THE LATE PLEISTOCENE ARVICOLINE RODENT *ATOPOMYS*

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INTRODUCTION

The arvicoline genus *Atopomys* was described and named by Patton (1965) on the basis of two M₁'s from a small fissure in Texas, now referred to as Fyllan Cave. The genus is characterized, in part, by small size, confluency of the first and second alternating triangles on the lower molars, and well-developed dentine tracts. It has been suggested that *Atopomys* was derived from the arvicoline *Nebraskomys*, which it resembles primarily in the occlusal pattern (Hibbard, 1970).

Remains of both of these genera are rare in the fossil record. *Nebraskomys* is known from the Rexroad local fauna (late Pliocene of Kansas) and the Sand Draw local fauna (early Pleistocene of Nebraska). *Atopomys* is known from Fyllan Cave (Kansan), the lower levels of Trout Cave in West Virginia, and Cumberland Cave in Maryland (both questionably Illinoian). Additional material has been obtained from Fyllan Cave by Ernest L. Lundelius, Jr., University of Texas at Austin; and from Cumberland Cave as a result of the continuing excavations under the direction of John E. Guilday, Carnegie Museum of Natural History. The Cumberland Cave find became the impetus for this study.

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All additional materials are isolated teeth, but they refine the diagnostic characters and degree of variation expected for the genus. Differences between the Texas and eastern forms prompt the naming of a new species for the latter.

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SYSTEMATIC PALEONTOLOGY

Order Rodentia Bowdich, 1821
Family Arvicolidae Gray, 1821
Genus *Atopomys* Patton, 1965

*type species: Atopomys texensis.*

**HORIZON AND TYPE LOCALITY:** The holotype, an isolated RM, (UTBEG 40682-1), was excavated from a fissure fill in the Edwards formation (Cretaceous) exposed in the Texas Crushed Stone Company quarry on Balcones Trail in Austin, Travis County, Texas. The fissure deposit is composed largely of brown-to-red silty clay of Pleistocene (Kansan) age. The material from the site is referred to as the Fyllan Cave local fauna.

**SUPPORTIVE MATERIAL:** Specimens consist of isolated molars found in Fyllan Cave, Trout Cave (3½ miles southwest of Franklin, Pendleton County, West Virginia), and Cumberland Cave (½ mile south of Corriganville, Allegany County, Maryland). Catalog numbers of the holotype, paratypes, and referred material are listed below.

**EMENDED GENERIC DIAGNOSIS:** A small vole with rooted teeth, cementless re-entrant angles, and well developed dentine tracts (Fig. 1, g, h). The enamel along the occlusal surface is variable in thickness both on and among specimens (Fig. 1).

The M, (Fig. 1, a, g, h) consists of a posterior loop, three alternating triangles, and an anterior loop. The posterior loop is generally closed off from the alternating triangles. The first alternating triangle opens broadly into the second, and in some instances the triangles are almost confluent (directly opposite each other rather than alternating). The relationship between the second and third triangle varies, but generally the third is isolated from the first two, and opens broadly into the anterior loop. The anterior loop is relatively simple, and sometimes slightly crenulated. Occasionally, a nubbin of a fourth triangle is present. Pits and prism folds are absent.
Figure 1. *Atopomys* and *Nebraskomys* isolated molars: a-e, g; *A. salvelinus*; a, M₁, CM24226; b, M₁, CM24544; c, M¹, CM12540; d, M², CM24229; e, M¹, CM24231; g, M₁, holotype, CM20040. h, *A. texensis*, M₁, holotype, UTBEG 40682-1. f, *N. mcgrewi*, M³, UMMP V57227. gl=greatest length; gw=greatest width; th=dentine tract height; dr=depth of second lingual re-entrant angle. Horizontal line=1 mm.
The M₂ (Fig. 1b) consists of a posterior loop and four alternating triangles. The first is confluent with the second, and the third is confluent with the fourth. These sets are separate from each other, imparting a trilophate appearance to the tooth. The tooth is strongly curved labially from its midline toward the roots, which suggests that the lower incisor passes from the lingual to labial side near the M₂. The M₃ is unknown.

The M₁ consists of an anterior loop and four broadly open alternating triangles (Fig. 1c). The enamel along the occlusal surface is variable, ranging inconsistently from thick to thin. A pit is present on one specimen (Fig. 1c). The M₁ generally has two roots, but there is evidence of fusion of the anterior root with a median one, and in one instance three roots are present.

The M₂ consists of an anterior loop and three alternating triangles (Fig. 1d). It has two roots.

The M₃ consists of an anterior loop, two alternating triangles, and a reduced posterior loop (Fig. 1e). The first triangle opens broadly into the second with some suggestion of confluency. The tooth has two roots.

*Atopomys* is distinguished from *Nebraskomys*, the only North American genus it closely resembles, by the occlusal shape of the M₃. In the M₃ of *Nebraskomys* (Fig. 1f) the alternating triangles are not as confluent, nor is the posterior loop as reduced, as in *Atopomys* (Fig. 1e). In *Atopomys* all the teeth are more hypsodont relative to the length of the tooth and the dentine tracts are better developed on the sides of the teeth than they are in *Nebraskomys*.

