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A NEW SPECIES OF *PARALLELOCRINUS* FROM THE VINLAND SHALE, PENNSYLVANIAN, OF KANSAS

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ABSTRACT

An inadunate crinoid, *Parallelocrinus mercenarius* sp. nov., from the Vinland Shale, Douglas Group, Virgilian Series, (Pennsylvanian) of Kansas is described. The species is distinguished by (1) a globe-shaped cup with round and shallowly scalloped outline in dorsal and ventral views; (2) a wide, steep-walled basal impression; (3) prominent basal plates with steep proximal slopes; (4) radials with proximal tips well above the basal plane; (5) hollows that border the plates extend to distal reaches of interbasal borders; and (6) distinctive rugose ornament. Comparison is made with two crinoid species from the Permian of Timor. Possibility of relationship to *Lopadiocrinus tuberculatus* Wanner is suggested. Close resemblances of species of *Parallelocrinus* to "*Delocrinus*" *rugosus* Wanner in external structures of dorsal cups are noted, but attributed to homomorphy; radial articular structure indicates that the Wanner species is referable to *Apographiocrinus*, consequently it is herewith designated *Apographiocrinus rugosus* (Wanner, 1916) comb. nov.

INTRODUCTION

The inadunate crinoid genus *Parallelocrinus* was proposed by Knapp (1969) having for its type species *Parallelocrinus typus* from the Burgner Formation, Atokan Series, of Missouri. Since then (Burke, 1971) I have attributed to the genus a second species, *Parallelocrinus sturgeonii* from the Ames Limestone, Conemaughan Series, of Ohio. In the present paper a third species, *Parallelocrinus mercenarius* sp. nov. from the Vinland Shale, Virgilian Series, of Kansas, is described.

I wish to thank Dr. Porter M. Kier and Dr. Richard E. Grant of the National Museum of Natural History, and Dr. Eugene S. Richardson, Jr. of the Field Museum for the privilege of studying specimens that were pertinent to this investigation.

I am also grateful to my wife Emily for arranging the illustrations for this paper, and to Bruce Frumker, Staff Photographer, for photographs from which the illustrations were made.

SYSTEMATIC PALEONTOLOGY

Class CRINOIDEA Miller, 1821

Family CATACRINIDAE Knapp, 1969

Genus PARALLELOCRINUS Knapp, 1969

Parallelocrinus mercenarius* sp. nov.

Figs. 1-4

Diagnosis: A species differing from *Parallelocrinus typus* and *P. sturgeoni* mainly in the following features: Dorsal cup more rounded in dorsal and ventral views and globe shaped, rather than bowl shaped, in lateral view, lateral walls showing greater curvature; base more sharply truncate; basal impression steeper walled and wider; basals more prominent in dorsal and lateral views, with steeper proximal slopes; proximal tips of radials arising higher on cup walls; hollows between plate borders extending beyond proximal tips of radials and entering slightly along borders between basals; depressions at proximal tips of radials shallower and broader; cup surface appears shaggy, showing distinctive rugose ornament.

Holotype: CMNH 3977, a dorsal cup lacking the infrabasal circlet.

Repository: Cleveland Museum of Natural History, Cleveland, Ohio.

