

A RE-EVALUATION OF FOSSIL TURTLES OF THE  
*CHRYSEMYS SCRIPTA* GROUP

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## ABSTRACT

Fossil turtles previously assigned to *Trachemys* (= *Chrysemys scripta* group) by Hay (1908) are re-evaluated in the light of recent fossil discoveries from Florida. Of the nine species of *Trachemys* listed by Hay, six are placed in synonymy as *Chrysemys scripta petrolei*, a mid-Pleistocene subspecies. Hay's *Trachemys nuchocarinata* and *T. jarmani* are shown to be *Terrapene* and *Deirochelys*, respectively. *Trachemys hilli* is believed to be closer to *Chrysemys picta* than to *C. scripta*. Two new fossil species are described from the Pliocene (*C. inflata*) and Pleistocene (*C. platymarginata*) of Florida.

## I. INTRODUCTION

The *Chrysemys scripta* complex is a large and confusing group of New World fresh

water turtles. Williams (1956) divides the *scripta* complex into two subseries on the basis of head and shell color patterns. These groups are presumably separated by intermediate populations in the southwestern United States, northern Mexico, and Baja California. Populations north of this area comprise the *scripta* subseries of *C. s. scripta*, *C. s. elegans*, *C. s. troosti*. Populations south of the area as far as Uruguay and including the Caribbean Islands comprise the *ornata* subseries.

In McDowell's (1964) recent re-classification of aquatic testudinidae, based on skull osteology and foot architecture, *Pseudemys*, *Chrysemys* and *Trachemys* are considered subgenera of *Chrysemys*. The *scripta* complex is synonymous with the subgenus *Trachemys*. In this paper we will use the

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name *Trachemys* for convenience when referring to the *scripta* complex, and Williams' terminology when referring to a particular subseries of *Trachemys*. In evaluating the fossils we have used the following extant comparative material. The number of specimens and their geographic origins are in parentheses. *Chrysemys s. scripta* (26, Florida, Georgia), *C. s. elegans* (14, Texas), *C. s. scripta* x *C. s. elegans* (18, Georgia), *C. s. ornata* (10, Tabasco, Mexico; Vera Cruz, Mexico; Honduras), *C. s. callirostris* (13, purchased), *C. p. picta* (9, Georgia, Pennsylvania, New York), *C. p. marginata* (12, Tennessee), *C. floridana peninsularis* (20, Florida), *C. concinna suwanniensis* (20, Florida), *C. nelsoni* (20, Florida), *Deirochelys reticularia* (20, Florida).

## II. STATUS OF TRACHEMYS

Those turtles closely related to *C. scripta* have long been recognized as representing a natural group. Earlier workers placed them together in the genus *Trachemys*. One of the best earlier attempts to diagnose *Trachemys* was by Hay (1908) who defined the group on the basis of the presence of a dorsal median carapace keel, serrate peripherals, carapace sculptured with wrinkles and grooves, a distinct anterior epiplastral lip, and a shallow xiphiplastral notch at the posterior edge of the plastron. The wrinkled carapace is also found in *Deirochelys*, *Chrysemys nelsoni*, *C. floridana* and large *C. concinna*. Serrate peripherals are found in *C. concinna* but are not double toothed as in *C. scripta* (Fig. 1). A reduced posterior xiphiplastral notch is characteristic both of *C. scripta* and *C. nelsoni*.

McDowell (1964) considers *Trachemys* a subgenus of *Chrysemys*, separating it from the subgenus *Pseudemys* by three rather than four phalanges on the fifth toe, dentary rounded ventrally, no contact between the quadratojugal and the maxilla, and the close proximity of the posterior end of the pterygoid and the exoccipital. No feet or skulls have yet been found with fossil specimens so that comparison of these characters in the described fossil species is impossible. We accept McDowell's usage of *Chrysemys*, but studies by Rose and Weaver, question his concept of the subgenera (Rose and Weaver, 1967; Weaver and Rose, 1967).

## III. PREVIOUS STUDIES ON FOSSIL TRACHEMYS

Since the last full treatment of fossil turtles belonging to the *scripta* group was by Hay (1908), we have used his generic nomenclature in the following account.

*Trachemys hilli* (Cope) 1879. This species was assigned to *Trachemys* by Hay (1908). The only specimen available is the type, collected from Late Pliocene Loup Fork deposits, Decatur County, Kansas, it is composed of only the plastron and a partial carapace lacking the nuchal bone. However the absence of both double toothed peripheral bones and a median carapacial keel, and the thinness of the pleural bones indicate that this species is closer to *C. picta* than to *Trachemys*. *Trachemys hilli* is currently under study by Kraig Adler.

*Trachemys jarmani* Hay, 1908. The type, an aberrant nuchal bone from Hillsborough County, Florida, was referred provisionally to *Trachemys* by Hay. We refer it to the genus *Deirochelys*, already suggested as a possibility by Hay (1908). Hay considered the greater thickness of *jarmani* grounds to separate it from *Deirochelys floridana*. Jackson (1964) showed Hay's (1908) *D. floridana* was actually *D. reticularia*. We tentatively refer *C. jarmani* to *D. reticularia* on the basis of the nearly flat, unsculptured, dorsal surface of the nuchal bone and the characteristic pattern of fine rugose lines (Fig. 2).

*Trachemys petrolei* (Leidy), 1868. The type, from the Pleistocene of Harden County, Texas, consists of both right and left epiplastra of a single individual. A nuchal bone and hypoplastron found in the same area, but from a different individual were referred provisionally to this species by Hay (1908). Hay used the greater ventral width of the nuchal scute in *petrolei* to separate it from living *Chrysemys* (then *Trachemys*) *scripta*. We consider it to be conspecific with *scripta*.

*Trachemys bisornata* (Cope) 1878. This species is known from portions of three individuals from Pleistocene deposits of Atascosa County, Texas. The nuchal strongly resembles Hay's *sculpta* and large individuals of extant North American races of *C. s. scripta* and *C. s. elegans*. Hay (1908) separated the fossil from these species on the basis of its thicker and more sculptured