*Atopomys texensis* Patton, 1965

*Atopomys texensis* Patton, 1965:466-468.

**Microtine indet.** Patton, 1965:468-469.

**Holootype:** RM₁, UTBEG 40682-1
**Paratype:** RM₁, UTBEG 40682-2

**Horizon and Type Locality:** Same as for genus.

**Additional Material:** UTBEG 40682-6, 9, 19, 20, 22, M₁ s; UTBEG 40682-4, 21, M₂ s; UTBEG 40682-3, 5, 14, M₁ s.

**Emended Diagnosis:** *Atopomys texensis* is distinguished from the other species in the genus by its less-developed dentine tracts, slightly more complex anterior loop, and the fact that the second internal reentrant consistently is not as deep on the M₁ (Fig. 1h).

*Atopomys salvelinus*, new species

**Holoype:** CM20040, LM₁. Fig. 1g.

**Horizon and Type Locality:** Nine to 10 feet below the surface from fill in Trout Cave.
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Paratypes: All paratypes are isolated teeth. Trout Cave: 8-9 feet below surface, CM20039 (M,) and CM24544 (M,); 9-10 feet below surface, CM24545 and 24546 (M,s); 10-11 feet below surface, CM20041 and 24547 (M,); CM24548 (M). Cumberland Cave: CM24226 (M,), CM12539, 12542, 12544, and 24230 (M,s), CM12538, 12540, 12541, 12543, 24227 and 24228 (M,s), CM24229 (M), CM24231(M). Atopomys salvelinus is distinguished from A. texensis by its better developed dentine tracts, simpler anterior loop, and deeper second internal re-entrant on the M, (Fig. 1g).

Description of Holotype: The holotype consists of a posterior loop, three alternating triangles, and a simple anterior loop. The posterior loop is closed off from the alternating triangles. The first alternating triangle opens broadly into the second, and the two triangles are almost confluent. The third triangle is closed off from the first two alternating triangles and opens broadly into the anterior loop. The anterior loop is simpler and more oval than in the type series of Atopomys texensis. The enamel is thick and consistent around the occlusal surface. The length is 1.69 mm, width 1.05 mm, height of crown 1.68 mm, and the height of the dentine tract on the posterior loop 1.24 mm. The last measurement is almost twice that of the type of A. texensis, which measures 0.66 mm.

Etymology: Salvelinus is the generic name for the brook trout (Pisces) and is used here in a geographic sense to refer to Trout Cave.

Inter- and intra-specific variation: The general occlusal pattern of the teeth was described in the generic diagnosis. One of the major differences between the two species is that the M, s of Atopomys texensis have an anterior loop that is slightly more complex. Four of the five undamaged M, s of A. texensis exhibit crenulations or additional small re-entrants. In the holotype (Fig. 1h) and paratype a rectangular-shaped nubbin that could be interpreted as a fourth triangle is present. This nubbin is separated from the anterior loop by a shallow re-entrant. Patton (1965) incorrectly considered this re-entrant to represent a prism fold. A true prism fold, if present, would be found on the rectangular nubbin. Although these crenulations are lost relatively rapidly in the ontogeny of A. texensis, they do not represent ontogenetic differences between it and A. salvelinus, because specimens of similar ontogenetic age in the latter taxon lack any crenulations on the anterior loop. In fact, in A. salvelinus there appears to be a reduction of the anterior loop in the sense that the third triangle becomes incorporated into the loop in some instances. This feature can best be seen in CM24226, the M, from Cumberland Cave (Fig. 1a). Differences in mensural data for M, (Fig. 1h) are shown in Table 1.

The M1 that Patton (1965) described as “Microtine indet,” because its enamel is differentiated into thin and thick tracts and because its dentine tracts are high, is considered to pertain to the genus Atopomys. Examination of additional M's revealed that the enamel is dif-
differentiated on these teeth, as in Patton’s original specimen, and that the differentiation is not consistent as to location of thickness.

Another interesting character found on one of the M’s (CM12540) of *A. salvelinus* from the Cumberland Cave is the presence of a shallow enamel pit between the first and second alternating triangles (Fig. 1c). This is the first arvicoline tooth, other than an M₁ or M³, that I have seen with an enamel pit on the occlusal surface.

**RELATIONSHIPS:** Although *Atopomys salvelinus* is more advanced than *A. texensis* with regard to development of dentine tracts, the relatively simple nature of the anterior loop in the former suggests that *A. texensis* is not directly ancestral to *A. salvelinus*. While it is not impossible for a simpler pattern to be derived from a relatively more complex one, this would be the first evidence of such a trend in the evolution of the arvicolines. A similar argument could be used in considering the ancestral relationship of *Nebraskomys* to *Atopomys*. Reduction in the length of the M₁ and in loop development on the M³ must have occurred if the former gave rise to the latter. Again, while this would not be impossible, it would be unprecedented in arvicoline phylogeny. Therefore, it seems probable the resemblance in the occlusal pattern between *Nebraskomys* and *Atopomys* is the result of parallelism.

