Festschrift for Marian Młynarski

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A new species of *Geochelone* (*Testudinata*: *Testudinidae*) from the Pleistocene of Florida (U.S.A.) *

[With plates XXIX—XXXII and 4 text-figs]

Nowy gatunek *Geochelone* (*Testudinata*: *Testudinidae*) z plejstocenu Florydy (Stany Zjednoczone Ameryki)

Abstract. A new species of fossil land tortoise, *Geochelone mlynarskii*, is described from the Coleman IIA, late Irvingtonian mammal age, middle Pleistocene, central Florida, U.S.A. It is clearly a member of the *turgida*-complex (sensu Auffenberg, 1963). The new species differs from its closest relative *Geochelone incisa* (Hay) (Rancholabrean faunal age, Florida) in its significantly smaller adult size and in certain measurements and architectural details of especially the plastron.

I. INTRODUCTION

The extensive Coleman IIA fauna was recovered from a sinkhole in the Eocene limestone of Sumter County, Florida, U. S. A. The mammalian fauna has been described by Martin (1974) and its age is considered as middle Pleistocene, late Irvingtonian (Webb, 1974).

Among the fossils recovered from the site are many fragments of land tortoises. These remains are particularly important, for up to the present time all Pleistocene fossil tortoise remains from the southeastern United States represent late Pleistocene geologic time. Thus the Coleman IIA tortoise material is representative of a new, earlier time period in the Pleistocene.

As is typical of most Tertiary and Pleistocene deposits in temperate parts of the world, the land tortoise fossils from this site can be referred to one large and one small species (Auffenberg, 1963, 1966). The larger species is unquestionably referable to *Geochelone crassiscutata* (Hay), which extends from this geologic time through the late Pleistocene into the early Recent. The smaller species is clearly an undescribed member of the *turgida*-complex

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* Contribution No. 304 from the Vertebrate Paleontology Collection, Florida State Museum.

(sensu AUFFENBERG, 1963) on the basis of shell measurements, shape, and scutes. The new species is named in honor of Dr. Marian MŁYNARSKI in view of his significant contributions to the study of fossil tortoises.

II. DESCRIPTION

Geochelone mlynarskii sp. n.

Holotype. — Florida State Museum Collections, UF 18960, a plastron of an adult male, lacking epiplastra (pl. XXIX).

Type locality and Horizon. — Coleman IIA site (SE 1/4, NW 1/4, Sec 7, T 20 S, R 23 E) near Coleman, Sumter County, Florida, U. S. A. The specimen was collected from Pleistocene sediments that had slumped into a post depositional solution pit in the underlying Ocala limestone of the Eocene Series. The bone-bearing matrix contains fossils representing the Irvingtonian mammal age of middle Pleistocene age.

Description and Comparison

A species of the genus *Geochelone*, subgenus *Hesperotestudo*, and a member of the *turgida*-complex on the basis of the presence of a supracaudal buckler (proven by the hinge surface for the buckler on the inner surface of the pygal bone), small adult size (proven by the lack od shell fenestra between the pleurals and peripherals and between the plastral elements along the median line, as are characteristic of young age), and the greater proportionate thickness of the shell (particularly the epiplastral projection). Other species of the *turgida*-complex reported from Florida (collectively called the *incisa* group) are *G. alleni* and *G. incisa*. Its closest relative is *Geochelone incisa* (HAY), as redefined by AUFFENBERG (1963), from late Pleistocene Rancholabrean mammal age deposits of Florida. It differs from this species partly by being smaller (see Tables I, II for measurements of *G. mlynarskii*). The plastral length of the two specimens for which it is possible to estimate total lengths are 150 mm (UF 18960, an adult male lacking epiplastra), and 185 mm (UF 18957, an adult female, lacking both xiphi- and epiplastra). *G. mlynarskii* also differs from *G. incisa* in having a significantly shallower xiphiplastral notch, a thinner plastron both at its median longitudinal suture and at its external vertical surface, a less inflated epiplastral lip with a less convex profile, epiplastral keels less developed, with shallower gulo-humeral sulci, and with a greater proportion of the nuchal bones possessing sulci of the first costal scutes.

Geochelone alleni from the middle Pliocene, Hemphillian age of Florida is also closely related to *G. mlynarskii*. *G. alleni* is slightly smaller. It differs from *G. incisa* and *G. mlynarskii* in possessing a thinner shell and in lacking a well defined keel on the epiplastral projection. The epiplastral lip of *G. mlynarskii* is intermediate in shape and relative thickness between *G. alleni* and

G. incisa. However, relative notch depth and width are greater than in *G. incisa* relative to *G. alleni.*

The remaining species of the *turgida* complex as presently conceived occur in the Great Plains (AUFFENBERG, 1962, 1966). *Geochelone turgida* (upper Miocene of Texas), *G. riggsi* (upper Pliocene of Kansas), and *G. johnstoni* (middle Pleistocene of Texas) (Fig. 1) are larger and more rugose than *G. alleni,* and both possess distinct keels on the dorsal and ventral surfaces of the epiplastral projection.