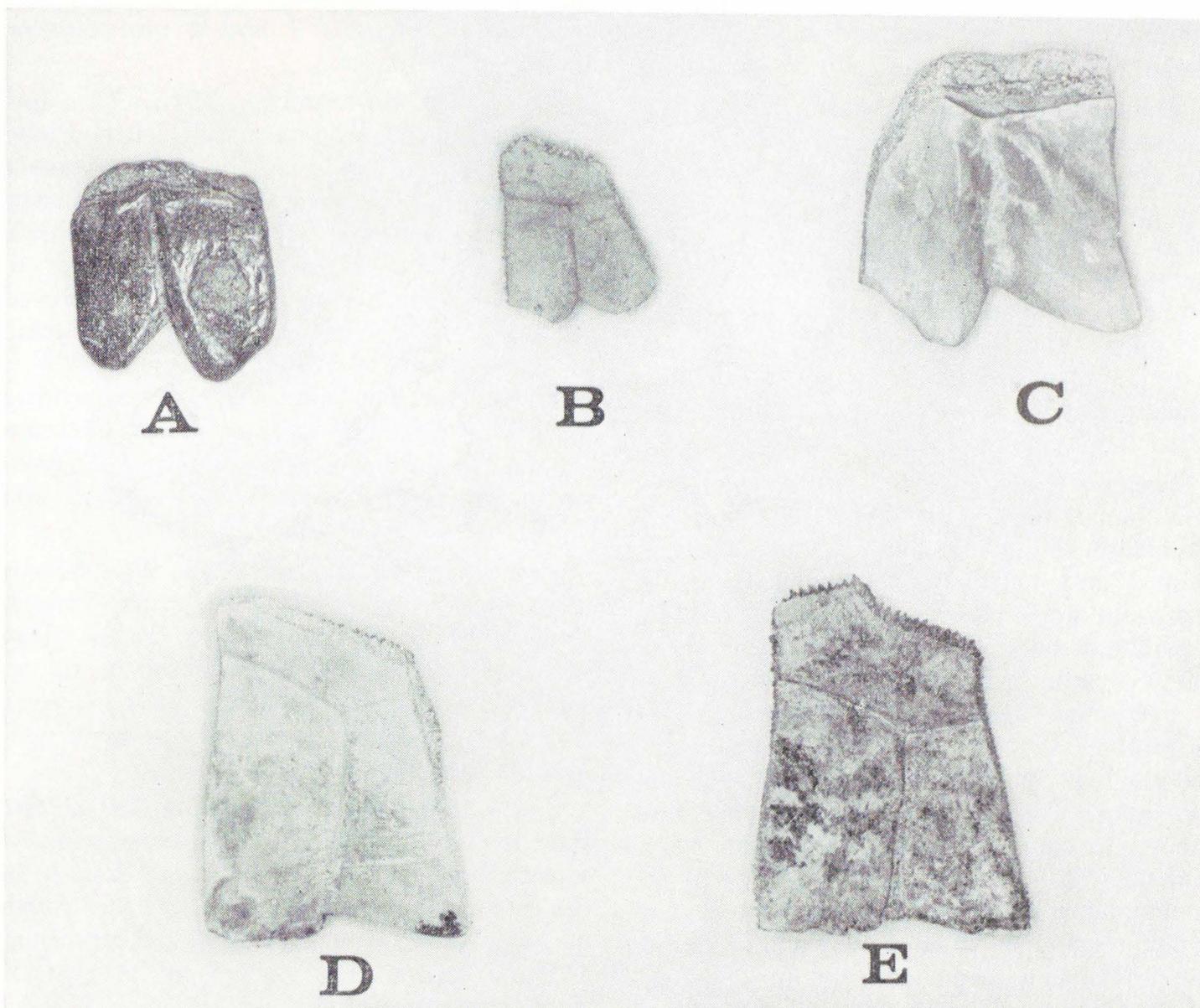


Figure 1. Dorsal view of peripheral bones of fossil and Recent emydine turtles: A. Pliocene *Chrysemys inflata* (Manatee County specimen); B. Recent *C. s. scripta*; C. Pliocene *C. inflata* (Bone Valley specimen); D. Recent *C. concinna suwanniensis*; E. Recent *C. floridana peninsularis*.

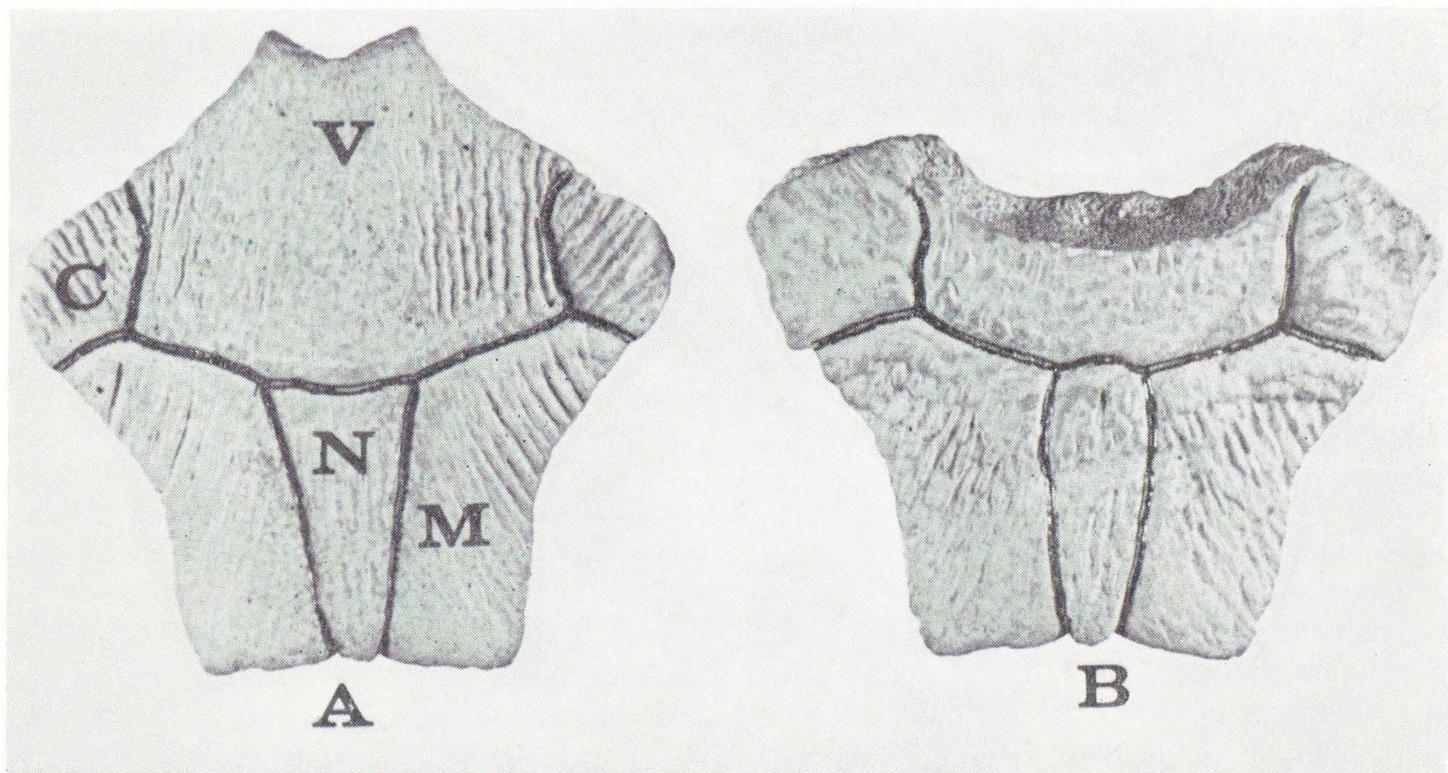


Figure 2. Dorsal view of nuchal bones of Pleistocene *Deirochelys*; A. *D. reticularia*; B. Cast of Hay's *Trachemys jarmani* (= *D. reticularia*); C. costal scute area; M. marginal scute area; N. nuchal scute area; V. vertebral scute area.

carapace and poorly defined median dorsal keel.

*Trachemys euglypha* (Leidy), 1889. Hay redescribed the type, a nuchal bone, in detail (see Leidy, 1889 for illustration), placed the species in *Trachemys* and referred another nuchal from the type locality along Peace Creek, Florida, to the same species. The referred specimen is not *Trachemys* but *Terrapene carolina*. Later (1916) he referred a third nuchal from the Pleistocene Peace Creek beds to *euglypha* on the basis of its large size.

*Trachemys sculpta* Hay, 1908. The type is a nuchal bone from Pleistocene deposits of Hillsborough County, Florida. Several pleural and peripheral elements from the same site were referred to this species. Hay considered the nuchal to be that of *bisornata* but separated it nomenclatorially because of a presumed age difference between the "Pliocene" Peace Creek beds from which *sculpta* was collected and the Pleistocene *bisornata*. The Peace Creek beds are now known to contain Pleistocene faunas (Auffenberg, 1963). The anterior border of the nuchal bone of *sculpta* was said to be narrower than that of *euglypha* while that of the latter has a deeper anterior notch, broader excavation for the first neural, and is wider and shorter than *sculpta*. Additional specimens were reported from Pleistocene deposits in Hillsborough, Lee and St. Lucie counties, Florida (Hay, 1916). The Lee County specimen, a nuchal collected from Pleistocene beds on the banks of the Caloosahatchee River, differs from the Texas *bisornata* by its larger size and smoother marginal scute area. Some peripheral and pleural bones from Vero (=Vero Beach), Florida were referred provisionally to this species by Hay.

Gilmore (1930) described a nearly complete *sculpta* from Pleistocene deposits near Melbourne, Brevard County, Florida. In this specimen pleurals 3 and 5 are expanded distally, 2 and 4 constricted distally. Gilmore contrasted this condition with that in recent species, and concluded that the distal widths of the pleurals in Recent species were more nearly equal. Our sample of Recent and fossil turtles shows that in extant *Chrysemys scripta*, *C. nelsoni*, *C. floridana*, and *Graptemys barbouri* distal expansion of pleurals 3 and 5 and the concomitant con-

striction of pleurals 2 and 4 are common features.

*Trachemys delicata* Hay, 1916. This species was named from a right pleural found near La Belle, Florida, on the Caloosahatchee River. Hay considered the deposit Pliocene, but it is probably Pleistocene (Dunbar, 1958). The specimen was assigned to *Trachemys* because of its delicate sculptured pattern. The extent or type of sculpturing on the pleurals is highly variable, and it is now known that the kind of sculpturing found on the type of *delicata* is common on the pleurals of Recent and fossil *Chrysemys floridana*, *C. scripta*, *C. nelsoni*, and *Deirochelys reticularia*.

