THE BRYOZOAN *FISTULIPORA CANDIDA* FROM THE AMES LIMESTONE (CONEMAUGH) OF OHIO[1]

R. M. PETERSON, R. D. HOARE, AND M. T. STURGEON

Department of Geology, Bowling Green State University, Bowling Green, Ohio 43403, and Department of Geology, Ohio University, Athens, Ohio 45701

ABSTRACT

The bryozoan *Fistulipora candida* (Moore & Dudley, 1944) has been found at two localities in the Ames Limestone; no other occurrences of massive bryozoans have been reported from Pennsylvanian rocks in Ohio. These occurrences suggest a possible correlation of the Ames Limestone with the Coal Creek Limestone (Virgilian Series) in the Western Interior Basin.

INTRODUCTION

The Ames Limestone, a member of the Conemaugh Group in eastern Ohio, contains a fauna dominated by crinoids and brachiopods, but also including bivalves, trilobites, cephalopods, gastropods, bryozoans, and shark teeth. Fifteen specimens of a large, massive, hemispherical, fistuliporid bryozoan were collected from two closely associated localities in Carroll County, Ohio, and form the basis for this study. No other occurrences of massive bryozoans, nor of fistuliporid bryozoans, have been reported or encountered in the Pennsylvanian in Ohio during a span of 40 years of collecting.

The Pennsylvanian and Permian fistuliporid bryozoans from the Midcontinent region were extensively studied by Moore and Dudley (1944). Warner and Cuffey (1973) studied the fistuliporacean forms from the Lower Permian Wreford Megacyclothem in Kansas. *Fistulipora candida* is a common species in the Coal Creek Limestone Member of the Topeka Formation, Shawnee Group, Virgilian Series, in Kansas and Nebraska (Moore and Dudley, 1944, p. 252), but is unknown in other stratigraphic units in the Western Interior Basin. The restricted occurrence of this form in the Ames Limestone in Ohio supports Thompson's (1936) assignment of the Ames as Virgilian in age on the basis of fusulinids.

LOCALITIES

CAc–1. Abandoned quarry (formerly owned by the Hanna Coal Co.), N½ sec. 13, T.14 N., R.5 W., Carrollton quad., east of Carrollton, Center Twp., Carroll Co., Ohio.

CAc–2. Abandoned quarry (formerly operated by the Hanna Coal Co. and later by Joe Skinner), ctr. and SE¼ sec. 14, T.14 N., R.5 W., Carrollton quad., east of Carrollton, Center Twp., Carroll Co., Ohio.

SYSTEMATIC PALEONTOLOGY

Order EXPLECTOCYSTIDA Cuffey, 1973
Suborder CYSTOPORINA Astrova, 1964
Superfamily FISTULIPORACEA Astrova, 1964
Family FISTULIPORIDAE Ulrich, 1882
Genus *Fistulipora* M'Coy, 1850
Fistulipora candida (Moore & Dudley, 1944)
Figs. 1–6

Cyclotrypa candida Moore & Dudley, 1944, p. 281, pl. 5, fig. 9; pl. 9, figs. 5, 6; pl. 17, figs. 2, 3; pl. 27, figs. 5, 6; pl. 31, figs. 4, 7; Warner & Cuffey, 1973, p. 11.

Zoarium composed of superposed laminae; variable in form, ranging from small discoidal and flattened to hemispherical or moundlike, with a thin outward-flaring periphery; base con-

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cave and circular to subelliptical in outline; upper surface generally irregular and bearing evenly distributed monticles, which may be low and rather broad upswellings or flat and indistinct; fairly distinct maculae, smooth or slightly depressed, spaced 7–8 mm apart, located at the apices of the monticles; maculae marked by slightly larger zooecial apertures than those in the intermacular areas; apertures circular to subcircular, fairly large, and separated by interspaces approximately equal to the zooecial diameter; lunaria present on well-preserved specimens, lunaria then moderately strong in their development; thin fairly conspicuous peristomes present.

Tangential sections: Zooecial apertures circular to subcircular in outline; thin-walled, with slight lunarial wall thickenings; separated commonly by one and rarely by two series of vesicles; vesicles variable in size and shape, generally polygonal to subpolygonal in outline; and commonly about one-half the zooecial diameter in size.

Longitudinal sections: Zooecial tubes long and relatively straight; walls thin, and in some instances the adjacent vesicles protrude into the tube; tubes commonly separated by two series of polygonal to subpolygonal vesicles and rarely by a single series; diaphragms abundant, regularly spaced, horizontally to slightly obliquely inclined; zonation of vesicles prominent, with closely packed zones of small vesicles interlayered with loosely packed zones of larger vesicles; rejuvenation surfaces evident and emphasized by thin layers of rock material present within the zoarium; rejuvenation surfaces associated with abrupt termination of zooecial tubes below the surface and subsequent strongly inclined growth of new tubes above that same surface.

Measurements of diagnostic characteristics are given in table 1.

