994, 1995).

3. Systematic paleontology

The mammal taxa included in the Pondaung fauna are briefly explained here. A new Pondaung mammal faunal list revised in this paper is shown in Table 3.

Class Mammalia Linnaeus, 1758
Order Primates Linnaeus, 1758

Plate 2

Comments.--Four species of primates, *Pondaungia cotteri* and *Amphipithecus mogaungensis* (Amphipithecidae), *Bahinia pondaungensis* (Eosimiidae), and a new genus and species (family indet.) (Takai *et al.*, 2000), have been recognized from the Pondaung fauna, indicating that primates flourished relatively well in the fauna compared with other East Asian Eocene faunas. All these primate species are considered to be very primitive anthropoids; they were morphologically more advanced than prosimians but did not reach the condition expected for the clade defined by Recent catarrhines and platyrhines. They are morphologically more primitive than the anthropoids from the late Eocene/early Oligocene Fayum fauna, Egypt, and as primitive as those of the contemporaneous Krabi fauna, Thailand. The Amphipithecidae are shared with the Krabi fauna, and the Eosimiidae are shared with the contemporaneous Rencun and Zhaili faunas of the Heti Formation, Shanxi and Henan, China, and Shanghuang fauna of Jiangsu, China. These Pondaung primates having low-crowned teeth are considered to have lived in the forest, to have eaten fruits, buds or insects, and to have been arboreal locomotion. *Pondaungia* and *Amphipithecus* are larger in size than the new primate. *Bahinia* is much smaller.

Order Creodonta Cope, 1875
Family Hyaenodontidae Leidy, 1869

Plate 3

Comments.--Two hyaenodontid creodonts (Hyaenodontidae gen. *et* sp. nov. and "*Pterodon*" *dahkoensis*) are the only known carnivorous species from the fauna so far (Egi and Tsubamoto, 2000). These are relatively large carnivorous mammals. The new hyaenodontid creodont is related to *Paratritemnodon indicus* from the early to middle

Eocene Subathu and Kuldana faunas of Indo-Pakistan. "*Pterodon*" *dahkoensis* has been known from the Eocene Upper Lumeiyi fauna, southern China (Chow, 1975; Russell and Zhai, 1987). "*Pterodon*" sp. cf. "*P.*" *dahkoensis* was recorded from the Rencun fauna, middle part of China, which has been correlated to the Sharamurunian EALMA (Chow, 1975; Russell and Zhai, 1987; see "Mammal biostratigraphy and biochronology" section).

Order Rodentia Bowdich, 1821
Family Phiomyidae Wood, 1955
Phiomyidae gen. *et* sp. nov.

Plate 4

Comments.--Only one species of a new phiomyid rodent which has brachyodont teeth has been discovered so far (Tsubamoto *et al.*, 2000a). Although the tooth anterior to M_1 is not preserved in the all material, the preserved alveoli anterior to M_1 in NMMP-KU 0213 (a left mandibular fragment with M_{1-3}) occupies mesiodistally very long part as a whole (Tsubamoto *et al.*, 2000a, p. 72, pl. 1, fig. 2), and shows that the elongated dP_4 was retained. This is a diagnosis of the Phiomyidae. The present lower molar morphology is similar to that of phiomyid *Phiomys*. However, the dP_4 of the present material is much larger than that of *Phiomys*, judged from the preserved alveoli of the present material.

The size of the rodent collections in the Pondaung fauna is very small. The rarity of small mammal specimens may be caused by the taphonomic and sampling biases.

The phiomyid rodent had ever been found only from the late Eocene to middle Miocene fauna of Africa/West Eurasia (Europe and West Asia), such as the Fayum fauna in Egypt (Wood, 1968; Stucky and McKenna, 1993; McKenna and Bell, 1997). This is the first discovery of phiomyid rodent from East Asia.

Grandorder Ungulata Linnaeus, 1766
Order *et* family indet.
Genus ***Hsanotherium*** Ducrocq *et al.*, 2000
Hsanotherium parvum Ducrocq *et al.*, 2000

Plates 5, 6

Comments.--Hsanotherium parvum is a small ungulate mammal. Its systematic

assignment at ordinal and familial level is not clear. This mammal have very low-crowned teeth. The material was firstly reported by Tsubamoto *et al.* (2000a). The upper dental material was described as *Hsanotherium parvum* and assigned in the Anthracobunidae (Tethytheria) which was recorded from the early to middle Eocene of South Asia (Indo-Pakistan) by Ducrocq *et al.* (2000). However, the reason that they referred the upper dental material to the Anthracobunidae is not persuasive, and it is better to classify *Hsanotherium* as a indeterminate ungulate. The lower dental material support this idea. The P_4 of *Hsanotherium* is simple, and its hypoconulid on the molars is as high as the hypoconid and entoconid, while the P_4 of the anthracobunids is more molariform and complex, and its hypoconulid on the molars is very low than the hypoconid and entoconid.

Order Artiodactyla Owen, 1848

Comments.--The following four families of the artiodactyls are recognized: Anthracotheriidae , Helohyidae, an undetermined family of the Ruminantia (*Indomeryx* and cf. *Indomeryx*), and the other undetermined family (Artiodactyla gen. *et* sp. nov. and cf. Artiodactyla gen. *et* sp. nov.).

Artiodactyla gen. *et* sp. nov. (Plate 7) and cf. Artiodactyla gen. *et* sp. nov. (Plate 8A, A', B), which was described as ?Agriochoeridae indet. E by Tsubamoto *et al.* (2000a), have brachyodont and selenodont teeth, and relatively small artiodactyl. The upper molar has paraconule.

Family Helohyidae Marsh, 1877

Genus ***Pakkokuhyus*** Holroyd and Ciochon, 1995

Pakkokuhyus lahirii (Pilgrim, 1928) Holroyd and Ciochon, 1995

Plate 8C, C', D, D'

Comments.--The Helohyidae belong to dichobunoid artiodactyls, of which fossil records are known from the middle Eocene of North America and middle to late Eocene of Asia (McKenna and Bell, 1997; Ducrocq *et al.*, 1997). They are relatively small artiodactyl, having brachyodont teeth, and are estimated to have lived in the dense undergrowth and thickets of paratropical and subtemperate woodlands (Stucky, 1998). In the Pondaung fauna, one species of the family, *Pakkokuhyus lahirii* has been recorded,

and its dentition is more bunodont among the family has been recorded.

Family Anthracotheriidae Leidy, 1869
Genus ***Anthracotherium*** Cuvier, 1822

Plate 9-13

Comments.--The Anthracotheriidae have low-crowned teeth, and have been reconstructed as browsers living near rivers or lakes like modern hippopotamus (Kron and Manning, 1998). In the Pondaung fauna four species of one bunodont genus, *Anthracotherium* are now recognized. The Anthracotheriidae make of a very large portion of the samples collected from the Pondaung fauna, and can be considered as the most common mammal in the fauna. All four species of the Pondaung *Anthracotherium* are morphologically very similar to one another, and have very high degree of morphological variations, suggesting that the Pondaung *Anthracotherium* was temporally and spatially very closely located to the origin of genus *Anthracotherium.* This genus has been recorded from several later Eocene faunas of southern East Asia, such as Naduo fauna, Guangxi, southern China and Krabi fauna , Thailand.

See "Anthracotheres from the Pondaung fauna and the other East Asian Eocene localities" section for the detail.

Suborder Ruminantia Scopoli, 1777
Family indet.
Genus ***Indomeryx*** Pilgrim, 1928

Plate 14, 15

Comments.--Ruminants are advanced artiodactyls, having selenodont dentition, and consist of living and extinct tragulids and pecorans (bovids, cervids, giraffids, and others), and other extinct groups. Their first radiation occurred in the late middle Eocene of Asia and North America (Carroll, 1988; Webb, 1998). Primitive ruminants are small and have low-crowned teeth, and have been reconstructed as browsers or frugivores in forest understory and woodland settings (Webb, 1998). In the Pondaung fauna, one genus of primitive ruminant, *Indomeryx* (and cf. *Indomeryx*) has been reported. It has low-crowned and primitive selenodont teeth, and is small artiodactyl. *Indomeryx* are also

recorded from the later Eocene faunas such as Naduo fauna (Russell and Zhai, 1987). *Indomeryx* from the Pondaung fauna consists of two (large and small) species: *Indomeryx cotteri* (*Indomeryx "pilgrimi"*) (large species) and *Indomeryx arenae* (*Indomeryx "minus"*) (small species) (Figure 9).

Order Perissodactyla Owen, 1848

Comments.--The following six families of the perissodactyls are recognized from the Pondaung fauna: Brontotheriidae, Hyracodontidae, Amynodontidae, Deperetellidae undetermined family of the Tapiroidea, and undetermined family of the Ceratomorpha are recognized. All Pondaung perissodactyls are medium to large-sized perissodactyls.

Family Brontotheriidae Marsh, 1873

Plate 16

Comments.--The Brontotheriidae is an extinct family of the Perissodactyla, and they are the most spectacular perissodactyls in the Eocene of North America and Asia (Carroll, 1988). They appeared probably in the early Eocene of North America, then radiated to Asia, and became extinct at the end of Eocene (Mader, 1998; Meng and McKenna, 1998). Their size ranged from small dog-size to medium-sized proboscideans (Mader, 1998). The later derived species evolved frontonasal hornlike prominences (Mader, 1998). Their teeth are brachyodont and have distinct bunoselenodont morphology; thus they have been estimated as obligatory browsers occupying warm temperate to subtropical environments with habitats ranging from forest to relatively open woodland (Mader, 1998).

In the Pondaung fauna, three genera and four species (*Sivatitanops cotteri*, *Sivatitanops birmanicum*, *Metatelmatherium? lahirii* (= *Metatelmatherium? browni*), and *Bunobrontops savagei* (including *Bunobrontops* sp.) have been known. *S. birmanicum* are the largest mammal in the Pondaung fauna (AMNH 20014 (a right and left mandibles) which had been described as *S. cotteri* by Colbert (1938) was referred to *S. birmanicum* in his paper based on its size). It lacks the frontonasal hornlike prominences unlike latter derived brontotheres. The presence/absence of the prominences in the other Pondaung brontotheres are not clear due to the fragmentary condition of the specimens, but their dental characteristics suggest that they are rather primitive brontotheres, which usually lack the prominences. The material of *Sivatitanops? rugosidens* Pilgrim, 1925 were too

fragmentary to make a new species (Colbert, 1938), and so this species are considered to be invalid. The materials of *S.? rugosidens* are probably those of other species of *Sivatitanops*. *Metatelmatherium? lahirii* from the Pondaung fauna is not clearly referred to the genus *Metatelmatherium*. This genus is recorded from the early middle to middle middle Eocene Irdin Manha fauna (Irdinmanhan EALMA; see below) of north Asia and from the North American fauna (Colbert, 1938). *Metatelmatherium?* sp. cf. *M? lahirii* (= *M? browni*) from the Naduo fauna, southern China seems related to the Pondaung species and indicate the faunal similarity of the two fauna.

Suborder Ceratomorpha Haeckel, 1866
Family indet.

Plate 17A, A'

Comments.--This is represented by a fragmentary material which indicates the bilophodont structure in the preserved tooth, and familial assignment can not be decided until other details become clear for this form.

Superfamily Rhinocerotoidea Gray, 1825
Family Hyracodontidae Cope, 1879
Cf. ***Ilianodon lunanensis*** Chow and Xu, 1961

Plate 17 B, B', C, C'

Comments.--The Hyracodontidae were flourished during the middle to late Eocene and Oligocene of Eurasia and North America (Radinsky, 1967; Prothero, 1998). Primitive hyracodontids are cursorial, and the tooth are slightly more hypsodont compared to the contemporaneous mammals, suggesting the ability to browse on tougher vegetation (Prothero, 1998). In the Pondaung fauna, the material of this form is very poor. *Ilianodon lunanensis* (Plate 17D) has been reported in the Upper Lumeiyi fauna, Yunnan, south China (Chow and Xu, 1961).

Family Amynodontidae Scott and Osborn, 1883

Plate 18, 19

Comments.--Amynodonts were Holarctic rhinocerotoids known from the middle Eocene to early Miocene (Wall, 1989), and they were one of the most dominant mammal in North America and Asia. In the Pondaung fauna, two species of two genera, *Paramynodon birmanicus* (including *Paramynodon cotteri*) and undetermined genera (Amynodontidae indet.) have been recorded (Tsubamoto *et al.*, 2000a). *Paramynodon* is a metamynodontine amynodont which is considered to have been semi-aquatic, a hippo-like mode of life, and most likely a subcursorial to mediportal terrestrial browser (Wall, 1989, 1998). *Paramynodon* is closely related with *Megalamynodon* form the late Uintan and Duchesnean NALMAs (see below) of North America (Wall, 1989, 1998). Another amynodontid mammal (Amynodontidae indet.) from the Pondaung fauna is smaller than *Paramynodon*, but the details are unclear because the fossil material are so poor.

Superfamily Tapiroidea Gray, 1825

Plate 20

Comments.--The Tapiroidea includes the perissodactyls which have brachyodont teeth, and upper and lower molars with complete cross lophs and short ectolophs and it has been widely accepted that the superfamily is a paraphyletic group (Radinsky, 1963). In case of tapirids at least, they seem to have been lived in humid mesothermal areas, where a large quantity of diverse foliage can be kept (Colbert and Schoch, 1998).

In the Pondaung fauna, two species, *Indolophus guptai* (family indet.) and *Deperetella birmanica* (Deperetellidae) are recorded. *Indolophus* have low-crowned and primitive dental morphology for the Tapiroidea. The family Deperetellidae, genus *Deperetella* and species *D. birmanica* is one of the common mammal in all over the Asia during the middle to late Eocene (e.g., Tsubamoto *et al.*, 2000b).

4. Discussion

4.1. Anthracotheres from the Pondaung fauna and the other East Asian Eocene localities

The Anthracotheriidae is an extinct group of browsing suiform artiodactyl that achieved wide distribution across Eurasia, parts of Africa and North America from Eocene to Plio-Pleistocene (Black, 1978; Ducrocq, 1997; Kron and Manning, 1998). Their body size ranged from small, terrier-sized animals to beasts approaching the hippopotamus (Black, 1978). Typical early anthracotheres have complete dentition and bunodont or bunoselenodont molars of five cusped upper molars and four cusped lower molars without paraconid (Ducrocq *et al.*, 1996). Their low-crowned teeth and frequent occurrence in paleochannel deposits suggest habits and habitat similar to those of modern hippos (Kron and Manning, 1998).

The fossil record of anthracotheres is relatively abundant and diverse in the world. They appeared in East Asia from the middle Eocene until Plio-Pleistocene (Colbert, 1938; Ducrocq, 1997). They appeared in Europe during the late Eocene and became extinct in the Miocene, and evolved in Africa from the late Eocene to the Plio-Pleistocene (Black, 1978; Ducrocq, 1994a, 1997). In North America, they are recorded from late middle Eocene (Duchesnean) to early Miocene (early Hemingfordian), although the fossil record of North American anthracotheres is neither so abundant nor very diverse (Kron and Manning, 1998).

Because some types of anthracotheres are considered to have had a hippopotamid mode of life (Black, 1978; see above) and a body structure similar to hippos, several workers (e.g., Colbert, 1935; Gentry and Hooker, 1988) considered that anthracotheres might have been the ancestors of extant hippos. Others (e.g., Pickford, 1983; but see Ducrocq, 1994b for discussion), however, suggested that hippopotamids could have originated from a peccary stock (Ducrocq, 1997).

So far, many workers have discussed about the phyletic origin of anthracotheres: most researchers considered that the anthracotheres might be originated from a helohyid stock (Matthew and Granger, 1925; Pilgrim, 1928, 1940, Coombs and Coombs, 1977; Ducrocq *et al.*, 1997), or from the diacodexoid forms (Ducrocq, 1994b).

Many workers considered that the anthracotheres may be originated in East Asia during the Eocene (e.g., Pilgrim, 1928; Suteethorn *et al.*, 1988; Ducrocq, 1994a, 1999), because Eocene Asian anthracotheres are well abundant and diversified, and those from

the Pondaung fauna, Krabi, and other faunas show a primitive bunodont condition (Ducrocq, 1999). Especially, the Pondaung anthracotheres are one of the oldest forms in the East Asia, containing many species (Pilgrim and Cotter, 1916; Pilgrim, 1928; Colbert, 1938; see below), so many workers have paid attention to the Pondaung anthracotheres in relation to the origin and early radiation of this group (e.g., Pilgrim and Cotter, 1916; Pilgrim, 1928; Colbert, 1938; Ducrocq, 1999).

In the Pondaung fauna, anthracotheres are most dominantly collected from the field, suggesting the dominant population size. Half of all identifiable mammal dental material which were labeled under the NMMP-KU serial were referred to anthracotheres (Figure 10). Also in the late Eocene Krabi fauna of Thailand, which is slightly later than the Pondaung fauna, about 80% of the mammal dental specimens have been attributed to anthracotheres (Ducrocq *et al.*, 1992).

Despite the richness of the fossil specimens, the classification of the Pondaung anthracotheres has been problematic (Figure 11). The Pondaung anthracotheres contains three genus, which are not so clearly distinct on the dental morphology, including many species (Pilgrim and Cotter, 1916; Pilgrim, 1928; Colbert, 1938), while anthracotheres from Krabi contains several genus, all of which are obviously distinct from each dental morphology (Ducrocq *et al.*, 1992, 1995; Ducrocq, 1999).

The taxonomic confusion on the Pondaung anthracotheres is likely to be due to the high degree of morphological, both in size and shape, variation among them. Because all three genera (*Anthracohyus*, *Anthracothema*, and *Anthracokeryx*) of the Pondaung anthracotheres are types of the each genus and are ones of the oldest anthracotheres in East Asia, their systematic revision will contribute to the systematics of anthracotheres of other Eocene localities of East Asia and to their early evolution in East Asia.

Review of the previous study on the genera of the Pondaung anthracotheres

Pilgrim and Cotter (1916) first described seven species included in the three genus: *Anthracohyus*, *Anthracotherium* and *Anthracokeryx* (Figure 11). Pilgrim (1928), describing new material, revised the Pondaung anthracotheres into three genera (*Anthracohyus*, *Anthracothema* and *Anthracokeryx*) and 13 species (Figure 11). Colbert (1938), moreover, reviewed the Pondaung anthracotheres, recognizing three same genera same as those of Pilgrim (1928) and seven to nine species (Figure 11). Thus three anthracothere genera, *Anthracohyus*, *Anthracothema* and *Anthracokeryx*, have been traditionally recognized by all researchers.

Among the three genera, *Anthracohyus* have unusual upper molar morphology, and consists of only a few material. The other two genera, *Anthracothema* and *Anthracokeryx*, have been commonly found.

***Anthracohyus*:** Genus *Anthracohyus* erected on the material from the Pondaung fauna by Pilgrim and Cotter (1916) was characterized particularly by the absence or very feeble development of the styles on the upper molars. Although they admitted three species in the genus, *A. choeroides*, *A. rubricae* and *A. palustris*, Pilgrim (1928) moved *A. rubricae* and *A. palustris* to a new genus *Anthracothema*. and Colbert (1938) followed this classification. The remaining species, *Anthracohyus choeroides*, was characterized by the conical cusps on the molar, by the absence or very feeble development of the styles on the upper molar and by the fact that the mesiodistal diameter of the upper molar is less on the buccal than on the lingual side (Colbert, 1938).

***Anthracothema* (= *Anthracotherium*):** Genus *Anthracothema* was erected by Pilgrim (1928) based on the material from the Pondaung fauna. He referred four species, *Anthracohyus rubricae*, *Anthracohyus palustris*, *Anthracotherium pangan* and *Anthracotherium crassum*, which had been created by Pilgrim and Cotter (1916) to *Anthracothema*: that is, *Anthracothema pangan*, *Anthracothema crassum*, *Anthracothema rubricae* and *Anthracothema palustre*. However, Colbert (1938) recognized just two species, *A. rubricae* and *A. pangan*, in the genus *Anthracothema*, synonymizing *A. palustre* to *A. pangan* (Figure 11). *Anthracothema* was characterized by its larger size, weak styles on the upper molars, and its more conical molar cusps than those of *Anthracokeryx*, (Pilgrim, 1928; Colbert, 1938). Recently, Ducrocq (1999) synonymized *Anthracothema* to *Anthracotherium* in his descriptive paper of *Anthracotherium* from the Krabi fauna.

***Anthracokeryx*:** Genus *Anthracokeryx* was established by Pilgrim and Cotter (1916) based on the material from the Pondaung fauna. They erected two species in

Anthracokeryx, *A. birmanicus* and *A. tenuis*, but Pilgrim (1928) recognized eight species in the Pondaung fauna: *A. birmanicus*, *A. tenuis*, *A. hospes*, *A. bambusae*, *A. myaingensis*, *A. ulnifer*, *A. moriturus*, and *A.*? *lahirii*. Colbert (1938), moreover, synonymized *A. hospes* and (part of) *A. bambusae* to *A. birmanicus*, and did *A. myaingensis*, (part of) *A. bumbusae*, and (questionably) *A. ulnifer* to *A. tenuis*. That is, he recognized four species in *Anthracokeryx*: *A. moriturus*, *A. birmanicus*, *A. tenuis*, *A.*? *lahirii*. The taxonomic validity of *Anthracokeryx lahirii* in the Anthracotheriidae have been discussed by Pilgrim (1928) and Colbert (1938), and Holroyd and Ciochon (1995) moved recently *Anthracokeryx*? *lahirii* to the Helohyidae, renaming as *Pakkokuhyus lahirii*. Genus *Anthracokeryx* was characterized by its smaller size, better marked styles on the upper molars, and its more crescentic (selenodont) molar cusps than *Anthracothema* and *Anthracohyus*, (Pilgrim, 1928; Colbert, 1938).

Variations in dental size and morphology of the Pondaung anthracotheres

As mentioned above, after the review of Colbert (1938) the Pondaung anthracotheres have been classified into three genus. *Anthracohyus*, *Anthracothema* (or *Anthracotherium*), and *Anthracokeryx*. Apart from *Anthracohyus* which consists of a few material, however, the two genera, *Anthracothema* and *Anthracokeryx*, are very similar to each other in the dental morphology, and the diagnosis of each genus seems not sufficient. Although *Anthracokeryx*, a smaller anthracothere, generally has rather selenodont molars with better-developed styles on the upper molars, and *Anthracothema*, a larger one generally has rather bunodont molars with less-developed styles, the variations in the fossils specimens of each genus are so high that the generic differentiation between them is not supported (Plate 9, 10).

Furthermore, the dental morphologies of both *Anthracothema* and *Anthracokeryx* are referable to that of genus *Anthracotherium*, because the two genera have dentition as bunodont as *Anthracotherium*, and have mesiodistally elongated simple P_4, and also have no distinct morphological characters distinguishing the two genera and *Anthracotherium*. Therefore, both *Anthracothema* and *Anthracokeryx* are synonymized to *Anthracotherium*.

Compared with other species of *Anthracotherium*, such as *Anthracotherium chaimanei* from the late Eocene Krabi fauna, *Anthracotherium monsvialense* from the late Eocene of Europe, *Anthracotherium magnum* from the Oligocene of Europe, all Pondaung *Anthracotherium* are quite similar to each other in the dental morphology. In any material of the Pondaung *Anthracotherium*, P^3 has a mesiodistally elongated triangular outline in occlusal view with pre- and postprotocrista extending mesiodistally, while in *A. chaimanei* it has more mesiodistally compressed triangle outline with the pre- and postprotocrista running more diagonally, and in *A. monsvialense* and *A. magnum*, it has trapezoidal outline in occlusal view with pre- and postprotocrista running more diagonally; P^4 is less selenodont and have much less weaker styles than in *A. monsvialense* and *A. magnum*, and the it also has less weaker styles than in *A. chaimanei*. These characters were discussed among the Pondaung "*Anthracothema*" and *Anthracotherium* from the Krabi fauna and the European faunas by Ducrocq (1999), but the these characters of Pondaung "*Anthracothema*" are also applied to all material of Pondaung "*Anthracothema*" and "*Anthracokeryx*". Furthermore, P_4 of the Pondaung *Anthracotherium* have a vestigial metaconid but do not have any trace of paraconid as in *A. chaimanei*, while it has not only a vestigial metaconid but also a vestigial paraconid in *A. magnum* (the presence/absence of a paraconid in the P_4 of *A. monsvialense* is unknown).

Thus, Pondaung *Anthracotherium* are very similar to each other in the basic structure

of upper and lower posterior premolars among the genus. The distribution of the dental size also support this fact: the scatter plot of the mesiodistal length and buccolingual width of the upper and lower P3-M3 are very well regressed on a straight line (Figures 12, 13), suggesting that these animals belong to the same taxonomic category.

On the other hand, the size distribution of each tooth class is highly variable. However, that of M_1 can be well divided into four groups (Figure 13). First molars erupt firstly in the adult dentition, and have less size variation among the adult dentition. A number of extant herbivores, including both browsing and grazing forms and certain species of hippos and suids, compensate for tooth wear by sequential or delayed tooth eruption (Kron and Manning, 1998). As the anterior teeth (and/or teeth erupting earlier) wear out, the emerging last molars (typically enlarged) take a progressively greater role in food comminution, resulting in the no net loss of feeding efficiency (Kron and Manning, 1998). Therefore, the posterior molars and/or the teeth erupting later are considered to have much more dental size variations than first molars do. Particularly, lower first molars have been considered to be very well correlated to the body size of the mammal compared to other tooth class (Legendre, 1986, 1989; see below), suggesting rather less size variation than the upper ones.

Therefore, this distributional pattern suggests that Pondaung anthracotheres can be divided into four subgroups within a single taxonomic group, that is four species within a single genus, based on the M_1 size (= body size), and that there is very high degree of size variation particularly in the posterior molars. (One dental structure on M_3 should be mentioned here. Pilgrim (1928) distinguished "*Anthracokeryx*" *ulnifer* from "*Anthracokeryx*" *myaingensis* on the basis of the morphology of the hypoconulid on M_3: the former has single cusp at double cusp at hypoconulid region on M_3; while the latter has a double cusp. Although most of the Pondaung anthracotheres have a double cusps at the hypoconulid region on M_3 of which buccal one is always larger and more distinct than the lingual one, the development of the lingual one is highly variable. For example, the lingual cusp in the hypoconulid on M_3 is almost as large as the buccal one in NMMP-KU 0330 (Plate 11D), while it is very small and faint in NMMP-KU 0419 (Plate 11H). This difference is considered to be individual variations, and is not considered to be specific distinction.)

The remaining genus, *Anthracohyus*, also have size variations, and falls in this size distribution. NMMP-KU 0452 (a left M^3), 0453 (a right M^3), 0454 (a left M^3), 0475 (a right M^3) and 0500 (a left maxillary fragment with P^{3-4}) (these latter four specimens probably belong to same individual) seem to belong to *Anthracohyus* because their upper

molars have rather conical cusps and no (or very vestigial) styles, and mesiodistally shorter buccal margin than the lingual one. The holotype of *Anthracohyus choeroides* (GSI B603, a left M^3) (length: 21.2 mm; width: 25.4 mm), NMMP-KU 0452 (a left M^3) (length: 27.9 mm; width: 33.0 mm), NMMP-KU 0453 (a right M^3) (length: 19.6 mm; width: 21.8 mm) are separately scattered in the same regressed size-distributional pattern among the Pondaung anthracotheres (Figure 12). Although these material are not M_1 and considered to have high size variation, they may be referred to second large, largest and second smallest groups mentioned above. Therefore *Anthracohyus* also has same size-variation pattern as in other Pondaung anthracotheres. Furthermore, GSI B605 (a right mandibular fragment with complete dentition), which was described as *Anthracohyus choeroides* by Pilgrim and Cotter (1916, pl. 2, fig. 3, 4), is obviously referable to "*Anthracokeryx*" *birmanicus* based on the dental size and morphology. Therefore, taking very high morphological and size variations of the Pondaung anthracotheres into consideration, it seems better to interpret *Anthracohyus* as one of the unusual individual variation of the other Pondaung anthracotheres, that is, *Anthracotherium*. Otherwise, so many species of anthracotheres which are morphologically and phyletically very close with one another can be recognized in one fauna, as suggested by previous workers (Pilgrim and Cotter, 1916; Pilgrim, 1928; Colbert, 1938), and it seems to be not actual.

Classifications and comments of the Pondaung anthracotheres

As mentioned above, the dental morphology shows that the Pondaung anthracotheres can be treated as a single genus (*Anthracotherium*) with four species in relation to M_1 size (= body size). The body weight of these species were estimated by using a formula of Legendre (1989) that is, 240 kg, 130 kg, 60 kg, and 16 kg (see below). As implied by Holroyd and Ciochon (1991), there is a possibility that the larger two (estimated body weight: 240 kg and 130 kg) and smaller two (estimated body weight: 60 kg and 16 kg) might reveal sexual dimorphic species, respectively. Actually, most anthracotheres show a moderate amount of sexual dimorphism, but it is expressed by the canines: the individuals adjudged to have been male have larger canines than the females (Kron and Manning, 1998). However, fossil material of the Pondaung anthracotheres is too poor to make sure the canine size distribution, an there is no way to evaluate this hypothesis at present. Therefore, the Pondaung anthracotheres are treated as a single genus and four species in this paper.

Although the specific nomenclature of the Pondaung anthracotheres has been so much complicated as mentioned above (Pilgrim and Cotter, 1916; Pilgrim, 1928; Colbert, 1938; Figure 11), the generic name is determined as *Anthracotherium* by the priority rule, and four species can be named as follows:

largest species, *Anthracotherium pangan*;
second largest species, *Anthracotherium rubricum*;
second smallest species, *Anthracotherium birmanicus*;
smallest species, *Anthracotherium tenuis*.

There is a possibility that some of these species might be combined as a sexually dimorphic species in the future.

On the other hand, in the basic dental structure the Pondaung *Anthracotherium* are likely to be more primitive than other species of *Anthracotherium*, discovered from Europe and East Asia. Pondaung *Anthracotherium* is the oldest among the genus, and one of the oldest fossil record of anthracotheres. Also, in the Pondaung fauna, many species (four species) of *Anthracotherium* having high dental size and morphological variations are most dominantly corrected, suggesting the dominant population size. These facts confirms that the hypothesis that *Anthracotherium* have differentiated in the Southeastern Asia as early as the middle Eocene (temporally and spatially close to the Pondaung fauna).

Reappraisal and comments on some other East Asian Eocene anthracotheres relating to the Pondaung anthracotheres

"*Anthracothema*" and "*Anthracokeryx*" have been recorded also from other deposits in the Eocene of Asia. Because the Pondaung "*Anthracothema*" and "*Anthracokeryx*" are types of the two genera and the two were referred to *Anthracotherium*, all species which have been referred to "*Anthracothema*" and "*Anthracokeryx*" from those other Asian Eocene faunas should be referred to *Anthracotherium*, as mentioned above. However, some species will be suggested to be referred not to *Anthracotherium*, but to a new genus.

The other East Asian Eocene anthracotheres relating to the Pondaung anthracotheres are explained below.

***"Anthracothema" minima, "Anthracokeryx" dowsoni* and *"Anthracokeryx" sinensis*:** Both "*Anthracothema*" *minima* and "*Anthracokeryx*" *dowsoni* may be synonymized to "*Anthracokeryx*" *sinensis*. "*Anthracothema*" *minima* described by Xu (1962) from the Rencun fauna consists of only one upper molar, and have conical cusps like that of Pondaung "*Anthracothema*" or "*Anthracohyus*", but overall dental morphology and size is very similar to that of "*Anthracokeryx*" *sinensis* from the same fauna. Taking the case of the Pondaung anthracotheres as mentioned above, it seems better to consider that "*A.*" *minima* is not a distinct species but one of the individual variation of "*A.*" *sinensis*. Similarly, "*Anthracokeryx*" *dowsoni* described by Wang (1985) from the Zhaili fauna which also yields "*A.*" *sinensis* have also similar dental morphology as those of "*A.*" *sinensis*, except for a few minor differences. "*A.*" *dowsoni* is probably also one of the individual variation of "*A.*" *sinensis*.

"*A.*" *sinensis* may not be a bunodont anthracothere but a primitive bunoselenodont anthracothere, and be referred not to *Anthracotherium* but to a new genus. P_4 of "*A.*" *sinensis* (Zdansky, 1930, plate 1, fig. 18) is much more molarized than that of *Anthracotherium magnum*, which have relatively more molarized P_4 among the genus (see above). It compares that of bunoselenodont or selenodont anthracotheres. The upper molars of "*A.*" *sinensis* reveal much higher selenodonty than those of *Anthracotherium magnum*.

"*A.*" *sinensis* is recorded from the Zhaili and Rencun (the upper and lower part of the Heti Formation, respectively, Yuanqu basin, Shanxi and Henan, China), Xiangshan (Lijiang basin, Yunnan, China), and Huangzhuang (Qufu, Shandong, China) faunas of the Eocene of China.

***"Anthracokeryx" gungkangensis"* and *"Anthracokeryx" kwangsiensis*:** These two species, which are from the Gongkang fauna, Guangxi, southern China, are

referred to *Anthracotherium*. Ducrocq (1999) mentioned that these two species likely correspond to only one form by their very similar morphology and dimensions. He did not discuss more, because the material of these species are poor. If his suggestion is true, the specific name "*gungkangensis*" has the priority, and these two species are referred to *Anthracotherium gungkangensis*.

The Pondaung *Anthracotherium* differs from these two species in that the upper molars are slightly more wider and shorter and its outline in occlusal view is slightly more rounded in the former than the latter.

"*Anthracothema rubricae*", "*Anthracokeryx moriturus*", "*Anthracokeryx birmanicus*", and "*Anthracokeryx* sp." ("*Anthracokeryx* cf. *bumbusae*") from the Naduo fauna, Guangxi, southern China: Material of these species which are conspecific with that of the Pondaung anthracotheres are recorded from the Naduo fauna. These material are very poor, so that for the time being these material are referred to the Pondaung species. "*Anthracothema rubricae*" and "*Anthracokeryx moriturus*" are referred to *Anthracotherium rubricum*, "*Anthracokeryx birmanicus*" to *Anthracotherium birmanicus*. "*Anthracokeryx* sp." from this fauna is moved to *Anthracotherium* sp.

"*Anthracokeryx*" *thailandicus*: This species was described from the Krabi fauna, Thailand by Ducrocq (1999). This species is referred to genus *Anthracotherium* in this paper.

A. tenuis of which mandibular morphology has been known among the Pondaung *Anthracotherium*, differs from this species in that the mandibular symphysis of *A. tenuis* is rather anteroposteriorly elongated and not salient ventrally, while that of *A. thailandicus* is very high and ventrally salient under P_1 and in having longer diastema the anterior premolar region.

"*Anthracokeryx*" sp. from the Lizhuang fauna, Henan, China: This material is described based on the astragalus and metacarpus, and not based on the dental material (Wang and Zhou, 1982). Because "*Anthracokeryx*" and *Anthracotherium* is diagnosed by the dentition, the reference of these material to "*Anthracokeryx*" sp. is very difficult to confirm.

"Cf. *Anthracokeryx* sp." from the early to early middle Eocene Kuldana fauna, Indo-Pakistan: "Cf. *Anthracokeryx* sp." was cited in the mammal fauna of the Kuldana fauna by Gingerich *et al.* (1979) and Russell and Zhai (1987). Its material from this fauna is BMNH 32168, a left M_3, which had been referred to *Lammidhania wardi* (Anthracobunidae) by Gingerich (1977). However, the dental morphology of BMNH 32168 is similar to that of M_3 of bunoselenodont anthracotheres such as *Bothriogenys*,

and is definitely not referred to "*Anthracokeryx*" (= *Anthracotherium*). Besides, BMNH 32168 may be from the overlying Murree Formation (Russell and Zhai, 1987). Therefore, the existence of this anthracothere material in the Kuldana fauna is very doubtful.

"Cf. *Anthracokeryx* sp." from the Shara Murun fauna, Inner Mongolia, northern China: "Cf. *Anthracokeryx* sp." are also cited in the mammal fauna of the Shara Murun fauna by Russell and Zhai (1987). This material, AMNH 22090 (a right mandibular fragment with M_3), is originally labeled and described as *Gobiohyus robustus* (Helohyidae) by Matthew and Granger (1925). The M_3 of the specimen has three relatively large and distinct cusps at the hypoconulid region, and also reveal a bilophodont structure, which have never seen in that of anthracotheres. Therefore, the reference of AMNH 22090 to "cf. *Anthracokeryx*" is also very doubtful.

***Anthracotherium chaimanei*:** This species was originally reported as *Anthracothema* sp. cf. *A. pangan* from the Krabi fauna by Ducrocq *et al.* (1992). It was described as *Anthracotherium chaimanei* by Ducrocq (1999). This species is very closely related to *Anthracotherium pangan* of Pondaung fauna, and the former is a little derived than the latter (Ducrocq, 1999; see above).

***"Anthracothema" lijiangensis*:** This species, which is from the Eocene Xiangshan fauna, Lijiang basin, Yunnan, southern China, differs from *Anthracotherium* in having straight, not V-shaped hypolophid, rather mesiodistally oriented cristid obliqua than mesiolingually oriented, and no buccal premetacristid directing mesiobuccally on the lower molars (Zong *et al.*, 1996, p.279, pl. 35, fig. 2). Therefore, this species is also referred to a new genus. This material was referred to the Anthracotheriidae by Zong *et al.* (1996) and Huang (1999), but the familial position is doubtful because the species have straight hypolophid and no mesiobuccally-directed premetacristid on the lower molars, not as in anthracotheres (Holroyd and Ciochon, 1995, p. 181).

"*Anthracotherium*? spp." from the Upper Lushi fauna, Henan, China: *Anthracotherium*? spp. was cited in the Upper Lushi fauna by Chow *et al.* (1973). However, there was no illustration of the material in Chow *et al.* (1973), and the Upper Lushi fauna, which was traditionally referred to Irdinmanhan EALMA, is much earlier than the Pondaung fauna (see below). The presence of genus *Anthracotherium* in the Upper Lushi fauna is highly doubtful (Russell and Zhai, 1987).

***Heothema* and *"Huananothema imparilica"*:** *Huananothema imparilica* from the Naduo fauna, which also yields *Heothema*, was described by Tang (1978). Genus *Huananothema* consists of only one upper molariform tooth, IVPP V4964. This specimen is characterized by the anterior buccolingual width narrower than the posterior one, while

the anterior buccolingual width wider than the posterior one in all other molars of anthracotheres. This feature of IVPP V4964 is also seen in NMMP-KU 0327, a specimen of the Pondaung anthracothere. The feature is actually typical dP^4 morphology of anthracotheres as seen in TF 2901, a right dP^4 of *Anthracotherium chaimanei* from Krabi fauna (Ducrocq, 1999, pl. 5, fig. B). Therefore, NMMP-KU 0327 and IVPP V4964 are also considered to be dP^4. IVPP V4964 may be a dP^4 of *Heothema chengbiensis* according to the size, and it is suggested that *Huananothema imparilica* is a junior synonym of *Heothema chengbiensis*.

Ducrocq (1999) synonymized *Heothema* to *Anthracotherium*, however, *Heothema* has more selenodont dentitions than those of *Anthracotherium* (bunodont anthracothere) and *Bothriogenys* (bunoselenodont anthracothere), and its degree of molarization of the P_4 of *Heothema* also looks between those of *Anthracotherium* and *Bothriogenys*. So, the genus *Heothema* is tentatively treated as a valid genus here. Ducrocq (1999) reorganized previous six species of *Heothema* into two species: *Heothema bellia* (including *Heothema media* and *Heothema nanningensis*) and *Heothema chengbiensis* (including *Heothema angusticalxia* and *Heothema youngi*). I follow this specific synonymies suggested by him.

Heothema is recorded from the late Eocene of southern China, such as the Naduo and Gongkang faunas (Russell and Zhai, 1987).

***Probrachyodus*:** Material of this genus are very poor. Russell and Zhai (1987, p. 130) mentioned that this genus may be inseparable from "*Anthracokeryx*" (= *Anthracotherium*? or "*Anthracokeryx*" *sinensis*?). However, the upper molars of this genus show bunoselenodonty. They also have somewhat lingually procumbent paracone and metacone like that of selenodont anthracotheres than that of bunodont anthracotheres. So, this genus may be primitive bunoselenodont anthracothere, and is considered to be valid.

Probrachyodus panchiaoensis was described from the Upper Lumeiyi fauna, Yunnan, Lunan basin, southern China by Xu (1962). Also, *Probrachyodus*? sp. nov. was cited in the Dongjun fauna, Guangxi, southern China by Ding *et al.* (1977).

4.2. The Pondaung fauna

The Pondaung fauna includes six orders of mammals, consisting of 16 families, 21 genera, and 28 species (Table 3), but the typical "archaic mammals", such as pantodonts, tillodonts or uintatheres, have never been discovered so far.

In the Pondaung fauna, there are only two carnivorous (hyaenodontid creodonts) and two small-sized (phiomyid rodent and eosimiid primate) mammals. All primates are considered to be primitive anthropoids (= higher primates, which include living New and Old World monkeys, apes, and humans). Both artiodactyls and perissodactyls are abundant and successful in the Pondaung fauna, judging from the great number of fossil materials of these taxa. Artiodactyls are more abundant in the number of the specimens but less taxonomically diversified both on familial and generic levels than perissodactyls (Table 3). Especially, anthracothere artiodactyls (four species of *Anthracotherium*) are the most abundant mammal among the Pondaung fauna, suggesting its diversification (Figure 10).

Among 21 genera, 12 (= 57%) have been discovered only from the Pondaung fauna, that is, endemic to the fauna: *Pondaungia*, *Amphipithecus*, *Bahinia*, and an unnamed new genus (primates), an unnamed new phiomyid rodent, an unnamed new hyaenodontid creodont, *Hsanotherium* (order indet.), *Pakkokuhyus* and an unnamed new genus (artiodactyl), and three genus of perissodactyls (*Sivatitanops*, *Bunobrontops* and *Indolophus*).

Estimation of the paleoenvironment

The paleoenvironment of the Pondaung fauna was estimated based on the following evidences:

(1) Most of herbivorous mammals of the Pondaung fauna have brachyodont teeth, which is generally believed to be an adaptation to the diet of soft plants, such as buds, young leaves and fruits, suggesting that their habitats were not open lands (savanna) but a forest environment.

(2) There is no herbivorous species with complete hypsodonty, which is regarded to be adapted to the diet of hard, abrasive plants, such as grasses at the open lands.

(3) All primates of the Pondaung fauna are considered as the primitive insectivorous/frugivorous anthropoids (or "protoanthropoids"). Moreover, although the postcranial materials of these monkeys have not yet discovered, the primitive locomotion type of early anthropoids is considered as arboreal quadripedalism in the forest environment.

(4) Some dominant animals of the Pondaung fauna, such anthracotheres and amynodonts, are considered to have the semi-aquatic habit near large rivers.

(5) The formations above and below the "Upper Member" of the Pondaung Formation are all marine or mostly marine deposits. The "Lower Member" of the Pondaung Formation is dominated by brackish to marine deposits, and the Tabyin and Yaw Formations, which are stratigraphically below and above the Pondaung Formation, are marine deposits (Bender, 1983).

Also considering relatively low latitude of the Pondaung area, it is concluded that the Pondaung fauna were in subtropical to tropical environment with relatively humid, thick forests and large rivers, located not so far from the sea shore, presumably the eastern Tethys Sea.

Cenogram analysis of the estimated body weight

Above, the paleoenvironment of the Pondaung fauna was estimated based on the inferred ecology of the mammal species and the geological evidences. Here, mammalian community of the Pondaung fauna is analyzed using the cenogram method, also to estimate the paleoenvironment of the fauna.

The cenogram method was originally proposed by Valverde (1964, 1967), and developed by Legendre (1986, 1989) and Legendre and Hartenberger (1992). It describes a mammalian community using the body-size distribution of species within the community, and the result is summarized into a cenogram graph, which is constructed by plotting the natural logarithm of the mean body weight of each mammal species except for bats and carnivorous species (carnivores, creodonts, and carnivorous condylarths). The estimated body weights are plotted on the Y-axis, and the species are ranked in decreasing-size order on the X-axis (Legendre, 1986, 1989; Figure 14).

Among the extant faunas, the distributional pattern of body sizes is clearly related to their environments (Legendre, 1986, 1989; Legendre and Hartenberger, 1992; Figure 14): (1) In open environments, medium-sized species (body weight ranging from 500 g to 8 kg) are so rare that there is a gap at the middle range of the cenogram, whereas in more closed or forest environments, medium-sized animals are normally present so that the graph curve is smooth without a gap. (2) In arid environments, large-sized species (weighing over 8 kg) are so rare that the graph curve decreases steeply, whereas in humid environments large-sized animals are so commonly present that the graph curve decrease smoothly.

Recently, it is widely admitted that these schematic pattern of the cenogram, that is the taxonomic composition, of the extant fauna, is well related to the vegetational and climatic environment in any continent (Legendre, 1989, Legendre and Hartenberger, 1992). Although the cenogram analysis has been applied to several Eocene to Oligocene faunas of East Asia (late Eocene Krabi fauna, Thailand; late Eocene Ergilin Dzo fauna, Mongolia; middle to late Eocene Naduo fauna, Guangxi Province, China; middle Eocene Heti fauna, Shanxi and Henan Province, China; and Oligocene Hsand-Gol fauna, Mongolia) by Ducrocq *et al.* (1995), it has never been applied to the Pondaung fauna.

In order to make a cenogram of the Pondaung fauna, the body weight of each animal were estimated from M_1 area (i.e., mesiodistal length x buccolingual width) using regression parameters taken from Legendre (1989, table 1). The M_1 areas of the species whose M_1 was unknown (*Sivatitanops cotteri*, *Bunobrontops savagei*, Amynodontidae indet., *Indolophus guptai*, and cf. *Indomeryx cotteri*) were inferred by comparing the

sizes of the molar specimen with related mammal species. The mean body weights of *Amphipithecus mogaungensis*, *Pondaungia cotteri* and Anthropoidea gen. *et* sp. nov. were from Takai (pers. com.). The datum of the indeterminated ceratomorph was excluded here, because the material is too poor to estimate the body weight. Mean body weights of species of the Pondaung fauna range from about 150 g for the smallest species (Phiomyidae gen. et sp. nov.) to about 2000 kg for the largest (*Sivatitanops birmanicum*) (Table 4).

Figure 15 shows the cenogram of the Pondaung fauna. The graph decreases smoothly from the large-sized through the small-sized animals without any distinct gap, suggesting the humid, forest environment for the Pondaung fauna. The absence of small-sized species in the Pondaung fauna could be explained by the taphonomic and sampling biases. Among the Recent faunas the cenogram of the tropical forest and that of the mosaic of tropical forest and savanna seem to be the best analogue for that of the Pondaung fauna (Legendre, 1989, figs. 20-30; Figures 14, 15).

4.3. Mammal biostratigraphy and biochronology

The Land Mammal Ages are the geochronologic units based on an association of fossil mammals considered to represent a particular interval of geologic time, originally informal in that it was not based on a chronostratigraphic stage (Wood *et al.*, 1941). They were first presented in North America (Wood *et al.*, 1941) and now defined in North America, Europe, East Asia, and South America (McKenna and Bell, 1997, fig. 1; Figure 16). Land Mammal Ages are used as a terrestrial geological age instead of using marine standard stage (e.g., Woodburne and Swisher, 1995).

Particularly, the North American Land Mammal Ages (NALMAs) and European Land Mammal Ages (ELMAs) have already been well established, being correlated to the standard stages, which are established by the radiometric ages, magnetostratigraphy and the marine index fossils (e.g., Legendre and Hartenberger, 1992; Woodburne and Swisher, 1995; Steininger *et al.*, 1996; Figure 16). Both NALMAs and ELMAs have been widely used to determine the geological ages of the terrestrial deposits with mammal fossils and to correlate these deposits and faunas.

However, the East Asian Land Mammal Ages (EALMAs) in the Paleogene (Figure 16) had not so well correlated to the standard stages, because few data of the radiometric ages, magnetostratigraphy and marine index fossils have been obtained from the Paleogene mammal-bearing deposits of East Asia so far. The EALMA were proposed based on the faunal correlation between East Asia and Europe/North America (e.g., Russell and Zhai, 1987; Ting, 1998) and on the faunal similarity indices (Meng and McKenna, 1998; see also the next section).

Also, the East Asian Eocene to Oligocene mammal biostratigraphy and EALMAs have been mainly proposed on the northern East Asian faunas (e.g., Russell and Zhai, 1987; Meng and McKenna, 1998). In the middle to late Eocene (relating the Pondaung fauna), three (Arshantan, Irdinmanhan and Sharamurunian) EALMAs of the middle Eocene and two (Ulangochuian and Ergilian) EALMAs of the late Eocene have been proposed (Meng and McKenna, 1998).

The Pondaung fauna in the southern East Asia has been correlated to the Bartonian stage in Europe, to the late Uintan and Duchesnean NALMAs, and Sharamurunian EALMA (e.g., Colbert, 1938), all of which are now referred to the late middle Eocene (e.g., Holroyd and Ciochon, 1994; see "Introduction" section). This correlation was based on the evolutional stages of the mammals, such as anthracotheres, brontotheres, and amynodonts, between the Pondaung fauna and other faunas (e.g., Colbert, 1938).

The new faunal list of the Pondaung fauna also supports the previous estimation for the relative age of the Pondaung fauna. The existence of a phiomyid rodent, and the evolutional stages of *Anthracotherium* (Artiodactyla), ?*Metatelmatherium* and *Paramynodon* (Perissodactyla) of the Pondaung fauna are correlated to the mammals from the other middle to Eocene faunas of Europe, North America, and northern East Asia (see "Systematic paleontology" section).

Method and its basic concept

In order to analyze the EALMA quantitatively and to determine the relative position of the Pondaung fauna in the EALMAs, appearance event ordination (AEO) method proposed by (Alroy, 1994) and developed by Alroy (1996, 1998c, 2000) was applied in this work. The AEO is a modified biochronologic method of "conjunction method" or disjunct distribution ordination (DDO) method proposed by Alroy (1992).

The AEO algorithm infers age-ranges by analyzing locality-specific faunal lists quantitatively (Alroy, 2000 = in press). The AEO analysis is related to correspondence analysis (Digby and Kempton, 1987), but makes use of both faunal association ("conjunction" (Alroy, 1992)) and stratigraphic data instead of raw presence-absence data (faunal similarity indices) (Alroy, 1994; Wing *et al.*, 1995). This is accomplished by translating the conjunction and stratigraphic data into statements about first and last appearance events (Alroy, 1994; Wing *et al.*, 1995). The use of conjunction data, which are observations that pairs of taxa have been found at least once in the same sample (in a single faunal list), is important because continued sampling leads to an improved knowledge of conjunctional relationships, reducing taphonomic bias, small sample size effects, and small-scale ecological factors (Wing *et al.*, 1995, p. 125).

Thus, conjunction data sets have a property of convergence that presence-absence data sets (faunal similarity indices) lack: generating more and more raw species lists does nothing to free the lists themselves of these effects, but it does cause the conjunction data set to converge on the real set of conjunctions (Wing *et al.*, 1995, p. 125). The more detailed concept and description of AEO is given by Alroy (1992, 1994, 1996, 1998c, 2000).

The method has been applied to the North American mammal faunas (Wing *et al.*, 1995; Alroy, 1996, 1998a, 1998b, 1998c, 2000), to the European ones (Alberdi *et al.*, 1997; Alroy *et al.*, 1998), and to the African one (Alroy, 1994). However, it has never been applied to the East Asian faunas.

Basic steps

The basic steps of the AEO are summarized as follows (Alroy, 2000, p. 710-711):

"(1). Singleton taxa, which are found only in one fossil collection, are excluded from the data set.

(2). F/L statements are computed for all remaining pairs of taxa (species or genera). If two taxa *i* and *j* are found in the same faunal list, they are "conjunct": the statement "F*i* comes before [<] L*j*" is true and vice versa. If an occurrence of *i* is found below one of *j* in any stratigraphic section, F*i* < F*j* but the converse is not necessarily true. L*i* < F*j* is tentatively assumed if no list includes both taxa and no section shows *i* occurring below *j*. F*i* < L*j* statements are assumed to be known with certainly, but L*i* < F*j* statements are treated as hypothesis to be tested against candidate age ranges. F*i* < L*i* statements are generated automatically for all pairs of taxa for which either (a) *i* = *j*, because a taxon's first appearance must come before its own last appearance; or (b) *j* is a living taxon.

(3). The square, pairwise F/L matrix is augmented by adding "virtual" conjunctions using the square graph algorithm (Alroy, 1998c), which compensates for biographic effects that keep coeval taxa from ever being found in the same locality or section. The virtual conjunctions are used in the next step and then discarded.

(4). As a starting point, a candidate linear sequence of F/L statements is computed by (a) using a variant of reciprocal averaging to derive scores for taxa from the F/L matrix, (b) using these scores to compute mean scores for faunal lists, (c) ordering the lists by their scores, and (d) computing first and last appearances by scanning across the sequence of lists. The event sequence is identical to an age range chart in which each taxon is represented by one F statement and one L statement occurring later on.

(5). The initial appearance event sequence is optimized by a swapping algorithm. Earlier papers used a simple parsimony criterion to perform this optimization; a maximum likelihood approach to the problem is discussed below.

(6). The appearance event sequence is numbered from oldest to youngest, and event positions are computed for the faunal lists. An event position is a minimal span of events going across the sequence that includes all of the taxa in a list; so, if a list's position is 222-224, then all first appearances of the taxa occur by event 222 and all last appearances by event 224. In contrast to earlier studies, here the numbering is based on consecutive runs of like events (e.g., first appearances) instead of simple counts of events. For example, a stretch of seven events like F-F-F-L-F-L-L would count as just four runs. The new practice of counting event runs instead of events makes only a tiny difference to the

calibration. However, by removing some small-scale distortions in the calibration the new numbering scheme decreases apparent variation among sampling bins in counts of lists and taxonomic occurrences.

(7). Geochronologic age estimates are matched to the event positions using a new linear interpolation algorithm [detailed in Alroy, 2000 = in press]. The algorithm seeks to fined the largest set of "hinge" calibration points that implies a monotonic and reasonably steady relationship between time and the event sequence. In contrast, earlier studies used interpolation methods that employed small sets of statistically significant hinge points (Alroy, 1996, 1998c).

(8). The interpolation is used to estimate the age of each event in Ma, and these estimates in turn define numerical values for the age ranges of each taxon and the maximum/minimum ages of each list."

In Alroy (2000), the optimization algorithm has been improved by employing an explicitly formulated maximum likelihood criterion in deciding amongst alternative event sequences. This new algorithm is called maximum likelihood appearance event ordination (ML-AEO) (Alroy, 2000). The basic idea is to compute the probability of obtaining the observed F/L data given a candidate event sequence, a probabilistic model of sampling, and some set of nuisance parameters (Alroy, 2000). See Alroy (2000) for the details of the ML-AEO.

Data and analysis

In this work, 92 mammal faunal lists of the Paleogene of East Asia were obtained mainly from Li and Ting (1983), Russell and Zhai (1987), Tong (1989), Ducrocq *et al.* (1995), Meng and McKenna (1998), and Wang *et al.* (1998), and from other recent publications (for the detailed data source, see Appendix 3). 34 mammal faunal lists of the Neogene of East Asia (Qiu and Qiu, 1995; and on other recent publications, see Appendix 3) were also prepared to "root" the event sequence (Alroy, 1998c) on the end of the Oligocene sequence.

In this analysis: ML-AEO were used; both genus- and species-level F/L statement were employed in the same data matrix; and the intermediate identifications in the list of Appendix 3 were ignored, as taxonomic modifications such as "cf." or "?". Both the Paleogene and Neogene faunas were analyzed in the same data matrix, then the Neogene faunas were omitted from the resultant faunal sequence.

Three radiometric age are available in the Paleocene faunas of East Asia: 37.2 Ma of

the Pondaung fauna (see "Fission-track zircon age section); 32 Ma of the Lava between Tatal and Shand members of the Hsanda Gol Formation, Mongolia (corresponds to the age between Ulaan Khongil (Tatal Member) fauna and Ulaan Khongil (Shand Member) fauna) (Evernden *et al.*, 1964; Russell and Zhai, 1987; Meng and McKenna, 1998); 51 Ma of the basalt between Member II and III of Gashato Formation, Nei Mongol (Inner Mongolia), north China (corresponds to the age between Gashato Mbr II fauna and Gashato Mbr III fauna) (Meng and McKenna, 1998; Meng *et al.*, 1998).

In this analysis, the age of event number zero was treated as 65 Ma (K-T boundary), and the age of the maximum event number of the last Oligocene fauna (the topmost of the Paleogene sequence) was treated as 23.8 Ma (Oligocene-Miocene boundary) (Woodburne and Swisher, 1995), because the dating data are too poor to estimate the geological age of the faunas.

Result and discussion

The resultant faunal sequence of the Paleogene faunas of East Asia by ML-AEO is shown in Table 5. The sequence indicates good agreement with the traditional sequence of the EALMAs (Russell and Zhai, 1987; Tong *et al.*, 1995; Meng and McKenna, 1998; Figure 16), with a few disagreements.

The results of this analysis lead the following suggestions:

(1) The Pondaung fauna is referred to the Sharamurunian EALMA, as suggested by the previous workers.

(2) The Arshantan EALMA, which was proposed by Qi (1987), is better to be included in the Irdinmanhan EALMA rather than the forming an independent EALMA like Russell and Zhai (1987), because the Arshanto fauna, which is a main element of the Arshantan EALMA, is located between the Kholboldzhi-Nur fauna, which is one of the main elements of the Irdinmanhan EALMA, and other Irdinmanhan faunas (Figure 16, Table 5).

(3) The Ulangochuian EALMA, which was used by (Meng and McKenna, 1998), being defined between the Sharamurunian and Ergilian EALMAs, is better to be included in the Ergilian EALMA like Russell and Zhai (1987), because two main faunas of the Ulangochuian EALMA (the Ulan Gochu and Urtyn Obo faunas) are positioned between the Ergilin Member faunas and Sevkhul faunas, all of which are the main elements of the Ergilian EALMA (Figure 16, Table 5).

(4) The "Naduan" Land Mammal Age of China, which was proposed by Tong (1989) and followed by Tong *et al.* (1995), and was defined between the Sharamurunian and

Ulangochuian Land Mammal Ages of China, because the "Naduan" mammal faunas, that is the Naduo, Caijiachong, Zhaili, and Changxindian faunas (Tong *et al.*, 1995), are scattered among the faunas of the Sharamurunian and Ergilian EALMAs without forming any definite chronological range.

Finally, the Paleogene EALMAs can be identified as follows from early Paleocene to late Oligocene in order: Shanghuan, Nongshanian, Gashatan, Bumbanian (Lingchan of Tong *et al.* (1995)), Irdinmanhan (including Arshantan), Sharamurunian (including a part of Naduan), Ergilian (including Ulangochuian and a part of Naduan), Hsandagolian (Ulantatalian of Tong *et al.* (1995)), and Tabenbulakian EALMAs (Figure 16; Table 5). The faunal boundaries are based on those of Russell and Zhai (1987), Meng and McKenna (1998), and Ting (1998).

The correlations among the Paleogene East Asian mammal faunas have not yet been analyzed sufficiently, but the further studies of the paleontological, geological, and geochronologic field on the East Asian Paleogene faunas would establish the EALMAs in the near future.

4.4. Faunal comparison

In order to clarify the mammal faunal evolution in the later Eocene of southern East Asia, the Pondaung fauna is compared with the 28 middle to late Eocene East Asian faunas. The evolution of the Eocene mammals in the East Asia has been studied mainly based on the fossil records of northern East Asian faunas. The latest middle Eocene Pondaung fauna in Myanmar and the late Eocene Krabi fauna in Thailand will supply important information on the study of evolution of East Asian faunas.

