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REDESCRIPTION OF TAPHROSPHYS OLSSONI A FOSSIL TURTLE FROM PERU

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In 1931, Karl P. Schmidt described a fossil turtle from the Eocene of Mogollon, Peru, referring it to the genus *Podocnemis*. The specimen, C.N.H.M. P14172, was enclosed in a hard sandstone concretion, one side of which had been split off and lost. Most of the bones of the carapace apparently had adhered to this lost portion. As a result, the dorsal portion of the shell is now represented only by a more or less weathered cast of the inside of the carapace, with the buttress pillars, the neurapophyses of the vertebrae, and the dorsal ends of the ilia (apparently) entering the matrix mold of the shell. After the specimen reached the Museum it was split, in an effort to expose the plastron. The split unfortunately went through the bone, only a small part of which remained in its natural position. The greater portion broke away and was visible only from the visceral side (see Schmidt, 1931, pl. 46).

During a recent study of the morphological relationships between the pelomedusid turtles in general and the members of the genus *Podocnemis* in particular (Zangerl, 1947), further preparation of this specimen seemed desirable. It proved possible to remove the larger portion of the plastron from the concretion, so that its outer surface could be studied. Figure 12 shows the central part of the concretion, which consists mostly of the internal mold of the shell with the left half of the posterior lobe and the tip of the right xiphiplastron attached to it. Most of the plastron, including the ventral half of the right bridge, can now be seen on both sides. It was no small surprise to discover from this newly uncovered evidence that the species does not belong to *Podocnemis* but to *Taphrosphys*, a genus so far known only from North America, most of the described species coming from the Greensand pits of New Jersey. Almost all of the species referred to this genus are based on fragmentary specimens, *T. longinuchus* being the most completely known form of the North American

members of the group. The type and only known specimen of this species (A.M.N.H. 1125) furnishes important parts of both carapace and plastron, but it is by no means a complete shell. The materials that form the basis of the remaining six species recognized by Hay (1908) supplement each other, but many details of the morphology of the shell remain unknown. Some additional information is contained in the following redescription of the Peruvian specimen.

Taphrosphys olssoni (Schmidt)

Podocnemis olssoni Schmidt, Field Mus. Nat. Hist., **4**, No. 8, pp. 249–254, pls. 46, 47, 1931.

Emended diagnosis.—Carapace oval in outline, moderately arched. Plastron with anterior lobe slightly bent dorsad; anterior lobe very short, broadly rounded; posterior lobe very broad as in *T. molops*, but with deep, nearly circular notch. Pubic scar reaching almost to the hypo-xiphiplastral suture. Entoplastron wider than long, subquadrangular (in outer view) as in *T. leslianus*. Intergular shield very large, separating small, triangular gulars. Abdominal scales narrow medially, broad laterally; pectoro-abdominal sulci extending onto the mesoplastra, essentially as in *T. longinuchus*.

Description.—Almost all the bones of the carapace are missing and the surface of the internal mold is weathered in places. In spite of this, a few anatomical features are preserved and are worthy of brief consideration. The inner suture lines of the costal plates and some of the marginals are visible on the mold (fig. 13). These lines do not necessarily correspond to the suture lines on the outside, since the sutures are often oblique rather than vertical to the plane of the bones. In thick-shelled turtles the difference in the patterns formed by the sutures on the outside and inside of the shell differ considerably. In this specimen the outer ends of the third, fourth, and fifth costal plates adhere to the mold, and are 3.5 mm. thick. Thus the pattern here illustrated (fig. 13) should not be used for close comparison with an outside pattern of another shell, or for specific differentiation.

The buttress scars, located underneath the first and fifth costals, as is usual in pelomedusid turtles, are not elevated from the visceral surfaces of these plates. The axillary buttresses occupied about half the length of the first costals, the inguinal buttresses about the lateral third of the fifth costals.

Of the vertebral column only broken sections of the neurapophyses of the carapacial vertebrae are visible (fig. 10). These are strong,

up to 7 mm. wide, and extend the length of the corresponding centra, one adjoining the next without any gap between them. The small ribs belonging to the first carapacial vertebra are not visible. They are either buried in the mold or fused to the ribs of the second vertebra. These are large and form low ridges on the visceral surfaces of the first costals. The ridges are acutely bent, to form, together with the buttresses laterally, an anteriorly open portion of a circle. Between the inguinal buttresses and the medial rib-ends

