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FIRST FOSSIL RECORD FOR THE DIAMONDBACK TERRAPIN, *MALACLEMYS TERRAPIN* (EMYDIDAE), AND COMMENTS ON THE FOSSIL RECORD OF *CHRYSEMYS NELSONI* (EMYDIDAE)

JAMES L. DOBIE AND DALE R. JACKSON

ABSTRACT: A nuchal bone and a first left costal bone from two different individuals represent the first fossil record for the diamondback terrapin, *Malaclemys terrapin*. The bones are from a Pleistocene deposit at Edisto Beach, Colleton County, South Carolina, a locality that is within the present range of *M. terrapin*. Fossil *Chrysemys nelsoni* recovered from the same deposit indicate that the ranges of *Chrysemys nelsoni* and *Chrysemys rubriventris* were probably once continuous and that gene flow between the two "species" may have occurred as recently as late Pleistocene.

Key words: *Chrysemys nelsoni*; *Malaclemys*; Pleistocene; South Carolina; Testudines.

THE first fossil record of *Malaclemys terrapin* is documented by two bones, a nuchal (UF/FSM 22849a) and a first left costal (UF/FSM 22849b), found in a Pleistocene deposit at Edisto Beach, Colleton County, South Carolina, by C. T. Thomas in 1957. The elements are from different individuals because the corresponding suture planes between the two bones do not match. Other elements, including a right epiplastron (ChM # GPV1508), a nuchal bone (ChM # GPV1540), and a second right peripheral (ChM # GPV1549), of *Chrysemys nelsoni* have been recovered from the same deposit.

McDowell's (1964) synonymy of *Graptemys* with *Malaclemys* has received little support, and we do not abide by his conclusion. We therefore stress features that distinguish nuchal and costal bones of *Malaclemys* from those of *Graptemys*. A

FIG. 1.—Dorsal (upper) and ventral (lower) surface of nuchal bone of fossil *Malaclemys terrapin* (UF/FSM 22849a). Maximum width of nuchal bone is 43.5 mm.

study by the senior author (to be submitted separately for publication) on the taxonomic relationship between *Graptemys* and *Malaclemys* indicates that certain features, previously unrecognized, consistently serve to distinguish the two taxa.

The fossil nuchal bone of *Malaclemys terrapin* (Fig. 1) is entire except for that part which would contact the first neural bone. Scute sulci of pleural and nuchal scutes and the anterior part of the first vertebral scute are plainly visible. The pleural scute just overlaps the outer edge of the nuchal bone and does not contact the first vertebral scute on the nuchal bone; the nuchal scute overlap is barely longer than wide, and its underlap is wider than long (Figs. 1–3). Impressions of growth zones (indicated by dashes) are evident on the nuchal bone as they are in Holocene *Malaclemys* (Fig. 4). The posterolateral borders of the nuchal bone posterior to the pleural scute sulci are straight and unnotched. Dimensions of the nuchal bone (in mm) are: width of anterior border, 23.1; length of anterolateral border, 21.9; maximum width, 43.5. The dimensions of the scutes on the nuchal bone are: anterior width of first vertebral scute, approximately 45.0; midline lengths of nuchal scute overlap and underlap, 7.1 and 2.6, respectively; distal widths of nuchal scute overlap and underlap, 6.8 and 11.2, respectively. The large size of the nuchal bone indicates that it was probably from a mature female (approximate carapace length, 165).

A number of morphological characters distinguish the nuchal bone of *Malaclemys* from that of other North American emydine turtles. (1) The relative anterior width of the first vertebral scute (Fig. 5) is as great or greater than the corresponding relative width of that scute in all *Graptemys*, some *Terrapene* (*carolina* and *ornata*), and most *Chrysemys* (except for some *C. picta* and the Pliocene *C. williamsi*), but narrower than that of most *Clemmys*, some *Deirochelys reticularia*, and all *Emydoidea blandingi*. Contact between the first vertebral and pleural scutes of *Malaclemys* occurs with almost equal frequency on either the first peripheral (7 of 15) or near the extreme lateral corners of the nuchal bone (8 of 15), but never occurs as far medially as in *Graptemys*, *Clemmys insculpta*, some *Terrapene* (*carolina* and *ornata*), and *Chrysemys* (except for some *C. picta*). There is never contact between the two scutes on the nuchal bones of *Clemmys marmorata* and *Emydoidea blandingi*, and only rarely in *Deirochelys reticularia* and the Pliocene *Deirochelys carri*. (2) The posterolateral borders of the nuchal bone are straight in *Malaclemys* (a slight notch was noted in only 1 of 15 individuals examined) but notched (Fig. 4) in all *Graptemys* and *Terrapene* and in most *Chrysemys picta* (15 of 20), *Chrysemys* (*Pseudemys* and

