TULANE STUDIES IN GEOLOGY AND PALEONTOLOGY

Volume 29, Number 4 February 26, 1997

A NEW SPECIES OF *CALYPTRAPHORUS* (MESOGASTROPODA:STROMBIDAE) FROM THE MAASTRICHTIAN OF SOUTHERN MEXICO; SOME PALEOBIOGEOGRAPHIC AND EVOLUTIONARY IMPLICATIONS

MARIA DEL CARMEN PERRILLIAT and FRANCISCO J. VEGA

INSTITUTO DE GEOLOGÍA, UNIVERSIDAD NACIONAL AUTONÓMA DE MÉXICO
CIUDAD UNIVERSITARIA, COYOACÁN
MÉXICO, D.F., MÉXICO.

I. ABSTRACT

A new species of strombid gastropod is described from the lower Maastrichtian deposits from the Mexcala Formation, Guerrero State, southern México. More than 300 specimens of the new species were collected at one locality. The specimens include all stages of development, from juveniles to adults.

Paleobiogeographic and evolutionary analysis for the genus of this gastropod suggests that it had a wide distribution around the Tethyan Province, and that after the K-T event, the genus migrated northward, until the Eocene, when it became extinct.

II. INTRODUCTION

A diverse, poorly known, and well-preserved Maastrichtian molluscan fauna has been recently restudied from intensive sampling at a few localities from the Upper Cretaceous Mexcala Formation in Guerrero State, southern México. The first report of this fauna included only illustrations, without description, of 15 gastropod species (Alencáster, 1980), some of which were misidentified.

The diversity of groups present at these localities includes planktic and benthic foraminiferans, corals, gastropods, nautiloids, ammonites, bivalves, scaphopods, annelids, crustaceans, echinoids, and vertebrate remains. This material was collected at three outcrops, located 125 km south of México City, and 70 km southeast of Iguala (Fig. 1), near a town locally known as Texmalac.

The lithology consists of light-brown marls, becoming sandier and blue to gray-green toward the top of the sequence, as the abundance and diversity of fossils also decreases. It is interesting to note that several meters above the main localities, gastropods are the only group present, and their sizes are larger compared with samples of the same species at the levels with more abundance.

The Mexcala Formation is very complicated structurally and lithologically. Its outcrop areas include the states of Morelos, México, Guerrero, and Puebla. It was defined by Fries (1960, p. 2), based on the type section proposed by Bohnenberg-Thomas (1955), as a flysch sequence of about 1,220 meters of rhythmic alternation of coarse and fine clastics, with lateral and vertical variations. The Mexcala Formation is extremely folded and faulted at the area of study. It ranges in age from the Turonian, exposed in the central portion of Guerrero State (Bohnenberg-Thomas, 1955; Böse, 1923; Dávila-Alcocer, 1974; González-Arreola, 1977; López-Ramos, 1983; Perrilliat-Montoya, 1974) to the Maastrichtian, exposed to the northeast of Guerrero State (Alencáster, 1980; de Cserna *et al.*, 1980; Ortega-Gutiérrez, 1980).

In a second paper on the Texmalac fauna, Vega and Feldmann (1992) reported a new species of retroplumid crab. In this paper, a more extensive discussion on the paleoenvironment is given, as well as some implications on the paleobiogeographic significance of that genus of crab. Some palynomorphs are also reported, and some were recognized as typical of the paleoflora of South America (Enrique Martínez, pers. comm.). Planktic foraminiferans from the studied localities include *Gansserina gansseri, Rosita fornicata, Globotruncana ventricosa, Globotruncana linneiana, Rugoglobigerina rugosa, Hedbergella mon-*

