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MISSISSIPPIAN STRATA OF ALBERTA

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EDRIOASTEROID WITH UNIQUE SHAPE FROM MISSISSIPPIAN STRATA OF ALBERTA

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ABSTRACT—*Lispidecodus plinthotus*, new genus and species of edrioasteroid, is so unusual that a new family is proposed for it. Although the aboral end is missing, the remainder of the holotype and only specimen is well preserved, showing a vertically elongate, pentangular, pestle-shaped theca on which broad, mosaic-plated interambulacra form the flat sides and long, narrow ambulacra extend down along the edges. Both hydropore and anal pyramid are strongly elevated. No lineage is known leading to this edrioasteroid. It was found in the Canadian Rockies of Alberta and probably came from the Banff Limestone.

To emphasize the unique morphology of the Lispidecodidae, a key is offered to all edrioasteroid families, including Pyrgocystidae, n. fam. This key, based on current knowledge of general external characters, probably does not portray phylogenetic relationships.

INTRODUCTION

DEPENDENT upon discovery of reasonably well-preserved, representative specimens, the history and extent of any taxonomic group are traced and established sporadically. This is particularly true for Edrioasteroidea. Despite a few fortunate discoveries of good faunas, limited geographically and geologically, edrioasteroids are relatively rare and inadequately known through most of their range. Occasionally a specimen comes to light for which no lineage can even be suggested. So it is with the new form described here.

Around 1956, in the vicinity of Maligne Lake in Jasper National Park, some 30 miles southeast of the town of Jasper, Alberta, Canada, Mr. James R. Kilps found a small fossil. From the location of the discovery site and the nature of preservation, it is reasonably certain that the specimen came from the Mississippian Banff Limestone. From Mr. Kilps, a student, the fossil was taken into the care of Professor L. R. Laudon, of the University of Wisconsin, who recently presented it to the United States National Museum. I am very grateful to Mr. Kilps for his discovery, to Prof. Laudon for recognizing the scientific value of the specimen, and Dr. Porter M. Kier, of the U. S. National Museum, for making it available to me for study and description.

The edrioasteroid can be definitely identified as such by the nature of its ambulacral covering plates, peristomial region, hydropore, and anal pyramid. Otherwise, its construction is alien to the class. The theca has extreme vertical development, with long narrow ambulacra extending down the sides; in this respect, it resembles certain cystoids, but it cannot be a cystoid because it lacks both pore rhombs and diplopores. Features of the species are so bizarre that it is placed in a new genus and new family. The relationship

of the new family to other edrioasteroids is suggested in a revised key to the families.

SYSTEMATIC PALEONTOLOGY LISPIDECODIDAE, n. fam.

Type genus.—*Lispidecodus*, n. gen.

Description.—Theca with general shape of high, pentagonal spindle or inverted pestle. Peristome at or near oral pole, relatively small. Ambulacra long, nearly straight, inset along five edges of theca. Interambulacra nearly equal in size. Hydropore distinct, long slit, slightly offset to right near junction of peristome and posterior interambulacrum. Anal pyramid near oral pole.

Remarks.—The mosaic nature of interambulacral plates is intentionally excluded as a familial character because both mosaic and imbricated plates are known to occur within the same edrioasteroid family. Because only one specimen is known of this family, the extent of these characters cannot be estimated with any assurance. It might seem that an elongate, erect theca would invariably require mosaic plates for rigidity; yet this is not the case, for species of *Pyrgocystis* have a very elongate and presumably erect theca consisting of a small circular oral face set atop a petaliferous stalk with narrow plates arranged in flaring, imbricating, nested rosettes.

A key to edrioasteroid families is presented here, including the Pyrgocystidae, a new family erected below. The Lispidecodidae differs from the Pyrgocystidae in having much longer ambulacra and flat surfaces on the five sides; it differs from all other families in its greater vertical development.

