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Abstract

I describe a new fossil turtle from the Miocene (Serravallian) of the La Tatacoa Desert in Colombia, which I have identified as a new species of the Podocnemididae family. An articulated shell and skull (VPPLT-1730) and an articulated shell (VPPLT-1721) are among the specimens. Characteristics of these fossils include a broad anterior margin with lateral notches, a gular scute that completely separates the humerals and is in contact with the pectorals, and a vertebral scute 1 that only overlaps the nuchal bone. Because of these traits, I was able to determine that these specimens belong to a new genus and species of Podocnemididae family. According to the phylogenetic analysis, this new taxon is closely related to other Podocnemididae members, the future full description and study of the new genus and species could bring new insights on the evolution and paleodiversity of podocnemidids in South America.

Introduction

The Podocnemididae family includes turtles that currently inhabit only northern South America (*Podocnemis* and *Peltocephalus* genera) and Madagascar (*Erymnochelys* genus) (Rhodin et al., 2021). These turtles belong to the Pleurodira group, or side-necked turtles, unlike the Cryptodira group, which retract their heads backward (hidden-necked) (Gaffney et al., 2006). The origin and current geographical distribution of the extant taxa of Podocnemididae have been controversial. Molecular studies show that the Madagascarian *Erymnochelys* is more closely related to the South American *Podocnemis*, while the two geographically and ecologically concurrent South American genera are not phylogenetically close to each other (Pereira et al., 2017, references therein). The separation of continents and continental drift, which fragmented Gondwana and isolated this lineage on the island of Madagascar, could explain this (White et al., 2022).

In terms of the South American genera, a single species represents the genus *Peltocephalus*, *Peltocephalus dumerilianus*, predominantly found in the Amazon rainforest drainages. Its range extends across the river basins of the Orinoco and Amazon, encompassing regions of countries such as Venezuela, Colombia, Brazil, Ecuador, Peru, and Bolivia (Gentil, 2021; Rhodin et al., 2021).

In contrast, the genus *Podocnemis* comprises six extant species of freshwater turtles distributed in several basins of northern South America. Among them are *Podocnemis expansa*, known as the Arrau Turtle, inhabiting rivers such as the Orinoco and Amazon. The three species, *Podocnemis unifilis (*yellow-spotted river turtle), *Podocnemis sextuberculata* (six-tubercled river turtle), and *Podocnemis erythrocephala*, are found in the Amazon River basin., Colombia, and Venezuela, *Podocnemis lewyana*, exclusively restricted to the Magdalena River basin of Colombia, and *Podocnemis vogli*, known as the Savanna Side neck turtle, present in the Orinoco basin drainages (Rhodin et al., 2021).

The fossil record of South American podocnemidids is still far from being fully explored and documented. Recently, researchers described the first fossil of the genus *Peltocephalu*s, corresponding to a new species, *Peltocephalus maturin*, from an isolated dentary bone (Ferreira et al., 2024). This species inhabited the Amazon basin during the late Pleistocene (Ferreira et al., 2024), leaving much of the genus's evolutionary history unknown. In the case of *Podocnemis*, its fossil record has been controversial due to a lack of diagnostic characteristics of the shell, making most of the fossils attributed to the genus dubious (Cadena and Vanegas, 2023). Currently, undisputed fossil specimens of *Podocnemis* include *Podocnemis bassleri*, represented by an isolated skull from the late Miocene in the Río Aguaytia region of Peru, which is nearly indistinguishable from *P. expansa* (Williams, 1956; Gaffney et al., 2011). Recently, Cadena and Vanegas (2023) found that the number of musk foramina constitutes a solid characteristic for recognizing shells of podocnemidids as truly belonging to the *Podocnemis* genus. They used this characteristic to validate some of the previous fossils attributed to the genus, which now include *P. medemi, P. pritchardi, P. negrii,* and *P. tatacoensis* (Wood, 1997; Carvalho et al., 2002; Cadena and Vanegas, 2023).

Recently, the team from the Museo de Historia Natural La Tatacoa (MHNT) discovered two fossil specimens in the Tatacoa Desert area. The first specimen is an articulated shell (carapace and plastron) and the skull (VPPLT-1730). A second specimen corresponds to an articulated shell (carapace and plastron) (VPPLT-1721). Both specimens were prepared at the MHNT's facilities. Preliminary observations suggest that both specimens may belong to the same taxon, suggesting the possibility of representing a new genus and species within the Podocnemididae family, with potential implications to improve our knowledge of these turtles' evolution and phylogenetic relationships. Here, the aim is to fully describe the new fossil specimens and make some initial inferences about their phylogenetic placement within the Podocnemididae turtles.

Materials & Methods

Fossil collection and preparation

The fossil specimens were found and reported to members of the Museo de Historia Natural La Tatacoa (MHNT) as follow: VPPLT-1730 specimen from Finca la Fortuna 3 located at coordinates 3°21′15.94″ N, 75°10′9.156″ W, whereas VPPLT-1721 specimen from La Repartidora locality 3°22′11.99″N, 75°8′56.29″W (Figure 1).

The techniques for studying the fossils primarily involved two stages: fieldwork and laboratory. Initially, the fossils were carefully excavated from the rock layer in which they were embedded, ensuring minimal damage to the specimens, usually creating a plaster jacket to protect the fossil during its transportation from the field to the lab, and also collecting all information about the rock where they were found, geospatial and geographical location, as well as stratigraphic and taphonomic information. Subsequently, in the lab, they were cleaned to remove the remaining rock matrix using dental picks and air scribes (pneumatic hammer). This was followed by preservation, either encasing it in plaster to prevent breakage or storing it in expanded polystyrene foam. The fossils were stabilized for major cracks or fractures using a consolidant such as Paraloid B-72. All these activities were performed by the staff of the MHNT.

