# *Palaxius caucaensis* n. sp., a crustacean microcoprolite from the basal Nogales Formation (Campanian to Maastrichtian) of Colombia

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**ABSTRACT:** From a sandstone layer of the basal Nogales Formation (Campanian to Maastrichtian) of Colombia (South America) the new crustacean microcoprolite *Palaxius caucaensis* is described. It represents the first finding of these microfossils in Cretaceous beds in South America.

## INTRODUCTION

Until now crustacean microcoprolites from South America have been known only from Triassic and Jurassic sediments (Förster and Hillebrandt 1984, Senowbari-Daryan and Stanley 1986, Blau et al. 1993, Blau and Senff 1993). Whereever these coprolites occur, they are often the only fossil group preserved and therefore of great stratigraphical interest. The value of crustacean microcoprolites for biostratigraphy has been demonstrated by Molinari Paganelli et al. (1980, 1986). Additionally, crustacean microcoprolites are a good tool for paleobiogeography and the reconstruction of faunal migration paths (e.g., Blau et al. 1993). In this paper, we describe the first Cretaceous crustacean microcoprolite from South America.

## ORIGIN OF THE SAMPLE

The investigated outcrop is situated SE of Monteloro (Departamento Valle del Cauca) at the western flank of the Central Cordillera of Colombia on sheet 261 Tuluá. Close to the locality known as "El Paraiso," about 200m of shallow marine conglomerates, sandstones and claystones crop out in a nameless eastern confluent of the Quebrada (creek) La Mina (text-fig. 1). The sample which yields the coprolites originates from a sandstone layer near the base of the profile.

### The Nogales Formation

The Nogales Formation crops out in a narrow north-south directed strip along the western flank of the Central Cordillera of Colombia, southeast of the city of Tuluá. It is limited to the west by a fault against rocks of the Amaime Formation and the batolith of Buga, while to the east the Nogales Formation disappears under the tertiary cover. It was described first by Nelson (1957) as a unit consisting of black cherts and grey sandstones. Pardo et al. (1993) subdivided the Nogales Formation into three units. The lower part contains (graded) sandstones and matrix-supported conglomerates which sometimes have an important content of carbonate. The conglomerates are composed of metamorphic, volcanic and sedimentary rock fragments and show diameters up to 10cm.

The middle part of the Nogales Formation shows an alternation of sandstones and claystones with some intercalated chert layers. Slumping structures are frequent.

The upper part is dominated by claystones and cross-bedded, fine-grained sandstones. Especially in the lower part, the Nogales Formation yields plant remains, internal molds of bivalves, gastropods and ammonites. F. Etayo-Serna (Bogotá) kindly determined *Trochoceramus* sp. and *Nostoceras* sp., which indicate a Late Cretaceous (Campanian to Maastrichtian) age for the lower part of the Nogales Formation which also contains the finding horizon of the coprolite-bearing sandstone layer. In the upper part of the Nogales Formation van der Hammen (1960) found a sporal assemblage of Paleocene age. According to these data, the Nogales Formation is the youngest marine sedimentary unit at the western flank of the Colombian Central Cordillera.

## SYSTEMATIC PALEONTOLOGY

Phylum ARTHROPODA
Subclass MALACOSTRACA
Superorder EUCARIDA
Order DECAPODA
Family THALASSINIDAE
Genus *Palaxius* Brönnimann and Norton 1960

