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THE FIRST LATE PLEISTOCENE RECORD OF *KINOSTERNON* (CRYPTODIRA: KINOSTERNIDAE) TURTLES FOR NORTHERN SOUTH AMERICA, PUBENZA LOCALITY, COLOMBIA.

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ABSTRACT: The first fossil record of *Kinosternon* turtles in South America, from the late Pleistocene (16500 years before present) at the Pubenza locality, Department of Cundinamarca, in the Bogotá River basin of Colombia is described. The fossil material is composed of an epiplastron, a hypoplastron, a peripheral, two costals, and a neural bone, which suggest an affinity to the Kinosterninae subfamily based upon the absence of an entoplastron and an abdominal scale. The presence of a hinge in the anterior and posterior plastral lobe and a large epiplastron longer than wide indicate an affinity to the genus *Kinosternon.* The presence of a marked scar for the insertion of the cervico-plastral ligament on the visceral surface of the epiplastron indicates a close relationship to *Kinosternon leucostomum* and *Kinosternon scorpioides.* More shell and cranial material must be found in order to define precisely if the *Kinosternon* of Pubenza corresponds to some extant species, or if it is a new extinct species.

KEYWORDS: Kinosternidae, *Kinosternon,* late Pleistocene, Colombia.

INTRODUCTION

The turtle family Kinosternidae is endemic to the New World and its fossil record comes principally from North America and Mexico (Fichter 1969; Hutchison, 1980; Hutchison and Bramble, 1981; Bramble *et al.,* 1984; Hutchison, 1991; Holman, 1998). Modern members of the family are grouped into two subfamilies (Staurotypinae and Kinosterninae), known as mud or musk turtles, which inhabit semiaquatic environments from Canada to South America (Ernst and Barbour, 1989; Bonin *et al.,* 2006). The subfamily Kinosterninae is represented by *Kinosternon,* which is composed of at least twenty different species and many subspecies (Bonin *et al.,* 2006). Only three species of *Kinosternon* inhabit the fluvial systems of Colombia: *Kinosternon dunni* Schmidt, 1947, endemic to the Baudo and Sinu River basins; *Kinosternon leucostomum* (Duméril and Bibron, 1851), widespread in the Baudo, Sinu and Magdalena rivers, the Pacific coast, and the west Atlantic coast; and *Kinosternon scorpioides* (Linnaeus, 1766), from San Andres island, the Atlantic coast, the Llanos Orientales and Colombian Amazonia (Iverson, 1992; Ceballos, 2000).

The phylogeny of Kinosternidae has been defined using molecular and morphological data (Bramble *et al.,* 1984; Seidel *et al.,* 1986; Iverson, 1991). Recent studies of its phylogenetic relationships to other cryptodires (hidden-neck turtles) have determined that it is closely related to the family Dermatemydidae (Shaffer *et al.,* 1997; Krenz *et al.,* 2005; Joyce, 2007). However, its past diversity and biogeography are still poorly understood due to the lack of fossils, especially from Central and South America.

We describe here the first fossil record of Kinosternidae turtles from South America, consisting of shell elements found in a late Pleistocene (16500 years before present) colluvial deposit (Van Der Hammen and Correal, 2001) at Pubenza, Cundinamarca, Colombia.

Geographic Setting, Geology and Age

Turtle shell elements described here were recently discovered by a field commission of INGEOMINAS (Instituto Colombiano de Geología y Minería) Pubenza locality, Department of Cundinamarca, Bogotá River basin, Colombia, 4°24'21"N, 74°42'12"W (Fig. 1). The fossil record of the Pubenza locality includes various specimens of *Haplomastodon waringi* (Mayorga, 1996), fragmentary elements of *Megatherium,* armadillos, rodents, turtles (described in this work), gastropods, crabs and also archeological obsidian elements that suggest the presence of human activity (Van Der Hammen and Correal, 2001).

All fossil vertebrates were found in a colluvial deposit composed of gray paleosoils rich in clay, plant remains, gypsum, volcanic ash and peat. Radiocarbon dating put the age of the deposit at approximately

17000 to 13000 years before present (20000 to 16000 years before present calibrated). A more precise age was determined for the mastodon layer, where the *Kinosternon* material also originated. The age of this layer is 16500 years before present (19500 years before present calibrated), suggesting a late Pleistocene age (Van Der Hammen and Correal, 2001).

