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WISCONSINAN) OF MEADE COUNTY, KANSAS**

BY

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SNAKES FROM THE ROBERT LOCAL FAUNA (LATE WISCONSINAN) OF MEADE COUNTY, KANSAS

By

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Abstract.—Ten species of snakes from the late Wisconsinan Robert local fauna of Meade County, Kansas, mainly represent species that live in the area today; in contrast to the mammalian fossil fauna which has several northern extralimital species. Since High Plains northerly occurring snakes have broad ranges in the south, movement of northern populations would be impossible to detect in the fossil record. Somewhat cooler summers would allow the northern mammals to have lived in the area, but summers could not have been too cool or the fossil snake fauna would not have survived.

INTRODUCTION

Late Wisconsinan Appalachian mammalian faunas typically contain many northern extralimital species, leading to the hypothesis that the climate was a tundra-like or boreal-like one. But the herpetofaunas of these sites are often similar or identical to those inhabiting the areas today, posing an interpretive dilemma (Fay, 1984; Holman, 1985a; Lundelius et al., 1983). The lack of tight stratigraphic control in these Appalachian faunas, many of which are in cave or fissure fillings, has led to the suspicion among some workers that the herpetological species represent intrusive elements into the faunas, and that many of the amphibians and reptiles were not contemporaneous with the mammalian species.

Thus the occurrence of a moderately large fossil snake fauna, stratigraphically in context with a mammalian and snail fauna with a Carbon-14 date of $11,100 \pm 390$ ybp is of considerable importance; especially in the light of the fact that the mammalian fauna contains extralimital northern species (Schultz, 1967). The identification and interpretation of this snake fauna, heretofore unreported from the Robert local fauna of Meade County, Kansas, is thus the purpose of the present paper. Again, the snake fauna differs markedly from the mammalian fauna, consisting mainly of serpents that occur in or near the area today. A hypothesis of this situation, as well as for the parallel situations in the late Wisconsinan faunas of the Appalachians is suggested.

The Robert Local Fauna

The Robert local fauna (Schultz, 1967, p. 332-335) lies at the top of the stratigraphic section near Butler Spring in the SW 1/4, SW 1/4, Sec. 33, T 34 S, R 29 W, Meade County, Kansas. It lies 24.4 meters above the Cragin Quarry faunal horizon and occurs in a dark gray zone that is .3

meters thick. This zone is thought to represent an old marsh deposit (Schultz, 1967, p. 332). Terrestrial snails from this bed (*Succinea ovalis* Say) yielded radiocarbon date of $11,100 \pm 390$ ybp (SM-762). This local fauna is therefore of quite late Wisconsinan age.

Invertebrates identified from the site are molluscs: *Succinea ovalis* Say; ostracods: *Eucypris meadensis* Gutentag and Benson, *Cypridopsis vidua* (O.F. Müller), *Ilyocypris bradyi* Sars, and *Candona* sp.; the mammalian fauna consists of *Sorex cinerea* Kerr, *S. palustris* Richardson, *Blarina b. brevicauda* (Say), *Cynomys ludovicianus* (Ord), *Citellus* cf. *C. richardsoni* (Sabine), *C. tridecemlineatus* (Mitchill), *Geomys* sp., *Thomomys* cf. *T. talpoides* (Richardson), *Reithrodontomys* sp., *Peromyscus* cf. *P. maniculatus* Wagner, *Microtus pennsylvanicus* (Ord), *M. [Pedomys] ochrogaster* (Wagner), *Synaptomys cooperi* Baird, *Zapus* cf. *Z. hudsonius* (Zimmermann), and *Sylvilagus* sp. (Schultz, 1967).

SYSTEMATIC PALEONTOLOGY

Numbers are of the University of Michigan Museum of Paleontology Vertebrate Collections (UMMP V). The classification used follows Dowling and Duellman (1978).

Checklist of the Robert Local Fauna Fossil Snakes

Heterodon sp. indet.

Diadophis punctatus (Linnaeus)

Coluber constrictor Linnaeus

Lampropeltis getulus (Linnaeus)

Nerodia sipedon (Linnaeus)

Regina grahami Baird and Girard

Storeria cf. *Storeria dekayi* (Holbrook)

Thamnophis proximus (Say)

Thamnophis proximus (Say) or *Thamnophis sirtalis* (Linnaeus)

Thamnophis radix (Baird and Girard)

Annotated List of the Robert Local Fauna Fossil Snakes

All of the following fossil snakes from the Robert local fauna come from the collecting site designated UM-K1-57 (*Succinea* locality) by the University of Michigan Museum of Paleontology collectors.