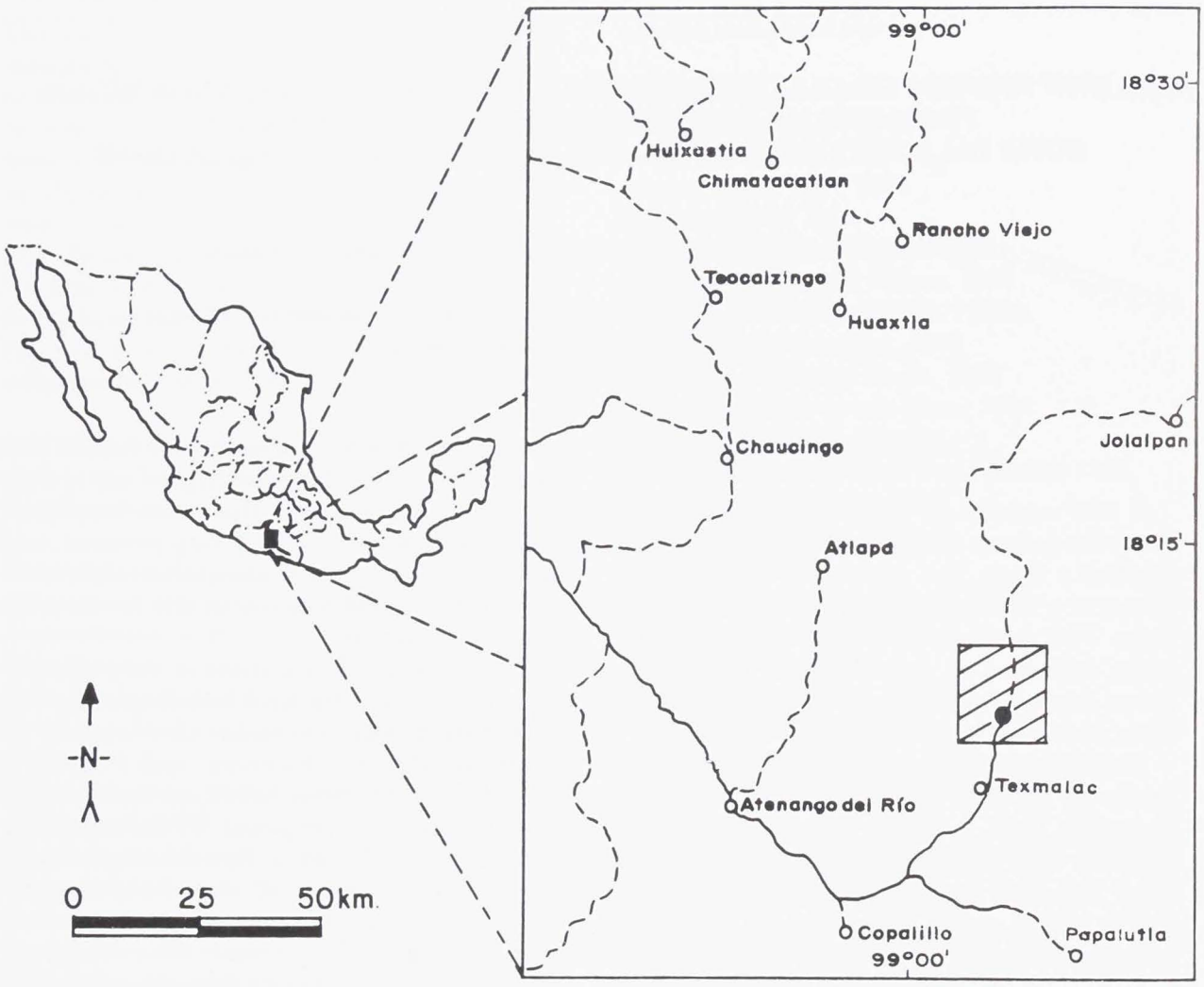

Figure 1. Location map of the studied area (framed) at outcrops from the Mexcala Formation near Texmalac, Guerrero.

mouthensis, Globigerinelloides prairiehillensis, Heterohelix globulosa, and *Pseudotextularia nuttalli.* These species are indicative of a lower Maastrichtian age (Brian Huber, pers. comm.).

Alencáster (1980) suggested a close relationship between the Texmalac fauna and the faunas of the Atlantic and Gulf Coastal Plains. Preliminary systematic studies on certain gastropods and bivalves from Texmalac (Salceda *et al.*, 1995; Vega and Perrilliat, 1995; Vega *et al.*, 1995) suggest paleobiogeographic affinities with the Atlantic and Gulf Coastal Plains, but also with the Caribbean and Tethyan Provinces. More than 25 species of gastropods and 10 species of bivalves have been identified, However, among the gastropods there are some specimens which seem to belong to new genera and new species. Among these, the new species described herein represents one of the most abundant gastropods, including nearly all sizes from juveniles to adults, the latter recognized by the development of a callus that covers the spire completely.

