CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY

THE UNIVERSITY OF MICHIGAN

VOL. XIX, NO. 8, pp. 105–114 (1 pl., 1 fig.) NOVEMBER 25, 1964

A NEW SPIRACULATE BLASTOID, *PYRAMIBLASTUS,* FROM THE MISSISSIPPIAN HAMPTON FORMATION OF IOWA

BY

DONALD B. MACURDA, JR.

MUSEUM OF PALEONTOLOGY
THE UNIVERSITY OF MICHIGAN
ANN ARBOR

CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY

Director: LEWIS B. KELLUM

The series of contributions from the Museum of Paleontology is a medium for the publication of papers based chiefly upon the collections in the Museum. When the number of pages issued is sufficient to make a volume, a title page and a table of contents will be sent to libraries on the mailing list, and to individuals upon request. A list of the separate papers may also be obtained. Correspondence should be directed to the Museum of Paleontology, The University of Michigan, Ann Arbor, Michigan.

VOLUME XIX

1. Silicified Trilobites from the Devonian Jeffersonville Limestone at the Falls of the Ohio, by Erwin C. Stumm. Pages 1–14, with 3 plates.
2. Two Gastropods from the Lower Cretaceous (Albian) of Coahuila, Mexico, by Lewis B. Kellum and Kenneth E. Appelt. Pages 15–22, with 2 figures.
3. Corals of the Traverse Group of Michigan, Part XII, The Small-celled Species of *Favosites* and *Emmonsia,* by Erwin C. Stumm and John H. Tyler. Pages 23–36, with 7 plates.
4. Redescription of Syntypes of the Bryozoan Species *Rhombotrypa quadrata* (Rominger), by Roger J. Cuffey and T. G. Perry. Pages 37–45, with 2 plates.
5. Rare Crustaceans from the Upper Devonian Chagrin Shale in Northern Ohio, by Myron T. Sturgeon, William J. Hlavin, and Robert V. Kesling. Pages 47–64, with 5 plates.
6. A Fossil Dennstaedtioid Fern from the Eocene Clarno Formation of Oregon, by Chester A. Arnold and Lyman H. Daugherty. Pages 65–88, with 7 plates.
7. A New Species of Melocrinites from the Middle Devonian Bell Shale of Michigan, by Robert V. Kesling. Pages 89–103, with 2 plates.
8. A New Spiraculate Blastoid, *Pyramiblastus,* from the Mississippian Hampton Formation of Iowa, by Donald B. Macurda, Jr. Pages 105–114, with 1 plate.

VOL. XIX, No. 8, pp. 105–114 (1 pl., 1 fig.) NOVEMBER 25, 1964

A NEW SPIRACULATE BLASTOID, *PYRAMIBLASTUS,* FROM THE MISSISSIPPIAN HAMPTON FORMATION OF IOWA

BY
DONALD B. MACURDA, JR.

ABSTRACT

Restudy of the Lower Mississippian blastoid species *Orophocrinus fusiformis* Wachsmuth and Springer from the Hampton Formation in Iowa has shown that it is a spiraculate blastoid, not fissiculate as previously described. Its generic characters warrant assignment to a new genus, for which the name *Pyramiblastus* is herein proposed. The calyx of this blastoid is very fragile, disarticulating before the brachioles. This type of phenomenon complicates the interpretation of blastoid paleoecology and may explain some gaps in the geologic record of blastoids.

