

# *Lower Eocene Large Ostreids from the Viento Formation; Stratigraphic and Paleoecologic Implications for the La Popa Basin, Nuevo León, Mexico*

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## ABSTRACT

Three species of lower Eocene ostreids are reported from the Viento Formation of the La Popa Basin, Nuevo León, northeastern Mexico. Two of them are described as new: *Ostrea (Turkostrea) ventosa* new species, and *Ostrea (Turkostrea) ovata* new species. *Ostrea* sp. is also reported associated with the new forms. The large size of these species, in contrast with their small relatives from equivalent depositional environments in the underlying Adjuntas Formation, suggests that paleoclimate played an important role in their size development. These ostreids are the youngest fossils reported from the La Popa Basin, as the Viento Formation has remained undated prior to this contribution. The age suggested for the Viento Formation corresponds to the early Eocene, probably the upper part of the Ypresian.

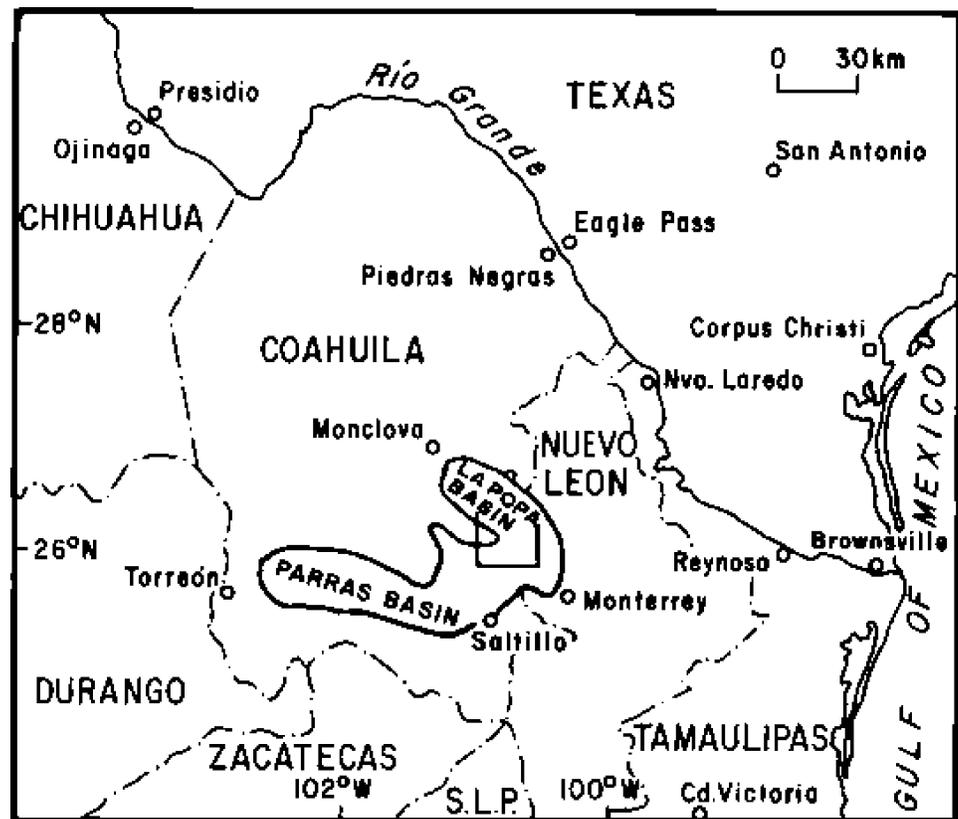
## INTRODUCTION

Ostreid bivalves probably are the most abundant fossils found in the entire Difunta Group. Located in northeastern Mexico (Figure 1), the Difunta Group (Upper Cretaceous–lower Tertiary) was accumulated in two sedimentary basins, known as the Parras and La Popa (McBride et al., 1974). The Difunta Group includes several stratigraphic units that range in age from Upper Jurassic to lower Eocene (McBride

et al., 1974; Vega et al., 1989; Giles and Lawton, 1999). Most of the Upper Cretaceous–lower Tertiary formations include paralic sequences in which ostreid banks developed in association with coastal and fluvial depositional systems. Campanian, Maastichtian, and Paleocene strata contain marine ostreids, whereas those from lower Eocene strata are found in brackish water environments.

