

FOSSIL *ENCOPE* (ECHINOIDEA) FROM THE PACIFIC COAST OF SOUTHERN MEXICO

J. Wyatt Durham*

INTRODUCTION

The only Cenozoic fossil echinoid recorded from the Pacific coast to mainland Mexico, between the Guatemalan border and Puerto Vallarta, at the entrance to the Gulf of California, is *Encope micropora* L. Agassiz (Palmer and Hertlein, 1936, p. 66) from the Pleistocene Colotepec Formation of the southern coast of Oaxaca (Caso, 1951, 1961; Buitrón, 1978). Recently, several Cenozoic marine basins have been discovered along the Pacific Coast (Durham *et al.*, 1981). In two of these basins, one near La Mira, Michoacán, and the other near Santa Cruz, Oaxaca, fossil keyhole urchins (genus *Encope*) were found.

Near La Mira, the echinoid occurs in the lower part of the marine beds cropping out around the Ferrotepec iron mines (Sicartsa Mining Company). These beds are of late early to early middle Miocene age and rest unconformably on the ore bearing strata of pre-Cenozoic age (Durham *et al.*, 1981). The La Mira *Encope* represents a new species and has affinities with species (Jackson, 1917, 1918) from the Gatún Formation ("middle" Miocene) of the Panama Canal Zone, as well as *E. loretoensis* Durham (1950, p. 41, figs. 1, 4, 5) from the lower Pliocene of Baja California. The single fossil specimen from near Santa Cruz, Oaxaca, may be an immature individual of a living species. It is the purpose of this paper to put these occurrences on record. The specimens are in the collections of the Museo de Paleontología, Instituto de Geología, Universidad Nacional Autónoma de México, hereafter referred to by the initials IGM. The specimen numbers and localities are those of the Museum Register.

SYSTEMATICS

Family *Mellitidae* Stefanini, 1911

Genus *Encope* L. Agassiz, 1840

Type species *Encope grandis* L. Agassiz, 1840

Encope michoacanensis n. sp.

Plate 1; Plate 2, figures 1, 3; Figure 1

Description—A moderately sized, flattened species with open ambulacral lunules, large posterior interambulacral lunule, and thin ambitus; petals partially closed, about 75% length of corresponding radius, sides of paired petals nearly parallel, anterior petal more ovate; posterior paired petals

about 10% longer than anterior pair, anterior petal slightly shorter than anterior paired petals; anterior ambulacral lunule very shallow, broadly "V" shaped, anterior paired lunules similar but slightly deeper, posterior paired lunules "U" shaped and slightly deeper than anterior paired lunules; a broad shallow, almost "V" shaped indentation of posterior interambulacral margin; aboral surface with densely spaced, moderately small tubercles; primary food grooves on oral surface well developed, details of secondary branches not visible on available specimens.

Types—Holotype IGM no. 2939; paratypes IGM nos. 2940, 2941, 2942, 2943. All from IGM locality Mch 2, late early Miocene, near La Mira, Michoacán, Mexico.

Dimensions—All approximate because of fracturing of specimens. Holotype, length 80 mm, width 84 mm, height (crushed) probably about 6 mm; paratype 2942, length >83 mm, half width 42 mm, height about 6 mm.

Occurrence—IGM localities Mch 2 and Mch 9 (fragments), lower part of marine Miocene sequence overlying basement rocks around Ferrotepec iron mines near La Mira, Michoacán, Mexico. For a discussion of the age and stratigraphy of these deposits, see Durham and coworkers (1981).

Discussion—All available specimens are either fragmentary or have suffered considerable post-mortem minor fracturing and/or dislocation of segments, usually along the radial sutures, most often the perradial. The oral surface is not well preserved on any available specimen and neither the periproct nor the peristome have been observed. The general pattern (Figure 1), but not the detailed secondary branching of the food grooves, is recognizable. The food groove pattern is generally similar to that of the middle Miocene *Encope annexans* Jackson (1917, pl. 66, fig. 1), but differs by its wider spacing of the anterior pair. The similar aged *E. platytata* Jackson (1917, pl. 67, fig. 2) has more rectilinear grooves. The food groove pattern also resembles that of *E. loretoensis* Durham (1950, pl. 41, fig. 5) except for the adinterambulacral branches of the posterior area. *E. tatetlaensis* Böse (1906, p. 71, pl. 6, figs. 1, 2; pl. 7, figs. 1, 2) from the Tuxtepec Formation, Pliocene, of the eastern coast (Veracruz) of Mexico is likewise similar. All of the species are grossly similar: all have open ambulacral lunules, thin margins, and flattened test. The posterior interambulacral lunule of *E. michoacanensis* is large, elongate ovate, and largely anterior to a line connecting the distal ends of the posterior paired petals; the lunule of *E.*

*Department of Paleontology, University of California, Berkeley, California 94720, U.S.A.