III. SYSTEMATIC PALEONTOLOGY

Phylum MOLLUSCA Linnaeus, 1758
Class GASTROPODA Cuvier, 1797
Subclass PROSOBRANCHIA
Milne-Edwards, 1848
Order MESOGASTROPODA Thiele, 1925
Family STROMBIDAE Rafinesque, 1815
Genus CALYPTRAPHORUS Conrad, 1857

Calyptraphorus CONRAD, 1857, Acad. Nat. Sci. Philadelphia, Proc., v. 9, p. 166.

Type species: Rostellaria velata Conrad, 1833, by subsequent designation, Cossmann, 1904. Eocene; Claiborne, Alabama.

CALYPTRAPHORUS BINODIFERUS
Perrilliat and Vega, n. sp.
Plate 1, figures 1-8
Plate 2, figures 1-8

Description: Shell medium-sized. Protoconch with three, rounded smooth whorls; teleoconch with seven rounded whorls. Sculpture of shell consisting of numerous axial ribs; first whorl with 30 axial, rounded, prosocline ribs; interspaces as wide as ribs. On next whorls ribs lessen, on one whorl 14, on the next 12, with interspaces wider than ribs. On last whorl ribs disappearing, with shell practically smooth. Weak spiral ribs present on spire, being more pronounced near suture. Suture impressed. Aperture not preserved in any specimen. Callus covering entire surface of shell. Canal extending upward, forming a curved channel through the callus, not covering first three whorls of spire; then curving downward. Callus irregularly thickened on either side of groove. The most distinctive feature of the species being the presence of two nodes on the body whorl, one near aperture and another near the canal. No sculpture on the side of body whorl opposite the nodes, with exception of spiral striae near suture.

Holotype: IGM 5887, height 32.5 mm, diameter 17.4 mm.

Paratype: IGM 5888, height 29.2 mm, diameter 19.8 mm.

Type locality: IGM 2448; 125 km south of México City, near the borderline between the states of Puebla, Morelos, and Guerrero. Access from México City is via Highway 95, México-Acapulco. About 5 km beyond Iguala, Guerrero, a crossroad leads to Atenango del Río. From this point, a dirt road to the northeast passes beside Texmalac. About 5.5 km beyond Texmalac, a roadcut on the left side exposes bright brown marls, with a diverse molluscan fauna. The locality is registered in the Locality Catalogus of the Museo de Paleontología of the Instituto de Geología, at the Universidad Nacional Autonóma de México (UNAM).

Occurrence: Mexcala Formation. México; lower Maastrichtian.

Etymology: The name of the species is based on the presence of two nodes on the last whorl.

Discussion: The Mexican specimens have no similarities to any species that have been described from the Upper Cretaceous elsewhere. *Rostellaria palliata* Forbes (1846, p. 129, pl. 13, fig. 15), from the Cretaceous of Pondicherry, India, has a shell that, when full grown, becomes enveloped by the callus, which envelops it so that only the body whorl and part of the first three volutions are exposed. The surface is smooth and polished. Stoliczka (1868, p. 34, pl. 2, figs. 18-20) recorded this species from the Trichinopoly and Arrialoor Groups (Maastrichtian) of South India. These specimens are more inflated, and they have neither tubercles, nor nodes, nor axial ribs.

Rostellaria palliata Forbes also has been reported from the Maastrichtian and Danian from Tunisia, North Africa (Pervinquière, 1912, p. 30, pl. 2, figs. 12-16); from the Senonian of Madagascar as *Rostellaria (Calyptraphorus) palliata* Forbes (Cottreau, 1922, p. 161, pl. 15, figs. 16-19); and from the Upper Cretaceous of Madagascar (Basse, 1932, p. 168, 1933, pl. 10, figs. 11-13) as *Rostellaria (Cyclomolops) palliata* Forbes.

