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# TWO NEW EOMYID RODENTS (MAMMALIA) FROM THE CHADRONIAN (LATEST EOCENE) OF MONTANA AND WYOMING

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ABSTRACT

Two new species of eomyid rodents are described from the Chadronian: *Adjidaumo lophatus* n. sp., from the Canyon Ferry area of Montana and *Centimanomys gigantus* n. sp., from the Chadron Formation of Wyoming. *Adjidaumo lophatus* differs from all other species of *Adjidaumo* Hay in its greater lophodonty, approaching that of *Paradjidaumo* Burke. *Centimanomys gigantus* differs from the type species of the genus *C. major* in its larger size and more molariform p4. *Centimanomys galbreathi* Martin and Ostrander is synonymized with the type species. The recognition of these two additional species from the Chadronian of North America increases the diversity of Eomyidae from this horizon.

## INTRODUCTION

The greatest diversity of eomyid rodents in North America was during the Chadronian (Fahlbusch, 1979; Korth, 1994). In the latest survey of the family, Flynn (2008) listed 12 genera and 19 species from this horizon. More recently, Emry and Korth (2012) recognized three additional species from the early Chadronian, increasing the number of species to 22. Additional specimens of undescribed eomyids have been discovered among the collections of the American Museum of Natural History and National Museum of Natural History from the Chadronian of Wyoming and Montana, respectively. Two additional species of eomyids can be recognized from this material, increasing diversity of the family even more.

Dental terminology follows that of Wood and Wilson (1936). Mandibular teeth are designated by lower-case letters (e.g. m1, m2). Institutional abbreviations: FAM, Frick Collections, American Museum of Natural History; KU, University of Kansas; USNM, National Museum of Natural History, Smithsonian.

## SYSTEMATIC PALEONTOLOGY

Order Rodentia Bowditch, 1821
Family Eomyidae Winge, 1887
*Adjidaumo* Hay, 1899
*Adjidaumo lophatus* n. sp.
(Figure 1; Table 1)

**Type and Only Specimen**—USNM 362472, right mandible with i1 and p4-m2.

**Horizon and Locality**—Canyon Ferry area, USNM locality 24LC16 (White, 1954), Dunbar Creek Formation, Lewis and Clark County, Montana.

**Age**—Chadronian (latest Eocene).

**Diagnosis**—Small size (near that of *Adjidaumo minimus* [Matthew, 1903]); cheek teeth more lophate than in all other species of the genus (similar to *Paradjidaumo* Burke, 1934) but brachydont in height; mesolophids long, extending to lingual edge of the tooth; anterior cingulid on lower molars free buccally (as in *Adjidaumo*).

**Etymology**—Latin, *lopho-*, crest; and *–atus*, provided with or having.

**Description**—The mandible is slender and not very deep, typical of other species of *Adjidaumo* (Black, 1965: fig. 6b). The diastema is shallow and nearly as long as the entire tooth row (3.07 mm). The masseteric scar ends anteriorly at mid-depth of the mandible below the posterior root of p4. The ascending ramus rises lateral to the anterior margin of m3. The base of the incisor is on the ascending ramus posterior to the tooth row, just below the alveolar margin. The mental foramen is high on the mandible, nearly on the dorsal edge of the diastema, at a point just posterior to the center of the diastema.

The lower incisor is small and longer than wide in cross section with a slightly convex anterior enamel surface. In cross-section, its widest transverse width is approximately one-third the height of the tooth.

The lower cheek teeth are brachydont and the lophids thin and high. The p4 is much smaller than the molars, and narrower anteriorly than posteriorly. The trigonid consists of the metaconid and protoconid that are connected posteriorly by the metlophulid II, enclosing the trigonid basin posteriorly. The trigonid is

open anteriorly, but a transversely wide anterostylid is present along the anterior margin. The mesolophid arises from the center of the metalophulid II, and extends to the lingual edge of the tooth where it bends anteriorly, fusing with the posterior side of the metaconid, producing a small, oval depression. The ectolophid originates on the posterior side of the protoconid, connects with the small mesoconid, then bends lingually. After this bend, a small lophule connects the ectolophid with the posterior side of the mesolophid, isolating a small, circular depression in the center of the tooth. After this connection, the ectolophid extends directly posteriorly, fusing with the lingual slope of the entoconid (hypolophid), then continues posterorly, joining the posterior cingulid at its center. The entoconid is anteroposterioly compressed and the hypoconid is round in occlusal view. The posterior cingulid extends from the hypoconid for the entire width of the tooth.