GEOLOGICAL AGE	MAMMALIAN AGE	GREAT PLAINS SPECIES	FLORIDA SPECIES	FLORIDA LOCAL FAUNAS
PLEISTOCENE	Rancholabrean		*incisa*	Reddick I, Zuber
	Irvingtonian		*mlynarskii*	Coleman IIA
		Sp? Seymour	SP?	Leisey, Haile XXI
		Crooked Creek	Undescribed	Sante Fe IIB
PLIOCENE	Blancan	*riggsi*	Sp?	Inglis
		johnstoni		
	Hemphillian		Undescribed	Bone Valley
		turgida		
MIOCENE	Clarendonian		*alleni*	McGeehee
			None	Love Bone Bed

Fig. 1. Geologic and geographic distribution of species comprising the *Geochelone turgida* complex

Description of Holotype

A partial plastron, composed of the hyo-, hypo-, and xiphiplastron of the right side and the hypoplastron of the left. The remains are from an adult male, suggested by, collectively, the lack of fenestra between any of the plastral elements and the ventral concavity of the hyo- and xiphiplastra. Pertinent measurements are given in Table I.

A single axillary and inguinal scute are present on each side; the latter over twice as large as the former. The pectoral scute is short along the midline, with the humero-abdominal suture forming an obtuse angle about half way

Table I

Measurements (in mm) of holotype (UF 18960) of *Geochelone mlynarskii* sp. n.

Bridge length	67.5	Xiphiplastron height	11.6
Post. lobe length	42.0	Xiphiplastron thickness	5.5
Plastron width	80.0	Hypoplastron length	35.7
Pect. scute length	8.8	Hypoplastron width	49.9
Abdom. scute length	47.8	Anal notch width	37.8
Fem. scute length	20.3	Anal scute depth	16.5
Xiphiplastron length	19.7	Anal scute length	8.0
Xiphiplastron width	34.7	Anal scute width	23.7

Table II

Summary of important shell measurements (in mm) of holotype and referred material of *Geochelone mlynarskii* sp. n., all from the type locality

Measurements	OR	Mean	SD	CV
Bridge l.	60.0—86.0	70.4	8.8	12.5
Post. lobe l.	33.0—49.0	40.5	6.3	15.6
Ant. lobe l.	—	41.0	0.0	0.0
Plastron w.	66.0—92.0	75.4	10.8	11.8
Pect. scute l.	7.3—11.9	9.3	2.2	23.4
Abdom. scute l.	38.9—60.0	49.1	10.6	21.5
Anal scute l.	6.0—12.1	9.5	2.0	20.8
Xiphiplastron l.	16.3—32.7	22.9	4.6	20.0
Xiphiplastron w.	26.0—46.2	36.4	5.4	14.9
Xiphiplastron ht.	9.5—18.8	14.0	2.6	18.3
Xiphiplastron th.	4.0—8.2	5.5	1.0	19.1
Anal notch w.	24.2—54.6	39.0	6.6	17.0
Anal notch d.	8.0—16.5	12.3	2.4	20.8
Entoplastron l.	19.5—33.5	26.0	5.7	22.0
Entoplastron w.	18.1—32.4	26.1	5.7	22.0
Epiplastron gr. l.	17.7—44.8	30.2	5.8	19.9
Epiplastron med. l.	14.6—29.0	20.2	3.4	17.0
Epiplastron lip th.	12.0—21.4	16.7	2.6	15.2
Epiplastron lip l.	12.0—25.1	19.3	3.6	18.7
Pygal dorsal w.	24.0—30.4	27.6	2.7	9.6
Pygal ventral w.	13.9—20.9	17.1	2.7	15.9
Pygal l.	17.3—23.3	20.3	2.8	13.7
Precentral gr. w.	37.4—50.9	43.3	4.3	10.0
Precentral l.	29.4—42.9	34.0	4.6	13.5
Precentral ant. w.	19.8—33.6	25.1	3.9	15.6
Nuchal sc. ant. w.	1.3—7.8	4.3	4.1	95.4
Nuchal sc. post. w.	1.3—19.0	5.6	4.3	76.3
Nuchal sc. l.	3.3—18.3	9.5	3.6	37.5
Precentral gr. w.	37.4—50.9	43.3	4.3	10.0
Precentral ant. w.	19.8—33.6	25.1	3.9	15.6
Precentral l.	29.4—42.9	34.0	4.6	13.5

Abbreviations: OR — observed range; SD — standard deviation, CV — coefficient of variation; d — depth, ht — height, l — length th — thickness, w — width.

along its length. The abdominal-femoral sulcus is gently curved posteriorly. The anal scute is short along the midline and the posterior tip of the xiphiplastron is projected, the anal notch forming an acute angle medially if both xiphiplastra were in place. The outer lateral edge of the xiphiplastron is sharp--edged and convex in outline from the xiphiplastral tip to the junction of this bone and the hypoplastron.