CONTENTS

Introduction 105
Acknowledgments 106
Systematic descriptions 106
Literature cited 112
Plate ..... (*after*) 113

INTRODUCTION

NEAR THE END of the nineteenth century, an unusual echinoderm fauna was discovered in a quarry in the Lower Mississippian Hampton Formation (Kinderhookian) near Le Grand, Iowa. Slabs of rock were blasted out from the quarry wall; these contained large numbers of crinoids with intact arms and stems. The crinoids occurred in colonies which are now on display in museums throughout the world. Associated with the crinoids in these colonies, there are two species of blastoids, *Orophacrinus conicus* Wachsmuth and Springer and *Orophocrinus fusiformis* Wachsmuth and Springer. *Orophocrinus* is a fissiculate blastoid, i.e., it has no hydrospire pores. A restudy of the two species has shown that *fusiformis* is a spiraculate blastoid, having pores through the ambu-

lacra; it also has spiracles rather than spiracle slits. These characters exclude it from the genus *Orophocrinus*. A comparison of the characters of "*O.*" *fusiformis* with those of other blastoids has established that it belongs to a new genus, for which the name *Pyramiblastus* is herein proposed.

ACKNOWLEDGMENTS

Permission to study specimens in the U. S. National Museum was granted by G. Arthur Cooper, Head Curator, Department of Geology, and Porter M. Kier, Associate Curator, Division of Invertebrate Paleontology, who also provided some of the photographs used in this and other publications. Lowell R. Laudon, University of Wisconsin, made his collection of blastoids available. Specimens of the genus *Pyramiblastus* were loaned by: Lewis M. Cline, University of Wisconsin, George T. Farmer, Jr., University of Cincinnati, Lois S. Kent, Illinois State Geological Survey, and Matthew N. Nitecki, University of Chicago. I. G. Reimann, University of Michigan, loaned a specimen of *Schizotremites* for comparison. Bernice H. Beane of Le Grand, Iowa, allowed me to examine his entire collection; Beane, Laudon, and Richard Boyt, Iowa State Department of History and Archives, discussed, with me, the stratigraphy and sedimentary environment of the Hampton Formation at Le Grand, Iowa. I visited Le Grand to study the Hampton Formation during the summers of 1961 and 1962.

The support of a National Science Foundation Summer Fellowship for Graduate Teaching Assistants during the summer of 1961 and an NSF Graduate Fellowship during 1962 is gratefully acknowledged.

SYSTEMATIC DESCRIPTIONS

Class BLASTOIDEA

Order SPIRACULATA

Genus *Pyramiblastus,* n. gen.

Type species.—*Pyramiblastus fusiformis* (Wachsmuth and Springer).

Diagnosis.—Spiraculate blastoids with eight spiracles in addition to a paired anispiracle; anus occurs between a superdeltoid, two cryptodeltoids (?), and a hypodeltoid; lancet widely exposed; one hydrospire pore between each side plate along both radial and deltoid, deltoids overlap radials, six or more hydrospire folds per ambulacral side, deltoids visible in side view, bipyramidal shape. *Mississippian,* Kinderhookian, Iowa.

Remarks.—During life, a blastoid was held above the ocean floor by its stem; upon death, it sank to the bottom. Tissue was the only substance

which held the plates of the calyx, stem, and brachioles together. When this was completely decomposed, currents would scatter the plates and incorporate them into the sediment. The plates of the calyx were more tightly integrated than other plates; one occasionally finds a complete calyx but it is very unusual to find either stem, brachiolar, or ambulacral cover plates still in place on the calyx. *Pyramiblastus,* however, differs from most genera in that the calyx was the more fragile part of the organism. The plates of the calyx are usually crushed and partially disoriented while the brachioles and stem are still in place. This is due in part to diagenesis. It indicates the unlikelihood, however, of any calices being preserved intact. Calices of *Orophocrinus conicus,* which occur in the colonies with *Pyramiblastus fusiformis,* also have arms and stems in place but the calyx plates are not deformed or disarticulated. Only *O. conicus* has been collected outside the colonies, *P. fusiformis* being too fragile to withstand deposition in a more energetic environment.

The slabs containing these colonies are found at a restricted horizon in the main south quarry in the Lower Mississippian Hampton Formation at Le Grand, Iowa (Laudon, 1931; Laudon and Beane, 1937, p. 235). There has been some speculation over the sedimentary conditions responsible for the preservation of these colonies (*e.g.,* Boyt, 1962). They must be a result of rapid burial or a local, less energetic environment. If these had not been preserved, *Pyramiblastus* would be unknown in the fossil record. Such rapid disarticulation of the calyx complicates the interpretation of blastoid paleoecology and phylogeny and may explain many of the gaps in the geologic record of blastoids.

