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THE OSTEOLOGY OF THE FOSSIL TURTLE *TESTUDO*  
*PRAEEXTANS* LAMBE, WITH NOTES ON OTHER  
SPECIES OF *TESTUDO* FROM THE OLIGOCENE OF  
WYOMING

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Among the fossil vertebrate materials collected from the Oligocene of the Indian Creek Basin area in Wyoming by the Smithsonian Paleontological Expeditions of 1932 and 1942 were six well-preserved specimens of the land tortoise *Testudo*. Interest in these specimens centers primarily in the fact that they contribute the first information to be had of the skull and internal skeleton of *Testudo praeextans* Lambe, as well as illustrating the individual variation found in the shell structure of that species. Two of these specimens pertain to *Testudo laticunea* Cope, this being the first time this species has been recognized in this area.

Family TESTUDINIDAE

Genus *TESTUDO* Linnaeus

*TESTUDO PRAEEXTANS* Lambe

PLATES 38-41; PLATE 44, FIGURE 2

*Testudo praeextans* LAMBE, Ottawa Nat., vol. 27, pp. 57-61, pls. 4, 5, 1913.—HAY, Carnegie Inst. Washington Publ. 390, p. 104, 1930.

*Diagnosis*.—The characters that at this time appear to distinguish *Testudo praeextans* are as follows: Carapace depressed, with flattened top in the vertebral region; prominent epiplastral lip, projecting beyond the borders of the carapace and with parallel sides; sulci usually shallowly impressed and usually ending, on free borders, in

\*Mr. Gilmore died on September 27, 1945.—ED.

a projecting point or mucro; neurals variable but usually less differentiated than in most species of the genus; first neural longest of the series; entoplastron pointed in front, rounded behind; gular scutes constantly encroaching on the entoplastron; suprapygals usually in contact with the eleventh peripheral only, rarely reaching the pygal; median longitudinal ridge in front of the choanae.

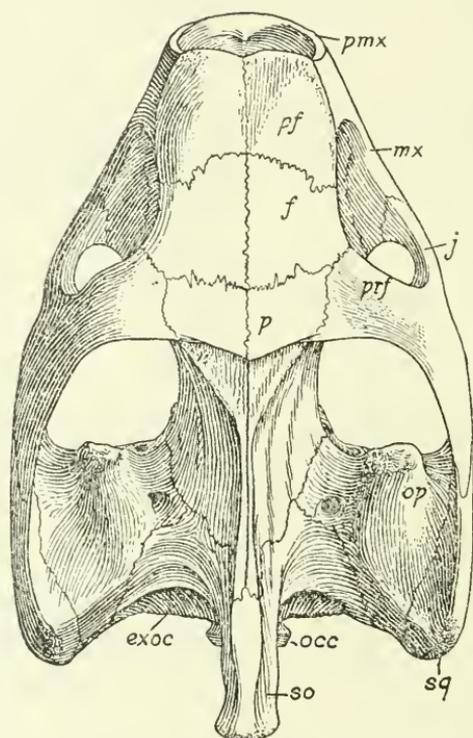


FIGURE 20.—Skull of *Testudo praeextans* Lambe (U.S.N.M. No. 15874), superior view: *exoc*, exoccipital; *f*, frontal; *j*, jugal; *mx*, maxillary; *occ*, occipital condyle; *op*, opisthotic; *p*, parietal; *pf*, prefrontal; *pmx*, premaxillary; *prf*, postfrontal; *so*, supraoccipital; *sq*, squamosal. Natural size.

*Materials*.—The four specimens pertaining to *Testudo praeextans* are all from Niobrara County, Wyo., and from the Brule division of the Oligocene. The best-preserved specimen, U.S.N.M. No. 15874, collected in 1932, consists of the complete carapace, plastron, skull, lower jaws, pectoral and pelvic girdles, both humeri, both ulnae, one radius, both femora, both tibiae, one fibula, and parts of all four feet. It was found on the Anderson Ranch on the south side of Young Woman Creek; specimen U.S.N.M. No. 15878, collected in 1932, was found on the east side of Little Indian Creek and consists of the complete shell, parts of both humeri, both ulnae, both radii, one articulated forefoot, and portions of the other three forefeet; specimen U.S.N.M.

No. 16728 was found in 1942 about a mile north of Whitman Post-office and consists of carapace, plastron, humerus, both scapulae, both coracoids, both tibiae, both fibulae, tarsals, and some foot bones; specimen U.S.N.M. No. 16732 was collected in 1942 on the Anderson Ranch on the north side of Young Woman Creek and consists of carapace, plastron, pelvis, two humeri, coracoid, two scapulae, tibia, two ulnae, two radii, parts of both fibulae, and foot bones.

## DESCRIPTION

*Skull.*—Of the 48 or more species of *Testudo* described from North America, the skulls of only six are known at the present time. These are *Testudo thomsoni* Hay, *T. peragrans* Hay, *T. osborniana* Hay, *T. impensa* Hay, *T. orthopygia* (Cope), and *T. gilberti* Hay; and only one of these, *T. thomsoni*, is from the Oligocene. To this list we may now add *T. praeextans* Lambe, represented by an unusually well preserved skull and lower jaws belonging to specimen U.S.N.M. No. 15874 and illustrated in three views in figures 20–22.

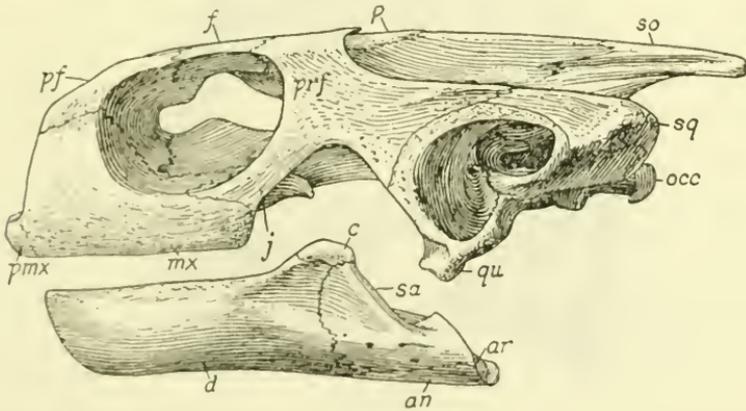


FIGURE 21.—Lateral view of skull and lower jaws of *Testudo praeextans* Lambe (U.S.N.M. No. 15874): *an*, angular; *ar*, articular; *c*, coracoid; *d*, dentary; *f*, frontal; *j*, jugal; *mx*, maxilla; *occ*, occipital condyle; *p*, parietal; *pf*, prefrontal; *pmx*, premaxillary; *prf*, postfrontal; *qu*, quadrate; *sa*, surangular; *so*, supraoccipital; *sq*, squamosal. Natural size.

The skull and lower jaws of this specimen are practically complete and undistorted, with many of the cranial sutures clearly distinguishable (fig. 21). The skull is of moderate size. Its length, from the tip of the premaxillary to the occipital condyle, is 81 mm.; its width across the squamosals is 57 mm.; the height from the cutting edge of the maxilla to the upper surface of the frontal is 26 mm. The sides of the skull forward to the backs of the orbits are nearly parallel; beyond here they regularly converge to the broadly rounded snout. Viewed from the side the upper outline of the skull is nearly straight to a point above the anterior borders of the orbits where the prefrontals bend strongly downward.

The prefrontals meet along the median line, a distance of 16 mm., and this is also the length of the suture between the frontals. The lateral angles of the skull extend backward to a point slightly posterior to the occipital condyle. The orbit has a greatest anteroposterior diameter of 23 mm.; the nasal opening is 17 mm. wide; the interorbital space is 22 mm. wide.