Referred material

UF 18962, represented by both hypoplastra and the right xiphiplastron of an adult male. These differ in no significant way from those of the holotype. UF 18961 is composed of the same elements, but of an adult female. They differ from those of the type in having a straighter abdominal-femoral sulcus, a wider anal notch, and in having the outer lateral edge of the xiphiplastron and adjacent hypoplastral bone parallel with the midline. UF 18976 is composed of a partial costal and both xiphiplastra of an adult male. The latter do not differ significantly from that of the holotype. UF 18964 is the left hyo- and hypoplastra of an adult female. They differ from the holotype in having an arched pectoral-abdominal sulcus (rather than straight), a longer pectoral scute along the midline, and proportionately thicker bones with deeply impressed growth rings. UF 18967 represents the right and left hyo- and hypoplastra of an adult female, which are not significantly different from the type except in features related to sexual dimorphism. UF 18963 is the left hyo- and hypoplastra of an adult female, which are almost identical to those of UF 18964, except that the growth rings are less obvious. UF 18966 (pl. XXXI) is composed of the right and left epiplastra of an adult individual (male?), possessing a slightly projected epiplastral lip with converging lateral edges, somewhat projecting anterior tips (placed laterally), very weak dorsal and ventral keels, and an extensively excavated hollow on the posterior dorsal surface; the gulo humeral sulcus enters the entoplastron. UF 18965 (pl. XXXII) is a right and left epiplastron of an adult individual (female?), similar to UF 18966, except that the tips of the epiplastral projections are less projected and the dorsal and ventral keels even less well developed. UF 18974 (pl. XXX) comprises the posterior part of the carapace, including the pygal, suprapygals 1 and 2, a complete adjacent pleural on the left side and a partial one on the right, with the last two juxtaposed peripherals on each side. The fossil clearly shows that in *G. mlynarskii* the entire posterior edge of the shell was recurved, forming a shallow gutter, most evident on the pygal and adjacent last peripherals. The pygal is much narrower distally than proximally, and the lateral ventrally projecting arms of suprapygal 1 fail to embrace suprapygal 2 (Fig. 2). A deep sulcus for the ligaments associated with the supracaudal buckler can be seen on the ventral surfaces of the pygal and the two adjacent peripherals. UF 18976 comparises more of the posterior part of the carapace, including the last two neurals, the last five peripherals on the left side, the last four pleurals on the

right, and the last three on the left. The ventral edge of the posterior periphe-
rals and the pygal are similarly recurved. However, the lateral arms of
suprapygal 1 enclose suprapygal 2 in a typical embrasure pattern on one
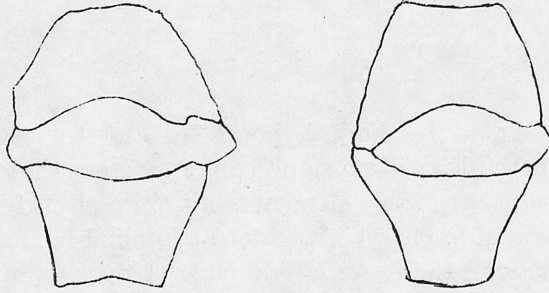side (Fig. 2).

Fig. 2. Pygal and suprapygal area of referred specimens of *Geochelone mlynarskii* sp. n., sho-
wing variation in embrasure patterns of suprapygal. Left — UF 18974, right — UF 18976

Variation

The most significant variation in the available material of *Geochelone
mlynarskii* is in size. The two plastra from which almost all measurements
can be taken happen to represent a single male and female. The estimated
plastral length of the male is 150 mm, and of the female is 185 mm. Rather
careful estimates were made for the remainder of the plastral elements, sugge-
sting a total range for plastral lengths in adults of about 145 to 188 mm. Male
elements are smallest (ca 145—163 mm), based on degree of plastral concavity
and divergence of the xiphiplastral projections (males 36—45 females 49—56).
Minor details of shape regarding the epiplastral projection are related to sexual
differences, as is true in many other land tortoise species. Thus males of *G. mly-
narskii* tend to have a slightly, but significantly longer epiplastral projection
than females.

Individual variation not associated with sex or age is manifest in a few
minor structural features of the shell. Of these the most important is divided
supracaudal scute in one specimen. Other character variations are discussed
below.

III. DISCUSSION

In addition to the description of a new species of land tortoise from Florida,
another major purpose of this study was to determine those combinations of
characters that best separate populations of the *turgida* complex from one
another in Florida and to determine how widely separated these species are
from one another. In order to do this, an analysis was conducted of all the

important *turgida*-complex fossils known from Florida. These fossils originate from 24 sites in Florida, representing the entire time sequence from Hemphillan through Rancholabrean mammal ages (= late Miocene through late Pleistocene). Though other shell and limb elements are available from almost all of these sites, the emphasis is placed on epi- and xiphiplastral elements in view of their generally diagnostic characteristics in North American land tortoise (see AUFFENBERG, 1963, 1966, 1976) and their common occurrence in fossil deposits. The sample of material specifically analyzed for this paper consists of 272 xiphiplastra, 20 pygals and 177 epiplastra; some from complete plastra, through most are represented by isolated elements.

In earliest papers I (1963, 1966) showed that within at least the eastern United States two major phyletic lines can be recognized within the genus *Geochelone*. This separation (subgenus *Hesperotestudo*, type *G. crassiscutata* vs subgenus *Caudochelys*, type *G. crassiscutata*) was based on the presence or absence of a supracaudal buckler. Within the Pleistocene of Florida, *G. crassiscutata* (= *Caudochelys*) was additionally separated from *G. incisa* (= *Hesperotestudo*) by size and shape of a number of shell, girdle and limb characters (AUFFENBERG, 1963). This subgeneric separation is no longer quite so clear, for there is growing evidence that that the *crassiscutata* line in the Florida Pleistocene lost its supracaudal buckler (previously represented as fused series of elements in Pliocene species from Texas to Florida) through a process of deossification. This resulted in the elements being freed of contact with one another. On this basis I assume that the process occurred slowly throughout the Pleistocene and became most marked in Florida individuals representing the very end of that period. It was additionally marked by a progressive reduction in shell thickness. The reasons for this deossification trend (if it indeed occurred) remain unclear. The entire matter requires additional and better preserved fossil land tortoises before the suggestion made here can be proven correct or not. The results of such eventual analyses will have a bearing on the validity of the subgenus *Caudochelys* AUFFENBERG (1963).

