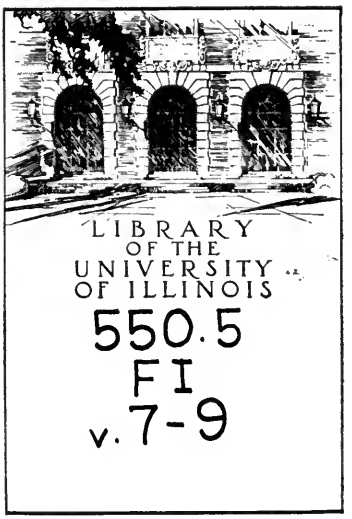

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TWO NEW THALASSEMYD TURTLES FROM THE CRETACEOUS OF ARKANSAS

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Discoveries of vertebrate fossils from the marine Cretaceous of the Mississippi Embayment have been relatively few, as the nature of the deposits and the relative rarity of vertebrate remains in them has made it impractical for field parties from museums or universities to undertake organized collecting in the scattered outcrops. Fortunately for the progress of paleontology in this region, Mr. C. M. Barber, of Hot Springs, Arkansas, has interested himself in fossil collecting and has spent week ends and other available time in a systematic search of the Cretaceous outcrops in his state for vertebrate remains. His finds include occasional mosasaurs and plesiosaurs, fragments of crocodilians and fishes, and remains of turtles. A most notable fossil turtle, *Podocnemis barberi*, was described by the writer from his collections in 1940. It is gratifying to be able to describe two more Cretaceous turtles from Arkansas collected by Mr. Barber for the Museum of Comparative Zoology, and acquired by Field Museum in exchange with that institution. Mr. Barber has supplemented this specimen by gifts of more fragmentary turtles to Field Museum, which thus becomes the principal repository for fossil turtles from the Arkansas segment of the Cretaceous of the Mississippi Embayment.

As in the case of the fossil *Podocnemis* previously described, Mr. Barber has returned to the sites of his finds in successive seasons, and has thus found additional pieces, sometimes even five years after the original discovery, that fit neatly into gaps in the assembled turtle shells. It is usually impossible to find the specimen in place; fossil fragments are found washed out into the gullies of the pastured

hillsides, and in the case of a good specimen it is desirable to return at frequent intervals, especially after rains, to search for additions to the fragmentary shell that has meanwhile been pieced together. In the case of the interesting smaller turtle, described below as a new genus, the specimen might have been much more complete had not the owner of the farm on which it was found been seized with the delusion that Mr. Barber was searching her pastures for diamonds, and forbidden him to trespass on her property.

The assembling and mounting of the shells of the specimens here described were done in Field Museum's Laboratory of Vertebrate Paleontology by Mr. James H. Quinn, Chief Preparator. I am much indebted to him for aid in interpreting certain elements of the shell and in tracing the course of the sutures of the horny shields. His skill in this tedious kind of preparation, in which patience is rewarded by notably accurate restoration of the specimen, forms the basis for the relatively simple task of comparison and description. The geological and paleontological problems involved have been discussed with Mr. Bryan Patterson, Curator of Paleontology.

The turtles in question appear to be referable to the family Thalassemydidae (as defined by Hay), and one of them to the genus *Catapleura* Cope. *Catapleura* has hitherto been known only from very fragmentary remains as *Catapleura repanda* and *C. ponderosa* from the uppermost Greensands of New Jersey. While the New Jersey Greensands are in part of Eocene age, as remarked by the writer in comparing *Podocnemis barberi* with the pleurodire turtles of New Jersey (Schmidt, 1940, p. 10), Mr. Patterson has pointed out to me that the undoubtedly Eocene Manasquan Marl and Rancocas group (including the Vincenttown Sand and the Hornerstown Marl) are underlain by the Monmouth group, the Matawan group and the Magothy formation, and that these are upper Cretaceous. Without renewed and critical collecting of the Greensands vertebrates, which will be extremely difficult unless active exploitation of the marl-pits should be resumed, it is difficult to allocate many of the forms thus far known correctly to the Cretaceous or Eocene. Thus, the presence of *Catapleura* in the exactly determined Cretaceous horizon in Arkansas bears on the stratigraphic problem in New Jersey. The Thalassemydidae, appearing in the Jurassic of Europe, reach a considerable development in the New Jersey Greensands, where no less than five genera are represented. There is considerable divergence of opinion as to the systematic position of these Cretaceous and presumably Eocene forms.