Systematic Paleontology

Testudines Linnaeus, 1758 or Batsch, 1788
Cryptodira Cope 1868
Kinosternidae Baur, 1893
Kinosternon Spix, 1824
Kinosternon sp. indet.

Referred material – MGJRG (Museo Geológico José Royo y Gómez, paleontological collection INGEOMINAS, Bogotá, Colombia). MGJRG G-165-01, a right epiplastron (Fig. 2 A, B, C); MGJRG G-165-02, a left hypoplastron (Fig. 2 D, E); MGJRG G-165-03, a right IX peripheral bone (Fig. 2 I); MGJRG G-165-04, a second left costal bone (Fig. 2 F); MGJRG G-165-05, a sixth left costal bone (Fig. 2 H) and MGJRG G-165-06, a neural bone (Fig. 2 G). More fragmentary costal, neural and peripheral bones were also collected and stored as MGJRG G-165.

Compared material – MNHN (Muséum national d'Histoire naturelle, Paris, France, laboratoires: Z, Zoologie des Reptiles et Amphibiens). MNHN Z 1972, complete shell of *Kinosternon leucostomum;* MNHN Z 1967, complete shell of *Kinosternon subrubrum.* ICN (Instituto de Ciencias Naturales Universidad Nacional de Colombia, Bogotá, Colombia). ICN 7443, ICN 7677, complete shells of *Kinosternon leucostomum;* ICN 7435, ICN 7447, ICN 7630 complete shells of *Kinosternon scorpioides.*

Description

In order to refer to the elements described here we have taken as a Kinosternid model the figures of the carapace (see Fig. 2 J) and plastron (see Fig. 2 K) of *Kinosternon leucostomum* as presented by Joyce (2007).

Kinosternon sp. (MGJRG G-165-01) is a complete right epiplastron lacking an entoplastron. The specimen is longer (38 mm) than wide (25 mm), tapering anteriorly and with the posterolateral corner slightly oblique and bearing an evident surface of the hinge posteriorly. The visceral surface has a marked scar for the insertion of the cervico-plastral ligament at the position of the gular and on the ventral surface the plastral scales are recognized by their sulci and lateral margins. The intergular is small and triangular; it projects slightly to the exterior along its anterior margin, and posteromedially contacts the gular. The gular is long, almost reaching the posteromedial margin of the epiplastron. Anteromedially the gular is in contact with the intergular and posteromedially with the humeral, which is triangular and very short medially.

The size of the epiplastron (length near 70 mm along the midline of the shell) suggests that the specimen is from a very young animal. It has a mean thickness of 4 mm, and on the ventral surface shows microvermiculation, which is more finely spaced in the intergular area.

Kinosternon sp. (MGJRG G-165-02) is a left hypoplastron that by its size probably corresponds to the same specimen as the epiplastron described above. Wider than long, it bears a longer lateral extension at the carapace-plastron bridge. Its posterior margin is slightly shorter than the anterior, showing a hinge surface slightly broken laterally. The inguinal notch is shallow and V-shaped. The ventral surface has no scale sulcus, indicating the lack of abdominal scales. Also on ventral surface the microvermiculation is present but less marked than in the epiplastron.

Figure 1. Location of the Pubenza locality, Department of Cundinamarca, Bogotáa River basin, Colombia.

Kinosternon sp. (MGJRG G-165-03) is a right peripheral probably IX. On the dorsal surface the sulcus between marginals is clearly recognized as well as the presence of a microvermiculation pattern similar to that described above for the plastron.

