# ON A NEW SPECIES OF *VENERICARDIA* FROM THE LOWER EOCENE IN NORTHEASTERN MEXICO (DIFUNTA GROUP)

FRANCISCO J. VEGA
and
MARIA DEL CARMEN PERRILLIAT
*INSTITUTO DE GEOLOGIA*
*UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO*

## I. ABSTRACT

*Venericardia (Venericor) elongata*, n. sp., from the lower Eocene of northeastern Mexico, associated with *Venericardia (Venericor) planicosta* and *Turritella mortoni postmortoni*, is the first fossil described from the Adjuntas Formation.

The paleoenvironmental analysis suggests that conditions of geographic isolation were propitious for the speciation of this locally distributed species.

## II. INTRODUCTION

The Difunta Group represents an Upper Cretaceous-Tertiary transition of terrigenous sediments that were deposited in two sedimentary basins in northeastern Mexico, known as the Parras and La Popa basins (McBride *et al.*, 1974). The group is subdivided into 13 formations, with the proposed stratigraphic range for the Difunta Group being Campanian to Paleocene. Recent studies have revealed the existence of lower Eocene beds (Ypresian or Wilcox) in the Adjuntas Formation of the La Popa basin (Vega and Perrilliat, 1986).

The geographic distribution of the Difunta Group extends to east of Torreón, Coahuila, north of Saltillo, Coahuila, northwest of Monterrey, Nuevo Leon, and southeast of Monclova, Coahuila. The La Popa basin is located between 25°55′-26°40′ N lat. and 100°40′-101°10′ W long. (Fig. 1).

Several paleontological studies have been made on units in the Difunta Group. Imlay (1937) described some molluscan species from the Senonian of Laguna de Mayrán, Coahuila, and Wolleben (1977) reported 52 invertebrate species collected in formations of the Difunta Group. Of these species, the youngest are the Paleocene nautiloids *Cimomia haltomi* (Aldrich) and *Hercoglossa* sp. aff. *H. fricator* (Beck), found in the Rancho Nuevo Formation (Parras basin), considered as the uppermost unit of the Difunta Group. A Maastrichtian age was assigned to the Adjuntas Formation (McBride *et al.*, 1974; Wolleben, 1977; Laudon, 1984), but Eocene molluscan species have been reported in recent studies (Vega and Perrilliat, 1986). The marine Eocene deposits from the La Popa basin is the westernmost report of rocks of this age in northeastern México. The eocenic strata of northeastern Nuevo León contain venericardian species such as *Venericardia (Venericor) cacamai* Gardner and Bowles, *V. (V.) zapatai* Gardner and Bowles, *V. (V.) densata malinchae* Gardner and Bowles, *V. (V.) hatcheplata* Gardner and Bowles, *V. (V.) diga* Gardner and Bowles. *Venericardia (V.) densata* Conrad was reported from northern Tamaulipas by Gardner and Bowles (1939) and Perrilliat (1963). None of these species was found in the Adjuntas Formation, which, however, contains abundant specimens of *V. (V.) planicosta*, widely distributed in the lower Eocene strata of the world.

The material here described was found in outcrops of the Adjuntas Formation, in an anticlinal structure known regionally as "Cerro La Carroza" (Fig. 2). The Adjuntas Formation is underlain by the Potrerillos Formation. The lower three members of the Potrerillos are Maastrichtian in age, while the upper two belong to the Paleocene (Vega, 1987a; 1987b). The Adjuntas Formation is overlain by the Viento and Carroza formations (Fig. 3). The scarcity of fossils in these formations make dating difficult.