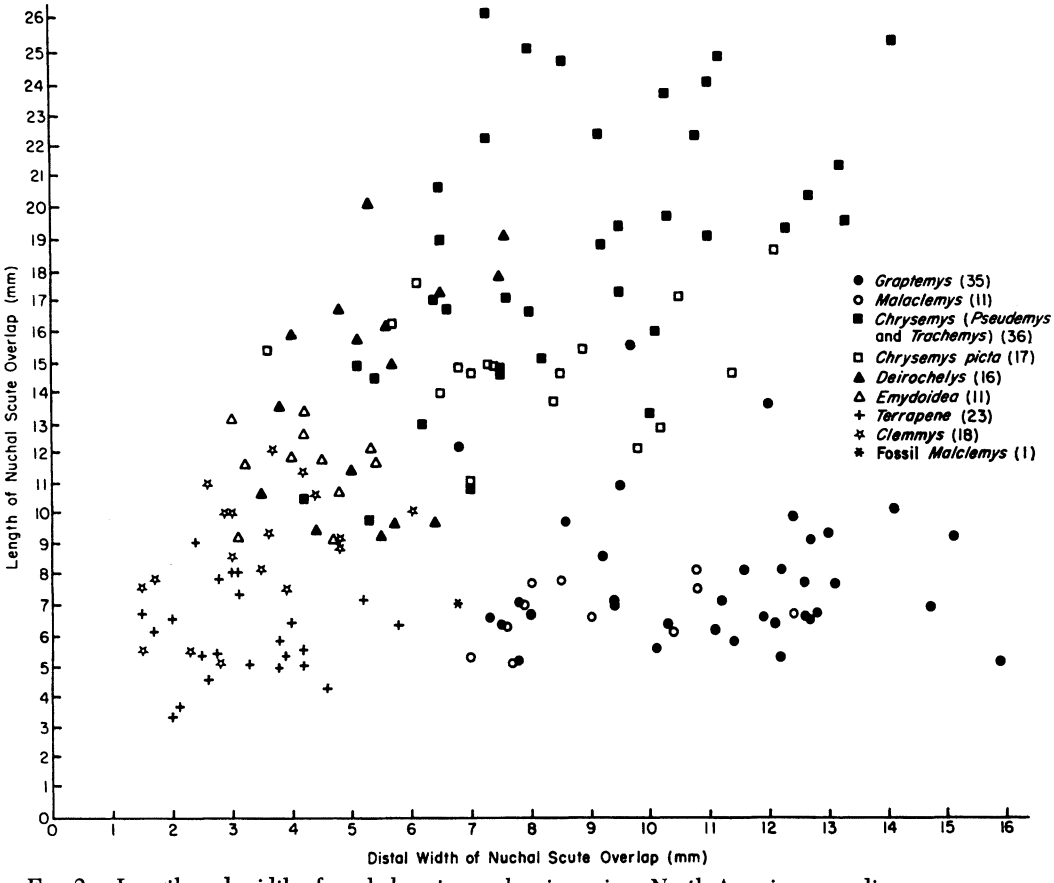

FIG. 2.—Length and width of nuchal scute overlap in various North American emydines.