The m1 is nearly equal in width and length and larger than p4. The anterior and posterior widths are equal. The metaconid and entoconid are anteroposteriorly compressed, and the protoconid and hypoconid are obliquely compressed. The anterior cingulid extends for nearly the entire width of the tooth, fusing with the center of the protoconid, then extending buccally to the edge of the tooth. The metalophid is continuous from the metaconid to the protoconid and nearly straight. The ectolophid connects the protoconid and hypoconid buccally with a slight lingual bend near its center at the base of the mesolophid. The mesolophid is long, extending to the lingual edge of the tooth, separated from both the metalophid and hypolophid. The posterior cingulid originates at the posterolingual corner of the hypoconid and extends lingually, for slightly less than half the width of the tooth.

The m2 is slightly wider than long. The occlusal morphology is nearly identical to that of m1 except that the posterior cingluid is shorter.

**Discussion**—*Adjidaumo lophatus* is similar in size and crown-height to other small species of *Adjidaumo* (Table 1) but has more lophate cheek teeth with longer mesolophids. The cheek teeth of *A. lophatus* have narrower, higher, and longer lophids than the later occurring "*A.*" *douglassi* that was diagnosed as having more lophate cheek teeth than other species of *Adjidaumo* (Burke, 1934; =*Leptodontomys* Korth and Bailey, 1992; Korth, 2008). The degree of lophodonty in *A. lophatus* is similar to that of *Paradjidaumo* but the crown-height is brachydont as in *Adjidaumo*, not mesodont as in the former. *A. lophatus* also differs from *Paradjidaumo* in having the buccal end of the anterior cingulid on the cheek teeth free, not attached to the protoconid as in *Paradjidaumo*.

*Adjidaumo* ranges in age from the Uintan to the Whitneyan (Flynn, 2008:fig. 25.3). Morphologically, there is little change in the species except increase in size and slightly greater lophodonty in the later species (Wood, 1980; Korth, 1989). *Adjidaumo lophatus* is the most derived species in terms of dental morphology, having much higher lophs and less distinct cusps on the cheek teeth, but occurs in the middle of the time range of the genus.

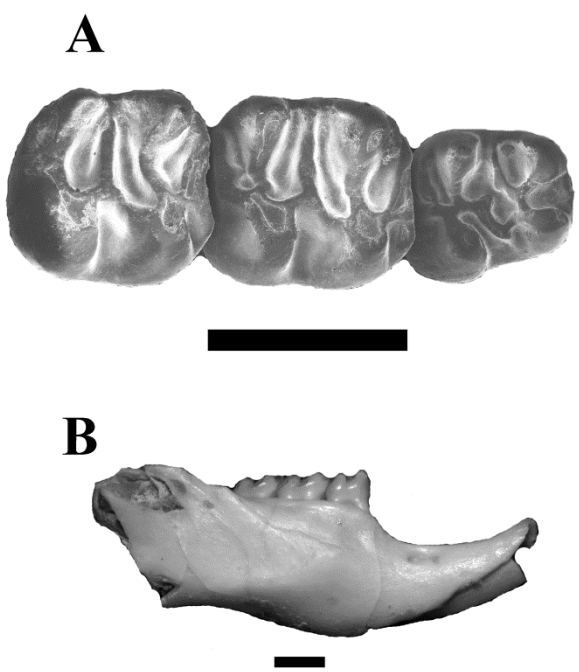


FIGURE 1. Holotype of *Adjidaumo lophatus*, USNM 362472, mandible with p4-m2. A, occlusal view, p4-m2. B, lateral view of mandible. Bar scales = 1 mm.

*Centimanomys* Galbreath 1955
*Centimanomys gigantus* n. sp.
(Figure 2; Table 1)

**Type Specimen**—FAM 97804, left mandible with i1 and p4-m3.

**Referred Specimen**—FAM 97803, partial left mandible with p4-m2 and possible associated I1.

**Horizon and Locality**—Chadron Formation, "15 feet below purplish white layer, SW of Seaman Hills" (museum catalog description), Niobrara County, Wyoming.

**Age**—Late Chadronian (latest Eocene).

**Diagnosis**—Larger than type species; p4 with well-developed protoconid and metaconid, separated by distinct valley, not connected by well-developed metalophid.