*Trachemys trulla* Hay, 1908. The type is a portion of the epiplastron from Pleistocene beds in Hardin County, Texas. Hay assigned it to *Trachemys* because of its resemblance to the epiplastra of *C. scripta elegans* which now occurs in the same geographic area.

*Trachemys nuchocarinata* Hay, 1916. The type is composed of the anterior portion of a nuchal bone from a Pleistocene deposit in the Florida Coast Line Canal 20 miles north of St. Augustine, Florida. Auffenberg (1958) showed the nuchal to be that of *Terrapene carolina*.

#### IV. RE-EVALUATION OF FOSSIL

##### TRACHEMYS

Newly discovered Pliocene, Early Pleistocene (Late Blancan) and Middle Pleistocene (Rancholabrean) fossils from Florida referable to *Trachemys* enables us to re-evaluate species previously assigned to this group.

In the following discussion we restrict the terms sculpturing to indicate the total relief of a scute area and the term rugosity to indicate any etchings, ridges, or unevenness occurring on a scutal area.

##### *Chrysemys inflata*, sp. nov.

*Holotype*: University of Florida collections (UF), a nuchal bone collected by Mr. Omar Buckner (Fig. 3).

*Type locality and horizon*: The type was collected in a phosphate mining area known as Palmetto Washer, R 24 E, T 31 S, Sec. 30, 5 miles east of Mulberry, Polk County, Florida. Deposits in this area have been assigned to the Middle and Upper Miocene

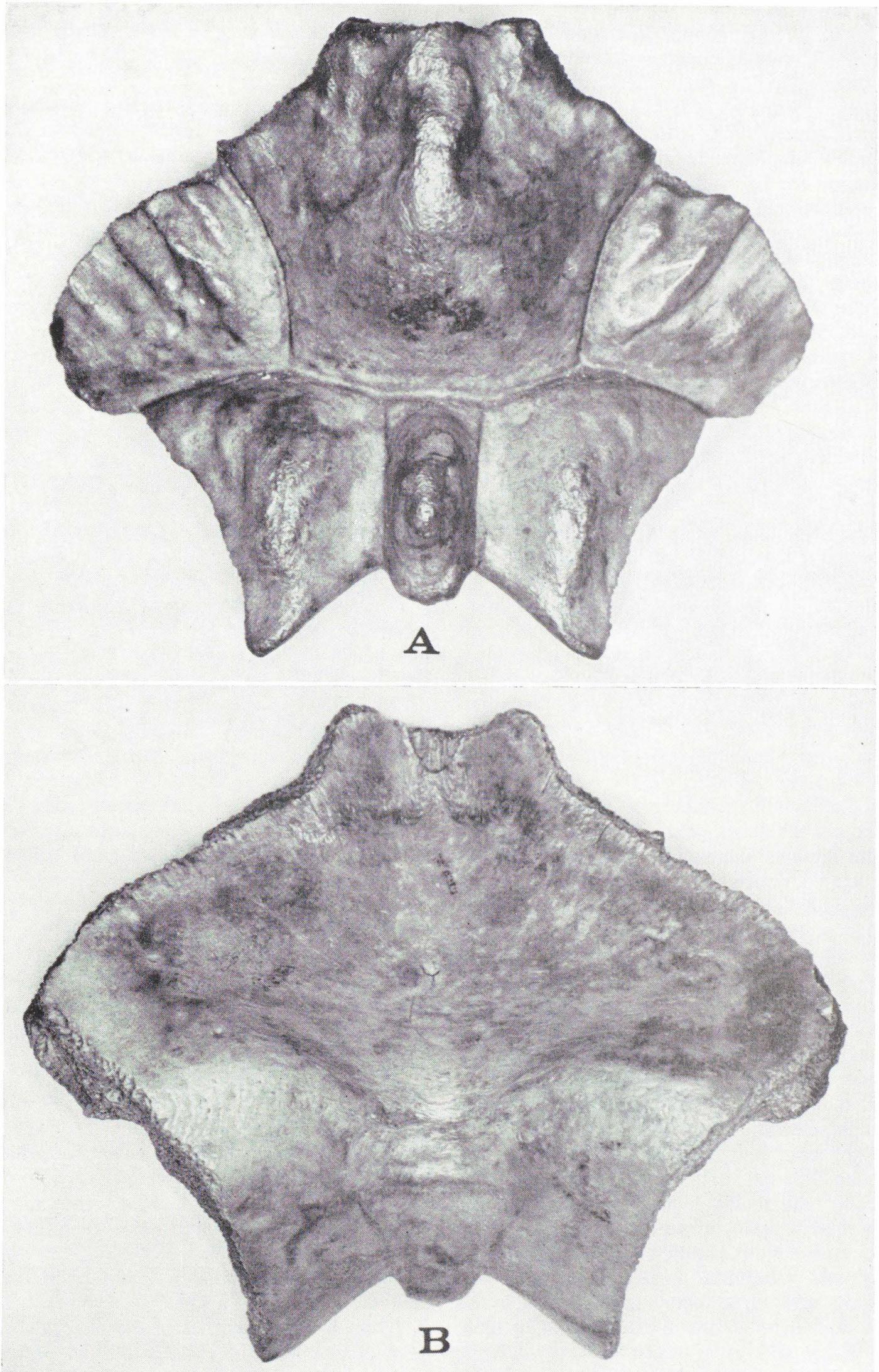


Figure 3. Type specimen of *Chrysemys inflata*: A. dorsal view of nuchal bone; B. ventral view of nuchal bone.

(Olsen, 1956), Upper Miocene (Matson, 1913), Upper Miocene and Lower Pliocene (Olsen, 1957), and Pliocene (Sellards, 1916). Simpson (1933) dated the land vertebrate fauna as Pliocene, while Brodkorb (1955) suggested Late Miocene to Middle Pliocene for the avifauna.

Pleistocene fossils have been found in place within the rock sequence of the Bone Valley phosphate district at a new locality known as the Pool Branch site (3 mi. E. NE. of Fort Meade, Hardy County, Florida). Fossil *Chrysemys* are known from this site but are not identifiable as to species.

Recent excavations at Palmetto Washer by S. David Webb and Norman Tessman produced a peripheral bone from this species found in a spoil bank with *Nannippus*, *Hipparion*, and *Neohipparion* fossils, typical Pliocene indicators. More convincing evidence of a Pliocene age for *C. inflata* is the discovery, also by Webb and Tessman, of a peripheral bone from Manatee County 16 miles E. of Bradenton, 1 mile N. of State Road 64, 1/2 mile E. of Dam Face on south side of Manatee River (Verna Quadrangle), 27° 30' x 82° 20', a known Pliocene deposit. We refer the specimen, although water worn, to *C. inflata* because of its well-developed serrations and exaggerated rugosity (Fig. 1).

*Diagnosis:* A member of the *scripta* complex on the basis of the highly sculptured scute areas of the nuchal bone (Fig. 3), the associated double toothed peripheral bones (Fig. 1A), epiplastra having an extensive gular scute overlap and nuchal bone with extensive nuchal scute underlap, (Weaver and Rose, 1967), and neural bones whose architecture suggest the presence of a well defined median keel on the carapace. Differs from the fossil *Chrysemys scripta petrolei* and extant *C. s. scripta*, *C. s. troosti*, and *C. s. elegans* by the shape of the anterior nuchal notch (Figs. 3-6), nuchal notch depth and width, (Figs. 7, 8), and the smooth medial half of the marginal scute area of the nuchal bone. Differs from the *Chrysemys ornata* complex of Mexico, Central and South America, by having double toothed peripheral bones, a rugose and highly sculptured carapace particularly on the nuchal bone, and a greater nuchal scute underlap and gular scute overlap. Differs from *C. platymarginata* by the rugose lateral portion of the marginal scute area of the

nuchal bone, and by a more acute notch angle (Fig. 9).

In some of the peripherals the second (posterior) serration forms an apex with the first (anterior) serration of the adjacent posterior peripheral bone. In all of our *C. platymarginata* and fossil *C. scripta* and in all adult extant *C. s. scripta* in our sample the serrations form two complete peaks on each peripheral bone (Fig. 1).

*Description of the holotype:* An extremely sculptured, rugose nuchal bone (Fig. 3). Diagonal rugose lines are present on the costal scute area and the lateral half of the marginal scute areas. The anterior end of the nuchal bone is steeply notched. Ventrally the nuchal scute extends back nearly as far as it does dorsally. The anterior part of the vertebral scute area rises medially to a rounded hump which is compressed posteriorly, suggesting a well developed median carapace keel.