Several Cretaceous ostreid species have been reported from both the Parras and La Popa Basins. Böse

**Figure 1.** Location map of Parras and La Popa Basins (Difunta Group) in northeastern Mexico. Framed area is illustrated in Figure 2.



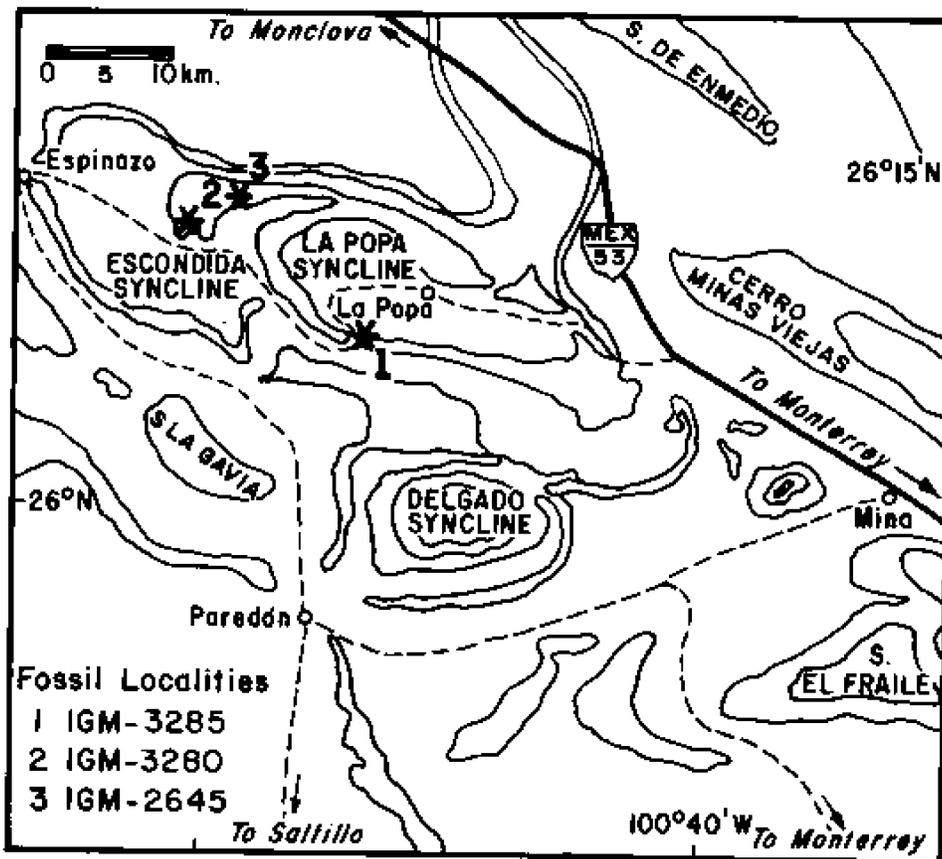
(1913) mentioned some ostreids from the Upper Cretaceous beds in the southeastern part of the Difunta Group, Coahuila. Ostreids have been shown to be useful in dating some of the formations of the Difunta Group. For the Cerro del Pueblo Formation in western outcrops of the Parras Basin, McBride et al. (1974) and Wolleben (1977) reported *Exogyra ponderosa* Römer, an index species for the Campanian. These same authors considered *Exogyra costata* Say to be an index fossil for the Maastrichtian of the Cerro del Pueblo and Cañón del Tule Formations in the Parras Basin. They also reported *Exogyra costata spinifera* Stephenson from the Maastrichtian Potrerillos Formation of the La Popa Basin. Other Maastrichtian ostreids reported from the Parras and La Popa Basins are *Pycnodonte mutabilis* (Morton), *Ostrea semiarmata* Böse, *Flemingostrea subspatulata* (Forbes), *Lopha arizpensis* (Böse), and *L. saltillensis* (Böse). *Arctostrea aguilerae* Böse has been reported from Maastrichtian strata of the Potrerillos Formation (Vega and Feldmann, 1991).

Lower Tertiary ostreids are abundant in the Parras and La Popa Basins. *Ostrea* (*Ostrea*) *parrensis* Vega, Perrilliat, and Mitre-Salazar has been reported from the Paleocene of the Las Encinas Formation in the

Parras Basin (Vega et al., 1999). In addition, four species of lower Eocene ostreids have been reported from the Ypresian strata of the Adjuntas Formation of the La Popa Basin (Perrilliat and Vega, 1993): *Ostrea* (*Turkostrea*) *strictiplicata* Raulin and Delbos, *O. (T.) duvali* Gardner, *O. (T.) escondida* Perrilliat and Vega, and *O. (?) popaensis* Perrilliat and Vega.

