THE EOSIMIID AND AMPHIPITHECID PRIMATES (ANTHROPOIDEA) FROM THE OLIGOCENE OF THE BUGTI HILLS (BALOCHISTAN, PAKISTAN): NEW INSIGHT INTO EARLY HIGHER PRIMATE EVOLUTION IN SOUTH ASIA

by

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SOMMAIRE

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Mots-cles: Eosimiidae; Amphipithecidae; phylogénie des primates anthropoïdes; Oligocène inférieur; Collines Bugti; Pakistan

Key-words: Eosimiidae; Amphipithecidae; Anthropoid phylogeny; early Oligocene; Bugti Hills; Pakistan

Palaeovertebrata, Montpellier, **34** (1-2): 29–109, 7 fig., 4 tabl., 3 pl.
(Publié le 15 Octobre 2006)

ABSTRACT

Eosimiid and amphipithecid primates document a long and significant history of primate evolution throughout the Eocene in Southeast Asia. Despite the absence of a comprehensive post-Eocene fossil record, it was generally hypothesized that both families left no descendant in Asia. Recently, two new small-bodied taxa, *Bugtipithecus* and *Phileosimias*, have been recovered in early Oligocene coastal deposits from the Bugti Hills (Balochistan, central Pakistan) and referred to the families Amphipithecidae and Eosimiidae, respectively, on the basis of dental fossil remains. In this paper, we provide more exhaustive description, comparison, and discussion of these taxa. As for tarsiid and sivaladapid primates, the persistence of eosimiids and amphipithecids into the Oligocene clearly demonstrates that low latitudes of South Asia provided a continuous access to tropical refugia during the climatic deterioration characterizing the late Eocene-early Oligocene interval, which was seemingly lethal for primate communities elsewhere across the Holarctic continents. As a contribution to the ongoing phylogenetic debates regarding the position of eosimiids and amphipithecids on the primate family tree, we have performed a cladistic analysis in a high-level primate systematic context in order to assess the position and the role of these new taxa in that phylogenetic issue. Our results support the view according to which eosimiids and amphipithecids (and by extension *Phileosimias* and *Bugtipithecus*, respectively) are stem anthropoids. These fossils from Pakistan document an unsuspected Oligocene phase of the evolutionary history of anthropoid primates in southern Asia, which clearly enhances the extent of the anthropoid radiation in this province during the Paleogene. Several phylogenetic and paleobiogeographic aspects are discussed, notably the intra- and inter-relationships between Paleogene Asian and Afro-Arabian anthropoids, and the resulting potential dispersal models between both land-masses during the Paleogene.

RESUME

Les Eosimiidae et les Amphipithecidae documentent une longue et importante phase de l'histoire évolutive des Primates au cours de l'Éocène en Asie du Sud. Malgré l'absence de registre fossile post-Éocène dans cette région, il semblait évident que ces deux familles n'avaient laissé aucun descendant en Asie. Récemment, des restes dentaires de deux nouveaux taxons, *Bugtipithecus* et *Phileosimias* ont cependant étaient mis au jour sur le territoire Bugti au Pakistan (Balouchistan) dans des dépôts fluvio-deltaïques d'âge Oligocène. *Phileosimias* est un représentant de la famille des Eosimiidae, et *Bugtipithecus* de la famille des Amphipithecidae. Dans cet article, nous proposons une analyse plus descriptive et comparative du matériel dentaire. Ainsi, à l'instar des primates tarsiidés et sivaladapidés, la persistance en Asie des éosimiidés et des amphipithécidés au cours de l'Oligocène démontre clairement que les basses latitudes d'Asie du Sud ont constitué un zone refuge tropicale durant l'importante détérioration climatique qui caractérise la fin de l'Éocène et le début de l'Oligocène - intervalle qui coïncide avec la disparition des communautés de primates sur l'ensemble de la Province Holarctique. Afin d'apporter des éléments de réponse au débat concernant la position des Eosimiidae et des Amphipithecidae dans la phylogénie des Primates, une analyse cladistique a été réalisée dans un contexte systématique de haut rang taxinomique. Les résultats de cette analyse supportent l'hypothèse selon laquelle les Eosimiidae et les Amphipithecidae représentent deux groupes souches au sein des primates anthropoïdes (clade Anthropoidea). Ces fossiles de l'Oligocène du Pakistan mettent ainsi en évidence une phase insoupçonnée de l'histoire évolutive des primates anthropoïdes en Asie du Sud, laquelle démontre bien l'ampleur de la radiation de ce groupe dans la Province Asiatique au cours du Paléogène. Plusieurs aspects phylogénétiques et paléobiogéographiques sont discutés, notamment les liens phylogénétiques entre les formes anthropoïdiennes d'Asie et d'Afrique du Nord (plus Oman), et les scénarii potentiels de dispersions entre ces deux masses continentales durant le Paleogene qui en découlent.

INTRODUCTION

For decades, the abundant fossils of primates from the Eocene of western Europe and North America, as well as primate remains from the Paleogene of the Afro-Arabian plate provided the main record of early primate evolution (see Szalay & Delson, 1979; Hartwig, 2003). However, over the last decade it has become increasingly clear that Asia, notably South Asia (South China, Thailand, Myanmar), has also played an important role in the evolutionary history of several groups of primates (such as Adapiformes and Tarsiiformes; e.g. Beard *et al.*, 1994; Gingerich *et al.*, 1994; Beard, 1998a, b; Qi & Beard, 1998; Tong, 1999; Gebo *et al.*, 2001; Marivaux *et al.*, 2001, 2002), and more particularly in the origins and early diversification of higher primates: the Anthropoidea (Beard *et al.*, 1994, 1996; Beard & Wang, 2004; Chaimanee *et al.*, 1997, 2000a, b; Ducrocq, 1998, 1999; Gebo *et al.*, 2000; Jaeger *et al.*, 1999; Tong, 1997; Takai *et al.*, 2001; Marivaux *et al.*, 2003). The discovery of the Eosimiidae from the middle Eocene of both China (*Eosimias* BEARD *et al.*, 1994; *Phenacopithecus* BEARD & WANG, 2004) and Myanmar (*Bahinia* JAEGER *et al.*, 1999) has been one of the most significant developments in primate palaeontology in recent years. Although the group is primarily known from fragmentary fossils, eosimiids document an early structural phase in the evolution of higher primates (Beard *et al.*, 1996; Beard, 2002; Beard & Wang, 2004; Gebo *et al.*, 2001; Gebo & Dagosto, 2004). Most authorities now regard eosimiids as stem anthropoids on the primate tree (e.g. Kay *et al.*, 1997, 2004a; Ross *et al.*, 1998; Ross, 2000; Seiffert *et al.*, 2004; but see Ciochon & Gunnell, 2002a,b; Schwartz, 2003; Simons, 2003), thereby assuming the antiquity of that group in Asia - a critical point that challenges the role of Africa as the ancestral homeland for the anthropoid clade. A supplemental line of evidence supporting an early and basal anthropoid radiation in Asia derives from the Amphipithecidae, a group of primates known from the late middle Eocene Pondaung Formation of Central Myanmar (*Pondaungia* PILGRIM, 1927, *Amphipithecus* COLBERT, 1937, and *Myanmarpithecus* TAKAI *et al.*, 2001) and from the late Eocene Krabi Basin in Peninsular Thailand (*Siamopithecus* CHAIMANEE *et al.*, 1997). The phylogenetic position of these primates has been, however, an issue of long-standing debate (e.g. Ciochon & Holroyd, 1994; Ciochon *et al.*, 2001; Ciochon & Gunnell, 2002, 2004; Godinot, 1998; Gunnell *et al.*, 2002; Kay *et al.*, 2004a). The fragmentary nature of amphipithecid dental and postcranial material has engendered considerable confusion and phylogenetic debate since their initial discoveries (anthropoid *versus* stepsirrhine affinities). Even though amphipithecid dental and gnathic anatomy consistently points toward anthropoid affinities (Simons, 1971; Ba *et al.*, 1979; Ciochon *et al.*, 1985; Ducrocq, 1998, 1999, 2001; Jaeger *et al.*, 1998a, 2004; Chaimanee *et al.*, 2000a, b; Chaimanee, 2004; Takai *et al.*, 2001; Beard, 2002; Shigehara *et al.*, 2002; Takai & Shigehara, 2004; Kay *et al.*, 2004b; Kay, 2005), postcranial evidence (humerus and calcaneus; Ciochon *et al.*, 2001; Ciochon & Gunnell, 2004) seems to indicate that amphipithecids are outside the clade of the late Eocene-Oligocene African anthropoids (oligopithecids, parapithecids, and propliopithecids) (Kay *et al.*, 2004a, b; Kay, 2005; but see Marivaux *et al.*, 2003). The most significant line of doubt regarding the anthropoid status of the Amphipithecidae derives from recently described cranial fragments consisting of two isolated "frontal bones" that have been attributed to *Amphipithecus* (Takai *et al.*, 2003; Gunnell *et al.*, 2002; Shigehara *et al.*, 2002; Shigehara & Takai, 2004; Takai & Shigehara, 2004; Ciochon & Gunnell, 2004). These "frontal bones" would indicate that *Amphipithecus* did not possess postorbital closure - the so-called "key adaptive innovation" that seemingly unites living tarsiers and anthropoids (Cartmill, 1980; Simons & Rasmussen, 1989; Ross, 1994; but see Beard & MacPhee, 1994; Beard, 2002). However, a recent reappraisal of these cranial elements has revealed that "several anatomical details observable on these specimens are incompatible with their attribution to any primate and strongly suggest that they cannot be ascribed to Mammalia" (Beard *et al.*, 2005). Although several authorities still challenge the anthropoid affinities of the Amphipithecidae, new anatomical evidence has recently come to light that further substantiates the anthropoid status of these fossils (Chaimanee *et al.*, 2000a, b; Marivaux *et al.*, 2003; Jaeger *et al.*, 2004).

Regardless of the ongoing controversy over their affinities, eosimiids and amphipithecids document a long history of primate evolution during the Eocene of Asia. Such a successful adaptive radiation naturally raises questions regarding their subsequent evolutionary history in Asia. In the absence of an adequate Oligocene fossil record from South Asia, Beard (2002) hypothesized that eosimiids and amphipithecids may have left no descendant in Asia. That was actually the case for the flourishing Eocene primates (adapids and omomyids) from northern continents (North America, Europe, and Central Asia), which are unknown during the paleontologically well-documented Oligocene (but see Köhler & Moyà-Solà, 1999). The late Eocene-early Oligocene interval was indeed one of the most significant episodes of climatic deterioration during the Tertiary (e.g. Berggren & Prothero, 1992), coinciding with drastic changes in faunal structure across the whole Holarctic Province (e.g. Janis, 1993; Meng & MacKenna, 1998). However, the persistence of sivaladapid adapiforms (Thomas & Verma, 1979; Chopra & Vasishat, 1980; Gingerich & Sahni, 1984; Wu & Pan, 1985; Pan, 1988) and tarsiid tarsiiforms (Hoffstetter, 1977; Ginsburg & Mein, 1987) well into the Neogene in southern China-Pakistan and Thailand, respectively, indicated that South Asia was characterized by a relative stability of environmental conditions during the climatic deterioration (Qi & Beard, 1998; Beard, 1998b; Jablonski, 2003, 2005). This hypothesis was recently corroborated by the discovery of a sivaladapid from the Oligocene of Pakistan (Bugti Hills, Balochistan) that bridges the gap between Eocene and Miocene adapiform communities in southern Asia (Marivaux *et al.*, 2002a).

Recent collaborative field expeditions (February-March 2000 and 2004) to the South Gandoï syncline of the Bugti Hills (Balochistan, Pakistan; Fig. 1) by the "*Mission Paléontologique Française au Balouchistan*" (MPFB) and the Earth Sciences Division of the Pakistan Museum of Natural History (PMNH) have enabled us to excavate the primate-bearing locality of Paali Nala (DBC2; Dera Bugti locus C2). This site is situated in the lowermost levels of the Lower Chitarwata Formation (Bugti Member), which is early Oligocene in age (Marivaux *et al.*, 1999; Welcomme *et al.*, 2001; Helmcke *et al.*, 2003). During the course of this fieldwork, intensive screen-washing operations have allowed the recovery of several dozen of primate remains (primarily isolated teeth). On the basis of dental material including incomplete upper and lower dentitions (composite tooth rows), two new genera have been described and referred to the families Amphipithecidae and Eosimiidae (Marivaux *et al.*, 2005).

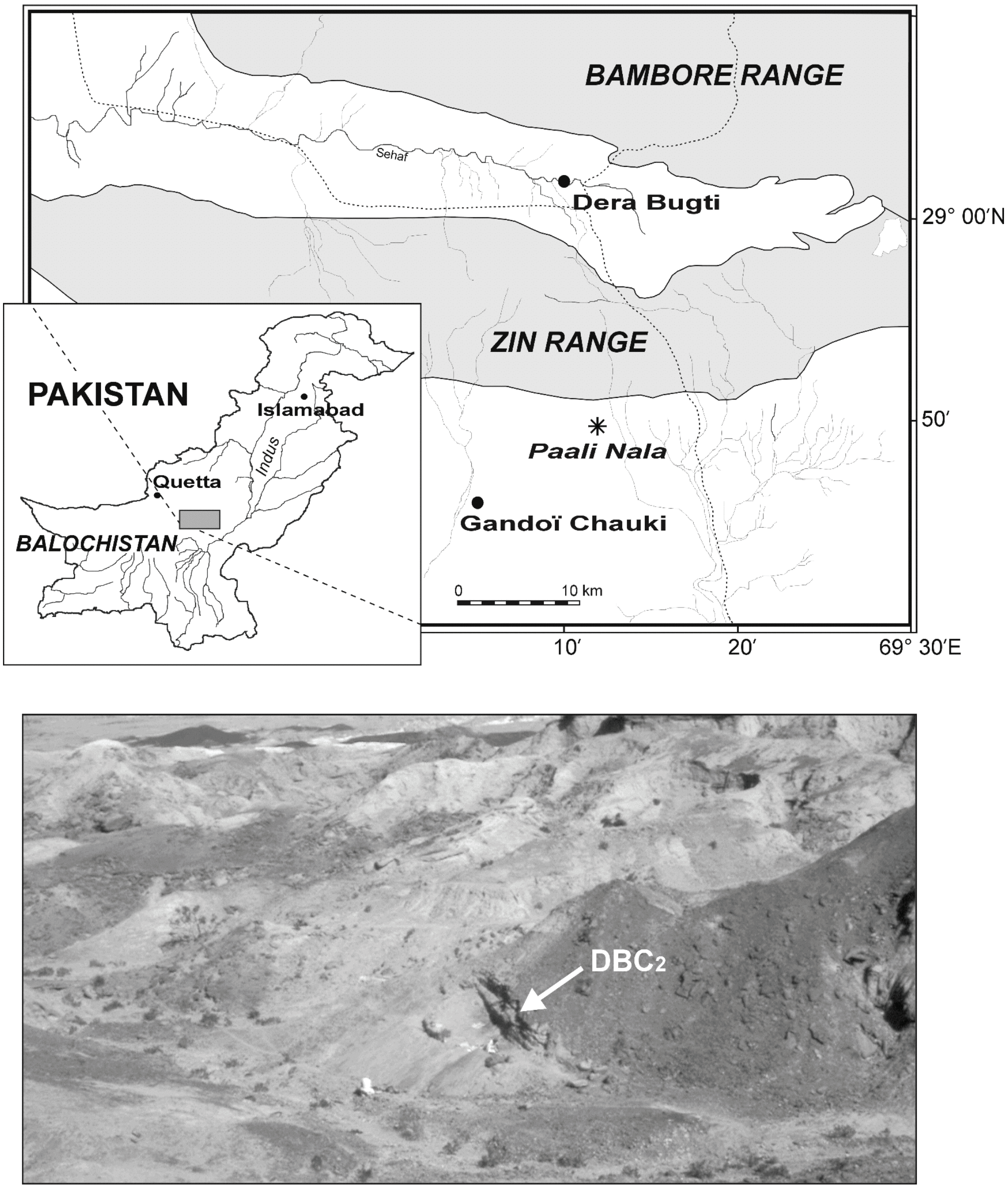

Figure 1.— Map of the Bugti Hills (central Pakistan, eastern Balochistan) showing the geographic location of the primate-bearing locality of Paali Nala (DBC2, denoted by an asterisk) in the lowermost part of the Chitarwata Formation (Oligocene, Bugti Member). The locality is situated in the South Gandoï syncline (southern side of the Zin anticline), about 30 km from the village of Dera Bugti.

In this paper we provide more exhaustive description and comparison of these new anthropoid taxa. These new fossils extend the stratigraphic range of both families to the Oligocene, thereby underscoring the taxonomic diversity that was achieved by anthropoid primates in South Asia during the Paleogene. As a contribution to the paleobiogeographic debates regarding anthropoid origins and their subsequent diversification, we will explore the phylogenetic relationships between Paleogene

African and Asian forms in the light of these discoveries from the Oligocene of Pakistan.

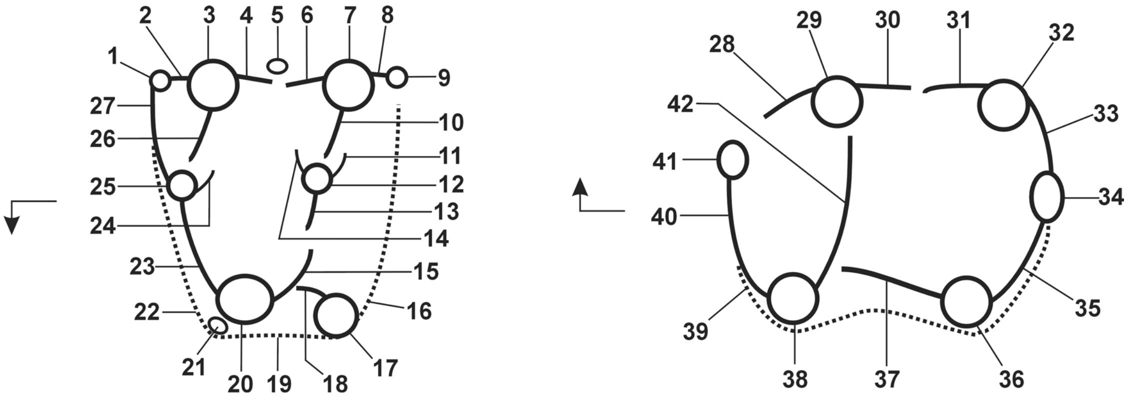

Figure 2.— Occlusal dental morphology of upper and lower teeth of primates and related nomenclature (modified after Szalay & Delson, 1979).

Upper teeth: 1, parastyle; 2, preparacrista; 3, paracone; 4, postparacrista; 5, mesostyle; 6, premetacrista; 7, metacone; 8, postmetacrista; 9, metastyle; 10, hypometacrista; 11, postmetaconule crista; 12, metaconule; 13, hypometaconule crista; 14, premetaconule crista; 15, postprotocrista; 16, postcingulum; 17, hypocone; 18, prehypocrista; 19, lingual cingulum; 20, protocone; 21, pericone; 22, anterocingulum; 23, preprotocrista; 24, postparaconule crista; 25, paraconule; 26, hypoparacrista; 27, preparaconule crista.

Lower teeth: 28, premetacristid; 29, metaconid; 30, postmetacristid; 31, pre-entocristid; 32, entoconid; 33, postentocristid; 34, hypoconulid; 35, hypocristid; 36, hypoconid; 37, cristid obliqua; 38, protoconid; 39, buccal cingulid; 40, paracristid; 41, paraconid; 42, protocristid.

SYSTEMATIC PALAEONTOLOGY

Order: **PRIMATES** LINNAEUS, 1758
Suborder: **ANTHROPOIDEA** MIRVART, 1864
Family: **AMPHIPITHECIDAE** GODINOT, 1994

Included genera: *Pondaungia* PILGRIM, 1927; "*Amphipithecus*" COLBERT, 1937; *Siamopithecus* CHAIMANEE, SUTEETHORN, JAEGER & DUCROCQ, 1997; *Myanmarpithecus* TAKAI, SHIGEHARA, AUNG, TUN, SOE, TSUBAMOTO & THEIN, 2001; *Bugtipithecus* MARIVAUX, ANTOINE, BAQRI, BENAMMI, CHAIMANEE, CROCHET, DE FRANCESCHI, IQBAL, JAEGER, MÉTAIS, ROOHI & WELCOMME, 2005. "*Amphipithecus*" is also considered by some authors (Jaeger *et al.*, 2004) as a junior synonym of *Pondaungia*.

Genus ***BUGTIPITHECUS*** MARIVAUX *et al.*, 2005

Bugtipithecus inexpectans MARIVAUX *et al.*, 2005

(Plate 1 A to O)

Material: UMC-DBC 2174, right M1/ (holotype); UMC-DBC 2172, left M1/; UMC-DBC 2173, left M2/; UMC-DBC 2191, left P4/; UMC-DBC 2178, left P/4; UMC-DBC 2177, right M/1; UMC-DBC 2175, right M/3; UMC-DBC 2176, left M/3 (temporarily housed in the Palaeontology Department, University of Montpellier, France).

Locality: Paali Nala level C2 (DBC2), Gandoï syncline, south side of the Zin anticline, Bugti Hills (Balochistan, Pakistan; Fig. 1).

Formation and age: Bugti Member, Lower Chitarwata Formation, early Oligocene.

Diagnosis (after Marivaux *et al.*, 2005)**:** Small-bodied amphipithecid similar in size to the modern mouse lemur *Mirza coquereli*. Differs from *Myanmarpithecus*, *Siamopithecus*, and *Pondaungia* (including "*Amphipithecus*") in having cusps less inflated and more marginally positioned, upper molars with a relatively high degree of "waisting" lingual to the metacone, a stronger hypoparacrista, a complete lingual cingulum, lower molars showing a massive but deeply notched lingual talonid wall (strong postmetacristid and pre-entocristid), a smaller and more lingually positioned M/3 heel, and in lacking enamel wrinkles on the occlusal surfaces of both upper and lower teeth.

Description

The left P4/ (UMC-DBC 2191; Plate 1N-O; Table 1) attributed to *Bugtipithecus* is suboval and exhibits a simple bicuspidate morphology. The paracone is the largest cusp, which is high, conical, and situated near the buccal margin of the crown. Distal to the paracone, a small swelling of enamel may correspond to a small metastyle. The parastyle is in contrast minute to indistinct. The protocone is well inferior to the paracone and its lingual wall forms the lingual margin of the crown. The postprotocrista is strong, and it terminates on the postcingulum. The preprotocrista is short and transverse, and it joins a tiny hypoparacrista. Cingula occur only on the mesial and distal margins of the tooth.

The two upper molars identified here as right M1/ (UMC-DBC 2174, the holotype; Plate 1J, M) and left M2/ (UMC-DBC 2173; Plate 1K) bear quite similar dental morphology. The posterior margin of M1/ is slightly more waisted than that of M2/ and differs mainly in showing a greater development of its parastyle and metastyle. Both teeth are characterized by salient and equally sized protocone, paracone and metacone, and by the presence of well-marked and continuous anterior, posterior, buccal and lingual cingula, surrounding the teeth. The anterocingulum is uninterrupted on the mesial side of the tooth, running continuously from the protocone to the parastyle. The lingual cingulum is strong and complete, and it bears a large cuspidate hypocone, situated slightly distolingually with respect to the protocone. A strong prehypocrista connects the hypocone with the postprotocrista. The postprotocrista runs distobuccally and ends against the lingual face of a minute metaconule. A tiny, short hypometacrista occurs between the metacone and the metaconule. The preprotocrista runs mesiobuccally, eventually joining a strong hypoparacrista. The hypometacrista and hypoparacrista are parallel and mesiolingually oriented (oblique). A minute swelling, occupying the position of a paraconule, can be observed on M2/, which is indistinct on M1/. The trigon basin is relatively shallow and closed buccally by the presence of a moderately elevated centrocrista.

Among the lower teeth, we have identified one left P/4 (UMC-DBC 2178), one right M/1 (UMC-DBC 2177), and two M/3 (right UMC-DBC 2175, and left UMC-DBC 2176). The P/4 (Plate 1C, F, I, L) is characterized by an inflated protoconid, which represents the main cuspid of the tooth. The paracristid is weakly developed and shows a small swelling in its lingual extremity. The specimen bears a distinct metaconid, which is located distally with respect to the protoconid and much lower on the crown. The premetacristid is not developed and the trigonid is lingually open. The talonid is lower and mesiodistally shorter than the trigonid. Distal to the protoconid, the hypoconid is the only distinct talonid cuspid. The talonid is lingually and distally bordered by a low hypocristid, which is connected to the weakly elevated and short postmetacristid. The cristid obliqua is lacking and the talonid remains open buccally. The buccal cingulid is only developed between the hypoconid and the protoconid.

The three molars are characterized by wide talonid basins and massive development of their lingual talonid walls, which are marked by deep notches that separate the postmetacristid from the pre-entocristid. On M/1 (UMC-DBC 2177; Plate 1B, E, H), the metaconid lies slightly distolingual to the protoconid and is extended distally and mesially by the development of a strong and elevated postmetacristid and a short premetacristid, respectively. The trigonid of M/1 is slightly higher than the talonid, buccolingually pinched, mesiodistally enlarged, and lingually closed. The low paracristid shows a minute swelling reminiscent of a paraconid. The main cuspids of the trigonid are moderately inflated and the entoconid is slightly distal to the hypoconid. The postentocristid is strong and elevated, and connects the hypocristid slightly buccally to midline. There is no hypoconulid. The buccal cingulid is limited between the protoconid and the hypoconid. The cristid obliqua is round and weakly elevated, and reaches the base of the trigonid wall at a point distal to the protoconid. The hypoflexid is shallow.

The two M/3 (UMC-DBC 2175 and UMC-DBC 2176; Plate 1 A, D, G) referred to *Bugtipithecus* display a dental pattern that is similar to that of M/1 but differ in showing greater development of the premetacristid, a postmetacristid that is more lingually directed, an indistinct entoconid on the strong lingual talonid marginal crest, and in having a narrow talonid heel that is lingual in position. Both the protoconid and the hypoconid occupy a marginal buccal position. The cristid obliqua is nearly lateral and reaches the base of the trigonid wall.

Specimen	**Tooth**	**Length MD**	**Breadth BL**
DBC 2191	left P^4	1.75	2.75
DBC 2172	left M^1	2.63	2.99
DBC 2174	right M^1	2.58	3
DBC 2173	left M^2	2.39	2.99
DBC 2178	left P_4	2.39	1.84
DBC 2177	right M_1	2.83	2.28
DBC 2176	left M_3	3.18	2.13
DBC 2175	right M_3	3.09	2.19

Table 1.— Dental measurements (in mm) for *Bugtipithecus inexpectans* gen. sp. nov. (MD, maximum mesiodistal length; BL, maximum buccolingual width).

Comparisons

The Amphipithecidae are generally known to be large-bodied (6-9 kg: *Pondaungia*, "*Amphipithecus*", *Siamopithecus*) or medium-sized (1-2 kg: *Myanmarpithecus*) primates, having upper and lower cheek teeth strongly bunodont with moderately to highly crenulated enamel surfaces. *Bugtipithecus* contrasts with the classic amphipithecid condition in being much smaller (~ 350 g, estimated from the area of the lower first molar by using the all primate least-squares regression equation of Conroy [1987]) and in having teeth with more acute cusps (-ids) and smooth enamel surfaces. Although differing in these respects, *Bugtipithecus* exhibits, however, a set of features otherwise found only in the Amphipithecidae. For instance, as in *Pondaungia*, *Siamopithecus* and *Myanmarpithecus*, M1-2/ in *Bugtipithecus* each possess a relatively well-developed hypocone on the distolingual cingulum that is united with the protocone (via the postprotocrista) by a strong prehypocrista. This latter character is particularly distinct in *Siamopithecus,* in which the prehypocrista is nearly lateral and connected to a short and mesiodistally oriented postprotocrista. In *Bugtipithecus*, this protocone-hypocone connection occurs in the same way that it does in *Siamopithecus* by means of the prehypocrista and the postprotocrista. However, in *Bugtipithecus* the postprotocrista is not as buccally restricted as it is in *Siamopithecus*. Rather, it extends distobuccally as it does in a number of other Paleogene taxa customarily regarded as Anthropoidea (Eosimiidae, Proteopithecidae, Oligopithecidae and Propliopithecidae) and also, but to a lesser degree, in some omomyiform (e.g. *Omomys*) and adapiform (e.g. sivaladapids) lineages. In contrast to *Siamopithecus*, *Myanmarpithecus* and *Pondaungia* have small conules on their upper molars. The M1-2/ of *Bugtipithecus* show a distinct metaconule but differ from those of *Myanmarpithecus* and *Pondaungia* in lacking the paraconule. The presence of well-developed conules on the upper molars is a fairly widespread condition in omomyiforms and also in some adapiforms. In contrast, most of the early anthropoid lineages have reduced (Eosimiidae: *Eosimias*, *Phenacopithecus*) or absent (Eosimiidae: *Bahinia*, Proteopithecidae, Oligopithecidae, Proteopithecidae) conules, although exceptions to this generalization are found among parapithecids (e.g. *Parapithecus, Apidium*) and *Algeripithecus* (a poorly known taxon from Algeria; Godinot & Mahboubi, 1992), which resemble amphipithecids (*Pondaungia* and *Myanmarpithecus*) in bearing well-developed conules. In *Bugtipithecus*, the metaconule is connected lingually to the postprotocrista (and not to the "hypometaconule crista" as in omomyiforms and adapiforms; Figs 2 and 4) and buccally to a very short crest, which is probably homologous with the hypometacrista found in *Siamopithecus* and in many early and crown anthropoids (e.g. *Bahinia*, *Eosimias*, *Phenacopithecus*, *Catopithecus*, *Oligopithecus*, *Moeripithecus*, *Aegyptopithecus,* pliopithecids, and platyrrhines). Mesially and parallel to this short hypometacrista, upper molars of *Bugtipithecus* display an oblique hypoparacrista (distinct from the postparaconule crista occurring in most omomyiforms and some adapiforms; Fig. 2; Plate 1), which is a character observable in many anthropoids (except *Proteopithecus*) but with different degrees of development (i.e., lower, thinner, or shorter; Fig. 3). In *Bugtipithecus*, the hypoparacrista is long, strong and elevated as in *Siamopithecus* and *Bahinia*. In most species of early primates, the preprotocrista, stemming from the protocone, connects the paraconule or ends at the level of its virtual location (if the paraconule is absent or lost). The preparaconule crista generally represents a buccal extension of the preprotocrista and usually connects a small parastyle (Fig. 3). Upper molars of *Bugtipithecus*, as well as those of *Pondaungia*, exhibit an unusual condition among early primates in lacking the preparaconule crista. The anterior cingulum is therefore not interrupted as it is in most primate species, extending continuously from the protocone to the parastyle. Upper molars in *Bugtipithecus* bear a strong and continuous lingual cingulum as in early anthropoids (except *Parapithecus* and *Siamopithecus*, which show an important lingual inflation of the protocone). This aspect of the lingual cingulum differs from the condition found in many omomyiforms and adapiforms, in which this cingulum is not continuous but broken lingually to the protocone. As in propliopithecids (*Propliopithecus*, *Moeripithecus*, *Aegyptopithecus*) and all other amphipithecids, the M1-2/ in *Bugtipithecus* have a cuspate hypocone. This character is not as well-developed in oligopithecids (especially *Oligopithecus*) and proteopithecids, in which a small enamel swelling occurs on a distolingual expansion of the lingual cingulum (*Catopithecus* and

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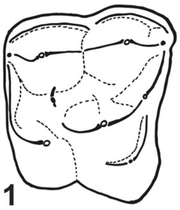
Figure 3.— Schematic drawings of M1/ or M2/ structures in some Paleogene primates, scaled to have equal buccolingual width. *Leptadapis magnus* (1), *Aframonius dieides* (2), *Cantius eppsi* (3), *Periconodon helveticus* (4), *Hoanghonius stehlini* (5), *Absarokius abotti* (6), *Shoshonius cooperi* (7), *Hemiacodon gracilis* (8), *Teilhardina belgica* (9), *Macrotarsius montanus* (10), *Omomys carteri* (11), *Nannopithex zuccolae* (12), *Tarsius spectrum* (13), *Bahinia pondaungensis* (14), *Eosimias centennicus* (15), *Phenacopithecus krishtalkai* (16), *Altiatlasius koulchii* (17), *Myanmarpithecus yarshensis* (18), *Pondaungia cotteri* (19), *Siamopithecus eocaenus* (20), *Dionysopithecus shuangouensis* (21), *Saimiri sciureus* (22), *Oligopithecus rogeri* (23), *Catopithecus browni* (24), *Aegyptopithecus zeuxis* (25), *Moeripithecus markgrafi* (26), *Proteopithecus sylviae* (27), *Simonsius grangeri* (28), *Phileosimias brahuiorum* (29), *Phileosimias kamali* (30), *Bugtipithecus inexpectans* (31). See Table 4 for the classification of these taxa. Drawings n° 14-16, 24 and 27 are modified from Beard & Wang (2004), the others are from the author.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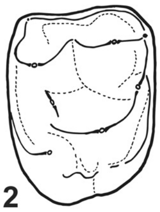
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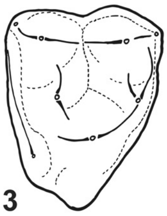
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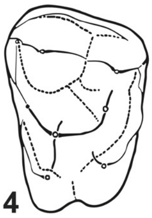
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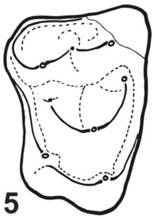
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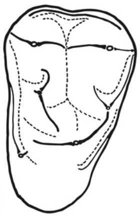
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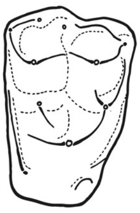
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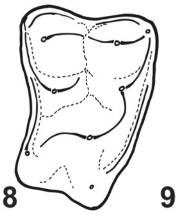
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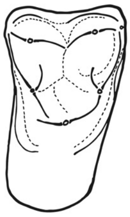
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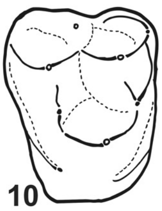
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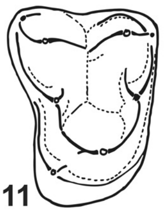
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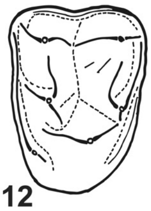
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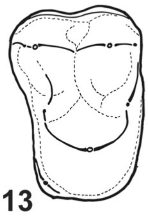
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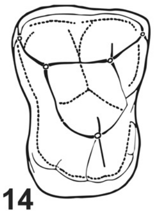
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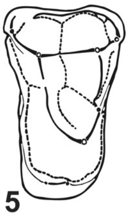
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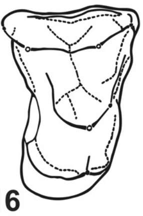
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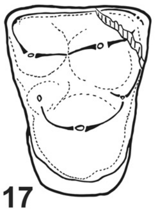
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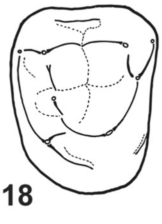
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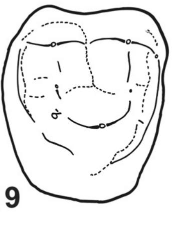
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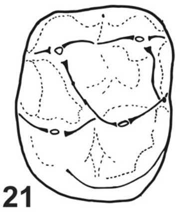
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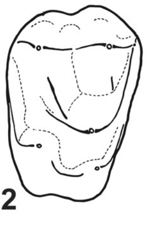
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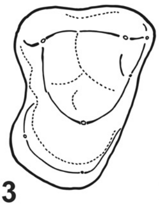
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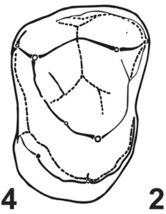
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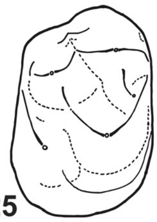
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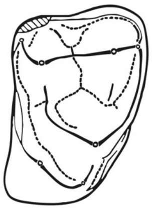
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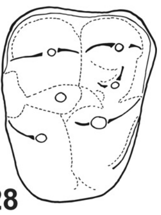
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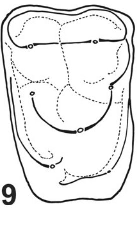
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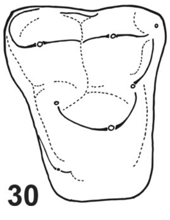
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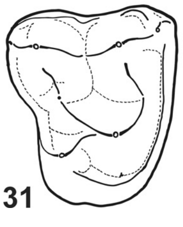
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Proteopithecus). Eosimiids have a similar distolingual expansion of the M1-2/ talon region but have no hypocone. The P4/ in *Bugtipithecus* resembles its homologue in other amphipithecids or propliopithecids, but differs in having a narrower trigon with the postprotocrista oriented buccally rather than distally. This orientation of the postprotocrista is similar to that which is found in oligopithecids.

