EARLY EOCENE OSTREIDS FROM THE ADJUNTAS FORMATION, DIFUNTA GROUP, NORTHEASTERN MÉXICO

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I. ABSTRACT

Four ostreid species from the Lower Eocene Adjuntas Formation are reported, two of them described herein. The stratigraphic range and paleoenvironmental interpretation of the material reinforces previous conclusions on deltaic plain deposits of Lower Eocene age for the Adjuntas Formation.

II. INTRODUCTION

The Adjuntas Formation has proved to be the youngest and one of the most fossiliferous formations of the Difunta Group. Previous works have been devoted to the description of new molluscan taxa, found in the deltaic plain and inner shelf deposits of this formation (Vega and Perrilliat, 1989a; 1989b; 1992). The first formal stratigraphic report on the Difunta Group considered the Adjuntas Formation to be of Maastrichtian age, based on the presence of *Exogyra costata* Say (McBride *et al.*, 1974). Subsequently, Vega and Perrilliat (1989a) reported in the Adjuntas Formation the presence of *Venericardia (Venericor) planicosta* Lamarck and *Turritella mortoni postmortoni* Conrad, index fossils for the Ypresian of the Gulf Coastal Plain (Shimer and Shrock, 1944). Without detailed morphological examination, the ostreid species here reported superficially resemble *Exogyra costata*. It is probable that previous authors confused this Cretaceous grypheid with the Tertiary ostreids present in the Adjuntas Formation outcrops (McBride *et al.*, 1974; Wolleben, 1977).

The Adjuntas Formation has its most extensive outcrop areas in the synclines of the La Popa basin (Text-figure 1). The ostreids here described were collected at three localities in the Escondida and Delgado synclines (Text-figure 2).

III. STRATIGRAPHY AND PALEOENVIRONMENT

The ostreid subgenus *Turkostrea* has been reported in the Lower and Middle Eocene beds of the Mesogean region and the southern United States (Raulin and Delbos, 1855; Gardner, 1927; Vyalov, 1936, 1948). A wide distribution of ostreid taxa is proposed to be the result of island-hopping, when explaining interoceanic distributions (Stenzel, 1971). Ostreid beds of the Adjuntas Formation are included in a deltaic plain sequence, chiefly of red and green beds. The Adjuntas comprises mudstones, siltstones, and sandstones, with a thickness of 260 meters. Some gray beds at the base and the top of the formation include *Venericardia (Venericor) planicosta* and *Turritella mortoni postmortoni*, indicative of a Lower Eocene age. These gray beds have been interpreted as inner shelf deposits (Vega and Perrilliat, 1989b). The green beds of this formation contain a great abundance of freshwater gastropods, interpreted as inhabitants of deltaic plain deposits, below the phreatic level (Vega and Perrilliat, 1992).

The lithology of the Adjuntas Formation varies laterally and between the synclines where it outcrops. Lithology at localities IGM 1973 and IGM 2645 is more sandy than at the type section (McBride *et al.*, 1974), with almost no green beds, and the ostreids are distributed in well-defined strata of 1 to 2 meters thickness. Some sandstone beds between the ostreid banks contain tree-trunks in vertical position, replaced by light brown sandstone. Some red beds include leaf remains. The ostreid banks seem to be monospecific and the valves, although very near one to each other, rarely are found to be cemented. A coarse sandstone matrix of brown color includes all the ostreid remains. In other parts of the locality 2645, the left valves of the ostreids were found still attached to bored limestone fragments. This could represent an estuary, near the distributary channels, at whose edges the ostreid banks proliferated. A subsidence period in the La Popa basin generated conditions for the deposition of the Adjuntas Formation sediments, forming marshes, swamps, and estuaries, in which a diverse molluscan

fauna developed during Lower Eocene time.

IV. ACKNOWLEDGMENTS

We are grateful to M. en C. Zoila Graciela Castillo R. of the Instituto de Ciencias del Mar y Limnología, UNAM, for her kind help in comparison of the fossil material with collections of Recent ostreids at her laboratory. Mr. Luis Burgos P. cheerfully helped in doing the figures. Dr. E.H. Vokes (Tulane University) made valuable comments and critically reviewed the manuscript.