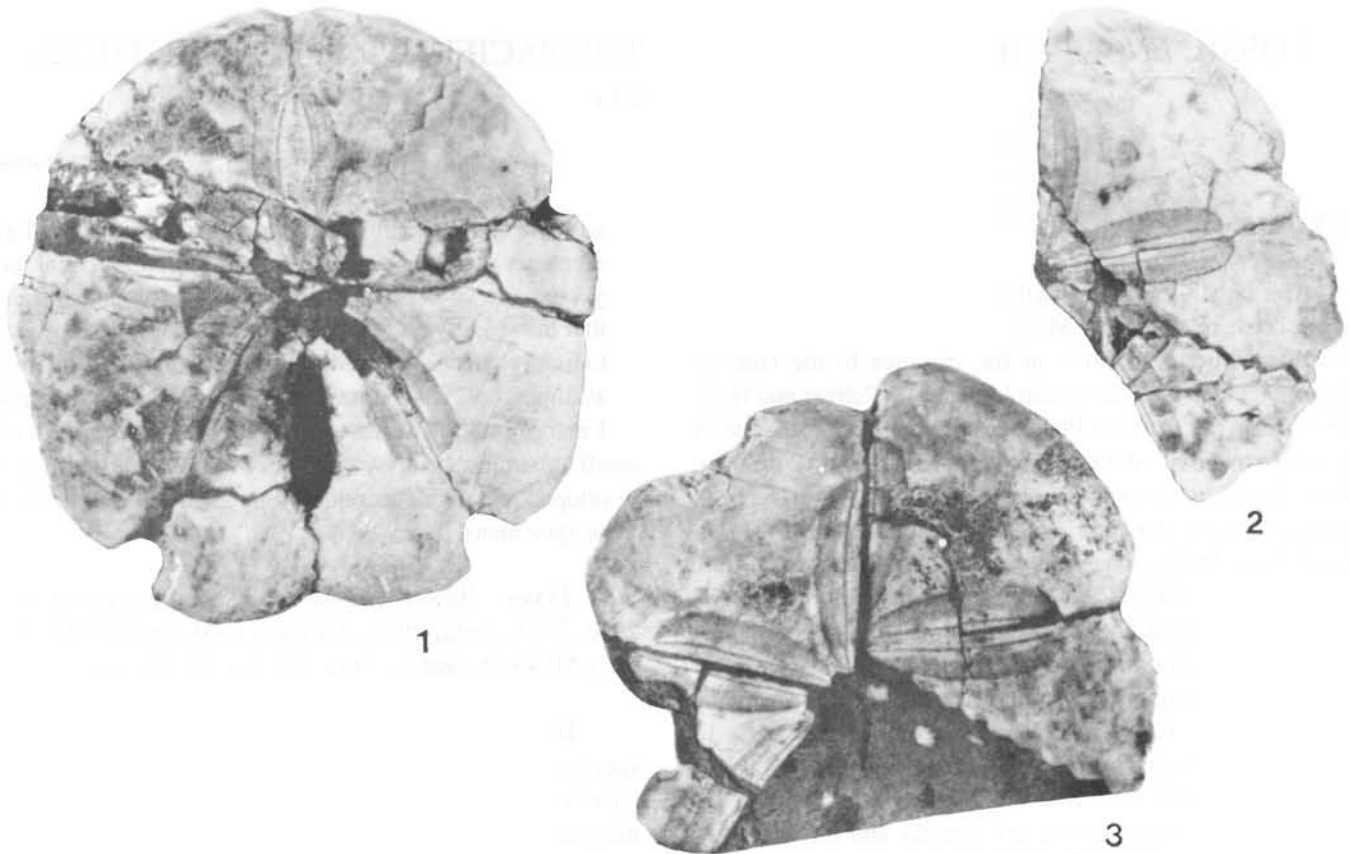


Plate 1.- *Encope michoacanensis* n. sp. Specimens immersed in xylene, apical surface, approximately x 1. All from IGM locality Mch 2. All specimens with anterior petal at top; figure 1—holotype, IGM 2939; figure 2—paratype, IGM 2940; figure 3—paratype, IGM 2941.

tatellaensis is large and rounded but mostly outside the line connecting the distal ends of the posterior paired petals; the lunule of *E. loretoensis* is elongate, narrow, and about equally divided by the line connecting the distal ends of the posterior petals; the lunule of *E. annectans* is small and outside of the line connecting the distal ends of the posterior petal; the lunule of *E. platytata* is likewise small but internal to the reference line.