*Referred material:* All the following material was collected at Palmetto Washer. UF 11279, epiplastron; UF 11280, one nuchal bone; two nuchals now in the collection of Mr. Omar Buckner; UF 11281 various fragmentary carapace and plastral parts; UF 11581 peripheral from Manatee County. We feel that it is reasonable tentatively to refer the less diagnostic elements from Palmetto Washer to this species since all of the nuchals and marginals known from this locality suggest affinities with *Trachemys*.

*Chrysemys platymarginata*, sp. nov.

*Holotype:* University of Florida collections (UF) 11046, an almost complete carapace and plastron of an adult collected by J. S. Robertson, L. B. Ober, S. David Webb, 1964.

*Type locality and horizon:* Haile XVA, R 17 E, T 95, S 25, Alachua County, Florida, Irvingtonian Age, Pleistocene. The specimen was taken from a layer of clay which interfingered with, and is considered to be contemporaneous with, white sand layers which contain an Irvingtonian mammalian fauna. Additional specimens of *Chrysemys platymarginata* have been taken from both the clay and white sand.

*Diagnosis:* A member of the *scripta* complex on the basis of doubly toothed peripheral bones, a highly sculptured nuchal bone, epiplastra with extensive gular scute over-

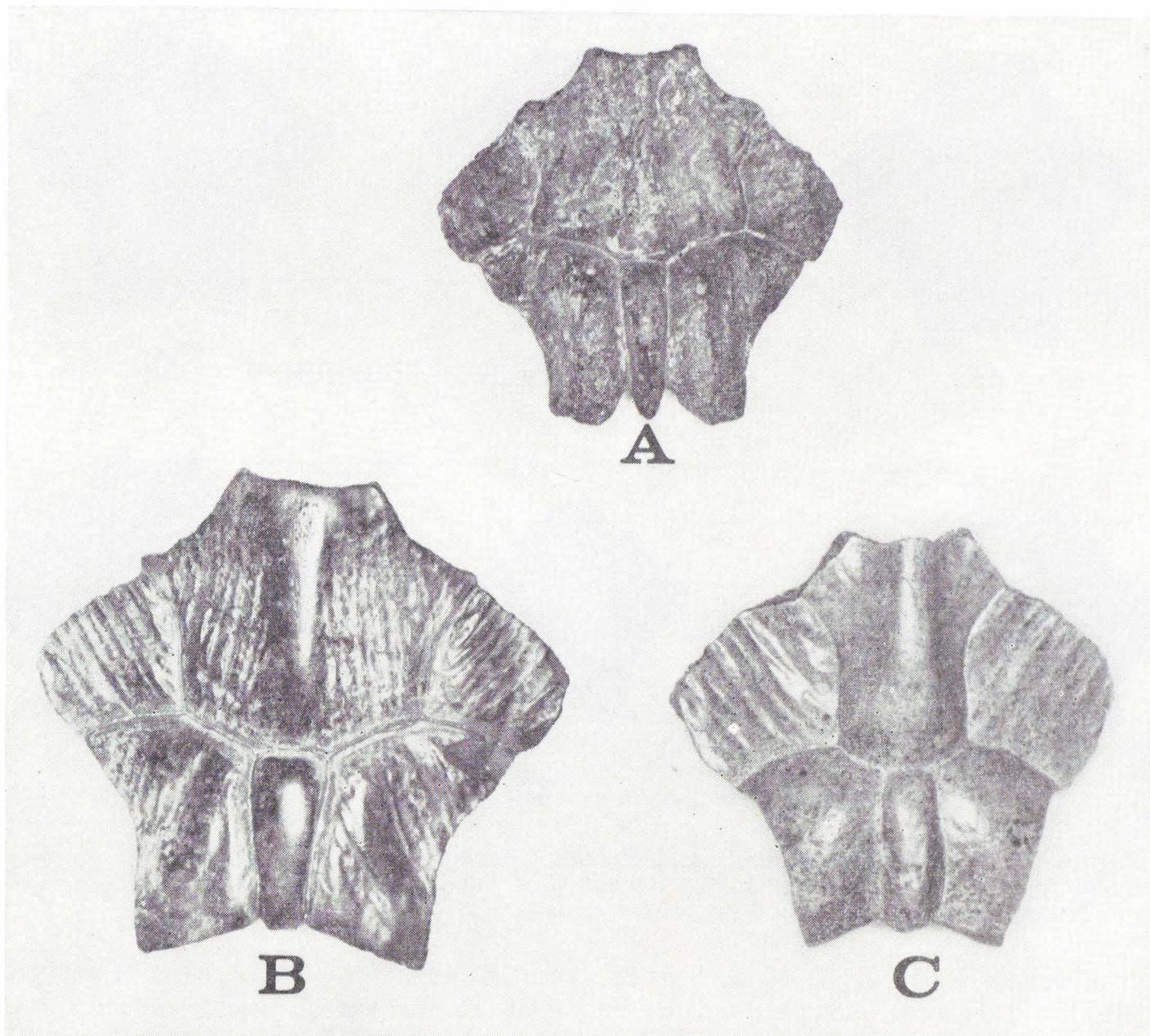


Figure 4. Dorsal view of the nuchal bone in Pleistocene *Trachemys*. A. *Chrysemys scripta petrolei*; B. *C. s. petrolei* (Nocatee specimen); C. *C. s. platymarginata*.

lap and nuchal bone with extensive nuchal scute underlap (Weaver and Rose, 1967), and well developed median keel on the carapace. It differs from *C. scripta petrolei* and extant members of the *scripta* and *ornata* subseries by a deeper and wider nuchal notch (Figs. 7, 8), and a greater nuchal notch angle (Fig. 9). Its closest relative is probably *C. scripta petrolei* (discussed below). It differs from all turtles of the *scripta* complex, living or fossil, in consistently having (in 100% of our sample) smooth marginal scute areas of the nuchal bone (Table 1, Fig. 4B). The carapace is only faintly rugose (Figs. 10A, C) contrasting with those of *C. inflata*, *C. scripta petrolei*, or living *C. scripta*.

*Description of the Holotype:* The carapace lacks right peripheral bones 2-11, and left peripherals 10 and 11. The supra-pygals

and pygals are also missing. The distal ends of right pleurals 1-6, and all of 7 and 8 are missing as is the left eighth pleural. The absence of diastemas between the pleural and marginal bones indicate that the specimen is adult size.

The plastron is expanded posteriorly and has a well developed notch at the lateral border of the femoral-anal scute junction (Figs. 10B, D). The epiplastral lip is thick, squared, and well defined. A broad scute overlap occurs on the epiplastral lips and lateral borders of the hyo- and xiphiplastron.

*Paratype and referred specimens:* The paratype is UF 10047, carapace, and plastron; Haile XV. Referred specimens are: 19 nuchal bones; Haile XVA: UF 10048, four nuchal bones, Santa Fe River UF 10427 R 16 E, T 7 S, S 34, Gilchrist County, Florida; UF 10277 one nuchal, Charlotte Co.