V. SYSTEMATIC DESCRIPTIONS

Order PTERIOIDA Newell, 1965

Suborder OSTREINA Ferussac, 1822
Superfamily OSTREACEA Rafinesque, 1815
Family OSTREIDAE Rafinesque, 1815

Genus OSTREA Linnaeus, 1758

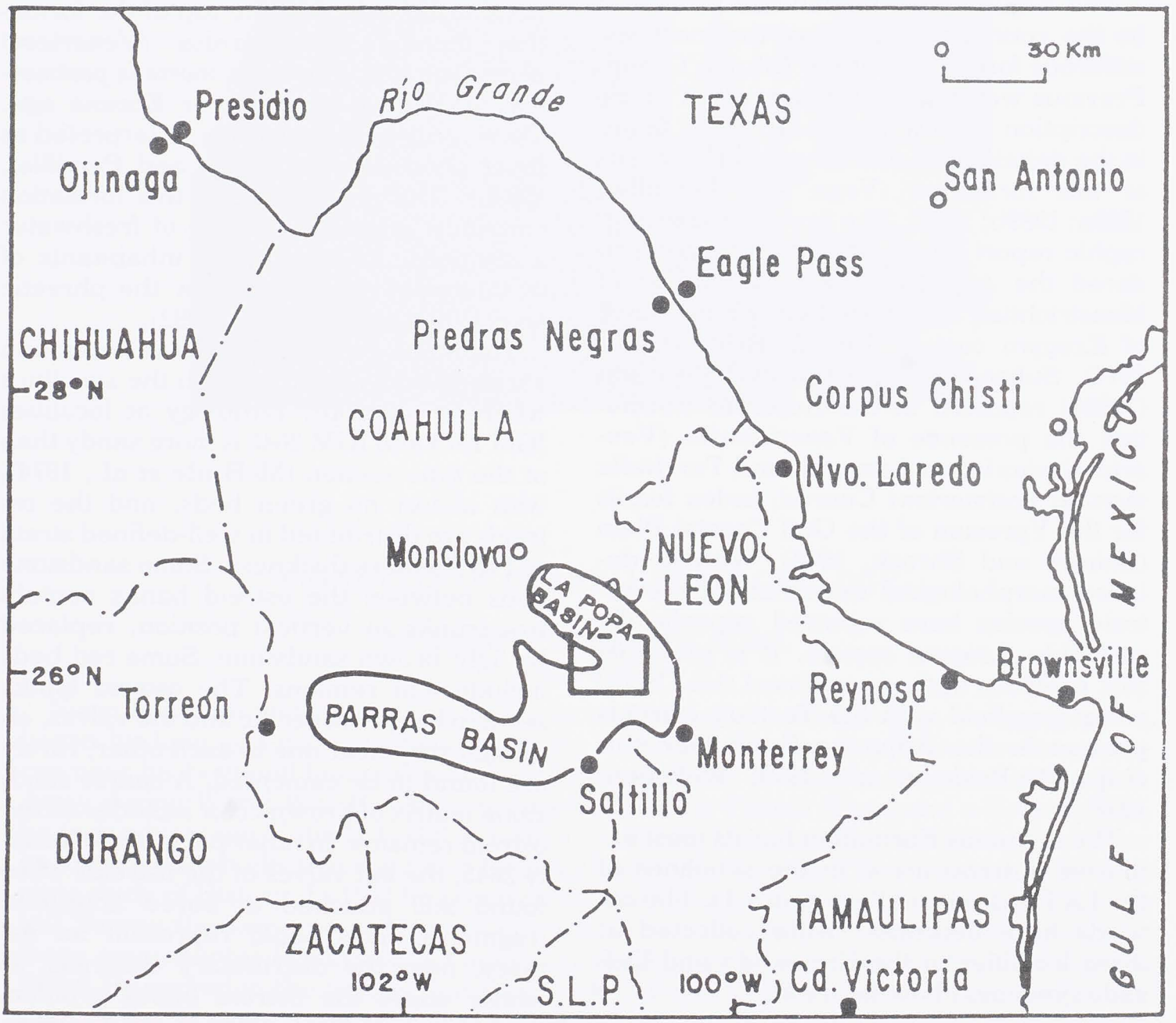
Ostrea Linnaeus, 1758, Systema naturae per tria regna naturae, p. 696.

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

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* Roma-



Text-figure 1. Generalized location map of Difunta Group in northeastern México, showing distribution of Parras and La Popa basins in Coahuila and Nuevo León states. Enclosed area in center is shown in text-figure 2.

novsky = *Ostrea strictiplicata* Raulin and Delbos; Central Asia (USSR, Uzbekistan); Montagne-Noire (Aude), France; Middle Eocene; by original designation.

OSTREA (TURKOSTREA) STRICTIPLICATA
Raulin and Delbos, 1855
Plate 1, figures 2, 5;
Plate 2, figures 2, 3

Ostrea strictiplicata RAULIN and DELBOS, 1855, Bull. Soc. Géol. France, sér. 2, v. 12, p. 1158.

Ostrea (Ostrea) moussoulensis ASTRE, 1922, Bull. Soc. Hist. Nat. Toulouse, v. 50, p. 161, pls. 1-6.

