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TWO CRETACEOUS ECHINOIDS FROM PERU

C. WYTHE COOKE
U. S. Geological Survey, Washington, D. C.

ABSTRACT—*Orthopsis titicacana* and *Hemiaster* (*Macraster*) *cascajalensis* are described as new. The species from Brazil described by C. A. White in 1887 as *Cottaldia australis* is transferred to *Orthopsis*.

Several collections recently made by Norman D. Newell (1946) from near the base of the Ayavacas limestone member of the Moho formation west and northwest of Lake Titicaca in the Department of Puno, Peru, include two species of echinoids representing different genera. Although one, a *Tetragramma*, is not specifically identifiable and the other, an *Orthopsis*, is apparently undescribed, they throw some light on the correlation of the Ayavacas limestone, which is usually regarded as Aptian and Albian.

The geologic range of both *Tetragramma* and *Orthopsis*, as reported by Lambert and Thiery (1910, pp. 187, 199), is Jurassic and Cretaceous, but as both genera are the more abundant in the Cretaceous, their occurrence in Peru tends to corroborate the reference of the Ayavacas limestone member of the Moho formation to the Cretaceous. However, the genotype of *Tetragramma* comes from the Cenomanian and that of *Orthopsis* from the Senonian, and both genera attained their maximum proliferation in the Cenomanian. So it may be suspected that the Ayavacas limestone is somewhat younger than Aptian.

The species of *Tetragramma* is represented by five individuals from Newell's locality 104, north end of the bridge over Río Ilave at Ilave. None of them are well enough preserved for specific identification.

Orthopsis occurs at five localities, but apparently only one species is represented. It is most abundant at locality 159, a well about 4½ kilometers east-southeast of Ayavacas, from which 27 small individuals were obtained. These juveniles might be mistaken for a *Cottaldia* because of their nearly spherical shape and speciously imperforate tubercles, but their decoration is not that characteristic of *Cottaldia*, and a few tubercles retain the small perforated mamelon that is characteristic of *Orthopsis*,

The collection has been divided between the American Museum of Natural History at New York, which retains the holotype, and the United States National Museum at Washington.

One nearly complete *Hemiaster* and two siliceous crusts probably representing the same species, all the property of the Instituto Geologico del Perú, were placed in my hands for study by Dr. Newell. They were collected at Cerro Cascajal, near Lima, Peru, from greenish limestone referred to the Neocomian. Their resemblance to *Hemiaster elegans* Shumard (Cooke, 1946, p. 227), a species supposed to be restricted to deposits of late Albian age, casts doubt on this correlation.

ORTHOPSIS TITICACANA Cooke, n. sp.
Plate 22, figures 1–5

Subglobular; small, horizontal outline circular to subpentagonal. Apical system di-

EXPLANATION OF PLATE 22

FIGS. *1–5*—*Orthopsis titicacana* Cooke, n. sp. *1, 2*, Side and bottom of type, AMNH, ×2; *3*, paratype, USNM, ×2; *4*, details of surface, enlarged; *5*, apical system, enlarged. (p. 84)

6–11—*Hemiaster* (*Macraster*) *cascajalensis* Cooke, n. sp., type. *6, 7, 9*, Posterior end, side, and bottom, ×1; *8*, apical system, enlarged; *10*, top, ×1.5; *11*, top, ×2, photographed under water. (p. 85)

Drawings by Elinor Stromberg; photographs by Nelson A. Shupe except *11*, which is by G. Arthur Cooper.

cyclic, pentagonal. Ambulacral areas less than half as wide as the interambulacral; poriferous zones forming a straight line from ocular plates to peristome, three zygopores to each compound plate; interporiferous zones much wider than the zygopores, bearing one primary tubercle near the outer edge of each compound plate, the tubercles forming two continuous rows adjacent to the poriferous zones. Interambulacral areas wide, each bearing one primary tubercle near the middle of each plate and several smaller tubercles between it and the poriferous zones. Peristome small, less than half the total diameter, nearly circular, moderately notched. Periproct central, subcircular, rather large. Tubercles consisting of a large tumid boss surmounted by a very small perforated mamelon, which is commonly not preserved. Miliary areas scattered with granules. Spines slender, acicular.

