

GENERIC ALLOCATION AND PROBABLE HORIZON OF OCCURRENCE OF THE ENIGMATIC GEOMYOID RODENT *DIPLOLOPHUS PARVUS* TROXELL FROM NORTHEASTERN COLORADO

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ABSTRACT

Diplolophus parvus Troxell is known from a single mandible with complete lower dentition from rocks in northeastern Colorado. It has been assigned to a number of geomyoid genera, mainly heteromyids, throughout its taxonomic history. The horizon of occurrence of the type specimen is also uncertain. A redescription of the type specimen and comparisons with the holotype and a large sample of the early florentiamyid *Kirkomys nebraskensis* (Wood) indicates that “*D.*” *parvus* should be referred to *Kirkomys* Wahlert. Based on the morphology of the type of *K. parvus*, the age of other known species of *Kirkomys*, and the stratigraphy of northeastern Colorado, it is believed that the specimen most likely came from the Whitneyan aged Vista Member of the Brule Formation rather than from the Hemingfordian or Barstovian rocks that were previously suggested. The recognition of additional species of *Kirkomys* from the Whitneyan demonstrates that the Florentiamyidae began increasing in diversity before the Arikareean.

INTRODUCTION

Diplolophus was first named by Troxell (1923) from the “Oreodon beds” (=Orellan) of Colorado. The genus included the type species *D. insolens* and a referred species *D. parvus*, supposedly from the same horizon. *D. insolens* has been described in detail elsewhere (Barbour and Stout, 1939). Its unique combination of geomyoid-like cheek teeth (six-cusped, bilophate occlusal pattern) and mureoid-like dental formula (premolars lacking) has made it impossible to assign to any recognized family of rodents (Korth, 1994). Its occurrence is limited to the late Orellan of the northern Great Plains (Galbreath, 1953; Wood, 1980; Korth, 1989a).

Diplolophus parvus, however, is distinct from the type species in being markedly smaller and having a geomyoid dental formula (premolar present) as well as geomyoid cheek tooth morphology. It is known only from the holotype, YPM 10362 (mandible with all cheek teeth), and has been assigned to a number of geomyoid genera. In his second bibliography of fossil vertebrates, Hay (1930) listed the species as belonging to *Heliscomys*, a small, primitive geomyoid known also from the Orellan of Colorado. A year later Wood (1931), in his preliminary systematic survey of the Heteromyidae, included it in his newly recognized genus *Mookomys*, otherwise only known from the

Hemingfordian of Montana. Finally, Wood (1935) reassigned “*D.*” *parvus* to *Proheteromys*, a genus he erected for two heteromyid species from the Hemingfordian of Florida (Wood, 1932). Nearly all subsequent authors have followed Wood’s (1935) generic allocation. However, in an unpublished dissertation, Reeder (1956) erected a new genus and included in it a number of previously described species from several different genera. Among the species included were “*D.*” *parvus*, *Proheteromys nebraskensis*, and several species now assigned to *Mioheteromys* Korth (1997).

Along with the generic assignment of “*D.*” *parvus*, the horizon and locality of the type specimen has been equally uncertain. Although originally assigned to the Orellan (=Oreodon beds) by Troxell (1923), Wood (1935) believed that the specimen was too advanced morphologically for any Orellan heteromyid. In his research, Wood discovered that the only locality data for the specimens was simply the state of Colorado. Based on what he believed were advanced characters of the cheek teeth, Wood (1935) suggested that it was from either the Barstovian Pawnee Creek Formation or the early Hemingfordian Martin Canyon Formation, both exposed in northwestern Colorado (Tedford, et al., 2004) where Chadronian to Whitneyan rocks are also exposed (Galbreath, 1953; Prothero and Emry, 2004).

With the exception of Reeder's (1956) unpublished dissertation, no authors have compared the holotype of "*D.*" *parvus* to *Proheteromys nebraskensis* in their discussions of either species. *P. nebraskensis* is known from the Whitneyan of Nebraska, and the holotype (MCZ 5051) consists of a mandible with all cheek teeth (Figure 1A) which can be directly compared to that of "*D.*" *parvus*. A redescription of the holotype of "*D.*" *parvus* and a comparison of it to the holotype of *P. nebraskensis* and a large sample of the species suggests that they are congeneric.

Dental nomenclature follows that of Korth and Branciforte (2007:fig. 1). Crown height of cheek teeth measured on buccal side of tooth from base of enamel to base of transverse valley. Crown height index (ht/W) is crown height divided by transverse width of the tooth. Abbreviations for institutions: FAM, Frick Collections, American Museum of Natural History; MCZ, Museum of Comparative Zoology, Harvard; YPM, Yale-Peabody Museum.

