

**A LATE PLEISTOCENE RECORD OF THE HEATHER VOLE
(*PHENACOMYS INTERMEDIUS*) IN THE NASHVILLE BASIN, TENNESSEE**

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ABSTRACT

Remains of the heather vole, (*Phenacomys intermedius*), consisting of four isolated molars and sections of three jaws and one maxilla containing partial dentitions, were recovered in 1978 in the late Pleistocene levels of Cheek Bend Cave, Maury County, Tennessee. This record of the heather vole from Middle Tennessee constitutes the southernmost occurrence of this species in eastern North America and suggests that its former distribution in the state in suitable mountain and river bluff habitat correlates with prevailing climax spruce forests at the end of the last glaciation.

INTRODUCTION

Several small rock shelters situated in the Duck River bluffs were tested for aboriginal occupation during archaeological survey work in 1978 in the proposed Tennessee Valley Authority Columbia Reservoir area. One of these, Cheek Bend Cave (40MU261), is located approximately 13 km ESE of the city of Columbia, Maury County, and testing (three 1 × 2 m excavation units) showed it to contain stratified deposits of bone and shell to a depth of approximately 4.5 m. On the basis of the species composition within and among strata, differing fill zones, and certain other stratigraphic features, the deposit reflects two distinct and well-defined major episodes of fill. The top 2 m represent the Holocene stage and contain, on the basis of preliminary determinations, remains of only extant modern species. In contrast, the faunal assemblage in the bottom 2 m, although it includes some species that still inhabit the cave area (deciduous—Western Mesophytic Forest), contains many that are now extirpated and reflect a prairie habitat (prairie chicken, *Tympanuchus cupido*; thirteen-lined ground squirrel, *Spermophilus tridecemlineatus*; pocket gopher, *Geomys* sp.) and/or a boreal environment (e.g. arctic shrew, *Sorex arcticus*; water shrew, *Sorex palustris*; red-backed vole, *Clethrionomys gapperi*; yellow-cheeked vole, *Microtus xanthognathus*; red squirrel, *Tamiasciurus hudsonicus*; northern flying

P. intermedius appears to be adaptable to a greater variety of habitat conditions than most species of voles. In his summary of habitat descriptions recorded in the literature, Foster (1961) noted that dryness was mentioned in 80 percent of the references, proximity to water 29 percent, wet habitats 20 percent, spruce and pine 32 percent, and grass 16 percent. One or more of the diversified habitats found in the immediate vicinity of Cheek Bend Cave (dry bluff tops probably covered with xeric vegetation including grasses and some trees, heavily wooded bluff faces and talus, narrow flood plain along the Duck River) would have been suitable for the heather vole.

METHODS

Cave fill from two of the three 1 × 2 m columns was removed in arbitrary 10 cm levels; fill from the third (middle) column was excavated according to natural strata. Layers or pockets consisting of uniform deposits of silt, rock particles and faunal materials, or combinations of other naturally deposited debris were removed separately. These natural lenses were then correlated with the arbitrary levels from the other two columns in an effort to establish an accurate depositional pattern through time. All material was water screened (approximately 1.5 mm mesh screen) at the site; initial sorting of the bone, shell, and plant remains from the gravel matrix was undertaken at the archaeology field headquarters near Columbia and in the laboratory in the Department of Anthropology, University of Tennessee, Knoxville. Several hundred thousand pieces of bone, representing a minimum of 120 species identified thus far, were obtained from the three excavated columns. Species identifications were made using the comparative osteological collections housed in the Zooarchaeology Section, Department of Anthropology, University of Tennessee, Knoxville. Archaeologically recovered specimens are curated in the Department of Anthropology (40MU261;22-78, 29-78, 30-78, 84-78).

RESULTS

with M_1 , one left jaw with M_{1-2} , one right jaw with M_{1-2} , two right M_1 , one left M_1 , one left maxilla section with M^1 , one left M^1 (Fig. 1). Judging from molar size and degree of wear, five or six individuals are represented.