The brachioles, which are preserved on most specimens of *Pyramiblastus fusiformis,* cover the summit of this blastoid and hide the side plates of the ambulacra. However, by examining most of the known specimens, it was possible to diagnose the oral and ambulacral characters. The fine carbonate sediment of the Hampton Formation frequently obscures ambulacral detail but a specimen from the collections of the Illinois State Geological Survey shows the presence of hydrospire pores along both the radials and deltoids, eight spiracles and a paired anispiracle surrounding the mouth, an exposed lancet, and the bipyramidal character of the calyx (Pl. 1, Fig. 2). These and other characters warrant the assignment of this species to a new genus.

The configuration of the spiracles relates *Pyramiblastus* to genera listed by Fay (1961*a,* p. 111–12; 1964, p. 84–85)) in the families Troosticrinidae and Granatocrinidae. Its bipyramidal shape readily distinguishes it from all but one genus of the Granatocrinidae, *Calycoblastus,* which, except for this genus, have a globose calyx. It is distinguished from *Calycoblastus*

by the fact that the lancet of the latter is completely covered by the side plates, the radials do not extend under the deltoid, and the ambulacra extend over two-thirds of the way down the calyx (see Wanner, 1924). *Pyramiblastus* is readily distinguished from all genera of the Troosticrinidae except *Schizotremites* by the shape of the calyx and exposure of the deltoid in the side of the calyx. It differs from this latter genus in having a widely exposed lancet, the deltoid overlaps the radial instead of the converse, and it has ovoid spiracles instead of elongate, slit-like spiracles (see Fay, 1961*b*; Reimann, 1945).

Fay has used the term "paired spiracles" for the spiracles in such genera as *Metablastus* and *Troosticrinus* (1961*a*, p. 110); this is characteristic of the family Troosticrinidae. He also used this for *Schizotremites*; here the separation is wider and more distinct. The spiracles in *Pyramiblastus* have about the same degree of separation as in *Schizotremites* but the use of the term "paired" for the spiracles of these two genera is not recommended because the separation is more distinct than in *Metablastus* and *Troosticrinus*.

The generic name is derived from the Greek *pyramis* in *reference to* the bipyramidal shape of the calyx.

Pyramiblastus fusiformis (Wachsmuth and Springer)
(Pl. 1, Figs. 1–5)

Orophocrinus fusiformis Wachsmuth and Springer, 1888, p. 14; 1890, p. 203–205, Pl. 17, Fig. 4; Beyer, 1896, p. 224; Bather, 1897, p. 101, Fig. 157; 1899, p. viii; 1900, p. 82, Fig. 4; 1907, p. 66, Fig. 30; Van Tuyl, 1925, p. 83; Laudon, 1931, p. 428; Fay, 1961*a*, p. 37, Pl. 15, Figs. 3–8; Fay and Reimann, 1962, p. 44, 47, Pl. 23, Figs. 2, 6.

Codonites fusiformis Miller, 1889, p. 233, Fig. 269.

Description.—Calyx bipyramidal, with vault and pelvis approximately equal. Pelvic profile conical, straight sided, pelvic angle 29–51°, average 41°. Vault paraboloid, elongate; slightly flattened on oral surface. Length of calyx typically about 18 mm, width one-half the length. Greatest width at aboral tips of ambulacra. Cross section at ambulacral tips pentagonal with slightly concave interambulacral areas.

Basalia three, form one-half of pelvis, each longer than wide. Azygous quadrilateral, larger basals hexagonal. Surface ornamented with growth lines parallel to basal-radial and interbasal sutures; latter more closely spaced. Secondary deposits of calcite obscures origin of basals (Pl. 1, Fig. 4).