The P/4 of *Bugtipithecus* clearly resembles that of *Siamopithecus* in being moderately exodaenodont and simply constructed with a low and mesiodistally short talonid (lingually closed by the strong development of the hypocristid), and in showing a small and low hypoconid. As in *Siamopithecus*, the trigonid of P4 in *Bugtipithecus* does not show a distinct paraconid, the metaconid is present and situated inferiorly and distally with respect to the strong protoconid as in parapithecids - an important feature distinguishing them from other African anthropoids (Fleagle & Kay, 1988). The P4 of *Bugtipithecus* differs from that of *Siamopithecus* in lacking the cristid obliqua and in showing a stronger development of the lingual talonid crest.

These aspects of P/4 morphology match conditions in eosimiids and differ from conditions in oligopithecids, proteopithecids, propliopithecids and to some extent in *Pondaungia*, in all of which P/4 has a stronger metaconid and a more important mesiodistal development of the talonid (broad basin, except for *Serapia*), with the occasional presence of a distinct entoconid (especially in oligopithecids). The P/4 in *Bugtipithecus* further differs from that of oligopithecids in lacking the paraconid. The M/1 and M/3 of *Bugtipithecus* are remarkably similar to those of *Myanmarpithecus* in showing a very strong development of both the postmetacristid and pre-entocristid, M/1 without development whatsoever of paraconid and hypoconulid, and M/3 with a narrow talonid heel that is lingual in position. These aspects of lower molar morphology in *Bugtipithecus* differ from conditions in eosimiids, oligopithecids and proteopithecids, in which the lower molars (notably M/1) possess a paraconid and have a well-developed and cuspidate hypoconulid. Lower molars of propliopithecids lack development of a paraconid as well, but in contrast possess a strong hypoconulid as in all other early and more recent Old-World anthropoid primates. The absence of a hypoconulid on the lower molars of *Bugtipithecus* and *Myanmarpithecus* is a shared/derived character for both genera, but does not characterize all amphipithecids inasmuch as *Siamopithecus* and *Pondaungia* show weak development of that cuspid.

Family **EOSIMIIDAE** BEARD *et al.*, 1994

Included genera: *Eosimias* BEARD, QI, DAWSON, WANG & LI, 1994; *Bahinia* JAEGER, THEIN, BENAMMI, CHAIMANEE, SOE, LWIN, WAI & DUCROCQ, 1999; *Phenacopithecus* BEARD & WANG, 2004; *Phileosimias* MARIVAUX, ANTOINE, BAQRI, BENAMMI, CHAIMANEE, CROCHET, DE FRANCESCHI, IQBAL, JAEGER, METAIS, ROOHI & WELCOMME, 2005.

Genus ***PHILEOSIMIAS*** MARIVAUX *et al.*, 2005

Included species: *Phileosimias kamali* MARIVAUX *et al.*, 2005; *Phileosimias bra-*

huiorum MARIVAUX *et al.*, 2005

Generic diagnosis (after Marivaux *et al.*, 2005)**:** Eosimiid of the size of *Phenacopithecus*. Upper molars differ from those of *Eosimias*, *Phenacopithecus* and *Bahinia* in showing cuspate conules, weaker development of lingual and buccal cingula, less "waisting" distolingual to the metacone (more especially with *Eosimias* and *Phenacopithecus*), and in lacking both hypoparacrista and hypometacrista. Lower molars have the hypoconulid located slightly more lingual to the midline than in other eosimiids, and the P/4 has no mesiolingual cingulid.

Phileosimias kamali MARIVAUX *et al.*, 2005

(Plate 2 A to U)

Material: UMC-DBC 2199, right M1/ (holotype); UMC-DBC 2192, left M1/; UMC-DBC 2196, left M1/; UMC-DBC 2194, left M2/; UMC-DBC 2197, left M2/; UMC-DBC 2200, left M2/; UMC-DBC 2193, right M2/; UMC-DBC 2202, right M2/; UMC-DBC 2198, left M3/; UMC-DBC 2195, right M3/; UMC-DBC 2201 right M3/; UMC-DBC 2203, right P/3; UMC-DBC 2204, left P/4; UMC-DBC 2205, left P/4; UMC-DBC 2206, left M/1; UMC-DBC 2209, left M/1; UMC-DBC 2211, left M/1; UMC-DBC 2207, left M/2; UMC-DBC 2210, left M/2; UMC-DBC 2212, left M/2; UMC-DBC 2213, left M/2; UMC-DBC 2214, left M/2; UMC-DBC 2215, left M/3; UMC-DBC 2216, left M/3; UMC-DBC 2217, left M/3; UMC-DBC 2208, right M/3; UMC-DBC 2218, right M/3; UMC-DBC 2219, right M/3 (temporarily housed in the Palaeontology Department, University of Montpellier, France).

Locality: Paali Nala level C2 (DBC2), Gandoï syncline, south side of the Zin anticline, Bugti Hills (Balochistan, Pakistan; Fig. 1).

Formation and age: Bugti Member, Lower Chitarwata Formation, early Oligocene.

Diagnosis (after Marivaux *et al.*, 2005)**:** Differs from *Phileosimias brahuiorum* in being slightly larger, in showing more triangular and distally waisted upper molars, a buccal expansion of the metacone, no hypocone, a massive and lingually inflated protocone, the metacone of M3/ distal to the paracone, and in having less extensive lingual and buccal cingula.

Description

Among the isolated upper teeth attributed to *Phileosimias kamali*, only molars have been recovered. M1/ (Plate 2N, S) and M2/ (Plate 2O, T) differ in size (M2/ > M1/; Table 2) and shape (M1/ triangular, M2/ quadrangular) but have a similar pattern of cusp and crest arrangement. Both teeth are characterized by bulbous and equally sized protocone, paracone and metacone, moderately developed paraconule and metaconule, and considerable expansion of the stylar regions. The metacone and paracone are mesiodistally aligned, and have short, low, and mesiodistally oriented premetacrista and postparacrista, respectively. A strong and curved postmetacrista links the metacone and the metastyle, which is located buccal to the metacone. The parastyle is mesial to the paracone, being connected to it by a short preparacrista. The buccal cingulum is broad and extends from the parastyle to the metastyle. The protocone is linked to the metaconule and the paraconule by strong post- and preprotocristae, respectively (U-shaped protocone). The paraconule is smaller than the metaconule and connected to the parastyle by a thin and elevated preparaconule crista. There is no postmetaconule crista, hypoparacrista and hypometacrista, and the conules are separated from the metacone and the paracone by narrow and shallow grooves. The postcingulum is complete and broad, and shows (especially on M1/) a minute swelling of enamel in its distolingual part. The anterocingulum is strong but short (limited to its lingual part). The lingual cingulum is indistinct to absent and the lingual wall of the protocone, nearly vertical, forms the lingual margin of the crown.

The dental organization of M3/ (Plate 2P, U) is similar to that of M1-2/ but differs in having a smaller metacone distal to the paracone, the postcingulum restricted to the lingual part of the crown, a minute metaconule, and in lacking the metastyle.

The composite lower dentition attributed to *Phileosimias kamali* includes P/3, P/4, M/1, M/2 and M/3. UMC-DBC 2203 is a right P/3 (Plate 2Q, R) characterized by a relatively simple crown morphology without paraconid, metaconid nor entoconid, but showing a high and conical protoconid. The talonid is mesiodistally shorter than the trigonid and displays a small swelling of enamel distal to the protoconid that corresponds to a minuscule hypoconid. A tiny and rounded hypocristid forms the distal talonid crest that reaches the lingual margin of the tooth. The hypoconid and the protoconid are linked by a thin and mesiodistally oriented cristid obliqua, which runs up the distal slope of the protoconid. The tooth is damaged at the base of the crown, rendering it difficult to determinate whether a cingulid occurs on the entirely periphery of the crown.

The P/4 of *Phileosimias kamali* is documented by two specimens (UMC-DBC 2204, UMC-DBC 2205), one of which is well-preserved and described here (UMC-DBC 2204; Plate 2A, E, I, M). Like P/3, P/4 has two roots that are aligned but slightly oblique with respect to the mesiodistal axis of the tooth, and its crown is moderately exodaenodont and morphologically more complex than that of P/3. The trigonid, which is dominated by the protoconid, is slightly longer than the talonid. The metaconid is situated inferiorly and distolingually with respect to the protoconid. The postprotocristid is complete but thin and low, and joins the protoconid with the metaconid. There is a small swelling of enamel at the mesiolingual extremity of the paracristid that could correspond to a very small paraconid. This small swelling is mesial to the metaconid and widely spaced from it. The postmetacristid is strong and elevated, and runs distally to merge with the short hypocristid. There is no entoconid. The hypoconid appears as a tiny cuspid, distal to the protoconid. The cristid obliqua is low and lateral, and joins the hypoconid with the protoconid. The buccal cingulid is complete and runs from the hypoconid to the paraconid at the base of the crown. In contrast, there is no trace of a lingual cingulid.

M/1 and M/2 share a similar pattern of crown morphology but differ in some details noted on the trigonid. Both teeth exhibit a paraconid distinctly cuspidate but nonetheless lower than the protoconid, which is slightly lower than the metaconid. On M/1 (Plate 2B, F, J, F, J), the paraconid is nearly mesial to the metaconid and widely spaced from it. On M/2 (Plate 2C, G, K), the trigonid is mesiodistally pinched and therefore less open than on M/1, and the paraconid occurs between the protoconid and the metaconid. The trigonid is distinctly higher than the talonid, and its distal wall (postprotocristid) is deeply notched. On M/1, the trigonid is buccolingually narrower than the talonid, whereas on M/2, trigonid and talonid are similar in width. The hypoconid and the entoconid are equally sized and transversely aligned. A cuspidate but mesiodistally pinched hypoconulid occurs distally and slightly lingual to midline in position. Distolingually, a small sulcus separates the hypoconulid from the entoconid. Moderately developed postmetacristid and pre-entocristid form the lingual wall of the talonid. Both crests generally do not merge together and generate a narrow notch. Buccally, the hypoflexid is shallow, and a trenchant cristid obliqua runs from the hypoconid to the base of the trigonid wall at a point distal to the protoconid. The buccal cingulid at the crown base is well-developed and mesiodistally continuous between the paraconid and the hypoconulid.

Specimen	**Tooth**	**Length MD**	**Breadth BL**
DBC 2192	left M^1	2.44	3.22
DBC 2196	left M^1	2.73	3.48
DBC 2199	right M^1	2.67	3.19
DBC 2194	left M^2	-	-
DBC 2197	left M^2	2.71	3.58
DBC 2200	left M^2	2.5	3.61
DBC 2193	right M^2	2.78	3.77
DBC 2202	right M^2	2.45	3.23
DBC 2198	left M^3	1.82	3.13
DBC 2195	right M^3	1.48	2.46
DBC 2201	right M^3	1.64	2.88
DBC 2203	right P_3	2.12	1.33
DBC 2204	left P_4	2.12	1.7
DBC 2205	left P_4	2	1.56
DBC 2206	left M_1	2.47	2.08
DBC 2209	left M_1	2.5	-
DBC 2211	left M_1	2.47	2.25
DBC 2207	left M_2	2.73	2.21
DBC 2210	left M_2	2.56	2.09
DBC 2212	left M_2	2.51	2.29
DBC 2213	left M_2	2.47	-
DBC 2214	left M_2	2.74	-
DBC 2215	left M_3	2.55	1.74
DBC 2216	left M_3	2.42	1.59
DBC 2217	left M_3	2.24	1.44
DBC 2208	right M_3	2.95	1.97
DBC 2218	right M_3	2.45	1.42
DBC 2219	right M_3	2.46	1.48

Table 2.— Dental measurements (in mm) for *Phileosimias kamali* gen. sp. nov. (MD, maximum mesiodistal length; BL, maximum buccolingual width).

Except for the presence of a stronger hypoconulid, which forms a heel on the talonid, the M/3 (Plate 2D, H, L) displays a dental configuration very similar to that of M/2. Comparatively, the tooth is longer and narrower than M/2, the buccal cingulid is less apparent at the level of the hypoconid, and the postmetacristid is less developed. However, the latter character varies across the sample of M/3 recovered.

Phileosimias brahuiorum MARIVAUX *et al.*, 2005

(Plate 3 A to D)

Material: UMC-DBC 2221, right M2/ (holotype); UMC-DBC 2220, right M3/ ; UMC-DBC 2222, right M1/ or 2/.

Locality: Paali Nala level C2 (DBC2), Gandoï syncline, south side of the Zin anticline, Bugti Hills (Balochistan, Pakistan; Fig. 1).

Formation and age: Bugti Member, Lower Chitarwata Formation, early Oligocene.

Diagnosis (after Marivaux *et al.*, 2005)**:** Differs from *Phileosimias kamali* in having upper molars with more rectangular and transverse outline (not distally waisted), better development of buccal and lingual cingula, the presence of a minute but well-distinct hypocone, a slender protocone, no buccal expansion of the metacone, and in showing the metacone of M3/ distally more lingual with respect to the paracone.

Description

UMC-DBC 2221 (Plate 3A, C) is a right M2/ showing a perfect rectangular outline (with the long axis being buccolingual; Table 3), and highly cuspate protocone, metacone, and paracone. The paraconule and the metaconule are moderately developed and equivalent in size, and both are connected to the protocone by the preprotocrista and the postprotocrista, respectively (U-shaped protocone). There is no junction between the conules and the buccal cusps. The preparaconule crista is very thin and joins the anterocingulum. The buccal cingulum is broad and continuous between the metastyle and the parastyle, which are both crestiform. The lingual cingulum is complete, joining the anterocingulum with the postcingulum. Distally, the lingual cingulum displays a small swelling of enamel that corresponds to a minute hypocone.

Specimen	Tooth	Length MD	Breadth BL
DBC 2220	right M^3	1.74	3.11
DBC 2221	right M^2	2.28	3.34
DBC 2222	right $M^{1/2}$	2.32	3.13

Table 3.— Dental measurements (in mm) for *Phileosimias brahuiorum* gen. sp. nov. (MD, maximum mesiodistal length; BL, maximum buccolingual width).

UMC-DBC 2220 (Plate 3B, D) is a right M3/ showing the same morphological characteristics that occur on M1/ or 2/ with conules that are equivalent in size, a thin preparaconule crista, and complete lingual and buccal cingula. This tooth is characterized by a reduced metacone, which is located slightly lingual to the paracone. The postprotocrista is directed toward the metaconule but does not reach it. In contrast, the metaconule is connected to the postcingulum. The tooth is worn mesiobuccally, preventing any determination of the configuration of the metastyle.

Comparisons

At first glance, when considering upper molars only, *Phileosimias* may appear morphologically divergent with respect to other eosimiids (*Eosimias*, *Bahinia* and *Phenacopithecus*). Indeed, the presence of cuspate conules, weaker development of the buccal and lingual cingula (especially in *Phileosimias kamali*), and the absence of both hypoparacrista and hypometacrista differ from the typical eosimiid dental pattern and could even better match that of omomyiforms (notably *Omomys*). Eosimiids generally exhibit an important distolingual expansion of the lingual cingulum (talon region), have a moderately (*Eosimias*, *Phenacopithecus*) to strongly (*Bahinia*) developed buccal cingulum, and show minute (*Eosimias*, *Phenacopithecus*) to indistinct (*Bahinia*) conules (Fig. 3). However, the weak development of buccal and lingual cingula on the upper molars of *Phileosimias* is not uniform within the genus since a couple of specimens attributed to *Phileosimias brahuiorum* show well-developed cingula. As in all eosimiids and more generally in early anthropoids (oligopithecids, proteopithecids, parapithecids, propliopithecids and amphipithecids), both species of *Phileosimias* have upper molars without metaconule cristae (pre-, post-, hypo-) and postparaconule crista, and lack even rudimentary development of a postprotocingulum (*Nannopithex* fold), which are common characters in adapiforms and omomyiforms (except *Omomys*). Upper molars of *Phileosimias* show, in contrast, well-developed and buccally oriented pre- and postprotocristae (U-shaped protocone), which connect the paraconule and the metaconule, respectively. These teeth also exhibit a buccal expansion of their stylar regions (parastyle and metastyle), a feature that is particularly well-developed in eosimiids, but which also occurs in some omomyiforms such as *Macrotarsius*, *Shoshonius*, and *Altiatlasius* (Fig. 3). The taxonomic status of *Altiatlasius* is still questioned because of the paucity of the material. This genus, from the late Palaeocene of Morocco, was originally considered by Sigé *et al.* (1990) as a primitive omomyid and subsequently as a possible relative of anthropoids (Godinot, 1994; Beard, 1998b, 2002, 2006; Seiffert *et al.*, 2004). The lack of both postprotocingulum and pre- and post- conule cristae, and a more or less complete lingual cingulum on M2/ of *Altiatlasius* are indeed eosimiid-like similarities. Intriguing in this regard is the striking resemblance in overall dental pattern that is shared by *Phileosimias* and *Altiatlasius*. In addition to the aforementioned characters, upper molars of both taxa possess conules, show strong development of pre- and postprotocristae (U-shaped protocone), have a similar expansion of their stylar regions, and show a comparable degree of waisting lingual to the metacone. Upper molars of *Phileosimias* differ, however, in having stronger paraconule and preparaconule crista, and in showing a better development of the posterior cingulum. Lower molars of *Phileosimias* resemble also those of *Altiatlasius* in having a cuspidate paraconid, a moderately developed hypoconulid, and in showing a well-marked buccal cingulid that surrounds the protoconid mesiobuccally and generally breaks off at the level of the hypoconid. Lower molars of *Phileosimias* and *Altiatlasius* differ, nonetheless, in various aspects, notably in features related to size and shape. For instance: the difference in height between the trigonid and talonid is much more important in lower molars of *Altiatlasius* than in *Phileosimias*; compared with trigonid length in both taxa, the talonid of M/1-2 in *Phileosimias* is proportionally longer than in *Altiatlasius*. Lower molars of *Phileosimias* also show a much more cuspidate entoconid, hypoconid and hypoconulid, and the cristid obliqua on M/1 is invariably lateral and reaches the base of the trigonid wall at a point distal to the protoconid rather than distolingual to the protoconid or to the metaconid as in *Altiatlasius* and more generally in omomyiforms and adapiforms. The morphology of the lower molars of *Phileosimias* does not depart from that of other eosimiid primates. The main anatomical difference is the position of the hypoconulid, which is lingual to midline in *Phileosimias* and not centrally located as in *Phenacopithecus* or slightly buccal to midline as in *Eosimias* and those omomyiforms that have a hypoconulid. The location of this distal cuspid in *Phileosimias* recalls the condition that occurs in early anthropoids from North Africa (*Catopithecus*, *Oligopithecus*, *Proteopithecus*, *Serapia* and *Arsinoea*) and sivaladapid adapiforms from Asia (e.g. *Hoanghonius*, *Guangxilemur*), in which the hypoconulid is more lingual and frequently twinned with the entoconid. Lower molars in *Phileosimias*, as in all other eosimiids, have trigonids that are open lingually and possess a strongly cuspidate paraconid. Except for M/1, on which the paraconid is commonly reduced in early anthropoids (notably in *Proteopithecus*, *Serapia*, *Arsinoea*, *Catopithecus* and *Oligopithecus*), the paraconid is generally absent on M/1-3 and the trigonid is closed lingually in anthropoids (propliopithecids, parapithecids, amphipithecids, pliopithecids, platyrrhines). The presence of a paraconid on all lower molars is observed in omomyiforms and the living *Tarsius*. In eosimiids, the paraconid on M/2-3 is, however, widely spaced from the metaconid and sometimes mesiolingually positioned between the protoconid and the metaconid (in *Phenacopithecus*, *Phileosimias*), whereas it is generally mesial and twinned to the metaconid in omomyiforms.

As mentioned by Beard & Wang (2004), P/4 is "a particularly diagnostic tooth locus among eosimiids". The P/4 of *Phileosimias* is remarkably similar to those of other eosimiids in showing a slight degree of exodaenodonty, a low and short talonid bearing only a small hypoconid mesial to the strong protoconid, a minute to crestiform metaconid situated distally and inferiorly with respect to the protoconid, and in having a simple swelling of enamel in place of the paraconid. The P/4 of *Phileosimias* shows, however, a talonid that is more pinched buccolingually and with stronger development of the postmetacristid. These aspects of the P/4 metaconid morphology and location differ from conditions in other early anthropoids (e.g. proteopithecids, oligopithecids, propliopithecids) in which this cuspid is relatively much larger and located farther mesially with respect to the protoconid.

PHYLOGENETIC ANALYSES: MATERIALS AND METHODS

The origin of Anthropoidea remains one of the most hotly contested issues in primate evolution. Furthermore, the nature of the phylogenetic relationships between

Eocene Asian and Eocene-Oligocene African forms is still unclear and actively discussed. As a contribution to these phylogenetic debates, here we provide an assessment of the position and the role of these new primates from the Oligocene of Pakistan in a high-level phylogenetic context.

Selected characters

We mainly used the updated compilation of characters (primarily morphological) and character states recently published by Kay *et al.* (2004a) on a large number of living and fossil primates, but substantially modified based on both personal observations and interpretations (Appendixes 1 and 2). Of the morphological characters, 207 are dental (Ross *et al.*, 1998 [for a review]; Marivaux *et al.*, 2001), 52 are cranial (Beard & MacPhee, 1994; Ross *et al.*, 1998 [for a review]; Seiffert *et al.*, 2004), 68 are postcranial (Ross *et al.*, 1998 [for a review]; Gebo *et al.*, 2001; Seiffert *et al.*, 2004), 3 are characters of the soft-tissues (Martin, 1990; Kay *et al.*, 2004a), and 6 are developmental features (Luckett, 1975, 1993). Following Kay *et al.* (2004a) 3 molecular and physiological characters were included from the work of Schmitz *et al.* (2001; Schmitz & Zischler, 2004) and Pollock & Mullin (1987). All the selected characters are equally weighted. The multistate characters were considered as ordered (Option 1) if changes from one state to another required passing through intermediate states (Slowinski, 1993). With such an *ad hoc* assumption, character state assignments do not convey *a priori* judgments about character polarity (unconstrained parsimony). However, analyses were performed with unordered multistate characters as well (Option 2) in order to evaluate the effects of character ordering on tree topologies.

Selected taxa

Our taxonomic sampling (Table 4) derives from that of Ross *et al.* (1998) and Kay *et al.* (2004a). However, some taxa were deleted (such as *Aycrossia*, *Ignacius*, *Pseudoloris*, *Rooneyia*, *Tetonoides*, and *Trogolemur*) because we did not have the opportunity to observe originals or casts of specimens for updating the matrix with respect to the changes we introduced on character descriptions and character states. On the other hand, several taxa were added to the matrix, those for which originals or casts were available in the collections of the University of Montpellier [UMC] (*Branisella*, *Guangxilemur*, *Hoanghonius*, *Moeripithecus*, *Neosaimiri*, *Oligopithecus*, *Periconodon*, *Phenacopithecus*, *Sivaladapis*, and *Xanthorhysis*). As in previous studies of Ross *et al.* (1998) and Kay *et al.* (2004a), some taxa included in the analysis were composites of several species of one genus (Appendix 3), or from unassociated specimens representing several areas of the body. The data set was systematically supplemented when possible. Within the Amphipithecidae, following Jaeger *et al.* (2004), *Amphipithecus* may be considered as a junior synonym of *Pondaungia.* In this analysis, *Pondaungia* was, therefore, a composite of *Pondaungia* and "*Amphipithecus*" (small and large forms) for which morphological variations were included and pooled as polymorphism. Furthermore, cranial characters previously scored for "*Amphipithecus*" (characters CR23, 24, 31; Appendix 1) were not coded in this new matrix since the skull fragments attributed to this genus ("frontal bones") have been both incorrectly assigned and interpreted (see Beard *et al.*, 2005). As in the case of Ross *et al.* (1998) and Kay *et al.* (2004a), Primates were examined within a context of higher-level phylogeny, together with Scandentia and Plesiadapiformes, which were designated as out-groups.

Altiatlasius koulchii SIGÉ *in* Sigé, Jaeger, Sudre & Vianey-Liaud, 1990 from the late Palaeocene of Morocco has figured prominently in discussions dealing with primate origins, seeing that it represents the oldest member of the order to be known thus far. However, the affinities of this taxon within the order remain uncertain: it was originally considered as an early omomyid (Sigé *et al.*, 1990), more cautiously as a basal primate (Gingerich, 1990), and subsequently as a possible close relative of anthropoids (Godinot, 1994; Beard, 1998b, 2002, 2006; Seiffert *et al.*, 2004). Despite the paucity of the material referred to *Altiatlasius* (few isolated teeth), 98 dental characters (47% completeness) were nonetheless scored for that genus, in order to assess its phylogenetic position in a high-level primate phylogeny.

Order Primates

Semiorder Strepsirrhini
Suborder Lemuriformes
Family Lemuridae: *Lemur*
Family Cheirogaleidae: *Microcebus*
Suborder Lorisiformes
Family Galagonidae: *Galagoides*
Family Loridae: *Nycticebus*
Suborder Adapiformes
Family Adapidae: *Adapis, Leptadapis*
Family Notharctidae: *Aframonius, Cantius, Donrussellia, Mahgarita, Notharctus, Periconodon, Pronycticebus, Protoadapis*
Family Sivaladapidae: *Guangxilemur, Hoanghonius, Sivaladapis*
Semiorder Haplorhini
Family Afrotarsiidae: *Afrotarsius*
Family Tarsiidae: *Tarsius, Xanthorhysis*
Suborder Omomyiformes (or Tarsiiformes: Omomyidae + Tarsiidae)
Family Omomyidae: *Absarokius*, *Anaptomorphus*, *Anemorhysis*, *Arapaphovius*, *Dyseolemur*, *Hemiacodon*, *Loveina*, *Macrotarsius*, *Microchoerus*, *Nannopithex*, *Necrolemur*, *Omomys*, *Shoshonius*, *Steinius*, *Strigorhysis*, *Teilhardina*, *Tetonius*, *Uintanius*, *Washakius*
Suborder Anthropoidea
Family Eosimiidae: *Eosimias*, *Bahinia*, *Phenacopithecus*
Family Oligopithecidae: *Catopithecus*, *Oligopithecus*
Family Proteopithecidae: *Proteopithecus*, *Serapia*
Family Propliopithecidae: *Aegyptopithecus*, *Moeripithecus*
Family Parapithecidae: *Apidium*, *Arsinoea*, *Parapithecus*, *Qatrania*, *Simonsius*
Family Amphipithecidae: *Myanmarpithecus*, *Pondaungia*, *Siamopithecus*
Infraorder Platyrrhini: *Aotus*, *Branisella*, *Callicebus*, *Dolichocebus*, *Neosaimiri*, *Saimiri*

Table 4.— Classification followed in the text and taxa included in analyses

Phylogenetic analysis

Data were managed by MacClade 3.04 (Maddison & Maddison, 1992). Phylogenetic reconstructions were performed by PAUP* 4.0 beta 10 Win (Swofford, 2002). As the data set contained too many taxa for executing an exact search (Branch and Bound option), heuristic search methods (Hsearch) with a random step-wise addition (1000 replications with randomised input order of taxa) and tree bisection-reconnection (TBR) branch-swapping options were applied.