Viewed from above, the skull of *Testudo praeextans* has its closest resemblances in the cranium of the Miocene *T. osborniana*, differing

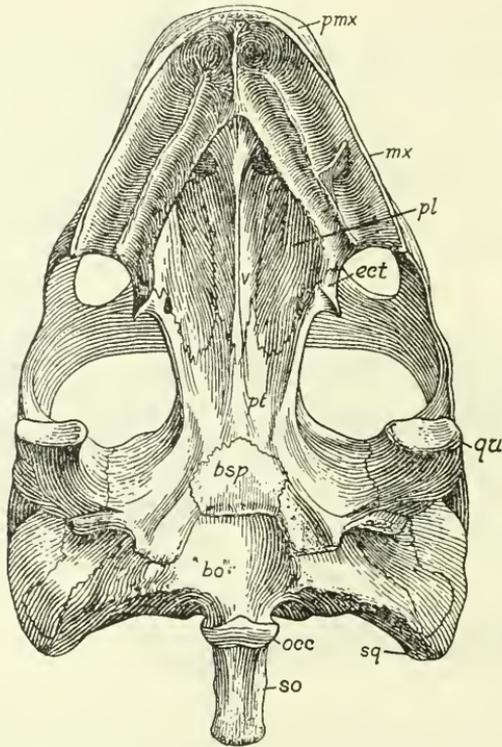


FIGURE 22.—Palatal view of the skull of *Testudo praeextans* Lambe (U.S.N.M. No. 15874): *bo*, basioccipital; *bsp*, basisphenoid; *ect*, ectopterygoid; *mx*, maxillary; *occ*, occipital condyle; *pl*, palatine; *pmx*, premaxillary; *pt*, pterygoid; *qu*, quadrate; *sq*, squamosal; *v*, vomer. Natural size.

in its smaller size, the more abruptly truncated snout, the more bluntly pointed squamosal region, the longer supraoccipital process, and the straighter cutting edge of the maxillary. The orbit also has a greater anteroposterior diameter, being one-fourth the over-all length of the skull. The anteroposterior extent of the otic region measured across the paraoccipital and the prootic is 22 mm.

The incomplete skull of *Testudo thomsoni*, the only other Oligocene species in which the cranium is now known, differs from the skull

before me in having shorter prefrontals, smaller frontals, and longitudinal channels on the masticatory surfaces unequal in width. Whether these differences constitute stable characters that can be relied upon for their specific separation cannot be determined until more skulls are available.

The roof of the mouth is moderately vaulted and traversed along the midline by a sharp ridge (fig. 22), the anterior end of which abruptly widens where the vomer articulates with the premaxillaries and

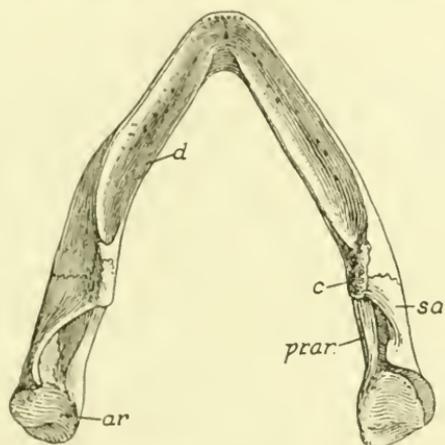


FIGURE 23.—Lower jaw of *Testudo praeextans* Lambe (U.S.N.M. No. 15874), superior view: *ar*, articular; *c*, coronoid; *d*, dentary; *prar.*, prearticular; *sa*, surangular. Natural size.

maxillary bones. Posteriorly this vomerine ridge underlaps the pterygoid part of the ridge, which merges into the palatal surfaces of the pterygoid slightly in advance of their median union with the basisphenoid.

The masticatory surface of the maxillary is divided by a low median ridge that is received in a groove of the mandible. This ridge is bordered on each side by longitudinal grooves of about equal width. In this respect this specimen differs markedly from *Testudo thomsoni*, which has a very narrow inner groove and a widened outer groove. The inner ridge is unusually low, and it meets its fellow of the opposite side on the posterior border of the premaxillary. At the midline along the symphysis of the premaxillae there is a prominent longitudinal ridge, as in *Gopherus* and in some living species of *Testudo*. This ridge is absent in the skulls of other American fossil *Testudo* now known. It was the supposed absence of this ridge in front of the choanae that led Hay to use it as one of the important characters for distinguishing *Testudo* from *Stylomys*.<sup>1</sup>

<sup>1</sup> Hay, O. P., Fossil turtles of North America. Carnegie Inst. Washington Publ. 75, p. 397, 1908.

The lower jaw, as in *Testudo* generally, is massive and heavy. Its length from the symphysis to the angle is 59 mm., height at the coronoid process 59 mm., height at the symphysis 10.5 mm. The masticatory surface is traversed longitudinally by a deep groove. Inner cutting edge of the mandible is nearly as high as the outer. Inner cutting edge of the rami is separated by a notch at the symphysis; cutting edge not denticulated. The extent of the several elements forming the mandible is clearly shown in figures 21 and 23.

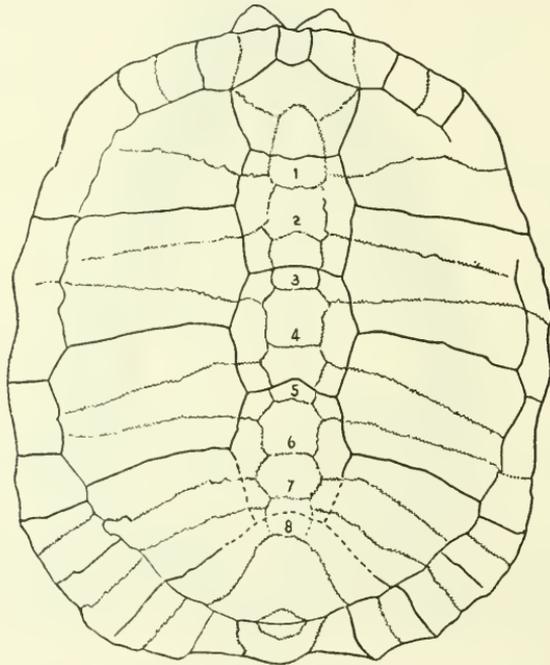


FIGURE 24.—Carapace of *Testudo praestans* Lambe, type (C. N. M. No. 8401): 1, 2, 3, 4, 5, 6, 7, 8, neurals 1-8, respectively. One-sixth natural size.

*Carapace*.—In the general contour of the carapace and plastron, but more especially in the depressed character of the shell as a whole, all these specimens are in close agreement with the type of the species. The carapaces of all are flattened on top in the vertebral region and when viewed from the side present a nearly straight profile except where they curve downward at the ends. This depression of the carapace, with the exception of *Testudo laticunea* Cope, appears to distinguish this species from all other North American members of the genus. Among the large land tortoises only *Testudo grandidieri* Vaillant, of northern Madagascar, has a somewhat similar depressed and flattened shell.

The four specimens under discussion show a considerable difference in size of the shell, as indicated in table 1.

TABLE 1.—Comparative measurements of carapaces of *Testudo praeextans*

Specimen	Greatest length	Greatest width	Greatest height	Sex	Width to length
	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>		<i>Percent</i>
C.N.M. No. 8401 (type)---	479	410	120	Female----	85
U.S.N.M. No. 15878-----	485	392	140	Male-----	80
U.S.N.M. No. 16728-----	525	438	184	-----do-----	83
U.S.N.M. No. 16732-----	<sup>1</sup> 497	450	182	-----do-----	90
U.S.N.M. No. 15874-----	540	452	160	-----do-----	83

<sup>1</sup> Shortened by crushing.

The larger size of the National Museum specimens as compared with the type may be accounted for partly by difference in age and partly by sex. The hollowed-out plastra of the National Museum specimens clearly indicate them to be males, whereas the flattened plastron of the type of *T. praeextans* shows it to be a female. Among living land tortoises it is a well-established fact that the males of a species attain a larger size than the females. Furthermore, that the larger specimens (U.S.N.M. Nos. 15874 and 16732) are aged individuals is shown by the strong incurving of the pygal region (pl. 40, fig. 1; pl. 41, fig. 2), for it has been observed by Lord Rothschild,<sup>2</sup> in his study of the Galápagos tortoises, that "very old individuals of both sexes show an inclination often very strong, for the supracaudal to curve round towards and even under the posterior end of the plastron."

Viewed from above, all the specimens (pls. 38, 39), including the type, are very similar in having their anterior borders broadly rounded from side to side; the breadth of the shell decreases more rapidly toward the front than toward the back, and so the posterior half has a squarer outline than the anterior half. This is brought about chiefly by the enlargement of the peripherals. The posterior border may be described as angularly rounded, though this contour differs considerably with the age of the individual. The oldest specimens (Nos. 15874 and 16732) are more squarely truncate across the pygal region than the others, owing to the downward and forward deflection of this midportion of the shell.

