

SHORT PAPER

Zooarchaeological Evidence of Prairie Taxa in Central Missouri during the Mid-Holocene

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Previous studies report that remains of prairie taxa are common in western Missouri archaeological sites. There is no reported evidence of prairie taxa, such as *Bos bison*, from sites within the northern Ozark Highlands of Missouri. New data indicate that prairie taxa inhabited the area during the warm and dry mid-Holocene (8500–5000 ¹⁴C yr B.P.). Evidence suggests prairie taxa were farther east and south than previously documented in central Missouri and underscores the importance of biogeographic data in studies of prehistoric environments. © 2002 University of Washington.

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INTRODUCTION

Habitat preferences of modern mammals are used here to understand mid-Holocene environment in Missouri. The archaeofaunal presence of remains of modern prairie taxa is assumed to reflect that local habitat was open and grassy in the past. However, few remains of grassland taxa have been recovered from central Missouri sites. Now, fossils from three sites in central Missouri—Graham Cave (23MT2), Arnold Research Cave (23CY64), and Little Freeman Cave (23PU565) (Fig. 1)—challenge this finding and provide additional constraints for Holocene ecological and climatological conditions there. Today Graham and Arnold Research caves are located between patchy prairie habitat to the north and the Ozark Highlands to the south and Little Freeman Cave is within the Ozarks. It is thought that these sites were near the forest–prairie border or within deciduous forest of the Ozark Highlands during the Holocene (Klippel, 1971; O’Brien, 2001).

From 8500 to 5000 ¹⁴C yr B.P. climate was warm and dry in the Midwest compared to more recent conditions. The effects of mid-Holocene climate are diverse, but grasslands expanded in western and northern Missouri (King, 1980; Royall *et al.*, 1991; but see Baker *et al.*, 1990; Chumbley *et al.*, 1990). Remains of prairie taxa are common in Holocene sites from west-

ern Missouri (Table 1); however, less is known concerning the distribution of such taxa in central Missouri. Local effects of mid-Holocene climate are poorly understood because lines of evidence are few (e.g., local pollen sequences). The specimens discussed below illustrate the biogeographic potential of rare, securely dated faunal remains.

PRAIRIE TAXA

Archaeofaunal remains of three taxa described as prairie dwellers (e.g., Lindzey, 1982; Reynolds *et al.*, 1982; Meagher, 1986; Purdue and Styles, 1987) shed light on mid-Holocene climate in central Missouri. Badgers (*Taxidea taxus*), although they inhabit parts of the Midwest, “are generally associated with treeless regions, prairies, parklands, and cold desert areas” (Lindzey, 1982, p. 653). Remains of badger were found at Graham Cave (Klippel, 1971). Although bison (*Bos bison*) browse, they are primarily prairie grazers (Reynolds *et al.*, 1982). Wolverton (2001) identified one bison specimen from Arnold Research Cave, and Styles and White (1997) identified one from Little Freeman Cave. The spotted skunk (*Spilogale putorius*) occurs in parts of the southern United States and throughout the eastern Great Plains. Within Missouri, spotted skunks are found in open, rocky, brushy habitat in proximity to cover but not in dense woodlands (Howard and Marsh, 1982). Although Schwartz and Schwartz (1981) indicate that spotted skunks occur in the Missouri Ozarks historically, they are rare and tend to live in grassland areas. Wolverton (2001) identified two specimens of spotted skunk from Arnold Research Cave, and two specimens from Little Freeman Cave were securely identified to species by Styles and White (1997).

Members of these taxa do not live exclusively in grasslands, but they prefer prairie habitat. A potential problem in using archaeological remains to monitor environmental change is that people might have transported carcasses to central Missouri from other areas. However, as prey, badger and spotted skunk offer low caloric returns and it is unlikely that carcasses of either would have been transported far. Although hides may have been



FIG. 1. Map of Missouri showing the locations of Arnold Research Cave, Graham Cave, Little Freeman Cave, and Rodgers Shelter. The modern gradual transition between Ozark Highland deciduous forests to the south and patchy grassland to the north is in the rough vicinity of Arnold Research and Graham caves.

transported, fossils of these taxa probably reflect their local presence in the past.