KEY TO FAMILIES OF EDRIOASTEROIDEA

(Artificial, not designed or intended to show phylogeny)

1. Aboral side fully plated. Stomatocystitidae
Aboral side not fully plated. 2

2. Basal plates ankylosed to form attached base supporting oral face, theca stumplike.....Cyathocystidae
Basal plates not ankylosed.....3
3. Theca vertically elongate, not disk-shaped or globose.....4
Theca globose, disk-shaped, or planoconvex, not elongate.....5
4. Ambulacra short and broad, on gently domed area atop turret- or stumplike support of numerous plates.....Pyrgocystidae
Ambulacra long and narrow, extending down edges of pentangular spindle- or pestle-shaped theca.....Lispidecodidae
5. Ambulacral flooring plates biserial, no peripheral ring, theca globose or rotund.....Edrioasteridae
Ambulacral flooring plates uniserial, peripheral ring present, theca disk-shaped or planoconvex.....6
6. Peristome covered by four or more plates, of which four have definite arrangement: three in left anterior, right anterior, and posterior positions meeting in center, and one asymmetrically placed in right posterior (in some genera associated with hydropore).....Hemicystitidae
Peristome covered by more than four plates, not in any definite arrangement.....Agelacrinitidae

LISPIDECODUS, n. gen.

Type species.—*L. plinthotus*, n. sp.

Description.—Theca spindle- or pestle-shaped, ambulacra long and nearly straight, interambulacra wide and nearly equal, hydropore elongate, and anal pyramid near oral pole, as described for the family Lispidecodidae. Hydropore and anal pyramid both strongly elevated, exceptionally close to each other. Ambulacral covering plates of each side with two general shapes, alternating: narrow, tongue-like plates extending well past centerline of ambulacrum, and short, broad, U-shaped plates each fitting around terminus of opposing long plate.

Remarks.—There is no question about this genus being an edrioasteroid. The structure of ambulacral covering plates, mosaic interambulacra, symmetry of peristomial region, and form of hydropore closely resemble those in other genera. Differences between this and other edrioasteroids are no greater than, for example, those between *Rhombifera* and other cystoids.

The theca has the same overall shape as that of the blastoid *Nucleocrinus* or the cystoid *Dactylocystis*, but this is wholly superficial and not indicative of close relationships. It could be pointed out that the unusual pentremite shape was attained by the unrelated diploporan cystoid *Asteroblastus*, the rhombiferan cystoid *Cystoblastus*, the edrioblastoid *Astrocystites*, the parblastoid *Blastoidocrinus*, and the eublastoid *Pentremites* at different geologic times. Among edrioasteroids, *Lispidecodus* holds the same relationship in shape to *Edrioaster* and *Isorophus* that, for example, among echinoids *Lepidesthes* holds to *Echinus* and *Dendraster*.

In general form of theca, *Lispidecodus* has the

appearance of a *Lepidodiscus* or *Discocystis* that settled at the bottom of a narrow cylinder, to which by necessity it was forced to conform as it grew. Yet the interambulacral surfaces on the sides are flat and the ambulacral covering plates are unaffected by any restraining boundary, so that one must concede that the spindle or pestle shape is natural for the edrioasteroid. The long meridional extent and equal development of ambulacra indicate an upright position during life. One is led to suppose that the animal had some special process for fixation.

The mystery is how a filter-feeder could evolve such a precarious form, depending all the while upon currents for its food supply. The natural position, degree of shelter from currents or waves, and flexibility of the attachment are not known.

The generic name is derived from the Greek *lispos*, *idios*, and *kodeia*, referring to the theca being a smooth, peculiar, little head; it is an anagram of *Lepidodiscus*, which the genus resembles in general form of curved hydropore, long ambulacra, and cyclic ambulacral covering plates.

LISPIDECODUS PLINTHOTUS, n. sp.