RESULTS AND COMMENTS

Heuristic searches performed on the data set including some ordered multistate characters (Option 1) have yielded two equally most-parsimonious trees of 2810 steps each (CI= 0.273; RI= 0.53). Analyses made on the same data set but considering all characters unordered (Option 2) have yielded 38 trees of 2646 steps each (CI= 0.289; RI= 0.51). In these latter analyses, most of the alternative topologies generated (equally parsimonious) mainly reflect the numerous irresolutions within the omomyid and adapid clades. Strict consensus trees of both types of analyses are presented in Fig. 4 (A and B). Derived from these large cladograms, we have generated two simplified high-level trees (Fig. 5A-B) showing the main dichotomies among higher taxonomic primate groups. Similar to the analyses of Kay *et al.* (2004a), we obtain in both cases (Option 1 and Option 2) the monophyly of the Amphipithecidae (nodes IV, Fig. 4A-B) here including *Siamopithecus*, *Pondaungia, Myanmarpithecus* and *Bugtipithecus* - a result that supports the amphipithecid status of *Bugtipithecus*. Analyses performed with unordered multistate characters (Option 2) provide support for an eosimiid clade including *Phileosimias* with *Eosimias*, *Phenacopithecus* and *Bahinia* (node II', Fig. 4B). By contrast, analyses considering some ordered multistate characters (Option 1) identify an eosimiid clade including *Eosimias*, *Phenacopithecus* and *Bahinia*, but to the exclusion of *Phileosimias* (node II, Fig. 4A). In this phylogenetic context, *Phileosimias* represents the most basal member of the larger anthropoid clade (node I', Fig. 4A), that is the sister group of Eosimiidae. Whatever the multistate character assumptions (ordered *versus* unordered), the results of these analyses consistently point toward the monophyly of a large clade (nodes I, Fig. 4A-B) including Eosimiidae, Amphipithecidae, Oligopithecidae, Propliopithecidae, Proteopithecidae, Parapithecidae and platyrrhine primates. Assuming this clade to be the Anthropoidea clade (e.g. Beard, 2004), from the present evidence, eosimiids and amphipithecids (and by extension *Phileosimias* and *Bugtipithecus*, respectively) are stem anthropoids (Beard, 2004; Kay *et al.*, 2004b; Kay, 2005) and as such support the hypothesis that Asia was the ancestral homeland of the Anthropoidea clade (Beard *et al.*, 1994, 1996; Beard, 2004; Jaeger *et al.*, 1999; Kay *et al.*, 2004). The Eosimiidae represent the earliest offshoot of the Anthropoidea and the Amphipithecidae are the sister group of a smaller clade (nodes V, Fig. 4A-B) consisting of Paleogene Arabo-African anthropoids (Para-, Proteo-, Oligo-, Propliopithecidae) and South American crown platyrrhines. Among the Afro-Arabian anthropoids, the Oligopithecidae (*Oligopithecus* and *Catopithecus*) are closely related

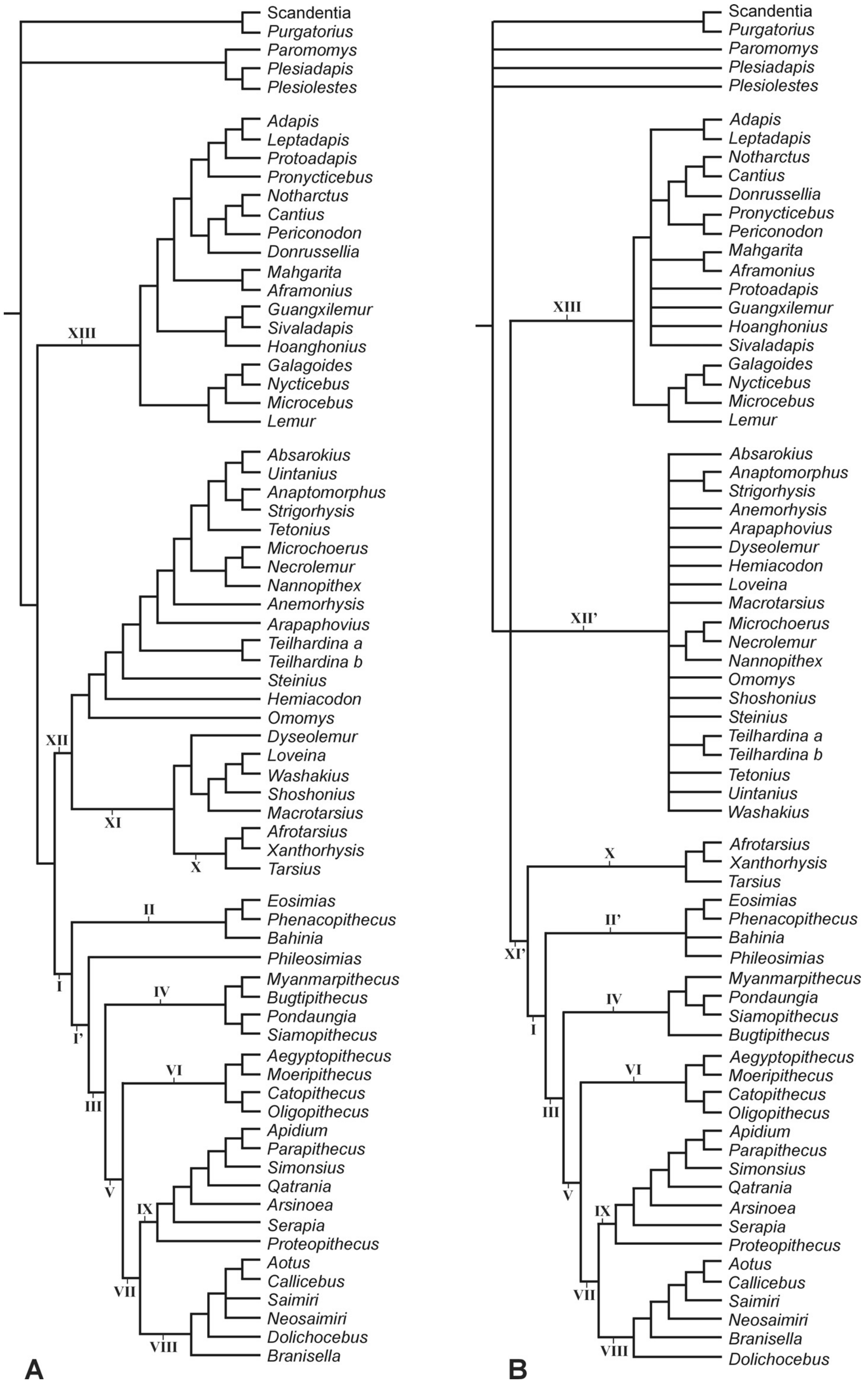

Figure 4.— Results of phylogenetic analyses performed with Option 1 (**A**) and Option 2 (**B**). **A**, strict consensus of two equally most-parsimonious trees of 2810 steps each (CI= 0.273; RI= 0.53); **B**, strict consensus of 38 equally most-parsimonious trees of 2646 steps each (CI= 0.289; RI= 0.51).

to the Propliopithecidae (*Aegyptopithecus*, *Moeripithecus*) (nodes VI, Fig. 4A-B), thus supporting the hypothesis that oligopithecids are crown anthropoids (Kay *et al*., 2004a), more precisely stem catarrhines (Seiffert & Simons, 2001; Seiffert *et al*., 2004), and not stem anthropoids as it had been previously argued (Kay *et al*., 1997; Ross *et al*., 1998).

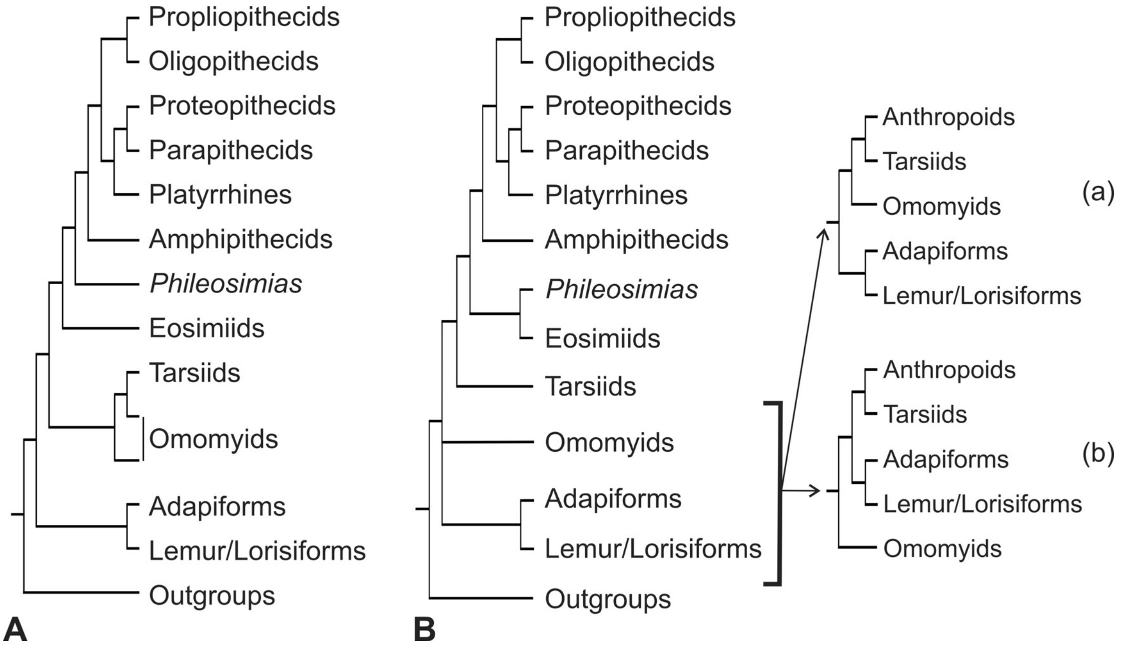

Figure 5.— **A-B**, simplified high-level trees of strict consensus presented in Fig. 4A and Fig. 4B, respectively, showing the main dichotomies among higher taxonomic primate groups.

Similar to the analyses of Kay *et al.* (2004a), our results reveal that *Proteopithecus* and *Serapia* (Proteopithecidae) are basal to Parapithecidae (here including *Apidium*, *Parapithecus*, *Simonsius*, *Qatrania*, and *Arsinoea*) (nodes IX, Fig. 4A-B), thus suggesting that both taxa might be regarded as parapithecids (Simons & Seiffert, 1997; Kay *et al*., 2004a) and not stem platyrrhines as suggested by Miller & Simons (1997) and Takai *et al.* (2000). Our phylogenetic scenario rather suggests that the "Proteopithecidae"-Parapithecidae clade is the stem group of crown platyrrhines (nodes VII, Fig. 4A-B). However, the apparent sister group relationship between these Paleogene African primates and the neotropical crown platyrrhines does not preclude the existence (possibly out of Africa) of a more compelling candidate for the stem platyrrhine evolution.

Concerning the phylogenetic position of the Anthropoidea in a higher-level primate phylogeny, the tarsiid-omomyid-anthropoid model of anthropoid origin receives greater support here than the adapiform-anthropoid or prosimian/anthropoid models. Only analyses performed with unordered multistate characters (Option 2) have generated, in addition to the omomyid-tarsiid-anthropoid relationships (Fig. 5B[a]), alternative topologies showing links between adapids-lemurs-lorises and tarsiids-anthropoids to the exclusion of omomyids (Fig. 5B[b]), thus involving a trichotomy between the omomyid, tarsiid-anthropoid and adapiform clades on the strict consensus tree (Figs 4B and 5B). The overall consensus emerging from both analyses primarily reflects the haplorhine (tarsiids, omomyids, anthropoids) / strepsirrhine (adapiforms, lemuriforms-lorisiforms) dichotomy, which is supported by a wide variety of neontological and paleontological data (e.g. Martin, 1990; Luckett, 1993; Beard & MacPhee, 1994; Kay *et al.*, 1997; Ross *et al.*, 1998; Gebo *et al.*, 2000; Gebo & Dagosto, 2004; Covert, 2004; Kay *et al.*, 2004a; Schmitz & Zischler, 2004). However, the two types of analyses performed (Option 1 and Option 2) offer substantially different phylogenetic scenarios regarding the tarsiid position (nodes X, Fig. 47A-B) within the Haplorhini clade. The phylogenetic position of the Tarsiidae (here including *Tarsius*, *Xanthorhysis* and *Afrotarsius*) is perhaps the most controversial issue in primate phylogeny (for a review see Dagosto, 2002). Our results express in fact the two major and current variants of the Haplorhini concept. On the one hand, considering the Option 1 (node XI, Fig. 4A; Fig. 5A), Tarsiidae are nested within Omomyidae (which are paraphyletic; node XII, Fig. 4A) on the bases of characters from the cranial anatomy (for details see Rosenberger, 1985; Beard & MacPhee, 1994). This scenario advocates a fundamental dichotomy within Haplorhini between Tarsiiformes (tarsiids + "omomyids"; node XII, Fig. 4A) and Anthropoidea (Hoffstetter, 1977; Beard *et al.*, 1991; Beard, 2002), and therefore implies a long independent history for anthropoids. On the other hand, considering the Option 2, Tarsiidae and Anthropoidea are more closely related to each other (node XI', Fig. 4B; Fig. 5B[a]) than either is to omomyid primates (which are monophyletic; node XII', Fig. 4B). This scenario is based primarily on the presence of a postorbital septum in both modern tarsiers and anthropoids (+ Paleogene African forms), and on shared characters in the morphology of their auditory region (for details see Cartmill, 1980; Cartmill *et al.*, 1981; Ross, 1994; Ross *et al.*, 1998; Kay *et al.*, 1997, 2004a). However, there is ongoing debate as to whether these morphological characters, notably postorbital closure, are homologous between tarsiers and anthropoids (e.g. Simons & Rasmussen, 1989; Beard & MacPhee, 1994; MacPhee *et al.*, 1995). Besides, there is no fossil evidence yet available for demonstrating that stem tarsiids (for instance *Xanthorhysis*) and stem anthropoids (eosimiids and amphipithecids) had already developed such a character. As suggested by Beard (2002), "possibly, these highly diagnostic traits evolved relatively recently in anthropoid phylogeny", and in the tarsiid lineage as well. Whatever the higher-level pattern of relationships considered within the Haplorhini clade (i.e. "omomyids"-tarsiids to the exclusion of anthropoids *versus* tarsiids-anthropoids to the exclusion of omomyids), characters supporting a scenario become homoplasious when considering the other one. So, we do not attempt to resolve this phylogenetic issue since we do not provide here substantial fossil evidence, notably cranial evidence, for supporting one of these scenarios.

The addition of *Altiatlasius* in the data matrix does not change the phylogenetic results obtained from heuristic searches running with the Option 1. Analyses have yielded 4 trees of 2821 steps each (CI = 0.273; RI = 0.53) for which a simplified strict consensus is presented in Fig. 6A. In these phylogenetic trees, *Altiatlasius* occupies a basal position within the large clade previously identified as the Anthropoidea clade (nodes I, Fig. 4A-B). In this phylogenetic context, *Altiatlasius* is closely related to the Asian eosimiids, and therefore it gains a stem anthropoid status. This result corroborates the point of view of Godinot (1994), Beard (1998b, 2002, 2006) and Seiffert *et al.*

(2004). In contrast, phylogenetic results obtained from analyses performed with the Option 2 are not so obvious regarding the status of *Altiatlasius*. Heuristic searches have yielded 44 equally-most parsimonious trees of 2658 steps each (CI = 0.289; RI = 0.51). The simplified strict consensus tree presented in Fig. 6B shows important areas where there is a lack of resolution with regard to high-level primate phylogenetic relationships.

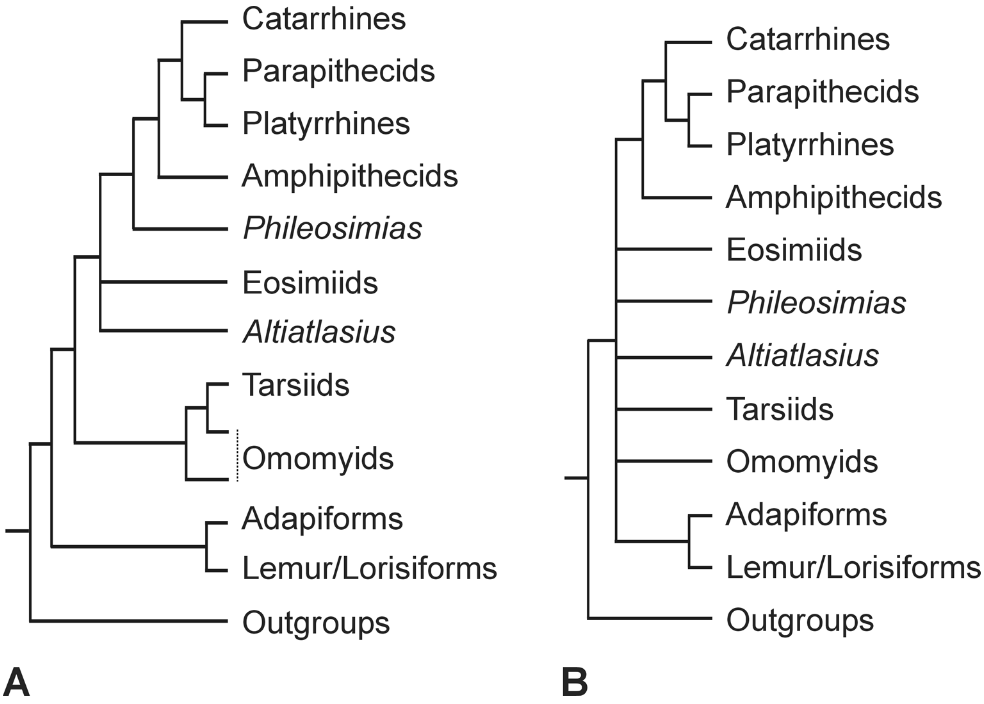

Figure 6.— Simplified high-level trees of the results of the phylogenetic analyses including *Altiatlasius* in the dataset. **A**, strict consensus of 4 equally most-parsimonious trees of 2821 steps each (CI= 0.273; RI= 0.53), performed with Option 1; **B**, strict consensus of 44 equally most-parsimonious trees of 2658 steps each (CI= 0.289; RI= 0.51), performed with Option 2.

Most of these apparent polytomies stem from the unstable phylogenetic position of *Altiatlasius*. Among the generated trees, *Altiatlasius* is either closely related to the eosimiids or nested within the eosimiid clade, but also appears as the earliest offshoot of the omomyids, or even as the closest out-group of the Haplorhini clade.

DISCUSSION

The Paleogene primate fossil record of Pakistan, or more widely of the Indian Subcontinent, was previously limited to scanty dental remains (either isolated teeth or fragments of mandibles) from the early middle Eocene Kuldana Formation (Pakistan; Russell & Gingerich, 1980, 1987; Thewissen *et al.*, 1997) and the Subathu Group (India; Thewissen *et al.*, 2001; Kumar *et al.* 2002). These poorly known fossils have been attributed to omomyid and adapid primates. This Paleogene record was rather disappointing in comparison with the primate fossil record from the rest of Southeast

Asia, notably that of China, Myanmar and Thailand. For the last decade, Southeast Asia has revealed an astonishing diversity of Eocene primates requiring considerable changes in the classical view of early primate evolution in the Old-World. Asian sivaladapids (e.g. Zdansky, 1930; Gingerich *et al.*, 1994; Ducrocq *et al.*, 1995b; Qi & beard, 1998), adapids (Beard *et al.*, 1994), amphipithecids (e.g. Pilgrim, 1927; Colbert, 1937; Chaimanee *et al.*, 1997; Takai *et al.*, 2001), eosimiids (e.g. Beard *et al.*, 1994; Beard & Wang, 2004; Tong, 1997; Jaeger *et al.*, 1999), omomyids (Beard *et al.*, 1994; Ni *et al.*, 2004), and tarsiids (Beard *et al.*, 1994; Beard, 1998b) now figure prominently in models of early primate radiation. Such high Paleogene primate diversity in South Asia, however, contrasts markedly with that of the early Neogene, which is apparently limited to sivaladapids (Thomas & Verma, 1979; Chopra & Vasishat, 1980; Gingerich & Sahni, 1984; Wu & Pan, 1985; Pan, 1988), tarsiids (Hoffstetter, 1977; Ginsburg & Mein, 1987), and African immigrating pliopithecoids (e.g. Harrison & Yumin, 1999). Sivaladapids and tarsiids have long been regarded as the only primate groups surviving in southern Asia far beyond the extirpation of their close Holarctic relatives near the Eocene-Oligocene boundary, which is characterized by an important global climatic deterioration (e.g. Berggren & Prothero, 1992; Janis, 1993). The temporal persistence in southern Asia of both groups was probably mediated by the paleogeography of this province, which extended in lower latitudes, thus allowing virtually continuous access to tropical refugia during the middle Cainozoic climatic event (Beard, 1998b; Qi & Beard, 1998; Jablonski, 2003, 2005; Antoine *et al.*, 2003a; Marivaux *et al.*, 2002a, 2004). The discovery of a diverse primate fauna in early Oligocene coastal deposits from central Pakistan (Bugti Hills, Paali Nala DBC2 locality; Welcomme *et al.*, 2001), including representatives of sivaladapids (*Guangxilemur singsilai* MARIVAUX, WELCOMME, DUCROCQ & JAEGER, 2002a), lemur-like strepsirrhines (*Bugtilemur mathesonae* MARIVAUX, WELCOMME, ANTOINE, MÉTAIS, BALOCH, BENAMMI, CHAIMANEE, DUCROCQ & JAEGER, 2001), eosimiids and amphipithecids (this paper), reveals an extensive presence of primates in South Asia at that time. This unequivocal fauna demonstrates that the paleoenvironmental conditions were relatively favourable in low latitudes of South Asia at least during part of the Oligocene. The composition of the associated mammal fauna from this primate-bearing locality characterizes particularly well such paleoenvironmental conditions in revealing lophiomerycid and tragulid artiodactyls (Métais *et al.*, 2004), dermopterans, petauristine sciurid and anomaluroid rodents (Marivaux, 2000, unpublished data), for which their closest living relatives are mostly related to dense forested habitats, notably tropical and subtropical forests. The paleolatitude of the Bugti Hills ca. 31 Ma was indeed ~ 14° farther south than in recent times (i.e., 15°N) due to the northward drift of the Indian Plate (e.g. Mattauer *et al.*, 1999). The co-occurrence of eosimiids and amphipithecids in the Oligocene of Pakistan extends considerably the paleogeographic distribution and the stratigraphic extension of both families, which were apparently restricted to Southeast Asia during the Eocene. Furthermore, the strong faunal similarity between the early Oligocene Paali Nala locality (Marivaux *et al.*, 2000, 2002a, b; Antoine *et al.*, 2003a; Métais *et al.*, 2004) and the late Eocene mammal localities from southern China and peninsular Thailand (e.g. Ducrocq *et al.*, 1995a; Qi & Beard, 1998; Métais *et al.*, 2001) suggests that a wide South Asian faunal province existed during this time interval.

Based upon results from our phylogenetic analyses, we endorse the phylogenetic hypothesis according to which Eosimiidae and Amphipithecidae are stem anthropoids. Our knowledge of these two South Asian families has been greatly improved in recent years. Their fossil record is still scarce but sufficient for demonstrating that anthropoids were a diverse and successful group in South Asia during the Paleogene, almost certainly as diversified as their coeval Afro-Arabian counterparts, for which the fossil record represents nearly one century of collection (e.g. Osborn, 1908; Schlosser, 1911; Simons, 1959, 1961…). A simple examination of body-weights of the well-known Eocene forms (predicted from the M1 area) reveals a large spectrum of body size, ranging from very tiny species (100-400 g: *Eosimias*, *Phenacopithecus*, *Bahinia*) to much larger-bodied forms (1-2 kg: *Myanmarpithecus*; 6-9 kg: *Pondaungia*, *Siamopithecus*). *Bugtipithecus* and *Phileosimias*, interpreted here as representatives of Amphipithecidae and Eosimiidae, respectively, document an unsuspected and more recent phase of the evolutionary history of small-bodied anthropoid primates in Asia. However, although unequivocal, this discovery presumably provides only a limited perspective on the total anthropoid diversity in this region during the early Oligocene. As for the other mammal groups identified at the Paali Nala DBC2 locality, the lack of large-bodied primate forms that might have occurred at this time may be interpreted as a taphonomic bias due to size sorting. Only small (*Bugtilemur*, ~ 100 g; *Phileosimias*, ~ 250 g; *Bugtipithecus*, ~ 350 g) to medium (*Guangxilemur*, ~ 2 kg) sized primate taxa have been unearthed thus far in Paali Nala C2 sands.

From the current evidence, South Asia and North Africa represented two major centres of early anthropoid primate radiation during the Paleogene. The discovery of *Phileosimias* and *Bugtipithecus* from the Oligocene of Pakistan demonstrates that eosimiids remained highly evolutionary conservative through time and that amphipithecids were very autapomorphic with respect to their coeval African relatives, which had evolved into advanced species with more or less modern anatomy (e.g. Kay *et al.*, 1981; Gheerbrant *et al.*, 1995; Simons, 1995; Seiffert & Simons, 2001; Seiffert *et al.*, 2004). This apparent evolutionary disparity between Eocene-Oligocene anthropoids of Asia and Africa suggests that anthropoids must have dispersed rapidly between the two continents just after their common Asian ancestry and evolved in relative isolation on both continents during the Paleogene. Eosimiids represent the earliest offshoot of the anthropoid radiation in Asia. Amphipithecids have differentiated in Asia and remained seemingly restricted to that continent (Beard, 2002; Kay *et al.*, 2004a). Parapithecids, proteopithecids, oligopithecids and propliopithecids are the result of a successful radiation in Africa by "at least" the late middle Eocene (Fig. 7A). Although extremely fragmentary, dental remains recovered from the early middle Eocene of Algeria (Glib Zegdou) and Tunisia (Chambi) suggest, indeed, that supposed basal anthropoids (*Algeripithecus*, *Tabelia;* Godinot & Mahboubi, 1992, 1994; Fig. 7C) inhabited northern Africa prior the interval documented in the Fayum sequence (late Eocene-early Oligocene of Egypt) or the Nementcha deposits (late middle Eocene of Algeria). These poorly sampled taxa have been regarded by Godinot (1994) as possibly the earliest members of the Parapithecidae (*Algeripithecus*) and Propliopithecidae (*Tabelia*), thus extending back to the early middle Eocene the chronostratigraphical range of these African families (Fig. 7C). However, better understanding of the phylogenetic positions of these supposed early anthropoids require further morphological support than current data allow. These taxa testify, nonetheless, to the great antiquity of the Anthropoidea clade (e.g. Hoffstetter, 1977; Godinot & Mahboubi, 1992, 1994; Godinot, 1994; Beard *et al.*, 1994, 1996; Beard, 2002; Kay *et al.*, 2004a; Seiffert *et al.*, 2004), which is consistent with the widespread North African - South Asian distribution of early anthropoids by the middle Eocene. Such a wide geographic range implies, in turn, the existence of early Paleogene communications between both provinces. Our phylogenetic results suggest that amphipithecids share a common Asian ancestor with both African anthropoids and South American platyrrhines (node III, Fig. 4A-B; "CAA" on Fig. 7A, C). In this phylogenetic context and from the current paleontological evidence, the African anthropoid fauna from the late middle Eocene (Algeria/Nementcha) and the late Eocene-early Oligocene (Egypt/Fayum; Oman), or even from the early middle Eocene (Algeria, Tunisia), might be descended from an Asian anthropoid migrant, which entered Africa during the middle Eocene (Fig. 7A, C). Several instances of faunal exchanges between South Asia and North Africa before the late middle Eocene have been demonstrated from other mammalian groups (for a review see Tabuce & Marivaux, 2005), but earlier exchanges are still inadequately documented, except for those evidenced between Africa and Europe (Tabuce & Marivaux, 2005). Interesting in these regards is *Altiatlasius koulchii* from the late Palaeocene of Morocco. Unfortunately, we have failed to obtain a clear phylogenetic signal for this taxon, for which possibilities of close relationships with the Eosimiidae have been suggested, but also possibilities with the Omomyidae (earliest offshoot) or the Haplorhini (closest out-group). The ambiguous phylogenetic position of *Altiatlasius* is admittedly related to the lack of morphological evidence, but also reflects the primitiveness of this very basal primate. The hypothesis according to which *Altiatlasius* would be a stem anthropoid and, furthermore, closely related to the Eosimiidae, has several implications for the early history of anthropoids. This would extend the root of the Anthropoidea clade back to the late Palaeocene, thereby implying an early Eocene hiatus for the anthropoid fossil record of both Asia and Africa (Fig. 7D, F). One of the most significant temporal ghost range implied by this phylogenetic assumption is that of the Eosimiidae in Asia, for which an occurrence during the late Palaeocene-early Eocene interval might be expected (Fig. 7D, F). The same seems to be true for the Amphipithecidae for which the first occurrence of this group in Asia might be expected by the early middle Eocene (Fig. 7E-F). These potential phylogenetic relationships between *Altiatlasius* and eosimiids would further suggest a much earlier (late Palaeocene) episode of faunal communication than those previously suspected during the middle Eocene between Africa and Asia (Beard, 2006). However, such a very early dispersal event between both provinces remains paleontologically undocumented from other mammalian groups.

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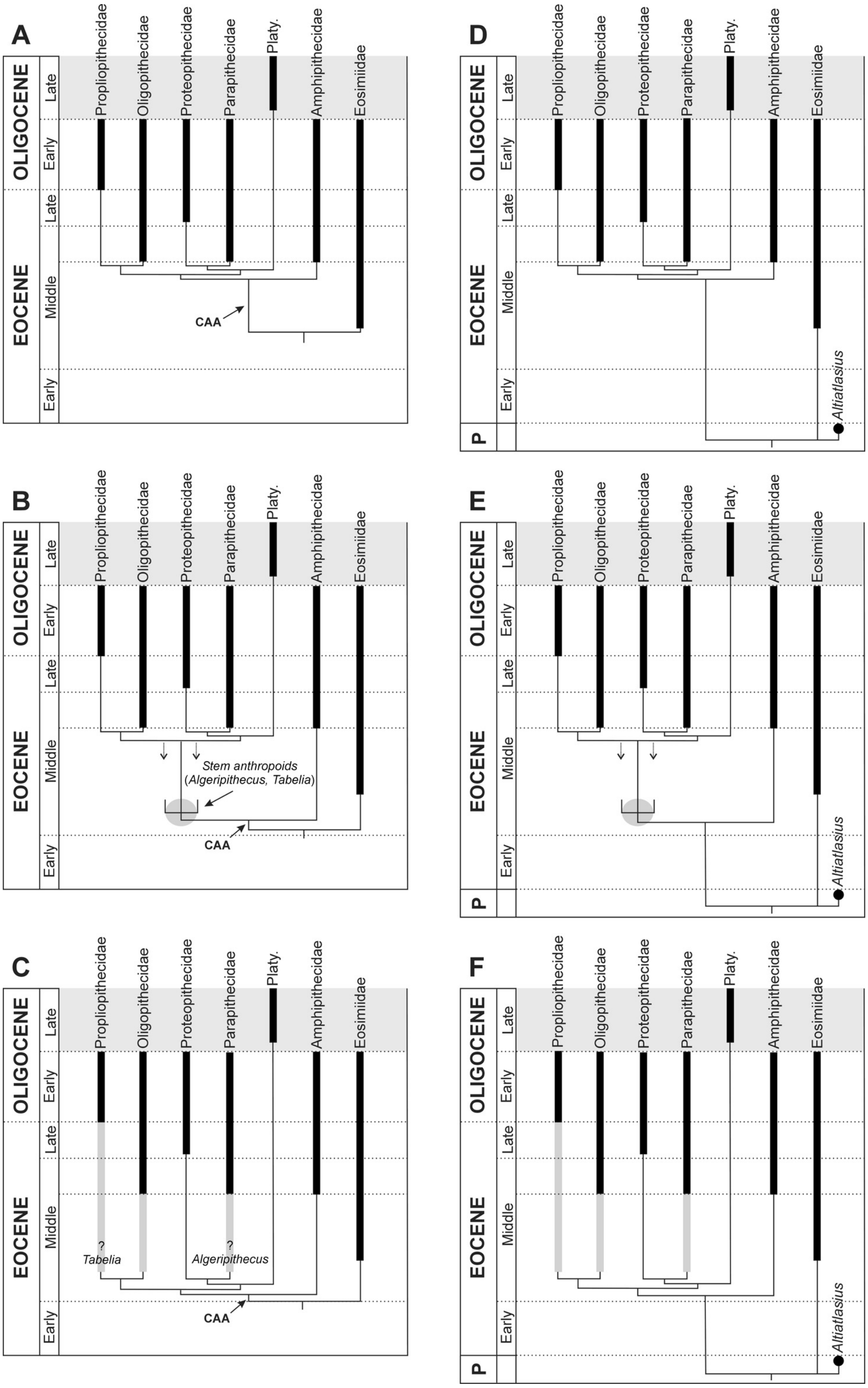
Figure 7.— Simplified patterns of phylogenetic relationships among Anthropoidea (based on results of our phylogenetic analyses) transposed onto a chronostratigraphical context. **A-C**, results of Option 1 and 2 without *Altiatlasius*. **D-F**, results of Option 1 and Option 2 with the addition of *Altiatlasius* (for the Option 2, only hypotheses of close phylogenetic relationships between *Altiatlasius* and eosimiids are illustrated here). **A**, simple transposition without considering early middle Eocene anthropoid forms from Africa; **B**, simple transposition by considering that stem anthropoids (*Algeripithecus*, *Tabelia*) inhabited North Africa by the early middle Eocene; **C**, simple transposition by considering that early middle anthropoids from North Africa (*Algeripithecus* and *Tabelia*) are members of the late Eocene-Oligocene anthropoid families (Parapithecidae and Propliopithecidae, respectively); **D**, similar condition than A but considering *Altiatlasius*, that extends back to the late Paleocene the root of the Anthropoidea clade; **E**, similar condition than B but considering *Altiatlasius*; **F**, similar condition than C but considering *Altiatlasius*. "CAA", Common Asian Ancestor.


A
B
C
D
E
F
OLIGOCENE
EOCENE
Late
Early
Middle
P
Propliopithecidae
Oligopithecidae
Proteopithecidae
Parapithecidae
Platy.
Amphipithecidae
Eosimiidae
CAA
Stem anthropoids (Algeripithecus, Tabelia)
?
Tabelia
?
Algeripithecus
Altiatlasius

All these paleobiogeographic implications on the early evolutionary history of anthropoid primates emphasize the critical role of *Altiatlasius*, for which additional morphological support is necessary for assessing more precisely the phylogenetic position of this pivotal taxa.