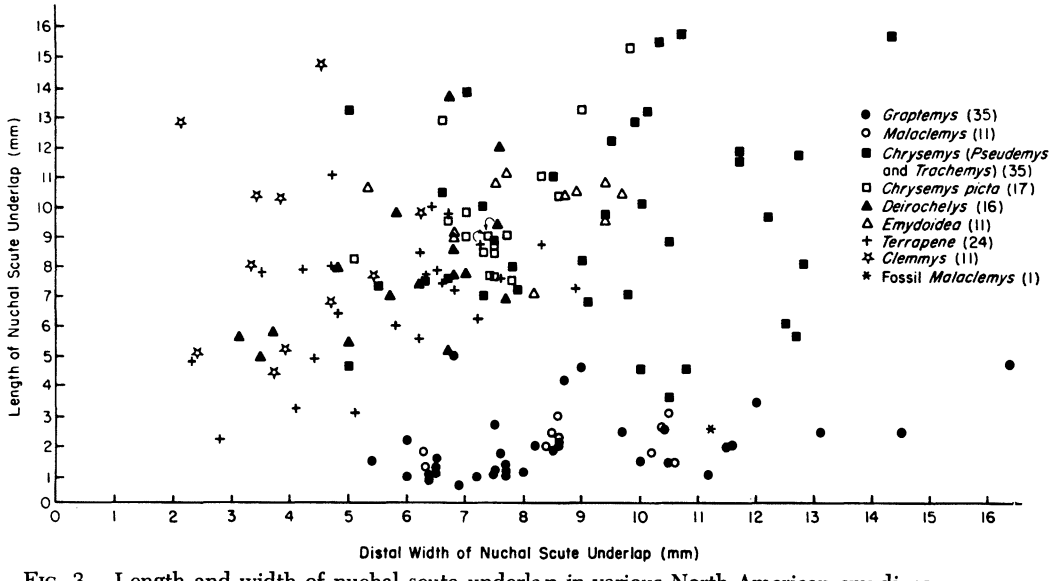

FIG. 3.—Length and width of nuchal scute underlap in various North American emydines.

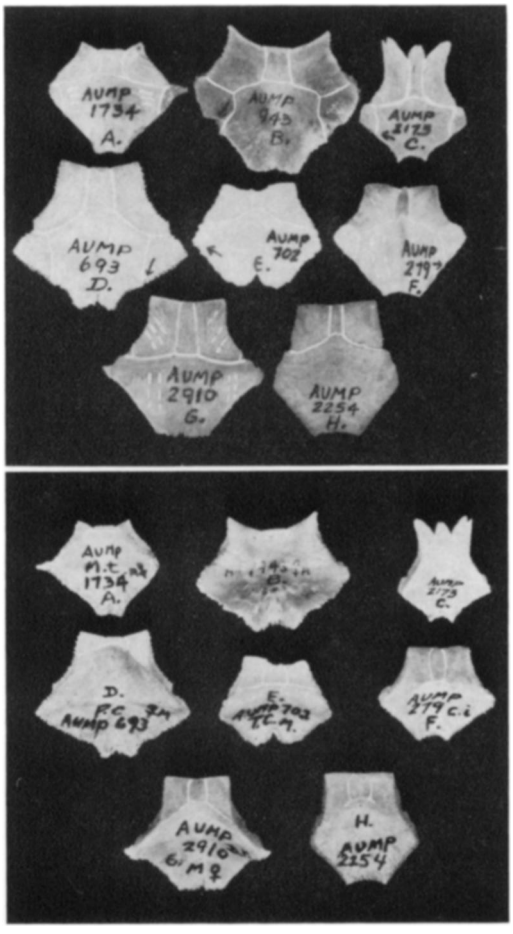

FIG. 4.—Dorsal (upper) and ventral (lower) surfaces of nuchal bones of (A) Holocene *Malaclemys terrapin*, (B) *Graptemys pulchra*, (C) *Chrysemys picta*, (D) *Chrysemys concinna*, (E) *Terrapene carolina*, (F) *Clemmys insculpta*, (G) *Deirochelys reticularia*, and (H) *Emydoidea blandingi*. Maximum width of nuchal bone of AUMP 943 is 51.1 mm. Arrows indicate notches; specimen numbers as shown.