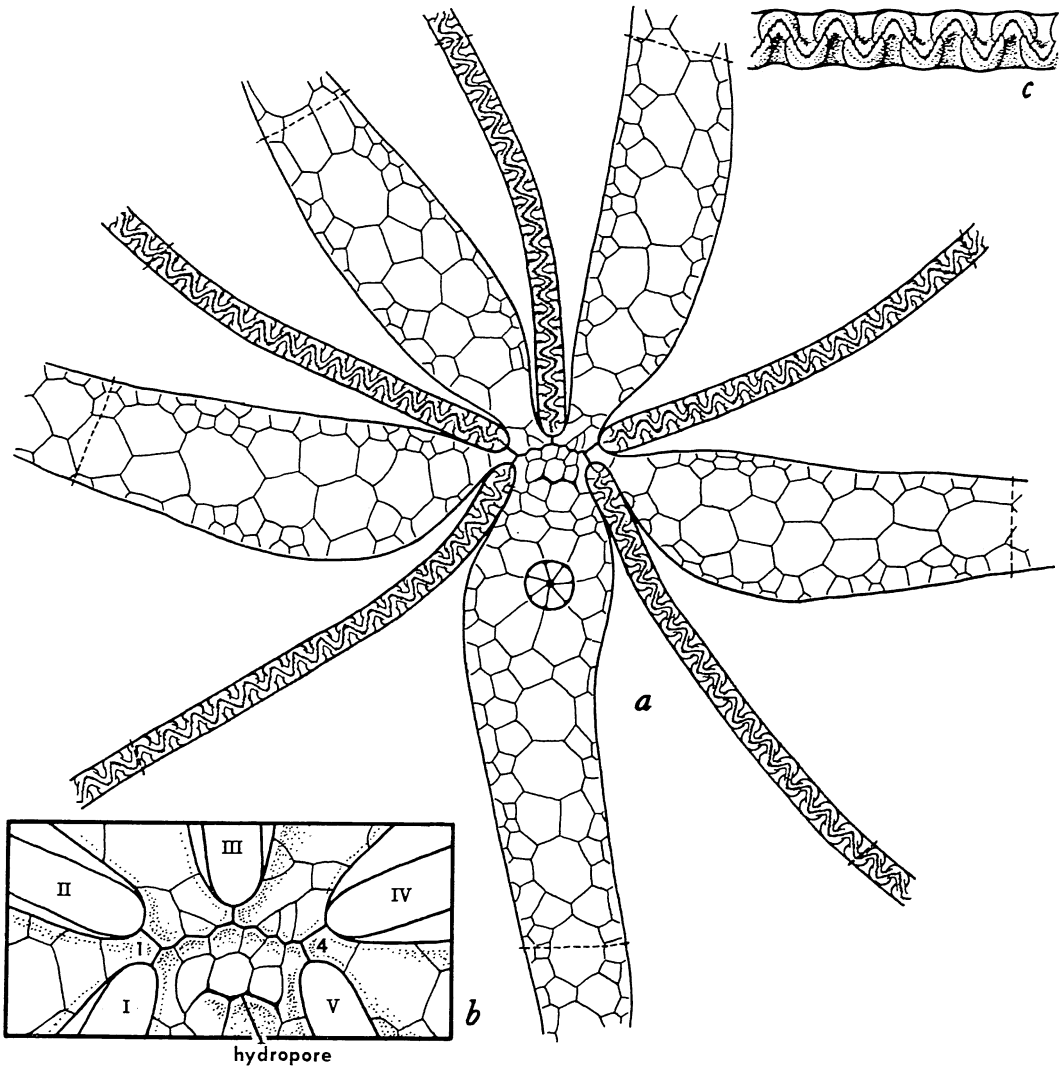
Pl. 21, figs. 1–9; text-figs. 1,2

Description.—Theca relatively small in only known specimen; preserved part of theca 18 mm high, complete theca probably not over 24 mm high; specimen somewhat crushed, as reconstructed greatest diameter estimated to have been about 9 mm. Theca pestle-shaped, greatest diameter near oral end (text-figs. 1a,2e,2h; pl. 21, figs. 2–4); in cross section pentagonal, with broad interambulacra forming nearly flat sides and narrow ambulacra inset at corners (text-fig. 2b; pl. 21, figs. 1–7).

Ambulacra very long, distinctly set off from peristomial region, none terminated at lower limit of specimen. From its junction with peristome, each ambulacrum passing outward and downward along edge of pentangular theca; ambulacra I and V curved somewhat posteriorly to fit alongside posterior interambulacrum (text-figs. 2a,h); distal sections of ambulacra nearly straight (text-figs. 2a,d-g; pl. 21, figs. 2–4,6,7).

As seen from broken end of specimen (pl. 21 fig. 5), ambulacral flooring plates narrow and deep; cross sections V-shaped, none showing plate junctions, strong evidence for uniserial arrangement of flooring plates.

Ambulacral covering plates distinct and regular, not directly aligned or continuous with adjacent plates of peristome region (pl. 21, fig. 8). Two types of plates: long, narrow, tongue-like plates alternating with short, broad, U-shaped plates along each side (text-fig. 1c). Each

