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A MIOCENE TERRAPENE (TESTUDINES: EMYDIDAE) AND OTHER BARSTOVIAN TURTLES FROM SOUTH-CENTRAL NEBRASKA

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ABSTRACT: The anterior lobe of a plastron of a box turtle (*Terrapene* Merrem) represents the earliest known occurrence of this *Emys* group genus (Barstovian: middle Miocene). This specimen comes from the same stratigraphic horizon as the oldest previously known member of the *Emys* group, *Emydoidea* sp., also from the Barstovian of Nebraska. The *Terrapene* fossil comes from the Myers Farm Fauna, Webster County, south-central Nebraska, and was associated with turtles of the genera *Trionyx*, *Macroclemys* and *Geochelone*, and several species of snakes discussed elsewhere. Two forms of *Geochelone* are present: a very large one and an unnamed very distinct small one with a quite narrow, dorsoventrally thickened epiplastral projection. The climate in which these reptiles lived must have been at least as mild as that of the Gulf Coastal Plain of the United States, today, and the winters were probably even milder.

Key words: *Terrapene*; Testudines; Emydidae; Miocene; Barstovian; Nebraska

A SNAKE fauna from the Myers Farm Local Fauna (Barstovian: middle Miocene) of south-central Nebraska consisted of two extinct boids, seven colubrids, an elapid and a viperid (Holman, 1977). It is believed that these snakes lived in a subtropical climate. The turtles of this fauna are also of considerable interest and form the subject of the present paper. The fossil quarry is on the property of the Gary Myers family of Red Cloud, Nebraska, and is in the NW ¼, sec. 26, T 1 N, R 11 W, Webster County, Nebraska. The middle Miocene age of the Myers Farm Fauna is based on a study of the mammalian fauna (Corner, 1976). Stratigraphically, the Myers Farm mammalian fauna is similar to the type Valentine Quarry (Railroad Quarry) of north-central Nebraska. The fauna is younger than the Norden Bridge Quarry (Voorhies, in press) but older than the Burge Fauna (Webb, 1969).

The Myers Farm mammalian fauna differs from those of similar age in north-central Nebraska in consisting of fewer open-plains species and more "southern" species such as *Prosynthetoceras* sp., *Longirostromeryx blicki* and *Pseudoparablastomeryx francesita*. The perissodactyls also differ in that there is a decidedly higher frequency of low-crowned anchitherine horses (Corner, 1976) and tapirs (Schultz et al., 1975) at Myers Farm than in the north-central Nebraska sites. The absence of the zapodid genus *Megasminthus*, the almost total lack of heteromyids, and an abundance of cricetids at Myers Farm are also distinct from the north-central Nebraska faunas where *Megasminthus* and various heteromyid species dominate the

rodent fauna (Korth, 1979, 1980). These mammalian occurrences may indicate a somewhat warmer, moister climate, and more deeply wooded areas in south-central Nebraska during middle Miocene times.

Systematic Paleontology

Order Testudines

Family Trionychidae

Trionyx sp. indet.

Material.—A hyoplastral or hypoplastral fragment, a neural fragment, and several indeterminate shell fragments (University of Nebraska State Museum (UNSM) 45264) and 10 indeterminate shell fragments (UNSM 45248).

Remarks.—These fragments have rather large, rounded pits, similar to those of *Trionyx quinni* Holman, a species that is known only from the Norden Bridge Quarry Fauna (Miocene: Barstovian) of Brown County, Nebraska.

Family Chelydridae

Macroclemys sp. indet.

Material.—Two left scapulae UNSM 21607 and 21608, tenth left peripheral UNSM 21610 (Fig. 1), and second right peripheral UNSM 88410.

Remarks.—The above elements seem unquestionably referable to the genus *Macroclemys*, but they show some differences from the living species *M. temmincki* (Troost). Whether these differences are due to ontogenetic variation, individual variation, or specific variation, will only be determined when more fossil material is recovered and more modern skeletal specimens are available.

Family Emydidae

Emydidae gen. et sp. indet.

