ON FOSSIL TURTLES FROM THE PLEISTOCENE OF FLORIDA

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INTRODUCTION

In the collections of vertebrate fossils made in Florida by the joint Amherst-Smithsonian Expedition in 1925 and by Dr. J. W. Gidley in 1926 are a number of well-preserved turtle specimens pertaining to the genus *Terrapene*. One of these, presented to the United States National Museum together with other fossil specimens by Mr. C. P. Singleton, of Melbourne, Fla., represents a new species, and I take pleasure in naming it in his honor.

The other specimens to be described belong to the little known *Terrapene canaliculata* Hay, and their description gives us for the first time a complete knowledge of the carapace and plastron, and thus places the species on an adequate basis.

At this time I take pleasure in acknowledging my obligation to Dr. F. B. Loomis for his generosity in placing the excellent Amherst College specimens in my hands for study and description.

TERRAPENE SINGLETONI, new species

Plate 1

Type.—No. 11,181, United States National Museum; consists of the greater part of a well-preserved carapace. Collected by C. P. Singleton, 1924.

Type locality.—Two miles west of Melbourne, Brevard County, Fla.

Horizon.—Pleistocene.

A nearly complete carapace of an extinct box turtle included in a collection of Pleistocene fossils presented to the United States National Museum by Mr. C. P. Singleton, of Melbourne, Fla., displays features which show it to be an undescribed species, and the name *Terrapene singletoni* is therefore proposed for its reception.

When received at the museum the specimen was attached by matrix to the lower end of the femur of *Mastodon americanus*, No. 11,185, U.S.N.M., a partial skeleton, including the skull, tusks, and lower jaw.

The carapace, except for the loss of a small area on the right hinder side, is uncrushed and in an excellent state of preservation. All of the bones are solidly united, so that none of their sutural contacts can now be determined; hence the form of the individual bones is unknown.

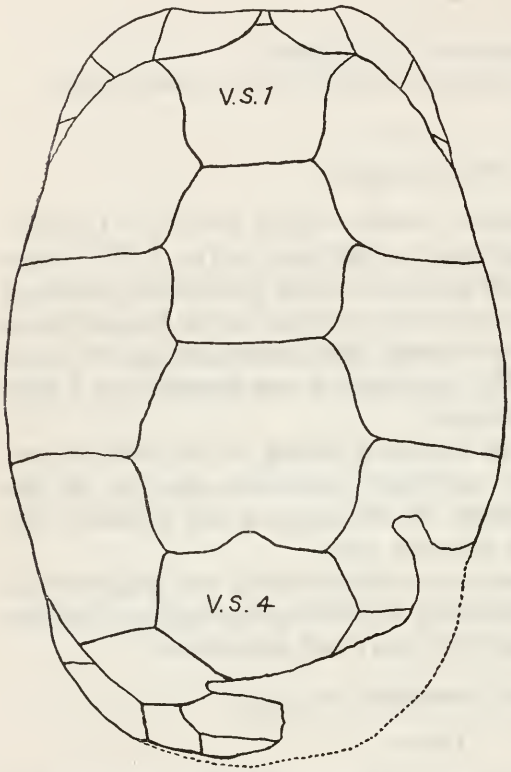


FIG. 1.—CARAPACE OF TERRAPENE SINGLETONI. No. 11,181, U.S.N.M. TYPE V. S. 1, FIRST VERTEBRAL SCUTE; V. S. 4, FOURTH VERTEBRAL SCUTE. ONE-HALF NATURAL SIZE

The bone of the carapace is somewhat thickened when contrasted with the very thin shells of *Terrapene innoxia* Hay and *T. formosa* Hay[1] from these same deposits.

The shell is relatively long and narrow when contrasted with the known species of the genus, highest at the center and sloping off more rapidly behind than in front. It is estimated that the complete carapace had a greatest length, taken in a straight line at the center, of 200 mm. and a greatest width of 132 mm. These measurements show the width to be 0.66 of the length, whereas in the living *T. carolina*, as given by Hay,[2] the ratio is 0.86, and in the extinct species, *T. formosa*, *T. innoxia*, and *T. canaliculata*, is 0.72, 0.68, and 0.70, respectively.

The nuchal border is broadly and shallowly excavated, resembling in this respect adult specimens of *T. major*. The borders of the

[1] Hay, O. P., Ann. Rept. Florida State Geol. Survey, 1916, pp. 57–58 and 61–64, pl. 4, fig. 3; pl. 6, figs. 3 and 4.