The anterior peripherals in all specimens agree in being produced almost horizontally forward; the lateral ones continue the general convexity of the shell downward, whereas those more posteriorly flare outward and somewhat upward above the openings for the posterior extremities.

The nuchal, as shown by the measurements in table 2, is fairly constant in its extent and proportions. The same observation may be made of the pygal, suprapygal, and second suprapygal.

<sup>2</sup> Rothschild, L. W., *Nov. Zool.*, vol. 22, p. 428, 1915.

TABLE 2.—Comparative measurements (in millimeters) of nuchals, pygals, and suprapygals of *Testudo praeextans*

Specimen	Nuchal		Pygal		Second suprapygal		First suprapygal	
	Maximum length	Maximum width	Maximum length	Maximum width	Maximum length	Maximum width	Maximum length	Maximum width
C.N.M. No. 8401 (type)	95	103	70	62	---	---	84	102
U.S.N.M. No. 15878	82	103	66	76	51	74	81	99
U.S.N.M. No. 16728	102	113	---	82	---	---	---	---
U.S.N.M. No. 16732	107	113	54	84	50	---	87	99
U.S.N.M. No. 15874	102	113	74	83	49	74	100	118

TABLE 3.—Comparison of shape of neurals of *Testudo praeextans*

Neural No.	C.N.M. No. 8401 (type)	U.S.N.M. No. 15878	U.S.N.M. No. 16732	U.S.N.M. No. 15874	U.S.N.M. No. 16728
1	Ovate	Ovate	Ovate	Hexagonal	Hexagonal
2	Hexagonal	Octagonal	Octagonal	do	Do.
3	Quadrangular	Quadrangular	Quadrangular	Quadrangular	Quadrangular
4	Hexagonal	Octagonal	Hexagonal	Hexagonal	Hexagonal
5	do	Hexagonal	do	do	Do.
6	do	do	do	do	---
7	do	do	do	do	---
8	---	do	do	do	---
9	---	do	---	---	---

The free border of the pygal in specimen No. 15874 differs from the others in being strongly toothed. The bifurcated first suprapygal in the type and in specimen No. 15874 is in contact with the pygal and eleventh peripheral, whereas in the other three specimens it articulates only with the eleventh peripheral.

In the shape of the neural bones three features are found common to all available specimens: (1) The first neural is the longest of the series; (2) the third neural is always quadrangular; (3) the fifth to eighth neurals, inclusive, are hexagonal. One individual, No. 15878, has two octagonal neurals, the second and fourth; one, No. 16732, has only the second neural octagonal; and No. 16728 has none octagonal. In most species of *Testudo* there are two octagonal neurals, the second and fourth, but a series of specimens of other species might show them to be equally variable as in *T. praeextans*. The variation in the form of the neurals in *T. praeextans* is shown in table 3.

In discussing the neurals of *T. laticunea*, Hay<sup>3</sup> says, "The neurals have not attained so high a degree of differentiation of form as they have in most of the species of the genus." If reference is made to the absence of octagonal neurals the statement is true of the types of

<sup>3</sup> Hay, O. P., Carnegie Inst., Washington Publ. 75, p. 403, 1908.

both *T. laticunea* and *T. praeextans*. In my judgment the difference found in the neural bones of the specimens under consideration represents individual variations well within the species.

Specimen U.S.N.M. No. 15878 (pl. 38, fig. 2) has an extra neural, or nine in all. It is quite evident from an examination of the specimen that the extra element has developed between number 7 and the last, which is without corresponding costals. Lambe<sup>4</sup> has described a greater deviation of carapace structure in a specimen of *Stylenmys nebrascensis*, which has not only an extra neural but also a ninth pair of costal bones and an additional vertebral scute. This same authority points out that the type of *Stylenmys culbertsoni* likewise has an additional neural.

The variation in shape of the neurals has brought about a corresponding variation in the proportions of these bones, as shown in table 4. In *Testudo praeextans* the first neural is consistently the longest of any of the series.

The costal plates in all these specimens are highly modified, and as usual in *Testudo* the second, fourth, and sixth are widened distally and narrowed proximally, while the third and fifth are narrowed distally and widened at the proximal ends.

The sulci in most of the specimens are narrow and shallowly impressed, and where they reach the free edges of the peripherals there is usually a small obtuse projection or mucro.

In the type of *Testudo praeextans* the sulcus forming the posterior boundary of the third vertebral curves strongly forward at the center where it crosses the fifth neural, as in U.S.N.M. Nos. 15878, 16728, and 16732. In specimen No. 15874, however, the sulcus crosses the sixth neural as in the type of *T. laticunae* Cope.

The proportions of the vertebrae are variable, as shown in table 5. In the type of *T. laticunea* and No. 15878 the fifth vertebral is the longest of the series, whereas in No. 15874 the first is the longest. In the type of *T. laticunea* and No. 15874 the first vertebral is longer than wide, but in the type of *T. praeextans* and No. 15878 this same vertebral is wider than long. No. 15874 is the only specimen having the third vertebral longer than wide.

The most distinctive feature of the plastron is the extended epiplastral lip that always projects well beyond the line of the front margin of the carapace. It was the "marked prominence and size of the epiplastral lip" that Lambe<sup>5</sup> stressed as the most important character for distinguishing *Testudo praeextans*, a character to which the specific name refers. In the light of these additional specimens it is clearly shown that the extent and shape of this lip constitute one of the more stable characters of this species.

<sup>4</sup> Lambe, L. M., Ottawa Nat., vol. 27, p. 63, 1913.

<sup>5</sup> Lambe, L. M., Ottawa Nat., vol. 27, pp. 57-61, pls. 4, 5, 1913.

The relative proportions of the lobes and other measurements of the plastron are clearly shown in table 6.

TABLE 4.—Comparative measurements (in millimeters) of neurals of *Testudo praeextans*

Specimen	Length									Width								
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
C. N. M. No. 8401 (type)-----	68	40	41	37	36	34	---	---	---	44	47	34	48	45	44	44	---	---
U.S.N.M. No. 15878-----	62	42	37	39	36	34	41	15	38	33	42	40	---	---	50	49	35	39
U.S.N.M. No. 16732-----	67	46	43	41	55	36	38	46	---	34	49	41	49	45	58	57	38	---
U.S.N.M. No. 15874-----	76	48	44	39	42	34	35	51	---	46	51	39	42	51	46	55	53	---
U.S.N.M. No. 16728-----	76	43	42	54	---	---	---	---	---	48	55	43	54	---	---	---	---	---

TABLE 5.—Comparative measurements (in millimeters) of vertebrals of *Testudo praeextans*

Specimen	Length					Width				
	1	2	3	4	5	1	2	3	4	5
C. N. M. No. 8401 (type)-----	100	77	78	---	---	97	82	88	82	162
U.S.N.M. No. 15878-----	100	82	81	103	105	110	79	86	87	170
U.S.N.M. No. 16728-----	103	91	86	---	---	113	91	103	---	---
U.S.N.M. No. 16732-----	120	97	90	109	106	114	91	101	97	211
U.S.N.M. No. 15874-----	122	109	112	86	117	100	86	90	89	188

TABLE 6.—Comparative measurements (in millimeters) of plastra of *Testudo praeextans*

Measurement	C. N. M. No. 8401	U.S.N.M. No. 15878	U.S.N.M. No. 16732	U.S.N.M. No. 15874	U.S.N.M. No. 16728
Greatest length of plastron-----	493	495	540	580	-----
Length of anterior lobe-----	163	154	178	187	191
Width of anterior lobe-----	229	205	258	243	-----
Length of posterior lobe-----	147	135	145	155	-----
Width of posterior lobe-----	239	225	245	270	-----
Length of epiplastral lip-----	72	60	71	85	76
Width of lip at base-----	97	81	95	102	97
Extension of epiplastral lip be- yond border of carapace-----	---	47	72	88	75
Depth of posterior notch-----	40	34	39	48	-----

The free borders of the plastra in all five specimens are acute, except those parts of the borders adjacent to the notches, which are thickened and rounded. The posterior lobes are terminated behind in two broadly rounded apices separated on the median line by wide V-shaped notches. The borders of the apices are usually slightly toothed. Likewise, the anterior ends of the epiplastral lips are notched at the center and the borders are toothed with six blunt teeth, except in the type of *Testudo praeextans*, as shown in figure 25.