From the Maastrichtian of Jamaica, Trechmann (1927, p. 39, pl. 4, fig. 29) described *Rostellaria (Calyptraphorus)* sp., on the basis of an incomplete specimen, with only some badly preserved whorls of the spire but the callus may be seen. It does not show sculpture. Sohl (1987, p. 1101) also mentioned a new species of *Calyptraphorus* from the Maastrichtian of Ducketts Crossroads Area of Jamaica, without any description.

Our material differs from *Calyptraphorus hopkinsi* Olsson (1934, p. 68, pl. 10, fig. 2; 1944, p. 96, pl. 15, figs. 8, 12) from the Monte Grande Formation (Upper Cretaceous) in Monte Grande, northwestern Peru. These specimens are not wholly covered by the callus. The first whorls of the spire have axial ribs that disappear and the surface of the whorl becomes smooth. The body whorl does not develop nodes.

From the Gramame Formation, Pernambuco, Brasil, Muñiz (1993, p. 128, pl. 11, figs. 5, 8) described *Calyptraphorus*

itamaracensis, of supposed Campanian age, which would be the most ancient species of this genus. The sculpture consists of axially curved opistocyrt ribs, present on the first whorls. This species does not possess tubercules or nodes on the body whorl, differing in this respect from the Mexican specimens.

From the Paleocene and Eocene there are several species of this genus. Specimens of *Calyptraphorus septentrionalis* Stanton (1920, p. 39, pl. 7, figs. 5a-5d, 6), from the Cannonball Marine Member, Lance Formation at Cannonball River, North and South Dakota, have spiral striae and curved ribs, which are obsolete on the last whorls in immature specimens. In mature specimens, a thick callus completely covers the frontal side of the spire, and a thin deposit is found at the dorsal side.

From the lower Eocene there are several species that should be mentioned because they present similarities with the Mexican specimens. *Calyptraphorus trinodiferus* Conrad (1857, p. 166), from the Eocene of Alabama, presents a peculiar accumulation of the callus as three irregular nodes. The middle one is the largest and is formed in the central part of the back of the shell. The other two nodes occur at the beginning and ending of the posterior canal. The Mexican specimens have only two nodes. They differ from *Calyptraphorus indicus* Cossmann and Pissarro (1909, p. 44, pl. 5; figs. 1, 2; pl. 8, figs. 3, 3a) and *Calyptraphorus hollandi* Cossmann and Pissarro (1909, p. 45, pl. 4, fig. 20) from the Eocene of India, neither of which has nodes.

From the Eocene of Maria Farinha, Province of Pernambuco, Brazil, *Calyptraphorus? chelonites* (White, 1887, p. 174, pl. 11, figs. 17-19), has small shells lacking nodes and the number of whorls is indistinguishable.

The differences between our material and *Calyptraphorus velatus nodovelatus* Palmer (1937, p. 243, pl. 32, figs. 1-3, 5, 9), from the Eocene of Alabama, are that this species presents more nodes, and a medium, irregular node near the beginning of the posterior canal, such as in *C. trinodiferus*; an elongated node occurs in the opposite side near the canal's terminus. Callus swellings of irregular size occur also on opposite sides of the body whorl. Examples of *C. jacksoni* Clark (1896, p. 68, pl. 12, figs. 2a, 2b), from the Paleocene of Aquia Creek, Maryland, lack nodes on the body whorl, and are larger than the specimens from Guerrero.

From the Paleocene and Eocene of Nuevo León and Tamaulipas in northeastern México, Gardner described *Calyptraphorus popenoe* (Gardner, 1945, p. 166) from the Midway Formation, in Agualeguas and Cerralvo, Nuevo León, and *Calyptraphorus carrizensis* (*ibid.*, p. 167, pl. 17, figs. 11, 18, 21; pl. 27, fig. 6) from the Eocene Carrizo Sandstone of Alamo River, Tamaulipas-Nuevo León; this species is characterized by its small size, relatively slender outline, and flattened aperture. Paredes-Mejía (1989, p. 191-195) mentioned the presence of two new species of *Calyptraphorus (Calyptraphorus)* (spp. A and B) from the Paleocene Bateque Formation, Baja California. These species are different from the material here described, by being bigger in size, lacking nodes and having four to five whorls.