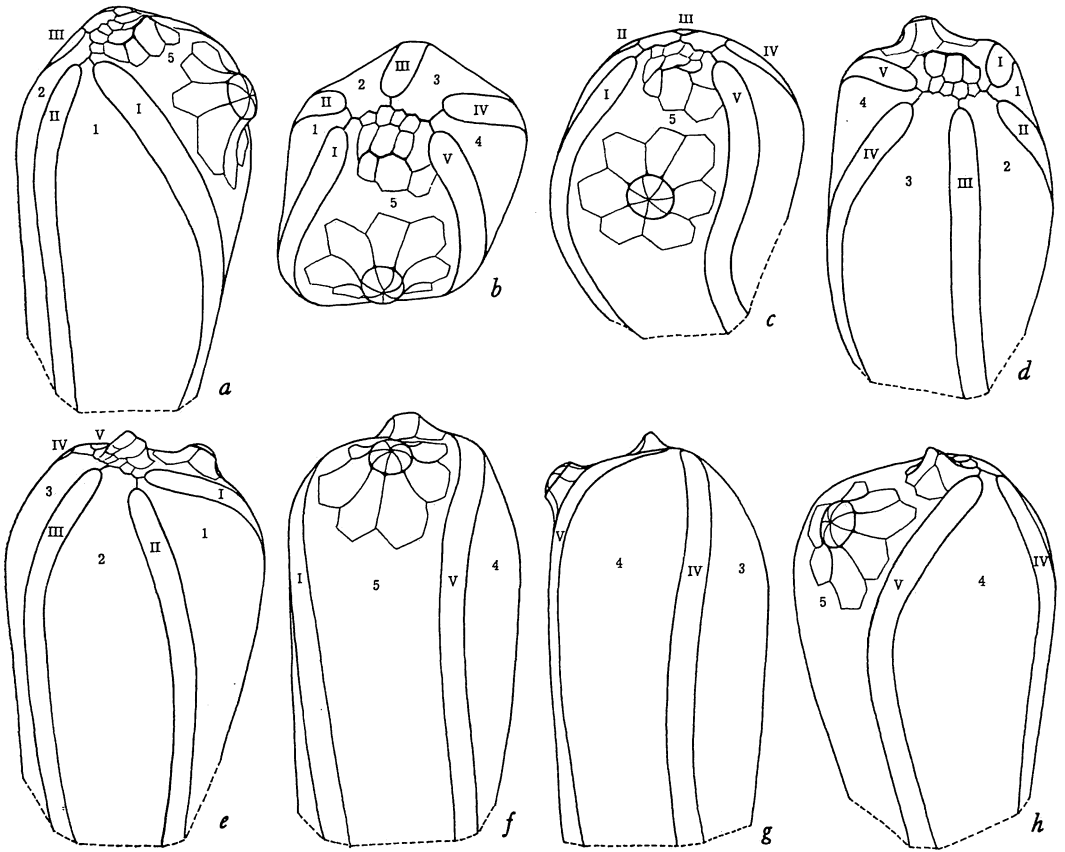


TEXT-FIG. 1—*Lispidocodus plinthotus*, n. sp. *a*, Plate diagram, slightly modified where theca was distorted and crushed; anal pyramid plates hypothetical. *b*, Diagram of peristomial region and hydropore; Roman numerals are conventional symbols for ambulacral areas; uppermost plates of interambulacra 1 and 4 designated by appropriate numbers; some plates broken or cracked, making it difficult to ascertain correct plate boundaries, so that there are probably some additional small, wedgelike plates inserted along major suture (cf. pl. 21, fig. 8). *c*, Ambulacral covering plates (cf. pl. 21, fig. 9).

narrow plate extending well beyond middle of ambulacrum, its inner and outer ends expanded and its sides concave; each broad plate curved around terminus of opposing long plate, its ends (in closed cover plates) in contact with two similar offset plates of opposite side. Where worn thin, some kind of internal septation indicated normal to direction of ambulacrum (pl. 21, fig. 9), suggesting interfingered baffles from opposing plates to form an effective strainer when plates opened; for plates to open, however, extensions of baffles beyond plate border necessarily short and directed inward toward ambulacral floor.

Zigzag junction of opposing columns of plates further marked by small serrations; edges of plates along median junction raised to form ridge (as in *Discocystis laudoni*).

Interambulacra subequal, those of interambulacra 2 and 3 slightly narrower in upper part (text-fig. 1a). Plates mosaic, with large polygonal plates along center of interambulacrum and smaller irregular plates filling space between larger plates and nearly straight border. Interambulacrum 5 (posterior) longer than others, containing hydropore and anal pyramid. Uppermost plates of interambulacra 1 and 4



TEXT-FIG. 2—*Lissipidecodus plinthotus*, n. sp. a-h, Various views of cardboard model, constructed from camera lucida drawings of plates in ambulacra and interambulacra adjusted to eliminate distortion by crushing insofar as possible. Dashed lines represent a horizontal plane through the specimen, and correspond to the dashed lines in the plate diagram shown in text-figure 1a.