General comparisons among the middle to late Eocene mammal faunas of East Asia

The faunal lists of the 28 middle to late Eocene East Asian mammal faunas used here are shown in Table 6. Most of these faunas contain relatively large numbers of mammal taxa compared to other contemporaneous faunas, so they are useful for the studies of mammal biostratigraphy in East Asia (e.g., Li and Ting, 1983; Russell and Zhai, 1987; Meng and McKenna, 1998). These middle to late Eocene East Asian faunas were classified into three areas for the sake of convenience: northern (13 faunas), middle (seven faunas), and southern (nine faunas) areas (Figure 17, Table 6). The Pondaung fauna is included in the southern area.

Among the families of the Pondaung fauna, nine families are shared with other East Asian faunas: the Hyaenodontidae (Creodonta), Anthracotheriidae and Helohyidae (Artiodactyla), and Brontotheriidae, Hyracodontidae, Amynodontidae and Deperetellidae (Perissodactyla) are commonly recorded in the middle to late Eocene faunas of East Asia (Table 7); The Amphipithecidae (Primates) is shared with the late Eocene Krabi fauna, and the Eosimiidae (Primates) is shared with the Eocene Rencun, Zhaili and Shanghuang faunas (Table 7). It is notable that the sole rodent of the Pondaung fauna, Phiomyidae, has never been discovered from the East Asian faunas (see below).

At the generic level, the Pondaung fauna resembles well with the southern East Asian faunas, particularly with the Naduo fauna in southern China: five of 19 identified genera are shared with the 24 identified genera of the Naduo fauna (see below). Although the Pondaung fauna shares a few genera, such as *Deperetella* and "*Pterodon*", with the contemporaneous faunas of middle to northern East Asia, such as the Rencun and Shara Murun faunas (Table 7), they are widely distributed in East Asia during the middle to late Eocene, probably indicating no special resemblance among them.

Comparison using faunal similarity index (Simpson's FRI) at generic level

These 29 middle to late Eocene mammal faunas of East Asia (including the Pondaung fauna) were compared with one another, using faunal similarity index at generic level. The generic level was chosen because it is more taxonomically robust than the familial and specific level. The similarity index used here is Simpson's Faunal Resemblance Index (FRI), which is obtained by the following formula: FRI (%) = (N_c / N_l) x 100, where N_c is the number of taxa shared by two faunas, and N_l is the number of taxa in the smaller of the two faunas (Simpson, 1960; Flynn, 1986; Holroyd and Maas, 1994).

When taxonomic lists differ markedly in size, Simpson's FRI is useful because it eliminates the effect of the size differences of the two faunas, compared to other indices such as Jaccard and Dice indices, and is most commonly applied to the vertebrate fossil records (e.g., Simpson, 1960; Flynn, 1986; Holroyd and Ciochon, 1994; Holroyd and Maas, 1994).

Simpson's FRI has been applied to some East Asian faunas: Holroyd and Ciochon (1994) analyzed the resemblances among four East Asian mammal faunas (the Lushi (Upper and Lower Lushi), Irdin Manha, Heti (Zhaili and Rencun), and Shara Murun faunas. On the other hand, Meng and McKenna (1998) analyzed the faunal comparisons on the late Paleocene to Oligocene northern East Asian faunas using a different indices, the Jaccard and Dice indices.

The number of identified genera of each fauna and the number of shared genera between the each two faunas, and the each FRI are shown in Table 8. The intermediate identifications with such as "cf." or "?" in Table 3 and 6 were treated as the exact identifications in calculating FRIs.

Among middle and northern faunas, all faunas of the Irdinmanhan EALMA (the Kholboldzhi-Nur, Arshanto, Irdin Manha at Camps Margetts, Irdin Manha at Irdin Manha, Ulan Shireh, and Khaychin (II, III, V), Hetaoyuan, Upper Lushi, Shanghuang, and Huangzhuang faunas) have relatively high FRIs with one another more than with the faunas of the Ergilian EALMA, while six faunas of the Ergilian EALMA (Chaganbulage, Sevkhul at Khoer Dzan, Ulan Gochu, Urtyn Obo, Ergilian at Ergilin Dzo, and Ergilian at Khoer Dzan faunas) (no faunas of the Ergilian EALMA in middle East Asia) show much higher FRIs with one another than with the faunas of the Irdinmanhan EALMA (Table 8). The faunas of the Sharamurunian EALMA (the Shara Murun, Zhaili, and Rencun faunas) has relatively high FRIs with the faunas of both the Irdinmanhan and Ergilian EALMA, indicating the intermediate position between them. In sum, the result of the faunal comparison of northern East Asian faunas is well consistent with the result of the EALMA

sequence (Figure, 16; Table 5).

The southern East Asian faunas, however, show the different pattern from other areas. Three southern East Asian faunas (the Lower Lumeiyi, Xiangshan, and Dongjun faunas) of the Irdinmanhan EALMA and the one fauna (the Upper Lumeiyi fauna) of the Sharamurunian EALMA show high FRIs not only with one another but also with the middle and northern East Asian faunas of the Irdinmanhan and Sharamurunian EALMAs (Figure, 16; Table 5, 8). In contrast, two southern East Asian faunas (the Pondaung and Naduo faunas) of the Sharamurunian EALMA and the two faunas (the Gongkang and Krabi faunas) of Ergilian EALMA show low FRIs with any middle and northern faunas of the middle to late Eocene and , suggesting the occurrences of the faunal endemism during the later Eocene (Figure, 16; Table 5, 8). The Pondaung, Naduo and Gongkang faunas show relatively high FRIs with one another, and the Pondaung and Naduo faunas (of the Sharamurunian EALMA) have relatively high FRIs with the southern East Asian faunas of the Irdinmanhan and Sharamurunian EALMAs (Figure, 16; Table 5, 8). The Caijiachong fauna of the Ergilian EALMA show the relatively high FRIs with most of the southern East Asian faunas, and the northern faunas of the Sharamurunian and Ergilian EALMAs.

In sum, the result of the faunal similarity analysis on the middle to late Eocene East Asian faunas suggest that the faunal transition occurred as early as later Sharamurunian EALMA, that is, around the latest middle Eocene, in the southern area of East Asia, resulting in slight faunal endemism.

Comparison among the middle to late Eocene mammal faunas of southern East Asia, and the mammal evolution of these faunas

Among the southern East Asian faunas (Figure 17, Table 3, 6), the Pondaung fauna most resembles the Naduo fauna, Guangxi Province, southern China, sharing five genera (*Anthracotherium*, *Indomeryx*, *Metatelmatherium*, *Paramynodon*, and *Deperetella*) and four species (*Anthracotherium rubricum*, *Anthracotherium birmanicus*, *Indomeryx cotteri*, and *Metatelmatherium lahirii*). The Naduo fauna including rather progressive types such as the Tayassuidae, Suidae and Tragulidae indicates that this fauna is slightly later in age than the Pondaung fauna. Of course, the Gongkang fauna which overlies the Naduo fauna is considered to be later in age than the Pondaung and Naduo faunas.

Also, it shares four genera ("*Pterodon*", *Ilianodon*, *Paramynodon* and *Deperetella*) and three species ("*Pterodon*" *dahkoensis*, *Ilianodon lunanensis* and *Deperetella birmanica*) with the Upper Lumeiyi fauna, Lunan basin, Yunnan Province, southern China. Since both the Naduo and Upper Lumeiyi faunas are of the Sharamurunian EALMA (Table 5) and located at the Southern East Asia, the high similarity between the Pondaung fauna and these faunas could be interpreted as indicating their chronological and paleozoogeographical closeness.

The Dongjun fauna includes *Eudinoceras* of which last appearance was Irdinmanhan LMA (Meng and McKenna, 1998), indicating earlier age than the Pondaung fauna, although the two shares several taxa such as *Deperetella birmanica* and *Paramynodon*. The Lower Lumeiyi fauna includes the Lophialetidae which is an archaic family, and existence of helohyid *Gobiohyus* which was found from Irdinmanhan EALMA, indicating the much earlier age than the Pondaung fauna. The Xiangshan fauna of Lijiang basin includes many lophialetid perissodactyls which was the most dominated in Irdinmanhan EALMA and declined in Sharamurunian EALMA, also indicating the earlier age than the Pondaung fauna.

The Krabi fauna of Thailand shares *Anthracotherium* and also primitive anthropoids (Amphipithecidae) with the Pondaung fauna. *Anthracotherium* of the Krabi fauna is somewhat more progressive than that of the Pondaung fauna (Ducrocq, 1999; see "Anthracotheres from the Pondaung fauna and the other East Asian Eocene localities" section). The fauna including rather progressive types such as the Tayassuidae, Suidae, ?Tragulidae, and indicating later age than the Pondaung fauna. The Krabi fauna is very highly endemic, having 14 endemic genera of 26 identified genera. The Caijiachong fauna includes *Karakoromys* and *Parasminthus* (= *Plesiosminthus*?) (Rodentia) which firstly appeared in Hsanda Gol Svita (Hsandagolian = Oligocene) of Mongolia

(Dashzeveg, 1993) in the northern East Asia, indicating much later in age than the Pondaung fauna.

From another view, The faunal composition calculated at the generic level of the 29 middle to late Eocene East Asian faunas used above are shown in Figure 18, 19 and Table 9. The evolution of mammal faunas in the middle to late Eocene of southern East Asia would be characterized as follows: in earlier perissodactyls are highly dominant and flourishing, and artiodactyls are rare; and in later age, artiodactyls (particularly anthracotheres and primitive ruminants) become much more dominant and flourishing, and perissodactyls become decline compared to the former. This can be well explained particularly by comparing in the faunas from the same basin and by comparing faunas united based on the EALMAs as explained below. In the Bose and Yongle basins, Guangxi, southern China, there are three faunas regarded: from older to younger, the Dongjun, Naduo, and Gongkang faunas (Li and Ting, 1983; Russell and Zhai, 1987). The ratio of the artiodactyls to perissodactyls is very low (artiodactyls:perissodactyls in number of genera = 1:10) in the Dongjun fauna, be became much higher in the Naduo and Gongkang faunas (12:7 and 6:4, respectively), suggesting the evolutional tendency of the declining of perissodactyls (Figure 18, 19; Table 9). Although it is not so different, between the Upper and Lower Lumeiyi faunas, of which former is younger than the latter, the ratio of artiodactyls and perissodactyls is consistent with the above example: in the Lower Lumeiyi fauna the ratio = 16:2, and in the Upper Lumeiyi fauna the ratio = 15:3. Compared with the faunas of the Irdinmanhan EALMA (Lower Lumeiyi Xiangshan, and Dongjun faunas), the faunas of the Sharamurunian and Ergilian EALMAs contains fewer perissodactyls. Although the ratio of perissodactyls in the Caijiachong fauna of Ergilian is much higher than that of other faunas (the Gongkang and Krabi faunas), the value is much lower than that of the faunas of the Irdinmanhan EALMA. The Pondaung fauna has four genera (four families) of artiodactyls and does nine genera (six families) of perissodactyls, suggesting the some flourishing of the artiodactyls and some decline of the perissodactyls compared with the other middle to late Eocene faunas of southern East Asia, suggesting the beginning of the faunal turnover.

Comparison of faunal composition between the northern and southern parts of East Asia in the middle to late Eocene

The artiodactyls became more dominant and perissodactyls did more declined from the middle Eocene to late Eocene in the southern East Asia, as mentioned above. It is clearly indicated that the mammal faunas of southern East Asia evolved somewhat uniquely in the later Eocene time compared to the contemporaneous northern East Asian ones (see below). This different faunal transition may be caused by the climatic and/or vegetational differentiation between the relatively warmer southern region and relatively cooler northern region at that time (e.g., Prothero, 1994).

The northern middle to late Eocene East Asian faunas are generally dominated by perissodactyls (Figure 18, 19; Table 9). Although artiodactyls became slightly more dominant in the later faunas (Sharamurunian and Ergilian faunas), perissodactyls was still flourished in the northern East Asian faunas, in contrast to the southern ones (Figure 18, 19; Table 9).

The perissodactyls clearly declined and artiodactyls became comparatively more dominant in the Oligocene faunas of northern East Asia (Meng and McKenna, 1998). But, the most remarkable faunal turnover in the Oligocene faunas of northern East Asia is that the hypsodont rodents and lagomorphs became clearly much more dominant than the other mammals (Meng and McKenna, 1998). Unfortunately, there is no useful Oligocene mammal faunas in the southern East Asia, so that it cannot be mentioned directly on the mammal faunal differentiation between the southern and northern East Asia.

It is noteworthy that the most of the faunas of the later Eocene of southern East Asia (i.e., Pondaung, Krabi, Naduo, and Gongkang faunas) are characterized by the existence of many bunodont anthracotheres such as *Anthracotherium*, *Heothema*, and/or *Siamotherium*, which are most dominant in the fossil materials (suggesting dominant population size?) at least in the Pondaung and Krabi faunas. These bunodont anthracotheres have not been found from the Paleogene of northern East Asia.

Comparisons with the contemporaneous mammal faunas of other continents

Although the Pondaung fauna shares some mammal taxa (at ordinal, familial and generic levels) with the contemporaneous faunas of other continents, such as Europe, Africa, India, and North America, there is no more special resemblances among them than with southern East Asian faunas. There is no clearly congeneric species between the Pondaung fauna and the contemporaneous mammal faunas of North America, although there were some mammal faunal exchange between Asia and North America though the Beringian region (e.g., Bread 1998a). However, for example the Krabi fauna shares *Miacis* (Miacidae; Carnivora), and *Nimravus* and *Hoplophoneus* (Nimravidae; Carnivora) with the contemporaneous North American and East Asian faunas (Ducrocq *et al.*, 1995; McKenna and Bell, 1997; Peigné *et al.*, 2000), indicating faunal exchange between southern East Asia and North America via Beringian region and northern East Asia at that time.

The new genus and species of the hyaenodontid creodont from the Pondaung fauna have close affinity with the *Paratritemnodon indicus* from the early to middle Eocene Subathu and Kuldana fauna of Indo-Pakistan (Egi and Tsubamoto, 2000), suggesting the faunal exchange between the Southeast Asia and Indo-Pakistan region at that time via Tethys Sea.

The Pondaung fauna shares *Anthracotherium* with the late Eocene and Oligocene mammal faunas of Europe, such as the late Eocene fauna of Dincu Beds in Rumania and that of Detan Dverce (late Eocene) in old Czechoslovakia (Ducrocq, 1994). The European *Anthracotherium* is more progressive than that of the Pondaung and Krabi ones (Ducrocq, 1994, 1999; see "Anthracotheres from the Pondaung fauna and the other East Asian Eocene localities" section). The Krabi fauna shares *Bothriogenys* (bunoselenodont anthracothere) with the late Eocene/early Oligocene Fayum fauna in Egypt. Furthermore, both Pondaung and Krabi fauna shares primitive anthropoids with the Fayum fauna. Also, the discovery of a phiomyid rodent, which had ever been found only from the fauna of Western Part (Europe, Africa and West Asia) such as the Fayum fauna and early Oligocene Dhofar fauna in Oman, Arabian Peninsula (Wood, 1968; Stucky and McKenna, 1993; McKenna and Bell, 1997; Thomas *et al.*, 1999), from the Pondaung fauna (Southeast Asia) makes it sure that mammals could migrate between Southeast Asia and Africa/West Eurasia in the middle to late Eocene time through the Turgai Straight and the Tethys Sea which had already been relatively shallow (Holroyd and Maas, 1994; Ducrocq, 1994, 1997, 1999; Ducrocq *et al.*, 1995).

5. Summary and Conclusions

The purposes of this paper are; (1) to determine the radiometric age of the Pondaung fauna; (2) to reconstruct the Pondaung mammal fauna; and (3) to clarify the mammal faunal evolution in the middle to late Eocene of southern East Asia including Myanmar.

1) The radiometric age, 37.2 ± 1.3 (1 sigma) Ma, for the Pondaung fauna was calculated by the fission-track analysis for the zircon grains obtained from the "Upper Member" of the Pondaung Formation. This value corresponds to the latest middle Eocene age (Woodburne and Swisher, 1995), which is consistent with the geologic age, middle to late Eocene, suggested by previous studies based on the paleontological evidences (Pilgrim and Cotter, 1916; Pilgrim, 1925, 1928; Colbert, 1938; Holroyd and Ciochon, 1994, 1995).

2) The Pondaung fauna includes mammals of six orders, 16 families and 21 genera:

Order Primates
- *Pondaungia*
- *Amphipithecus*
- *Bahinia*
- Anthropoidea gen. nov.

Creodonta
- Hyaenodontidae gen. nov.
- "*Pterodon*"

Rodentia
- Phiomyidae gen. nov.

Artiodactyla
- *Anthracotherium*
- *Pakkokuhyus*
- *Indomeryx*
- Artiodactyla gen. nov.

Perissodactyla
- *Sivatitanops*
- ?*Metatelmatherium*
- *Bunobrontops*
- Ceratomorpha family *et* genus indet.

Cf. *Ilianodon*
Paramynodon
Amynodontidae genus indet.
Indolophus
Deperetella
Order indeterminated (Ungulata)
Hsanotherium

3) The classification of the Pondaung anthracotheres, which was the most dominant mammal in the Pondaung fauna, was reviewed, referring to one genus (*Anthracotherium*) and four species (*A. pangan*, *A. rubricum*, *A. birmanicus*, and *A. tenuis*). Compared with other *Anthracotherium* species discovered from localities of Asia and Europe, the Pondaung species are oldest in age and primitive in morphology, and show high degree of morphological variation, suggesting that the genus might have originated in Southeast Asia as early as the middle Eocene.

4) The paleoenvironment of the Pondaung fauna is estimated as subtropical/tropical forest with large rivers, located near the sea shore (probably of the Tethys Sea) based on the following evidences: (1) there are many herbivorous mammals with brachyodont molars (e.g. brontotheres) but few species with hypsodont teeth, suggesting the existence of soft-leaves eaters rather than hard-grasses ones; (2) there are several primitive anthropoid primates, which are considered to be arboreal and frugivorous animals, indicating forest environment; (3) there are several species of anthracotheres and a metamynodontine amynodont, which are considered to have lived in the riverside; (4) the lower part of the Pondaung Formation is dominated by marine deposits, and the formations below and above the Pondaung Formation are marine deposits; and (5) the result of a cenogram analysis suggested the similarity of the Pondaung fauna to Recent faunas in the tropical forests.

5) The Pondaung fauna was referred to the Sharamurunian EALMA by using the AEO method. In the result of AEO analysis, the Paleogene EALMAs can be identified as follows from early Paleocene to late Oligocene in order: Shanghuan, Nongshanian, Gashatan, Bumbanian (Lingchan of Tong *et al.* (1995)), Irdinmanhan (including Arshantan), Sharamurunian (including a part of Naduan), Ergilian (including Ulangochuian and a part of Naduan), Hsandagolian (Ulantatalian of Tong *et al.* (1995)),

and Tabenbulakian EALMAs (Figure 16; Table 5). The combination of the absolute age of the Pondaung Formation and more detailed correlation among East Asian Paleogene mammal faunas would establish the EALMAs in the future.

6) The Pondaung fauna correlates well to some Southern East Asian faunas, especially to the middle/late Eocene Naduo fauna (the Guangxi Province, southern China), which shares five genera and four species with the Pondaung fauna. However, there is no special resemblances between the Pondaung fauna and the contemporaneous northern East Asian faunas. In the later Eocene, the faunas of the southern East Asia are characterized by the dominance of artiodactyls compared with perissodactyls, while, in contrast, in the northern East Asian faunas perissodactyls are still more dominant than artiodactyls both in the taxonomic and populational respects. This contrast is consistent with the inference of this study that the anthracothere artiodactyls might have originated in Southeast Asia as early as the middle Eocene.

7) Although there is no clearly congeneric taxa between the Pondaung fauna and the contemporaneous mammal faunas of North America, the Krabi fauna shares some carnivorous mammals, such as *Miacis* (Miacidae; Carnivora) and *Nimravus* and *Hoplophoneus* (Nimravidae; Carnivora), with the contemporaneous North American faunas (Ducrocq *et al.*, 1995; McKenna and Bell, 1997; Peigné *et al.*, 2000), suggesting faunal exchanges between East (or Southeast) Asia and North America at that time. On the other hand, diverse primitive anthropoids, phiomyid rodent, or *Anthracotherium* shared by the Pondaung fauna and the late Eocene to early Oligocene faunas of Africa/West Eurasia (Europe and West Asia) suggest mammal migrations between Southeast/East Asia and Africa/West Eurasia, which was accomplished probably across the shallowed Turgai Straight and Tethys Sea, at that time.

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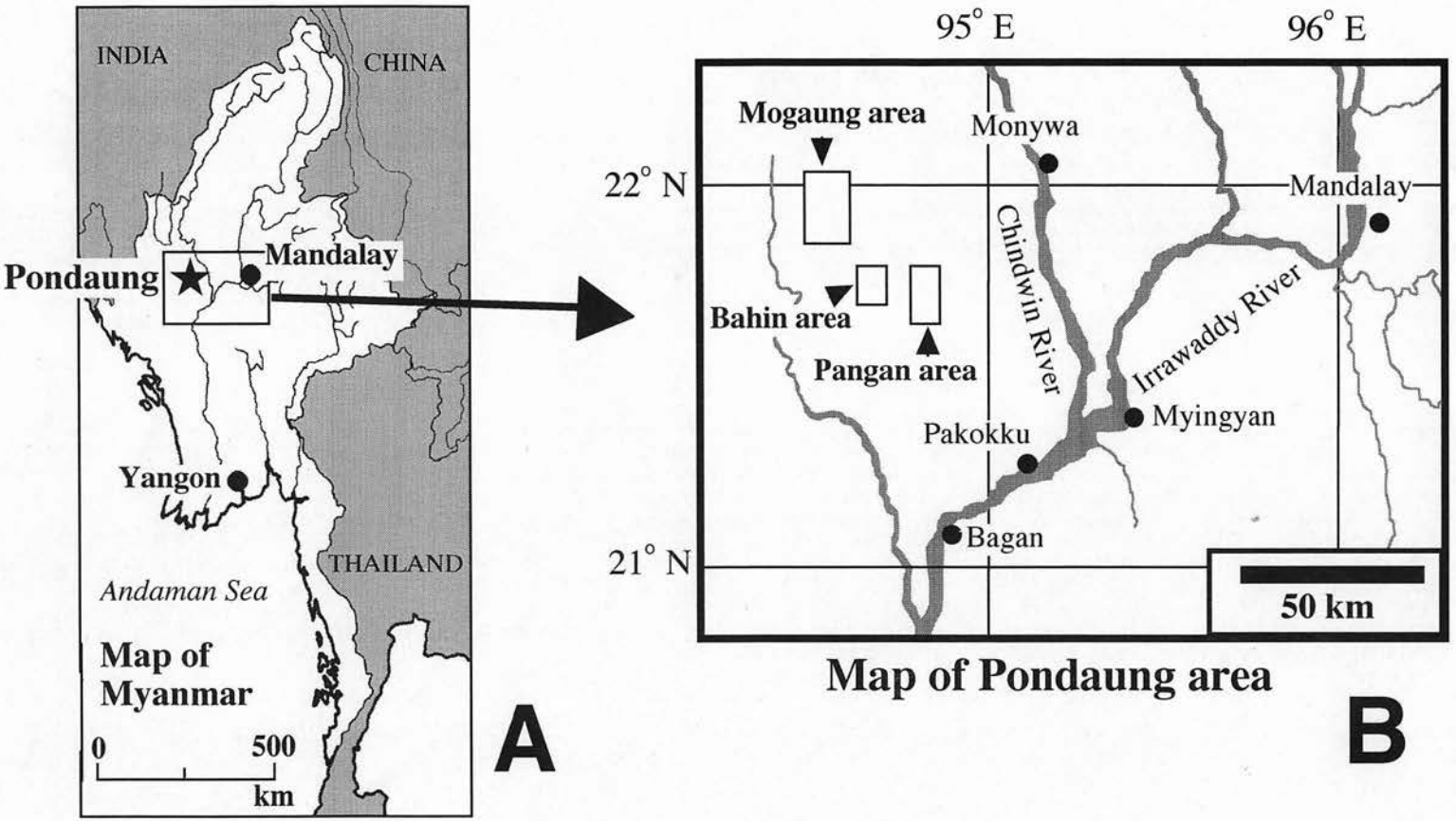

Figure 1. A, map of Myanmar showing the location of the Pondaung area. **B**, map of the Pondaung area showing the location of the three main regions of fossil localities. Black circle, cities.

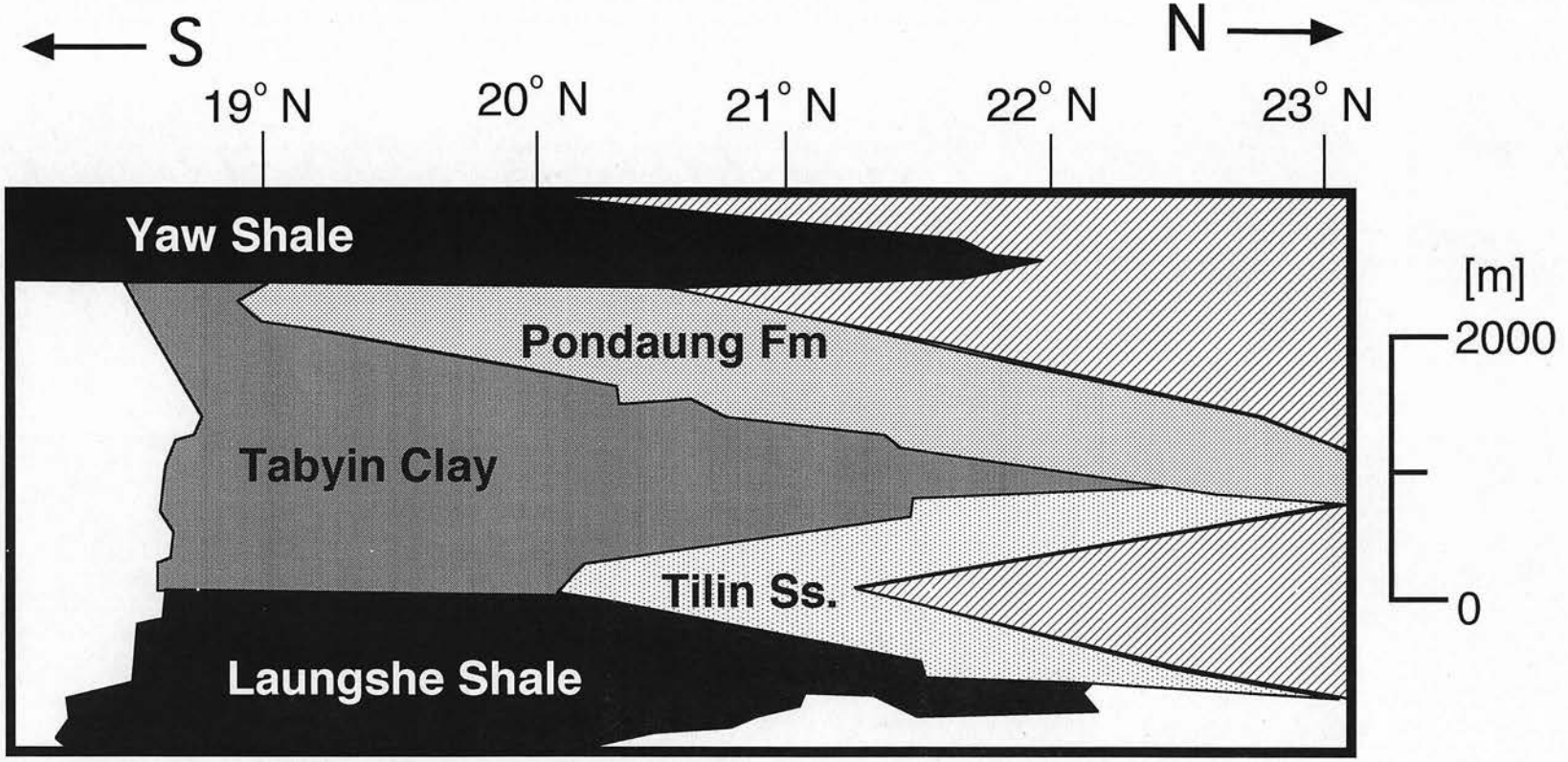

Figure 2. Eocene geological section of the stratigraphy of the Eocene deposits in central Myanmar (after Stamp, 1922; Holroyd and Ciochon, 1994).

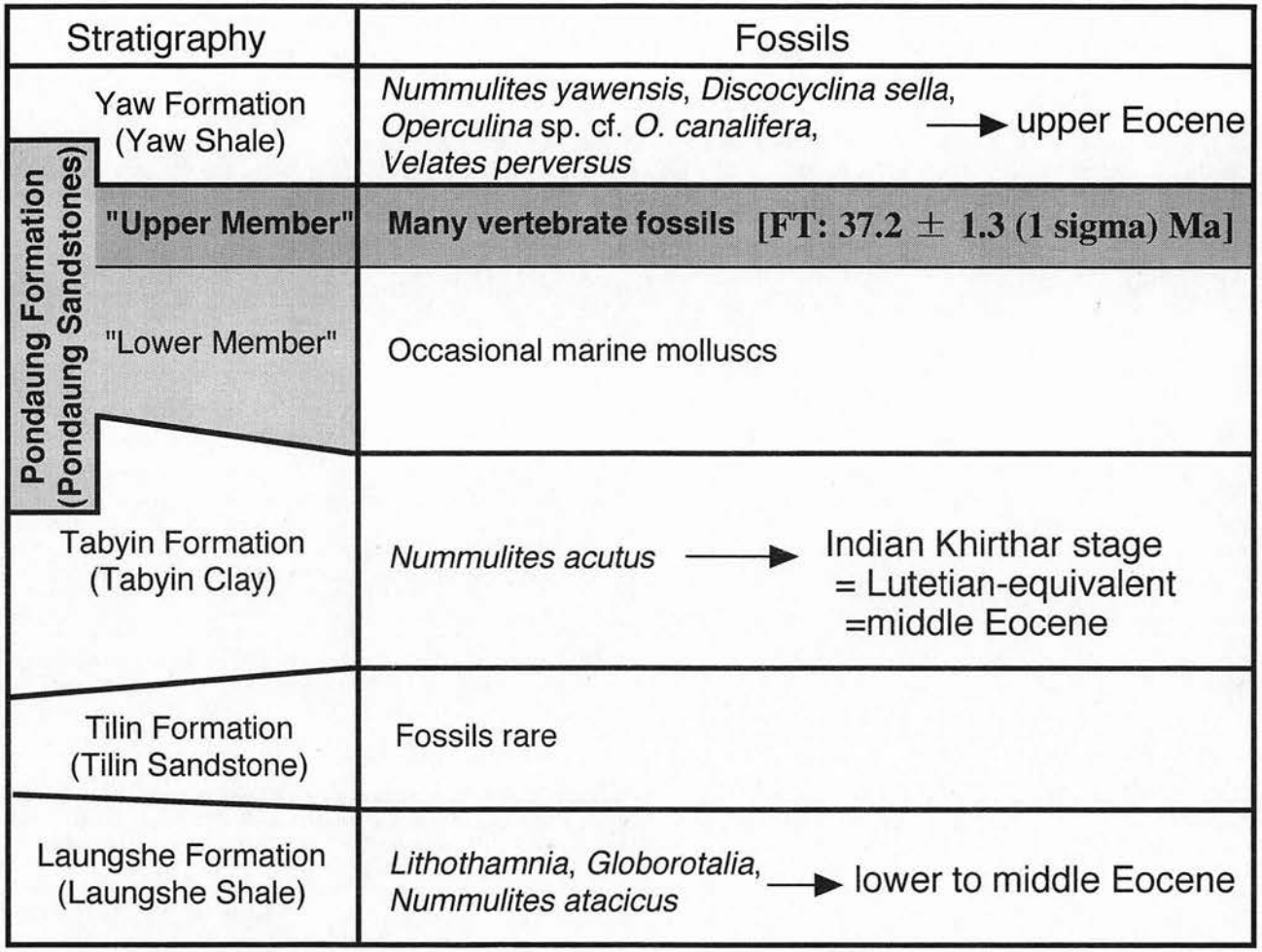

Figure 3. Generalized schematic diagram ~~summary~~ of the stratigraphy of the Eocene deposits in central Myanmar. The data are based on Stamp (1922), Eames (1951), Bender (1983), Holroyd and Ciochon (1994), and Aye Ko Aung (1999).

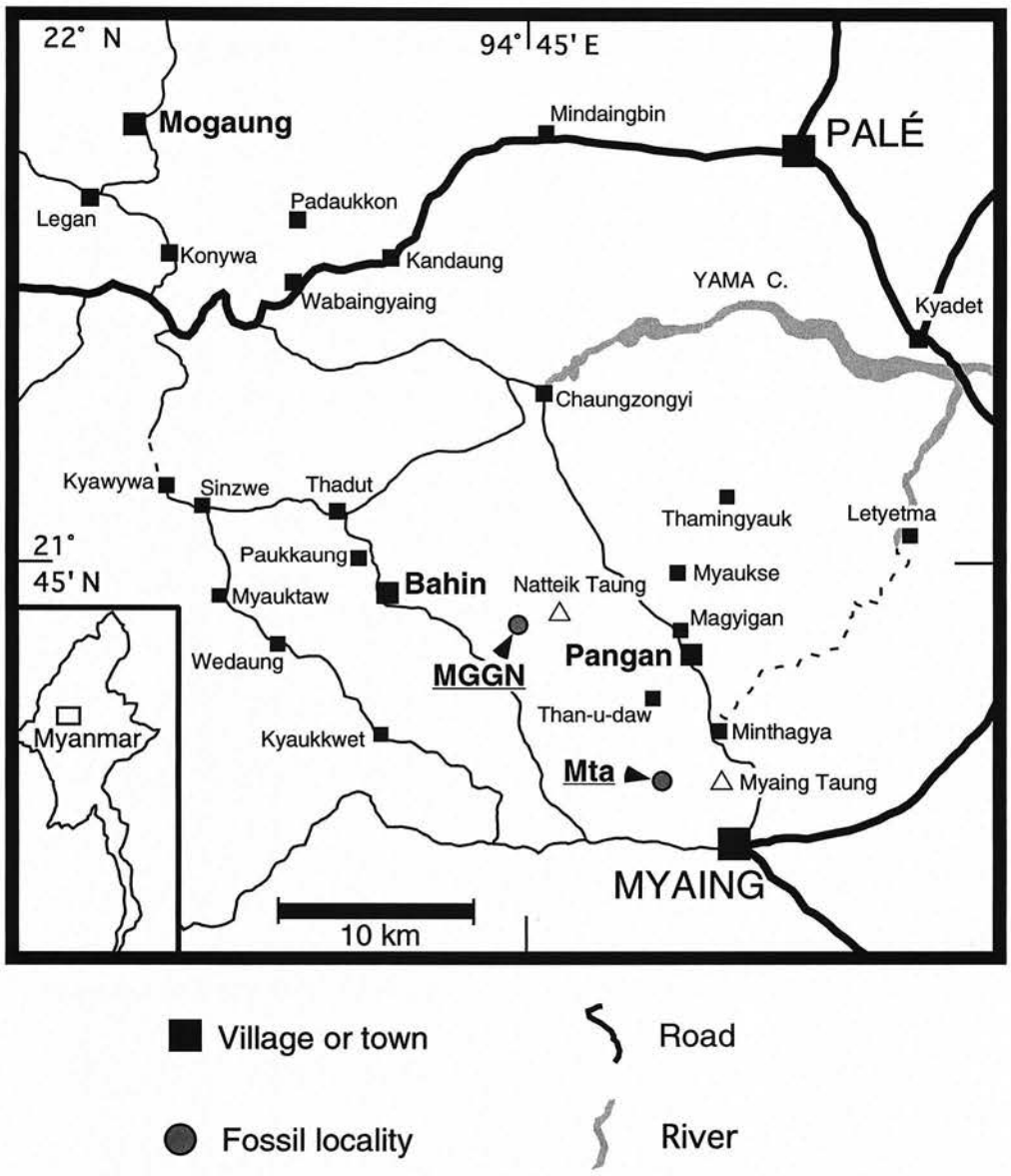

Figure 4. Local topographic map of Pondaung area in Myaing and Palé Township, central Myanmar, showing some fossil localities (after Aye Ko Aung, 1999). The words with underline indicate the name of the fossil localities.

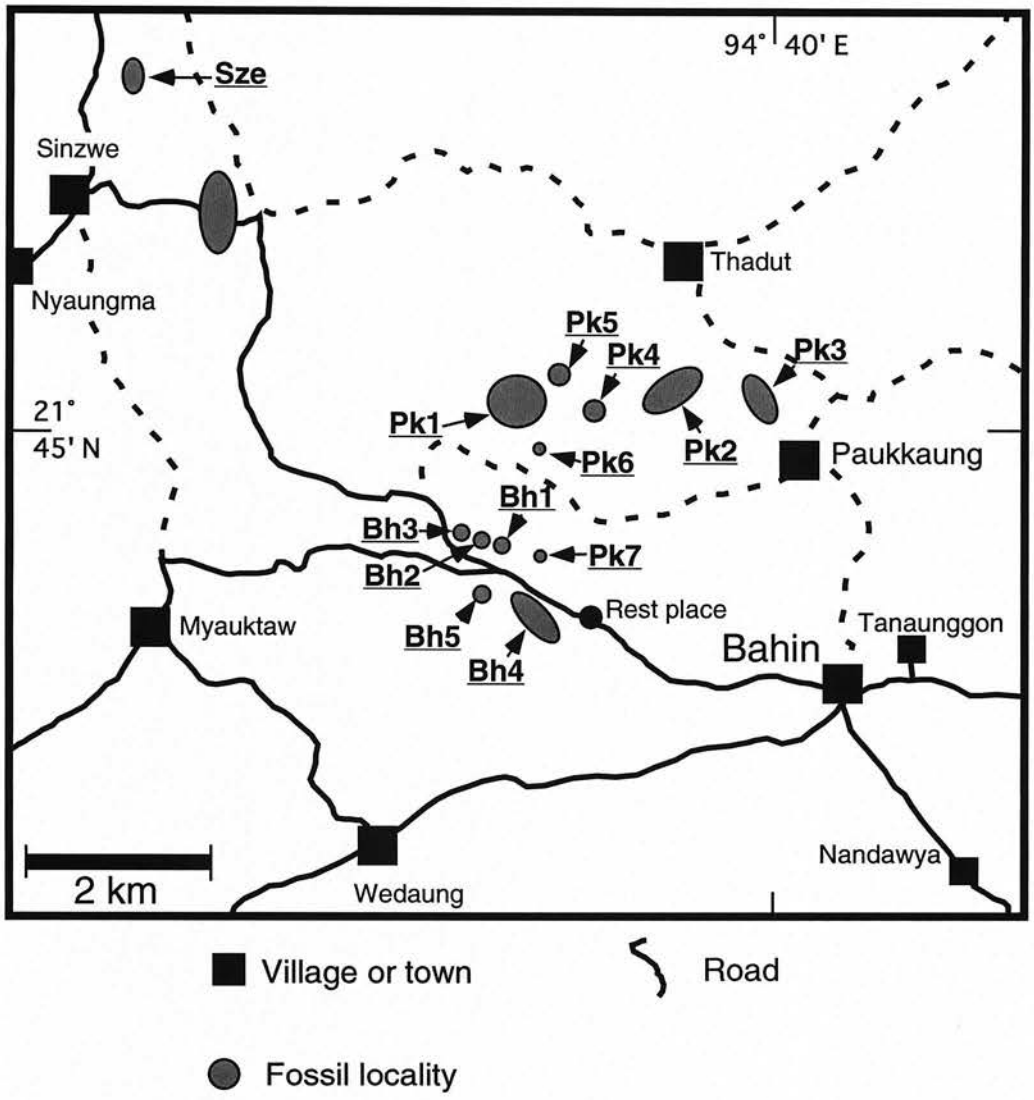

Figure 5. Detailed local topographic map of Bahin area in Myaing Township, central Myanmar (after Pondaung Fossil Expedition Team, 1997). The words with underline indicate the name of the fossil localities.

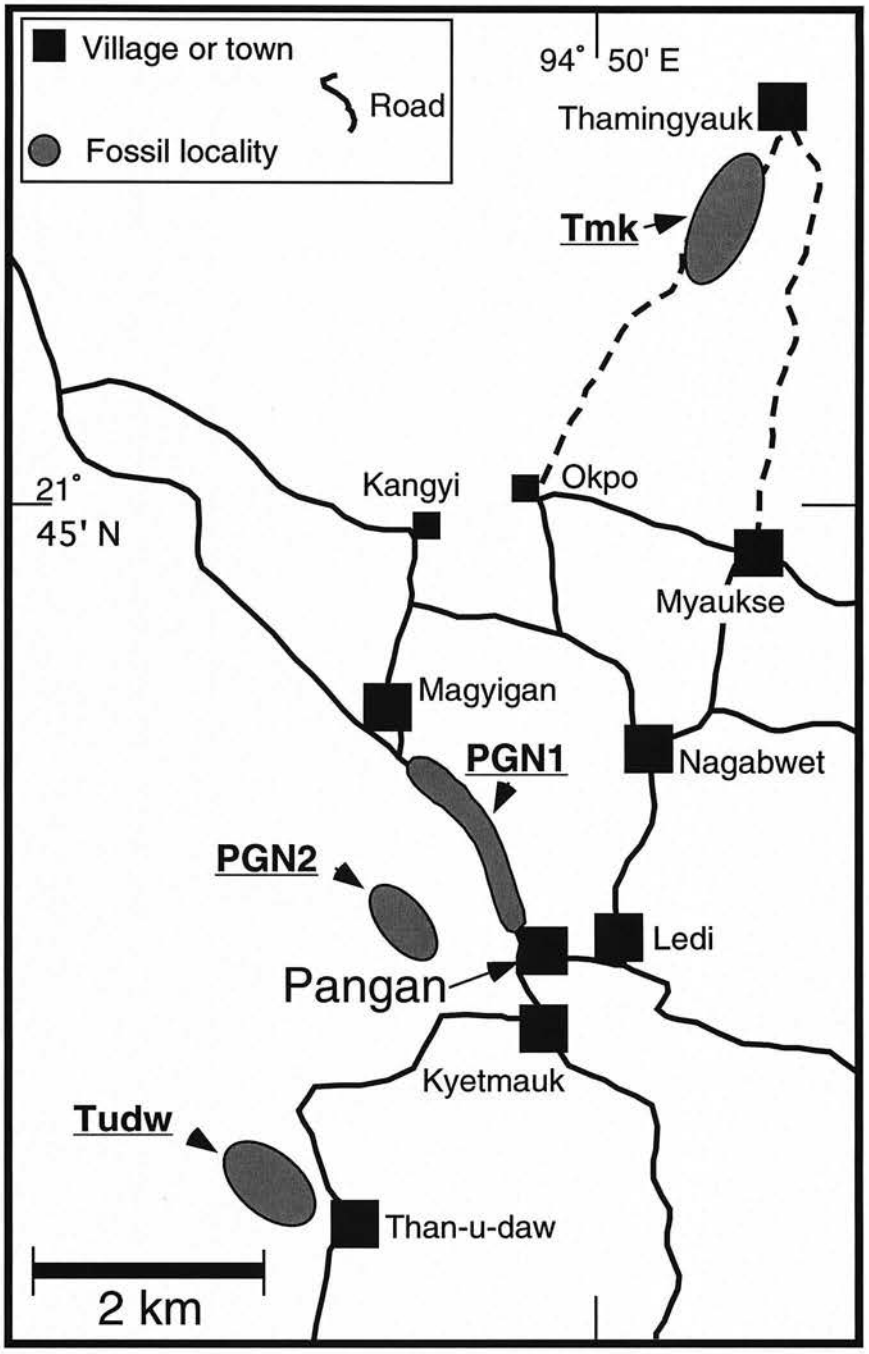

Figure 6. Detailed local topographic map of Pangan area in Myaing Township, central Myanmar, showing fossil localities (after Pondaung Fossil Expedition Team, 1997). The words with underline indicate the name of the fossil localities.

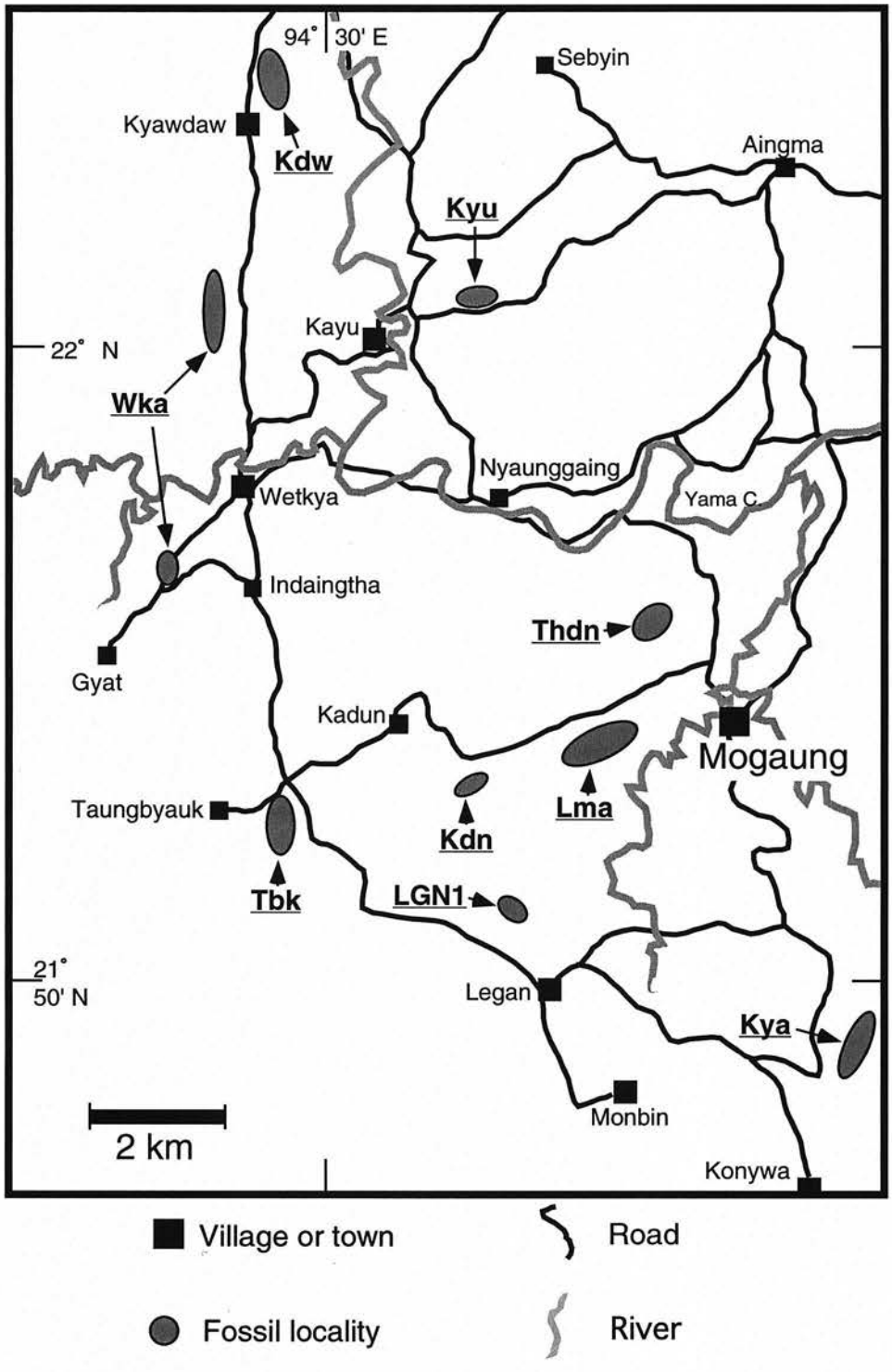

Figure 7. Detailed local topographic map of Mogaung area in Palé Township, central Myanmar, showing fossil localities (after Pondaung Fossil Expedition Team, 1997). The words with underline indicate the name of the fossil localities.

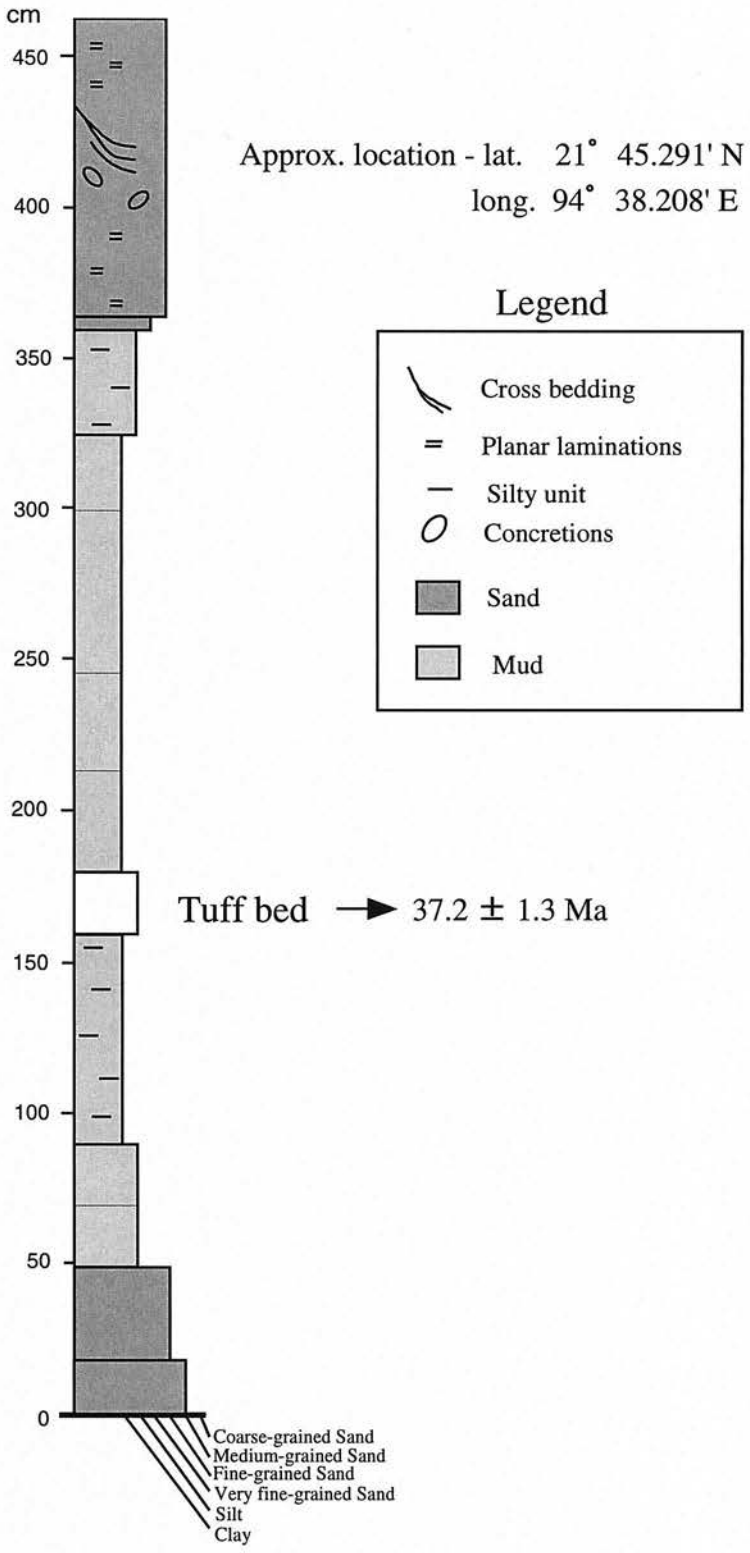

Figure 8. Columnar section around the tuff bed of the "Upper Member" of the Pondaung Formation at Pk1 locality (Figure 4).

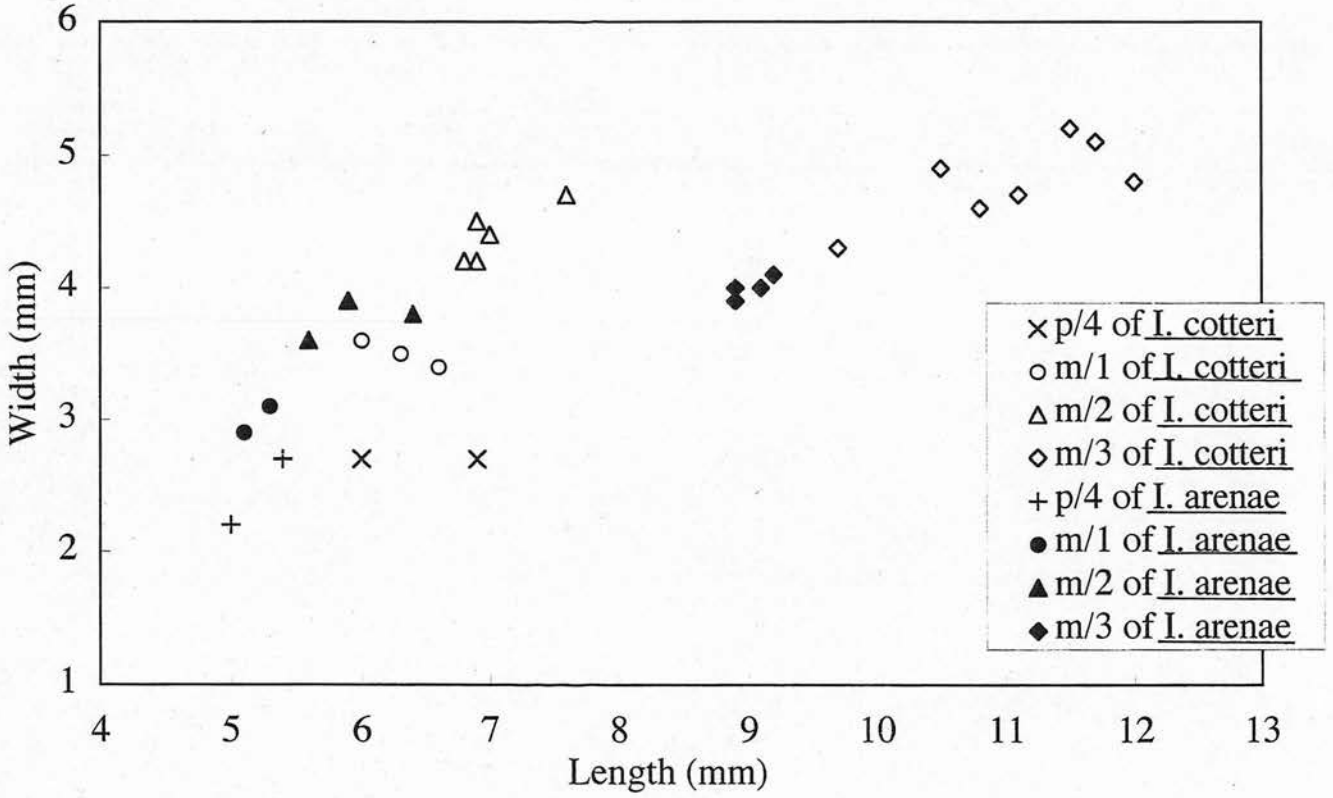

Figure 9. Size distribution of P_4 and lower molars of *Indomeryx* from the Pondaung fauna.

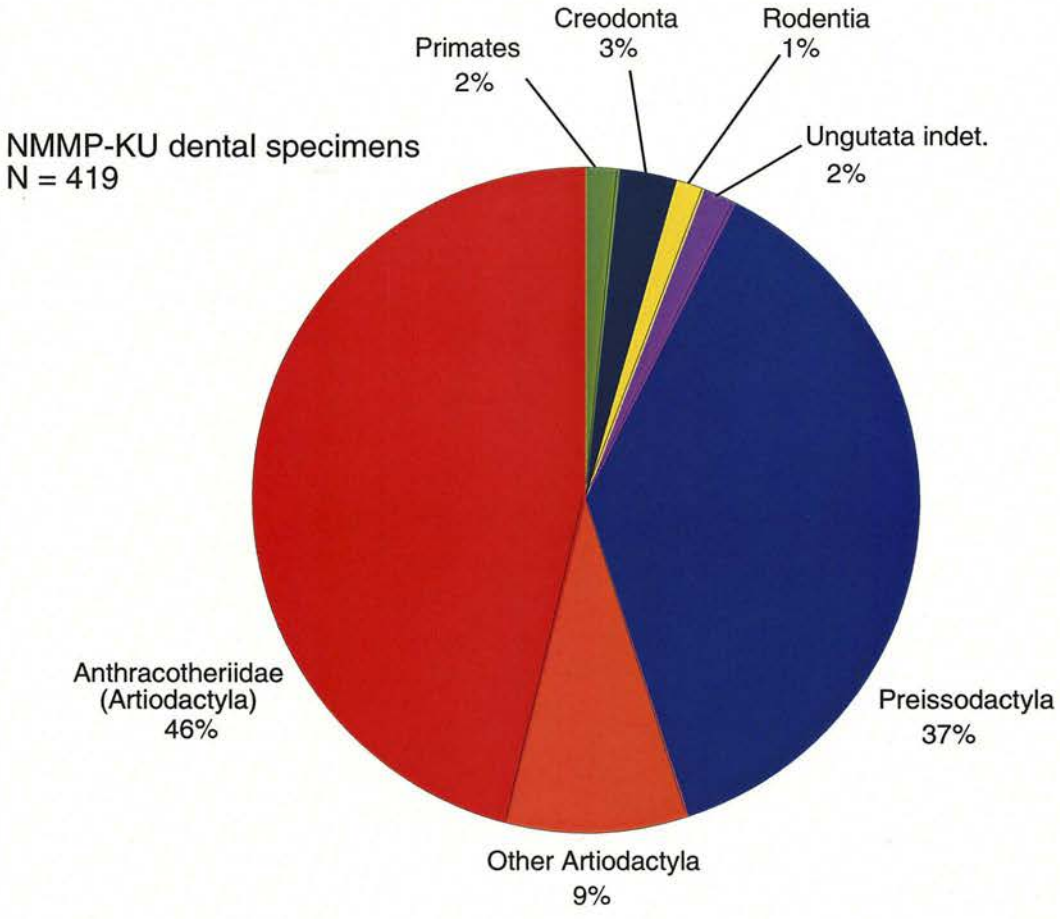

Figure 10. The ratios of the numbers of the identified NMMP-KU dental material of the Pondaung fauna. Total = 419 material.