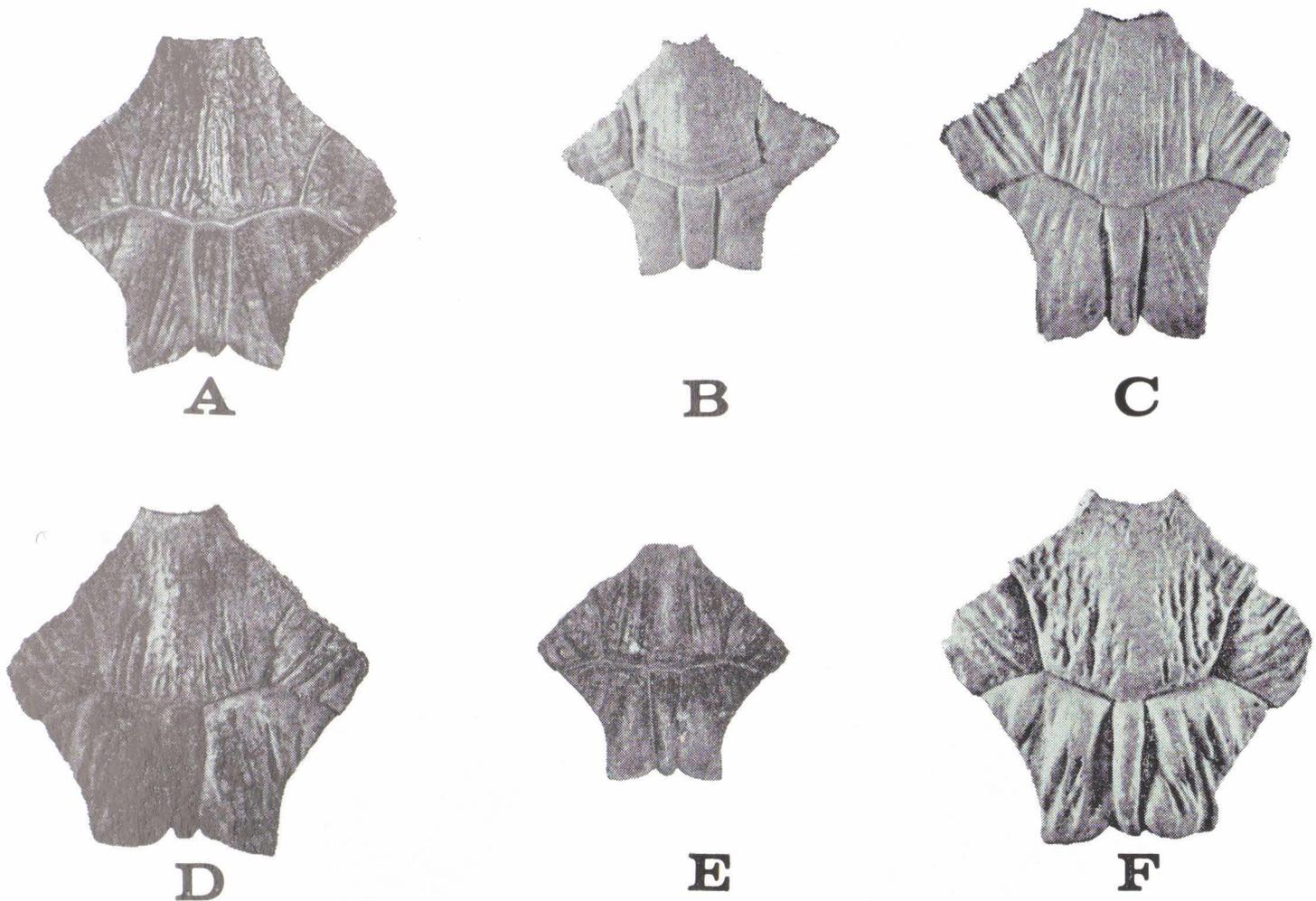


Figure 5. Dorsal view of fossil and Recent *Chrysemys scripta*. A, D, and E. *C. s. petrolei* from Ichatucknee River; B. Recent *C. s. scripta* from Florida; C. *C. s. elegans* from Texas; F. cast of Hay's *Trachemys sculpta* (= *C. s. petrolei*).

Port Charlotte R 23 E, T 40 S, Sec. 29, Charlotte Co. Florida. Though the Santa Fe I fauna contains both Blancan and Late Pleistocene mammals (Kurten, 1965), the turtle nuchals here referred to this species from Santa Fe I are believed to be part of

the Blancan fauna on the basis of the geologic distribution of similar elements from other deposits. Nuchals of the Rancholabrean *C. s. petrolei* are also found at Santa Fe I as well as several other fossil deposits in the river but this need not indicate contemporaneity since Late Pleistocene bones have apparently been carried into Santa Fe I by the action of the river and bear no temporal relationship to the Blancan fauna. No nuchals of *C. platymarginata* have been found in the river other than at Santa Fe I.



Figure 6. Measurements made on the nuchal bone to compare relative nuchal notch width (2/1), and depth (3/2). The angle of the nuchal notch is the angle between the sides of the notch with the angle apex toward the rear of the bone.

#### Rancholabrean Fossils From Florida

The Floridian Rancholabrean fossils have a characteristically rugose carapace pattern of short, raised, longitudinal lines, doubly serrate marginals, nuchal with well sculptured and rugose scutal areas, and raised and thickened, square or rectangular epiplastral lips. The variation exhibited by these fossils, particularly the nuchal bones, easily includes the features of the species listed under *Trachemys* by Hay (1908). Similarities between the species listed by Hay (1908) and the Floridian Rancholabrean fossils, and

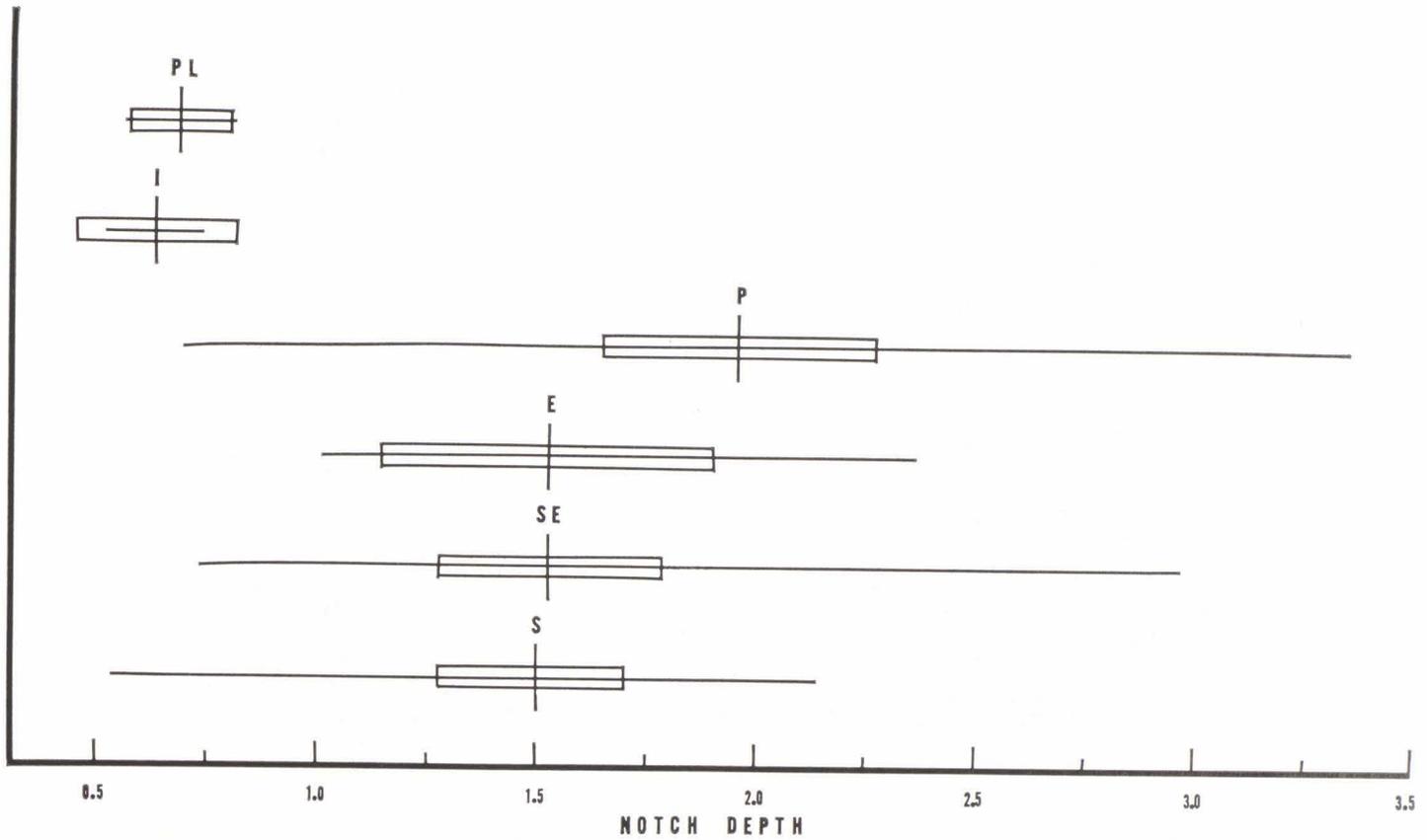


Figure 7. Nuchal notch depth in *Chrysemys s. scripta* (S), intergrades between *C. s. scripta* and *C. s. elegans* (SE), *C. s. elegans* (E), *C. s. petrolei* (P), *C. inflata* (I), and *C. platymarginata* (PL). The mean, range, and two standard errors are indicated N=*scripta* 17, *scripta* x *elegans* 18, *elegans* 9, *petrolei* 22, *platymarginata* 13, *inflata* 3.