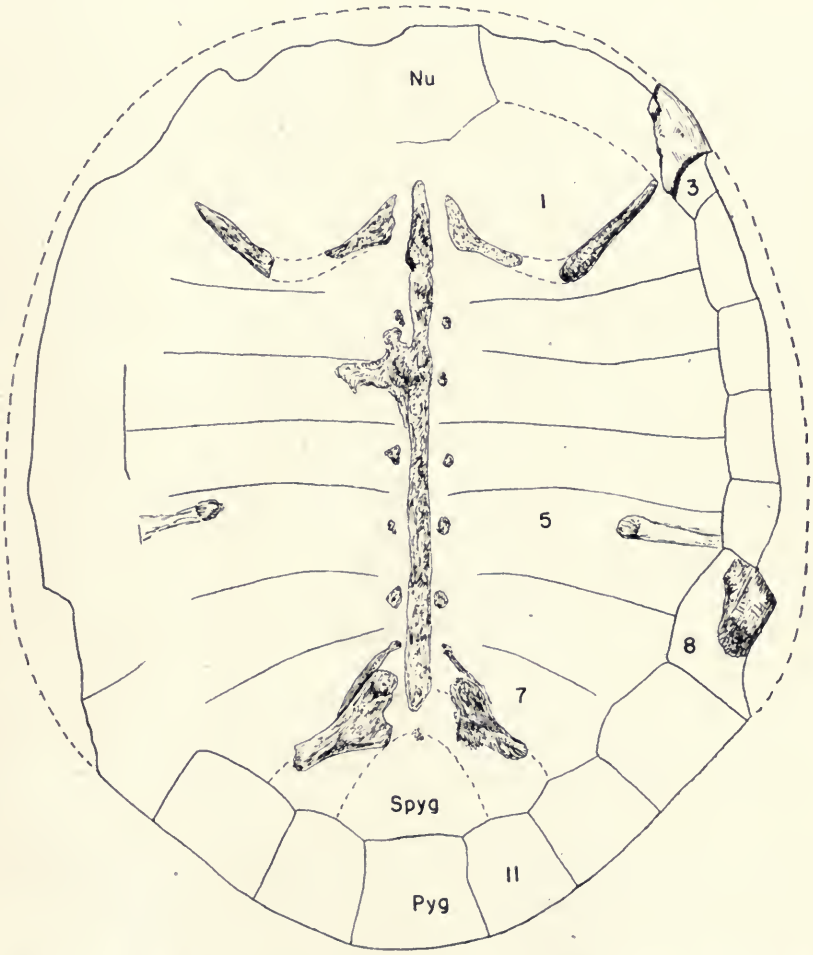

FIG. 10. Sketch of the carapace mold of *Taphrosphys olssoni*. *Nu*, nuchal bone in outline; *Spyg*, suprapygal in outline; *Pyg*, pygal bone in outline; 1, 5, 7, costal plates in outline; 3, 8, 11, marginal plates in outline. About ×2/5.

there are similar ridges that run approximately parallel with the anterior borders of the fifth costals. The sacral region reveals the extent of the iliac scars and the course of the eighth pair of carapacial ribs (located on the seventh costal pair). The iliac scars have

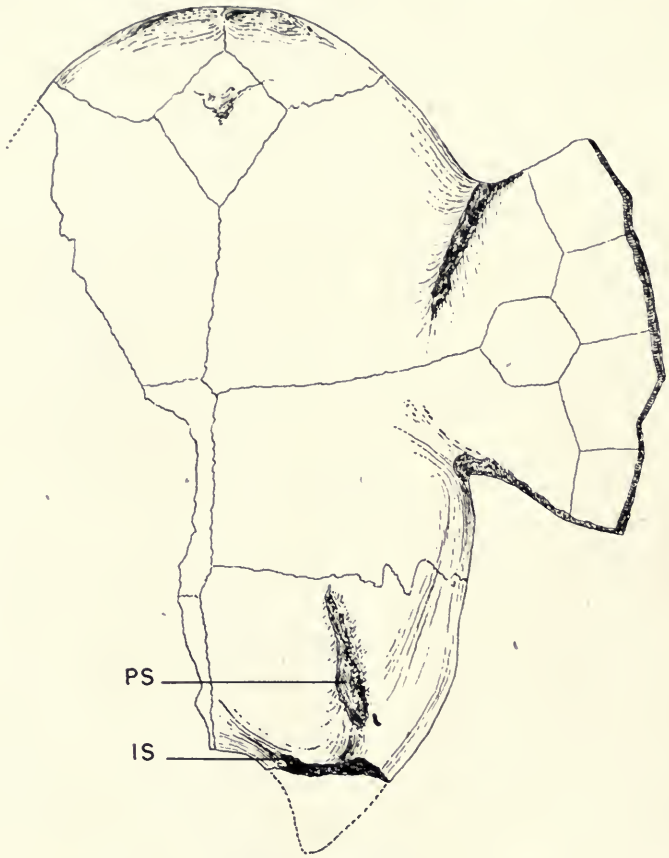

FIG. 11. Visceral view of part of the plastron of *Taphrosphys olssoni*. *PS*, pubic scar; *IS*, ischiac scar. About ×2/5.

