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A New Cretaceous Echinoid from the Franciscan Formation
of California

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Abstract

A new species of *Stereocidaris* is described from the Franciscan formation of Santa Teresa Hills, Santa Clara County, California. Its affinities apparently are with *S. merceyi* (Cotteau) from the Senonian of Europe, but it differs in having primary areoles contiguous with the ambulacra. The age of the material is estimated as not earlier than lower Cretaceous.

THE cidarid described in the present paper was collected by Dr Edgar H. Bailey, of the United States Geological Survey, in limestone of the Franciscan formation, Santa Clara County, California. In forwarding the specimen to me for examination, Dr Porter M. Kier, of the Smithsonian Institution, mentioned (letter, July 7, 1959) that the age of the Franciscan formation of Western North America has proved difficult to interpret, and he indicated that if it were possible to deduce whether the cidarid is of Jurassic or Cretaceous age, even this approximate dating would be useful. Although the specimen is in a poor state of preservation, it has proved to be a recognizable member of the genus *Stereocidaris*, which is unknown from horizons earlier than the Cenomanian. Further, the remarkable condition of the supra-ambital interambis, which form a tall conical series, devoid of primary tubercles or areoles, shows that the species falls in the section of *Stereocidaris* known as *Phalacrocidaris*. Extreme reduction of the areoles is seen in *Stereocidaris* (*Phalacrocidaris*) *merceyi* (Cotteau), from the Senonian, where the upper interambis form a conical series like those of the Californian specimen. It is evident that the Californian species is closely related to *S. merceyi*, but differs in having the areoles of the lower side in direct contact with the ambis, the scrobicular tubercles bordering the pore-zones. The Californian species may be described as follows.

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STEREOCIDARIS Pomel, 1883

Type species: *Cidaris cretosa* Mantell*Stereocidaris baileyi* n.sp. (Plate 1, figs. 1-3).

HOLOTYPE. A somewhat crushed, eroded, leached test, No. USNM 138377 in the Division of Invertebrate Paleontology, United States National Museum, Washington, D.C.

TEST. Conical, broadest near the base at about the level of the fifth to sixth interamb-plate from the apex, tapering upwards towards the somewhat flattened apex, more or less flattened below; h.d., 72 mm; ht. approximately 68 mm (the apex missing).

AMBULACRA. Somewhat sinuate, but not conspicuously so, broad (ca 20% interamb-width). Interporiferous area at least twice the width of the pore-zone. Marginal series of tubercles prominent, somewhat irregular, contiguous at the adoral end, lost elsewhere from specimen through erosion, but apparently less prominent and smaller above. Internal tubercles smaller than marginals in the subambital region, where they are irregularly arranged—but not observable elsewhere on the specimen. Interporiferous area severely eroded in holotype, but evidently raised somewhat above the level of the pore-zones. On the best preserved parts of the ambis the pores are seen to be non-conjugate.

INTERAMBULACRA. Nine or 10 interamb-plates to the column. The adapical plate missing or broken on all columns. The next three plates nearly as high as broad, evenly covered by scattered secondary tubercles, with no trace of an areole or primary tubercle. The fifth plate somewhat higher than broad, evenly covered by uniform secondary tubercles, with no trace of an areole or primary tubercle. The sixth plate (ambital) much broader than high, with a conspicuous areole and primary tubercle occupying the outer two-thirds of the plate, the inner one-third uniformly clothed by secondary tubercles. The succeeding plates all broader than high, with conspicuous areoles and primary tubercles, the scrobicules all confluent, and an internal area clothed by uniform secondary tubercles. The areoles and primary tubercles are thus restricted to the more or less flattened region from the ambitus to the peristome. As can be seen in the photograph, on some interamb-plates where the secondary tubercles are preserved, the tubercle is often "perforate", or even entirely replaced by a "pore". This is an artificial condition brought about by leaching of the fossil.