The entoplastra in all the specimens except No. 15878 are in agreement in having pointed anterior ends and a broad somewhat rounded posterior border, with the gular scutes overlapping the front of this bone.

There is some variation in the extent of the plastral scutes in these specimens, as shown in table 7.

*Pelvis.*—The pelvis of specimen No. 15874 is in an unusually perfect state of preservation, the two halves being coalesced along the median

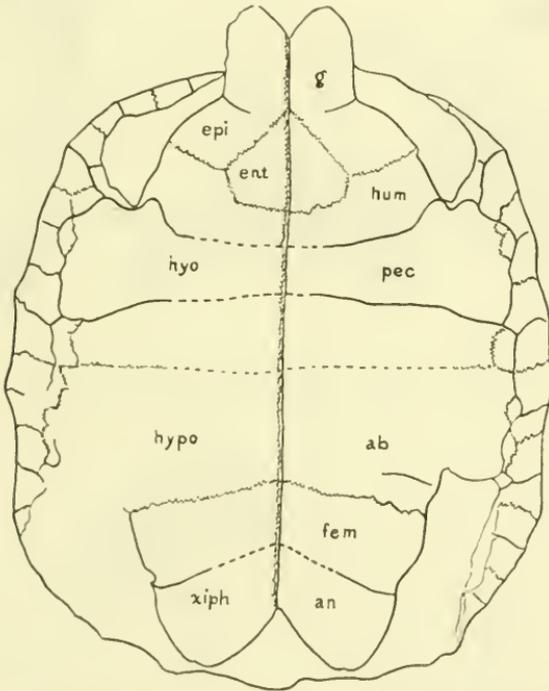


FIGURE 25.—Plastron of *Testudo praeextans* Lambe, type (C. N. M. No. 8401): *ab*, abdominal scute; *an*, anal scute; *ent*, entoplastron; *fem*, femoral scute; *g*, gular scute; *hum*, humeral scute; *hyo*, hyoplastral bone; *hypo*, hypoplastral bone; *pec*, pectoral scute; *xiph*, xiphoplastral bone. One-sixth natural size.

line, as represented in figures 26 and 27. The pelvis of No. 16732 is also well preserved, but the two halves were separated along the median suture. Except for minor details these two pelvises are in close agreement and thus are probably typical of *Testudo praeextans*.

Of these two turtle specimens of nearly equal size and presumably of equivalent age one has the pelvic sutures coalesced, while in the other these same sutures are open, thus indicating that the relative age of an individual cannot always be judged by the non-coalescence of the sutural junctures.

The anterior extremities of the pubes are complete in specimen No. 15874, which shows that border to be broadly rounded, thus

suggesting that Hay may have erred in restoring this missing end in the pelvis of the type of *T. laticunea* as being bilobed.<sup>6</sup> The un-

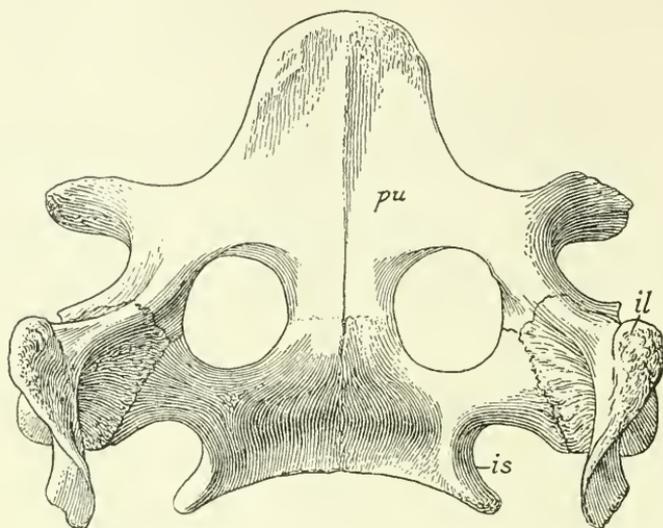


FIGURE 26.—Pelvis of *Testudo praeextans* Lambe (U.S.N.M. No. 15874), viewed from above: *il*, ilium; *is*, ischium; *pu*, pubis. One-half natural size.

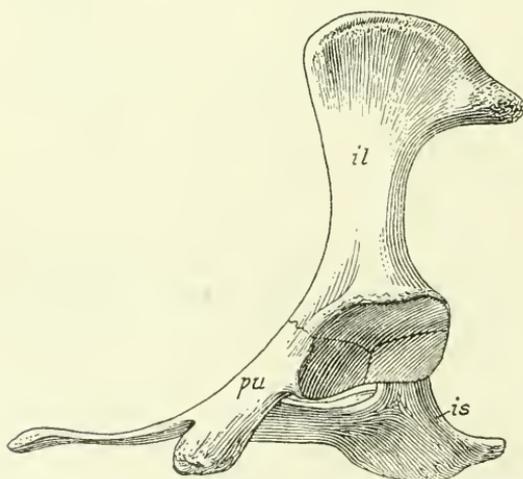


FIGURE 27.—Pelvis of *Testudo praeextans* Lambe (U.S.N.M. No. 15874), viewed from the left side: *il*, ilium; *is*, ischium; *pu*, pubis. One-half natural size.

usual length of the anterior pubic process, forward of the lateral pubic tuberosities, appears to be a distinctive feature of this species. The apices of the ischial tuberosities are bluntly pointed and 80 mm. apart.

<sup>6</sup> Hay, O. P., Carnegie Inst. Washington Publ. 75, p. 404, fig. 512, 1908.

Careful comparison made of the other skeletal parts preserved with these various specimens, with each other and with homologous bones of other species of *Testudo*, failed to disclose, except that of size, differences that would be of assistance in specific differentiation. On that account there seems no point in illustrating or describing these parts here, although most of the bones present are in excellent preservation. In order, however, that there may be a record of relative proportions between carapace and limb bones, a table of measurements of the more important elements of the specimens here discussed is given (table 8).

TABLE 7.—Comparative measurements (in millimeters) of plastral scutes of *Testudo praeextans*

Scute (length on the midline)	C.N.M. No. 8401 (type)	U.S.N.M. No. 15878	U.S.N.M. No. 16732	U.S.N.M. No. 15874	U.S.N.M. No. 16728
Gular.....		93	80		92
Humeral.....			103	102	
Pectoral.....	34		43	44	
Abdominal.....		135	147	143	
Femoral.....		63	58	72	
Anal.....		50	46	51	

TABLE 8.—Comparative measurements (in millimeters) of girdle and limb bones of *Testudo praeextans*

Measurement	U.S.N.M. No. 15878	U.S.N.M. No. 16732	U.S.N.M. No. 16728	U.S.N.M. No. 15874
Greatest length of coracoid.....		88	82	74
Greatest width at inner end.....		77	65	76
Greatest length of scapula from tip to tip.....		153	151	<sup>1</sup> 150
Greatest length of humerus.....		155	153	157
Greatest length of ulna.....		99		99
Greatest length of radius.....	80	98		97
Greatest length of femur.....				113
Greatest length of tibia.....		78	77	82
Greatest length of fibula.....			80	82

<sup>1</sup> Estimated.

*Feet.*—All four of the National Museum specimens considered in the preceding pages have various parts of the carpi, tarsi, and feet present, but only in No. 15878 are the bones preserved at all in articulation. The right forefoot, with carpus and radius, although lacking a few elements, has the others articulated in normal relationship as shown in plate 44, figure 2. This foot clearly shows the presence of five well-developed digits, each having a claw. The small blocklike bones of the carpus are but little disturbed and can be quite certainly identified. The ulnare and intermedium furnish the main articulation of the ulna, which is missing. Occupying the position of the radiale at the distal end of the radius is an angular blocklike element that, following Baur

and Williston,<sup>7</sup> we may identify as centrale 1. Its outer side is in juxtaposition to a smaller pentagonal bone regarded as centrale 2. These two centralia although distinct elements in this individual are often found fused into a single bone, and this appears to have happened in specimen No. 15874. Williston, in the book cited, observes, "Among terrestrial tortoises the radiale has disappeared until nothing is left of it but a nodule of cartilage united with the first centrale which has usurped its place." Hay, however, in his "Fossil Turtles of North America," continues to regard the first centrale as the radiale.

