A LATE PLEISTOCENE HERPETOFAUNA FROM MISSOURI

J. ALAN HOLMAN

Illinois State University, Normal

ABSTRACT.—A salamander, frog, legless lizard, and at least 10 species of snakes from a cave near St. Louis, Missouri, may represent a herpetofauna of interglacial or recessional time in the late Pleistocene.

A large number of Pleistocene amphibian and reptile bones were collected from a cave near St. Louis by Mr. Ronald D. Oesch of Kirkwood, Missouri. Through the kindness of the collector I have been permitted to study this assemblage of 1,894 snake vertebrae and a few amphibian and lizard remains.

The following information has been supplied by Mr. Oesch who plans to describe the mammalian remains, the exact location, and the geology of the deposit in a future publication. The site is in a cave called Crankshaft Pit, which is about twenty miles southwest of St. Louis, Missouri. The cave developed in Ordovician Jonchim Dolomite, and is entered through a two by three foot opening that leads into a 59-foot vertical shaft. The animals were evidently trapped by falling into the shaft. The bone bed is located in a filled crevice about 30 feet from the bottom of the shaft in the floor of a horizontal tunnel. The unstratified matrix may represent a mud flow into the crevice. The fossils came from about 105 gallons of this matrix that was removed from the cave and washed. In the concentrate were the remains of the extinct armadillo, *Dasypus bellus*, and tapir bones. Thus, a Pleistocene age is indicated.

MATERIALS AND METHODS

Disarticulated amphibian and reptile skeletons housed at Illinois State University as well as specimens donated by G. R. Rabb of Brookfield, Illinois, and by G. Hartz of Chicago, Illinois were utilized as comparative material. All measurements are in millimeters.

Intercolumnar, ontogenetic, and individual variations combine to present a bewildering array of problems in the identification of individual snake vertebrae. Nevertheless, several authors have been able to assign well-preserved vertebrae to the generic level, and often specific identifications are possible (see Holman, 1962 and 1963; Brattstrom, 1954 and 1964; and especially Auffenberg, 1963). Usually, fragmentary vertebrae, caudals, and those from the anteriormost or posteriormost parts of the remaining column are not designated taxonomically.

The fossils have been deposited in the collections (abbreviation CM) of the Department of Biology of Central Missouri State College, Warrensburg, Missouri.

DESCRIPTION OF THE SPECIMENS

Ambystoma maculatum (Shaw). Material: 1 body vertebra, CM 260. Tihen (1958) has discussed vertebral characters of the species groups of *Ambystoma*, and Holman (1964) has detailed differences between the body vertebrae of *Ambystoma texanum* and *A. maculatum*. The fossil ambystomatid vertebra has the elongated shape of those of *A. texanum* and *A. maculatum* (Tihen, op. cit.). Unfortunately, the tip of the neural arch is broken, but appears to have extended at least as far posteriorly as the ends of the postzygapophyses. The length of the vertebra is 5.5; thus the fossil appears to represent *A. maculatum* (see Holman, op. cit., p. 74, Table 1).

Rana sp.—A fragmentary body vertebra (CM 261) representing a rather small individual of the genus *Rana* is not assigned to species.

Ophisaurus ventralis (Linnaeus). Material: 1 body vertebra (CM 262) of an adult individual. The three species of *Ophisaurus* in the United States may be distinguished from one another by vertebral characters (Auffenberg, 1955, and Etheridge, 1960 and 1961). The angle between the posterior border of the neural spine and the longitudinal axis of the centrum in the fossil is 80 degrees. It ranges from 65-84 degrees in *O. ventralis*, 45-65 degrees in *O. attenuatus*, and 78-91 degrees in *O. compressus* (Etheridge, 1961, p. 180). The ratio between the length of the centrum of the fossil (8.9 when measured from the greatest depth of the glenoid cavity to the most posterior extent of the condyle) divided by the least width of the neural arch (2.7) is 1.44. This ratio ranges from 1.12-1.55 in *O. ventralis*, 1.10-1.40 in *O. attenuatus*, and 1.50-2.00 in *O. compressus* (Etheridge, loc. cit.). The fossil represents *O. ventralis*.

Ophisaurus ventralis has an odd distribution today. It is principally distributed in the southeastern United States, but there are isolated records from southeastern Oklahoma and east-central Missouri (McConkey, 1954, p. 139, fig. 3). The sole Missouri records (one from Jefferson County, and one from St. Louis) are from localities that are near the Crankshaft Pit fossil site.

Thamnophis sirtalis (Linnaeus). —Material: 52 precaudal vertebrae, CM 263.

Thamnophis cf. *Thamnophis proximus* (Say).—Material: 25 precaudal vertebrae, CM 264.

Holman (1962) discussed the specific identification of isolated *Thamnophis* vertebrae. At this time he considered *T. sauritus* and *T. proximus* to be subspecifically related. Rossman (1962) has shown that both are valid species. Thus, vertebral characters given by Holman (op. cit.) for "*T. sauritus*" apply to both *T. sauritus* and *T. proximus*.

Heterodon platyrhinos Latreille. Material: 15 precaudal vertebrae, CM 265. The three living species of *Heterodon* (*H. simus*, *H. nasicus*, and *H. platyrhinos*) may be separated on vertebral characters (Holman, 1963).