Only a few hundred yards from the find of the *Catapleura*, and in the same year, Mr. Barber made an even more interesting turtle discovery in a gullied field on the farm of Mrs. Cox, of Arkadelphia, Arkansas. When the specimen in question finally came into the possession of Field Museum, Mr. Quinn found the carapace nearly complete in the elements essential to its restoration, yet exasperatingly incomplete in the region of the suprapygals and eighth costals. Mr. Barber was accordingly urged to make a renewed search for turtle-shell fragments at the original locality. After the lapse of five years, these had become further dispersed and lost, but by means of extensive sieving of the soil along the gully and from the fan at its mouth, a considerable number of additional fragments were obtained, including the complete seventh neural, parts of the second suprapygal, and the base of the left seventh costal, together with other pieces of costal.

The assembly of the great number of fragments of this smaller specimen into a convincingly restored turtle shell has been a labor of love, begun by Mr. Barber in 1938, continued by myself and Mr. Quinn, with a few days' aid from my son John, on furlough, and with a final session during a visit to the Museum by Mr. Barber, in 1943.

The resulting turtle shell is made up of curiously thin and dense plates of apparently silicified bone. It has much larger fenestrae, between the disk of the carapace and the peripherals, than in *Catapleura*, resembling in this respect *Lytoloma*. It differs from *Catapleura* in the suprapygal region, and from *Lytoloma* in the complete contact of the first peripheral with the first costal. I have accordingly distinguished it as a new genus.

Order **Testudinata**

Suborder **Cryptodira**

Family **Thalassemydidae**

Phyllemys gen. nov.

Diagnosis.—A thalassemyd turtle with a very flat shell, with the bones of the carapace and plastron very thin; carapace as wide as long; eighth costals narrowed medially to a point; and large fenestrae between the peripherals and disk of the carapace.

Allied to *Catapleura* with which it agrees in the contact of the first costal with the first and second peripheral; differing from *Catapleura* in the broad free edge of the first suprapygal (adjacent

to the pygal); the medial narrowing of the eighth costals; the large, nearly rectangular first neural; and in having the xiphiplastra movably articulated to the hypoplastra in a straight joint instead of by a firm angular suture. Distinguished from *Lytoloma* by the