Encope michelini L. Agassiz (Phelan, 1972, p. 109-125, figs. 5-7, for clarification of taxonomy) has open ambulacral lunules but they are much deeper than on the species noted above. The anterior petal of *E. michoacanensis* n. sp. is ovate like that of the Miocene and Pliocene species previously noted but its anterior paired petals are nearly parallel sided in contrast to the more ovated shape of these petals on the others.

Encope perspective L. Agassiz (?)

Plate 2, figure 2

Description—The single specimen from IGM locality Oax 15 is small (length about 40 mm), thin, and immature. It is slightly broken around parts of the ambitus and the oral surface is not exposed. At first, it was identified as a new species because of the apparently shorter petals, and relatively large posterior lunule that is well within the posterior petals. However, comparison with small (length 72 mm) specimens

of *E. perspective* L. Agassiz (1841) suggests that it is probably referable to this species. The present specimen has about 32 pores on the left side of the anterior petal, and adult (length 103 mm) *E. perspective* has about 72 pores in the same position; a specimen about 70 mm long has 57 pores. These data suggest that the fossil is quite immature, with its apparent relative age about two-fifths that of a fully mature adult; however, the genital pores are open, presumably indicating sexual maturity. An adult *E. micropora* L. Agassiz (length 116 mm) has 84 pores in the same position. This species differs from the fossil by the posterior lunule being largely posterior to a line connecting the distal ends of the posterior petals. The petals of the fossil are more nearly parallel-sided than those of adult *E. perspective*, but this may be a function of its immaturity. Larger, more mature, specimens are needed before its taxonomic status can be clarified.

Type—Hypotype IGM no. 2944.

DISCUSSION

Specimens identified as *Encope micropora*, with the original Palmer Collection label, from the Colotepec Formation of Oaxaca and now in the Museum of Paleontology (UCMP locality A-196) of the University of California (Berkeley) seem to be correctly identified, although they are largely

