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A NEW TESTUDO FROM MADISON COUNTY,
MONTANA

BY

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A NEW TESTUDO FROM MADISON COUNTY, MONTANA

By

THOMAS M. OELRICH

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INTRODUCTION

DISCOVERY of a new species of *Testudo* in the Miocene deposits of Madison County, Montana, is significant because of its transitional position, as indicated by the morphological characters, and because it presents evidence on the age and origin of the nonmarine strata in which it occurred. The specimen is nearly complete and was the only one found at the locality. Although the carapace and plastron had been crushed and weathered due to the exposed position on top of a small knoll and had sustained slight additional damage from grazing sheep, it was possible to assemble and cement together the fragments in their proper positions.

The specimen was collected in the summer of 1948 by a field party from the Museum of Paleontology of the University of Michigan consisting of Walter H. Wheeler, George Gaughran, and Henry Zuidema under the direction of Professor Claude W. Hibbard. The writer was not a member of the expedition but has studied the specimen in the laboratory of the Museum at Ann Arbor.

Appreciation for advice and suggestions from Dr. E. C. Case and Dr. Claude W. Hibbard of the Museum of Paleontology and from Dr. Rainer Zangerl of the Chicago Natural History Museum is gratefully tendered. The writer is indebted to Dr. Norman E. Hartweg, of the Museum of Zoology, for the loan of Recent turtle skeletons which were used for comparison with the fossil specimen; to W. H. Buettner, Preparator in the Museum of Paleontology, for assistance in preparing the specimen; and to Dr. L. B. Kellum, Director of the Museum of Paleontology, for permission to study the fossil material in the Museum.

Assistance given to the University of Michigan field party by ranchers and others living in southwestern Montana is acknowledged by the Director of the Museum of Paleontology. Special mention should be made of the help and co-operation of Mr. A. P. Williams, of Belmont Park Ranch, on whose property the fossil turtle was excavated, and of the hospitality and help of Mr. Elwyn L. Metzler and his mother, of York Ranch, who granted permission to camp on their land. The services of Mr. George Goetschius, who guided the field party to the collecting localities of the late Mr. Earl Douglass in the Ruby Basin, were especially important in expediting the work.

***Testudo primaeva* Oelrich, sp. nov.**

(Pl. I, Figs. 1-2)

Holotype.—No. 25758, Museum of Paleontology, University of Michigan, consists of a nearly complete plastron and carapace, a complete pelvic girdle, a right femur, a right fibula, the proximal half of the right tibia, the glenoid elements of the pectoral girdle, the central part of the left scapula, the proximal part of the coracoid, several disconnected elements of both coracoids, and several poorly preserved cervical and caudal vertebrae. The specimen was collected by the University of Michigan field party, July 6, 1948.

Horizon and type locality.—Probably Lower Miocene. The specimen was taken on the west side of Sweetwater Creek, approximately two miles southwest of the Belmont Park Ranch house in the NE. $\frac{1}{4}$, sec. 32, T. 8 S., R. 5 W., Madison County, Montana.

Diagnosis.—A generalized form of *Testudo* closely resembling *Styemys nebrascensis* Leidy, distinguished by its high-arched carapace, deep scutellations, well-sutured costoperipheral junction and its prominent epiplastral lip. It is differentiated from other species of *Testudo* by the arrangement of the neural and costal plates and the relationship of the pectoral scute to the abdominal scute in length.

Description of holotype.—The elements found consist of a nearly complete plastron and carapace, a complete pelvic girdle, a right