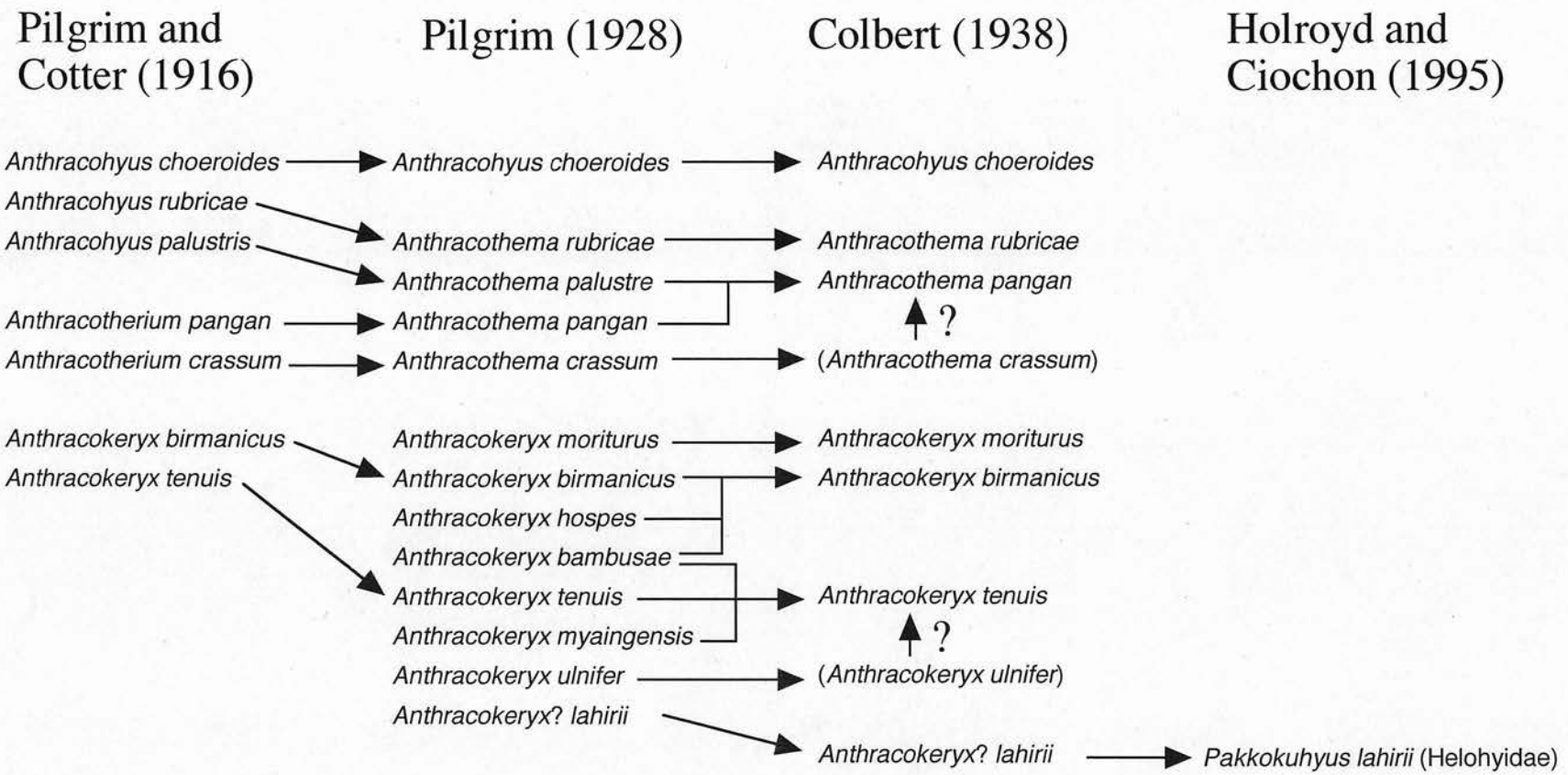

Figure 11. The classifications used in several previous studies for the Pondaung anthracotheres.

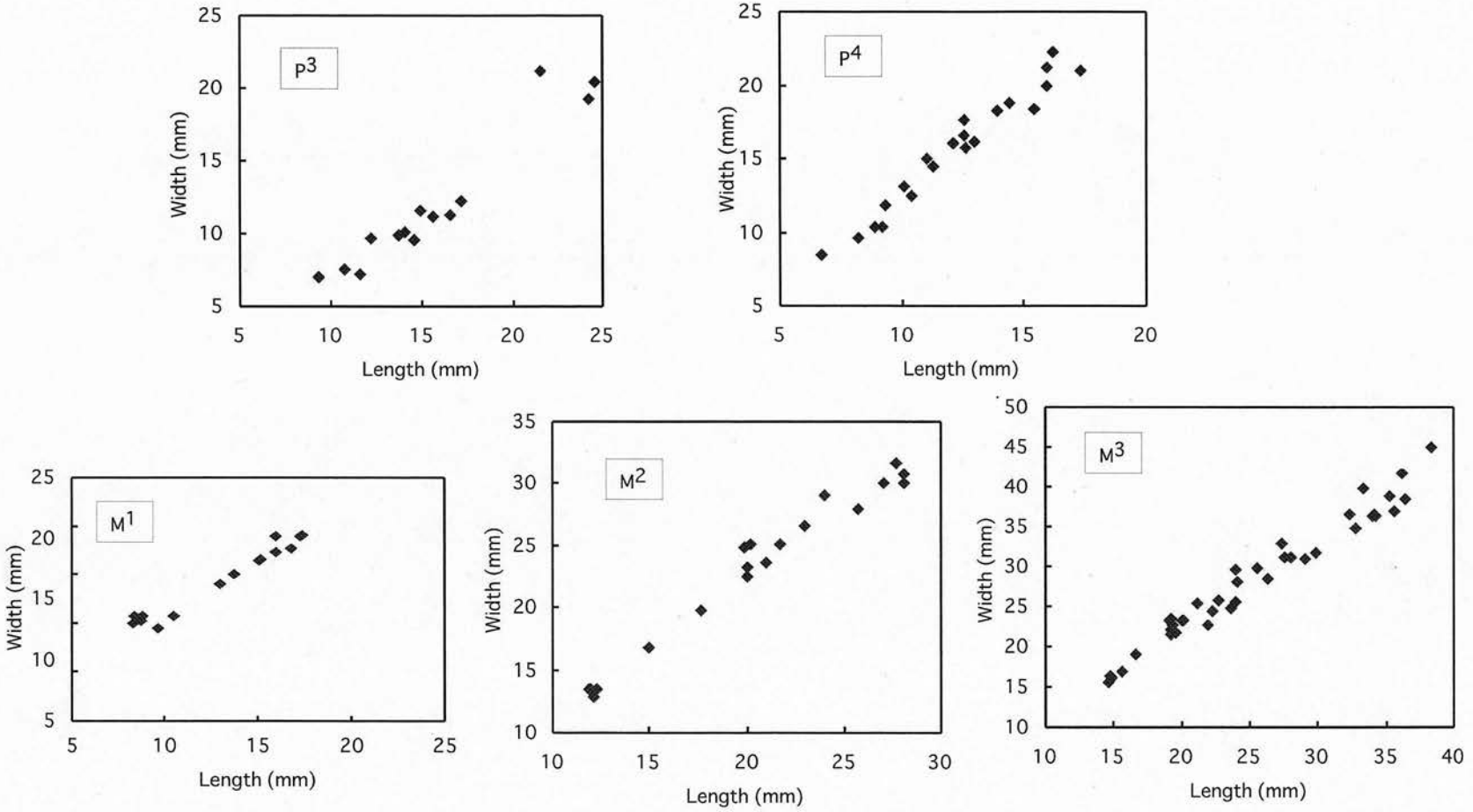

Figure 12. Size distribution of P^{3-4} and upper molars of the anthracotheres from the Pondaung fauna.

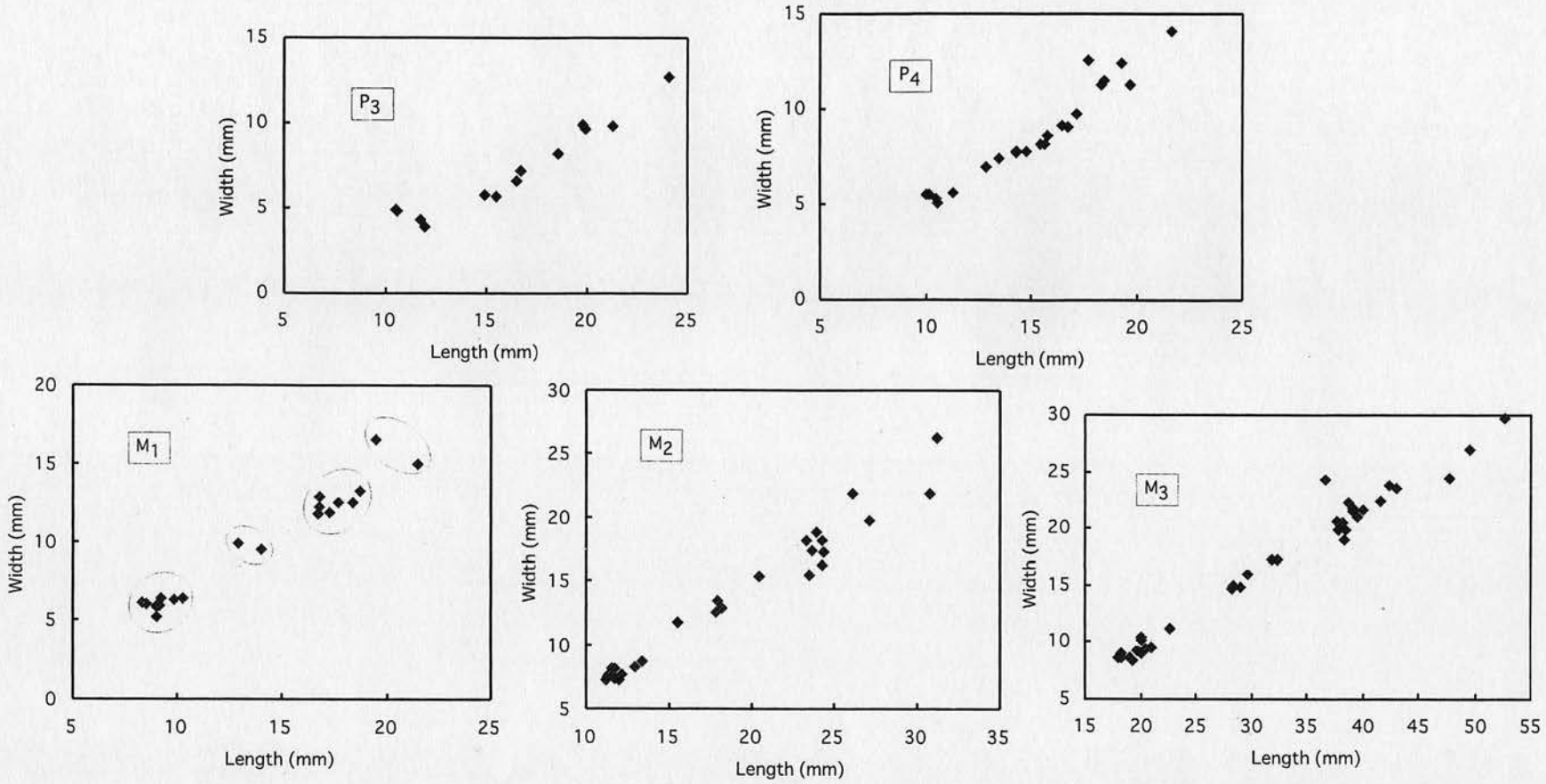

Figure 13. Size distribution of P_{3-4} and lower molars of the anthracotheres from the Pondaung fauna.

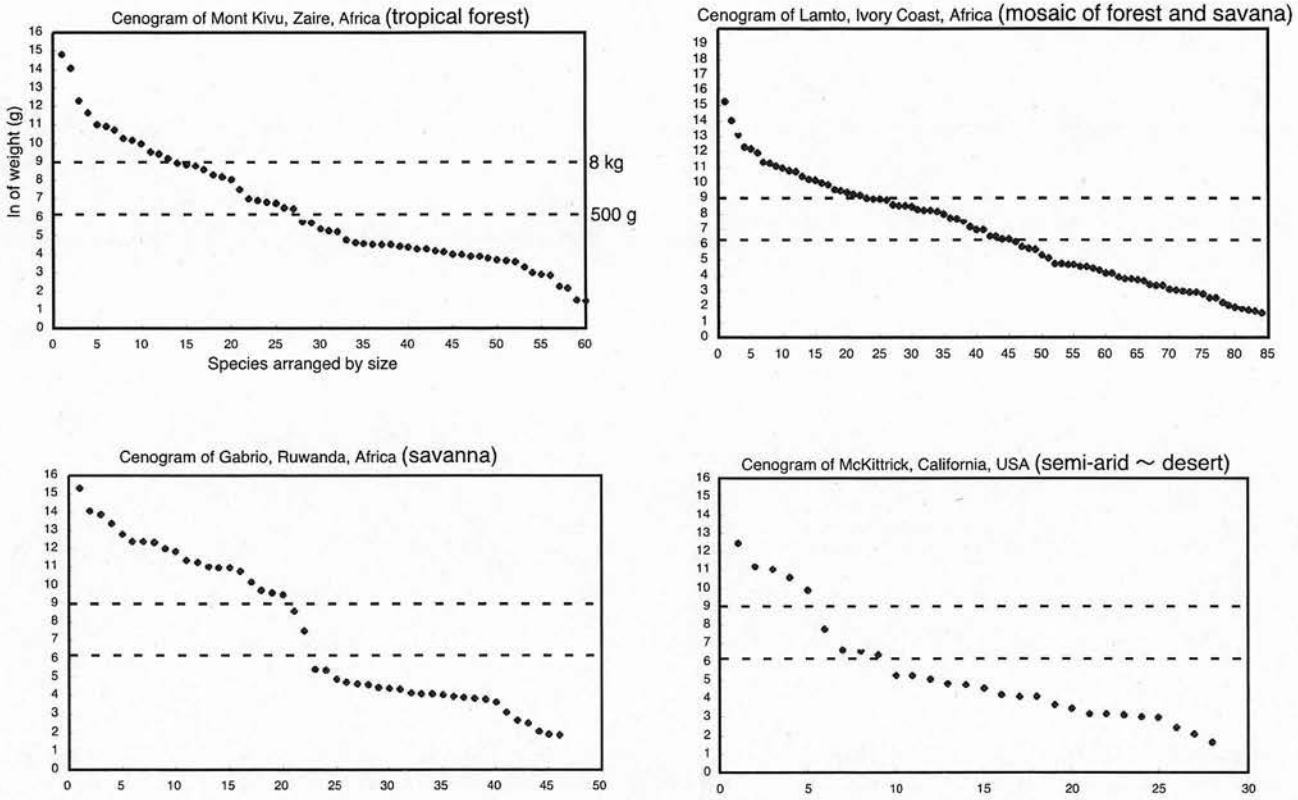

Figure 14. Cenograms of the Recent faunas (after Legendre, 1989).

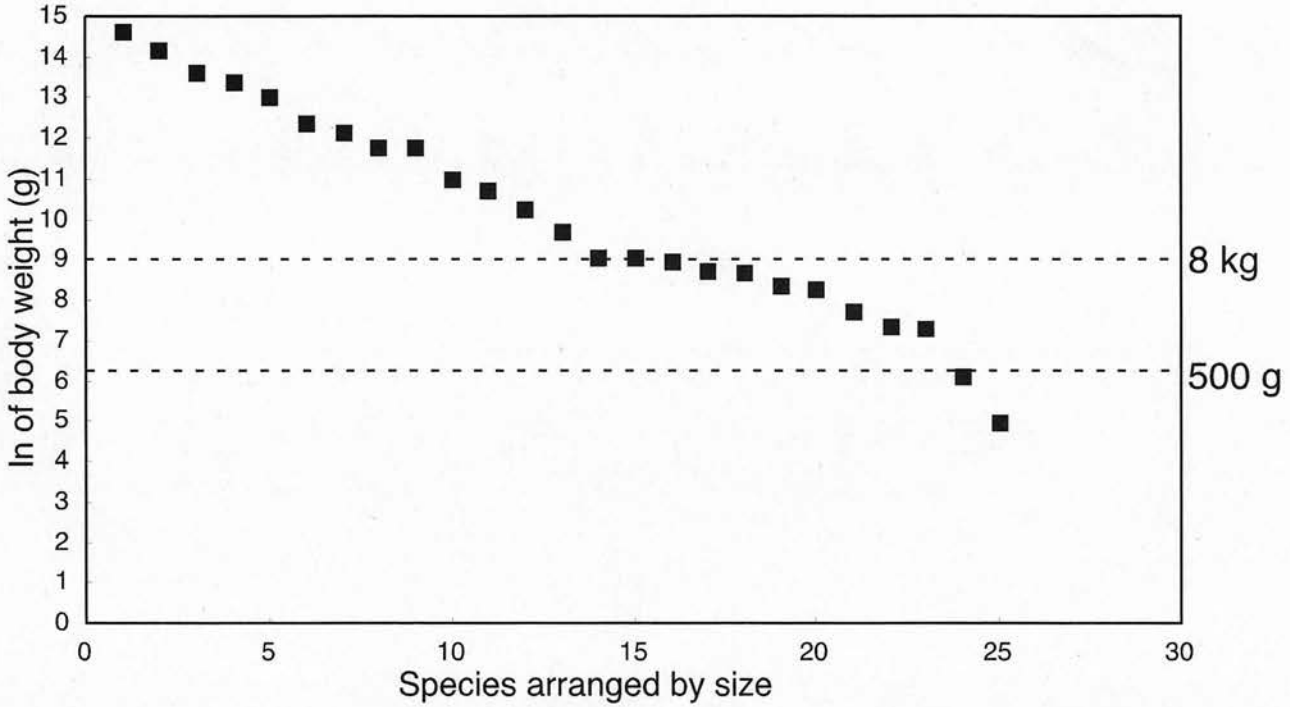

Figure 15. Cenogram of the Pondaung fauna.

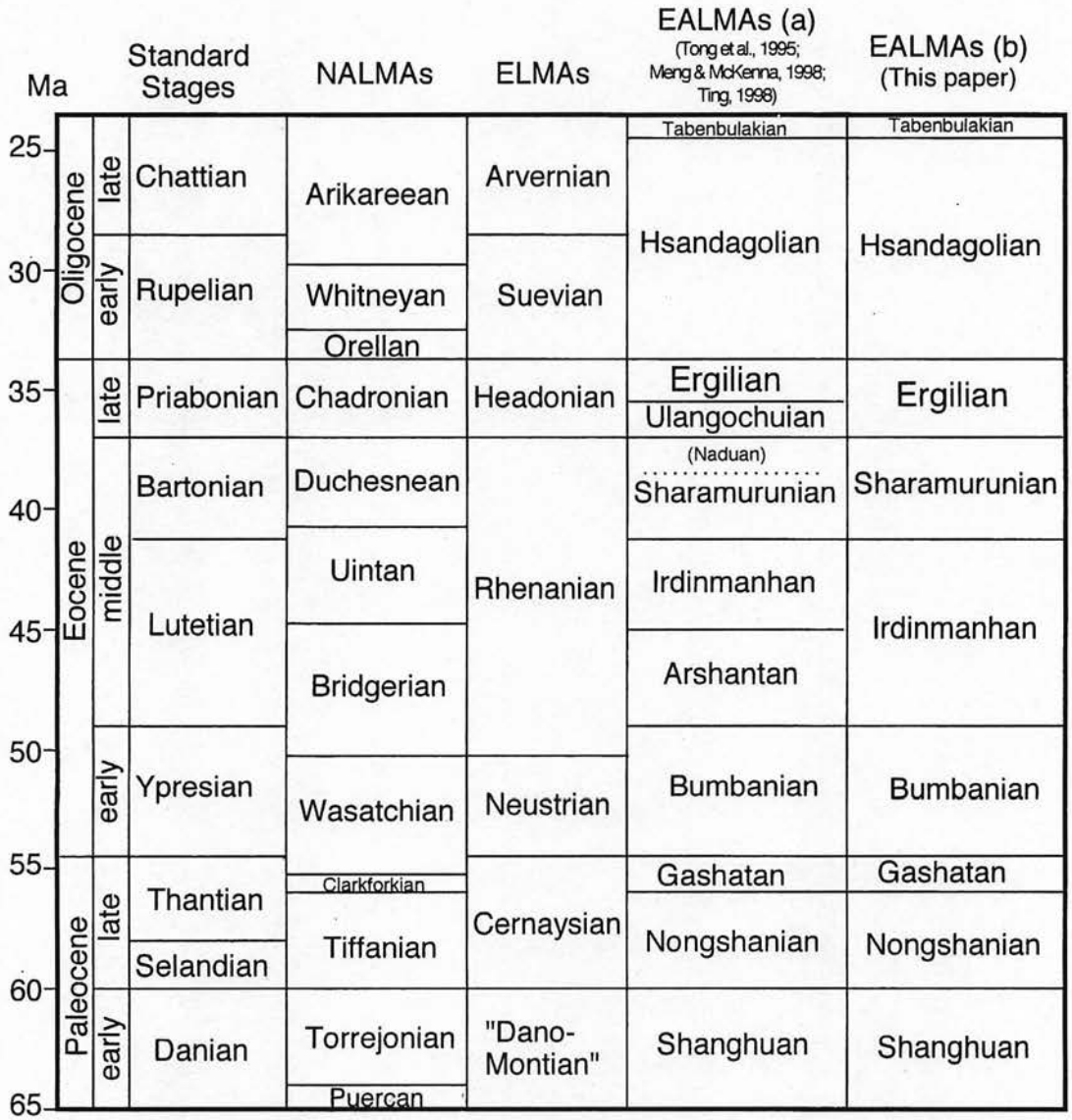

Figure 16. Paleogene standard stages and Paleogene Land Mammal Ages of North America (NALMAs), Europe (ELMAs) and East Asia (EALMAs). The data of standard stage and NALMAs are taken from Woodburne and Swisher (1995), those of ELMAs are from McKenna and Bell (1997). EALMAs (a) are those compiled from Tong *et al.* (1995), Meng and McKenna (1998) and Ting (1998), and EALMAs (b) are those preliminary suggested in this paper.

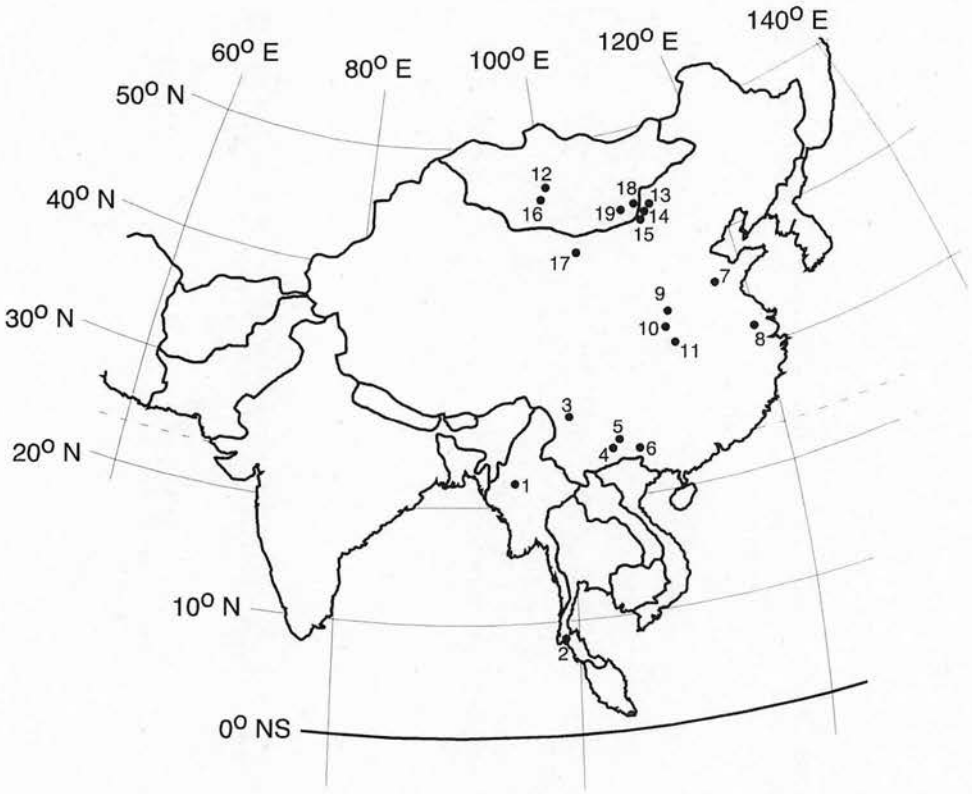

Figure 17. Location map of the 29 middle to late Eocene mammal faunas of East Asia used for "Faunal comparison" (Tables 3, 6). **Southern faunas: 1**, Pondaung fauna; **2**, Krabi fauna; **3**, Xiangshan fauna (Lijiang fauna); **4**, Lower and Upper Lumeiyi faunas; **5**, Caijiachong fauna; and **6**, Dongjun, Naduo and Gongkang faunas. **Middle faunas: 7**, Huangzhuang fauna (Qufu fauna); **8**, Shanghuang fauna; **9**, Rencun and Zhaili faunas (lower and upper Heti faunas); **10**, Lower and Upper Lushi faunas; and **11**, Hetaoyuan fauna. **Northern faunas: 12**, Kholboldzhi-Nur fauna; **13**, Arshanto fauna and Irdin Manha fauna at Irdin Manha; **14**, Irdin Manha fauna at Camps Margetts and Urtyn Obo fauna; **15**, Ulan Shireh, Shara Murun and Ulan Gochu faunas; **16**, Khaychin (II, III, V) fauna; **17**, Chaganbulage fauna; **18**, Sevkhul and Ergilin faunas at Khoer Dzan; **19**, Ergilin fauna at Ergilin Dzo.

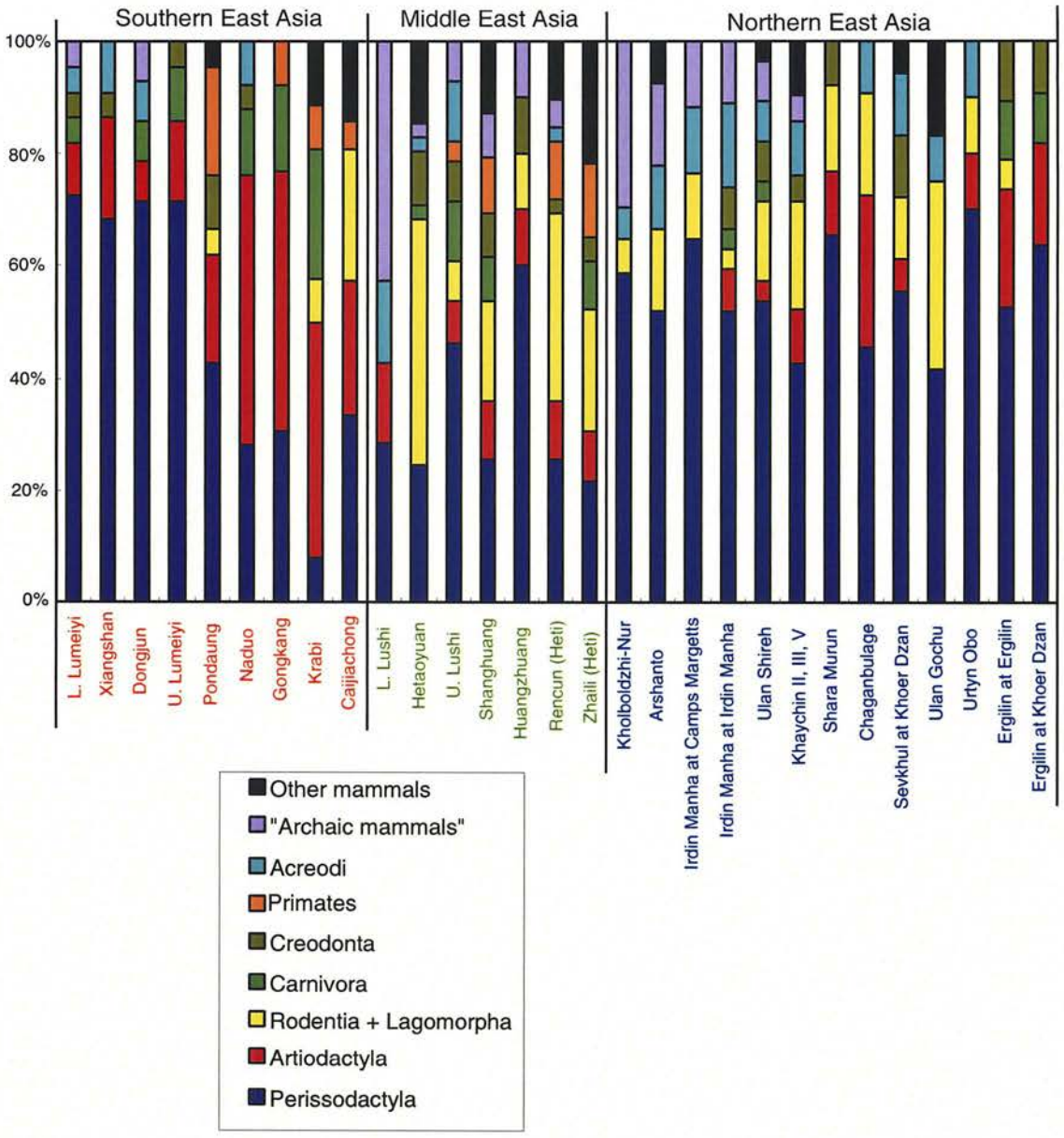

Figure 18. Faunal composition of the 29 mammal faunas of the middle to late Eocene of East Asia (Figure 17; Table 3, 6, 9). The compositions are calculated based on the genus numbers. The faunas are basically ordered from the left (earlier age) to right (later age) in each regions (southern, middle, and northern faunas) based mainly on the previous studies (e.g., Russell and Zhai, 1987) and AEO results in this paper.

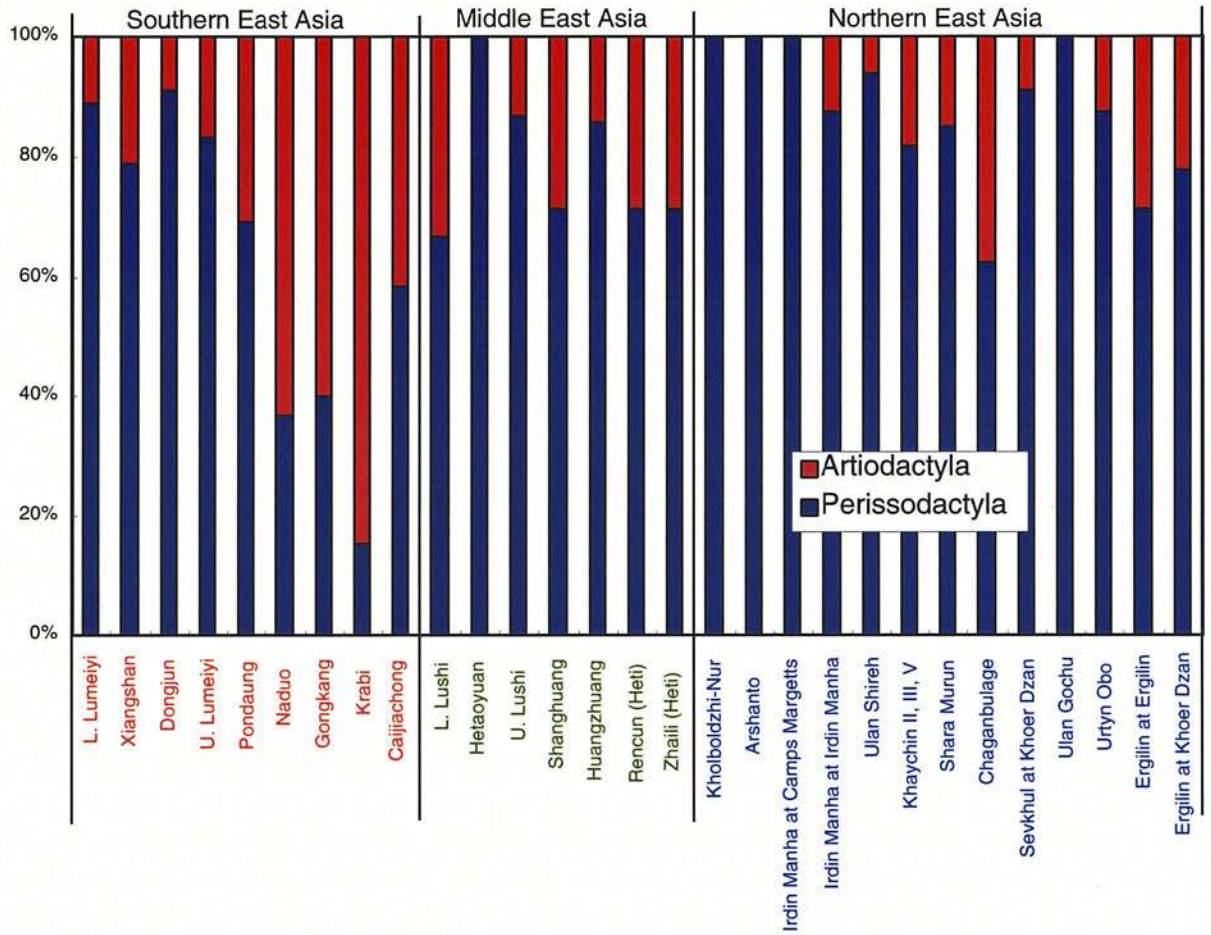

Figure 19. The ratios of the generic numbers of the Perissodactyla vs. Artiodactyla, among the 29 mammal faunas (Figure 17; Table 3, 6, 9). The compositions are calculated by the genus numbers. The faunas are basically ordered from the left (earlier age) to right (later age) in each regions (southern, middle, and northern faunas) based mainly on the previous studies (e.g., Russell and Zhai, 1987) and AEO results in this paper.

Table 1. Fossil localities in the Pondaung Formation visited in 1998 and 1999.

Locality	GPS data	Research date
Bahin area (Figs. 1, 4, 5)		
Bh1 (Yashe Kyitchaung) (Fig. 5)	N 21° 44' 13.3", E 94° 38' 13.1"	6, 7 and 11/Nov./1998; 13/Nov./1999
Bh2 (Fig. 5)	N 21° 44' 23.8", E 94° 38' 00.4"	7/Nov./1998; 13/Nov./1999
Bh3 (Fig. 5)	N 21° 44' 19.6", E 94° 38' 10.4"	7/Nov./1998
Bh4 (Fig. 5)	N 21° 43' 38.9", E 94° 38' 30.3"	7 and 11/Nov./1998; 13/Nov./1999
Bh5 (Fig. 5)	not available	13/Nov./1999
Pk1 ("Humerus Site") (Tuff bed) (Fig. 5)	N 21° 45' 08.4", E 94° 38' 11.2"	8/Nov./ 1998; 14/Nov./ 1999
Pk2 (Fig. 5)	N 21° 45' 15.8", E 94° 39' 13.5"	9/Nov./1998; 15, 16 and 17/Nov./1999
Pk3 (Fig. 5)	N 21° 45' 15.8", E 94° 39' 21.0"	9/Nov./1998; 16/Nov./1999
Pk4 (Fig. 5)	N 21° 45' 10.3", E 94° 38' 50.2"	10/Nov./1998
Pk5 (Fig. 5)	N 21° 45' 23.6", E 94° 38' 22.2"	10/Nov./1998
Pk6 (Fig. 5)	not available	14/Nov./1999
Pk7 (Fig. 5)	not available	14/Nov./1999
Pangan area (Figs. 1, 4, 6)		
PGN1 (Fig. 6)	N 21° 42' 47.6", E 94° 49' 16.3"	12, 13 and 15/Nov./1998; 19/Nov./1999
PGN2 (Taungni Kyitchaung) (Fig. 6)	N 21° 42' 31.6", E 94° 48' 45.6"	14 and 15/Nov./1998; 20/Nov./1999
Tmk (Fig. 6)	N 21° 45' 28.7", E 94° 50' 18.3"	13/Nov./1998
MGGN (near Magyigon Village) (Fig. 4)	N 21° 45' 28.7", E 94° 50' 18.3"	14/Nov./1998
Mta (near Minthagya Village) (Fig. 4)	not available	19 and 21/Nov./1999
Mogaung area (Figs. 1, 4, 7)		
Lma (Lema Kyitchaung) (Fig. 7)	N 21° 57' 06.7", E 94° 32' 14.4"	17 and 19/Nov./1998; 6 and 8/Nov./1999
Thdn (Thandaung Kyitchaung) (Fig. 7)	N 21° 57' 49.6", E 94° 32' 37.2"	18/Nov./1998; 7 and 9/Nov./1999

Table 2. Analytical results of fission-track dating on zircon samples from the "Upper Member" of the Pondaung Formation at Pk1 locality.

Sample name	n	Spontaneous ρ_s (N_s) ($\times 10^6$ cm^{-2})	Induced ρ_i (N_i) ($\times 10^6$ cm^{-2})	P(χ^2) (%)	Dosimeter ρ_d (N_d) ($\times 10^4$ cm^{-2})	r	U	Age ($\pm 1\sigma$) (Ma)	Method
Pk1 tuff	75	3.40 (4221)	1.44 (1783)	38	8.524 (2619)	0.749	140	37.2 ± 1.3	ED1

n = number of crystals counted.

ρ and N = the density and the total number of fission tracks counted, respectively.

Analysis was made by the external method using geometry factors of 0.5 for $2\pi/4\pi$ (ED1).

Age was calculated using a dosimeter glass SRM612 and a calibration factor ζ (ED1) = 370 ± 4.

P(χ^2) = the probability of obtaining the observed χ^2-value for υ degrees of freedom (where υ = number of crystals - 1).

r = correlation coefficient between ρ_s and ρ_i.

U = uranium content.

Sample was irradiated using TRIGA MARK II reactor of the St. Paul's University (Rikkyo Daigaku) in Japan.

The sample were analyzed by T. Danhara of Kyoto Fission-Track Co., Ltd.

Table 3. Mammalian list of the Pondaung fauna.

Primates
- Anthropoidea
  - Eosimiidae
    - *Bahinia pondaungensis*
  - Amphipithecidae
    - *Amphipithecus mogaungensis*
    - *Pondaungia cotteri*
  - Family indet.
    - Anthropoidea gen. *et* sp. nov.

Creodonta
- Hyaenodontidae
  - Hyaenodontidae gen. *et* sp. nov.
  - "*Pterodon*" *dahkoensis*

Rodentia
- Phiomyidae
  - Phiomyidae gen. *et* sp. nov.

Ungulata
Order *et* family indet.
- *Hsanotherium parvum*

Artiodactyla
- Family indet.
  - Artiodactyla gen. *et* sp. nov.
  - cf. Artiodactyla gen. *et* sp. nov.

Suiformes
- Anthracotheriidae
  - *Anthracotherium pangan*
  - *Anthracotherium rubricum*
  - *Anthracotherium birmanicus*
  - *Anthracotherium tenuis*
- Helohyidae
  - *Pakkokuhyus lahirii*

Ruminantia
- Family indet.
  - *Indomeryx cotteri*
  - *Indomeryx arenae*
  - cf. *Indomeryx cotteri*

Perissodactyla
- Brontotheriidae
  - *Sivatitanops cotteri*
  - *Sivatitanops birmanicum*
  - *Metatelmatherium? lahirii*
  - *Bunobrontops savagei*

Ceratomorpha
- Fam. indet.
  - Ceratomorpha indet.

Rhinocerotoidea
- Hyracodontidae
  - cf. *Ilianodon lunanensis*
- Amynodontidae
  - *Paramynodon birmanicus*
  - Amynodontidae indet.

Tapiroidea
- Fam. indet.
  - *Indolophus guptai*
- Deperetellidae
  - *Deperetella birmanica*

Table 4. Estimated body weights of the mammals of the Pondaung fauna used for the cenogram analysis. Most of the mean body weight of the each Pondaung species was estimated from the M_1 area (i.e., length × width) using regression parameters taken from Legendre (1989, table 1). The mean body weights of *Amphipithecus mogaungensis, Pondaungia cotteri* and Anthropoidea gen. *et* sp. nov. are from Takai (pers. com.).

Mammal species	Estimated body weight (kg)
Sivatitanops birmanicum	2240
Sivatitanops cotteri	1430
Metatelmatherium ? lahirii	810
Bunobrontops savagei	650
Paramynodon birmanicus	460
Anthracotherium pangan	237
Amynodontidae indet.	190
cf. *Ilianodon lunanensis*	131
Anthracotherium rubricum	130
Anthracotherium birmanicus	59.4
Deperetella birmanica	46.1
Indolophus guptai	29.2
Anthracotherium tenuis	16.1
Pakkokuhyus lahirii	8.82
Amphipithecus mogaungensis	8.60
Pondaungia cotteri	8.00
Artiodactyla gen. *et* sp. nov.	6.33
cf. Artiodactyla gen. *et* sp. nov.	6.05
cf. *Indomeryx cotteri*	4.34
Indomeryx cotteri	3.93
Indomeryx arenae	2.32
Hsanotherium parvum	1.58
Anthropoidea gen. *et* sp. nov.	1.50
Bahinia pondaungensis	0.452
Phiomyidae gen. *et* sp. nov.	0.143

Table 5. Resultant sequence of the East Asian Paleogene mammal faunas by appearance event ordination (AEO).

Estimated age in Ma	Mean event number	Minimum event number	Maximum event number	Number of genera + species	Stratigraphy: place	Stratigraphy: order	Fauna	EALMA
23.9	724.5	724	725	21	Taben	3	Lower_Taben_Bulak_(Yindirte)_fauna	
24.7	716.5	716	717	24	NeiM1	3	Yikebulage_fauna	Tabenbulakian
26.2	701.5	701	702	24	Taben	2	Upper_Shargaltein_(Shihchiangtzuku)_fauna	
28.5	679.5	679	680	37	Hsand	5	Zavlia_(Shand_Mbr)_fauna	
31.1	654.5	654	655	57	Hsand	5	Ulaan_Khongil_(Shand_Mbr)_fauna	
31.5	650.5	650	651	19	---	-	Hsanda_Gol_fauna_at_Tsagan-Obo	
32.1	641.5	641	642	25	---	-	Khatan-Khayrkhan_fauna	
32.1	639.5	637	642	27	---	-	Hsanda_Gol_fauna_at_Shunkht	
32.1	638	596	680	4	---	-	Shuidonggou_fauna	
32.2	637.5	637	638	80	Hsand	4	Ulaan_Khongil_(Tatal_Mbr)_fauna	
32.2	637.5	637	638	16	---	-	Tsakhir_fauna	Hsandagolian
32.5	617	596	638	8	---	-	Qingshuiying_fauna	
32.7	610.5	610	611	50	Ulant	2	Ulantatal_fauna	
32.8	605	568	642	7	Taben	1	Lower_Shargaltein_(Wutaoyayu)_fauna	
32.9	596.5	596	597	57	---	-	Saint-Jacques_fauna	
33.4	568.5	568	569	26	NeiM1	2	Wulanbulage_(upper)_fauna	
33.9	546.5	546	547	14	NeiM1	1	Wulanbulage_(lower)_fauna	
34.0	539.5	539	540	12	Ulant	1	Kekeamu_fauna	
34.1	534.5	534	535	7	---	-	Houldjin_fauna	
34.2	525.5	525	526	22	---	-	Caijiachong_fauna	
34.6	507.5	507	508	41	Hsand	2	Ergilin_member_fauna_at_Ergilin_Dzo	
34.8	498.5	498	499	18	Hsand	2	Ergilin_member_fauna_at_Khoer_Dzan	
34.8	496	484	508	6	---	-	Baron_Sog_fauna	
34.9	491.5	491	492	17	---	-	Urtyn_(Erden)_Obo_fauna	
35.0	484.5	484	485	22	NeiM2	5	Ulan_Gochu_fauna	Ergilian

(Continued)

Table 5.

35.2	473.5	473	474	36	Hsand	1	Sevkhul_fauna_at_Khoer_Dzan	
35.5	457.5	457	458	12	---	-	Chaganbulage_fauna	
35.7	446.5	446	447	27	---	-	Krabi_fauna	
35.7	446.5	446	447	21	Bose	3	Gongkang_fauna	
35.8	442.5	442	443	4	Lunan	3	Xiaotun_fauna	
35.9	439.5	439	440	6	---	-	Changxindian_fauna	
35.9	434.5	434	435	9	Wulid	2	Wulidui_fauna	
36.6	397.5	397	398	41	Heti	2	Zhaili_fauna	
36.6	397.5	397	398	67	Heti	1	Rencun_fauna	
36.8	391.5	385	398	7	---	-	Jiyuan_fauna	
36.9	385.5	385	386	13	Wulid	1	Lishigou_fauna	
37.0	379.5	379	380	42	Lunan	2	Upper_Lumeiyi_fauna	Sharamurunian
37.2	367.5	367	368	34	Bose	2	Naduo_fauna	
37.2	367.5	367	368	36	---	-	Pondaung_fauna	
38.0	353.5	353	354	7	Lushi	3	Chugouyu_fauna	
38.4	346.5	346	347	50	---	-	Shara_Murun_fauna	
39.2	333.5	333	334	17	Bose	1	Dongjun_fauna	
39.9	321.5	321	322	37	---	-	Shanghuang_fauna	
40.3	314.5	314	315	22	---	-	Huangzhuang_fauna	
40.4	312.5	312	313	10	Turp2	2	Liankan_fauna	
41.0	302.5	302	303	35	---	-	Xiangshan_fauna	
41.7	289.5	289	290	46	Lushi	2	Upper_Lushi_fauna	
42.3	280.5	214	347	3	---	-	Jeminay_fauna	
42.5	276.5	276	277	32	Lunan	1	Lower_Lumeiyi_fauna	
43.1	265.5	265	266	10	---	-	Lizhuang_fauna	Irdinmanhan
43.8	254.5	254	255	53	---	-	Ulan_Shireh_fauna	
44.4	244.5	244	245	51	NeiM2	4	Irdin_Manha_fauna_at_Irdin_Manha	
45.2	230.5	230	231	74	---	-	Hetaoyuan_fauna	
46.1	214.5	214	215	31	---	-	Khaychin_(II,_III,_V)_fauna	
46.7	204.5	204	205	7	Lushi	1	Lower_Lushi_fauna	
47.3	194.5	194	195	29	NeiM2	4	Irdin_Manha_fauna_at_Camps_Margetts	

(*Continued*)

Table 5.

47.6	188.5	188	189	63	NeiM2	3	Arshanto_fauna	
49.0	165.5	165	166	22	---	-	Kholboldzhi-Nur_fauna	
49.3	159.5	159	160	30	---	-	Guanzhuang_fauna	
50.2	144.5	144	145	9	---	-	Yuhuangding_fauna	
50.4	140.5	140	141	16	---	-	Limuping_(Lingcha)_fauna	
50.4	140.5	140	141	7	---	-	Akasaki_fauna	
51.0	130.5	130	131	2	Khash	3	Gashato_Mbr_III_fauna	
51.0	130.5	130	131	2	Khash	2	Gashato_Mbr_II_fauna	Bumbanian
51.0	130.5	130	131	1	Naran	4	Aguyt_fauna	
51.0	130.5	130	131	36	Naran	3	Bumban_(Tsagan_Khushu)_fauna	
51.0	130.5	130	131	8	Turp1	2	Shisanjianfang_fauna	
52.0	121.5	121	122	30	---	-	Wutu_fauna	
52.4	117.5	117	118	7	---	-	Xinyu_fauna	
54.2	100.5	100	101	27	Naran	2	Naran_fauna	
54.5	97.5	97	98	4	Turp1	1	Dabu_fauna	
55.1	92	83	101	7	---	-	Khaychin-Ula_I_fauna	
55.5	88.5	88	89	33	NeiM2	2	Bayan_Ulan_fauna	Gashatan
55.7	86.5	55	118	2	Chiji	4	Pinghu_fauna	
56.0	83.5	83	84	22	NeiM2	1	Nomogen_fauna	
57.0	74.5	74	75	25	Khash	1	Gashato_Mbr_I_fauna	
57.0	74.5	74	75	20	Naran	1	Zhigden_fauna	
59.0	55.5	55	56	13	Turp2	1	Taizicun_fauna	
59.7	49.5	49	50	8	Chiji	3	Wangwu_fauna	
59.7	49.5	49	50	12	Qians	5	Upper_Doumu_fauna	
60.2	44.5	44	45	10	---	-	Shuangtasi_fauna_at_Xuancheng	
60.2	44.5	44	45	6	---	-	Shuangtasi_fauna_at_Tongling	Nongshanian
60.8	39.5	39	40	17	Chiji	2	Lannikeng_fauna	
61.3	34.5	34	35	23	Nanxi	3	Datang_fauna	
61.3	34.5	34	35	2	Nanxi	2	Zhunguikeng_fauna	
61.9	28.5	28	29	8	Qians	4	Lower_Doumu_fauna	
62.4	24.5	24	25	30	Qians	3	Upper_Wanghudun_fauna	

(Continued)

Table 5.

63.3	15.5	15	16	19	Qians	1	Lower_Wanghudun_fauna	Shanghuan
63.7	12	8	16	2	Chiji	1	Shizikou_fauna	
63.8	11.5	11	12	11	---	-	Zaoshi_fauna	
64.1	8.5	8	9	34	Nanxi	1	Shanghu_fauna	
64.1	8.5	8	9	9	---	-	Fangou_fauna	

Table 6. Lists of 28 mammal faunas of the middle to late Eocene East Asia used for "Faunal comparison" section. The data are based mainly on Li and Tong (1983), Russell and Zhai (1987), Tong (1989), Ducrocq *et al.* (1995), and Meng and McKenna (1998). The number in the parenthesis posterior to each faunal names indicate the regional number shown in Figure 17. For the additional data source, see in the square brackets of each faunal list ([references; formation and region]).

Table 6. (6-1)

Southern East Asian faunas:

Krabi fauna (2)
[Ducrocq et al. (1995, 1996, 1997, 1998), Chaimanee et al. (1997), Ducrocq (1999) Peigne et al. (2000), Tsubamoto (2000 = this paper); Krabi basin, southern Thailand]

Dermoptera
- Cynocephalidae
  - *Dermotherium major*

Insectivora
- Fam. indet.

Chiroptera
- Megachiroptera
  - Pteropodidae
    - gen. *et* sp. indet.

Primates
- Anthropoidea
  - Propliopithecidae
    - *Wailekia orientale*
    - *Wailekia* sp.
  - Amphipithecidae
    - *Siamopithecus eocaenus*

Carnivora
- Miacidae
  - *Miacis thailandicus*
- ?Mustelidae indet.
- ?Procyonidae indet.
- Nimravidae
  - *Nimravus* sp. cf. *N. mongoliensis*
  - *Nimravus* sp. cf. *N. intermedius*
  - *Hoplophoneus* sp.
- Caniformia indet.

Rodentia
- Ctenodactyloidea indet.
  - Fam. indet. 1
  - Fam. indet. 2

Artiodactyla
- Tayassuidae
  - *Egatochoerus jaegeri*
- Suidae
  - *Siamochoerus banmarkensis*
- Entelodontidae
  - gen. et sp. indet.
- Anthracotheriidae
  - *Siamotherium krabiense*
  - *Anthracotherium chaimanei*
  - *Anthracotherium thailandicus*
  - *Bothriogenys orientalis*
  - *Bothriogenys* sp. cf. *B. orientalis*
  - *Atopotherium bangmarkensis*
- Anthracotheriinae
  - gen. *et* sp. nov.
- Helohyidae
  - *Progenitohyus thailandicus*
- Ruminantia
  - Lophiomerycidae
    - gen. *et* sp. nov.
  - ?Tragulidae
    - gen. *et* sp. nov.

Perissodactyla
- Helaletidae
  - gen. *et* sp. nov.
- ?Hyracodontidae
  - gen. *et* sp. nov.

Dongjun fauna (6)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989), Tsubamoto et al. (2000b); Dongjun Fm, Bose Basin, southern China]

Pantodonta
- Coryphodontidae
  - *Eudinoceras crassum*

Carnivora
- Nimravidae
  - *Eusmilus*? sp.

Acreodi
- Triisodontidae
  - *Andrewsarchus crassum*

Artiodactyla
- Anthracotheriidae
  - *Probrachyodus*? sp. nov.

Perissodactyla
- Brontotheriidae
  - *Metatelmatherium* sp.
  - cf. *Protitan* sp.
- Deperetellidae
  - *Deperetella birmanica*
  - *Teleolophus* sp.
- Hyracodontidae
  - *Forstercooperia* sp.
  - *Ilianodon*? sp.
  - *Prohyracodon* sp.
- Amynodontidae

(*Continued*)

Table 6. (6-2)

cf. *Gigantamynodon* sp.
Amynodon sp.
cf. *Paramynodon* sp.

Naduo fauna (6)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989), Ducrocq (1999), Tsubamoto (2000 = this paper); Naduo Fm, Bose and Yongle Basins, southern China]

Placentalia
Order *et* fam. indet.
Eodesmatodon spanios

Carnivora
Hemicionidae
Cephalogale sp. nov.
cf. *Cephalogale* sp.
Amphicyonidae
Guangxicynodon sinocalifornіae
Phocoidea
Fam. indet.
Pachycynodon? sp. nov.

Creodonta
Hyaenodontidae
Propterodon? sp.

Acreodi
Mesonychidae
Guilestes acares
Guilestes sp. cf. *G. acares*
cf. *Harpagolestes* sp.

Artiodactyla
Entelodontidae
indet.
Tayassuidae
gen. nov.
Suidae
gen. nov. A
gen. nov. B
?Choeropotamidae (?Helohyidae)
gen. nov.
Anthracotheriidae
Anthracotherium rubricum
Anthracotherium birmanicus
Anthracotherium sp.
"Bothriodon" chyelingensis
Heothema bellia
Heothema media
Ruminantia
Family indet.
Notomeryx besensis
Notomeryx major
Indomeryx cotteri
Gobiomeryx sp.
Tragulidae
indet.

Perissodactyla
Brontotheriidae
cf. *Metatelmatherium*? *browni*
Deperetellidae
Deperetella sp.
Eomoropidae
Eomoropus sp. cf. *E. quadridentatus*
?Rhinocerotidae
Huananodon hui
Guixia simplex
Amynodontidae
Caenolophus sp.
Paramynodon sp.

Gongkang fauna (6)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989), Tong and Zhao (1986), Qi and Beard (1998), Ducrocq (1994b, 1999), Tsubamoto (2000 = this paper); Gongkang Fm, Bose and Yongle basins, southern China]

Carnivora
Felidae
Machairodontinae
gen. nov.
Nimravidae
Hoplophoneus? sp.

Primates
Sivaladapidae
Guangxilemur tongi

Artiodactyla
Tayassuidae
"Eopecarihyus sp. nov."
Suidae
Odoichoerus uniconus
Anthracotheriidae
Anthracotherium gungkangensis
Anthracotherium sp.
"Bothriodon" tientongensis
Heothema media
Heothema chengbiensis
Ruminantia
Family indet.
cf. *Indomeryx* sp.

(Continued)

Table 6. (6-3)

Perissodactyla
- Chalicotheriidae
  - *Schizotherium nabanensis*
  - *Schizotherium* sp.
- ?Rhinocerotidae
  - *Huananodon hypsodonta*
  - *Guixia youjiangensis*
- Hyracodontidae
  - *Forstercooperia* sp. nov.

Lower Lumeiyi fauna (4)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989); lower part of Lumeiyi Fm, Lunan Basin, Yunnan, southern China]

Creodonta
- indet.

Carnivora
- Nimravidae
  - indet.

Tillodontia
- indet.

Acreodi
- Hapalodectidae
  - *Honanodon* sp.

Artiodactyla
- Helohyidae
  - *Gobiohyus* sp.
- Anthracotheriidae
  - indet.

Perissodactyla
- Brontotheriidae
  - *Protitan* sp. cf. *P. robustus*
  - *Rhinotitan* sp.
  - indet.
- Lophialetidae
  - *Breviodon lumeiyiensis*
  - *Lophialetes expeditus*
  - *Lophialetes sp.* cf. *L. expeditus*
  - *Lophialetes yunnanensis*
  - *Rhodopagus pygmaeus*
  - *Rhodopagus minimus*
- Deperetellidae
  - *Deperetella* sp.
  - *Teleolophus* sp.
- Helaletidae
  - *Helaletes mongoliensis*
  - *Hyrachyus lunanensis*
  - *Hyrachyus minor*
- Eomoropidae
  - *Lunania youngi*
- Hyracodontidae
  - *Forstercooperia* sp.
  - *Prohyracodon* sp.
- Amynodontidae
  - *Teilhardia pretiosa*
  - *Teilhardia*? sp.
  - *Caenolophus medius*
  - *Caenolophus* sp.
  - *Lushiamynodon menchiapuensis*
  - *Amynodon lunanensis*
  - *Amynodon* spp.

Upper Lumeiyi fauna (4)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989), Ducrocq (1999); upper part of Lumeiyi Fm, Lunan Basin, Yunnan, southern China]

Creodonta
- Hyaenodontidae
  - *"Pterodon" dahkoensis*

Carnivora
- Miacidae
  - *Chailicyon crassidens*
- ?Canidae (?Miacidae)
  - indet.

Artiodactyla
- Entelodontidae
  - *Eoentelodon yunnanense*
- Anthracotheriidae
  - *Probrachyodus panchiaoensis*
  - *Bothriogenys hui*
  - indet.

Perissodactyla
- Brontotheriidae
  - *Rhinotitan quadridens*
  - *Rhinotitan* sp.
  - *Dianotitan lunanensis*
  - indet.
- Lophialetidae
  - *Breviodon sahoensis*
- Deperetellidae
  - *Deperetella dienensis*
  - *Deperetella birmanica*
  - *Teleolophus medius*
  - *Teleolophus* sp. cf. *T. magnus*
  - *Teleolophus*? *rectus*

(Continued)

Table 6. (6-4)

Eomoropidae
Litolophus? *ulterior*
Eomoropus sp. cf. *E. quadridentatus*
Hyracodontidae
Forstercooperia shiwopuensis
Forstercooperia sp.
Juxia sp.
Indricotherium parvum
Indricotherium sp. cf. *I. parvum*
Indricotherium? sp.
Prohyracodon progressa
Prohyracodon meridionale
Prohyracodon sp. cf. *P. orientale*
Ilianodon lunanensis
indet.
Amynodontidae
Amynodon altidens
Amynodon sp.
cf. *Metamynodon* sp.
cf. *Paramynodon* sp.

Xiangshan fauna (3)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989), Huang (1999), Tsubamoto et al. (2000); Xiangshan Fm, Lijiang Basin, Yunnan, southern China]

Creodonta
indet.
Hyaenodontidae
"*Pterodon*"? sp.

Acreodi
Hapalodectidae
Honanodon hebetis
Honanodon sp.
Lohoodon lushiensis

Artiodactyla
Entelodontidae
Eoentelodon likiangensis
Anthracotheriidae
"*Anthracokeryx*" *sinensis*
"*Anthracothema*" *lijiangensis*
?Leptomerycidae
indet.

Perissodactyla
Brontotheriidae
Metatelmatheriinae
indet.
Lophialetidae
Lophialetes? sp.
Breviodon lumeiyiensis
Schlosseria sp.
Rhodopagus yunnanensis
Lijiangia zhangi
Lophiodontidae
Lophiodon? spp.
Deperetellidae
Deperetella birmanica
Teleolophus xiangshanensis
Eomoropidae
Lunania youngi
Eomoropus minimus
Grangeria canina
Hyracodontidae
Prohyracodon major
Prohyracodon meridionale
Amynodontidae
Amynodon sp.
Caenolophus sp.

Caijiachong fauna (5)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989), Ducrocq (1999); Caijiachong Fm, Yuezhow Basin, Yunnan, southern China]

Insectivora
Dormaaliidae
indet.
Erinaceoidea
indet.

Chiroptera
Vespertilionoidea
indet.

?Primates
indet.

Lagomorpha
indet.

Rodentia
Cricetidae
Eucricetodon sp.
Ctenodactylidae
Karakoromys sp.
Dianomys obscuratus
Dianomys qujingensis
Dipodidae
Parasminthus (= *Plesiosminthus*?) sp.

Artiodactyla
Entelodontidae

(Continued)

Table 6. (6-5)

Entelodon sp.
Anthracotheriidae
Bothriodon chowi
Ruminantia
Family indet.
cf. *Indomeryx* sp.
Leptomerycidae
Miomeryx sp.
Lophiomerycidae
Lophiomeryx sp.

Perissodactyla
Brontotheriidae
indet.
Amynodontidae
Gigantamynodon giganteus
Gigantamynodon sp. cf. *G. giganteus*
Gigantamynodon sp.
Cadurcodon ardynensis
Cadurcodon sp.
Caenolophus sp.
cf. *Metamynodon* sp.
Hyracodontidae
Indricotherium intermedium
Indricotherium qujingensis
Indricotherium sp.
Prohyracodon sp.
indet.