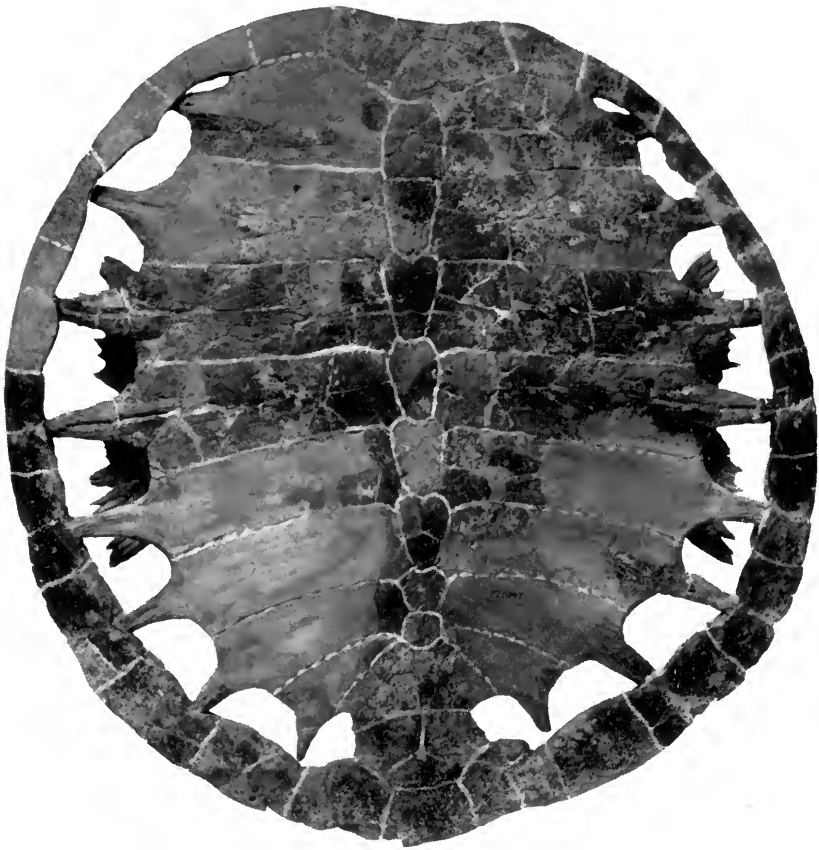

FIG. 20. Carapace of *Phyllemys barberi* gen. et sp. nov.

arrangement of the first and second peripherals and the broad contact of the first suprapygal with the eleventh peripheral on each side.

Type.—Phyllemys barberi sp. nov.

Phyllemys barberi sp. nov.

Holotype.—F.M. No. P27047, a carapace with about half the elements preserved and a plastron complete except for the epiplastra and entoplastron. Collected by Charles M. Barber, 1938.

Horizon and type locality.—Marlbrook Marl, Gulf Series, upper Cretaceous, on the "Widow Cox farm," about one mile northeast of the junction of the Hollywood-Okolona Road to Arkadelphia. This is on the N.W. ¼, sec. 28, T. 7 S., R. 20 W.

FIG. 21. Plastron of *Phyllemys barberi* gen. et sp. nov.

Diagnosis.—The characters of the genus serve to distinguish the species from all known forms; the anterior border of the carapace is little emarginate, the pygal not notched or slightly, fenestrae between costal disk of carapace and peripherals large; shell notably thin and dense.

Description of type.—General form nearly round, with little anterior emargination; shell very low, its depth little more than a sixth of its length; plastron essentially flat. Nuchal wide. First neural subquadrangular, meeting the second in a straight suture;

succeeding neurals 3–6 with concave anterior and convex posterior border; seventh and eighth neurals reduced, as wide as long. Costals strongly emarginate terminally, with a projecting rib-end to the peripherals, which have deep corresponding pits.

Peripherals, except the first and second, deeply grooved on their inner faces; rib-ends entering pits in peripherals 3–9, the pit for the eighth rib being between peripherals ten and eleven.

The only trace of marginal grooves for horny shields is a transverse groove on the third neural and adjacent portions of the third costals.

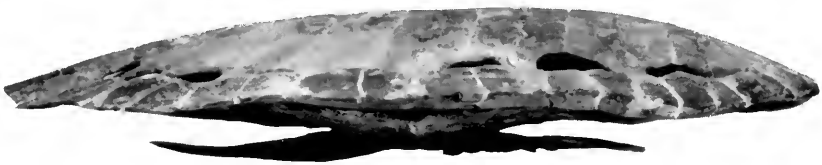

FIG. 22. Shell of *Phyllemys barberi*, from left side.

In the absence of the eighth costals, eighth neural, and portions of the second suprapygal, the restoration of this region of the carapace is governed (1) by the adjustment of the peripherals to the only arc in which they can fall; (2) by the arch of the costals and neurals, which indicates a very flat shell; and (3) by the base of the seventh left costal, which outlines part of the eighth neural, and convinces us that the eighth costal is proximally much reduced. The direction of its rib-end is shown accurately by the pit between the tenth and eleventh costals.

First suprapygal (complete), with a broad thin free edge at each side, broadly in contact with the eleventh peripheral on each side, and meeting the second suprapygal in a broad convex arc. Second suprapygal (partially restored) with thin latero-posterior border, broadly notched in front for the eighth neural.