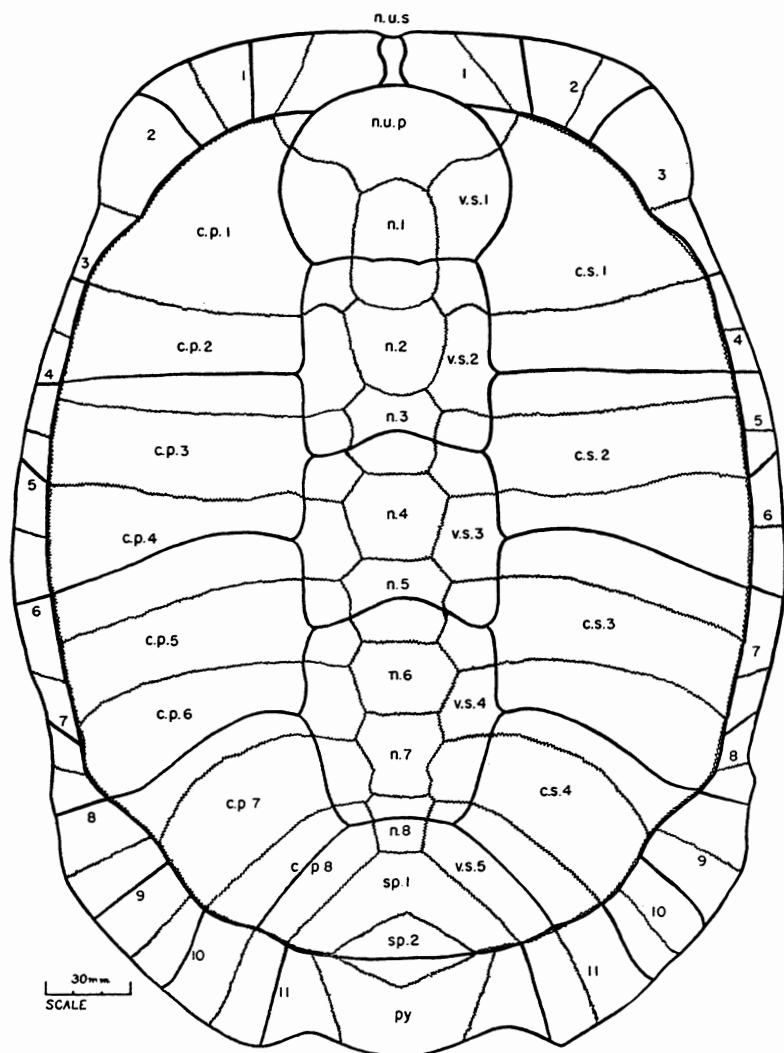


FIG. 1. Dorsal view of carapace of *Testudo primaeva*, sp. nov. Holotype No. 25758, Museum of Paleontology, University of Michigan. Explanation of lettering; c.p.1, c.p.2 etc., costal plates, or bones; c.s.1, c.s.2, etc., costal scutes; n.1, n.2, etc., neural bones; n.u.p., nuchal plate, or bone; n.u.s., nuchal scute; py., pygal bone; sp.1-1, suprapygals Nos. 1 and 2; v.s.1, v.s.2, etc., vertebral scutes; Nos. 1-11 (right), marginal scutes; Nos. 1-11 (left), peripheral bones.

femur, a right fibula, and the proximal half of the right tibia, the glenoid elements of the pectoral girdle, the central part of the left scapula, and the proximal part of the coracoid, several disconnected elements of both coracoids, and several poorly preserved cervical and caudal vertebrae.

The carapace is 350 mm. in length and 265 mm. in width, approximately 76 per cent of the length. The carapace is very highly arched, measuring 157 mm. at its highest point. The anterior part of the carapace rises rather abruptly and then gradually increases in height to a point which is approximately two-thirds of the distance from the anterior end of the carapace. At this point the carapace descends slowly in a convex curve to the posterior end (Fig. 2).

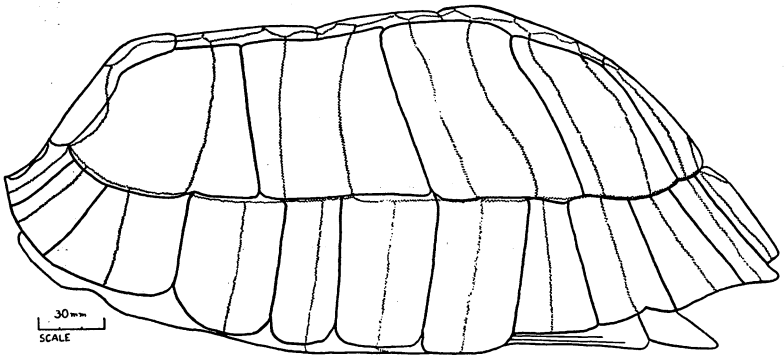


FIG. 2. Lateral view of *Testudo primaeva*, sp. nov. Holotype No. 25758, Museum of Paleontology, University of Michigan.