The material described herein was collected at three outcrops of the Viento Formation in the Escondida and La Popa synclines (Figure 2). Locality IGM 3280 is found on the northeast side of a small hill (Mesa Chivos) located 2 km north of the Escondida Ranch and 20 km northwest of the town of San José de La Popa. Locality IGM 3285 is in Rancho La Leona, approximately 1.5 km west of San José de La Popa and near the dirt road that leads from this town to Espinazo. Locality IGM 2645 is found on the northwest margin of the Escondida syncline, 2.5 km north of the Escondida Ranch and 15 km southeast of Espinazo.

Although we describe here two new species of *Ostrea* (*Turkostrea*), this subgenus has been reported solely from lower and middle Eocene deposits of Texas, northeastern Mexico, Northern Africa, and Central Asia (Stenzel, 1971). Association of the gastropod



**Figure 2.** Fossil localities in the La Popa and Escondida synclines, La Popa Basin, Nuevo León, México.

*Turritella mortoni postmortoni* Conrad with our specimens confirms a lower Eocene age for the Viento Formation. The stratigraphic range of La Popa Basin thus far known is Upper Jurassic to lower Eocene, but the Carroza Formation, which overlies the Viento Formation, is the only stratigraphic unit remaining to be dated in order to complete the stratigraphy of La Popa Basin (Figure 3).

Lower Eocene ostreids of comparable size are known only from Tunisia. It is interesting to note that the valves described here are larger and thicker than those of species of the same subgenus from the Adjuntas Formation and other parts of the world (Perrillat and Vega, 1993). Based on the lithology and associated fauna, the depositional paleoenvironments in which ostreids are found were similar in both the Adjuntas and Viento Formations. The differences in valve size and thickness may be related to an increase in the mean annual water temperature and/or the concentration of dissolved calcium carbonate in the water (Stenzel, 1971, p. 1140).

The specimens are found in banks approximately 50 cm thick, where they are articulated with both valves well preserved. Right valves are smaller

and thinner and therefore more fragile than left valves. The ostreid banks are found in rhythmic sequences approximately 20 m apart from each other (Figure 4).

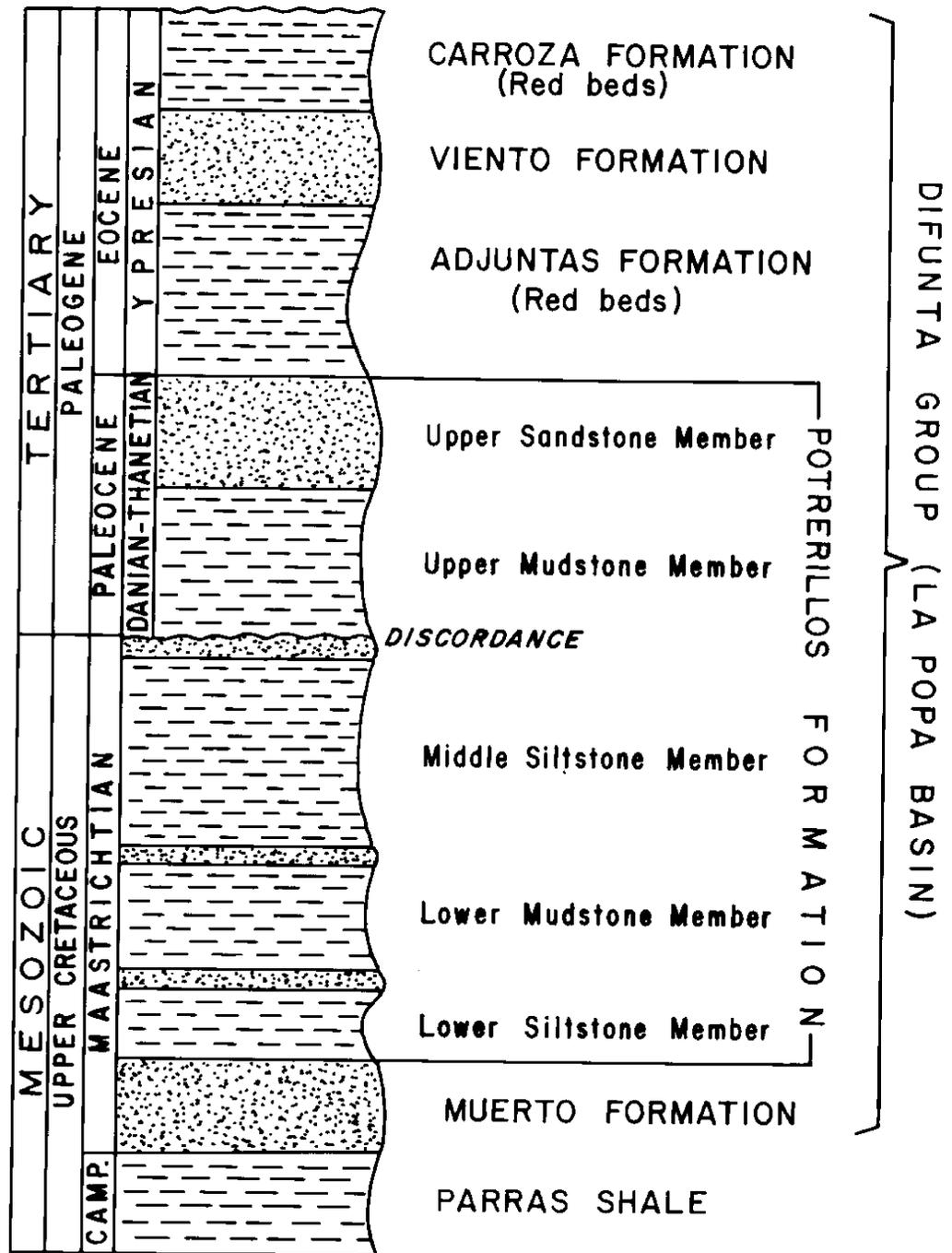
The material studied is deposited in the Museo de Paleontología of the Instituto de Geología, Universidad Nacional Autónoma de México. Types are included in the Type Collection and cataloged under the acronym IGM. The type localities are registered in the locality catalogue of the Museo de Paleontología.