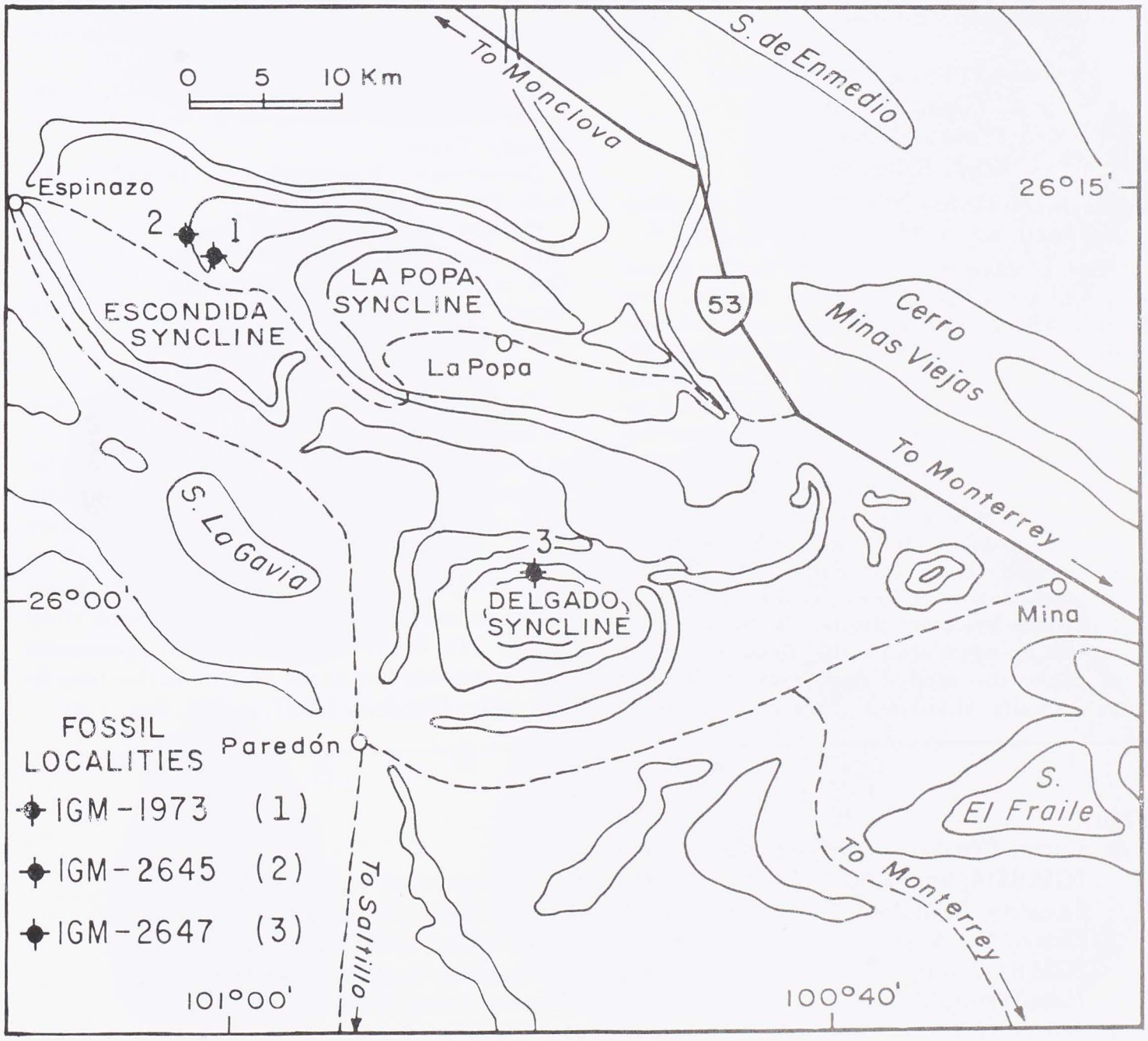
Ostrea multicostata Deshayes. KIEH, 1930, Bull. Soc. Géol. France, sér. 4, v. 30, p. 89.

"Test épais. Coquille arrondie-ovalaire. Valve gauche ornée d'environ 60 plis fins; surface d'adhérence petite; crochet, 1/6; canal assez profond, 1/2; bourrelets saillants; sillons profonds se continuant dans la valve par des points; expansions bien développées. Valve droite un peu convexe. Impression musculaire grande au centre de la moitié postérieure." (Raulin and Delbos, 1855)

Type locality: Terrain a Nummulites de la Montagne Noire (Aude), France.

Occurrence: Lutetian, Paris Basin; Lower Eocene, between Moussolens and Montolieu (Aude); Lutetian, Egypt, Transylvania Basin, Perse and Turkestan.

Figured specimens: Plate 1, figs. 2, 5, IGM 6312; length 24.9 mm, height 38.4 mm, diameter (both valves) 22.8 mm. Plate 2, figs. 2, 3, IGM 6311; length 75.4 mm, height 91.2 mm, diameter (both valves) 60.7 mm; locality IGM 1973.