Family Colubridae
Subfamily Xenodontinae
Heterodon sp. indet.

Material.—One posterior trunk vertebra UMMP V46007.

Remarks.—This vertebra may be confidently assigned to the genus *Heterodon*, but on the basis of its posterior position in the vertebral column, it is not identified to the specific level. Both the plains form, *H. nasicus*, and the eastern species, *H. platyrhinos*, occur in Meade County, Kansas, today (Collins, 1974, maps p. 159 and 163). Both species feed extensively on toads of the genus *Bufo* and are most commonly found in sandy areas (personal observations).

Diadophis punctatus (Linnaeus)

Material.—Eleven trunk vertebrae UMMP V46210.

Remarks.—The trunk vertebrae of *Diadophis punctatus* have better developed neural spines and are more robust than in the other tiny xenodontine genera *Carphophis* and *Tantilla*; and they are more elongate and have broader, flatter hemal keels than in *Sonora*. *Diadophis punctatus* occurs in Meade County, Kansas, today (Collins, 1974, map p. 157). This snake is said to inhabit the rocky hillsides of open woodlands in Kansas at present (Collins, 1974, p. 157).

Subfamily Colubrinae
Coluber constrictor Linnaeus

Material.—Nine trunk vertebrae UMMP V48458.

Remarks.—Based on the small size of these vertebrae and the restricted openings of the neural canals, I am assigning these vertebrae to the species *Coluber constrictor*, rather than to any of the species of *Masticophis* which have somewhat similar vertebrae. *Coluber constrictor* occurs in Meade County, Kansas, today (Collins, 1974, map p. 169). This snake is said to occur in open grassland and prairies in Kansas at present (Collins, 1974, p. 110).

Lampropeltis getulus (Linnaeus)

Material.—One vertebra from a juvenile individual UMMP V41461, (Fig. 1).

Remarks.—The vertebrae of juvenile *L. getulus* appear to be more definitive at the specific level than those of the adults. A combination of characters that separate juvenile *L. getulus* vertebrae from those of other young colubrids includes (1) very produced, narrow, hemal keel, (2) neural arch depressed, and (3) posterior border of neural arch thickened. It may be that these early, distinct, vertebral modifications may be related to the well-developed constricting habits in young snakes of the species *Lampropeltis getulus*. This kingsnake occurs in Meade County, Kansas, today (Collins, 1974, map p. 186). This species is said to be an inhabitant of moist areas of open woodland, woodland edges, or lowlands; but it may be found in open prairies (Collins, 1974, p. 186-187).

Subfamily Natricinae
Nerodia sipedon (Linnaeus)

Material.—Twenty-two vertebrae UMMP V41462.

Remarks.—Brattstrom (1967, p. 189) gives characters that separate the trunk vertebrae of *Nerodia* from *Thamnophis* in most cases. Holman (1967, p. 161) has given vertebral characters that allow one to distinguish *N. sipedon* from other large *Nerodia* species from eastern and central North America. This watersnake is found in Meade County, Kansas, today (Collins, 1974, map p. 227). This species is said to be found in almost every aquatic situation in Kansas today (Collins, 1974, p. 227).

Regina grahami Baird and Girard

Material.—Two trunk vertebrae UMMP V60039.

Remarks.—Holman (1972, p. 93) gives a combination of vertebral characters that separate the trunk vertebrae of *R. grahami* from other North American species of *Regina*, *Nerodia*, and *Thamnophis*. At present, *R. grahami* extends westward in Kansas only to Pratt, Stafford, and

