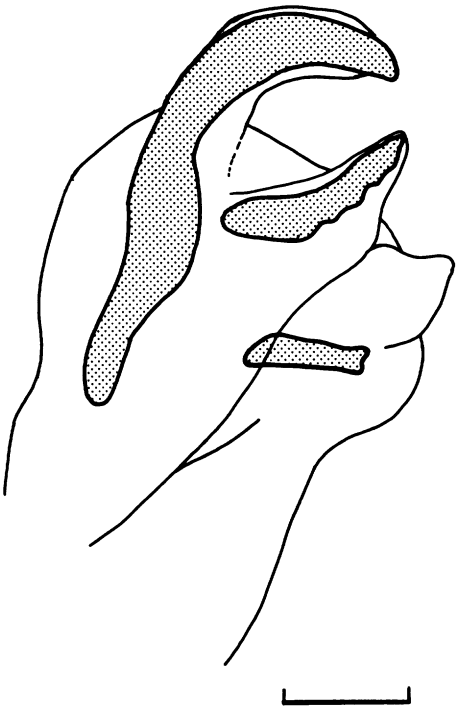

FIG. 3. Hemipenial bones (shaded) in everted left hemipenis of *Varanus gilleni*. Dorsal (sulcal) aspect. Scale bar = 1 mm.

tween C_1 and C_6. One male *V. gilleni* (AM R60202) was later cleared and double stained with alcian and alizarin (Hanken and Wassersug, 1981). The everted left hemipenis of this specimen has three distinct ossifications (Fig. 3), the two largest contributing to the two apical horns described for this species (Branch, 1982), while the third, smallest element lies transversely deep within the apical bulb of the hemipenis. Homologous bones are present in the inverted right hemipenis. There is no trace of any cartilage associated with these bones, despite its presence elsewhere in the preparation.

From their position in both inverted and everted hemipenes of *V. gilleni*, we consider that the similarly-placed ossifications in *V. komodoensis* and *V. varius* are hemipenial bones as well. *Varanus komodoensis* and *V. varius* are both large species, and the hemipenes of *V. komodoensis* are of relatively primitive form, while *V. gilleni* is one of the smallest varanids, and shows amongst the most derived hemipenial morphology (Branch, 1982). The presence of hemipenial bones in these three species suggest that they may be widespread in varanids.

Hemipenial surface morphology is a useful taxonomic aid, not only in platynotan lizards, but also in other squamates (Branch, 1982). However, with the exception of Arnold's (1973) analysis of the internal supportive armature of the lacertid hemipenis, and Kluge's (1982) description of projecting hemipenial bones in the gekkonid genus *Aristelliger*, there appear to be no published data on the internal structure of the lizard hemipenis. The apical horns of the hemipenis of *Varanus* and *Lanthanotus* are apparently a synapomorphy among living saurians, and their interspecific variation a useful phylogenetic tool (Branch, 1982). Further comparative studies of the hemipenial bones of varanids may offer additional characters useful in analyzing relationships within *Varanus*. The radiographic visualization of hemipenial bones may also provide a useful non-invasive means of sexing large varanids.

Radiographic dosages used ranged from 57.5 kV, 125 mA and 0.04 sec (Kodak high speed screen film) for live *V. komodoensis* to 30 kV, 5 mA and 40 secs (Agfa Structurix DP4 film) for preserved *V. gilleni*.

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Butler Spring Herpetofauna of Kansas (Pleistocene: Illinoian) and Its Climatic Significance

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The Butler Spring local fauna of Meade County, Kansas, represents the Illinoian age of the Pleistocene, and is about equivalent in age to the her-

petologically well-known Williams local fauna of Rice Co., Kansas (Zakrzewski, 1975). Although five species of turtles (Preston, 1979) and two species of snakes (Brattstrom, 1967) have been reported from the Butler Spring fauna, additional fossils are now available, and the herpetofauna has not been discussed as a unit. Four amphibians and eight snakes are reported here for the first time, and comments are made on how the herpetofauna bears on previous paleoclimatic interpretations.

All of the fossils reported here come from Butler Spring local fauna Locality UM-K3-61 from the NW¼, NE¼, NW¼, Sec. 5, T 35 S, R 29 W, Meade Co., Kansas. This faunule ("Sloth Locality" of Preston, 1979) represents a restricted unit of time. The fossils were collected by parties of C. W. Hibbard of the University of Michigan, and were processed using the microvertebrate collecting techniques of Hibbard (1949). Specimen numbers below are those of the University of Michigan Museum of Paleontology Vertebrate Collections (UM-V). Unless otherwise noted, all species recorded still occur in Meade Co., Kansas.

AMPHIBIA

CAUDATA

Ambystoma tigrinum (Green). Five vertebrae (UM-V60062). Tihen (1958) and Holman (1969) discuss the identification of *A. tigrinum* on the basis of individual vertebrae.

ANURA

Acris crepitans Baird. Left ilium (UM-V41594). The anterior position of the dorsal ilial protuberance and the dorsal ilial shaft ridge are diagnostic for *Acris* and I can find no differences between the fossil ilium and that of modern *A. crepitans.*

Rana sp. indet. Fragmentary left ilium and sacral vertebra (UM-V60064). These elements are easily identified as *Rana,* but are too fragmentary for specific identification.

REPTILIA

TESTUDINES

Kinosternon flavescens (Agassiz). A right hyoplastron and 4th and 10th peripherals (UM-V61851) reported by Preston (1979).