Text-figure 2. Location map of the three ostreid localities in the Escondida and Delgado synclines, La Popa basin, Nuevo León, México.

Other occurrences: IGM locality nos. 1973, 2647.

Discussion: The complete synonymy of this species is in Kieh (1930, p. 89), who made a revision of the subspecies and varieties that have been assigned to this species, and which need not to be repeated here. Within the Mexican specimens from locality IGM 1973, we have smaller specimens than those called by Kieh as exogyroidals. We also have the gryphaeiform type; the Asiatic specimens show this feature also, while those from the meridional region of France and northern Africa have this feature only partially. Kieh (1930, p. 87) mentioned that this species lived in littoral zones or shores during the Middle Eocene, having numerous varieties, following various living conditions.

OSTREA (TURKOSTREA) DUVALI
Gardner, 1927
Plate 1, figures 1, 6;
Plate 2, figures 1, 6

Ostrea duvali GARDNER, 1927, Jour. Washington Acad. Sci., v. 17, no. 14, p. 366, figs. 1-4.

"Shell of moderate dimensions for the genus, inequivalve, ovate-trigonal in outline, frequently with a large attachment area and relatively broad in consequence. Surface layer decorticated; right valve built up of overlapping concentric lamellae so that the shell thins toward the ventral margin, and would be heaviest in the umbonal area were it not for the encroachment of the ligament area; a subcutaneous radial threading on the right valve but no true radial sculpture developed; left valve fluted with narrow radials ranging in number from 20 to 25 in the narrower forms, and running to 35 and 40 in the broader; obsolete on the attached surface. Ligament area large, flattened in the right valve; the medial depression in the left valve broadly U-shaped. Lateral margins of right valve finely pitted, the pitting persistent in some individuals around the entire inner margin. Adductor scars rather small, crescentic, not deeply excavated, posterior and below the median horizontal." (Gardner, 1927)

Description: Shell of large size, inequivalve and inequilateral, ovate-trigonal. The left valve has 20 to 25 radial ribs, some of them bifurcated in the ventral region. In the attachment area the surface of the shell is smooth. The ligament area is broad, the catachomata are present in almost all the margin of the shell. The adductor muscle is reniform. The right valve has an ornamentation of concentric lamellae. The anachomata are present all around the margin of the shell. The adductor muscle is big and deep. The Quenstedt muscle is present.

Type material: USNM 369239. Right valve; altitude 10.6 mm, latitude 6.1 mm, semi-diameter 2.4 mm. Left valve of another individual; altitude 10.5 mm, latitude 6.95 mm, semi-diameter 3.45 mm.

Type locality: Austin-Elgin Ferry road, 1 mile north of Austin-Bastrop Highway, Bastrop County, Texas.

Occurrence: Wilcox Group, probably the Indio Formation, Eocene.

Figured specimens: Plate 1, figs. 1, 6, IGM 6314; length 80.1 mm, height 78.3 mm, diameter (left valve) 34.0 mm. Plate 2, figs. 1, 6, IGM 6315; length 78.4 mm, height 93.7 mm, diameter (right valve) 24.6 mm; locality IGM 2645.

Discussion: The Mexican specimens are broader than the one described and figured from Texas, possibly due to the polymorphism of the oysters. We also have to consider the temperature of the water where they grew. In many of the valves the sculpture is worn, which may have been caused by the currents where they lived. We have only one small specimen that presents the same shape as the one figured by Gardner (1927, p. 366, figs. 1-4).

PLATE 1

Figures

1, 6. *Ostrea (Turkostrea) duvali* Gardner, 1927 (x 1).
IGM 6314; length 80.1 mm, height 78.3 mm, diameter (left valve) 34.0 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

2, 5. *Ostrea (Turkostrea) strictiplicata* Raulin and Delbos, 1855 (x 1).
IGM 6312; length 24.9 mm; height 38.4 mm, diameter (both valves) 22.8 mm.
Locality: IGM 1973, Adjuntas Formation, Nuevo León, México.

3, 4. *Ostrea (Turkostrea) escondida* Perrilliat and Vega, n. sp. (x 1).
IGM 6317 (holotype); length 48.9 mm, height 56.9 mm, diameter (both valves) 36.0 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

PLATE 1

OSTREA (TURKOSTREA) ESCONDIDA
Perrilliat and Vega, n. sp.
Plate 1, figures 3, 4;
Plate 2, figures 4, 5;
Plate 4, figures 1, 2, 4, 6

Description: Shell small for the genus, inequivalve and inequilateral. The left valve is convex, ovate-trigonal in outline. The sculpture is of numerous, thin radial ribs, some of them bifurcated in the ventral region. The umbo is opisthogyrous and the ligament area is narrow and trigonal, the catachomata are visible. The adductor muscle scar is reniform. The right valve has the same outline as the left one, the sculpture is of numerous, low concentric lamellae on the whole surface of the shell. Each lamella presents slender radial threads with narrow interspaces. The umbo is opisthogyrous and the ligament area is narrow. The anachomata are clear and the adductor muscle scar is reniform.

