

## A TRIONYCHIDAE (REPTILIA: TESTUDINES, CRYPTODIRA) FROM THE PLIOCENE OF COSTA RICA, SOUTHERN CENTRAL AMERICA

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**ABSTRACT:** Fossil remains of soft-shelled turtles, Trionychidae, are recorded from the Pliocene fluvial sediments of Costa Rica. This is the first record of the trionychids from the Neotropical lands of Central America. These fossils revealed new faunal elements involved in the American Biotic Interchange, and permit a better knowledge of the evolution and composition of our paleoherpetofauna.

**Keywords:** Reptilia, Testudines, Trionychoidea, *Apalone*, lower Pliocene, Costa Rica.

**RESUMEN:** Restos fósiles de tortugas de caparazón blando han sido recuperados de sedimentos fluviales del Plioceno de Costa Rica. Esta es la primera vez, fuera del hallazgo venezolano que un trionychido es descrito para la Región Neotropical y para América Central. Su registro aporta nuevos elementos a la fauna involucrada en el Intercambio Biótico entre las Américas y permite una mejor comprensión de la composición y evolución de nuestra herpetofauna.

**Palabras clave:** Reptilia, Testudines, Trionychoidea, *Apalone*, Plioceno Inferior, Costa Rica.

### INTRODUCTION

Soft-shelled turtles of the family Trionychidae today live in rivers and freshwater swamps of Asia, the Indo-Australian archipelago, Intertropical Africa, and North

America. They are characterized in the Western Hemisphere by a distribution in predominantly temperate habitats of North America, although they do range into the subtropical region of northeastern Mexico; they do not currently live in Central or South America.

Fossil trionychids have been found in Europe and elsewhere in that hemisphere (see discussion in Webb, 1990). Tertiary sediments in North America frequently contain trionychids, which have been reported in the genus *Trionyx*, but now placed in the genus *Apalone* (see Meylan, 1987). An unusual find of a trionychid was described from sediments of Huayquerian age (Pliocene) from Venezuela, South America (Wood & Patterson, 1973). The appearance of a trionychid in South America is not understood and assumed to have occurred via waif dispersal which did not result in colonization (Estes & Báez, 1985). An additional possibility is that trionychids entered South America over land via Central America. Reports of fossil turtles from Central America are rare; any record is of importance. Acuña and Laurito (1996) record a late Neogene fossil *Rhinoclemmys* (Emydidae) from Costa Rica. Here, we report on the first record of the trionychid, *Apalone*, from the Pliocene of Costa Rica.

The specimens collected by Luis Gerardo Pérez Rivera and presented here come from the locality of Limoncito (8°51'23.8" N and 83°04'19.9" W), located 14 km west of San Vito, Canton of Coto Brus in the province of Puntarenas (Fig. 1).

## PALEONTOLOGY

**Class** REPTILIA

**Order** TESTUDINES

**Suborder** CRYPTODIRA

**Superfamily** TRIONYCHOIDEA

**Family** TRIONYCHIDAE

Upper Jurassic - Lower Cretaceous – Recent

The Trionychidae family is typified by primarily carnivorous, freshwater turtles. They are characterized by a shell lacking epidermal scutes, replaced instead by a soft cover of leathery skin. The shell is low, rounded, and typically lacks the peripheral bones and marginal scutes (Carroll, 1988).

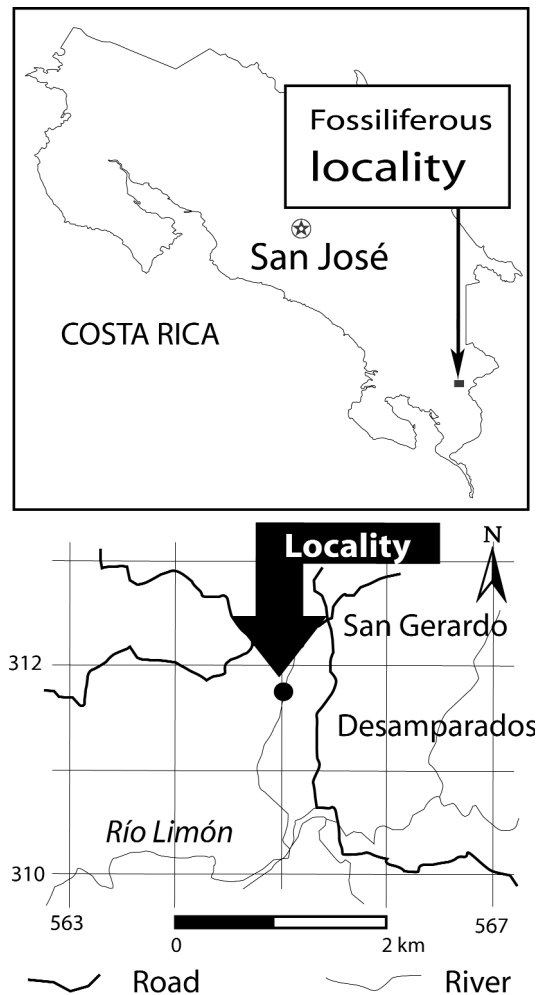


Fig. 1: Map of the locality of Limoncito, canton of Coto Brus Puntarenas, Costa Rica.