Plastron extremely like that of *Porthochelys laticeps* (Hay, 1908, pl. 31, fig. 3) in general form, and like that of *Catapleura arkansaw* (fig. 24), but apparently peculiar in having the xiphiplastra much less firmly and perhaps movably united to the hypoplastra. No trace of epiplastra or entoplastron was found.

Remarks.—The possible relation of the present turtle to *Desmatochelys*, distinguished as a distinct family by Williston, has been considered. Only fragments of the shell of *Desmatochelys* are known (associated with an excellent skull). The pygal of *Desmatochelys*

lowi is very much thinner than in *Phyllemys*. Williston regards the humerus as indicating a paddle-like forelimb, while the shell of *Phyllemys* does not exhibit any antero-lateral excavation for a paddle. The shell characters of *Phyllemys*, in general, point plainly to relations with *Catapleura*. The typical material of the shell of *Desmatochelys lowi* was made available to me for comparison with the new form through the courtesy of Dr. C. H. Hibbard, of the University of Kansas.

MEASUREMENTS

All measurements are made by caliper in millimeters, estimated dimensions ending in zero, i.e., to the nearest centimeter

Length of carapace on mid-line	460
Depth of anterior emargination	5
Greatest width of carapace (at fourth costal)	460
Greatest width of carapacial disk (without rib-ends)	310
Greatest depth of shell	80
Length of nuchal	53
Anterior width of nuchal	90
Greatest width of nuchal	108
Length and width of neurals	
First	46, 35
Second	44, 30
Third	45, 31
Fourth	45, 28
Fifth	41, 29
Sixth	40, 30
Seventh	23, 27
Eighth	21, 22
Length and width of second suprapygal	35, —
Length and width of first suprapygal	47, 77
Length and width of pygal	33, 54
Antero-mesial point of hypoplastron to tip of xiphiplastron	280
Width of plastron	370
Length of xiphiplastron on outer border	110
Antero-posterior width at hyoplastral-hypoplastral constriction, left and right	71, 73
Length of peripherals on outer border, left and right	
First	—, 51
Second	—, 52
Third	—, 46
Fourth	—, 49
Fifth	—, 60
Sixth	59, 60
Seventh	66, 64
Eighth	65, 68
Ninth	67, 67
Tenth	62, 61
Eleventh	55, 55

Catapleura arkansaw sp. nov.

Holotype.—F.M. No. P27045, a nearly complete carapace and plastron. Collected by Charles M. Barber, August 25, 1934.

Horizon and type locality.—Marlbrook Marl, Gulf Series, upper Cretaceous. Gather Brothers farm, one mile northeast of Okolona, Clark County, Arkansas; in the N.E. ¼, sec. 29, T. 73 S., R. 20 W.