Stems long; 9 stem plates per 2 mm, taper gradually in width away from calyx. Crenellar facets near edge of plate, about 48 in a ring. Center of plate pierced by round lumen.

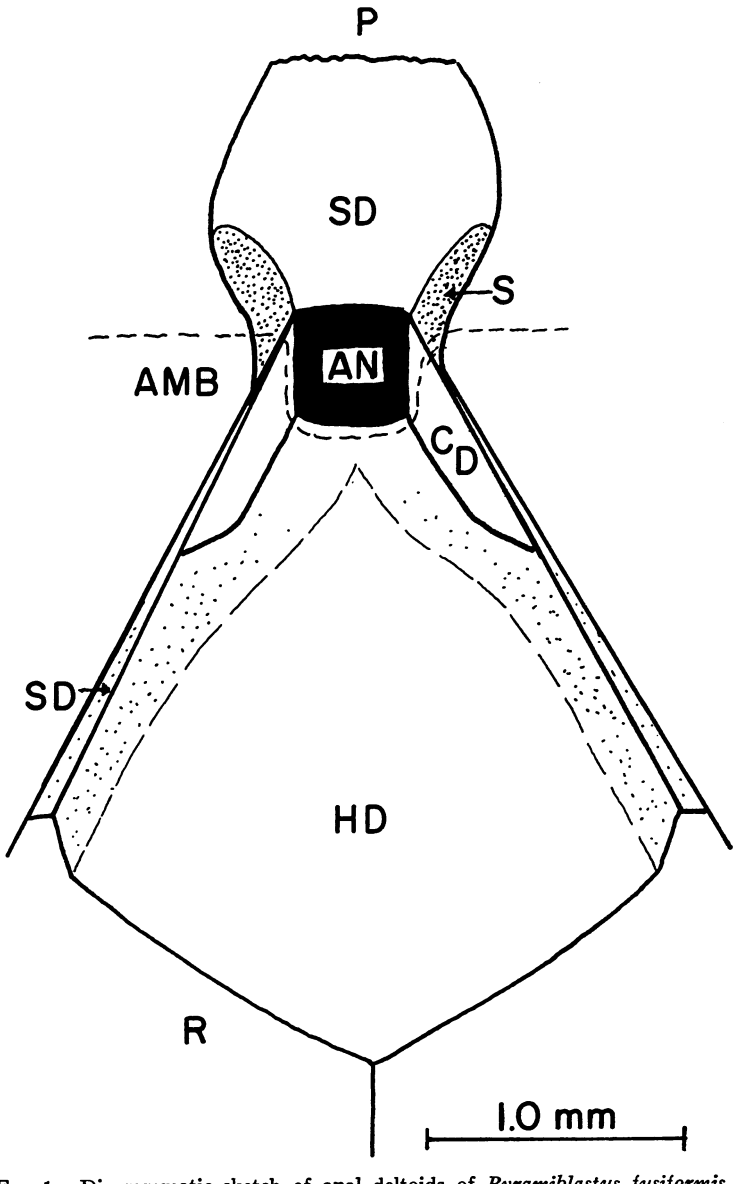


FIG. 1. Diagrammatic sketch of anal deltoids of *Pyramiblastus fusiformis* based on I.G.S.(I.S.M.) 13444. Relations best seen on left side (D ambulacrum) of anus; those on right reconstructed. Plates slope downward sharply below dashed line. AMB = ambulacrum; AN = anus; CD = cryptodeltoid; HD = hypodeltoid; P = peristome; R = radial; S = spiracle; SD = superdeltoid.

Radials five, elongate, narrow, hexagonal, with embayed oral end for ambulacra; limbs and body about equal in length. Growth lines prominent, parallel radial sutures.