## SYSTEMATIC PALEONTOLOGY

- Order Pterioida Newell, 1965
- Suborder Ostreinae Férussac, 1822
- Superfamily Ostreoidae Rafinesque, 1815
- Family Ostreidae Rafinesque, 1815
- Subfamily Ostreinae Rafinesque, 1815
- Genus *Ostrea* Linnaeus, 1758

*Ostrea* Linnaeus, 1758, Systema naturae per tria regna naturae, p. 696.

**Figure 3.** Stratigraphic section (no vertical scale) of the Upper Cretaceous and lower Tertiary formations in the La Popa Basin.



Type species: *Ostrea edulis* Linnaeus; Recent, England; by subsequent designation, Children, 1823.

(USSR, Uzbekistan); Montagne—Noire (Aude), France; Middle Eocene; by original designation.

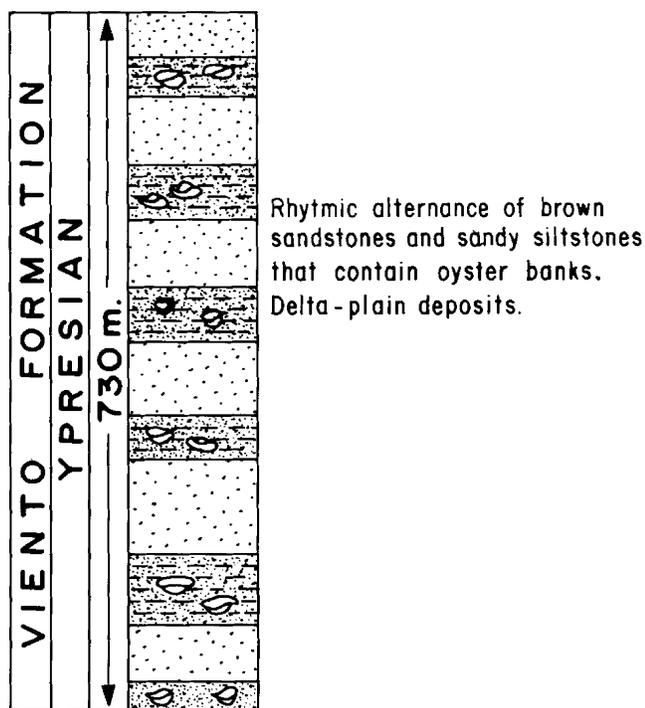
**Subgenus *Turkostrea* Vyalov, 1936**

*Turkostrea* Vyalov, 1936, Acad. Sci. USSR, Comptes Rendus (Doklady), new ser., v. 4 (13), no. 1, p. 18.