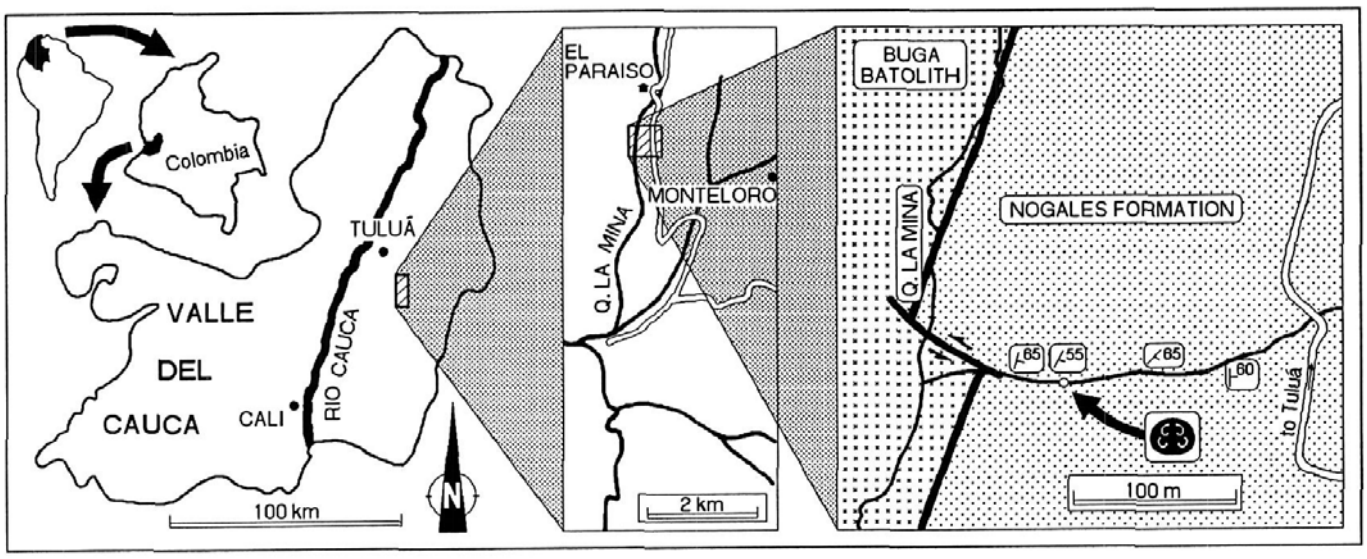
The genus *Palaxius* was defined by Brönnimann and Norton (1960) as having crescent shaped canals in cross-sections. Recently, Blau et al. (1994) have demonstrated that crescent-shaped canals also occur together with triangle-shaped canals in *Parafavreina thoronetensis* Brönnimann et al. 1972a.

***Palaxius caucaensis*** Blau, Moreno and Senff **n. sp.**
Text-figures 2a-e, 3a-d

*Etymology:* Named after the Valle del Cauca, where the coprolites were found.

*Holotype:* The specimen illustrated in text-fig. 2c, thin section no. M-12, stored at the Institut für Angewandte Geowissenschaften, Fachgebiet Paläontologie, Justus-Liebig-Universität, Diezstrasse 15, D-35390 Giessen.

*Type locality:* Nameless eastern confluent of the Quebrada La Mina (text-fig. 1).




TEXT-FIGURE 1
Location and geological situation of the finding site.

*Type level:* Basal Nogales Formation (Campanian to Maastrichtian), Colombia, South America.

*Differential-Diagnosis: Palaxius caucaensis* n. sp. differs from all other species of *Palaxius* by the arrangement of its canals.

*Description: Palaxius caucaensis* n. sp. is characterized in cross sections by a subcircular to circular shape and by four longitudinal canals which are crescent shaped. The four canals form two bilateral-symmetrically arranged groups with two canals each (text-figs. 2, 3, 4a). The "dorsal" pair of canals lies closer to the symmetrical-plane of the coprolite than the "ventral" pair. The "ends" (terminology based on thin section observation) of each of the canals are blown up and are almost circular.

The direction in which the concave part of a single canal points, is illustrated by an arrow as shown in text-fig. 4. In *P. caucaensis* n. sp. the concave parts of the "ventral" pair of canals point to the center of the coprolite, the concave parts of the "dorsal" canals point slightly to the dorsal side (text-fig. 4a). This mode of canal arrangement is unique within the genus *Palaxius*.

