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(Continuation of Contributions from the Museum of Geology)

UNIVERSITY OF MICHIGAN

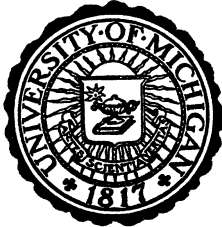
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A SPECIMEN OF *STYLEMYS NEBRASCENSIS*
LEIDY, SHOWING THE BONES OF
THE FEET AND LIMBS

BY

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A SPECIMEN OF *STYLEMYS NEBRASCENSIS*
LEIDY, SHOWING THE BONES OF
THE FEET AND LIMBS

By E. C. CASE

AMONG the hundreds of specimens of *Stylemys* recovered from White River Oligocene beds of South Dakota and other states few retain the bones of limbs, girdles, neck, or skull. This is probably due to the relaxation of the cadaver as decay set in and the protruding limbs and neck were washed away or devoured by carrion eaters.

The expedition from the Museum of Paleontology of the University of Michigan to the Big Badlands of South Dakota in 1932 was so fortunate as to recover a specimen of *Stylemys*, number 17600 in the collection of the Museum, in which the bones of the feet, most of those of the limbs and the girdles, the neck and the tail were preserved. The skull, the right scapula, and the right humerus were, unhappily, not present.

The limbs were preserved in nearly normal position, but the bones of the feet were somewhat disturbed, though close together. It has been possible to restore the feet with a large degree of confidence in the accuracy of the result, both from the size and the fit of the individual bones and by comparison with the feet of other turtles, living and fossil.

In Figure 1, Plate I, is shown the specimen as it has been restored and mounted. The plastron has been removed to show the axial skeleton. The bones of the limbs and the feet have been placed in their normal position, with the exception of those of the right hind foot, which have been left as found to show the original condition of the specimen.

The right forefoot is displayed showing the ventral surface and the left forefoot showing the dorsal surface. The left hind foot is displayed showing the dorsal surface but, before mounting, the bones were assembled and a cast was made showing the ventral surface.

The cervical and the caudal vertebrae and the bones of the girdles have been left as found.

Since all the bones of the skeleton except those of the feet and the tail have been previously described,¹ only the parts that are new will be discussed in detail.

The specimen possesses most of the characters of *Stylemys nebrascensis*, but since there are three phalanges in each digit it cannot, following Hay's definitions, be placed in the family Testudinidae, but must be placed in the family Emydidae. The familial position of *Stylemys* has been in doubt. Hay, in his *Fossil Turtles of North America*, cited below, reviews the history of attempts to classify it (p. 386) and notes the paucity of limb and foot bones among the recovered material. After discussing the situation he places it in the family Testudinidae, largely because of its evident terrestrial adaptations and the supposed number of phalanges in the digits. He says: "Professor Cope recognized the validity of the genus. While regarding the Emydidae and the Testudinidae as forming distinct families, he referred *Stylemys* to the former, doubtless supposing that the digits possess three phalanges each.

"It is the opinion of the present writer [Hay] that the genus in question belongs to the Testudinidae." A little farther along in his discussion Hay says: "It seems quite certain that none of the digits possess more than two phalanges, but the proof is incomplete."

It is evident that both Cope and Hay made their familial

¹ Hay, O. P., *Fossil Turtles of North America*. Publication No. 75, Carnegie Institution of Washington. 1908.

Case, E. C., "Notes on a Specimen of *Stylemys nebrascensis* Leidy," *American Journal of Science*, Fourth Series, Vol. 47, pp. 435-438, 5 figs. 1919.

Case, E. C., "A Specimen of *Stylemys nebrascensis*, with the Skull Preserved," *Contributions from the Museum of Geology, University of Michigan*, Vol. 2, pp. 87-91, 7 figs. 1925.

assignments of the genus *Stylemys* upon suppositions as to the number of phalanges in the digits, influenced, no doubt, by their interpretation of minor characters in other parts of the skeleton.

Considering the uncertainty and the difference of opinion as to the distinctions between the two families and even the validity of their separation, and considering how closely certain specialized genera assigned to one group approach the other (as *Terrapene* approaches in its terrestrial adaptations typical members of the Testudinidae), it is easily seen how the difference of opinion arose. Hay constantly compares *Stylemys* with *Gopherus*, but repeatedly cites the resemblance of *Terrapene* to the Testudinales.

The following major characters are mentioned by Hay as distinctive of the two families:

<i>Testudinidae</i>	<i>Emydidae</i>
1. Coracoid greatly expanded at mesial border	1. Coracoid not greatly expanded at mesial border
2. Phalanges never more than 2	2. Phalanges 3 in most digits and genera
3. Anterior end of plastron extended as a lip	3. Anterior end of plastron not extended as a lip
4. Digits short	4. Digits long, except in <i>Terrapene</i>
5. Otic notch open	5. Otic notch closed
6. Neural plates "sometimes mostly" hexagonal, but often (<i>Testudo</i>) octagonal alternating with tetragonal	6. Neural plates hexagonal with broad end forward, "mostly"

The sixth character mentioned by Hay, together with certain minor characters which might easily be altered in the process of fossilization, are not dependable in determinative work. The fifth character may not be used in this case, since the skull was not recovered. Of the others the present specimen is Testudinate in first character, Emydid in the second and the third, and might be referred to either in the fourth.