Description and comparisons

The fossil specimens were brougth to the Universidad del Rosario for their full description, photography and the future taxonomic identification which included photos of the fossil to identify the sutural contacts between bones and sulci between scutes, because bones and scutes are essential for taxonomic identification in turtles because their unique morphological features, species-specific patterns, and evolutionary indicators help distinguish species, understand phylogenetic relationships, and identify fossils.. Subsequently, I used Adobe Illustrator 2023 to generate the figures of the shells and skull with all the anatomical parts labeled. Then, I performed a detailed description of the fossils, This description was carried out by observing the fossil under a micro stereoscope equipped with a Nikon F-200 camera and taking high resolution photographs, which allowed for a more precise analysis of the characteristics, including the bones, the sutural contacts between them, their shape and size, as well as the sulci left by the scutes on the bone surface. As well as comparing the fossil specimens with shells and skulls of extant and fossil podocnemidids including several specimens of *Podocnemis*, *Peltocephalus*, and *Erymnochelys* specimens (Figures 2, 3).

Phylogenetic analysis

I used the character-taxon matrix where all the characters are continuous, these address the morphological composition of different bone features, scutes, their contacts, and their shapes from the *Podocnemis tatacoensis* paper (Cadena and Vanegas, 2023), adding and coding the characters for the new fossils (considering them as belonging to a single species). With this data, I applied the same parameters used in the aforementioned article to conduct the morphological analysis of the VPPLT-1730 and VPPLT-1721 (considering both as a same species, because their identical morphology), and proceeded with the phylogenetic analysis. In order to establish the position of both fossil species among the Pan-Pleurodira clade, I used *Proganochelys quenstedti* as the outgroup taxon because it retains primitive characteristics from early turtle evolution, making it an ideal reference for identifying derived traits within the Podocnemididae family~~.~~. For the analysis, I considered all the taxa and characters, for a total of 269 characters. I used the following settings for the analyses in TNT 1.6 version (Goloboft et al., 2008): traditional search, because this analysis provides robustness as it ensures that all possible configurations of the data are considered, which can result in identifying trees that are more representative of actual evolutionary relationships. Additionally, the results obtained through a traditional search are generally easier to interpret and communicate, which is crucial in studies aiming to establish new phylogenetic relationships., 10 trees to save per replication, and other parameters by default; memory tree increased to max. trees 1000; collapse of zero-length branches according to rule 1; light implied weighting k value of 12; and 1000 replicates of random addition sequences. I also considered all characters equally weighted, because, by assigning equal weight to all characters, the analysis is simplified and avoids the additional complexity that could arise from attempting to determine different weights for each character. and treated some as ordered, following Cadena and Vanegas (2023, references therein). A strict consensus tree was generated for the analysis, and statistics obtained included Consistency (CI) and Retention (RI) indexes and Bremer support, provide a measure of support for each node (or clade) in a phylogenetic tree. They indicate how much longer the tree would be if that clade were not included, calculated using implemented scripts in TNT.

Geologic Framework

Both fossil specimens (VPPLT-1730 and 1721) and the localities where they were found are part of the La Victoria Formation, specifically from the lower segment of the formation. Which, it is dated as Middle Miocene (Serravallian) 13.6 ± 0.2 Ma; (Flynn et al., 1997; Cadena et al., 2020) (Figure 1). The entire La Victoria Formation is a sequence of fluvio-lacustrine deposits, with a thickness of approximately 522 meters, ranging from less than 16 Ma and more than 12.58 Ma (Mora-Rojas et. al 2023, references therein). La Victoria Formation contains five stratigraphic segments, most of which are composed of sandstones and siltstones. Additionally, the paleoenvironment interpretation for the lower segment of the formation is that represents a depositional system driven by migratory barriers and gravitational deposits (Mora-Rojas et. al 2023, references therein).