IV. PALEOBIOGEOGRAPHY AND EVOLUTION

As stated above, Upper Cretaceous

PLATE 1

Figures

1-8. *Calyptraphorus binodiferus* Perrilliat and Vega, n. sp.
1,2. (X 1.8) IGM 5887 (holotype); height 32.5 mm, diameter 17.4 mm.
3. (X 2.05) IGM 5888 (paratype); height 29.2 mm, diameter 19.8 mm.
4,5. (X 1.8) IGM 5889 (paratype); height 33.4 mm, diameter 22.1 mm.
6,7. (X 2.65) IGM 5890 (paratype); height 21.9 mm, diameter 11.9 mm.
8. (X 2.4) IGM 5891 (paratype); height 25.3 mm, diameter 11.7 mm.
Locality of all: IGM 2448, Mexcala Formation, Guerrero, México.

PLATE 1

species of *Calyptraphorus* have been reported from Jamaica, Peru, Brazil, Tunisia, Madagascar, and India. The oldest species is *C. itamaracensis* from the Campanian of Brazil. No species from the Upper Cretaceous possess nodes on the body whorl, except for *C. binodiferus* n. sp. The other species of this genus, which do show nodes are *C. trinodiferus* and *C. velatus nodovelatus*, both from the Eocene of Alabama. Considering development of nodes as an evolutionary trend into a phyletic line of *Calyptraphorus*, it seems reasonable to propose that *C. binodiferous* is the ancestral species, which gave rise to the nodose Eocene species (Fig. 2).

It is evident that during the Late Cretaceous, *Calyptraphorus* had a wide distribution, all around the Tethyan Province. Although during early Tertiary time some species prevailed in this province (*Rostellaria palliata*, Paleocene of Tunisia; *Calyptraphorus indicus* and *C. hollandi*, Eocene of India; *Calyptraphorus? chelonites*, Eocene of Brazil), there was an expansion of the distribution northward in North America, to the Pacific realm (*Calyptraphorus* spp. A and B, Paleocene of Baja California), the Western Interior (*C. septentrionalis*, Paleocene of North and South Dakota), and to the Atlantic and Gulf Coastal Plains (*C. jacksoni*, Paleocene of Maryland; *C. popenoe*, Paleocene of northeastern México; *C. carrizensis*, Eocene of northeastern México; *C. trinodiferus, C. velatus,* and *C. velatus nodovelatus*, Middle Eocene of Alabama; *C. stamineus*, Late Eocene of Louisiana and Mississippi). Along with this northward migration, there was an increase in size and of amount covered by the callus, as compared with the size and morphology between Cretaceous and Tertiary species.

Figure 2 summarizes paleobiogeographic distribution and possible phyletic relationships between Cretaceous and Tertiary species of *Calyptraphorus*. It seems important to note that genus-level survivorship across the K-T boundary and northward migration to the Pacific realm and Gulf Coast Plain also has been registered for crustacean genera such as *Lophoranina*, which also had a Tethyan distribution during Late Cretaceous, and migrated during early Tertiary to Baja California, Alabama, Europe, the Middle East, and the Indo-Pacific, becoming extinct by Oligocene time (Feldmann *et al.*, 1996). There are more groups like these to be restudied and reevaluated in terms of paleobiogeographic, biostratigraphic and evolutionary implications. Most gastropods at the studied area show strong spines and/or nodes. This feature could be related to a high predation pressure, mainly by crustaceans and other gastropods. It seems important to continue searching for poorly known Maastrichtian and early Tertiary faunas.