The fifth carpale (pl. 44, fig. 2, C<sub>5</sub>) is present and remains in articulation with metacarpal 5. Carpalia 3 and 4 are missing. The third digit lacks its metacarpal, and a phalange is missing from the fifth digit; otherwise the foot is complete. Comparison of these wrist and foot bones with those of the living Galápagos *Testudo* of comparable size shows a close correspondence in form, as well as in the arrangement of the individual elements.

The hind foot of No. 15878 contributes nothing new to our knowledge of the pes of *Testudo*.

#### SUMMARY

In the original description of *Testudo praeextans* Lambe called attention to the close similarity in the form of the epiplastral beak to that of *T. thomsoni* but concluded that the "much greater proportionate size of the epiplastral lip and differences throughout of the elements forming the lobe" were sufficient to indicate their specific distinctness.

In view of the very fragmentary character of the type of *T. thomsoni*, and especially of the considerable variation in the form of the anterior lobe as shown by the present specimens, it would now appear that Lambe was not justified in establishing the new species *T. praeextans*. On plastral parts alone I should unhesitatingly regard *T. praeextans* to be a synonym of *T. thomsoni*, which has priority by several years. However, when the skulls are compared, differences in proportion of the elements forming the skull roofs, and the different widths of the channels on the triturating surfaces, strongly suggest that the discovery of more complete materials of *T. thomsoni* may disclose other and more important distinctive characters. For the present, therefore, it seems desirable to continue the use of both names.

In the preliminary study of the present materials it was first thought that these specimens could not be specifically distinguished from *Testudo laticuneae* Cope and that such differences as existed might be attributed to the female sex of the type of that species. This idea was abandoned, however, with the discovery that the Wyoming

<sup>7</sup> Williston, S. W., The osteology of the reptiles, p. 179, 1925.

specimens all had broadly rounded anterior carapace borders and prominent epiplastral lips with parallel sides, as contrasted with the more truncate carapace border and wedge-shaped epiplastral lip in *T. laticunea*.

This study of a number of *Testudo* specimens from a restricted area and apparently of a single species shows enough variation in shell structure to cast much doubt on the validity of many described species, especially those founded on fragmentary materials. Furthermore, it raises the perplexing question as to what features are to be relied on for specific differentiation. It has been demonstrated (pls. 38-41) that the neural, costal, and other elements forming the carapace, as well as the form and proportions of the vertebral and plastral scutes, are seldom in themselves sufficiently constant in shape and proportion to be relied on for specific designation.

Whether characters of the skull in fossil *Testudo* will be found more stable can only be determined when a series of crania is available for comparison, and at this time no such series exists. It is in the general form of the carapace and plastron and especially in the development of epiplastral beak that most reliance has been placed in diagnosing the present species.

#### TESTUDO LATICUNEA Cope

##### PLATES 42, 43

*Testudo laticunea* COPE, Paleont. Bull. No. 15, p. 6, 1873.—HAY, Carnegie Inst. Washington Publ. 75, p. 402, pl. 67, figs. 1, 2, 1908.

Two specimens (U.S.N.M. Nos. 15854 and 16731) in the Oligocene collections from eastern Wyoming are identified as pertaining to *Testudo laticunea* Cope, the first recorded occurrence of the species in this area. These specimens are remarkably alike (cf. pls. 42 and 43) both in size and structural detail, a condition calling for comment, as anyone will agree who has had occasion to study a series of *Testudo* specimens.

The type of *T. laticunea* is an essentially complete shell, with some of the internal skeleton, and was found in the Oligocene badlands along the head of Horse Tail Creek in northeastern Colorado. Two other specimens, one from the *Titanotherium* beds (Chadron) of South Dakota and one from the *Oreodon* beds (Brule) of Sioux County, Nebr., were identified by Hay<sup>8</sup> as pertaining to this species. These together with the two in the U. S. National Museum comprise all the known materials of the species.

Specimen U.S.N.M. No. 15854 consists of a nearly complete carapace and plastron (pl. 43), left humerus, proximal end of right; left ulna, radius, and part of forefoot; incomplete right scapula, left

<sup>8</sup> Hay, O. P., Carnegie Inst. Washington Publ. 75, pp. 404-405, 1908.

coracoid; left femur, tibia, fibula, and portion of hind foot. It was collected by C. W. Gilmore on the Thomas Ranch, Niobrara County, Wyo., in 1932. Specimen U.S.N.M. No. 16731 consists of a complete carapace and plastron (pl. 42). It was collected 1 mile northeast of Whitman Postoffice, Niobrara County, Wyo., by George B. Pearce in 1942. Both of these specimens are from the Brule division of the Oligocene.

In size and general contour of the shell these specimens are in close agreement with the type, as shown by the measurements given in table 9.

TABLE 9.—Comparative measurements (in millimeters) of carapace and plastron of *Testudo laticunea*

Measurement	Type specimen	U.S.N.M. No. 15854	U.S.N.M. No. 16731
Greatest length of carapace.....	408	436	435
Greatest width of carapace.....	356	332	340
Greatest length of plastron.....	440	440	443
Greatest length of anterior lobe.....	132	132	137
Greatest width of anterior lobe.....	200	202	203
Greatest length of posterior lobe.....	120	110	110
Greatest width of posterior lobe.....	200	193	196
Greatest width of bridge.....	-----	200	197
Greatest width of anterior lip at gular notch.....	87	90	88

Specimens U.S.N.M. Nos. 15854 and 16731 are practically free from distortion and thus give a true picture of the normal shell. It will be noted in the table of measurements that the Wyoming carapaces are considerably narrower than that of the type. This difference may be partly due to the crushing to which the type has been subjected. In cross section at midlength the shells of Nos. 15854 and 16731 are evenly rounded from side to side, whereas the type is said to be flattened on top. All three, however, can be classed as having a depressed style of shell, and all are of female sex, as shown by the flatness of their plastra.

Other minor differences observed between these two specimens and the type fall well within the variations expected in individuals of a single species.

The skeletal parts preserved with the shell of U.S.N.M. No. 15854 have been carefully compared with the homologous bones of *T. praeextans* and other species of *Testudo*, but except for their smaller size no other characters for distinguishing between them were discovered.

Hay<sup>9</sup> has pointed out in his study of the type of *T. laticunea* that the "neurals have not attained so high a degree of differentiation as they have in most species of the genus." Although the complete neural series cannot be traced out in either specimen, the correctness of the

<sup>9</sup> Hay, O. P., Carnegie Inst. Washington Publ. 75, p. 403, 1908.

above conclusion is verified by these new materials. Specimen No. 16731 appears to show the second neural to be octagonal as it is in the South Dakota specimen studied by Hay.<sup>10</sup>

The slight variation in the vertebrals of the three specimens discussed here is shown by the measurements given in table 10.

TABLE 10.—Comparative measurements (in millimeters) of vertebrals of *Testudo laticunea*

Specimen	Length					Width				
	1	2	3	4	5	1	2	3	4	5
Type specimen.....	86	80	81	75	90	102	80	85	82	135
U.S.N.M. No. 15854.....	78	89	83	83	88	94	82	82	---	133
U.S.N.M. No. 16731.....	91	77	78	78	90	94	74	78	79	142

TABLE 11.—Comparative measurements (in millimeters) of epiplastral beak of *Testudo quadrata*

Measurement	Type (A.M.N.H.)	U.S.N.M. No. 16737
Width of beak at base.....	120	135
Length of beak from gular groove.....	70	54
Thickness of beak at base.....	29	41

The combination of characters that appear to distinguish *Testudo laticunea* Cope is as follows:

Diagnosis: Carapace depressed with truncated anterior border, but slightly rounded from side to side across the vertebral region; prominent epiplastral lip, projecting beyond the borders of the carapace with converging sides; neurals less differentiated than in most species of the genus, and usually without those of octagonal form.

#### TESTUDO QUADRATA Cope

#### PLATE 44, FIGURE 1

*Testudo quadratus* COPE, The Vertebrata of the Tertiary formations of the West, p. 764, pl. 61, fig. 5, 1884.

*Testudo quadrata* HAY, Bibliography and catalogue of the fossil Vertebrata of North America, p. 451, 1902; Carnegie Inst. Washington Publ. 75, p. 410, figs. 532, 533, 1908; Second bibliography and catalogue of the fossil Vertebrata of North America, vol. 2, p. 104, 1930.