In any event, it is still clear that two major land tortoise phyletic lines (by whatever subgeneric designation) can be recognized in Florida — one represented by the large species *G. crassiscutata* and the other by the small species *G. incisa* — each characterized by many features. The smaller *G. incisa* has been shown to be closely related to certain other small land tortoise species of the American Great Plains states (Texas, Kansas, Oklahoma). These relationships have been discussed in AUFFENBERG (1962, 1963, and 1966). There is no evidence suggesting that the previously proposed relationships between the eastern and western members of this group of small tortoises (= the *turgida* group, sensu AUFFENBERG's earlier papers) should be modified. However, the relationships of the constituent Florida species of this group require reexamination in light of the discovery of the new species described here from Irvingtonian beds (*G. mlynarskii*) and as yet underscribed from the Pliocene Bone Valley Gravel Formation of south-central Florida. The latter, while not re-

presented by good material at present, is clearly an important member of this group.

I have previously shown that of all the elements of the shell, the precentral, pygal, epiplastron, and xiphiplastron are the most diagnostic at the species level within the *turgida*-complex even when complete shells are available for study. Because of the fragmentary nature of the newer Florida *turgida*-complex material, these elements were independently analyzed. Of the four elements considered, the most diagnostic is the xiphiplastron. Important characteristics are the length of the element along the middline (XL), greatest width (XW), depth and width of the posterior anal notch (ND, NW), length of the interanal sulcus (AL), greatest height at the external face (XH), thickness of the xiphiplastron medially (XT), and width at a line drawn perpendicular to the median suture and passing through the outermost anterior point of the anal-femoral sulcus at the lateral edge of the xiphiplastron (XMW). Positions of these measurements are indicated in Fig. 25 of AUFFENBERG (1976).

Length. — There is a significant difference in the length of the xiphiplastron along the median length between the several populations of the *crassiscutata* group found in Florida to date. However, this is not true of populations of the *incisa* group. Of the several populations studied so far. *G. alleni* from middle Hemphillian Miocene deposits is the smallest. But during the upper Hemphillian Pliocene in central Florida an as yet undescribed species of the *incisa* group is the largest known member (difference between the means of XL significant at $p > 0.003$, $t = 2.40$, df 10). All later populations are intermediate in size between these two early species; the difference of the means of *G. alleni* and the *G. incisa* fossils being highly significant at $p > 0.001$ ($t = 4.19$, df 137).

Thickness. — As suggested earlier (AUFFENBERG, 1962), there is a trend within the *incisa* group in which fossils representing later geologic time are thinner than those from earlier deposits. In this study the analysis was based on the ratio of xiphiplastral thickness (XT) plus height (XH), divided by width (XW) to adjust for differences in specimen size. The thickest shells were found in Bone Valley and Blancan populations ($\overline{X}$ combined 0.49 and 0.14, no statistical difference between them); the Irvingtonian fossils are somewhat intermediate, but more similar to the Rancholabream populations ($\overline{X}$ 0.62 and 0.66 respectively). There is no significant difference between these, but the differences are significant between all preBlancan and all postBlancan when samples are pooled ($t = 3.88$, $p > 0.001$, df 240). Xiphiplastral thickness is related to size in a linear relationship ($R_2 = 0.74$) expressed by the formula $Y = -0.86 \pm 0.34^{\times}$. A parallel trend can also be demonstrated in the *crassiscutata* line during the same periods, but it is better illustrated in bones other than the xiphiplastron, which is already thin by Blancan time in Florida. Nevertheless, the differences are significant at the 0.01 level ($t = 2.47$, df 44).

Anal Scute Length. — One of the best decriminative ratios for separating the *incisa* from the *crassiscutata* group in Florida is the median xiphipla-

stron width (XMW) divided by the internal scute length (AL). There is little overlap in the values, and the difference in means is highly significant, whether considering Pliocene or Pleistocene fossils. For all Pleistocene *incisa* group fossils combined the overall range is 2.28 to 5.10, with a mean of 1.67 ± 1.07 (N = 217); for *crassiscutata* group Pleistocene populations OR = 1.11 to 3.24 ± 0.29 (N = 94), t = 14.05, df 309, p > 0.0005. The same holds true for Pliocene populations of the same two groups from Florida ($\overline{X}$ 2.91 ± 0.49 and 1.85 ± 0.51 respectively, t = 2.6, df 16). Thus throughout the entire known series of populations of both groups the anal scute of the *crassiscutata* group is consistently proportionately longer than that of the *incisa* group.

While there is no or little significant change in this ratio within the entire *crassiscutata* group in Florida (ar far as is known), there is considerable change from one population to another in the *incisa* group. As has been shown in other populations, the undescribed Bone Valley population is clearly distinct from the earlier *G. alleni* (BV population $\overline{X}$ XMW/AL 2.91 ± 1.13; *G. alleni* $\overline{X}$ 6.20 ± 1.22). Blancan (upper Pliocene) age populations in Florida (Inglis) have a mean of 2.44 (N = 15) for the same ratio and are not significantly different from the population from the Bone Valley (lower Pliocene). Irvingtonian populations (Coleman IIA and some of the Sante Fe local faunas) have a mean of 2.87 (N = 80) and are not significantly different from any of the earlier Pliocene populations, though they are significantly different from the combined Rancholabrean sample ($\overline{X}$ 3.72, N = 132, t = 2.33, df 210, p > 0.02).