(text-fig. 1b) spearhead-shaped, their concave sides bounded by adjacent ambulacra and their pointed ends fitting into angles formed by bifurcations of opposite ends of major peristomial suture (text-figs. 1a,b; pl. 21, fig. 8). Plates of interambulacra 2,3, and 5 not set off from peristomial covering plates, several plates of each reaching major peristomial suture; very short suture between uppermost plates of interambulacra 2 and 3.

Peristomial region indefinite, no demarkation from adjacent parts of interambulacra, slightly offset from apex of theca, bilaterally symmetrical (text-fig. 1b; pl. 21, fig. 8). Major suture of peristomial cover plates with general shape of strongly obtuse angle, with minor serrations between interambulacra 2 and 5 and between 3 and 5. Short suture joining midpoint of major suture, separating interambulacra 2 and 3. Each end of major suture bifurcate, its short extensions bounding apices of interambulacrum 1 on one side and 4 on the other. Rims of plates along

peristomial sutures slightly elevated (text-fig. 1b).

Hydropore especially prominent, strongly elevated, set at pole of theca, not definitely part of peristome or interambulacrum 5. Long zigzag suture subparallel to major peristomial suture along apex; steeply inclined side plates not reaching peristomial suture, separated from it by row of small plates (text-figs. 1b, 2a-e).

Anal pyramid sharply elevated. Seven supporting plates rising steeply from rest of interambulacrum 5, large, concave (text figs. 2a-h; pl. 21, figs. 1,3,4). Outer edges of supporting plates forming subcircular rim, presumably constituting outer articulating facets for rosette of small, triangular plates of anal pyramid.

Remarks.—Above remarks on the family and genus apply equally here. From the development and extent of the ambulacra, one must conclude that, whatever its nature, the attachment was wholly below the preserved part of the specimen. The general form of hydropore is

reminiscent of that in *Discocystis laudoni*, termed type VI (Kesling, 1960, p. 173). This unusual edrioasteroid is without known lineage.

Holotype.—U. S. National Museum No. 154961, from Locality 6347.

PYRGOCYSTIDAE, n. fam.

Type genus.—*Pyrgocystis* Bather, 1915 (see discussion and description by Bather, 1915a, p. 5-12, 49-60; 1915b).

Description.—Theca tall, rather broad ambulacra of large simple plates confined to gently domed area atop turret- or stump-like support of numerous plates. Anal pyramid and hydro-pore inconspicuous.

Remarks.—This family is described here to compare with the Lispidecodidae. It includes *Pyrgocystis*, with a turretlike support of petaliform plates set in flaring, imbricating rosettes

around a stalk or axis, and probably *Cystaster*, with a stumplike base studded with numerous tiny ossicles. The latter genus bears some resemblance to the older genus *Cyathocystis*, but does not have the basal elements ankylosed.

LITERATURE CITED

- BATHER, F. A., 1915a, *Pyrgocystis* n.g.: Geol. Mag., n. ser., decade 6, v. 2, p. 5-12, pls. 2,3 (part I); p. 49-60 (part II).
—, 1915b, Studies in Edrioasteroidea I-IX. [Articles published in Geological Magazine between 1898 and 1915 were reissued, including plates and original pagination, with added preface and index, as a book; the title page states that it was "published by the Author at 'Fabo,' Marryat Road, Wimbledon, England, October, 1915."]
KESLING, R. V., 1960, Hydro-pores in edrioasteroids: Contr. Mus. Paleontology, Univ. Mich., v. 15, no. 8, p. 139-92, 13 pls., 14 text-figs.

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(Explanation of Plate 21 appears on the following page)

EXPLANATION OF PLATE 21

(Figures 8 and 9, $\times 20$; all others, $\times 4$)

FIGS. 1-9—*Lispidocodus plinthotus*, n. sp. Holotype, USNM 154961; coated with ammonium chloride in figures 1-4, 8; submersed in xylol in figures 5-7, 9. 1, Inclined posterior view, directly above anal pyramid; peristome and hydropore near top of figure. 2-4, Lateral views centered on ambulacrum III, interambulacrum 5 (posterior), and interambulacrum 4; protuberance at top is hydropore. 5, Broken aboral end, showing deep ambulacral flooring plates. 6, 7, Lateral views centered on ambulacra II and V. 8, Peristomial region and hydropore; slight displacement along major peristomial suture and some plates apparently broken; compare with text-fig. 1b. 9, Section of ambulacrum II, showing cyclic covering plates.