A third species of *Testudo* occurring in the Indian Creek Basin area is represented in the National Museum Oligocene collection by an epiplastral beak (U.S.N.M. No. 16737), shown in plate 44, figure 1. This specimen was collected from the Brule, about 1 mile north of Whitman Postoffice, Niobrara County, Wyo., in 1942.

<sup>10</sup> *Ibid.*, p. 404.

The quadrate form of this beak with diverging lateral edges is more like that of *T. quadrata* Cope than of any other species, but it differs in having the gulohumeral sulci running backward and inward to meet on the median line instead of directly across this bone at right angles to the midline, as in the type of the species. This feature, stressed by both Cope and Hay, is so at variance with all other known species of *Testudo*, both living and extinct, that it leaves one wondering if it is not an abnormal condition peculiar only to that individual.

Specimen No. 16737 is larger than the type, as shown by the measurements given in table 11.

With the possible exception of length, the other differences observed between the two specimens may be regarded as individual variations. The beak is shorter than that of the type although exceeding it in all other dimensions. Regardless of the question of doubt that this difference may engender as to its proper specific assignment, this fragmentary specimen certainly indicates the presence in the Brule of the Hat Creek Basin of a third species of *Testudo*.

#### NOTE ON THE GEOLOGICAL DISTRIBUTION OF TESTUDO IN NORTH AMERICA

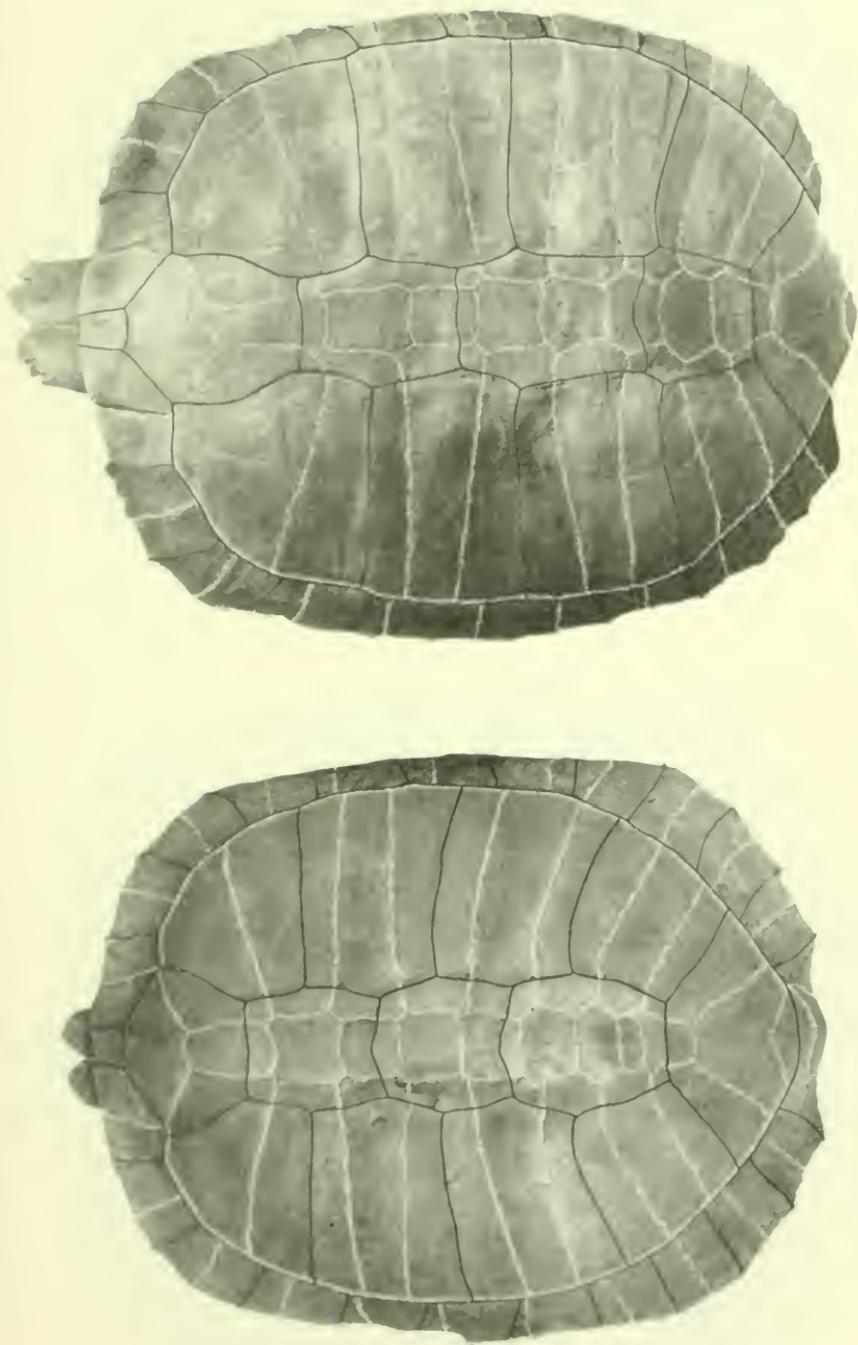
In the "Fossil Turtles of North America," p. 397, 1908, Hay lists six species of Oligocene *Testudo* as occurring in the *Oreodon* beds (Brule) and two as coming from the *Titanotherium* beds (Chadron), as follows:

BRULE	CHADRON
<i>Testudo amphithorax</i> Cope	<i>T. brontops</i> Marsh
<i>T. cultrata</i> Cope	<i>T. exornata</i> Lambe
<i>T. laticunea</i> Cope	
<i>T. ligonia</i> Cope	
<i>T. quadrata</i> Cope	
<i>T. thomsoni</i> Hay	

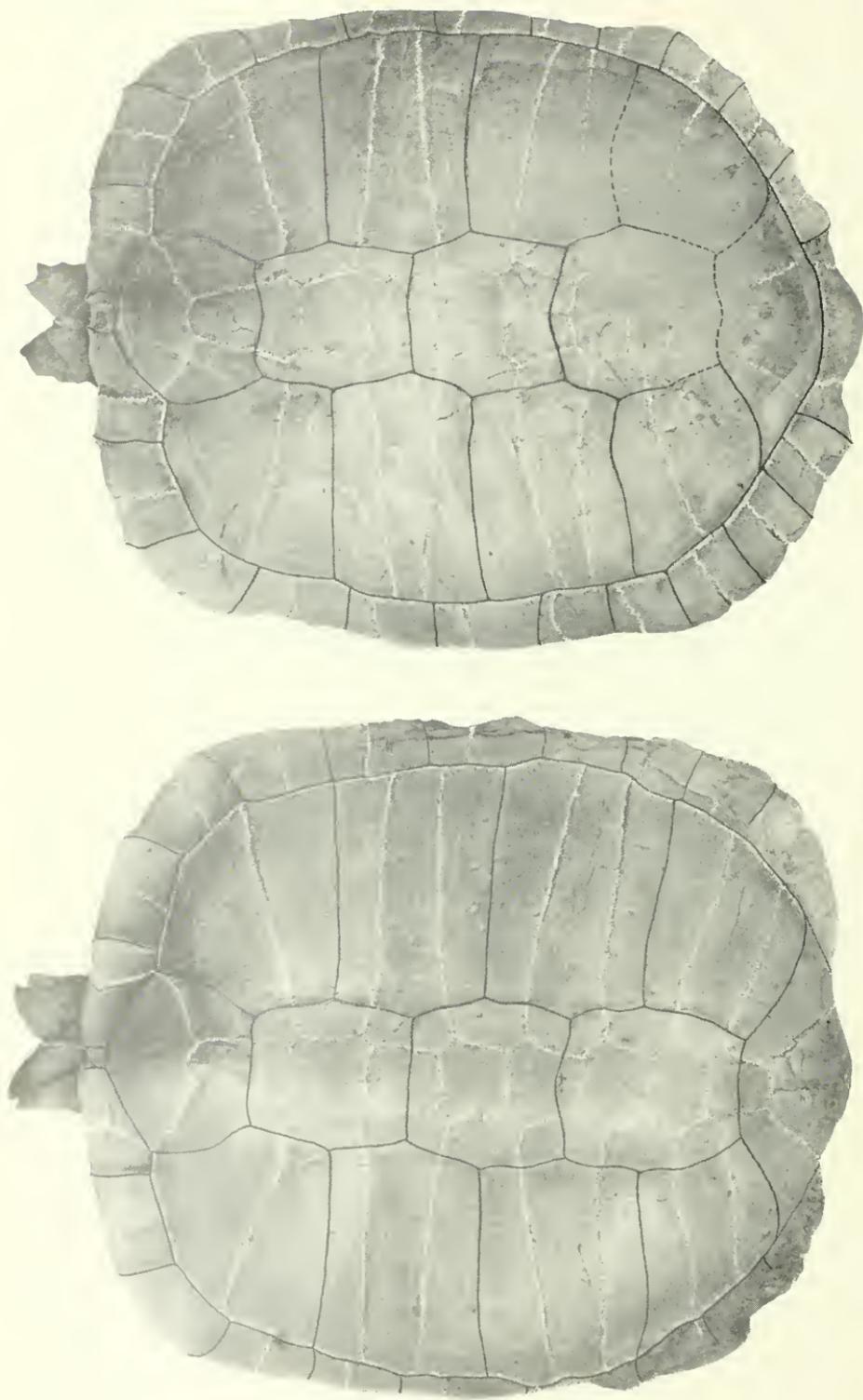
In a subsequent publication, "Second Bibliography and Catalogue of the Fossil Vertebrates of North America," Hay assigned all the Brule species to the Chadron. One is at a loss to understand whether this change was made on the basis of new information or whether it was a slip of the pen.