Laterally, the arching of the carapace has been distorted by crushing. The dorsal surface is fairly flat and the right side descends obtusely. The left side appears to be normal and descends acutely. This distortion appears not to affect any other contour of the carapace. The carapace is so arched that the lateral peripheral bones are barely visible dorsally. The posterior peripheral bones flare laterally to a much greater extent than the anterior peripherals, making the posterior region appear much wider than the anterior region. The lateral peripherals are 65 mm. high, or approximately 40 per cent of the total height. The entire surface of the carapace is rough and in

certain areas there are inconsistent ridges and depressions resembling lines of growth.

The bone formula of the carapace is as follows: 1 nucal, 8 neurals, 2 suprapygals, 1 pygal, 8 costals, and 11 peripherals. The neural bones are different from those reported in other forms of *Testudo* and appear characteristic of *Testudo primaeva*. The first neural is 45 per cent longer than any of the others in the series (see Table I).

TABLE I
BONES OF CARAPACE
Dimensions in millimeters

Neurals				Other Bones			
Number	Length	Width	Number of Sides		Length	Width	
1	51	28	5				
2	29	35	6	Nucal	65	90	
3	28	35	8				
4	29	38	6	Pygal	50	65	
5	28	37	8				
6	25	37	6	Suprapygal 1 ...	36	84	
7	29	30	6				
8	23	25	6	Suprapygal 2 ...	39	54	
Costals				Peripherals			
Number	Length	Width		Number	Length	Width	
		Proximal	Distal			Proximal	Distal
1	127	45	80	1	..	35	50
2	...	31	46	2	39	25	50
3	...	31	28	3	..	52	52
4	...	28	50	4	..	35	32
5	...	29	24	5	..	33	33
6	131	24	38	6	65	..	..
7	111	21	30	7	65	28	38
8	80	20	35	8	55	32	40
				9	55	28	40
				10	54	30	40
				11	55	22	45

The second is hexagonal. The third and fifth are fairly well differentiated into octagonal bones (the hexagonal bones of some authors). The median lateral side in neurals No. 3 and No. 5 is concave (Fig. 1). The angles which differentiate the sides are well formed and definite. This is more evident on the left side in both No. 3 and No. 5 than on the right side, where fracturing makes the sutures uncertain. Neurals Nos. 4, 6, and 8 are definitely hexagonal. The lateral anterior sides in all neurals are the shortest. Neural No. 7 apparently has six sides.

Suprapygal bone No. 2 is quadrangular in shape and approximately 25 per cent wider than long. Suprapygal No. 1 bifurcates; the distal ends articulate mostly with the eleventh peripheral, slightly with the pygal. The pygal bone, which probably extended well down to a flaring point, is well rounded from weathering or has been otherwise destroyed; it is not perpendicular to the plastron like that of *Styemys nebrascensis*.

The costal plates, or bones, vary in width to a marked degree. The second, fourth, and sixth are wide distally and narrowed proximally; the third and fifth are narrowed distally and are slightly wider proximally. The fourth costal is much more differentiated than either the second or the sixth, being nearly twice as wide distally as proximally. The suture between the second and third costal is inserted upon the third neural bone; this is a character found in *Styemys nebrascensis*. As a result of this arrangement there is an intercostal suture inserting upon every neural with the exception of the first.

The peripheral bones range in length from 39 mm. at the anterior end to 55 mm. at the posterior end. The anterior peripherals extend or project anteriorly and then diminish posteriorly until the lateral peripherals are almost perpendicular. The posterior peripherals flare greatly over the hind leg and tail region giving rise to an angulated curve at the posterior margin of the carapace, which is in contrast to its rounded anterior margin.