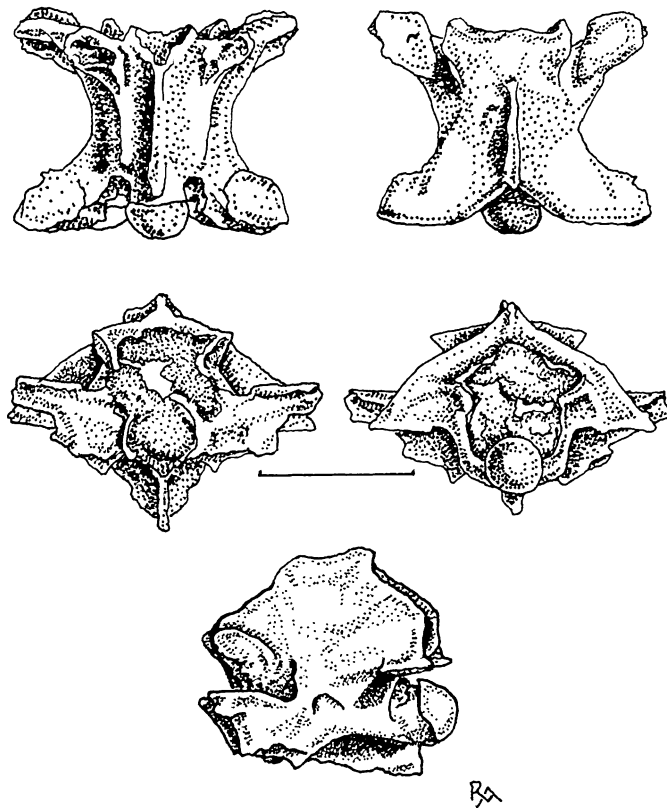


FIG. 1— Trunk vertebra of juvenile *Lampropeltis getulus* UMMP V41461 from Robert local fauna. Upper left ventral, right dorsal; middle left anterior, right posterior; bottom lateral. The line equals 2 mm. and applies to all figures.

Barton Counties (Collins, 1974, map p. 219), about 88 km. from the northeastern corner of Meade County, Kansas. This snake occurs near ponds and sluggish streams of prairie meadows and river valleys in Kansas at present (Collins, 1974, p. 219-220).

Storeria cf. *Storeria dekayi* (Holbrook)

Material.—Eleven trunk vertebrae UMMP V60040 (Fig. 2).

Remarks.—Auffenberg (1963, p. 192) and Holman (1984, p. 29) discuss the identification of individual vertebrae of *S. dekayi*. This species has not been recorded from Meade County, Kansas, today, but is found in Clark County just to the east (Collins, 1974, map p. 215). This snake is not common in western Kansas today, and is said to range just into the High Plains in the north and into the Red Hills in the south (Collins, 1974, p. 215). At present, *S. dekayi* prefers moist situations in woodlands and woodland edges.

Thamnophis proximus (Say)

Material.—Two trunk vertebrae UMMP V60041.

Remarks.—It now appears that vertebrae of large specimens of *T. proximus* may be rather confidently separated from those of large specimens of *T. sirtalis* (characters and illustrations given in Holman (1985b). The ribbonsnake occurs in Meade County, Kansas, today (Collins,

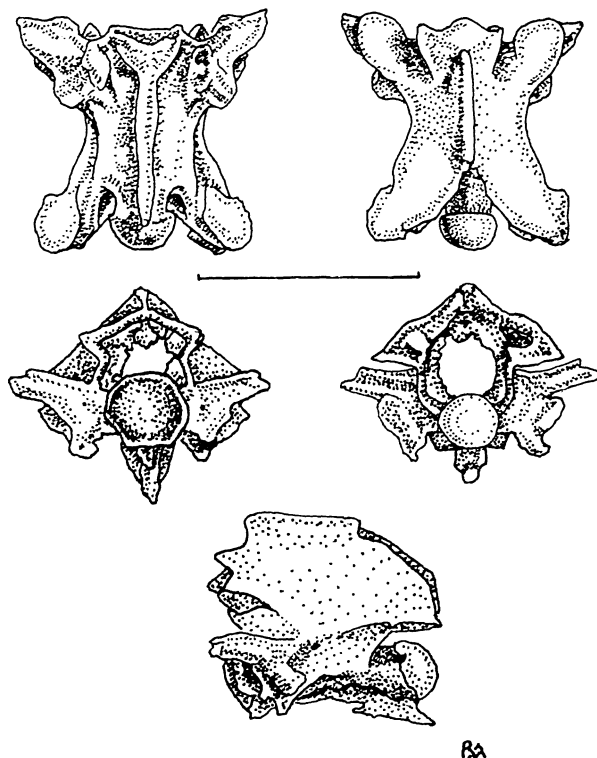


FIG. 2— Trunk vertebra of *Storeria* cf. *S. dekayi* UMMP V60040 from Robert local fauna. Upper left ventral, right dorsal; middle left anterior, right posterior; bottom lateral. The line equals 2 mm. and applies to all figures.

1974, map p. 203). This species lives near the edges of streams, rivers, lakes, marshes, and swamps in Kansas today.

Thamnophis proximus (Say) or *Thamnophis sirtalis* (Linnaeus)

Material.—Seven trunk vertebrae UMMP V60042.

Remarks.—These vertebrae represent either *T. proximus* or *T. sirtalis*, but they are from small individuals, and thus cannot be assigned to either species with certainty. They do not represent *T. radix* or *T. marcianus* (Holman, 1984, see discussion p. 30-31, and figs. 9 and 10). Both *T. proximus* and *T. sirtalis* are found in Meade County, Kansas, today.