Trachemys) (29 of 31), and *Clemmys* (14 of 16). (3) The nuchal scute overlap (Figs. 1, 2, 4) of *Malaclemys* is shorter and its relative width (approximately as wide as long) generally greater than that of all other emydines except *Graptemys*. (4) The nuchal scute underlap (Figs. 1, 3, 4) of *Malaclemys* is considerably shorter than that of all North American emydines except *Graptemys*, *Chrysemys concinna* and *C. williamsi*. (5) The absence of a well-defined middorsal keel distinguishes the nuchal bone of *Malaclemys* from that of *Clemmys insculpta* and most *Terrapene*. (6) Finally, the shapes of the nuchal bones of most genera are distinct (Figs. 1, 4).

The first left costal bone of the fossil *Malaclemys terrapin* (Fig. 6) is entire, and that part of its anterior border that would adjoin the nuchal is straight, unnotched, and not extended outward as in some emydine genera (Fig. 7). Concentric grooves (indicated by dashes) and a semirounded depression (outlined on the fossil *M. terrapin*) on the dorsal surface of the costal, characteristic of Holocene *M. terrapin* (Figs. 6, 7), are present. Dimensions of the costal bone (in mm) are: length of posterior border, 38.1; anterolateral length from proximal end of costal to end of pleural scute sulcus, 16.3. The costal bone is from a smaller individual than that represented by the nuchal (estimated carapace length, 125 mm).

The first left costals of all *Graptemys* and *Terrapene* and most *Chrysemys* and *Clemmys* are notched and extended outward at that part of the anterior border where contact is made with the nuchal bone (Fig. 7); we have observed this character in only 1 of 15 *Malaclemys* examined. The first left costals of most *Deirochelys* and all *Emydoidea* are straight and unnotched (Fig. 7G, H), as in *Malaclemys*, but *Deirochelys* may be distinguished from *Malaclemys* by its characteristic surface sculpturing (Jackson, 1978*a*) and from *Emydoidea* by its complete lack of sculpturing. A semirounded depression on the dorsal surface of the first costal bone was present in all Holocene *M. terrapin* examined; this depression may extend onto the second costal bone in some larger individuals. *Clemmys insculpta* and the species of *Terrapene* have scultpuring similar to that found on the first costal of *M. terrapin*. The sculpturing patterns in those species are, however, distinct from that of *Malaclemys*. It is therefore possible to distinguish the