Middle East Asian faunas:

Hetaoyuan fauna (11)
[Tong (1989, 1997); Hetaoyuan Fm, Henan, middle China]

Tillodontia?
Fam. indet.
Chungchienia sichuanica

Insectivora
Apternodontidae
Iconapterodus qii
Palaeoryctidae
Neoryctes qinlingensis

Leptictida
Didymoconidae
Jiajianictis muricatus
Ardynictis zhaii
indet.

Chiroptera
Archaeonycteridae?
indet.

Scandentia
Tupaiidae
Eodendrogale parvum

Lagomorpha
Leporidae
Strenulagus shipigouensis
Lushilagus? *danjiangensis*
Lushilagus lohoensis
Shamolagus sp.
?Leporidae
Dituberolagus venustus

Rodentia
?Ischyromyidae
indet.
Cylindrodontidae
Orientocylindrodon liguanqiaoensis
cf. *Pareumys* sp.
cf. *Mysops* spp.
Tamquammyidae
Tamquammys dispinorum
Viriosomys jingweni
Tsinlingomys youngi
Chuankueimys xichuanensis
Yuomyidae
Saykanomys cf. *bohlini*
Stelmomys parvus
Boromys obtusus
Boromys brachyblastus
Zoyphiomys sinensis
Zoyphiomys grandis
?Gemyoidea
Hydentomys crybelophus
Hydentomys major
Cricetidae
Primisminthus yuenus

Carnivora
Miacidae
Miacis lushiensis

Creodonta
Oxyaenidae
Sarkastodon? *henanensis*
Hyaenodontidae
Sinopa? sp.
Prolaena parva
Propterodon sp.
Propterodon? *shipigouensis*

Acreodi

(Continued)

Table 6. (6-6)

Triisodontidae
Andrewsarchus? sp.

Perissodactyla
Amynodontidae
Sianodon sp.
Lophialetidae
Lophialetes expeditus
Schlosseria hetaoyuanensis
Breviodon minutus
Breviodon sp. cf. *B. minutus*
Rhodopagus minimus
Brontotheriidae
Protitan? sp.
Deperetellidae
Deperetella sichuanensis
Teleolophus danjiangensis
Pachylophus xui
Hyracodontidae
Prohyracodon sp.

Lower_Lushi_fauna (10)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989) and Chow et al. (1996); lower part of Lushi Fm, Henan, middle China]

Pantodonta
Coryphodontidae
Eudinoceras sp.

Tillodontia
Esthonychidae
Chungchienia lushia

Dinocerata
indet.
Uintatheriidae
Uintatherium sp.

Acreodi
Mesonychidae
indet.

Artiodactyla
Helohyidae
Gobiohyus sp.

Perissodactyla
Lophialetidae
Breviodon sp.
Lophialetes sp.

Upper Lushi fauna (10)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989); upper part of Lushi Fm, Henan, middle China]

Tillodontia
Esthonychidae
Trogosinae
indet.

Primates
Fam. indet.
Lushius qinlinensis

Pantodonta
Coryphodontidae
Eudinoceras sp.

Lagomorpha
Leporidae
Lushilagus lohoensis

Rodentia
Ctenodactylidae
Tsinlingomys youngi

Carnivora
Miacidae
Miacis lushiensis
Amphicyonidae
Cynodictis sp.
Nimravidae
cf. *Eusmilus* sp.

Creodonta
Hyaenodontidae
Hyaenodon sp.
Propterodon morrisi

Acreodi
Triisodontidae
Andrewsarchus henanensis
Andrewsarchus mongoliensis
Mesonychidae
Honanodon hebetis
Honanodon macrodontus
Lohoodon lushiensis

Artiodactyla
Dichobunidae
Dichobune sp.
Helohyidae
Gobiohyus orientalis
Gobiohyus robustus

(Continued)

Table 6. (6-7)

Perissodactyla
- Amynodontidae
  - *Sianodon honanensis*
  - *Lushiamynodon menchiapuensis*
  - *Caenolophus* sp.
- Lophialetidae
  - *Breviodon minutus*
  - *Rhodopagus minimus*
- Brontotheriidae
  - *Protitan grangeri*
  - *Microtitan*? sp.
- Deperetellidae
  - *Deperetella* sp.
- Hyracodontidae
  - *Forstercooperia* spp.
  - *Prohyracodon* sp.
- Helaletidae
  - *Colodon* sp.
- Eomoropidae
  - *Lunania youngi*
  - *Eomoropus* sp.

Mammalia indet.
- indet. [*Anthracotherium*? spp.]

Zhaili_fauna (9)
[Russell and Zhai (1987), Li and Ting (1983), Qi and Zhou (1989), Tong (1989, 1997), Beard (1998), Huang et al. (1998, 1999); Zhaili Mbr, upper part of Heti Fm, Yuanqu basin, Henan and Shanxi, middle China]

Insectivora
- Changlelestidae
  - *Ictopidium lechei*
- Nyctitheriidae
  - *Yuanqulestes qiui*
- Apternodontidae?
  - cf. *Iconapterodus* sp. II

Chiroptera
- Palaeochiropterygidae
  - *Lapichiropteryx xiei*
  - *Lapichiropteryx* sp.
- Archaeonycteridae
  - *Icaronycteris*? sp.

Primates
- Sivaladapidae
  - *Hoanghonius stehlini*
- Tarsiidae
  - *Xanthorhysis tabrumi*
- Eosimiidae
  - *Eosimias centennicus*

Rodentia
- Cricetidae
  - *Pappocricetodon schaubi*
- Zapoidae
  - *Primisminthus jinus*
  - *Banyuesminthus diconjugatus*
- Tataromyidae
  - *Protataromys yuanquensis*
- Yuomyidae
  - *Anadianomys* cf. *declivis*
  - indet.

Carnivora
- Miacidae
  - *Chailicyon crassidens*
  - *Miacis*? *boqinghensis*

Creodonta
- Hyaenodontidae
  - *Hyaenodon yuanchuensis*

Artiodactyla
- Fam. indet.
  - "*Hoanghonius stehlini*"
- Anthracotheriidae
  - "*Anthracokeryx*" *sinensis*
  - "*Anthracokeryx*" sp. cf. "*A.*" *sinensis*

Perissodactyla
- Brontotheriidae
  - *Rhinotitan mongoliensis*
- Amynodontidae
  - *Sharamynodon mongoliensis*?
  - *Sianodon sinensis*
  - *Amynodon* sp.
- Hyracodontidae
  - *Juxia borissiaki*

Rencun fauna (9)
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989, 1997), Tsubamoto et al. (2000); Rencun Mbr, lower part of Heti Fm, Yuanqu basin, Henan and Shanxi, middle China]

Insectivora
- Changlelestidae
  - *Ictopidium* sp. cf. *I. lechei*
- Apternodontidae
  - cf. *Apternodus* sp.
- Apternodontidae?

(Continued)

Table 6. (6-8)

cf. *Iconapterodus* sp. I

Chiroptera
Microchiroptera
indet.

Lagomorpha
Leporidae
Strenulagus? sp.
Shamolagus sp. cf. *S. medius*
Gobiolagus sp.

Rodentia
?Ischyromyidae
Hulgana? *eoertnia*
Hulgana? sp.
Cricetidae
Pappocricetodon rencunensis
Raricricetodon minor
Raricricetodon zhongtiaensis
Zapoidae
Primisminthus shanghenus
Primisminthus sp. cf. *P. jinus*
Banyuesminthus uniconjugatus
cf. *Sinosminthus* sp.
Tataromyidae
Protataromys mianchiensis
Yuomyidae
Yuomys cavioides
Anadianomys declivis
Xueshimys dissectus
Zodiomys longmensis

Primates
Sivaladapidae
Hoanghonius stehlini
Rencunius wui
Rencunius zhoui
Adapidae
indet.
Eosimiidae
Eosimias sp. cf. *E. centennicus*

Tillodontia
Esthonychidae
Trogosinae
indet.
Tillotheriidae
Adapidium huanghoensis

Creodonta
Hyaenodontidae
"*Pterodon*" sp. cf. "*P.*" *dahkoensis*

Acreodi
Hapalodectidae
Honanodon hebetis

Artiodactyla
Dichobunidae?
Dichobune sp.
Anthracotheriidae
"*Anthracokeryx*" *sinensis*
Anthracosenex ambiguus
Raoellidae
Indohyus? *yuanchuensis*

Perissodactyla
Eomoropidae
Eomoropus quadridentatus
Litolophus major
?Isectolophidae
indet.
Deperetellidae
Deperetella depereti
Deperetella birmanica
?Lophialetidae
Rhodopagus? sp.
Hyracodontidae
Prohyracodon sp. cf. *P. meridionale*
Amynodontidae
Sharamynodon mongoliensis
Sianodon sinensis
Sianodon mienchiensis
Amynodon? sp.
Caenolophus sp. cf. *C. promissus*

Huangzhuang_fauna (7)
[Shi (1989), Wang (1994), Wang and Wang (1997), Tsubamoto et al. (2000), Tsubamoto (2000 = this paper); Huangzhuang Fm, Qufu, Shandong, middle China]

Mammalia
indet. [cf. "*Pterodon*" *dahkoensis*]

Rodentia
Yuomyidae
Yuomys huangzhuangensis

Creodonta
Hyaenodontidae
cf. *Propterodon* sp.

Pantodonta
Coryphodontidae
Eudinoceras sishuiensis

(*Continued*)

Table 6. (6-9)

Artiodactyla
- Anthracotheriidae
  - *"Anthracokeryx" sinensis*

Perissodactyla
- Brontotheriidae
  - Metatelmatheriinae
    - *Qufutitan zhoui*
- Eomoropidae
  - *Eomoropus minimus*
  - *Eomoropus quadridentatus*
- Lophialetidae
  - *Breviodon minutus*
- Deperetellidae
  - *Deperetella birmanica*
  - *Deperetella* sp.
- Amynodontidae
  - *Caenolophus suprametalophus*
  - *Caenolophus magnus*
  - *Caenolophus proficiens*
  - *Caenolophus minimus*
  - *Caenolophus* sp.
- Hyracodontidae
  - *Forstercooperia* sp.
  - indet.

Shanghuang fauna (8)
[Qi et al. (1991, 1996), Beard et al. (1994), Qi and Beard (1996); Jiangsu, middle China]

Marsupialia
- Didelphidae
  - indet.

Leptictida
- Didymoconidae
  - *Ardynictis* sp.

Insectivora
- Erinaceidae
  - indet.

Lagomorpha
- indet.
- Leporidae
  - Palaeoginae
    - *Lushilagus lohoensis*

Carnivora
- Miacidae
  - *Miacis lushiensis*
  - *Miacis gracilis*
  - *Vulpavus* sp.
- Canidae
  - *Procynodictis* sp.

Creodonta
- Hyaenodontidae
  - *Limnocyon* sp.
  - *"Pterodon"* sp.
  - *Hyaenodon* sp.
  - indet.

Primates
- Adapidae
  - *Adapoides troglodytes*
- Omomyidae
  - *Macrotarsius macrorhysis*
- Tarsiidae
  - *Tarsius eocaenus*
- Eosimiidae
  - *Eosimias sinensis*

Rodentia
- Cricetidae
  - *Pappocricetodon antiquus*
  - *Pappocricetodon rencunensis*
  - *Pappocricetodon schaubi*
  - *Eucricetodon* sp.
- Ischyromyidae
  - gen. et sp. nov.
  - indet.
- Yuomyidae
  - indet.
- Ctenodactylidae
  - indet.
- Fam. nov.
  - gen. et sp. nov.

Chiroptera
- Microchiroptera
  - indet. 1
  - indet. 2

Tillodontia
- indet. 1
- indet. 2

Condylarthra
- Hyopsodontidae
  - indet.

Artiodactyla
- Homacodontidae
  - gen. et sp. nov.
- Entelodontidae

(Continued)

Table 6. (6-10)

?*Eoentelodon* sp.
Anthracotheriidae
indet.
?Leptomerycidae
gen. et sp. nov.

Perissodactyla
Eomoropidae
Eomoropus sp.
Brontotheriidae
Nanotitan shanghuangensis
Microtitan sp. cf. *M. mongoliensis*
Helaletidae
Heptodon sp.
Helaletes mongoliensis
Helaletes sp.
Hyrachyus sp.
Lophialetidae
Rhodopagus sp.
Hyracodontidae
Forstercooperia sp.
Amynodontidae
Caenolophus sp.
Palaeotheriidae
gen. et sp. nov.

Northern East Asian faunas:

Arshanto_fauna (13)
[Meng and McKenna (1998), Dashzeveg and Hooker (1997); Arshanto Fm, Nei Mongol, north China]

Acreodi
Hapalodectidae
Hapalodectes? serus
Mesonychidae
Mongolonyx dolichognathus
Mesonyx cf. *obtusidens*

Pantodonta
Coryphodontidae
Metacoryphodon? minor
Metacoryphodon sp.
Metacoryphodon luminis
Pantolambdodontidae
Pantolambdodon fortis
Pantolambdodon? minor

Dinocerata
Uintatheriidae
Gobiatherium mirificum
Gobiatherium? major
Gobiatherium? monolobotum
cf. *Uintatherium* sp.

Leptictida
Didymoconidae
Archaeoryctes borealis

Rodentia
Ischyromyidae
Asiomys dawsoni
Paramys sp.
Chapattimyidae
Tamquammys wilsoni
Advenimus burkei

Soricomorpha
Micropternodontidae
Sinosinopa sinensis

Perissodactyla
Hyracodontidae
Hyrachyus crista
Hyrachyus neimongoliensis
Hyrachyus sp.
cf. *Hyrachyus eximius*
Forstercooperia confluens
Forstercooperia huhebulakensis
Forstercooperia? grandis
Forstercooperia sp.
Isectolophidae
Homogalax reliquius
Lophialetidae
Schlosseria magister
Schlosseria cf. *magister*
Lophialetes expeditus
Breviodon minutus
Brontotheriidae
Protitan minor
Metatelmatherium cristatum
Microtitan? elongatus
Microtitan sp.
Desmatotitan sp
Amynodontidae
Teilhardia pretiosa
Deperetellidae
Teleolophus cf. *medius*
Teleolophus? rectus
Teleolophus primarius
Helaletidae
Helaletes fissus
Helaletes fissus?
Helaletes medius
Heptodon minimus

(*Continued*)

Table 6. (6-11)

Irdin Manha fauna at Irdin Manha (13)
[Meng and McKenna (1998); Irdin Manha Fm, Nei Mongol, north China]

Carnivora
- Miacidae
  - *Miacis invictus*

Acreodi
- Mesonychidae
  - *Pachyaena* sp.
  - *Mesonyx* sp.
  - indet.
- Hapalodectidae
  - *Hapalodectes serus*
- Triisodontidae
  - *Andrewsarchus mongoliensis*

Cimolesta
- Fam. indet.
  - Wyolestinae
    - *Mongoleryctes acutus*

Pantodonta
- Pantolestidae
  - ?*Pantolestes* sp.
  - indet.
- Coryphodontidae
  - *Eudinoceras mongoliensis*

Rodentia
- Ischyromyidae
  - indet.

Creodonta
- Oxyaenidae
  - *Sarkastodon mongoliensis*
- Hyaenodontidae
  - *Propterodon morrisi*

Artiodactyla
- Leptomerycidae
  - Archaeomerycinae
    - cf. *Archaeomeryx* sp.
- Helohyidae
  - *Gobiohyus pressidens*
  - *Gobiohyus robustus*
  - *Gobiohyus orientalis*

Perissodactyla
- Hyracodontidae
  - *Forstercooperia totadentata*
  - *Triplopus*? *proficiens*
  - *Rhodopagus pygmaeus*
  - *Breviodon minutus*
  - *Simplaletes sujiensis*
  - *Lophialetes* sp.
  - *Lophialetes expeditus*
- Brontotheriidae
  - *Metatelmatherium parvum*
  - *Microtitan mongoliensis*
  - *Gnathotitan berkeyi*
  - *Epimanteoceras robustus*
  - *Protitan grangeri*
  - *Protitan obliquidens*
- Eomoropidae
  - *Litolophus gobiensis*
- Deperetellidae
  - *Teleolophus medius*
  - *Irdinolophus mongoliensis*

Irdin Manha fauna at Camps Margetts (14)
[Li and Ting (1983), Russell and Zhai (1987); Irdin Manha Fm, Nei Mongol, north China]

Pantodonta
- indet.

Dinocerata
- Uintatheriidae
  - *Gobiatherium mirificum*

Rodentia
- Paramyidae
  - indet.
- Chapattimyidae
  - *Advenimus burkei*

Acreodi
- Mesonychidae
  - *Mongolonyx dolichognathus*
- Triisodontidae
  - *Andrewsarchus mongoliensis*

Perissodactyla
- Brontotheriidae
  - *Metatelmatherium cristatum*
  - *Protitan minor*
  - *Protitan*? *cingulatus*
- Eomoropidae
  - *Litolophus gobiensis*
- Deperetellidae
  - cf. *Teleolophus medius*
- Helaletidae
  - *Helaletes fissus*
  - *Helaletes fissus*?

(*Continued*)

Table 6. (6-12)

Helaletes sp.
cf. *Hyrachyus* sp.
Lophialetidae
Lophialetes expeditus
Breviodon? sp.
cf. *Schlosseria magister*
Amynodontidae
Rostriamynodon grangeri
Hyracodontidae
Forstercooperia grandis

Ulan Shireh fauna (15)
[Meng and McKenna (1998); Nei Mongol, north China]

Carnivora
Miacidae
indet.

Acreodi
Hapalodectidae
Hapalodectes? *serus*
Mesonychidae
indet.
Harpagolestes? *orientalis*
cf. *Mesonyx* sp.

Pantodonta
Coryphodontidae
Eudinoceras mongoliensis
Pantolambdodontidae
Pantolambdodon fortis
Pantolambdodon inermis

Creodonta
Hyaenodontidae
Propterodon sp. cf. P. *morrisi*
Oxyaenidae
Sarkastodon mongoliensis

Lagomorpha
Palaeolaginae
indet.
Leporidae
Shamolagus grangeri

Leptictida
Didymoconidae
Kennatherium shirensis

Rodentia
Chapattimyidae
Advenimus bohlini
cf. *Advenimus* sp.
Yomyidae
Yuomys weijingensis

Artiodactyla
Helohyidae
Gobiohyus orientalis

Perissodactyla
Lophialetidae
Simplates ulanshirehensis
Lophialetes sp.
Lophialetes? *expeditus*
Zhongjianoletes chowi
Zhongjianoletes sp.
Breviodon minutus
Breviodon? sp.
Rhodopagus pygmaeus
Amynodontidae
Lushiamynodon sharamurenensis
Brontotheriidae
Epimanteoceras formosus
Acrotitan ulanshirehensis
Microtitan mongoliensis
Dolichorhinoides angustidens
Desmatotitan tukhumensis
Protitan bellus
Deperetellidae
Teleolophus medius
Hyracodontidae
Forstercooperia sp. cf. *F. grandis*
Forstercooperia sp.
Triplopus? *proficiens*

Khaychin (II, III, V) fauna (16)
[Meng and McKenna (1998); Mongolia]

Acreodi
Mesonychidae
Mongolonyx robustus
Hapalodectidae
Metahapalodectes makhchinus

Cimolesta
Coryphodontidae
cf. *Eudinoceras* sp.

Creodonta
Hyaenodontidae
"*Pterodon*" *rechetovi*

Erinaceomorpha
indet.

(*Continued*)

Table 6. (6-13)

Lagomorpha
indet.

Rodentia
Chapattimyidae
Euboromys grandis
Petrokozlovia notos
Saykanomys bohlini

Soricomorpha
Apternodontidae
indet.

Artiodactyla
"Hypertragulidae"
indet.
Helohyidae
Gobiohyus sp. nov.

Perissodactyla
Lophialetidae
Lophialetes expeditus
Breviodon minutus
Amynodontidae
indet
Hyracodontidae
Triplopus? proficiens
Forstercooperia totadentata
Brontotheriidae
Protitan reshetovi
Protitan khaitshinus
Microtitan mongoliensis
Deperetellidae
Teleolophus medius
Teleolophus sp.
Deperetella khaitchinulensis

Kholboldzhi-Nur fauna (12)
[Meng and McKenna (1998); Mongolia]

Acreodi
Hapalodectidae
indet

Pantodonta
Pantolambdodontidae
Pantolambdodon bodgensis
Archaeolambda prima
Coryphodontidae
Eudinoceras kholobochiensis
cf. *Hypercoryphodon* sp.

Pantolesta
Pantolestidae
Bodgia orientalis

Lagomorpha
indet.

Perissodactyla
indet.
Isectolophidae
indet.
Hyracodontidae
Pataecops parvus
indet.
Brontotheriidae
indet.
Amynodontidae
Teilhardia sp.
Lophialetidae
Breviodon sp.
Lophialetes expeditus?
Schlosseria magister
Rhodopagus sp.
Palaeotheriidae
Gobihippus menneri
Deperetellidae
Irdinolophus tuiensis?

Shara Murun fauna (15)
[Meng and McKenna (1998), Tsubamoto (2000 = this paper); Shara Murun Fm, Nei Mongol, north China]

Creodonta
Hyaenodontidae
"Pterodon" hyaenoides
Propterodon cf. *morrisi*

Lagomorpha
Ochotonidae
Desmatolagus sp.
Leporidae
Shamolagus medius
Gobiolagus tolmachovi

Rodentia
Yuomyidae
Yuomys cavioides

Artiodactyla
Leptomerycidae
Archaeomerycinae
Archaeomeryx optatus
Anthracotheriidae
Ulausuodon parvus

(Continued)

Table 6. (6-14)

indet. [cf. *Anthracokeryx* sp.]

Perissodactyla
- Amynodontidae
  - *Lushiamynodon sharamurenensis*
  - *Sianodon ulausuensis*
  - *Sianodon* sp.
  - *Sharamynodon mongoliensis*
  - cf. *Cadurcodon* sp.
  - *Caenolophus promissus*
  - *Caenolophus obliquus*
  - *Gigantamynodon promissus*
- Lophialetidae
  - *Lophialetes* sp.
  - *Rhodopagus minimus*
- Hyracodontidae
  - *Triplopus? progressus*
  - *Juxia borissiaki*
- Brontotheriidae
  - *Titanodectes ingens*
  - *Titanodectes minor*
  - *Rhinotitan andrewsi*
  - *Rhinotitan kaiseni*
  - *Rhinotitan mongoliensis*
  - *Pachytitan ajax*
  - *Metatelmatherium?* (= *Manteoceras*) sp.
- Deperetellidae
  - *Deperetella cristata*
  - *Teleolophus ?medius*
- Chalicotheriidae
  - *Schizotherium* sp.

Urtyn (Erden) Obo fauna (14)
[Meng and McKenna (1998); Urtyn Obo Fm, Nei Mongol, north China]

Acreodi
- Mesonychidae
  - indet

Lagomorpha
- Leporidae
  - *Gobiolagus? major*

Artiodactyla
- Entelodontidae
  - *Entelodon* sp.

Perissodactyla
- Amynodontidae
  - *Cadurcodon ardynensis*
  - *Cadurcodon* sp.
  - *Amynodontopsis parvidens*
  - *Amynodon alxaensis*
- Chalicotheriidae
  - *Schizotherium* cf. *avitum*
- Hyracodontidae
  - *Ardynia praecox*
  - *Urtinotherium incisivum*
- Brontotheriidae
  - *Parabrontops gobiensis*

Ulan Gochu fauna (15)
[Meng and McKenna (1998), Lucas et al. (1996); Ulan Gochu Fm, Nei Mongol, north China]

Anagalida
- Anagalidae
  - *Anagale gobiensis*

Acreodi
- Mesonychidae
  - *Mongolestes hadrodens*

Lagomorpha
- Leporidae
  - *Gobiolagus andrewsi*

Lagomorpha
- Ochotonidae
  - *Desmatolagus vetustus*

Rodentia
- Ischyromyidae
  - *Hulgana ertinia*
  - indet.
- Cylindrodontidae
  - *Ardynomys* sp.

Leptictida
- Didymoconidae
  - indet.

Perissodactyla
- Brontotheriidae
  - *Metatitan primus*
  - *Metatitan progressus*
  - *Embolotherium grangeri*
  - *Embolotherium loucksii*
  - *Embolotherium andrewsi*
- Amynodontidae
  - *Amynodontopsis* sp.
  - *Cadurcodon* sp.
  - *Zaisanamynodon borisovi*
  - indet

(Continued)

Table 6. (6-15)

Chaganbulage fauna (17)
[Meng and McKenna (1998); Chaganbulage Fm, Nei Mongol, north China]

Acreodi
- Mesonychidae
  - *Harpagolestes alxaensis*

Lagomorpha
- indet.

Rodentia
- indet.

Artiodactyla
- Bovidae
  - indet.
- Cervidae
  - indet.
- Entelodontidae
  - indet.

Perissodactyla
- Amynodontidae
  - *Amynodon alxaensis*
  - *Cadurcodon suhaituensis*
  - *Sianodon* sp.
  - indet.
- Deperetellidae
  - *Teleolophus magnus*
  - *Teleolophus* cf. *medius*
- Brontotheriidae
  - *Embolotherium grangeri*

Ergilin member fauna at Ergilin Dzo (19)
[Meng and McKenna (1998); Mongolia]

Carnivora
- Viverridae
  - *Stenoplesictis simplex*
- Nimravidae
  - *Nimravus mongoliensis*

Creodonta
- Hyaenodontidae
  - *Hyaenodon* sp.
  - *"Pterodon" mongoliensis*

Rodentia
- Cylindrodontidae
  - *Ardynomys silentii*
  - *Ardynomys olseni*
  - *Ardynomys chihi*

Artiodactyla
- Anthracotheriidae
  - *Bothriodon* sp.
- Lophiomerycidae
  - *Lophiomeryx gobiae*
  - *Miomeryx altaicus*
- Entelodontidae
  - *Entelodon gobiensis*

Perissodactyla
- Hyracodontidae
  - *Forstercooperia* sp.
  - *Forstercooperia ergiliiensis*
  - *Ardynia mongoliensis*
  - *Ardynia praecox*
- Rhinocerotidae
  - *Ronzotherium brevirostris*
  - *Ronzotherium orientale*
- Amynodontidae
  - *Cadurcodon ardynensis*
  - *Gigantamynodon cessator*
  - *Armania asiana*
  - *Cadurcotherium progressus*
- Brontotheriidae
  - *Embolotherium ergiliense*
  - *Embolotherium andrewsi*
- Chalicotheriidae
  - *Schizotherium avitum*
- Helaletidae
  - *Colodon inceptus*

Ergilin member fauna at Khoer Dzan (18)
[Meng and McKenna (1998); Mongolia]

Carnivora
- Nimravidae
  - *Nimravus mongoliensis*

Creodonta
- Hyaenodontidae
  - *Hyaenodon incertus*

Artiodactyla
- Anthracotheriidae
  - *Bothriodon* sp.
- Entelodontidae
  - *Entelodon orientalis*

Perissodactyla
- Amynodontidae
  - *Gigantamynodon cessator*
- Brontotheriidae

(Continued)

Embolotherium sp.
Chalicotheriidae
Schizotherium avitum
Eomoropidae
Eomoropus sp.
Deperetellidae
Teleolophus magnus
Hyracodontidae
Indricotherium sp.
Rhinocerotidae
Ronzotherium orientale

Sevkhul fauna at Khoer Dzan (18)
[Meng and McKenna (1998); Mongolia]

Acreodi
Mesonychidae
Mongolestes hadrodens
Metahapalodectes sp.

Creodonta
Hyaenodontidae
"Pterodon" exploratus
"Pterodon" sp.
Hyaenodon incertus
Hyaenodon eminus

Lagomorpha
Ochotonidae
Desmatolagus vetustus

Rodentia
Cylindrodontidae
Ardynomys sp.

Leptictida
Didymoconidae
Ardynictis furunculus

Artiodactyla
Entelodontidae
Eoentelodon trofimovi

Perissodactyla
Amynodontidae
Amynodon lunanensis
Gigantamynodon cessator
Armania asiana
Hyracodontidae
Ardynia mongoliensis
Ardynia praecox
Prohyracodon meridionalis
Brontotheriidae
Embolotherium grangeri
Deperetellidae
Teleolophus magnus
Deperetella cf. *D. birmanica*
Chalicotheriidae
Schizotherium avitum
Helaletidae
Colodon inceptus

Table 7. Families, genera and species of the Pondaung fauna shared by other East Asian mammal faunas

	Pondaung fauna	Dongjun fauna	Xiangshan fauna	Lower Lumeiyi fauna	Upper Lumeiyi fauna	Naduo fauna	Gongkang fauna	Krabi fauna	Caijiachong fauna	Hetaoyuan fauna	Upper Lushi fauna	Rencun fauna	Huangzhuang fauna	Shanghuang fauna	Arshanto fauna	Irdin Manha fauna at Camps Margetts	Irdin Manha fauna at Irdin Manha	Shara Murun fauna	Khaychin (II, III, V) fauna	Sevkhul fauna	Ergilin Mbr fauna at Ergilin Dzo
Region	**south**	south	south	south	south	south	south	south	south	middle	middle	middle	middle	middle	north	north	north	north	north	north	north
Family																					
Amphipithecidae	**O**							O													
Eosimiidae	**O**											O		O							
Hyaenodontidae	**O**		O		O	O				O	O	O	O	O			O	O	O	O	O
Anthracotheriidae	**O**	O	O	O	O	O	O	O	O			O	O	O				O			O
Helohyidae	**O**			O				O			O						O		O		
Brontotheriidae	**O**	O	O	O	O	O			O	O	O		O	O	O	O	O	O	O	O	O
Hyracodontidae	**O**	O	O	O	O		O	?	O	O	O	O	O	O	O	O	O	O	O	O	O
Amynodontidae	**O**	O	O	O	O	O			O	O	O	O	O	O	O	O		O	O	O	O
Deperetellidae	**O**	O	O	O	O	O				O	O	O	O		O	O	O	O	O	O	
Genus																					
"Pterodon"	**O**		?		O							O						O	O	O	O
Anthracotherium	**O**					O	O	O													
Indomeryx	**O**					O	cf.		cf.												
Metatelmatherium	**?**	O				?									O	O	O	?			
Ilianodon	**cf.**	?			O																
Paramynodon	**O**	cf.			cf.	O															
Deperetella	**O**	O	O	O	O	O				O	O	O	O	O				O	O	O	
Species																					
"Pterodon" dahkoensis	**O**				O							cf.									
Anthracotherium rubricum	**O**					O															
Anthracotherium birmanicus	**O**					O															
Indomeryx cotteri	**O**					O															
Metatelmatherium ? lahirii	**O**					cf.															
Deperetella birmanica	**O**	O	O		O							O	O							cf.	

Table 8. Numbers of the identified genera of each 29 mammal faunas of the middle to late Eocene of East Asia (Figure 17; Table 3, 6), and the shared genera and Simpson's FRI on the genera among those faunas. Left and upper nine faunas are southern East Asian faunas, middle seven faunas are middle East Asian faunas, and right and lower 13 faunas are northern East Asian faunas. The faunas are basically ordered from the left and upper (earlier age) to right and lower (later age) in each region (southern, middle, and northern faunas) based on the EALMA sequence (Figure 16).

Table 8.

Upper right: Number of shared genera

Lower left: Simpson's FRI

Fauna	L. Lumeiyi	Xiangshan	Dongjun	U. Lumeiyi	Pondaung	Naduo	Gongkang	Krabi	Caijiachong	L. Lushi	Hetaoyuan	U. Lushi	Shanghuang	Huangzhuang	Rencun, Heti	Zhaili, Heti	Kholboldzhi-Nur	Arshanto	Irdin Manha at Camps Margetts	Irdin Manha at Irdin Manha	Ulan Shireh	Khaychin II, III, V	Shara Murun	Chaganbulage	Sevkhul at Khoer Dzan	Ulan Gochu	Urtyn Obo	Ergilin at Ergilin	Ergilin at Khoer Dzan
identified genera	**18**	**20**	**14**	**20**	**19**	**24**	**13**	**18**	**15**	**6**	**39**	**27**	**29**	**10**	**36**	**23**	**13**	**27**	**15**	**26**	**27**	**16**	**25**	**6**	**18**	**11**	**9**	**19**	**11**
L. Lumeiyi	-	10	6	7	1	2	1	0	2	3	7	9	5	4	5	2	4	8	7	7	8	7	7	2	4	0	1	1	1
Xiangshan	56	-	4	8	2	3	0	0	2	2	7	9	4	5	9	2	4	4	4	4	4	5	6	2	6	0	1	1	2
Dongjun	43	29	-	8	4	3	1	0	1	1	4	7	1	3	3	1	1	3	5	6	4	5	4	2	5	0	1	1	2
U. Lumeiyi	39	40	57	-	4	3	1	1	3	1	4	5	4	4	6	4	1	3	4	4	3	5	5	2	6	0	1	2	3
Pondaung	6	11	29	21	-	5	2	1	1	0	1	1	1	1	1	0	0	1	1	1	0	2	2	0	2	0	0	1	0
Naduo	11	15	21	15	26	-	6	1	3	0	2	4	2	4	3	0	0	1	1	2	2	1	4	1	1	0	0	1	2
Gongkang	8	0	8	8	15	46	-	2	2	0	0	1	1	1	0	0	0	1	1	1	1	1	1	0	1	0	1	3	2
Krabi	0	0	0	6	6	6	15	-	0	0	1	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1
Caijiachong	13	13	7	20	7	20	15	0	-	0	1	1	1	0	1	0	0	0	0	0	0	0	2	1	2	1	2	6	4
L. Lushi	50	33	17	17	0	0	0	0	0	-	3	3	0	2	0	0	3	3	2	4	4	4	1	0	0	0	0	0	0
Hetaoyuan	39	35	29	20	5	8	0	6	7	50	-	11	3	3	8	4	4	6	6	9	8	6	7	2	4	0	0	0	1
U. Lushi	50	45	50	25	5	17	8	6	7	50	41	-	6	6	8	3	3	5	4	10	7	7	6	1	3	1	0	2	1
Shanghuang	28	20	7	20	5	8	8	6	7	0	10	22	-	3	6	4	1	5	4	4	3	3	3	0	3	0	0	3	1
Huangzhuang	40	50	30	40	10	40	10	0	0	33	30	60	30	-	5	1	2	2	2	4	4	4	4	0	1	0	0	1	1
Rencun, Heti	28	45	21	30	5	13	0	0	7	0	22	30	21	50	-	13	0	0	1	1	1	2	9	2	4	2	2	1	0
Zhaili, Heti	11	10	7	20	0	0	0	6	0	0	17	13	17	10	57	-	0	0	0	1	0	0	4	2	2	0	1	1	1
Kholboldzhi-Nur	31	31	8	8	0	0	0	0	0	50	31	23	8	20	0	0	-	4	3	5	3	3	2	0	0	0	0	0	0
Arshanto	44	20	21	15	5	4	8	0	0	50	22	19	19	20	0	0	31	-	12	9	11	7	3	1	1	0	0	1	1
Irdin Manha at Camps Margetts	47	27	36	27	7	7	8	0	0	33	40	27	27	20	7	0	23	80	-	8	6	6	3	1	1	0	0	1	1
Irdin Manha at Irdin Manha	39	20	43	20	5	8	8	6	0	67	35	15	15	40	4	4	38	35	53	-	16	9	7	1	1	0	0	1	1
Ulan Shireh	44	20	29	15	0	8	8	0	0	67	30	26	11	40	4	0	23	41	40	62	-	9	6	2	1	0	0	1	1
Khaychin II, III, V	44	31	36	31	13	6	8	0	0	67	38	19	19	40	13	0	23	44	40	56	56	-	3	1	4	0	0	2	1
Shara Murun	39	30	29	25	11	17	8	0	20	17	28	12	12	40	36	17	15	12	20	28	24	19	-	3	5	3	2	4	3
Chaganbulage	33	33	33	33	0	17	0	0	17	0	33	0	0	0	33	33	0	17	17	17	33	17	50	-	3	2	2	2	2
Sevkhul at Khoer Dzan	22	33	36	33	11	6	8	0	13	0	22	17	17	10	22	11	0	6	7	6	6	25	28	50	-	4	2	8	5
Ulan Gochu	0	0	0	0	0	0	0	0	9	0	0	0	0	0	18	0	0	0	0	0	0	0	27	33	36	-	3	3	1
Urtyn Obo	11	11	11	11	0	0	11	0	22	0	0	0	0	0	22	11	0	0	0	0	0	0	22	33	22	33	-	4	2
Ergilin at Ergilin Dzo	6	5	7	11	5	5	23	6	40	0	0	16	16	10	5	5	0	5	7	5	5	13	21	33	44	27	44	-	8
Ergilin at Khoer Dzan	9	18	18	27	0	18	18	9	36	0	9	9	9	10	0	9	0	9	9	9	9	9	27	33	45	9	22	73	-

Table 9. Table of faunal composition of the 29 mammal faunas of the middle to late Eocene of East Asia (Figure 17).

The compositions are calculated by the genus numbers.

	L. Lumeiyi	Xiangshan	Dongjun	U. Lumeiyi	Pondaung	Naduo	Gongkang	Krabi	Caijiachong	L. Lushi	Hetaoyuan	U. Lushi	Shanghuang	Huangzhuang	Rencun, Heti	Zhaili, Heti	Kholboldzhi-Nur	Arshanto	Irdin Manha at Camps Margetts	Irdin Manha at Irdin Manha	Ulan Shireh	Khaychin II, III, V	Shara Murun	Chaganbulage	Sevkhul at Khoer Dzan	Ulan Gochu	Urtyn Obo	Ergilin at Ergilin	Ergilin at Khoer Dzan
Total numbers of the genera	**22**	**22**	**14**	**21**	**21**	**25**	**13**	**26**	**21**	**7**	**41**	**28**	**39**	**10**	**39**	**23**	**17**	**27**	**17**	**27**	**29**	**21**	**26**	**11**	**18**	**12**	**10**	**19**	**11**
Perissodactyla	16	15	10	15	9	7	4	2	7	2	10	13	10	6	10	5	10	14	11	14	15	9	17	5	10	5	7	10	7
Artiodactyla	2	4	1	3	4	12	6	11	5	1	0	2	4	1	4	2	0	0	0	2	1	2	3	3	1	0	1	4	2
Rodentia + Lagomorpha	0	0	0	0	1	0	0	2	5	0	18	2	7	1	13	5	1	4	2	1	4	4	4	2	2	4	1	1	0
Carnivora	1	0	1	2	0	3	2	6	0	0	1	3	3	0	0	2	0	0	0	1	1	0	0	0	0	0	0	2	1
Creodonta	1	1	0	1	2	1	0	0	0	0	4	2	3	1	1	1	0	0	0	2	2	1	2	0	2	0	0	2	1
Primates	0	0	0	0	4	0	1	2	1	0	0	1	4	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Acreodi	1	2	1	0	0	2	0	0	0	1	1	3	0	0	1	0	1	3	2	4	3	2	0	1	2	1	1	0	0
"Archaic mammals"	1	0	1	0	0	0	0	0	0	3	1	2	3	1	2	0	5	4	2	3	2	1	0	0	0	0	0	0	0
Other mammals	0	0	0	0	1	0	0	3	3	0	6	0	5	0	4	5	0	2	0	0	1	2	0	0	1	2	0	0	0

Appendices

Appendix 1 . Collection list of the National Museum of the Union of Myanmar (List of NMMP-KU).

Appendix 2 . Dental measurements (in mm) of the Pondaung mammals.

Abbreviations: L, anteroposterior length; W, buccolingually width; AW, anterior width of upper dentition; PW, posterior width of upper dentition; TRDW, trigonid with of lower dentition; TALDW, talonid width of lower dentition.

*, Estimated value.

[ ] (square bracket), the data are from the literatures (Pilgrim and cotter, 1916; Pilgrim, 1925, 1928; Colbert, 1938).

Appendix 3 . Faunal list of 92 Paleogene and 34 Neogene mammal faunas of East Asia prepared for the AEO analysis. For the data source and place of the fauna, see in the square bracket ([ ]) of each faunal list.

Appendix 4 . Data of the stratigraphic relationships of the East Asian mammal faunas used for AEO analysis (data from Russell and Zhai, 1987; Dashzeveg, 1993; Meng *et al.*, 1998).

Appendix. 1. (1-1)

NMMP-KU No.	ID	Material	Field number	Locality	Collection year	Collection team
NMMP-KU 0001	Anthropoidea gen. et sp. nov.	max. and mand. with teeth		Bh1	1998	Myanmar-Japan
NMMP-KU 0002	Anthropoidea gen. et sp. nov.	mand. with m/3		Bh1	1998	Myanmar-Japan
NMMP-KU 0003	*Pondaungia cotteri*	upper teeth		PGN2	1998	Myanmar-Japan
NMMP-KU 0004	?*Pondaungia cotteri*	canine		PGN2	1998	Myanmar-Japan
NMMP-KU 0005	*Deperetella birmanica*	L max. with LP\1-3	Bhn-1041	Bahin area	1997	Myanmar
NMMP-KU 0006	*Deperetella birmanica*	R max. with RP\1-3	Kdw-139	Kdw	1997	Myanmar
NMMP-KU 0007	*Indomeryx arenae*	R max. with RM\1-3 (or dP\4M\1-2?)	Bhn 1115 (Bhn-915)	Bahin area	1997	Myanmar
NMMP-KU 0008	*Indomeryx cotteri*	L max. with LM\1-3	mgg-2	Mogaung area	1997	Myanmar
NMMP-KU 0009	*Indomeryx cotteri*	L max. with LM\2-3	mgg-14	Mogaung area	1997	Myanmar
NMMP-KU 0010	*Indomeryx cotteri*	L max. with LdP\4M\1-2 (or dP\3-4M\1?)	Lema KC (-1@)	Lma	1998	Myanmar-Japan
NMMP-KU 0011	*Indomeryx arenae*	L mand. with Lp/4-m/3	Bhn-3	Bahin area	1997	Myanmar
NMMP-KU 0012	*Indomeryx arenae*	R mand. with Rm/3	Bhn-4	Bahin area	1997	Myanmar
NMMP-KU 0013	*Indomeryx arenae*	R mand. with Rp/4-m/3	Bhn-5	Bahin area	1997	Myanmar
NMMP-KU 0014	*Indomeryx arenae*	L mand. with Lm/3	Bhn-6	Bahin area	1997	Myanmar
NMMP-KU 0015	*Indomeryx cotteri*	L mand. with Lm/1-3	Bhn 911 (Bhn-913+1114)	Bahin area	1997	Myanmar
NMMP-KU 0016	*Indomeryx cotteri*	L mand. with Lm/1-3	Bhn-915? or 1115? + mgg-11	Bahin or Mogaung area	1997	Myanmar
NMMP-KU 0017	*Indomeryx cotteri*	R mand. with Rm/3	mgg-5	Mogaung area	1997	Myanmar
NMMP-KU 0018	*Indomeryx cotteri*	L mand. with Lm/2-3	mgg-7	Mogaung area	1997	Myanmar
NMMP-KU 0019	*Indomeryx cotteri*	R mand. with Rp/3-m/3	mgg-8 + 9 + 241	Mogaung area	1997	Myanmar
NMMP-KU 0020	*Indomeryx cotteri*	L mandible	mgg-10	Mogaung area	1997	Myanmar
NMMP-KU 0021	*Indomeryx cotteri*	R mand. with Rp/4	mgg-12	Mogaung area	1997	Myanmar
NMMP-KU 0022	*Indomeryx cotteri*	R mand. with Rp/4	Bh-4 (-1@)	Bh4	1998	Myanmar-Japan
NMMP-KU 0023	?Artiodactyla gen. et sp. nov.	Rm/x	PGN-1 (-5@)	PGN1	1998	Myanmar-Japan
NMMP-KU 0024	*Indomeryx cotteri*	R mand. with Rm/1 or 2	Lema KC-3@ (1998.11)	Lma	1998	Myanmar-Japan
NMMP-KU 0025	cf. *Indomeryx cotteri*	RM\1 or 2	mgg-6? or 9?	Mogaung area	1997	Myanmar
NMMP-KU 0026	Artiodactyla gen. et sp. nov.	RM\3?	Bh-1-8@ (1998.11)	Bh1	1998	Myanmar-Japan
NMMP-KU 0027	Artiodactyla gen. et sp. nov.	R mand. with Rm/2-3	Bhn-9	Bahin area	1997	Myanmar
NMMP-KU 0028	Artiodactyla gen. et sp. nov.	R mand. with Rm/3	mgg-3	Mogaung area	1997	Myanmar
NMMP-KU 0029	Artiodactyla gen. et sp. nov.	R mand. with Rm/1-2	mgg-4	Mogaung area	1997	Myanmar
NMMP-KU 0030	cf. Artiodactyla gen. et sp. nov.	R mand. with Rm/1 or 2	mgg-6	Mogaung area	1997	Myanmar
NMMP-KU 0031	*Hsanotherium parvum* type. 1	R max. with RM\2-3	Bhn-11	Bahin area	1997	Myanmar

(Continued)

Appendix. 1. (1-2)

NMMP-KU 0032	*Hsanotherium parvum* type. 3	L mand. with Lm/3	Bhn-7	Bahin area	1997	Myanmar
NMMP-KU 0033	*Hsanotherium parvum* type. 1	R mand. with Rm/2	Bh-1-2@ (1998.11)	Bh1	1998	Myanmar-Japan
NMMP-KU 0034	*Hsanotherium parvum* type. 3 or 1	Lm/3' talonid	Bh-1-6@ (1998.11)	Bh1	1998	Myanmar-Japan
NMMP-KU 0035	*Hsanotherium parvum* type. 2	R max. with RM\1-3	Bhn-10	Bahin area	1997	Myanmar
NMMP-KU 0036	*Hsanotherium parvum* type. 2	L mand. with Lp/4-m/3	Bhn-8	Bahin area	1997	Myanmar
NMMP-KU 0037	*Hsanotherium parvum* type. 1	R mand. with Rdp/4m/1-2	Bh-1-(4)@ (1998.11)	Bh1	1998	Myanmar-Japan
NMMP-KU 0038	*Pakkokuhyus lahirii*	R mand. with Rm/2-3	Bhn-906	Bahin area	1997	Myanmar
NMMP-KU 0039	*Pakkokuhyus lahirii*	R max. with RM\2-3	Kdw-6	Kdw	1997	Myanmar
NMMP-KU 0040	*Indolophus guptai*	L mand. with Lm/2?	Bhn-40	Bahin area	1997	Myanmar
NMMP-KU 0041	*Indolophus guptai*	R mand. with Rp/4	Pk-2-(1)@ (1998.11)	Pk2	1998	Myanmar-Japan
NMMP-KU 0042	Hyaenodontidae gen. *et* sp. nov.	skull and others	Kdw-1	Kdw	1997	Myanmar
NMMP-KU 0043	Hyaenodontidae gen. *et* sp. nov.	Lm/3	Kdw-2	Kdw	1997	Myanmar
NMMP-KU 0044	Hyaenodontidae gen. *et* sp. nov.	LI\2-3	Kdw-4	Kdw	1997	Myanmar
NMMP-KU 0045	Hyaenodontidae gen. *et* sp. nov.	R mand. with Rm/1	Bhn-31	Bahin area	1997	Myanmar
NMMP-KU 0046	Hyaenodontidae gen. *et* sp. nov.	Rm/2?	Bh-1-(3)@ (1998.11)	Bh1	1998	Myanmar-Japan
NMMP-KU 0047	Phiomyidae gen. *et* sp. nov.	Lm/2		Wka or Kdw	1997	Myanmar
NMMP-KU 0048	Phiomyidae gen. *et* sp. nov.	R max. with RP\3-4?		Wka or Kdw	1997	Myanmar
NMMP-KU 0049	Phiomyidae gen. *et* sp. nov.	? L mand. with Lm/2-3		Wka or Kdw	1997	Myanmar
NMMP-KU 0050	*Indomeryx cotteri*	L mand. with Lm/2-3?	Bh-1-(5)@ (1998.11)	Bh1	1998	Myanmar-Japan
NMMP-KU 0051	*Pondaungia cotteri*	M\x' frag.		Lma	1998	Myanmar-Japan
NMMP-KU 0052	*Anthracotherium tenuis*	R mand. with Rp/1p/4-m/3	Bh-1-(1)	Bh1	1998	Myanmar-Japan
NMMP-KU 0053	*Anthracotherium birmanicus*	R max. with RP\3-M\3	Pk-1-(1)	Pk1	1998	Myanmar-Japan
NMMP-KU 0054	*Anthracotherium pangan*	Rm/3	Pk Peop. Loc. unknown	Bahin area	1998	Myanmar-Japan
NMMP-KU 0055	*Anthracotherium pangan*	L mand. with Lm/3	Pk Peop. Loc. unknown	Bahin area	1998	Myanmar-Japan
NMMP-KU 0056	*Anthracotherium pangan*	max. with RM\2-3	Sinzwe U Mye Aye	Sze	1998	Myanmar-Japan
NMMP-KU 0057	? cf. *Ilianodon lunanensis*	Upper molariform tooth	Pk Peop. Loc. unknown	Bahin area	1998	Myanmar-Japan
NMMP-KU 0058	Ceratomorpha indet.	max. with upper molariform tooth	Pk-2-1	Pk2	1998	Myanmar-Japan
NMMP-KU 0059	Brontothere	LM\x	MGGN	MGGN	1998	Myanmar-Japan
NMMP-KU 0060	*Paramynodon birmanicus*	Rm/x	MGGN 11/14	MGGN	1998	Myanmar-Japan
NMMP-KU 0061	*Paramynodon birmanicus*	L max. with LM\1	Pk-2-2	Pk2	1998	Myanmar-Japan
NMMP-KU 0062	*Anthracotherium pangan*	R mand. with Rm/2?	2km NE from Pakkaung	Bahin area	1998	Myanmar-Japan
NMMP-KU 0063	*Anthracotherium tenuis*	RM\1	Pk-2-2@	Pk2	1998	Myanmar-Japan
NMMP-KU 0064	?*Indomeryx* ?	p/4?	Bh-1-7@	Bh1	1998	Myanmar-Japan
NMMP-KU 0065	?Rodentia	incisor?	Pk-4-1@	Pk4	1998	Myanmar-Japan

(Continued)

Appendix. 1. (1-3)

NMMP-KU 0066	*Anthracotherium tenuis*	RM\1	Bh-4-2	Bh4	1998	Myanmar-Japan
NMMP-KU 0067	*Anthracotherium rubricae*	LP\4	Bh-1-2	Bh1	1998	Myanmar-Japan
NMMP-KU 0068	Artiodactyla gen. et sp. nov.	R mand. with Rm/3	Bh-1-2	Bh1	1998	Myanmar-Japan
NMMP-KU 0069		teeth frags.	Bh-1-2	Bh1	1998	Myanmar-Japan
NMMP-KU 0070	*Anthracotherium birmanicus* ?	RM\3	Bh-1-4	Bh1	1998	Myanmar-Japan
NMMP-KU 0071	*Anthracotherium*	RP\4M\1	Bh-1-4	Bh1	1998	Myanmar-Japan
NMMP-KU 0072		teeth frags.	Bh-1-3, (11/6)	Bh1	1998	Myanmar-Japan
NMMP-KU 0073		teeth frags.	Bh-1-4, (11/7)	Bh1	1998	Myanmar-Japan
NMMP-KU 0074	*Anthracothema pangan*	LP\4	Bh-1-6, (11/11)	Bh1	1998	Myanmar-Japan
NMMP-KU 0075	mammal	tooth root	Bh-1-6, (11/11)	Bh1	1998	Myanmar-Japan
NMMP-KU 0076		astragals, digit, etc., 3 materials	Bh-1, (11/7)	Bh1	1998	Myanmar-Japan
NMMP-KU 0077	*Anthracotherium*	M\2?, Rm/3	(11/7)	Bh3	1998	Myanmar-Japan
NMMP-KU 0078	*Anthracotherium birmanicus*	Lm/1	Bh-4-2, (11/7)	Bh4	1998	Myanmar-Japan
NMMP-KU 0079	*Anthracotherium birmanicus*	Lp/3?	Bh-4-2, (11/7)	Bh4	1998	Myanmar-Japan
NMMP-KU 0080		teeth frags.	Bh-4-2, (11/7)	Bh4	1998	Myanmar-Japan
NMMP-KU 0081	*Anthracotherium birmanicus* ?	RM\3	PGN-1-1, (11/12)	PGN1	1998	Myanmar-Japan
NMMP-KU 0082	*Anthracotherium birmanicus* ?	LM\3	PGN-1-1, (11/12)	PGN1	1998	Myanmar-Japan
NMMP-KU 0083	*Anthracotherium birmanicus* ?	LM\3	PGN-1-1, (11/12)	PGN1	1998	Myanmar-Japan
NMMP-KU 0084		teeth frags.		PGN1	1998	Myanmar-Japan
NMMP-KU 0085	*Anthracotherium*	Lm/1?	PGN-1-4, (11/15)	PGN1	1998	Myanmar-Japan
NMMP-KU 0086	*Anthracotherium rubricae*	Lp/4?	PGN-1-4, (11/15)	PGN1	1998	Myanmar-Japan
NMMP-KU 0087	*Anthracotherium rubricae*	Rm/3	PGN-2-1, (11/15)	PGN2	1998	Myanmar-Japan
NMMP-KU 0088	*Anthracotherium* ?	canine?	PGN-2-1, (11/15)	PGN2	1998	Myanmar-Japan
NMMP-KU 0089		teeth frags.		PGN2	1998	Myanmar-Japan
NMMP-KU 0090		teeth frags.	(11/14)	MGGN	1998	Myanmar-Japan
NMMP-KU 0091		Humerus and ulna	PGN1-2, (11/13)	PGN1	1998	Myanmar-Japan
NMMP-KU 0092	fish	bone		PGN1	1998	Myanmar-Japan
NMMP-KU 0093	*Anthracotherium tenuis*	L mand with Lm/3	Lema KC-3, (11/16)	Lma	1998	Myanmar-Japan
NMMP-KU 0094		mand. condyle	Lema KC-4, (11/17)	Lma	1998	Myanmar-Japan
NMMP-KU 0095		teeth frags.		Lma	1998	Myanmar-Japan
NMMP-KU 0096	Brontothere?	incisor?	Lema KC-2, (11/19)	Lma	1998	Myanmar-Japan
NMMP-KU 0097	Brontothere?	incisor?	Lema KC-1, (11/17)	Lma	1998	Myanmar-Japan
NMMP-KU 0098	Brontothere?	incisor?	Lema KC-1, (11/17)	Lma	1998	Myanmar-Japan
NMMP-KU 0099	Brontothere	Upper molariform teeth frag.	Lema KC-1, (11/17)	Lma	1998	Myanmar-Japan

(Continued)

Appendix. 1. (1-4)

NMMP-KU 0100	*Paramynodon birmanicus*	Lm/x'trigonid	Thandaung, (11/18)	Thdn	1998	Myanmar-Japan
NMMP-KU 0101		teeth frag.	Bh-4-1, (11/11)	Bh4	1998	Myanmar-Japan
NMMP-KU 0102	*Anthracotherium*	LM\1 or 2	(11/14)	MGGN	1998	Myanmar-Japan
NMMP-KU 0103	*Anthracotherium pangan*	RP\4	(11/14)	MGGN	1998	Myanmar-Japan
NMMP-KU 0104		teeth & bone frags.	11/13, TMK	Tmk	1998	Myanmar-Japan
NMMP-KU 0105	*Anthracotherium*	RP\4	11/13, TMK	Tmk	1998	Myanmar-Japan
NMMP-KU 0106	*Anthracotherium*	LP\3	11/13, TMK	Tmk	1998	Myanmar-Japan
NMMP-KU 0107	*Anthracotherium tenuis*	Lp/3	11/13, TMK	Tmk	1998	Myanmar-Japan
NMMP-KU 0108	?*Anthracotherium*	canine?	11/13, TMK	Tmk	1998	Myanmar-Japan
NMMP-KU 0109	Brontothere	incisor?	11/13, TMK	Tmk	1998	Myanmar-Japan
NMMP-KU 0110	?	Metatarsal?	Pk-2, (11/9)	Pk2	1998	Myanmar-Japan
NMMP-KU 0111	?	Metacarpal	Pk-2, (11/9)	Pk2	1998	Myanmar-Japan
NMMP-KU 0112		bones	Pk-2, (11/9)	Pk2	1998	Myanmar-Japan
NMMP-KU 0113	*Anthracotherium*	Lp/4	11/10, 2 km from paukkaung	Bahin area	1998	Myanmar-Japan
NMMP-KU 0114		teeth frags.	11/10, 2 km from paukkaung	Bahin area	1998	Myanmar-Japan
NMMP-KU 0115	?Artiodactyla (?Primates)	right femur	Pk-1-3, (11/8)	Pk1	1998	Myanmar-Japan
NMMP-KU 0116	*Anthracotherium*	mand. with teeth	Pk-1-2, (11/8)	Pk1	1998	Myanmar-Japan
NMMP-KU 0117	*Anthracotherium tenuis*	R mand with Rm/3'talonid	Pk-1-2, (11/8)	Pk1	1998	Myanmar-Japan
NMMP-KU 0118	?	incisor	Pk-1-3, (11/8)	Pk1	1998	Myanmar-Japan
NMMP-KU 0119	?	incisor	Pk-1-3, (11/8)	Pk1	1998	Myanmar-Japan
NMMP-KU 0120		teeth & bone frags.	Pk-1-3, (11/8)	Pk1	1998	Myanmar-Japan
NMMP-KU 0121		teeth frags	Pk-2, (11/9)	Pk2	1998	Myanmar-Japan
NMMP-KU 0122	*Anthracotherium*	RP\3,4,M\1	Pk-2-2, (11/9)	Pk2	1998	Myanmar-Japan
NMMP-KU 0123	*Anthracotherium*	LM\x	Pk-2, (11/9)	Pk2	1998	Myanmar-Japan
NMMP-KU 0124		teeth& bone frags.	Pk-4, (11/10)	Pk4	1998	Myanmar-Japan
NMMP-KU 0125	*Anthracotherium*	L mand. with Lp/3-4m/2-3	Pk-5, (11/10)	Pk5	1998	Myanmar-Japan
NMMP-KU 0126		teeth & bone frags.	Pk-5, (11/10)	Pk5	1998	Myanmar-Japan
NMMP-KU 0127	*Anthracotherium*	RM\x	Pk-5, (11/10)	Pk5	1998	Myanmar-Japan
NMMP-KU 0128	*Anthracotherium*	LM\x	Pk-5, (11/10)	Pk5	1998	Myanmar-Japan
NMMP-KU 0129	*Bahinia pondaungensis*	L mand. with i,c,p,m/1'trigonid	Bh-1-	Bh1	1998	Myanmar-Japan
NMMP-KU 0130	?*Anthracotherium*	?incisor	(11/15)	PGN2	1998	Myanmar-Japan
NMMP-KU 0131	small mammal	Rm/3' hyld	(11/15)	PGN2	1998	Myanmar-Japan
NMMP-KU 0132		large bones		Pk2	1998	Myanmar-Japan
NMMP-KU 0133		large bones		Bahin area	1998	Myanmar-Japan

(Continued)

Appendix. 1. (1-5)