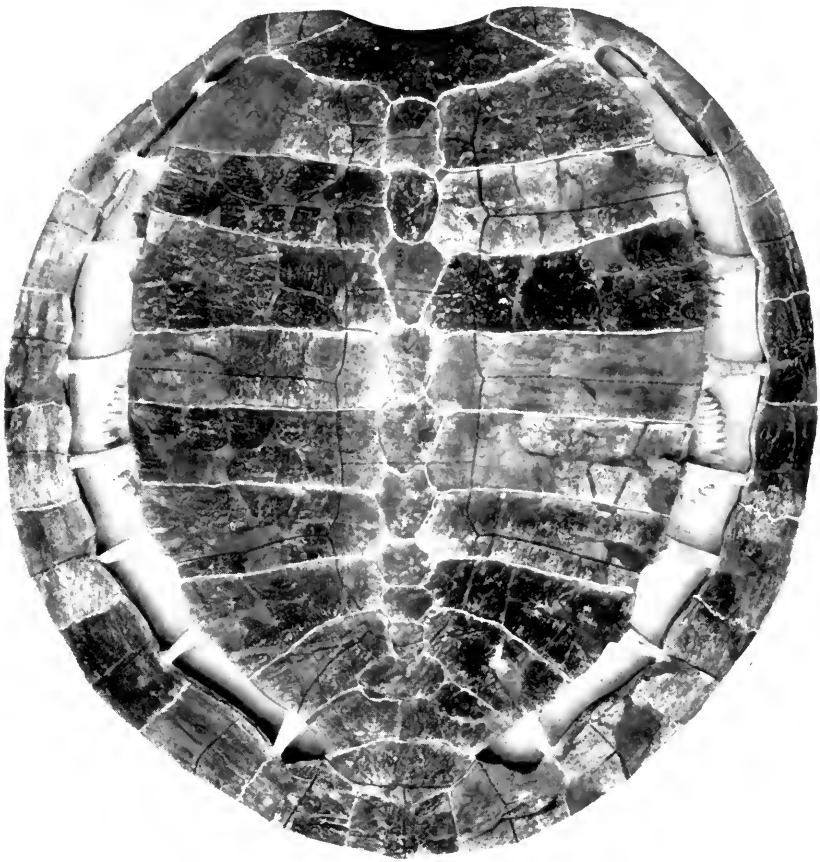

FIG. 23. Carapace of *Catapleura arkansaw* sp. nov.

Diagnosis.—A species of *Catapleura* with the generic characters evident, i.e. dorsal disk entirely free from the peripherals, except for contact of the latter with the first costal; first peripheral nearly triangular. The fontanelles between the disk and peripherals narrow and the projecting rib-ends correspondingly short; carapace broadly notched anteriorly; nuchal broad; first peripheral resembling that

of *Catapleura repanda,* with a broad external and narrow internal border; nine neurals, the last three much shortened; first suprapygal without free edge; second with broad free edges at the sides. Plastron with a rounded central fontanelle; hyoplastra, hypoplastra, and xiphiplastra not in contact on the mid-line; entoplastron free at the sides; xiphiplastra suturally connected with the hypoplastra;

FIG. 24. Plastron of *Catapleura arkansaw* sp. nov.

hyoplastron and hypoplastron on each side meeting in a long suture. Horny scutes essentially in agreement with those of *Osteopygis.*

Differing from the species of the New Jersey Greensands in the strongly concave anterior margin of the carapace.

Description of type.—Carapace cordate, the anterior notch a smooth concave curve, slightly arched, the highest part at the third to fifth neurals; plastron nearly flat.

Nuchal extremely wide, with a concave anterior border; twenty-two peripherals, grooved on their inner faces, numbers one and four to eleven represented in the present specimen on each side; first peripheral with an extremely short inner border, making it nearly triangular, suturally in contact with the first costal; sutural contact of first costal extending about halfway along the second peripheral (as shown by the costal). Fourth (and presumably the third) to ninth peripherals each with a deep pit for the rib-end and an eighth pit between the tenth and eleventh peripherals. Pygal with a slight median external tubercle; a similar tubercle on the eleventh peripheral, with more weakly developed ones on the sixth to tenth. Nine neurals, the first with a convex anterior and concave posterior border, the second convex at both ends, the third to sixth roughly six-sided and notched or concave anteriorly, the seventh to ninth much shortened and with nearly straight anterior and posterior borders. Costals eight, only the first in sutural contact with the peripherals (i.e. with the nuchal and first and second peripherals). The first, third, and seventh costals much widened at the outer end; the second distinctly narrowed. Second costal, meeting the reduced second neural, with an angular process both anteriorly and posteriorly, meeting both first and third neurals; remaining costals each in contact with only two neurals. Third suprapygal small, transverse; second with a convex anterior border, its outer edges free, and strongly concave posterior border. First suprapygal[1] without free border, entering the fenestrum between the eleventh peripheral and the eighth costal at a point; its posterior border angulate, in broad contact with the pygal.

Plastron with nine elements. The epiplastra similar to those elements in *Eretmochelys*. Entoplastron with grooved lateral edges, free posteriorly. Hyoplastron and hypoplastron of each side with a long, nearly straight sutural contact; xiphiplastra suturally connected with the hypoplastra. The several paired elements except the entoplastron separated medially and digitate toward the median line. Outer borders of hyoplastra and hypoplastra strongly digitate; these two elements much as in *Porthochelys*.