The type section of the Adjuntas Formation is located in a stream east of Cerro la Carroza, with an approximate thickness of 260 m (McBride *et al.*, 1974). The lithology is chiefly red beds, but also present are green, yellow, and gray beds. The gray strata are present at the base and top of the formation and contain an abundant but not diverse macro-invertebrate fauna. *Venericardia planicosta* Lamarck and *Turritella mortoni postmortoni* Conrad are present as part of this fauna (Vega and Perrilliat, in press). These two species are

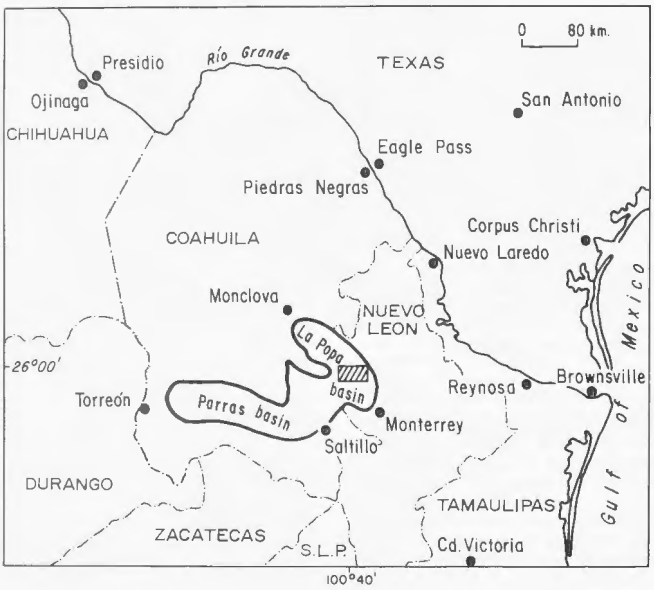


Figure 1. Location map of the Parras and La Popa basins (Difunta Group) in northeastern Mexico. Study area is diagonally ruled.

index fossils for the Ypresian (lower Eocene) deposits of the Atlantic and Gulf Coastal Plain (Shimer and Shrock, 1944). Associated with these molluscan species are a few ostreids and the bivalve here described. The green beds at the base of the formation contain nodules not greater than 20 cm in diameter and many gastropods, which will be the object of another report.

## III. PALEOENVIRONMENT

The red, green, and yellow beds of the Difunta Group have been interpreted as deltaic plain deposits, represented as mudstones, siltstones, and, in minor amounts, sandstones. These sediments were deposited in a subhumid-semiarid climate, with seasonal episodes of dry conditions (McBride, 1974). The color diversity of the rocks is attributed to the following factors: 1) content of Fe and organic matter in the sediments; 2) post-depositional physio-chemical events; and 3) variations of the phreatic level and climatic conditions. Gray beds owe their color to a greater organic matter content and minor concentration of iron. These rocks represent pro-deltaic and, in lesser amounts, deltaic-plain facies. The red beds suggest oxydation of the sediments, which were exposed seasonally to dry conditions, while the green beds owe their color to a high concentration of illite and chlorite, and to reducing conditions below the phreatic level. For the green beds associated with channel-fill sandstones, a percolation of reducing water formed by accumulation and putrefaction of organic matter (fairly vegetal) in the channel water is proposed (McBride, 1974).

The abundance of infaunal deposit-feeder gastropods (cerithids) in the green mudstones suggests a brackish water environment with a high content of organic


Figure 2. Location of Cerro La Carroza in La Popa basin. Type locality is at the eastern side of the hill.

matter. The red and green beds were deposited in lagoons, estuaries and swamps, which must have contained brackish and fresh water. Shell fragments and mollusca were found in the gray beds. The molluscan species (*V. planicosta* and *T. mortoni postmortoni*) are characteristic of shallow marine environments (Woods, 1922; Park, 1968). Thus, the sedimentary cycles of the Adjuntas Formation include deltaic plain (red, green, and yellow beds), and inner shelf facies (gray beds). The environmental changes were caused by subsidence episodes, followed by deltaic progradations in which the red beds were oxydized.

Deltaic systems are characterized by a wide diversity of mineral environments, such as lagoons, estuaries, swamps and inner shelf. These environments are adequate for species with ecological restrictions that could augment speciation events, by means of geographic isolation. Park (1968, p. 978-979) proposed that the *Venericor* species seem to comprise a relatively homogeneous ecologic group, with a single optimum environment, characterized by shallow water and low-sedimentation rates. The sedimentary cycles of the Adjuntas Formation include transgression events in which the Nuevo León and other molluscan species proliferated, as the sedimentation rate of the inner shelf was very low. The morphological and paleoecological affinities between *Venericor* and *Glyptoactis* (Heaslip, 1963, Park, 1968), suggest that the Nuevo León form could be an intermediate one between these two subgenera.