NMMP-KU 0134	Rhinocerotoidea indet.	maxilla with teeth roots	Magyigan people	Pangan area	1998	Myanmar-Japan
NMMP-KU 0135		bones		Pk2	1998	Myanmar-Japan
NMMP-KU 0136		two bones	(11/15 PM)	PGN1	1998	Myanmar-Japan
NMMP-KU 0137		bones and teeth frags	(11/12)	PGN1	1998	Myanmar-Japan
NMMP-KU 0138		bones	(11/11 AM)	Bh4	1998	Myanmar-Japan
NMMP-KU 0139		two bones	(11/14)	MGGN	1998	Myanmar-Japan
NMMP-KU 0140		bones	(11/7)	Bh4	1998	Myanmar-Japan
NMMP-KU 0141		large and small bones	(11/9)	Pk2	1998	Myanmar-Japan
NMMP-KU 0142		two large bones	(11/10 AM)	Pk4	1998	Myanmar-Japan
NMMP-KU 0143		bones	(11/7)	Bh1	1998	Myanmar-Japan
NMMP-KU 0144		bones	(11/6 AM)	Bh1	1998	Myanmar-Japan
NMMP-KU 0145		small teeth and bones	(11/11 AM)	Bh4	1998	Myanmar-Japan
NMMP-KU 0146		bones	(11/6 AM)	Bh1	1998	Myanmar-Japan
NMMP-KU 0147		bones and teeth frags.	(11/14 PM)	PGN2	1998	Myanmar-Japan
NMMP-KU 0148	snake? lizard?	vertebrae and bones	(11/12)	PGN1	1998	Myanmar-Japan
NMMP-KU 0149		bones	(11/15 PM)	PGN1	1998	Myanmar-Japan
NMMP-KU 0150		bones	(11/11)	Bh4	1998	Myanmar-Japan
NMMP-KU 0151		three bones		Pk2	1998	Myanmar-Japan
NMMP-KU 0152		bones	(11/13)	Tmk	1998	Myanmar-Japan
NMMP-KU 0153		bones	(11/19 AM)	Lma	1998	Myanmar-Japan
NMMP-KU 0154		bones and teeth frags.	(11/18 AM)	Thdn	1998	Myanmar-Japan
NMMP-KU 0155		bones and teeth frags.	(11/17 PM)	Lma	1998	Myanmar-Japan
NMMP-KU 0156		bones	(11/13 PM)	PGN1	1998	Myanmar-Japan
NMMP-KU 0157		large bones	(11/9)	Pk2	1998	Myanmar-Japan
NMMP-KU 0158	?*Anthracotherium*	?canine	(11/6)	Bh1	1998	Myanmar-Japan
NMMP-KU 0159		bones and teeth frags.	(11/6)	Bh1	1998	Myanmar-Japan
NMMP-KU 0160		bones and teeth frags.	(11/15 AM)	PGN2	1998	Myanmar-Japan
NMMP-KU 0161		bones	(11/7 AM)	Bh4	1998	Myanmar-Japan
NMMP-KU 0162		bones and teeth frags.	(11/10 AM)	Pk4	1998	Myanmar-Japan
NMMP-KU 0163		three bones and a tooth	(11/9)	Pk3	1998	Myanmar-Japan
NMMP-KU 0164		bones		Bh1	1998	Myanmar-Japan
NMMP-KU 0165		four bones and a tooth	(11/11 PM)	Bh3	1998	Myanmar-Japan
NMMP-KU 0166		bones and teeth frags.	(11/7 AM)	Bh3	1998	Myanmar-Japan
NMMP-KU 0167		bones and teeth frags.	(11/8 AM)	Pk1	1998	Myanmar-Japan

(Continued)

Appendix. 1. (1-6)

NMMP-KU 0168		a large bone	(11/17 PM)	Lma	1998	Myanmar-Japan
NMMP-KU 0169		bones		Bahin area	1998	Myanmar-Japan
NMMP-KU 0201	*Indomeryx cotteri*	L mand. with Lm/1-3 (broken)	(11/6)	Lma	1999	Myanmar-Japan
NMMP-KU 0202		teeth frags	(11/6)	Lma	1999	Myanmar-Japan
NMMP-KU 0203		bone frags	(11/6)	Lma	1999	Myanmar-Japan
NMMP-KU 0204	fish	bones & teeth	(11/7)	Thdn	1999	Myanmar-Japan
NMMP-KU 0205	mammal	mand. with teeth roots	(11/7)	Thdn	1999	Myanmar-Japan
NMMP-KU 0206	mammal & reptile	bones	(11/7)	Thdn	1999	Myanmar-Japan
NMMP-KU 0207		bones & teeth frags	(11/7)	Thdn	1999	Myanmar-Japan
NMMP-KU 0208	mammal	bone & teeth frags	(11/8)	Lma	1999	Myanmar-Japan
NMMP-KU 0209		bone & teth frags	(11/8)	Lma	1999	Myanmar-Japan
NMMP-KU 0210	?*Anthracotherium*	astragals	(11/9)	Thdn	1999	Myanmar-Japan
NMMP-KU 0211	mammal	teeth frags	(11/9)	Thdn	1999	Myanmar-Japan
NMMP-KU 0212		bones & teeth frags	(11/9)	Thdn	1999	Myanmar-Japan
NMMP-KU 0213	Phiomyidae gen. *et* sp. nov.	L mand. with Lm/1-3	(11/13)	Bh1	1999	Myanmar-Japan
NMMP-KU 0214	Hyaenodontidae gen. *et* sp. nov.	lower teeh frags	(11/13)	Bh1	1999	Myanmar-Japan
NMMP-KU 0215	*Anthracotherium*	RP\3	(11/13)	Bh1	1999	Myanmar-Japan
NMMP-KU 0216	*Anthracotherium*	RM\2-3	(11/13)	Bh1	1999	Myanmar-Japan
NMMP-KU 0217		bones & teeth frags	(11/13)	Bh1	1999	Myanmar-Japan
NMMP-KU 0218	?? *Metatelmatherium ? lahirii*	Lp/1?	(11/13)	Bh5	1999	Myanmar-Japan
NMMP-KU 0219		bone frags	(11/13)	Bh5	1999	Myanmar-Japan
NMMP-KU 0220		bone frags (large)	(11/13)	Bh4	1999	Myanmar-Japan
NMMP-KU 0221		bone frags	(11/13)	Bh2	1999	Myanmar-Japan
NMMP-KU 0222	*Indomeryx arenae*	R mand. with Rm/2-3	(11/14)	Pk1	1999	Myanmar-Japan
NMMP-KU 0223		bone frags	(11/14)	Pk1	1999	Myanmar-Japan
NMMP-KU 0224		teeth frags	(11/14)	Pk1	1999	Myanmar-Japan
NMMP-KU 0225	?*Paramynodon birmanicus*	upper teeth	(11/14)	Pk6	1999	Myanmar-Japan
NMMP-KU 0226		teeth and bone frags	(11/14)	Pk6	1999	Myanmar-Japan
NMMP-KU 0227		teeth and bone frags	(11/14)	Pk7	1999	Myanmar-Japan
NMMP-KU 0228	*Amphipithecus mogaungensis*	RP\4M\1-3	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0229	*Amphipithecus mogaungensis*	part of skull	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0230	small mammal	incisor? canine?	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0231	Phiomyidae gen. *et* sp. nov	R mand with Rm/1-3	(11/15)	Pk2	1999	Myanmar-Japan

(Continued)

Appendix. 1. (1-7)

NMMP-KU 0232	?brontothere or amynodontid	incisor	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0233	*?Paramynodon birmanicus*	P\x	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0234	*Anthracotherium*	canine	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0235	*?Praramynodon cotteri*	canine?	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0236	mammal	tooth	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0237	mammal	teeth	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0238	fish & crocodile	teeth	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0239	mammal	R mand. frag.	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0240	*?Indolophus guptai*	lower teeth frags	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0241	mammal	mand. frag	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0242	mammal	bones	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0243		bones from same point	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0244		bones	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0245		bones from U shige point	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0246		useful bones from U shige point	(11/15)	Pk2	1999	Myanmar-Japan
NMMP-KU 0247	large mammal	mand. frag	(11/16)	Pk3	1999	Myanmar-Japan
NMMP-KU 0248	*Anthracotherium*	L mand. with Lm/1	(11/16)	Pk3	1999	Myanmar-Japan
NMMP-KU 0249	mammal	incisor	(11/16)	Pk3	1999	Myanmar-Japan
NMMP-KU 0250		bones & teeth frags	(11/16)	Pk3	1999	Myanmar-Japan
NMMP-KU 0251	*Anthracotherium*	Rm/1	(11/16)	Pk2	1999	Myanmar-Japan
NMMP-KU 0252	?smaller amynodont	LP\2?	(11/16)	Pk2	1999	Myanmar-Japan
NMMP-KU 0253		bones & teeth frags	(11/16)	Pk2	1999	Myanmar-Japan
NMMP-KU 0254		large bones	(11/16)	Pk2	1999	Myanmar-Japan
NMMP-KU 0255	mammal	teeth frags.	(11/16)	Pk2	1999	Myanmar-Japan
NMMP-KU 0256	Creodonta	metatarsal	(11/17)	Pk2	1999	Myanmar-Japan
NMMP-KU 0257		bone frags	(11/17)	Pk2	1999	Myanmar-Japan
NMMP-KU 0258		large bones	(11/17)	Pk2	1999	Myanmar-Japan
NMMP-KU 0259		bone frags	(11/17)	Pk2	1999	Myanmar-Japan
NMMP-KU 0260		bones & teeth frags	(11/17)	Pk2	1999	Myanmar-Japan
NMMP-KU 0261	*"Pterodon " dahkoensis*	R mand with Rp/2-4m/1' talonid	(11/17)	near Thadut, Bahin area	1999	Myanmar-Japan
NMMP-KU 0262	*"Pterodon " dahkoensis*	trigonids of Rm/1 and 2	(11/17)	near Thadut, Bahin area	1999	Myanmar-Japan
NMMP-KU 0263	*Anthracotherium*	L mand. with Lm/3	(11/17)	near Thadut, Bahin area	1999	Myanmar-Japan
NMMP-KU 0264	Artiodactyla gen. et sp. nov.	L mand. with Lm/2-3	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0265	*Indolophus guptai*	LM\3	(11/19)	Mta	1999	Myanmar-Japan

(Continued)

Appendix. 1. (1-8)

NMMP-KU 0266	*Indomeryx cotteri*	R mand. with Rm/1-2	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0267	*Anthracotherium tenuis*	L mand. with Lm/1-2	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0268	*Indomeryx coterri*	L mand. with Lm/3'talonid	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0269	*Anthracotherium*	Rm/1 or 2	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0270	*Anthracotherium*	LM\x (broken)	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0271	*Anthracotherium*	LM\x	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0272	*Paramynodon birmanicus*	LM\3	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0273	?*Indomeryx cotteri*	astragals	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0274	Anthracotherium	R mand. with Rp/3,4, m/1	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0275	*Anthracotherium pangan*	RM\3	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0276	mammal	teeth frags	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0277	Perissodactyla	astragals	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0278		bone & teeth frags	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0279		large bones	(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0280	gastropods		(11/19)	Mta	1999	Myanmar-Japan
NMMP-KU 0281	Amynodontidae indet.	RM\3	(11/19)	PGN1	1999	Myanmar-Japan
NMMP-KU 0282	? *Metatelmatherium* ? *lahirii*	Rp/2?	(11/19)	PGN1	1999	Myanmar-Japan
NMMP-KU 0283		tooth & bone	(11/19)	PGN1	1999	Myanmar-Japan
NMMP-KU 0284	*Anthracotherium*	RM\3	(11/20)	PGN2	1999	Myanmar-Japan
NMMP-KU 0285	amynodont	incisor	(11/20)	PGN2	1999	Myanmar-Japan
NMMP-KU 0286		bones & teeth frags	(11/20)	PGN2	1999	Myanmar-Japan
NMMP-KU 0287	*Anthracotherium*	LM\x	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0288	cf. *Ilianodon lunanensis*	RM\3	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0289	*Indomeryx cotteri*	R mand. with Rm/3	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0290	*Indomeryx cotteri*	L mand. with Lm/x,x+1	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0291	large mammal	incisor	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0292	*Paramynodon birmanicus*	Lp/3	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0293	mammal	teeth frags	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0294		bones & teeth frags	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0295	?*Paramynodon* (large mammal)	large bones & teeth	(11/21)	Mta	1999	Myanmar-Japan
NMMP-KU 0296	*Bunobrontops savagei*	half of M\x	(11/8)	Lma	1999	Myanmar-Japan
NMMP-KU 0297		bones	(11/17-21)	Pk2	1999	Myanmar-Japan
NMMP-KU 0298	mammal	incisor	(11/19 or 21)	Mta	1999	Myanmar-Japan
NMMP-KU 0299	mammal	teeth frags	(11/19 or 21)	Mta	1999	Myanmar-Japan

(Continued)

Appendix. 1. (1-9)

NMMP-KU 0301	Hyaenodontidae gen. *et* sp. nov.	Lc/1	Kdw-3	Kdw	1997	Myanmar
NMMP-KU 0302	Hyaenodontidae gen. *et* sp. nov.	Rc/1	Kdw-5	Kdw	1997	Myanmar
NMMP-KU 0303	carnivorous mammal	part of L mand.	Tudw-1	Tudw	1997	Myanmar
NMMP-KU 0304	*"Pterodon " dahkoensis*	L max. with M\1	mgg-1	Mogaun area	1997	Myanmar
NMMP-KU 0305	*Paramynodon birmanicus*	L max. with dP\4M\1 (or dP\3-4?)	Bhn-165	Bahin area	1997	Myanmar
NMMP-KU 0306	*Anthracotherium*	Rp/3 or 2?		?	1997	Myanmar
NMMP-KU 0307	*Anthracotherium*	Lp/4		?	1997	Myanmar
NMMP-KU 0308	*?Anthracotherium*	incisor? canine?		?	1997	Myanmar
NMMP-KU 0309	*?Sivatitanops*	RM\x frag.		?	1997	Myanmar
NMMP-KU 0310	*?Paramynodon birmanicus*	Rm/x' trigonid		?	1997	Myanmar
NMMP-KU 0311	*Metatelmatherium ? lahirii*	L mand. with Lm/1-3	Bhn-1120	Bahin area	1997	Myanmar
NMMP-KU 0312	*Bunobrontops savagei*	LM\3	Bhn-67	Bahin area	1997	Myanmar
NMMP-KU 0313	*Bunobrontops savagei*	RM\1?	Bhn-1080	Bahin area	1997	Myanmar
NMMP-KU 0314	*Paramynodon birmanicus*	RM\3	Bhn-142	Bahin area	1997	Myanmar
NMMP-KU 0315	*Paramynodon birmanicus*	R mand. with Rp/3m/1-3	Bhn-158	Bahin area	1997	Myanmar
NMMP-KU 0316	*Paramynodon birmanicus*	RM\2	Bhn-1091	Bahin area	1997	Myanmar
NMMP-KU 0317	*Paramynodon birmanicus*	R max. with RM\2-3	mgg-24	Mogaung area	1997	Myanmar
NMMP-KU 0318	*Paramynodon birmanicus*	L mand. with Lm/3	mgg-202	Mogaung area	1997	Myanmar
NMMP-KU 0319	*Bunobrontops savagei*	LM\2? or 1?	Kdn-1	Kdn	1997	Myanmar
NMMP-KU 0320	Brontothere	LP\4?	Bhn-140	Bahin area	1997	Myanmar
NMMP-KU 0321	*? Metatelmatherium ? lahirii*	Rp/3?	Bhn-72	Bahin area	1997	Myanmar
NMMP-KU 0322	*? Metatelmatherium ? lahirii*	Rp/4?	Bhn-108	Bahin area	1997	Myanmar
NMMP-KU 0323	*? Metatelmatherium ? lahirii*	Lp/4?	Bhn-136	Bahin area	1997	Myanmar
NMMP-KU 0324	*?Svatitanops*	Rp/4?	Czn-1	near Chaungzongyi	1997	Myanmar
NMMP-KU 0325	*Anthracotherium tenuis*	R max. with RdP\3-4M\1-2	Bhn-19	Bahin area	1997	Myanmar
NMMP-KU 0326	*Anthracotherium*	R max. with RM\3 or 2	Bhn-24	Bahin area	1997	Myanmar
NMMP-KU 0327	*Anthracotherium*	R max. with RdP\4	Bhn-53	Bahin area	1997	Myanmar
NMMP-KU 0328	*Anthracotherium*	RM\3	mgg-23	Mogaung area	1997	Myanmar
NMMP-KU 0329	*Anthracotherium*	L max. with LM\1-3	Tmk-18	Tmk	1997	Myanmar
NMMP-KU 0330	*Anthracotherium*	L mand. with Lm/2-3	Bhn-56	Bahin area	1997	Myanmar
NMMP-KU 0331	*Anthracotherium*	R mand. with Rm/2	mgg-20	Mogaung area	1997	Myanmar
NMMP-KU 0332	*Anthracotherium*	R mand. with Rm/3	Tudw-30	Tudw	1997	Myanmar
NMMP-KU 0333	*Bunobrontops savagei*	Lm/1 or 2 frag.	Kdw-136	Kdw	1997	Myanmar

(Continued)

Appendix. 1. (1-10)

NMMP-KU 0334	?*Svatitanops*	Rm/3 frag.	Bhn-1114	Bahin area	1997	Myanmar
NMMP-KU 0335	? *Metatelmatherium* ? *lahirii*	L mand. with m/x' talonid	Bhn-1087	Bahin area	1997	Myanmar
NMMP-KU 0336	Brontothere	R mand. with c/1, roots of p/1-3?	mgg-19	Mogaung area	1997	Myanmar
NMMP-KU 0337	Brontothere	M\x farg.	mta-1	Mta	1997	Myanmar
NMMP-KU 0338	Brontothere	M\x farg.	Tmk-32	Tmk	1997	Myanmar
NMMP-KU 0339	?*Svatitanops*	RP\4 or 3 frag.	Sze-5	Sze	1997	Myanmar
NMMP-KU 0340	? *Metatelmatherium* ? *lahirii*	RP\3?	Bhn-1061	Bahin area	1997	Myanmar
NMMP-KU 0341	Brontothere	Rm/x (1?)' trigonid	Bhn-1068	Bahin area	1997	Myanmar
NMMP-KU 0342	? *Metatelmatherium* ? *lahirii*	m/x' trigonid or talonid	Bhn-1070	Bahin area	1997	Myanmar
NMMP-KU 0343	Brontothere	RP\4? frag.	Bhn-170	Bahin area	1997	Myanmar
NMMP-KU 0344	Brontothere	canine	Bhn-1089	Bahin area	1997	Myanmar
NMMP-KU 0345	?*Paramynodon birmanicus*	Lower canine	Bhn-1078	Bahin area	1997	Myanmar
NMMP-KU 0346	?brontothere ?amynodont	incisor	Bhn-1076	Bahin area	1997	Myanmar
NMMP-KU 0347	?brontothere ?amynodont	incisor	mgg-46	Mogaung area	1997	Myanmar
NMMP-KU 0348	amynodont	incisor	Bhn-89	Bahin area	1997	Myanmar
NMMP-KU 0349	amynodont	incisor	Bhn-1086	Bahin area	1997	Myanmar
NMMP-KU 0350	amynodont	incisor	Bhn-1077	Bahin area	1997	Myanmar
NMMP-KU 0351	amynodont	incisor	Tudw-176	Tudw	1997	Myanmar
NMMP-KU 0352	amynodont	incisor	Tmk-28	Tmk	1997	Myanmar
NMMP-KU 0353	amynodont	incisor	mgg-36	Mogaung area	1997	Myanmar
NMMP-KU 0354	amynodont	incisor	Bhn-1058	Bahin area	1997	Myanmar
NMMP-KU 0355	amynodont	incisor	Wka-2	Wka	1997	Myanmar
NMMP-KU 0356	?brontothere ?amynodont	incisor	Bhn-1059	Bahin area	1997	Myanmar
NMMP-KU 0357	amynodont	incisor	Wka-3	Wka	1997	Myanmar
NMMP-KU 0358	?brontothere	incisor??	mgg-35	Mogaung area	1997	Myanmar
NMMP-KU 0359	?brontothere ?amynodont	incisor	Bhn-1066	Bahin area	1997	Myanmar
NMMP-KU 0360	amynodont	canine	Kdw-189	Kdw	1997	Myanmar
NMMP-KU 0361	amynodont	canine	Bhn-1079	Bahin area	1997	Myanmar
NMMP-KU 0362	?brontothere ?amynodont	canine	Bhn-1090	Bahin area	1997	Myanmar
NMMP-KU 0363	?brontothere ?amynodont	tooth root	Bhn-1083	Bahin area	1997	Myanmar
NMMP-KU 0364	?brontothere ?amynodont	tooth root	mgg-239	Mogaung area	1997	Myanmar
NMMP-KU 0365	*Paramynodon birmanicus*	RM\x (1?) frag.	Wka-5	Wka	1997	Myanmar
NMMP-KU 0366	*Paramynodon birmanicus*	?LM\2' protocone	Tmk-1	Tmk	1997	Myanmar
NMMP-KU 0367	?Rhinocerotoidea	M\x frag.	Tudw-55	Tudw	1997	Myanmar

(Continued)

Appendix. 1. (1-11)

NMMP-KU 0368	?*Paramynodon birmanicus*	M\1?	Bhn-1082	Bahin area	1997	Myanmar
NMMP-KU 0369	*Paramynodon birmanicus*	m/1	Bhn-1085	Bahin area	1997	Myanmar
NMMP-KU 0370	brontothere	RI\3	Bhn-1118	Bahin area	1997	Myanmar
NMMP-KU 0371	mammal	?RM\x' hypocone	Kdw-17	Kdw	1997	Myanmar
NMMP-KU 0372	*Paramynodon birmanicus*	Lm/2	Bhn-1119	Bahin area	1997	Myanmar
NMMP-KU 0373	*Paramynodon birmanicus*	L mand. with Lm/1-2	Bhn-1093	Bahin area	1997	Myanmar
NMMP-KU 0374	*Paramynodon birmanicus*	R mand. with Rdp/3-4m/1	Bhn-1117	Bahin area	1997	Myanmar
NMMP-KU 0375	?	?	Bhn-155	Bahin area	1997	Myanmar
NMMP-KU 0376	*Paramynodon birmanicus*	R mand. with Rdp/3-4	Tudw-56	Tudw	1997	Myanmar
NMMP-KU 0377	*Paramynodon birmanicus*	RM\3	Bhn-1092	Bahin area	1997	Myanmar
NMMP-KU 0378	*Paramynodon birmanicus*	R mand. with Rm/2	Bhn-1088	Bahin area	1997	Myanmar
NMMP-KU 0379	*Anthracotherium*	LM\3?	Bhn-22	Bahin area	1997	Myanmar
NMMP-KU 0380	*Anthracotherium*	L max. with LM\1 (or LdP\4?)	Bhn-26	Bahin area	1997	Myanmar
NMMP-KU 0381	*Anthracotherium*	?canine	Bhn-897	Bahin area	1997	Myanmar
NMMP-KU 0382	*Anthracotherium*	L max. with LM\2-3 (or 1-2?)	Bhn-28	Bahin area	1997	Myanmar
NMMP-KU 0383	*Anthracotherium*	R mand. with Rm/1 (or 2?)	Bhn-15	Bahin area	1997	Myanmar
NMMP-KU 0384	*Anthracotherium*	RM\1 or 2	Kdw-12	Kdw	1997	Myanmar
NMMP-KU 0385	*Anthracotherium*	R max. with RM\1 (or RdP\4?)	Bhn-21	Bahin area	1997	Myanmar
NMMP-KU 0386	*Anthracotherium*	R mand. with Rm/3 (lacking hyld)	Bhn-18	Bahin area	1997	Myanmar
NMMP-KU 0387	*Anthracotherium*	RdP\4? or RM\1?	Kdw-10	Kdw	1997	Myanmar
NMMP-KU 0388	*Anthracotherium*	L max. with LdP\4? or LM\1?	Kdw-9	Kdw	1997	Myanmar
NMMP-KU 0389	*Anthracotherium*	L max. with RdP\4M\1, unerupted M\2	Bhn-17	Bahin area	1997	Myanmar
NMMP-KU 0390	*Anthracotherium*	L mand. with Lm/1 (or m/2?)	Bhn-12	Bahin area	1997	Myanmar
NMMP-KU 0391	*Anthracotherium*	L mand. with Lm/1 frag.	Bhn-37	Bahin area	1997	Myanmar
NMMP-KU 0392	*Anthracotherium*	LM\x frag. (buccal part)	Kdw-11	Kdw	1997	Myanmar
NMMP-KU 0393	*Anthracotherium*	R mand. with Rm/1 or 2 farg.	mgg-15	Mogaung area	1997	Myanmar
NMMP-KU 0394	*Anthracotherium*	Rm/2 (or 1)	mgg-16	Mogaung area	1997	Myanmar
NMMP-KU 0395	*Anthracotherium*	Lm/2 (or 1)	Bhn-30	Bahin area	1997	Myanmar
NMMP-KU 0396	*Anthracotherium*	LM\1 or 2	Bhn-76	Bahin area	1997	Myanmar
NMMP-KU 0397	*Anthracotherium*	Rm/2 or 1	Bhn-29	Bahin area	1997	Myanmar
NMMP-KU 0398	*Anthracotherium*	Rm/1 or 2	Bhn-57	Bahin area	1997	Myanmar
NMMP-KU 0399	*Anthracotherium*	R mand. with Rm/3	Kdw-8	Kdw	1997	Myanmar
NMMP-KU 0400	?*Anthracotherium*	?RP\3	(no number)	?	1997	Myanmar
NMMP-KU 0401	*Anthracotherium*	RM\3?	mgg-240	Mogaung area	1997	Myanmar

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Appendix. 1. (1-12)

NMMP-KU 0402	*Anthracotherium*	L max. with LM\1 or 2	Tudw-179	Tudw	1997	Myanmar
NMMP-KU 0403	*Anthracotherium*	RM\3	Bhn-70	Bahin area	1997	Myanmar
NMMP-KU 0404	*Anthracotherium*	RM\3	mgg-22	Mogaung area	1997	Myanmar
NMMP-KU 0405	*Anthracotherium*	LM\1 or 2	Tudw-47	Tudw	1997	Myanmar
NMMP-KU 0406	*Anthracotherium*	RM\3?	Pgn-6	Pangan area	1997	Myanmar
NMMP-KU 0407	*Anthracotherium*	RM\3	Tudw-46	Tudw	1997	Myanmar
NMMP-KU 0408	*Anthracotherium*	LM\1 or 2	Pgn-153	Pangan area	1997	Myanmar
NMMP-KU 0409	*Anthracotherium*	RM\3	Bhn-68	Bahin area	1997	Myanmar
NMMP-KU 0410	*Anthracotherium*	L max. with LM\2-3	Bhn-895	Bahin area	1997	Myanmar
NMMP-KU 0411	*Anthracotherium*	L max. with LM\3	Pgn-7	Pangan area	1997	Myanmar
NMMP-KU 0412	*Anthracotherium*	R max. with RM\2-3	Tudw-45	Tudw	1997	Myanmar
NMMP-KU 0413	*Anthracotherium*	R max. with RP\4M\1-2	Bhn-62	Bahin area	1997	Myanmar
NMMP-KU 0414	*Anthracotherium*	L max. with LdP\4M\1-2 and unerupted P\4?	Tudw-42	Tudw	1997	Myanmar
NMMP-KU 0415	*Anthracotherium*	Rm/3	Pgn-4	Pangan area	1997	Myanmar
NMMP-KU 0416	*Anthracotherium*	L mand. with Lm/2-3	Bhn-51	Bahin area	1997	Myanmar
NMMP-KU 0417	*Anthracotherium*	Rm/3	Tudw-28	Tudw	1997	Myanmar
NMMP-KU 0418	*Anthracotherium*	Lm/2	Tmk-10	Tmk	1997	Myanmar
NMMP-KU 0419	*Anthracotherium*	L mand. with talonid of Lm/3	Wka-1	Wka	1997	Myanmar
NMMP-KU 0420	*Anthracotherium*	Rm/1 or 2	Tudw-31	Tudw	1997	Myanmar
NMMP-KU 0421	*Anthracotherium*	R mand. with Rm/1	Bhn-39	Bahin area	1997	Myanmar
NMMP-KU 0422	*Anthracotherium*	R mand. with Rm/2-3	Bhn-42	Bahin area	1997	Myanmar
NMMP-KU 0423	*Anthracotherium*	R mand. with Rm/2' talonid and m/3	Bhn-35+36	Bahin area	1997	Myanmar
NMMP-KU 0424	*Anthracotherium*	R mand. with Rm/3	Bhn-64	Bahin area	1997	Myanmar
NMMP-KU 0425	*Anthracotherium*	L mand. with Lm/3 lacking hyld	Tudw-16+35	Tudw	1997	Myanmar
NMMP-KU 0426	*Anthracotherium*	R mand. with Rm/2-3	Tmk-24	Tmk	1997	Myanmar
NMMP-KU 0427	*Anthracotherium*	R mand. with Rm/3	mgg-204	Mogaung area	1997	Myanmar
NMMP-KU 0428	*Anthracotherium*	L mand. with Rm/2-3	Tudw-44	Tudw	1997	Myanmar
NMMP-KU 0429	*Anthracotherium*	R mand. with Rm/2-3	Bhn-1057	Bahin area	1997	Myanmar
NMMP-KU 0430	*Anthracotherium*	R mand. with Rp/3-4	Bhn-54+58	Bahin area	1997	Myanmar
NMMP-KU 0431	*Anthracotherium*	Rm/1 or 2	Sze-1	Sze	1997	Myanmar
NMMP-KU 0432	*Anthracotherium*	R mand. with Rp/4	Bhn-59	Bahin area	1997	Myanmar
NMMP-KU 0433	*Anthracotherium*	Lp/4 (or 3?)	Tmk-8	Tmk	1997	Myanmar
NMMP-KU 0434	*Anthracotherium*	Lp/4	Bhn-96	Bahin area	1997	Myanmar
NMMP-KU 0435	*Anthracotherium*	R mand. with Rp/4	Tudw-12	Tudw	1997	Myanmar

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Appendix. 1. (1-13)

NMMP-KU 0436	*Anthracotherium*	Lp/2 or 3	Bhn-1046	Bahin area	1997	Myanmar
NMMP-KU 0437	*Anthracotherium*	Rp/2 or 3	Bhn-1049	Bahin area	1997	Myanmar
NMMP-KU 0438	*Anthracotherium*	Rp/2 or 3	Tudw-23	Tudw	1997	Myanmar
NMMP-KU 0439	?brontothere	L mand with root of Lc/1	Kdw-135	Kdw	1997	Myanmar
NMMP-KU 0440	*Anthracotherium*	canine	Tmk-4	Tmk	1997	Myanmar
NMMP-KU 0441	*Anthracotherium*	canine	Pgn-24	Pangan area	1997	Myanmar
NMMP-KU 0442	*Anthracotherium*	canine	Tmk-58	Tmk	1997	Myanmar
NMMP-KU 0443	?anthracothere ?brontothere	?canine ?incisor	Kdw-131	Kdw	1997	Myanmar
NMMP-KU 0444	*Anthracotherium*	incisor	Kdw-127	Kdw	1997	Myanmar
NMMP-KU 0445	*Anthracotherium*	?canine	Pgn-150	Pangan area	1997	Myanmar
NMMP-KU 0446	amynodont	incisor	Kdw-22	Kdw	1997	Myanmar
NMMP-KU 0447	?brontothere ?amynodont	?incisor (Ri/2??)	mgg-39	Mogaung area	1997	Myanmar
NMMP-KU 0448	*Sivatitanops cotteri* ?	LM\x' trigonid	Bhn-117	Bahin area	1997	Myanmar
NMMP-KU 0449	amynodont	incisor	Bhn-87	Bahin area	1997	Myanmar
NMMP-KU 0450	*Anthracotherium*	L mand. with Lp/1	Bhn-13	Bahin area	1997	Myanmar
NMMP-KU 0451	*Anthracotherium*	R mand. with Rp/1	Bhn-14	Bahin area	1997	Myanmar
NMMP-KU 0452	*Anthracotherium*	LM\3?	Tmk-15	Tmk	1997	Myanmar
NMMP-KU 0453	*Anthracotherium*	RM\3	Tmk-9	Tmk	1997	Myanmar
NMMP-KU 0454	*Anthracotherium*	LM\3	Tmk-6	Tmk	1997	Myanmar
NMMP-KU 0455	*Anthracotherium*	R max. with RP\3-4	Bhn-23	Bahin area	1997	Myanmar
NMMP-KU 0456	*Anthracotherium*	Lm/3' talonid	Tmk-19	Tmk	1997	Myanmar
NMMP-KU 0457	*Anthracotherium*	Lm/3	Tudw-37	Tudw	1997	Myanmar
NMMP-KU 0458	*Anthracotherium*	L mand. with Lm/1-3	mgg-17	Mogaung area	1997	Myanmar
NMMP-KU 0459	*Anthracotherium*	L max. with LM\3?	Kdw-15	Kdw	1997	Myanmar
NMMP-KU 0460	*Anthracotherium*	RM\1 or 2	Bhn-69	Bahin area	1997	Myanmar
NMMP-KU 0461	*Anthracotherium*	L mand. with Lm/3' talonid	Bhn-66	Bahin area	1997	Myanmar
NMMP-KU 0462	*Anthracotherium*	R mand. with Rm/3' talonid	Bhn-79(A)	Bahin area	1997	Myanmar
NMMP-KU 0463	*Anthracotherium*	L max. with LM\3	Bhn-63	Bahin area	1997	Myanmar
NMMP-KU 0464	*Anthracotherium*	R mand. with Rm/3' talonid	Bhn-1055	Bahin area	1997	Myanmar
NMMP-KU 0465	*Anthracotherium*	L mand. with Lm/3	Tudw-26	Tudw	1997	Myanmar
NMMP-KU 0466	*Anthracotherium*	R mand. with Rm/1-2	Kdw-7	Kdw	1997	Myanmar
NMMP-KU 0467	*Anthracotherium*	L mand. with Lm/1 or 2	Bhn-34	Bahin area	1997	Myanmar
NMMP-KU 0468	*Anthracotherium*	L mand. with Lp/4m/1	Bhn-1053	Bahin area	1997	Myanmar
NMMP-KU 0469	*Anthracotherium*	Lm/1 or 2	Pgn-3	Pangan area	1997	Myanmar

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Appendix. 1. (1-14)

NMMP-KU 0470	*Anthracotherium*	R mand. with Rm/2-3	Bhn-1056	Bahin area	1997	Myanmar
NMMP-KU 0471	*Anthracotherium*	R mand. with Rm/1 or 2	Bhn-44	Bahin area	1997	Myanmar
NMMP-KU 0472	*Anthracotherium*	Rm/1 or 2	Bhn-77	Bahin area	1997	Myanmar
NMMP-KU 0473	*Anthracotherium*	Rm/1 or 2	Bhn-25	Bahin area	1997	Myanmar
NMMP-KU 0474	*Anthracotherium*	Rm/1 or 2	Tmk-5	Tmk	1997	Myanmar
NMMP-KU 0475	*Anthracotherium*	Rm/3	Tmk-11	Tmk	1997	Myanmar
NMMP-KU 0476	*Anthracotherium*	RP\4	Bhn-74	Bahin area	1997	Myanmar
NMMP-KU 0477	*Anthracotherium*	L mand. with Lm/2' talonid, m/3	Bhn-52	Bahin area	1997	Myanmar
NMMP-KU 0478	*Anthracotherium*	R mand. with Rm/1-2	mgg-13	Mogaung area	1997	Myanmar
NMMP-KU 0479	*Anthracotherium*	R mand. with Rp/4m/1 (or p/3dp/4?)	Bhn-45	Bahin area	1997	Myanmar
NMMP-KU 0480	*Anthracotherium*	RP\4	Tudw-20	Tudw	1997	Myanmar
NMMP-KU 0481	*Anthracotherium*	RM\3	Bhn-1052	Bahin area	1997	Myanmar
NMMP-KU 0482	*Anthracotherium*	LM\1 or 2	Bhn-79(B)	Bahin area	1997	Myanmar
NMMP-KU 0483	*Anthracotherium*	RM\x	Bhn-905	Bahin area	1997	Myanmar
NMMP-KU 0484	?*Anthracotherium*	?canine	Bhn-84	Bahin area	1997	Myanmar
NMMP-KU 0485	*Anthracotherium*	Lm/1 or 2	Tmk-13	Tmk	1997	Myanmar
NMMP-KU 0486	*Anthracotherium*	LM\1 or 2 (or dP\4?)	Tudw-25	Tudw	1997	Myanmar
NMMP-KU 0487	*Anthracotherium*	Lm/x' trigonid	Tudw-9	Tudw	1997	Myanmar
NMMP-KU 0488	*Anthracotherium*	Lm/x' trigonid	Bhn-899	Bahin area	1997	Myanmar
NMMP-KU 0489	*Anthracotherium*	RP\4	Tudw-34	Tudw	1997	Myanmar
NMMP-KU 0490	*Anthracotherium*	Lm/3' talonid	Bhn-71	Bahin area	1997	Myanmar
NMMP-KU 0491	*Anthracotherium*	L mand. with Lm/1 or 2	Bhn-167	Bahin area	1997	Myanmar
NMMP-KU 0492	*Anthracotherium*	LM\1 or 2	Tudw-48	Tudw	1997	Myanmar
NMMP-KU 0493	*Anthracotherium*	R mand. with Rm/1 or 2	Bhn-79(C)	Bahin area	1997	Myanmar
NMMP-KU 0494	*Anthracotherium*	RM\1 or 2	Pgn-5	Pangan area	1997	Myanmar
NMMP-KU 0495	*Anthracotherium*	LM\3	Bhn-79(D)	Bahin area	1997	Myanmar
NMMP-KU 0496	*Anthracotherium*	Rm/1 or 2	Tmk-14	Tmk	1997	Myanmar
NMMP-KU 0497	*Anthracotherium*	Lm/x' trigonid	Tudw-8	Tudw	1997	Myanmar
NMMP-KU 0498	*Anthracotherium*	talonid of Rm/1 or 2	Tudw-18	Tudw	1997	Myanmar
NMMP-KU 0499	*Anthracotherium*	Rm/ 1 or 2	Tmk-23	Tmk	1997	Myanmar
NMMP-KU 0500	*Anthracotherium*	L max. with LP\3-4	Tmk-12	Tmk	1997	Myanmar
NMMP-KU 0501	?*Anthracotherium*	?canine	Bhn-86	Bahin area	1997	Myanmar
NMMP-KU 0502	?*Anthracotherium*	?canine	Tudw-41	Tudw	1997	Myanmar
NMMP-KU 0503	*Anthracotherium*	LM\x	Bhn-901	Bahin area	1997	Myanmar

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Appendix. 1. (1-15)

NMMP-KU 0504	*Anthracotherium*	Rm/3	Bhn-706	Bahin area	1997	Myanmar
NMMP-KU 0505	*Anthracotherium*	Lp/4	Bhn-896	Bahin area	1997	Myanmar
NMMP-KU 0506	*Anthracotherium*	L mand. with Lm/3' talonid	Bhn-65	Bahin area	1997	Myanmar
NMMP-KU 0507	*Anthracotherium*	LP\3	Bhn-134(C)	Bahin area	1997	Myanmar
NMMP-KU 0508	*Anthracotherium*	Lp/1?	Bhn-97	Bahin area	1997	Myanmar
NMMP-KU 0509	Amynodontidae indet.	R mand. with Rm/3	Pgn-13	Pangan area	1997	Myanmar
NMMP-KU 0510	*Sivatitanops cotteri* ?	Lm/3	Bhn-171	Bahin area	1997	Myanmar
NMMP-KU 0511	Amynodontidae indet.	LM\1	Pgn-16	Pangan area	1997	Myanmar
NMMP-KU 0512	?*Paramynodon birmanicus*	Lm/2? (or 1?)	mgg-33	Mogaung area	1997	Myanmar
NMMP-KU 0513	?*Paramynodon birmanicus*	R mand. with Rm/3	Bhn-148	Bahin area	1997	Myanmar
NMMP-KU 0514	?*Paramynodon birmanicus*	RP\4	Kdw-19	Kdw	1997	Myanmar
NMMP-KU 0515	Amynodontidae indet.	LM\2-3	Pgn-15+19	Pangan area	1997	Myanmar
NMMP-KU 0516	*Sivatitanops cotteri* ?	Lm/2	Bhn-129	Bahin area	1997	Myanmar
NMMP-KU 0517	?*Paramynodon cotteri*	Rp/4	Bhn-107	Bahin area	1997	Myanmar
NMMP-KU 0518	?*Paramynodon cotteri*	Rp/4	Bhn-157	Bahin area	1997	Myanmar
NMMP-KU 0519	?*Paramynodon cotteri*	Lm/1? (or 2?)	Bhn-121	Bahin area	1997	Myanmar
NMMP-KU 0520	brontothere	Rm/x' trigonid	mgg-32	Mogaung area	1997	Myanmar
NMMP-KU 0521	Amynodontidae indet.	R max. with RM\2 (and frag. of 1)	Pgn-14	Pangan area	1997	Myanmar
NMMP-KU 0522	?*Paramynodon birmanicus*	R mand. with R/m1? (or 2?)	Tudw-49	Tudw	1997	Myanmar
NMMP-KU 0523	?*Paramynodon birmanicus*	RP\3? or 2?	Bhn-75	Bahin area	1997	Myanmar
NMMP-KU 0524	*Paramynodon birmanicus*	Rm/2? (or 1?)	Bhn-149	Bahin area	1997	Myanmar
NMMP-KU 0525	*Paramynodon birmanicus*	Rm/3	Bhn-150	Bahin area	1997	Myanmar
NMMP-KU 0526	*Paramynodon birmanicus*	Lm/2?' talonid	Bhn-151	Bahin area	1997	Myanmar
NMMP-KU 0527	*Paramynodon birmanicus*	Lm/2?' trigonid	Bhn-152	Bahin area	1997	Myanmar
NMMP-KU 0528	*Paramynodon birmanicus*	L/m3?' trigonid	Bhn-153	Bahin area	1997	Myanmar
NMMP-KU 0529	*Paramynodon birmanicus*	L/m3?' talonid	Bhn-154	Bahin area	1997	Myanmar
NMMP-KU 0530	?*Paramynodon birmanicus*	RM\3?	mgg-25	Mogaung area	1997	Myanmar
NMMP-KU 0531	brontothere	Lm/x' trigonid	Bhn-111	Bahin area	1997	Myanmar
NMMP-KU 0532	brontothere	LP\4	Bhn-93	Bahin area	1997	Myanmar
NMMP-KU 0533	brontothere	?RP\4	Bhn-146	Bahin area	1997	Myanmar
NMMP-KU 0534	brontothere	?Rm/3' talonid	Bhn-119	Bahin area	1997	Myanmar
NMMP-KU 0535	Rhinocerotoidea	RM\x	Tudw-55(A)	Tudw	1997	Myanmar
NMMP-KU 0536	?*Paramynodon birmanicus*	Rm/1 or 2 (or dp/4?)	Tmk-30(A)	Tmk	1997	Myanmar
NMMP-KU 0537	brontothere	Lm/x' trigonid	Bhn-170(A)	Bahin area	1997	Myanmar

(Continued)

NMMP-KU 0538	brontothere	talonid of Lm/1 or 2	Bhn-118	Bahin area	1997	Myanmar
NMMP-KU 0539	brontothere	RP\4	Bhn-134(A)	Bahin area	1997	Myanmar
NMMP-KU 0540	?*Paramynodon birmanicus*	Rp/4?	Bhn-134(B)	Bahin area	1997	Myanmar
NMMP-KU 0541	brontothere	M\x frag.	Bhn-134(D)	Bahin area	1997	Myanmar
NMMP-KU 0542	?*Paramynodon birmanicus*	Lm/x' trigonid	Bhn-134(F)	Bahin area	1997	Myanmar
NMMP-KU 0543	?*Paramynodon birmanicus*	Lm/x	mgg-29	Mogaung area	1997	Myanmar
NMMP-KU 0544	?brontothere ?amynodont	?incisor ?canine	Bhn-147	Bahin area	1997	Myanmar
NMMP-KU 0545	Amynodontidae indet.F	Lm/3	Bhn-132+Pgn-11	Bahin or Pangan area	1997	Myanmar
NMMP-KU 0546	?*Paramynodon birmanicus*	RP\4	Bhn-122	Bahin area	1997	Myanmar
NMMP-KU 0547	Rhinocerotoidea	?RP\3	Tudw-55(B)	Tudw	1997	Myanmar
NMMP-KU 0548	?*Paramynodon birmanicus*	Lp/3	mgg-44	Mogaung area	1997	Myanmar
NMMP-KU 0549	?*Paramynodon birmanicus*	Rm/x	Kdw-24	Kdw	1997	Myanmar
NMMP-KU 0550	?*Paramynodon birmanicus*	talonid of Rm/1 or 2	Kdw-25	Kdw	1997	Myanmar
NMMP-KU 0551	?brontothere	?Lp/x' trigonid	Bhn-170(C)	Bahin area	1997	Myanmar
NMMP-KU 0552	?brontothere ?amynodont	?incisor	Bhn-123	Bahin area	1997	Myanmar
NMMP-KU 0553	?brontothere ?amynodont	?incisor	Bhn-80	Bahin area	1997	Myanmar
NMMP-KU 0554	?brontothere ?amynodont	?incisor	Bhn-92(A)	Bahin area	1997	Myanmar
NMMP-KU 0555	?brontothere ?amynodont	?incisor	Bhn-92(B)	Bahin area	1997	Myanmar
NMMP-KU 0556	?brontothere ?amynodont	?incisor	Bhn-85	Bahin area	1997	Myanmar
NMMP-KU 0557	?brontothere ?amynodont	?incisor	Bhn-94	Bahin area	1997	Myanmar
NMMP-KU 0558	?brontothere ?amynodont	?incisor	Bhn-90	Bahin area	1997	Myanmar
NMMP-KU 0559	?brontothere ?amynodont	?incisor	Tbk-2	Tbk	1997	Myanmar
NMMP-KU 0560	?brontothere ?amynodont	?incisor	Bhn-98	Bahin area	1997	Myanmar
NMMP-KU 0561	?brontothere ?amynodont	?incisor	Bhn-95	Bahin area	1997	Myanmar
NMMP-KU 0562	?brontothere ?amynodont	?incisor	Bhn-82	Bahin area	1997	Myanmar
NMMP-KU 0563	?brontothere ?amynodont	?incisor	mgg-34	Mogaung area	1997	Myanmar
NMMP-KU 0564	?brontothere ?amynodont	?incisor	Bhn-77	Bahin area	1997	Myanmar
NMMP-KU 0565	?*Paramynodon birmanicus*	P\x	mgg-50	Mogaung area	1997	Myanmar
NMMP-KU 0566	?brontothere ?amynodont	?incisor	Bhn-92(C)	Bahin area	1997	Myanmar
NMMP-KU 0567	?brontothere ?amynodont	?incisor	Bhn-92(D)	Bahin area	1997	Myanmar
NMMP-KU 0568	?brontothere ?amynodont	?incisor	mgg-42	Mogaung area	1997	Myanmar
NMMP-KU 0569	?brontothere ?amynodont	?incisor	mgg-38	Mogaung area	1997	Myanmar
NMMP-KU 0570	?brontothere ?amynodont	?incisor	mgg-43	Mogaung area	1997	Myanmar
NMMP-KU 0571	amynodont	?incisor	mgg-40	Mogaung area	1997	Myanmar

(Continued)

Appendix. 1. (1-17)

NMMP-KU 0572	small mammal	mandible	Bhn-1	Bahin area	1997	Myanmar
NMMP-KU 0573	small mammal	mandible	Bhn-2	Bahin area	1997	Myanmar
NMMP-KU 0574	*Anthracotherium tenuis*	R mandible	Bhn-27	Bahin area	1997	Myanmar
NMMP-KU 0575	*?Sivatitanops*	RM\2?? frag.	Bhn-137 + 145	Bahin area	1997	Myanmar
NMMP-KU 0576	*Anthracotherium*	mandible	Kdw-13	Kdw	1997	Myanmar
NMMP-KU 0577	*Anthracotherium*	mandible	Bhn-33	Bahin area	1997	Myanmar
NMMP-KU 0578	*Anthracotherium*	mandible	Bhn-16	Bahin area	1997	Myanmar

Appendix. 2. (2-1)

Taxa	Specimen number	Tooth class: Correct? or not?	P3/ L	P3/ W	P4/ L	P4/ W
Phiomyidae gen. *et* sp. nov.	NMMP-KU 0048	Correct	0.9	1.1	2.4	

Taxa	Specimen number	Tooth class: Correct? or not?	m/1 L	m/1 W	m/2 L	m/2 W	m/3 L	m/3 W
Phiomyidae gen. *et* sp. nov.	NMMP-KU 0047	Correct			2.8	2.8		
Phiomyidae gen. *et* sp. nov.	NMMP-KU 0049	?Correct			2.8	2.5	3.1	2.2
Phiomyidae gen. *et* sp. nov.	NMMP-KU 0213	Correct	2.6	2.2	2.7	2.5	3.2	2.6
Phiomyidae gen. *et* sp. nov.	NMMP-KU 0231	Correct		2.1	2.3	2.2	2.5	2.2

Taxa	Specimen number	Tooth class: Correct? or not?	M1/ L	M1/ W	M2/ L	M2/ W	M3/ L	M3/ W
Hsanotherium parvum	NMMP-KU 0031	Correct			6.3	6.5	7.4	7.8
Hsanotherium parvum	NMMP-KU 0035	Correct	5.4	5.7	6.3	6.7	6.9	7.9

Taxa	Specimen number	Tooth class: Correct? or not?	dp/4 L	dp/4 TRDW	dp/4 TALDW	p/4 L	p/4 W	m/1 L	m/1 TRDW	m/1 TALDW	m/2 L	m/2 TRDW	m/2 TALDW	m/3 L	m/3 TRDW	m/3 TALDW
Hsanotherium parvum	NMMP-KU 0032	Correct												9.3	4.8	4.5
Hsanotherium parvum	NMMP-KU 0033	Correct									6.8	3.6	3.6			
Hsanotherium parvum	NMMP-KU 0034	Correct														4.1
Hsanotherium parvum	NMMP-KU 0036	Correct				5.9	2.9	5.4	2.8	3.1	6.0	3.7	3.6	7.8	4.5	4.2
Hsanotherium parvum	NMMP-KU 0037	Correct	7.3*	2.7*	2.5*			5.3*	3.0		7.0	4.0	4.2*			

Taxa	Specimen number	Tooth class: Correct? or not?	M3?/ L	M3?/ AW	M3?/ PW
Artiodactyla gen. *et* sp. nov.	NMMP-KU 0026	?	7.8	9.5	7.5

Taxa	Specimen number	Tooth class: Correct? or not?	m/1 L	m/1 TRDW	m/1 TALDW	m/2 L	m/2 TRDW	m/2 TALDW	m/3 L	m3 TRDW	m/3 TALDW
?Artiodactyla gen. *et* sp. nov.	NMMP-KU 0023	??					5.5	5.2			
Artiodactyla gen. *et* sp. nov.	NMMP-KU 0027	Correct				7.7	5.2	5.4		6.0	5.6
Artiodactyla gen. *et* sp. nov.	NMMP-KU 0028	Correct							10.7	5.0	5.0
Artiodactyla gen. *et* sp. nov.	NMMP-KU 0029	Correct	7.0	4.0	4.3	7.4	4.9	4.9			
Artiodactyla gen. *et* sp. nov.	NMMP-KU 0068	Correct								5.8	5.5
Artiodactyla gen. *et* sp. nov.	NMMP-KU 0264	Correct						5.7		6.0	5.5

(Continued)

cf. Artiodactyla gen.et sp. nov.	NMMP-KU 0030	m1 or m2	6.8	4.2	4.3									

Taxa	Specimen number	Tooth class: Correct? or not?	M2/ L	M2/ AW	M2/ PW	M3/ L	M3/ AW	M3/ PW
Pakkokuhyus lahirii	NMMP-KU 0039	Correct	8.3	10.2	8.9	8.9	11.2	8.6

Taxa	Specimen number	Tooth class: Correct? or not?	m/1 L	m/1 TRDW	m/1 TALDW	m/2 L	m/2 TRDW	m/2 TALDW	m/3 L	m/3 TRDW	m/3 TALDW
Pakkokuhyus lahirii	NMMP-KU 0038	Correct				8.4	6	6.2	11.8	6.6	6.0*
Pakkokuhyus lahirii	GSI B766	Correct	7.4	5.0	5.1	8.6	6.6	7.2	12.5	7.6	7.3

Taxa	Specimen number	Tooth class: Correct? or not?	dP4/ PW	M1/ L	M1/ AW	M1/ PW	M2/ L	M2/ AW	M2/ PW	M3/ L	M3/ AW	M3/ PW
Indomeryx arenae	NMMP-KU 0007	M1-3? or dP4M1-2		5.4	5.6	5.7	5.8	6.6	6.3	6.4	7.3	6.1
Indomeryx cotteri	NMMP-KU 0008	Correct		6.0	6.2	6.2	6.6	7.6	7.3	7.5	8.5	7.7
Indomeryx cotteri	NMMP-KU 0009	Correct					6.7	7.6	7.5	7.7	8.5	7.7
Indomeryx cotteri	NMMP-KU 0010	dp4M1-2 or dP3-4M1	4.1	5.4	4.8	5.0	6.1	6.2	5.9			
cf. *Indomeryx cotteri*	NMMP-KU 0025	M1 or 2					6.6	7.9	7.8			

Taxa	Specimen number	Tooth class: Correct? or not?	p/3 L	p/3 W	p/4 L	p/4 W	m/1 L	m/1 TRDW	m/1 TALDW	m/2 L	m/2 TRDW	m/2 TALDW	m/3 L	m/3 TRDW	m/3 TALDW
Indomeryx arenae	NMMP-KU 0011	Correct			5.0	2.2	5.3	2.8	3.1	5.6*	3.3	3.6		3.6	3.9
Indomeryx arenae	NMMP-KU 0012	Correct											8.9	4.0	3.9
Indomeryx arenae	NMMP-KU 0013	Correct			5.4	2.7	5.1	2.6	2.9	5.9	3.5	3.9		3.9	
Indomeryx arenae	NMMP-KU 0014	Correct											8.9	3.7	3.9
Indomeryx cotteri	NMMP-KU 0015	Correct					6.0	3.4	3.6	7.6	4.3	4.7	11.7	5.0	5.1
Indomeryx cotteri	NMMP-KU 0016	Correct							3.3	7.0	4.0	4.4	10.8	4.5	4.6
Indomeryx cotteri	NMMP-KU 0017	Correct											12.0	4.8	4.8
Indomeryx cotteri	NMMP-KU 0018	Correct										4.3	10.8	4.6	4.6
Indomeryx cotteri	NMMP-KU 0019	Correct	6.4	2.2	6.9	2.7			3.3	6.8	4.1	4.2	11.1	4.7	4.6
Indomeryx cotteri	NMMP-KU 0021	Correct			6.0	2.7									
Indomeryx cotteri	NMMP-KU 0022	Correct			6.0	2.7									
Indomeryx cotteri	NMMP-KU 0024	m1 or m2					6.4*	3.2	3.3						
Indomeryx cotteri	NMMP-KU 0201	Correct					6.3	3.0	3.5	6.9	3.9	4.5		4.5	
Indomeryx arenae	NMMP-KU 0222	Correct								6.4	3.8	3.8	9.1	4.0	3.8
Indomeryx cotteri	NMMP-KU 0266	?					6.3	3.5	4.0		4.2				
Indomeryx cotteri	NMMP-KU 0268	Correct													4.6
Indomeryx cotteri	NMMP-KU 0289	Correct											10.5	4.8	4.9

(Continued)

Indomeryx cotteri	NMMP-KU 0290	m/2-3?							6.5	3.5				4.3					
Indomeryx cotteri	AMNH 20023	Correct										[11.5*]	5.2						
Indomeryx cotteri	AMNH 32521	m/2-3 or 1-2							6.6	3.9	4.2		4.4						
Indomeryx cotteri	GSI B768	Correct					[6.6]		[3.4]	[6.9]		[4.2]	[9.7]		[4.3]				
Indomeryx arenae	GSI B769	Correct											[9.2*]		[4.1]				

Taxa	Specimen number	Tooth class: Correct? or not?	dP3/ L	dP3/ W	dP4/ L	dP4/ AW	dP4/ PW	P3/ L	P3/ W	P4/ L	P4/ W	M1/ L	M1/ AW	M1/ PW	M2/ L	M2/ AW	M2/ PW	M3/ L	M3/ AW	M3/ PW
Anthracotherium	NMMP-KU 0053	Correct						14.1	10.1	10.4	12.5	13.8	15.0	14.3	17.7	19.8	17.5	19.2	21.6	18.7
Anthracotherium	NMMP-KU 0056	Correct													23.0	26.6	24.4	28.1	31.2	27.6
Anthracotherium	NMMP-KU 0066	M\1? or x or dP\4?										10.8	11.4	10.4						
Anthracotherium	NMMP-KU 0067	Correct								12.1	16.1									
Anthracotherium	NMMP-KU 0070	Correct																20.2	23.2	19.0
Anthracotherium	NMMP-KU 0071	Correct									15.4*	15.1	16.4	15.9*						
Anthracotherium	NMMP-KU 0074	Correct								13.9	18.3									
Anthracotherium	NMMP-KU 0077	M\2 (or 1?)													23.9	26.0	24.9			
Anthracotherium	NMMP-KU 0081	Correct																19.2	23.4	19.5
Anthracotherium	NMMP-KU 0082	Correct																19.4	22.6	19.3
Anthracotherium	NMMP-KU 0083	Correct																19.1	23.3	19.3
Anthracotherium	NMMP-KU 0102	M\2 or 1													25.7	29.9	29.3			
Anthracotherium	NMMP-KU 0103	Correct								15.9	21.2									
Anthracotherium	NMMP-KU 0105	Correct								11.0	15.0									
Anthracotherium	NMMP-KU 0106	Correct						13.7	9.9											
Anthracotherium	NMMP-KU 0122	Correct						17.1*	12.2	12.5	16.6	15.2	16.5	15.7						
Anthracotherium	NMMP-KU 0123	M\x or dP\4													16.7	16.7	16.4*			
Anthracotherium	NMMP-KU 0127	M\x													18.1*		18.1			
Anthracotherium	NMMP-KU 0128	Correct																21.9	22.7*	20.9
Anthracotherium	NMMP-KU 0215	Correct						14.9	11.6											
Anthracotherium	NMMP-KU 0216	Correct														24.7	22.0	24.1	28.0	25.1
Anthracotherium	NMMP-KU 0270	M\x														28.4				
Anthracotherium	NMMP-KU 0271	M\1 or 2													19.6	21.8	21.7			
Anthracotherium	NMMP-KU 0275	Correct																38.3	45.0	40.1
Anthracotherium	NMMP-KU 0284	M\3?																23.3	25.3	23.9
Anthracotherium	NMMP-KU 0287	M\x(1 or 2?)													25.6	28.8	27.0			
Anthracotherium	NMMP-KU 0325	Correct		6.1	8.5	8.6	8.1					10.5	10.7	10.2						
Anthracotherium	NMMP-KU 0326	M\3 or 2																13.5	14.5	12.7
Anthracotherium	NMMP-KU 0327	Correct			15.8	14.7	16.6													
Anthracotherium	NMMP-KU 0328	Correct																35.6	37.0	33.5
Anthracotherium	NMMP-KU 0329	Correct										20.5*			27.7	31.6	29.7	36.2	41.8	36.9
Anthracotherium	NMMP-KU 0379	M\3?																13.7	15.3	13.5
Anthracotherium	NMMP-KU 0380	M\1 or dP\4										8.5	9.7	8.7						

(Continued)

Appendix. 2. (2-4)