The presence of bison is more problematic. Carcasses of these high-caloric-benefit prey could have been transported great dis-

TABLE 1

Sites in Western Missouri with Holocene Remains of *Spilogale putorius*, *Bison bison*, and/or *Taxidea taxus* (after Purdue and Styles, 1987)

Site	Age ^{14}C yr B.P.	County
Rodgers Shelter	8500–5000	Benton
Fisher-Gabert	5000–2800	Hickory
Mellor		Saline
Lutz Bluff Shelter	1300–800	Cooper
Beck Shelter		Hickory
Bryant Cave		St. Clair
Magnolia Spring Shelter		St. Clair
Rocky Hollow Shelter		St. Clair
Vista Shelter		St. Clair
Gumbo Point	400–100	Saline
Utz		Saline
Historic Observation	Recent	Western Missouri

tances because it was worth the effort. This may be the case at Arnold Research Cave, where one proximal femur fragment was found. The femur represents a particularly high food-value body part. Yet given what we know about Holocene climate and vegetation in the Midwest, it is reasonable to assume that bison were in or near central Missouri during different periods within the Holocene (McMillan and Klippel, 1981; Purdue and Styles, 1987). The specimen from Little Freeman Cave is a low-food-value foot bone (the distal calcaneus epiphysis) and is unlikely to have been transported far unless it was attached to a limb bone or carried in carnivore scat.

Previous research on mid-Holocene faunas from central Missouri suggests that patches of grassland opened within forests during the period (McMillan and Klippel, 1981). This interpretation is based in part on increases in the abundance of white-tailed deer and cottontail rabbit remains at Graham Cave (Klippel, 1971). Both species prefer forest edge (Chapman *et al.*, 1980; Williamson and Hirth, 1985); however, there is little evidence of prairie taxa in central Missouri sites. Archaeofaunal interpretations that forest-prairie edge increased during the mid-Holocene have thus relied on indirect evidence that grasslands expanded. Evidence from sites discussed here suggests prairie

taxa inhabited central Missouri from 8500 to 5000 yr ago, thus bolstering claims that open habitat increased.

IDENTIFICATIONS

Archaeofaunal specimens from these caves were identified through comparison to modern specimens and according to criteria discussed below. Remains of badger (number of identified specimens [NISP] = 3) are reported at Graham Cave in Level 5A by Klippel (1971). Although parts of the deposit at Graham Cave are disturbed, Level 5A is within relatively consolidated stratigraphic Zone III. Four dates on charcoal from Zone III range between 8800 and 6800 ^{14}C yr B.P. (Table 2). Dry conditions in the cave resulted in excellent preservation of bone. Styles and White (1997) identified a bison calcaneus and two specimens of spotted skunk at Little Freeman Cave from mid-Holocene cultural deposits (Table 2). The stratigraphic sequence at the site is intact, and the site was carefully excavated (Ahler *et al.*, 1997). In this multicomponent site, which spans the Holocene, remains securely identified as *Spilogale putorius* and *Bos bison* are present only in late Early Archaic and late Middle Archaic deposits (Table 2), both of which are mid-Holocene (Styles and White, 1997, p. 182). Three securely identified prairie chicken (*Tympanuchos cupido*) specimens were also recovered in the Early and Middle Archaic deposits at the cave (Table 2).

The cultural deposit at Arnold Research Cave is disturbed (Wolverton, 2001), but preservation of bone and other organic materials within the cave is excellent (Kuttruff *et al.*, 1998). The bison proximal left femur fragment from Arnold Research Cave was identified by criteria outlined by Balkwill and Cumbaa (1992; Fig. 2A), and an accelerator mass spectrometry (AMS) date on collagen from the specimen produced an age of $7016 \pm 71^{14}\text{C}$ yr B.P. Spotted skunk remains were difficult to identify because of the preponderance of striped-skunk remains in the Arnold Research Cave fauna (NISP = 257). Spotted and striped skunks can be distinguished by the following characteristics: 1) spotted skunks tend to be smaller than striped skunks; 2) spotted skunks lack a conspicuous notch on the posterior base of the mandible that is present in striped skunks; and 3) frontal crania of spotted skunks are flatter and less protruding than those of striped skunks (Schwartz and Schwartz, 1981).