CONCLUSION

Until recently, the Oligocene in southern Asia remained virtually undocumented paleontologically. This fossil discovery from the early Oligocene of Pakistan reveals an extensive presence of primates in low latitudes of South Asia at this time. Even more remarkable in this regard is the presence of eosimiids and amphipithecids, which document an Oligocene phase of the evolutionary history of stem anthropoid in South Asia. These fossils provide new data on temporal and paleobiogeographic aspects of the early anthropoid evolution and significantly expand the record of stem anthropoid evolution in the Paleogene of South Asia. The demonstration that anthropoids persisted in southern Asia raises the critical issue of their subsequent evolution. Early Neogene anthropoid communities from South Asia consist of members of the Dionysopithecidae, a group of primates generally considered as stem pliopithecoids among catarrhine anthropoids (e.g. Harrison & Yumin, 1999), which seemingly entered Asia from Africa (Harrison & Yumin, 1999; Seiffert *et al.*, 2004) by the early Miocene (as part of the well-known faunal interchanges that occurred as a result of collision between the Afro-Arabian and Eurasian plates) or even earlier during the Oligocene (Bohlin, 1946; Antoine *et al.*, 2003). The eventual extinction of eosimiids and amphipithecids may have resulted from a phenomenon of competitive exclusion when pliopithecoids arrived in South Asia. However, the possibility of continuity and Asian ancestry for some of the Miocene Asian anthropoids from Palaeogene Asian forms (Jaeger *et al.*, 1998b), although widely contested (Harrison & Yumin, 1999; Kay *et al.*, 2004b; Seiffert *et al.*, 2004), cannot be totally precluded in the light of these new discoveries from the Oligocene of Pakistan (Marivaux et al., 2005). The Bugti Hills in Pakistan represent an important record of Himalayan Foreland sediments, which extend from the early Oligocene to the late Miocene (Welcomme *et al.*, 1997, 2001). These continental deposits open, therefore, tantalizing new perspectives on the mammal fossil record, notably on the late Paleogene-early Neogene primate record.

ACKNOWLEDGEMENTS

I thank Nawab Mohammad Akbar Khan Bugti, Lord of the Bugti Tribes, for its invitation to visit the Bugti territory. I am particularly indebted to Kamal Madjidulah for his courtesy and his high efficiency to organize the French paleontological missions in Balochistan. Many thanks to Marc de Grossouvre, former "*Attaché de Coopération Scientifique et Universitaire*" (French Embassy, Islamabad) for his great interest in our French/Pakistani collaboration program. K. Christopher Beard (Carnegie Museum of Natural History, Pittsburgh), Erik Seiffert (University of Oxford), and Marc Godinot ("*Muséum National d'Histoire Naturelle*", Paris) offered valuable comments and advices on fossils. Many thanks to Richard

F. Kay and Blythe A. Williams (Duke University Medical School, Durham) for providing me the data matrix of their cladistic analysis, and for their interesting discussions dealing with high-level primate phylogeny during the course of their stay in South of France at the "*Institut des Sciences de l'Évolution*" (ISE-M) (*Université Montpellier II*). I thank all the members of the "*Mission Paléontologique Française au Balouchistan*" (MPFB) Jean-Loup Welcomme, Pierre-Olivier Antoine ("*Institut des Sciences de la Terre*", Toulouse), Jean-Yves Crochet (ISE-M), Dario de Franceschi ("*Muséum National d'Histoire Naturelle*", Paris), Grégoire Métais (Carnegie Museum of Natural History, Pittsburgh), as well as Jean-Jacques Jaeger (ISE-M), Yaowalak Chaimanee (Department of Mineral Resources, Bangkok, Thailand), Syed Rafiqul Hassan Baqri (PMNH, Islamabad, Pakistan), Nayyer Iqbal (PMNH, Islamabad, Pakistan), and Ghazala Roohi (PMNH, Islamabad, Pakistan) for their efficient help during fieldworks in the Bugti Hills. The artwork in this paper are due to the great talent of Laurence Meslin, scientific illustrator at the ISE-M. We thank K. Christopher Beard and Marie Richard-Marivaux for improving the English version of the manuscript. Fieldworks were funded by the Ministry of Foreign Affairs (MAE, French Embassy, Islamabad), the program CNRS-ÉCLIPSE. I gratefully acknowledges the "*Fondation Fyssen*" and the "*Fondation Singer Polignac*" for funding my postdoctoral works. This is publication n° 2006-013 of the "*Institut des Sciences de l'Évolution de Montpellier*" (ISE-M, UMR - CNRS 5554), and the "*Mission Paléontologique Française au Balouchistan*" publication n° 28.

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APPENDIX 1

List of selected characters for the cladistic analyses

Dental, cranial, and postcranial characters and character states used in the phylogenetic analyses. Characters followed by an asterisk are considered “ordered”. Some characters have been modified (different character state interpretation) from the original works (see Character references). These characters have been labeled by “ **′** ” or “ **“** ”. A score of “ ? ” is used if information is unavailable due to a lack of material or if the character does not apply to a particular taxon. Tooth areas are calculated as the product of mesiodistal (md) length and buccolingual (bl) breadth.

Lower teeth:

Incisors

i1*. Lower incisor number: 0 = three; 1 = two; 2 = one: I/1 present, I/2 absent; 3 = lower incisors absent.

i2. Lower incisor occlusal arrangement: 0 = arcuate battery from lateral perspective (U-shaped arcade); 1 = cusp tips staggered (V-shaped arcade).

i3. Lower incisor crown spacing: 0 = no spaces; 1 = spaces present between crowns.

i4. I/2-C diastema: 0 = present; 1 = absent.

i5*. I/1-2 size (ratio of I/1-2 area to M/1 area): 0 = very small (≤ 0.69); 1 = moderate sized (≥ 0.70, ≤ 1.07); 2 = large (> 1.07).

i6*. I/1:I/2 proportions (ratio of I/1 area to I/2 area): 0 = I/1 much smaller than I/2 (< 0.65); 1 = I/1 smaller than I/2 (≥ 0.65, < 0.82); 2 = I/1 almost as large as I/2 (≥ 0.83, < 1.00); 3 = I/1 > I/2 (≥ 1.01, < 1.25); 4 = I/1 >> I/2 (≥ 1.25).

i7*. I/1 crown width (spatulate incisors only): 0 = considerably wider (m-d) than root (spatulate): 1 = narrow at apex, wider than root; 2 = “styliform” (crown apex approximately the same width as the cervical margin).

i8. I/2 crown cross-sectional shape (ratio of m-d length to b-l breadth): 0 = rounded oval (≥ 0.64); 1 = mesiodistally compressed (< 0.64).

i9*. Lower incisors crown height (crown heights judged from cementoenamel junction to crown tip on the buccal surface): 0 = low crowned; 1 = moderately high crowned; 2 = high crowned.

i10. I/1-2 crown buccal outline: 0 = gently curved in lateral perspective; 1 = acutely curved.

i11*. Lower incisor roots: 0 = erect or vertical; 1 = slightly procumbent; 2 = very procumbent.

i12*. Lower incisor crowns: 0 = erect or vertical; 1 = procumbent; 2 = very procumbent.

i13. Tooth comb: 0 = absent; 1 = with three teeth; 2 = with two teeth.

i14. I/1 crown shape: 0 = spatulate; 1 = lanceolate, pointed.

i15. I/2 heel development (a lingual swelling at the base of crown): 0 = heel absent; 1 = heel present.

i16. Incisor lingual enamel: 0 = well developed; 1 = very thin or absent.

i17*. Lower first incisor lingual cingulum: 0 = absent to weak; 1 = strong but incomplete; 2 = strong and complete.

i19*. Relative size of I/1 to M/1 (based on occlusal areas): 0 = I/1 very small (I/1 << M/1); 1 = moderately enlarged (I/1 < or = M/1); 2 = grossly enlarged (I/1 > M/1).

Canines

c1*. Female C/1 cross-sectional area relative to molar cross sectional area: 0 = very small (C/1:M/1 < 0.40); 1 = moderate (≥ 0.4, < 0.80); 2 = large (≥ 0.80, ≤ 1.20); very large (≥ 1.20)

c2*. C1/1dimorphism (square root of male C/1 area/square root of female C/1 area): 0 = low (< 1.07); 1 = moderate (≥ 1.07, < 1.17); 2 = high (≥ 1.17).

c3. C/1 cross-sectional shape: 0 = rounded oval; 1 = mesiodistally compressed; 2 = buccolingually compressed.

c4. C/1 lingual crest development: 0 = rounded; 1 = sharp.

c5. Canine paracristid (not scored if species has canine incorporated into a tooth comb): 0 = oblique to occlusal plane; 1 = nearly horizontal to occlusal plane; 2 = forms part of cropping mechanism with I/1-2.

c6. Canine height (females): 0 = low, squat; 1 = narrow, short; 2 = tall, at or above tooth row.

Premolars

p1. P1/1: 0 = present; 1 = absent

p2. P/2: 0 = present; 1 = absent.

p3. P/2 roots: 0 = single; 1 = double.

p4'. P/3 roots: 0 = single; 1 = double.

p4”. P/4 roots: 0 = single; 1 = double.

p5*. Premolar crowding (overlapping of crowns): 0 = no crowding; 1 = slightly crowded; 2 = very crowded-mesial root positioned buccal to distal root.

p6*. P/3 paraconid: 0 = large; 1 = small; 2 = absent or extremely small.

p7*. P/4 paraconid: 0 = large; 1 = small; 2 = absent or extremely small.

p9'*. P/4 paraconid position (labiolingually): 0 = mesial to protoconid; 1 = mesiolingual, between protoconid and metaconid; 2 = mesial to metaconid.

p9''. P4 paraconid position (mesiodistally): 0 = widely spaced from the metaconid; 1 = twinned with metaconid.

p11*. P/3-4 cristid obliqua: 0 = absent; 1 = weak; 2 = strong.

p13. P/2 protoconid height and shape: 0 = slender, projects above protoconids of P/3-4; 1 = massive, projects above protoconids of P/3-4; 2 = not projecting, in line with P/3; 3 = extremely short, shorter than P/3.

p14. P/4 metaconid position: 0 = close to protoconid; 1 = widely spaced from protoconid.

p15. P/2 metaconid size: 0 = absent or trace; 1 = small.

p16*. P/3 metaconid size: 0 = absent or trace; 1 = small; 2 = large (as big as protoconid).

p17*. P/4 metaconid size: 0 = absent or trace; 1 = small; 2 = large (as big as protoconid).

p18. P/4 trigonid-configuration of lingual wall : 0 = closed; 1 = open.

p19. P/3 entoconid and lingual talonid crest: 0 = absent; 1 = lingual talonid crest present but an entoconid does not stand out above it; 2 = entoconid forms a small discrete cusp.

p20. P/4 entoconid and lingual talonid crest: 0 = absent; 1 = lingual talonid crest present but an entoconid does not stand out above it; 2 = entoconid forms a small discrete cusp.

p21. P/4 lateral and medial protocristid: 0 = continuous between metaconid and protoconid; 1 = discontinuous between metaconid and protoconid.

p22. P/3 lateral protocristid orientation: 0 = transversely oriented; 1 = distolingually oriented; 2 = absent.

p23. P/4 lateral protocristid orientation: 0 = transversely oriented; 1 = distolingually oriented.

p24. P/3-4 posterior trigonid wall: 0 = complete [taxa without metaconids are assigned this character state]; 1 = deeply notched.

p25. P/3-4 hypoconid size: 0 = large; 1 = small or absent.

p26. P/3-4 hypoconid (or distal terminus of oblique cristid) position: 0 = distal to protoconid; 1 = distal to metaconid, or between protoconid and metaconid

p27*. P/4 hypocristid shearing development: 0 = absent; 1 = weak; 2 = strong.

p28*. P/2 buccal cingulum development: 0 = absent; 1 = incomplete, broken at protoconid and hypoconid; 2 = complete.

p29*. Lower premolar inflation: 0 = not basally inflated; 1 = slightly basally inflated; 2 = very basally inflated.

p30*. P/4 exodaenodonty: 0 = not exodaenodont; 1 = slightly exodaenodont; 2 = very exodaenodont.

p31*. P/4 talonid length (ratio of midline m-d length of trigonid to m-d length of talonid): 0 = extremely short or non-existent (tri:tal ≥ 1.61); 1 = short (much shorter than trigonid) (tri:tal ≥ 1.27, < 1.61); 2 = equal or slightly shorter in length to trigonid (tri:tal ≥ 0.92, < 1.27); 3 = talonid longer than trigonid (tri:tal < 0.91).

p33*. Premolar orientation: 0 = Crown bases vertical in lateral perspective; 1 = slightly oblique; 2 = strongly oblique, projecting medial over the anterior.

p34. P/4 anterobuccal cingulum development: 0 = absent or trace; 1 = strong.

p36*. P/4 postprotoconid ridge: 0 = weak or absent; 1 = moderate; 2 = very strong.

p37*. P/4 postmetaconid ridge: 0 = weak or absent; 1 = moderate; 2 = very strong.

p40*. P/4 paraconid height: 0 = low; 1 = moderate; 2 = high (nearly as high as protoconid).

p41*. P/3-4 protoconid height: 0 = P/3 much lower than P/4; 1 = P3 slightly lower than P/4; 2 = P/3 equal in height to P/4; 3 = P/3 higher than P/4.

p42*. P/3 to P/4 area: 0 = 0.45-0.59; 1 = 0.60-0.69; 2 = 0.70-0.79; 3 ≥ 0.80.

p43*. P/4 m-d L/ b-l W: 0 = (< 0.95); 1 = (≥ 0.96, < 1.14); 2 = (≥ 1.15, < 1.20); 3 = (≥ 1.21, < 1.35; 4 = (≥ 1.36, < 1.46); 5 = (> 1.47).

p44*. Ratio of P/4 area to M/1 area: 0 = (< 0.62); 1 = (≥ 0.63, < 0.72); 2 = (≥ 0.73, < 0.82); 3 = (≥ 0.83, < 0.92); 4 = (≥ 0.93, < 1.02); 5 = (> 1.03).

p45. P/3-4 root orientation: 0 = P/3-4 roots aligned mesiodistally; 1 = P/3 root shifted laterally, P/4 mesial root aligned mesiodistally; 2 = P/3 roots aligned mesiodistally, P/4 mesial root shifted laterally. [Scored as missing if roots are single].

Molars

m1. M/3: 0 = present; 1 = absent.

m2. M/1 root number: 0 = one; 1 = two.

m3. M/2 root number: 0 = one; 1 = two.

m4. M/3 root number: 0 = one; 1 = two.

m6*. M/2 trigonid width (ratio of buccolingual breadths of trigonid and talonid): 0 = much wider than talonid (≥ 1.11); 1 = widths similar (< 1.11, > 0.90); 2 = much narrower than talonid (≤ 0.90).

m7*. M/3 trigonid width (based on relative buccolingual breadths): 0 = much wider than talonid (≥ 1.20); 1 = trigonid and talonid widths similar (≤ 1.20-1.05); 2 = trigonid narrower than talonid (< 1.05).

m8'*. M/1 paraconid position: 0 = mesial to protoconid; 1 = mesiolingual, between protoconid and metaconid; 2 = mesial to metaconid.

m9'*. M/2 paraconid position: 0 = mesial to protoconid; 1 = mesiolingual, between protoconid and metaconid; 2 = mesial to metaconid.

m10*. M/3 paraconid position: 0 = mesial to protoconid; 1 = mesiolingual, between protoconid and metaconid; 2 = mesial to metaconid.

m8-9-10'. M/2-3 paraconid location: 0 = widely spaced from the metaconid; 1 = twinned with metaconid.

m11. M/1 parastylid: 0 = absent; 1 = present.

m12*. Molar metastylids (postmetacristids): 0 = absent; 1 = small; 2 = large.

m13. M/3 hypoconulid: 0 = single; 1 = double

m14*. M/3 heel: 0 = absent; 1 = narrower than talonid; 2 = approximately equal in width to talonid.

m15*. Molar enamel surface: 0 = smooth; 1 = slightly crenulated; 2 = highly crenulated.

m16*. M/1 trigonid height (ratio of trigonid height to talonid height measured on the buccal aspect of the crown): 0 = higher than talonid (≥ 1.20); 1 = slightly higher than talonid (≥ 1.10, < 1.20); 2 = trigonid and talonid of similar height(< 1.10).

m17. M/1-2 cusp relief: 0 = moderate to high; 1 = low.

m18. M/1 trigonid lingual configuration: 0 = open; 1 = closed.

m19. M/1 metaconid position: 0 = transversely aligned-lingual to protoconid; 1 = slightly distolingual to protoconid.

m20*. M/1-2 paraconid development: 0 = absent; 1 = small; 2 = large.

m21. M/1-2 lateral protocristid orientation: 0 = runs toward metaconid; 1 = runs toward hypoflexid.

m22. M/1 distal trigonid wall: 0 = complete; 1 = deeply notched by protoconid/metaconid sulcus; 2 = medial and lateral protocristid do not meet but no sulcus is visible.

m23. M/2 distal trigonid wall: 0 = complete; 1 = deeply notched by protoconid/ metaconid sulcus; 2 = medial and lateral protocristid do not meet but no sulcus is visible.

m24. M/1-3 wear facet X: 0 = present; 1 = absent.

m25*. M/1-2 entoconid: 0 = absent; 1 = barely stands out on lingual talonid marginal crest; 2 = a small discrete cusp; 3 = a large cusp.

m26*. M/1-2 postentoconid sulcus: 0 = prominent; 1 = faintly visible; 2 = absent.

m27*. M/1 hypoconulid size: 0 = large; 1 = moderate; 2 = small; 3 = absent.

m28*. M/2 hypoconulid size: 0 = large; 1 = moderate; 2 = small; 3 = absent.

m29*. M/3 hypoconulid size: 0 = large; 1 = moderate; 2 = small; 3 = absent.

m30*. M/1-2 hypoconulid position: 0 = twinned to entoconid; 1 = near midline; 2 = slightly buccal to midline.

m31*. M/1-2 cristid obliqua development: 0 = weak (rounded); 1 = strong (trenchant); 2 = very strong (trenchant).

m32*. M/1 cristid obliqua orientation: 0 = reaches trigonid wall at a point distal to protoconid; 1 = reaches trigonid wall at a point distolingual to protoconid; 2 = reaches trigonid wall at a point distal to metaconid.

m33*. M/2 cristid obliqua orientation: 0 = reaches trigonid wall at a point distal to protoconid; 1 = reaches trigonid wall at a point distolingual to protoconid; 2 = reaches trigonid wall at a point distal to metaconid.

m34. M/1 cristid obliqua terminus: 0 = runs to base of trigonid; 1 = runs part way up the distal trigonid wall; 2 = connects with protoconid tip or protocristid; 3 = connects with metaconid.

m35. M/2 cristid obliqua terminus: 0 = runs to base of trigonid; 1 = runs part way up the distal trigonid wall; 2 = connects with protoconid tip or protocristid; 3 = connects with metaconid.

m36. M/3 cristid obliqua terminus: 0 = runs to base of trigonid; 1 = runs part way up the distal trigonid wall; 2 = connects with protoconid tip or protocristid; 3 = connects with metaconid.

m37. M/1-2 centroconid development: 0 = present; 1 = absent but cristid obliqua bends sharply in hypoflexid; 2 = absent.

m38*. M/1-2 hypocristid development: 0 = absent or seen only as a trace; 1 = weak; 2 = strong.

m39*. M/3 hypocristid development: 0 = absent or seen only as a trace; 1 = weak; 2 = strong.

m40*. Lingual configuration of M/1-2 talonid: 0 = open; 1 = notched lingually but not open; 2 = closed.

m41. M/1-2 distal fovea: 0 = absent; 1 = present (weak); 2 = present (large).

m42. M/1-2 hypocristid configuration: 0 = simple; 1 = with accessory cusp close to hypoconid.

m43. M/1-2 cristid obliqua: 0 = notched; 1 = straight.

m44*. Molar cusp inflation: 0 = cusps not inflated, marginally positioned; 1 = slightly inflated; 2 = very inflated.

m45*. M/1-2 buccal cingulid development: 0 = absent to trace; 1 = partial, broken at protoconid and hypoconid; 2 = complete.

m46*. M/1 hypoflexid depth: 0 = very shallow; 1 = moderate; 2 = deep.

m47*. M/2 hypoflexid depth: 0 = very shallow; 1 = moderate; 2 = deep.

m53*. Ratio of M/2 length to M/3 length: 0 = M/3 much longer than M/2 (0.71-0.80); 1 = M/3 longer than M/2 (0.81-0.90); 2 = M/3 equal than M/2 (0.91-1.00); 3 = M/3 smaller than M/2 (1.01-1.12); 4 = M/3 much smaller than M/2 (≥ 1.13); 5 = if M/3 absent.

m55*. M/1 mesiodistal length/buccolingual breadth: 0 = 1.0-1.15; 1 = 1.16-1.22; 2 = 1.23-1.32; 3 = > 1.33.

m56. Convergence of buccal and lingual molar cusp walls: 0 = convergent; 1 = vertically sided.

m57. M/1-2 entoconid position relative to hypoconid: 0 = transverse to hypoconid; 1 = distal to hypoconid.

ML88*. M/1-3 Pre-entocristid: 0 = indistinct to absent; 1 = weakly developed (low); 2 = well-developed (strong and high).

Upper teeth

Incisors

I1*. I1/-I2/ interstitial contact: 0 = absent; teeth widely spaced; 1 = present as narrow contact; 2 = I2/ tightly packed against I1/, I1/ preparacrista abbreviated.

I2. I1/-I1/ interstitial contact: 0 = present; 1 = absent: a wide space occurs in the midline between these teeth.

I3. I2/-C diastema: 0 = present; 1 = absent.

I4*. I1/ area:I2/ area: 0 = areas approximately equal (≤ 1.00); 1 = I1/ slightly larger than I2/ (> 1.00, < 1.40); 2 = I1/ much larger than I2/ (> 1.40).

I5*. I1/ size (I1/ area: M1/ area): 0 = incisor small (≤ 0.50); 1 = incisor moderate (> 0.50, < 0.56); 2 = incisor large (≥ 0.56).

I6*. I1/ occlusal shape (mesiodistal length/buccolingual breadth): 0 = rounded oval (< 1.05); 1 = buccolingually compressed (> 1.05, < 1.30); 2 = extremely compressed (> 1.30).

I7*. I2/ occlusal shape (mesiodistal length /buccolingual breadth): 0 = rounded oval (≤ 1.05); 1 = slightly buccolingually compressed (> 1.05, < 1.30); 2 = extremely buccolingually compressed ≥ 1.30).

I8. I1/ crown shape: 0 = spatulate; no apparent occlusal cusp, mesial and distal edges continuous and rounded; 1 = semi-spatulate; central cusp present but blunt with discernable mesial and distal occlusal crests; 2 = central occlusal cusp pointed, occlusal edges steep.

I9. I1/ lingual fovea: 0 = simple; 1 = dual, with mid-crown pillar.

I10. I1/ occlusal edge orientation (for spatulate incisors only; all others scored as " ? "): 0 = occlusal edge orthogonal to long axis of root; 1 = occlusal edge wears at a steep angle to long axis of root; 2 = crown with pronounced mesial asymmetry (= mesial process) in unworn state.

I11*. I1-2/ lingual cingulum: 0 = weak, discontinuous; 1 = moderate, continuous; 2 = strong.

I12. I1/ basal lingual cusp: 0 = absent; 1 = present.

I13. I1/-I2/ buccal cingulum: 0 = absent; 1 = present.

Canines

C1. C1/ cross-sectional shape: 0 = oval; 1 = rounded.

C2*. Upper canine occlusion: 0 = C1/ wears against P/1-2; 1 = C1/ wears against

P/2; 2 = C1/ wears against P/2-3; 3 = C1/ wears against P/3.

C3. C1/ mesial groove (females): 0 = shallow or absent; 1 = deep.

C4*. C1/ lingual cingulum: 0 = weak or absent; 1 = strong; 2 = very strong.

Premolars

P1*. P2/ root number: 0 = one (if tooth is absent, taxon scored “ 0 ”); 1 = two; 2 = three.

P2*. P3/ root number: 0 = one; 1 = two; 2 = three.

P3*. P4/ root number: 0 = one; 1 = two; 2 = three.

P4*. Ratio of P2/ area to P3/ area: 0 = P2/ much smaller (≤ 0.85) (if tooth is absent, taxon scored “ 0 ”); 1 = P2/ smaller (> 0.85, < 0.95); 2 = P2/ equal (≥ 0.95).

P5*. Ratio of P4/ area to M1/ area: 0 = P4/ << M1/ (≤ 0.66); 1 = P4/< M4/ (> 0.66, ≤ 0.76); 2 = P4/ = M1/ (0.77-1.05); 3 = P4/ > M1/ (> 1.06).

P6. P2/ occlusal outline: 0 = triangular; 1 = suboval with the long axis b-l; 2 = suboval with the long axis m-d; 3 = round.

P7. P4/ occlusal outline: 0 = triangular; 1 = suboval; 2 = squared.

P8. P3-4/ trigon/talon proportions: 0 = trigon > = talon; 1 = trigon < talon.

P9. P3/ protocone: 0 = present; 1 = absent.

P10. P4/ metacone: 0 = absent; 1 = present.

P11. P4/ protocone: 0 = low relative to paracone; 1 = high relative to paracone.

P12. P2/ protocone: 0 = present; 1 = absent (if tooth absent, taxon scored “ 1 ”).

P13'. P2/ hypocone: 0 = absent; 1 = present.

P14*. P4/ paraconule: 0 = large; 1 = small; 2 = absent.

P15. P3-4/ parastyles: 0 = present; 1 = absent.

P16. P3-4/ metastyles: 0 = absent; 1 = present.

P17. P3-4/ postprotocrista: 0 =strong; 1 = weak, short.

P18. P2-3/ distal crown margin: 0 = smoothly rounded; 1 = waisted between buccal and lingual cusps.

P19. P3-4/ lingual cingulum: 0 = absent or weak; 1 = strong.

P20. P3/ metacone: 0 = absent; 1 = present

P21. P3-4/ buccal cingulum development: 0 = absent or weak; 1 = strong.

ML126*. P4/ hypocone: 0 = minute to absent; 1 = present but small; 2 = strong.

ML127*. P3/ hypocone: 0 = minute to absent; 1 = present but small; 2 = strong.

Molars

M1*. M1-2/ root number: 0 = three, three; 1 = three, two; 2 = two, two.

M2*. M3/ root number: 0 = three; 1 = two; 2 = one.

M3*. M2/ shape (bl/md): 0 = very transverse (> 1.65); 1 = transverse (< 1.65, > 1.30); 2 = squared (≤ 1.30).

M4*. Ratio of M1/ area to M2/ area: 0 = M1/ >> M2/ (≥ 1.40); 1 = M1/ > M2/ (< 1.40, > 1.0); 2 = M1/ ≤ M2/ (≤ 1.0).

M7'*. M1-2/ metaconule: 0 = absent; 1 = single; 2 = double.

M9*. M1-2/ preprotoconule: 0 = absent; 1 = weak; 2 = strong.

M10*. M1/ hypocone size: 0 = large; 1 = small; 2 = minute to absent.

M11*. M2/ hypocone size: 0 = large; 1 = small; 2 = minute to absent.

M12'*. M1-2/ hypocone position: 0 = distal, far lingual to protocone; 1 = distal, slightly lingual to protocone; 2 = distal, slightly buccal to protocone.

M13*. M1-2/ prehypocrista development: 0 = absent; 1 = weak; 2 = strong, reaches to postprotocrista, encloses the talon lingually.

M14*. M3/ prehypocrista development: 0 = absent; 1 = weak; 2 = strong, reaches to postprotocrista, encloses the talon lingually.

M15. M1/ or M2/ paraconule position: 0 = attached to preprotocrista; 1 = unattached to preprotocrista.

M16*. M1-2/ metaconule: 0 = absent to indistinct; 1 = small; 2 = moderate; 3 = large.

M17'*. M1-2/ mesostyle size: 0 = absent to indistinct; 1 = moderate; 2 = strong.

M17". M1-2/ mesostyle position: 0 = attached to ectocrista; 1 = present on buccal cingulum.

M20*. P4/-M1/ pericone: 0 = absent; 1 = small; 2 = large.

M22*. M1-3/ lingual cingulum development: 0 = absent to indistinct; 1 = weak, broken; 2 = strong, complete.

M24*. M1-2/ buccal cingulum development: 0 = absent to indistinct; 1 = weak; 2 = strong.

M27. M1-2/ pre-metaconule cristae: 0 = absent or weak; 1 = strong

M28. M1-2/ post-metaconule cristae: 0 = absent or weak; 1 = strong

M30*. M3/ paraconule: 0 = absent; 1 = small-moderate; 2 = large

M31*. Molar protocone lingual inflation: 0 = not inflated; 1 = slightly inflated; 2 = very inflated.

M33*. M2/ buccal expansion of paracone (specify which tooth): 0 = no expansion; 1 = slight expansion; 2 = considerable expansion.

M34*. M3/ metacone: 0 = absent or very small; 1 = moderate (but smaller than paracone; 2 = large (equal to paracone).

M36*. M3/ hypocone: 0 = absent or very small; 1 = small; 2 = large.

M37*. M1/ paraconule size: 0 = absent; 1 = small-moderate (smaller than paracone); 2 = large (nearly as large as or larger than paracone).

M44*. M1-3/ anterior cingulum: 0 = strong, complete, long (connected to parastyle); 1 = strong, short; 2 = weak or absent.

M46*. M3/ size relative to M1/: 0 = very small (half the size of M1/ or less); 1 = small (two thirds); 2 = large (approximately as large).

ML147*. M1-2/ metastyle: 0 = indistinct to absent; 1 = moderate; 2 = strong.

ML148*. M1-2/ parastyle: 0 = indistinct to absent; 1 = moderate; 2 = strong.

ML149. M1-2/ parastyle position: 0 = mesial to paracone; 1 = mesiobuccal to paracone.

ML150. M1-2/ metastyle position: 0 = distal to metacone; 1 = distobuccal to metacone.

ML151*. M1-3/ posterior cingulum: 0 = weakly developed; 1 = moderate, does not reach the metastyle; 2 = connected to metastyle.

ML152*. M1-3/ posterior margin (waisted between buccal and lingual cusps): 0 = indistinct to absent; 1 = present but shallow; 2 = present, deep.

ML153*. M1-2/ postparacrista: 0 = indistinct to absent; 1 = weakly developed; 2 = well developed (but well-marked notch between postparacrista and premetacrista); 3 = strongly elevated (weak notch between postparacrista and premetacrista).

ML154*. M1-2/ premetacrista: 0 = indistinct to absent; 1 = weakly developed; 2 = well developed (but well-marked notch between premetacrista and postparacrista); 3 = strongly elevated (weak notch between premetacrista and postparacrista).

ML155. M1-3 protocone arrangement: 0 = normal position; 1 = oblique.

ML156. M1-2/ postprotocrista development: 0 = strong; 1 = tiny.

ML157*. M1/ postprotocrista length: 0 = indistinct to absent; 1 = short; 2 = long.

ML158*. M2/ postprotocrista length: 0 = indistinct to absent; 1 = short; 2 = long.

ML159. M1/ postprotocrista direction: 0 = transverse, directed toward metaconule (or virtual metaconule emplacement); 1 = lateral, directed toward the lingual posterior cingulum (post-protocone fold-like).

ML160. M2/ postprotocrista direction: 0 = transverse, directed toward metaconule (or virtual metaconule emplacement); 1 = lateral, directed toward lingual posterior cingulum (post-protocone fold-like).

ML161. M1/ postprotocrista terminus: 0 = runs to base of metacone (with hypometacrista); 1 = runs to metaconule (at the level of the small or virtual metaconule); 2 = runs to posterior cingulum; 3 = limited at a point distal to protocone.

ML162. M2/ postprotocrista terminus: 0 = runs to base of metacone (with hypometacrista); 1 = runs to metaconule (at the level of the small or virtual metaconule); 2 = runs to posterior cingulum; 3 = limited at a point distal to protocone.

ML163. M1-2/ preprotocrista: 0 = low; 1 = elevated.

ML164. M1/ preprotocrista connection (buccal side): 0 = connected between paracone and parastyle (by way of preparaconule crista); 1 = connected to parastyle (by way of preparaconule crista); 2 = connected to paraconule (or near to it or to a virtual paraconule).

ML165. M2/ preprotocrista connection (buccal side): 0 = connected between paracone and parastyle (by way of preparaconule crista); 1 = connected to parastyle (by way of preparaconule crista); 2 = connected to paraconule (or near to it or to a virtual paraconule).

ML166*. M1-2/ postparaconule crista: 0 = indistinct to absent; 1 = moderate; 2 = well-developed (connected to paracone).

ML168*. M1-2/ hypometacrista: 0 = absent; 1 = weakly developed (low and short); 2 = well-developed (high).

ML169*. M1-2/ hypoparacrista: 0 = absent; 1 = weakly developed (short); 2 = well-developed (high).

MLN*. Hypometaconulecrista: 0 = indistinct to absent; 1 = moderate (not connected to protocone); 2 = well-developed (connected to protocone or postprotocrista).

Cranial characters

Cr 1. Transverse septum arising from the cochlear housing: 0 = Absent; 1 = present and forming the lateral wall of an anterior accessory cavity pneumatized from the tympanic cavity; 2 = present and forming the lateral wall of an anterior accessory cavity pneumatized from the epitympanic recess.

Cr 2. Extent of pneumatization of anterior accessory cavity: 0 = Anterior accessory cavity lies anterior to the tympanic cavity and is not trabeculated; 1 = anterior accessory cavity extends medial to the tympanic cavity, and is trabeculated.

Cr 3. Pneumatization of mastoid (from epitympanic recess?): 0 = absent; 1 = present.

Cr 4. Presence or absence of perbullar pathway: 0 = absent; 1 = present and formed exclusively by the petrosal bone.