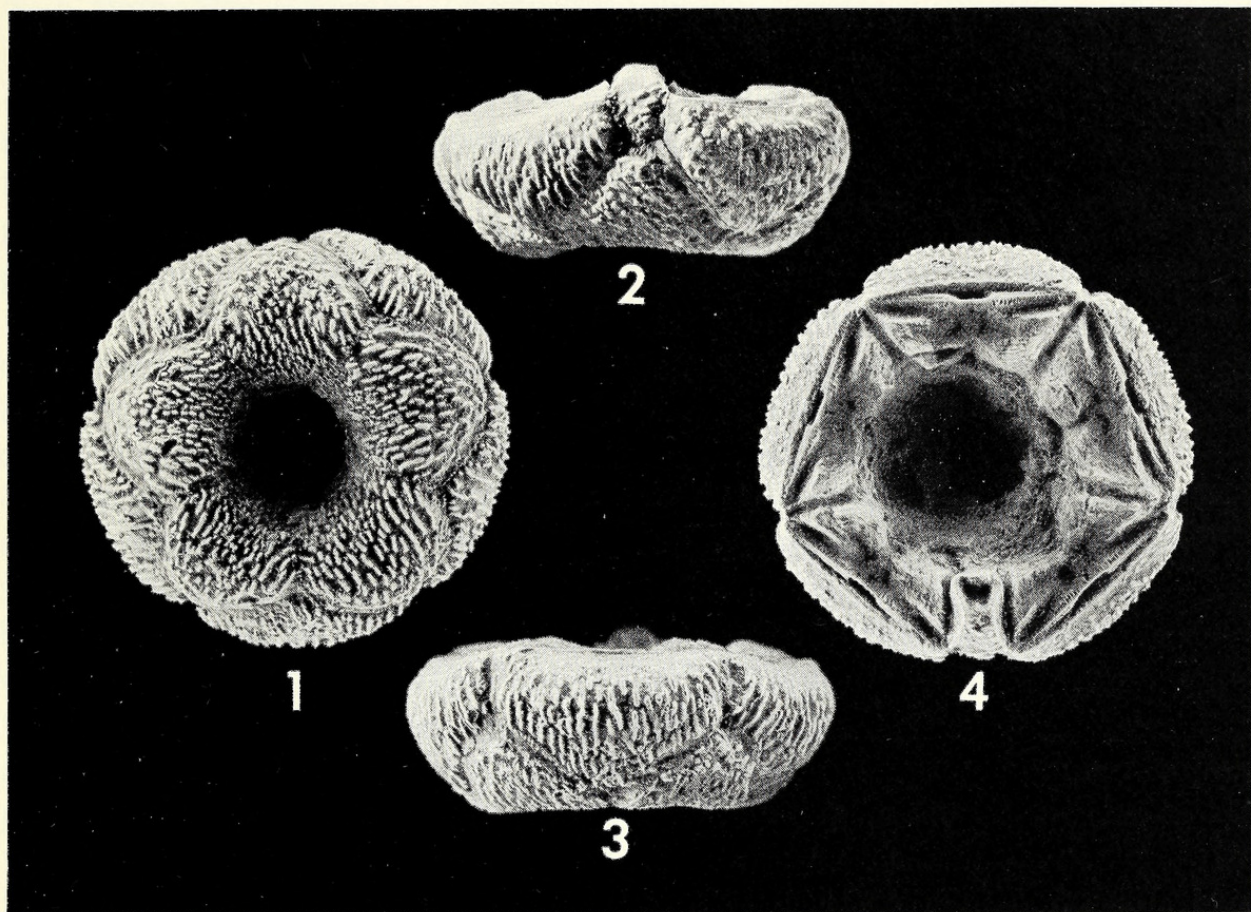
Occurrence: Vinland Shale, Stranger Formation, Douglas Group, Upper Pennsylvanian (Virgilian).

Locality: Homewood, Franklin County, Kansas.

Description: Dorsal cup $2\frac{1}{2}$ times as wide as high, and truncate low globe shaped; outline round and shallowly scalloped in dorsal and ventral views; right side of cup slightly higher than left. Basal impression steep walled and wide. Infrabasal circlet missing; height of impression unknown.

Basal plates downflaring steeply for most of their height within the basal impression, but bending rather abruptly outward on approach to basal plane; beyond basal plane plates slope gently outward and upward to their distal terminations.

*The holotype specimen was purchased from a dealer in geological supplies, hence the specific name. The specimen had been identified as *Graffhamicrinus magnificus* (Strimple).



Figures 1-4. *Parallelocrinus mercenarius*, sp. nov. Holotype, CMNH 3977, from the Vinland Shale, Douglas Group, Homewood, Franklin County, Kansas. Fig. 1, dorsal view; fig. 2, posterior view; fig. 3, anterior view; fig. 4, ventral view. X 2

Radial plates with proximal tips well above the basal plane and sloping upward and outward slightly steeper than basals to region of forefacets, where their surfaces curve inward, with gentler slopes, to summit of cup. Forefacets prominent, with depths about one-third those of the radial articular surfaces.

Radial facets face outward. Outer ligament ridge slightly arcuate, sags below transverse ridge; denticulate, at least in vicinity of slitlike ligament pit. Transverse ridge sharply defined, denticulate, contracts in vicinity of ligament pit, then expands on either side, but contracts again opposite inner reaches of lateral furrows, narrowing sharply to lateral extremities. Lateral furrows well defined, extend almost opposite extremities of ligament pit, flanked on inner side by steep-walled denticulate oblique ridge. Small central pit or foramen just below midline of transverse ridge on

inner side. Adsutural slopes steep; adsutural channels widening and deepening toward exits on internal side. Intermuscular notches broadly V-shaped. Intermuscular furrows short, angular, terminating between muscle areas. Muscle areas basin-like, separated also by rounded triangular area that expands upward, terminating below transverse crest opposite ligament pit.

Anal X convex from side to side, truncates distal tip of elongate CD basal, is impressed between C and D radials and extents for about a third of its height above the summits of those plates. It curves inward and upward, narrowing above, with concave lateral surfaces; distal articular surface faces both inward and upward and displays depressions on each side of the midline.

Wide hollows border sutures between cup plates, extending along interrarial sutures, sutures between radials and basals, and entering slightly along interbasal sutures. Hollows marked by smooth areas, shared by adjacent plates along interrarial and interbasal sutures; confined to basals along sutures between radials and basals. Distal tips of basals stand out in relief from floors of confluent hollows. Shallow depressions mark common sutures at proximal tips of radials, but small pits also present.

Ornament strikingly rugose, imparting shaggy appearance to cup; consists predominately of elongate ridges running parallel to length of plates (but opposite to length on anal X); ridges foreshortened or node-like within basal impression, on forefacet, and on anal X.