## IV. ACKNOWLEDGMENTS

We are grateful to E. H. Vokes (Tulane University) for her valuable comments and critical review of the manuscript.

## V. SYSTEMATIC DESCRIPTION

Phylum MOLLUSCA
Class BIVALVIA

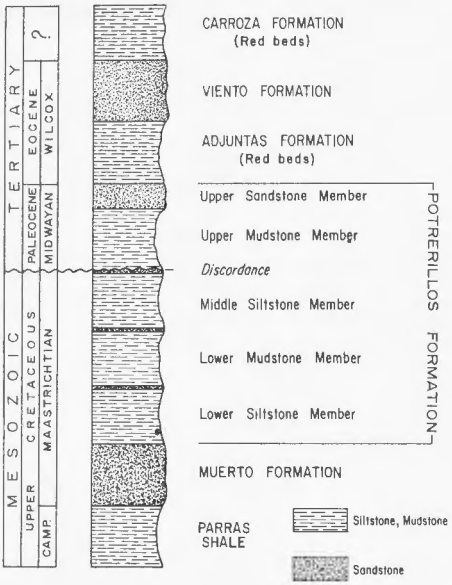


Figure 3. Composite stratigraphic column from the La Popa basin in Nuevo León State, México, showing the stratigraphic position of the Adjuntas Formation.

Order HETERODONTA
Superfamily CARDITACEA Fleming, 1820
Family CARDITIDAE Fleming, 1820
Genus VENERICARDIA Lamarck, 1801

*Venericardia* LAMARCK, 1801, Systéme des animaux sans vertèbres, p. 123.

Type species: *Venericardia imbricata* Lamarck = *Venus imbricata* Gmelin; Grignon, Seine et Oise, France; Lutetian, middle Eocene; by subsequent designation, Schmidt, 1818.

Subgenus VENERICOR Stewart, 1930

*Venericor* STEWART, 1930, Acad. Nat. Sci. Philadelphia, Spec. Pub. 3, p. 153.

Type species: *Venericardia planicosta* Lamarck; Paris Basin, Eocene; by original designation.

*VENERICARDIA (VENERICOR) ELONGATA*
Vega and Perrilliat, n. sp.
Figure 4

*Description:* Shell equivalve, inequilateral, subtrapezoidal in shape. Valves thick, inflated. Umbones prominent, well rounded, beaks in contact, prosogyrate, situated 1/3 the length of the shell from the anterior extremity. Anterior margin sharply rounded, except in the dorsal portion, where it is almost flat. Anteroventral region broadly rounded, continuous with an almost straight ventral margin, which ends in a strong angle at the posteroventral region. Posterior margin inflated and prominent. A sharply defined angular umbonal ridge, extending from the beak obliquely downward and backward to the lower posterior extremity, passing between the 19th and 20th ribs; the ridge more prominent at the middle height of the shell. Lunule deep, very small. Escutcheon large, well defined. Twenty-eight radial ribs in each valve, 20 on the medio-anterior portion and eight on the posterior. Crests of the ribs broad and flat, quadrangular in transverse section, crossed by concentric grooves to the ventral margin. Interspaces "U" shaped, crossed by numerous undulate lamellae near the ventral region; these lamellae

less conspicuous at the crest of the ribs. Interspaces well defined and representing 1/3 the width of the ribs at the ventral margin. The morphology of the hinge unknown, as all the specimens are articulated; however, the section of one specimen proved that it is clearly heterodont.

The height/length ratio of the holotype is 1.280, while the paratype is 1.285. Similar morphological characteristics, and the almost identical H/L ratio suggests that our specimens belong to the same species.

*Holotype:* IGM 4736; length 54.3 mm, height 42.4 mm, width 34.9 mm.

*Type locality:* IGM-1973, Adjuntas Formation, outcrop at the eastern side of Cerro La Carroza, approximately 16 km southeast of the town of San José de La Popa, northwest of Monterrey, Nuevo León, México.