SYSTEMATIC PALEONTOLOGY

Order Rodentia Bowdich, 1821

Family Florentiamyidae Wood, 1936

Kirkomys Wahlert, 1984

Type Species—*Proheteromys nebraskensis* Wood, 1937.

Included Species—*Diplolophus parvus* Troxell, 1923.

Range—Whitneyan and early Arikarean of the northern Great Plains.

Discussion—*Kirkomys* was originally named by Wahlert (1984) as a florentiamyid from the Whitneyan of Sioux County, Nebraska. He recognized the type species as *Kirkomys milleri*, known from a single specimen, a partial skull with upper dentition (FAM 105337). Korth (1989b, 1997) suggested that this species was the upper dentition of *Proheteromys nebraskensis*, which was also from the Whitneyan of Sioux County, Nebraska (Wood, 1937) but only known previously from lower dentitions. Green and Bjork (1980) referred to *P. nebraskensis*, a large sample of specimens from the Whitneyan of South Dakota which included upper cheek teeth with a great deal of similarity to that of *K. milleri*.

A large collection of *Proheteromys nebraskensis* from the early-early Arikarean of Nebraska has been recently described (Korth and Branciforte, 2007). This material, along with a sample of the South Dakota material cited by Green and Bjork (1980), was used to demonstrate that the cranial features of *Kirkomys* are present in these samples, as well as dental morphology of *P. nebraskensis* in the lower cheek teeth, which resulted in the synonymy of *K. milleri* and *P.*

nebraskensis (Korth and Branciforte, 2007). Since the latter has priority for a trivial name, the species was referred to *Kirkomys nebraskensis* which was, in turn, named as the type species of the genus. An emended diagnosis of the genus was presented in Korth and Branciforte (2007).

Kirkomys parvus (Troxell, 1923) new combination
(Figure 1B, C)

Diplolophus parvus Troxell, 1923

Heliscomys parvus (Troxell) Hay, 1930

Mookomys parvus (Troxell) Wood, 1931

Proheteromys parvus (Troxell) Wood, 1935

Type and Only Specimen—YPM 10362, right mandible with incisor and p4-m3.

Probable Age and Horizon—Wood (1935) argued that the holotype of *Kirkomys parvus* (= *Proheteromys parvus*) was from either the Hemingfordian or Barstovian horizons present in northeastern Colorado where the specimen was found. However, its similarity to *K. nebraskensis* from the Whitneyan of Nebraska and the fact that it was originally reported from the "White River" beds of Colorado (Troxell, 1923) suggests that *K. parvus* is from a horizon of similar age to that of *K. nebraskensis* in northeastern Colorado. The most likely horizon would be the Whitneyan Vista Member of the Brule Formation (see Galbreath, 1953:fig. 8; Emry et al., 1987:fig. 5.3).

Diagnosis—Similar in size to *K. nebraskensis*; p4 relatively larger than in *K. nebraskensis* and longer than wide (p4 of *K. nebraskensis* equal in length and width or slightly shorter than wide); lower premolar slightly lower-crowned than in *K. nebraskensis*.

Description—The mandible of the holotype is not complete, lacking the anterior end from approximately the middle of the diastema anteriorly, and lacking all of the posterior processes (coronoid, articular, and angular). The diastema is shallow, dipping slightly below the alveolar margin. The mental foramen is at mid-depth of the mandible below the center of the diastema. The masseteric scar is evidenced by a well-developed ventral ridge arising from the angle of the mandible and gradually reaching a point just ventral to the mental foramen. There is no marking for a dorsal ridge of the masseteric fossa. The ascending ramus originates below m2 and slopes posteriorly, blocking only the posterior half of m3 from lateral view. On the most anteroposterior part of the lateral side of the ascending ramus that is preserved is a slight rise in the bone, indicating the anterior margin of lateral capsule of bone that housed the base of the incisor. A broad, shallow pit separates the tooth row from the ascending ramus medially.