The cup shows evidence of damage by boring organisms. An ill defined subcircular depression with a central boss-like elevation, found near the tip of the EA basal, may represent the work of a gastropod. On the DE basal an elongate perforation is of the type usually attributed to the burrowing barnacle *Trypetesa*. Small round pits on the BC basal probably represent boring also.

Measurements: Linear measurements, in mm, taken on holotype CMNH 3977: Dorsal cup height, 8.0, width (max.), 20.0, H/W ratio 0.40; basal impression width, 8.9; EA basal length, 6.7 (appr.), width, 7.1; A radial length, 6.6, width 10.6; suture between BB, length, 4.9; suture between RR, length, 3.6; anal X height, 3.5, width, 2.7.

Discussion: *Parallelocrinus mercenarius* in several respects is more special-

ized than *Parallelocrinus typus* and *Parallelocrinus sturgeonii*. This is indicated by the steeper walled and wider proximal portion of the stem impression (and by inference a more robust stem); more prominent basals, having steeper proximal slopes; proximal tips of radials arising higher on the cup walls; presence of shallow depressions where the proximal tips of the radials meet subjacent basals; and hollows between plates prolonged slightly, extending to distal reaches of interbasal borders.

The peculiarities which I noted previously (Burke, 1971, p. 201) as characteristic of *Parallelocrinus*, notably "... the distal portions of the basals standing out in relief, with their tips elevated above the hollows" are also to be found in at least two specimens of crinoids from the Permian of Timor. The one, *Lopadiocrinus tuberculatus* Wanner (1937), not only shows the features noted above, but also essentially all of the distinctive surface structures of the cups of *Parallelocrinus*, including the deep forefacet, although the hollows between the plates are evidently more deeply entrenched and extend along the interbasal borders to merge with the basal impression. The radial articular facets are similar to those of *Parallelocrinus* and other Catacrinidae. It must be granted that the prominent asymmetrical infrabasal circlet and shallow basal impression would seem to exclude derivation of *Lopadiocrinus tuberculatus* from any known species of *Parallelocrinus*, but the possibility of descent of the Wanner species from *Parallelocrinus* or a *Parallelocrinus*-like ancestor deserves consideration.

In over-all external structure of the dorsal cup, the most striking similarity to species of *Parallelocrinus* is found in the Timor species originally described as "*Delocrinus*" *rugosus* by Wanner (1916). I have seen a specimen of this crinoid, USNM S3982, which is preserved in the Springer Collection of the National Museum of Natural History. It is labeled *Ceriocrinus rugosus* Wanner, and was probably identified by Wanner himself. In this Timor species we again find the distal reaches of the basals standing out in relief, and the hollows have the same distribution as in *Parallelocrinus* except that as in *Lopadiocrinus tuberculatus* they also parallel the interbasal sutures, terminating at the basal impression, just above the basal plane. The basal impression is moderate; it resembles that of *Parallelocrinus mercenarius* in being steep walled and relatively wide. The forefacet is prominent and deep. Anal X barely nicks the summit of the dorsal cup; it is wedged in between the shoulders of the C and D radials; below it is separated from the top of the CD basal

by these posterior radials, which have a common lateral suture. This is similar to the structure and disposition of the plates in the posterior interradius of *Parallelocrinus sturgeoni*, except that in that species, anal X and the CD basal are only slightly separated. Even the dorsal-cup ornament of USNM S3982 somewhat resembles that of *Parallelocrinus mercenarius*; the rugae, although coarse, are oriented much as are the more slender ridges of the latter species.

However, the articular surfaces of the radials of USNM S3982 are definitely indicative of *Apographiocrinus*; two of the interfacet "prongs" discussed by Moore and Plummer (1940, p. 117) are preserved in entirety, and it is evident that they are merely exaggerations of the same structures found in American species of the genus. It follows that the remarkable correspondence in surface structures of the dorsal cups of species of *Parallelocrinus* and those of Wanner's "*Delocrinus*" *rugosus* is quite evidently attributable to homeomorphy, and is not indicative of any close relationship between Wanner's species and representatives of *Parallelocrinus*.

As noted previously, Wanner first described this species (1916) as *Delocrinus rugosus*, then (1942) attributed it to *Cerocrinus*, and finally (1949) redescribed it as *Graphiocrinus?* *rugosus*. I am herewith designating it *Apographiocrinus rugosus* (Wanner, 1916) comb. nov. This adds a third species of *Apographiocrinus* to the Timor fauna; Moore and Plummer (1940) also placed *Graphiocrinus quinquelobus* Wanner and *Delocrinus pumilus* Wanner in synonymy under *Apographiocrinus*.

Moore and Plummer (1940) having relegated *Poteriocrinus rugosus* Shumard (1858) to synonymy under *Delocrinus*, argued (1940, footnote p. 272) that "*D. rugosus* Wanner, 1916 is a homonym of *D. rugosus* (Shumard) 1858 . . ." Inasmuch as Shumard's type was never illustrated and is no longer in existence, there is no way of determining what its generic affiliation may have been, and in any case there would now seem to be no grounds for applying a new trivial name to *Apographiocrinus rugosus*.

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