**Etymology**—Latin, *gigantus*, large.

TABLE 1. Dental measurements of *Adjidaumo lophatus* and *Centimanomys*. Abbreviations: L, maximum anteroposterior length; W, maximum transverse width. Measurements in mm. Measurements for the holotype of *C. major* taken from Galbreath (1955:table 1); those for *C. galbreathi* taken from Martin and Ostrander (1986:table 1).

| | | p4L | p4W | m1L | m1W | m2L | m2W | m3L | m3W | p4-m3 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Adjidaumo lophatus* -type | USNM 362472 | 0.76 | 0.78 | 1.01 | 0.99 | 0.94 | 0.99 | | | 3.76 |
| *Centimanomys gigantus* -type | FAM 97804 | 2.56 | 2.55 | 2.98 | 2.93 | 2.87 | 3.06 | 3.38 | 2.88 | 11.91 |
| *C. gigantus* | FAM 97805 | 2.95 | 3.06 | 3.05 | 3.19 | 3.11 | 3.12 | | | |
| *C. major* -type | KU 9902 | 2.37 | 2.35 | 2.55 | 2.54 | 2.58 | 2.80 | 2.95 | 2.39 | 10.6 |
| *C. galbreathi* -type | KU 11178 | | | 2.76 | 2.62 | 2.83 | 2.83 | 2.58 | 2.52 | |

**Description**—The mandible is broad and heavy. The masseteric scar ends anteriorly in a V-shape, ventral to the center of p4. The ascending ramus rises lateral to m2. There is a very slight digastric process on the ventral side of the mandible, below the center of the diastema. The diastema is shallow and approximately ¾ the length of the tooth row (8 mm). The mental foramen is just below the dorsal margin of the diastema, just anterior to the center of the diastema. The lower incisor is roughly D-shaped in cross-section (flattended medially) and widest near its center.

The cheek teeth are brachydont with robust cusps and thin lophids. The p4 is slightly smaller than m1. The occlusal outline of p4 is nearly square on the holotype (anterior and posterior widths equal), but narrower anteriorly than posteriorly on the referred specimen. There is a distinct protoconid and metaconid along the anterior margin of the tooth. The metaconid is slightly larger and more anteroposteriorly compressed than the protoconid. On the holotype, there is an additional cusp extending posteriorly from the metaconid along the lingual side of the tooth (=?metastylid). On the referred specimen, there is no distinct cusp, but a ridge extends posteriorly from the metaconid in the same position as the accessory cusp in the type specimen. The protoconid and metaconid are separated by a deep but narrow valley along the anterior margin of the tooth. In the referred specimen, there is a minute lophule connecting these cusps on the posterior side (metalophulid II) that is not present in the holotype. The ectolophid is complete on both specimens, and the mesolophid extends directly lingual, not quite reaching the edge of the tooth. The hypoconid is obliquely compressed and the entoconid is anteroposteriorly compressed. They are connected by a hypolophid that is slightly posteriorly convex. The posterior cingulid begins near the center of the hypolophid and extends to the lngual edge of the tooth, fusing its lingual end with the posterior side of the entoconid. On the holotype, there is a low anteroposteriorly oriented lophid connecting the center of the mesolophid to the center of the hypolophid that is not present on the referred specimen.

The m1 and m2 are similar in size and approximately equal in width and length. The lingual cusps (metaconid, entoconid) are anteroposteriorly compressed, and the buccal cusps (protoconid, hypoconid) are obliquely compressed. The anterior cingulid extends the entire width of the tooth and is connected at its buccal end to the protoconid. There is a slight swelling near the buccal end of the anterior cingulid (=anterostylid). The metalophid is continuous from the metaconid to the protoconid and parallel to the anterior cingulid. The ectolophid is continuous from the posterior side of the protoconid to the anterior side of the hypoconid with a slight lingual bend near its center. The mesolophid is long and straight, parallel to the metalophid, and ends short of the lingual margin of the tooth. The hypolophid is complete from the entoconid to the hypoconid and only slightly convex posteriorly. The posterior cingulid is as in p4. On m2 of the holotype there is a low, anteroposteriorly oriented lophid as in p4, connecting the center of the mesolophid with the center of the hypolophid. Again, this is not present on the referred specimen.