Deltoids four, visible in side view, forming one-half of vault. Steep sides bordering ambulacra exposed; radiodeltoid suture first vertical, then sharp bend and radial extends at least 2 mm under deltoid. Adoral ends of deltoids surround peristome. Just aboral to adoral end, deltoid deeply embayed by a pair of elongate ovoid spiracles (0.8 mm in length). Oral surface of deltoids flat as is thin crest (0.3 mm) between spiracles. Just aboral to spiracles, however, deltoid bends over sharply to form part of lateral wall of calyx; this is the largest part of the plate. Growth lines parallel to radiodeltoid suture ornament this portion of deltoid. Aboral part slightly concave in cross section.

Anal interarea apparently surrounded by four anal deltoids. Superdeltoid adoral to anus (Fig. 1). Aboral to anus is hypodeltoid, shape like that of aboral part of regular deltoid, tapering almost to a point adorally with the inner edge concave at the anus. Hyporadial suture vertical to plate surface, visible in lateral wall. Appears to be a point of juncture half way down in lateral wall; a suture extends adorally and one continues beneath the ambulacra. Interpreted as junction of hypodeltoid, radial, and prong of superdeltoid (Fig. 1). Super-hypodeltoid suture traced adorally 2.5 mm; it appears to bifurcate, lower portion continuing straight, other curving up and then paralleling lower portion to define a cryptodeltoid 0.5 mm wide and 2.0 mm long. Adoral end of this plate fractured but suture appears continuous to aboral corner of anus; suture apparently present all along other side of cryptodeltoid to separate it from body of superdeltoid. Lateral sides of anus thus appear to be bounded by two cryptodeltoids which separate superdeltoid and hypodeltoid; latter two join aborally, however. Anus set 0.5 mm below level of highest adoral edge of superdeltoid; adoral edges of hypo- and cryptodeltoids even with anus. Spiracle opening on either side of anus. Configuration not an anispiracle as in *Cryptoblastus* nor as clearly separated as in *Schizoblastus*.

Ambulacra lanceolate, extend one-half length of calyx; set below level of surrounding plates, bordering walls steep. Lancet exposed almost to aboral tip. Side plates 2½ per mm, thus about 29 per ambulacral side. Aboral abmedial edge embayed by ovoid outer side plate; triangular pore notches side plate and adoral edge of outer side plate. Abmedial border of hydrospire pore either radial or deltoid, one per side plate. Side plates ornamented with pore furrows (Pl. 1, Fig. 4) and brachiolar pits.

Six hydrospires seen in one specimen; Wachsmuth and Springer reported ten groups with eight each (1890, pp. 205–6).

Brachioles consist of a biserial row of plates, centers offset; brachioles angular ovoid in cross section. Long, over 30 mm in length, becoming smaller away from ambulacra. 3 plates per row per mm. Brachiolar food groove zigzag down center of two rows of plates; each plate bears a small moundlike ridge which borders the groove.

Remarks.—The above description is based mainly on a specimen from the Illinois State Geological Survey (IGS (ISM) 13444); it is the only one available which adequately shows the anal and ambulacral features. Other features are described from specimens in the Springer collection, U. S. National Museum (S 3227—holotype and 14 other specimens). Other specimens are in the Walker Museum, University of Chicago (13594, 51868, Gurley collection, 2 specimens; 18026—Tiffany collection, 2 specimens), University of Cincinnati (25607—1 specimen), the British Museum (Natural History) (E1726; E. 8173), University of Illinois (one specimen), the Laudon collection and the Cline Collection, University of Wisconsin, and the Beane collection, Le Grand, Iowa. Other specimens of this species, unknown to the writer, may well be in collections obtained from the Le Grand locality.

Wachsmuth and Springer described the anus as being very narrow, slitlike, and decidedly lateral (1890, p. 205). If their description was based on a specimen like that in Plate 1, Figure 4, they were describing a crease in the hypodeltoid.