Internally, the carapace is fairly smooth. The costal plates have very slight rib ridges. Proximally, the ribs are raised, but as a result of preservation, or perhaps in the removal of the specimen from the outcrop, the tips were destroyed, so that determination of the height

or extent of projection is impossible. The neurals present a continuous ridge from the first to the eighth, and the proximal ends of the ribs extend well below the neural ridge. These ends are very small and thin, and it is possible to infer that they were greatly reduced and did not articulate with the vertebrae, remaining only as vestigial projections; they are present on all of the costals. The neural ridge is fairly complete and in many places is perfect. Apparently, the vertebrae were not joined to the neurals for their full length, as in such forms as *Hadrianus* sp., to judge from a comparison of a specimen, U.M.M.P. No. 13168, of that species with *Testudo primaeva*. No dorsal vertebrae were found in place or intact in *T. primaeva*, which is more evidence that they were probably very loosely attached. This probability of weak costal and neural support indicates a very small vertebral series or one similar to that found in the existing forms of *Testudo*. The distal ends of the ribs do not project into the peripherals as they do in *Stylemys*. It seems likely that a few of the peripherals projected slightly onto the costals as in *Gopherus* (Hay, 1908: 370). The sacral enlargements for the reception of the ilia are well formed and located on the eighth costal.

The buttresses are well developed, but extend only slightly above the costoperipheral articulation. The axillary buttress rises in the first costal 5 to 10 mm. above the peripheral. The inguinal buttress rises in the suture between the fifth and the sixth costal plate beginning on the fifth and rising on the sixth. Though the dorsal part of the buttress is fractured, it appears to have been approximately 15 mm. above the costoperipheral junction.

The costoperipheral junction of the carapace is very tightly sutured and encircled by a deep sulcus of the costomarginal scutes.

Ventrally to the overhanging junction of the marginal and abdominal scutes the peripheral plates extend medially for a distance of 10 to 25 mm. before suturing on the hyoplastron and the hypoplastron. This means that the distal ends of the peripheral plates are extended horizontally on the plastral surface and that the plastron-carapace suture does not correspond with the ventral margin of the marginal scutes.

The plastron is particularly broad and deeply notched (23 mm.)

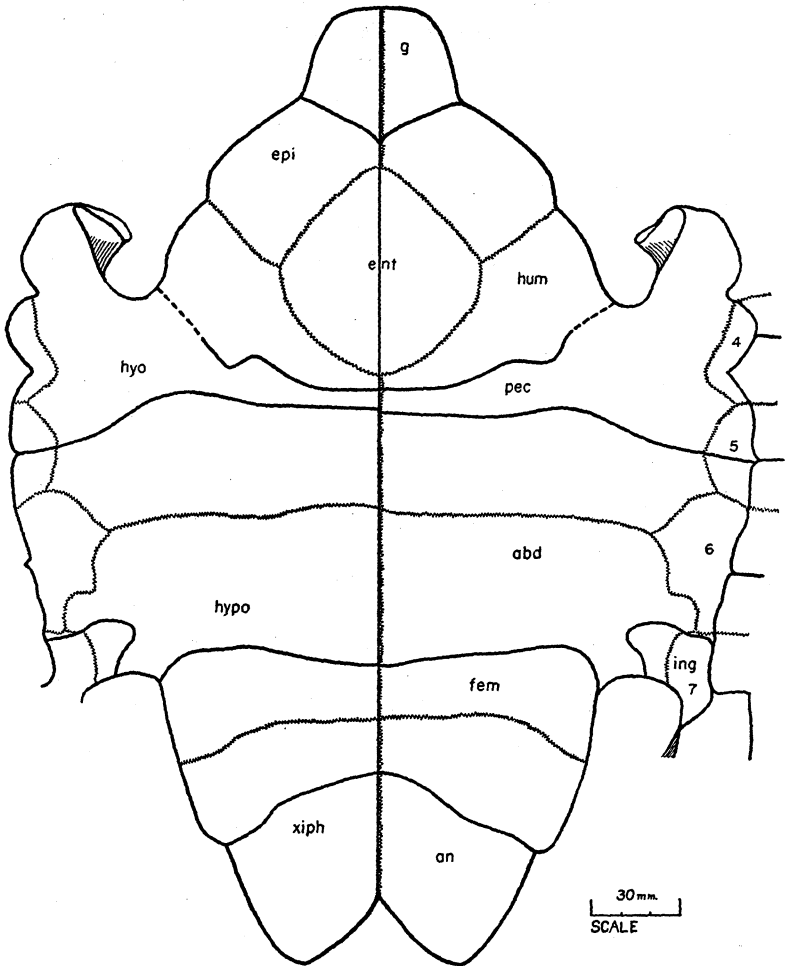


FIG. 3. Ventral view of plastron of *Testudo primaeva*, sp. nov. Holotype No. 25758, Museum of Paleontology, University of Michigan. Explanation of lettering: abd., abdominal scute; an., anal scute; ent., entoplastron; epi., epi-plastron; fem., femoral scute; g., gular scute; hum., humeral scute; hypo., hyoplastron; hypo., hypoplastron; ing., inguinal scute; xiph., xiphiplastron; Nos. 4-7, peripheral bones; pec., pectoral scute.