In view of the recognition of two, if not three, of the species in undoubted Brule deposits, it would appear to show the original geologic assignment was correct. That some of these species may have persisted from the Chadron into the Brule is suggested by a specimen in the Yale Museum from the *Titanotherium* beds, which Hay<sup>11</sup> identified as belonging to *Testudo laticunea*. That such was the case needs additional verification. This assertion is made on the fact that the commonest of all land tortoises of the Brule, *Stylemys nebrascensis*, has never been recognized as occurring in the Chadron.

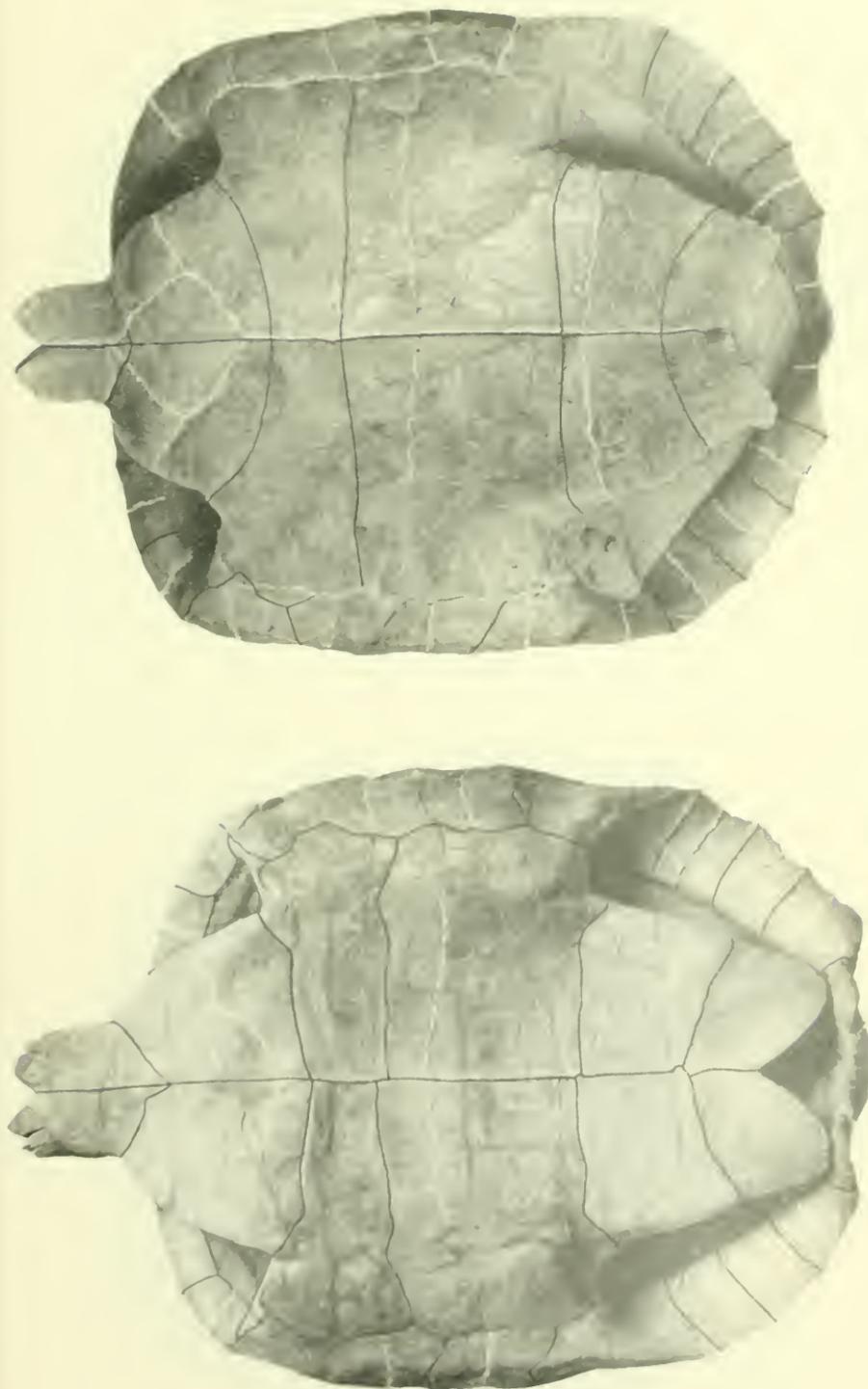
<sup>11</sup> Hay, O. P., Carnegie Inst. Washington Publ. 75, p. 404, 1908.



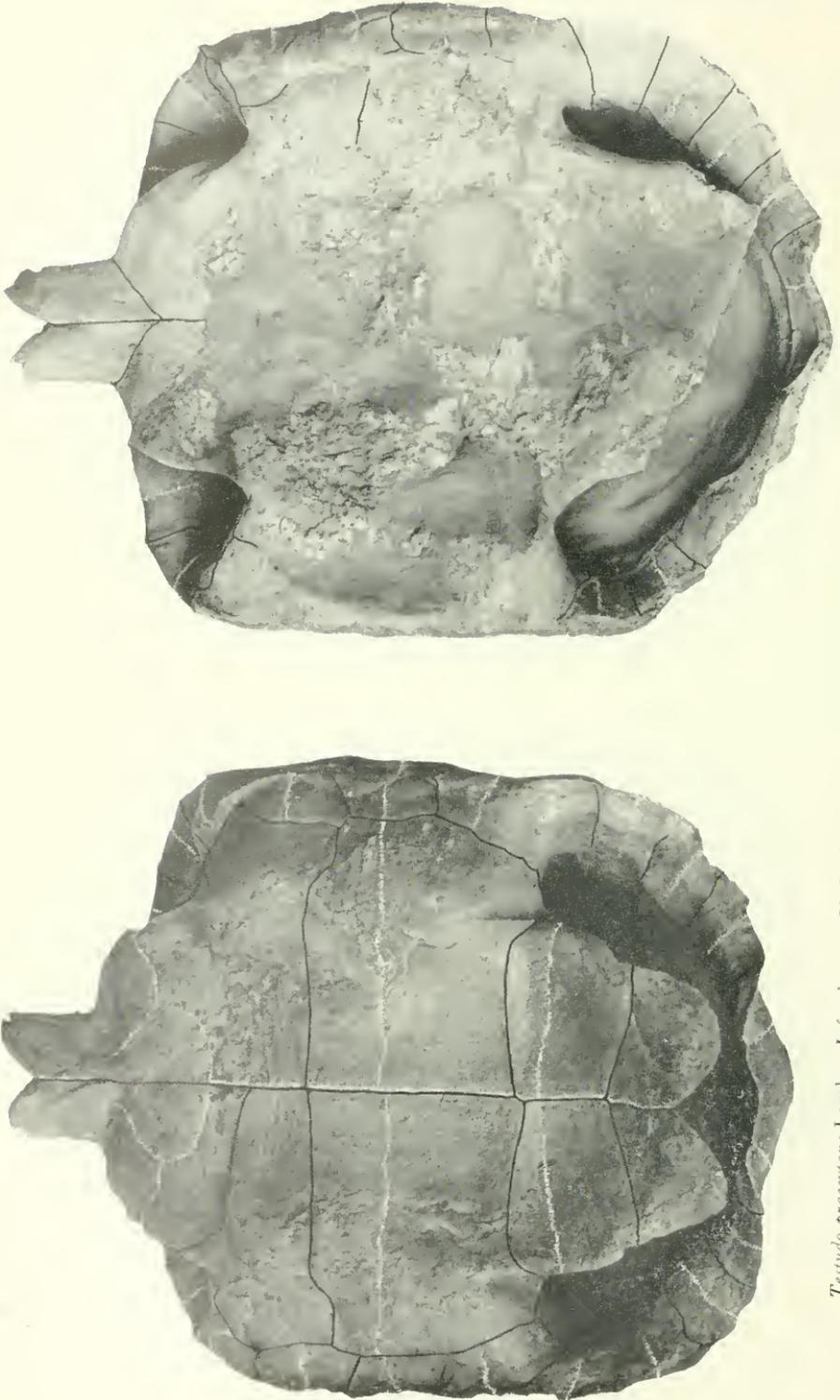
*Testudo praeextensa* Lambe: *Left*, carapace, U. S. N. M. No. 15874; *right*, carapace, U. S. N. M. No. 15878. One-fifth natural size.