Holotype: IGM 6317, length 48.9 mm, height 56.9 mm, diameter 36.0 mm.

Paratype: IGM 6318, length 36.6 mm, height 42.7 mm, diameter 13.0 mm.

Type locality: IGM 2645. Southwest margin of the La Escondida syncline, approximately 20 km northwest of the town of San José de la Popa, and 15 km southeast of Espinazo village, Nuevo León, México.

Occurrence: Adjuntas Formation, México; Lower Eocene.

Etymology: The name of the species is dedicated to the Escondida syncline, where outcrops of Tertiary rocks have yielded a diverse macroinvertebrate fauna, with a great number of oyster banks.

Discussion: The Mexican specimens are not like any other species described from the Eocene. The most similar species is *Ostrea kochae* Gardner (1933, p. 140, pl. 8, figs. 1-5) from the Tehuacana Member, Kincaid Formation (Paleocene), from 7 1/2 miles southeast of D'Hanis, Medina County, Texas, but this species has overlapping lamellae in both valves, being more foliaceous in the left valve. The submargins are strongly punctate in the left valve and weak in the right valve.

Ostrea cynthiae Maury (1912, p. 37, pl. 6, fig. 5) from the Midway (Eocene) of Soldado Rock, Gulf of Paria, has a very convex left valve, not plicated, with irregular concentric lamellae, and the right valve has no sculpture. The main feature of the right valve of the Nuevo León specimens is the numerous, low concentric imbrications, each one of these with thin radial threads with narrow interspaces.

OSTREA (Subgenus?) POPAENSIS
Perrilliat and Vega, n. sp.
Plate 3, figures 1-6;
Plate 4, figures 3, 5

Description: Shell of medium size, trigonal, sometimes the posterior margin is elongated, inequilateral, inequivalve and thick. The right valve has an ornamentation of numerous radial ribs, bifurcated in the ventral margin, and covered by concentric lamellae. In some valves the ribs have disappeared and only thick concentric lamellae are present. The umbo is prosogyrous. The anachomata and/or relict anachomata are present. In a few specimens the Quenstedt muscle scar is preserved. The adductor muscle is in the posterior region, reniform and big. In a few specimens the mantle muscle scars are present. The margin is smooth. The left valve is concave and the attachment area is small. It has the same sculpture as the right valve, but the ribs are less pronounced. The interior of the valve is smooth and presents the Quenstedt muscle scar, mantle muscle scars, and the reniform adductor muscle. The umbo is prosogyrous. The catachomata are present in almost three-quarters of the margin.

Holotype: IGM 6321; length 70.7 mm, height 76.2 mm, diameter 30.0 mm.

Paratype: IGM 6322; length 57.3 mm, height

PLATE 2

Figures

1, 6. *Ostrea (Turkostrea) duvali* Gardner 1927 (x 1).
IGM 6315; length 78.4 mm, height 93.7 mm, diameter (right valve) 24.6 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

2, 3. *Ostrea (Turkostrea) strictiplicata* Raulin and Delbos, 1855 (x 0.5).
IGM 6311; length 75.4 mm, height 91.2 mm, diameter (both valves) 60.7 mm.
Locality: IGM 1973, Adjuntas Formation, Nuevo León, México.

4, 5. *Ostrea (Turkostrea) escondida* Perrilliat and Vega, n. sp. (x 1).
IGM 6318 (paratype); length 36.6 mm; height 42.7 mm, diameter (right valve) 13.0 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