V. ACKNOWLEDGMENTS

The authors would like to express their gratitude to the Dirección General de Apoyo al Personal Académico de la UNAM, who provided financial support for this research. Special thanks to Emily H. Vokes (Department of Geology, Tulane University) for her support and revision of the manuscript. David T. Dockery III (Mississippi Department of Environmental Quality) made useful suggestions to improve the manuscript. Photographs were taken by Mr. Antonio Altamira (Laboratorio de Fotografía, Instituto de Geologia, UNAM). The map and figure were elaborated by Fernando Vega (Taller

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PLATE 2

Figures

1-8. *Calyptraphorus binodiferus* Perrilliat and Vega, n. sp.
1,2. (X 2.5) IGM 5892 (paratype); height 24.1 mm, diameter 12.7 mm.
3. (X 3.0) IGM 5893 (paratype); height 20.5 mm, diameter 9.9 mm.
4. (X 3.3) IGM 5894 (paratype); height 18.5 mm, diameter 8.7 mm.
5. (X 2.06) IGM 5895 (paratype); height 29.6 mm, diameter 14.7 mm.
6. (X 2.4) IGM 5896 (paratype); height 25.4 mm, diameter 13.2 mm.
7,8. (X 2.5) IGM 5897 (paratype); height 23.7 mm, diameter 12.4 mm.
Locality of all: IGM 2448, Mexcala Formation, Guerrero, México.

PLATE 2

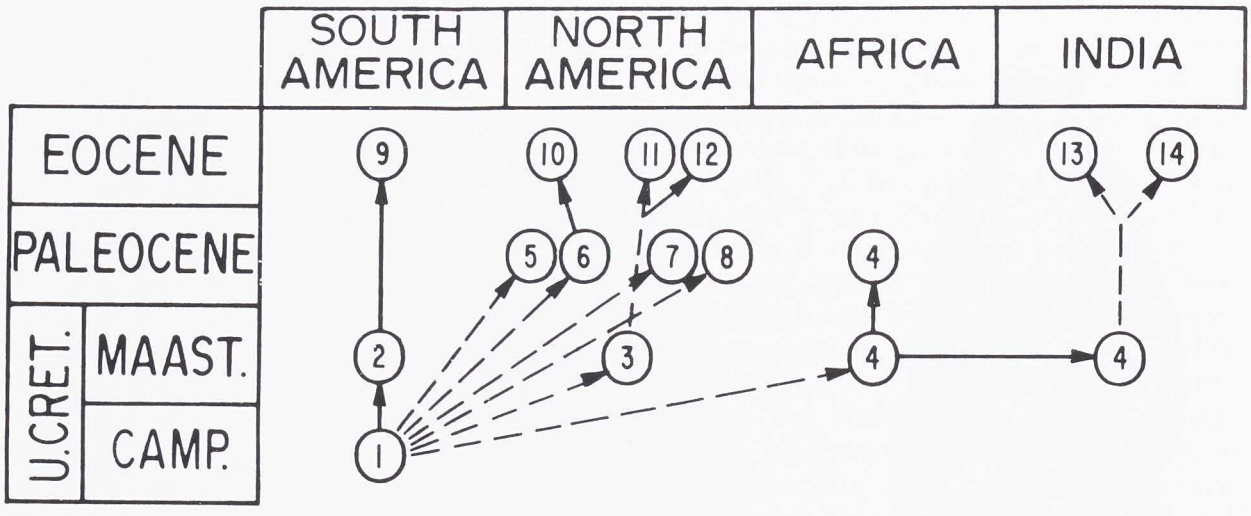

Figure 2. Paleobiogeographic and evolutionary table for species of *Calyptraphorus* from Late Cretaceous to early Tertiary. 1, *C. itamaracensis* (Campanian, Brazil); 2, *C. hopkinsi* (Maastrichtian, Peru); 3, *C. binodiferus* (Maastrichtian, México); 4, *Rostellaria palliata* (Maastrichtian, Madagascar; Maastrichtian and Paleocene, Tunisia); 5, *Calyptraphorus* spp. (Paleocene, Baja California, México); 6, *C. popenoe* (Paleocene, Nuevo León, México), 7, *C. septentrionalis* (Paleocene, North and South Dakota); 8, *C. jacksoni* (Paleocene, Alabama), 9, *Calyptraphorus? chelonites* (Eocene, Brazil); 10, *C. carrizensis* (Eocene, Tamaulipas, México); 11, *C. trinodiferus* (Eocene, Alabama); 12, *C. velatus nodovelatus* (Eocene, Alabama); 13, *C. indicus* (Eocene, India); 14, *C. hollandi* (Eocene, India).

de Dibujo, Instituto de Geología, UNAM). We are grateful to Mr. Luis Burgos for his usual kindness.

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