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HERPETOFAUNA OF THE NASH LOCAL FAUNA (PLEISTOCENE:AFTONIAN) OF KANSAS.—A fossil herpetofauna from Meade County, Kansas, reflects a shift from a maritime to a semiarid climate in late Aftonian times. The fossil amphibians and reptiles of the Nash local fauna (UM-K1-72) are from the badlands in the Borchers Pasture (Type locality of Crooked Creek Formation) above the Borchers fauna in the 0.5 m just below the Kukla Ash in the NW ¼, NE ¼, sec. 21, T 33 S, R 28 W, Meade County, Kansas. The Kukla Ash in this area is equivalent to the classic "caliche zone," an important stratigraphic marker in the area (Hibbard, 1958). I should like to thank the late C. W. Hibbard for the privilege of studying the fossils and for information about the stratigraphy of the deposit. Sherry Holmes and Merald Clark made the drawings.

Although the herpetofauna is small, the lizards are abundant and diverse. Following is an annotated list of the fauna.

Ambystoma tigrinum (Green).—Thirty vertebrae, University of Michigan Museum of Paleontology No. V61045. The vertebrae are assigned to *A. tigrinum* on the basis of characters of Tihen (1958) and Holman (1969). This salamander is well adjusted to living in arid lands and from time to time they have been observed coming out of prairie dog holes after dark (Smith, 1956). I have dug several adult salamanders out of their burrows in a sand lens under 4–5 m of overburden in Trego County, Kansas.

Scaphiopus (Spea) bombifrons Cope.—Three left and 4 right ilia, 1 sacrococcyx, and 3 ethmoids, UMMP V61046. These elements are assigned to this species on the basis of osteological characters in Holman (1970). The species today is found in somewhat arid regions on sandy or other loose soil and is found in grasslands rather than flood plains or woodlands.

Holbrookia maculata Girard.—Three right dentaries, UMMP V61048. These dentaries represent smaller lizards than *Sceloporus undulatus*; the teeth are slender, relatively high-crowned, unicuspid or very slightly tricuspid, and sharply pointed as in recent *H. maculata.* These lizards prefer a sandy soil where vegetation is sparse and low and where there is little grass (Smith, 1956).

Sceloporus undulatus (Latreille).—Three dentaries, UMMP V61049. Holman (1968) gives characters for distinguishing species of *Sceloporus* from one another on dentary characters. Today this lizard lives in arid areas of western Kansas, but tends to be around fallen trees and other such shelters.

Phrynosoma cornutum (Harlan).—Three left and 6 right dentaries, 3 vertebrae, UMMP V61050, Fig. 1A. The dentary of *P. cornutum* may be distinguished from that of *P. douglassi* on the basis that it is more massive (slenderer in *P. douglassi*); the borders of the Meckelian groove are open or only narrowly in contact (more broadly in contact in *P. douglassi*); teeth thicker, unicuspid, blunt terminally, lower crowned (thinner, tricuspid with middle cusp pointed, higher crowned in *P. douglassi*). The fossils resemble *P. cornutum* except that some fossils have slenderer teeth than in recent specimens of *P. cornutum.* The two fossils complete enough for a tooth-alveolar count showed a range of 20 to 21 (m, 20.50). In eleven recent *P. cornutum* the range was from 15–21 (m, 17.36); thus based on the small sample the tooth-alveolar count seems a little higher in the fossil than in the recent *P. cornutum.*

The Texas horned lizard eats mainly ants and will feed when temperatures are warm. Smith (1946) states "They feed only when temperatures are warm, refusing to eat at temperatures at which other iguanid lizards eat readily." Smith also states "As benefits a lizard which requires such high temperatures for feeding, hibernation occurs early–in September or October; emergence follows in April or May."

Cnemidophorus sexlineatus (Linnaeus).—Fourteen left and 9 right dentaries, 16 maxillary

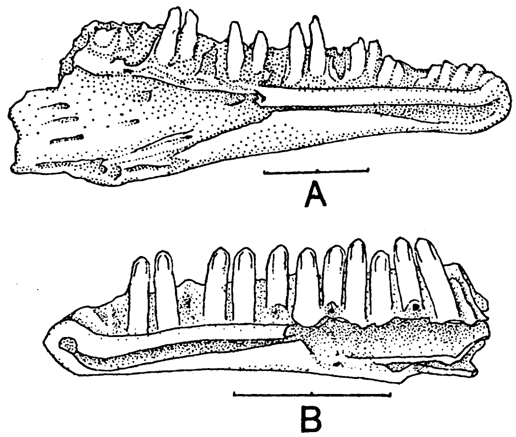

Fig. 1. Left dentary of *Phrynosoma cornutum* (UMMP V61050) and right dentary of *Eumeces obsoletus* (UMMP V61050) from the Nash local fauna (Pleistocene:Aftonian) of Meade County, Kansas. Each line equals two millimeters.

fragments, UMMP V61051. I am unable to distinguish these elements from those of modern *C. sexlineatus*. The habitat in western Kansas today is in dry, sandy areas, where there is low vegetation in which to hide from enemies.

Eumeces obsoletus (Baird and Girard).—Three dentary and 5 maxillary fragments, UMMP V61052, Fig. 1B. These bones appear identical to those of the living species. Holman (1972) gives characters *E. obsoletus* from another large skink, *E. laticeps*. Smith (1956) states "The species is found most commonly on grassy or somewhat wooded hillsides, but like *Sceloporus u. garmani*, this skink may be found even on flat prairies if there are enough burrows of mammals to afford protection."

