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**DENTITION OF THE EARLY EOCENE PRIMATES *NIPTOMOMYS*
AND *ABSAROKIUS***

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ABSTRACT

The mandibular dentition of *Niptomomys doreenae* was previously known only from an edentulous mandible preserving alveolae for all teeth, and jaw fragments preserving P_4 and M_{1-3} . A new mandible of *Niptomomys* is described here which preserves an enlarged, lanceolate lower incisor and a small, blunt, single-rooted P_3 . The incisor morphology confirms placement of *Niptomomys* in the Family Microsyopidae. The presence of a single-rooted P_3 invalidates the previous interpretation of the lower dental formula. Comparison with the related early primates *Navajovius*, *Palaechthon*, *Plesiolestes* and *Uintasorex* shows the lower dental formula of *Niptomomys* to be 1.1.3.3.

The total number of teeth in the mandible of *Absarokius* was previously determined to be eight (except for a single specimen of *Absarokius* "near *A. abbotti*" which Gazin, 1962, suggested might possibly have nine). Two mandibles of *A. abbotti* described here clearly had nine teeth and a lower dental formula of 2.1.3.3. The upper canine and P^2 of this species are also described here for the first time. Comparison of the new specimens of *A. abbotti* with the later *A. noctivagus noceri* demonstrates that the tooth previously interpreted in the latter taxon as P_2 is in fact the canine, thus the lower dental formula of *A.n. noceri* is 2.1.2.3, not 1.1.3.3. *Absarokius abbotti*, with a dental formula of $I^{1\frac{1}{2}}$, C_1^1 , P_3^3 , M_3^3 seems clearly to be derived from a species of *Tetonius*.

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INTRODUCTION

Recent Yale paleontological expeditions to the Bighorn Basin in northwestern Wyoming, under the direction of E. L. Simons, have recovered several specimens that reveal for the first time important elements of the anterior dentition of two species of small Early Eocene primates. The morphology of the anterior dentition is important to systematic studies and to the interpretation of feeding behavior and diet; however, for many genera and species of early Tertiary primates, the anterior dentition is unknown.

Lemur-like primates of the Family Adapidae and tarsier-like primates of the Family Anaptomorphidae are first known in the Early Eocene. The remaining Early Eocene primates are members of lineages originating in the Paleocene and are represented by three extinct families, Paromomyidae, Plesiadapidae and Microsyopidae. The new specimens described below reveal new elements of the anterior mandibular dentition of the microsyopid *Niptomomys* and the anterior mandibular and maxillary dentition of the anaptomorphid *Absarokius*.

Tooth nomenclature used in this paper is taken from Simons (1972, p. 63). The following abbreviations are used: AMNH, American Museum of Natural History; MCZ, Museum of Comparative Zoology, Harvard University; PU, Department of Geology, Princeton University; UCM, University of Colorado Museum; UCMP, University of California Museum of Paleontology, Berkeley; YPM, Peabody Museum of Natural History, Yale University.

Niptomomys Doreenae McKenna 1960

McKenna (1960) described four jaw fragments from the Early Wasatchian Four Mile fauna of northwestern Colorado as a new taxon, *Niptomomys doreenae*. Since that time 35 additional specimens of *N. doreenae* have been collected or recognized in previous collections (two from 1913). Szalay (1969b) reviewed the specimens known in 1969 and placed *Niptomomys* with *Uintasorex* in the Subfamily Uintasoricinae of the Family Microsyopidae.