Bather published a figure of *Pyramiblastus fusiformis* in a number of works which he wrote, showing it as having a short stem and roots (1899, p. viii; 1900, Fig. 4; 1907, Fig. 30; originally published in 1897, Fig. 157?). This was a reconstruction based on a calyx in the British Museum (Natural History) (E. 1726) (see Bather, 1899) which had brachioles but no stem. Bather's figure has been reproduced in other publications (as Bergounioux, 1953, fig. 1), but his reconstruction must be modified. The stem is much longer than shown and there is no evidence of a dendroid root in this blastoid species. The preservation of hold-fasts or roots is a very rare thing in the Le Grand crinoid colonies. There is a badly weathered echinoderm in the Cline collection which appears to be a specimen of *Pyramiblastus fusiformis*. It has a stem which is slightly over 100 mm in length; at the lower end there is a solid, rapidly flaring structure like the exposed base of the trunk of a tree. It has a solid interior when viewed from below. It is impossible to tell if it had extensions beyond it or whether it was composed of more than one piece of calcite.

Fay and Reimann have discussed the brachioles of *P. fusiformis* (1962, p. 47). They stated that they could not definitely determine if there were cover plates over the brachiolar food groove. In their photograph of a

brachiole cross section, however, they label cover plates (Pl. 3, Fig. 2). I have studied this specimen and others but have been unable to find brachiolar cover plates in *P. fusiformis*.

Occurrence.—Pyramiblastus has only been found in the Hampton Formation at Le Grand, Iowa (Mississippian; Kinderhookian). Laudon states that the large Le Grand crinoid fauna came from the lower ledges in the *Cactocrinus arnoldi* zone and lists *P. fusiformis* as occurring in it (1931, p. 428). He also lists it from the zone below (*Orophocrinus conicus* zone) but he labeled some of the larger specimens of *O. conicus* which he collected as "*Orophocrinus fusiformis*" (= *Pyramiblastus fusiformis*.) He also listed "*O.*" cf. *fusiformis* from the *Spirifer platynotus* zone at Iowa Falls (1931, p. 414), but the writer has shown elsewhere that this specimen was *Orophocrinus conicus* (Macurda, 1963, p. 140).

In a doctoral thesis at the University of Wisconsin, Beaver mentioned a specimen of *Orophocrinus* from the Gilmore City Formation (1954). The only blastoid which the writer was able to locate in the Laudon collection from the Gilmore City Formation was a small specimen with a bipyramidal shape; apparently this is the only blastoid which has been collected from this formation. This is presumably the specimen which Beaver identified as *Orophocrinus* (1954, p. 74), based on a resemblance to "*O.*" *fusiformis*. The writer had elsewhere expressed the opinion that this blastoid was related to "*O.*" *fusiformis* (Macurda, 1963, p. 109). Further work has rendered this untenable. The deltoid is confined to the upper oral surface; the rest of the oral surface is obscured by brachioles and its identity is unknown. It will be deposited at the U. S. National Museum.

LITERATURE CITED

BATHER, F. A. 1897. A Guide to the Fossil Invertebrates and Plants in the Department of Geology and Palaeontology in the British Museum (Natural History), Cromwell Road, London, S.W.: London, 158 pp. (not seen by me).

——— 1899. The Genera and Species of Blastoidea, with a List of Specimens in the British Museum (Natural History). London, 70 pp.

——— 1900. The Echinoderma, *in* Lankaster, E. R., ed., A Treatise on Zoology. London: Adam and Charles Black, Vol. 3, 344 pp.

——— 1907. A Guide to the Fossil Invertebrate Animals in the Department of Geology and Paleontology in the British Museum (Natural History), Cromwell Road, London, S.W.: London, 182 pp.

BEAVER, H. H. 1954. The Morphology and Stratigraphic Occurrence of the Blastoid Genus *Pentremites*. Unpublished doctoral thesis, Univ. of Wisconsin, 94 pp.

BERGOUNIOUX, F. M. 1953. Classe des Blastoides, *In*: Piveteau, Jean, ed., Traite de Paleontologie. Paris: Masson and Cie, Vol. 3, pp. 629–50.

BEYER, S. W. 1897. Geology of Marshall County. Iowa Geol. Survey, Vol. 7, pp. 197–262.