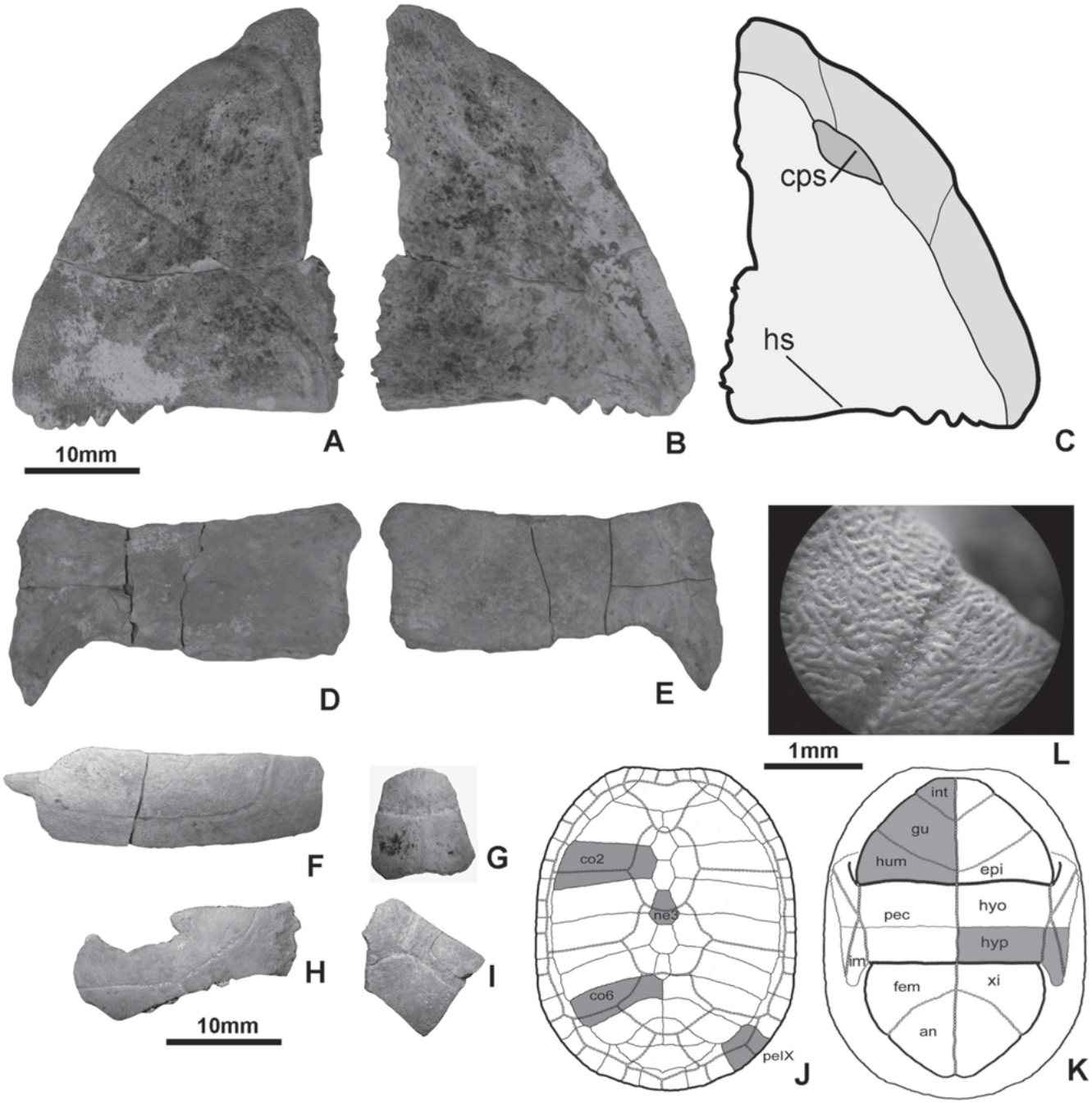

FIGURE 2. *Kinosternon* sp. from the late Pleistocene, Pubenza locality, Colombia. **A.** MGJRG G-165-01, right epiplastron in ventral view. **B, C**. MGJRG G-165-01, right epiplastron in visceral view. **D.** MGJRG G-165-02, left hypoplastron in visceral view. **E.** MGJRG G-165-02, left hypoplastron in ventral view. **F.** MGJRG G-165-04, left second costal bone in dorsal view. **G**. MGJRG G-165-06, third? neural bone in dorsal view. **H.** MGJRG G-165-05, left sixth costal bone in dorsal view. **I.** MGJRG G-165-03, right IX? peripheral bone. **J.** *Kinosternon leucostomum* carapace in dorsal view modified from Joyce (2007: Fig. 8), the probable correspondence with the carapaceal elements of *Kinosternon* sp. from Pubenza is showed in gray. **K.** *Kinosternon leucostomum* plastron in ventral view modified from Joyce (2007: Fig. 10); the correspondence with the plastral elements of *Kinosternon* sp. from Pubenza is shown in gray. **L.** Microvermiculation pattern on the dorsal surface of the right IX peripheral bone (MGJRG G-165-06), viewed with a stereomicroscope. **Abbreviations: an**, anal; **co2**, second costal; **co6**, sixth costal; **cps**, cervico-plastral scar; **epi**, epiplastron; **fem**, femoral scale; **gu**, gular scale; **hs**, hinge surface; **hum**, humeral scale; **hyo**, hyoplastron; **hyp**, hypoplastron; **im**, intermarginal; **int**, intergular; **ne3**, third neural; **pec**, pectoral scale; **peIX**, IX peripheral; **xi**, xiphiplastron.