The horny scutes agree in general disposition and number with those of *Osteopygis gibbi*, i.e. with a nuchal and five vertebral scutes, four costal scutes, and twelve marginals on each side. The course of the sutures of the plastral scutes is shown in figure 24.

[1] I have numbered the suprapygals forward from the pygal.

MEASUREMENTS

All measurements are made by caliper in millimeters, estimated dimensions ending in zero, i.e. to the nearest centimeter

Length of carapace on mid-line	750
Greatest length of carapace	780
Greatest width of carapace	730
Length of plastron on mid-line	534
Greatest width of plastron	550
Length of nuchal on mid-line	71
Anterior width of nuchal	122
Greatest width of nuchal	231
Length of neurals on mid-line	
First	64
Second	61
Third	70
Fourth	62
Fifth	64
Sixth	60
Seventh	39
Eighth	35
Ninth	35
Length of third suprapygal	26
Length of second suprapygal	54
Length of first suprapygal	59
Suture between epiplastra	55
Suture between hyoplastron and hypoplastron	175
Length of epiplastron	175
Length of xiphiplastron on inner border	143

Remarks.—With the nearly complete specimen here described, the genus *Catapleura* takes its place with *Osteopygis* and *Lytoloma* among the more adequately known genera of this group of extinct turtles. Associated skull and limb bones remain to be discovered. Some fragmentary elements of the pelvis are represented in the present specimen; they resemble the corresponding bones in the modern sea turtles, the Chelonidae.

Discussion.—Definitive classification of turtles requires knowledge of the carapace and plastron, the skull, the neck vertebrae, and the limbs and limb girdles. Thus we are still far from the possibility of an adequate revision of the fossil cryptodire marine turtles, and equally far from a clarification of the phylogeny of the existing genera of Chelonidae. Linkage between *Lytoloma* and *Catapleura* on one hand and the Dermochelidae (the leather-back turtles) on the other, postulated by Case (1897), is not evident.

Examination of the forms here described serves to define a problem in the phylogeny of the turtle group. The disk of the carapace is

connected with the peripherals composing the rim of the shell by the projecting rib ends. Among modern turtles such a condition may be found in the young of various forms in which the peripherals and costals are suturally joined in the adults. On the other hand, development of fenestrae, and thus of increased flexibility of the shell, appears to be clearly correlated with aquatic habits—as shown by the loss of the peripherals and development of fontanelles in the Trionychidae, by the persistence of the fontanelles between peripherals and carapacial disk in *Caretta*, and by the large vacuities in the shells of such evidently marine forms as *Toxochelys*. In the two turtles at hand, the proportionate extent of these fontanelles is widely different. It is evident that in the absence of series of specimens of different ages, of the extinct forms, the direction of evolution in the shell in marine turtles can not readily be established. Thus, the genera and species of the Thalassemydidae may be presumed to be in need of further critical revision. The remarkable *Testudo tornieri*, a land turtle adapted to life in rock crevices by reduction and fenestration of the shell, proves that both ontogenetic and phylogenetic increase of such fenestration (and thus of flexibility of shell) can take place, and the plasticity of the turtle shell is still further evidenced by the remarkable thinning of the carapace in the Galapagos species of *Testudo*. Thus it appears that the extent of fenestration is a decidedly unstable character, subject to evolutionary change in contrary directions. The interpretation of this condition in isolated fossil specimens is accordingly extremely difficult, and series of specimens of assorted age are not yet available. Within the Thalassemydidae (as defined by Hay) turtles like *Catapleura* and *Phyllemys* represent a degree of fenestration essentially equivalent to that of *Caretta*, while the much deeper fenestration of *Lytoloma* is found in a shell equivalent in length to the unfenestrated *Osteopygis*. The architecture of the turtle carapace is a topic of great interest, much in need of renewed comprehensive study.

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