Type species: *Ostrea turkestanensis* Romanovsky = *Ostrea strictiplicata* Raulin and Delbos; Central Asia

***Ostrea (Turkostrea) ventosa* New Species**

**Description:** The shell of *Ostrea (Turkostrea) ventosa* (Figures 5.1, 5.2) is of large size, almost inequilateral, and thick. The left valve is trigonal and convex and has an ornamentation of almost 20



**Figure 4.** Composite stratigraphic section of the Viento Formation.

well-pronounced plicated, rounded, narrow radial ribs; in the lower third, they become dichotomous; the interspaces are narrow and shallow. The entire shell is covered by concentric lamellae. The umbo is elongate and opisthogyrous. The ligament area is trigonal and wide. Relict catachomata present. The adductor muscle scar is in the middle of the shell and reniform. The margin is smooth.

**Etymology:** The name of the species is related with the occurrence of this new ostreid in the Viento Formation.

**Repository:** The holotype is IGM 8094, measures 170.0 mm in height (incomplete), 145.0 mm in length, and 56.0 mm in width.

**Locality:** IGM 2645.

**Remarks:** The Mexican specimen is unlike any other species described from the Eocene of North America. The most similar species is *Ostrea strictipliata* Raulin and Delbos (1855) var. *major* Locard (1889, p. 57, 58, Plate II, Figures 1, 1a) from the Eocene of Djebel, Teldja, Tunisia, but this species has a thinner shell, more numerous radial ribs, and the interspaces are very narrow; the shell is more triangular and the umbonal region is pointed. Another difference is that the Mexican specimen does not possess ribs in the posterior third of the shell.

### *Ostrea (Turkostrea) ovata* New Species

**Description:** The shell of *Ostrea (Turkostrea) ovata* new species (Figures 5.3, 5.5, 5.6, 5.7, 6.1, 6.4) is of large size, inequivalve, and thick. The left valve is roundish in shape and very convex and has an ornamentation of almost 30 plicated, plain, pronounced, wide radial ribs; in some specimens another rib appears in the lower third; the interspaces are narrow and shallow. The entire shell is covered by concentric lamellae. The umbo is elongate and ortho to opisthogyrous. The ligament area is very big, wide, and long; present are anterior and posterior bourelets; annual growth layers are present. Relict catachomata. Insertion of the adductor muscle is present. The interior margin of the shell is not preserved.

The right valve is also roundish in shape and convex, the ornamentation is of numerous low, concentric lamellae on the whole surface of the shell. The umbo is orthogyrous, the ligament area is very wide. The adductor muscle scar is not preserved.

**Etymology:** The specific name *ovata* is related to the ovoid shape of the left valve of this new species.

**Repository:** The holotype is IGM 8095 (right valve), measures 128.5 mm in height, 123.1 mm in length, and 47.5 mm in width. The paratypes are IGM 8096 (left valve), measures 122.0 mm in height, 113.0 mm in length, and 54.1 mm in width; IGM 8097 (left valve), measures 106.0 mm in height; 107.0 mm in length, and 48.9 mm in width; IGM 8098 (left valve), measures 122.1 mm in height, 135.4 mm in length, and 75.6 mm in width.