Material.—Right xiphiplastron UNSM 20903.

Remarks.—This element resembles those in several emydid genera including *Chrysemys* Gray, *Clemmys* Ritgen, and *Pseudemys* Gray, but we are unable to assign it to any of them with certainty.

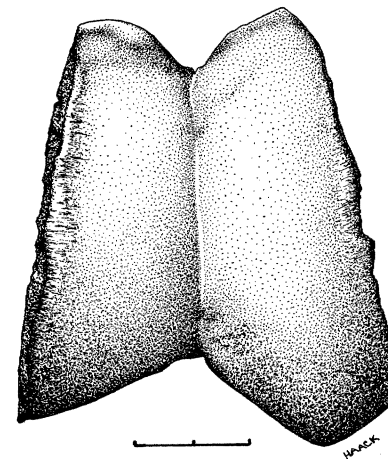

FIG. 1.—Tenth left peripheral (UNSM 21610) of *Macroclemys* sp. indet. in ventral view. The line equals 20 mm.

The fossil may belong to an undescribed taxon.

Terrapene Merrem

Material.—The anterior lobe of a plastron (UNSM 21618, Fig. 2A,B).

Remarks.—Hutchison (1981) reported the previously oldest record of the *Emys* group. This is a Barstovian hypoplastron of *Emydoidea* sp., also from Nebraska. We now report another genus of the *Emys* group, *Terrapene,* from the same stratigraphic horizon. The oldest previous records of *Terrapene* are based only on a left humerus assigned to *Terapene* cf. *carolina* (Holman, 1975) from the WaKeeney Local Fauna (Miocene: Clarendonian) of Trego County, Kansas; and a hyoplastron of *Terrapene* from the Ash Hollow Formation of Cherry County, Nebraska at the same stratigraphic horizon (Hutchison, 1981). The next oldest record is that of the extinct subspecies *Terrapene ornata longinsulae* (Hay) from the Long Island Quarries (late Miocene) of Kansas. These two records indicate that the two lines forming the "*carolina* group" and the "*ornata* group" of Milstead (1969) were established at least by late Miocene times, and probably somewhat earlier.

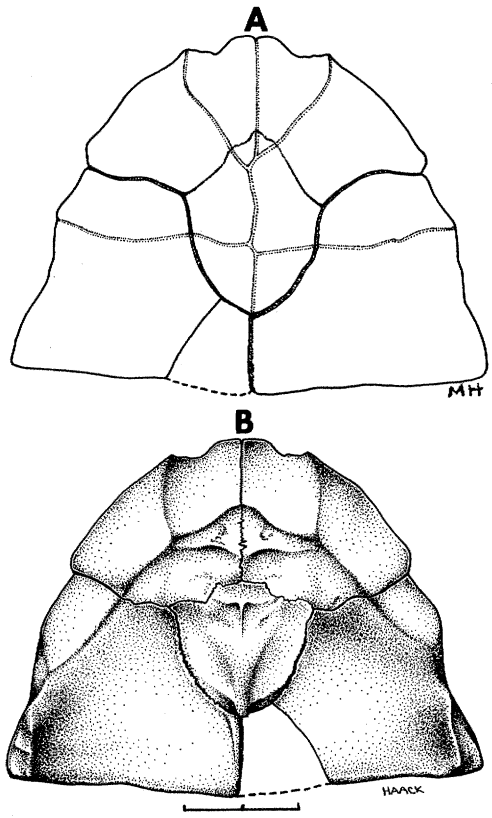

FIG. 2.—Anterior plastral lobe of *Terrapene* (UNSM 21618): (A) ventral view; (B) dorsal view. The line equals 20 mm and applies to both figures.

No extinct species of *Terrapene* are currently recognized, but two extinct subspecies are known. The very large *Terrapene carolina putnami* (Hay) is from the late Pleistocene of North America where it is especially common in the southeast and frequently intergrades with Holocene subspecies (Auffenberg, 1958). *Terrapene ornata longinsulae* (Hay) is known from the late Miocene of Kansas.