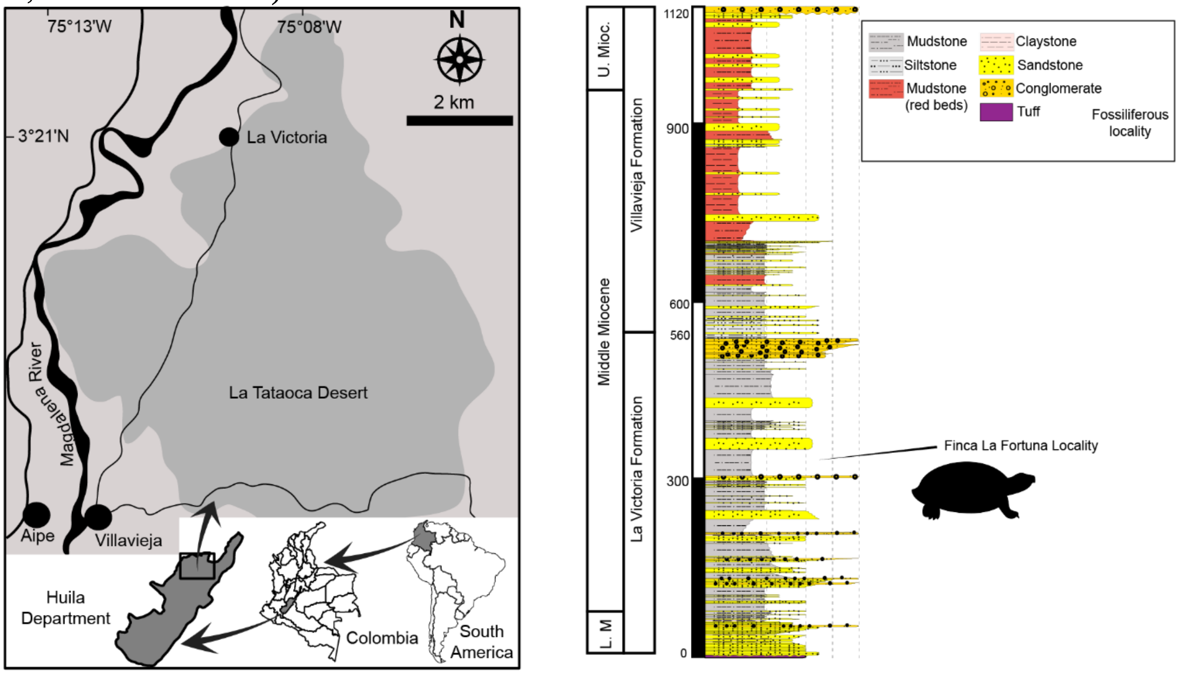
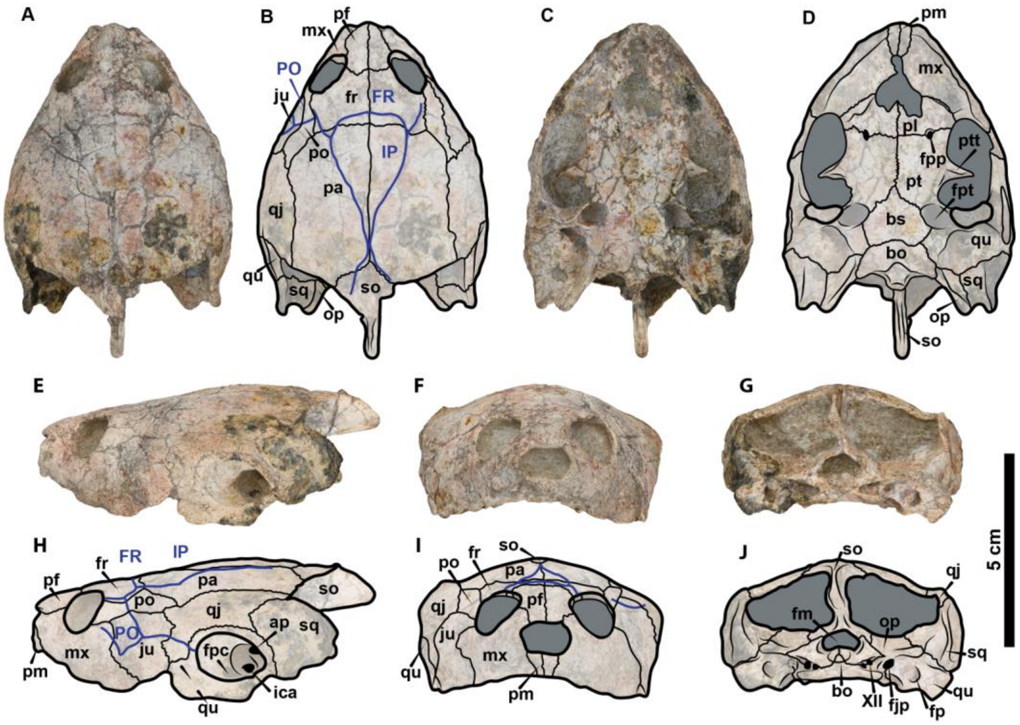
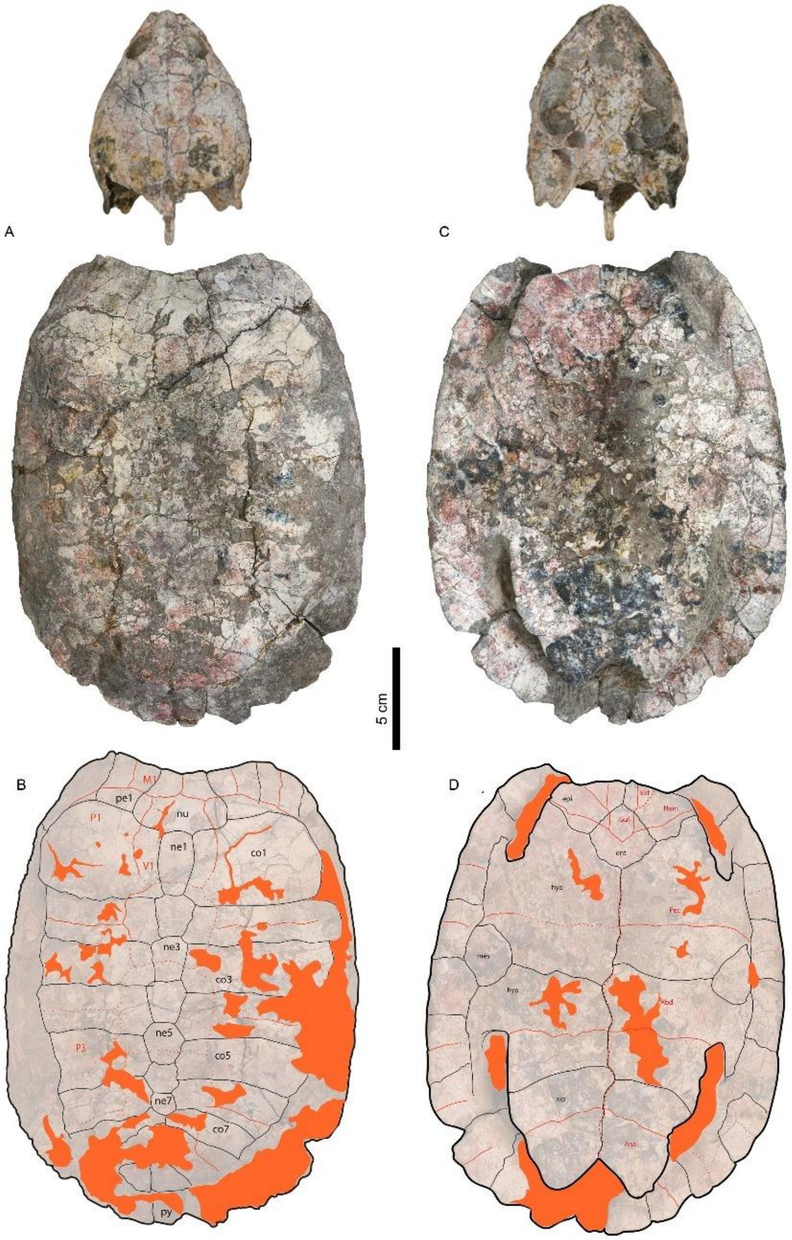