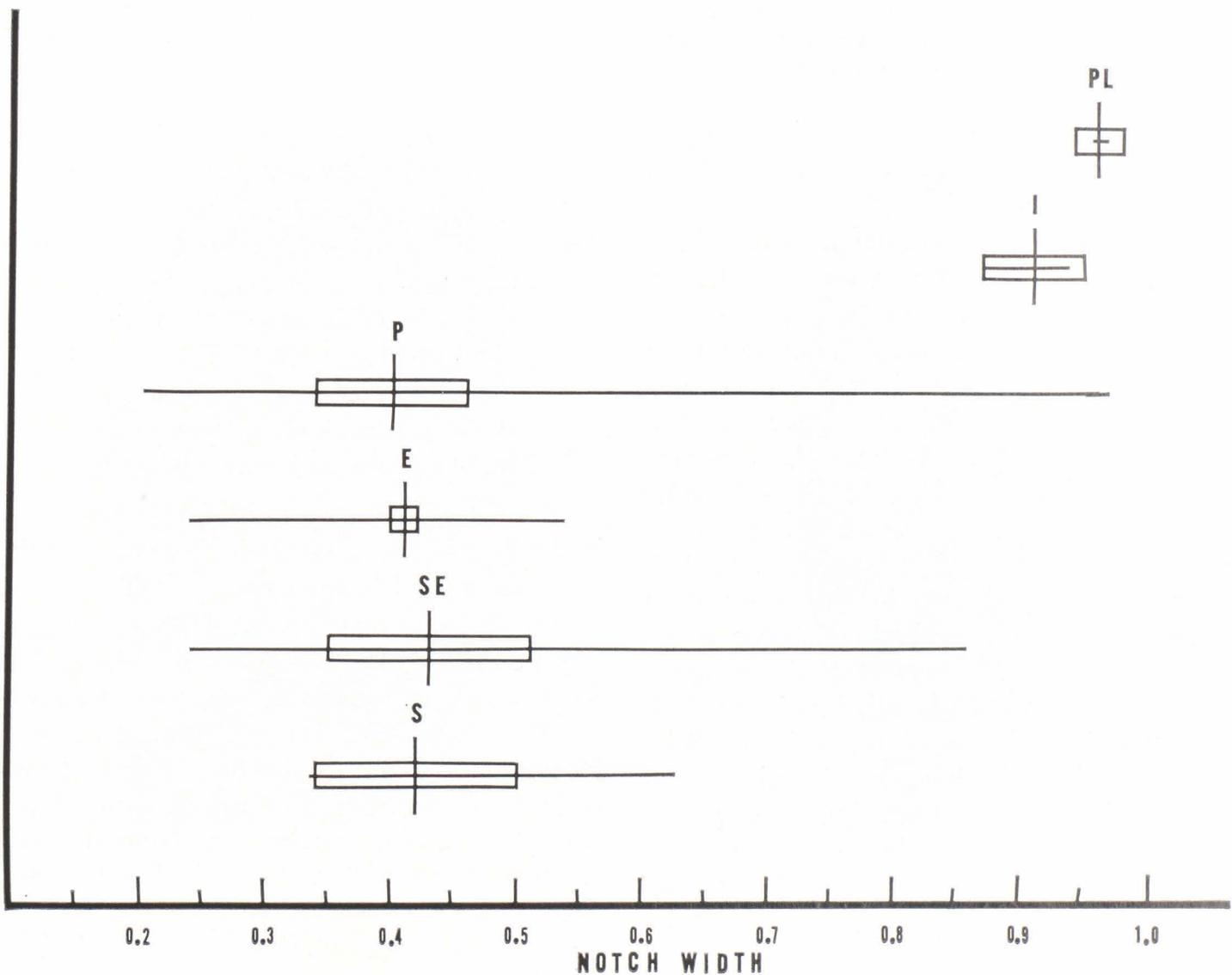


Figure 8. Nuchal notch width in fossil and recent members of the *Chrysemys scripta* group. Method of presentation and symbols as in figure 7.

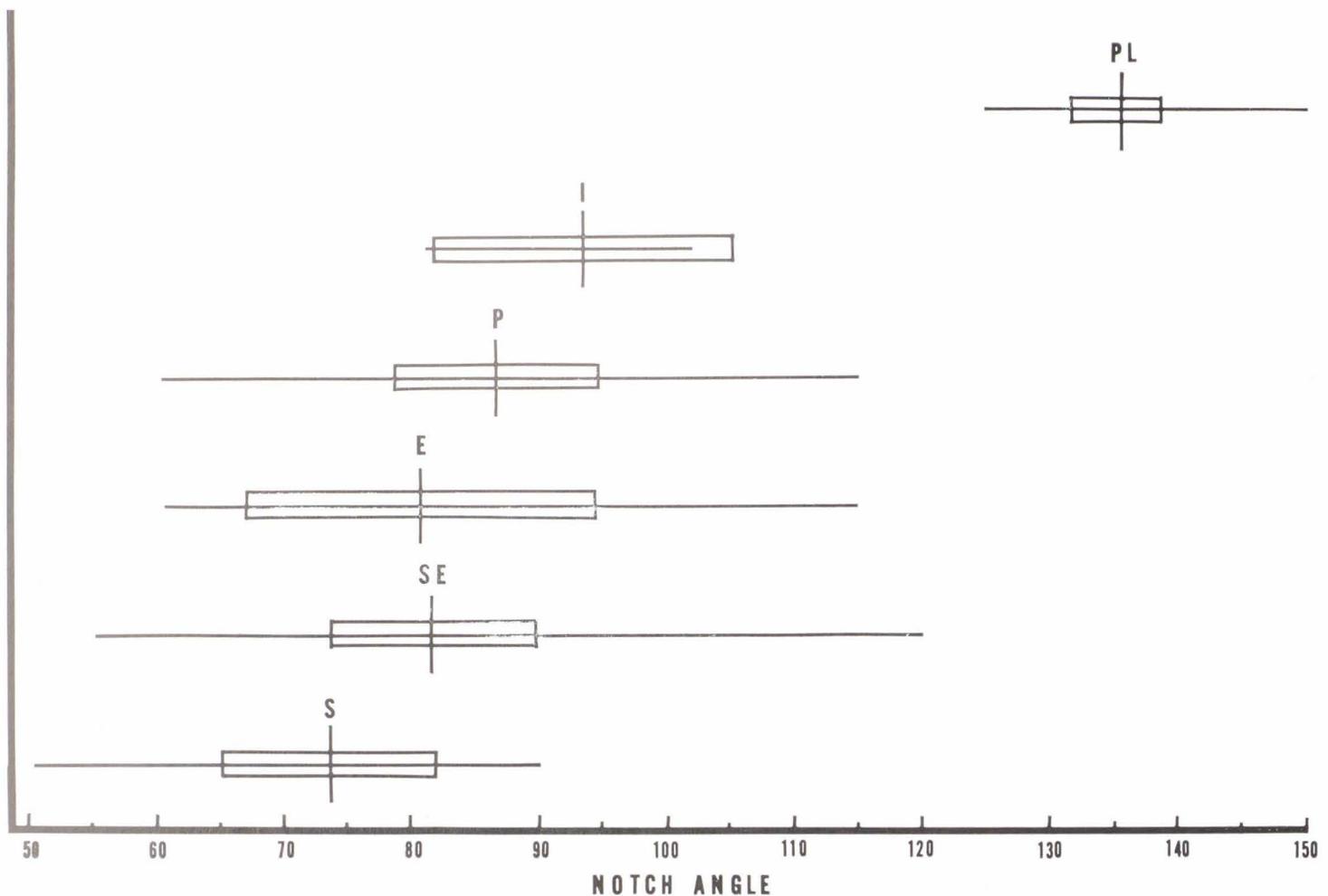


Figure 9. Nuchal notch angle in fossil and recent members of the *Chrysemys scripta* group. Method of presentation and symbols as in figure 7. The angle in degrees is shown at the bottom of the figure.

between those and recent *C. scripta scripta*, *C. s. troosti*, and *C. s. elegans* suggest that the entire assemblage of Hay's valid *Trachemys* as well as the Floridian Rancholabrean material is more appropriately included in *C. scripta*. The larger average size of the Rancholabrean fossils and their concomitant increase in rugosity and sculpturing is a minor distinction which may prove useful as a stratigraphic tool in Florida. Furthermore, an additional series of fossils from Ichatucknee Springs (Fig. 5) show a size gradation from typically large Rancholabrean nuchals to smaller ones which, in the absence of mineralization, are indistinguishable from those of extant *C. s. scripta*. If the Rancholabrean turtles are to be distinguished, it is best done by subspecific recognition. Such temporal subspecies have been used to identify members of an evolutionary sequence recognizable by minor but consistent features in turtles (Auffenberg, 1958), rodents (Klingener, 1963), and birds (Howard, 1947). This temporal race, which we consider as *C. s. petrolei*, is redefined here as follows:

*Chrysemys scripta petrolei* (Leidy)  
new combination

The following names are placed in synonymy and are subsequent to Hay (1908).