There is indication that the Nebraska fossil *Terrapene* is somewhat of a composite of characters found in the Holocene species, and that its small epiplastral beak may be unique to the genus. There are also resemblances, discussed below, to the living *Terrapene coahuila* that do not appear to occur in other living species of the genus. At this time, we shall refrain from describing a new fossil species in the hope that more complete fossil material may be found.

Generic Identification of the Nebraska Fossil

There are striking similarities in the shells of several genera that have evolved the ability to close the shell. *Terrapene* and *Cuora* share several plastral characters. (1) The anterior plastral lobe consists of the epiplastron, the entoplastron, and the hyoplastron; and the posterior plastral lobe consists of the hypoplastron and the xiphiplastron; (2) the hinge line has a well-developed groove; (3) the gular, humeral and pectoral epidermal scutes occur on the anterior lobe of the plastron, and the abdominal, femoral and anal scutes occur on the posterior lobe; and (4) the posterior part of the gular scute overlaps the anterior part of the entoplastron, and the anterior part of the pectoral scute overlaps well onto the posterior part of the entoplastron. We are also quite impressed with the striking similarities of the plastra of Old World *Emys* and New World *Emydoidea*, but we shall not discuss this here.

Both *Emys* and *Emydoidea* differ from *Terrapene* and *Cuora* in that the entoplastron is either completely excluded from or just barely enters the area covered by the pectoral epidermal scute, whereas in the latter two genera this bone is well-encroached upon by the pectoral epidermal scute. The fossil from Nebraska (Fig. 2A,B) resembles *Terrapene* and *Cuora* in this character. The fossil is assigned to the genus *Terrapene* rather than to *Cuora* in that it has the epiplastral lateral notches that occur in species of Holocene *Terrapene*, especially *Terrapene ornata* and that are lacking in three *Cuora amboinensis* (Daudin), one *Cuora flavomarginata* (Gray), one *Cuora galbifrons* Bourret, and one *Cuora trifasciata* (Bell). Moreover, in *Terrapene* the gular epidermal shield does not encroach upon the entoplastron to the extent that it does in *Cuora*. Moreover, depressions on each epiplastron on either side of the midline (Fig. 2B) are interpreted as being the fos-

sae for the insertion of cervico-plastral ligaments. These fossae occur in *Terrapene*, but not in *Cuora* (Bramble, 1974, Fig. 1B,D).

It is beyond the scope of the present paper to go into a detailed discussion of variation in shell morphology of Holocene and fossil *Terrapene*. Nevertheless, the fossil *Terrapene* from Nebraska resembles *Terrapene coahuila* in two characters that we have not seen in other Holocene species. These are: (1) the very wide areas where the gular and humeral scutes overlap the dorsal surface of the plastron, and (2) the large bridge buttresses of the posterolateral portions of either side of the anterior plastral lobe.

Skeletons of *Terrapene* examined were *Terrapene carolina bauri* (12), *Terrapene carolina carolina* (10), *Terrapene carolina major* (2), *Terrapene carolina mexicana* (1), *Terrapene carolina triunguis* (10), *Terrapene coahuila* (5), and *Terrapene ornata ornata* (24).