Kinosternon sp. (MGJRG G-165-04) is a second left costal bone, with the sulcus between the pleurals and the first vertebral scale clearly marked on the dorsal surface. On this surface a poorly marked microvermiculation can be recognized. On its lateral margin the costal bone preserves the distal portion of the rib, which ends in a cone shape, showing deep longitudinal channels.

Kinosternon sp. (MGJRG G-165-05) is an almost complete sixth left costal bone with part of its anterolateral margin and posterolateral corner broken. On the dorsal surface the sulcus between the third and fourth pleural scales is positioned close to the posterolateral margin. The contact of these pleurals with the fourth vertebral scale is posterior, at the central part of the costal. The microvermiculation pattern is also present in this costal.

Finally, we describe a neural bone of *Kinosternon* sp. (MGJRG G-165-06), probably the third, if the neural series is as in *K. leucostomum.* The bone is trapezoidal in shape, and its convex anterior margin and slightly oblique posterolateral corners are evidence of its contact with the posterolateral pair of costals. On the dorsal surface the sulcus between the second and the third vertebral scale is convex for the second vertebral. The microvermiculation pattern is well marked on the dorsal surface, including the sulcus between the scales (Fig. 2 L)

Discussion

The absence of an entoplastron and abdominal scales in the Pubenza turtle is indicative of their position within Kinosterninae (Bramble *et al.,* 1984; Iverson, 1991; Joyce, 2007). The presence of a hinge in the anterior and posterior plastral lobe and a large epiplastron longer than wide are indicative of the genus *Kinosternon* (Bramble *et al.,* 1984; Iverson, 1991). Bramble *et al.,* (1984) noted a marked scar for the insertion of the cervico-plastral ligament on the dorsal surface of epiplastron as a peculiarity of *K. leucostomum* and *K. scorpioides* (Linnaeus, 1766). All these features are also present in the Pubenza turtle. The hypoplastron with a long posterior margin for the hinge and small inguinal notch, and without a marked internal entrance on it, is another *Kinosternon* character (Bramble *et al.,* 1984: Fig. 1).

The position of the scale sulcus in the dorsal view of the costal bones is very similar to that in *Kinosternon leucostumon,* suggesting a possible relationship between the Pubenza material and this species, which is widespread in the lowland region of Colombia today. However, more complete shell and cranial material should be recovered from the Pubenza locality before assessing a precise determination at the species level.

Finally, this late Pleistocene record of *Kinosternon* in Pubenza, in the Bogotá River basin, where extant *Kinosternon* species do not live today, is evidence that this genus had a broader distribution in the recent past. The probable causes of its local extinction are still unknown.

Resumen

Describimos el primer registro fósil de tortugas del género *Kinosternon* en Sur América, proveniente del Pleistoceno tardío (hace 16500 años), localidad de Pubenza, Departamento de Cundinamarca, Cuenca del Rio Bogotá, Colombia. El material fósil está compuesto por un epiplastron, un hipoplastron, una periferal, dos costales y una placa neural pertenecientes a la subfamilia Kinosterninae con base en la ausencia de entoplastron y escama abdominal. La presencia de bisagra en el lóbulo anterior y posterior del plastron y un gran epiplastron más largo que ancho indica afinidad con el genero *Kinosternon.* La presencia de una marcada cicatriz para la inserción del ligamento cervico-plastral sobre la superficie visceral del epiplastron indica una relación cercana a las especies *Kinosternon leucostomum* y *Kinosternon scorpioides.* Más material craneal y de la concha necesita ser encontrado con el fin de precisar si el *Kinosternon* de Pubenza corresponde a una de las especies actuales o es una nueva especie extinta.

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