The diameters of the observed coprolites are between 0.3 and 1.5mm (text-fig. 2). All size stages show the same shape and arrangement of canals. The size differences can be explained by the size of the producing crustaceans as discussed by Blau and Grün (1989) for *Palaxius salataensis* Brönnimann et al. (1972b), and disproves the opinion of Senowbari-Daryan and Kuss (1992, p. 134) that the size of crustacean microcoprolites can be used for differentiation at the species-level. In our opinion, statistical values offer no further argument for species determination. Two size clusters within a statistical number of individuals can be explained by two producing organisms with different sizes.

*Preservation:* The sediment which yields the coprolite fauna consists of various clastic layers, which differ in the clast orientation and in the kind of matrix. In the lower part of text-figure 5, a bright layer can be observed. This layer consists of grain-supported quartz grains and few feldspars. Elongated grains show a slight imbrication. The matrix is fine-grained quartz.

The layer which follows above consists of mud-supported quartz grains, feldspars and rock fragments. Plant remains occur frequently. The matrix is recrystallized calcareous micrite. This layer is bioturbated and yields a bivalve shell (text-fig. 5) which contains the crustacean coprolites and is completely filled with secondary siliceous material. The preservation of the coprolites in the high energy environment was possible because they were protected inside the bivalve shell. The coprolites either are diagenetically silicified (text-fig. 2a, c) or show the original micritic structure (text-fig. 2e, d). The silicified specimens are best preserved.

*Comparisons:* Within the genus *Palaxius* two more species with four canals are known: 1) *P. salataensis* Brönnimann et al. (1972b) and 2) *Palaxius tetraochetarius* Palik (1965). The difference between these species lies in the arrangement and shape of the canals and in the direction to which the concave parts of the canals point.

In *P. salataensis* the arrangement of the canals is more or less circular (text-fig. 4c) and they lack blown up parts at the ends. The concave parts of all canals point to the center of the coprolite.

*P. tetraochetarius* resembles *P. caucaensis* in the spacial position of the canals, but the dorsal canals face to the center of the coprolite. The canals are bar-shaped (text-fig. 4b) and resemble the shape of the canals in *P. montemeranoensis* Blau and Grün (1989).