Coluber sp.—I am unable to separate the vertebrae of modern *Coluber constrictor* from those of *Coluber flagellum* on any qualitative or quantitative character. The 463 vertebrae (CM 266) assigned to *Colu-*

ber may represent either one or both species.

Elaphe vulpina (Baird and Girard).—Material: 72 precaudal vertebrae, CM 267. Many of the fossils are in excellent condition. Several sections of articulated column that appear to represent a single large individual are present.

Elaphe sp.—These 131 precaudal vertebrae (CM 268) represent either *E. guttata* or *E. obsoleta* or perhaps both species.

Members of the genera *Elaphe*, *Pituophis*, and *Lampropeltis* have similar vertebral characteristics. Nevertheless, *Pituophis* may be distinguished from *Elaphe* and *Lampropeltis* on the basis of the indented anterior edge and greater height of its neural spine. There is variation in the shape of the neural spine in the species of *Elaphe* and *Lampropeltis*, but the condition found in *Pituophis* is never seen. *Pituophis catenifer* (*Pituophis melanoleucus sayi* of some authors) may be distinguished from *Pituophis melanoleucus* in that the latter species has higher neural spines.

Elaphe and *Lampropeltis* are more difficult to separate. In the modern species of *Lampropeltis* available to me the neural arch is usually less vaulted than in species of *Elaphe*. *Lampropeltis getulus* may usually be distinguished from the larger species of *Elaphe* and *Lampropeltis* by a combination of rather subtle characters. In *L. getulus* the vertebrae are quite robust with thick neural spines and neural arches. The hemal keels and subcentral ridges are usually quite strong, and the valleys between the subcentral ridges and the hemal keel are usually very deep. Moreover, in most specimens the neural arch is flattened, although occasionally it may be slightly vaulted. Vertebrae of *Lampropeltis doliata*, *L. zonata*, and *L. pyromelana* have very low neural spines; this coupled with their small size separates them from other species of the *Elaphe-Lampropeltis* complex. The vertebral structures of *Lampropeltis calligaster* are similar to those of some species of *Elaphe*, but most *L. calligaster* have stronger hemal keels and subcentral ridges than do species of *Elaphe*.

Although some authors have identified individual vertebrae as *Elaphe guttata* and *E. obsoleta* I can not find characters that separate these two species. *E. vulpina* may be distinguished from the former two species by its much lower neural spine. This character holds in both large and small specimens.

Pituophis catenifer (*Blainville*).—Material: 17 precaudal vertebrae, CM 269. Characters for distinguishing the vertebrae of this species have been discussed in the previous section.

Lampropeltis getulus (Linnaeus).—Material: 27 precaudal vertebrae, CM 270.

Lampropeltis doliata (*Linnaeus*).—Material: 126 precaudal vertebrae, CM 271. Some of these vertebrae represent a rather large specimen or specimens of the milk snake.

Characters for distinguishing the vertebrae of *L. getulus* and *L. doliata* have been discussed in the *Elaphe* section.

Crotalus horridus Linnaeus.—Material: 24 precaudal vertebrae, CM 272. One or more small specimens, and at least one very large speci-

men are represented by the fossils.

Crotalus horridus may be distinguished from *Agkistrodon piscivorus* and *A. contortrix* in that the pits on either side of the cotyla of the latter species are more deeply excavated. In *Sistrurus catenatus* the prezygapophyses are tilted upward to a much greater degree than in *Crotalus* and *Agkistrodon*. Moreover, a tiny spine is usually visible just anterior to the neural spine in *Sistrurus*. This spine is lacking in *Crotalus* and *Agkistrodon*. *Crotalus horridus* is the only viperid snake represented in the Missouri fossil fauna.

Discussion

All of the genera and species of amphibians and reptiles from the Crankshaft Pit represent forms that are living today. Moreover, all of the species identified occur in or near the vicinity today (Conant, 1958).

The fossil herpetofauna is mainly a terrestrial one. Only a few forms (*Ambystoma maculatum*, *Rana* sp., *Thamnophis sirtalis*, and *T.* cf. *proximus*) indicate the proximity of moist or aquatic conditions, and these species are represented by only a few bones. The ecological conditions at the time of the accumulation of the bones were probably not much different from those of the area today, with most of the animals being accidentally derived from hardwood forests and glades near the cave.

Elaphe (*guttata* or *obsoleta*) may have entered the cave searching for bats. Both species of *Elaphe* are good climbers. Dr. Charles J. Flora of Western Washington State College (personal communication) has observed *Elaphe guttata* entering and leaving Grant's Cave (a well-known bat locality in Alachua County, Florida) by means of a 30 foot vertical shaft. Moreover, Carr (1940) reports several *Elaphe q. quadrivittata* *Elaphe obsoleta quadrivittata* frequenting a cave inhabited by thousands of bats, in Citrus County, Florida.

A glacial climate is definitely not indicated by the herpetofauna. Considering the presence of the armadillo, *Dasypus bellus*, an interglacial or recessional stage is suggested. Based on the striking similarity of the herpetofauna to one that could be found in or near the area today, it seems likely that the deposit represents late Pleistocene times.

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