Cr 5. Anteroposterior location of posterior carotid foramen in bulla: 0 = Posterior to line joining midpoints of tympanic bones; 1 = anterior to this line.

Cr 6*. Mediolateral position of posterior carotid foramen in bulla: 0 = medial; 1 = midline of the bulla; 2 = lateral.

Cr 7. Ventrodorsal position of the carotid foramen in the bulla: 0 = dorsal, adjacent to basioccipital or mastoid bone; 1 = ventral.

Cr 8*. Position of posterior carotid foramen relative to fenestra cochleae: 0 = posterior; 1 = ventral; 2 = anterior.

Cr 9. Position of the internal carotid canal relative to the fenestra cochleae: 0 = runs across ventral lip of the fenestra cochleae, shielding it from ventral view when a canal is present; 1 = internal carotid canal does not shield the fenestra cochleae from ventral view.

Cr 10. Position of the portion of the internal carotid/promontory artery (or its accompanying nerves) lying on the promontorium anterior to the fenestra cochleae: 0 = on ventrolateral surface of promontorium; 1 = contacting only the cupula of the cochlea.

Cr 11. Size of stapedial and promontory canals: 0 = both stapedial and promontory canals are large; 1 = stapedial slightly smaller than promontory; 2 = stapedial highly reduced or absent altogether; 3 = stapedial larger than promontory; 4 = both promontory and stapedial canals absent.

Cr 12. Morphology of promontory canal, when present: 0 = open trough; 1 = complete canal.

Cr 13. Presence or absence of canal for internal carotid artery or nerves: 0 = absent; 1 = present.

Cr 14. Position of ventral edge of the tympanic bone: 0 = intrabullar, or aphaneric; 1 = extrabullar or phaneric.

Cr 15. The shape of the tympanic bone: 0 = ribbon-like or only slightly expanded; 1 = laterally expanded into a collar or tube; ? = due to fusion with surrounding bones, of unknown shape.

Cr 16. Morphology of annular bridge: ? = This character is not analyzable in those taxa with an extrabullar tympanic, or those in which this region is not known; 0 = Linea semicircularis or partial anular bridge formed on a entotympanic bulla; 1 = linea semicircularis formed on a petrosal bulla; 2 = a complete annular bridge.

Cr 17. Encroachment of the auditory bulla on the pterygoid fossa: 0 = absent; 1 = present and formed by anterior accessory cavity; 2 = present and formed by the tympanic cavity.

Cr 18. Nature of contact between the lateral pterygoid plate and the bulla wall: 0 = absent; 1 = laminar; 2 = abutting.

Cr 19. Extent of contact between the lateral pterygoid plate and the bulla wall: 0 = slight; 1 = or very extensive.

Cr 20. Flange of basioccipital overlapping medial bulla wall: 0 = absent or minimal; 1 = extensive.

Cr 21. Suprameatal foramen: 0 = absent; 1 = present, small and in the posterior root of the zygomatic arch; 2 = present, large, and above the external auditory meatus.

Cr 22. Patent parotic fissure: 0 = present; 1 = absent.

Cr 23*. Size of orbits: 0 = small; 1 = large; 2 = extremely large.

Cr 24*. Postorbital closure: 0 = none; 1 = postorbital bar present; 2 = postorbital septum present.

Cr 25. Composition of the postorbital septum: 0 = zygomatic forms most of the septum; 1 = frontal forms most of the septum.

Cr 26. Zygomatic-lacrimal contact: 0 = present; 1 = absent.

Cr 27. Pronounced interorbital constriction: 0 = absent; 1 = present below olfactory tract.

Cr 28. Contact between lacrimal and palatine: 0 = present; 1 = separated by a large fronto-maxillary contact (and in some taxa, a small os planum of the ethmoid); 2 = separated by a large os planum.

Cr 29. Foramen rotundum: 0 = absent; 1 = present.

Cr 30. Position of lacrimal foramen: 0 = outside orbital margin; 1 = within the orbit or on the rim.

Cr 31. Metopic suture in adult: 0 = unfused; 1 = fused.

Cr 32. Orbital convergence: 0 = less convergent than primates; 1 = primate-like values for convergence.

Cr 33*. Posterior nasal spine: 0 = reduced or absent; 1 = small but distinct; 2 = robust and long

Cr 34. Posterior palatine torus: 0 = present; 1 = absent.

Cr 35. Pyramidal processes: 0 = medially placed; 1 = laterally placed.

Cr 36*. Length of medial pterygoid plate: 0 = long medial pterygoid plate extending one-third to one half of the distance to the anterior surface of the bulla; 1 = short but distinct from lateral pterygoid plate for its entire dorsoventral extent; 2 = medial pterygoid plate entirely absent, or reduced to a low rugosity.

Cr 37. Snout length: 0 = long snouts; 1 = short snouts.

Cr 38. Maxillary depth: 0 = deep; 1 = shallow.

Cr 39. Complete symphyseal fusion: 0 = absent; 1 = present.

Cr 40. Temporomandibular joint morphology: 0 = biconcave and transversely wide; 1 = anteroposteriorly oriented trough.

Cr 41. Entoglenoid process morphology: 0 = weak or absent; 1 = strong.

Cr 42. Inter-incisor diastema width: 0 = broad and wider than that of extant haplorhines; 1 = narrow, haplorhine-like.

Cr43. Coronoid height relative to condyle: 0 = very far above; 1 = slightly above or equal.

Cr44*. Condyle height relative to toothrow: 0 = at level of tooth row; 1 = slightly above; 2 = well above tooth row.

Cr45. Corpus robusticity: 0 = shallow; 1 = deep.

Cr46. Zygomatico-parietal contact at pterion: 0 = no postorbital closure; 1 = zygomatico-parietal contact; 2 = alisphenoid-frontal contact.

Cr47. Enclosure of intratympanic portion of facial nerve in a bony canal: 0 = no canal, facial runs in a sulcus; = bony canal present.

Cr48. Epitympanic crest: 0 = absent; 1 = present.

Cr49. Broad ascending wing of premaxilla: 0 = narrow; 1 = broad.

Cr 50/301. Basioccipital stem: 0 = narrow; 1 = broad.

Cr51/302. Choanal shape: 0 = narrow; 1 = broad.

Cr52/292. Orientation of the mandibular symphysis: 0 = symphysis procumbent; 1 = symphysis erect.

Postcranial characters

Humerus

H1*. Shape of distal edge of the humeral trochlea: 0 = cylinder, distal edge perpendicular to shaft; 1 = distal edge somewhat angled to shaft; 2 = distal edge very angled.

H2. Relative heights of medial and lateral edges of humeral trochlea: 0 = subequal; 1 = medial edge more flared than lateral edge.

H3*. Trochleocapitular ridge: 0 = absent; 1 = weak but distinct; 2 = moderately distinct; 3 = very distinct.

H4. Waisted trochlea (Minimum trochlear diameter/maximum trochlear diameter x 100): 0 = > 70 (unwaisted); 1 = ≤ 70 (waisted).

H5*. Width of capitulum relative to trochlea (100 x ventral capitulum width/ventral trochlear width): 0 = < 100; 1 = between 100 and 140; 2 = 140-200; 3 = greater than 200.

H6. Entepicondylar foramen: 0 = present; 1 = variable; 2 = absent .

H7. Entepicondylar foramen position: 0 = above medial epicondyle; 1 = above ventral trochlea; 2 = above dorsal trochlea.

H8. Medial epicondyle size: 0 = reduced; 1 = prominent.

H9. Dorsal placement of medial epicondyle: 0 = parallel ; 1 = slight dorsal; 2 = large dorsal angle.

H10'*. Shape of the lateral edge of the dorsal trochlea: 0 = not pronounced; 1 = moderately pronounced; 2 = very pronounced.

H10"*. Shape of the medial edge of the dorsal trochlea: 0 = not pronounced; 1 = moderately pronounced; 2 = very pronounced.

H11*. Dorsoepitrochlear fossa: 0 = present (strong); 1 = small, shallow; 2 = absent.

H12*. Olecranon fossa shape: 0 = shallow; 1 = moderate; 2 = deep.

H13. Supinator crest: 0 = prominent; 1 = low.

H14*. Brachialis flange; 0 = broad; 1 = moderate; 2 = narrow.

H15. Bicipital groove morphology: 0 = shallow; 1 = deep.

H16. Deltopectoral crest: 0 = prominent; 1 = low; 2 = flattened superiorly.

H17. Deltotriceps crest: 0 = low; 1 = prominent.

H18/. Capitular tail: 0 = ventral articular wdth <2.5 times the ventral capitular width; 1 = ventral articular wdth > 2.5 times the ventral capitular width.

H19/*. Ratio of humerus length to femur length (H/F): 0 = 100* H/F ≤ 65; 1 = H/F > 65, ≤ 80; 2 = H/F > 80.

Carpal bones

W1. Size of os centrale, orientation of centrale-trapezoid facet, and articulation with hamate: 0 = small os centrale, facet faces distally, no articulation with hamate; 1 = large centrale, facet faces distoradially, articulation with hamate.

W2. Ulnar-pisiform articulation: 0 = Facet on pisiform for ulnar styloid process is roughly equal in size to that for triquetrum; 1 = Facet on pisiform for ulnar styloid process is much enlarged and deeply excavated.

Os pelvis

OP1/299. Gluteal tuberosity: 0 = present; 1 = absent.

OP2/300. Position of posterior gluteal tuberosity: 0 = Proximal to or level with lesser trochanter; 1 = distal to lesser trochanter.

Femur

F1*. Length of femoral neck: 0 = ≤ 75; 1 = 75-120; 2 = ≥ 120.

F2*. Angle of femoral neck: 0 = < 60; 1 = 60-70; 2 = > 70.

F3. Angle of lesser trochanter: 0 = medial (0-30o); 1 = posterior (>30o)

F4*. Size of third trochanter: 0 = large; 1 = small; 2 = low crest or absent.

F5*. Knee index (Antero-posterior diameter of distal femur/ mediolateral diameter of distal femur): 0 = < 90 (shallow knee); 1 = 90 - 100; 2 = > 100 (deep knee).

F6*. Femoral head shape: 0 = spherical; 1 = semicylindrical; 2 = cylindrical.

F7. Anterior extension of greater trochanter: 0 = no extension; 1 = extension present.

F8. Anterior bend of proximal femur: 0 = none; 1 = bent

F9*. Relative length of trochanteric fossa: 0 = long (> 125); 1 = moderate (110-125); 2 = very short (< 110).

F10. Presence of intertrochanteric crest: 0 = crest absent; 1 = crest present.

F11*. Size of lesser trochanter: 0 = large; 1 = intermediate; 2 = small.

F12. Lateral rim of knee: 0 = low; 1 = high.

Tibia

T1'. Fusion of tibia and fibula: 0 = absent; 1 = present.

T1"*. Articulation tibia/fibula: 0 = small; 1 = moderate; 2 = extensive.

T3. Shape of distal surface of tibia: 0 = square/parallel; 1 = triangular.

T4*. Rotation of the medial malleolus: 0 = none; 1 = slight; 2 = strong.

T5*. Shape of medial malleolar articular surface: 0 = flat; 1 = anteriorly convex, posteriorly flat; 2 = all convex.

T6. Shape of distal tibial shaft: 0 = no compression; 1 = anteroposteriorly compressed.

T7. Position of tibialis posterior groove: 0 = on medial side of malleolus; 1 = on posterior side of malleolus.

Talus

A1. Position of the flexor hallucis longus groove: 0 = lateral to trochlea; 1 = central to trochlea.

A2'*. Shape of talo-fibular facet: 0 = steep-sided; 1 = steep-sided with a platar lip; 2 = sloped obliquely.

A4'*. Development of the talar posterior trochlear shelf: 0 = none; 1 = weakly developed; 2 = well developed (prominent).

A5'. Talar neck length (NL/TL x 100): 0 = short (< 50); 1 = long (> 50).

A6. Medial talo-tibial facet: 0 = short (does not reach to plantar edge of bone); 1 = long.

A7/295. Lateral talar trochlear asymetry: 0 = absent; 1 = present.

A8/296. Talar cotylar fossa: 0 = shallow; 1 = deep, medially projecting.

A9'/297. Width of the head of the talus (HW/HHT x 100): 0 = < 120; 1 = > 120.

GEB1*. Talar neck angle: 0 = < 20°; 1 = 20-30°; 2 = > 30°.

GEB2*. Talar body height (HT/MTRW x 100): 0 = < 100; 1 = 100-120; 2 = 120-150.

GEB3*. TW/TL x 100: 0 = < 60; 1 = > 60.

Calcaneus

C1*. Anterior calcaneal elongation: 0 = not elongate (ACL or anterior calcaneal ratio < 40); 1 = moderate (ACL ≥ .40-45); 2 = long (> .45).

C2*. Position of the peroneal tubercle: 0 = distal to joint; 1 = at joint; 2 = proximal to joint.

C3. Posterior calcaneal bowing: 0 = absent; 1 = present.

C4/298. Calcaneo-cuboid articulation: 0 = articular wedge absent (fan-shaped); 1

= articular wedge present (more circular).

Navicular

N1*. Length relative to width: 0 = short (< 90); 1 = moderate (100-150); 2 = long (> 150).

N3. Morphology of the naviculocuboid articulation: 0 = cuboid facet on navicular contacts only the ectocuneiform; 1 = cuboid facet contacts the ectocuneiform and mesocuneiform facet.

Entocuneiform

E1*. Shape of Entocuneiform/MT1 articulation: 0 = dorsally reduced; 1 = dorsal moiety of joint enlarged relative to ventral moiety; 2 = dorsal moiety greatly enlarged.

E2. Lateral process of entocuneiform: 0 = small; 1 = hypertrophied.

General Foot

O1. Foot axis: 0 = mesaxonic; 1 = paraxonic; 2 = ectaxonic.

O2. Toilet claw: 0 = absent; 1 = present.

O3. Prehallux: 0 = present; 1 = absent.

O4. Metatarsus length: 0 = short; 1 = long.

Metatarsal

MT1*. Peroneal tubercle of MTI: 0 = very large; 1 = large; 2 = small.

MT2. Hallux length: 0 = short; 1 = long.

Visual system

V1/288. Optic fovea: 0 = absent; 1 = present.

V2/290. Tapetum lucidum: 0 = present; 1 = absent.

Miscellaneous other characters

289. Haplorhini vs strepsirrhine: 0 = strepsirrhine; 1 = haplorhine.

Molecular and physiological

MOL1/303. SINE (short interspersed nuclear elements) markers at the human locations 12p13-pter on chromosome 12: 0 = SINE absent; 1 = SINE present.

MOL2/304. SINE (short interspersed nuclear elements) markers at the human location 7q22, on chromosome 7: 0 = SINE absent; 1 = SINE present.

MOL4/291. Ability to synthesize Vitamin C: 0 = synthysis possible; 1 = synthysis not possible.

Placentation

PL1/305. Placentation: 0 = Diffuse, epitheliochorial; 1 = Discoidal, hemochorial.

PL2/306. Blastocyst attachment: 0 = noninvasive; 1 = invasive.

PL3/307. Amniotic cavity: 0 = primordial cavity absent; 1 = primordeal cavity present.

PL4/308. Choriovitteline placenta: 0 = present; 1 = absent.

PL5/309. Embryonic body stalk: 0 = absent; 1 = present.

PL6/310. Allantois development: 0 = large, vesicular; 1 = rudimentary.

Character sources

- For details about the source of most characters: Ross *et al.*, 1998, Kay *et al.*, 2004;
- PL1/305, PL2/306, PL3/307, PL4/308, PL5/309, PL6/3010: Luckett, 1975; Luckett, 1976; Luckett & Hartenberger, 1985;
- MOL1/303, MOL2/304, MOL3/305: Schmitz & Zischler, 2004;
- MOL4/291: Pollock & Mullin, 1987;
- 289: Pocock, 1918;
- V1/288, V2/290: Martin, 1990;
- C4/298, A7/295, A8/296, A9/297, OP1/299, OP2/300, H18, H19, Cr50/301, Cr51/302: Seiffert *et al.*, 2004;
- Cr52/292: Beard *et al.*, 1994;
- A1, A2', A4, A5', A6, GEB1-3: Gebo *et al.*, 2001;
- M8-9-10', ML88, ML126-127, ML147-169: Marivaux *et al.*, 2001.

APPENDIX 2

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
TAXA	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	i11	i12	i13	i14	i15	i16	i17	i19	c1
Scandentia	0	0	?	?	?	?	?	?	?	0	2	2	?	1	?	?	?	?	0
Paromomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	1	1	1	?	2	4	?	?	2	?	2	1	0	1	?	0	2	2	0
Plesiolestes	1	?	1	0	1	4	?	0	2	0	2	1	0	1	0	0	0	2	0
Purgatorius	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0
Adapis	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	2	0	1
Notharctus	1	0	0	1	0	1	0	0	0	0	1	1	0	0	1	0	1	0	1
Cantius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Donrussellia	?	1	?	1	?	?	?	?	?	?	?	?	0	?	?	?	?	?	?
Leptadapis	1	?	?	0	?	0	?	?	0	0	0	0	0	0	1	?	2	0	1
Mahgarita	1	?	0	1	0	0	?	?	?	?	1	?	0	0	?	?	?	0	1
Aframonius	1	0	?	1	0	?	?	0	?	?	0	0	0	?	?	?	?	0	1
Pronycticebus	1	?	?	?	0	1	0	?	0	?	0	0	0	0	1	0	?	?	1
Protoadapis	1	?	?	?	0	1	?	?	?	?	?	?	?	?	?	?	?	?	1
Periconodon	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	1	0	0	?	?	?	0	?	0	0	1	0	0	0	?	?	1	0	3
Galagoides	1	0	0	1	0	2	?	1	2	0	1	2	1	1	1	0	1	0	0
Microcebus	1	0	0	1	0	2	?	1	2	0	1	2	1	1	1	0	1	0	0
Nycticebus	1	0	0	1	0	2	?	1	2	0	1	2	1	1	1	0	0	0	0
Lemur	1	0	0	0	0	2	?	1	2	0	1	2	1	1	1	0	1	0	0
Absarokius	1	0	0	1	0	2	?	?	?	?	?	?	0	?	?	?	?	0	0
Anaptomorphus	1	0	0	1	0	2	?	?	?	?	0	?	0	?	?	?	?	1	0
Anemorhysis	1	1	?	1	2	4	?	?	?	?	2	?	0	?	?	?	?	2	0
Arapaphovius	1	1	0	1	2	4	?	0	2	0	2	2	0	1	1	0	2	2	0
Dyseolemur	1	0	0	1	0	3	?	?	1	0	0	?	0	3	?	0	?	0	0
Hemiacodon	1	1	0	1	1	3	?	0	?	?	2	1 or 2	0	?	1	?	1 or 2	1	0
Loveina	1	0	?	1	0	2	?	?	?	?	0 or 1	?	0	?	?	?	?	0	?
Macrotarsius	1	?	?	1	0	3	?	?	?	?	1	?	0	?	?	?	?	1	?
Microchoerus	1	1	0	1	2	4	?	?	2	0	1	1	0	1	?	0	2	2	0
Nannopithex	1	1	0	1	2	4	?	?	2	0	1	2	0	1	1	0	2	?	0
Necrolemur	1	1	0	1	2	4	?	?	2	0	1	2	0	1	?	0	2	2	0
Omomys	1	1	0	1	2	3 & 4	?	0	1 or 2	0	1	1	0	1	0	?	2	1	0
Shoshonius	1	0	?	1	0	2	?	?	?	?	0	?	0	?	?	?	?	0	0
Steinius	1	1	?	1	0	3	?	?	?	?	1 or 2	?	0	?	?	?	?	?	1
Strigorhysis	1	0	?	1	1	2	?	?	?	?	0	?	0	?	?	?	?	1	0
Teilhardina_a	1	1	0	1	1	3	?	?	?	?	2	?	0	?	?	?	?	0 or 1	0
Teilhardina_b	1	1	?	1	0	2 or 3	?	?	?	?	?	?	0	?	?	?	?	0	0
Tetonius	1	1	0	1	2	4	?	0	2	0	2	2	0	1	1	0	2	2	0
Uintanius	1	0	?	1	0	2 & 3	?	?	?	?	1	?	0	?	?	?	?	0	0
Washakius	1	0	0	1	0	2	?	0	0 or 1	?	0	?	0	1	1	0	2	0	0
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
Phenacopithecus	?	?	?	?	?	?	?	0	0	0	0	0	0	0	1	0	0	?	?
Bahinia	1	?	0	?	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2
Tarsius	2	?	?	1	?	?	?	1	2	0	0	0	0	1	?	0	0	0	1
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1
Aegyptopithecus	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	1
Moeripithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	2	0	1
Arsinoea	1	0	0	1	1	0 or 1	?	0	1	0	0	0	0	0	1	0	2	0	1
Catopithecus	1	?	0	?	?	1	0	0	1	0	0	0	0	0	1	0	?	?	1
Oligopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	?	0	0	1	0	1	0 or 1	0	0	0	0	0	0	0	1	0	2	0	1
Proteopithecus	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Qatrania	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1
Simonsius	3	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	?	?	1
Aotus	1	0	0	1	1	2	0	0	0	0	0	0	0	0	1	0	?	0	1
Saimiri	1	0	0	1	2	1	0	0	0	0	0	0	0	0	1	0	?	0	2
Callicebus	1	0	0	1	0	1	1	1	1	0	0	0	0	0	1	0	?	0	1
Neosaimiri	1	0	0	0	1	1	1	0	0	0	0	0	0	?	1	0	?	0	?
Dolichocebus	1	?	?	?	?	?	0	0	0	0	?	0	0	0	1	0	1	?	1
Branisella	1	1	0	1	1	1	?	1	?	0	0	0	0	?	0	0	?	0	1
Myanmarpithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1
Pondaungia	1	?	0	1	0	3	?	0	?	?	0	?	0	?	?	?	?	0	2
Siamopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1
Bugtipithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

TAXA	**20** c2	**21** c3	**22** c4	**23** c5	**24** c6	**25** p1	**26** p2	**27** p3	**28** p4'	**29** p4''	**30** p5	**31** p6	**32** p7	**33** p9'	**34** p9''	**35** p11	**36** p13	**37** p14	**38** p15
Scandentia	0	0	0	?	?	1	0	0	0	1	1	2	0	1	0	0	2	0	0
Paromomys	?	?	?	?	?	1	0	1	1	1	0	2	1	1	0	1	2	1	0
Plesiadapis	0	?	?	?	1	1	0	0	1	1	0	2	2	?	?	0	?	?	0
Plesiolestes	0	0	0	0	1	1	0	0	1	1	0	2	0	1	0	2	2	0	?
Purgatorius	?	?	?	?	?	0	0	1	1	1	0	2	0	1	0	2	2	0	0
Adapis	?	0	1	2	2	0	0	1	1	1	0	2	?	?	?	2	2	1	0
Notharctus	?	0	?	0	2	0	0	1	1	1	0	2	1	1	0	1	2	0	0
Cantius	?	?	?	?	?	?	0	1	1	1	0	2	1	1	0	2	?	1	?
Donrussellia	?	?	?	?	?	0	0	1	1	1	0	2	1	1	0	1	?	1	?
Leptadapis	?	1	1	0	2	0	0	1	1	1	0	2	1	0	0	2	2	0	0
Mahgarita	?	0	0	0	2	1	0	0	1	1	0	2	2	?	?	1	2	?	0
Aframonius	?	0	0	0	2	1	0	0	1	1	0	2	2	?	?	2	3	0	0
Pronycticebus	?	?	?	?	?	0	0	1	1	1	0	2	1	1	0	1	?	1	?
Protoadapis	?	0	0	?	2	0	0	1	1	1	0	2	2	?	?	2	2	0	0
Periconodon	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	1	?	?	2	?	?	?	1	?	?	?
Hoanghonius	?	0	?	?	?	1	0	1	1	1	0	2	2	?	?	1	2	1	0
Sivaladapis	?	0	0	0	3	1	0	1	1	1	0	2	1	1	0	2	1	1	0
Galagoides	0	1	0	?	?	1	0	0	1	1	2	2	2	?	?	2	0	1	0
Microcebus	0	1	0	?	?	1	0	0	0	1	1	2	2	?	?	0	2	?	0
Nycticebus	0	1	0	?	?	1	0	0	1	1	1	2	2	?	?	0	0	?	0
Lemur	0	1	0	?	?	1	0	0	1	1	0	2	2	?	?	1	0	1	0
Absarokius	?	0	?	?	?	1	0	0	1	1	2	2	2	?	?	1	3	0	0
Anaptomorphus	?	1	?	?	?	1	1	?	1	1	1	?	2	?	?	1	?	0	?
Anemorhysis	?	?	?	?	?	1	0	0	1	1	1	2	1	1	0	1	?	0	?
Arapaphovius	?	2	0	1	0	1	0	0	1	1	1	2	0	2	0	1	3	0	0
Dyseolemur	?	0	0	0	?	1	0	0	1	1	1	2	1	1	0	1	?	0	0
Hemiacodon	?	2	?	?	0 or 1	1	0	0	1	1	1	2	2	?	?	2	3	1	0
Loveina	?	?	?	?	?	1	0	0	1	1	1	1	0	0	0	1	?	1	?
Macrotarsius	?	?	?	?	?	1	0	0	1	1	0	?	0	1	0	1	?	1	?
Microchoerus	?	2	0	1	0	1	1	0	0	1	2	2	2	1	0	0	?	1	?
Nannopithex	?	0	0	1	0	1	1	0	0	1	2	2	2	0	0	1	2	1	?
Necrolemur	?	0	0	1	0	1	1	0	0	1	2	2	2	1	0	1	?	1	?
Omomys	?	0	0	0	1	1	0	0	1	1	1	2	2	?	?	1	3	0	0
Shoshonius	?	0	0	1	1	1	0	0	1	1	1	1	1	2	0	1	3	1	0
Steinius	?	?	?	?	?	0	0	0	1	1	0	2	2	1	0	1	?	0	?
Strigorhysis	?	?	?	?	?	1	1	0	1	1	2	?	2	?	?	1	?	0	?
Teilhardina_a	?	0	0	0	1	0 & 1	0	0	1	1	0	2	1	2	0	1	3	0	0
Teilhardina_b	?	?	?	?	?	0 & 1	0	0	1	1	0	2	1	1	0	1	?	0	?
Tetonius	?	0	0	1	0	1	0	0	1	1	2	2	1 & 2	2	0	1	3	0	0
Uintanius	?	?	?	?	?	1	0	0	1	1	2	2	1	0	0	1	?	0	?
Washakius	?	0	0	?	0 or 1	1	0	0	1	1	1	1	0	2	0	0	2 & 3	1	0
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	?	0	0	0	2	1	0	0	1	1	1	2	1	2	0	1	3	0	0
Phenacopithecus	?	?	?	?	?	?	0	0	1	1	?	2	2	?	?	1	3	1	0
Bahinia	?	0	?	?	2	1	0	0	1	1	0	?	2	?	?	2	2	?	0
Tarsius	0	0	1	0	0	1	0	0	0	1	2	2	2	?	?	1	2	0	0
Xanthorhysis	?	0	?	?	?	1	0	0	1	1	2	2	2	?	?	1	?	0	?
Aegyptopithecus	2	0	0	0	2	1	1	?	1	1	0	2	2	?	?	1	?	1	?
Moeripithecus	?	?	?	?	?	1	1	?	1	1	0	2	2	?	?	1	?	1	?
Apidium	2	0	0	0	2	1	0	0	1	1	0	2	2	?	?	0	0	0	0
Arsinoea	?	1	0	0	2	1	0	?	?	1	2	1	1	1	0	1	2	0	0
Catopithecus	2	0	0	0	2	1	1	?	1	1	0	1	1	1	0	0	?	1	?
Oligopithecus	?	0	0	0	2	1	1	?	1	1	0	2	1	1	0	2	?	1	?
Parapithecus	?	0	0	0	2	1	0	0	1	1	0	2	2	?	?	0	1	0	0
Proteopithecus	2	?	?	?	2	1	0	0	1	1	2	2	1	1	0	1	0	1	0
Qatrania	?	?	?	?	?	?	0	0	1	1	0	?	1	1	0	1	?	0	?
Serapia	?	1	0	0	2	1	0	0	1	1	1	2	1	1	0	1	0	1	0
Simonsius	?	0	0	0	2	1	0	0	1	1	0	1	1	?	0	0	1	0	0
Aotus	0	0	0	0	2	1	0	0	0	0	0	2	2	?	?	1	2	1	1
Saimiri	2	0	0	0	0	1	0	0	0	0	0	2	2	?	?	0	2	1	0
Callicebus	0	0	0	0	2	1	0	0	0	0	0	2	2	?	?	0	2	1	0
Neosaimiri	?	0	0	0	?	1	0	0	0	0	0	2	2	?	?	1	2	1	1
Dolichocebus	2	0	0	0	2	1	0	0	0	0	1	2	2	?	?	1	2	0	1
Branisella	?	0	0	?	?	1	0	0	0	0	0	2	2	?	?	0	2	1	0
Myanmarpithecus	?	0	?	?	2	1	0	0	1	?	2	?	?	?	?	?	2	?	0
Pondaungia	?	0	?	?	2	1	0	0	1	1	0	2	1	1	0	1 & 2	2	0	0
Siamopithecus	?	0	0	0	2	1	0	0	1	1	0	2	2	?	?	1	?	0	?
Bugtipithecus	?	?	?	?	?	?	?	?	?	1	?	?	2	?	?	0	?	1	?
Phileosimias	?	?	?	?	?	?	?	?	1	1	?	2	1	2	0	1	?	1	?
Altiatlasius	?	?	?	?	?	?	?	?	1	1	?	2	?	?	?	1	?	?	?