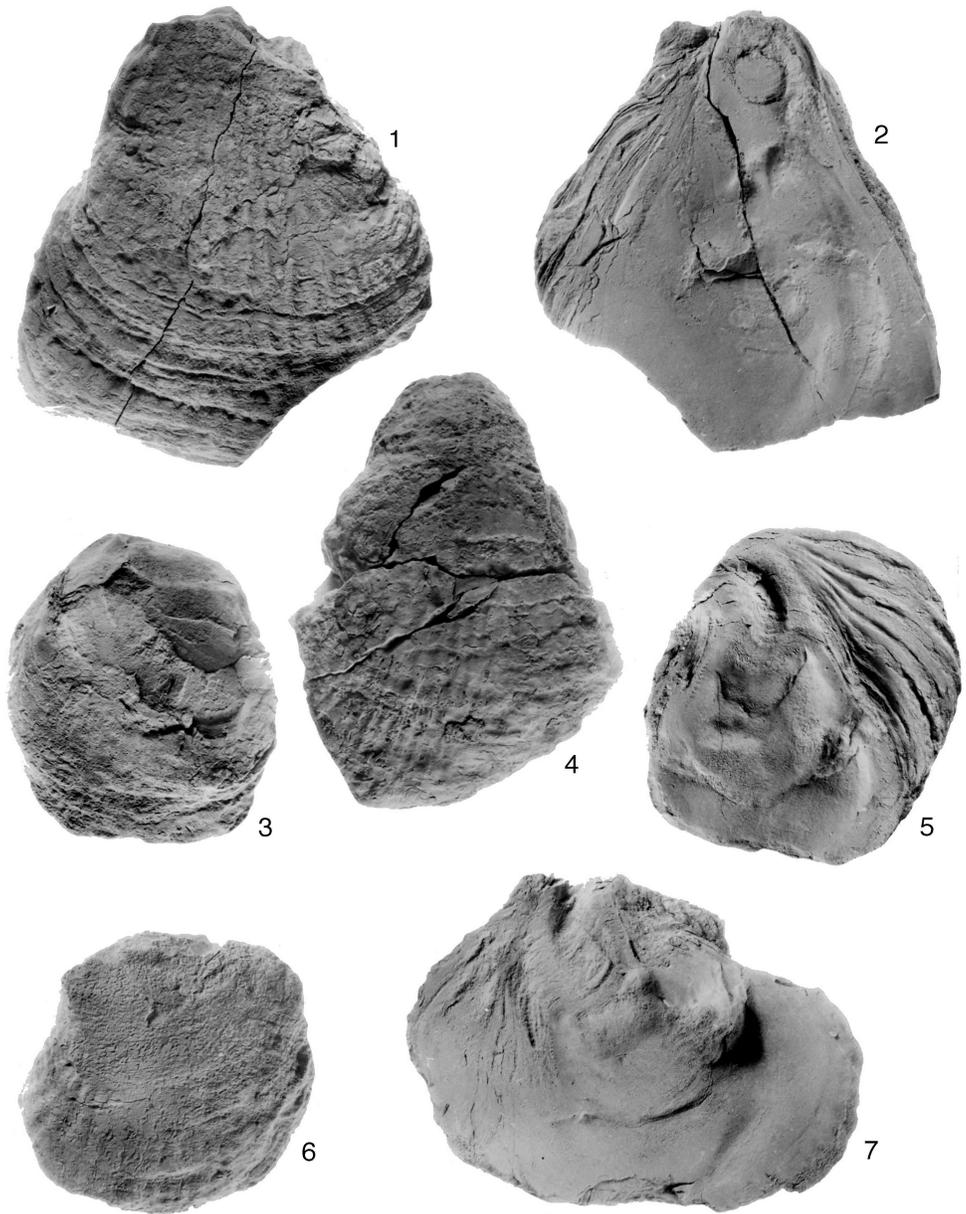
**Locality:** IGM 3280, IGM 3285.

**Remarks:** The Mexican specimens are unlike any other species described from the Eocene of North America. The most similar species is *Ostrea arrosis* Aldrich (1904, p. 61, Plate 3, Figures 1–4) from the lower Eocene (Nanafalia Formation) of Fleming's Mill, on Pea River, in southern Alabama, but this species is oval, with numerous radiating ribs, bifurcating in the middle of the shell, close-set and cross marked by growth lines, differing from the Mexican specimens in the shape of the shell and the ornamentation, and presenting a constriction close to the umbonal region. The ligament area is not very large.

### *Ostrea* sp.

**Description:** The shell of *Ostrea* sp. (Figures 5.4, 6.1, 6.4) is of large size and thick. The left valve is ovoid and trigonal in shape and convex, and has an ornamentation of numerous elevated, wide radial

**Figure 5.** *Ostrea (Turkostrea) ventosa* new species. (1) External view of left valve, X0.5, holotype IGM 8094; (2) Internal view of left valve, X0.5, holotype IGM 8094. *Ostrea (Turkostrea) ovata* new species. (3) External view of left valve, X0.49, paratype IGM 8096; (5) Internal view of left valve, X0.52, paratype IGM 8096; (6) External view of left valve, X0.51, paratype IGM 8097; (7) Internal view of left valve, X0.53, paratype IGM 8098. *Ostrea* sp. (4) External view of left valve, X0.51, hypotype IGM 8100.