HYPODIGM. *Niptomomys* is presently known from the Early Eocene Hiawatha Member of the Wasatch Formation, northwestern Colorado (Four Mile fauna) and from the Willwood Formation, Bighorn Basin, Wyoming (Graybullian and "Lysitian"). The complete hypodigm as now known is: Four Mile fauna—East Alheit Quarry: AMNH 59612, 59621, 59655, 80079, 80080, 80088, 80955, 80957, 80959, 80960, 80961, 80962, 80963; Despair Quarry: UCMP 44038, UCM 29681, AMNH 59692, 59693, 59694, 80055; Timberlake Quarry: UCMP 46978, AMNH 80958; Kent Quarry: UCMP 44080, 44081 (type), 44082, 47106. Willwood Formation—Gray-

bullian: AMNH 16828, 16829, PU 17412, 17833, 17880, 17885, 17897, 19550, MCZ 19005, YPM 23600, 26462, 30341; "Lysitian": YPM 18711, 27577.

We recently studied the entire hypodigm and concluded, as did Szalay (1969b), that it represents only one species. Specimens from the East Alheit Quarry sample differ from most of the remaining specimens in their smaller size and more prominent metaconid development on P_4 ; however, individual size and the condition of the metaconid appear to be correlated and variable. A species distinction for this sample thus seems unwarranted.

NEW MATERIAL. In 1971 a mandible of *Niptomomys doreenae* (YPM 27577, Fig. 1) preserving the incisor, a single-rooted P_3 , P_4 and M_1 was collected by the Yale party at YPM Locality 175, in the NE $\frac{1}{4}$ Section 1, T48N, R97W, Washakie County, Wyoming. This locality has yielded 171 identifiable specimens, including *Pelycodus jarrovii* and *Heptodon calciculus* on which the "Lysitian" age determination is based. The *Niptomomys* specimen is slightly distorted; however, by comparison with previously known material, this distortion can be corrected. The incisor has been rotated, with its dorsal edge moved medially. The dorsal surface of the mandible between the enlarged incisor and P_3 is damaged. P_3 is displaced slightly forward and its crown has been rotated.

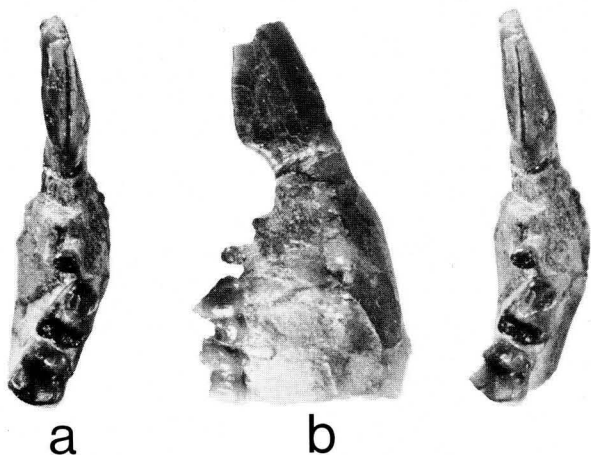


FIG. 1. Anterior portion of a right mandible of *Niptomomys doreenae* (YPM 27577) showing the enlarged I_1 , P_{3-4} , and M_1 . a. Stereophotograph of occlusal view; b. lateral view. Both $\times 6$.

DESCRIPTION. YPM 27577 is the only mandible of *Niptomomys* known that preserves the large, procumbent first incisor. This incisor is lanceolate in lateral profile. Its root extends posteriorly below M_1 . The crown has a

complete enamel cover, is mediolaterally compressed and shallowly excavated on the medial-dorsal surface (below the occlusal crest). A minor crest arises from the medial surface of the crown just anterior to the root and extends forward to the point where the tip of the crown is broken. The morphology of this incisor is a specialization characteristic of the Microsyopidae. Discovery of a microsyopid type of lower central incisor in the *Niptomomys* dentition apparently confirms allocation of the genus to this family (Russell, Louis and Savage, 1967).

The third premolar of YPM 27577 is a small, blunt, single-rooted tooth with only a faint anteroposteriorly oriented crest. This tooth is also preserved in the mandibles PU 19550 and AMNH 59692. The fourth premolar and the molars of *Niptomomys* have been adequately described and figured by McKenna (1960) and Szalay (1969b) and will not be redescribed here.