[2] Idem, p. 57.

carapace, both in front and behind, are very slightly flared upward, and there is no lateral keel above the bridge, both features which serve to distinguish it from the larger *T. canaliculata* Hay. A low, flattened median keel traverses the first, second, and third vertebral areas but is inconspicuously developed on vertebrals four and five. The posterior peripherals are greatly thickened when compared with such species as *T. formosa* Hay and the extant *T. major*, and relatively thicker than the much larger *T. canaliculata* from these same deposits.

In the thickening of the peripherals this species resembles *T. innoxia* Hay, as it does in the elongated shape of the carapace. In size, however, it is fully twice as large as the type of *T. innoxia*.

The sulci which separate the various scutes are deeply impressed and thus clearly outline their respective boundaries. The vertebral scutes reflect the elongate nature of the shell in being nearly as long as they are wide. The form of these scutes is clearly depicted in the illustrations, and their dimensions are given in the table below:

Measurements of vertebral scutes

Vertebral scutes	Length	Width
	Mm.	*Mm.*
1	45. 1	45. 5
2	45. 0	44. 0
3	44. 0	54. 0
4	[1] 48. 0	[1] 48. 0
5	[1] 34. 0	[1] 45. 0

[1] Estimated.

Four extinct species of *Terrapene* have been recognized from Florida; *T. formosa* Hay, *T. innoxia* Hay and *T. canaliculata* Hay from the Pleistocene, and *T. putnami* Hay doubtfully from the Pliocene. A fifth species, *Terrapene singletoni*, here described, may be at once distinguished from *T. innoxia* and *T. formosa*, in fact from all other species with the exception of *T. canaliculata* and *T. putnami* by its much larger size. From *T. canaliculata*, which it most nearly resembles, it is distinguished by its smaller size, thinner shell, absence of lateral keel above the bridges, relatively narrower carapace, with greatest width at the middle, first vertebral widest at the anterior end and with thickened posterior peripherals that are but little flared upwards.

TERRAPENE CANALICULATA Hay

Plates 2, 3, 4, and 5

Terrapene canaliculata HAY, O. P., Bull. Amer. Mus. Nat. Hist., vol. 23, 1907, p. 850, figs. 5–7; Fossil Turtles of N. A., Carnegie Institution of Washington, 1908, pp. 363–364, figs. 463–465.

Terrapene antipex HAY, O. P., 8th Ann. Rept. Florida Geol. Survey, 1916. pp. 58–61, pl. 4, figs. 4, 5; pl. 5, figs. 1–5.

In 1907 Dr. O. P. Hay established a new species of box turtle, *Terrapene canaliculata* on some fragmentary remains, No. 5500,[3] United States National Museum, found on either Whitemarsh or Skedaway Island, below Savannah, Ga. Since its establishment nothing has been contributed to a further knowledge of the species and it was therefore of interest to find in the collections made in Florida by the joint Amherst-Smithsonian Paleontological Expedition of 1925, and by Dr. J. W. Gidley in 1926, four well-preserved specimens which may be attributed to this little known species.

A study of these specimens in conjunction with the type now gives a comprehensive understanding of the entire shell structure, and for the first time adequately establishes the species. Furthermore, a study of this new material in conjunction with the type and other specimens attributed to *Terrapene antipex* by Hay, from the Pleistocene of Florida leads to the conclusion that all are one and the same thing and consequently *T. antipex* becomes a synonym of *T. canaliculata* which has priority by several years.

The identification of the present specimens with the fragmentary type of *T. canaliculata* rests upon the large size of the individuals, the presence of a sharp longitudinal keel running from the free border of the anterior peripherals to that of the posterior peripherals; the development of a gutter-like groove above the keel, which is especially pronounced on peripherals four and five; the decided outward flare of the posterior peripherals, a development that begins on the seventh, and the relatively thick bone forming the shell. The more detailed comparison of the above-mentioned specimens will be found in the description to follow.