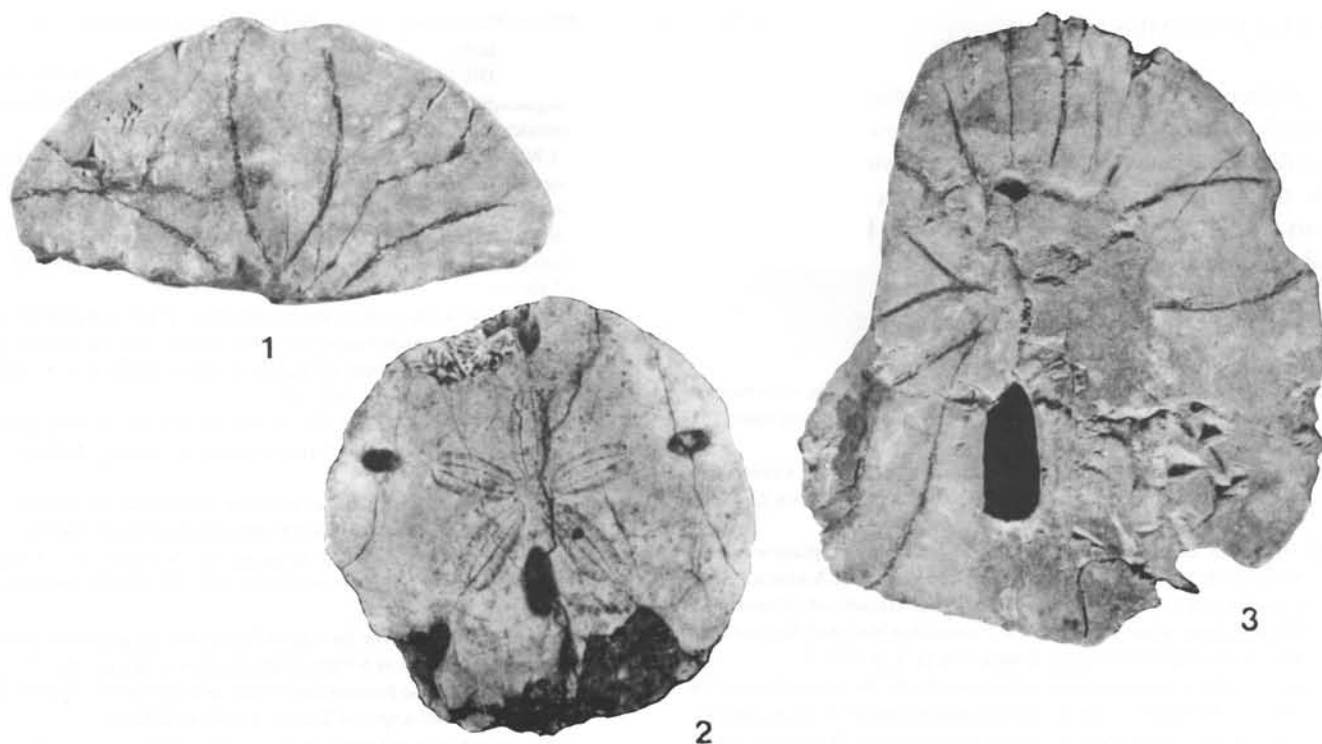


Plate 2.- Figures 1, 3—*Encope michoacanensis* n. sp., oral surface, approximately x 1. IGM locality Mch 2; figure 1, paratype IGM 2942; figure 3, paratype IGM 2943, immersed in xylene. Figure 2—*Encope perspectiva* L. Agassiz (?). Locality IGM Oax 15, hypotype IGM 2944. Apical surface immersed in xylene, approximately x 1.5. Immature individual.

encrusted by a hard calcareous sandstone. The interambulacral lunule is distinctly posterior in position. For comparison, Caso (1961, figs. 114-116) has illustrated good examples of *E. perspectiva* L. Agassiz and *E. micropora* L. Agassiz.

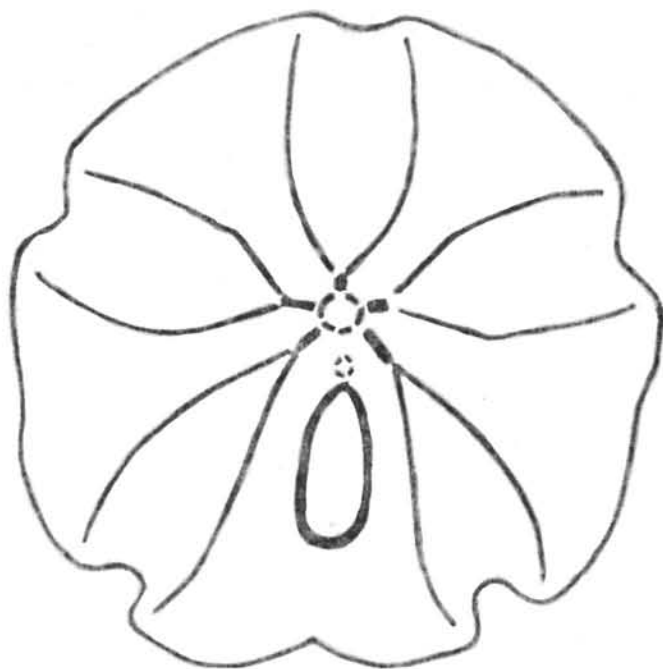


Figure 1.- *Encope michoacanensis* n. sp. Food grooves, oral surface. Reconstruction based on paratypes illustrated on Plate 2.

The species of *Encope* recorded herein indicate that the genus has been a member of the shallow water tropical Pacific Coast biota since at least the early Miocene. The affinities of *E. michoacanensis* with Panamic Miocene species, with *E. loretoensis* of the lower Pliocene of Baja California, and with *E. tateltaensis* from the Pliocene of the Tampico embayment, show that Woodring's (1966, 1978) "Tertiary Caribbean Province", which is based on fossil mollusca, is also reflected in the distribution of echinoids and shows that it extended farther to the northwest than he indicated and also supports the inference of Perrilliat (1979), that it extended to the northwest.

SUMMARY

Encope michoacanensis n. sp. is described from beds of late early to early middle Miocene age near La Mira, Michoacán, on the Pacific Coast of Mexico. It is compared with the fossil *E. annectans* Jackson, *E. platytata* Jackson, *E. loretoensis* Durham, and *E. tateltaensis* Böse, as well as the living *E. michelini* L. Agassiz.