DISCUSSION. Szalay (1969b) accepted Jepsen's (1934) determination of the mandibular dental formula of *Uintasorex* as 1.0.3.3. He further proposed that the mandibular dental formula of *Niptomomys* is 1.0.3.3 to be consistent with that of *Uintasorex* and *Microsyops*. The discovery that P_3 of *Niptomomys* is a single-rooted tooth requires a new interpretation of the dental formula of this genus. In *Niptomomys* (Fig. 2) I_1 is followed by

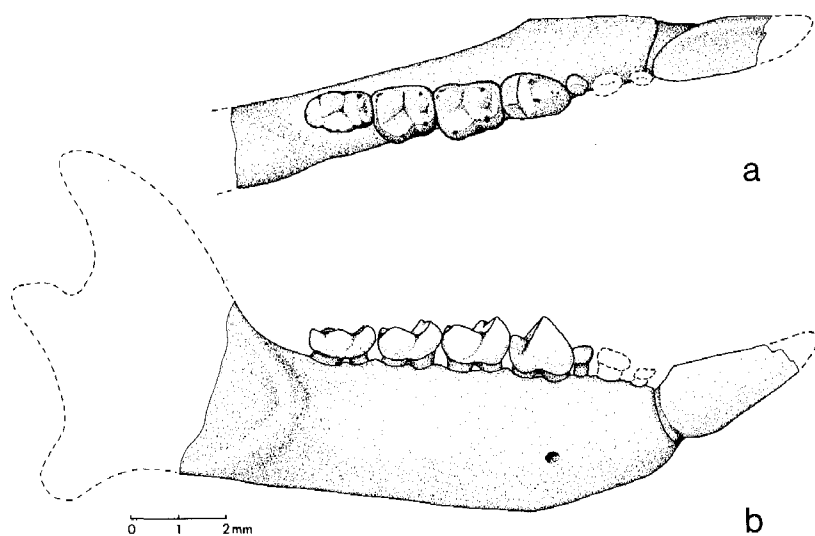


FIG. 2. Reconstruction of right mandible of *Niptomomys doreenae*, based on YPM 27577; AMNH 16829, 80079, 80955; PU 17833, and 19550. Morphology of parts shown with dashed line is unknown.

alveoli for two small, single-rooted teeth, then P_{3-4} and M_{1-3} . In view of the microsyopid affinities of the Middle Paleocene genera *Plesiolestes* and *Palaechthon* (Bown and Gingerich, in preparation), the primitive mandibular dental formula of the family was probably 2.1.3.3. Thus the two small teeth following I_1 in *Niptomomys* could be either I_2 and C, or C and P_2 . Szalay (1969a) discussed the probable microsyopid affinities of *Navajovius*. Simpson's (1935) interpretation of the mandibular dental formula of the Late Paleocene *Navajovius kohlhaasae* as 1.1.3.3 is consistent with the presumed ancestral formula of Microsyopidae and suggests that the correct mandibular formula of *Niptomomys* is probably also 1.1.3.3. Thus the teeth following I_1 in *Niptomomys* are the lower canine and P_2 .

In the reconstruction of the mandible of *Niptomomys* (Fig. 2) the lower canine and P_2 have been tentatively restored with blunt crowns like that of P_3 and paralleling those of the marsupials *Phalanger* and *Petaurus*; however, they may have had pointed crowns as does an undescribed uita-soricine (UCMP 95949) collected by D. E. Savage from the Late Wasatchian of the Washakie Basin, Wyoming.

Absarokius Abbotti (Loomis, 1906)

Among other significant specimens recovered from the Willwood Formation in 1971 are two mandibles of *Absarokius*, referred here to *A. abboti* (Loomis). These specimens are remarkable in that the symphyseal regions of the jaws are preserved with alveoli present, enabling an accurate determination of the lower dental formula to be made. A maxilla found by the 1962 field party is believed to be the most complete known upper dentition of this species and is therefore described and figured here. Comparison with all Middle Wasatchian *Absarokius* in the Yale Bighorn Basin collections (65 upper and lower jaws) suggests that the dental formula of this taxon is constant within the above areal and stratigraphic range in the Bighorn Basin.