	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
TAXA	p16	p17	p18	p19	p20	p21	p22	p23	p24	p25	p26	p27	p28	p29	p30	p31	p33	p34	p36
Scandentia	0	0	1	0	0	0	1	1	0	1	?	0	0	0	0	0	?	0	?
Paromomys	0	1	1	?	2	0	?	0	0	1	0	1	?	1	?	2	1	0	0
Plesiadapis	0	0	1	1	1	?	2	?	?	1	0	0	?	1	1	0	1	0	0
Plesiolestes	1	2	1	2	2	0	1	1	0	1	0	2	?	0	?	?	?	?	?
Purgatorius	0	0	1	1	1	0	1	1	0	1	0	0	0	0	0	2	0	0	0
Adapis	0	2	1	0	2	0	1	1	0	0	0	2	2	?	0	3	1	1	0
Notharctus	0	2	0 & 1	0	1	0	1	1	0	1	0	1	0	0	0	1	0	1	1
Cantius	0	2	1	1	1	0	1	1	0	0	0	1	?	0	0	2	0	1	1
Donrussellia	0	1	1	?	1	0	?	1	0	1	0	2	?	0	0	1 & 2	0	1	2
Leptadapis	0	2	1	0	1	0	1	1	0	0	0	2	2	0	0	1	0	1	0
Mahgarita	0	0	1	0	1	?	1	1	0	1	0	0	?	0	0	1	0	1	1
Aframonius	0	1	1	1	1	0	?	1	0	?	0	0	0	0	0	2	0	0	1
Pronycticebus	0	1	1	0	2	0	1	1	0	1	0	1	?	0	0	2	0	1	0
Protoadapis	0	1	1	1	1	0	1	1	0	0	1	0	?	0	0	2	0	1	0
Periconodon	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	0	?	?	0	?	?	1	?	0	1	1	?	?	?	?	?	?	?	?
Hoanghonius	0	0	1	0	1	0	1	1	0	1	1	1	0	0	0	1	0	0	0
Sivaladapis	0	2	1	0	2	0	1	1	0	0	0	2	0	0	0	3	0	0	0
Galagoides	0	2	1	0	2	0	1	1	0	0	0	1	0	1	0	3	1	0	0
Microcebus	0	0	1	0	0	?	1	1	0	0	1	0	2	1	0	1	1	1	0
Nycticebus	0	0	1	0	0	?	1	1	0	1	0	0	0	1	0	0	0	0	0
Lemur	0	1	1	0	0	0	1	1	0	1	0	0	0	1	0	2	0	0	1
Absarokius	0	1	1	0 & 1	1	0	2	1	0	1	1	0	0	2	2	0	1 & 2	0	0
Anaptomorphus	0	1	1	?	1	0	2	1	0	1	1	0	?	2	1	1	1	0	0
Anemorhysis	0	1	1	0	2	0	1	1	0	1	1	0	?	1	0	1	2	1	0
Arapaphovius	1	2	1	1	2	0	1	1	0	1	1	0	0	1	1	0	2	1	1
Dyseolemur	0	1	1	0	1	0	1	1	0	1	0	1	?	2	1	1	2	1	1
Hemiacodon	0	2	0 & 1	2	2	0	1	0	0	1	0	1	0	0	0	1	1	1	1
Loveina	0	1	1	0	0	0	1	1	0	1	0	1	?	2	1	1	2	1	1
Macrotarsius	?	2	1	?	2	0	0	0	0	1	0	1	?	2	1	1	0	1	2
Microchoerus	0	2	0	1	1	0	1	0	0	1	1	1	?	2	1	1	2	1	1
Nannopithex	0	1	1	0	0	0	1	1	0	1	0	1	?	2	2	1	2	0	0
Necrolemur	0	2	0	1	1	0	1	1	0	1	1	1	?	2	1	1	2	1	1
Omomys	0	1	1	0	1	0	1	0	0	1	0	1	0	0	0	1	1	1	1
Shoshonius	1	1	1	0	0 & 1	0	0	1	0	1	0	0	0	2	1	1	2	1	1
Steinius	0	1	0 & 1	2	2	0	1	1	0	1	0	0	?	0	0	1	2	1	1
Strigorhysis	0	1	1	?	1 & 2	0	0	1	0	1	1	1	0	2	1	1	1	0	0
Teilhardina_a	0	1	1	1	1 & 2	0	1	1	0	1	1	0	0	0	1	0 & 1	1	1	0
Teilhardina_b	0	1	1	1	2	0	1	1	0	1	0	0	?	0	0	1	1	0	0
Tetonius	0	1	1	1	1	0	2	1	0	1	1	2	0	2	1	1	1	0	0
Uintanius	0	0	1	0	0	0	2	1	0	1	1	0	?	2	2	0	0	0	0
Washakius	1	1	0 & 1	0	0	0	1	1	0	1	0	0	0	2	1	1	2	1	1
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	?
Eosimias	0	1	1	0	0 or 1	0	1	1	0	0 & 1	1	0	1	1	1	1	1	1	0
Phenacopithecus	0	1	1	0	0 or 1	0	1	1	0	1	0	1	2	1	1	1	?	1	0
Bahinia	0	0	0	1	1	0	?	1	0	1	0	1	0	0	0	1	1	1	1
Tarsius	0	1	1	0 or 1	0 or 1	0	1	1	0	1	0	0	2	1	1	0	1	1	1
Xanthorhysis	0	1	1	1	1	0	1	1	0	1	0	0	?	1	1	0	1	1	1
Aegyptopithecus	0	2	0	0	1	0	1	0	0	1	0	0	?	1	0	3	0	1	0
Moeripithecus	0	2	0	1	1	0	1	0	0	1	1	1	?	1	?	2	0	0	1
Apidium	1	1	1	0	0	1	1	1	1	0	1	0	1	2	0	1	0	0	0
Arsinoea	1	1	0	1	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0
Catopithecus	0	2	1	0	1	0	1	0	0	1	1	1	?	0	0	2	0	0	1
Oligopithecus	0	2	1	0	2	0	1	0	0	1	0	1	?	1	0	2	0	0	1
Parapithecus	1	1	1	0	0	1	1	1	1	0	1	0	1	2	0	2	0	0	0
Proteopithecus	0	2	1	0	2	0	1	0	0	1	1	1	2	1	1	2	0	1	0
Qatrania	?	1	1	?	0	1	?	1	1	1	1	0	?	0	1	2	0	0	0
Serapia	0	1	1	0	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0
Simonsius	1	1	1	0	0	1	1	0	1	1	0	0	0	1	0	2	0	0	1
Aotus	2	2	0	1	1	0	0	0	0	0	0	1	0	0	0	2	0	0	1
Saimiri	2	2	0	2	2	0	0	0	0	1	0	0	0	1	0	1	0	0	0
Callicebus	2	2	0	1	2	0	0	0	0	1	?	1	0	0	0	2	0	1	2
Neosaimiri	2	2	0	1	2	0	0	0	0	1	0	0	0	1	0	1	0	0	1
Dolichocebus	1	2	1	1	2	0	1	1	0	1	0	0	0	2	0	0	0	0	0
Branisella	1	2	1	1	2	0	0	0	0	1	1	1	0	1	0	1	0	0	0
Myanmarpithecus	0	?	?	1	?	?	1	?	0	1	?	?	0	1	?	?	1 or 2	?	?
Pondaungia	1	1	1	0	2	0	1	0	0	0	0	1	0	1	0	2	1	0	1
Siamopithecus	0	1	1	0	1	0	0	0	0	1	0	1	?	1	1	1	1	0	0
Bugtipithecus	?	1	1	?	1	0	?	0	0	1	0	0	?	?	0	1	?	0	0
Phileosimias	0	0 or 1	1	0	1	0	1	1	0	1	0	0	?	0	1	1	?	1	0
Altiatlasius	0	?	?	0	?	?	1	?	0	0	0	?	?	2	?	?	?	?	?

	58	**59**	**60**	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**
TAXA	p37	p40	p41	p42	p43	p44	p45	m1	m2	m3	m4	m6	m7	m8	m9	m10	10	m11	m12
Scandentia	?	1	0	0	?	?	?	0	1	1	1	1	0	2	2	2	0	0	0
Paromomys	1	1	0	?	5	0	0	0	1	1	1	1	1	1	2	2	1	0	1
Plesiadapis	?	?	2	3	1	1	0	0	1	1	1	2	1	2	2	2	1	0	0
Plesiolestes	?	?	?	?	?	?	?	0	1	1	1	2	1	2	2	2	1	0	0
Purgatorius	0	1	0	1	5	1	0	0	1	1	1	1	1	2	2	2	0	0	0
Adapis	0	?	2	1	4	3	0	0	1	1	1	1	1	?	?	?	?	0	2
Notharctus	0	0	1	1 & 2	3	2	0	0	1	1	1	1	1	2	2	2	1	0 & 1	1
Cantius	0	0	2	3	4	2	0	0	1	1	1	1	1	2	2	?	0	0	1
Donrussellia	0	0	1	?	5	3	0	0	1	1	1	1	1	2	2	2	0	0	0
Leptadapis	0	?	2	3	4	4	1	0	1	1	1	1	1	?	?	?	?	0	2
Mahgarita	1	?	3	3	5	2	0	0	1	1	1	1	1	?	?	?	?	0	0
Aframonius	1	?	3	2	3 & 4	1	0	0	1	1	1	1	2	?	?	?	?	0	0
Pronycticebus	0	0	?	2	4	3	0	0	1	1	1	2	1	2	0	0	0	1	0
Protoadapis	1	?	3	2 & 3	3	5	0	0	1	1	1	2	1	1	1	?	0	0	1
Periconodon	?	?	?	?	?	?	?	0	1	1	1	2	1 & 2	?	?	?	?	1	0
Guangxilemur	?	?	?	?	?	?	?	0	1	1	?	1	?	1	?	?	0	0	1
Hoanghonius	?	?	2	2	5	2	0	0	1	1	1	1	1	2	1	?	0	0	1
Sivaladapis	1	1	?	0	4	5	0	0	1	1	1	1	2	2	1	1	0 or 1	0	2
Galagoides	0	?	2	3	2	0	1	0	1	1	1	1	1	?	?	?	?	0	0
Microcebus	?	?	2	3	1	2	?	0	1	1	1	1	1	?	?	?	?	0	0
Nycticebus	?	?	2	2	3	1	2	0	1	1	1	1	0	?	?	?	?	0	0
Lemur	0	0	1	0	5	3	0	0	1	1	1	2	2	1	?	?	?	0	2
Absarokius	0	?	0	0	0	5	0	0	1	1	1	1	0 & 1	2	2	2	1	0	1
Anaptomorphus	0	?	?	0 or 1	1	3	0	0	1	1	1	1	1	2	2	2	1	0	1
Anemorhysis	0	0	1	1	1 & 2	1	0	0	1	1	1	1	1	2	2	2	1	0	0
Arapaphovius	1	1	1	2	2 & 3	0 & 1	0	0	1	1	1	1	1	2	2	2	1	0	1
Dyseolemur	1	1	?	2	1	1	0	0	1	1	1	1	1	1	1	1	0	1	2
Hemiacodon	1	?	2	3	3	0	0	0	1	1	1	2	1	2	2	1	1	0 & 1	0
Loveina	1	1	1	3	2	2	0	0	1	1	1	2	1	1 & 2	1 & 2	1 & 2	0	0	1
Macrotarsius	1	0	?	?	1 & 2	0	0	0	1	1	1	1	2	2	2	2	0	1	1
Microchoerus	1	0	2	3	1	0	0	0	1	1	1	1	1	2	?	?	?	0	1
Nannopithex	1	0	0	0	2	2	0	0	1	1	1	1	1	2	1	1	0	0	0
Necrolemur	1	?	2	3	1	0	0	0	1	1	1	1	1	2	?	?	?	0	0
Omomys	1	0	2	3	3 & 4	2	0	0	1	1	1	1	1	2	1	1	0	0	1
Shoshonius	1	1	1	2 & 3	1 & 2	2	0	0	1	1	1	1	1	1 & 2	1 & 2	1 & 2	0	0 & 1	2
Steinius	1	?	2	3	3	1	0	0	1	1	1	2	1	2	2	2	1	0	1
Strigorhysis	1	?	0	0	1	3	0	0	1	1	1	1	1	?	2	2	1	?	0
Teilhardina_a	0	0	1	1 & 2	2	1	0	0	1	1	1	1	0	2	2	2	1	0	1
Teilhardina_b	0	0	1	1 & 2	3 & 4	3	0	0	1	1	1	1	0	2	2	2	1	0	1
Tetonius	1	1	0	1	1	2 & 3	0	0	1	1	1	1	0	2	2	2	1	0	0
Uintanius	1	2	1	1	0	5	0	0	1	1	1	1	1	1	1	1	0	0	1
Washakius	1	1	1	2	1 & 2	2	0	0	1	1	1	1	1	1	1	1	0	0 & 1	1 & 2
Afrotarsius	?	?	?	?	0	?	2	0	1	1	1	1	0	1	1	1	0	0	0
Eosimias	0	0	2	0	3	2	2	0	1	1	1	1	0	2	1	1	0	0	0
Phenacopithecus	0	?	?	3	3	2	?	0	1	1	1	1	0	1	1	1	0	0	1
Bahinia	2	?	1 or 2	3	3	2	0	0	1	?	?	?	?	2	?	?	0	0	1
Tarsius	1	0	0	0	1 & 2	0 & 1	1	0	1	1	1	1	0 & 1	1	1	1	0	0	1
Xanthorhysis	1	0	1	0	3	1	0	0	1	1	1	1	1	1	1	1	0	0	0
Aegyptopithecus	1	?	3	3	0	1	2	0	1	1	1	1	1	?	?	?	?	0	1
Moeripithecus	1	?	3	3	1	2	2	0	1	1	1	1	1	?	?	?	?	0	1
Apidium	0	?	1	3	1	1	2	0	1	1	1	1	1	1	?	?	?	0	1
Arsinoea	0	1	2	1	0	1	2	0	1	1	1	1	0	2	2	?	1	0	1
Catopithecus	1	1	2	2	1	1	2	0	1	1	1	1	1	1	1	?	1	0	1
Oligopithecus	1	0	2	3	3	1	1	0	1	1	1	1	1	2	1	?	0	0	1
Parapithecus	0	?	2	2	2	3	2	0	1	1	0	0	0	?	?	?	?	0	1
Proteopithecus	0	0	1	1	2	2	1	0	1	1	1	1	0	1	?	?	?	0	1
Qatrania	0	0	?	?	0 & 1	0	2	0	1	1	1	0	0	1	?	?	?	0	0
Serapia	0	0	2	0	0	1	2	0	1	1	1	1	0	1	1	?	0	0	0
Simonsius	1	?	2	3	0	2	2	0	1	1	1	0	0	?	?	?	?	0	1
Aotus	1	?	2	2 & 3	0	1 & 2	?	0	1	1	0	1	1	?	?	?	?	0	1
Saimiri	1	?	2	3	0	2 & 3	?	0	1	1	0	0 & 1	0	?	?	?	?	0	1
Callicebus	1	?	2	3	0	0	?	0	1	1	0	1	1	?	?	?	?	0	2
Neosaimiri	2	?	2	3	0	2	?	0	1	1	0	1	0	?	?	?	?	0	2
Dolichocebus	2	?	?	3	0	1	?	0	1	1	?	1	?	?	?	?	?	0	0
Branisella	1	?	2	2	0	0	?	0	1	1	1	1	1	?	?	?	?	1	1
Myanmarpithecus	?	?	?	?	?	?	?	0	1	1	1	1	2	?	?	?	?	1	1
Pondaungia	0	1	2	2 & 3	0 & 1	0	0	0	1	1	1	1	0 & 1	1	?	?	?	1	1
Siamopithecus	1	?	2	3	1 & 2	2	1	0	1	1	1	1	0	?	?	?	?	0	0
Bugtipithecus	1	?	?	?	3	?	?	0	1	1	1	?	2	?	?	?	?	0	2
Phileosimias	2	0	?	?	3	?	?	0	1	1	1	2	1	2	1	1	0	0	1
Altiatlasius	?	?	?	?	?	?	?	?	1	1	?	1	?	2	1	?	0	0	1

	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TAXA	m13	m14	m15	m16	m17	m18	m19	m20	m21	m22	m23	m24	m25	m26	m27	m28	m29	m30	m31
Scandentia	0	1	0	0	0	0	1	2	0	0	0	1	3	0	1	1	2	0	2
Paromomys	1	2	0	0	0	0	1	1	0	1	1	1	3	2	3	3	0	?	1
Plesiadapis	1	2	0	0	0	0	1	2	0	0	0	1	3	1	1	2	0	1	1
Plesiolestes	1	2	0	0	0	0	1	2	0	0	0	1	3	2	2	2	0	0	1
Purgatorius	0	1	0	0	0	0	1	2	0	0	0	1	3	2	1	1	0	1	2
Adapis	0	1	0	1	0	0	1	0	0	0	0	1	3	1	3	3	0	?	1
Notharctus	0 & 1	1	0	0 & 1	0	0	1	2	0	0	0	1	3	2	2	2	0	2	1
Cantius	0	1	0	0	0	0	1	2	0	0	0	1	3	2	2	2	0	2	1
Donrussellia	0	1	0	0	0	0	1	1	0	0	0	1	3	2	2	2	0	2	2
Leptadapis	0	1	0	2	0	0	1	0	0	0	0	1	2	1	3	2	0	2	1
Mahgarita	0	1	0	?	0	?	1	0 or 1	0	0	0	1	3	2	?	?	1	?	1 or 2
Aframonius	0	1	0	1	0	0	1	0	0	0	0	1	3	1	2 or 3	2 or 3	0	1	2
Pronycticebus	0	0	0	0	0	0	1	1	0	0	0	1	3	2	3	3	0	?	1
Protoadapis	0	1	0	0	0	0	1	1	0	0	0	1	3	2	3	3	1	?	1
Periconodon	0	1	1 or 2	0	0	1	1	0	0	0	0	1	3	2	2 or 3	2 or 3	1	2	1
Guangxilemur	?	?	0	1	0	0	1	0 or 1	0	1	0	?	3	1	0	0	?	0	1
Hoanghonius	0	1	0	1	0	0	1	1	0	0	0	1	3	1	0	0	0	0	1
Sivaladapis	0	1	0	2	0	0	1	1	0	0	0	1	3	1	0	0	0	0	1
Galagoides	0	1	0	0	0	0	1	0	0	0	0	1	3	1	3	3	0	?	2
Microcebus	0	1	0	1	0	0	1	0	0	0	0	1	3	2	3	3	0	?	1
Nycticebus	0	1	0	1	0	0	1	0	0	0	0	1	3	2	3	3	0	?	1
Lemur	?	0	0	2	0	0	1	1	0	0	0	1	3	2	3	3	3	?	1
Absarokius	0	1	0 & 1	1	0	0	1	2	0	0	0	1	3	2	2	2	0	2	1
Anaptomorphus	0	1	0	1	0	0	1	2	0	0	0	1	3	2	2	2	0	2	1
Anemorhysis	0	1 & 2	0	1	0	0	1	2	0	0	0	1	3	2	3	3	0	?	2
Arapaphovius	0	2	2	1	0	0	1	2	0	0	0	1	3	2	2	2	0	1 & 2	2
Dyseolemur	0	1	1 & 2	1	0	0	1	2	0	0	0	1	3	2	2	2	0	2	1
Hemiacodon	0 & 1	1 & 2	2	1	0	0	1	2	0	0	0	1	3	1	2	2	0	1	2
Loveina	0	1	0	1	0	0	1	2	0	0	0	1	3	2	2	2 & 3	0	1 & 2	2
Macrotarsius	0	1	1	2	0	0 & 1	1	2	0	0	0	1	3	1	1	1	0	1	2
Microchoerus	1	2	2	2	1	0	1	2	0	0 or 1	0	1	3	2	3	2	0	2	1
Nannopithex	1	1	0 & 1	0 or 1	0	0	1	1	0	0	0	1	3	2	3	3	0	?	1
Necrolemur	1	1	1	2	0	0	1	2	0	0	0	1	3	2	3	3	0	2	1
Omomys	0	1	0	1	0	0	1	2	0	0	0	1	3	2	2 & 3	2 & 3	0	1 & 2	1
Shoshonius	0	1 & 2	1 & 2	1 & 2	0	0	1	2	0	0	0	1	3	2	2	2	0	1	2
Steinius	0	1	0	1	0	0	1	2	0	0	0	1	3	2	2 & 3	2 & 3	1	1 & 2	1
Strigorhysis	0	2	2	1	0	0	1	2	0	0	0	1	3	2	?	2	?	2	1
Teilhardina_a	0	1	0	0	0	0	1	2	0	0	0	1	3	2	2 & 3	2 & 3	0	2	2
Teilhardina_b	0	1	0	0	0	0	1	2	0	0	0	1	3	2	2	2	0	2	2
Tetonius	0	1	0	0	0	0	1	2	0	0	0	1	3	2	2	2	0	2	1
Uintanius	0	1	0	0	0	0	1	2	0	0	0	1	3	2	2	2	0	2	2
Washakius	1	2	2	1 & 2	0	0	1	2	0	0	0	1	3	2	1	1	0	1	2
Afrotarsius	0	1	0	0	0	0	0	2	0	0	0	1	3	2	2	2	2	1	2
Eosimias	0	1	0	0	0	0	1	2	0	0	0	1	1 & 2	2	1 & 2	1 & 2	1	1 or 2	2
Phenacopithecus	0	1	0	0	0	0	1	2	0	0	0	1	2	2	1 & 2	2	0	1	1
Bahinia	?	?	0	0	0	1	1	2	0	0	?	1	1	2	3	?	?	?	1
Tarsius	0	1	0	0	0	0	1	2	0	0	0	1	2 & 3	2	2 or 3	2 or 3	1	1	2
Xanthorhysis	0	1	0	0	0	0	1	1	0	0	0	1	3	2	3	3	0	?	2
Aegyptopithecus	0	1	0	2	1	1	0	0	0	0 & 1	0 & 1	0	3	0	0	0	0	1	0
Moeripithecus	0	1	0	2	1	1	0	0	0	0	0	0	2	0	0	0	0	1	0
Apidium	0	2	0	2	1	1	1	0	1	1	1	0	3	0	0	0	1	1	0
Arsinoea	0	1	0	1	1	0	1	1	0	0	0	1	2	1	1	1	1	1	0
Catopithecus	0	1	0	1	0	1	0	1	0	0	0	1	3	1	1	1	1	0	1
Oligopithecus	0	1	0	2	0	0	1	1	0	0	0	1	3	1	1	1	0	0	1
Parapithecus	1	1	0	2	1	1	1	0	1	1	1	0	3	0	0	0	1	1	0
Proteopithecus	0	0 & 1	0	1	0	0	1	0	0	0	0	1	3	1	1	2	& 3	0	1
Qatrania	0	1	0	1	1	0	1	1	0	0	0	1	3	0	0	0	1	1	0
Serapia	0	1	0	1	1	0	1	1	0	0	0	1	3	0	0	0	0	0	0
Simonsius	0	1	0	2	1	1	1	0	1	1	1	0	3	0	0	0	2	1	1
Aotus	?	0	0	2	0	1	0	0	0	0	0	1	3	2	3	3	3	?	1
Saimiri	?	0	0	2	0	1	1	0	0	0	0	1	3	2	2 or 3	2 or 3	3	1	1
Callicebus	?	0	0	2	1	1	1	0	0	0	0	1	3	1	1	1	3	1	1
Neosaimiri	?	0	0	1	0	1	1	0	0	0	0	1	3	1	1 & 2	2	3	1	1
Dolichocebus	?	?	0	2	0	1	1	0	0	0	0	1	3	0	2	2	?	1	1
Branisella	0	0	0	1	1	1	1	0	0	0	0	1	3	2	2	2	2	1	0
Myanmarpithecus	0	1	2	1	0	1	1	0	0	0	0	1	3	2	3	3	1	?	1
Pondaungia	0	1	2	1	1	1	1	1	0	1	1	0	3	2	2 or 3	2 or 3	0	1 or 2	0
Siamopithecus	0	1	1	2	1	1	0	0	0	0	0	1	2	2	2	2	1	2	0
Bugtipithecus	0	1	0	1	0	1	1	0	0	0	?	?	3	2	3	?	1	?	1
Phileosimias	0	1	0	0	0	0	1	2	0	1	1	?	3	1	0	0	0	1	1
Altiatlasius	?	?	0	0	0	0	1	2	0	0	0	?	2	2	2	2 r	o ?3	1	1 r o

	96	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**
TAXA	m32	m33	m34	m35	m36	m37	m38	m39	m40	m41	m42	m43	m44	m45	m46	m47	m53	m55	m56
Scandentia	1	1	0	0	0	2	2	1	1	0	0	1	0	2	2	2	?	?	1
Paromomys	1	1	0	0	0	2	2	1	2	0	0	1	1	1 & 2	2	1	1	2	1
Plesiadapis	2	1	3	0	0	2	2	2	2	0	0	1	1	1	2	2	0	2	1
Plesiolestes	1	1	3	0	0	2	2	2	1	0	0	1	1	2	2	2	0	3	1
Purgatorius	2	2	3	3	3	2	2	2	2	0	0	1	0	1	2	2	2	3	0
Adapis	1	1	2 or 3	1	1	2	2	2	0	0	0	1	1	1	2	2	0	3	1
Notharctus	1	1	3	1	1	2	2	2	2	0	0	1	1	2	2	2	0	1 & 2	0
Cantius	1	1	3	0	1	2	2	2	2	0	0	1	1	2	2	2	0	3	0
Donrussellia	1	1	3	1 & 2	1	2	2	2	1	0	0	1	0 & 1	1	2	2	0 & 1	2 & 3	1
Leptadapis	2	1	2	1	1	2	2	2	0	0	0	1	0	2	2	2	0	3	0
Mahgarita	?	1	?	2	2	2	2	2	2	0	0	1	0	1	2	2	1	3	?
Aframonius	1	1	2 or 3	2 or 3	1	2	2	2	0	0	0	1	0	0	2	2	1	3	1
Pronycticebus	1	1	2	0	1	2	2	2	1	0	0	1	0	1	2	2	0	2	1
Protoadapis	2	1	3	1	1	2	2	2	2	0	0	1	1	1	2	2	0	2	1
Periconodon	1	1	1	1	1	2	2	2	1	1	0	1	1	2	2	2	0	2	1
Guangxilemur	1	1	0	0	?	2	2	?	0	0	0	1	1	1	1	1	?	3	1
Hoanghonius	1	1	1	1	1	2	2	2	1	0	0	1	1	2	2	2	2	3	1
Sivaladapis	1	1	3	1	1	2	2	2	0	1	0	1	1	1	2	2	2	3	1
Galagoides	1	1	0	0	0	2	2	2	2	1	0	1	0	0	2	2	1	1	1
Microcebus	1	1	0	0	0	2	2	2	2	0	0	1	0	1	2	2	0	1	1
Nycticebus	1	1	2	2	2	2	2	2	2	0	0	1	1	0	2	2	1	2	0
Lemur	1	1	0	0	0	2	2	2	0	0	0	1	1	0	2	2	2	3	0
Absarokius	1	0 & 1	0	0	1	2	1	1	2	0	0	1	1	2	2	2	2	0	0
Anaptomorphus	1	0 & 1	3	0	2	2	1	1	1	0	0	1	1	0 & 1	2	1 & 2	2	2	0
Anemorhysis	1	0 & 1	3	0	0	2	2	1	2	0	0	1	1	2	2	1	1	1 & 2	1
Arapaphovius	1	1	3	1	1	2	2	2	2	0	0	1	0	2	2	2	1	1	0 & 1
Dyseolemur	1	1	0	0	0	2	2	2	0	0	0	1	1 & 2	2	2	2	0	0	0
Hemiacodon	1	1	0 or 1	1	1	2	2	2	1	0	0	0	1	2	2	1 & 2	1	2	1
Loveina	1	1	0	0	0	2	2	2	1	0	0	1	1	1 & 2	2	2	0	2	0
Macrotarsius	1	1	0	0	1	2	2	2	2	0	0	1	1	1	2	2	0	1	0
Microchoerus	1	1	3	0	2	1	2	2	0	0	0	1	1	2	2	2	1	0	1
Nannopithex	1	1	3	0	2	2	2	2	0	0	0	1	1	2	2	2	1	2	1
Necrolemur	1	1	3	0	2	2	2	2	0	0	0	1	1	2	2	2	1	1	1
Omomys	1	0 or 1	0	0	0	2	2	2	1	0	0	1	1	1	2	1	1	2	1
Shoshonius	1	1	3	0	0	2	2	2	1	0	0	1	1	1	2	2	0	2	0
Steinius	1	0	1	0	1	2	2	2	1	0	0	1	0	2	2	1	1	2	1
Strigorhysis	1	0 & 1	0	0	?	2	2	2	0	0	0	1	2	0 & 1	2	1 & 2	1 & 2	0	0
Teilhardina_a	1	0 & 1	1	0	0	2	2	2	2	0	0	1	1	1 & 2	2	2	1	2	0 & 1
Teilhardina_b	1	0 & 1	1	0	0	2	2	2	2	0	0	1	1	1	2	2	1	2	0 & 1
Tetonius	1	0 & 1	& 2	0	0	2	2	2	2	0	1	1	1 & 2	0 & 1	2	1 & 2	2	0	0
Uintanius	1	1	0	0	0	2	2	2	2	0	0	1	1	1 or 2	2	1	1	2	0
Washakius	1	1	2	0	1	1	2	2	0	0	0	1	1	1	2	2	0	2	0
Afrotarsius	0	0	0	0	0	2	2	2	1	0	0	1	0	2	2	2	2	1	1
Eosimias	1	1	0	0	0	2	2	2	1	0	0	1	0	1	1	1	1	3	1
Phenacopithecus	1	1	1	1	1	2	2	2	1	0	0	1	0	1	1	1	1	3	1
Bahinia	1	?	0	?	?	2	2	?	2	0	0	1	0	0	1	?	?	2	1
Tarsius	0	0	0	0	0	2	1	1	2	0	0	1	0 or 1	2	1	1	1	1	0
Xanthorhysis	0	0	0	0	0	2	2	2	1	0	0	1	1	2	2	1	2	2	0
Aegyptopithecus	0	0	0	0	1	2	1	1	1	2	0	1	1	1	1	0	1	0	0
Moeripithecus	1	0	1	0	1	2	1	1	2	0	0	1	1	1	1	0	2	0	0
Apidium	1	0	0	0	0	0	1	1	1	0	1	1	2	1	2	1	2	0	0
Arsinoea	0	0	0	0	1	2	1	1	2	0	0	1	2	0	1	1	3	1	0
Catopithecus	0	0	0	0	0	2	1	1	2	0	0	1	0	1	1	0	3	0	1
Oligopithecus	0	0	0	0	0	2	1	1	2	0	0	1	0	0	1	1	3	1	1
Parapithecus	1	1	1	0	0	2	1	1	1	2	0	1	2	1	2	1	2	0	0
Proteopithecus	1	0	0	0	0	2	2	2	1	0	0	1	1	1	1	1	3	0	1
Qatrania	1	0	0	0	0	2	0 or 1	1	1	2	0	1	2	1	2	1	0	1	0
Serapia	1	0	0	0	0	2	2	1	0	1	0	1	1	1	1	1	3	0	0
Simonsius	0	0	0	0	0	2	1	1	1	1	0	1	1	1	1	1	2	0	0
Aotus	0	0	2	2	2	2	1 or 2	0 or 1	2	0	0	1	0	0	1	1	3	0	1
Saimiri	1	0	0	0	1	2	2	2	2	0	0	1	1	1	2	1	4	0	1
Callicebus	0	0	2	2	2	2	2	1	1	1	0	0	0	0	1	0	3	0	1
Neosaimiri	0	0	2	2	2	2	2	1	2	0 or 1	0	1	1	1	1	1	3	2	1
Dolichocebus	1	0	1	2	?	2	2	?	1	1	0	1	1	1	1	1	?	0	1
Branisella	0	0	1	1	0	2	2	1	2	0	0	0	1	0	1	1	3	0	1
Myanmarpithecus	0	0	0	1	2	2	1	1	2	1	0	1	1	0 & 1	1	1	0	0	1
Pondaungia	0	0	1	1 or 2	2	2	1	1	1 & 2	0 or 1	0	1	1 & 2	1	0	0	& 2	0	0
Siamopithecus	0	0	1	1	2	2	2	1	2	0	0	1	2	0	0	0	0	0	0
Bugtipithecus	0	?	0	?	0	2	1	1	1	0	0	1	1	1	1	?	?	1	1
Phileosimias	0	0	0	0	0	2	2	1	1	1	0	1	0	1 & 2	1	1	?	2	1
Altiatlasius	1	0	2	0	?	2	2	?	2	0	0	1	1	1	1 r	o 2	?	2	?