**HABITAT AND CORRELATION**

Because *Atopomys* is rare and the local faunas in which it is found are not well understood, the habitat preferences of the genus cannot be established with any certainty at this time.

Guilday (personal communication) reports that the Trout Cave material was discovered between the 8- and 10-foot levels of a 12-foot-deep stratified sequence. A poorly-defined flowstone at the 5-foot level separates the 12-foot sequence into two lithic units. Many of the taxa found below the flowstone are equivalent to those found in the Cumberland Cave local fauna.

The Cumberland Cave local fauna is definitely pre-Wisconsin in age and thought to be Illinoian (Guilday, 1971). Guilday (personal communication) reports that a date of 250,000 B.P. has been obtained for the Cumberland Cave local fauna based on the racimization of amino acids in a horse phalanx. But, because this process is temperature-dependent, the date should be considered as a minimum one. White (1970) suggests a middle Illinoian age or older for those faunas, e.g., the Cumberland Cave, that contain the erethizonid genus *Coendu*.

Patton (1965) tentatively considered the Fyllan Cave local fauna to be Kansan in age. Hibbard had suggested this age to him as a maximum, a conclusion based on the stage of evolution of the rabbits in the Fyllan Cave local fauna, and supported by the presence of *Pedomys llanensis* in that fauna. *P. llanensis* is known from the Cudahy local fauna (Kansan) of Kansas and its equivalents in the Great Plains.
If the Cumberland Cave local fauna had been located on the Great Plains, the association of *Ondatra annecens*, *Neofiber*, and *Atopomys*, and the lack of *Microtus pennsylvanicus*, would suggest a pre-Illinoian age. Because of the geographic position of Cumberland Cave and the lack of other pre-Wisconsin faunas in the area with which it can be compared, the determination of the exact age is moot.

### TABLE 1. Measurements (in mm) of M₁ in *Atopomys* and *Nebraskomys*

| Taxon               | N  | O. R.         | X  | Sₓ      | S. D. |
|---------------------|----|---------------|----|---------|-------|
| Greatest length     |    |               |    |         |       |
| *A. salvelinus*     | 7  | 1.45-1.72     | 1.64| 0.04    | 0.10  |
| *A. texensis*       | 4  | 1.63-1.91     | 1.76| 0.06    | 0.12  |
| *N. mcgrewi*        | 4  | 2.07-2.28     | 2.15| 0.04    | 0.09  |
| *N. rexroadi*       | 1  | 2.16          |    |         |       |
| Greatest width      |    |               |    |         |       |
| *A. salvelinus*     | 5  | 0.77-1.12     | 0.99| 0.06    | 0.14  |
| *A. texensis*       | 6  | 0.85-1.08     | 0.92| 0.04    | 0.09  |
| *N. mcgrewi*        | 4  | 1.13-1.29     | 1.19| 0.04    | 0.08  |
| *N. rexroadi*       | 1  | 1.17          |    |         |       |
| Dentine tract height (see fig. 1h) |    |               |    |         |       |
| *A. salvelinus*     | 4  | 1.24-1.42     | 1.34| 0.05    | 0.09  |
| *A. texensis*       | 4  | 0.60-0.74     | 0.68| 0.03    | 0.06  |
| *N. mcgrewi*        | 3  | 0.48-0.49     | 0.49| 0.00    | 0.01  |
| *N. rexroadi*       | 1  | 0.16          |    |         |       |
| Depth of second lingual re-entrant angle (see fig. 1h) |    |               |    |         |       |
| *A. salvelinus*     | 7  | 0.00-0.19     | 0.14| 0.03    | 0.07  |
| *A. texensis*       | 5  | 0.24-0.32     | 0.28| 0.02    | 0.04  |
| *N. mcgrewi*        | 4  | 0.22-0.27     | 0.24| 0.01    | 0.02  |
| *N. rexroadi*       | 1  | 0.26          |    |         |       |

N=sample size; O.R.=observed range; X=mean; Sₓ=standard error of mean; S.D.= standard deviation.

### REFERENCES CITED

**GUILDAY, J. E.**

1971. The Pleistocene history of the Appalachian mammal fauna. *In* Holt, P. C. (ed.), The distributional history of the biota of the southern Appalachians. Part III: Vertebrates. Va. Poly. Inst. & State Univ. Research Div., Mono. 4: 233-262.

**HIBBARD, C. W.**

1970. A new microtine from the upper Pliocene of Kansas. Contrib. Mus. Paleont., Univ. Mich., 23: 99-103.

**PATTON, T. H.**

1965: A new genus of fossil microtine from Texas. Jour. Mammal., 46: 466-471.

**WHITE, J. A.**

1970. Late Cenozoic porcupines (Mammalia, Erethizontidae) of North America. Amer. Mus. Novitates, 2421: 1-15.
Zakrzewski, Richard J. 1975. "The late Pleistocene arvicoline rodent Atopomys." *Annals of the Carnegie Museum* 45, 255–261.

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