NEW MATERIAL. YPM 27791 (Fig. 3a,c) is a left mandible preserving the lower canine, P_{2-4} , M_{1-3} , and two alveoli anterior to the canine. YPM 28205 (Fig. 3b,d) is a right mandible with the root of the canine, P_{2-4} , M_{1-2} , and two alveoli anterior to the canine root. Both specimens are from YPM Locality 185 ("Lysitian"), in the SE $\frac{1}{4}$ Section 26, T49N, R97W, Buffalo Basin, Bighorn County, Wyoming. YPM 18686 (Fig. 4a,b) is a left maxilla preserving the root of the upper canine, part of P^2 , P^{3-4} , and M^{1-3} from YPM Locality 40 ("Lysitian"), in the SW $\frac{1}{4}$ Section 34, T49N, R96W, Buffalo Basin, Bighorn County, Wyoming.

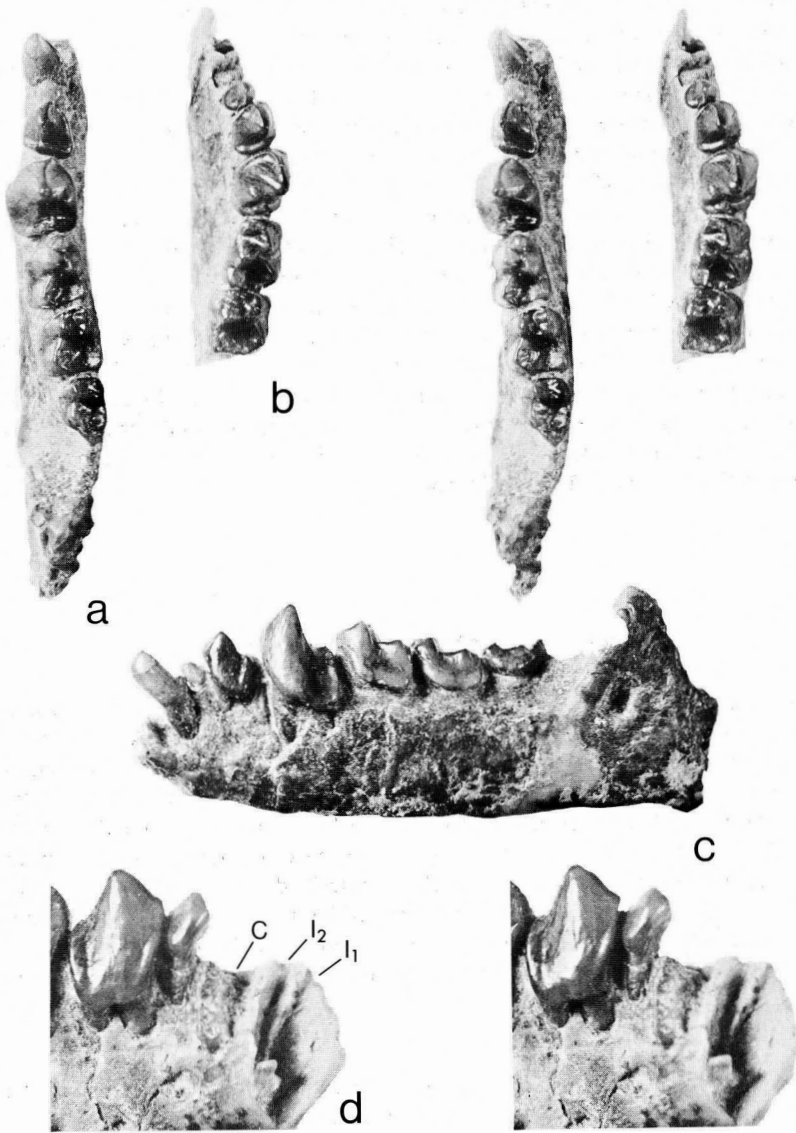


FIG. 3. Mandibular dentition of *Absarokius abbotti*. a. Stereophotograph of occlusal view of left mandible (YPM 27791) with alveoli for I_{1-2} , and intact C, P_{2-4} , M_{1-3} ; b. stereophotograph of occlusal view of right mandible (YPM 28205) with alveoli for I_{1-2} , C, and intact P_{2-4} , M_{1-2} ; c. lateral view of YPM 27791; d. stereophotograph of anterior portion of YPM 28205 showing alveoli for I_{1-2} and C, followed by intact P_2 and P_3 . FIG. 3a-c, $\times 4$; d, approximately $\times 8$.

DESCRIPTION. In YPM 27791, 28205 and 18686 the upper and lower fourth premolars are smaller than samples of those teeth in *Absarokius noctivagus* (Guthrie, 1971), *A.n. nocerai* (Robinson, 1966) and *A. witteri* (Morris, 1954). Both the third lower premolar and the last lower molar are somewhat smaller than recorded in samples of *A. abbotti* from the Wind River Lysite Member (Guthrie, 1967). P^3 is slightly wider transversely than observed in most specimens of *A. abbotti*. The cheek teeth of *A. abbotti* posterior to P^2 have been adequately described by earlier authors and need not be analyzed again.

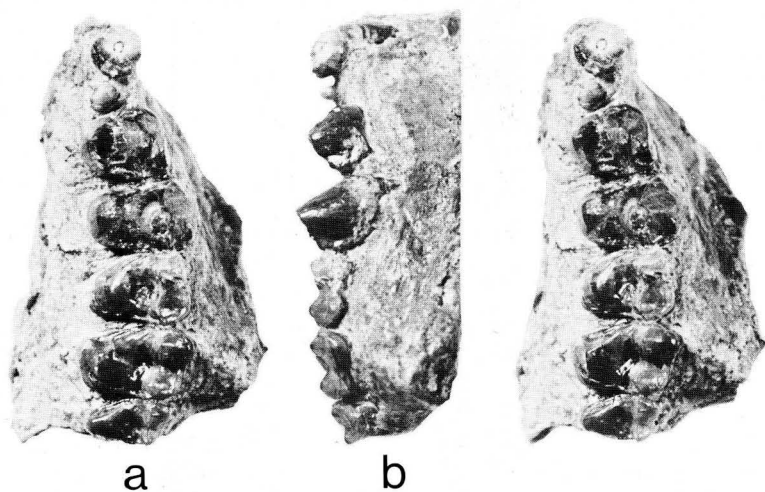


FIG. 4. Left maxilla of *Absarokius abbotti* (YPM 18686) with broken C and P^2 , and intact P^3-4 , M^1-3 . a. stereophotograph of occlusal view; b. lateral view. Both $\times 4$.

P^2 is a diminutive, single-rooted, peglike tooth, somewhat lingually situated just anterior to the protocone of P^3 (Gazin, 1958). The crown is broken with only the anterobuccal portion complete; however, this part suggests that the tooth was unicusate with the solitary cusp located on the preserved remnant of the crown (Fig. 4.).

The root anterior to P² indicates that the canine was a relatively large tooth with a minor posterolingual cingulum. The root of this tooth is also present in YPM 23177.

P₂ is a small, single-rooted and unicuspid tooth with the lingual margin of the crown greatly distended (Fig. 3). The single cusp is anteriorly and somewhat buccally removed from the center of the crown. A lingual shelf is apparent and is broadest at the rear of the tooth; there is no buccal cingulid. The posterior slope of the protoconid is convex buccally and excavated lingually, resulting in a weak cristid developed at the rear of the tooth which is attenuated anteriorly where it merges with the protoconid (similar to the condition observed in P₃).