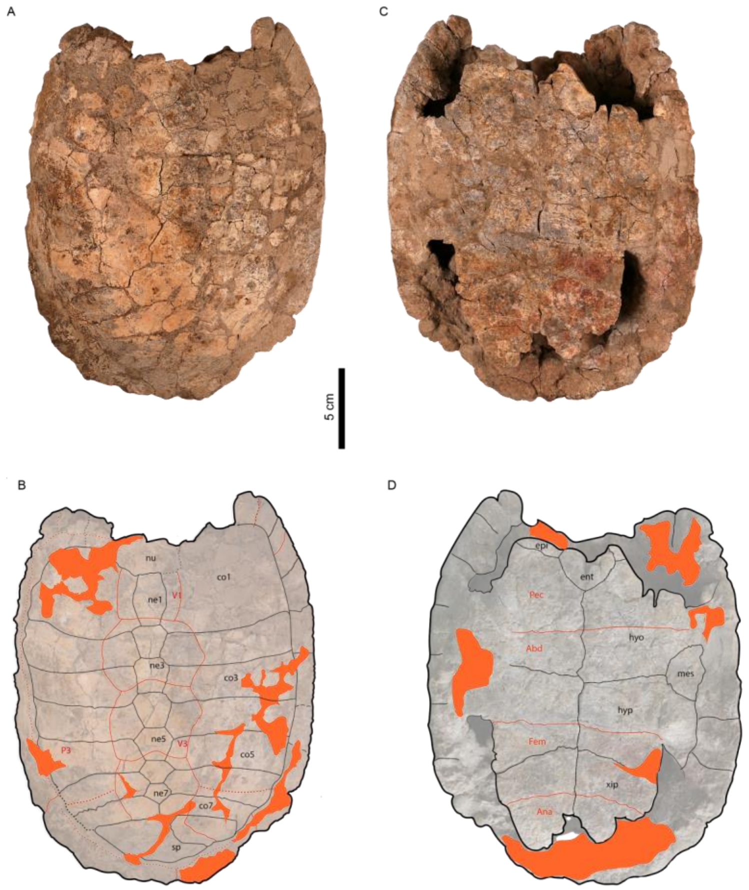
Figure 1. Map and stratigraphic column of the La Victoria and Villavieja Formations, including the horizon where the fossil specimen (VPPLT-1730) described herein were found. Stratigraphic column taken and modified from Mora-Rojas et al. (2023), map figure from Cadena et al (in prep.)



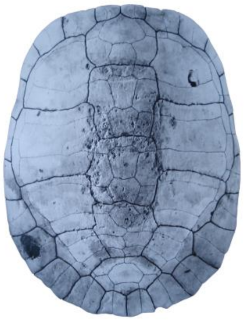
Figures 2. Skull of VPPLT-1730 from the Middle Miocene (Finca La Fortuna), La Tatacoa Desert, Colombia. A, B, Skull in dorsal view; C, D, Skull in ventral view; E, H, Skull in left view; F, I, Skull in frontal view; G, J, Skull in Posterior view. Abbreviations: mx: maxilla, pf: prefrontal, ju: jugal, po: postorbital, pa: parietal, qj: quadratojugal, qu: quadrate, sq: squamosal, op: opisthotic, so: supraoccipital, pl: processus clinoideus, fpp: foramen palatinum posterium, pt: pterygoid, fpt:, bs: basiphenoid, bo: basioccipital, fpc: fossa precolumellaris, ap: antrum postoticum, ica: incisura columellae auris, fm; fjp: foramen jugulare posterium, fp: foramen praepalatinum, XII: foramen nervi hypoglossi. Figure taken from Cadena et al. (in prep.)



Figures 3. Skull and shell of VPPLT-1730 from the Middle Miocene (Finca La Fortuna), La Tatacoa Desert, Colombia. A, B, shell in dorsal view; C, D, shell in ventral view. Orange shadows means parts of the fossil covered by rock matrix. Abbreviations: Abd, abdominal scute; Ana, anal scute; co, costal; ent, entoplastron; epi, epiplastron; Ext, extragular scute; Fem, femoral scute; Hum, humeral scute; hyo, hyoplastron; hyp, hypoplastron; Int, intergular scute; M, marginal scute; mes, mesoplastron; mfo, musk foramina; ne, neural; nu, nuchal; P, pleural scute; pe, peripheral; Pec, pectoral scute; sp, suprapygal; py, pygal; V, vertebral scute; xip, xiphiplastron. Photographs taken from Cadena et al. (in prep.)



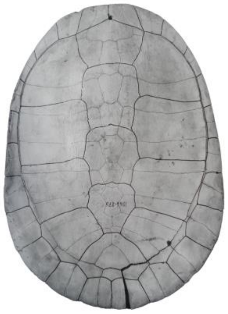
Figures 4. shell of VPPLT-1721 1730 from the Middle Miocene (Finca La Fortuna), La Tatacoa Desert, Colombia. A, B, shell in dorsal view; C, D, shell in ventral view. Orange shadows means parts of the fossil covered by rock matrix Abbreviations: Abd, abdominal scute; Ana, anal scute; co, costal; ent, entoplastron; epi, epiplastron; Ext, extragular scute; Fem, femoral scute; Hum, humeral scute; hyo, hyoplastron; hyp, hypoplastron; Int, intergular scute; M, marginal scute; mes, mesoplastron; mfo, musk foramina; ne, neural; nu, nuchal; P, pleural scute; pe, peripheral; Pec, pectoral scute; sp, suprapygal; py, pygal; V, vertebral scute; xip, xiphiplastron. Photographs taken from Cadena et al. (in prep.)