By combining data from the several columns the following composite tabulation may be derived:—

Interamb Plate		Width (mm)	Height (mm)	Diam. of Areole (mm)	No. of Amb. Plates Opposite
No. 1	(adapical)	Missing or broken on all columns			
No. 2	.....	9.5	8.0	none	9
No. 3	.....	11.5	10.5	none	10
No. 4	.....	15.0	13.0	none	14
No. 5	.....	18.0	20.5	none	22
No. 6	.....	18.0	14.5	11	10
No. 7	.....	15.5	9.0	8	8
No. 9	.....	10.0	5.5	5	4
No. 10	(adoral)	7.5	4.0	4	2

APICAL SYSTEM. Unknown.

PERISTOME. Damaged and distorted, but evidently less than half h.d.



Stereocidaris baileyi n.sp., holotype. All figures uniformly enlarged to the scale indicated. Fig. 1—Lateral aspect of test, showing the best preserved amb and interamb. Fig. 2—Adoral aspect of test, showing primary tubercles and areoles. Fig. 3—Lateral aspect of test, showing relative proportions of the amb and interamb, primary areoles and tubercles visible below, the surface detail lost from the remainder of the visible plates.

Photo: M. D. King.

RADIOLES. Unknown.

MATERIAL EXAMINED. Holotype only.

LOCALITY. Dr Edgar H. Bailey (private communication, November 10, 1959), gives the following data:—

“The echinoid was found in a prominent knot of limestone lying at an altitude of 1,000ft at the junction of two major branches of Baldy Ryan Canyon (formerly known as Longwall Canyon) in the SE quarter of the Santa Teresa Hills 7½-minute quadrangle, Santa Clara County, California. This point is 4,800ft S. 69° of Fern Peak.

“Because of structural complexities the detailed stratigraphy of the area cannot be entirely deciphered. The fossil-bearing limestone is exposed as a series of discontinuous outcrops extending in a north-westerly direction through the district for a distance of about 15 miles. In many places the limestone lenses lie stratigraphically a short distance above a distinctively altered tachylytic tuff, suggesting they are parts of a single discontinuous ‘horizon’. The other associated rocks are greywacke, shale, greenstone, and chert, and the entire unit has been assigned to the Franciscan formation on the basis of its lithology.

“Near the echinoid locality *Nerinea* sp. was collected from the limestone. Another exposure of similar limestone lying eight miles north-west of the echinoid-bearing lens yielded the foraminifera described by Cushman and Todd (1948) and by Kupper (1955). The geology of the New Almaden district, which contains the most productive mercury mine in the United States, is described in detail in a report by Bailey and Everhart (in press).”

AGE OF THE FOSSIL CIDARID

In the classification of Cidaroida employed by Mortensen (1928) and adopted by Fell (1954), and Durham and Melville (1957), *Phalacrocidaris* is treated only as a section of *Stereocidaris*. The genus is well represented in the Pacific at present, and ranges back in time so far as the lower Cretaceous. The *Phalacrocidaris* section of the genus is known from the Senonian onwards, and is represented in the North Pacific at present, especially in the waters of southern Japan. In the alternative classification proposed by Lambert and Thiery (1909) the species *merceyi* Cotteau is referred to *Stereocidaris*, and the earliest species in the list of species included in the genus by these authors is of Cenomanian age. As Lambert and Thiery recognize *Phalacrocidaris* Döderlein as a valid independent genus, it appears that *merceyi* ought to have been referred to that genus, not to *Stereocidaris*; but even if this adjustment is made, it makes no difference to the question of the age of the material, for the oldest known species of *Phalacrocidaris* again proves to be Cenomanian. It can therefore be seen that in either of the rival systems of classification the conclusion emerges that the species belongs to a genus unknown from horizons older than Cenomanian, and the species may well be no older than Cenonian, or even younger. If the species were Jurassic it would be by far the oldest known member of its genus, and cogent external evidence would be required before that conclusion could be acceptable. It is inferred, therefore, that the species is probably no older than Cenomanian, and that its closer congener is *S. merceyi* of Senonian age.

The foregoing conclusions were reached on the basis of echinoid evidence alone, and were communicated to Dr Kier, of the Smithsonian Institution. He has since informed me that Dr Imlay, of the United States Geological Survey, has deduced, from different evidence, that the Franciscan is a facies formation which varies in age from Portlandian to Campanian. Thus, the independent sources of evidence lead to consistent results.

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