a different shape from those in *Podocnemis;* they are wider laterally and their postero-medial extensions are stronger. The eighth pair of ribs is much more strongly developed than in *Podocnemis*.

The matrix mold shows, furthermore, a few peculiarities that appear to be significant. Slightly antero-lateral to the place of fusion of the neurapophysis of the first carapacial vertebra with the first neural plate, there are small shallow depressions in the neural

plate. These depressions, observed in all available material of *Podocnemis*, tend to become perforations of the shell in the genus *Pelomedusa*.[1] In *Taphrosphys olssoni* the depressions are, in all respects, very similar to those of *Podocnemis*. The canalis collateralis vertebralis, which, in the living animal, is filled mostly with the longissimus dorsi muscles, is small in the Peruvian form, but it extends back to the sacral region of the shell, as in *Podocnemis*. Between successive rib-heads the shell plates formed depressions that are visible on the mold as protuberances (fig. 13).

The plastron is sufficiently complete to permit description of all its details (fig. 12). It is broad and nearly flat in the region of the posterior lobe; the short anterior lobe is upturned. The lateral sides of the posterior lobe are convex and the posterior end is deeply excavated to form an almost circular notch. The bridge, at its narrowest point, measures one-third of the over-all length of the plastron. The anterior lobe is less than half of the total length of the posterior lobe. The mesoplastra, laterally located between the hyo- and hypoplastra, have already been described by Schmidt (1931). They are six-sided plates that lie entirely in the bridge region, lateral to the axillary and the inguinal notches. The sutural pattern on the outer side of the plastron differs from that on the inner side, particularly in the shape of the entoplastron. Seen from the inside, the entoplastron is longer than wide; from the outside, however, it is much wider than long. The right hyoplastron is notably wider laterally than it is medially; on the left these dimensions are about equal.

On the visceral side (fig. 11), shallow depressions lie next to and run parallel with the anterior borders of the epiplastra. The central part of the entoplastron is slightly elevated and forms a rugosity just in front of the center of the bone. The full extent of the ischiac scar cannot be determined, since the tips of both xiphiplastra adhere firmly to the concretion and can be seen from the outside only. The medial end of the scar is, however, preserved on the free part of the plastron. It is located close to the border of the xiphiplastral notch, as is typical of the genus *Taphrosphys*. The distance between the antero-medial end of the scar and the border of the notch is 10 mm.; the distance of this point from the medial suture is 22.5 mm. A small, rounded ridge from the ischiac scar runs antero-medially toward, but does not reach the midline. The

[1] In *Pelusios* these depressions are present also, but the morphology of this region is quite different from that of the other pelomedusid turtles.

pubic scar is long and narrow. Its anterior end lies about at mid-width of the xiphiplastron and about 5 mm. behind the hypo-xiphiplastral suture. The scar is 35 mm. long and stands at an angle of about 20° to the midline of the plastron. A shallow, longitudinal depression connects the two scars. A foramen enters the plastron immediately behind the pubic scar. The ends of the xiphiplastra are partially set off from the main parts of the plates by sharp depressions (fig. 12), the significance of which is not understood.

MEASUREMENTS

(*In millimeters*)

		Inner		Outer	
Length of carapace (approx.)	333.0				
Width of cast	266.0				
Length of pygal		44.0			
Anterior width of pygal		34.0			
Posterior width of pygal		50.0			
Peripheral edge of eleventh peripheral		50.0			
Peripheral edge of tenth peripheral		40.0			
Peripheral edge of ninth peripheral		44.5			
Length of plastron on midline	235.0				
Total length of plastron	273.0				
Width at epi-hyoplastral sutures		100.4		102.0	
Width to inner angles of mesoplastra		179.0			
Width at hypo-xiphiplastral suture		145.0		152.0	
Length of epiplastral suture	14.0				
		Right	Left	Right	Left
Length of hyoplastral suture		50.0	62.0	44.0	50.0
Length of hypoplastral suture		61.0	52.5	73.0	65.0
Length of xiphiplastral suture		61.0	67.5	56.0	58.0
Length of entoplastron		51.0		42.0	-
Width of entoplastron		46.0		53.5	
Length of mesoplastra		38.5	41.0	38.5	....
Width of mesoplastra		40.5	44.0	41.0	....
Distance between xiphiplastral tips	50.0				
Length of intergular shield	51.0				
Anterior width of intergular	34.5				
Length of gulars	16.0				
Anterior width of gulars	15.0				
Length of humero-pectoral sulcus	51.0				
Length of pectoral sulcus (midline)				57.0	51.0
Length of abdominal sulcus (midline)				21.0	26.0
Length of abdominal scale at bridge	54.5				
Length of femoral sulcus at midline				73.0	75.5
Length of anal sulcus at midline				35.0	35.0