Erymnochelis madagascarensis
MNHN 1946-71

Peltocephalus dumerulianus
CRI3344

Podocnemis erytrocephala
1980-1463 MNHN



Podocnemis expansa
MNHN275

Podocnemis leywana
MNHN283

Podocnemis sextuberculata
CRI65

Podocnemis unifilis
CRI4376

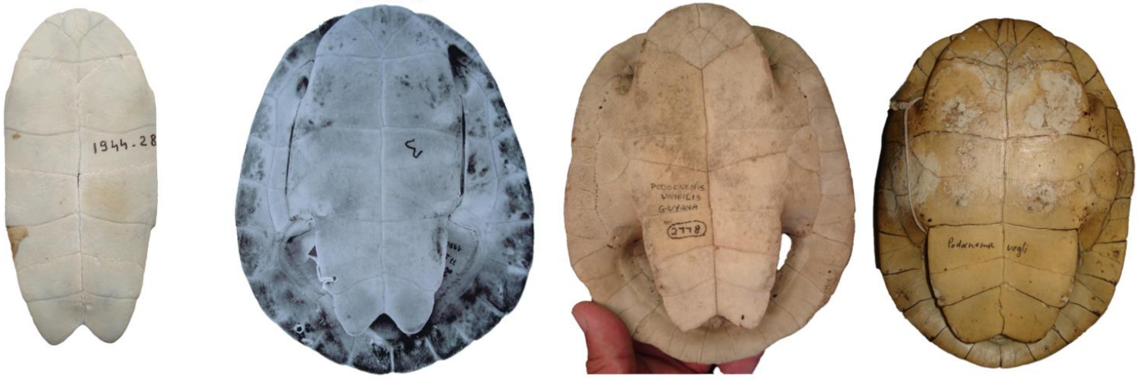
Podocnemis vogli
MNHN A507A

Erymnochelis madagascarensis MNHN 1946-71

Peltocephalus dumerulianus CRI3344

Podocnemis erytrocephala 1980-1463 MNHN

Podocnemis expansa USNM 29476



Podocnemis leywana MNHN283

Podocnemis sextuberculata MNHN 610-5

Podocnemis unifilis CRI2778

Podocnemis vogli MNHN A507A

Figure 5. Shells of extant podocnemidids used for comparisons with the VPLT-1730-1721 specimens. Photographs granted from E.-A. Cadena.

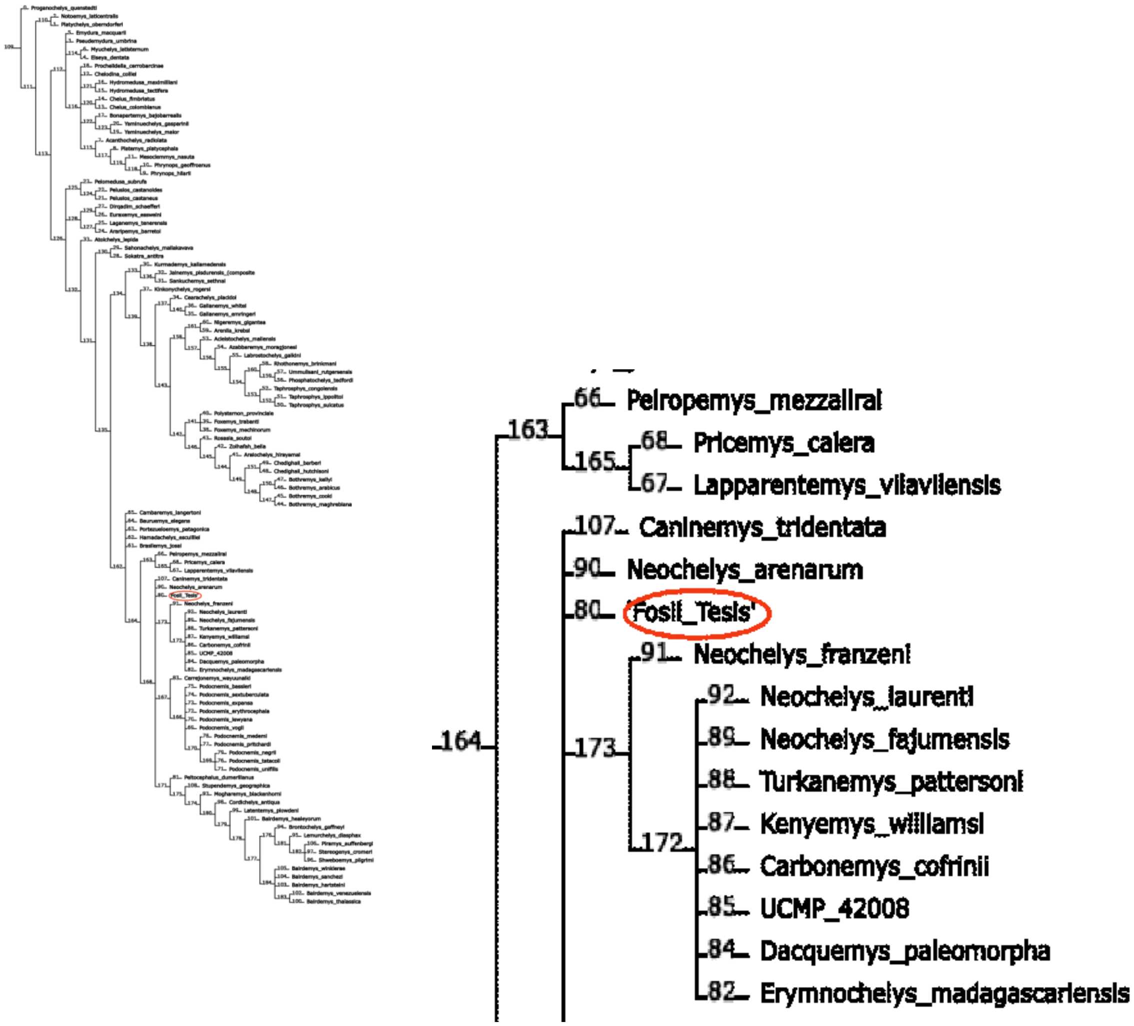


Figure 6. Phylogenetic hypothesis, Strict consensus tree obtained from 2704 MPTs. The new fossil genus and species is temporarily named "Fossil_Tesis".

Results

Systematics Paleontology

Testudines Batsch, 1788
(Joyce et al. 2020b)
Pleurodira Cope, 1865
(Joyce et al. 2020a)
Podocnemididae Cope, 1868
(Joyce et al. 2021b)

Diagnosis

The fossil specimens I studied differ from other podocnemidids in several characteristics: 1) the vertebral scute 1 overlaps only the nuchal bone, without reaching peripherals 1; 2) the anterior margin of the carapace is wide, with a medial embayment and lateral indentations at the sutural contact between peripherals 1 and 2; 3) the lateral margins of the carapace are almost parallel to each other; 4) a wider than long marginal scute 1; 5) the gular scute completely separates the humerals and is in contact with the pectorals; 6) the length of the pectoral scute is greater than that of the humeral scute; 7) the end of the entoplastron is aligned with the axillary notch. VPPLT-1730 and 1721 specimens share some similarities with other species of podocnemidids, such as: 1) the length of the cranial lobe, which is small, being wider than long, as seen in *Peltocephalus dumerilianus*, 2) the marginal scute 1 has a rectangular shape like in *Podocnemis erythrocephala*, and 3) it also has seven costal bones, like *Podocnemis negrii*, some specimens of *Podocnemis lewyana*, *Podocnemis erythrocephala*, *Podocnemis expansa*, and *Peltocephalus dumerilianus*.