	115	**116**	**117**	**118**	**119**	**120**	**121**	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**
TAXA	m57	ML88	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	C1	C2	C3	C4
Scandentia	0	1	0	?	0	1	2	?	?	?	?	?	?	?	?	0	?	0	0
Paromomys	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	1	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiolestes	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Purgatorius	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Adapis	1	0	1	0	?	0	?	2	2	0	?	2	?	?	1	0	0	?	?
Notharctus	1	1	?	1	?	?	?	0	?	0 or 1	0	?	?	?	?	?	?	0	?
Cantius	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Donrussellia	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Leptadapis	1	1	?	?	?	?	?	?	?	0	?	?	?	?	?	?	0	?	?
Mahgarita	1	0	?	?	?	?	?	?	?	?	?	?	?	?	?	0	2	1	1
Aframonius	1	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	2	?	?
Pronycticebus	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?
Protoadapis	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Periconodon	0 & 1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Galagoides	0	1	0	1	1	0	0	0	0	1	0	?	0	0	0	0	1	0	0
Microcebus	0	1	0	1	1	2	0	1	0	1	0	0	2	1	0	0	1	0	1
Nycticebus	0	1	0	1	0	2	0	1	1	1	0	0	0	0	0	0	1	0	0
Lemur	1	0	0	1	0	?	0	?	?	?	?	?	?	?	?	0	1	?	?
Absarokius	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anaptomorphus	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anemorhysis	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Arapaphovius	0	1	?	?	?	?	0	2	?	1	?	?	1 or 2	?	0	?	1	?	?
Dyseolemur	0	0	1	0	?	1	0	0	0	2	0	?	1	0	0	1	1	0	2
Hemiacodon	0	1	?	?	1	?	?	?	?	?	?	?	?	?	?	0	1	0	0
Loveina	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Macrotarsius	0	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?
Microchoerus	0	0	1	1	1	2	2	0	0	2	1	?	0	1	0	0	3	0	1
Nannopithex	0	1	1	1	1	2	2	?	?	2	0	?	?	1	?	0	3	0	1
Necrolemur	0	0	1	1	1	2	2	?	?	2	?	?	0	?	?	?	3	?	?
Omomys	0	1	1	?	?	?	0	?	?	?	?	?	?	?	?	1	1	?	?
Shoshonius	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Steinius	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0 or 1	?	?
Strigorhysis	0	1	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_a	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_b	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tetonius	0	1	1 or 2	0	1	2	2	1 or 2	?	1	?	?	2	0	?	1	?	0	1
Uintanius	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Washakius	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	0	2
Afrotarsius	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phenacopithecus	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bahinia	0	1	1	?	0	1	0	?	?	0	?	0	?	?	?	0	1	1	1
Tarsius	0	1	2	0	0	2	0	0	1	2	0	?	2	0	1	1	1	1	1
Xanthorhysis	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	0	2	?	?	?	?	?	?	?	?	?	?	?	?	?	0	3	1	1
Moeripithecus	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	0	0	?	?	?	?	?	?	?	0	?	?	?	?	?	?	1	?	?
Arsinoea	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	0	1	1	0	0	0	0	1	1	0	0	0	2	0	0	0	3	1	0
Oligopithecus	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?
Proteopithecus	0	2	?	?	?	1	?	?	?	0	?	?	?	?	?	0	1	1	1
Qatrania	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?
Aotus	0	1	1	0	0	2	2	2	0	0	0	0	2	0	0	1	1	0	1
Saimiri	0	1	1	0	0	2	2	1	?	0	0	0	2	0	0	1	1	1	2
Callicebus	0	1	1	0	0	1	1	1	0	0	0	0	2	1	0	1	1	0	2
Neosaimiri	0	1	?	?	?	1	1	1	?	0	0	0	1	0	0	1	1	0	1
Dolichocebus	0	?	1	0	0	0	?	1	0	0	0	0	1	0	0	0	1	1	1
Branisella	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Myanmarpithecus	1	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pondaungia	0	2	1	?	?	?	2	2	?	0	0	0	1	0	0	0	1	0	1
Siamopithecus	0	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?
Bugtipithecus	1	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	134	**135**	**136**	**137**	**138**	**139**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**147**	**148**	**149**	**150**	**151**	**152**
TAXA	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13'	P14	P15	P16	P17	P18	P19
Scandentia	1	2	2	0	0	2	0	0	1	0	0	1	0	2	0	1	0	1	0
Paromomys	1	2	2	?	1	?	2	1	1	1	1	?	?	1 or 2	0	0	0	0	0
Plesiadapis	2	2	2	0	1	2	1	0	0	1	1	1	0	0	0	0	1	0	0
Plesiolestes	?	?	2	?	2	?	0	1	?	1	1	?	0	1	0	0	1	?	0
Purgatorius	?	?	2	?	1	?	0	0	?	1	1	?	0	2	0	0	0	?	0
Adapis	1	2	2	1	1	2	2	0	1	1	1	1	0	1	1	0	1	0	1
Notharctus	0	2	2	0 or 1	1	2	1	0	0	0	1	1	0	1	0 & 1	0 & 1	0	1	0
Cantius	?	2	2	?	1	?	1	0	0	0	1	?	0	2	0	0	0	1	0
Donrussellia	?	?	2	?	1	?	1	0	0	0	1	?	0	2	1	1	0	1	0
Leptadapis	1	2	2	0	2	2	2	1	0	1	1	1	0	2	0	0	1	0	1
Mahgarita	0	2	2	0	1	3	1	0	0	0	1	1	0	1	1	1	0	1	1
Aframonius	0	2	2	0	1	3	0	0	1	0	0	1	0	2	0	1	0	1	0
Pronycticebus	2	2	2	?	0	?	1	0	0	0	1	?	?	2	0	0	1	1	0
Protoadapis	?	2	2	?	1	?	1	0	?	0	1	?	?	2	1	0	0	0	0
Periconodon	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	2	?	1	?	2	?	?	1	1	?	1	1	0	0	0	0	1
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	?	?	2	?	2	?	2	0	1	1	1	?	0	2	0	1	0	?	1
Galagoides	1	2	2	1	1	1	1	1	0	1	0	1	0	1	1	0	0	1	0
Microcebus	0	2	2	0	1	3	0	0	1	0	0	1	0	2	0	0	1	0	1
Nycticebus	0	2	2	2	0	3	1	1	0	0	0	1	0	2	0	1	1	1	1
Lemur	1	2	2	0	1	1	0	0	1	0	0	1	0	2	0	0	1	1	0
Absarokius	0	2	2	0	3	3	1	0	0	0	0	1	0	2	0 & 1	1	0	1	0
Anaptomorphus	?	?	2	?	?	?	1	0	?	0	0	?	0	2	0	0	0	?	?
Anemorhysis	?	2	2	?	1	?	1	0	0	0	0	?	?	2	1	1	1	1	0
Arapaphovius	0	2	2	0	0	2	1	1	0	0	0	1	0	2	0	1	0	1	0
Dyseolemur	0	2	2	2	0	3	1	0	0	0	0	1	0	2	0	0	2	1	0
Hemiacodon	0	2	2	0 or 1	0	?	1	0	0	0	0	?	?	2	0	0	0	1	0
Loveina	?	?	2	?	1	?	1	0	?	?	1	?	?	2	0	?	1	?	0
Macrotarsius	?	2	2	?	1	?	1	0	?	0	1	?	?	1	0	1	1	0	0
Microchoerus	0	2	2	0	1	2	2	1	0	0	0	1	0	2	0	1	0	0	0
Nannopithex	1	2	2	0	1	1	1	0	0	0	0	1	0	2	0	1	0	0	0
Necrolemur	0	2	2	0	1	2	1 & 2	1	0	0	0	1	0	2	0	1	0	0	0
Omomys	0	2	2	0	1	2	1	0	0	0	0	1	0	2	0	1	0	1	0
Shoshonius	0	2	2	0	1	1	1	0	0	0 & 1	1	1	?	2	0	0	1	1	0
Steinius	?	2	2	?	1	?	1	0	0	0	0	?	0	2	0	1	0	1	0
Strigorhysis	0	2	2	0	2	?	1	0	0	0	0	1	0	2	0	0	0	1	0
Teilhardina_a	?	2	2	?	0 & 1	?	1	0	0	0	0	?	0	2	0	1	1	1	0
Teilhardina_b	?	2	2	?	0 or 1	2	1	0	0	0	0	?	?	2	0	1	1	1	0
Tetonius	0	2	2	0	2	3	1	0	0	0	0	1	0	2	0 & 1	0	1	1	0 & 1
Uintanius	?	2	2	?	2	?	0	0	1	0	0	?	?	2	0	0	0	1	0
Washakius	0	2	2	0	1	1	1	0	0	0 & 1	0	0	0	2	0	1	1	1	0
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	?	2	2	?	?	?	0	0	0	0	0	?	?	?	0	1	1	1	1
Phenacopithecus	?	?	2	?	0	?	0	0	?	0	0	?	?	2	0	1	1	1	1
Bahinia	0	2	2	0	1	3	0	1	0 & 1	0	0	1	0	2	0	1	?	0	?
Tarsius	0	2	2	0	0	3	1	0	1	0	0	1	0	2	0 & 1	1	0	1	0
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	0	2	2	0	1	?	1	0	0	0	1	1	0	2	1	1	0	0	1
Moeripithecus	0	1	2	0	1	?	1	0	0	0	1	?	0	2	0	1	0	0	1
Apidium	1	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0 or 1	0	0
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	0	2	2	0	1	?	1	0	0	0	0	1	0	2	0	1	0	1	1
Oligopithecus	0	2	2	0	1	?	1	0	0	0	1	1	0	2	0	0	0	1	1
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	0	2	2	0	2	0	1	0	0	0	0	0	0	2	0	1	1	1	1
Qatrania	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	1	2	2	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0
Aotus	1	1	1	2	0 & 1	0	1	0	0	0	1	0	0	2	1	0	0	0	0
Saimiri	1	1	1	1	1 & 2	0	1	0	0	0	1	1	1	2	1	0	0	0	1
Callicebus	1	1	1	1	0	0	1	0	0	0	0	0	0	2	1	0	0	0	1
Neosaimiri	1	1	1	2	1	0	1	0	0	0	1	0	1	2	0	1	1	0	1
Dolichocebus	1	1	1	?	0	0	1	0	0	0	0	?	0	2	0	1	1	0	1
Branisella	0	1	1	0	0	?	1	0	0	0	1	?	?	2	0	1	1	0	1
Myanmarpithecus	?	?	2	?	0	?	1	0	?	0	1	?	?	1	1	1	0	?	0
Pondaungia	0	2	2	0	1	3	1	0	0	0	0	?	?	1	0	1	0	0	0
Siamopithecus	?	2	2	0	1	?	1	0	?	0	0	?	?	2	0 & 1	0	0	0	0
Bugtipithecus	?	?	2	?	?	?	1	0	?	0	0	?	?	2	0	1	0	?	0
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

TAXA	153 P20	154 P21	155 6	156 7	157 M1	158 M2	159 M3	160 M4	M5	161 M7'	162 M9	163 M10	164 M11	165 M12'	166 M13	167 M14	168 M15	169 M16	170 M17'
Scandentia	0	?	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0	0	0
Paromomys	0	0	0	0	0	0	1	2		1	0	2	2	?	0	0	0	1	0
Plesiadapis	0	1	0	0	0	0	0	2	2	1	0	2	2	?	0	0	0	1	2
Plesiolestes	?	?	0	0	0	0	1	2	2	1	0	2	2	?	0	0	0	1	0
Purgatorius	?	?	0	?	0	?	0	2	1	1	0	1	1	1	0	0	0	2	0
Adapis	0	1	0	0	0	0	2	2	0	0	0	0	1	1	0	0	0	0	0
Notharctus	0	1	0	0	0	0	2	2	1	1	0	0	0	1	0	0	0	2	1
Cantius	0	1	0	0	0	0	1	2		1	0	2	2	?	0	0	0	2	0
Donrussellia	0	1	0	0	0	0	1	2	0	0 or 1	0	2	2	?	0	0	0	0 & 1	0
Leptadapis	0	1	0	0	0	0	2	2	1	0	0	0	1	1	0	0	0	0	0
Mahgarita	0	1	0	0	0	0	2	2	0	1	0	0	0	1	0	0	0	1	0
Aframonius	0	1	0	0	0	0	2	2	0	1	0	1	0	1	0	1	0	1	0
Pronycticebus	0	0	0	0	0	0	1	2	0	1	0	0	1	0	0	0	0	1	0
Protoadapis	0	1	0	0	0	?	2	2	0	0	0	1	1	0	0	0	0	0	0
Periconodon	?	?	?	?	0	0	1	2		1	0	1	0 or 1	0	1	0	0	1	0
Guangxilemur	?	1	0	?	0	?	1	2	?	0	0	1	1	1	0	?	?	0	0
Hoanghonius	?	?	?	?	0	?	1	?	?	1	0	?	1	1	0	?	0	1	1
Sivaladapis	0	1	0	0	0	0	2	2	?	1	0	2	2	?	0	0	0	1	2
Galagoides	0	0	2	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
Microcebus	0	1	0	0	0	0	1	2	0	0	0	1	1	0	0	0	?	0	0
Nycticebus	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0
Lemur	0	0	0	0	0	0	2	1	0	0	0	1	1	0	0	0	?	0	0
Absarokius	0	0	0	0	0	0	0	2	1	1	0	2	2	?	0	0	0	1	0
Anaptomorphus	0	?	?	?	0	0	0	2	1	1	0	2	2	?	0	0	0	1	0
Anemorhysis	0	1	0	0	0	0	0	2	?	1	0	2	2	?	0	0	0	1	0
Arapaphovius	0	1	0	0	0	0	0	2	1 & 2	1	0	2	2	?	0	0	0	2	0
Dyseolemur	0	1	0	0	0	0	0 & 1	2	1	1	0	2	2	0	0	0	0	2	0
Hemiacodon	0 & 1	1	0	0	0	0	1	2	1	1	0	2	1 or 2	0	0	0	0	2	0
Loveina	?	1	0	?	0	0	0	2	0 & 1	1	0	2	2	?	0	0	0	1	1
Macrotarsius	?	1	0	0	0	0	2	2	?	1	0	2	2	?	0	0	0	2	2
Microchoerus	0	1	1	0	0	0	2	2	1	2	0	0	0	1	0	0	1	3	0 & 1
Nannopithex	0	0	1	0	0	0	0 & 1	1	1 & 2	1	0	2	1 & 2	1	0	0	0	1	1
Necrolemur	0	1	0	0	0	0	2	1 & 2	1	2	0	1	1	1	0	1 & 2	0 & 1	2	0
Omomys	0	0 & 1	0	0	0	0	1	2	0	1	0	2	2	1	0	0	0	1	0
Shoshonius	1	1	0	0	0	0	0 & 1	?	1	1	0	2	2	?	0	0	0	2	1
Steinius	0	1	0	0	0	0	1	1	1 & 2	1	0	2	2	?	0	0	0	1	0
Strigorhysis	0	0	0	0	0	0	0	2	2	1	0	2	2	?	0	0	0	1	0
Teilhardina_a	?	1	0	0	0	0	0	2	1 & 2	1	0	2	2	?	0	0	0	1	0
Teilhardina_b	0	0	0	0	0	0	0	2	0	1	0	2	2	?	0	0	0	1	0
Tetonius	0 & 1	0 & 1	0	0	0	0	0	1	1	1	0	2	2	?	0	0	0	1	0
Uintanius	0	0	0	0	0	0	1	2	0	1	0	2	2	?	0	0	0	2	0
Washakius	0	1	1	1	0	0	0 & 1	2	1	2	0	1	1	0	0	0	0	2	1
Afrotarsius	?	?			?	?	?	?	?		?	?	?	?	?	?	?	?	
Eosimias	0	1	0	0	0	?	0	?	0	0	0	2	2	?	0	0	0	0	0
Phenacopithecus	?	1	0	?	0	?	0	2	0	1	0	2	2	0	0	0	0	0	0
Bahinia	0	1	0	0	0	?	0	2	0	0	0	2	2	?	0	?	?	0	0
Tarsius	0	1	0	0	0	0	1	2	0	1	0	1 or 2	1 or 2	1	0	0	0	0 or 1	0
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	0	0	2	2	0	0	1	2	0	1	1	0	0	1	0	0	0	1	0
Moeripithecus	0	0	0	0	0	?	1	2	0	0	0	0	1	1	1	?	?	0	0
Apidium	0	0	0	0	0	0	1	2	0	1	2	0	0	0	1	0	1	3	0
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	0	1	0	0	0	0	1	2	0	0	0	1	1	1	0	0	?	0	1
Oligopithecus	0	0	0	0	0	0	1	2	0	0	0	1	1	1	0	0	?	0	0
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	0	1	1	0	0	1	0	1	0	1	0	1	1	1	0	0	?	0 or 1	0
Qatrania	?	?	?	?	0	?	1	?	0	1	0	0	?	1	0	?	0	2	0
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	0	0	0	0	0	0	2	1	0	1	0	0	0	1	0	0	1	2	0
Aotus	0	0	0	0	1	2	2	1 or 2	0	0	0	0	0	1	2	2	?	0	0
Saimiri	0	0	0	0	1	2	1	1	0	0	0	0	0	1	1	?	?	0	0
Callicebus	0	0	1	1	0	1	1 & 2	1	0	0	0	0	0	1	2	2	?	0	0
Neosaimiri	0	0	1	0	0	2	1	1		0	0	0	0	1	1	?	0	0	0
Dolichocebus	0	0	1	1	0	1	0 or 1	2	0	0	0	0	0	1	1	?	0	0	0
Branisella	0	0	0	0	0	1	1	1		0	0	0	0	0	0	0	0	0	0
Myanmarpithecus	0	0	0	0	0	0	2	2	0	1	0	1	1	1	?	?	0	1	1
Pondaungia	0	0	0	0	0	0	1	2	0	1	0	1	0	2	2	?	?	1	0 & 1
Siamopithecus	0	0	0	0	0	1	0	1	0	0	1	1	1	1	2	2	?	0	0
Bugtipithecus	?	0	0	?	0	?	2	?	?	1	0	0	0	1	2	?	0	1	0
Phileosimias	?	?	?	?	0	0	2	2	0	1	0	1 or 2	2	?	0	0	0	2	0
Altiatlasius	?	?	?	?	0	0	1	2	?	1	0	2	2	?	0	0	0	1	& 2

	171	**172**	**173**	**174**	**175**	**176**	**177**	**178**	**179**	**180**	**181**	**182**	**183**	**184**	**185**	**186**	**187**	**188**	**189**	
TAXA	M17''	M20	M22	M24	M27	M28	M30	M31	M33	M34	M36	M37	M44	M46	7	8	9	0	1	
Scandentia	?	0	2	2	?	?	0	0	0	1	0	1	1	1	1	1	1	1	1	
Paromomys	?	0	0	2	0	0	1	0	1	1	0	1	0	2	1	1	1	1	2	
Plesiadapis	1	0	0	2	0	0	1	0	0	1	0	1	1	2	0	1	1	?	2	
Plesiolestes	?	0	0	2	0	1	1	0	0	1	0	1	2	1	0	1	1	?	1	
Purgatorius	?	0	2	1or 2	1	1	?	0	?	?	?	1	?	?	1	1	1	1	1	
Adapis	?	0	2	2	0	0	1	0	0	2	0	1	1	2	1	1	0	0	2	
Notharctus	0	0	2	1 & 2	0	0	0 & 1	1	1	1	0	1	1	1	2	2	1	1	2	
Cantius	?	0	1 & 2	2	1	0	1	1	0	1	0	1	0	1	1	0 or 1	0	0	2	
Donrussellia	?	0	2	1 & 2	0	0	0	0	0	2	?	1	1	2	0	1	0	?	2	
Leptadapis	?	0	1	2	0	0	1	0	0	2	1	1	1	2	1	1	0	0	2	
Mahgarita	?	0	2	2	1	0	0	0	0	2	1	1	1	1	0	0	?	?	2	
Aframonius	?	0	2	2	0	0	1	0	0	2	1	1	1	2	1	1	0	1	2	
Pronycticebus	?	0	2	2	1	0	?	1	1	2	1	1	1	2	1	1	1	1	2	
Protoadapis	?	0	2	1 & 2	0	0	0	0	0	2	0	1	0	1	1	1	0	0	2	
Periconodon	?	2	1 or 2	1	1	0	1	0	0	2	0	1	1	2	0	1	0	?	2	
Guangxilemur	0	1	2	2	0	1	1	0	0	?	?	1	1	?	1	2	0	0	1	
Hoanghonius	0	2	2	2	0	0	?	0	?	?	?	1	0	?	0	?	?	1	2	
Sivaladapis	0	0	2	2	0	1	1	1	0	1	0	1	1	2	0	2	0	?	1	
Galagoides	?	0	0	0	0	0	0	1	0	1	0	1	2	0	1	2	0	1	2	
Microcebus	?	0	2	1	0	0	0	0	0	2	1	0	2	1	0	0	0	0 or 1	2	
Nycticebus	?	0	1	2	0	0	0	1	1	1	0	1	2	0	1	1	1	1	2	
Lemur	?	2	2	0	0	0	0	1	0	1	0	0	1	1	0	1	0	0	1	
Absarokius	?	0	1	2	1	0	0 & 1	1 & 2	1	1	0	0 & 1	1	0	0	1	0	?	2	
Anaptomorphus	?	0	0	1	0	0	0 & 1	2	1	1	0	1	1	1	0	1	0	?	2	
Anemorhysis	?	0	0	2	1	1	1	1	0	1	0	1	1	1	1	1	0	1	2	
Arapaphovius	?	0	1	2	1	1	1	1	0	1 & 2	0	1	1	2	1	1	0	1	1	
Dyseolemur	?	0	2	2	0	0	1	0	?	2	0	1	1	1	0	0	?	?	2	
Hemiacodon	?	0 & 1	1	2	1	1	2	1	0 & 1	2	0	1 & 2	0	1 & 2	1	1	0	1	2	
Loveina	1	0	0	2	0	0	1	1	1	1	0	1	0	2	0	1	1	?	2	
Macrotarsius	1	?	1	2	0	0	1	1	1	1	0	1	0	2	2	2	1	1	2	
Microchoerus	1	0	1 or 2	2	0	0	1	1	0	1	0	1	1	1	1	1	0	0	2	
Nannopithex	1	0	1 & 2	0 & 1	1	1	0 & 1	0	1	1	0	1	0	1 & 2	1	1	0	0	2	
Necrolemur	?	0	0	2	0	0	0	1	1	1	0	1	1	1	1	1	0	0	2	
Omomys	?	0 & 1	2	2	1	0 & 1	1	0	0	2	0	1	0	2	1	1	0	1	2	
Shoshonius	1	1	1	2	0	0	1	0	1	2	0	1	0	2	1	1	1	1	2	
Steinius	?	0	1	2	1	0	0 & 1	0	0	1	0	1	0	1	1	1	1	1	2	
Strigorhysis	?	0	0	1	0	0	0 & 1	2	1	1	0	1	1 & 2	1	1	1	0	0	2	
Teilhardina_a	?	0	2	2	1	1	0 & 1	1	1	1	0	0 & 1	0	1	1	1	0	1	2	
Teilhardina_b	?	0	1	1	1	1	0 & 1	1	0	1	0	0 & 1	1	0	0 or 1	1	0	1	1	
Tetonius	?	0	1	2	1	1	0 & 1	1	1	1	0	0 & 1	0	1	1	1	0	1	2	
Uintanius	?	0	0 & 1	0 & 1	0	0	1	0	?	1	0	1	0 & 1	1 & 2	1	2	0	0	2	
Washakius	1	1	1	2	0	0 or 1	2	0	0	1	0	1 & 2	0	2	1	1	1	1	2	
Afrotarsius		?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	
Eosimias	?	0	2	2	0	0	1	0	0	1	0	1	1	?	1	1	1	1	2	
Phenacopithecus	?	0	2	2	0	0	1	0	0	1	0	1	1	?	2	1	1	1	2	
Bahinia	?	0	2	2	0	0	?	0	0	?	?	0	1	?	1	1	1	1	2	
Tarsius	?	0	2	1 & 2	0	0	1	0	0	2	0	1	0 & 1	2	0	1	0	?	2	
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	
Aegyptopithecus	?	0	2	1	0	0	0	1	2	0	0	0 or 1	1	2	0	1	0	?	2	
Moeripithecus	?	1	2	1	0	0	?	0 & 1	2	?	?	0	2	?	0	1	0	?	2	
Apidium	?	2	2	1	0	0	2	1	0	0	2	2	1	1	1	1	0	0	2	
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	
Catopithecus	1	0	2	2	0	0	0	1	0	1	0	0	0 & 1	1	1	1	0	1	2	
Oligopithecus	?	0	2	0	0	0	0	1	0	1	0	0	1	1	0 & 1	1	0	0	2	
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	
Proteopithecus	?	0	2	2	0	0	0	0	1	0	0	0	1	0	0	1	0	0	2	
Qatrania	?	0	2	0	0	0	?	1	?	?	?	1	0	?	?	?	?	?	2	
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	
Simonsius	?	0	2	1 & 2	0	0	1	1	1	0	0	1	1	0	0	1	0	0	2	
Aotus	?	0	0	0	0	0	0	0	1	1	1	0	2	1	0	0	?	?	2	
Saimiri	?	1	2	0 & 1	0	0	0	0	0 or 1	1	1	0	1	0	1	1	0	0	2	
Callicebus	?	0	2	0	0	0	0	0	0	0	1	0	1	0	0	1	0	?	2	
Neosaimiri	?	1	2	0	0	0	0	0	0 or 1	0	0	0	2	0	1	1	0	0	2	
Dolichocebus	?	0	2	1	0	0	0	0	1	1	1	1	1	0	1	1	0	0	2	
Branisella	?	0 or 1	2	0	0	0	0	0	0	0	0	0	2	0	1	2	0	0	2	
Myanmarpithecus	1	0	1	1	0	0	0	1	0	2	0	1	0	1	1	1	0	0	2	
Pondaungia	1	0	2	1	0	0	?	0	2	1	?	0	0	1	0	1	0	?	2	
Siamopithecus	?	0	0	0	0	0	0	2	2	?	1	0	1	0	0	0	?	?	2	
Bugtipithecus	?	0	2	1	0	0	?	0	0	?	?	0	0	?	1	1	0	0	2	
Phileosimias	?	0	1	1	0	0	1	1	0	1	0	1	1	1	1	1	0	1	2	
Altiatlasius	?	0	1	& 2	0	0	1	1	?	1	0	1	1	1	1	1	1	1	1	&

	190	**191**	**192**	**193**	**194**	**195**	**196**	**197**	**198**	**199**	**200**	**201**	**202**	**203**	**204**	**205**	**206**	**207**
TAXA	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	8	9	MLN
Scandentia	2	0	0	0	0	2	2	0	0	0	0	1	2	2	?	0	0	0
Paromomys	1	1	1	1	0	2	2	1	1	2	2	1	1	1	1	0	0	1
Plesiadapis	0	1	1	0	0	2	2	1	1	2	2	1	1	1	0	0	0	1
Plesiolestes	1	0	0	0	1	2	2	1	1	2	2	1	1	1	0	0	0	2
Purgatorius	2	0	0	0	1	1	1	0	0	1	1	0	1	1	1	0	0	0
Adapis	0	2	2	0	1	1	1	0	0	1	1	1	1	1	0	0	0	0
Notharctus	0	2	2	0	0	1	1	0	0	3	3	1	1	1	0	0	0	0
Cantius	0	1	1	0	0	1	0	1	?	3	3	0	1	1	0	0	0	1
Donrussellia	0	1	1	1	1	1	0	0	?	1	3	1	1	1	0	0	0	0
Leptadapis	0	1	2	0	1	1	1	0	1	0	3	1	1	1	0	0	0	0
Mahgarita	0	2	1	0	1	2	2	0	0	1	1	1	1	1	0	0	0	0
Aframonius	0	2	1	0	1	1	1	0	1	1	1	1	1	1	0	0	0	0
Pronycticebus	0	1	0	0	1	2	2	0	0	0	0	1	1	1	1	0	0	0
Protoadapis	0	1	1	0	0	2	2	0	0	0	0	1	1	1	0	0	0	0
Periconodon	0	1	1	0	0	1	1	0 & 1	1	2 or 3	2 or 3	1	1	1	0	0	0	1
Guangxilemur	1	2	2	0	0	2	2	0	0	1	1	1	1	1	0	0	0	0
Hoanghonius	1	1	1	0	0	?	2	?	0	?	1	1	?	2	0	0	0	0
Sivaladapis	1	2	2	0	0	2	2	0	0	2	2	1	1	1	0	0	0	0
Galagoides	2	1	1	0	0	2	1	0	0	1	1	1	1	1	0	0	0	0
Microcebus	1	0	0	1	0	2	2	0	0	1	1	1	0	0	0	1	0	0
Nycticebus	2	1	1	0	0	2	2	0	0	0	0	1	1	1	0	0	0	0
Lemur	1	1	1	0	1	0	1	1	0	3	1	1	1	1	0	0	0	0
Absarokius	1	1	1	0	1	1	2	1	1	3	1	0	1	2	1	0	0	1
Anaptomorphus	0	1	0	1	0	1	1	1	1	2	2	1	1	1	0	0	0	1
Anemorhysis	0	0	0	1	1	1	1	1	1	3	2	1	1	1	1	0	0	2
Arapaphovius	0	1	1	1	1	2	2	1	1	2	2	1	1	1	1	0	0	1
Dyseolemur	0	1	1	0	1	1	2	1	1	?	2	1	1	1	0	0	0	1
Hemiacodon	1	1	1	0	1	1	1	1	1	3	2	0	2	2	0	0	0	0
Loveina	1	1	1	0	1	0	1	1	1	3	3	1	1	1	0	0	0	1
Macrotarsius	0	2	2	0	0	2	2	1	1	1	2	1	2	2	0	0	0	0
Microchoerus	0	1	1	1	0	1	1	1	1	3	3	0	1	1	0	0	0	0
Nannopithex	0	1	0	0	1	1	2	1	1	3	2	1	1	1	1	0	0	2
Necrolemur	0	0	0	1	0	1	1	1	1	3	3	0	1	1	1	0	0	0
Omomys	1	1	0	0	0	1	1	1	0	1	1	1	1	1	1	0	0	0
Shoshonius	0	1	1	0	0	2	2	1	1	2	2	1	1	1	0	0	0	1
Steinius	1	1	1	0	0	1	1	1	1	2	2	1	1	1	1	0	0	1
Strigorhysis	0	1	0	1	0	2	2	1	1	2	2	1	2	2	1	0	0	1
Teilhardina_a	1	1	1	0	0	2	2	1	1	2	2	1	1	1	0	0	0	1
Teilhardina_b	1	0	0	0	0	1	1	1	1	3	2	1	1	1	1	0	0	2
Tetonius	0	1	0	1	0	1	1	1	1	2	2	0	1	1	1	0	0	2
Uintanius	1	1	0	1	1	0	1	1	1	3	3	1	1	1	0	0	0	1
Washakius	0	1	1	1	1	0	0	1	1	3	3	0	1	1	0	0	0	0
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	1	1	0	0	1	2	2	0	0	1	1	1	1	1	0	1	1	0
Phenacopithecus	2	1	1	0	0	2	2	0	0	1	1	1	1	1	0	1	0 & 1	0
Bahinia	1	1	1	0	0	2	2	0	0	1	1	1	1	1	0	1	1	0
Tarsius	1	1	1	0	0	2	2	0	0	1	1	1	1	1	0	1	0 or 1	0
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	0	1	0	0	0	1	0	0	0	1	1	1	1	1	0	1	1	0
Moeripithecus	0	1	1	0	0	2	1	0	0	1	1	1	1	1	0	1	1	0
Apidium	0	1	1	0	?	0	0	?	?	?	?	1	1	1	0	0	1	0
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	1	1	0	0	0	2	2	0	0	1	1	1	1	1	0	1	1	0
Oligopithecus	2	1	1	0	0	2	2	0	0	1	1	1	1	1	0	2	1	0
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	0	1	1	0	0	2	2	0	0	1	1	1	1	1	0	?	0	0
Qatrania	0	?	?	0	0	0	?	0	?	?	?	0	2	?	0	?	?	0
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	0	1	1	0	?	0	0	?	?	?	?	1	1	1	0	0	1	0
Aotus	0	1	1	0	0	1	1	0	0	1	1	1	2	2	0	2	2	0
Saimiri	0	1	1	0	0	1	1	0	0	1	1	1	1	1	0	2	1	0
Callicebus	0	2	2	0	0	1	1	0	0	3	3	1	1	1	0	2	1	0
Neosaimiri	0	1	1	0	0	2	1	0	0	1	1	1	1	1	0	2	0	0
Dolichocebus	0	1	1	0	0	1	1	0	0	3	3	1	1	1	0	2	0	0
Branisella	0	1	1	0	0	1	0	0	0	1	3	1	1	1	0	1	0	0
Myanmarpithecus	0	1	1	1	0	1	1	0	0	1	1	1	2	2	0	1	0	0
Pondaungia	0	1	1	1	0	?	0	?	?	?	3	1	?	2	0	2	1	0
Siamopithecus	0	1	1	1	0	0	0	1	1	3	3	1	1	1	0	2	1	0
Bugtipithecus	0 or 1	1	1	0	0	2	2	0	0	1	1	1	2	2	0	1	2	0
Phileosimias	1	1	1	0	0	2	2	0	0	1	1	1	1	1	0	0	0	0
Altiatlasius	1	1	1	0	1	2	1 r	o 02	0	1	1	0	1	1	0	0	0	0