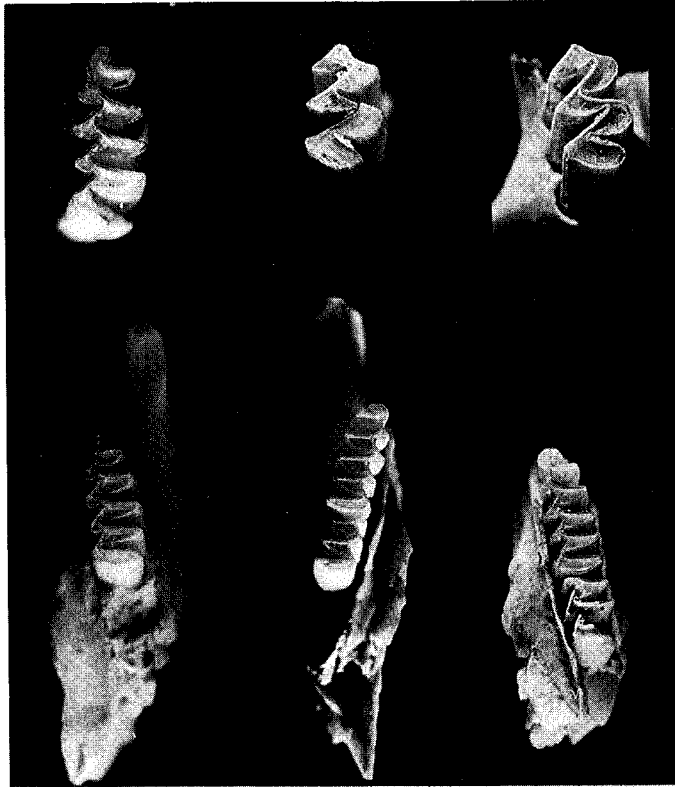


FIG. 1. *Phenacomys intermedius* from Cheek Bend Cave, Maury County, Tennessee. Top row: left, left M_1 ; center, left M_2 ; right, maxilla section with left M_2 . Bottom row: left, left jaw with M_1 ; center, right jaw with M_{1-2} ; right, left jaw with M_{1-2} . Scale: top row $\times 15$, bottom row $\times 10$.

DISCUSSION

Although no longer found in eastern United States, remains of the heather vole have been reported from 17 late Pleistocene-early Holocene cave sites in 10 states east of the Great Plains and as far south as northern Arkansas and northeast Tennessee (Guilday and Parmalee, 1972; Guilday et al., 1978). *P. intermedius*, like the boreal red-backed vole with which it is often associated in cave deposits, has rooted molars and consequently is not well suited to a diet of grasses (Guilday et al., 1977). With reference to its present status in Canada, Banfield (1974) comments that "Most have been taken in dry, open coniferous forests of pine or spruce with an understory of heaths . . . usually near water. Another favorite habitat seems to be shrubby vegetation on the borders of forests and in moist, mossy meadows." Food of the heather vole varies from bark and buds of shrubs in winter to a variety of berries, seeds, and green

foliage of such plants as blueberry, willow, and dwarf birch in summer.

There are three previous paleofaunal records of *P. intermedius* from Sullivan County, Tennessee (Guy Wilson Cave, Carrier Quarry Cave, Baker Bluff Cave) in the extreme northeastern section of the state. As Guilday and Parmalee (1972) have pointed out, based on the Baker Bluff and Guy Wilson sites, the heather vole occurred in the Ridge and Valley section of the south-central Appalachians as far south as latitude 36° . In the Cumberland Plateau, Guilday et al. (1971) recorded *P. intermedius* from Welsh Cave, Woodford County, Kentucky; however, for some reason it was absent in the extensive microtine fauna from Robinson Cave, Overton County, Tennessee which is located approximately 209 km S of Welsh Cave (Guilday and Parmalee, 1972). In view of this fact, the presence of heather vole in the Cheek Bend Cave deposit is especially noteworthy since the Maury County cave is located within the Nashville Basin approximately 62 km SW of Robinson Cave, latitude $35^\circ 50'$ (Fig. 2).