Anthracotherium	NMMP-KU 0382	M\1-2 or 2-3								11.6	12.5*	11.2*	13.7*	14.3	12.5			
Anthracotherium	NMMP-KU 0384	M\2 or 1											11.9	13.0	11.8			
Anthracotherium	NMMP-KU 0385	M\1 or dP4								8.4	9.8	8.7						
Anthracotherium	NMMP-KU 0387	M\1 or dP4								9.5	10.0	9.6						
Anthracotherium	NMMP-KU 0388	M\1 or dP4								10.0	10.0	9.4						
Anthracotherium	NMMP-KU 0389	Correct	8.5	8.5*	8.1					10.5	10.7	10.2						
Anthracotherium	NMMP-KU 0392	M\x											15.1					
Anthracotherium	NMMP-KU 0396	M\1 or 2											16.0	18.2	17.0			
Anthracotherium	NMMP-KU 0400	?P3					11.9											
Anthracotherium	NMMP-KU 0401	Correct														22.8	25.8	22.1
Anthracotherium	NMMP-KU 0402	M\1 or 2											20.9	23.1	21.8			
Anthracotherium	NMMP-KU 0403	Correct														29.1	30.9	28.1
Anthracotherium	NMMP-KU 0404	Correct														34.2	36.4	35.2
Anthracotherium	NMMP-KU 0405	M\2 or 1											24.8	26.8	25.3			
Anthracotherium	NMMP-KU 0406	M\3 (or 2?)														28.2	31.6	28.9
Anthracotherium	NMMP-KU 0407	Correct														34.1	36.5	33.1
Anthracotherium	NMMP-KU 0408	Correct											28.1	30.0	29.5			
Anthracotherium	NMMP-KU 0409	Correct														27.4	32.9	27.3
Anthracotherium	NMMP-KU 0410	Correct											20.2	25.1*	21.9	24.0	29.6	24.8
Anthracotherium	NMMP-KU 0411	Correct														29.8	31.7	29.2
Anthracotherium	NMMP-KU 0412	Correct												29.9	26.8	35.3	38.9	34.2
Anthracotherium	NMMP-KU 0413	Correct						12.6	15.7	16.8	17.7	17.1	21.0	23.6	22.4			
Anthracotherium	NMMP-KU 0414	Correct	14.4	14.9	15.0*					17.4	19.1	18.8	25.7	28.0	25.3			
Anthracotherium	NMMP-KU 0452	M\3?														27.9	33.0	28.1
Anthracotherium	NMMP-KU 0453	Correct														19.2	22.1	20.8
Anthracotherium	NMMP-KU 0454	Correct														19.6	21.8	20.6
Anthracotherium	NMMP-KU 0455	Correct				9.3	7.0	6.7	8.5									
Anthracotherium	NMMP-KU 0459	Correct														25.6	29.9	
Anthracotherium	NMMP-KU 0460	M\2 (or 1?)											26.7	28.6	27.1			
Anthracotherium	NMMP-KU 0463	Correct														22.3	24.5*	22.6
Anthracotherium	NMMP-KU 0476	Correct						15.4	18.4									
Anthracotherium	NMMP-KU 0480	Correct						17.3	21*									
Anthracotherium	NMMP-KU 0481	Correct																28.0
Anthracotherium	NMMP-KU 0482	M\1 or 2											25.0*	25.5*				
Anthracotherium	NMMP-KU 0483	M\x												29.4				
Anthracotherium	NMMP-KU 0486	M\1 or 2 or dP4											16.2	16.9	17.0			
Anthracotherium	NMMP-KU 0489	Correct						14.4										
Anthracotherium	NMMP-KU 0492	M\1 or 2											25.0*		27.0			
Anthracotherium	NMMP-KU 0494	M\1 or 2											22.4	25.0	23.9			
Anthracotherium	NMMP-KU 0495	Correct																30.2
Anthracotherium	NMMP-KU 0500	Correct				12.2	9.7	10.1	13.1									
Anthracotherium	NMMP-KU 0503	M\x												29.4				
Anthracotherium	NMMP-KU 0507	Correct					13.0											

(Continued)

Appendix. 2. (2-5)

"*Anthracokeryx moriturus* "	AMNH 20011	Correct					16.5*	11.3	11.3	14.5	16.0	17.3	16.9	20.0	23.3	22.5	23.7	24.8	23.7
"*Anthracokeryx birmanicus*"	AMNH 20015	Correct															20.0	23.3	20.3
"*Anthracokeryx ulnifer*"	AMNH 20017 (right)	Correct									8.4	10.0	9.6	12.0	13.5	12.1	14.7	16.3	13.7
"*Anthracokeryx ulnifer*"	AMNH 20017 (left)	Correct					10.8	7.6	8.2*	9.6	8.8	10.2	9.6	11.9	13.5	11.7	14.9	16.1	13.9
"*Anthracothema*"	AMNH 20024	Correct												20.0*	22.5*	21.7	24.0*	25.5	
"*Anthracothema rubricae*"	AMNH 20027	Correct							12.5*	17.6	16.0	18.9	18.7	19.9	24.9	22.8	26.3	28.4	25.6
"*Anthracothema rubricae*"	AMNH 32525	Correct							13.0	16.2	17.3*	18.9	17.7						
"*Anthracothema pangan*"	AMNH 32526	?Correct												[24]	[29]		32.3	36.5	32.3
"*Anthracohyus choeroides*"	GSI B603	Correct															21.2	25.4	23.5
"*Anthracohyus choeroides*"	GSI B604	Correct					15.6	11.2											
"*Anthracothema palustre*"	GSI B606	Correct															39.3		
"*Anthracothema palustre*"	GSI B608	Correct					24.6	20.4											
"*Anthracothema rubricae*"	GSI B609	Correct															32.8	34.8	31.3
"*Anthracothema rubricae*"	GSI B610	M1 or 2												26.3	30.2	28.9			
"*Anthracothema rubricae*"	GSI B611	Correct							14.4	18.8									
"*Anthracothema crassum*"	GSI B615	Correct												21.7	25.1	22.8	27.6	31.2	26.1
"*Anthracothema crassum*"	GSI B616	Correct							15.9	19.9									
"*Anthracothema pangan*"	GSI B618	Correct					24.2	19.3											
"*Anthracothema pangan*"	GSI B619	Correct												27.1	30.0*	28.3	34.0	36.4	32.8
"*Anthracokeryx birmanicus*"	GSI B621	Correct					14.6	9.6	9.3*	11.8	13.0*	14.0*		15.0	16.8	15.9	16.7	19.0	16.5
"*Anthracokeryx bambusae*"	GSI B622	Correct												12.1	12.9	11.4	14.6	15.6	13.5
"*Anthracokeryx birmanicus*"	GSI B624	Correct	[13.9]	[8.8]	[11.6]	[11.9]													
"*Anthracokeryx tenuis*"	GSI B625	Correct			7.4	7.7	7.5				9.7	9.5	9.3						
"*Anthracothema palustre*"	K.18/847	?												[33.8]	[40.9]				
"*Anthracothema pangan*"	GSI B747	Correct								21.9									
"*Anthracothema pangan*"	GSI B748	Correct					21.5*	21.2*	16.2	22.3									
"*Anthracothema pangan*"	GSI B750	Correct												[28.1]	[30.8]		36.4	38.4	33.5
"*Anthracothema palustre*"	GSI B752	Correct															33.4	39.8	34.8
"*Anthracokeryx ulnifer*"	GSI B756 (right)	Correct					11.6	7.2	8.9	10.4	8.5	10.7	9.6	11.9	13.5	11.6	15.6	17.0	14.6
"*Anthracokeryx ulnifer*"	GSI B756 (left)	Correct							9.2	10.4	8.9	10.7	9.5	12.3	13.5	11.6			
"*Anthracokeryx moriturus*"	GSI B763	?															27.6*	30.0*	27.1
"*Anthracokeryx moriturus*"	GSI B764	?												23.8		25.5			
"*Anthracokeryx moriturus*"	GSI B765	M1 or 2									17.0	19.3	18.7						

Taxa	Specimen number	Tooth class: Correct? or not?	p/1 L	p/1 W	p/2 L	p/2 W	p/3 L	p/3 W	p/4 L	p/4 W	m/1 L	m/1 TRDW	m/1 TALDW	m/2 L	m/2 TRDW	m/2 TALDW	m/3 L	m/3 TRDW	m/3 TALDW
Anthracotherium	NMMP-KU 0052	Correct	6.5	3.8					10.6	5.1	9.1	5.1	5.8	12.0	7.1	7.3	19.0	8.6	8.3
Anthracotherium	NMMP-KU 0054	Correct																26.2	26.5
Anthracotherium	NMMP-KU 0055	Correct																22.2	23.7
Anthracotherium	NMMP-KU 0062	Correct												27.1	18.7	19.8			
Anthracotherium	NMMP-KU 0063	Correct									9.1	5.6	5.9						
Anthracotherium	NMMP-KU 0077	Correct															43.1	22.7	23.5

(Continued)

Appendix. 2. (2-6)

Anthracotherium	NMMP-KU 0078	m/1 (or 2?)					14.8	8.1	9.3							
Anthracotherium	NMMP-KU 0079	p/3?	16.2	7.0												
Anthracotherium	NMMP-KU 0085	m/1 or 2								19.9	12.6	14.2				
Anthracotherium	NMMP-KU 0086	Correct			15.5	8.2										
Anthracotherium	NMMP-KU 0087	Correct											38.8*		22.3	
Anthracotherium	NMMP-KU 0093	Correct											18.2	8.4	8.7	
Anthracotherium	NMMP-KU 0107	p/3?	11.5	5.0												
Anthracotherium	NMMP-KU 0113	Correct			10.5	5.3										
Anthracotherium	NMMP-KU 0116	Correct			14.8	7.8				18.2*	12.0*	12.9				
Anthracotherium	NMMP-KU 0117	Correct													9.2	
Anthracotherium	NMMP-KU 0125	Correct	15.5	5.7	13.5	7.4				17.9	11.5*	12.6		13.8*	14.5	
Anthracotherium	NMMP-KU 0248	m/1 or 2					9.8	6.4	6.7							
Anthracotherium	NMMP-KU 0251	m/2?								12.0	7.8	7.7				
Anthracotherium	NMMP-KU 0263	Correct											20.1	10.2	10.1	
Anthracotherium	NMMP-KU 0267	Correct					9.2	5.7	5.9	11.2	5.9	7.3				
Anthracotherium	NMMP-KU 0269	m/1 or 2								24.5	15.8	18.1				
Anthracotherium	NMMP-KU 0274	Correct	19.9	9.7	18.5	11.5	17.7*		12.5*							
Anthracotherium	NMMP-KU 0306	?p/3 or 2	22.8	9.6												
Anthracotherium	NMMP-KU 0307	Correct			18.3	11.3										
Anthracotherium	NMMP-KU 0330	Correct								24.3	16.5	18.2	39.2	20.5	21.5	
Anthracotherium	NMMP-KU 0331	Correct								24.4	15.0	17.3				
Anthracotherium	NMMP-KU 0332	Correct											28.2	14.7	14.5	
Anthracotherium	NMMP-KU 0383	m/1 (or 2?)					9.6	5.2	5.5							
Anthracotherium	NMMP-KU 0386	Correct												7.4	7.9	
Anthracotherium	NMMP-KU 0390	m/1 or 2					10.3	5.9	6.5							
Anthracotherium	NMMP-KU 0391	Correct							5.8							
Anthracotherium	NMMP-KU 0393	m/1 or 2									7.5*					
Anthracotherium	NMMP-KU 0394	m/2 or 1								12.5	7.1	7.5				
Anthracotherium	NMMP-KU 0395	m/2 or 1								12.6	7.6	8.2				
Anthracotherium	NMMP-KU 0397	m/1 or 2					13.4	9.0	9.0							
Anthracotherium	NMMP-KU 0398	m/2 or 1								20.4	13.1	14.0				
Anthracotherium	NMMP-KU 0399	Correct											19.3	8.4	8.2	
Anthracotherium	NMMP-KU 0415	Correct											42.4	22.6	23.8	
Anthracotherium	NMMP-KU 0416	Correct									12.2	13.3		14.8	14.6	
Anthracotherium	NMMP-KU 0417	Correct											40*	21.7	21.7	
Anthracotherium	NMMP-KU 0418	Correct								31.2	23.6	26.3				
Anthracotherium	NMMP-KU 0419	Correct													23.3	
Anthracotherium	NMMP-KU 0420	m/2 (or 1)								25.8	17.2	19.9				
Anthracotherium	NMMP-KU 0421	Correct					17.3	10.6	11.9							
Anthracotherium	NMMP-KU 0422	Correct								11.7	7.5	8.2	20.0*	8.8	10.4	
Anthracotherium	NMMP-KU 0423	Correct										7.3	18.3	8.9	9.0	
Anthracotherium	NMMP-KU 0424	Correct											38.5	18.9	19.9	
Anthracotherium	NMMP-KU 0425	Correct												24.1	24.7	

(Continued)

Appendix. 2. (2-7)

Anthracotherium	NMMP-KU 0426	Correct											23.3*	16.0*	18.2*	39.5*	20.5*	21.0*
Anthracotherium	NMMP-KU 0427	Correct														41.6	21.8	22.4
Anthracotherium	NMMP-KU 0428	Correct													20.0		23.1	24.4
Anthracotherium	NMMP-KU 0429	Correct											24.3	15.6	16.3	37.7	20.6	20.0
Anthracotherium	NMMP-KU 0430	Correct			16.5	6.6	14.3	7.8										
Anthracotherium	NMMP-KU 0431	m/1 or 2											19.3	11.3	12.0			
Anthracotherium	NMMP-KU 0432	Correct					15.7	8.2										
Anthracotherium	NMMP-KU 0433	p/4 (or 3?)					19.9	11.3										
Anthracotherium	NMMP-KU 0434	Correct					17.7	12.6										
Anthracotherium	NMMP-KU 0435	Correct					16.8	9.1										
Anthracotherium	NMMP-KU 0436	p/2 or 3				9.4												
Anthracotherium	NMMP-KU 0437	p/2 or 3			23.1	9.9												
Anthracotherium	NMMP-KU 0438	p/2 or 3			20.0	8.4												
Anthracotherium	NMMP-KU 0450	Correct	6.0	2.8														
Anthracotherium	NMMP-KU 0451	Correct	6.2	2.9														
Anthracotherium	NMMP-KU 0456	Correct																31.0
Anthracotherium	NMMP-KU 0457	Correct														38.4	17.2	19.0
Anthracotherium	NMMP-KU 0458	Correct							9.9*		6.3		13.4	8.7	8.7	22.6		
Anthracotherium	NMMP-KU 0461	Correct																17*
Anthracotherium	NMMP-KU 0462	Correct																19.1
Anthracotherium	NMMP-KU 0464	Correct																9.6
Anthracotherium	NMMP-KU 0465	Correct														22.6		11.2
Anthracotherium	NMMP-KU 0466	Correct									6.1		12.2	7.4	7.7			
Anthracotherium	NMMP-KU 0467	m/2 or 1											15.7	9.3	10.5			
Anthracotherium	NMMP-KU 0468	Correct						9.8	18.4	11.0	12.5							
Anthracotherium	NMMP-KU 0469	m/1 or 2											19.7	12.7	14.1			
Anthracotherium	NMMP-KU 0470	Correct											11.3	7.5	7.3	20.5	9.4	9.4
Anthracotherium	NMMP-KU 0471	m/1 or 2							19.0	11.9	12.9							
Anthracotherium	NMMP-KU 0472	m/1 or 2											18.4	12.3	13.9			
Anthracotherium	NMMP-KU 0473	m/1 or 2							14.5	9.3	10.2							
Anthracotherium	NMMP-KU 0474	m/1 or 2											20.8	13.8	14.8			
Anthracotherium	NMMP-KU 0475	Correct																15.8
Anthracotherium	NMMP-KU 0477	Correct														29.0		
Anthracotherium	NMMP-KU 0478	Correct							10.3	5.9	6.4		12.9	7.9	8.3			
Anthracotherium	NMMP-KU 0479	p/4m/1 (or dp/3-4?)					13.6	7.5		6.4								
Anthracotherium	NMMP-KU 0485	m/1 or 2											15.4	11.7	12.7			
Anthracotherium	NMMP-KU 0487	m/x												24.3				
Anthracotherium	NMMP-KU 0488	m/x												14.1				
Anthracotherium	NMMP-KU 0490	Correct																24.1
Anthracotherium	NMMP-KU 0491	m/1 or 2													16.8			
Anthracotherium	NMMP-KU 0493	m/1 or 2											22.5*		16.9			
Anthracotherium	NMMP-KU 0496	m/2 (or 1?)													24.0			
Anthracotherium	NMMP-KU 0497	m/3?															27.2	

(Continued)

Anthracotherium	NMMP-KU 0498	m/2 (or 1?)													18.5			
Anthracotherium	NMMP-KU 0499	m/1 or 2											18.2	12.2	13.2			
Anthracotherium	NMMP-KU 0505	Correct						15.8	8.6									
Anthracotherium	NMMP-KU 0506	Correct																19.5
Anthracotherium	NMMP-KU 0508	p/1?	9.4	5.5														
"*Arthracothema pangan*"	AMNH 20006	Correct														49.5*	26.2	27.0
"*Arthracokeryx morturus*"	AMNH 20011 (right)	Correct					16.7	7.2	16.5	9.2	16.8*	9.9	12.2	20.5	13.0*	15.4	31.9	16.0	17.3
"*Arthracokeryx morturus*"	AMNH 20011 (left)	Correct															32.4	16.0	17.3
"*Arthracokeryx birmanicus*"	AMNH 20015 (right)	Correct															29.0*	14.5	14.9
"*Arthracokeryx birmanicus*"	AMNH 20015 (left)	Correct															28.4	14.6	15.0
"*Arthracokeryx ulnifer*"	AMNH 20017 (right)	Correct			9.6	4.4	10.5*	4.9	10.2*	5.5	8.4	5.5	6.1	11.4*	7.3	7.7	20.0	8.8	9.0
"*Arthracokeryx ulnifer*"	AMNH 20017 (left)	Correct			9.5	4.3	10.6	4.8	10.0	5.5	8.6	5.3	6.0	11.4	7.2	7.6	19.7	8.9	9.3
"*Arthracothema*"	AMNH 20028	Correct					18.6	8.2	17.2	9.8									
"*Arthracothema rubricae*"	AMNH 20029	Correct															37.9	18.5	19.9
"*Arthracothema*"	AMNH 32522	Correct									18.7	12.7	13.2	23.5*	15.1	15.5*			
"*Arthracokeryx hospes*"	GSI B605	Correct	[8.2]	[4.0]	[12.8]	[4.5]	[14.9]	[5.8]	14.3	7.7	14.0	9.1	9.5	18.0	12.0	13.4	29.7	15.3	16.0
"*Arthracothema palustre*"	GSI B607	Correct															52.7	29.1	29.7
"*Arthracothema rubricae*"	GSI B612	Correct								[10.8]	[16.7]		[11.8]	[23.7]		[17.4]			
"*Arthracothema rubricae*"	GSI B613	Correct															38.2	18.9	20.5
"*Arthracothema rubricae*"	GSI B614	?Correct			21*		21.26	9.8											
"*Arthracothema crussum*"	GSI B617	Correct							19.3	12.4	19.5*		16.5*	26.1	20.3	21.9	36.7	24.3	22.2
"*Arthracothema pangan*"	GSI B620	Correct															47.7	24.4	24.5
"*Arthracokeryx tenuis*"	GSI B626	m/1-2 or dp/4m/1									9.2	5.4	6.0						
"*Arthracokeryx myaingensis*"	GSI B627	Correct												11.7	7.1	7.4	18.0	8.4	8.7
"*Arthracothema pangan*"	GSI B745	Correct					24.1	12.7	21.7	14.1	21.5*		15.0*	30.8	18.3	21.9			
"*Arthracothema pangan*"	GSI B749	?Correct			[24.0*]		[24.0*]												
"*Arthracothema rubricae*"	GSI B751	Correct	8.8	5.3	16.4	7.8	19.8	9.9	19.7	11.3	16.8	11.6	12.9	23.9	15.8	18.8	39.2	19.6	21.8
"*Arthracothema palustre*"	GSI B754	Correct			22.5	11.1													
"*Arthracokeryx ulnifer*"	GSI B755	Correct	6.7		10.4		[11.7]	[4.3]	11.3	5.6	9.3		6.4	11.6	7.8	8.1	21.0	9.5	9.4
"*Arthracokeryx myaingensis*"	GSI B759	m2 or 1												11.5	6.8	7.1			
"*Arthracokeryx myaingensis*"	GSI B760	?Correct									[9.1]		[5.2]						
"*Arthracokeryx myaingensis*"	GSI B761	?Correct					11.9	3.9											
"*Arthracokeryx birmanicus*"	GSI B767	Correct							12.9	7.0	12.9	8.3	9.9	15.5	9.9	11.8			

Taxa	Specimen number	Tooth class: Correct? or not?	P2/ L	P2/ W	P4/ L	P4/ W	M1/ W	M2/ L	M2/ W	M3/ L	M3/ W
Bunobrontops savagei	NMMP-KU 0059	M\x						43.2	53*		
Bunobrontops savagei	NMMP-KU 0296	M\x							40.7*		
Bunobrontops savagei	NMMP-KU 0312	Correct								43.0	47.2
Bunobrontops savagei	NMMP-KU 0313	M\1?					43.3				
Bunobrontops savagei	NMMP-KU 0319	M\2 or 1						37.7			
?*Metatelmatherium ? lahirii*	NMMP-KU 0320	P4?			25.8	33.4					

(Continued)

?*Sivatitanops* sp.	NMMP-KU 0339	P4			31.6*	
?*Metatelmatherium ? lahirii*	NMMP-KU 0340	P2 or 3?	18.8	22.0		
brontothere	NMMP-KU 0532	P4			26.7	
brontothere	NMMP-KU 0533	P4				37.0
brontothere	NMMP-KU 0539	P4			25.5	32*

Taxa	Specimen number	Tooth class: Correct? or not?	p/1 L	p/1 W	p/2 L	p/2 TRDW	p/2 TALDW	p/3 L	p/3 TRDW	p/3 TALDW	p/4 L	p/4 TRDW	p/4 TALDW	m/1 L	m/1 TRDW	m/1 TALDW	m/2 L	m/2 TRDW	m/2 TALDW	m/3 L	m/3 TRDW	m/3 TALDW
?*Metatelmatherium ? lahirii*	NMMP-KU 0218	?	10.6	6.8																		
?*Metatelmatherium ? lahirii*	NMMP-KU 0282	p/2?			19.2	11.8	10.7															
Metatelmatherium ? lahirii	NMMP-KU 0311	Correct												36.9	21.7	24.3	47.1	25.7	26.7	63.4	27.6	27.9
?*Metatelmatherium ? lahirii*	NMMP-KU 0321	p/2 or 3?			20.4	14.5	15.6															
?*Metatelmatherium ? lahirii*	NMMP-KU 0322	p/3 or 4?						27.6	17.1	19.3												
?*Metatelmatherium ? lahirii*	NMMP-KU 0323	p/3 or 4?						27.4	16.9	19.5												
Sivatitanops cotteri	NMMP-KU 0324	p/4?									31.9	19.7	20.3									
?*Sivatitanops birmanicum*	NMMP-KU 0334	m/x																				37.4
?*Metatelmatherium ? lahirii*	NMMP-KU 0335	m/x																	27.2			
brontothere	NMMP-KU 0341	m/x														21.6						
?*Sivatitanops cotteri*	NMMP-KU 0448	m/x																			32.7	
?*Sivatitanops cotteri*	NMMP-KU 0510	Correct																		72.0*	32.4	32.0*
?*Sivatitanops cotteri*	NMMP-KU 0516	Correct (?)															49.3	29.4	31.2			
brontothere	NMMP-KU 0520	m/x																28.5				
brontothere	NMMP-KU 0531	m/x																29.0				
brontothere	NMMP-KU 0537	m/x																28.0				
brontothere	NMMP-KU 0538	m/1 or 2																	31.2			

Taxa	Specimen number	Tooth class: Correct? or not?	? L	dP4/ L	dP4/ W	P2/ L	P2/ W	P3/ L	P3/ W	P4/ L	P4/ W	M1/ L	M1/ W	M2/ L	M2/ W	M3/ L	M3/ W
cf. *Ilianodon lunanensis*	NMMP-KU 0288	Correct														23.7*	27.0
?cf. *Ilianodon lunanensis*	NMMP-KU 0057	?	22.0														
Ceratomorpha indet.	NMMP-KU 0058	?	20.6*														
Paramynodon birmanicus	NMMP-KU 0061	Correct										31*	36.7*				
Paramynodon birmanicus	NMMP-KU 0272	Correct														41.7	40.2*<
?*Paramynodon birmanicus*	NMMP-KU 0305	?		30.8	29.4							36.5	37.5*				
Paramynodon birmanicus	NMMP-KU 0316	Correct												54.0	54.8		
Paramynodon birmanicus	NMMP-KU 0317	Correct												47*			
Paramynodon birmanicus	NMMP-KU 0377	Correct														45.8	
?*Paramynodon birmanicus*	NMMP-KU 0514	Correct								21.2							
?*Paramynodon birmanicus*	NMMP-KU 0523	P2 or 3				13.7	18.1										
?*Paramynodon birmanicus*	NMMP-KU 0530	M3?														36*	44*

(Continued)

Appendix. 2. (2-10)

?*Paramynodon birmanicus*	NMMP-KU 0546	Correct								19.4											
?*Paramynodon birmanicus*	NMMP-KU 0547	P3? or 2?						15.8	19.8												
Amynodontidae indet.	NMMP-KU 0281	Correct															29.9	30.8			
Amynodontidae indet.	NMMP-KU 0511	Correct										29.9	32.4								
Amynodontidae indet.	NMMP-KU 0515	Correct												34*			31.5				
Amynodontidae indet.	NMMP-KU 0521	Correct												35.2*	35.0*						

Taxa	Specimen number	Tooth class: Correct? or not?	dp/3 L	dp/3 TRDW	dp/3 TALDW	dp/4 L	dp/4 TRDW	dp/4 TALDW	p/3 L	p/3 W	p/4 L	p/4 TRDW	p/4 TALDW	m/1 L	m/1 TRDW	m/1 TALDW	m/2 L	m/2 TRDW	m/2 TALDW	m/3 L	m/3 TRDW	m/3 TALDW
Paramynodon birmanicus	NMMP-KU 0060	m/x (3?)																		45.9		
Paramynodon birmanicus	NMMP-KU 0100	m/x																19.5				
?*Paramynodon birmanicus*	NMMP-KU 0292	Correct							12.6	9.2*<												
?*Paramynodon birmanicus*	NMMP-KU 0310	?													14.4							
Paramynodon birmanicus	NMMP-KU 0369	Correct												29.3	14.0	16.6						
Paramynodon birmanicus	NMMP-KU 0315	Correct							14.0*	10.2				29.7	12.8	15.8	39.0	15.4	18.2			
Paramynodon birmanicus	NMMP-KU 0318	Correct																		43.3	22.2	20.6
Paramynodon birmanicus	NMMP-KU 0372	Correct															39.7	19.1	20.6			
Paramynodon birmanicus	NMMP-KU 0373	Correct												29.3	12.8	15.6	37.6	16.5	18.5			
Paramynodon birmanicus	NMMP-KU 0374	Correct	21.3	9.8	10.7	25.5	12.1	13.2						31.6	13.3	15.6						
Paramynodon birmanicus	NMMP-KU 0376	Correct	24.0	10.7	12.6		12.9															
Paramynodon birmanicus	NMMP-KU 0378	Correct																	24.9			
?*Paramynodon birmanicus*	NMMP-KU 0512	m/2? or 1?															45.5	23.9				
?*Paramynodon birmanicus*	NMMP-KU 0513	Correct																		40.8*	19.1	18.6
?*Paramynodon birmanicus*	NMMP-KU 0517	?Correct									22.5	14.2	15.1									
?*Paramynodon birmanicus*	NMMP-KU 0518	?Correct									22.2	13.9	15.8									
?*Paramynodon birmanicus*	NMMP-KU 0519	m/2 or 1															34.6	16.0	18.0			
?*Paramynodon birmanicus*	NMMP-KU 0522	m/1 or 2												33.8	13.8	15.5						
Paramynodon birmanicus	NMMP-KU 0524	m/2 or 1															41.7	20.3	20.4			
Paramynodon birmanicus	NMMP-KU 0525	Correct																		49.4	19.8	20.0
Paramynodon birmanicus	NMMP-KU 0526	m/2?																	23.3			
Paramynodon birmanicus	NMMP-KU 0527	m/2?															44*	21.2				
Paramynodon birmanicus	NMMP-KU 0528	?Correct																			21.1	
Paramynodon birmanicus	NMMP-KU 0529	?Correct																		49*		20.9
?*Paramynodon birmanicus*	NMMP-KU 0536	m\1 or 2 or dp/3 or dp/4												33.2	15.5	18.0						
??*Paramynodon*	NMMP-KU 0540	?									15.8	10.0	11.4									
?*Paramynodon birmanicus*	NMMP-KU 0542	?													13.7							
?*Paramynodon birmanicus*	NMMP-KU 0543	?													15.8	18.0						
?*Paramynodon birmanicus*	NMMP-KU 0548	?Correct							14.0	11.9												
?*Paramynodon birmanicus*	NMMP-KU 0549	?												34.4								
?*Paramynodon birmanicus*	NMMP-KU 0550	m/1 or 2																	25.8			

(Continued)

Appendix. 2. (2-11)

Amynodontidae indet.	NMMP-KU 0509	Correct	34.4	14.1	14.3
Amynodontidae indet.	NMMP-KU 0545	Correct	33.7	14.0	13.8

Taxa	Specimen number	Tooth class: Correct? or not?	P2/ L	P2/ W	P3/ L	P3/ W	P4/ L	P4/ W	M1/ L	M1/ W	M2/ L	M2/ AW	M2/ PW	M3/ L	M3/ AW	M3/ PW
Indolophus guptai	NMMP-KU 00265	Correct												12.8	14.5	11.1
Indolophus guptai	GSI C347	Correct	[8.7]	[8.1]	[9.1]	[10.6]	[10.3]	[11.9]	[10.8]	[11.8]						

Taxa	Specimen number	Tooth class: Correct? or not?	p/4 L	p/4 TRDW	p/4 TALDW	m/2 L	m/2 TRDW	m/2 TALDW
Indolophus guptai	NMMP-KU 0040	?Correct				13.6	7.9	7.7
Indolophus guptai	NMMP-KU 0041	?Correct	10.6	7.1	7.8			

Taxa	Specimen number	Tooth class: Correct? or not?	P1/ L	P1/ W	P2/ L	P2/ W	P3/ L	P3/ W
Deperetella birmanica	NMMP-KU 0005	Correct	7.2**	6.9**	9.8	12.2	9.9	14.1
	NMMP-KU 0006	Correct	7.4**	7.1**	9.4*			

**, The measurements are of the roots, not the crown.

Taxa	Specimen number	Tooth class: Correct? or not?	p/4 L	p/4 W	m/1 L	m/1 W	m/2 L	m/2 W	m/3 L	m/3 W
Deperetella birmanica	GSI C348	Correct	11.7	9.7*	12.3	9.7	13.8	10.6	15.2	11.8

Appendix 3. (3-1)

Paleogene faunas:

Pondaung_fauna
[Tsubamoto (2000 = this paper) 37.2 Ma Pondaung Fm Myanmar]
Bahinia pondaungensis
Amphipithecus mogaungensis
Pondaungia cotteri
Anthropoidea indet. [gen. et sp. nov.]
Hyaenodontidae indet. [gen. et sp. nov.]
Pterodon dahkoensis
Phiomyidae indet. [gen. et sp. nov.]
Hsanotherium parvum
Artiodactyla indet. [gen. et sp. nov.]
cf. Artiodactyla indet. [gen. et sp. nov.]
Anthracotherium pangan
Anthracotherium rubricum
Anthracotherium birmanicus
Anthracotherium tenuis
Pakkokuhyus lahirii
Indomeryx cotteri
cf. Indomeryx cotteri
Sivatitanops cotteri
Sivatitanops birmanicum
Metatelmatherium lahirii
Bunobrontops savagei
cf. Ilianodon lunanensis
Paramynodon birmanicus
Amynodontidae indet.
Indolophus guptai
Deperetella birmanica
Ceratomorpha indet.

Krabi_fauna
[Ducrocq et al. (1995, 1996, 1997, 1998) Chaimanee et al. (1997) Ducrocq (1999) Peigne et al. (2000) Tsubamoto (2000 = this paper) southern Thailand]
Dermotherium major
Insectivora indet.
Pteropodidae indet.
Wailekia orientale
Wailekia sp.
Siamopithecus eocaenus
Miacis thailandicus
?Mustelidae indet.
?Procyonidae indet.
Nimravus cf. mongoliensis
Nimravus cf. intermedius
Hoplophoneus sp.
Caniformia indet.
Ctenodactyloidea indet. [1]
Ctenodactyloidea indet. [2]
Egatochoerus jaegeri
Siamochoerus banmarkensis
Entelodontidae indet.
Siamotherium krabiense
Anthracotherium chaimanei
Anthracotherium thailandicus
Bothriogenys orientalis
Bothriogenys cf. orientalis
Atopotherium bangmarkensis
Anthracotheriinae indet. [gen. et sp. nov.]
Progenitohyus thailandicus
Lophiomerycidae indet. [gen. et sp. nov.]
?Tragulidae indet. [gen. et sp. nov.]
Helaletidae indet. [gen. et sp. nov.]
?Hyracodontidae indet. [gen. et sp. nov.]

Dongjun_fauna
[Russell and Zhai (1987), Li and Ting (1983) and Tong (1989) Dongjun Fm Bose Basin southern China]
Eudinoceras crassum
Eusmilus? sp.
Andrewsarchus crassum
Probrachyodus? sp. [sp. nov.]
Metatelmatherium sp.
cf. Protitan sp.
Deperetella birmanica
Teleolophus sp.
Forstercooperia sp.
Ilianodon? sp.
Prohyracodon sp.
cf. Gigantamynodon sp.
Amynodon sp.
cf. Paramynodon sp.

Naduo_fauna
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989), Ducrocq (1999) and Tsubamoto (2000 = this paper) Naduo Fm Bose and Yongle Basin, southern China]
Eodesmatodon spanios
Cephalogale sp. [sp. nov.]
cf. Cephalogale sp.
Guangxicynodon sinocaliforniae
Pachycynodon? sp. [sp. nov.]
Propterodon? sp.
Guilestes acares
Guilestes cf. acares
cf. Harpagolestes sp.
Entelodontidae indet.
Tayassuidae indet. [gen. nov.]
Suidae indet. [gen. nov. A]
Suidae indet. [gen. nov. B]
?Choeropotamidae (?Helohyidae) indet. [gen. nov.]
Anthracotherium rubricum
Anthracotherium birmanicus
Anthracotherium sp.

(Continued)

Appendix 3. (3-2)

"Bothriodon" chyelingensis
Heothema bellia
Notomeryx besensis
Notomeryx major
Indomeryx cotteri
Gobiomeryx sp.
Tragulidae indet.
Metatelmatherium cf. lahirii
Deperetella sp.
Eomoropus cf. quadridentatus
Huananodon hui
Guixia simplex
Caenolophus sp.
Paramynodon sp.

Gongkang_fauna
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989), Tong and Zhao (1986), Qi and Beard (1998), Ducrocq (1999) and Tsubamoto (2000 = this paper) Gongkang Fm Bose and Yongle Basin, southern China]
Guangxilemur tongi
Machairodontinae indet. [gen. nov.]
Hoplophoneus? sp.
Eopecarihyus sp. [sp. nov.]
Anthracotherium kwangsiensis
Anthracotherium sp.
"Bothriodon" tientongensis
Heothema bellia
Heothema chengbiensis
Schizotherium nabanensis
Schizotherium sp.
Huananodon hypsodonta
Guixia youjiangensis
Forstercooperia sp. [sp. nov.]
Odoichoerus uniconus
cf. Indomeryx sp.

Lower_Lumeiyi_fauna
[Russell and Zhai (1987), Li and Ting (1983) and Tong (1989) lower part of Lumeiyi Fm Lunan Basin, southern China]
Creodonta indet.
Nimravidae indet.
Tillodontia indet.
Honanodon sp.
Gobiohyus sp.
Anthracotheriidae indet.
Brontotheriidae indet.
Protitan cf. robustus
Rhinotitan sp.
Breviodon lumeiyiensis
Lophialetes expeditus
Lophialetes cf. expeditus
Lophialetes yunnanensis
Rhodopagus pygmaeus
Rhodopagus minimus
Deperetella sp.
Teleolophus sp.
Helaletes mongoliensis
Hyrachyus lunanensis
Hyrachyus minor
Lunania youngi
Forstercooperia sp.
Prohyracodon sp.
Teilhardia pretiosa
Teilhardia? sp.
Caenolophus medius
Caenolophus sp.
Lushiamynodon menchiapuensis
Amynodon lunanensis
Amynodon sp. [spp.]

Upper_Lumeiyi_fauna
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989) and Ducrocq (1999) upper part of Lumeiyi Fm Lunan Basin, southern China]
Pterodon dahkoensis
Chailicyon crassidens
?Canidae (?Miacidae) indet.
Eoentelodon yunnanense
Anthracotheriidae indet.
Probrachyodus panchiaoensis
Bothriogenys hui
Brontotheriidae indet.
Rhinotitan quadridens
Rhinotitan sp.
Dianotitan lunanensis
Breviodon sahoensis
Deperetella dienensis
Deperetella birmanica
Teleolophus medius
Teleolophus cf. magnus
Teleolophus? rectus
Litolophus? ulterior
Eomoropus cf. quadridentatus
Forstercooperia shiwopuensis
Forstercooperia sp.
Juxia sp.
Indricotherium parvum
Indricotherium cf. parvum
Indricotherium? sp.
Rhinocerotidae indet.
Prohyracodon progressa
Prohyracodon meridionale
Prohyracodon cf. orientale
Ilianodon lunanensis
Amynodon altidens

(Continued)

Appendix 3. (3-3)

Amynodon sp.
cf. Metamynodon sp.
cf. Paramynodon sp.

Xiangshan_fauna
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989) and Huang (1999) Xiangshan Fm Lijiang Basin, southern China]
Creodonta indet.
Pterodon? sp.
Honanodon hebetis
Honanodon sp.
Lohoodon lushiensis
Eoentelodon likiangensis
Anthracokeryx sinensis
"Anthracothema" lijiangensis
?Leptomerycidae indet.
Metatelmatheriinae indet.
Lophialetes? sp.
Breviodon lumeiyiensis
Schlosseria sp.
Rhodopagus yunnanensis
Lijiangia zhangi
Lophiodon? sp. [spp.]
Deperetella birmanica
Teleolophus xiangshanensis
Lunania youngi
Eomoropus minimus
Grangeria canina
Prohyracodon major
Prohyracodon meridionale
Amynodon sp.
Caenolophus sp.

Caijiachong_fauna
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989) and Ducrocq (1999) Caijiachong Fm Yuezhow Basin, southern China]
Dormaaliidae indet.
Erinaceoidea indet.
Vespertilionoidea indet.
?Primates indet.
Lagomorpha indet.
Eucricetodon sp.
Karakoromys sp.
Dianomys obscuratus
Dianomys qujingensis
Parasminthus sp.
Entelodon sp.
Bothriodon chowi
cf. Indomeryx sp.
Miomeryx sp.
Lophiomeryx sp.
Brontotheriidae indet.
Rhinocerotidae indet.
Prohyracodon sp.
Gigantamynodon giganteus
Gigantamynodon cf. giganteus
Gigantamynodon sp.
Cadurcodon ardynensis
Cadurcodon sp.
Caenolophus sp.
cf. Metamynodon sp.
Indricotherium intermedium
Indricotherium qujingensis
Indricotherium sp.

Limuping_(Lingcha)_fauna
[Russell and Zhai (1987) and Ting (1993) Limuping (Lingcha) Fm Hengyang Basin Hengdong County Hunan southern China]
?Palaeoryctidae indet. [gen. et sp. nov.]
Hsiangolestes youngi
Matutinia nitidulus
Hapalodectes hetangensis
Archaeolambda sp.
Asiocoryphodon sp.
Cocomyidae indet.
Cocomys lingchaensis
Propachynolophus hengyangensis
Orientolophus hengdongensis
Hunanictis inexpectatus

Xinyu_fauna
[Russell and Zhai (1987) Xinyu Fm Yuanshui Basin Jiangxi southern China]
"Coryphodon" ninchiashanensis
Coryphodon sp.
Prodinoceras sinyuensis
Miacis tenuis
Heptodon? sp.

Hetaoyuan_fauna
[Tong (1989, 1997) Hetaoyuan Fm Henan middle China]
Chungchienia sichuanica
Iconapterodus qii
Neoryctes qinlingensis
Didymoconidae indet.
Jiajianictis muricatus
Ardynictis zhaii
Archaeonycteridídae? indet.
Eodendrogale parvum
Strenulagus shipigouensis
Lushilagus? danjiangensis
Lushilagus lohoensis
Shamolagus sp.
Dituberolagus venustus

(Continued)

Appendix 3. (3-4)

?Ischyromyidae indet.
Orientocylindrodon liguanqiaoensis
cf. Pareumys sp.
cf. Mysops spp.
Tamquammys dispinorum
Viriosomys jingweni
Tsinlingomys youngi
Chuankueimys xichuanensis
Saykanomys cf. bohlini
Stelmomys parvus
Boromys obtusus
Boromys brachyblastus
Zoyphiomys sinensis
Zoyphiomys grandis
Hydentomys crybelophus
Hydentomys major
Primisminthus yuenus
Miacis lushiensis
Sarkastodon? henanensis
Sinopa? sp.
Prolaena parva
Propterodon sp.
Propterodon? shipigouensis
Andrewsarchus? sp.
Sianodon sp.
Lophialetes expeditus
Schlosseria hetaoyuanensis
Breviodon minutus
Breviodon cf. minutus
Rhodopagus minimus
Protitan? sp.
Deperetella sichuanensis
Teleolophus danjiangensis
Pachylophus xui
Prohyracodon sp.

Guanzhuang_fauna
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989) and Dashzeveg and Hooker (1997) Guanzhuang Fm Shandong middle China]
Coryphodontidae indet.
Coryphodon? flerowi
Eudinoceras xintaiensis
Kuanchuanius shantunensis
Uintatheriidae indet.
Rodentia indet.
Thinocyon? sichowensis
Haplomylus? sp.
Heptaconodon dubium
Palaeosyops sp.
Propalaeotherium sinense
Propalaeotherium sp.
Grangeria canina
?Irdinolophus? shandongensis
Teleolophus sp.
Hyrachyus modestus?
Hyrachyus metalophus
Hyrachyus sp.
Helaletes sp.
Lophialetes sp.
Schlosseria sp.
Breviodon minutus
Rhodopagus zdanskyi
Rhodopagus laiwuensis

Lower_Lushi_fauna
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989) and Chow et al. (1996) lower part of Lushi Fm Henan middle China]
Eudinoceras sp.
Chungchienia lushia
Dinocerata indet.
Uintatherium sp.
Mesonychidae indet.
Gobiohyus sp.
Breviodon sp.
Lophialetes sp.

Upper_Lushi_fauna
[Russell and Zhai (1987), Li and Ting (1983) and Tong (1989) upper part of Lushi Fm Henan middle China]
Trogosinae indet.
Lushius qinlinensis
Eudinoceras sp.
Lushilagus lohoensis
Tsinlingomys youngi
Miacis lushiensis
Cynodictis sp.
cf. Eusmilus sp.
Hyaenodon sp.
Propterodon morrisi
Andrewsarchus henanensis
Andrewsarchus mongoliensis
Honanodon hebetis
Honanodon macrodontus
Lohoodon lushiensis
Dichobune sp.
Mammalia indet. [Anthracotherium? spp.]
Gobiohyus orientalis
Gobiohyus robustus
Sianodon honanensis
Lushiamynodon menchiapuensis
Caenolophus sp.
Breviodon minutus
Rhodopagus minimus
Protitan grangeri
Microtitan? sp.
Deperetella sp.

(Continued)

Appendix 3. (3-5)

Prohyracodon sp.
Forstercooperia sp. [spp.]
Colodon sp.
Lunania youngi
Eomoropus sp.

Zhaili_fauna
[Russell and Zhai (1987), Li and Ting (1983), Qi and Zhou (1989) Tong (1989, 1997), Beard (1998) and Huang et al. (1998, 1999) Zhaili Mbr upper part of Heti Fm Yuanqu basin Henan and Shanxi middle China]
Ictopidium lechei
Yuanqulestes qiui
cf. Iconapterodus sp. [II]
Lapichiropteryx xiei
Lapichiropteryx sp.
Icaronycteris? sp.
Hoanghonius stehlini
Xanthorhysis tabrumi
Eosimias centennicus
Pappocricetodon schaubi
Primisminthus jinus
Banyuesminthus diconjugatus
Protataromys yuanquensis
Yuomyidae indet.
Anadianomys cf. declivis
Chailicyon crassidens
Hyaenodon yuanchuensis
Artiodactyla indet. ["Hoanghonius stehlini"]
Anthracokeryx sinensis
Anthracokeryx cf. sinensis
Rhinotitan mongoliensis
Sharamynodon mongoliensis?
Sianodon sinensis
Amynodon sp.
Juxia borissiaki
Miacis? boqinghensis

Rencun_fauna
[Russell and Zhai (1987), Li and Ting (1983), Tong (1989, 1997) and Tsubamoto et al. (2000) Rencun Mbr lower part of Heti Fm Yuanqu basin Henan and Shanxi middle China]
Ictopidium cf. lechei
cf. Apternodus sp.
cf. Iconapterodus sp. [I]
Microchiroptera indet.
Strenulagus? sp.
Gobiolagus sp.
Hulgana? eoertnia
Hulgana? sp.
Pappocricetodon rencunensis
Raricricetodon minor
Raricricetodon zhongtiaensis
Primisminthus shanghenus
Primisminthus cf. jinus
Banyuesminthus uniconjugatus
cf. Sinosminthus sp.
Protataromys mianchiensis
Yuomys cavioides
Anadianomys declivis
Xueshimys dissectus
Zodiomys longmensis
Hoanghonius stehlini
Rencunius wui
Rencunius zhoui
Adapidae indet.
Eosimias cf. centennicus
Trogosinae indet.
Adapidium huanghoensis
Pterodon cf. dahkoensis
Honanodon hebetis
Dichobune sp.
Anthracokeryx sinensis
Anthracosenex ambiguus
Indohyus? yuanchuensis
Eomoropus quadridentatus
Litolophus major
?Isectolophidae indet.
Depereteila depereti
Depereteila birmanica
Rhodopagus? sp.
Prohyracodon cf. meridionale
Sharamynodon mongoliensis
Sianodon sinensis
Sianodon mienchiensis
Amynodon? sp.
Caenolophus cf. promissus

Huangzhuang_fauna
[Shi (1989), Wang (1994), Wang and Wang (1997) and Tsubamoto et al. (2000) Huangzhuang Fm Qufu Shandong middle China]
Yuomys huangshuangensis
Mammalia indet. ["cf. Pterodon dahkoensis"]
cf. Propterodon sp.
Eudinoceras sishuiensis
Anthracokeryx sinensis
Qufutitan zhoui
Eomoropus minimus
Eomoropus quadridentatus
Breviodon minutus
Depereteila birmanica
Depereteila sp.
Caenolophus suprametalophus
Caenolophus magnus
Caenolophus proficiens

(Continued)

Appendix 3. (3-6)

Caenolophus minimus
Caenolophus sp.
Hyracodontidae indet.
Fostercoopera sp.

Yuhuangding_fauna
[Russell and Zhai (1987) Yuhuangding Fm Xichuan Basin Henan middle China]
Asiocoryphodon conicus
Asiocoryphodon lophodontus
<<Coryphodon>> flerowi
Dinocerata indet.
Advenimus hupeiensis
Rhombomylus sp.
cf. Heptodon sp.

Shanghuang_fauna
[Qi et al. (1991, 1996), Beard et al. (1994) and Qi and Beard (1996), Jiangsu, middle China]
Didelphidae indet.
Ardynictis sp.
Erinaceidae indet.
Lagomorpha indet.
Lushilagus lohoensis
Miacis lushiensis
Miacis gracilis
Vulpavus sp.
Procynodictis sp.
Hyaenodontidae indet.
Limnocyon sp.
Pterodon sp.
Hyaenodon sp.
Adapoides troglodytes
Macrotarsius macrorhysis
Tarsius eocaenus
Eosimias sinensis
Pappocricetodon antiquus
Pappocricetodon rencunensis
Pappocricetodon schaubi
Eucricetodon sp.
Ischyromyidae indet.
Ischyromyidae indet. [gen. et sp. nov.]
Yuomyidae indet.
Ctenodactylidae indet.
Rodentia indet. [fam., gen. et sp. nov.]
Microchiroptera indet. [1]
Microchiroptera indet. [2]
Tillodontia indet. [1]
Tillodontia indet. [2]
Hyopsodontidae indet.
Homacodontidae indet. [gen. et sp. nov.]
?Eoentelodon sp.
Anthracotheriidae indet.
?Leptomerycidae indet. [gen. et sp. nov.]
Eomoropus sp.
Nanotitan shanghuangensis
Microtitan sp. cf. mongoliensis
Heptodon sp.
Helaletes mongoliensis
Helaletes sp.
Hyrachyus sp.
Rhodopagus sp.
Forstercooperia sp.
Caenolophus sp.
Palaeotheriidae indet. [gen. et sp. nov.]

Wutu_fauna
[Russell and Zhai (1987) and Tong and Wang (1998) Wutu Fm Wutu Basin Shandong middle China]
Mesodmops dawsonae
Auroratherium sinense
?Palaeoryctidae indet.
Changlelestidae indet. [gen. et sp. nov.]
Changlelestes dissetiformis
Erinaceidae indet. [gen. et sp. nov.]
?Nyctitheriidae indet. [gen. et sp. nov.]
Pseudictopidae indet. [gen. et sp. nov.]
Chronolestes simul
Carpocristes oriens
cf. Ignacius sp. [sp. nov.]
?Micromomyidae indet. [gen. et sp. nov.]
Rodentia indet.
Bandaomys zhonghuaensis
Alagomys oriensis
Acritoparamys? wutui
Taishanomys changlensis
Oxyaena? sp. [sp. nov.]
cf. Protictis sp. [sp. nov.]
Esthonychidae indet. [gen. et sp. nov.]
Dissacus sp.
Hapalodectes sp. [sp. nov.]
Hyopsodontidae indet. [gen. et sp. nov.]
Lophocion asiaticus
Pastoralodon sp. [sp. nov.]
Arctostylopidae indet. [gen. et sp. nov.]
Isectolophidae indet. [gen. et sp. nov.]
Homogalax wutuensis
Ampholophus luensis
Eomoropidae indet. [gen. et sp. nov.]
?Entelodontidae indet. [gen. et sp. nov.]

Nomogen_fauna
[Meng and McKenna (1998) Nomogen Fm Nei Mongol north China]
Pseudictops lophiodon
Palaeostylops iturus
Gashatostylops macrodon
Dissacus serratus

(Continued)

Appendix 3. (3-7)

Pastoralodon haliutensis
Pastoralodon convexus
Pastoralodon lacustris
Eomylus borealis
Sphenopsalis sp.
Prionessus lucifer
Sphenopsalis nobilis
Lambdopsalis bulla
Rodentia indet.
Sarcodon pygmaeus

Gashato_Mbr_III_fauna
[Russell and Zhai (1987) and Meng et al. (1998) Mbr III Khashat Fm Mongolia]
Gomphos elkema

Gashato_Mbr_II_fauna
[Russell and Zhai (1987) and Meng et al. (1998) Mbr II Khashat Fm Mongolia]
Gomphos elkema

Gashato_Mbr_I_fauna
[Meng and McKenna (1998) Mbr I Khashat Fm Mongolia]
Pseudictops lophiodon
Gashatostylops macrodon
Palaeostylops iturus
Dissacus sp.
Prodinoceras martyr
Praolestes nanus
Eurymylus laticeps
Prionessus lucifer
Sphenopsalis nobilis
Khashanagale? sp.
Khashanagale zofiae
Sarcodon pygmaeus
Hyracolestes ermineus
Phenacolophus fallax

Aguyt_fauna
[Meng et al. (1998) Aguyt Mbr Naran-Bulak Fm Mongolia]
Gomphos sp.

Bumban_(Tsagan_Khushu)_fauna
[Meng and McKenna (1998) Bumban Mbr Naran-Bulak Fm (Tsagan Khushu) Mongolia]
Artiodactyla indet.
Hapalodectes sp.
Tsaganius ambiguus
Naranius infrequens
Pantolestidae indet.
Hyopsodus orientalis
Hyaenodontidae indet.
Lipotyphla indet.
Gomphos elkema
Rhombomylus turpanensis
Zagmys insolitus
?Orientolophus namadicus
?Orientolophus gabuniai
Altanius orlovi
Kharomys gracilis
Tribosphenomys sp. [n. sp.]
Sharomys parvus
Kharomys mirandus
Alagomys inopinatus
Sharomys singularis
Tsagamys subitus
Ulanomys mirificus
cf. Hyracolestes sp.
Oedolius perexiguus
Bumbanius rarus
Nyctitheriidae indet.

Naran_fauna
[Meng and McKenna (1998) Naran Mbr Naran-Bulak Fm Mongolia]
Pseudictops lophiodon
Gashatostylops macrodon
Palaeostylops iturus
Dissacus indigenus
Pachyaena nemegetica
Archaeolambda planicanina
Coryphodon tsaganensis
Ernanodon sp.
Oxyaena sp.
cf. Sinopa sp.
Prodinoceras martyr
Eurymylus laticeps
Eomylus zhigdenensis
Amar aleator
Prionessus lucifer
Prionessus sp.

Zhigden_fauna
[Russell and Zhai (1987) Zhigden Mbr Mongolia]
Prionessus lucifer
cf. Prionessus lucifer
Sarcodon sp.
cf. Praolestes nanus
Archaeolambda planicanina
Prodinoceras martyr
Pseudictops lophiodon
Eurymylus laticeps
cf. Eurymylus sp.
Eurymylidae indet.
Dissacus indigenus
Ernanodon sp.

(Continued)

Appendix 3. (3-8)

Palaeostylops iturus
Gashatostylops macrodon
Didymoconidae indet.

Bayan_Ulan_fauna
[Meng and McKenna (1998) Bayan Ulan Fm Nei Mongol north China]
?? Palaeoryctoidea indet.
Pseudictops lophiodon
Palaeostylops iturus
Gashatostylops macrodon
cf. Viverravus sp.
Dissacus serratus
Pachyaena sp.
Pastoralodon lacustris
Prolimnocyon chowi
Prodinoceras xinjiangensis
Leptictidae indet. [n. gen. and sp.]
?Khaichina elongata
Eomylus borealis
Prionessus lucifer
Prionessus cf. lucifer
Lambdopsalis bulla
Perissodactyla indet.
Tribosphenomys minutus
Hyracolestes ermineus
Sarcodon minor
Bayanulanius tenuis
?Sarcodon pygmaeus

Arshanto_fauna
[Meng and McKenna (1998) and Dashzeveg and Hooker (1997) Arshanto Fm Nei Mongol north China]
Hapalodectes? serus
Mongolonyx dolichognathus
Mesonyx cf. obtusidens
Metacoryphodon? minor
Metacoryphodon sp.
Metacoryphodon luminis
Pantolambdodon fortis
Pantolambdodon? minor
Gobiatherium mirificum
Gobiatherium? major
Gobiatherium? monolobotum
cf. Uintatherium sp.
Archaeoryctes borealis
Hyrachyus crista
Forstercooperia? grandis
Hyrachyus neimongoliensis
Forstercooperia huhebulakensis
cf. Hyrachyus eximius
Forstercooperia sp.
Homogalax reliquius
Schlosseria cf. magister
Schlosseria magister
Lophialetes expeditus
Breviodon minutus
Forstercooperia confluens
Hyrachyus sp.
Helaletes medius
Protitan minor
Metatelmatherium cristatum
Microtitan? elongatus
Microtitan sp.
Desmatotitan sp.
Teilhardia pretiosa
Teleolophus cf. medius
?Irdinolophus? primarius
Helaletes fissus?
Heptodon minimus
Helaletes fissus
Teleolophus? rectus
Asiomys dawsoni
Tamquammys wilsoni
Paramys sp.
Advenimus burkei
Sinosinopa sinensis

Irdin_Manha_fauna_at_Irdin_Manha
[Meng and McKenna (1998) Irdin Manha Fm Nei Mongol north China]
cf. Archaeomeryx sp.
Gobiohyus pressidens
Gobiohyus robustus
Gobiohyus orientalis
Miacis invictus
Mesonychidae indet.
Hapalodectes serus
Andrewsarchus mongoliensis
Pachyaena sp.
Mesonyx sp.
?Pantolestes sp.
Pantolestidae indet.
Eudinoceras mongoliensis
Mongoleryctes acutus
Sarkastodon mongoliensis
Propterodon morrisi
Triplopus? proficiens
Breviodon minutus
Rhodopagus pygmaeus
Forstercooperia totadentata
Simplaletes sujiensis
Lophialetes sp.
Lophialetes expeditus
Metatelmatherium parvum
Microtitan mongoliensis
Gnathotitan berkeyi

(Continued)

Appendix 3. (3-9)

Epimanteoceras robustus
Protitan grangeri
Litolophus gobiensis
Teleolophus medius
Irdinolophus mongoliensis
Protitan obliquidens
Ischyromyidae indet.

Irdin_Manha_fauna_at_Camps_Margetts
[Li and Ting (1983) and Russell and Zhai (1987) Irdin Manha Fm Nei Mongol north China]
Pantodonta indet.
Gobiatherium mirificum
Paramyidae indet.
Advenimus burkei
Mongolonyx dolichognathus
Andrewsarchus mongoliensis
Metatelmatherium cristatum
Protitan minor
Protitan? cingulatus
Litolophus gobiensis
cf. Teleolophus medius
Helaletes fissus
Helaletes fissus?
Helaletes sp.
cf. Hyrachyus sp.
Lophialetes expeditus
Breviodon? sp.
cf. Schlosseria magister
Rostriamynodon grangeri
Forstercooperia grandis

Ulan_Shireh_fauna
[Meng and McKenna (1998) Nei Mongol north China]
Gobiohyus orientalis
Miacidae indet.
Harpagolestes? serus
cf. Mesonyx sp.
Mesonychidae indet.
Harpagolestes? orientalis
Eudinoceras mongoliensis
Pantolambdodon fortis
Pantolambdodon inermis
Propterodon cf. morrisi
Sarkastodon mongoliensis
Palaeolaginae indet.
Shamolagus grangeri
Kennatherium shirensis
Simplates ulanshirehensis
Lophialetes sp.
Lushiamynodon sharamurenensis
Epimanteoceras formosus
Zhongjianoletes chowi
Acrotitan ulanshirehensis
Zhongjianoletes sp.
Breviodon minutus
Lophialetes? expeditus
Breviodon? sp.
Microtitan mongoliensis
Dolichorhinoides angustidens
Desmatotitan tukhumensis
Teleolophus medius
Protitan bellus
Rhodopagus pygmaeus
Forstercooperia cf. grandis
Forstercooperia sp.
Triplopus? proficiens
Advenimus bohlini
cf. Advenimus sp.
Yuomys weijingensis

Shara_Murun_fauna
[Meng and McKenna (1998) Shara Murun Fm Nei Mongol north China]
Archaeomeryx optatus
Ulausuodon parvus
Artiodactyla indet. [cf. Anthracokeryx sp.]
Propterodon cf. morrisi
Pterodon hyaenoides
Desmatolagus sp.
Shamolagus medius
Gobiolagus tolmachovi
Lushiamynodon sharamurenensis
Lophialetes sp.
Caenolophus obliquus
Rhodopagus minimus
Triplopus? progressus
Sianodon sp.
Sianodon ulausuensis
Juxia borissiaki
Sharamynodon mongoliensis
cf. Cadurcodon sp.
Caenolophus promissus
Titanodectes ingens
Rhinotitan andrewsi
Pachytitan ajax
Gigantamynodon promissus
Rhinotitan kaiseni
Rhinotitan mongoliensis
Deperetella cristata
Schizotherium sp.
Titanodectes minor
Teleolophus ?medius
Telmatherium? (= Manteoceras) sp.
Yuomys cavioides

Khaychin_(II,_III,_V)_fauna

(Continued)

Appendix 3. (3-10)

[Meng and McKenna (1998) Mongolia]
"Hypertragulidae" indet.
Gobiohyus sp. [n. sp.]
Mongolonyx robustus
Metahapalodectes makhchinus
cf. Eudinoceras sp.
Pterodon rechetovi
Erinaceomorpha indet.
Lagomorpha indet.
Breviodon minutus
Amynodontidae indet.
Triplopus? proficiens
Lophialetes expeditus
Forstercooperia totadentata
Protitan reshetovi
Protitan khaitshinus
Teleolophus sp.
Deperetella khaitchinulensis
Microtitan mongoliensis
Teleolophus medius
Euboromys grandis
Petrokozlovia notos
Saykanomys bohlini.
Apternodontidae indet.