The species *Terrapene antipex* Hay was founded on fragmentary parts of carapace and plastron pertaining to several individuals of which a complete posterior plastral lobe, No. 8,820 U.S.N.M., was selected as the type. This specimen was collected at the now famous Vero locality, Saint Lucie County, Fla., and it was at this same locality that two of the specimens, No. 11,330 U.S.N.M. and No. 25–144 Amherst College, here referred to *Terrapene canaliculata* Hay were found. The large size of these *Terrapene* specimens at

[3] Not catalogue No. 8211 U.S.N.M. as originally given by Hay.

once raised the question of their specific identity. Fortunately, one of the newly discovered specimens, No. 11,428 U.S.N.M., had the plastral part of the shell preserved so that direct proof of its identity with the type of *T. antipex* was to be obtained. Both are males, as shown by the concavity of their posterior lobes. No. 11,428 is slightly larger than the type, but with the exception of some minor differences is in such close agreement with it in contour, arrangement, and extent of the plastral scutes, as to leave no doubt of their specific identity. Further substantiation of the identity of *T. antipex* with *T. canaliculata* was found in comparing the type lobe of the former with a fragmental portion of the hinder lobe belonging to the type of *T. canaliculata*. Here again, except for a slight difference in size, the closest resemblances were found.

At the time of describing *T. antipex*, Hay [4] recognized its close relationship with *T. canaliculata*, but chose to consider them as distinct species for the reasons that in *T. antipex* "the lateral keel is much more conspicuous, the free borders of the peripherals are more strongly recurved, and the shell is still thicker and heavier." It will be observed that all of the differences noted are those of degree, and well represent the variations in structure to be found within the species; in fact, such differences are noted in a comparison of the specimens now before me.

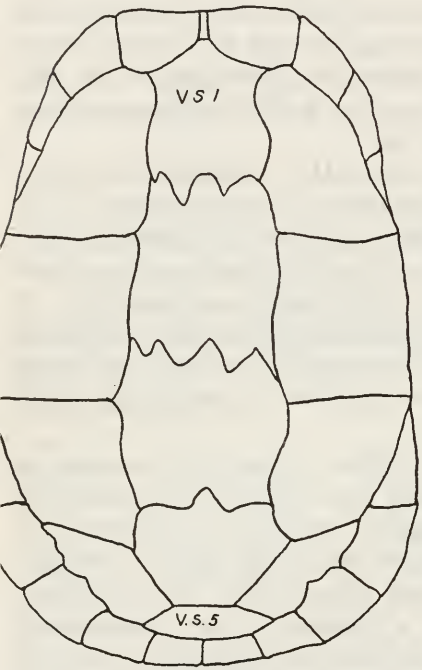
Description.—The description to follow of the shell structure of *Terrapene canaliculata* is based upon the following new materials: No. 11,428 U.S.N.M., a nearly complete carapace and plastron collected by Dr. J. W. Gidley in 1926 on the "Golf Course Locality," 2 miles west of Melbourne, Brevard County, Fla., from Sellard's No. 2 level; No. 11,330 U.S.N.M., a carapace in two disconnected parts; the complete right anterior fourth extending across the midline and the complete left side and rear past the middle, collected by Dr. J. W. Gidley, near Sellard's locality (Sellard's level No. 2), Vero Beach, St. Lucie County, Fla.; No. 25–144 Amherst College, a complete carapace collected by Dr. F. B. Loomis at Vero, Fla., from Sellard's No. 2 level; No. 25–145, A.C., a nearly complete carapace collected by Dr. F. B. Loomis, from the bank of the canal, 1 mile north of the center of the town of Melbourne, Brevard County, Fla.

Primarily the description to follow is based upon the best preserved specimen, No. 11,428 U.S.N.M., although much supplementary information is furnished by the other specimens enumerated above. All of the specimens are fully adult individuals having the bones of the shell so firmly united that the forms of the neural, costal and peripheral bones are largely unknown. A few costal and peripheral sutures can be detected in specimen No. 11,330 U.S.N.M.,

[4] Eighth Ann. Rept. State Geol. Survey of Florida, 1916, p. 61.

but these give only a hint of the detailed bony structure of the shell.

The thickness of the bone of the carapace, as in the type, is comparatively heavy. Viewed from above (see Plates 2 and 3), the carapace is suboval in outline, being wide and broadly rounded behind. It gradually narrows toward the front, the anterior border being truncate with a broad but shallow emargination above the neck.