## ACKNOWLEDGMENTS

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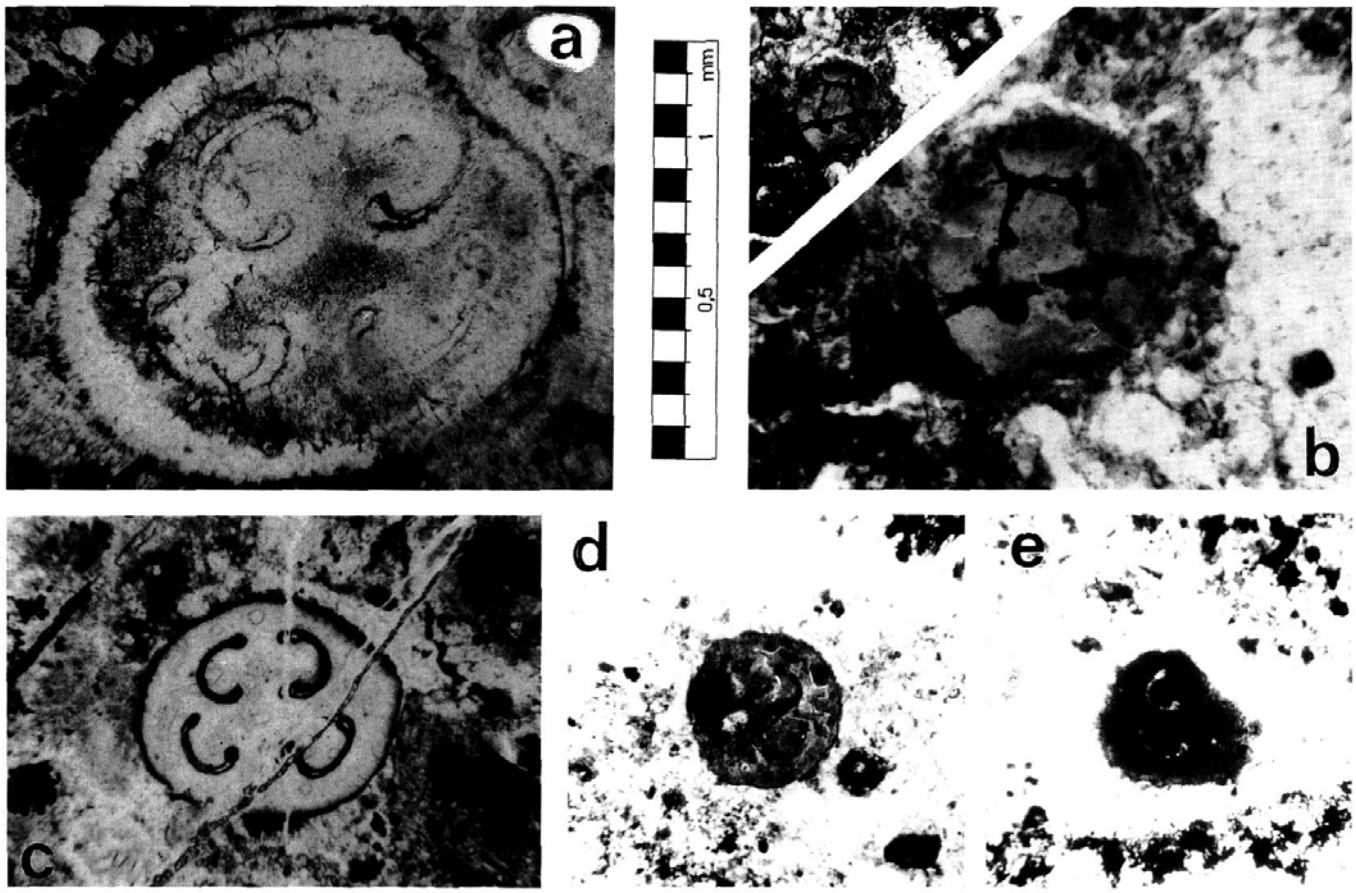


TEXT-FIGURE 2a-e
*Palaxius caucaensis* n. sp. The figure demonstrates the variability in the size of the coprolites. The scale is valid for figures a, c-e and for the inset in figure b. The specimen illustrated in figure b is slightly compressed due to diagenesis.