Description of the Nebraska Terrapene *anterior plastral lobe.*—The term epidermal scute as used in this paper refers to that area of the fossil bone enclosed by the imprints of the epidermal scute in life. In general outline, the fossil anterior plastral lobe is ovaloid in shape and has a small, projecting epiplastral beak. There is a small lateral notch in each side of the fossil at the juncture of the epiplastral and hyoplastral bones. In ventral view, the gular scutes form a triangle with the apex of the triangle directed posteriorly. This apex barely enters the anterior part of the entoplastral bone. Each of the humeral scutes is roughly triangular in shape, with the apex of each of their triangles directed posteromedially. The median contact lines between the gular scutes and the humeral scutes are about of equal length. The median line of contact between the humeral scutes extends about two-thirds the length of the entoplastral bone. The pectoral scutes are rectangular in shape. The anterior part of their median line of contact extends about the posterior one-third of the entoplastral bone. The epiplastral bones are very roughly triangular in shape with the truncated apices of these triangles directed posteromedially. The entoplastral bone is ovaloid in shape and separates the posterior parts of the epiplastra from one another and the anterior parts of the hyoplastra from one another. The posteromedial corner of the right hyoplastral bone is broken. In dorsal view, the shell bones have the same general shape and relationships to one another with the following exception. The entoplastron is roughly triangular in shape with its apex directed posteriorly. This allows a median contact between the epiplastral bones for almost their entire lengths. Depressions on the dorsal surface of each epiplastral lobe on either side of the midline are interpreted as being the fossae for the insertion of the cervico-plastral ligaments. The bevelled area covered in life by the gular and humeral scutes is quite extensive as compared to modern species of *Terrapene* with the exception of *Terrapene coahuila*.

Family Testudinidae

Geochelone cf. *Geochelone orthopygia* (Cope)

Material.—Partial left humerus UNSM 83413, proximal right humerus UNSM 21614, distal left femur UNSM 21614, entoplastron UNSM 45380 (Fig. 3A,B), and three indeterminate shell elements UNSM 20900 (two pieces) and 20904 (one piece).

Remarks.—These fossils represent a very large land tortoise. The entoplastron appears to be very similar if not identical to the one figured for the type of *Geochelone orthopygia* (Hay, 1908, p. 441, Fig. 583), and for this reason the above material is tentatively assigned to this quite large species.

Geochelone small species indet.

Material.—Nuchal bone UNSM 45148, right epiplastron UNSM 21613 (Fig. 3C), right hyoplastron UNSM 88411, and right xiphiplastron UNSM 21612.

Remarks.—These elements represent a quite small land tortoise with a strikingly narrow, projecting, very dorsoventrally thickened epiplastral thickening (Fig. 3D). We believe that this material may repre-