Pygal Bone. — The size of the pygal reflects the same relationship already expressed in regard to the sizes of the different *incisa* group members in Florida, i. e., that *G. alleni* is the smallest, the Bone Valley Gravel form is the largest and all others are intermediate. There are no significant differences between the various pygal measurements of the Pleistocene populations. However, there is a very significant difference in the ratio of the dorsal width divided by the width of the ventral edge between members of the *incisa* and *crassiscutata* groups (PGDW/PGVW for *incisa* group $\overline{X}$ 1.87 ± 0.25, for *crassiscutata* group $\overline{X}$ 1.34 ± 0.21; t = 8.2, df 149, p > 0.003).

Earlier I showed that in *G. alleni* the supracaudal scute is divided by a vertical suture 56 percent of the time, whereas in *G. incisa* this occurs only 23 percent of the time. It is not divided in any specimens of *G. mlynarskii*, though the number of pygals available is small (5). It remains undivided in all western members of the *turgida* complex (AUFFENBERG, 1966).

Epiplastron. — The development of the epiplastron is often sexually related — particularly in its anterior projection. However, the ratio of the greatest width of this element (EGW) divided by the thickness of the lip itself (LT) provides a measure that avoids the sexual characters associated with lip length. Using this ratio, *G. incisa* from all the Rancholabrean sites and *G. mlynarskii* from the Irvingtonian ones cannot be separated from one another. However, when combined, this ratio ($\overline{X}$ 1.78 ± 0.26) for all Rancholabrean and Irvingtonian samples is significantly different from the Blancan Inglis sample ($\overline{X}$ $2.00 \pm$

0.52, t = 2.00, df 66, p = 0.05). The Bone Valley sample is not significantly different from the Blancan material. However *G. alleni* is again set apart, with a proportionately thicker lip ($\overline{X}$ 1.37±0.41) and it is significantly different from all other Florida populations (Pliocene and Pleistocene, p > 0.001 in both cases).

Precentral. — The greatest width (PW) divided by the greatest length (PL) shows a highly significant separation between the *incisa* and *crassiscutata* groups (t = 10.638, p > 0.0001, df 110), but not between any of the populations within the *incisa* group. Nor will any other ratios serve to separate them.
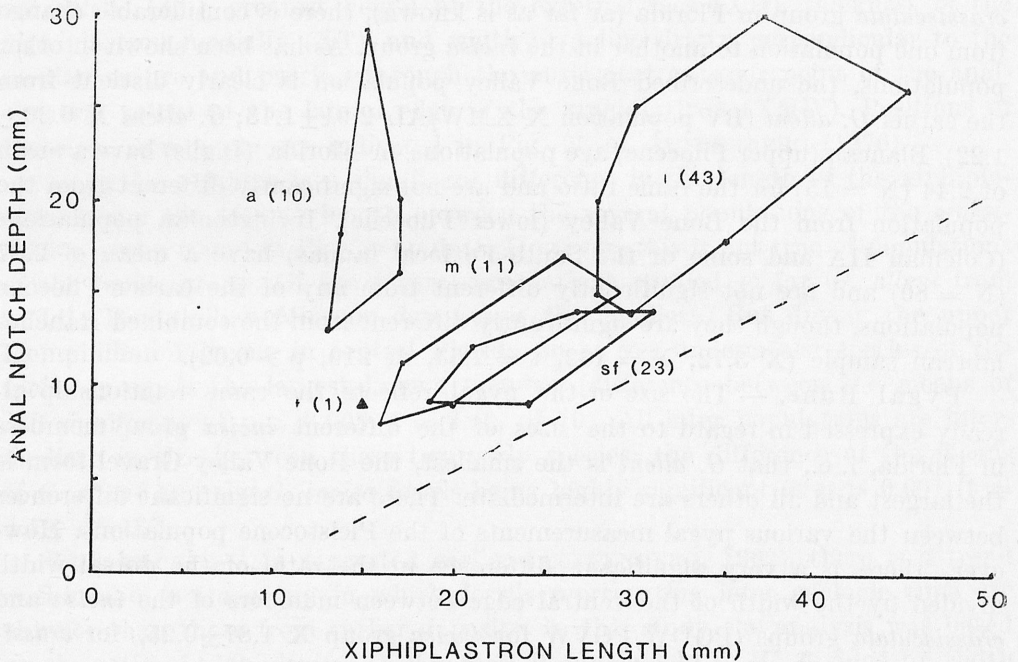
Fig. 3. Separation of Florida populations of the *incisa* group based on anal notch depth, adjusted for size (xiphiplastron length)

IV. STATUS OF THE *TURGIDA* GROUP

The discovery of a new species of miniature land tortoise in early Pleistocene deposits of Florida has required a reexamination of the relationships of all known members of the *turgida* group in eastern United States. While earlier studies (AUFFENBERG, 1962, 1966) suggested that the late Pleistocene *G. incisa* was closest to species of the same complex from western parts of North America, later work shows that the *turgida* complex had reached the southeastern United States by at least the latest Pliocene, and that the complex was already split

into eastern and western groups by that time. *G. alleni* was believed to have given rise to *G. incisa*. The discovery of two additional Florida species of intermediate age (Bone Valley and *G. mlynarskii*) suggests that the history is more complicated than devised earlier. Additionally, the deposits in which *G. alleni* occurs are now believed to represent Miocene, rather than Pliocene time (Fig. 1). Thus if the presumed eastward movement of the *turgida* complex during late Pliocene time is incorrect; it must have occurred by at least middle Miocene time. No member of this group has yet been recognized in lower Miocene deposits of Florida. Nor are any repretentatives of this group known from the well known Miocene deposits of Central and Western United States. Thus there is a possibility that the *turgida* complex arose in Florida.