The skull of the VPLT-1730 specimen differs from other podocnemidids by: 1) a postorbital having resembling an hourglass shape in ventral view; 2) the orbits are located at the top of the skull., this is shared with *Podocnemis bassleri* and *Baumerys elegans*, and differs from *Erymnochelys madagascariensis*, *Podocnemis expansa*, *Peltocephalus dumerulianus;* 3)The interparietal scute shield has a flask shape; 4) The frontal scute has sharp points surrounding the interparietal scute's base; 5) The fossa precolumellaris has a horizontal oval shape in the left view, like *Podocnemis bassleri* and differing from the rest of *Podocnemids;* 6) The anterior part of the skull has a straight tip, like *Podocnemis bassleri*, differing from *Erymnochelys madagascariensis, Podocnemis expansa, Peltocephalus dumerulianus.*

Descriptions

VPPLT-1730 specimen

VPPLT-1730 is an articulated shell (Fig. 3). The bone surface of both carapace and plastron is moderately eroded or covered by a hard rock matrix, with some cracks. However, there is no evidence of crushing, and the shell preserved its original low domed shape (Fig. 4A,B).
Carapace. The carapace of VPPLT-1730 specimen is nearly rectangular in outline, (Fig. 3A,B), exhibiting a slightly concave anterior margin, almost parallel lateral margins, and convex posterior edge. It measures a maximum width of 22.3 cm and a width of 17.8 cm. The nuchal bone has a wide Erlenmeyer-shape, being wider posteriorly. The neural series is composed of seven bones. Neural 1 is almost rectangular in shape and restricted to costals 1 and the nuchal. Neurals 2 to 5 are hexagonals, slightly wider anteriorly. Neural 6 is perfectly hexagonal, and neural 7 is pentagonal, being the smallest of the series. Additionally, it presents eight pairs of costal bones, of these, costal 1 is the largest. Costals 2 to 7 are rectangular. The right costal 8 is visible and exhibits a trapezoidal shape. There is a partial medial sutural contact between costals 7, only interrupted anteriorly by neural 7. Although covered by the rock matrix seems plausible that both costals 8 are in fully medial contact. There are eleven pairs of peripherals, better identifiable in the ventral view of the carapace (Fig. 3A-D). Of these, peripherals 1 and 2 are trapezoidal and larger than the other peripherals, which are smaller and rectangular. The anterior margin of peripherals 2 exhibits a particular single dentation (Fig. 3 C). The pygal bone exhibits a nearly squared shape.

The sulci left by the scutes are well-preserved at the anterior region of the carapace and partially at its mid-posterior portions. Marginal 1 contacted each other indicating the absence of a cervical scute. All of the preserved sulci indicate that the marginals were restricted to the peripherals without reaching the costals. It seems that were five vertebral scutes, of which vertebral 1 was restricted to the nuchal, costals 1 and neural 1, with a particular narrower anterior width. The partially preserved sulci of the other vertebrals indicate that they were hexagonal to slightly squared in shape. There were four pairs of pleural scutes, of which, pleural 1 was the largest of them covering most of the costals 1 and 2, the posterolateral corner of the nucha and the posterior regions of peripherals 1 to 3.

Plastron. The plastron of the VPPLT-1730 specimen is complete, measuring 19.5 cm maximum length, 7 cm width at the axillary level of the anterior lobe, 7.5 cm at the inguinal level of the posterior lobe, and 15.7 cm width at the mesoplastra level (Fig. 3C,D). It is relatively flat along its length without exhibiting any concavity at its posterior lobe. The anterior lobe does not extend beyond the margin of the carapace, exhibiting anteriorly tapering lateral margins, and an almost straight anterior edge. The posterior lobe of the plastron also ends before the posterior margin of the carapace and exhibits a V-shaped anal notch. The epiplastra exhibit a nearly triangular shape, meeting medially and having a concave posterior sutural contact with the hyoplastra. The entoplastron is a diamond-shaped, with a slightly curved posterior contact with the hypoplastra. The hyoplastra are larger than the hypoplastra. The right mesoplastron exhibits a convex medial sutural contact with the hyo- and hypoplastron, and more angular lateral contact with the peripherals. In contrast, both the medial and lateral sutural contacts of the left mesoplastron are straight lines, forming an elongated diamond shape. The xiphiplastral end in acute tips posteriorly, and at least the lateral margin of the right one exhibits a shallow notch at the level of the femoroanal sulcus.

The plastral scutes of VPPLT-1730 specimen indicated by the sulci include, two triangular extragular scutes that were restricted to each of the epiplastra (Fig. 3C, D). The gular was nearly rectangular with posterior acute tip ending, separating completely the humerals and in contact with the pectorals. The humerals were triangular elongated in shape. The abdominals and pectorals were the largest of the plastral scutes, giving altogether with the other scutes the following midline plastral formula Abd≥Pec>Fem>Ana>Gul>Ext>Hum. The pectoroabdominal sulcus is anteriorly positioned without reaching or touching the mesoplastra. The anal scutes were restricted to the xiphiplastra. The bone surface of the plastron exhibits a vermiculation sculpturing pattern (Fig. 3D).

VPPLT-1721 specimen

VPPLT-1721 is an articulated shell (Fig. 4). Like the shell of VPPLT-1730 specimen, the bone surface of both carapace and plastron is moderately eroded or covered by a hard rock matrix, with abundant cracks. Despite the high number of cracks, there is no evidence of major crushing, and the shell preserved relatively well its original low-domed shape, with just a minor displacement between costals 8 and the suprapygal due to a crack (Fig. 4A).