Eumeces septentrionalis (Baird).—Two left and 1 right dentaries, UMMP V61053. The dentaries of *E. septentrionalis* may be separated from *E. anthracinus* in having the tips of the teeth distinctly less swollen. *E. septentrionalis* may be distinguished from *E. fasciatus* on the basis of having teeth that are slimmer at their bases and that do not taper as sharply to a point as in *E. fasciatus*. *Eumeces septentrionalis* may be distinguished from small *E. obsoletus* in having lower crowned more closely spaced teeth.

At present *E. septentrionalis* does not occur in Meade County, Kansas (Collins, 1974), and the closest valid record is in southeast Comanche County, about 80 km due east of the eastern border of Meade County.

Heterodon platyrhinos (Latreille).—Two vertebrae, UMMP V61054. Holman (1963 and 1971) gives characters that separate *H. platyrhinos* from *H. nasicus*. This species is characteristic of sandy areas today.

Lampropeltis calligaster (Harlan).—Three trunk vertebrae, UMMP V61055. Hill (1971) gives characters that separate the vertebrae of *L. calligaster* from those of *L. getulus*. This snake is nocturnal and lives mainly in prairie areas, open woods, and fields (Smith, 1956).

Remarks.—The Borchers fauna which lies directly below the Nash fauna indicates a maritime climate, with frost free winters (Hibbard, 1970). Some time after the Borchers fauna lived there was a change to a semiarid climate, and during that time the extensive caliche (equals Kukla Ash above Nash fauna) was developed that forms the extensive cap rock of the area. The Nash herpetofauna is one that would be typical of a semiarid prairie region today. The nearest place on the map where all of the species could be found together today is in Comanche County, about 80 km east of the fossil locality (maps in Collins, 1974). The lizard species would be characteristic of a region with extended summers today. It seems probable that the Nash herpetofauna reflects the shift from a maritime to a semiarid climate in post-Borchers (late Aftonian) times.

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ICHTHYOLOGICAL NOTES

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ESTRADIOL-17β EFFECTS ON SERUM ORGANIC PO_4, CHOLESTEROL AND PROTEIN IN *CARASSIUS AURATUS*.—Yolk accumulation is the most prominent event responsible for growth of oocytes in nonmammalian vertebrates (Wallace, 1978). In some teleostean fishes two types of oocyte inclusions are regarded as yolk. Apparently produced by the oocyte itself, the first type of inclusion is a glycoprotein which predominates during the earlier phases of oocyte growth; these inclusions frequently are referred to as yolk vesicles, although it has not been shown conclusively that they can be defined as yolk in a classical sense (te Heesen, 1973, 1977; de Vlaming, 1974; Khoo, 1979). The second type of inclusion, termed yolk granules, predominate during the most active phase of vitellogenesis and are responsible for the majority of oocyte enlargement (de Vlaming, 1974; Khoo, 1979). This yolk granule phase of teleost oogenesis apparently is the result of oocyte accumulation of a blood-borne phospholipoglycoprotein (vitellogenin) which is produced by the liver under estrogenic control (Wallace, 1978).

Estrogen treatment is known to induce liver hypertrophy (Ishii and Yamamoto, 1970; McBride and van Overbeeke, 1971; de Vlaming et al., 1977a) and increased liver and/or plasma lipid levels (Takashima et al., 1972; de Vlaming et al., 1977a, b) in some teleosts. A plasma-borne, estrogen-induced yolk precursor (vitellogenin) has been identified in several fish species (Aida et al., 1973; Emmersen and Emmersen, 1976; Emmersen and Petersen, 1976; de Vlaming et al., 1977b; Hara and Hirai, 1978; Schackley and King, 1978; Craik, 1978).

Very little is known about the characteristics of piscine vitellogenins and indirect methods for assessing vitellogenic activity in fish have been used. Plasma cholesterol, phospholipid, protein, organic-bound PO_4, protein-bound PO_4 and calcium levels have been used as indices of vitellogenic activity (Lewander et al., 1974; Pickering, 1976; de Vlaming et al., 1977b; Yaron et al., 1977; Petersen and Emmersen, 1977; Hilmy et al., 1978; Balbontin et al., 1978; Craik, 1978; Whitehead et al., 1978).

The present study was undertaken to determine whether a dose-response relationship could be established between organic-bound PO_4, cholesterol and proteins and estradiol-17β in *Carassius auratus*.

An initial experiment was conducted to verify that estradiol-17β affects serum organic-bound PO_4 levels in goldfish. Postspawned goldfish obtained from Mt. Parnell Fisheries in August were acclimated to a 10L/14D photoperiod at 22 ± 2 C for 2 weeks. One group was then injected intraperitoneally with 10 μg estradiol-17β/fish/day for seven days. The estrogen was first dissolved in a small quantity of ethanol and then diluted with teleost saline (de Vlaming and Pardo, 1975) to the desired concentration. Control fish were injected with teleost saline (0.1 cc) containing ethanol equivalent to that in the estrogen solution.

In a second experiment the effects of two doses of estradiol-17β on serum organic PO_4, cholesterol and protein were analyzed. Goldfish, in the early phases of oocyte growth (obtained during October), were exposed to a 14L/10D photoperiod at 18 ± 1 C. Experimental groups consisted of: a) fish receiving 5 μg estradiol-17β/day, b) fish receiving 50 μg estradiol/day and c) fish receiving saline injections. All fish received a total of 11 injections.

In both experiments fish weighed between 30–55 g. Fish were fed TetraMin ad libitum, but starved for 48 h prior to killing. Animals were killed 24 h after the last injection and a