Chelydra serpentina (Linnaeus). A right 11th peripheral and shell fragments (UM-V61850) reported by Preston (1979).

Terrapene ornata Agassiz. A partial carapace (UM-V61852) reported by Preston (1979).

Emydoidea blandingi (Holbrook). A right 9th peripheral (UM-V57651) reported by Preston (1979). Today this turtle gets no closer to Meade Co., Kansas, than southern-central Nebraska (Conant, 1975, map 26).

Chrysemys picta (Schneider). A carapace and plastral parts (UM-V45872) reported by Preston (1979).

SQUAMATA

Ophisaurus cf. *O. attenuatus* Baird. A trunk vertebra (UM-V60063). The vertebra is assigned to *Opisaurus* on the basis of characters in Etheridge (1961). The single vertebra is too incomplete for a positive specific identification as vertebral ratios used by Etheridge (1961) for separation of species cannot be used. The fossil is tentatively assigned to *O. attenuatus* on zoogeographic grounds. The genus occurs today only in the eastern two-thirds of Kansas, getting no closer to the fossil locality than Barber Co., about 100 km to the eaast. (Collins, 1974:145).

Diadophis punctatus (Linnaeus). Five trunk vertebrae (UM-V60056). Holman (1981) summarized sources for the identification of trunk vertebrae of *D. punctatus.*

Heterodon sp. indet. One vertebra (UM-V45867) is identified as *Heterodon* based on its depressed neural arch and wide, flat hemal keel, but the fossil is too fragmentary for specific identification.

Coluber constrictor Linnaeus. Two very well-preserved trunk vertebrae (UM-V60053) are assigned to *C. constrictor* rather than to *Masticophis* because of the small size of the vertebra and the relatively small diameter of the neural canal.

Elaphe vulpina (Baird and Girard). Two trunk vertebrae (UM-V60054). Holman (1982) provided diagnostic characters for trunk vertebrae of *E. vulpina.* The fox snake has recently been identified from the Illinoian Berends local fauna of Beaver Co., Oklahoma (Holman, 1986) and from the Illinoian Williams local fauna of Rice Co., Kansas (Holman, 1984). Today, the species gets no closer to Meade Co., Kansas, than northwestern Missouri and southwestern Nebraska (Conant, 1975, map 148).

Pituophis melanoleucus (Daudin). Three fragmentary trunk vertebrae (UM-V60055). Holman (1981) summarized sources for the identification of individual trunk vertebrae of *P. melanoleucus.*

Nerodia sipedon (Linnaeus). Eighty-nine vertebrae (UM-V60057). Holman (1967) gave vertebral characters that distinguish the vertebrae of *N. sipedon* from other large specieis of Natricinae.

Regina grahami Baird and Girard. Seven trunk vertebrae (UM-V60058). Holman (1972) gave vertebral characters of *R. grahami.* Today the species occupies the eastern half of Kansas, getting no closer to the fossil locality than Pratt Co., about 100 km to the northeast (Collins, 1974:219).

Storeria cf. *S. dekayi* (Holbrook). One trunk vertebra (UM-V60059). Holman (1981) summarized literature on the identification of vertebrae of *Storeria.* Today, the species does not occur in Meade Co., but reaches Clark Co., the adjacent eastern county (Collins, 1974:215).

Thamnophis radix (Baird and Girard). Forty-one vertebrae (UM-V60060). Holman (1984) gave characters for the identification of individual vertebrae of *T. radix.*

Thamnophis proximus (Say). Two vertebrae (UM-V60061). This material represents a large ribbon snake with a total length of about 107 cm, based on projections from modern skeletons. The vertebrae of *T. proximus* are longer and narrower than

those of *T. radix* and *T. marcianus*. Vertebrae of large *T. proximus* are not as medially constricted as those of large *T. sirtalis*.

The Butler Spring herpetofauna includes at least one salamander, two frogs, five turtles, one lizard and ten snakes. Apparently none of these represents extinct species. Several members of the Butler Spring fauna are extralimital, living to the north and east of the area today. These species include: *Emydoidea blandingi* (NE), *Ophisaurus attenuatus* (E), *Elaphe vulpina* (NE), *Regina grahami* (E), and *Storeria dekayi* (E). The herpetofauna is typical of the Illinoian rather than the Kansan biotic province in which Meade Co., Kansas, lies today (map and summary of references in Kendeigh, 1961:273). In fact, the only area where the complete Butler Spring herpetofauna may be found living together today is in extreme northeastern Illinois (maps in Collins, 1974 and Conant, 1975) where annual precipitation averages 30 to 40 inches as opposed to about 20 inches in Meade Co., Kansas (Oosting, 1956, fig. 56).

Miller (1966) summarized the Pleistocene Butler Spring climate (based on mollusks, fishes, and mammals) as having cooler summers than today, and winters becoming as severe as in northcentral Nebraska. The herpetofauna indicates similar temperatures, but also indicates considerably more annual precipitation than occurs today in southwestern Kansas.

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Aging *Bufo americanus* by Skeletochronology

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During the past decade there has been renewed interest in sexual selection, and anurans have proved to be an excellent vehicle for such research. Bufonid species, in particular, have received a great deal of attention (Fairchild, 1984; Gatz, 1981; Hillis et al., 1984; Kruse, 1981; Kruse and Mounce, 1982; Sullivan, 1982*a*, *b*, 1983; Wells, 1977; Woodward, 1982*a*, *b*, 1984). Some of this research demonstrated that larger male toads participate disproportionately in matings because females prefer the calls of larger males (Fairchild,

* Deceased 4/18/85.