Carapace. Most the anterior region of the carapace is missing due to breaking, including most of the nuchal and the right peripheral 1 (Fig. 5A, B). Its outline is nearly rectangular, with the lateral margins almost parallels to each other. It measures a maximum length as preserved of 25 cm and a maximum width of 20.1 cm. The preserved posterior part of the nuchal indicates that it probably exhibited a similar shape as the nuchal of VPPLT-1730 specimen. Additionally, the carapace of VPPLT-1721 is identical to VPPLT-1730 specimen in having seven neurals exhibiting the same shape and contacts, eight pairs of costals of which costals 8 meet medially and costals 7 at least from the mid to posterior medial edges, eleven pairs of peripherals of which peripherals 2 exhibit an anterior indentation (Fig. 4B,C). The preserved sulci also indicate that there were five vertebral scutes, of which vertebral 1 was the narrowest in the series. Like the VPPLT-1730 specimen, there were four pairs of pleural scutes, of which pleurals 1 were the largest in the series.

Plastron. The plastron of the VPPLT-1721 specimen is flat along its entire surface, without any concavity particularly at its posterior lobe. Its most anterior and posterior edges are broken, making that most of both epiplastra, the anterior portion of the entoplastron and the most posterior portions of both xiphiplastra are missing. In terms of sutural bone contacts, shape, size, and the preserved plastral scute sulci, VPPLT-1721 is identical to those described for the VPPLT-1730 specimen measuring 19.5 cm maximum length, 7 cm width at the axillary level of the anterior lobe, 7.5 cm at the inguinal level of the posterior lobe, and 15.7 cm width at the mesoplastra level (Fig. 4C,D). The anterior lobe does not extend beyond the margin of the carapace, exhibiting anteriorly tapering lateral margins, and an almost straight anterior edge. The posterior lobe of the plastron also ends before the posterior margin of the carapace and exhibits a V-shaped anal notch. The epiplastra exhibit a nearly triangular shape, meeting medially and having a concave posterior sutural contact with the hyoplastra. The entoplastron is a diamond-shaped, with a slightly curved posterior contact with the hypoplastra. The hyoplastra are larger than the hypoplastra. The right mesoplastron exhibits a convex medial sutural contact with the hyo- and hypoplastron, and more angular lateral contact with the peripherals. In contrast, both the medial and lateral sutural contacts of the left mesoplastron are straight lines, forming an elongated diamond shape. The xiphiplastral end in acute tips posteriorly, and at least the lateral margin of the right one exhibits a shallow notch at the level of the femoroanal sulcus.

The plastral scutes of VPPLT-1730 specimen indicated by the sulci include, two triangular extragular scutes that were restricted to each of the epiplastra (Fig. 4C, D). The gular was nearly rectangular with posterior acute tip ending, separating completely the humerals and in contact with the pectorals. The humerals were triangular elongated in shape. The abdominals and pectorals were the largest of the plastral scutes, giving altogether with the other scutes the following midline plastral formula Abd≥Pec>Fem>Ana>Gul>Ext>Hum. The pectoroabdominal sulcus is anteriorly positioned without reaching or touching the mesoplastra. The anal scutes were restricted to the xiphiplastra. The bone surface of the plastron exhibits a vermiculation sculpturing pattern (Fig. 4D).

Phylogenetic analyses

The results of the phylogenetic analysis produced a total of 2704 most parsimonious trees with a tree length of 1284 steps, a consistency index of 0.283, and a retention index of 0.734. The strict consensus of all these trees is shown in the Fig. 6. The VPPLT-1730 and VPPLT-1721 were recovered inside Podocnemididae family, forming a new genus and a new specie being a sister taxon of *Caninemys tridentata* and *Neochelys arenarum* supported by the following characters: 173(CAR, first pleural scute reaches nuchal), 202(CAR, marginal scale 1 proportion overlapping the cranial margin), 218(PLA, cranial lobe), 224(CAR, vertebral scale 1 overlap onto cranial peripherals and nuchal), 232(PLA, entoplastron caudal end reaching the axillary notch level of plastron), 235(PLA, humeral scale).

Discussion

Four morphological characters and two morphological ones with potential relevance to support the attribution of fossil taxa to the extant *Podocnemis* genus were mentioned by Gaffney et al. (2011). In this study, it was evidenced not only how the morphological characteristics of the specimens indicate that it is a new species and possibly even a new genus, but also how there are many shared characteristics between Podocnemididae and *Peltocephalus*. Regarding the skull, it was observed that most of the shared characteristics are with *Peltocephalus,* in terms of the location of the scutes and bones. In terms of the shell, coincidences in the bones and scutes can be seen in both the carapace and the plastron. However, the fact that the characteristics in general do not completely match either of the three genera (*Podocnemis*, *Erymnochelys* or *Peltocephalus*) led me to hypothesize that this organism could be a new genus and species.

Conclusions

Although this study identified a new genus and species of podocnemid turtles, placing it alongside *Caninemiys tridentata* and *Neochelys arenarum* based on my morphological analysis, characterized by vertebral scute 1 overlapping the nuchal bone, a medial embayment and lateral indentations on the carapace’s anterior margin, nearly parallel carapace margins, a marginal scute 1 wider than long, a gular scute separating and contacting the pectoral scutes, a pectoral scute longer than the humeral, and an entoplastron aligned with the axillary notch, further analysis should be done to refined the descriptions here presented, including CT data analysis, geometric morphometric and other phylogenetic analysis.

The study of the fossil record of extant vertebrate lineages, such as Podocnemididae turtles in this case, can strengthen conservation efforts by providing a better understanding of their evolutionary history. It can highlight to people that the species they consume or whose habitats they destroy have inhabited this part of the continent for millions of years, and that we risk driving them to extinction within just a few decades. Additionally, studies like these are crucial for reconstructing the paleodiversity of a region and demonstrating how it has changed over geological time.