Height 5.1 mm., diameter 7.0 mm., diameter of peristome 2.8 mm., diameter of periproct 1.0 mm. One individual from locality 19 measures 16 mm. in diameter; its peristome is 6.6 mm. across.

Comparisons.—*Orthopsis titicacana* appears to agree in all generic features with *Cidarites miliaris* d'Archiac, the genotype of *Orthopsis* Cotteau, 1863, as figured by Cotteau (1864, p. 558, pl. 1131). In decoration, however, it more closely resembles *Orthopsis ovata* (Coquand) from the Cenomanian of Algeria as figured by Cotteau (1864, pl. 1132), but it is very much smaller and none of its ocular plates touch the periproct.

The only other South American *Orthopsis* to which I have a reference is *Orthopsis australis* (White) (1887, p. 251, pl. 27, figs. 13, 14), which was described as a *Cottaldia* but which has plainly perforate tubercles. (Lambert and Thiery, 1910, p. 201, refer it to *Hebertia*.) This Brazilian species is much more depressed than the Peruvian *O. titicacana*.

Two species of *Orthopsis* have been described from the Washita group of Texas, *O. occidentalis* Cragin and *O. charltoni* (Cragin) (Cooke, 1946, p. 214, pl. 31, figs. 6, 7). Both of these species are more depressed than *O. titicacana* and *O. occidentalis* has a much smaller peristome. *O. charltoni* occurs in the Main Street limestone, which is probably of early Cenomanian age.

Occurrence.—Newell's locality 159, about 4½ km. east-southeast of Ayavacas, Department of Puno, Peru; 800 meters southeast of the summit of Cerro Tucurgachí, open well at north side of Ayavacas-Urcunimuni road (type and 26 other individuals). Localities 17 and 19, 500 meters southwest of camp office, Pirín, Department of Puno (two individuals, each embedded in hard limestone). Locality 135, Cerro Conchacaní, highway cut on road to Moquegua, 7 km. southeast of Puno (one individual embedded in limestone). Locality 13, 400 meters west of Aguallane School, near Pirín, Department of Puno (one slab of limestone containing several poorly preserved echinoids probably representing this species).

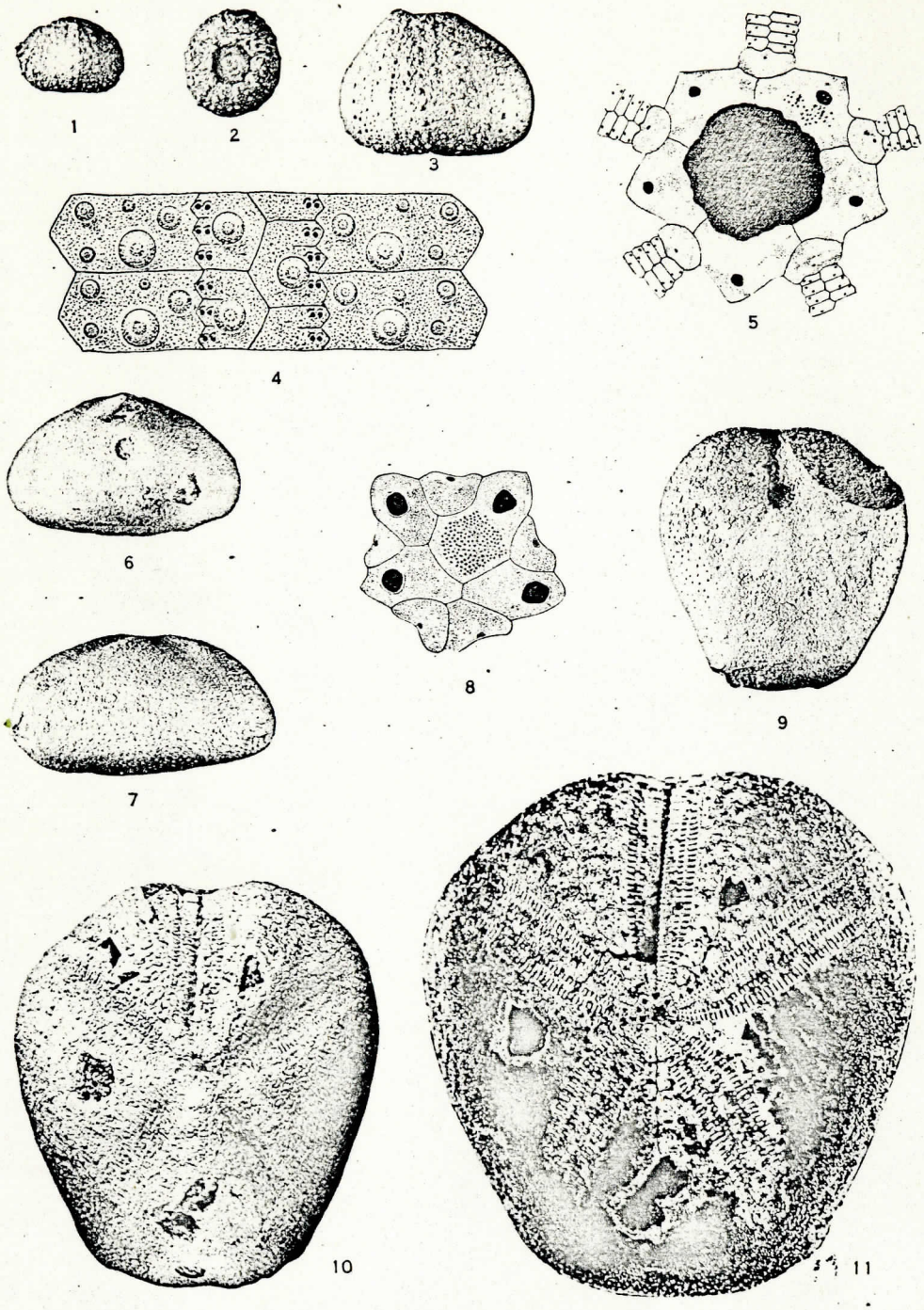
Geologic horizon.—Lower 2 meters of Ayavacas limestone member of the Moho formation, probably of Cretaceous age.