Thamnophis radix (Baird and Girard)

Material.—Four trunk vertebrae UMMP V60043.

Remarks.—These vertebrae are assigned to *T. Radix* based on characters discussed in Holman (1984, p. 30 and fig. 9). This gartersnake occurs in Meade County, Kansas, today (Collins, 1974, map p. 205). This species is said to prefer open grassy prairies, especially along the edges of streams, marshes, and lakes in Kansas today (Collins, 1974, p. 206).

DISCUSSION

Late Pleistocene reptiles and amphibians have been much less studied in the United States than the mammals, which are very well known (Lundelius et al., 1983). This is probably a reflection of the fact that (1) other than the turtles, late Pleistocene amphibians and reptiles are often represented by small, fragile bones that may be rare or overlooked, and (2) that herpetological fossils are more difficult to identify than the traditionally studied mammalian jaws and teeth. But herpetological information is quite essential in the consideration of late Pleistocene paleocology.

Hibbard (1960) first emphasized the importance of large land tortoises and crocodilians in the interpretation of Pliocene and Pleistocene climates. He also thought (personal communication) that data from the study of the smaller amphibian and reptile fossils would give important information about Pliocene and Pleistocene climates. He believed that these ectotherms would be much more sensitive to environmental changes than would mammals, and thus would be more indicative of climatic change. Moreover, most amphibians and reptiles of the Pleistocene represent species living today, many of whose ecological tolerances are fairly well known. As we shall see in the following paragraphs, the broad southern ranges of northerly occurring reptiles may hamper climatic interpretations.

I believe herpetological evidence from late Pleistocene faunas has sometimes been ignored. Several late Wisconsinan herpetofaunas of the Appalachian Region (Fay, 1984; Holman, 1985a; Lundelius et al., 1983) are quite similar to those of the area today. But the mammalian fossil faunas typically have many northern extralimital species. Based on these mammalian species, workers have often suggested that climates were tundra-like or boreal-like; but they have disregarded the herpetological evidence in the belief that the amphibians and reptiles were modern intrusions into the fauna.

Holman (1985a) argued that most of these herpetological faunal elements were probably not intrusive, as intrusive amphibians and reptiles may usually be recognized on the basis of being (1) obvious burrowing species, (2) represented by fossils of different density and color, and (3) represented by suspiciously complete skeletons. But some workers (personal communications from attendants at *Symposium on the Quaternary of Virginia*, September, 1984, Charlottesville) are doubtful about the significance of the Appalachian late Pleistocene amphibian and reptile fossils because many of them come from fissure and cave fillings where stratigraphic control is difficult. Therefore, the presence of a moderately large snake fauna from the Robert fauna in stratigraphic context with a mammalian fauna with a Carbon-14 date of $11,100 \pm 390$ BP is of considerable importance.

The Robert locality mammalian fauna (Schultz, 1967) "Indicates a marshy habitat surrounded by a moist low meadow with a good grass cover. A dry upland prairie grassland not far from the immediate environment of the deposition is indicated by fragmentary remains of prairie dog, ground squirrel, and cottontail." The snake fauna generally fits into the same ecological picture. Forms of the marshy habitat would be *Nerodia sipedon*, *Regina grahami*, *Storeria cf. dekayi*, *Thamnophis proximus*, and *Thamnophis radix*. *Lampropeltis getulus* and *Coluber constrictor* would range from the marshy habitat through the moist low meadow and up into the upland area. *Heterodon* sp. and *Diadophis punctatus* would be expected in the upland area.

But there are no extralimital northern species of snakes as there are of mammal species in the Robert local fauna. Figure 3 (arrow 4) shows the area in extreme northeastern South Dakota and adjacent Minnesota where the greatest number of extant Robert fauna mammals are living today (from Schultz, 1967, fig. 5, p. 334). In contrast, most of the snakes may be found living in Meade County, Kansas, today; and the nearest point where all of the Robert snakes would be sympatric

would be in Pratt County, in southern-central Kansas (Fig. 3, arrow 2). Moreover, the northernmost area where all of the Robert snakes could be found living in the same area today is in extreme southeastern Nebraska (Fig. 3, arrow 3).