Immediately anterior to the P₂ is a large premolariform tooth, much taller than P₂ and only slightly shorter than P₃. Due to its relative size and positioning, this tooth is believed to be the lower canine. The root is transversely much wider than it is long, and supports a high, anteriorly-directed crown. The crown morphology is similar to that of P₂. The posterolingual cingulid region is broken, but the outline of the tooth suggests the former presence of lingually distended enamel as observed in P₂.

Two alveoli are present in front of the canine in YPM 27791 and in front of the canine root in YPM 28205. These are the alveoli of I₁ and I₂. As observed in YPM 28205 (Fig. 3d), the I₁ alveolus is considerably larger anteroposteriorly than the alveolus for I₂. I₂, like the canine, has a transversely broad root and is somewhat "short-rooted," with the root of the larger I₁ emplaced partially beneath the I₂ root and extending posteriorly to the vicinity of the canine root. A fragment of an incisor root is associated with YPM 27791.

DISCUSSION. Questions of tooth homologies in *Absarokius* and other anaptomorphines have long been unresolved. Matthew (1915) determined the lower dental formula of all *Absarokius* material known to him as 1.1.3.3. He was followed in this interpretation by Gazin (1952, *A. noctivagus*), and Kelley and Wood (1954). Morris (1954) questioned Matthew's description and suggested that in *A. witteri* there may have been four single-rooted teeth in the mandible anterior to P₃. Gazin (1958) believed the lower dental formula "for the more typical of the anaptomorphids" was 2.1.2.3. He later described a "Gray Bull" specimen of *Absarokius* cf. *abbotti* from the Red Desert in which the P₂ was apparently retained (Gazin, 1962). Robinson (1966) named a subspecies of *Absarokius noctivagus*, *A.n. nocerae*, in which he described two alveoli anterior to "P₂" (also figured by Simons, 1963, p. 90). Comparison with YPM 27791 demonstrates that this "P₂" is actually the lower canine; by the stage of *A.n. nocerae* the P₂ had been lost from the dental series.

Based on the specimens here, the dental formula of the Willwood sample of *Absarokius abbotti* is I²₃, C¹₁, P³₃, M³₃. Other previously described samples of *Absarokius*, when known from more complete anterior den-

titions, may prove to share this dental formula also. However, the Huerfano subspecies *Absarokius noctivagus nocerae* seems clearly to be a more advanced form in which P_2 has been lost.

Robinson (1967) described a complete mandible of "*?Tetonoides*" in which the dental formula is the same as that of *Absarokius abbotti*. The type specimen of *Chlororhysis knightensis* Gazin (1958) also closely resembles the specimens of *Absarokius* figured here. In addition, several relatively complete specimens of *Tetonius* recovered in recent years by the Peabody Museum field parties and currently under study at Yale indicate that the lower dental formula of most specimens of this genus was probably I_2, C_1, P_3, M_3 as well. The condition of the closely packed anterior teeth and the peculiar arrangement of the incisor roots, as seen in *A. abbotti*, may have been misleading factors in earlier descriptions of the anterior dental homologies of anaptomorphine lower teeth. The presence of I_1 is difficult to establish unless most of the anterior portion of the mandible is present. The proliferation of anaptomorphine taxa based on size and the condition of the paraconid and metaconid of P_4 may have been due in part to a poor understanding of the dental anatomy of the early members of the subfamily. The relatively large and specialized P_4 of *Absarokius* can well be explained as an adaptive shift from a *Tetonius*-like ancestor, thus favoring a large P_4 protoconid at the expense of the accessory cusps (Simons, 1972, personal communication). As a result of the present study, Matthew's original (1915) inclination to regard *Absarokius* species as "progressively specialized descendents of *Tetonius*" species is strengthened.

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