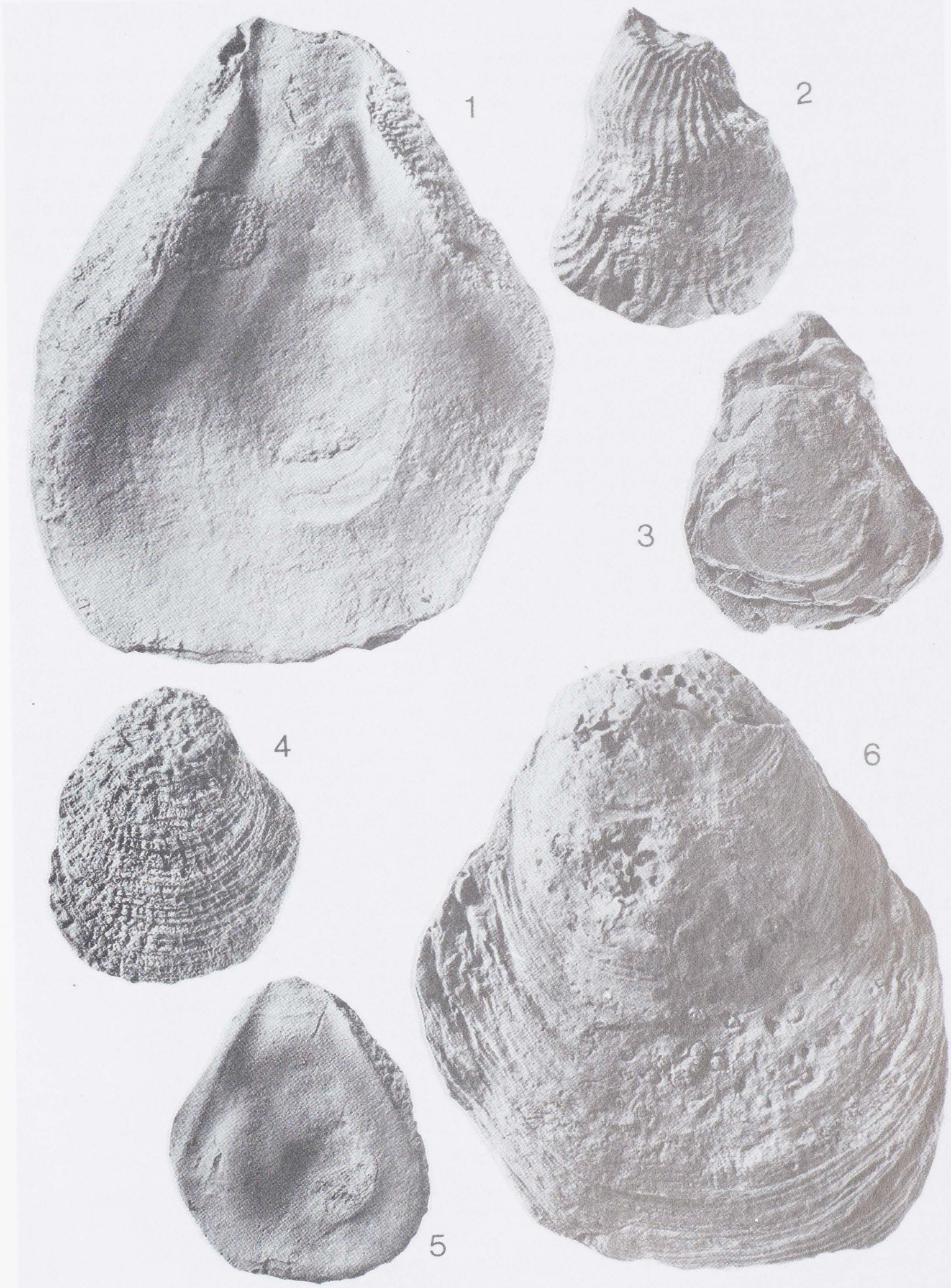


PLATE 2

67.0 mm, diameter 18.0 mm.

Type locality: IGM 2645. Southwest margin of the La Escondida syncline, approximately 20 km northwest of town of San José de La Popa, and 15 km southeast of Espinazo village, Nuevo León, México.

Occurrence: Adjuntas Formation, México; Lower Eocene.

Etymology: The name of the species is dedicated to the La Popa basin, the youngest and most fossiliferous area in the Difunta Group.

Discussion: Specimens of this new species are assigned to the genus *Ostrea*, but they cannot be assigned to any subgenus already described. In *Turkostrea* the right valve is smooth with concentric lamellae. In *Cubitostrea* the right valve is smooth and smaller than the left valve, but the trigonal shape is the same as in the Mexican specimens. In *Platygena* the outline is roughly orbicular; old shells are higher than long; outline of valve cavity in left valve banjo-shaped; no chomata, and its geological range is only Late Eocene.

Sokolowia is highly inequivalve, left valve umbonal region extending beyond right cavity; chomata well developed; valve cavity guitar-shaped in outline; right valve devoid of ribs, but with prominent growth squamae; many have auricles.

No similar species are known from the Eocene. The only species that can be compared to its triangular shape is *Ostrea villei* Coquand (1862, pl. 22, figs. 1-4; 1869, p. 27, pl. 5, figs. 1, 2) from the Maastrichtian of Djilail, Algeria, but the latter has the same sculpture in both valves, and at present is included in the genus *Ambigostrea* Malchus, 1990.

VI. LITERATURE CITED

ASTRE, GASTON, 1922, Recherches critiques sur l'*Ostrea*, dite *stricticostata*, des terrains nummulitiques de la Montange-Noire: Bulletin de la Société d'Histoire Naturelle de Toulouse, v. 50, p. 141-204, pls. 1-6.