The scale pattern is of particular interest (fig. 12). *T. olssoni* has an unusually large intergular shield flanked antero-laterally by tiny, triangular gular scales. The humeral scutes are sub-triangular and do not join at the midline. The intergular is even wedged for a short distance between the pectoral shields, but does not extend beyond the posterior margin of the entoplastron. The abdominal shields are exceptionally narrow medially and of about normal width laterally. The pectoro-abdominal sulcus forms, at the level of the

axillary notch, a sharp curve backwards, thereby crossing the hyomesoplastral suture; thereafter the sulcus remains on the mesoplastron (fig. 12).

Besides the general broadness of the plastron and the peculiarities of the ischiac and pubic attachments it is especially the scale arrangement on the front lobe of the plastron that makes the generic transfer of the Peruvian specimen necessary.

Comparison.—The following species of *Taphrosphys* have been recognized by Hay (1908), pp. 106–122:

T. sulcatus (Leidy), type specimen, from Greensand pit at Tinton Falls, Monmouth County, New Jersey. Consists of three peripherals and a xiphiplastron. Geological collection of Rutgers College, New Brunswick, New Jersey.

Another specimen, A.M.N.H. No. 1468, from the upper Greensand bed at Barnesboro, Gloucester County, New Jersey. Consists of the posterior part of the carapace and a few peripherals.

T. longinuchus Cope, from Greensand No. 5, at Medford, Burlington County, New Jersey. The type and only known specimen consists of large parts of both carapace and plastron, A.M.N.H. No. 1125.

T. leslianus Cope, from Greensand No. 5, at Hornersville, Monmouth County, New Jersey. The type and only known specimen consists of a portion of the anterior half of the carapace, and parts of a hypo- and xiphiplastron. A.M.N.H. No. 1467.

T. strenuus Cope. Only one, A.M.N.H. No. 1226, of the three specimens mentioned by Cope is now extant. It came from the West Jersey Marl Company's pits at Barnesboro, Gloucester County, New Jersey. The remains are badly broken fragments of carapace and plastron.

T. molops Cope, type, A.M.N.H. No. 1472, found in the upper Greensand bed at Barnesboro, Gloucester County, New Jersey. Consists of a few fragments of the carapace and a large part of the anterior lobe of the plastron.

Referred specimens are: A.M.N.H. No. 1343, part of the right hyoplastron; A.M.N.H. No. 1474, Birmingham, Burlington County, New Jersey, parts of several costals and of both hypoplastra and the complete left xiphiplastron; A.M.N.H. No. 1470, from Barnesboro, three neurals and the nuchal; A.M.N.H. No. 1477, from Barnesboro, a fragment of the posterior region of the carapace and parts of the plastron.

T. dares Hay, of unknown provenience but certainly not from the New Jersey Greensand. Possibly from North Carolina. The lot consists of a costal and a peripheral fragment, the entoplastron and parts of both xiphiplastra. A.M.N.H. No. 1127.

T. nodosus Cope, found in the uppermost bed of Greensand at Hornerstown, Monmouth County, New Jersey. Specimen fragmentary. A.M.N.H. No. 1480.

Even though all of these specimens are fragmentary, it is possible to give a fairly accurate picture of the basic organization of their

FIG. 12. Photograph of the outer aspect of the plastron of *Taphrosphys olssoni*. About ×2/5.