It appears to the author of this paper, especially in the light of the evidence that each digit possessed three phalanges, that *Stylemys* should be regarded as an Emydid with terrestrial adaptations rather than as a Testudinate.

The character of the feet is shown in the accompanying figures, but brief mention may be made of some points. In the right

forefoot (Pl. II,² Fig. 1), displayed from the ventral side, the second phalange has been restored in plaster; all other parts are bone. In this, as in the left forefoot, it is noticeable that the terminal phalanges are (proportionately) much larger and more clawlike than in any member of the Testudinidae; the shortness of the foot is due to the abbreviation of the first and second phalanges and the reduction of the carpalia. In both feet the radiale, the intermedium, and the ulnare are separate and unquestionably in place. There are five carpalia with a much larger presentation on the ventral than on the dorsal surface of the foot. The fourth and fifth carpalia are fused, at least upon the ventral surface. This is not an uncommon occurrence in certain genera of turtles. The second phalanges of the second, third, and fourth digits have strong tuberosities near the distal ends for tendinous attachment.

In the left forefoot (Pl. II, Fig. 2), displayed from the dorsal surface, the carpalia have small presentation and are all distinct. The second phalanges are little, if any, longer than the first. In both front feet the terminal phalanges are foreshortened in the photographs, owing to their attitude to the rest of the foot.

The right hindfoot (Pl. II, Fig. 3), displayed from the dorsal surface, shows the single, large proximal element in the tarsus, composed of coalesced astragalus and calcaneum. The first, second, and third tarsalia are small, but the fourth and fifth are notably larger. The fifth stands out sharply from the rest of the tarsus and supports the much-reduced fifth digit, which has only two phalanges, the last a mere rudiment. The first phalanges are longer than the second, especially in the second digit. The tips of the terminal phalanges of the second, third, and fourth digits have been restored, but, as indicated by the preserved portion, they were longer and more slender than those of the front foot. It is evident that both front and hind feet possessed strong and somewhat elongate claws and that this character was more pronounced in the posterior foot than in the anterior. It is

² Because of the difficulty of photographing the feet with sufficient detail and contrast, the figures are photographs of casts from the original, slightly retouched.

PLATE I



Specimen of *Stylemys nebrascensis*, mounted with the plastron removed and the feet restored

PLATE II

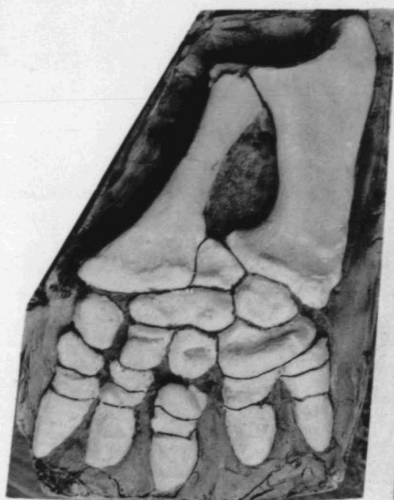


FIG. 1. Ventral surface of right front foot



FIG. 2. Upper surface of left front foot

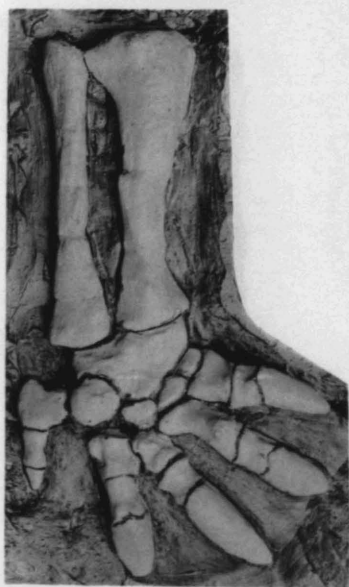


FIG. 3. Upper surface of right
~~front~~ foot
hind



FIG. 4. Lower surface of right hind foot

Photographs of casts of feet. All $\times \frac{2}{3}$

possible that in the restoration the terminal phalange of the third digit has been made a little too long, giving this digit an appearance of greater length than the second, but it has been restored as indicated by the preserved portion and is not longer than a terminal phalange present in the unrestored left hind foot. In Plate II, Figure 4, the ventral surface of the right hind foot is shown from the ventral surface.

There are eight small disk-shaped nodules of bone varying in diameter from 2 to 10 mm., which were found associated with the left front foot and two associated with the right forefoot; these are apparently dermal ossifications, such as occur in certain of the Testudinidae.

The series of caudal vertebrae is nearly complete, but is somewhat disturbed. The iliac portion of the pelvis has evidently been somewhat crushed, and the ribs of the last two sacral vertebrae have been forced downward and appear at the posterior end of the ischium. A single vertebra, perhaps a sacral, lies between the right sacral rib and the ischium. Three large vertebrae, the first three, lie in disturbed position near the head of the right femur. These have rudimentary transverse process, as in *Terrapene*. The remainder of the caudal series, eleven vertebrae, lie in normal association, the anterior end toward the left and running across the median line of the specimen almost at right angles. The vertebrae have broad neural arches without neural spines, and there are strong transverse processes on most. The terminal element is apparently formed of several coalesced vertebrae. The caudal series resembles closely the same series in *Terrapene*, in both form and relative length.

The author has been materially assisted in the preparation of this description by one of his former students, Dr. Norman E. Hartweg, now assistant curator in the division of herpetology in the Museum of Zoölogy of the University of Michigan.

(Continued from inside of front cover)

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