at the posterior end. Both xiphiplastral elements are pointed (Fig. 3). The posterior borders are acute. The tip of the xiphiplastron descends slowly on its dorsal side to a thin edge. The tips point posteriorly. The junction of the anal and femoral scutes forms a definite indentation in the xiphiplastron. The length of the bridge is 125 mm., about 39 per cent of the length of the plastron, which is somewhat of a reduction in proportion over that in *Stylemys nebrascensis*. The width of the plastron between the inguinal notches is slightly narrower than that between the axillary notches. This makes the plastron appear elongated posteriorly even though the bridge is very broad. For dimensions of the plastral elements, see Table II.

The general contour of the plastron is oval and it tapers posteriorly. It is 321 mm. in length, and the width, measured from the marginal scutes, is 242 mm., about 75 per cent of the length. The plastron is complete except for some sections of the left epiplastron

TABLE II
ELEMENTS OF THE PЛАSTRON
Dimensions in millimeters

Plates	Scutes
Xiphiplastron	Anal
Length 82	Mid-line length 45
Width 70	Width 52
Hypoplastron	Femoral
Greatest length 80	Greatest length 70
Mid-line length 72	Width 73
Greatest width 117	Abdominal
Hyoplastron	Length 83
Width 120	Width 121
Mid-line length 45	Pectoral
Greatest length 115	Mid-line length 7
Entoplastron	Width 115
Length 70	Humeral
Width 68	Length 87
Epiplastron	Width 79
Length 55	Gular
Width 58.5	Length 38
	Width 30

and of the right epiplastral lip. The plastron is characterized by the presence of a definite projecting epiplastral lip which is 30 mm. long and 58 mm. wide, or half as long as it is wide. Owing to the loss of a piece of the lip it is impossible to describe its anterior contour, but the anterior median thickness suggests that it was as wide anteriorly as it is posteriorly. The lip is flat dorsally and 20 mm. thick or about two and one-quarter times as thick as the rest of the plastron.

Dorsally, the posterior end of the epiplastral lip in the Montana turtle descends perpendicularly to the plastron to form a very acute depression (Fig. 4*b*). The lip is similar to that in *Testudo*. In *T. primaeva* it does not extend beyond the anterior end of the carapace. This is a character which distinguishes *Testudo primaeva* from the known forms of *Stylemys*. The ventral side of the plastron is highly arched anterioposteriorly (18 mm.) along the mid-line which indicates that the specimen is that of a male.

The entoplastron is rounded posteriorly and pointed anteriorly. It is significant that the anterior end of the entoplastron is posterior to the gular-humeral scutellation. This is not true in *Stylemys*.

TABLE III
SCUTES OF CARAPACE
Dimensions in millimeters

Marginal				Vertebral		
Number	Length	Width		Number	Length	Width
		Proximal	Distal			
1	..	..	..	1	78	80
2	45	34	40	2	57	65
3	49	..	..	3	58	65
4	..	45?	45?	4	77	68
5	..	30	35	5	75	107
6	..	38	38	Costal		
7	70	35	38	Number	Length	Width
8	58	16	28	1	107	100
9	55	33	35	2	120	58
10	52	26	38	3	125	59
11	56	32	40	4	95	49

Scutellation of the carapace and the plastron is deeply marked. The scute formula of the carapace is: 11 marginals, 1 nuchal, 1 pygal, 5 vertebrales, and 4 costals. The nuchal scute is very narrow, 23 mm. in length and 8 mm. in greatest width. It resembles a dumbbell in outline. The first vertebral is unusual in that it is rounded both laterally and anteriorly; the second, third, and fourth are quadrangular. The marginal scutes of the carapace are striking in that they overhang or form a lip on the ventral surface at their junctions.