FIG. 13. Photograph of the carapace mold of *Taphrosphys olssoni*. About ×2/5.

shell. In general, the pattern greatly resembles that of the Pelomedusidae and, among them, the Pelomedusinae (Zangerl, 1947). The carapace consists of a large nuchal plate, which is broad behind, and a series of seven neurals. The first is four-sided, longer than wide, the last pentagonal and the remaining ones hexagonal, essentially as in *Podocnemis*. The suprapygal is subtriangular and of about the same relative size as in *Podocnemis*. Of the eight pairs of costals, the eighth and the posterior half of the seventh join at the midline. The peripheral series is normal, and so is the scale pattern of the carapace. The lateral shield furrows of the first vertebral scute end, anteriorly, at the junction of the first and second marginal shields in *Taphrosphys longinuchus* and *T. leslianus*, and at the second marginal shield in *T. molops*. The marginal scales are low and do not extend onto the costal plates. The differences in vertebral scale proportions in the various species are probably due to age differences and need no further comment here. The axillary buttresses are strong and occupy about half the width of the first costal plates. The inguinal buttresses are relatively weak; their scars are visible on the lateral third of the fifth costal pair. A large iliac scar area beneath the seventh and eighth costals is of about the same relative size as in *Podocnemis*, but it is more elongated and narrower. Scars left by the neurapophyses on the visceral side of the neurals indicate that the spinous processes were strong and that they all adjoined each other.

The plastron consists of a relatively short, broadly rounded anterior lobe and a broad posterior lobe whose end is deeply excavated. Small mesoplastra are located in the bridge region, as in all pelomedusine turtles. The entoplastron is wider than long as seen from the outer side of the shell, longer than wide from the visceral aspect. The xiphiplastra bear ischiac and pubic scars. The latter are long and slender, the former small, almost circular and placed very close to the rim of the xiphiplastral excavation. The scale furrows present a somewhat more complicated picture. Hay (1908) states that the scale markings of the anterior lobe are not all satisfactorily determined. In *Taphrosphys longinuchus* and *T. molops* there seems to be a large intergular that is almost wholly situated on the entoplastron; the gular shields thus meet in front of the intergular. In *T. leslianus* the intergular is even larger, extending to the anterior border of the plastral lobe and separating the gular scutes. The humeral scales are always separated by the intergular. The abdominal shields are relatively narrow medially, but expand towards the sides.

The Peruvian specimen conforms very well with this characterization of the group and must therefore be transferred to the genus *Taphrosphys*. Specifically, *T. olssoni* can be distinguished from *T. sulcatus* by a difference in the shape of the ilio-carapacial attachment scar and the apparent absence of additional smaller scars behind it; from *T. longinuchus* and *T. molops* by the separation of the gular shields by the intergular; from *T. leslianus* by the smaller size of the gular scales and the relatively much longer posterior lobe of the plastron; from *T. strenuus* by the lack of an indentation of the anterior margin of the front lobe of the plastron, and by the general thinness of the bones of the plastron; from *T. dares*, in which the entoplastron has approximately the shape of an arrowhead, by the more quadrangular outline of the entoplastron. *T. nodosus* has a sculptured surface, much resembling that of a coarsely sculptured trionychid, that is not present in the Peruvian species. The validity of some of the features here listed as "distinguishing" characters is definitely doubtful. In the absence, however, of better knowledge of the New Jersey forms, the specific distinctness of which is by no means certain, a more elaborate comparison is not indicated.

Since *T. olssoni* is the best preserved specimen in the genus known to date, it greatly aids in strengthening and augmenting Hay's generic diagnosis. The genus can now be redefined as follows:

Genus **Taphrosphys** Cope 1869

A genus of the Podocneminae known only from the shell. Carapace with seven neurals, the seventh and eighth costals meeting their fellows at the midline; a large suprapygal; eleven pairs of peripherals, the posterior thin with acute free borders. No nuchal scute. Neurapophyses stout and low, adjoining each other. Plastron with eleven bones, the mesoplastra small and located on the bridges. Intergular much larger than in *Podocnemis* and *Pelomedusa*, either separating the gulars or confined behind them; humeral scales separated by intergular, relatively larger than in *Stereogenys*. Anterior lobe of plastron relatively short, posterior lobe longer than in *Stereogenys* and broader than in *Podocnemis* and *Pelomedusa;* xiphiplastra deeply notched. Ischiac scar on xiphiplastron very close to free edge of plastral notch; pubic scar long and narrow.

If the scale pattern of the anterior plastral lobe of *Taphrosphys*, as indicated by Hay (1908), is correct—Hay states that the shield furrows are often weak—it would seem that there are two groups within the genus. In the more primitive group the intergular is

large and separates the gular shields (*T. leslianus* and *T. olssoni*); in the more specialized group the intergular does not reach to the anterior edge of the plastron and the gular scales therefore meet at the midline (*T. longinuchus* and *T. molops*). Further discussion of this matter must await the discovery of additional materials.

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