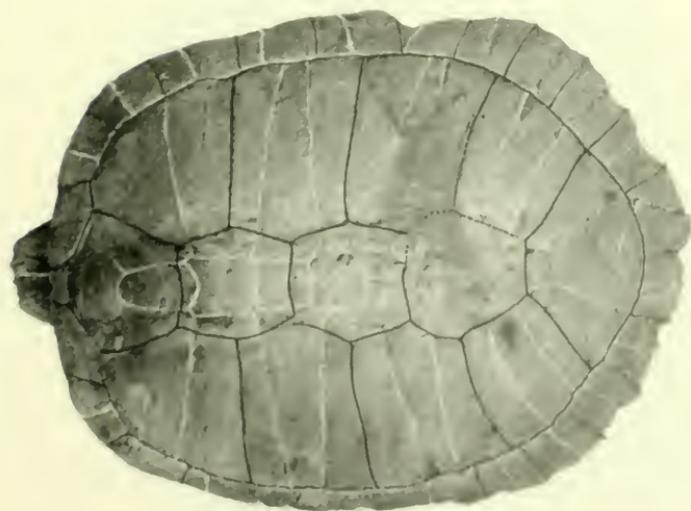
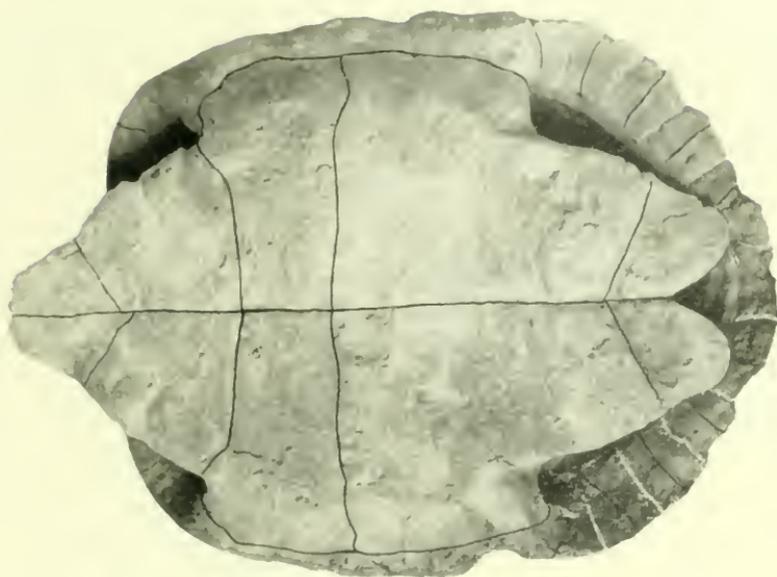
*Testudo praestans* Lambe: *Left*, carapace, U. S. N. M. No. 16732; *right*, carapace, U. S. N. M. No. 16728. One-fifth natural size.



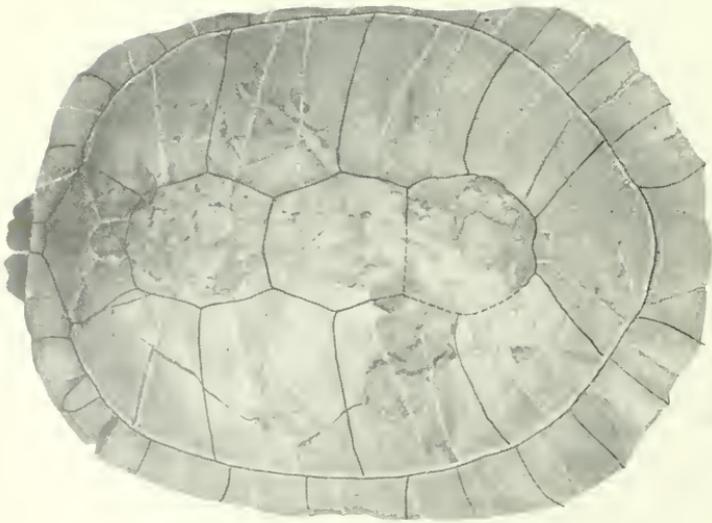
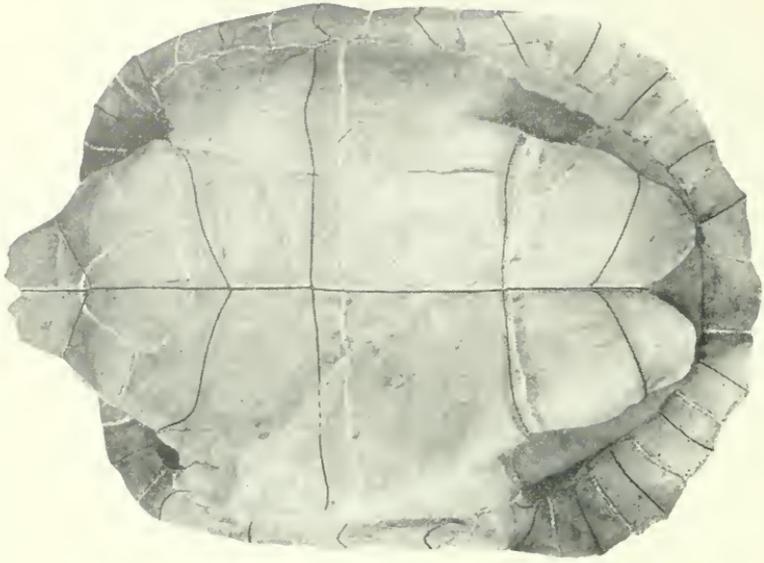
100. *Trionyx pringi* Lambe: *Left*, plastron, U. S. N. M. No. 15874; *right*, plastron, U. S. N. M. No. 15878. One-fifth natural size.



*Testudo praextans* Lambe: *Left*, plastron, U. S. N. M. No. 16732; *right*, plastron, U. S. N. M. No. 16728. One-fifth natural size.



*Testudo latirostris* Cope, U. S. N. M. No. 16731: *Left*, carapace; *right*, plastron. One-fifth natural size.



*Testudo laticunea* Cope, U. S. N. M. No. 15854: *Left*, carapace; *right*, plastron. One-fifth natural size.



1, Epiplastral beak of *Tetradactylus quadrata* Cope, U. S. N. M. No. 16757, ventral view; about one-half natural size.  
 2, Right forefoot and radius of *Tetradactylus praecox* Lambe, U. S. N. M. No. 15878; C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>, C<sub>4</sub>, carpalia 1, 2, and 5, respectively; I, intermedium; II, radius; III, ulna; IV, and V, digits 1 to 5, respectively; shown articulated as found. Natural size.