An immature specimen from strata of Pliocene-Pleistocene age on the coast near Santa Cruz, Oaxaca, is referred to *Encope perspectiva* L. Agassiz (?). Adult specimens are needed to confirm the identification. Previously, R.H. Palmer and L.G. Hertlein in 1936 recorded *E. micropora* L. Agassiz from the Pleistocene Colotopec Formation along the coast of Oaxaca between Puerto Ángel and Puerto Escondido.

ACKNOWLEDGMENTS

Shelton P. Applegate and Luis Espinosa-Arrubarrena graciously turned over to me for study the fossil echinoids they had collected. Blanca Estela Buitrón encouraged me to describe them. Ismael Ferrusquía-Villafranca gave me much support while I was visiting scientist at the Universidad Nacional Autónoma de México in 1978-1979.

BIBLIOGRAPHICAL REFERENCES

- Agassiz, Louis, 1841, *Monographies d'échinodermes. II Livraison, contenant les Scutelles*: Neuchatel, Suisse, Imprimerie de Petitpierre à Neuchatel, 151 p., 26 pls.
- Böse, Emilio, 1906, Sobre algunas faunas terciarias de México: Universidad Nacional Autónoma de México, Instituto de Geología, Boletín 22, 96 p., 12 pls.
- Buitrón, B.E., 1978, Distribución de los equinoides terciarios en la planicie costera del Golfo de México, en América Central, en el norte de América del Sur y en las Antillas, in Ferrusquía-Villafranca, Ismael, ed., *Conexiones terrestres entre Norte y Sudamérica*: Universidad Nacional Autónoma de México, Instituto de Geología, Boletín 101, pt. 7, p. 66-113.
- Caso, M.E., 1948, Contribución al conocimiento de los equinodermos de México—II. Algunas especies de equinoideos litorales: Universidad Nacional Autónoma de México, *Anales del Instituto de Biología*, v. 19, p. 183-231.
- 1951, Los equinoideos fósiles del Cenozoico de México: Boletín de la Asociación Mexicana de Geólogos Petroleros, v. 3, p. 57-96.
- 1961, Los equinodermos de México: Universidad Nacional Autónoma de México, Facultad de Ciencias, Ph. D. dissertation, 388 p., 122 figs., 20 pls. (unpublished).
- Durham, J.W., 1950, 1940 E.W. Scripps Cruise to the Gulf of California; Part II, Megascopic paleontology and marine stratigraphy: Geological Society of America Memoir 43, pt. 2, 216 p.
- Durham, J.W.; Applegate, S.P.; and Espinosa-Arrubarrena, Luis, 1981, Onshore marine Cenozoic along southwest Pacific coast of Mexico: Geological Society of America Bulletin, v. 92, p. 1384-1394.
- Jackson, R.T., 1917, Fossil echini of the Panama Canal Zone and Costa Rica: U.S. National Museum, Annual Report, Proceedings, v. 53, p. 489-501, pls. 62-68.
- Contributions to the geology and paleontology of the Canal Zone, Panama, and geologically related areas in Central America and the West Indies—Fossil echini of the Panama Canal Zone and Costa Rica: U.S. National Museum, Bulletin 103, p. 103-116.
- Palmer, R.H., and Hertlein, L.G., 1936, Marine Pleistocene mollusks from Oaxaca, Mexico: Southern California Academy of Sciences, Bulletin 35, pt. 2, p. 65-81.
- Perrilliat, M.C., 1979, Malacofauna miocénica de Michoacán suroccidental y su significación paleobiogeográfica: Centro Básico, Universidad Autónoma de Aguascalientes, Sociedad Mexicana de Zoología, A.C., Congreso Nacional de Zoología, 3, Aguascalientes, Ags., México, Resúmenes, p. 51 (abstract).
- Phelan, T.F., 1972, Comments on the echinoid genus *Encope* and a new subgenus: Proceedings Biological Society of Washington, v. 85, p. 109-130.
- Woodring, W.P., 1966, The Panama land bridge as a sea barrier: Proceedings of the American Philosophical Society, v. 110, p. 425-433.
- 1978, Distribution of Tertiary marine molluscan faunas in southern Central America and northern South America, in Ferrusquía-Villafranca, Ismael, ed., *Conexiones terrestres entre Norte y Sudamérica*: Universidad Nacional Autónoma de México, Instituto de Geología, Boletín 101, pt. 10, p. 153-165.