Types.—Holotype, American Museum of Natural History; paratypes, United States National Museum.

HEMIASTER (MACRASTER) CASCAJALENSIS Cooke, n. sp.

Plate 22, figures 6–11

Test cordate, moderately high, gently rounded below, truncated behind. Apical system central; ocular plates large, lunate, perforated, the posterior plate wanting; right anterior and left posterior plates touching all the other genital plates, the other two genital plates separated by the madreporite, which is almost central. Ambulacral areas petaliferous, petals open at the distal end, the anterior pair longer than the posterior pair and extending almost to the margin; paired petals in shallow depressions, anterior unpaired petal in a deeper groove, which extends to the peristome, anterior paired petals diverging at an angle approximating 108°, the posterior about 64°. Poriferous zones of anterior petal like the others, the zygopores consisting of a long outer slot and an inner slot about half as long as the outer and in line with it. Zygopores beyond the petals much smaller and farther apart, the pores commonly oval and forming an obtuse angle with each other. Peristome subpentagonal, rather large, the distance from its center to the anterior part of the ambitus less than one-third of the total length of the test. Periproct smaller



Cooke, Cretaceous Echinoids from Peru

than the peristome, oval, higher than wide, situated well up on the posterior truncation, plainly visible from above. Tubercles rather far apart except along the ambitus, where they are more numerous. No bare fasciole discernible.

Length 37.3 mm., width 34.6 mm., height 20.1 mm.

Comparisons.—*Hemiaster cascajalensis* most closely resembles *H. elegans washitae* (Lambert) (Cooke, 1946, p. 229, pl. 33, figs. 1–4) from the Comanche Washita group of Texas, from which it differs in its slightly shorter petals, less angular outline, and less steeply sloping posterior truncation. Moreover, the two slot-shaped pores comprising each zygopore of its anterior petal are aligned, whereas those of *H. washitae* are slightly inclined with respect to each other. In general appearance it resembles *H. whitei* (Clark) (Cooke, 1946, p. 224, pl. 32, figs. 16, 17), whose outline is more rounded, posterior truncation steeper, and whose anterior zygopores are not linear but consist of sharply inclined ovate pores separated by a granule.

Occurrence.—Cerro Cascajal, near Lima, Peru.

Geologic horizon.—In greenish limestone referred to the Neocomian. However, its resemblance to *Hemiaster elegans washitae*, a species supposed to be restricted to beds of upper Albian age, casts doubt on this correlation.

Type.—Instituto Geológico del Perú. Replicas in the United States National Museum and the American Museum of Natural History.

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