G. 2.—Carapace of Terrapene canaliculata Hay. No. 25–144, Amherst College Museum. V. S. 1, first vertebral scute; V. S. 5, fifth vertebral scute. One-third natural size

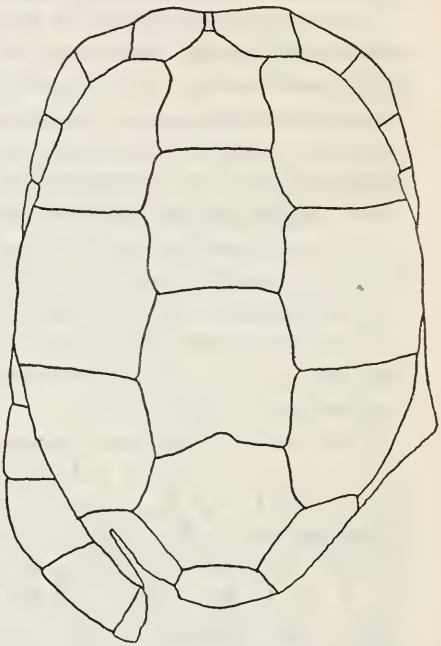


Fig. 3.—Carapace of Terrapene canaliculata Hay. No. 25–145, Amherst College Museum. One-third natural size

The carapace of No. 11,428 U.S.N.M. has a greatest length in a straight line through the middle of 262 mm., and a greatest width across the eighth peripherals of 185 mm.; the width thus being 0.70 of the length. At the center the shell has a height of about 110 mm. The other specimens have the same proportions. The sulci outlining the scutes are narrow but well defined and those bounding the vertebrals are especially deep and conspicuous.

Along the center of the back within the area of the vertebral scutes, the carapace is somewhat flattened. A low, rounded keel is present, being more especially conspicuous on vertebral three.

This keel is not continuous but is interrupted at the vertebral sulci separating the scutes; widest at the front of the scute it gradually narrows and completely subsides before reaching its posterior extremity. In specimens Nos. 11,428, 11,330 U.S.N.M., and No. 25–144 A. C. there is only the faintest suggestion of a median keel, whereas in No. 25–144 A. C. it is strongly developed at the anterior end, as shown in plate 2. Vertebral one has the center raised into a prominent obtusely rounded elevation that extends longitudinally the full length of the scute. The prominence of this ridge seems to be one of the distinctive features of the species. An incipient ridge is present in *T. innoxia*, *T. singletoni*, and in the living *T. major*, but none of these show such a conspicuous development as in the species under discussion.

The vertebrals are relatively long and narrow for a *Terrapene* resembling *T. singletoni* in this respect. Their measurements are given in the table below:

Measurements of vertebrals

No.	Length				Width			
	No. 11,428 U.S.N.M.	No. 11,330 U.S.N.M.	No. 25–144 A.C.	No. 25–145 A.C.	No. 11,428 U.S.N.M.	No. 11,330 U.S.N.M.	No. 25–144 A.C.	No. 25–145 A.C.
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
1	60	57. 5	58	57	49. 0	48	47	45
2	56	53. 0	58	52	59. 0	58	58	52
3	57	--------	58	56	64. 0	--------	59	58
4	60	--------	57	57	64. 0	--------	59	60
5	41	40. 0	44	--------	53. 5	52	57	56

The urnshaped form of the first vertebral is another feature that seems to be distinctive of this species. Anterior of its mid length the scute is strongly constricted as shown in Figures 2 and 3 and in three of the four specimens now before me all have the posterior half of this scute as wide, or wider than the anterior end. Comparative measurements are given in the table below:

Name	Width anterior end	Greatest width posterior to middle
Terrapene canaliculata:	*Mm.*	*Mm.*
No. 25–144 A. C	47. 0	47
No. 25–145 A. C	39. 5	49
No. 11,330 U.S.N.M	42. 0	49
No. 11,428 U.S.N.M	53. 0	53
Terrapene singletoni, type	46. 5	36
Terrapene innoxia, type	26. 0	21
Terrapene longinsulae, type No. 5983 U.S.N.M	31. 5	25
Terrapene major	35. 0	30
Terrapene carolina	31. 0	26

In most species of the genus *Terrapene* both living and extinct, the anterior end of the first vertebral is decidedly the widest. The transverse sulci separating vertical scutes one and two, and two and three, in specimen No. 25–144 A. C., differs from the other two specimens in the strong interdigiting character of its course, as plainly depicted in Figure 2. In the other specimens of this species these sulci take a more or less straight course, or with only a forward median loop. This median loop, which is only faintly developed in No. 25–145 A. C., is conspicuously developed in No. 11,330 U.S.N.M.