**Genus** *Apalone*  
Late Miocene – Recent

The trionychids of North America historically have been referred to the genus *Trionyx* and to another less common genus, *Amyda*, but are now considered to belong to the single taxon *Apalone* (Hulbert, 2001). Meylan (1987) revised this group and determined that the generic name *Apalone* is the most appropriate for the North American trionychids.

*Apalone* is a freshwater turtle with a soft shell, lacking the epidermal, keratinous scutes

and peripheral skeletal elements of the carapace, which is covered instead with a leather-type skin. The plastron is highly modified and reduced. The osteology of this genus has been discussed in detail by Sheil (2003).

The external surface of the shell bones is greatly dimpled with round to oval depressions which form a unique pattern, a distinctive character that permits generic identification, of even small fragments of the carapace or plastron (Hulbert, 2001).

### *Apalone* sp. indet.

#### Material

Five shell specimens appear to correspond to fragments of the hyoplastron or hypoplastron and fragments of the costal elements (figure 2 a-e). All specimens are housed at the Geology Section of the Natural History Department of the Museo Nacional de Costa Rica, with specimen numbers CFM-1163-1166 and 1193.

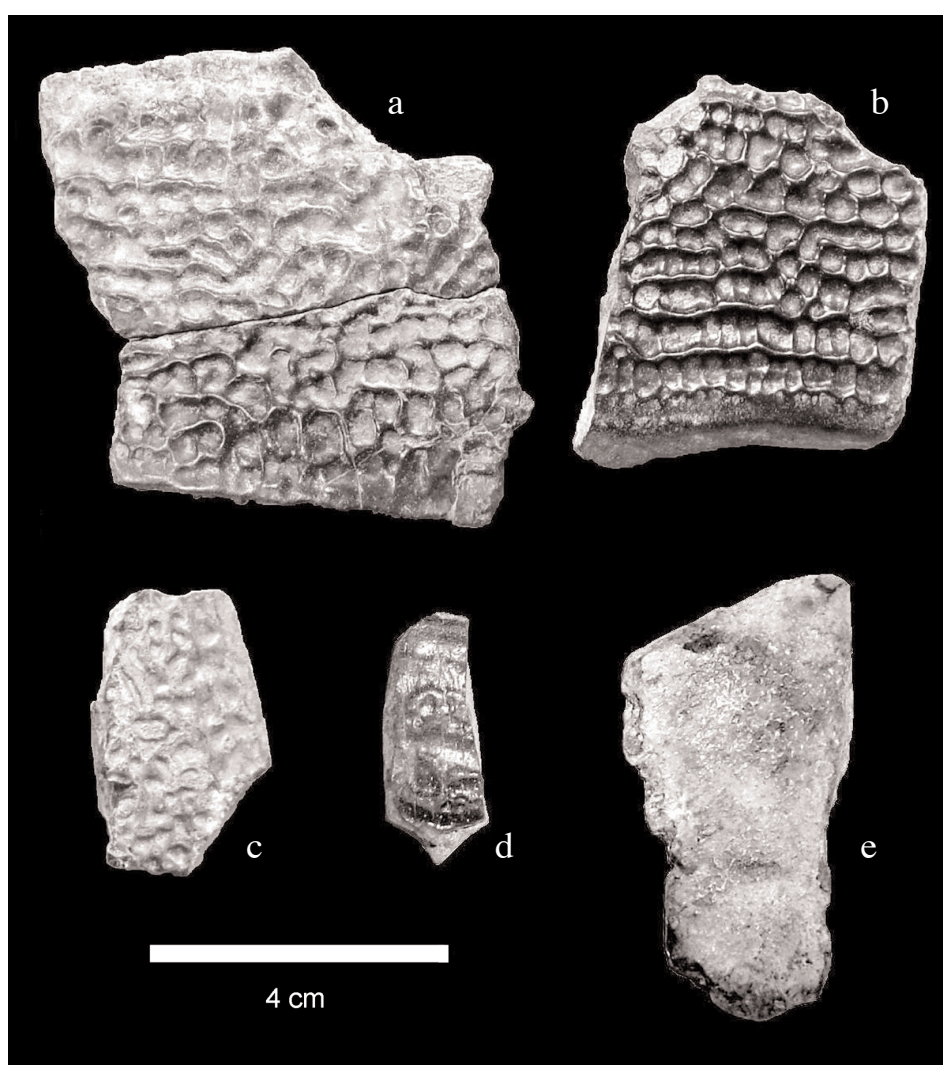


Fig. 2: Scutes of *Apalone* sp.: a) CFM-1163; b) CFM-1164, c) CFM-1165, d) CFM-1166 and e) CFM-1193. All of uncertain position, corresponding to costal elements or fragments from the hyo-hyoplastron.