In the plastral scutellation, each scute seems to overhang the one just posterior to it. The pectoral scutellation is posterior to the entoplastron. The pectoral scute along its mid-line is one-twelfth the length of the abdominal scute in *T. primaeva*, whereas in *Stylemys nebrascensis* it is three-tenths of the length of the abdominal scute (Hay, 1908: 386). In specimens of *S. nebrascensis* (U.M.M.P. Nos. 14508, 14509, 14520, 14462, 1116, and 1114) the average comparative length of the pectoral scute was three-tenths (.358) or 28.2 per cent of the abdominal scute. The greatest comparative length of a pectoral scute in these specimens was 38 per cent of the abdominal scute and the smallest was 21 per cent. None of these measurements fall within the range of *Testudo primaeva*. The abdominal scute extends into the inguinal region separating the femoral from the inguinal scute. The presence of an axillary scute could not be determined because of deficiencies due to preservation.

The pelvis is nearly complete except for the anterior tips of the pubes, which are broken off. The pubes, in view of their thinness, probably did not extend much farther forward than the broken termination. The ventral view of the pelvis resembles that of *Testudo impensa* (Hay, 1908: 435, Fig. 572); in *Testudo primaeva*, however, the ischia point anteriorly and are completely flattened. The ilia are 58 mm. high and rise almost perpendicularly from the flattened ventral surfaces of the ischia. At their distal ends the ilia flare into crests, 30 mm. in length. The sutures of the pubis, ischium, and ilium are distinct in the acetabulum as well as on the surface of the girdle. The pubis projects almost at a right angle from the perpendicular ilium, and the ischium projects ventrally from the pubis at an angle slightly greater than 90 degrees. The anterior pubic pro-

cesses are 17 mm. long and directed ventrally almost at right angles, so that the pubis is raised well off the surface of the plastron.

The median sutures between the pubic bones and the ischia are well fused but still visible. Ventrally, this junction of ischia and pubic bones forms a high median ridge. The obturator foramina are round. The measurements of the pelvic girdle are as follows: 55 mm., in length; 100 mm., in width; and 75 mm., in height.

The femur of *Testudo primaeva* closely resembles that of *Stylemys nebrascensis*. As compared with the femur of *S. nebrascensis*, U.M.M.P. No. 9269, the proportions are exactly the same and the general form almost identical; the posterior surface, however, of the greater trochanter in specimen No. 9269 is nearly flat and in *T. primaeva* fairly well rounded. The length of the femur is 65 mm. The depression between the greater and the lesser trochanter is slightly deeper in *T. primaeva* than in the specimen of *S. nebrascensis* (No. 9269). The fibula, which is 44 mm. in length, and the tibia resemble closely those of *S. nebrascensis*, U.M.M.P. No. 17600 (see Case, 1936: Pl. II, Fig. 3).

The rest of the skeletal elements obtained are so fragmentary that it is impossible to make comparisons with corresponding elements in other specimens.

Discussion.—*Testudo primaeva* closely resembles *Stylemys nebrascensis*, but it has many characters which definitely separate it from *Stylemys* and closely relate it to members of the genus *Testudo*. Similarity to both genera seems to indicate a transitional position between *Stylemys* and *Testudo*.

The neural bones in *Testudo primaeva* and the position of the second intercostal suture upon the third neural correspond to that of *Stylemys nebrascensis*. The carapaces of the two forms are similar in contour and in relative length and width, but the height of the carapace of *T. primaeva* is much greater than that of *S. nebrascensis*. The posterior marginal scutes of *T. primaeva* are curved upward instead of downward as in *S. nebrascensis*, and the pygal bone is directed ventroposteriorly instead of downward as in that form.