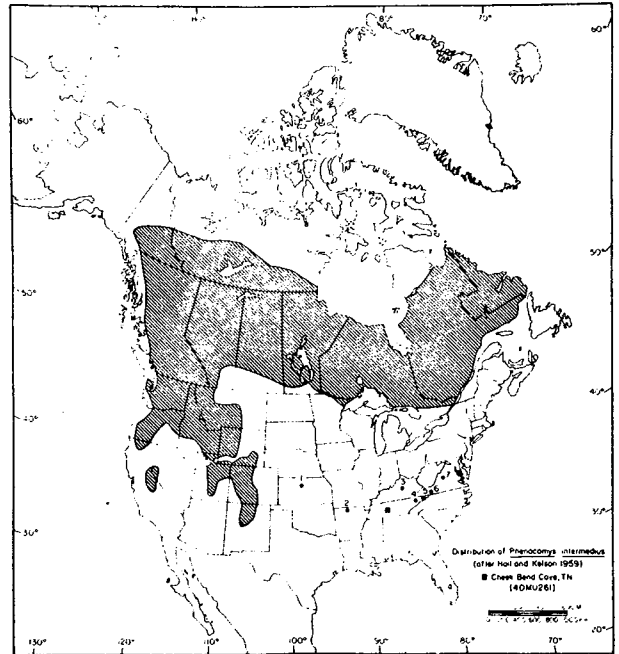


FIG. 2. Shaded area of outline map represents present distribution of *Phenacomys intermedius* in North America (adapted from Hall and Kelson, 1959). Numbered dots signify the most southern and eastern records of "*P. intermedius*" (from Guilday and Parmalee, 1972). 1, Cudahy fauna (Kansas), Lincoln Co., KS; 2, Peccary Cave, Newton Co., AR; 3, Welch Cave, Woodford Co., KY; 4, Guy Wilson Cave, Sullivan Co., TN; 5, Baker Bluff Cave, Sullivan Co., TN.; 6, Meadowview Cave, Washington Co., VA; 7, Natural Chimneys, Augusta Co., VA.

In a recent study dealing with the late Pleistocene vegetation of the eastern Highland Rim and Cumberland Plateau, Delcourt (1979) was able to show several

major vegetational changes that took place during the past 25,000 years, based on the analyses of pollen recovered from sediment cores from Anderson Pond (White County) and Mingo Pond (Franklin County). During the Late Wisconsinan glacial maximum (19,000 to 16,300 years BP) boreal taxa of jack pine, spruce, and fir were dominant, and "Between 16500 and 12500 yr BP, mixed coniferous deciduous forests covered the landscape between 34°N and 37° N latitude" (Delcourt, 1979). As previously mentioned, remains of other predominately boreal small mammals such as the red-backed vole, yellow-cheeked vole, northern flying squirrel, arctic shrew, and water shrew were recovered along with those of *P. intermedius* in the lower Pleistocene levels of Cheek Bend Cave. This assemblage, similar to others reported from such sites as Baker Bluff Cave (Guilday et al., 1978), coincides with climatic conditions characterized by somewhat lower summer temperature extremes than exist today and a climax vegetation dominated by coniferous forests. The beginning of moderating temperatures after 16,000 years BP brought about a gradual replacement of the spruce-fir-pine climax by a deciduous forest. Boreal insectivores and rodents such as *P. intermedius* which are typically associated with a cool coniferous forest habitat in eastern North America were gradually extirpated throughout most of the southern regions of their range during the late Pleistocene-early Holocene.

ACKNOWLEDGMENTS

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SEXUAL DIMORPHISM IN THE PELVIC GIRDLE OF THE PRAIRIE VOLE,
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ABSTRACT

The pelvic girdle of adult male prairie voles differ from adult females. The major differences are the shape of the ischium and the width and length of the pubis.

INTRODUCTION

Sex and relative age can be determined by the shape of the pelvic girdle of many rodents. Shape differences attributable to sex in the pelvic girdle have been described for several microtines: *Microtus pennsylvanicus* (Guilday, 1951), *Lemus trimucronatus* and *Microtus californicus* (Dunmire, 1955), and *Clethrionomys glareolus* and *Microtus agrestis* (Brown and Twigg, 1969). Studies have been made on other rodents by Hisaw (1924), Gardner (1936), Dunmire (1955), and Brown and Twigg (1969), but no study of a member of the subgenus *Pedomys* has been undertaken.

METHODS

The posterior ischial shape and pubic measurements were taken on 54 adult male and 47 adult female (1 1/2 months or older following Hoffmeister and Getz, 1969) from localities in eastern Illinois and western Indiana. The developmental changes were examined using a known age, captive population of 73 male and 63 female skeletons from Macoupin County, Illinois. This series of one- to twelve-month-old specimens was examined using linear regression for each parameter.

Measurements used in this study are those of Dunmire (1955); pubis width (p) is the thinnest width of the pubis, ischial length (b) is the distance from the posterior angle of the ischium to the nearest edge of the acetabulum, and the pubis length (a) is the distance from the ventral apex of the pubis to the nearest edge of the acetabulum (Fig. 1).