- Trachemys petrolei* (Leidy), 1868
- Trachemys bisornata* (Cope), 1878
- Trachemys euglypha* (Leidy), 1889
- Trachemys sculpta* Hay, 1908
- Trachemys trulla* Hay, 1908
- Trachemys delicata* Hay, 1916

*Holotype*: The two epiplastrals described by Leidy (1868) and again by Hay (1908) are considered the holotype.

*Referred material*: Nuchal bone (originally described as *T. petrolei* by Hay), UF 2336, anterior portion of carapace, Reddick 1B, R 21 E, T 13 S, Sec. 14, Marion County, Florida; UF 6531, nuchal, Bone Cave, R 18 E, T 18 S, Sec. 33 Citrus County, Florida; UF 2573, nuchal Arredondo, 1A, R 19 E, T 10 S, Sec. 22; UF 10560, 7 nuchals Santa Fe River, R 16 E, T 7 S, Sec. 29 Gilchrist County Florida; USNM 16681, nuchal, R 21 E, T 30 S, Sec. 16, Hillsborough County, Florida; UF 11278, 16 nuchals,

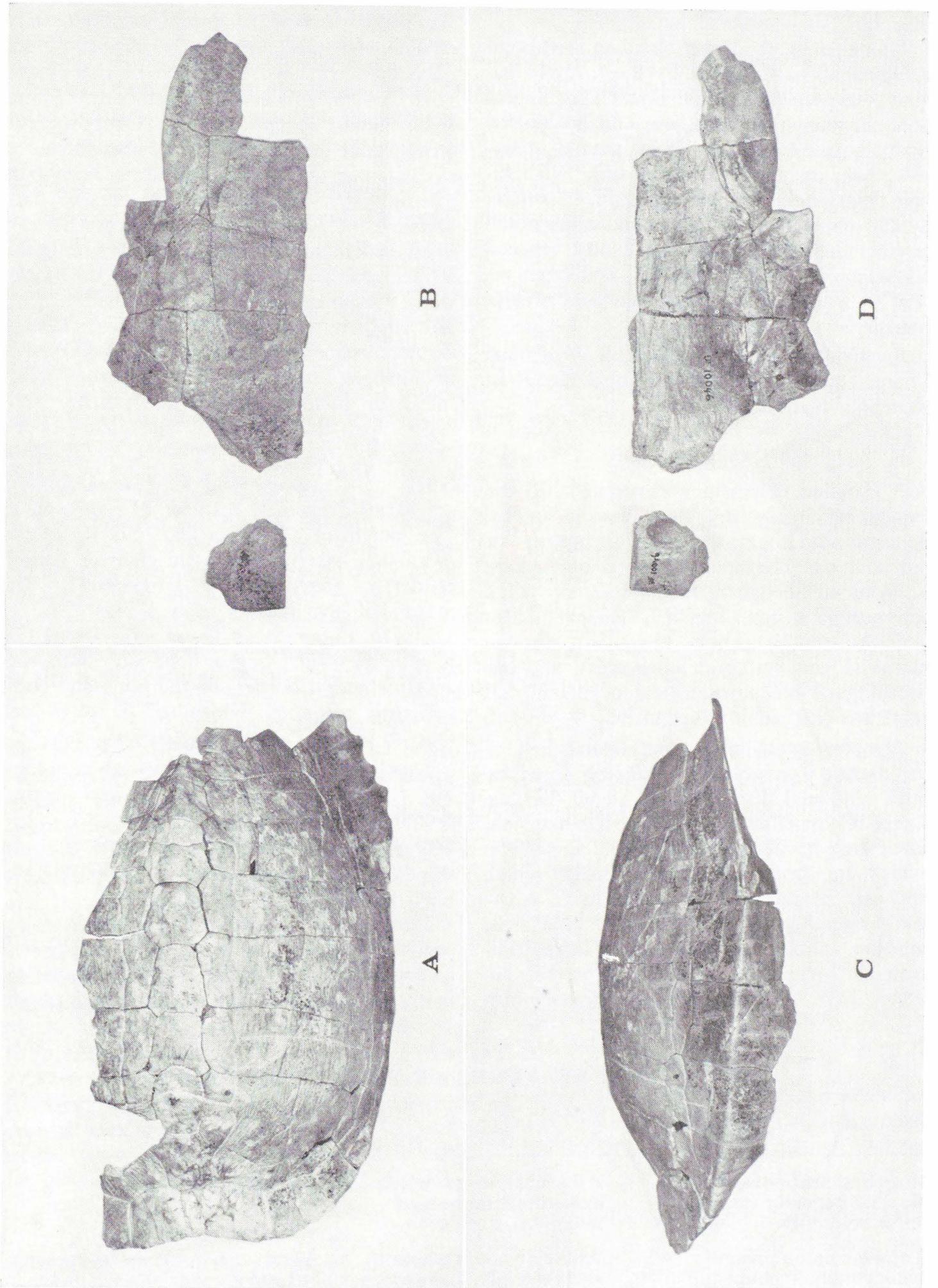


Figure 10. Type specimen of *Chrysemys s. platymarginata*. A. dorsal view of carapace; B. ventral view of plastron; C. side view of carapace; D. dorsal view of plastron. Length from anterior end of carapace to end of seventh neural bone is 259.4 mm.

Itchatucknee River, Columbia County, Florida.

*Diagnosis:* A Rancholabrean temporal subspecies characterized by a profusely rugose carapace and large size. The nuchal bone in particular is rugose and sculptured on all scutal areas. It differs from *C. platymarginata* in having a nuchal bone with rugose marginal scute areas, from *C. inflata* by the reduced depth of the anterior notch on the nuchal bone (Fig. 7), and reduced nuchal notch width (Fig. 8), and from recent *C. scripta* by its larger size and greater rugosity.

*Fossil Range:* From Florida (Alachua County) west to Atascosa County Texas in Rancholabrean times.

#### V. DISCUSSION

A detailed discussion of variation in the fossils is largely restricted to the nuchal bone on which we have relied so heavily for our analysis. The nuchal bone is covered by portions of the marginal, costal, vertebral, and nuchal scutes (Fig. 2). Relief (sculpturing) and roughness (rugosity) of the marginal and vertebral scute areas, and the notching of the anterior end of the nuchal bone are particularly diagnostic.

*Marginal scute area:* The lateral half of the marginal scute area is distinguished by faint diagonal rugose lines in *C. inflata*. These rugose lines cover the entire marginal scute area in all specimens of *C. s. petrolei* except one from the Nocatee site in which only the lateral half is rugose. In *C. platymarginata* this area is not rugose. Marginal rugosity is more pronounced in large individuals. Large specimens of *C. scripta petrolei* have diagonal lines elevated into

ridges, giving an eroded appearance. This also occurs in large examples of extant *C. s. scripta* with carapace length over 200 mm. Specimens we have examined of the extant *P. s. ornata*, however, are smooth. Some West Indian specimens have a rugose pattern similar to that of *C. s. scripta* and *C. s. elegans*, but others resemble *C. s. ornata* in this respect. Sculpturing of this area is characteristic of North American races and the West Indian species of the *scripta* group we have examined. *Chrysemys inflata* shows extreme sculpturing (Fig. 3). Sculpturing, like rugosity, is proportional to size. *Chrysemys s. ornata* of Mexico and *C. s. callirostris* of northern South America are noteworthy for their relative lack of sculpturing and rugosity on this region of the nuchal bone.