The m3 is present only on the holotype. The m3 is wider but shorter than m1 and m2. In overall occlusal morphology, m3 is similar to m1 and m2. The major difference is in the posterior portion of m3. The entoconid and hypoconid are relatively smaller on m3 than the anterior molars. The hypolophid on m3 is not compete, but ends halfway from the entoconid to the

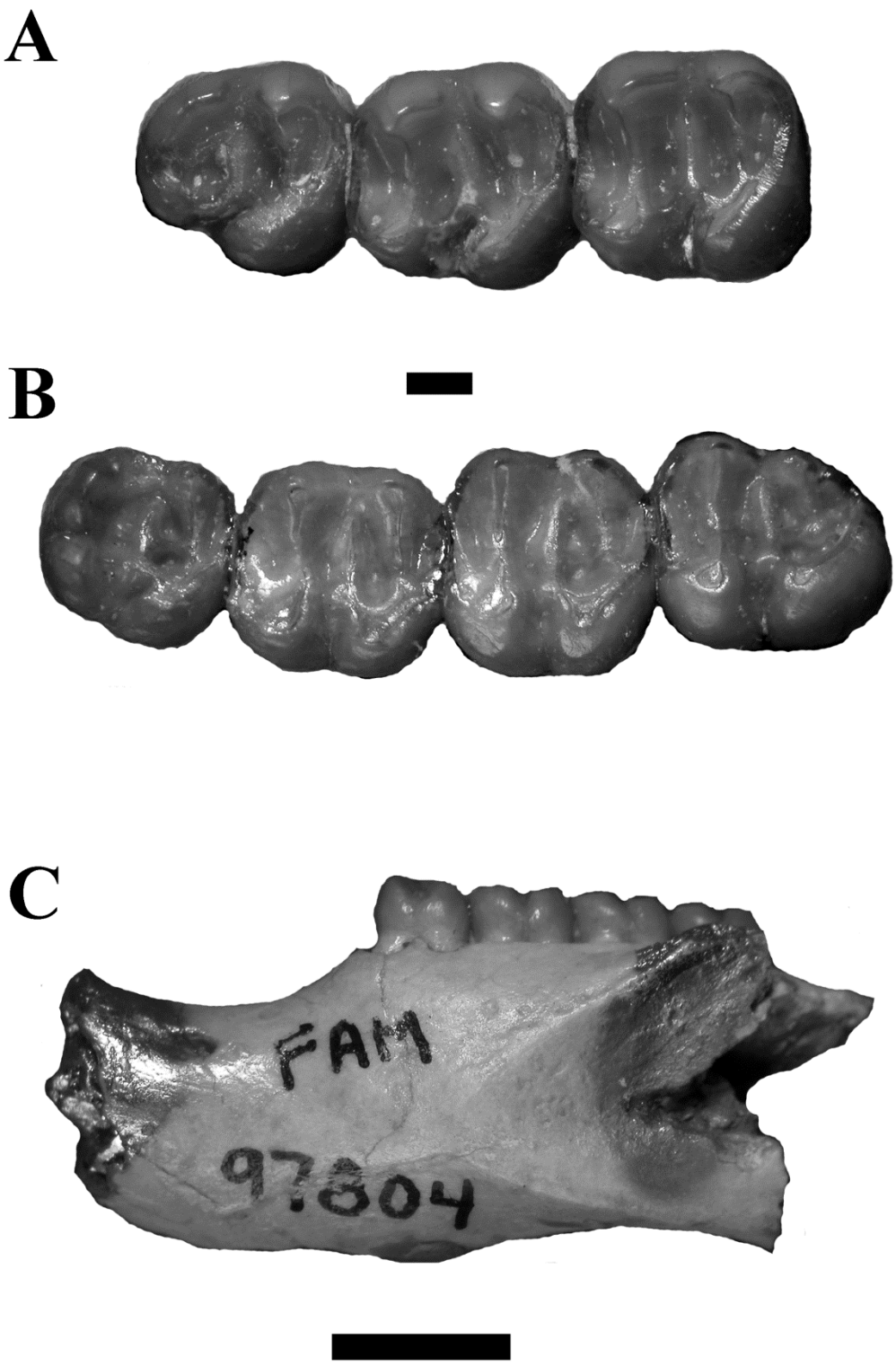


FIGURE 2. Dentition and mandible of *Centimanomys gigantus*. A, FAM 97803, left p4-m2. B-C, FAM 97804 (holotype). B, occlusal view of left p4-m3. C, lateral view of mandible. Bar scale for teeth (above) = 1 mm. Bar scale for mandible (below) = 5 mm.

hypoconid where it fuses with the anteroposteriorly oriented lophid similar to that on p4 and m2. On m3 this lophid is slightly higher than on p4 and m2 and runs from the mesolophid to the center of the posterior cingulid.

The upper incisor included with FAM 97803 is similar in size to the lower incisor (length = 4.04 mm, width = 2.27 mm). The anterior enamel surface is convex with enamel extending about 1/3 the height of the tooth on the lateral side. The incisor is widest near the anterior edge, and tapers posteriorly.