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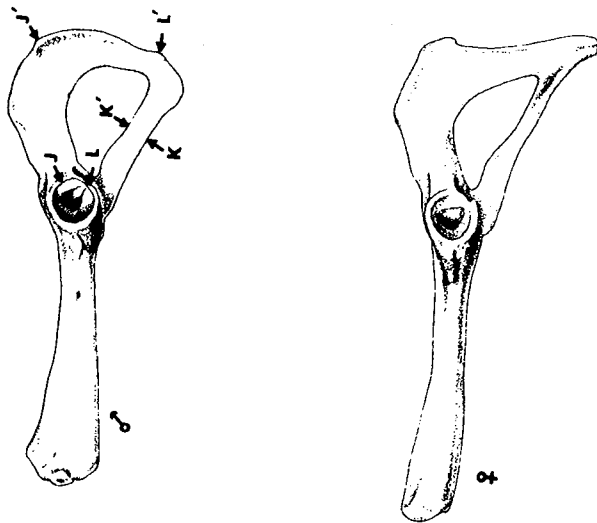


FIG. 1. Lateral views of left innominate bones. Descending portions of the ischia to the far right. Note convexity of descending portion of the ischium (male, UIMNH 44745) and concavity (female, UIMNH 44746). KK', pubis width (p); JJ', ischial length (b); and LL', pubis length (a).

RESULTS

It is possible to delineate males from females of *Microtus ochrogaster* by observing the descending portion of the ischium. The males have a convex shape and the females have a concave shape (Fig. 1). In individuals where the condition of the descending portion of the ischium could not be determined to be concave or convex, the sexes could be separated by plotting the b/a ratio against the width of the pubis as did Brown and Twigg (1969) for various other rodents. Males have a distinctly wider pubis (see Fig. 1, K-K') with the b/a ratio being smaller than that of the females (Fig. 2).

The width of the pubic in females decreases with age slightly ($y = 0.4974 - 0.0035x$) compared to that of the males which increases ($y = 0.6308 + 0.0211x$) at a more rapid rate. There is initially a difference in their widths with males being approximately 0.13 mm wider. The length of the pubis (see Fig. 1, L-L'), is initially virtually equal between the sexes. However, at one month of age, the growth rate of males ($y = 5.1227 + 0.1388x$) increases at a more rapid rate than that of the females ($y = 5.0933 + 0.0851x$). In the females ($y = 6.8163 + 0.1605x$), the length of the ischium

is almost 0.5 mm longer than that of the males ($y = 6.2262 + 0.0935x$) of the same age. For the first twelve months, the length of the ischium increases in females almost twice as fast as the increase of length in males.

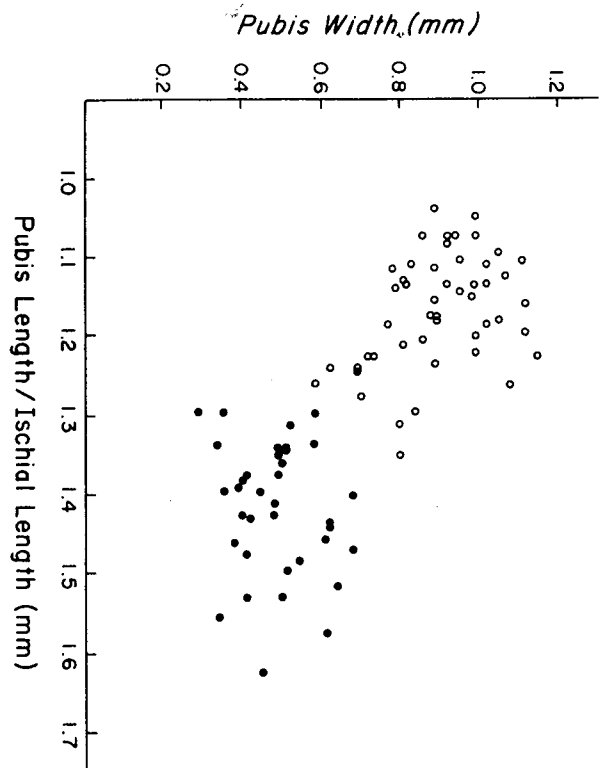


FIG. 2. Scattergram showing difference in Pubis Length/Ischial Length and Pubis Width between male (open circles) and female (solid circles) *Microtus ochrogaster*.

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