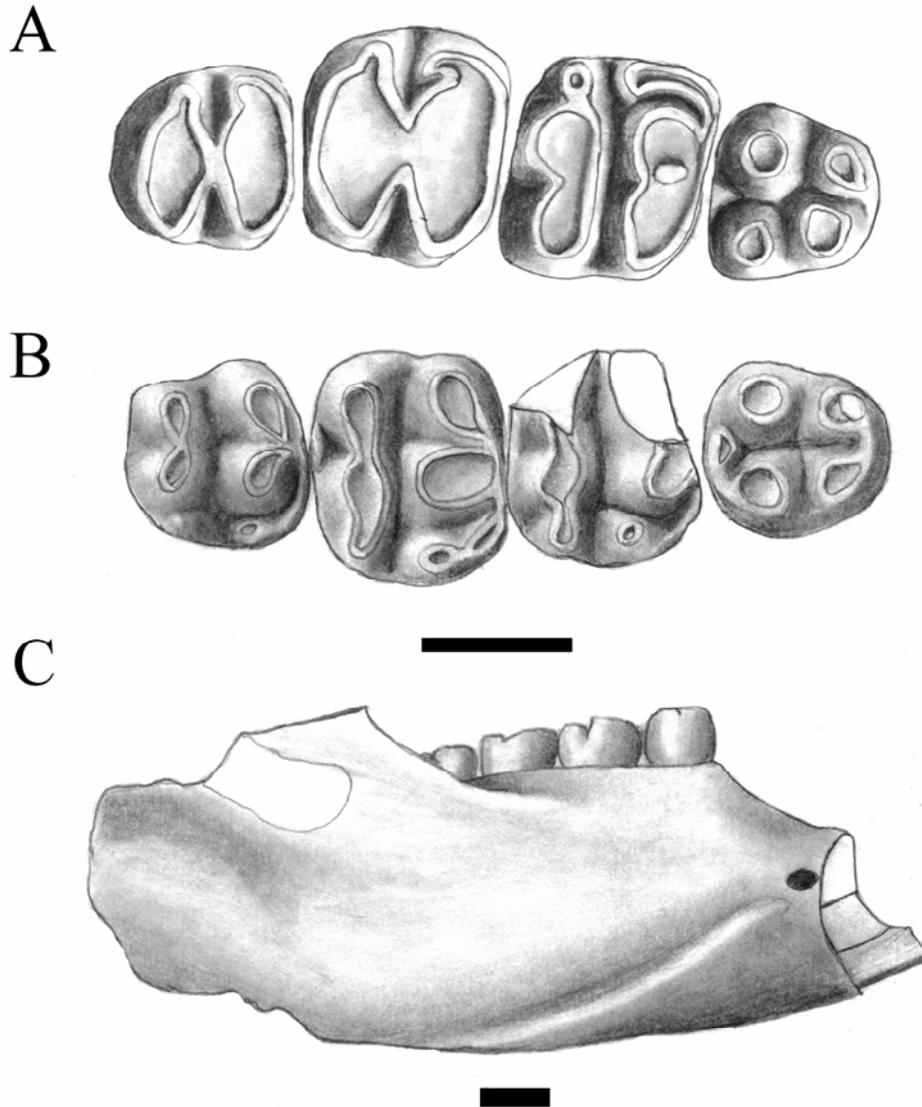


FIGURE 1. Lower dentition and mandible of *Kirkomys*. A, Left p4-m3, *K. nebraskensis*, MCZ 5051 (holotype). B-C, *K. parvus*, YPM 10362 (holotype). B, Occlusal view, right p4-m3. C, Lateral view of mandible. Figure A taken from Korth and Branciforte (2007:fig. 4). Bar scales = 1 mm. Upper scale for teeth, lower scale for mandible.

The cross-section of the lower incisor is much narrower than long and the anterior enamel surface is nearly flat. The enamel extends only slightly onto the medial side and about half the height of the tooth on the lateral side.

The cheek teeth are relatively low crowned; similar in height to those of *Proheteromys*. The crown height index for p4 is 0.46 (Table 1), slightly lower than in *K. nebraskensis*. In the large sample of *K. nebraskensis* from the early Arikareean of Nebraska, the range of crown height for p4 was 0.54-0.71 with a mean of 0.63 (Korth and Branciforte, 2007:table 5).

The premolar has four main cusps aligned in two transverse rows. The protostylid and metaconid make-up the metalophid and are equal in size. They are united anteriorly by a low loph (anterolophid) that connects the anterolingual corner of the protostylid to the anterobuccal corner of the metaconid, enclosing a narrow, anteroposteriorly-oriented valley between the cusps. A deep transverse valley separates the anterior cusps from the cusps of the hypolophid. The hypolophid cusps are equal to one another in size, and slightly larger than the metalophid cusps. This size disparity in the cusps of the two lophs makes the tooth

slightly wider posteriorly. In overall dimensions, the tooth is slightly longer than its greatest width. A distinct hypoconulid is present at the center of the posterior margin of the tooth. It is connected to the hypoconid by the posterolophid which ends lingually at the hypoconulid.

TABLE 1. Measurements of the holotypes of *K. nebraskensis* and *K. parvus*. Abbreviations: L, anteroposterior length; W, transverse width; ht, crown height (measured lingually: see Korth and Branciforte, 2007:fig. 1).