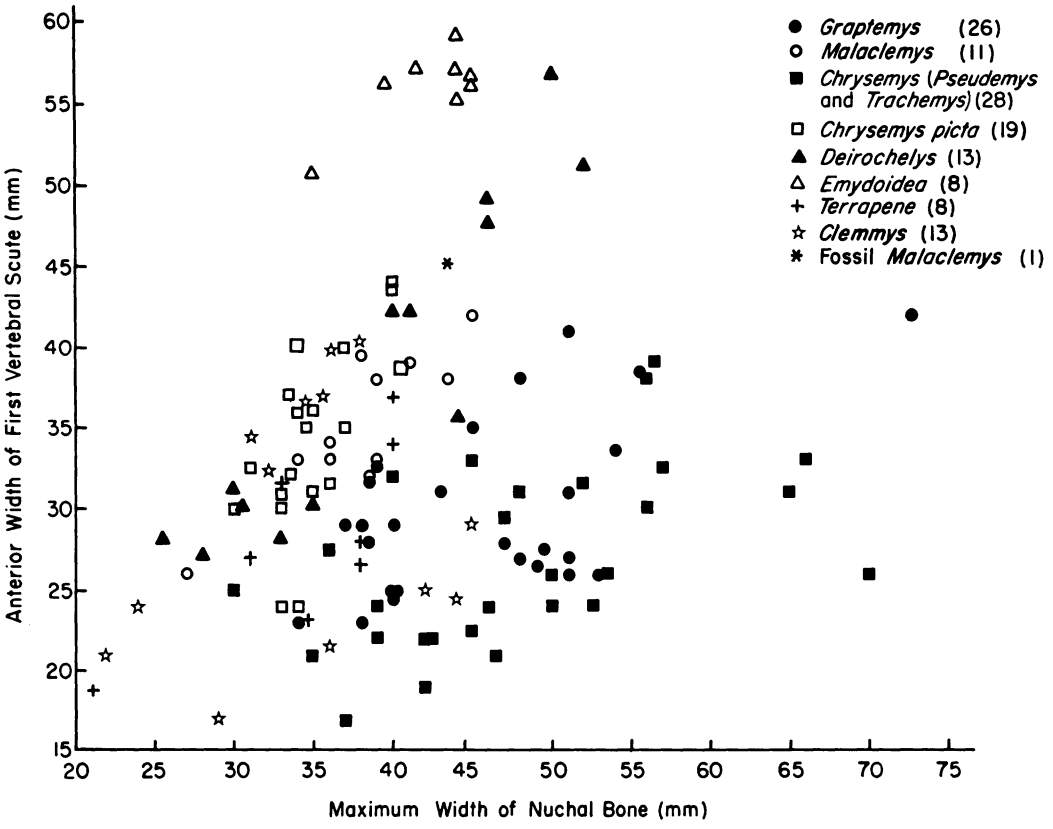

FIG. 5.—Relative anterior width of the first vertebral scute in various North American emydines.

first costal of *Malaclemys* from those of all other North American emydine genera.

Although fossils have been washing ashore at Edisto Beach for decades, the exact location and stratigraphy of the Edisto Beach deposit remain unknown. Cooke (1936) summarized the geological complexity of South Carolina's coastal plain, which is underlain by sediments ranging in age from late Cretaceous to Holocene. Hopson (1964) commented on the mixture of Miocene to Pleistocene fossils contained in many of the coastal plain phosphate deposits. A South Carolina coastal plain mammalian fauna, described by Allen (1926) and containing both Pleistocene and Pliocene genera, probably was derived from the same formation as Edisto Beach. A piece of glyptodont skull washed ashore at Edisto Beach (Ray, 1965) came presumably from a Pleistocene formation. Albert E. Sanders (*personal communication*), who has been studying the vertebrate fossils of Edisto Beach for several years, believes most are coming from Wisconsinan beds just offshore, although a number of specimens referred to *Bison latifrons* and *Bison alleni* suggest that Sangamonian beds (Robertson, 1974) are being eroded by the sea as well. All mammals thus far collected are Rancholabrean forms (A. E. Sanders, *personal communication*).

The composition of the remaining turtle fauna present as fossils at Edisto Beach (*Terrapene carolina* [UF/FSM 21957], *Chrysemys scripta* [UF/FSM 2381, 21958], *Chrysemys nelsoni* [ChM # GPV1508, 1540, 1549], *Chrysemys* cf. *C. floridana* [ChM # GPV1466, 1468], *Geochelone crassiscutata* [UF/FSM 21959], *Chelydra serpentina*

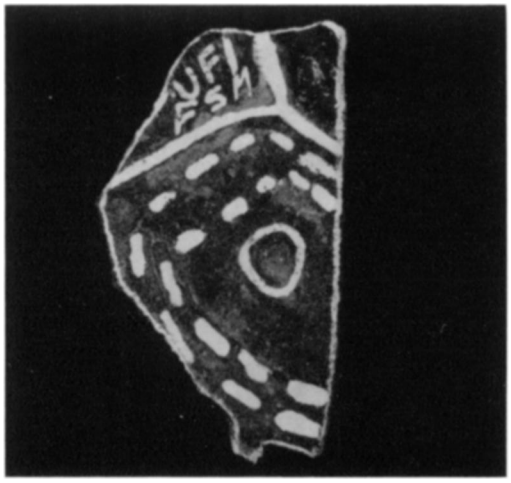

FIG. 6.—Dorsal surface of the first left costal bone of fossil *Malaclemys terrapin* (UF/FSM 22849b). Length of posterior border of costal is 38.1 mm.

FIG. 7.—Dorsal surfaces of the first left costal bones of (A) Holocene *Malaclemys terrapin*, (B) *Graptemys pulchra*, (C) *Chrysemys picta*, (D) *Chrysemys concinna*, (E) *Terrapene carolina*, (F) *Clemmys insculpta*, (G) *Deirochelys reticularia*, and (H) *Emydoidea blandingi*. Length of posterior border of AUMP 944 is 69.3 mm. Arrows indicate notches; specimen numbers are shown.