Kholboldzhi-Nur_fauna
[Meng and McKenna (1998) Mongolia]
Hapalodectidae indet.
Pantolambdodon bodgensis
Archaeolambda prima
Eudinoceras kholobochiensis
Bodgia orientalis
cf. Hypercoryphodon sp.
Lagomorpha indet.
Isectolophidae indet.
Hyracodontidae indet.
Perissodactyla indet.
Pataecops parvus
Brontotheriidae indet.
Teilhardia sp.
Breviodon sp.
Lophialetes expeditus?
Schlosseria magister
Gobihippus menneri
Rhodopagus sp.
Irdinolophus ?tuiensis

Ergilin_member_fauna_at_Ergilin_Dzo
[Meng and McKenna (1998) Mongolia]
Bothriodon sp.
Lophiomeryx gobiae
Miomeryx altaicus
Entelodon gobiensis
Stenoplesictis simplex
Nimravus mongoliensis
Hyaenodon sp.
Pterodon mongoliensis
Forstercooperia sp.
Forstercooperia ergiliiensis
Ardynia mongoliensis
Ronzotherium brevirostris
Ronzotherium orientale
Cadurcodon ardynensis
Cadurcotherium progressus
Embolotherium ergiliense
Ardynia praecox
Gigantamynodon cessator
Embolotherium andrewsi
Armania asiana
Schizotherium avitum
Colodon inceptus
Ardynomys silentii
Ardynomys olseni
Ardynomys chihi

Ergilin_member_fauna_at_Khoer_Dzan
[Meng and McKenna (1998) Mongolia]
Bothriodon sp.
Entelodon orientalis
Nimravus mongoliensis
Hyaenodon incertus
Gigantamynodon cessator
Embolotherium sp.
Schizotherium avitum
Eomoropus sp.
Teleolophus magnus
Indricotherium sp.
Ronzotherium orientale

Sevkhul_fauna_at_Khoer_Dzan
[Meng and McKenna (1998) Mongolia]
Eoentelodon trofimovi
Mongolestes hadrodens
Metahapalodectes sp.
Pterodon sp.
Hyaenodon incertus
Pterodon exploratus
Hyaenodon eminus
Desmatolagus vetustus
Ardynictis furunculus
Prohyracodon meridionalis
Amynodon lunanensis
Gigantamynodon cessator
Ardynia mongoliensis
Ardynia praecox
Embolotherium grangeri
Armania asiana
Teleolophus magnus

(Continued)

Appendix 3. (3-11)

Deperetella cf. birmanica
Schizotherium avitum
Colodon inceptus
Ardynomys sp.

Urtyn_(Erden)_Obo_fauna
[Meng and McKenna (1998) Urtyn Obo Fm Nei Mongol north China]
Entelodon sp.
Mesonychidae indet.
Gobiolagus? major
Cadurcodon ardynensis
Amynodontopsis parvidens
Cadurcodon sp.
Amynodon alxaensis
Schizotherium cf. avitum
Ardynia praecox
Urtinotherium incisivum
Parabrontops gobiensis

Ulan_Gochu_fauna
[Meng and McKenna (1998) and Lucas et al. (1996) Ulan Gochu Fm Nei Mongol north China]
Anagale gobiensis
Mongolestes hadrodens
Gobiolagus andrewsi
Desmatolagus vetustus
Didymoconidae indet.
Metatitan primus
Embolotherium grangeri
Embolotherium loucksii
Amynodontidae indet.
Metatitan progressus
Embolotherium andrewsi
Amynodontopsis sp.
Cadurcodon sp.
Zaisanamynodon borisovi
Ischyromyidae indet.
Hulgana ertinia
Ardynomys sp.

Chaganbulage_fauna
[Meng and McKenna (1998) Chaganbulage Fm Nei Mongol north China]
Bovidae indet.
Cervidae indet.
Entelodontidae indet.
Harpagolestes alxaensis
Lagomorpha indet.
Amynodon alxaensis
Teleolophus cf. medius
Cadurcodon suhaituensis
Sianodon sp.
Amynodontidae indet.
Embolotherium grangeri
Teleolophus magnus
Rodentia indet.

Hsanda_Gol_fauna_at_Tsagan-Obo
[Meng and McKenna (1998) Mongolia]
Eumeryx sp.
Eumeryx culminus
Palaeogale cf. ulysses
cf. Palaeoscaptor acridens
Sinolagomys tatalgolicus
Tachyoryctoides tatalgolicus
Tachyoryctoides obrutschewi
Tsaganomys altaicus
Yindirtemys deflexus
Cricetops dormitor
Selenomys mimicus

Hsanda_Gol_fauna_at_Shunkht
[Meng and McKenna (1998) Mongolia]
Palaeogale parvula
Stenogale sp. [n. sp.]
Palaeoprionodon gracilis
Amphicynodon teilhardi
Stenoplesictis elegans [see Dash 1996]
Hyaenodon sp.
Hyaenodon chunkhtensis
Palaeoscaptor acridens
Amphechinus rectus
Sinolagomys argyropuloi
Didymoconus colgatei
Indricotherium sp.
Tsaganomys altaicus
Selenomys mimicus
Karakoromys sp.
Cricetops dormitor

Ulaan_Khongil_(Tatal_Mbr)_fauna
[Meng and McKenna (1998) Mongolia]
"Entelodon" sp.
Eumeryx culminus
Miomeryx cf. altaicus
Pseudomeryx hypertalonidus
Pseudomeryx gobiensis
cf. Plesictis sp. [A]
cf. Plesictis sp. [B]
Amphicynodon teilhardi
Nimravus sp.
Palaeoprionodon gracilis
cf. Proailurus sp.
Palaeogale ulysses
Palaeogale parvulus
Mustelidae indet. [new taxon]
Stenoplesictis elegans

(Continued)

Appendix 3. (3-12)

Hyaenodon aymardi
Hyaenodon compressus
Tupaiodon morrisi
Amphechinus rectus
Exallerix hsandagolensis
Exallerix sp.
Tupaiodon? minutus
Palaeoscaptor acridens
Talpidae indet.
Proscalopidae indet.
Procaprolagus vetustus
Procaprolagus maximus
Ordolagus teilhardi
Desmatolagus simplex [= Agispelagus]
Desmatolagus robustus
Sinolagomys argyropuloi
Sinolagomys tatalgolicus
Desmatolagus gobiensis
Didymoconus colgatei
Didymoconus berkeyi
Ongghonia dashzevegi
Eggysodon minor
Indricotherium transouralicum
Forstercooperia sp.
Eucricetodon asiaticus [=Leidymys??]
Selenomys mimicus
Cricetops aeneus
Cricetops dormitor
Muridae new taxon
Tsaganomys altaicus
Karakoromys decessus
Anomomys lohiculus
Tataromys minor
Tataromys plicidens
Pseudocylindrodon mongolicus
Ardynomys sp.
Haplomys arboraptus
Tataromys sigmodon
Plesiosminthus tangingoli
Gobisorex kingae

Ulaan_Khongil_(Shand_Mbr)_fauna
[Meng and McKenna (1998) Mongolia]
Archaeomerycinae indet. [new taxon]
Eumeryx imbellis
Miomeryx cf. altaicus
Pseudomeryx hypertalonidus
Pseudomeryx gobiensis
Palaeoprionodon gracilis
cf. Proailurus sp.
Palaeogale ulysses
Palaeogale parvulus
Amphicticeps sp. [new sp.]
Amphicticeps shackelfordi
Stenoplesictis elegans
Hyaenodon aymardi
Hyaenodon compressus
?Palaeoscaptor sp. [new sp.]
Talpidae indet.
Ordolagus teilhardi
Desmatolagus robustus
Sinolagomys argyropuloi
Sinolagomys tatalgolicus
Desmatolagus gobiensis
Didymoconus colgatei
Didymoconus berkeyi
Eggysodon minor
Indricotherium transouralicum
Forstercooperia sp.
Eucricetodon asiaticus [=Leidymys??]
Cricetops dormitor
Cricetops elephantus
Tsaganomys altaicus
Anomomys lohiculus
Pseudocylindrodon mongolicus
Ardynomys sp.
Haplomys arboraptus
Castoridae indet. [new taxon]
Tataromys sigmodon
Plesiosminthus tangingoli
?Tachyoryctoides obrutschewi

Zavlia_(Shand_Mbr)_fauna
[Meng and McKenna (1998) Mongolia]
Palaeohypsodontus asiaticus
Eumeryx imbellis
Miomeryx cf. altaicus
Pseudomeryx hypertalonidus
Pseudomeryx gobiensis
cf. Proailurus sp.
Mustelidae indet. [new taxon]
Hyaenodon aymardi
Hyaenodon compressus
Exallerix sp.
Metexallerix gaolanshanensis
Talpidae indet.
Desmatolagus robustus
?Desmatolagus gobiensis
Didymoconus colgatei
Didymoconus berkeyi
Didymoconus sp.
Eggysodon minor
Indricotherium transouralicum
Rhinocerotidae indet. [undescribed taxon]
?Cricetops dormitor
Tachyoryctoides obrutschewi
Tsaganomys altaicus
?Yindirtemys deflexus

(Continued)

Appendix 3. (3-13)

?Yindirtemys suni
?Plesiosminthus tangingoli

Tsakhir_fauna
[Meng and McKenna (1998) Mongolia]
Entelodon sp.
Pseudomeryx gobiensis
Miomeryx sp.
Desmatolagus gobiensis
Amphechinus rectus
Karakoromys decessus
Cricetops dormitor
Selenomys mimicus
Tsaganomys sp.
Tsaganomys altaicus

Khatan-Khayrkhan_fauna
[Meng and McKenna (1998) Mongolia]
Amphicticeps shackelfordi
Amphicynodon teilhardi
Tupaiodon minutus
Didymoconus berkeyi
Eucricetodon asiaticus
Cricetops dormitor
Tsaganomys altaicus
Selenomys mimicus
Tataromys minor
Karakoromys decessus
Tataromys plicidens
Yindirtemys gobiensis
Anomomys lohiculus

Kekeamu_fauna
[Meng and McKenna (1998) Nei Mongol north China]
Tupaiodon sp.
Desmatolagus sp.
Ardynia cf. mongoliensis
Schizotherium turgaieum
Eucricetodon sp.
Plesiosminthus sp. [=Heosminthus]
Prosciurus sp.
Karakoromys decessus
Ardynomys sp.

Ulantatal_fauna
[Meng and McKenna (1998) Nei Mongol north China]
Hanhaicerus qii
Palaeohypsodontus cf. asiaticus
Eumeryx culminus
Palaeogale ulysses
Cynodictis? sp.
Palaeogale parvulus
Hyaenodon? sp.
Amphechinus rectus
Amphechinus cf. rectus
Palaeoscaptor acridens
Desmatolagus pusillus
Sinolagomys kansuensis
Desmatolagus cf. gobiensis
Ordolagus teilhardi
Sinolagomys major
Didymoconus colgatei
Aceratherium sp.
Cadurcodon sp.
Selenomys mimicus
Bounomys bohlini
Plesiosminthus tangingoli
Plesiosminthus asiaecentralis
Plesiosminthus parvulus
Plesiosminthus qiui
Plesiosminthus tongi
Euryodontomys exiguus
Cricetidae indet.
Tsaganomys cf. altaicus
Tsaganomys altaicus
Tataromys plicidens
Tataromys minor
Karakoromys decessus
Tataromys sigmodon
Bounomys ulantatalensis
Ardynomys sp.
Euryodontomys ampliatus

Wulanbulage_(lower)_fauna
[Meng and McKenna (1998) Nei Mongol north China]
Cervidae indet.
Eumeryx sp.
Tragulidae indet.
Lophiomeryx sp.
Lophiomeryx gobiae
Miacidae indet.
Carnivora indet.
Hyaenodon? sp.
Desmatolagus gobiensis
Leporidae indet.
Hyracodontidae indet.
Cadurcodon ardynensis
Karakoromys decessus
Plesiosminthus tangingoli
Tsaganomys sp.
Tsaganomys altaicus

Wulanbulage_(upper)_fauna
[Meng and McKenna (1998) Nei Mongol north China]

(Continued)

Appendix 3. (3-14)

Lophiomeryx sp.
Palaeohypsodontus asiaticus
Eumeryx sp.
Amphicyon sp.
Carnivora indet.
Hyaenodon sp.
Erinaceomorpha indet.
Leporidae indet.
Desmatolagus gobiensis
Schizotherium sp.
Paraceratherium sp.
Aprotodon sp. [sp. n.]
Tsaganomys sp.
Tataromys sigmodon
Tataromys parvus
Tataromys minor
Tsaganomys altaicus
Cricetops dormitor
Plesiosminthus asiaecentralis
Plesiosminthus sp.
Eomys orientalis
Eomyodon sp.
Karakoromys decessus

Yikebulage_fauna
[Meng and McKenna (1998) Nei Mongol north China]
Desmatolagus sp.
Sinolagomys gracilis
Sinolagomys kansuensis
Sinolagomys major
Sinolagomys sp.
Amphechinus cf. rectus
Amphechinus minimus
Amphechinus sp.
Distylomys qianlishanensis
Tataromys parvus
Yindirtemys ambiguus
Yindirtemys deflexus
Yindirtemys grangeri
Yindirtemys sp.
Yindirtemys suni
Plesiosminthus parvulus
Plesiosminthus tangingoli
Tachyoryctoides kokonorensis
Tachyoryctoides obrutschewi
Tsaganomys sp.
Castoridae indet.

Saint-Jacques_fauna
[Meng and McKenna (1998) Nei Mongol north China]
Eumeryx cf. culminus
Cervidae indet.
Amphicyon? sp.
Hyaenodon sp.
Amphechinus rectus
Desmatolagus pusillus
Sinolagomys cf. major
Ordolagus teilhardi
Desmatolagus gobiensis
Desmatolagus robustus
Hyrachyus sp.
Aceratherium? sp.
Schizotherium cf. avitum
Paraceratherium sp.
Indricotherium transouralicum
Gomphotherium? sp.
?Pseudotheridomys sp.
Pseudotheridomys asiaticus
Anomoemys lohiculus
Cricetops dormitor
Eomys orientalis
Cricetops minor
Tsaganomys altaicus
Selenomys mimicus
Eucricetodon caducus
Euryodontomys ampliatus
Bounomys bohlini
Karakoromys sp.
Karakoromys decessus
Promeniscomys sinensis
Prosciurus ordosicus
Tataromys minor
Tataromys plicidens
Bounomys ulantatalensis
Yindirtemys deflexus
Yindirtemys ambiguus
Tataromys sigmodon
Haplomys arboraptus

Lower_Taben_Bulak_(Yindirte)_fauna
[Meng and McKenna (1998) Gansu north China]
Eumeryx sp.
Carnivora indet.
Amphechinus rectus
Talpidae? indet.
Amphechinus minimus
Erinaceidae? indet.
Amphechinus cf. rectus
Sinolagomys major
Sinolagomys kansuensis
Didymoconus? sp.
Aceratherium sp.
Schizotherium? sp.
Rhinocerotidae indet.
?Kansupithecus sp.
"Sciurus" sp.

(Continued)

Appendix 3. (3-15)

Tachyoryctoides sp.
Sicistinae indet.
Yindirtemys grangeri
Yindirtemys cf. ambiguus
Eucricetodon sp.
Plesiosminthus asiaecentralis
Yindirtemys ambiguus
Plesiosminthus tangingoli
Plesiosminthus parvulus
Soricidae indet.

Upper_Shargaltein_(Shihchiangtzuku)_fauna
[Meng and McKenna (1998) Gansu north China]
Cervulinae indet.
Eumeryx? sp.
Bovidae indet.
Carnivora indet.
Amphechinus sp.
Erinaceidae indet.
Palaeoscaptor cf. acridens
Desmatolagus robustus
Sinolagomys gracilis
Desmatolagus pusillus
Sinolagomys major
Sinolagomys kansuensis
Didymoconus sp.
Indricotherium sp.
Sciuridae indet.
Sicistinae indet.
Tataromys sigmodon
Yindirtemys ambiguus
Tataromys parvus
Tachyoryctoides intermedius
Tachyoryctoides obrutschewi
Tachyoryctoides pachygnathus
Tsaganomys altaicus

Lower_Shargaltein_(Wutaoyayu)_fauna
[Russell and Zhai (1987) Gansu north China]
Eumeryx? sp.
Indricotherium sp.
Desmatolagus sp.
cf. Tataromys sp.
cf. Karakoromys sp.
Tsaganomys altaicus
Carnivora indet.

Houldjin_fauna
[Meng and McKenna (1998) and Lucas et al. (1996)
Houldjin Fm Nei Mongol north China]
Entelodon dirus
Caenopinae indet.
Rhinocerotidae indet.
Brontotheriidae indet.
Aprotodon sp. [n. sp.]
Paraceratherium sp. [n. sp.]
Cadurcodon sp.
Ctenodactyloidea indet. [gen. & sp. n.]
Zaisanamynodon borisovi

Baron_Sog_fauna
[Russell and Zhai (1987) and Lucas et al. (1996) Baron
Sog Fm Nei Mongol north China]
Embolotherium ultimum
Schizotherium avitum
Schizotherium sp.
Zaisanamynodon borisovi

Akasaki fauna
[Miyata and Tomida (1998) Akasaki Fm Japan]
Higotherium hypsodon
cf. Trogosus sp. [A]
cf. Trogosus sp. [B]
Coryphodontidae indet.
Asiocoryphodon cf. conicus
cf. Orientolophus hengdongensis
Rodentia indet.

Khaychin-Ula_I_fauna
[Russell and Zhai (1987) Naran-Bulak Fm Mongolia]
Archaeolambda planicanina
Pastoralodon trofimovi
Barylambda sp.
Prodinoceras sp.
Prodinoceras martyr
Mixodontia indet.

Datang_fauna
[Wang et al. (1998) and Russell and Zhai (1987)
Datang Mbr Nongshan Fm Nanxiong basin,
Guangdong, south China]
cf. Huaiyangale leura
Haltictops mirabilis
Haltictops meilingensis
Interogale datangensis
Yantanglestes datangensis
Altilambda pactus
Altilambda sp.
Nanlingilambda sp.
"Altilambda" minor [new family]
Ernanodon antelios
Petrolemur brevirostre
Minchenella grandis
Yuelophus validus
Radinskya yupingae

Zhunguikeng_fauna

(Continued)

Appendix 3. (3-16)

[Wang et al. (1998) and Russell and Zhai (1987) Zhunguikeng Mbr Nongshan Fm Nanxiong basin, Guangdong, south China]
Archaeolambda speciosa

Shanghu_fauna
[Wang et al. (1998) and Huang and Zheng (1999) Shanghu Fm Nanxiong basin, Guangdong, south China]
Carnilestes palaeoasiaticus
Carnilestes major
Linnania lofoensis
Astigale nanxiongensis
Zhujegale lirenensis
Zhujegale jintangensis
Lofochaius brachyodus
Dysnoetodon minuta
Yantanglestes feiganensis
Dissacusium shanghoensis
Hukoutherium ambigum
Yuodon protoselenoides
Palasiodon siurenensis
?Ectoconus sp.
?Phenacodontidae indet. [gen. et sp. nov.]
Bemalambda nanhsiungensis
Bemalambda pachyoesteus
Bemalambda crassa
Pappictidops acies
Pappictidops obtusus
Huananius youngi

Pinghu_fauna
[Wang et al. (1998) Pinghu Fm Chijiang basin, Jiangxi, south China]
Prodinoceras lacustris

Wangwu_fauna
[Wang et al. (1998) and Russell and Zhai (1987) Wangwu Mbr Chijiang Fm Chijiang basin, Jiangxi, south China]
Jiangxia chaotoensis
Archaeolambda tabiensis
Allostylops periconotus
Bothriostylops notios
Bothriostylops sp.

Lannikeng_fauna
[Wang et al. (1998) and Russell and Zhai (1987) Lannikeng Mbr Chijiang Fm Chijiang basin, Jiangxi, south China]
Archaeoryctes notialis
Hsiuannania minor
cf. Pseudictops tenuis
?Dissacus sp.
Hyopsodontidae indet.
Pseudanisonchus antelios
Nanlingilambda chijiangensis
Harpyodus decorus
Asiostylops spanios
Ganolophus lannikenensis

Shizikou_fauna
[Wang et al. (1998) Shizikou Fm Chijiang basin, Jiangxi, south China]
Bemalambda shizikouensis
Bemalambda sp.

Zaoshi_fauna
[Wang et al. (1998) Zaoshi Fm Chaling basin, Hunan, south China]
Stenanagale xiangensis
Dissacus rotundus
Meiostylodon zaoshiensis
Bemalambda nanhsiungensis
Hypsilolambda chalingensis
Hypsilolambda impensa

Upper_Doumu_fauna
[Wang et al. (1998) and Russell and Zhai (1987) Upper Mbr Doumu Fm Qianshan basin, Anhui, middle China]
Hyracolestes ermineus
Hsiuannania sp.
Heomys orientalis
Mimotona wana
Altilambda sp. [sp. nov.]
Archaeolambda tabiensis
Sinostylops promissus

Lower_Doumu_fauna
[Wang et al. (1998) and Russell and Zhai (1987) Lower Mbr Doumu Fm Qianshan basin, Anhui, middle China]
Hsiuannania tabiensis
Allictops inserrata
Mimotona robusta
Obtususdon hanhuaensis

Upper_Wanghudun_fauna
[Wang et al. (1998) and Russell and Zhai (1987) Upper Mbr Wanghudun Fm Qianshan basin, Anhui, middle China]
Zeuctherium niteles
Eosigale gujingensis
Huaiyangale chianshanensis
Qipania yui
Diacronus wanghuensis
Anictops tabiepedis

(Continued)

Appendix 3. (3-17)

Paranictops majuscula
?Paranictops sp.
Mimotona lii
Pappictidops orientalis
Harpyodus euros
Altilambda pactus
Altilambda yujingensis
Altilambda tenuis
Decoredon anhuiensis
Obtususdon hanhuaensis
Wania chowi

Lower_Wanghudun_fauna
[Wang et al. (1998) and Russell and Zhai (1987) Lower Mbr Wanghudun Fm Qianshan basin, Anhui, middle China (oldest fauna in this analysis)]
Anaptogale wanghoensis
Anictops tabiepedis
Cartictops canina
Astigale wanensis
Chianshania gianghuaiensis
Wanogale hodungensis
Yantanglestes conexus
Bemalambda sp.
Bemalambdidae indet.
Plethorodon chienshanensis
Anchilestes impolitus

Shuangtasi_fauna_at_Xuancheng
[Wang et al. (1998) Shuangtasi Fm Xuancheng basin, Anhui, middle China]
Hsiuannania maguensis
Dissacus magushanensis
Bothriostylops progressus
Archaeolambda yangtzeensis
Wanotherium xuanchengensis

Shuangtasi_fauna_at_Tongling
[Wang et al. (1998) Shuangtasi Fm Tongling basin, Anhui, middle China]
Bothriostylops progressus
Archaeolambda cf. yangtzeensis
Guichilambda zhaii

Fangou_fauna
[Wang et al. (1998) Fangou Fm Shimen basin, Shaanxi, middle China]
Prosarcodon luonanensis
Linnania qinlingensis
Bemalambda zhoui
Bemalambda cf. pachyoesteus
Hukoutherium shimenensis

Liankan_fauna
[Russell and Zhai (1987) Liankan Fm Turfan basin, Xinjiang, northwest China]
?Rhinotitan sp.
Teleolophus liankanensis
Lophialetes expeditus
Lophialetidae indet. [3 spp.]
Sharamynodon mongoliensis
Amynodon sp.
Xinjiangmeryx parvus
?Anthracotheriidae indet. [?Bothriodon sp.]

Taizicun_fauna
[Wang et al. (1998) Taizicun Fm Turfan basin, Xinjiang, northwest China]
Multituberculata indet.
Eurymylidae indet.
Pseudictops chaii
Archaeolambda speciosa
Archaeolambda sp. [2]
Prodinoceras turfanensis
Prodinoceras diconicus
Prodinoceras primigenum
Prodinoceras simplum
Tienshanilophus subashiensis
Tienshanilophus lianmuqinensis
Tienshanilophus shengjinkouensis

Shisanjianfang_fauna
[Russell and Zhai (1987) Shisanjianfang Fm Turpan basin Xinjiang northwest China]
Coryphodon sp.
Rhombomylus turpanensis
Hyopsodus sp.
Heptodon tienshanensis
Anatolostylops dubius

Dabu_fauna
[Russell and Zhai (1987) and Wang et al. (1998) Dabu Fm Turpan basin Xinjiang northwest China]
Coryphodon dabuensis
Prodinoceras xinjiangensis

Lizhuang_fauna
[Russell and Zhai (1987) Lizhuang Fm Pingchangguan basin Henan middle China]
Yuomys minggangensis
Carnivora indet.
Breviodon cf. minutus
Triplopus? cf. proficiens
Hyracodontidae indet.
Anthracokeryx sp.
Anthracotheriidae indet.
Gobiohyus orientalis
Gobiohyus? minor

(Continued)

Artiodactyla indet.

Wulidui_fauna
[Russell and Zhai (1987) Wulidui Fm Wucheng basin Henan middle China]
Imequincisoria mazhuangensis
Imequincisoria micracis
Imequincisoria? sp.
Juxia borissiaki
Sianodon sinensis
Gigantamynodon sp.
cf. Lushiamynodon sp.

Lishigou_fauna
[Russell and Zhai (1987) Lishigou Fm Wucheng basin Henan middle China]
Yuomys eleganes
Carnivora indet.
Hyaenodon sp.
Hyaenodontidae indet.
Eomoropus sp.
Deperetella sp.
Breviodon sp.
Lophialetidae indet. [gen. et sp. nov.]
Pappaceras sp.
Lushiamynodon wuchengensis
Sharamynodon mongoliensis
Sianodon sinensis
Sianodon sp.

Changxindian_fauna
[Russell and Zhai (1987) Changxindian Fm Beijing City north China]
Tupaiodon? sp.
Eudinoceras? sp.
Hypsimylus beijingensis
Miacis sp.
Canidae indet.
Imequincisoria sp.
Amynodontidae? indet.

Jiyuan_fauna
[Russell and Zhai (1987) Jiyuan Fm Henan middle China]
Yuomys cavioides
Lushiamynodon obesus
Sianodon chiyuanensis
Sianodon sinensis

Chugouyu_fauna
[Russell and Zhai (1987) Chugouyu Fm Lushi basin Henan middle China]
Palaeolaginae indet.
Yuomys sp. [sp. nov.]
Ctenodactylidae indet.
Litolophus major
Breviodon sp. [sp. nov.]
Forstercooperia sp.
Archaeomeryx optatus

Xiaotun_fauna
[Russell and Zhai (1987) Xiaotun Fm Lunan basin Henan south China]
Hyracodontidae indet.
cf. Gigantamynodon giganteus
Bothriogenys hui

Shuidonggou_fauna
[Russell and Zhai (1987) Lingwu District Ningxia north China]
Tsaganomys sp.
Indricotherium transouralicum
Hyracodontidae indet.
Eumeryx sp.

Qingshuiying_fauna
[Russell and Zhai (1987) Qingshuiying Fm Lingwu District Ningxia north China]
Cyclomylus lohensis
Schizotherium sp.
Indricotherium transouralicum
Entelodon ordosius
"Eumeryx" sp.

Jeminay_fauna
[Jin (2000) Jeminay Xinjiang northwest China]
Triplopus sp.
Triplopus? jeminaiensis
Lophialetes sp.
Hyaenodontidae indet.

Neogene faunas:

Upper_Taben_Buluk_(Tiehchiangku_and_Hsishui)_fauna
[Russell and Zhai (1987) Gansu north China]
Sayimys obliquidens
Bunolophodon? connexus ["Trilophodon"]
Schizotherium sp.
Proboscidea indet.
Cervulinae indet.
Bovidae indet.
Rhinocerotidae indet. [small]
Rhinocerotidae indet. [large]
?Kansupithecus sp.

Lanzhou_fauna

(*Continued*)

Appendix 3. (3-19)

[Qiu and Qiu (1995) Yehucheng Fm middle China]
Metexallerix gaolanshanensis
Tataromys grangeri
Tataromys suni
Tataromys sp.
Leptotararomys cf. gracilidens
Tsagannomys altaicus

Suosuoquan_fauna
[Qiu and Qiu (1995) Suosuoquan Fm Xinjiang northwest China]
Prodistylomys xinjiangensis
Sinolagomys ulungurensis
Palaeoerinaceus sp.
Tachyoryctoides sp.
Parasminthus sp.
Palaeogale sp.
Exallerix sp. [nov.]

Shawa_fauna
[Qiu and Qiu (1995) Shawa Fm Xinjiang north China]
Dzungariotherium orgosense
"Lophiomeryx" sp.

Xiejia_fauna
[Qiu and Qiu (1995) middle China]
Atlantoxerus sp.
Eucricetodon youngi
Plesiosminthus xiningensis
Plesiosminthus huangshuiensis
Plesiosminthus lajeensis
Tataromys suni
Tataromys sp.
Tachyoryctoides kokonorensis
Leporidae indet.
Sinolagomys pachygnathus
Sinolagomys cf. pachygnathus
Mustelidae indet.
?Diaceratherium sp.
Sinopalaeoceros xiejiaensis

Zhangjiaping_fauna
[Qiu and Qiu (1995) Xianshuihe Fm middle China]
Tataromys sp.
Sinolagomys sp.
Tachyoryctoides sp.
Hyaenodon sp.
Schizotherium sp.
Aprotodon sp.
Indricotheriidae indet.
?Proboscidea indet.

Jiaozigou_fauna
[Qiu and Qiu (1995) middle China]
Dzungariotherium orgosense
Paraentelodon macrognathus
Rhinocerotidae indet.
Proboscidea indet.

Wuertu_fauna
[Qiu and Qiu (1995) north China]
Amphechinus minimus
Amphechinus sp.
Sinolagomys cf. ulungurensis
Sinolagomys sp.
Distylomys qianlishanensis
Prodistylomys xinjiangensis
Tachyoryctoides sp.
Megacricetodon sp.
Protalactaga sp.
Gomphotherium sp.

Sihong_(Xiacaowan)_fauna
[Qiu and Qiu (1995) middle China]
Lanthanotherium sp.
Crocidosorex sp.
Myotis sp.
Vespertilionidae indet.
Ansomys orientalis
Parapetaurista tenurugosa
Shuanggouia lui
Eutamias sihongensis
Plesiosciurus sinensis
Sciurinae indet.
Youngofiber sinensis
Microdyromys orientalis
Sayimys sp.
Rhizomyidae indet.
Diatomys cf. shantungensis
cf. Cricetodon sp.
Megacricetodon sp.
Democricetodon sp.
Primus sp.
Neocometes sp.
Cricetidae indet.
Alloptox sp.
?Amphicyon sp.
Ursidae indet.
Proputorius sp.
Semigenetta huaiheensis
Pseudaelurus cf. lorteti
Mustela sp.
?Protictitherium sp.
Rulengchia huaiheensis
?Anchiterium sp.
Plesiaceratherium shanwangensis
Suidae indet.
Pecarichoerus sp.

(Continued)

Appendix 3. (3-20)

Dorcatherium orientale
Micromeryx sp.
Dicrocerus sp.
Amphimoschus sp.
Stephanocemas sp.
Lagomeryx sp.
Palaeomeryx sp.
Delphinus sp.
Dionysopithecus shuangouensis
Platodontopithecus jianghuaiensis
Hominoidea indet.

Shanwang_fauna
[Qiu and Qiu (1995) middle China]
Shanwangia unexpectula
Ansomys shanwangensis
Plesiosciurus aff. sinensis
Meinia asiatica
Diatomys shantungensis
Amphicyon confucianus
Hemicyon youngi
Ursavus orientalis
Thaumastocyoninae indet.
Gomphotherium sp.
Palaeotapirus xiejiaheensis
Chalicotherium sp.
Plesiaceratherium gracile
Plesiaceratherium shanwangensis
Diaceratherium sp.
Hyotherium penisulus
Palaeomeryx tricornis
Lagomeryx colberti

Dingjiaergou_fauna
[Qiu and Qiu (1995) middle China]
Erinaceidae indet.
Talpidae indet.
Soricidae indet.
Chiroptera indet.
Sayimys sp.
Tachyoryctoides sp.
Atlantoxerus sp.
Steneofiber sp.
?Leptodontomys sp.
Prodryomys sp.
Heterosminthus orientalis
Protalactaga grabaui
Paralactaga sp.
Megacricetodon sp.
Democricetodon sp.
Alloptox gobiensis
Tongxinictis primordialis
Gobicyon sp.
Hemicyon sp.
Sansanosmilus sp.
Platybelodon tongxinensis
Caementodon tongxinensis
Chalicotherium sp.
Kubanochoerus lantienensis
Stephanocemas sp.
Eotragus sp.
Turcoceros sp.
Pliopithecus zhanxiangi

Koujiacun_fauna
[Qiu and Qiu (1995) Koujiacun Fm middle China]
Kubanochoerus lantienensis
Kubanochoerus gigas
Bunolistriodon intermedius
Platybelodon grangeri
Lagomeryx complicidens
Antelopinae indet.

Jiulongkou_fauna
[Qiu and Qiu (1995) and Chen and Wu (1976) Cixian middle China]
Macrotherium cf. brevirostris
Percrocuta hebeiensis
Sansanosmilus palmidens
Dicerorhinus cixianensis
Dicerorhinus sp.
Plesiaceratherium gracile
Chilotherium sp.
Palaeomeryx sp.
Turcocerus jiulongkouensis
Turcocerus robustus
Turcocerus stenocephalus
Aceratheriinae indet.
Rhinocerotidae indet.
?Dicrocerus sp.
?Stephanocemas sp.
Cervidae indet.

Lengshuigou_fauna
[Qiu and Qiu (1995) and McKenna and Bell (1997) middle China]
Alloptox minor
Tsaganolagus wangi
Gomphotherium shensiensis
Platybelodon spectabilis
Hispanotherium lingtungensis
Listriodon lishanensis
Palaeotragus sp.
Stephanocemas sp.
Palaeomeryx sp.
?Micromeryx sp.
Turcocerus lishanensis

(Continued)

Appendix 3. (3-21)

Tunggur_fauna
[Qiu and Qiu (1995) north China]
Mioechinus? gobiensis
Mioechinus? sp.
Erinaceinae indet.
Proscapanus sp.
Yanshuella sp.
Quyania sp.
Desmanella sp.
Talpidae indet.
Mongolosorex qiui
Soricinae indet.
Soricidae indet.
Chiroptera indet.
Anomys? sp.
Eutamias aff. ertemtensis
Sinotamias primitivus
Atlantoxerus sp.
Anchitheriomys tungurensis
Monosaulax tunggurensis
Hystricops? sp.
Leptodontomys lii
Leptodontomys aff. gansus
Keramidomys fahlbuschi
Microdyromys wuae
Miodyromys sp.
Heterosminthus orientalis
Protalactaga grabaui
Protalactaga major
Gobicricetodon flynni
Gobicricetodon robustus
Gobicricetodon sp.
Plesiodipus leei
Plesiodipus progressus
Megacricetodon sinensis
Megacricetodon pusillus
Democricetodon lindsayi
Democricetodon tongi
Desmatolagus? moergenensis
Alloptox gobiensis
Bellatona forsythmajori
Gobicyon macrognathus
Pseudarctos sp.
Hemicyon teilhardi
Amphicyon tairumensis
Leptarctus neimonguensis
Melodon sp.
Mionictis sp.
Martes sp.
Tungurictis spocki
Percrocuta tungurensis
Metailurus mongoliensis
Machairodus sp.
Platybelodon grangeri
Serridentinus gobiensis
Zygolophodon sp.
Anchitherium gobiensis
Chalicotherium brevirostre
Chalicotheriidae indet.
Rhinocerotidae indet. [spp.]
Listriodon mongoliensis
Kubanochoerus sp.
Stephanocemas thomsoni
Dicerocerus grangeri
Dicerocerus sp.
Micromeryx sp.
Lagomeryx triacuminatus
Euprox sp.
Palaeotragus tungurensis
Turcocerus grangeri
Turcocerus noverca

Shaping_fauna
[Qiu and Qiu (1995) Shaping Fm Fangxian north China]
Tesselodon fangxianensis
Anchitherium aurelianense
Turcocerus noverca
Listriodon robustus

Karamagay_fauna
[Qiu and Qiu (1995) Karamagay Fm Xinjiang northwest China]
Sinomylagaulus halamagaiensis
Atlantoxerus junggarensis
Atlantoxerus giganteus
Amblycastor tunggurensis
Gomphotherium cf. shensiense
Platybelodon sp.
Zygolophodon junggarensis
Amphicyon ulungurensis
Ictitherium cf. gaudryi
Anchitherium cf. aurelianense
Brachypotherium sp.
Chilotherium sp.
Kubanochoerus sp.
Stephanocemas aff. thomsoni
Dicrocerus grangeri
Lagomeryx sp.
Palaeomeryx sp.
Eotragus halamagaiensis
Turcocerus noverca
Gobicyon sp.
Miohyaena sp.

Xianshuihe_fauna
[Qiu and Qiu (1995) Yongdeng Gansu middle China]
Protalactaga grabaui

(Continued)

Appendix 3. (3-22)

Heterosmithus orientalis
Plesiodipus leei
Paracricetulus schaubi
Kubanochoerus gigas
Gomphotherium sp.

Lingyanshan_fauna
[Qiu and Qiu (1995) 12.17 Ma middle China]
Tetralophodon sp.
Acerorhinus sp.
Hyotherium cf. palaeochoerus

Xiaolongtan_fauna
[Qiu and Qiu (1995) and Dong (1987) south China]
Dryopithecus keiyuanensis
Tapirus cf. yunnanensis
Propotamochoerus parvulus
Dicoryphochoerus sp.
Listriodon sp.
Tetralophodon xiaolongtanensis
Gomphotherium cf. macrognathus
Zygolophodon chinjiensis
Mustelidae indet.
Cervidae indet.
Castoridae indet.

Tsaidam_fauna
[Qiu and Qiu (1995) middle China]
?Ictitherium sp.
?Tetralophodon sp.
Acerorhinus tsaidamensis
Hipparion sp.
?Stephanocemas sp.
Lagomeryx tsaidamensis
?Dicrocerus sp.
Eostylocerus sp.
Qurliqnoria cheni
Tossunnonia pseudibex
Tsaidamotherium hedini
Olonbulukia sp.

Lufeng_fauna
[Qiu and Qiu (1995) south China]
Prodendrogale yunnanica
Lanthanotherium sanmigueli
Hylomys aff. suillus
Heterosorex wangi
Anourosorex oblongus
Blarinella sp.
Sorex sp.
Soricinae indet.
Yunoscaptor scalprum
Talpinae indet.
Pteropidae indet.
Hipposideridae indet.
Myotis sp.
Epthsicus sp.
Pipistrellus sp.
Plecotus sp.
Tamiops sp.
Sciurotamias sp.
Callosciurus sp.
Dremomys sp.
cf. Albanensia sp.
Hylopetes sp.
Castoridae indet.
Platacannthomys dianensis
Typhlomys primitivus
Typhlomys hipparionum
Leptodontomys sp.
Eomyidae indet.
Brachyrhizomys nagrii
Brachyrhizomys cf. pilgrimi
Brachyrhizomys tetracharax
Kowalskia hanae
Progonomys yunnanensis
Yunomys wui
Hystrix sp.
Alilepus longisinuosus
Ursavus sylvestris
Ursavus sp.
Indarctos sinensis
Indarctos sp.
Ailurarctos lufengensis
Martes cf. palaeosinensis
Martes sp.
Mustelinae indet.
Eomellivora wimani
Melinae indet.
Proputorius lufengensis
Proputorius sp.
Sivaonyx bathygnathus
Lutra sp.
Lutrinae indet.
Mustelidae indet.
Viverra sp.
Viverrinae indet.
Paradoxurinae indet.
Viverridae indet.
Ictitherium gaudryi
Ictitherium sp.
Epimachairodus fires
Pseudaelurus sp.
Felis sp.
Gomphotherium sp.
Serridentinus sp.
Zygolophodon lufengensis
Hipparion sp. [spp.]

(Continued)

Appendix 3. (3-23)

Chalicotherium salinum
Chalicotherium sp.
Tapirus sp.
Chilotherium sp.
Aceratherium sp.
Hyotherium sp.
Hyotherium cf. palaeochoerus
Lophochoerus lufengensis
Potamochoerus sp. [spp.]
Suidae indet.
Dorcabune progressus
Yunnanotherium simplex
Moschus sp.
Dicrocerus sp.
Metacervulus cf. simplex
Metacervulus sp. [spp.]
Muntiacus cf. nanus
Muntiacus sp. [spp.]
Cervidae indet.
Selenoportax sp.
Bovidae indet.
Sinoadapis carnosus
Sinoadapis shihuibaensis
Laccopithecus robustus
Lufengpithecus lufengensis

Baode_fauna_(Loc._30)
[Qiu and Qiu (1995) north China]
Sinocastor zdanskyi
Simocyon aff. primigenius
Indarctos lagrelii
Indarctos sinensis
Sinictis dolicognathus
Mustela palaeosinensis
Proputorius minimus
Plesiogulo brachygnathus
Lutra aonychoides
Parataxidea sinensis
Parataxidea crassa
Melodon majori
?Melodon incertum
Promephitis cf. maeotica
Eomellivora wimani
Ictitherium sinense
Ictitherium gaudryi
Thalassictis wongii
Hyaenictitherium hyaenoides
Aderocuta variabilis
?Lycyaena dubia
Machairodus palanderi
Machairodus tingii
Metailurus major
Metailurus minor
Tetralophodon exoletus
Dicerorhinus orientalis
Chilotherium habereri
Chilotherium planifrons
Chilotherium anderssoni
Acerorhinus palaeosinensis
Sinotherium lagrelii
Hipparion hippidiodus [subgenus (Hipparion)]
Hipparion dermatorhinum [subgenus (Hipparion)]
Hipparion fossatum [subgenus (Hipparion)]
Hipparion plocodus [subgenus (Hipparion)]
Hipparion forstenae [subgenus (Cremohipparion)]
Chleuastochoerus stehlini
Microstonyx major
Propotamochoerus hyothericides
Cervocerus novorossiae
Procapreolus latifrons
Palaeotragus microdon
Palaeotragus cf. coelophrys
Samotherium sp.
Honanotherium schlosseri
Urmiatherium intermedium
Plesiaddax depereti
Tragocerus spectabilis
Gazella paotehensis
Gazella dorcadoides
Gazella altidens
?Tragoreas lagrelii
?Tragoreas anderssoni
?Tragoreas palaeosinensis
Sinotragus wimani
Paraprotoryx minor
Palaeoryx sinensis

Ertemte_fauna
[Qiu and Qiu (1995) north China]
Erinaceus mongolicus
Erinaceidae indet.
Quyania chowi
Yanshuella primaeva
Talpinae indet.
?Anourosorex sp.
Neomyini indet.
Crocidura kormosi
Blarinella sp. [sp. nov.]
Alluvisorex sp.
Sorex sp. [spp.]
Soricinae indet.
Chiroptera indet.
Pseudaplodon asiaticus
Eutamias ertemtensis
Sciurus sp.
Sinotamias gravis
Spermophilus orientalis
Pliopetaurista rugosa

(Continued)

Appendix 3. (3-24)

Petinomys auctor
Sinocastor anderssoni
Dipoides cf. majori
Myomimus sinensis
Leptodontomys gansus
Sicista sp.
Eozapus similis
Lophocricetus grabaui
Lophocricetus pusillus
Paralactaga anderssoni
Brachyscirtetes wimani
Sminthoides fraudator
Sinocricetus zdanskyi
Nannocricetus mongolicus
Kowalskia neimengensis
Kowalskia similis
Microtodon atavus
Anatolomys teilhardi
Pseudomeriones abbreviatus
Prosiphneus eriksoni
Microtoscoptes praetermissus
Apodemus orientalis
Orientalomys cf. similis
Karnimata hipparionum
Occitanomys pusillus
Micromys chalceus
Alilepus annectens
Ochotona lagreli
Ochotona minor
Meles suillus
Promephitis alexejevi
Martes anderssoni
Martes sp.
Ictitherium aff. hipparionum
Viverridae indet.
Hyaena sp.
Machairodus sp.
Felis sp.
Mastodon sp.
Hipparion richthofeni
Hipparion sp.
Sinohippus zitteli
Chilotherium habereri
Propotamochoerus hyotherioides
Honanotherium sp.
Palaeotragus microdon
Axis speciosus
Procapreolus rutimeyeri
Procapreolus latifrons
Paracervulus brevis
Moschus grandaevus
Gazella sp.

Gaozhuang_fauna

[Qiu and Qiu (1995) about 4.3 Ma middle China]
Soriculus praecursus
Blarinini indet.
Yanshuella primaeva
Desmana kowalskae
Scaptochirus sp.
Eutamias cf. ertemtensis
Tamiasciurus sp.
Sinotamias sp.
Pliopetaurista rugosus
Sinocastor anderssoni
aff. Dipoides majori
Hystrix sp.
Myomimus sp.
Sminthoides fraudator
Kowalskia sp. [spp.]
Nannocricetus mongolicus
Allocricetus sp.
Prosiphneus truncatus
Prosiphneus eriksoni
Prosiphneus praetingi
Germanomys sp.
Mimomys sp.
Apodemus qiui
Micromys chalceus
Micromys tedfordi
aff. Karnimata hipparionum
Chardinomys yusheensis
Huaxiamys primitivus
Huaxiamys downsi
Ochotona lagreli
Alilepus sp.
Trischizolagus sp.
Hypolagus sp.
Agriotherium sp.
Ursus sp.
Plesiogulo brachygnathus
Martes sp.
Thalassictis sp.
Chasmaporthetes kani
Pliohyaena pyrenaica [subspecies orientalis]
Metailurus sp.
Nyctereutes tingi
Nyctereutes sinensis
Canis sp.
Mammut borsoni
Anancus sinensis
Sinomastodon intermedius
Hipparion platyodus [subgenus (Hipparion)]
Hipparion houfenense [subgenus (Plesiohipparion)]
Hipparion pater [subgenus (Proboscidipparion)]
Hipparion insperatum [subgenus (Baryhipparion)]
Hipparion licenti [subgenus (Cremohipparion)]
Dicerorhinus orientalis

(Continued)

Appendix 3. (3-25)

Acerorhinus sp.
Sus erymanthius
Paracamelus sp.
Moschus sp.
Cervocerus novorossiae
Paracervulus cf. killgusi
Procapreolus sp.
Axis speciosus
Cervavitus demissus
Metacervulus sp.
Muntiacus cf. lacustris
Gazella blacki
cf. Protoryx yushensis
cf. Tragoceras laticornis
Stegodon zdanskii

Mazegou_fauna
[Qiu and Qiu (1995) about 2.95 Ma middle China]
cf. Erinaceus sp.
cf. Blarinoides sp. [sp. nov.]
Peisorex pliocaenicus
Yanshuella primaeva
Scaptochirus sp.
Sciurus sp.
Tamiasciurus sp.
Pliopetaurista rugosus
Sinocastor sp.
Dipoides sp.
Hystrix sp.
Myomimus sp.
Sminthoides fraudator
Rhizomys shansius
Allocricetus sp.
?Cricetulus sp.
Prosiphneus praetingi
Germanomys sp.
Mimomys cf. orientalis
Apodemus zhangwagouensis
Micromys tedfordi
Chardinomys nihewanicus
Ochotonoides complicidens
Ochotona sp.
Alilepus annectens
Hypolagus schreueri
Agriotherium sp.
Ursus sp.
Meles sp.
Chasmaporthetes sp.
Pliohyaena sp.
Crocuta sp.
Metailurus sp.
Machairodus sp.
Homotherium sp.
Lynx sp.
Civettictis sp.
Nyctereutes sinensis
Canis sp.
Vulpes baihaiensis
Stegodon sp.
Anancus sp.
Sinomastodon intermedius
Archidiskodon sp.
Postschizotherium sp.
Hipparion platyodus [subgenus (Hipparion)]
Hipparion pater [subgenus (Proboscidipparion)]
Hipparion insperatum [subgenus (Baryhipparion)]
Dicerorhinus sp.
Sus sp.
Paracamelus sp.
Palaeotragus sp.
Axis sp.
Muntiacus sp.
Dama sp.
Rusa sp.
Gazella blacki
Antilospira licenti
Sinoryx cornucopia
Caprini indet. [gen. nov.]
Megalovis sp.
Lyrocerus sata

Xiashagou_fauna
[Qiu and Qiu (1995) the base of the fauna = about 2.75 Ma middle China (youngest fauna in this analysis)]
Erinaceus cf. dealbatus
Alactaga cf. annulata
Youngia tingi
Borsodia chinensis
Hystrix sp.
Ochotonoides complicidens
Vulpes chikushanensis
Nyctereutes sinensis
Canis chiliensis
Ursus etruscus
Pliohyaena licenti
Chasmaporthetes cf. ossifagus
Crocuta honanensis
Lutra licenti
Mustela pachygnatha
Meles chiai
Lynx sp.
Acinonyx pleistoceneus
Megantereon nihowanensis
Homotherium cf. crenatiders
Dicerorhinus yunchuensis
Coelodonta sp.
Elasmotherium sp.
Nestoritherium sp.

(Continued)

Appendix 3. (3-26)

Postschizotherium sp.
Hipparion sinensis [subgenus (Proboscidipparion)]
Equus sanmeniensis
Equus teilhardi
Sus cf. lydekkeri
Paracamelus gigas
Cervulus bohlini
Elaphurus bifurcatus
Eucladoceros boulei
Cervus elegans
Gazella sinensis
Gazella subgutturosa
Spirocerus wongi
Spirocerus peii
Antilospira robusta
Ovis shantungensis
?Budorcas sp.
Bison paleosinensis

Amuwusu_fauna
[Qiu and Qiu (1995) Qiu (1988) north China]
Anchitherium sp.
Hipparion sp.
Erinaceidae indet.
Talpidae indet.
Heterosoricinae indet.
Ansomyinae indet. [gen. et sp. nov.]
Rodentia indet. [Sciurus-group and Tamias-group]
Miopetaurista sp.
Monosaulax sp.
Sinocastor sp.
Keramidomys sp.
Protalactaga tunggurensis
Plesiosminthus sp.
Cricetodon sp.
Democricetodon sp.
Plesiodipus cf. leei
Prosiphneus sp. [sp. nov.]
Ochotona sp.
Ochotonidae indet. [gen. et sp. nov.]

Wuzhong_fauna
[Qiu and Qiu (1995) middle China]
Hipparion weihoense
Tetralophodon cf. exoletus
Acerorhinus tsaidamensis
Qurliqnoria cheni

Bulong_fauna
[Qiu and Qiu (1995) northern Tibet middle China]
Hipparion xizangense
Chilotherium tanggulaense
Dinocrocuta sp.

Har_Obo_fauna
[Qiu and Qiu (1995) north China]
Rhagapodemus sp.
Hypolagus sp.
Ochotona sp.
Anatolomys sp.
Microtodon sp.
Lophocricetus sp.
Microtoscoptes sp.

Bilike_fauna
[Qiu and Qiu (1995) Qiu (1988) north China]
Beremendia sp.
Drepanosorex sp.
Desmana sp.
Quyania aff. chowi
Yanshuella aff. primaeva
Talpidae indet.
Crocidura kormosi
Blarinella sp. [sp. nov.]
Sorex sp. [1]
Sorex sp. [2]
Sorex sp. [3]
Soricinae indet.
Chiroptera indet.
Spermophilina indet. [Spermophilinus-group]
Sinocastor cf. anderssoni
Myominus cf. sinensis
Sicista sp. [sp. nov.]
Sicista sp.
Paralactaga sp.
Sminthoides aff. fraudator
Sinocricetus sp.
Kowalskia sp.
Pseudomeriones sp.
Prosiphneus sp. [sp. nov.]
Mimomys sp. [sp. nov.]
Apodemus sp. [1]
Apodemus sp. [2]
Micromys sp.
Muridae indet. [1]
Muridae indet. [2]
Hypolagus sp.
Ochotona sp.

Youhe_River_fauna
[Qiu and Qiu (1995) middle China]
Elephas youheensis
Hipparion pater [subgenus (Proboscidipparion)]
Sus subtriqueta
Cervavitus sp.
Nyctereutes sinensis
Ochotonoides cf. complicidens
Mimomys youhenicus

(Continued)

Appendix 3. (3-27)

Mimomys orientalis

Daodi_fauna
[Qiu and Qiu (1995) Qiu (1988) north China]
Talpidae indet. [1]
Talpidae indet. [2]
Sorex sp.
cf. Sorex. sp.
Paenelimnoecus sp.
?Beremendia sp.
Soricidae indet. [1]
Soricidae indet. [2]
Soricidae indet. [3]
Eucastor sp.
Prosiphneus sp.
cf. Nannocricetus sp.
Cricetidae indet.
Mimomys orientalis
Germanomys sp. [sp. nov.]
Orientalomys sp. [sp. nov.]
Apodemus sp.
Mus sp.
Rattus sp.
Chardinomys sp.
Paralactaga sp.
Sminthoides sp. [sp. nov.]
Pliopentalagus nihewanensis
Hypolagus schreuderi
Ochotona cf. lagrelii
Ochotona erythrotis

Appendix 4. (4-1)

Bose and Yongle basin (southern China):

Gongkang Fm (Gongkang fauna)

Naduo Fm (Naduo fauna)

Dongjun Fm (Dongjun fauna)

Lunan basin (southern China):

Xiaotun Fm

---

upper part of Lumeiyi Fm (Upper Lumeiyi fauna)

---

lower part of Lumeiyi Fm (Lower Lumeiyi fauna)

Lushi basin (middle China):

Chugouyu Fm

---

upper part of Lushi Fm (Upper Lushi fauna)

---

lower part of Lushi Fm (Lower Lushi fauna)

Heti Fm (middle China):

Zhaili Mbr (Zhaili fauna)

Rencun Mbr (Rencun fauna)

Mongolia (1):

Shand Mbr of Hsand Gol Fm

Tatal Mbr of Hsand Gol Fm

Khetsu Mbr of Ergilin Dzo Fm

Ergilin Mbr of Ergilin Dzo Fm

Sevkhul Mbr of Ergilin Dzo Fm

Mongolia (2) (Nemegt Basin):

Aguyt Mbr (Naran-Bulak Fm)

Bumban Mbr (Naran-Bulak Fm)

Naran Mbr (Naran-Bulak Fm)

Zhigden Mbr (Naran-Bulak Fm)

Mongolia (Ulan-Nur Basin) (3):

Mbr III (Khashat Fm, Gashato)

Mbr II (Khashat Fm, Gashato)

Mbr I (Khashat Fm, Gashato)

Nei Mongol (northern China) (1):

Yikebulage Fm

Wulanbulage Fm (upper)

Wulanbulage Fm (lower)

Nei Mongol (northern China) (2):

?(Ulan Gochu Fm)

Irdin Manha Fm

Arshanto Fm

Bayan Ulan Fm

Nomogen Fm

Nei Mongol (northern China) (3):

Ulantatal Fm (Ulantatal fauna)

---

base of Ulantatal Fm (Kekeamu local fauna)

(Continued)

Appendix 4. (4-2)

North China (Taben Buluk area):

Upper Taben Buluk (Tiehchiangku and Hsishui)

Lower Taben Buluk (Yindirte)

Upper Shargatein Gol (Shihchiangtzuku)

Lower Shargatein Gol (Wutzoyayu)

Qianshan basin (middle China):

Upper Mbr of Doumu Fm

Lower Mbr of Doumu Fm

Upper Mbr of Wanghudun Fm

Middle Mbr of Wanghudun Fm

Lower Mbr of Wanghudun Fm

Nanxiong basin (southern China):

Datang Mbr of Nongshan Fm

Zhuguikeng Mbr of Nongshan Fm

Shanghu Fm

Chijiang basin (southern China):

Pinghu Fm

Wangwu Mbr of Chijiang Fm

Lannikeng Mbr of Chijiang Fm

Shizikou Fm

Turpan basin (Xinjiang, northwest China) (1):

Shisanjianfang Fm

Dabu Fm

Turpan basin (Xinjiang, northwest China) (2):

Liankan Fm

Taizicun Fm

Wucheng basin (middle China):

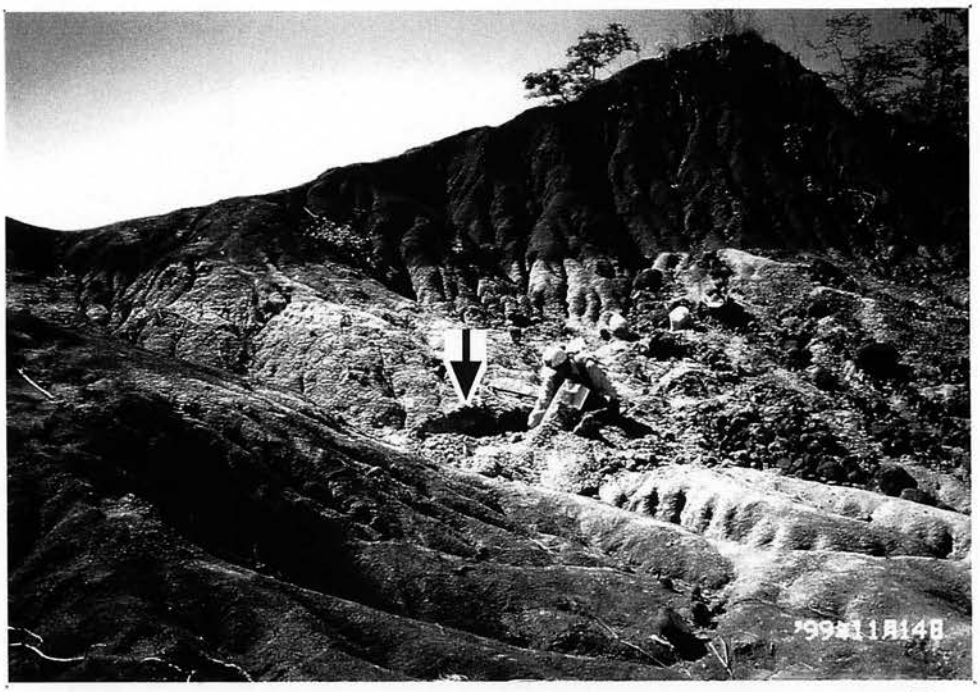
Wulidui Fm

Lishigou Fm

Plate 1 . A, Landscape of the Bh1 locality (Yashe Kyitchaung), Bahin area, Pondaung area, central Myanmar. **B**, the tuff bed (the arrow) of the "Upper Member" of the Ponduang Formation at Pk1 locality ("Humerus Site"), Bahin area, Pondaung area, central Myanmar.