The posterior peripherals are strongly flared outward and slightly upward. From the free border of the peripherals behind the hinge line a decided sharp edged keel runs forward and joins the free border of the anterior peripherals. The lateral peripherals immediately in front of the anterior hinge attachment have their outer borders strongly rolled up so as to form a shallow gutter, but forward this roll gradually subsides, leaving the upper surface evenly and shallowly concave. The nuchal scute is very much reduced and on the upper surface of two of the specimens now before me it barely reaches the free border of the shell. It has a length of 15.5 mm., and a width at the posterior end of 5 mm.

The height of the supracaudals is 16 mm. in No. 25–144 A. C. and 18 mm. in No. 11,330 U.S.N.M. and have a combined width of 48 and 50 mm., respectively. The hinder peripherals are strongly flared outward relatively more than in *T. major*, which is living in this region to-day. They are turned upward so that their lower surfaces are horizontal.

The lateral hinge articulation in No. 25–144 A. C. had a total length of 87 mm., of which 62 mm. may be attributed to the posterior lobe. Its thickness is 10 mm.

Specimen No. 11,428 U.S.N.M. is unique in being the first member of the present species found to have a complete plastron associated with the carapace, and this association was of the greatest importance in definitely deciding the status of *T. antipex*, which was based primarily upon a complete posterior lobe. In addition, there are portions of four plastra, all from the Melbourne locality, none of which could clearly be associated with carapacal parts. These are No. 11,369 U.S.N.M., anterior plastral lobe; No. 11,370 U.S.N.M., greater part of a posterior lobe; No. 11,371 U.S.N.M., anterior half of a posterior lobe; and No. 11,386 U.S.N.M., anterior half of a posterior lobe. The description to follow is based upon the plastron of specimen No. 11,428 U.S.N.M. Its greatest length taken at the center is 242 mm. The anterior lobe is 93 mm. long and 135 mm. wide on the hinge border; the posterior lobe is 150 mm. long and 145 mm. wide.

The anterior lobe as in most of the box turtles is convex from back to front on the ventral surface. The lateral posterior borders are slightly constricted behind the pectoral-humeral sulcus, but more forward rapidly round inward to the broad but slightly convex anterior border of the lip. The hinge border is slightly sinuous with a pronounced groove across its posterior median surface. At the center of the hinge the bone has a thickness of only 7 mm. but thickens to 10 mm. toward either side. Specimen No. 11369 U.S.N.M., a smaller individual, has a thickness of 13.5 mm. at the middle, exceeding the type of *T. antipex*. On the upper side above the gular area the lobe is broadly excavated and the lip portion is shallowly concave transversely, which has a greatest width of about 59 mm. The horn-covered upper surface is 16 mm. wide. The forms of the scutes are shown in Figure 4. The triangular gular scutes have a greatest length on the midline of 44 mm.; the humerals 25 mm., and pectorals 22 mm. The borders of the entoplastron can not be made out in this specimen. In a detached lobe attributed to this species, Hay [5] describes it as being circular with a diameter of 44 mm. The posterior two-thirds of thefree border is acute.

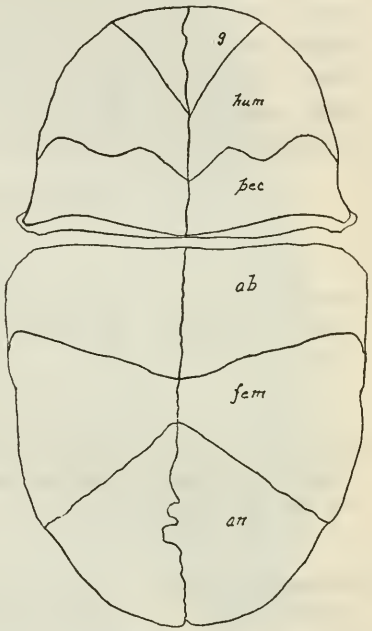


FIG. 4.—PLASTRON OF TERRAPENE CANALICULATA HAY. No. 11,428 U.S.N.M. AB, ABDOMINAL SCUTE; AN, ANAL SCUTE; FEM, FEMORAL SCUTE; G, GULAR SCUTE; HUM, HUMERAL SCUTE; PEC, PECTORAL SCUTE. ONE-THIRD NATURAL SIZE