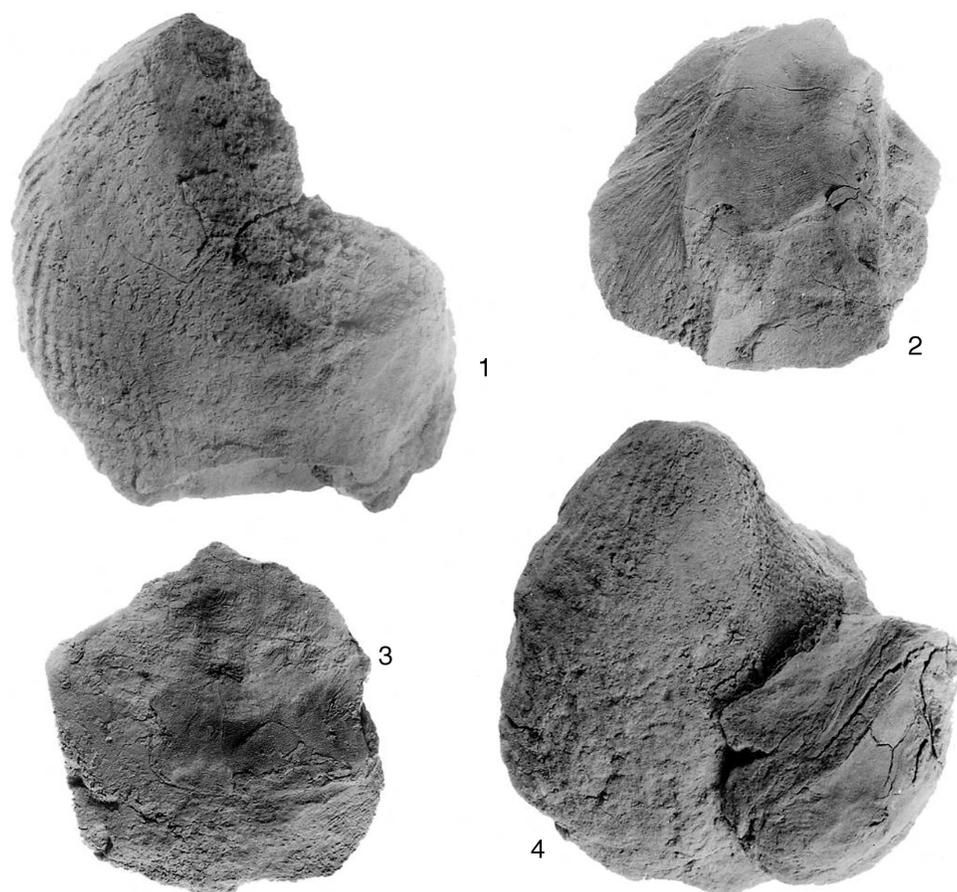
ribs; the interspaces are narrow and shallow. The entire shell is covered with concentric growth lines. The umbo is orthogyrous, and one specimen is opsythogyrous. The ligament area is small. The adductor muscle scar is large and reniform. The right valve is smaller than the left valve, trigonal, and a little convex; the ornamentation is of numerous low, concentric lamellae on the whole surface of the shell. The umbo is orthogyrous, the ligament area is small.

**Repository:** The hypotypes are IGM 8099 (left valve), measures 165.0 mm in height, 143.0 mm in length, and 45.2 mm in width. IGM 8100 (left valve),

measures 162.0 mm in height, 123.0 mm in length, and 53.6 mm in width. IGM 8101 (left valve), measures 137.0 mm in height, 123.0 mm in length, and 57.2 mm in width.

**Locality:** IGM 3280, IGM 3285.

**Remarks:** The Mexican specimens of *Ostrea* sp. differ from the two new species described above in that the shape of the valves are roundish and the ligament is larger. No other species described from the Eocene are similar to these specimens. They also differ from *Ostrea strictiplicata* Raulin and Delbos (1855) var. *major* Locard (1889), p. 57, 58, Plate 11, Figures 1, 1a) from the Eocene of Djebel, Teldja,



**Figure 6.** *Ostrea* sp. (1) External view of left valve, X0.57, hypotype IGM 8099; (4) External view of left valve, X0.6, hypotype IGM 8101. *Ostrea (Turkostrea) ovata* new species. (2) Internal view of right valve, X0.5, holotype IGM 8095; (3) External view of right valve, X0.5, holotype IGM 8095.

Tunisia, but this species is more triangular and the ribs are not so close or so numerous.

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