[ChM # GPV1531, 1535, 1536], *Kinosternon* sp. [ChM # GPV1554], and *Trionyx* sp. [ChM # GPV1526, 1527]) also implies a Pleistocene age for the eroding deposits. Patterns of surface sculpture on the *C. stripta* fossils indicate that they are no older than middle Pleistocene (Jackson, 1977). Like the mammalian fauna, the turtle fauna indicates that the eroding beds may represent more than one horizon. Remains of fossil *Malaclemys* washed onto Edisto Beach indicate the existence of a brackish to saltwater marsh environment very near to the present shoreline and therefore concurrent with an interglacial maximum (A. E. Sanders, *personal communication*). On the other hand, bones of terrestrial (*Terrapene*, *Geochelone*) and freshwater (*Chelydra*, *Chrysemys*, *Kinosternon*, *Trionyx*) genera were likely deposited during a glacial (Wisconsinan?) episode when eustatic lowering of sea level by as much as 120–140 m (Donn et al., 1962; Frey, 1965) exposed most of the continental shelf. The turtle fauna offers no evidence of a colder climate in South Carolina during glacial periods, as had been suggested by Auffenberg (1963) on the basis of mammalian and botanical remains.

The present distribution of *Malaclemys terrapin* is along the coastal strip and associated brackish marshes from Cape Cod to southeastern Texas, and the Edisto Beach area is within the present range of the species (Conant, 1975). *Malaclemys terrapin* is the only emydine species to have exploited such a habitat.

The presence of *Chrysemys nelsoni* (Fig. 8) as a member of the Pleistocene Edisto Beach fauna is noteworthy. The fossils are easily identified as *C. nelsoni* by the long, narrow nuchal scute underlap and overlap, the latter not incised deeply onto the nuchal bone; by carapacial rugosity consisting of fine, parallel ridges (also present but less pronounced on the plastron); by extensive overlap of most plastral scutes; by unnotched peripheral bones; and by large size and massive thickness of the shell. Pleistocene fossils of *Chrysemys nelsoni* have previously been recorded only from Florida

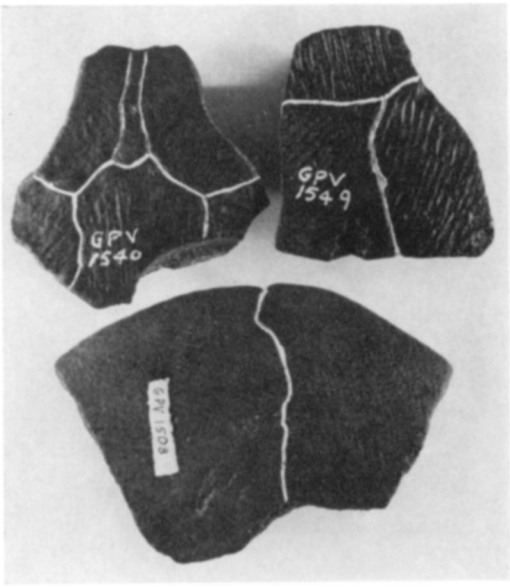

FIG. 8.—Fossil nuchal (ChM # GPV1540), second right peripheral (ChM # GPV1549), and right epiplastral (ChM # GPV1508) bones of *Chrysemys nelsoni*. Maximum width of nuchal bone is 60.1 mm.

(Jackson, 1978*b*). The South Carolina site lies approximately midway between the southernmost known Holocene populations of *Chrysemys rubriventris* in North Carolina (Crenshaw, 1965) and the northernmost populations of *Chrysemys nelsoni* in Florida (Jackson, 1978*b*; Powers and Smith, 1977). These two species of red-bellied turtles almost certainly share a common ancestor, although their ranges are presently separated by a hiatus of about 760 km. The Edisto Beach fossils effectively bridge this hiatus and support the hypothesis that at one time the ranges of the two "species" were continuous and that gene flow occurred, possibly as recently as late Pleistocene.

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