However, it is still fairly certain that the Florida species recognized as part of this complex are most closely related to one another (= *incisa* group) than any of them are to the Great Plains representatives of the same group (= *turgida* group). This is based on the shape of the xiphiplastron, internal scute length, and epiplastral width. While both eastern and western groups of the *turgida* complex probably were isolated from one another by the Mississippi Lowlands, parallel evolutionary trends can be illustrated in both areas. These are (1) the reduction in height of the external face of the xiphiplastron, (2) an increase in length of the posterior plastral lobe (see figures in AUFFENBERG, 1963), (3) an increase in complexity of the supracaudal buckler, (4) and increase in shell length, (5) a progressive decrease in degree of fusion of the second
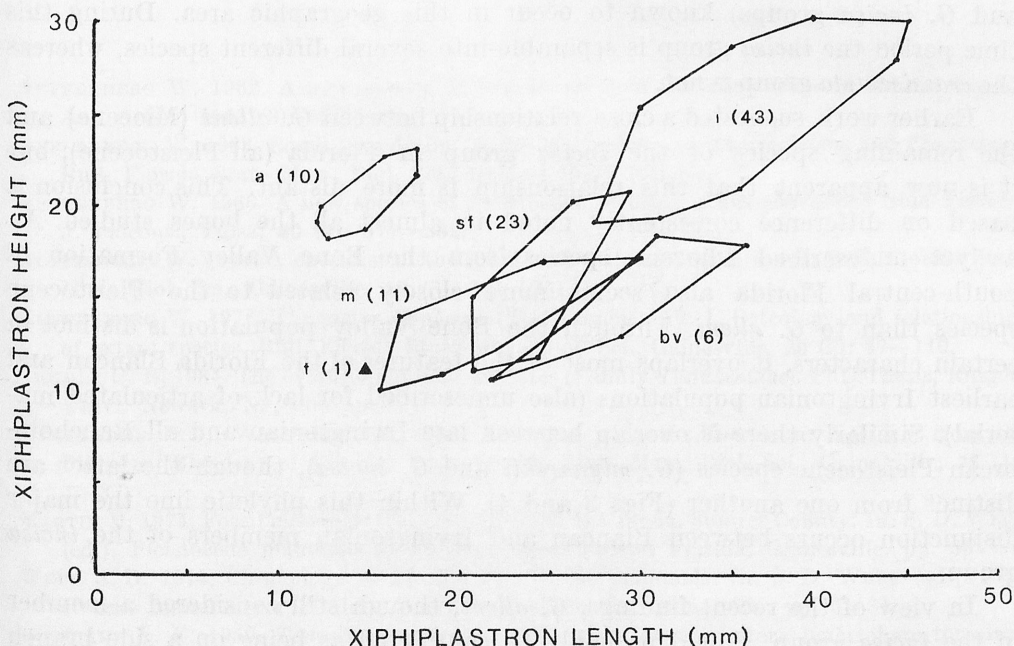

Fig. 4. Separation of Florida populations of the *incisa* group based on xiphiplastron height, adjusted for size (xiphiplastron length)

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suprapygal and pygal. Though the eastern line seems characterized by an extremely short interanal sulcus, the sulcus nevertheless became progressively longer from Pliocene into Pleistocene time (see figures in AUFFENBERG, 1969). This was probably correlated with an increase in posterior lobe length which occurs in later geologic time. The same trend can be demonstrated in the western group, from *G.turgida* through *G. riggsi* to *G. johnstoni* though the change is less obvious.

Geochelone *turgida* and *G. riggsi* are closer to one another than to any other species (either eastern or western) in the entire *turgida* complex. At least some overlap present in all characters with which the two species can be compared. On the basis of presently available material, only one character clearly separates them — the epiplastral lip is longer in respect to its thickness in *G. riggsi*.

The supracaudal buckler in both eastern and western groups became more complex with time. Thus the bucklers of Pliocene species in both areas possess fewer osteological elements, and these lack the low spurs found in Pleistocene populations from the same area.

V. CONCLUSION

All four of the bony elements analyzed during the study (xiphiplastron, pygal, epiplastron and nuchal) of the Plio-Pleistocene land tortoises of Florida are significantly different in the two major groups of *Geochelone* (*G. crassiscutata* and *G. incisa* groups) known to occur in this geographic area. During this time period the *incisa* group is separable into several different species, whereas the *crassiscutata* group is not.

Earlier work suggested a close relationship between *G. alleni* (Miocene) and the remaining species of the *incisa* group in Florida (all Pleistocene), but it is now apparent that this relationship is more distant. This conclusion is based on difference consistently noted in almost all the bones studied. An as yet undescribed Pliocene species from the Bone Valley Formation of South-central Florida also seems more closely related to the Pleistocene species than to *G. alleni*. Through the Bone Valley population is distinct in certain characters, it overlaps most of the features of the Florida Blancan and earliest Irvingtonian populations (also undescribed for lack of articulated material). Similarly there is overlap between late Irvingtonian and all Rancholabrean Pleistocene species (*G. mlynarskii* and *G. incisa*), though the latter are distinct from one another (Figs 3 and 4). Within this phyletic line the major disjunction occurs between Blancan and Irvingtonian members of the *incisa* group.