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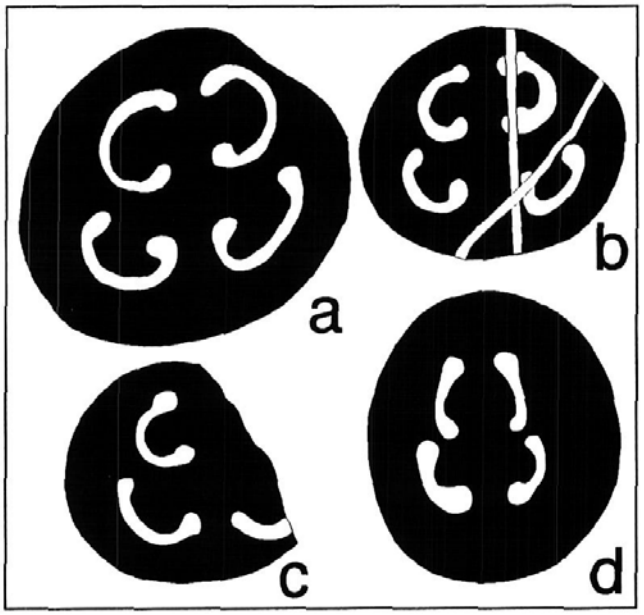
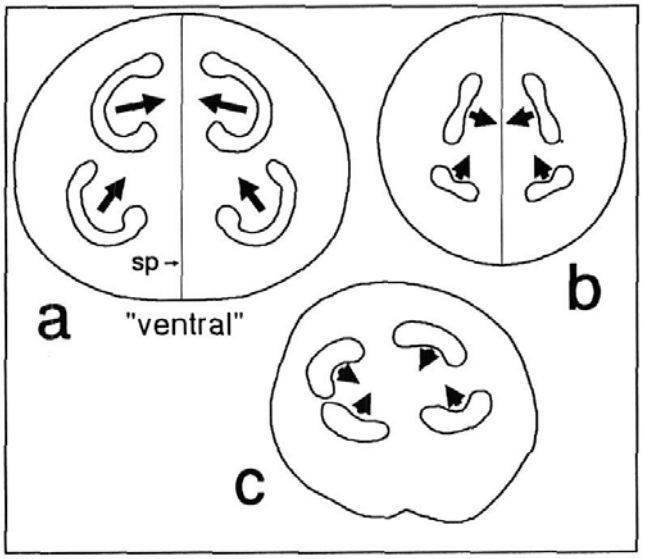
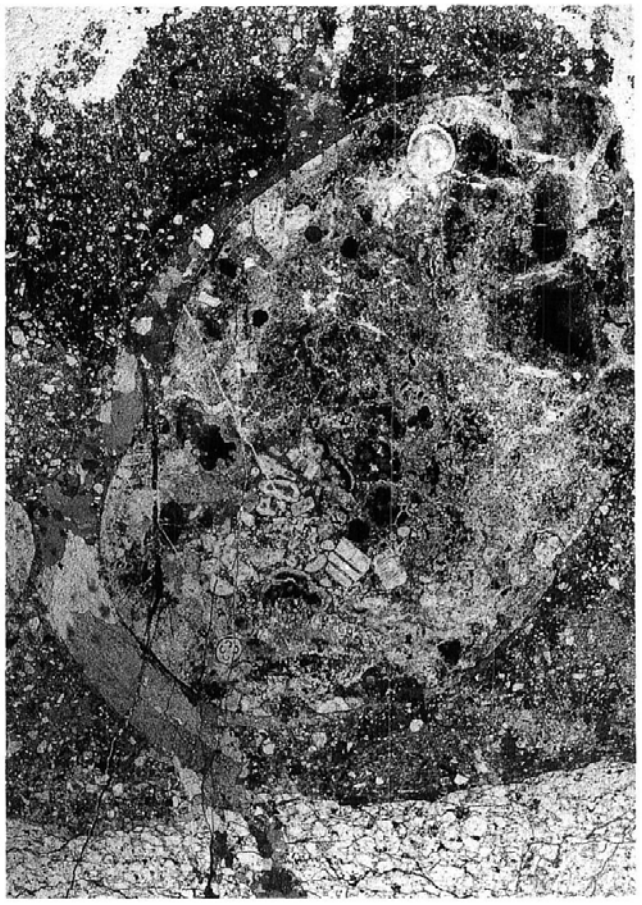



TEXT-FIGURE 3a-d
*Palaxius caucaensis* n. sp., drawn after text-fig. 2 (not to scale).




TEXT-FIGURE 4
Comparative drawings of the three known species of *Palaxius* with four canals. The arrows indicate the direction in which the concave parts of the canals point. sp = symmetrical plane, (not to scale). a: *Palaxius caucaensis* n. sp.; b: *Palaxius tetraochetarius* Palik (1965), redrawn after Palik (1965: plate 2, fig. 9, *left specimen*); c: *Palaxius salataensis*, Holotype redrawn after Brönnimann et al. (1972b).



TEXT-FIGURE 5
Photomicrograph of the thin section containing the crustacean coprolites. At the base, a bright layer is visible, followed by a bioturbated layer containing a bivalve shell. The sediment within the shell contains the coprolites. Magnification ×5.7.

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