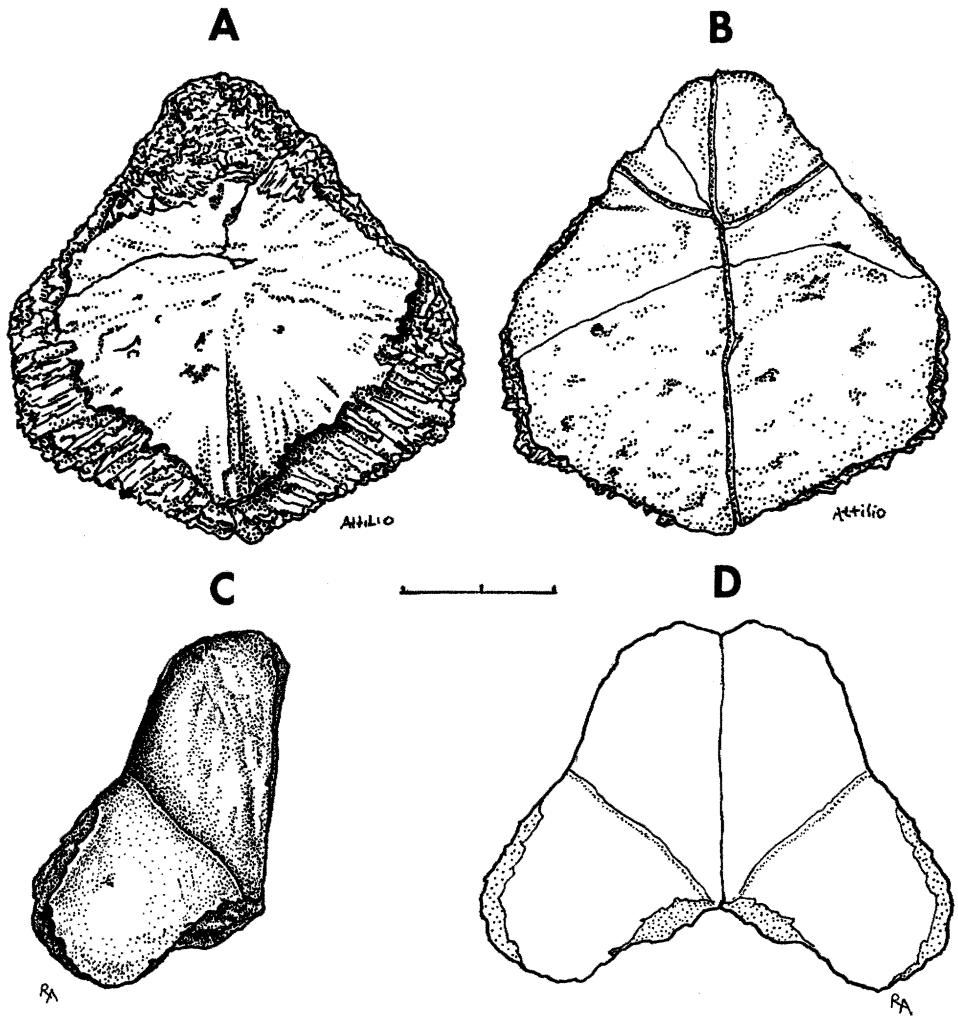

FIG. 3.—A and B, entoplastron of *Geochelone* cf. *G. orthopygia* (UNSM 45380): (A) dorsal view; (B) ventral view. (C) Right epiplastron of *Geochelone* small sp. indet. (UNSM 21613) in ventral view. (D) Outline of shape of epiplastral beak in ventral view of tortoise represented by UNSM 21613. The line equals 20 mm and applies to all figures.

sent a very distinctive new species. Curiously, the modern tortoise most closely resembling the fossil appears to be the monotypic South African genus *Chersina* Gray, the bowspit tortoise, which has no fossil record (Wermuth and Mertins, 1961, p. 90, Fig. 139; and Auffenberg, 1974, p. 141). But of course, on the basis of this fragmentary material, we cannot determine whether there are actual relationships with *Chersina*, or whether parallel morphological patterns evolved in the two continents in different testudinine genera. Therefore, we shall not attempt to give the fossil a specific name at this time, and we hope that more complete fossils may be collected in the future. Two other tortoises of the middle Miocene of Nebraska, *Geochelone niobrarensis* (Leidy) and *Geochelone nordensis* Holman, lack the projecting epiplastron and are otherwise different from the above fossil material.

Discussion

A fossil anterior plastral lobe represents the earliest (Barstovian: middle Miocene) record of the genus *Terrapene*. Associated with the fossil *Terrapene* in the Myers Farm Fauna were a softshelled turtle (*Trionyx* sp. indet.), an alligator snapping turtle (*Macroclemys* sp. indet.), an emydid turtle of unknown genus, a very large land tortoise (*Geochelone* cf. *G. orthopygia*), and a very distinctive small tortoise (*Geochelone* sp. indet.) with a projecting, dorsoventrally thickened epiplastron.

The snake fauna from the Myers Farm Fauna (Holman, 1977) contains genera that occur either in the southeastern (*Micrurus*) or southwestern (*Salvadora*) United States today, as well as two genera (*Geringophis* and *Pterygoboa*) of extinct Boidae. Thus it was suggested that subtropical conditions may have been present at the time. The turtle fauna supports this suggestion. *Macroclemys* occurs in the southeastern United States and Gulf Coastal Plain today (Conant, 1975, map 2) where it inhabits rivers, sloughs, lakes, oxbows and canals (Carr, 1952). Moreover, it has long been suggested that the presence in fossil faunas of large land tortoises of the genus *Geochelone* suggests a climate with very mild winters where the temperatures seldom if ever dropped to freezing (Hibbard, 1960). Also, small *Geochelone* species today are mainly restricted to the tropics. It thus seems likely that the climate in which all of these reptiles lived must have been at least as mild as that of the Gulf Coastal Plain of the United States today, and that the winters were perhaps even milder.

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