In view of the recent findings, *G. alleni*, though still considered a member of the *incisa* group, should probably be considered as being on a side branch of the main line ultimately leading to *G. incisa*. There are some features of this species that remind one of the fossil known as *Floridemys nana* (Pliocene?,

Florida, relationships unclear). WILLIAMS (1950) has suggested that the main diagnostic character of the latter is possibly an abnormality. The suggestion that this species may be related to *Stylemys* (AUFFENBERG, 1974) is probably incorrect (CRUMLY, 1974). It is clear that future studies of Florida fossil land tortoises should concern themselves with the status of *Floridemys nana* and the search for better material of both the Bone Valley and Blancan Pleistocene material so that the forms represented in these deposits can be placed with respect to the other described forms. Within the *crassiscutata* group, future investigations in Florida should explore the relationships between the Pliocene *G. hayi* and an as yet undescribed giant Pleistocene (Blancan) tortoise, both of which are presumed closely related to the Irvingtonian through Rancholabrean *G. crassiscutata*. The relationships of *G. hayi* of Florida to *G. rexroadensis* of the Kansas Pliocene, and of the undescribed Florida Blancan form to *G. campester* of the Texas Blancan also need study.

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STRESZCZENIE

Nowy gatunek kopalnego żółwia, *Geochelone mlynarskii* sp. n., został opisany ze stanowiska Coleman IIA (późny irvington, środkowy plejstocen) na Florydzie w Stanach Zjednoczonych Ameryki. Nowy gatunek należy do kompleksu *turgida* (sensu AUFFENBERG, 1963) i przypomina najbardziej *Geochelone incisa* (HAY) (rancholabr, Floryda), różniąc się znacznie mniejszymi rozmiarami, niektórymi proporcjami oraz szczegółami budowy, szczególnie plastronu.
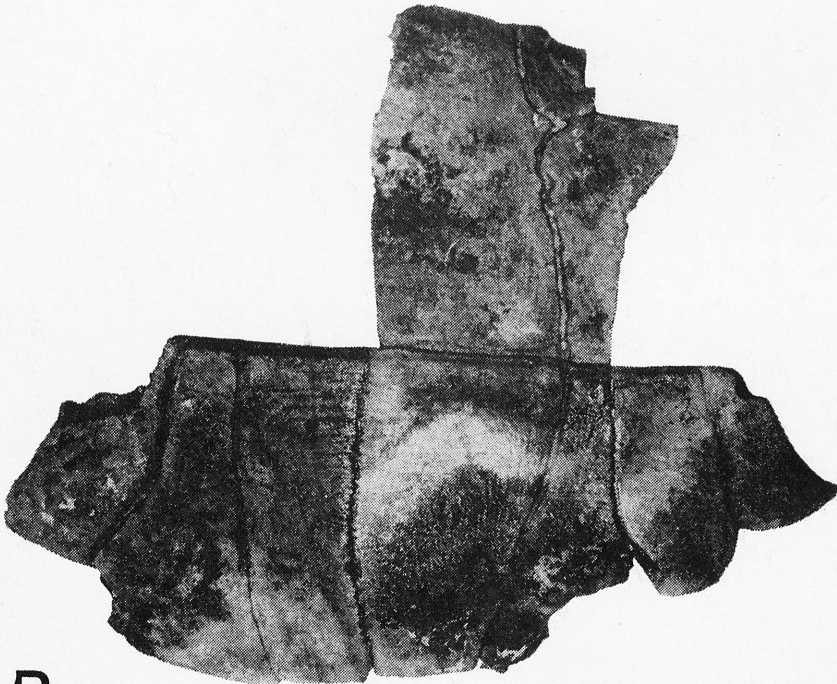
Edited by Dr. Z. Szyndlar

Plate XXIX

Geochelone mlynarskii sp. n. A — UF 18960, holotype, partial plastron, dorsal view; B — Same, ventral view
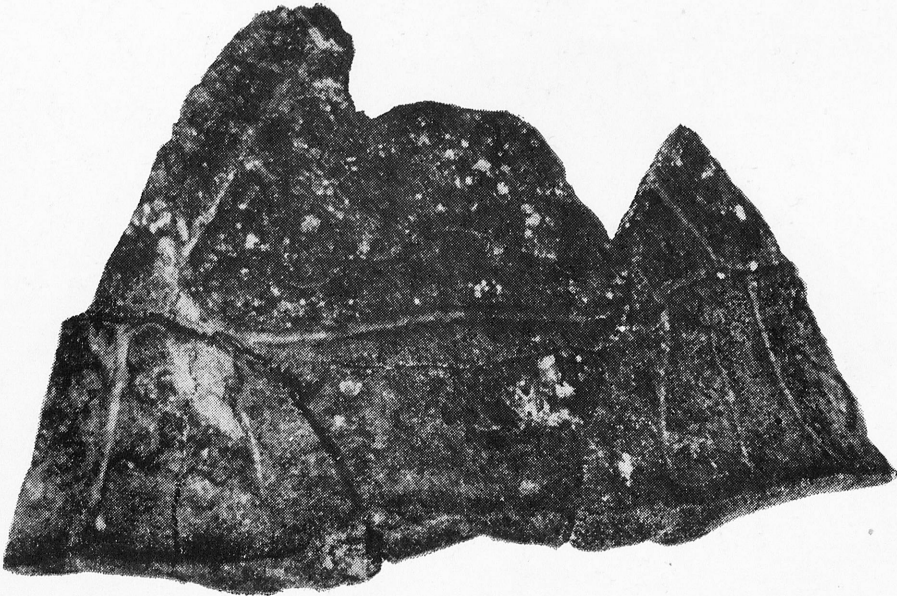
A