These characteristics were used to identify the left mandible from Arnold Research Cave (Fig. 2B). An AMS date on collagen from the mandible produced an age of $7937 \pm 78^{14}\text{C}$ yr B.P. A spotted skunk cranium, the only other specimen identified to *Spilogale putorius* in the Arnold Research Cave fauna, dates to $1171 \pm 54^{14}\text{C}$ yr B.P., which falls within a late Holocene warming event—from roughly 1300 to 800 ^{14}C yr B.P. The Arnold Research Cave cranium potentially corresponds to Late Woodland period (1600–1100 ^{14}C yr B.P.) remains from Little Freeman Cave tentatively identified as spotted skunk (cf. *Spilogale*

TABLE 2
Remains of Prairie Taxa Dated to the Mid-Holocene from Central Missouri Caves

Site	Taxon	(NISP)	Age, ^{14}C yr B.P.
Arnold Research Cave 23CY64 (Wolverton, 2001)	<i>Spilogale putorius</i>	(1)	7937 ± 78 (AA40213)
	<i>Bos bison</i>	(1)	7016 ± 71 (AA38930)
Graham Cave 23MT2 (Klippel, 1971)	<i>Taxidea taxus</i>	(3)	6800 ± 120 (I-5220)
			7360 ± 125 (I-5219)
			7900 ± 500 (M-132)
			8830 ± 500 (M-131)
Little Freeman Cave 23PU565 (Styles and White, 1997)	<i>Spilogale putorius</i> *	(2)	Stratum 4: Test Unit 3 8400–8000 (Late Early Archaic Deposit)
	<i>Bos bison</i>	(1)	Stratum 3: Test Unit 3 6000–5000
	<i>Tympanuchos cupido</i> *	(1)	Stratum 4A: Test Unit 8 6000–5000 (Late Middle Archaic Deposit)
		(1)	Stratum 1 (Zone B): Test Unit 4 9800–8000 (Early Archaic Deposit)**
		(1)	Stratum 5 (or below): Test Unit 3 9800–8000 (Early Archaic Deposit)**

* Tentative identifications (e.g., cf. *Spilogale putorius*) by Styles and White (1997) are not included in this table.

** These specimens potentially date to the mid-Holocene but were recovered in deposits that span the early and middle Holocene.

NISP = number of identified specimens.



FIG. 2. The proximal left bison femur (a) from Arnold Research Cave dates to approximately 7000 ^{14}C yr B.P. The left spotted skunk mandible (b) from Arnold Research Cave dates to roughly 7900 ^{14}C yr B.P. Notice the lack of a prominent notch along the ventral, posterior portion of the mandible, which is useful in separating spotted skunk mandibles from those of similar striped skunks (see description in text).

putorius; NISP = 1) and securely identified to *Tympanuchos cupido* (NISP = 1; Styles and White, 1997).

DISCUSSION

Archaeofaunal remains of prairie taxa from central Missouri sites are rare and might have been transported from other areas. However, in these sizeable archaeofaunas (several thousand NISP each) the few remains of prairie taxa date primarily to the mid-Holocene. This is in marked contrast to western Missouri where remains of prairie taxa are more common in archaeofaunas (Table 1). One inference is that uplands opened into patchy grassland in the northern and western Ozarks during the mid-Holocene. This proposition is supported by recently

AMS-dated pronghorn (*Antilocapra americana*) remains from Brynjulfson Cave, which lies roughly 50 km west of Arnold Research Cave (Parmalee and Oesch, 1972). The remains date to the mid-Holocene (Russell W. Graham, personal communication) and indicate the presence of another mammalian prairie taxon in central Missouri.

A handful of sites have been examined, and the discussion here is based on few specimens. Yet these few specimens are indeed from central Missouri and they date to the mid-Holocene, adding constraints to our understanding of Holocene environments in Missouri. In particular, dry and warm climate appears to have opened forests and created more grassland in the vicinities of these caves. This interpretation corroborates earlier work on the high abundance of edge-preferring taxa during the same period in central Missouri.

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