References

Cadena, E. A., & Vanegas, R. D. (2023). A new fossil turtle ends the controversy on the occurrence of the extant genus *Podocnemis* Wagler, 1830 at the Miocene fauna of La Venta, Colombia. Geodiversitas, 45(3), 127–138. https://doi.org/10.5252/GEODIVERSITAS2023V45A3

Cadena, E. A., Scheyer, T. M., Carrillo-Briceño, J. D., Sánchez, R., Aguilera-Socorro, O. A., Vanegas, A., Pardo, M., Hansen, D. M., & Sánchez-Villagra, M. R. (2020). The anatomy, paleobiology, and evolutionary relationships of the largest extinct side-necked turtle. Science Advances, 6(7), 4593–4605. https://doi.org/10.1126/SCIADV.AAY4593

Carvalho, P., Bocquentin, J., & Lapparent De Broin, F. (2002). Une nouvelle espèce de *Podocnemis* (Pleurodira, Podocnemididae) provenant du Néogène de la formation Solimões, Acre, Brésil. Geobios, 35(6), 677–686.

Edwin-Alberto Cadena and Rubén Dario Vanegas "A new fossil turtle ends the controversy on the occurrence of the extant genus *Podocnemis* Wagler, 1830 at the Miocene fauna of La Venta, Colombia," Geodiversitas 45(3), 127-138, (23 February 2023). https://doi.org/10.5252/geodiversitas2023v45a3

Ferreira G. S., Nascimento E. R., Cadena E. A., Cozzuol M. A., Farina B. M., Pacheco M. L. A. F., Rizzutto M. A. and Langer M. C. 2024. The latest freshwater giants: a new *Peltocephalus* (Pleurodira: Podocnemididae) turtle from the Late Pleistocene of the Brazilian Amazon.

Gaffney, E. S., Meylan, P. A., Wood, R. C., Simons, E., & De Almeida Campos, D. (2011). Evolution of the side-necked turtles: the family Podocnemididae. Bulletin of the American Museum of Natural History, 350, 1–237.

Gaffney, E. S., Tong, H., & Meylan, P. A. (2006). Evolution of the side-necked turtles: the families Bothremydidae, Euraxemydidae, and Araripemydidae. American Museum Novitates, 300, 1–700.

Gentil, E., de Medeiros, L. A., Vogt, R. C., & Barnett, A. A. (2021). Biology of the Big-headed Amazon River Turtle, *Peltocephalus dumerilianus* (Schweigger, 1812) (Testudines, Pleurodira): The basal extant Podocnemididae species. Herpetozoa, 34, 207–222. https://doi.org/10.3897/HERPETOZOA.34.E67807

Goloboff, P. A., Farris, J. S., & Nixon, K. C. (2008). TNT, a free program for phylogenetic analysis. *Cladistics*, 24(5), 774–786.

Guerrero, J. (1997). Stratigraphy, sedimentary environments, and the Miocene uplift of the Colombian Andes, in Kay R. F., Madden R. H., Cifelli R. L., & Flynn J. J. (eds), Vertebrate Paleontology in the Neotropics, the Miocene Fauna of La Venta, Colombia. Smithsonian Institution Press, Washington: 13-43.

Laura Mora-Rojas, Andrés Cárdenas, Carlos Jaramillo, Daniele Silvestro, Germán Bayona, Sebastián Zapata, Federico Moreno, César Silva, Jorge W. Moreno-Bernal, Juan Sebastián Jaramillo, Victor Valencia, and Mauricio Ibañez "Stratigraphy of a middle Miocene neotropical Lagerstätte (La Venta Site, Colombia)," Geodiversitas 45(6), 197-221, (13 April 2023). https://doi.org/10.5252/geodiversitas2023v45a6

McLaughlin, D. J., & Spatafora, J. W. (2014). Systematics and evolution: Part A: Second edition. Systematics and Evolution: Part A: Second Edition, 1–461. https://doi.org/10.1007/978-3-642-55318-9/COVER.

Montes, C., Silva, C. A., Bayona, G., Villamil, R., Stiles, E., Rodriguez-Corcho, A. F., Beltran-Triviño, A., Lamus, F., Muñoz Granados, M. D., Pérez-Angel, L. C., Hoyos, N., Gómez, S., Galeano, J. J., Romero, E., Baquero, E., Cárdenas-Rozo, A. L., & von Quadt, A. (2021). A middle to late Miocene trans-Andean portal: Geologic record in the Tatacoa Desert. Frontiers in Earth Science, 8, 587022. https://doi.org/10.3389/feart.2020.587022

Pereira, A.G., Sterli, J., Moreira, F.R.R., Schrago, C.G., Multilocus phylogeny and statistical biogeography clarify the evolutionary history of major lineages of turtles, Molecular Phylogenetics and Evolution (2017), doi: http://dx.doi.org/10.1016/j.ympev.2017.05.008

Turtle Taxonomy Working Group Rhodin, A.G.J., Iverson, J.B., Bour, R., Fritz, U., Georges, A., Shaffer, H.B., & Van Dijk, P.P.J. (2021). Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, Distribution, and Conservation Status (9th Ed.). In: Rhodin, A.G.J., Iverson, J.B., van Dijk, P.P., Stanford, C.B., Goode, E.V., Buhlmann, K.A., and Mittermeier, R.A. (Eds.). Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. Chelonian Research Monographs, 8:1-472. doi:10.3854/crm.8 checklist.atlas.v9.2021

White, N. F. D., Mennell, H., Power, G., Edwards, D., Chrimes, L., Woolaver, L., Velosoa, J., Randriamahita, Mozavelo, R., Rafeliarisoa, T. H., Kuchling, G., Lopez, J., Bekarany, E., Charles, N., Young, R., Lewis, R., Bruford, M. W., & Orozco-terWengel, P. (2022). A population genetic analysis of the Critically Endangered Madagascar big-headed turtle, *Erymnochelys madagascariensis* across captive and wild populations. Scientific Reports, 12(1), 1–14. https://doi.org/10.1038/s41598-022-12422-y

Williams, E. E. (1956). *Podocnemis bassleri*, a new species of Pelomedusid turtle from the Late Tertiary of Peru. American Museum Novitates, 1782, 1–10. http://hdl.handle.net/2246/2461

Wood, R. C. (1997). Turtles, in Kay R. F., Madden R. H., Cifelli R. L., & Flynn J. J. (eds), Vertebrate Paleontology in the Neotropics. The Miocene Fauna of La Venta, Colombia. Smithsonian Institution Press, Washington: 155–170.