B

W. Auffenberg
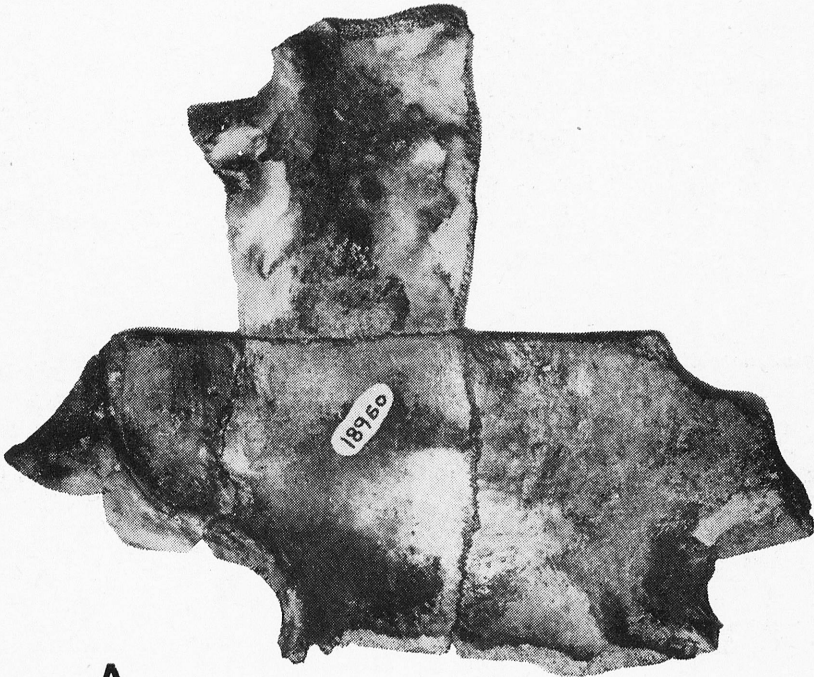
Geochelone mlynarskii sp. n. C — UF 18974, referred specimen, posterior part of carapace, internal view; D — Same, external view
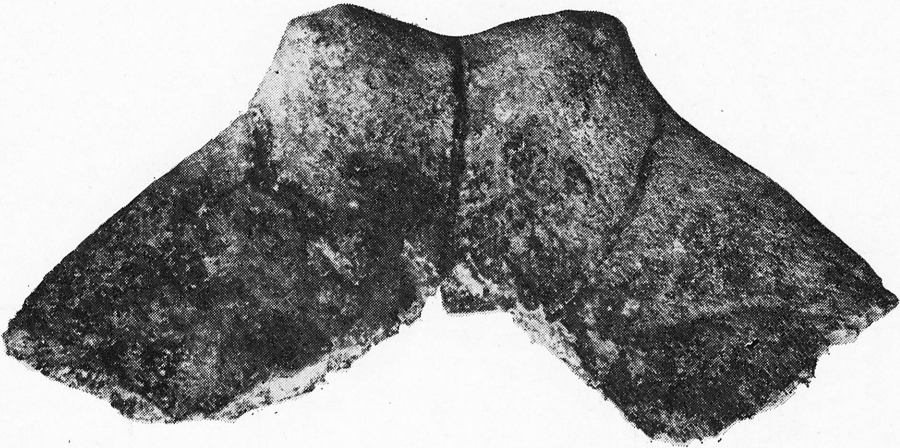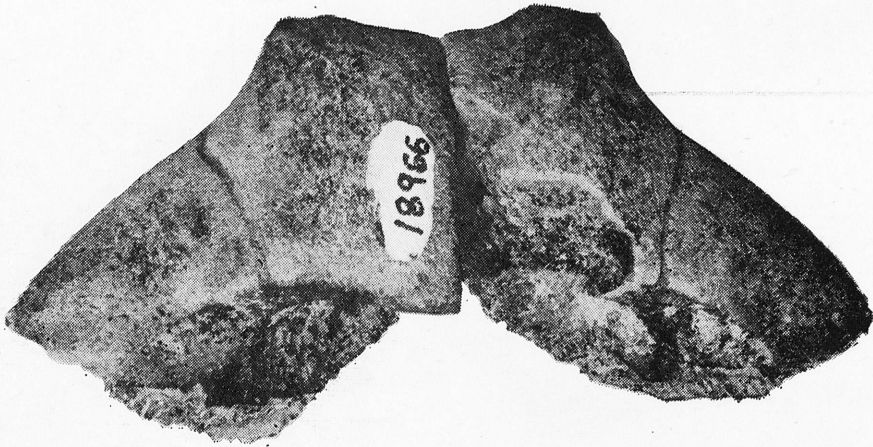
C

D

Plate XXXI

Geochelone mlynarskii sp. n. E — UF 18966, referred specimen, epiplastra of female, ventral view; F — Same, dorsal view

E

F

Plate XXXII

Geochelone mlynarskii sp. n. G — UF 18965, referred specimen, epiplastra of male, ventral view; H — Same, dorsal view

G

H