		<i>Kirkomys</i> <i>nebraskensis</i>	<i>Kirkomys</i> <i>parvus</i>
		type MCZ 5051	type YPM 10362
P ₄	L	0.95	1.12
	W	0.99	1.03
	ht/W	0.62	0.46
M ₁	L	1.22	1.25
	W	1.39	1.27
	ht/W	0.38	0.35
M ₂	L	1.25	1.26
	W	1.38	1.43
M ₃	L	1.02	1.07
	W	1.12	1.18
P ₄ -M ₃		4.63	4.83
I1	W	0.94	0.84

The first two lower molars are approximately equal in size and similar in morphology. The lingual cusps on m1 are broken away. The crown height index for m1 is 0.35, slightly less than that for the holotype of *K. nebraskensis* (Table 1), but within the range found in the sample of the latter from the Arikareean of Nebraska (0.31-0.45, mean = 0.38; Korth and Branciforte, 2007:table 5). The metaconid and protoconid are united anteriorly, the protoconid being the larger of the two cusps. The anterior cingulum arises from anterior to the protoconid and wraps around the anterobuccal corner of the tooth, ending in a small, distinct protostylid. On m2, there is a small swelling on the anterior cingulum anterior to the protostylid. The metalophid is separated from the hypolophid by a transverse valley that extends the entire width of the tooth. The cusps of the hypolophid, including the hypostylid, form a straighter line than the metalophid cusps, are united along the center of the cusps (rather than anteriorly), and are slightly anteroposteriorly compressed. On m2, there is a small posterior cingulum along the posterior margin of the tooth between the bases of the entoconid and hypoconid.

The last lower molar is distinctly smaller than m1-m2. The protoconid and metaconid are equal in size and unite anteriorly. The anterior cingulum is

arranged as in the anterior molars, but the protostylid is slightly smaller. The tooth is narrower (transversely) at the hypolophid. The entoconid and hypoconid are united as in the anterior molars, but the cusps are distinctly smaller than the cusps of the metalophid. The hypostylid is markedly smaller on m3 than on the other molars, so it is not continuous with the other hypolophid cusps. Perhaps at very late stages of wear, it may join the hypoconid.

Discussion—The molars of the holotype of *K. parvus* are indistinguishable from the holotype of *K. nebraskensis* in size, morphology, and crown-height (Figure 1). The lower premolar of the former is slightly larger, differently proportioned (longer than wide), and slightly lower crowned, which distinguishes it from *K. nebraskensis*. The proportions and crown height of the premolar in the holotype of *K. parvus* is not duplicated in a large sample of *K. nebraskensis* from the early Arikareean of Nebraska (Korth and Branciforte, 2007:table 5), supporting the assertion that it represents a distinct species.

CONCLUSIONS

The inclusion of "*Diplolophus*" *parvus* in *Kirkomys* as a distinct species increases the diversity and geographic occurrence of this genus. *K. nebraskensis* is known from the Whitneyan and earliest Arikareean of western Nebraska and *K. parvus* possibly from the Whitneyan of northeastern Colorado. The only other occurrence of the genus is an unnamed species from the Whitneyan of southwestern South Dakota, which is distinct from both *K. nebraskensis* and *K. parvus* in its larger size and lower crowned cheek teeth (Korth and Branciforte, 2007:table 6) but will not be named here. The occurrence of three species of *Kirkomys* in the Whitneyan shows a greater diversity of florentiamyids during this time.

Only one species of florentiamyid has been reported from deposits older than Whitneyan, *Ecclesimus tenuiceps* (Galbreath, 1948; Korth, 1989b). Previously, only one species, *K. nebraskensis* (= *K. milleri*) was known from the Whitneyan, but the Florentiamyidae is represented by two genera and as many as 11 species by the Arikareean (Wahlert, 1983). With the recognition of a greater diversity in the Whitneyan, the sudden increase in the number of florentiamyids in the Arikareean is not as dramatic.

ACKNOWLEDGMENTS

The holotype of *Proheteromys nebraskensis* was loaned by permission of C. R. Schaff of the Museum of Comparative Zoology. A cast of the holotype of *Diplolophus parvus* was provided by M. A. Turner of the Yale-Peabody Museum. Access to the Whitneyan

collections at the South Dakota School of Mines and Technology (SDSM) was granted by C. Herbel and J. E. Martin. C. Branciforte, also of SDSM, made the comparative measurements of the samples from Nebraska and South Dakota. The camera-lucida used in the figures was provided by the Geology Department of the State University of New York at Buffalo. Funding for this project was provided in part by private contributions to the Rochester Institute of Vertebrate Paleontology. Earlier versions of this paper were critically read by Drs. R. Emry and A. Kihm.

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