BOYT, RICHARD. 1962. Crinoid and Starfish Fossils from Le Grand, Iowa. Des Moines, Iowa State Department of History and Archives, 24 pp.

FAY, R. O. 1961*a*. Blastoid Studies. Kansas Univ., Paleont. Contr., Echinodermata, art. 3, 147 pp., 54 pl., 221 text figs.

——— 1961*b*. Type of *Schizotremites,* a Devonian Blastoid from New York. Okla. Geology Notes, Vol. 21, No. 12, pp. 331–33, 1 pl.

——— 1964. An Outline Classification of the Blastoidea. *Ibid,* Vol. 24, No. 4, pp. 81–90.

FAY, R. O., and REIMANN, I. G. 1962. Some Brachiolar and Ambulacral Struetures of Blastoids. *Ibid,* Vol. 22, No. 2, pp. 30–49, 4 pl.

LAUDON, L. R. 1931. The Stratigraphy of the Kinderhook Series of Iowa. Iowa Geol. Survey, Vol. 35, pp. 333–452.

LAUDON, L. R., and BEANE, B. H. 1937. The Crinoid Fauna of the Hampton Formation at Le Grand, Iowa. Iowa Univ. Studies in Nat. History, Vol. 17, No. 6, pp. 227–72, 5 pl.

MACURDA, D. B., JR. 1963. Studies in the Blastoid Genus *Orophocrinus.* Univ. of Wisconsin, doctoral thesis, 476 pp., 14 pl., 134 text-figs.

MILLER, S. A. 1889. North American Geology and Paleontology. Cincinnati: Western Methodist Book Concern, 664 pp.

REIMANN, I. G. 1945. New Devonian Blastoids. Buffalo Soc. Nat. Sci., Bull., Vol. 19, No. 2, pp. 22–42, pl. 5–9.

VAN TUYL, F. M. 1925. The Stratigraphy of the Mississippian Formations of Iowa. Ia. Geol. Survey, Vol. 30, pp. 39–349.

WACHSMUTH, CHARLES, and SPRINGER, FRANK. 1888. The Summit Plates in Blastoids, Crinoids, and Cystids, and their Morphologic Relations. Phil. Acad. Nat. Sci., Proc., Vol. 39, pp. 82–114.

———, and ———. 1890. New Species of Crinoids and Blastoids from the Kinderhook Group of the Lower Carboniferous Rocks at Le Grand, Iowa; and a New Genus from the Niagaran Group of Western Tennessee. Ill. State Geol. Survey, Vol. 8, pp. 155–208, pl. 14–17.

WANNER, J. 1924. Die Permischen Echinodermen von Timor. Paläont. Timor, Lief 14, Abh., 23., 81 pp., pl. 199–206, 31 text-figs.

Submitted for publication April 8, 1964

PLATE

EXPLANATION OF PLATE I

PAGE

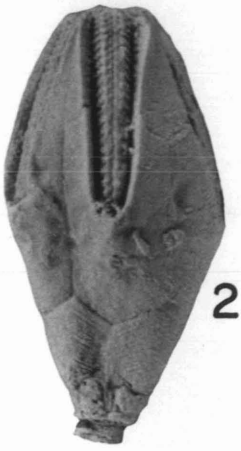
FIGS. 1, 2. *Pyramiblastus fusiformis* (Wachsmuth and Springer) 106
1. Oral view, anus at 6 o'clock; 2. D ambulacral view. I.G.S.(I.S.M.) 13444. × 3.

FIGS. 3, 4. *P. fusiformis* (W. & S.) 108
3. Oral view, A ambulacrum at 6 o'clock; 4. AB interambulacral view. U.S.N.M. S 4997. Photographs courtesy U.S.N.M. × 3.

FIG. 5. *P. fusiformis* (W. & S.) 108
Lateral view of holotype. U.S.N.M. S 3227. Photograph courtesy U.S.N.M. × 3.

PLATE I

1



2

3

4

5