COQUAND, HENRI, 1862, Géologie et paléontologie de la province de Constantine, 35 pls.

COQUAND, HENRI, 1869, Monographie du Genre *Ostrea;* Terrain Crétacé. J. B. Baillière & fils (Paris), 212 p., 75 pls.

GARDNER, J. A., 1927, New species of Mollusks from the Eocene of Texas, Journal of the Washington Academy of Sciences, v. 17, no. 14, p. 362-383, 44 figs.

GARDNER, J. A., 1933, The Midway Group of Texas: The University of Texas, Bulletin 3301, 403 p., 28 pls.

KIEH, YANG, 1930, Observations sur le genre *Ostrea* dans l'Éocène des regions Mésogéennes: Bulletin de la Societe Géologique de France, sér. 4, v. 30, fasc. 1-2, p. 77-100, pls. 6, 7.

LINNAEUS, CAROLUS, 1758, Systema naturae per tria regna naturae, Ed. 10, v. 1. Stockholm, 823 p.

MALCHUS, NIKOLAUS, 1990, Revision der Kreide-Austern (Bivalvia: Pteriomorphia) Aegyptens (Biostratigraphie, Systematik): Berliner Geowissenschaftliche Abhandlungen, Reihe A, v. 125, 231 p., 27 pls.

MAURY, C. J., 1912, A contribution to the Paleontology of Trinidad: Academy Natural Sciences of Philadelphia, Journal, ser. 2, v. 15, p. 25-112, pls. 5-13.

McBRIDE, E. F., A. E. WEIDIE, J. A. WOLLEBEN, and R. C. LAUDON, 1974, Stratigraphy and structure of the Parras and La Popa Basins, Northeastern Mexico: Geological Society of America, Bulletin, v. 84, no. 10, p. 1603-1622.

PLATE 3

Figures

1, 4. *Ostrea* (Subgenus?) *popaensis* Perrilliat and Vega, n. sp. (x 1).
IGM 6321 (holotype); length 70.7 mm, height 76.2 mm, diameter (right valve) 30.0 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

2, 3. *Ostrea* (Subgenus?) *popaensis* Perrilliat and Vega, n. sp. (x 1).
IGM 6323 (paratype); length 41.1 mm, height 46.0 mm, diameter (left valve) 18.2 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

5, 6. *Ostrea* (Subgenus?) *popaensis* Perrilliat and Vega, n. sp. (x 1).
IGM 6322 (paratype); length 57.3 mm, height 67.0 mm, diameter (right valve) 18.0 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

PLATE 3

RAFINESQUE, C. S., 1815, Analyse de la nature ou tableau de l'univers et des corps organisés. Palermo, 224 p.

RAULIN, V., and J. DELBOS, 1855, Extrait d'une monographie des *Ostrea* des terrains tertiaires de l'Aquitaine: Bulletin de la Société Géologique de France, sér. 2, v. 12, p. 1144-1164.

SHIMER, H. W., and R. R. SHROCK, 1944, Index fossils of North America. JohnWiley and Sons, London, 837 p.

STENZEL, H. B., 1971, Bivalvia, p. N954-N1224, *in* Treatise on Invertebrate Paleontology, Part N6(3) (R. C. Moore, ed.), Geological Society of America and University of Kansas Press, Lawrence, 1224 p.

VEGA, F. J., and M. C. PERRILLIAT, 1989a, La presencia del Eoceno marino en la cuenca de La Popa (Grupo Difunta), Nuevo León; orogenia postypresiana: Universidad Nacional Autónoma de México, Instituto de Geología, Revista, v. 8, no. 1, p. 67-70.

VEGA, F. J., and M. C. PERRILLIAT, 1989b, On a new species of *Venericardia* from the Lower Eocene in northeastern Mexico (Difunta Group): Tulane Studies in Geology and Paleontology, v. 22, no. 3, p. 101-106.

VEGA, F. J., and M. C. PERRILLIAT, 1992, Freshwater gastropods from early Eocene Difunta Group, northeastern Mexico: Journal of Paleontology, v. 66, no. 4, p. 603-609.

VYALOV, O. S., 1936, Sur la classification des huitres: Academie des Sciences de la USSR, Comptes Rendus (Doklady), new ser., v. 4 (13), no. 1, p. 17-20.

VYALOV, O. S., 1948, Printsiply klassifikatsii semeystva Ostreide: Lvovskiye geologicheskiye obshestvenniye trudy pri gosudarstvennom, Universitete imeny Ivan Franko, Paleontologicheskaya seria, no. 1, p. 30-40.

WOLLEBEN, J. A., 1977, Paleontology of the Difunta Group (Upper Cretaceous-Tertiary) in Northern Mexico: Journal of Paleontology, v. 51, no. 2, p. 373-398.