The carapace has a number of characters which are similar to those in *Testudo*. They include a roughness of the surface and prom-

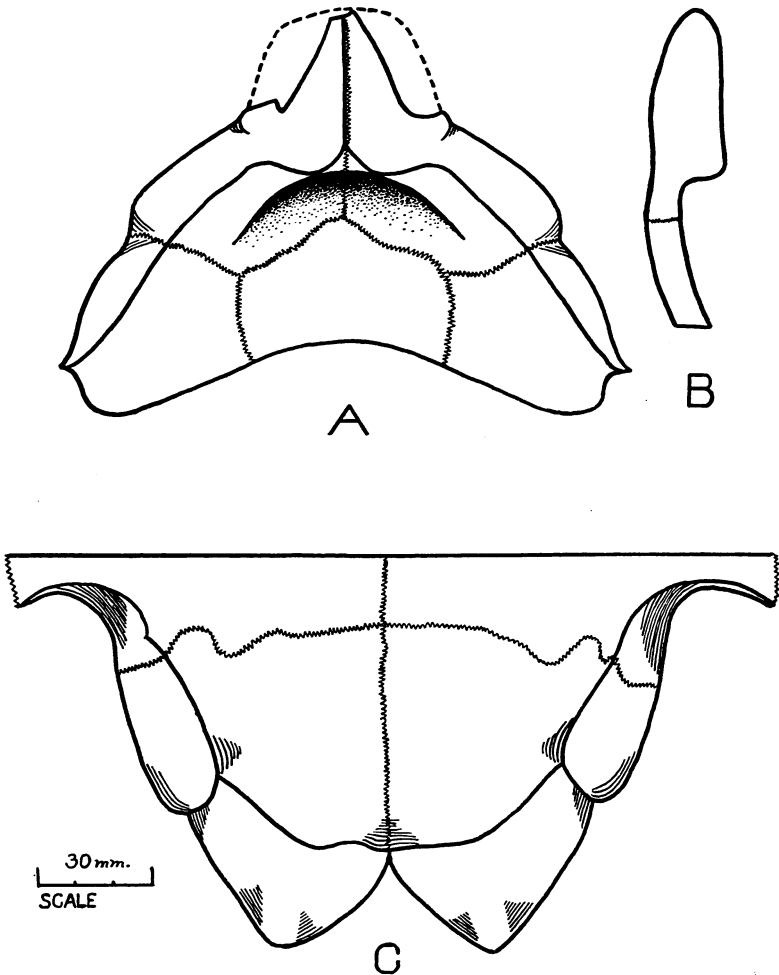


FIG. 4. *Testudo primaeva* Oelrich, sp. nov.

A. Dorsal view of epiplastron. Holotype No. 25758, Museum of Paleontology, University of Michigan.

B. Median sagittal view of epiplastron of the same specimen showing acute depression.

C. Dorsal view of xiphiplastron of the same specimen.

inent grooves, like lines of growth, that are not present on any of the specimens of *Stylemys* which I examined.

The pelvis and limb bones resemble those of *Stylemys nebrascensis*. A prominent pubic projection which is present in *S. nebrascensis*, however, is absent in *Testudo primaeva*.

The features of the Montana turtle which especially resemble those of *Testudo* are in the plastron. The well-developed epiplastral lip, with its thick anterior part and perpendicular descent into an acute depression at the posterior margin (see Fig. 4a, b) is a character not known in *Stylemys*. In *T. primaeva* the posterior end of the plastron has a deeply excavated notch and the tip of the xiphiplastron is well pointed; in *Stylemys* the posterior end is not as deeply notched and the tip of the xiphiplastron is not pointed. Neither the general elongation nor the relative narrowness of the plastron are typical of *Stylemys*. The length of the pectoral scute in respect to the length of the abdominal scute is less in *T. primaeva* than in *Stylemys*.

The junctions between the costal and the peripheral bones are well sutured. In *Testudo primaeva* the peripherals project into the distal ends of the costals; the reverse condition is present in *Stylemys*. The relative height of the peripherals in *T. primaeva* is less than that in *Stylemys*. In five specimens of *Stylemys* the peripherals measured 50 to 58 per cent of the total height; in the specimen of *T. primaeva* the peripherals measured 40 per cent of the total height. The peripherals in *T. primaeva* also extend ventrally and medially for a greater distance than in *Stylemys*.

Testudo primaeva is similar in general form to *Testudo copei* Koerner from the late Miocene, Deep River formation, Meagher County, Montana. *Testudo copei* differs from *T. primaeva* in that it has a longer pectoral scute, six-sided neurals, and a wider epiplastral lip.