### Description

The recovered fragments are small in size (59 mm x 55 mm or 37 mm x 25 mm) and are characterized by having the unique, highly dimpled surface pattern and are identifiable to the genus *Apalone*. Without larger specimens or more of an articulated specimen, the species cannot be determined.

### DISCUSSION

The distinctive dimpled pattern of sculpture of the shell fragments permits the identification to *Apalone*. The specimens phenotypically resemble the living species *A. ferox*.; although, the fossils seem to have a much more conspicuous sculpture than those of the living taxon. We question whether the Costa Rican specimens represent the living form, and suggest that additional and articulated specimens be used at a later date to determine what species lived in Central America in the Pliocene.

#### Discussion about the probable origin and the Paleobigography of the Costa Rican *Apalone*

When Wood & Patterson (1973) described the finding of the fossil trionychid from the Urumaco Formation of Venezuela, they assigned a Huayquerian mammal age, equivalent to the Middle Pliocene. Refinement of the age by Marshall (1985; see Estes & Báez, 1985) sets an Upper Miocene age for the Huayquerian (6 to 9 Ma). Most recent estimate is by Flynn and Swisher of 6.8-9.0 MA. Sánchez-Villagra *et al.* (2004) described remains of an undetermined genus within the Trionychoidea from the Lower Miocene of the Cerro La Cruz, Castillo Formation, Venezuela. Meylan in Sánchez-Villagra *et al.* (2004) presents an unpublished record of *Apalone sp.* from the Pleistocene of Guatemala.

Wood & Patterson (1973) assumed that the South American trionychids arrived during the early Miocene through the Central American

island arc. However, this possibility is not likely because during the middle and late Miocene the Straits of Bolivar (Central American Isthmus) were wide and constituted a marine barrier that would have limited most terrestrial vertebrates (Whitmore & Stewart, 1965), possibly including the trionychids. It is not until approximately 6 Ma. that the deep marine passage of the Straits of Bolivar started to close (Duque-Caro, 1990 a and b). The isthmus was closing throughout the latest Miocene and most of the Pliocene, with the only possible migration via waif dispersal from the emerging island land masses. A complete land corridor was not viable until at least 3.5 Ma (Duque-Caro, 1990 a).

The overview of the growing fossil record indicates that trionychids and other turtles were a component of the latest Miocene and Pliocene faunas as the isthmus formed. The *Apalone sp.* specimens reported here are clearly of lower Pliocene age (representative of the Blancan land mammal age). These fossils are from Curré Formation, where remains of *Rhynchotherium blicki* have been recovered and confirm this age assignment (Laurito & Valerio, in press). The trionychid remains suggest a dispersal route through low elevation wetlands of the emerging isthmus. The fossil records of trionychids recovered from Miocene deposits in Venezuela are intriguing and suggest an introduction into South America via waif dispersal. Clearly more evidence from Miocene and Pliocene deposits is needed to fully understand the early dispersal of this aquatic turtle.

#### Paleoecology

*Apalone* fossils were recovered from clastic sediments of variable grain size, including middle and coarse sands and fine conglomerates. However, based on the new paleontological finds (such as numerous fossils of large crocodiles, fishes, and mammals) found associated with the *Apalone*, the fauna permits a reconstruction of an extensive wetland along with associated river mouths near to the coast.

## CONCLUSIONS

The first fossil record for Central America of the trionychid *Apalone* is described from the Limoncito locality in Costa Rica. This fossil data not only enriches the Costa Rican paleovertebrate record, but also widely enhances the knowledge and the evolution of the herpetofauna, particularly the turtle record of Central America. The new data suggest that sediments of an ancient fan delta unit of the Curre Formation were deposited in low wetlands environments. It is not possible to unequivocally establish the path of dispersion for this North American genus. The Costa Rican fossils presented here are located in a geographical intermediate point between the known distribution of the living *A. ferox* and the Miocene data set from Venezuela. These important finds illustrate the need for further work on the latest Miocene, Pliocene, and earliest Pleistocene fossil deposits in this North American and South American corridor.

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