The posterior lobe, as in the type of *T. antipex*, has all of the bones consolidated into one piece (see Plate 5). The course of the hypo-xiphiplastral suture is scarcely distinguishable. The under surface of this lobe is deeply and broadly concave, thus indicating the male sex of the individual. At the midline in front, the bone has a thickness of 8 mm., but becomes thicker posteriorly. The lateral hinge lines are 47 mm. long. The horn-covered surfaces posterior to the lateral hinges are 20 mm. wide. The free edges are acute. There is a slight constriction at the femoral-anal sulcus, but otherwise the lobe presents an evenly rounded border that is slightly notched on the midline. Measured at the center the xiphiplastron has a length of 85 mm., the hypoplastron 65 mm. The median

[5] Eighth Ann. Rept. State Geol. Survey of Florida, 1916, p. 59.

sulcus separating the scutes of the two sides runs a very irregular course.

Terrapene canaliculata is with the possible exception of *T. putmani* Hay, from the Peace Creek beds, the largest species of the genus, and certainly the largest Pleistocene form.

At this time the main distinguishing features of this species are its large size; shell thick and heavy; carapace with its free borders curved upwards; posterior peripherals widely flaring; keel over the bridges connecting free borders of the front and back peripherals; gutter-like groove above this keel; first vertebral strongly urn-shaped with portion posterior to the middle as wide but usually wider than the anterior end; strongly elevated median longitudinal ridge, extending full length of first vertebral; median, keel out interrupted by transverse sulci.

EXPLANATION OF PLATES

Plate 1

Terrapene singletoni, new species, No. 11,181 U.S.N.M. Carapace viewed from above. Specimen from Melbourne, Brevard County, Florida. About ¾ natural size.

Plate 2

Terrapene canaliculata Hay No. 25–144 Amherst College Museum. Carapace viewed from above. Specimen from Vero, St. Lucie County, Florida. About ⅗ natural size.

Plate 3

Terrapene canaliculata Hay No. 25–145 Amherst College Museum. Carapace viewed from above. Specimen from Melbourne, Brevard County, Florida. About ⅗ natural size.

Plate 4

Terrapene canaliculata Hay No. 25–145 Amherst College Museum. Carapace viewed from the left side. About ⅗ natural size.

Plate 5

Terrapene canaliculata Hay No. 11,428 U.S.N.M. Plastron and carapace viewed from the lower side. Specimen from Melbourne, Brevard County, Florida. About ⅗ natural size.