	208	**209**	**210**	**211**	**212**	**213**	**214**	**215**	**216**	**217**	**218**	**219**	**220**	**221**	**222**	**223**	**224**	**225**	**226**
TAXA	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	CR11	CR12	CR13	CR14	CR15	CR16	CR17	CR18	CR19
Scandentia	0	?	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0
Paromomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	0	?	?	0	0	2	0	0	0	0	4	0	1	0	0	2	0	?	?
Plesiolestes	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Purgatorius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Adapis	0	?	1	0	0	2	0	0	0	0	1 & 3	0	1	0	0	1	0	2	0
Notharctus	0	?	?	0	0	2	0	0	0	0	3	0	1	?	?	?	?	?	?
Cantius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Donrussellia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Leptadapis	0	?	1	0	0	2	0	0	0	0	3	0	?	0	0	1	0	?	?
Mahgarita	0	?	1	0	0	2	0	0	0	0	1 & 2	1	1	0	0	1	0	1	1
Aframonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pronycticebus	0	?	0	0	0	2	0	0	0	0	3	1	1	0	0	1	1or 2	1	0
Protoadapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Galagoides	2	?	1	0	0	0	0	0	0	?	4	1	0	1	1	?	0	1	0
Microcebus	0	?	0	0	0	2	0	0	0	0	4	?	0	0	0	1	0	1	0
Nycticebus	2	?	1	0	0	0	1	0	?	0	4	?	0	1	1	?	0	0	?
Lemur	0	?	0	0	0	2	0	0	0	0	3	0	1	0	0	1	0	1	0
Absarokius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anaptomorphus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anemorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Arapaphovius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dyseolemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hemiacodon	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Loveina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Macrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Microchoerus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Nannopithex	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Necrolemur	0	?	1	0	0	0	0	0	1	0	1	1	1	0	?	2	2	1	1
Omomys	0	?	1	0	0	0	0	0	0	0	0	1	1	?	?	?	?	?	?
Shoshonius	0	?	0	0	0	2	0	0	?	0	0	1	1	0	?	2	2	1	1
Steinius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Strigorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_A	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_B	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tetonius	0	?	?	0	0	?	?	?	?	0	0	1	1	0	?	2	2	1	1
Uintanius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Washakius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	?	?	?	?	?	?	?	1	1	0	0	?	?	?	?	?	?	?	?
Phenacopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bahinia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tarsius	1	0	0	1	1	2	1	2	1	1	2	1	1	1	1	?	1	1	1
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	1	0	1	?	0	1	1	2	1	0	2	1	1	1	0	?	0	0	?
Moeripithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	1	1	1	1	?	0	?	2	1	0	2	1	1	1	0	?	?	?	?
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	?	?	1	?	0	0	1	2	1	0	?	?	?	1	0	?	?	?	?
Oligopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	1	1	1	1	0	0	1	2	1	0	?	1	1	1	0	?	0	0	?
Qatrania	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	1	1	1	1	0	0	1	?	?	?	2	1	1	1	0	?	0	1	1
Aotus	1	1	1	1	0	1	1	1	1	0	2	1	1	1	0	?	0	0	?
Saimiri	1	1	1	1	0	1	1	2	1	0	2	1	1	1	0	?	0	0	?
Callicebus	1	1	1	1	0	1	1	2	1	0	2	1	1	1	0	?	0	0	?
Neosaimiri	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dolichocebus	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Branisella	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Myanmarpithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pondaungia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Siamopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bugtipithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	227	**228**	**229**	**230**	**231**	**232**	**233**	**234**	**235**	**236**	**237**	**238**	**239**	**240**	**241**	**242**	**243**	**244**	**245**
TAXA	CR20	CR21	CR22	CR23	CR24	CR25	CR26	CR27	CR28	CR29	CR30	CR31	CR32	CR33	CR34	CR35	CR36	CR37	CR38
Scandentia	0	1	0	0	0 & 1	?	0	0	0	0	0	1	0	0	0	0	0	0	1
Paromomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	0	0	0	0	0	?	?	0	1	0	0	0	0	1	0	0	?	0	?
Plesiolestes	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Purgatorius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Adapis	0	0	1	0	1	?	0	0	1	?	0	0 & 1	1	1	0	1	2	1	0
Notharctus	0	?	1	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Cantius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Donrussellia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Leptadapis	0	0	1	0	1	?	?	?	?	?	0	?	1	?	?	1	2	?	?
Mahgarita	0	0	1	0	1	?	1	0	?	?	0	?	?	1	0	1	2	1	0
Aframonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pronycticebus	1	0	1	1	1	?	0	0	1	1	0	0	1	?	?	1	?	?	?
Protoadapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Galagoides	0	0	1	1	1	?	?	1	2	0	0	0	1	0	1	1	1	0	1
Microcebus	0	0	1	1	1	?	?	1	2	0	0	0	1	0	0	1	1	0	1
Nycticebus	0	0	1	1	1	?	?	2	2	0	0	0	2	1	1	1	2	1	1
Lemur	0	0	1	0	1	?	?	0	0	1	0	1	1	0	0	1	1	0	1
Absarokius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anaptomorphus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anemorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Arapahovius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dyseolemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hemiacodon	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Loveina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Macrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Microchoerus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Nannopithex	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Necrolemur	1	2	0	1	1	?	0	1	1	0	0	1	1	1	0	0	1	0	0
Omomys	?	?	0	2	1	?	?	?	?	?	0	?	?	?	?	?	?	0	?
Shoshonius	1	0	0	2	1	?	0	1	?	?	?	?	1	1	0	0	1	1	?
Steinius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Strigorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_A	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_B	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tetonius	?	?	0	1	1	?	0	1	?	?	0	1	1	1	0	0	?	1	?
Uintanius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Washakius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phenacopithecus	?	?	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bahinia	?	?	?	0	?	?	1	?	?	?	0	?	?	?	?	?	?	?	?
Tarsius	1	2	0	2	2	1	0	1	2	1	0	1	2	1	0	0	1	1	0
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	0	0	1	0	2	0	1	1	?	?	1	1	2	2	1	1	1	0	0
Moeripithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	?	?	1	0	2	0	?	1	?	?	1	1	2	?	?	?	?	1	0
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	0	0	1	0	2	0	?	1	?	?	1	1	2	?	1	?	?	1	0
Oligopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	0	0	?	0	2	0	1	1	?	?	1	1	2	2	1	1	1	1	0
Qatrania	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	0	?	?	0	2	0	1	1	?	?	1	1	2	0	1	1	0	1	0
Aotus	0	0	1	1	2	0	?	1	2	1	1	1	2	1	1	1	1	1	0
Saimiri	0	0 & 2	1	0	2	0	?	1	2	1	1	1	2	1	1	1	1	1	0
Callicebus	0	0	1	0	2	0	?	1	2	1	1	1	2	0	1	1	2	1	0
Neosaimiri	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dolichocebus	?	?	?	0	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Branisella	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Myanmarpithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pondaungia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	1
Siamopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bugtipithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	246	**247**	**248**	**249**	**250**	**251**	**252**	**253**	**254**	**255**	**256**	**257**	**258**	**259**	**260**	**261**	**262**	**263**	**264**
TAXA	CR39	CR40	CR41	CR42	CR43	CR44	CR45	CR46	CR47	CR48	CR49	CR50	CR51	CR52	H1	H2	H3	H4	H5
Scandentia	0	0	0	0	0	1	0	0	1	1	1	1	0	0	1	0	0	1	1
Paromomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	0	0	1	1	0	0	0	0	0	0	1	?	?	0	1	0	1	1	2
Plesiolestes	0	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	?	?
Purgatorius	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Adapis	1	0	0	?	0	1	1	0	1	1	1	1	0	0	1	0	1	1	2
Notharctus	0	0	0	?	0	1	0	?	1	1	1	?	?	0	1	?	3	0	2
Cantius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Donrussellia	0	?	?	?	?	?	?	?	?	1	?	?	?	?	?	?	?	?	?
Leptadapis	1	0	0	?	?	?	?	?	1	1	1	?	?	0	1	0	3	1	1
Mahgarita	1	0	0	?	0	1	1	0	1	1	?	?	?	0	?	?	?	?	?
Aframonius	1	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	?	?
Pronycticebus	0	0	?	?	1	2	1	0	1	1	1	1	0	?	?	?	?	?	?
Protoadapis	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Galagoides	0	0	0	0	0	1	0	0	1	0	1	1	0	0	1	0	2	0	1
Microcebus	0	0	0	0	0	1	0	0	1	0	1	?	?	0	0	0	3	0	0
Nycticebus	0	0	0	0	0	1	0	0	1	0	0	?	?	0	1	0	0	1	2
Lemur	0	0	0	0	0	1	0	0	1	1	1	1	0	0	2	0	3	0	1
Absarokius	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anaptomorphus	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anemorhysis	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Arapaphovius	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dyseolemur	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hemiacodon	0	?	?	?	?	?	?	?	?	?	?	?	?	?	1	0	3	?	1
Loveina	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Macrotarsius	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Microchoerus	0	?	?	?	?	?	?	?	1	1	?	?	?	?	1	0	3	?	1
Nannopithex	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Necrolemur	0	1	1	0	0	1	0	0	1	1	1	1	1	?	?	?	?	?	?
Omomys	0	?	?	?	?	?	?	?	1	1	?	?	?	?	?	?	?	?	?
Shoshonius	0	1	1	?	0	1	0	0	1	1	?	0	1	?	1	0	?	?	0
Steinius	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Strigorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_A	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_B	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tetonius	0	?	?	?	?	?	0	0	1	1	1	?	?	?	?	?	?	?	?
Uintanius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Washakius	0	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	?	?
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	0	?	?	?	0	1	1	?	?	?	?	?	?	1	1	?	2	?	?
Phenacopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bahinia	0	?	?	?	?	?	1	?	?	?	1	?	?	1	?	?	?	?	?
Tarsius	0	1	1	1	1	1	0	2	1	0	0	0	1	1	0	0	3	0	2
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	1	0	1	1	1	2	1	2	1	0	1	1	0	1	1	0	1	0	0 & 1
Moeripithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	1	?	?	?	?	1	0	1	1	0	?	?	?	0	1	1	0	0 & 1	1 & 2
Arsinoea	0	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	?	?
Catopithecus	0	0	1	1	0	2	0	?	?	?	1	1	0	0	1	0	1	?	0
Oligopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	?	?
Proteopithecus	0	0	1	1	0	2	0	?	?	?	0	1	0	1	1	1	0	?	1
Qatrania	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	0	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	?	?
Simonsius	1	0	1	1	?	1	0	2	?	?	0	1	0	1	?	?	?	?	?
Aotus	1	0	1	1	1	2	1	1	1	0	1	1	0	1	0 & 1	0	1	0 & 1	& 3
Saimiri	1	0	0	1	1	2	1	1	1	0	0	1	0	1	1	0	2	0 & 1	2 & 3
Callicebus	1	0	1	1	0	2	1	1	1	0	0	?	?	1	1	0	1 & 2	0 & 1	2
Neosaimiri	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dolichocebus	1	?	?	?	?	?	?	?	1	?	?	?	?	?	?	?	?	?	?
Branisella	1	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	?	?
Myanmarpithecus	0	?	?	?	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?
Pondaungia	0	?	?	?	?	1	1	?	?	?	?	?	?	1	0	1	2	1	1
Siamopithecus	0	?	?	?	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?
Bugtipithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	265	**266**	**267**	**268**	**269**	**270**	**271**	**272**	**273**	**274**	**275**	**276**	**277**	**278**	**279**	**280**	**281**	**282**	**283**
TAXA	H6	H7	H8	H9	H10'	H10''	H11	H12	H13	H14	H15	H16	H17	H18	H19	W1	W2	OP1	OP2
Scandentia	0	0	1	1	1	1	2	0	0	1	0	0	0	1	?	0	0	0	1
Paromomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	0	0	1	0	1	1	0	0	0	0	0	0	0	?	?	?	?	?	?
Plesiolestes	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Purgatorius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Adapis	0	1	1	0	0	0	1	0	0	0	0	0	0	0	?	0	1	0	0
Notharctus	0	1	?	0	?	?	?	?	?	1	?	?	?	?	0	?	?	?	?
Cantius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Donrussellia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Leptadapis	0	1	1	1	1	2	1	0	0	0	0	0	0	?	?	?	?	?	?
Mahgarita	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aframonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pronycticebus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Protoadapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Galagoides	0	1	1	0	1	1	2	0	0	0	1	0	0	0	0	1	1	0	0
Microcebus	0	2	1	0	0	0	2	0	0	0	0	0	1	?	1	1	1	?	?
Nycticebus	0	2	0	0	1	1	2	1	1	2	0	0	1	?	?	1	1	?	?
Lemur	0	1 & 2	1	0	0	0	2	0	0	1	0	0	0	0	?	1	1	0	?
Absarokius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anaptomorphus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anemorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Arapaphovius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dyseolemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hemiacodon	0	1	1	0	1	1	1	0	?	?	?	?	?	?	?	?	?	?	?
Loveina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Macrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Microchoerus	0	1	1	0	1	1	0	0	0	0	?	?	?	?	?	?	?	?	?
Nannopithex	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Necrolemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	0
Omomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	0
Shoshonius	0	1	1	1	1	1	1	0	?	0	1	0	?	0	0	?	?	0	0
Steinius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Strigorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_A	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_B	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tetonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Uintanius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Washakius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	0	1	1	1	?	?	0	?	0	0	?	?	?	1	?	?	?	?	?
Phenacopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bahinia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tarsius	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	0	0	1	1	1	1	0	1	0	1	0	0	0	1	2	?	?	0	1
Moeripithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	0	2	1	1	1	1	0	1	0	1	0	0	0	1	0	?	?	1	?
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	0	0	1	1	1	1	0	1	0	1	?	?	?	1	2	?	?	0	1
Oligopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	1	2	1	1	1	1	0	1	0	1	?	0	?	1	1	?	?	0	0
Qatrania	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	1	?
Aotus	1	0	1	0 & 1	1	1	0	1	0	2	0	0	0	1	?	0	0	0 & 1	0
Saimiri	0	0	1	1 & 2	1	1	0	1	0	2	0	0	0	1	2	0	0	0 & 1	0
Callicebus	2	?	1	1	1	1	0	1	0	2	0	0	0	?	?	0	0	?	?
Neosaimiri	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dolichocebus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Branisella	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Myanmarpithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pondaungia	0	1	1	0	1	1	1	0	0	1	0	1	0	?	?	?	?	?	?
Siamopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bugtipithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302
TAXA	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	T1'	T1"	T3	T4	T5	T6	T7
Scandentia	?	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Paromomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Plesiolestes	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Purgatorius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Adapis	1	0	0	0	0	0	0	0	1	0	1	1	0	0	1	2	2	0	1
Notharctus	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	2	2	0	1
Cantius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Donrussellia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Leptadapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Mahgarita	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aframonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pronycticebus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Protoadapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Galagoides	0	2	0	2	2	2	0	1	2	0	1	1	0	2	0	1	1	0	1
Microcebus	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	2	2	0	1
Nycticebus	0	0	0	1	1	0	0	0	2	0	1	1	0	0	1	2	2	0	1
Lemur	1	2	0	0	1	0	0	0	0	0	1	1	0	0	1	2	2	0	1
Absarokius	?	?	?	?	?	?	?	?	?	?	?	?	0	2	0	1	1	1	1
Anaptomorphus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anemorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Arapahovius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dyseolemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hemiacodon	0	2	0	0	2	1	1	1	1	0	1	1	0	1	0	1	1	0	1
Loveina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Macrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Microchoerus	?	?	?	0	?	?	1	1	2	0	1	?	?	?	?	?	?	?	?
Nannopithex	?	?	0	2	?	0	1	1	?	?	?	?	0	1	0	?	?	?	?
Necrolemur	2	1	1	2	2	0	1	1	0	1	1	?	1	?	0	1	1	1	0
Omomys	0	2	0	0	?	0	1	1	2	?	?	?	0	1	0	1	1	?	0
Shoshonius	0	2	0	0	2	1	1	1	1	0	?	?	0	2	0	1	1	1	0
Steinius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Strigorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_A	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_B	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tetonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Uintanius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Washakius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	?	?	?
Eosimias	?	?	?	?	?	?	?	?	?	?	?	?	0	0	0	1	?	?	?
Phenacopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bahinia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tarsius	0	2	0	0	2	2	1	1	2	0	1	1	1	?	0	1	1	1	0
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	?	0	?	1 & 2	0	?	0	?	?	0	?	?	0	0	?	?	?	?	?
Moeripithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	2	1	1	2	2	0	0	0	0	1	0	0	0	2	0	1	1	0	1
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	1	2	1	0	?	0	0	0	0	0	0	?	?	?	?	?	?	?	?
Oligopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	2	2	1	0	1	0	?	0	?	1	0	?	?	?	?	?	?	?	?
Qatrania	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aotus	2	0	1	2	1	0	0	0	1	0	2	0	0	2	0	1	1	0	0
Saimiri	1	0 & 1	1	2	1	0	0	0	0	0	2	0	0	1	0	1	1	0	0
Callicebus	2	0	1	2	1	0	0	0	0	0	2	0	0	1	0	1	1	0	0
Neosaimiri	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dolichocebus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Branisella	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Myanmarpithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pondaungia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Siamopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bugtipithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	303	**304**	**305**	**306**	**307**	**308**	**309**	**310**	**311**	**312**	**313**	**314**	**315**	**316**	**317**	**318**	**319**	**320**	**321**
TAXA	A1	A2'	A4'	A5'	A6	A7	A8	A9	GEB1	GEB2	GEB3	CA1	CA2	CA3	CA4	N1	N3	E1	E2
Scandentia	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Paromomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	1	0	0	0	0	?	0	1	1	0	0	0	0	0	?	?	?	0	1
Plesiolestes	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Purgatorius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Adapis	0	2	2	0	1	0	1	1	2	1	1	1	1	0	1	?	?	0	0
Notharctus	0	2	2	0	1	0	0	1	0	2	0	1	1	0	?	1	1	?	?
Cantius	0	2	2	0	1	?	?	1	0	2	0	?	?	?	?	?	?	?	?
Donrussellia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Leptadapis	0	2	2	0	1	0	0	1	2	2	1	1	2	?	?	?	?	0	0
Mahgarita	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aframonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pronycticebus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Protoadapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Galagoides	0	2	2	0	1	0	1	0	?	?	?	1	2	0	0	2	1	0	0
Microcebus	0	2	2	?	1	?	?	?	?	?	?	2	2	0	?	2	1	0	0
Nycticebus	0	2	2	0	1	?	?	?	?	?	?	1	2	0	?	1	1	0	0
Lemur	0	2	2	0	1	0	1	0	1	2	1	1	2	0	?	1	1	0	0
Absarokius	1	1	1	1	1	?	?	1	1	1	0	1	1	0	?	?	?	?	?
Anaptomorphus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anemorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Arapaphovius	1	1	1	1	1	?	?	0	1	2	0	2	1	0	?	2	0	1	?
Dyseolemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hemiacodon	1	1	1	1	1	0	0	1	1	1	0	1	1	0	?	2	0	1	1
Loveina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Macrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Microchoerus	1	1	2	0	1	1	0	0	2	2	0	1	?	?	?	?	?	?	?
Nannopithex	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Necrolemur	1	1	1	1	1	0	0	0	1	1	0	1	?	1	?	?	?	?	?
Omomys	1	1	1	1	1	0	0	1	1	1	0	1	1	0	?	2	?	?	?
Shoshonius	1	1	1	1	1	0	0	0	1	1	0	2	1	0	?	?	?	1	?
Steinius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Strigorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_A	?	?	?	?	?	?	?	?	?	?	?	2	0	0	?	?	?	?	?
Teilhardina_B	1	1	1	1	1	0	0	1	1	2	0	2	?	?	?	?	?	?	?
Tetonius	1	1	1	1	1	?	?	1	?	?	?	1	?	?	?	?	?	?	?
Uintanius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Washakius	1	1	1	1	1	?	?	0	?	?	?	2	?	?	?	?	?	?	?
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	1	1	1	1	1	0	1	1	1	1	0	0	1	?	?	?	?	?	?
Phenacopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bahinia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tarsius	1	1	0	0	1	0	0	0 & 1	0	0	0	1	1	1	0	2	0	1	1
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	1	1	0	0	0	1	1	1	2	1	1	0	1	0	1	?	?	2	1
Moeripithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	1	1	0	1	0	0	0	0 & 1	2	2	1	0	1	0	1	0	0	2	1
Arsinoea	?	?	?	?	?	?	?	?				?	?	?	?	?	?	?	?
Catopithecus	1	1	0	1	0	1	1	0	2	1	1	?	?	?	?	?	?	?	?
Oligopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	1	0	0	0	0	0	0	0	2	2	1	?	?	?	?	?	?	?	?
Qatrania	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	?	?	?	?	?	0	0	0	?	?	?	?	?	?	?	?	?	?	?
Aotus	1	1	0	1	0	0	0	1	2	1	0	1	1	?	1	0	0	2	1
Saimiri	1	1	0	1	0	0	0	1	1	1	0	2	1	?	1	0	0	2	1
Callicebus	1	1	0	1	0	?	?	1	2	1	0	1	1	0	?	0	0	2	1
Neosaimiri	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dolichocebus	0	?	?	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Branisella	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Myanmarpithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pondaungia	1	1	0	1	0	0	0	1	2	1	1	0	1	?	?	?	?	?	?
Siamopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bugtipithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

TAXA	**322** O1	**323** O2	**324** O3	**325** O4	**326** MT1	**327** MT2	**328** V1	**329** V2	**330** 289	**331** MOL1	**332** MOL2	**333** MOL4	**334** PL1	**335** PL2	**336** PL3	**337** PL4	**338** PL5	**339** PL6
Scandentia	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Paromomys	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiadapis	?	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiolestes	?	?	?	?	?	?	0	?	?	?	?	?	?	?	?	?	?	?
Purgatorius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Adapis	?	?	1	?	2	?	0	0	?	?	?	?	?	?	?	?	?	?
Notharctus	0	?	1	?	1	?	0	0	?	?	?	?	?	?	?	?	?	?
Cantius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Donrussellia	?	?	?	?	?	?	?	0	?	?	?	?	?	?	?	?	?	?
Leptadapis	?	?	1	?	2	?	0	0	?	?	?	?	?	?	?	?	?	?
Mahgarita	?	?	?	?	?	?	0	0	?	?	?	?	?	?	?	?	?	?
Aframonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pronycticebus	?	?	?	?	?	?	0	0	?	?	?	?	?	?	?	?	?	?
Protoadapis	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Guangxilemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hoanghonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sivaladapis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Galagoides	?	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Microcebus	?	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Nycticebus	?	1	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Lemur	?	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Absarokius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anaptomorphus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Anemorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Arapaphovius	?	?	1	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?
Dyseolemur	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Hemiacodon	?	?	1	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?
Loveina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Macrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Microchoerus	?	?	?	?	?	?	0	?	?	?	?	?	?	?	?	?	?	?
Nannopithex	?	?	?	?	?	?	0	0	?	?	?	?	?	?	?	?	?	?
Necrolemur	?	?	1	?	0	?	0	0	?	?	?	?	?	?	?	?	?	?
Omomys	?	?	?	?	?	?	0	0	?	?	?	?	?	?	?	?	?	?
Shoshonius	?	?	?	?	0	?	0	0	?	?	?	?	?	?	?	?	?	?
Steinius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Strigorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_A	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Teilhardina_B	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tetonius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Uintanius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Washakius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Afrotarsius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eosimias	?	?	?	?	2	?	?	?	?	?	?	?	?	?	?	?	?	?
Phenacopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bahinia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tarsius	2	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Xanthorhysis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aegyptopithecus	?	?	0	?	2	0	1	1	?	?	?	?	?	?	?	?	?	?
Moeripithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Apidium	?	?	?	?	?	0	1	1	?	?	?	?	?	?	?	?	?	?
Arsinoea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Catopithecus	?	?	?	?	?	?	1	1	?	?	?	?	?	?	?	?	?	?
Oligopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Parapithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Proteopithecus	?	?	?	?	?	?	1	1	?	?	?	?	?	?	?	?	?	?
Qatrania	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Serapia	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Simonsius	?	?	?	?	?	?	1	1	?	?	?	?	?	?	?	?	?	?
Aotus	1	0	0	1	2	0	1	1	1	1	1	1	1	1	1	1	1	1
Saimiri	1	0	0	1	2	0	1	1	1	1	1	1	1	1	1	1	1	1
Callicebus	1	0	0	1	2	0	1	1	1	1	1	1	1	1	1	1	1	1
Neosaimiri	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Dolichocebus	?	?	?	?	?	?	1	1	?	?	?	?	?	?	?	?	?	?
Branisella	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Myanmarpithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Pondaungia	?	?	?	?	?	?	0	0	?	?	?	?	?	?	?	?	?	?
Siamopithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Bugtipithecus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phileosimias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Altiatlasius	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

APPENDIX 3

Taxa (genera and species) selected for the phylogenetic analyses

Scandentia
Plesiadapis tricuspidens and *P. jepi*
Plesiolestes problematicus
Paromomys maturus - depressidens
Purgatorius unio
Adapis parisiensis
Notharctus robustior
Cantius eppsi
Donrussellia sp. *gallica*
Leptadapis magnus
Mahgarita stevensi
Aframonius dieides
Pronycticebus gaudryi
Protoadapis curvicuspidens
Periconodon jaegeri
Guangxilemur singsilai
Hoanghonius stehlini
Sivaladapis nagrii
Galagoides demidoff
Microcebus murinus
Nycticebus coucang
Lemur catta
Absarokius sp. - *abotti*
Anaptomorphus sp.- *westi*
Anemorhysis savagei - tenuiculus
Arapaphovius gazini
Dyseolemur pacificus
Hemiacodon gracilis
Loveina zephyri
Macrotarsius montanus
Microchoerus erinaceus
Nannopithex sp. - *pollicaris - zuccolae*
Necrolemur antiquus
Omomys sp. - *carteri*
Shoshonius cooperi
Steinius vespertinus
Strigorhysis sp - *bridgerensis*
Teilhardina americana
Teilhardina belgica
Tetonius sp. - *homunculus*
Uintanius ameghini
Washakius insignis - woodringi
Afrotarsius chatrathi
Eosimias sp. - *sinensis - centennicus*
Phenacopithecus krishtalkai - xueshii
Bahinia pondaungensis
Tarsius sp. - *spectrum*
Xanthorhysis tabrumi
Aegyptopithecus zeuxis
Moeripithecus markgrafi
Apidium phiomense
Arsinoea kallamos
Catopithecus browni
Oligopithecus savagei - rogeri
Parapithecus fraasi
Proteopithecus sylviae
Qatrania wingi
Serapia eocaena
Simonsius grangeri
Aotus trivirgatus - lemurinus
Saimiri sciureus
Callicebus moloch
Neosaimiri fieldsi
Dolichocebus gaimanensis
Branisella boliviana
Myanmarpithecus yarshensis
Pondaungia cotteri
Siamopithecus eocaenus
Bugtipithecus inexpectans
Phileosimias kamali - brahuiorum
Altiatlasius koulchii

PLATE 1

Bugtipithecus inexpectans MARIVAUX *et al.*, 2005. UMC-DBC 2175, right M/3: buccal (**A**), occlusal (**D**), lingual (**G**) views; UMC-DBC 2177, right M/1: buccal (**B**), occlusal (**E**), lingual (**H**) views; UMC-DBC 2178, left P/4: buccal (**C**), occlusal (**F**), lingual (**I**), mesial (**L**) views; UMC-DBC 2174, right M1/ [holotype]: occlusal (**J**), buccal (**M**) views; UMC-DBC 2173, left M2/: occlusal view (**K**); UMC-DBC 2191, left P4/: occlusal (**N**), mesial (**O**) views. Scale bar, 1 mm. Original art by Laurence Meslin, copyright CNRS-Meslin.

PLATE 1

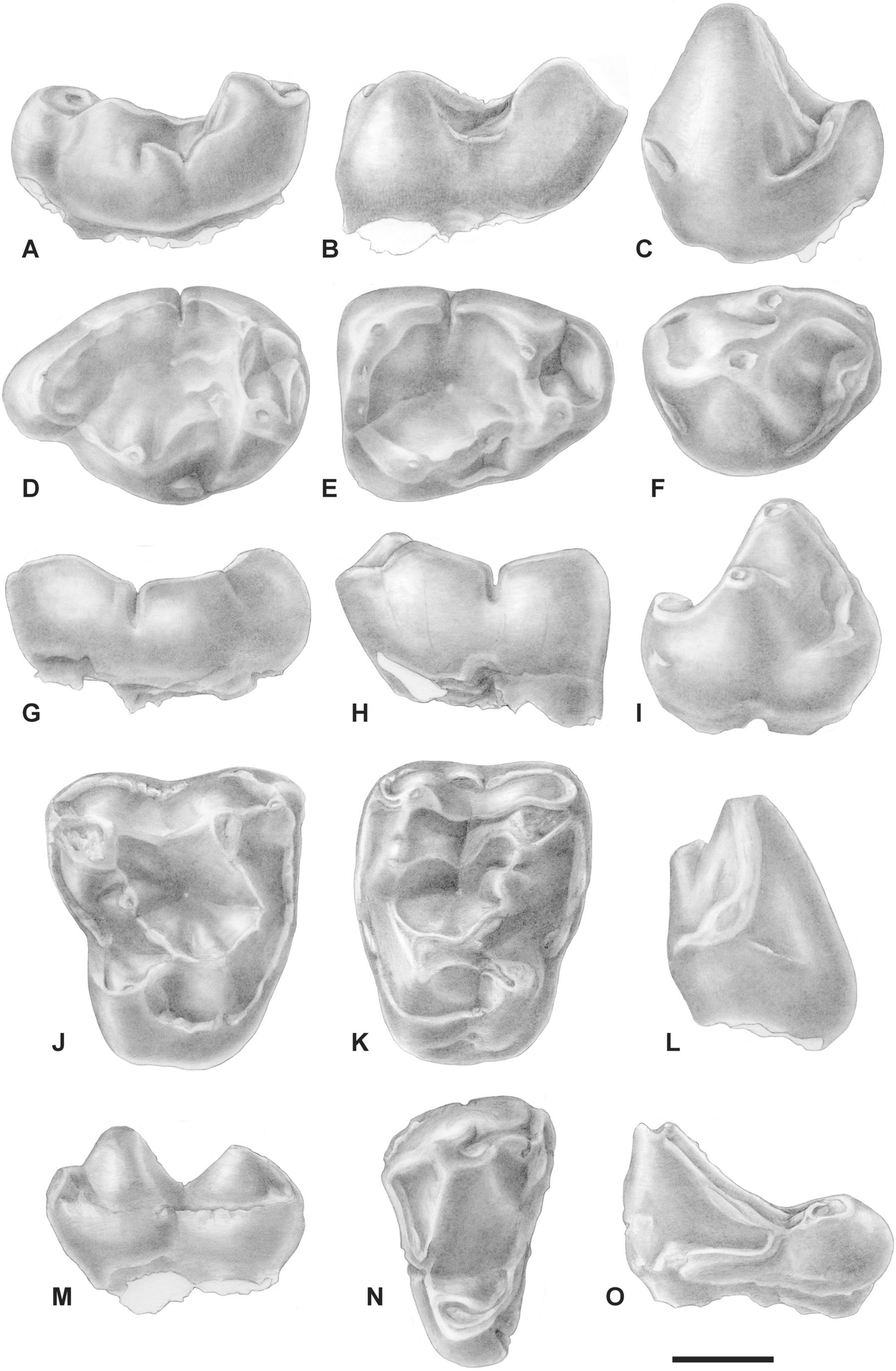

PLATE 2

Phileosimias kamali MARIVAUX *et al.*, 2005. UMC-DBC 2204, left P/4: lingual (**A**), occlusal (**E**), buccal (**I**), mesial (**M**) views; UMC-DBC 2206, left M/1: lingual (**B**), occlusal (**F**), buccal (**J**) views; UMC-DBC 2207, left M/2: lingual (**C**), occlusal (**G**), buccal (**K**) views; UMC-DBC 2208, right M/3: lingual (**D**), occlusal (**H**), buccal (**L**) views; UMC-DBC 2203, right P/3: lingual (**Q**), occlusal (**R**) views; UMC-DBC 2199, right M1/ [holotype]: buccal (**N**), occlusal (**S**) views; UMC-DBC 2197, left M2/: buccal (**O**), occlusal (**T**) views; UMC-DBC 2198, left M3/: buccal (**P**), occlusal (**U**) views. Scale bar, 1 mm. Original art by Laurence Meslin, copyright CNRS-Meslin.

PLATE 2

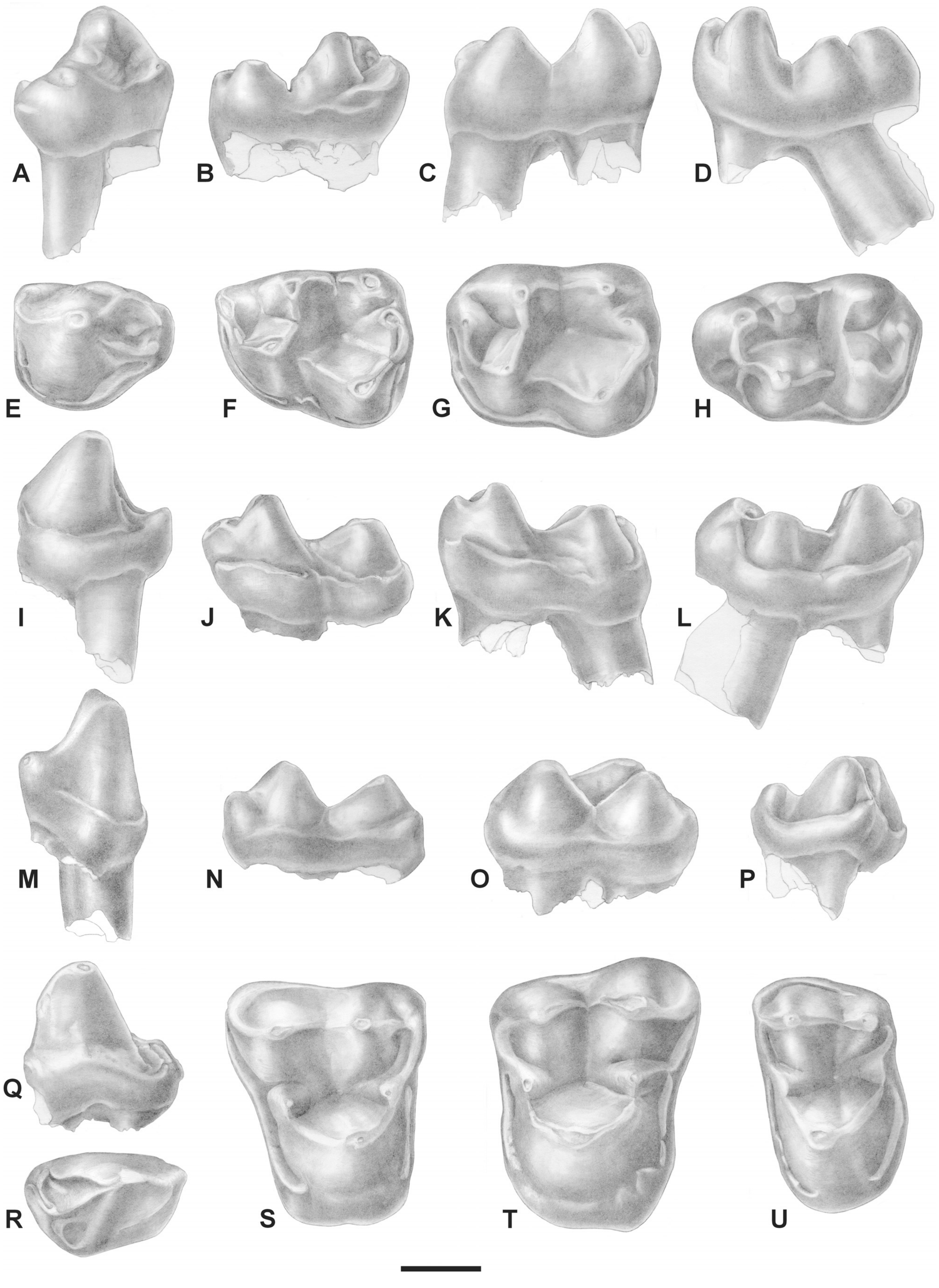

PLATE 3

Phileosimias brahuiorum MARIVAUX *et al.*, 2005. UMC-DBC 2221, right M2/: buccal (**A**), occlusal (**C**) views; UMC-DBC 2220, right M3/: buccal (**B**), occlusal (**D**) views. Scale bar, 1 mm. Original art by Laurence Meslin, copyright CNRS-Meslin.

PLATE 3