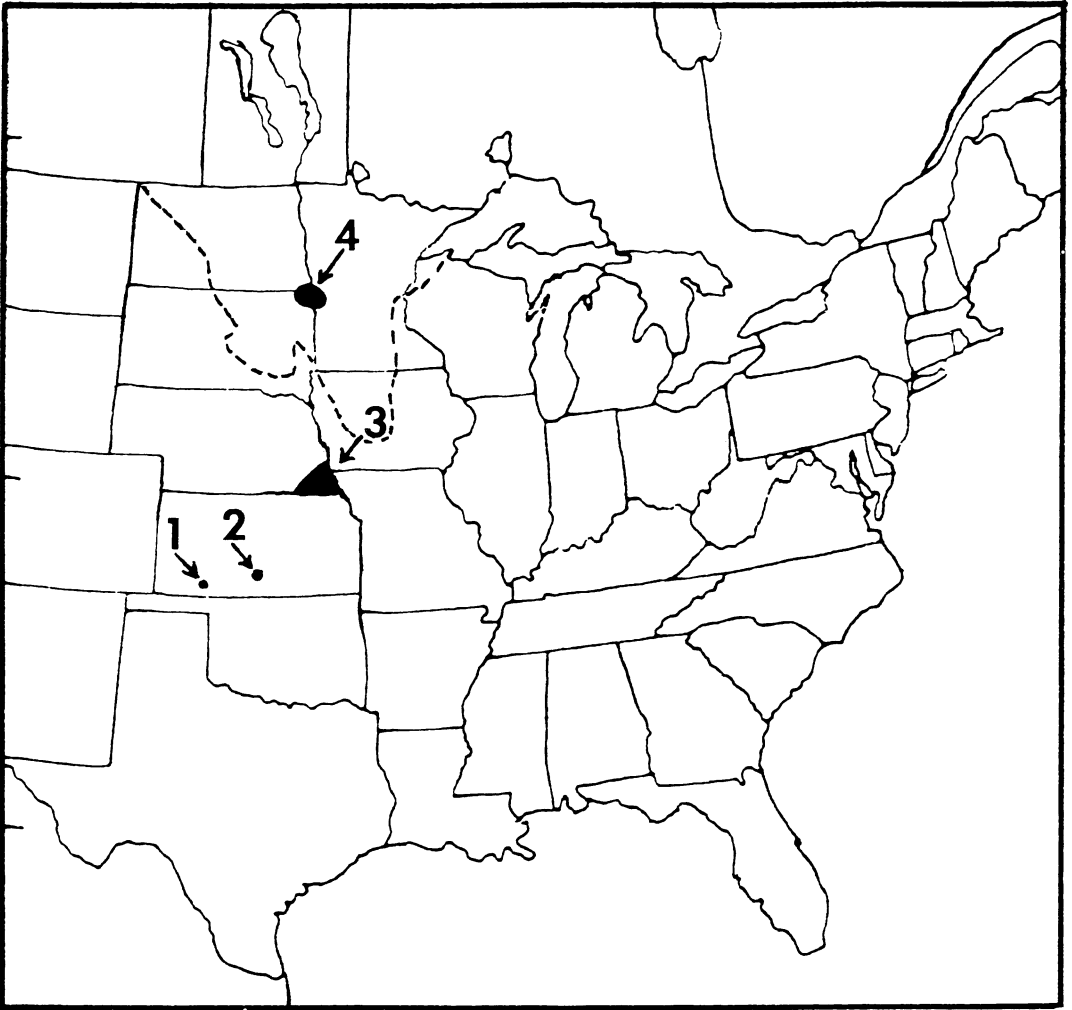


FIG. 3.— Dot at arrow one: Robert local fauna, Meade County, Kansas. Dot at arrow two: nearest point to Robert fauna where all Robert fauna snakes could be found sympatrically today. Area at arrow three: northernmost area where all Robert fauna snakes could be found sympatrically today. Area at arrow four: area where greatest number of extant Robert fauna mammals could be found sympatrically today. Dotted line: extent of late Wisconsin Laurentide Ice Sheet in United States.

Mickelson et al. (1983, Fig. 1-2) and Fig 3. (this paper, in part) show the extent of the lobes of the late Wisconsinan Laurentide Ice Sheet in the United States. These lobes cover the area (Fig. 3) where the greatest number of extant Robert fauna mammals are living today (Schultz, 1967). Since no snake species of the High Plains have ranges that are confined to the north, as is the case in mammals, movements of populations of northerly snakes (such as *Thamnophis radix*) would

not be detected in the fossil record. This is also the kind of situation that exists in Appalachian late Wisconsinan faunas (Fay, 1984; Holman 1985a) where most northerly herpetofaunal species also have broad ranges into the south.

The apparent disharmonious nature of the combined mammalian and snake fauna in the Robert local fauna thus seems best explained by southern movement of some northern mammalian species into the already existing mammalian and snake fauna in the late Wisconsinan, but with any movement of northern snake populations undetected. Somewhat cooler summers would account for the survival of the northern mammals; but the summers could not have been too cool or the snake species would not have survived.

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