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CARAPACE OF TERRAPENE SINGLETONI, NEW SPECIES

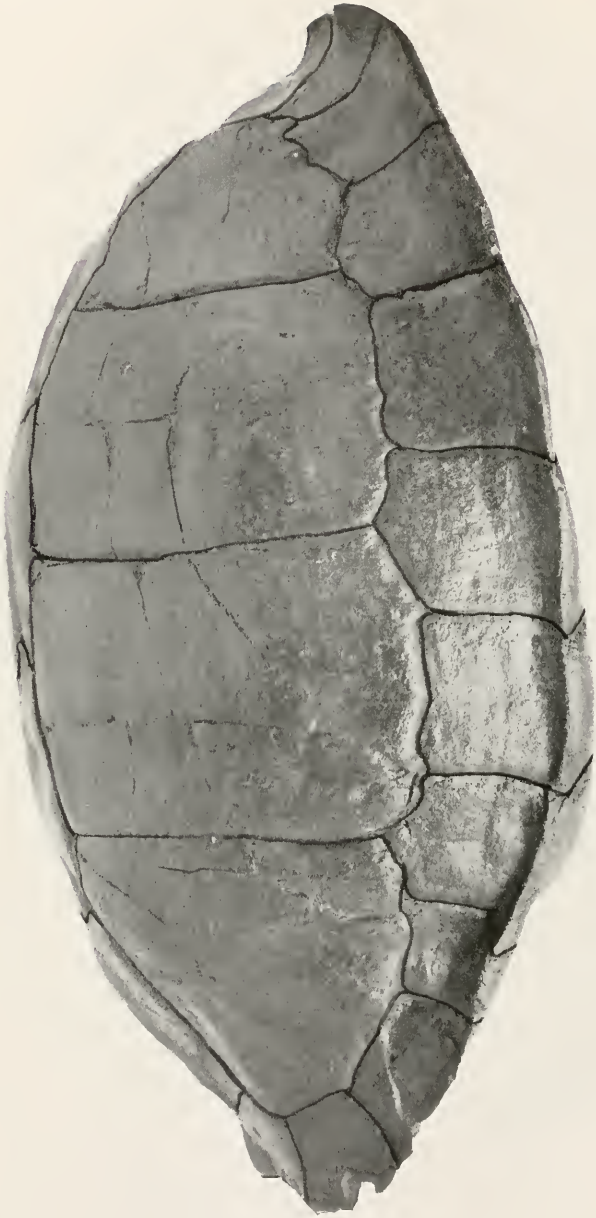
FOR EXPLANATION OF PLATE SEE PAGE 10

CARAPACE OF TERRAPENE CANALICULATA HAY

FOR EXPLANATION OF PLATE SEE PAGE 10

CARAPACE OF TERRAPENE CANALICULATA HAY

FOR EXPLANATION OF PLATE SEE PAGE 10



CARAPACE OF TERRAPENE CANALICULATA HAY

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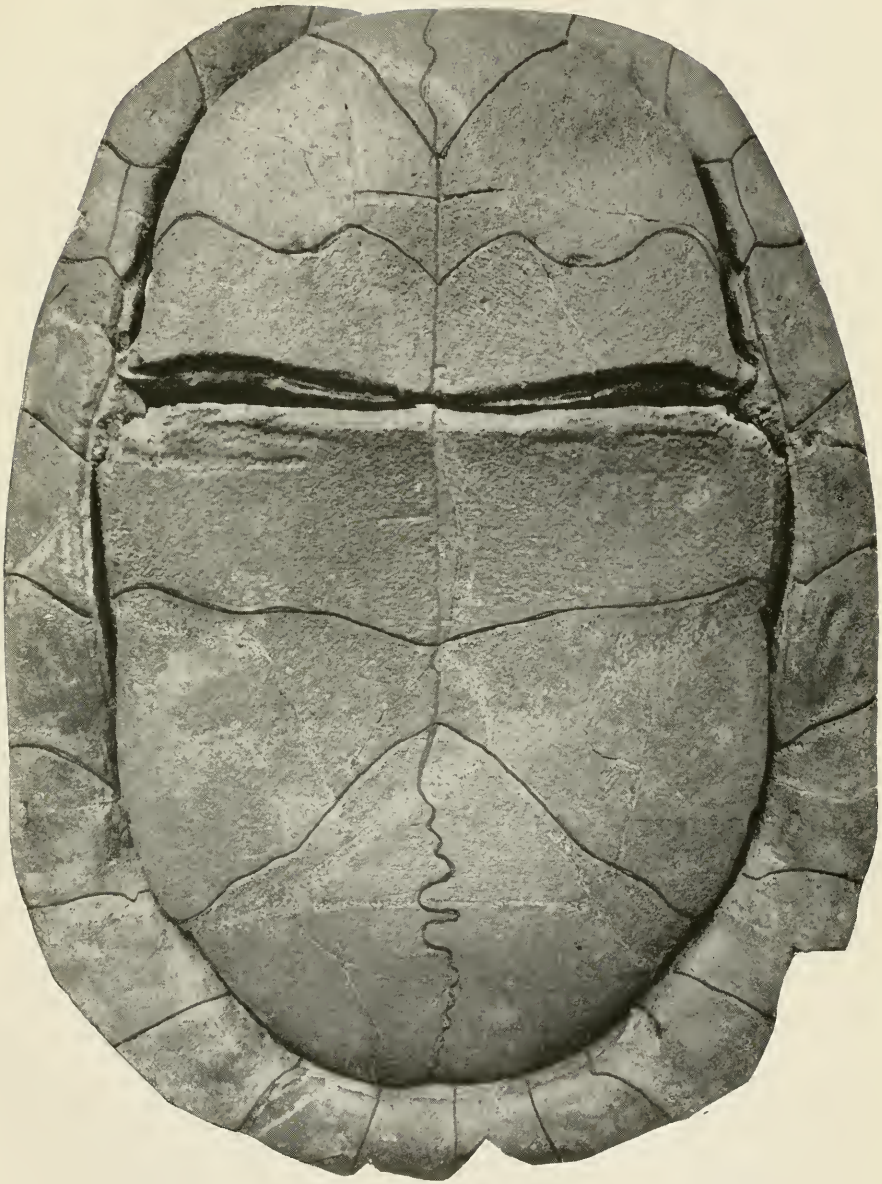

PLASTRON OF TERRAPENE CANALICULATA HAY

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