Plate 1

A

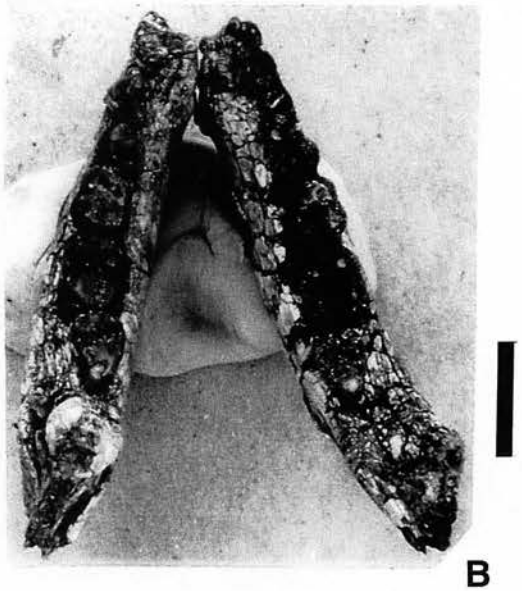


B

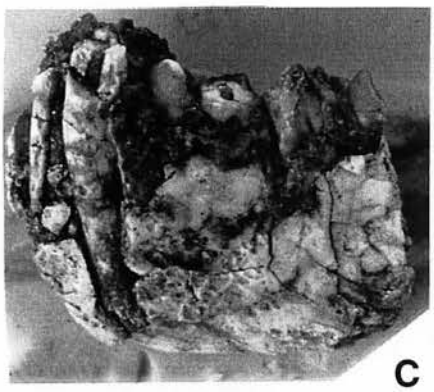
Plate 2 . Primates. **A**, *Pondaungia cotteri*, NMMP-KU 0003, left maxilla with I^1, C, P^3, (P^4-M^1), M^2 and (M^3), in occlusal view. **B**, *Amphipithecus mogaungensis*, NMMP 7, right and left mandibles with right P_4-M_3 and left P_3-M_3, in occlusal view. **C**, *Bahinia pondaungensis*, NMMP-KU 0129, a left mandible with C-M_1 and right I_2-C, in buccal view. **D**, Anthropoidea gen. *et* sp. nov., NMMP-KU 0001, a right maxilla with P^4-M^3, in occlusal view. Scale bars = 1 cm.

Plate 2

A



B

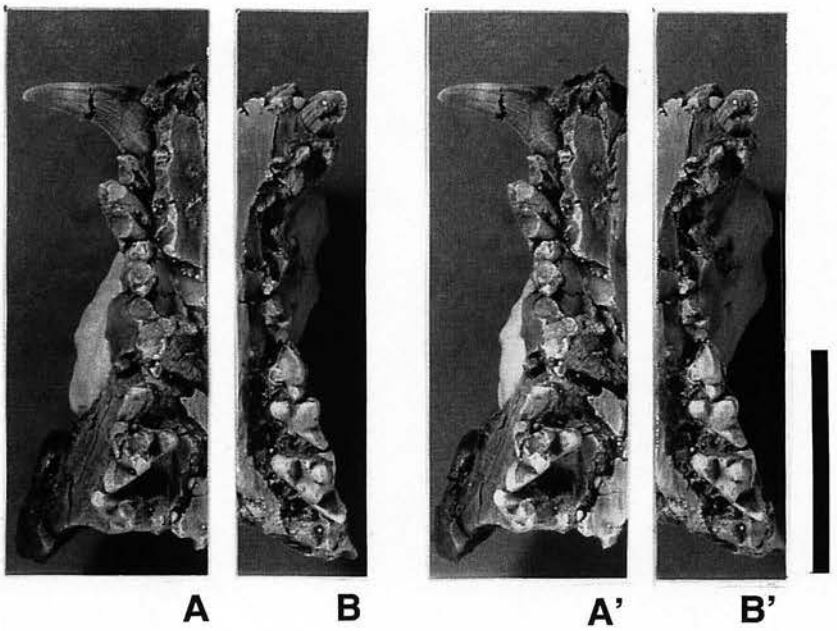


C

D

Plate 3 . Hyaenodontid creodonts. **A , A'**, Hyaenodontidae gen. *et* sp. nov., NMMP-KU 0042, right upper dentition, in occlusal view (stereo pair). **B , B'**, Hyaenodontidae gen. *et* sp. nov., NMMP-KU 0042, left upper dentition, in occlusal view (stereo pair). **C , C'**, "*Pterodon*" *dahkoensis*, NMMP-KU 0304, a left maxillary fragment with M^1, in occlusal view (stereo pair). **D , D'**, "*Pterodon*" *dahkoensis*, NMMP-KU 0261, a right mandibular fragment with P_2-M_1, in occlusal view (stereo pair). Scale bars = 5 cm (upper scale corresponds to A, A', B, B'; lower scale corresponds to C, C', D, D').

Plate 3



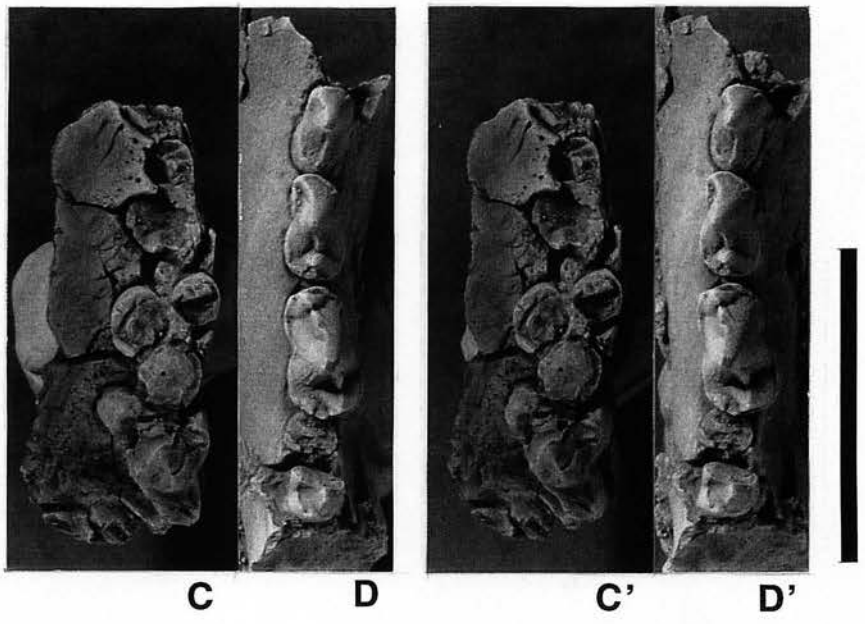


Plate 4. Phiomyidae gen. *et* sp. nov. **A, A'**, NMMP-KU 0213, left M_{1-3}, in occlusal view (stereo pair). **B, B'**, NMMP-KU 0231, right M_{1-3}, in occlusal view (stereo pair). **C, C'**, NMMP-KU 0048, a right maxillary fragment with P^{3-4}, in occlusal view (stereo pair). **D, D'**, NMMP-KU 0049, left M_{2-3}?, in occlusal view (stereo pair). **E, E'**, NMMP-KU 0047, a left M_2, in occlusal view (stereo pair). Scale bars = 2 mm (left scale corresponds to A-D and A'-D', right scale corresponds to E, E').

Plate 4

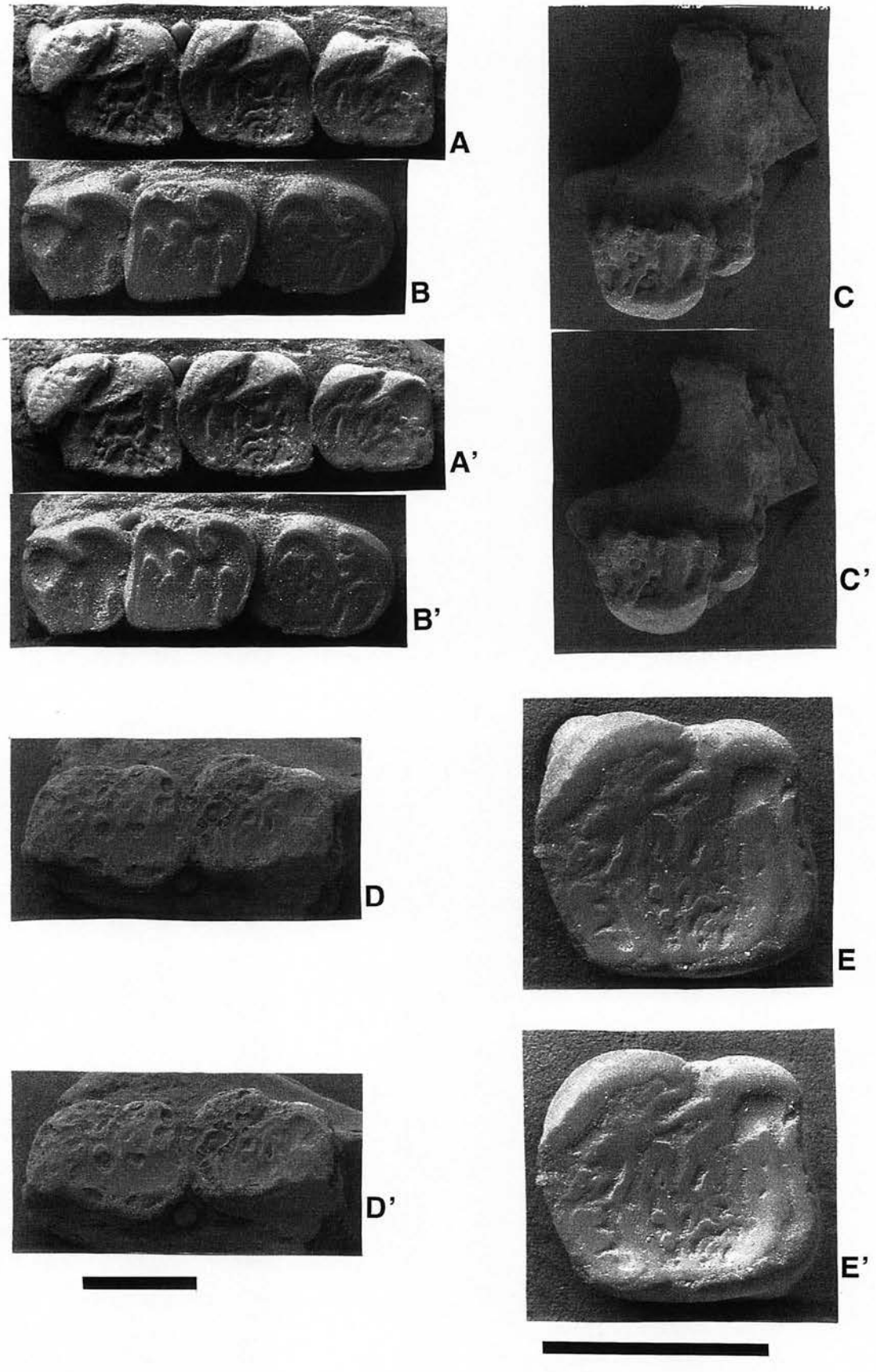
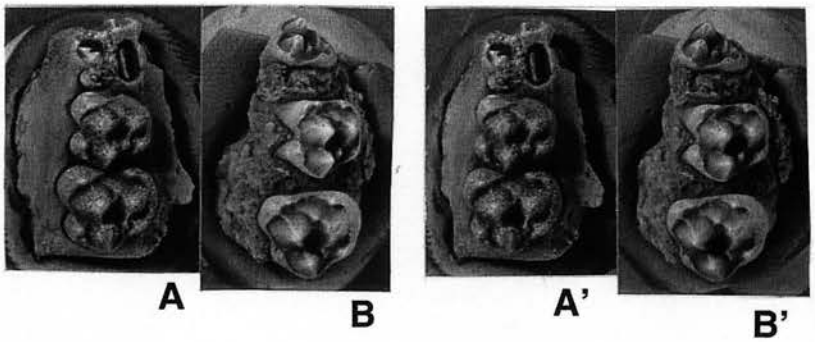
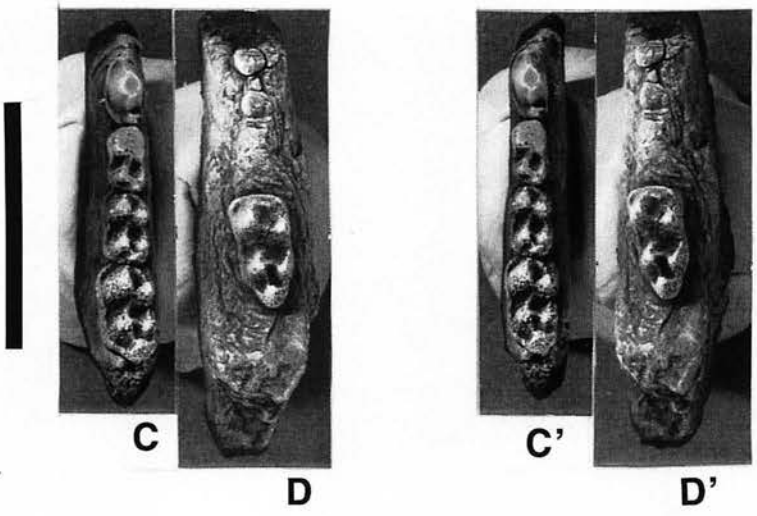


Plate 5 . *Hsanotherium parvum.* **A , A'**, NMMP-KU 0031 (Bhn 11), a right maxillary fragment with M^{2-3}, in occlusal view (stereo pair). **B , B'**, NMMP-KU 0035 (Bhn 10; Holotype), a left maxillary fragment with M^{1-3}, in occlusal view (stereo pair). **C , C'**, NMMP-KU 0036, a left mandibular fragment with P_4-M_3, in occlusal view (stereo pair). **D , D'**, NMMP-KU 0032, a left mandibular fragment with M_3, in occlusal view (stereo pair). **E**, NMMP-KU 0036, in buccal view. F, NMMP-KU 0032, in buccal view. Scale bars = 2 cm (upper scale corresponds to A-D and A'-D', lower scale corresponds to E, F).

Plate 5





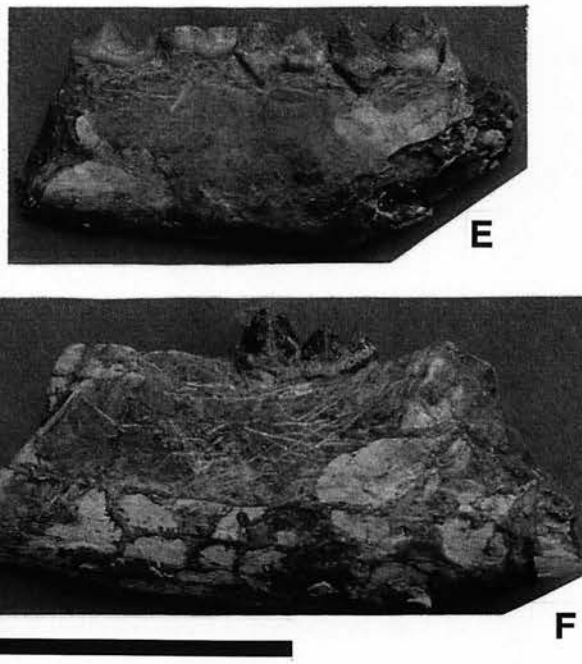
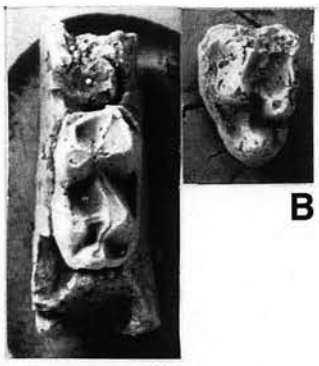


Plate 6 . *Hsanotherium parvum.* **A , A'**, NMMP-KU 0033, a right mandibular fragment with M_2, in occlusal view (stereo pair). **B , B'**, NMMP-KU 0034, a talonid part of left M_3, in occlusal view (stereo pair). **C , C'**, NMMP-KU 0037, a right mandibular fragment with dP_4M_{1-2}, in occlusal view (stereo pair). **D**, NMMP-KU 0037, in buccal view. Scale bar = 1 cm.

Plate 6



B

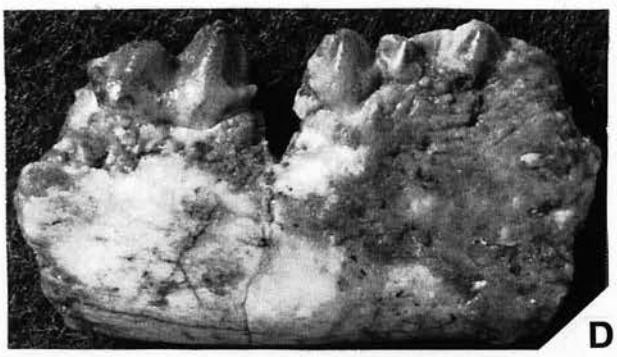
B'

A

A'

C

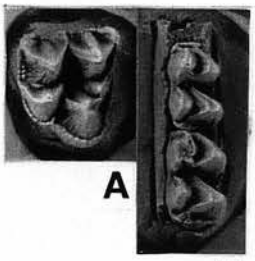
C'



D

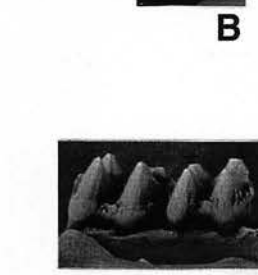
Plate 7. Artiodactyla gen. *et* sp. nov. **A, A'**, NMMP-KU 0026, a right $M^{3?}$, in occlusal view (stereo pair). **B, B'**, NMMP-KU 0029, a right mandibular fragment with M_{1-2}, in occlusal view (stereo pair). **C**, NMMP-KU 0029, in buccal view. **D**, NMMP-KU 0029, in lingual view. **E, E'**, NMMP-KU 0028, a right mandibular fragment with M_3, in occlusal view (stereo pair). Scale bars = 2 cm (upper scale corresponds to A-E, A', B', E', lower scale corresponds to F).

Plate 7

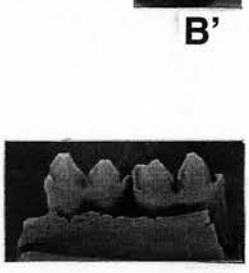


A

A'



B



B'

C

D

E

E'

F

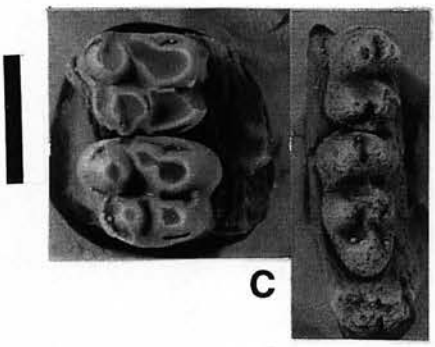
Plate 8. A, A', B, cf. Artiodactyla gen. *et* sp. nov. A, A', NMMP-KU 0030, a right mandibular fragment with $M_{1?}$, in occlusal view (stereo pair). B, NMMP-KU 0030, a right mandibular fragment with $M_{1?}$, in buccal view. **C, C', D, D'**, *Pakkokuhyus lahirii*. C, C', NMMP-KU 0039, a right maxillary fragment with M^{2-3}, in occlusal view (stereo pair). D, D', NMMP-KU 0038, a right mandibular fragment with M_{2-3}, in occlusal view (stereo pair). Scale bars = 1 cm (upper scale corresponds to A, A', middle scale corresponds to B, lower scale corresponds to C, C', D, D').

Plate 8

A

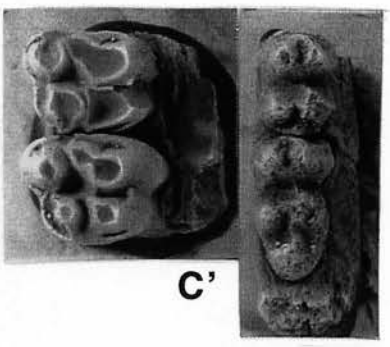
A'

B



C

D

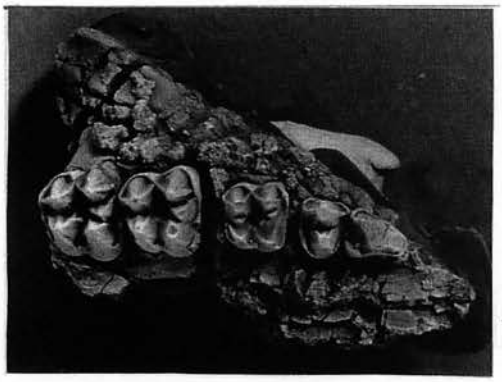


C'

D'

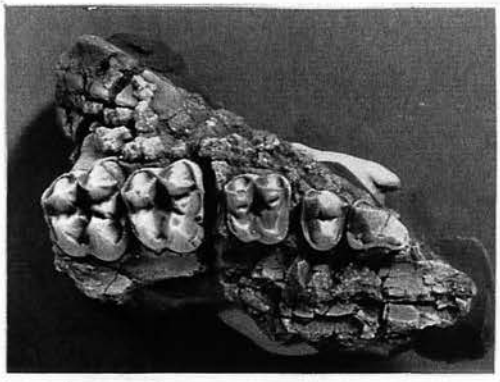
Plate 9 . Upper dentitions of *Anthracotherium.* **A, A'**, NMMP-KU 0053, an right upper jaw with P^3-M^3, in occlusal view (stereo pair). **B, B'**, NMMP-KU 0327, a right mandibular fragment with dP^4, in occlusal view (stereo pair). **C, C'**, NMMP-KU 0455, a right maxillary fragment with P^{3-4}, in occlusal view (stereo pair). **D**, NMMP-KU 0056, a right maxillary fragment with M^{2-3}, in occlusal view. **E**, NMMP-KU 0413 a right maxillary fragment with P^4M^{1-2}, in occlusal view. Scale bars = 2 cm (upper scale corresponds to A, A', lower left scale corresponds to B, B', C, C', lower right scale corresponds to D, E).

Plate 9



A

B

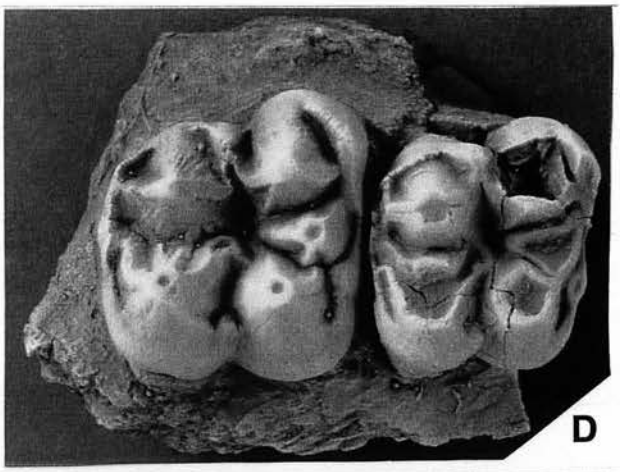


A'

B'

C

C'



D

E

Plate 10. Upper dentitions of *Anthracotherium*. **A**, NMMP-KU 0404, a right M^3. **B**, NMMP-KU 0411, a left maxillary fragment with M^3. **C**, NMMP-KU 0070, a right M^3. **D**, NMMP-KU 0382, a left maxillary fragment with M^{2-3} or M^{1-2}. **E**, NMMP-KU 0326, a right maxillary fragment with $M^{3 \text{ or } 2}$. **F**, NMMP-KU 0379, a left $M^{3?}$. **G**, NMMP-KU 0384, a right $M^{1 \text{ or } 2}$. In occlusal view. Scale bar = 2 cm.

Plate 10

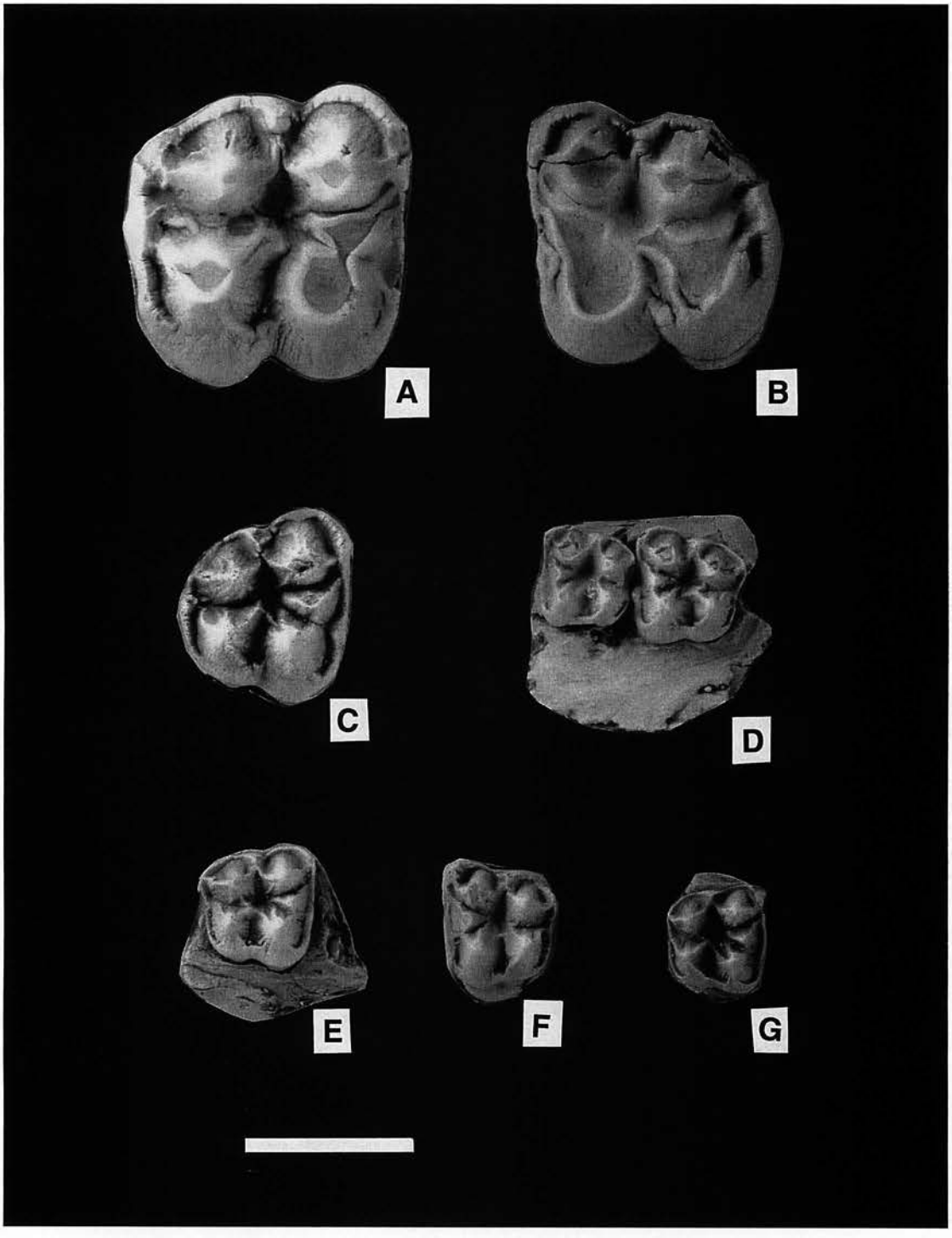


Plate 11. Lower dentitions of *Anthracotherium*. **A-C, A'**, NMMP-KU 0052, a right mandibular fragment with P_1P_4-M_3. A, A', occlusal view (stereo pair). B, lingual view. C, buccal view. **D**, NMMP-KU 0330, a left mandibular fragment with M2-3, in occlusal view. **E-G, G'**, NMMP-KU 0086, a left P_4. E, lingual view. F, buccal view. G, G', occlusal view (stereo pair). **H**, NMMP-KU 0419, a talonid part of left M_3, occlusal view. **I**, NMMP-KU 0332, a right mandibular fragment with M_3, occlusal view. Scale bars = 2 cm.

Plate 11

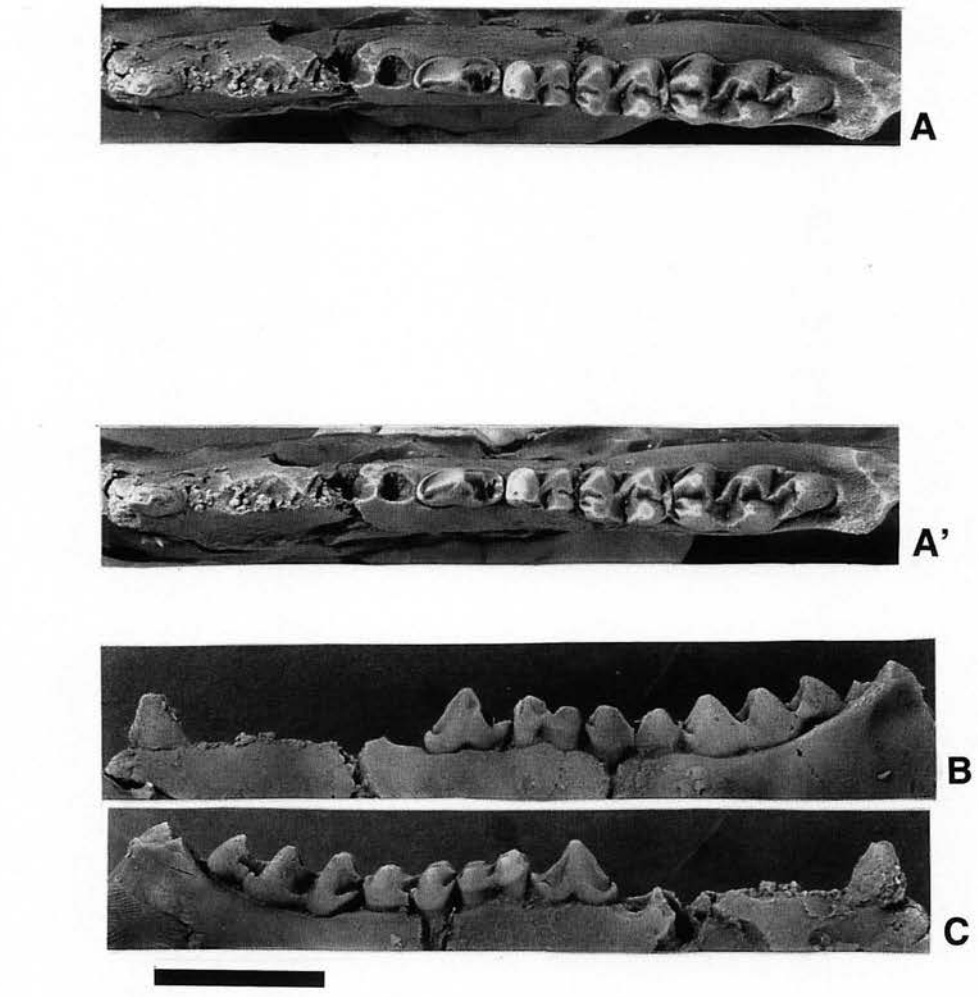
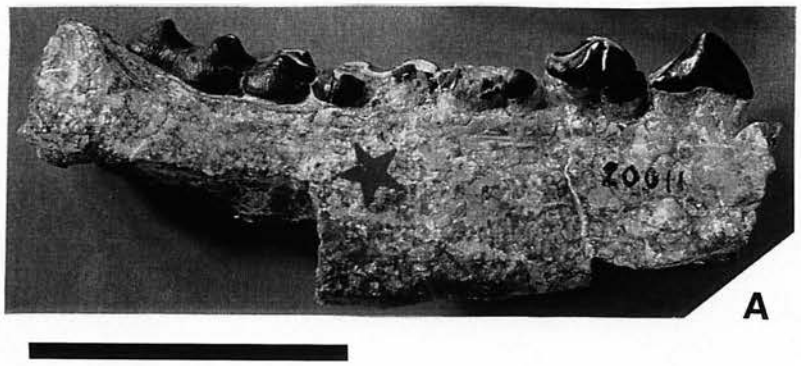
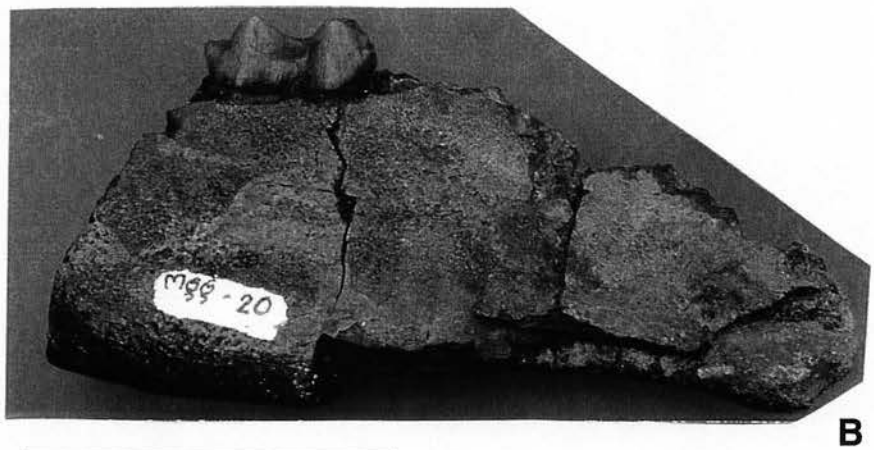


Plate 12. Mandibles of *Anthracotherium*, showing the depth. **A**, AMNH, 20011, a right mandibular fragment with P_3-M_3. **B**, NMMP-KU 0331, a right mandibular fragment with M_2. C, NMMP-KU 0574, a right mandibular fragment. Buccal view. Scale bars = 5 cm.

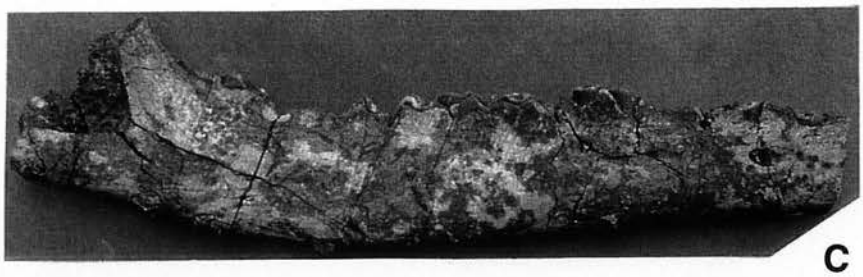
Plate 12



A

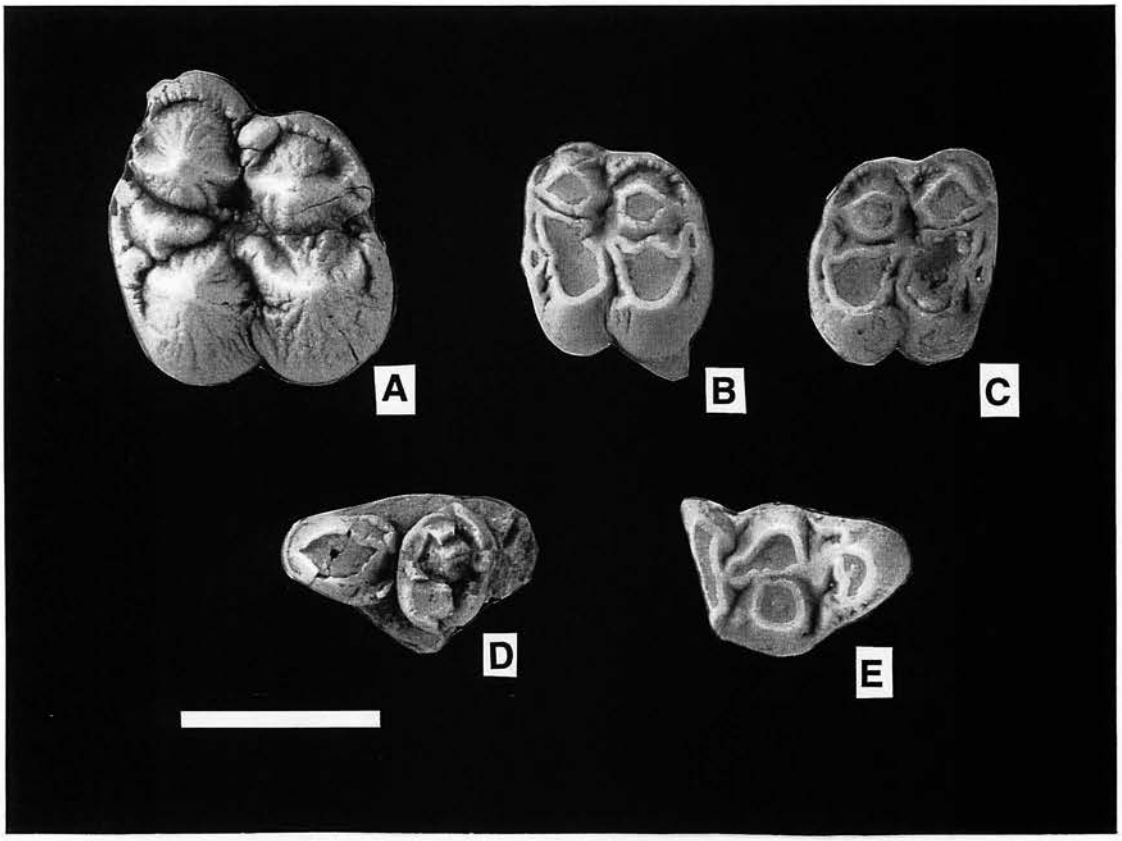


B



C

Plate 13. *Anthracotherium* of "*Anthracohyus*"-type. **A**, NMMP-KU 0452, a left M^3. **B**, NMMP-KU 0454, a left M^3. **C**, NMMP-KU 0453, a right M^3. **D**, NMMP-KU 0500, a left maxillary fragment with P^{3-4}. **E**, NMMP-KU 0475, a right M_3. **F, F'**, GSI B603 (holotype of "*Anthracohyus choeroides*"), a left M^3 (stereo pair). Occlusal view. Scale bars = 2 cm.


A
B
C
D
E

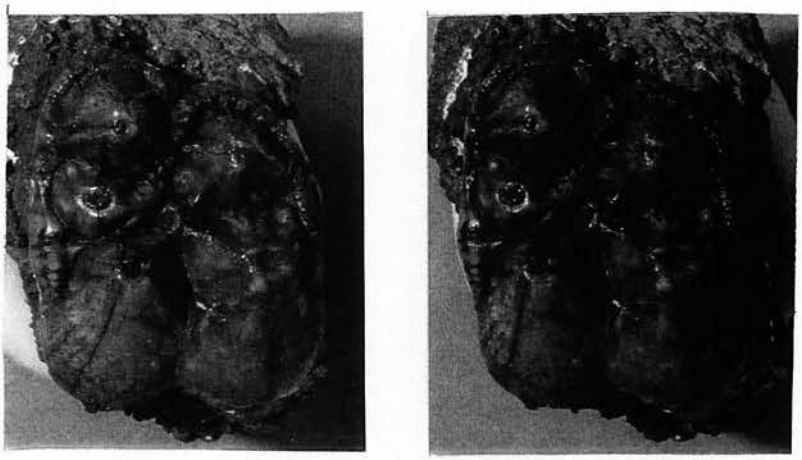

F
F'

Plate 14. A, A', B, B', E, F, *Indomeryx cotteri.* A, A', NMMP-KU 0015, a left mandibular fragment with M_{1-3}, in occlusal view (stereo pair). B, B', NMMP-KU 0019, a right mandibular fragment with P_3-M_3, in occlusal view (stereo pair). E, NMMP-KU 0015, in buccal view. F, NMMP-KU 0289, a right mandibular fragment with M_3, in buccal view. **C, C', D, D', G, H**, *Indomeryx arenae.* C, C', NMMP-KU 0011, a left mandibular fragment with P_4-M_3, in occlusal view (stereo pair). D, D', NMMP-KU 0013, a right mandibular fragment with P_4-M_3, in occlusal view (stereo pair). G, NMMP-KU 0011, in buccal view. H, NMMP-KU 0013, in lingual view. Scale bar = 2 cm (upper scale corresponds to A-D, A'-D', lower scale corresponds to E-H).

Plate 14

A

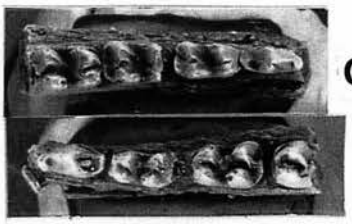
B

C

D

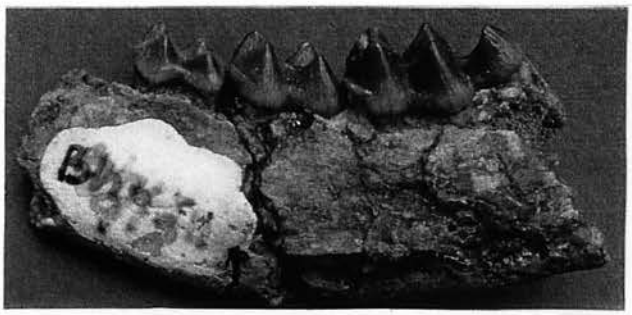
A'

B'



C'

D'



E

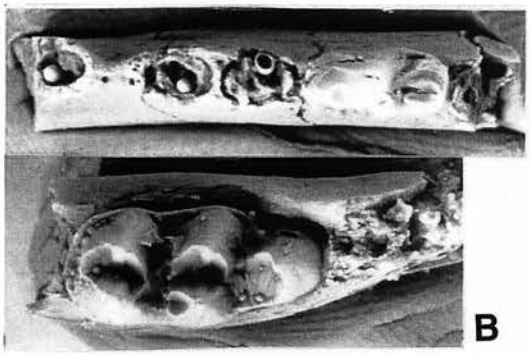
G

F

H

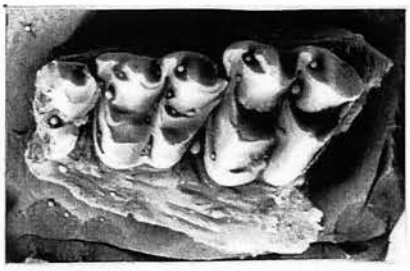
Plate 15. A-D, A'-D', *Indomeryx cotteri.* A, A', NMMP-KU 0021, a right mandibular fragment with P_4, in occlusal view (stereo pair). B, B', NMMP-KU 0289, a right mandibular fragment with M_3, in occlusal view (stereo pair). C, C', NMMP-KU 0010, a left maxillary fragment with ?$dP^{3-4}M^1$ (?or dP^4M^{1-2}), in occlusal view (stereo pair). D, D', NMMP-KU 0010, a left maxillary fragment with M^{2-3}, in occlusal view (stereo pair). **E**, cf. *Indomeryx cotteri*, NMMP-KU 0025, a right $M^{2\ (or\ 1?)}$, in occlusal view (stereo pair). Scale bar = 1 cm.

Plate 15



A

B



C

A'

B'

C'

D

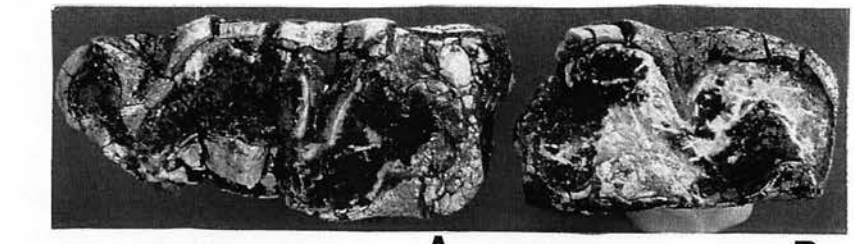
E

D'

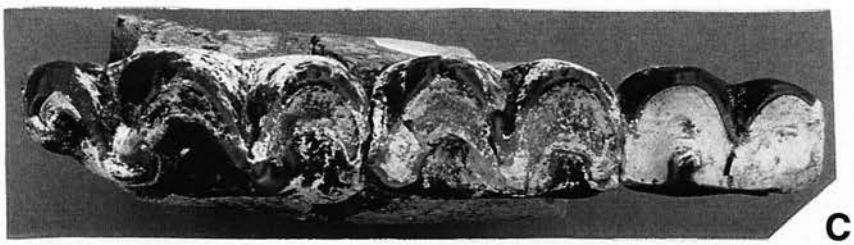
E'

Plate 16. Brontotheres. **A**, *Sivatitanops cotteri*?, NMMP-KU 0510, a left M_3, in occlusal view. **B**, *Sivatitanops cotteri*?, NMMP-KU 0516, a left M_2, in occlusal view. **C, D**, *Metatelmatherium*? *lahirii*, NMMP-KU 0311, a left mandibular fragment with M_{1-3}. C, occlusal view. D, buccal view. **E-G**, *Bunobrontops savagei*. E, NMMP-KU 0313, a right $M^{1 \text{ or } 2}$, in occlusal view. F, NMMP-KU 0319, a left $M^{1 \text{ or } 2}$, in occlusal view. G, NMMP-KU 0312, a left M^3, in occlusal view. Scale bars = 5 cm (upper scale corresponds to A, B, middle scale corresponds to C, D, lower scale corresponds to E-G).

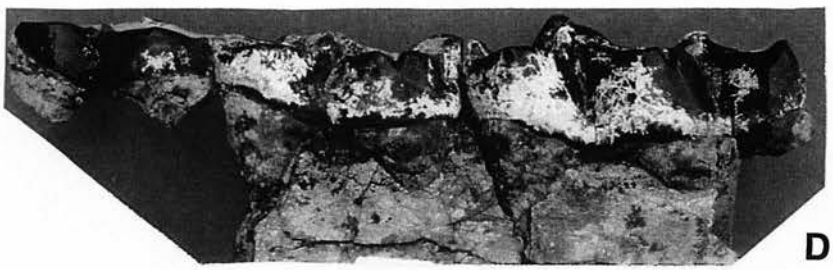
Plate 16



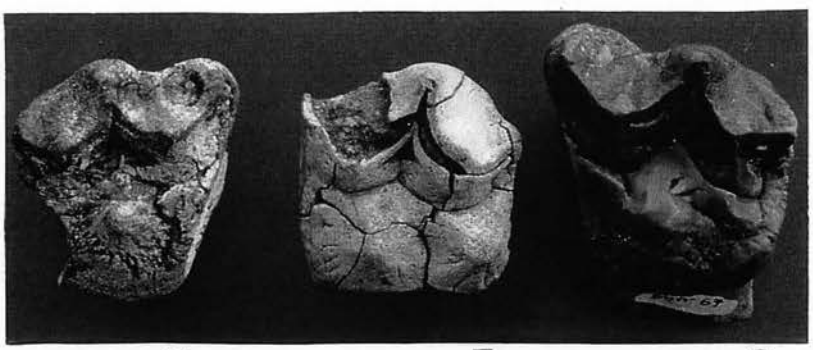
A B



C



D



E F G

Plate 17. A, A', Ceratomorpha indet., NMMP-KU 0058, a left maxillary fragment with a tooth, in occlusal view (stereo pair). **B, B'**, cf. *Ilianodon lunanensis*, NMMP-KU 0288, a right M^3, in occlusal view (stereo pair). **C, C'**, cf. *Ilianodon lunanensis*, NMMP-KU 0057, a right molariform tooth, in occlusal view (stereo pair). **D**, a right M^3 of *Ilianodon lunanensis*, IVPP V.2609.2, from the Upper Lumeiyi fauna (upper part of the Lumeiyi Formation), southern China (after Chow and Xu, 1961), in occlusal view. Scale bars = 2 cm (upper scale corresponds to A, A', lower scale corresponds to B-D, B', C').

Plate 17

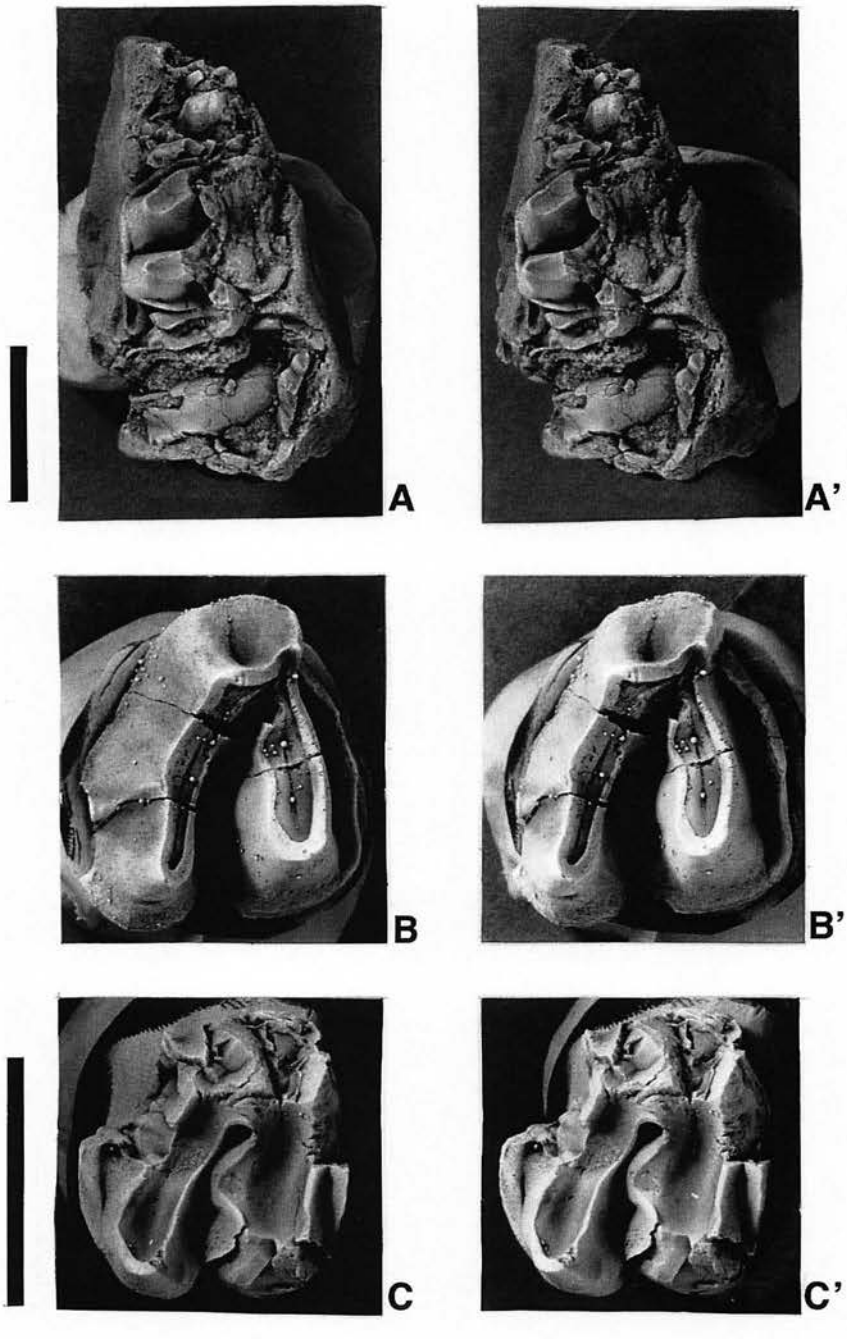


Plate 18. *Paramynodon birmanicus.* **A**, NMMP-KU 0316, a right M^2, in occlusal view. **B**, NMMP-KU 0305, a left maxillary fragment with dP^4M^1, in occlusal view. **C-E**, NMMP-KU 0315, a right mandibular fragment with P_3M_{1-3}. C, occlusal view. D, lingual view. E, buccal view. Scale bars = 5 cm.

Plate 18

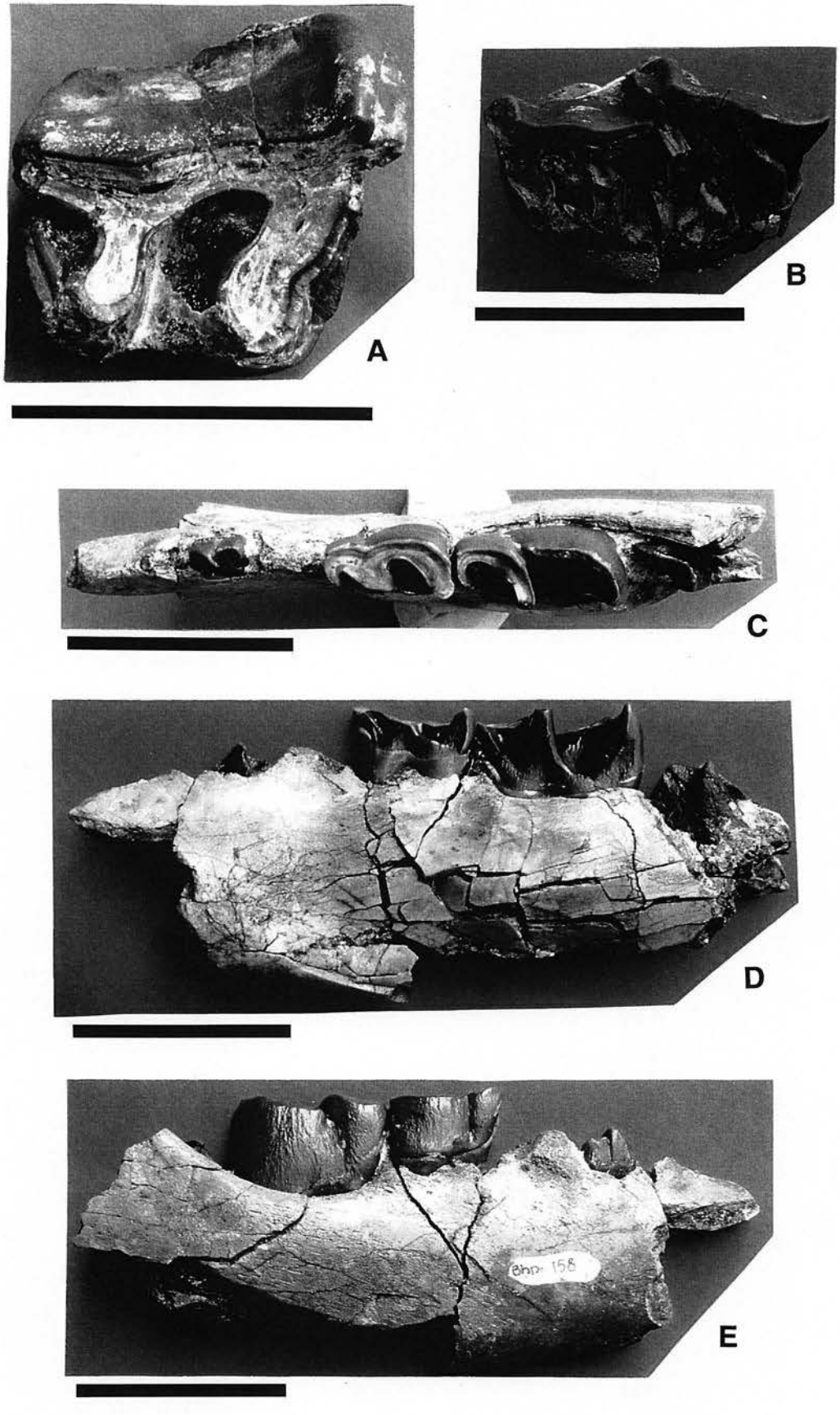
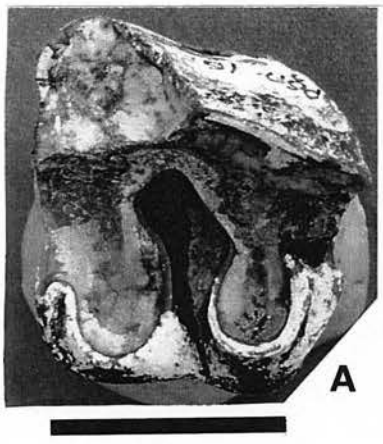
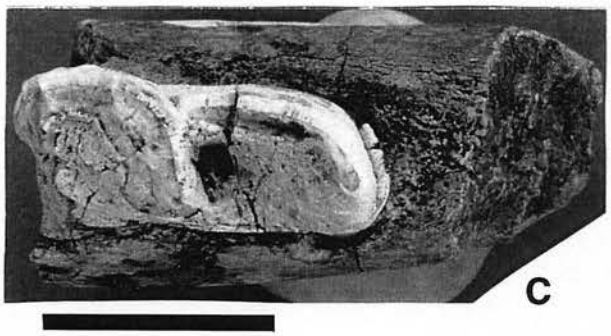


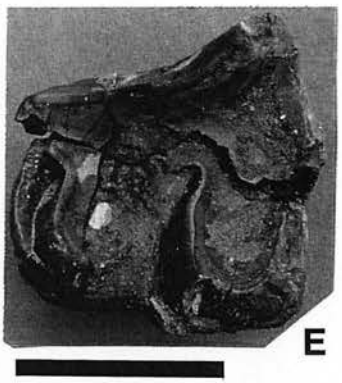
Plate 19. Amynodontidae indet. **A**, NMMP-KU 0511, a left M^1, in occlusal view. **B**, NMMP-KU 0515, a left M^2 and M^3, in occlusal view. **C-D**, NMMP-KU 0509, a right mandibular fragment with M_3. C, occlusal view. D, lingual view. **E**, NMMP-KU 0281, a right M^3, in occlusal view. Scale bars = 2 cm.

Plate 19


A


B


C


E

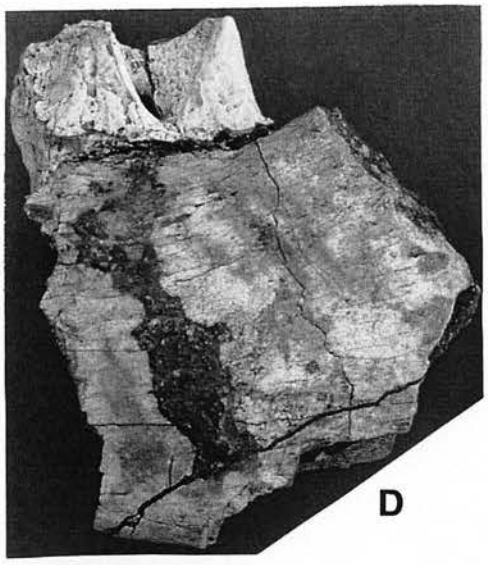
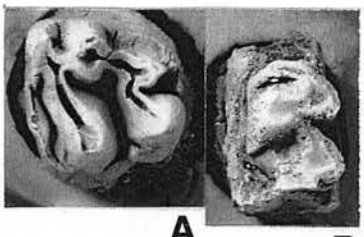
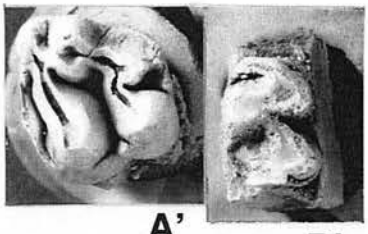

D

Plate 20. A-C, A'-C', *Indolophus guptai.* A, A', NMMP-KU 0265, a left M^3, in occlusal view (stereo pair). B, B', NMMP-KU 0041, a right mandibular fragment with $P_{4?}$, in occlusal view (stereo pair). C, C', NMMP-KU 0040, a left mandibular fragment with $M_{2?}$, in occlusal view (stereo pair). **D, E**, *Deperetella birmanica.* D, NMMP-KU 0005, a left maxillary fragment with P^{1-3}, in occlusal view. E, NMMP-KU 0006, a right maxillary fragment with P^{1-3}, in occlusal view. Scale bars = 2 cm (upper scale corresponds to A-C, A'-C', lower scale corresponds to D, E).

Plate 20



A B

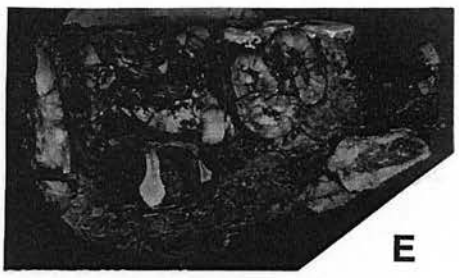


A' B'

C

C'

D



E