December 29, 1993

PLATE 4

Figures

1, 2. *Ostrea (Turkostrea) escondida* Perrilliat and Vega, n. sp. (x1).
IGM 6319 (paratype); length 44.4 mm, height 49.7 mm, diameter (right valve) 16.5 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

3, 5. *Ostrea* (Subgenus?) *popaensis* Perrilliat and Vega, n. sp. (x 1).
IGM 6324 (paratype); length 73.3 mm, height 90.2 mm, diameter (right valve) 23.3 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

4, 6. *Ostrea (Turkostrea) escondida* Perrilliat and Vega, n. sp. (x 1).
IGM 6320 (paratype); length 48.6 mm, height 58.0 mm, diameter (left valve) 16.2 mm.
Locality: IGM 2645, Adjuntas Formation, Nuevo León, México.

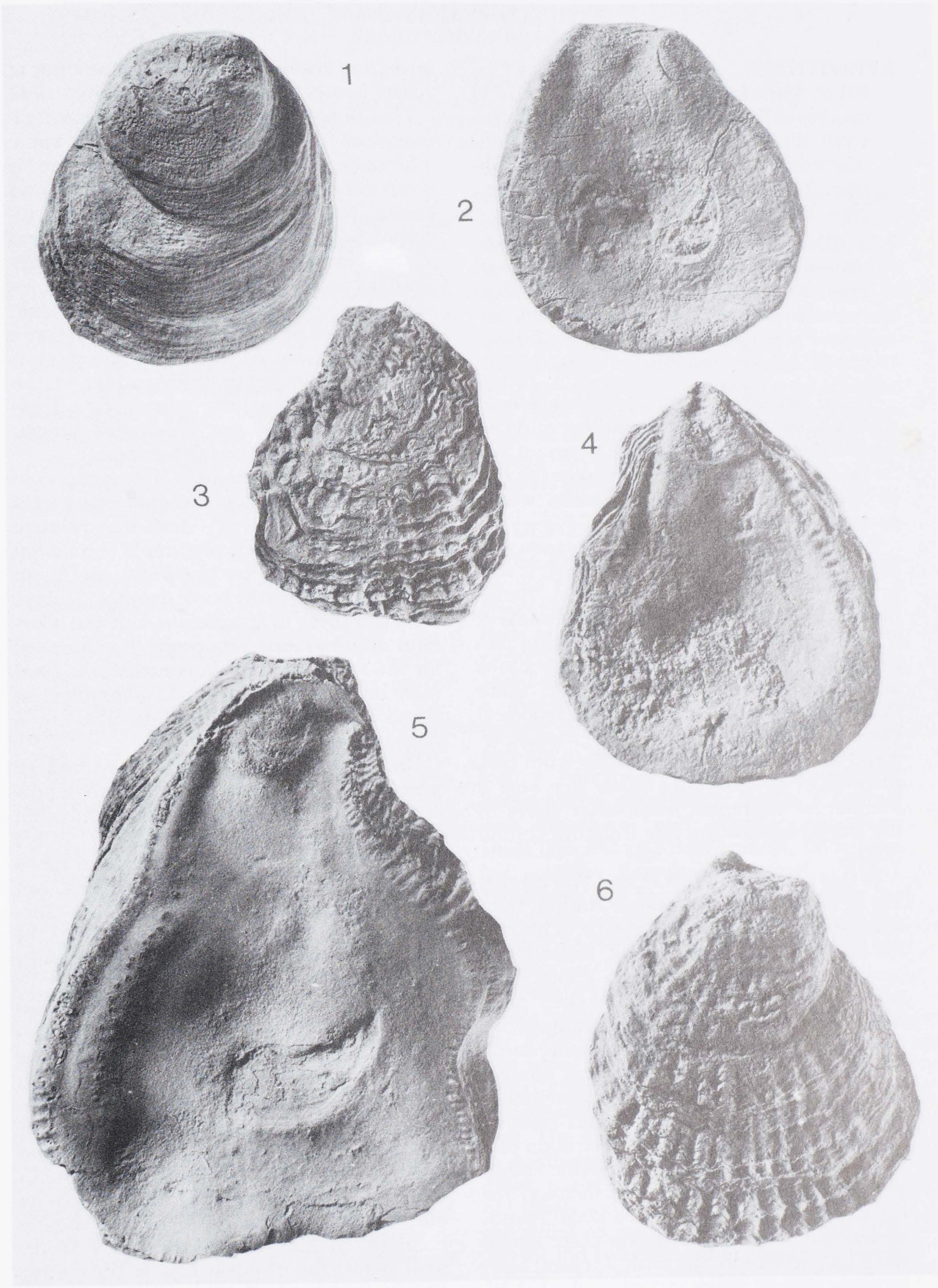


PLATE 4