Testudo primaeva, a high-arched turtle resembling *Stylemys nebrascensis*, has a prominent epiplastral lip twice as wide as long, which does not extend anterior to the carapace. The carapace is rough, with very large and heavy scutellations. The marginals overhang the abdominals at the bridge. The pectoral scute is one-twelfth the length of the abdominal at the mid-line and the gular-humeral sulcus is anterior to the entoplastron.

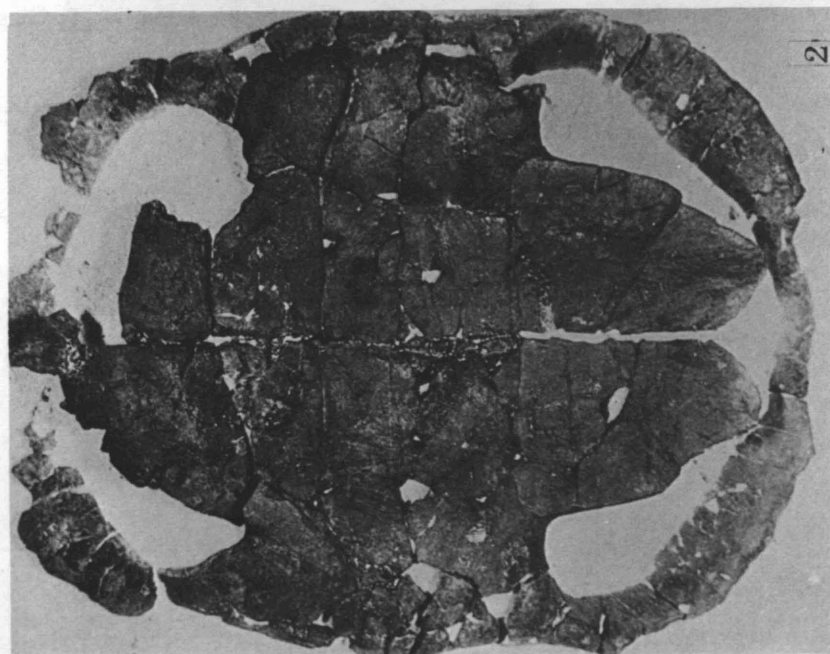
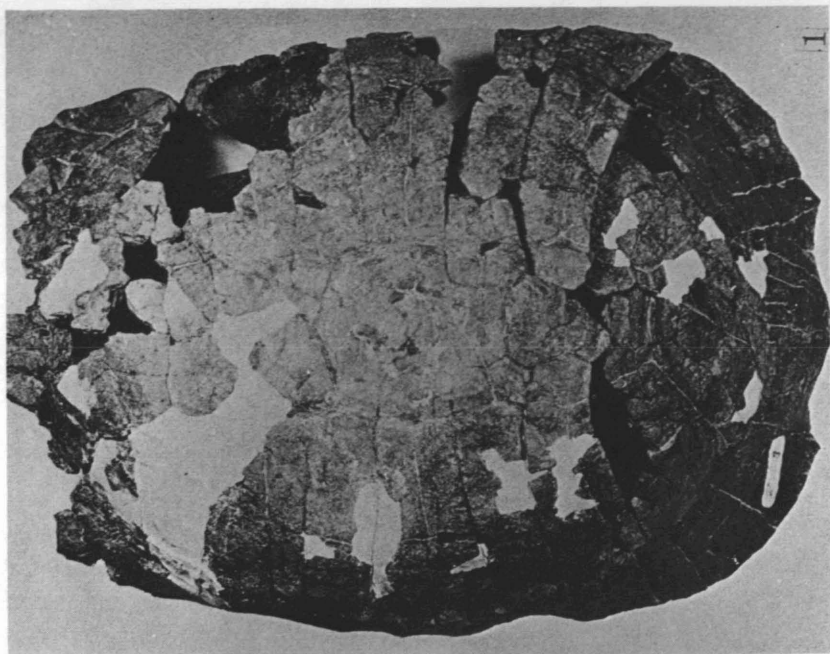
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EXPLANATION OF PLATE I

	PAGE
<i>Testudo primaeva</i> Oelrich, sp nov.	44
FIG. 1. Dorsal view. Holotype No. 25758, Museum of Paleontology, University of Michigan.	
FIG. 2. Ventral view of same specimen.	

PLATE I



VOLUME VIII

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