*Paratype:* IGM 4737; length 64.4 mm, height 50.1 mm, width 40.5 mm.

*Discussion:* The Nuevo León specimens are similar to the *Venericardia planicosta* group as the ribs are broad and flat. No form of the *alticostata* group is similar to our specimens, although some authors suggest that the alticostate forms could have given rise to *Venericor* forms (Heaslip, 1963). Some members of the *planicosta* group are similar to the Adjuntas specimens in number and shape of the ribs. *Venericardia (Venericor) densata* Conrad is a extremely abundant species from the middle Eocene in Alabama, Mississippi, Louisiana, Texas, and Tamaulipas. It has an oval shape, with 26-27 ribs that are cancellate toward the ventral margin. *Venericardia (V.) tonoensis* Rutsch, 1936, has a more oval shape and the interspaces are less broad. This species is found in the middle Eocene of Panama. *Venericardia (V.) pacifica* Olsson, 1928, has a semicircular shape, 28 ribs, which are narrower than those of the Adjuntas specimens, and its interspaces are also broader. This form belongs to the middle Eocene of Peru. *Venericardia (V.) turneri* Gardner and Bowles, 1939, has the umbones more displaced toward the anterior portion, is quadrate in shape, and has 28 ribs with

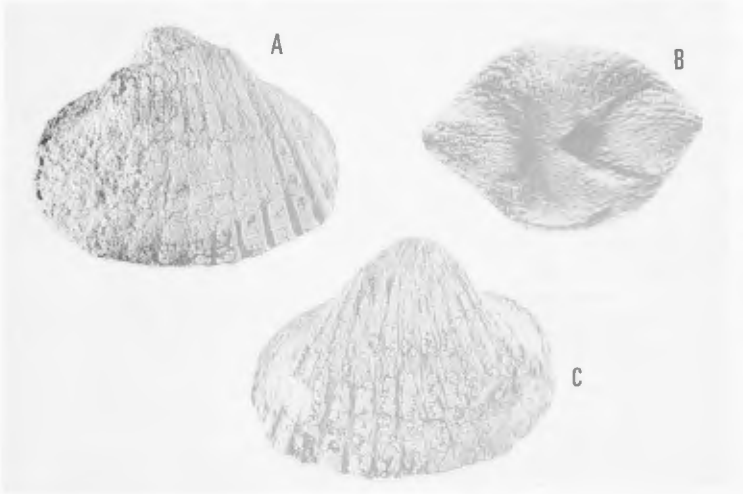


Figure 4. *Venericardia (Venericor) elongata* Vega and Perrilliat, n. sp. Holotype, IGM 4736; Length 54.3 mm, height 42.4 mm, width 34.9 mm (X 1). A, left valve; B, right valve; C, dorsal view. Locality: Adjuntas Formation, eastern side of Cerro La Carroza, approximately 16 mk southeast of San José de La Popa, Nuevo León, México.

narrow interspaces. It has been reported from the middle Eocene of Alabama. *Venericardia (V.) ascia* Rogers and Rogers, 1839, from the lower Eocene of Maryland and Virginia, has a suboval shape with 27-28 low ribs and narrow interspaces. *Venericardia (V.) claviger* Gardner and Bowles, 1939, has 27 ribs with deep, very narrow interspaces. The shape of this form is trigonal, with the posterior margin obtusely truncated. It has been reported from the middle Eocene of Alabama and South Carolina. *Venericardia (V.) mediaplata* Gardner and Bowles, 1939, from the lower Eocene of Georgia, Alabama, Mississippi, Tennessee, and Texas has a semioval shape, with 29 ribs separated by lineal interspaces. The subquadrate shape of *V. (V.) nanaplata nanna* Gardner and Bowles, 1939, and its obtusely truncated posterior margin, makes it different from the Adjuntas specimens. It also has 29 ribs separated by broad interspaces and is smaller than our specimens. That subspecies has been reported from the lower Eocene of Alabama. The subspecies *V. (V.) densata pendletonensis* Gardner and Bowles, 1939, is an excellent index fossil to the lower Claiborne of Texas. It has an oval-trigonal shape, 28-29 ribs, separated by lineal interspaces.

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December 28, 1989