**Discussion**—*Centimanomys gigantus* is larger than the type species *C. major*; the dimensions of the cheek teeth ranging from just over 10% to nearly 25% greater in *C. gigantus* (Table 1). In addition, the p4 of *C. gigantus* is more molariform than in *C. major*. In *C. major*, both the protoconid and metaconid are small and connected by a complete metalophulid II, but the anterior width of the tooth is much less than the posterior width (Martin and Ostrander, 1986:fig. 1B: this was not evident in the illustration provided by Galbreath [1955:fig. 1]). In *C. gigantus*, the protoconid and metaconid are nearly equal in size, there is a distinct, narrow valley that separates them that is not present on the p4 of *C. major*, the accessory cusp or loph posterior and lingual to the metaconid is nearly equal in size to the metaconid, and the metalophulid II is not complete between the cusps. The short, low anteroposterior lophid on p4, m2 and m3 of the holotype is not present on the referred specimen of *C. gigantus*, indicating that it is a variable character and not necessarily diagnostic of the species.

Martin and Ostrander (1986) named a new species of *Centimanomys*, *C. galbreathi*, from the same horizon of northeastern Colorado as the type species (Horsetail Creek Member, White River Formation) found less than two miles from the type locality of *C. major*. The new species was based on a single mandible with worn m1-m3. *C. galbreathi* was diagnosed as being larger than the type species with a more robust masseteric scar and more vertical ascending ramus and m3 more nearly square in occlusal outline. However, the dimensions of the cheek teeth of *C. galbreathi* are all less than 9% larger than those of *C. major* and average only a 2% difference (Table 1). The alveolar length of m1-m3 differs by only 1% between the two species. The greatest difference in size is the length of m3 which is larger in *C. major* than in *C. galbreathi* rather than smaller.

The second difference cited by Martin and Ostrander (1986) as distinguishing the two species, the angle of the ascending ramus, appears to be due to variation within a species or the age of the individual. It is not uncommon that the masseteric scar becomes more pronounced in older individuals, which would enhance the angle of the ascending ramus as well. For example, Martin and Ostrander (1986:table 2) listed the angle of the ascending ramus of *Paradjidaumo* as 138°. However, a small, random sample of *Paradjidaumo* from Chadronian and Orellan localities was measured and the angle of the ascending ramus had a wide range and was as low as 110°, steeper than in *C. galbreathi*. This angle on the holotype of *C. gigantus*, FAM 97604, measures 125°, intermediate between that given for *C. major* and *C. galbreathi*. The type of *C. galbreathi* is clearly from a much older individual based on the stage of wear of the teeth (Martin and Ostrander, 1986:fig. 1A). Neither size nor the mandibular differences seem to separate *C. major* from *C. galbreathi*.

Martin and Ostrander (1986) also noted that the anterior cingulid was unattached lingually on the molars of *C. galbreathi* but attached on *C. major*, and the valleys in the molars isolating the mesolophid were slightly oblique in *C. galbreathi* and not transverse as in *C. major*. The angle of the central valleys is extremely slight and do not seem to differ in the teeth of *C. major*, *C. galbreathi* or *C. gigantus*. The valley anterior to the mesolophid is always directly transverse, whereas the valley posterior to the mesolophid is angled slightly anteriorly. The connection of the anterior cingulid to the metaconid on the molars also seems to be related to wear. In *C. gigantus*, the type specimen (the most worn) has the lingual end of the anterior cingulid free, and on the less worn referred specimen, the anterior cingulid appears to attach to the metaconid (Figure 2). In all, the characters used by Martin and Ostrander (1986) to separated *C. galbreathi* from *C. major* appear to be due to differences in ontogenetic age and variation within a species, suggesting that *C. galbreathi* is a junior synonym of *C. major*.

## CONCLUSIONS

In his description of the mammalian fauna from the Canyon Ferry Reservoir area, Montana, White (1954) recognized only two specimens of eomyids, both referable to *Paradjidaumo* from the Orellan horizon, and none from the Chadronian horizon. The recognition of *Adjidaumo lophatus* from the Chadronian not only increases the rodent diversity from the Canyon Ferry area, but also the diversity of the Eomyidae in the Chadronian.

*Centimanomys* is rare in the fossil record, being limited to the Chadronian and reported only from its type area (northeastern Colorado) and nearby northwestern Nebraska (Ostrander, 1985). The recognition of an additional species from Wyoming

increases the diversity of the genus as well expands its known geographic occurrence.

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