*Anterior notching:* The deep anterior notch of *C. inflata* and *C. platymarginata* are major diagnostic features (Figs. 3, 4C). The notch in all *C. inflata* and *C. platymarginata* extends from the anterior lateral borders of the nuchal bone medially to the region of the nuchal scute (Figs. 2A, 3, 4B). In *C. scripta petrolei*, and living *C. scripta* the notch begins medially from the anterior lateral borders of the bone and consequently the notch width and depth is less than in *C. inflata* and *C. platymarginata*.

Less acute but extremely variable notching is present in both fossil and extant members of *C. scripta*. However, *C. s. ornata* and *C. s. callirostris* are consistent in lacking such a notch, resembling in this respect *C. floridana* and *C. concinna*.

*Vertebral Scute area:* This area is very rugose in adult *C. s. scripta*, *C. s. elegans*, *C. inflata* and *C. scripta petrolei*, but less so in *C. platymarginata*. A median longitudinal

TABLE 1  
NUCHAL BONE FEATURES OF FOSSIL TRACHEMYS

<i>Chrysemys platymarginata</i>	<i>Chrysemys inflata</i>	<i>Chrysemys scripta petrolei</i>
Marginal scute area smooth. Marked rugosity on costal scute area only.	All scutal areas rugose except medial half of marginal scute area.	All scutal areas rugose.
Anterior notch present, not strongly V shaped.	Anterior notch present and strongly V shaped.	Anterior notch may be present, but not as wide or deep as in <i>inflata</i> or <i>platymarginata</i> .
No diagonal rugose lines on marginal scute area.	Diagonal rugose lines on lateral half of marginal scute area only.	Diagonal rugose lines on entire marginal scute area in strong relief.

keel or rounded hump of the vertebral area is present on most *C. scripta*. This feature, present in both fossil and extant *C. scripta*, is absent in *C. s. ornata* and *C. s. callirostris*.

*Sexual Dimorphism:* By t-test analysis adult females have a significantly (at the .025 level) longer carapace, thicker marginal scute areas, and wider nuchals than do males. We believe, however, these differences are a reflection on the greater size of the specimens of the female sample (Table 2).

The Blancan *C. platymarginata* appears to be ancestral to *C. sculpta petrolei*, *C. s. scripta*, *C. s. elegans*, and *C. s. troosti* of the *scripta* subseries as defined by Williams (1956). The Nocatee fossil (Fig. 4B) has features which may represent a morphological step in the evolution to *Chrysemys scripta* from *C. platymarginata*. *Chrysemys inflata* is seemingly an extinct line from a Pliocene *C. platymarginata*-like ancestor.

The characteristic nuchal features (Table 1) of *C. scripta petrolei* are found in the extant North American races of the *scripta* subseries. The chief difference between living and Middle to Late Pleistocene forms is size. The extensive rugosity and sculpturing of the Rancholabrean fossils is often present in large extant specimens of *C. s. scripta*. The major evolutionary trends as seen in the carapace, particularly the nuchal bone, are increased rugosity and decreased sculpturing. These trends form the basis of our supposition that *C. inflata* is a morphological successor of stock similar to *C. platymarginata*. The extent of the nuchal and peripheral bone notching and the massive, rugose grooves and ridges of *C. inflata* suggest that it was a specialized or aberrant species characterized by an extreme development of *Trachemys* features and not representative of the main evolutionary sequence leading to recent *C. scripta*.

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VI. LITERATURE CITED

AUFFENBURG, WALTER, 1963. Fossil testudine turtles of Florida genera *Geocheilone* and *Floridemys*. Florida State Museum, Bull. 7(2):53-97.  
 AUFFENBURG, WALTER, 1958. Fossil turtles of the genus *Terrapene* in Florida. Florida State Museum, Bull. 3(2):53-92.

TABLE 2  
 NUCHAL MEASUREMENTS OF FOSSIL AND RECENT TRACHEMYS

	Recent ♀♀			Recent ♂♂			<i>C. s. petrolei</i>			<i>C. inflata</i>			<i>C. platymarginata</i>		
	$\bar{x}$	s	N	$\bar{x}$	s	N	$\bar{x}$	s	N	$\bar{x}$	s	N	$\bar{x}$	s	N
Greatest nuchal bone width	48.2	3.76	9	38.3	9.00	13	68.0	10.04	4	65.7	10.61	2	70.4	5.73	9
Nuchal bone length	43.1	4.06	9	33.3	3.31	13	57.9	5.95	6	48.2	4.03	3	57.4	4.92	13
Anterior nuchal bone width	23.5	3.26	9	20.1	2.39	13	35.2	6.68	6	30.7	2.87	3	32.2	4.21	13
Nuchal scute width	5.4	1.43	9	5.2	1.31	13	6.8	1.84	6	8.2	1.17	3	8.7	1.38	13
Nuchal scute length	18.5	2.99	9	13.6	2.34	13	21.1	3.70	6	18.5	2.06	3	23.7	3.03	13
Thickness of nuchal bone at marginal scute	9.2	2.17	9	6.0	1.38	13	14.9	1.95	6	17.4	3.38	3	14.9	2.47	13

- BRODKORB, PIERCE, 1955. The avifauna of the Bone Valley Formation. Florida Geol. Surv., Rpt. Invest., 14, 57 pp.
- DUNBAR, J. R., 1958. Stratigraphy and paleontology of the late Neogene strata of the Caloosahatchee River area of southern Florida. Florida Geol. Surv., Bull. 40, 266 pp.
- GILMORE, CHARLES W., 1930. A nearly complete shell of the extinct turtle *Trachemys sculpta*. Proc. U. S. Natl. Museum, 77(10):1-8.
- HAY, OLIVER PERRY, 1908. The fossil turtles of North America. Carnegie Inst. Washington, Pub. No. 75, pp. 1-568.
- HAY, OLIVER PERRY, 1916. Descriptions of some Floridian fossil vertebrates, belonging mostly to the Pleistocene. Florida Geol. Surv., 8th Ann. Rept., pp. 41-76.
- HOWARD, HILDEGARDE, 1947. An ancestral golden eagle raises a question in taxonomy. Auk, 64:287-291.
- JACKSON, C. G., 1964. The status of *Deirochelys floridana* Hay with comments on the fossil history of the genus. Tulane Stud. Geol., 2(3):103-106.
- KLINGENER, DAVID, 1963. Dental evolution of *Zapus*. Jour. Mammalogy, 44(2):248-260.
- KURTEN, BJORN, 1965. The Pleistocene Felidae of Florida. Florida State Museum, Bull. 9(6):215-273.
- LEIDY, JOSEPH, 1889. Description of vertebrate remains from Peace Creek, Florida. Trans. Wagner Free Institute Sci., Phila., 2:19-31.
- MATSON, G. C. and S. STANFORD, 1913. Geology and ground waters of Florida. U. S. Geol. Surv., Water-Supply Paper 319, 445 p.
- MCDOWELL, SAMUEL B., 1964. Partition of the genus *Clemmys* and related problems in the taxonomy of the aquatic Testudinidae. Proc. Zool. Soc. Lond., 143(2):239-279.
- OLSEN, STANLEY J., 1956. A new species of *Osteoborus* from the Bone Valley Formation of Florida. Florida Geol. Surv., Special Pub. No. 2, pp. 1-5.
- OLSEN, STANLEY J., 1957. A new beak-jawed mastodont from Florida. Jour. Palaeont. Soc. India, 2:131-135.
- ROSE, FRANCIS L. and W. G. WEAVER, JR., 1967. Two new species of *Chrysemys* (= *Pseudemys*) from the Florida Pliocene. Tulane Stud. Geol., 5(1):41-48.
- SELLARDS, E. H., 1916. Fossil vertebrates from Florida: a new Miocene fauna; new Pliocene species; the Pleistocene fauna. Florida Geol. Surv., 8th Ann. Rept., 77-168.
- SIMPSON, G. G., 1933. Glossary and correlation charts of North American Tertiary mammal-bearing formations. Bull. Amer. Mus. Nat. Hist., Vol. LXVII, Art. 111.
- WEAVER, W. G., JR. and FRANCIS L. ROSE, 1967. Systematics, evolution, and fossil history of the genus *Chrysemys*. Tulane Stud. Zool., 14(2):63-73.
- WILLIAMS, E. E., 1956. *Pseudemys scripta callirostris* from Venezuela with a general survey of the *scripta* subseries. Harvard, Bull. Mus. Comp. Zool., 115(5):145-160.