TABLE 1

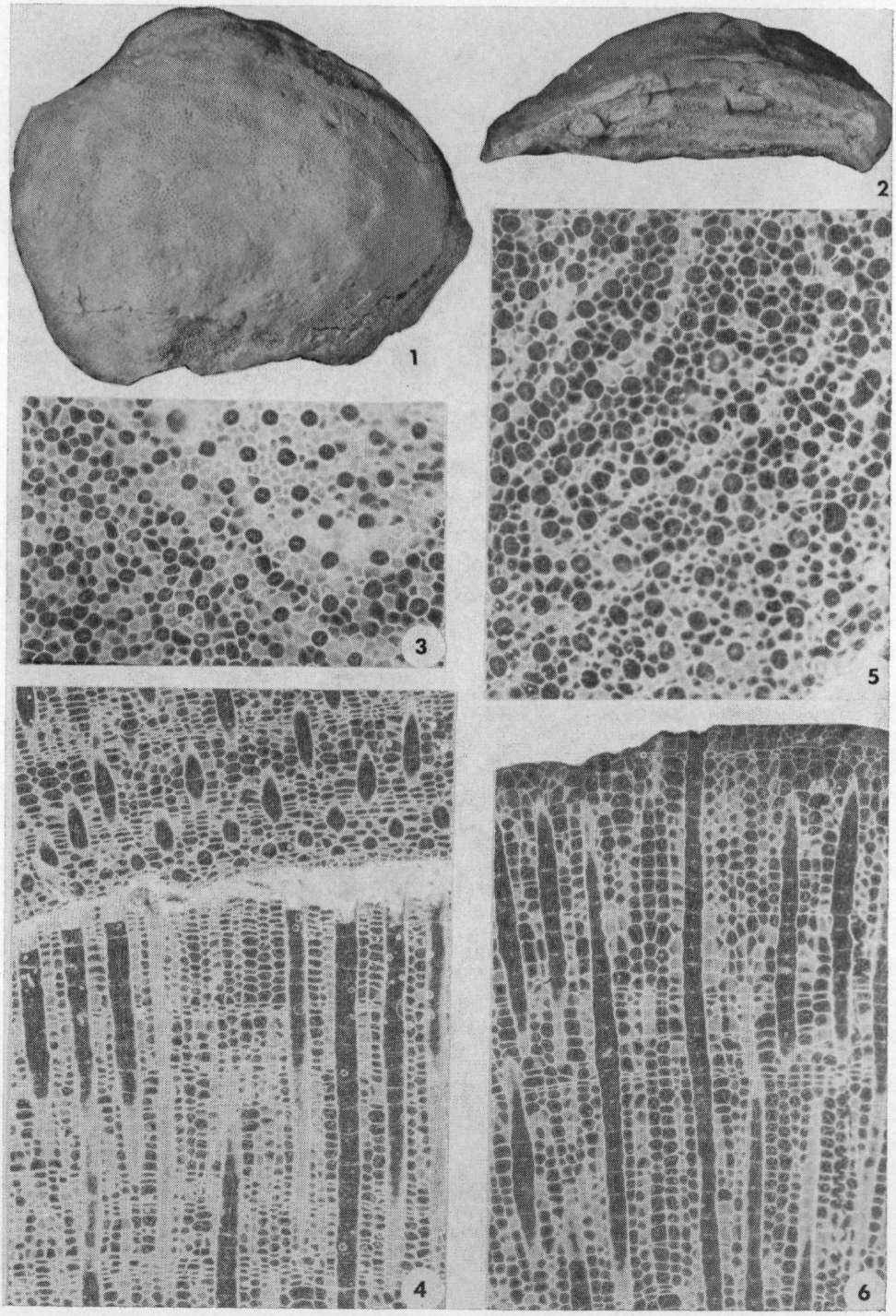
Measurements of Ames Limestone specimens of Fistulipora candida (Moore & Dudley)

Feature	Range (mm)	Mean (mm)	No. of measurements
Zoarium height	11.2–43.9	37.9	14
Zoarium width	45.6–84.1	65.2	14
Zooecial diameter	0.20–0.37	0.31	25
Diaphragm spacing	0.12–0.63	0.29	25
Interspace width (between zooecia)	0.19–0.48	0.33	25
Maculae spacing	7.5–10.0	8.4	19

Discussion—This species is characterized by the presence of distinct maculae, moderately strong lunaria, interspaces filled with one or two series of vesicles, and marked internal zonation. *Fistulipora candida* might be most easily confused with *F. zonata* Girty or *F. bennetti* Link. *Fistulipora zonata*, although possessing internal zonation, may be differentiated from this species by its lack of distinct monticles and maculae and the weakness of the lunaria (Moore and Dudley, 1944). *Fistulipora candida* is distinguished from *F. bennetti* by weaker

EXPLANATION OF FIGURES 1–6

FIGURES 1–6. *Fistulipora candida* (Moore & Dudley). 1, upper surface of zoarium, x1, showing monticles, loc. CAc–2, OSU–28994; 2, lateral view of zoarium, x1, with broken surface showing laminations, loc. CAc–2, OSU–28995; 3, 4, tangential and longitudinal sections, x10, showing spacing of zooecia and zonation, and change in inclination of zooecia, loc. CAc–1, OSU–28996; 5, 6, tangential and longitudinal sections showing diaphragms and upper surface of zoarium, x10, loc. CAc–1, OSU–28997.



FIGURES 1–6

lunarial development and less regular vesicular arrangement, and by distinctly larger zooecial diameters in the latter species. Noting the great morphologic variability present in Permian fistuliporid species, Warner and Cuffey (1973, p. 11) suggest the possibility that the three species named above may be synonyms of *F. incrustans* Moore (1929). Other species of this Pennsylvanian genus are not likely to be confused with *F. candida*.

Occurrence—Common in the Ames Limestone unit only at the localities noted above.

Repository—Hypotypes, OSU-28994 to 28997.

REFERENCES CITED

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Warner, D. J., and **R. J. Cuffey.** 1973. Fistuliporacean bryozoans of the Wreford Megacyclothem (Lower Permian) of Kansas. Univ. Kansas Paleont. Contrib. Paper 65. 24 p. 3 pls.

Geographical Ecology, Patterns in the Distribution of Species. *Robert H. MacArthur.* Harper and Row, New York. 1972. 269 p. $12.95.

The critic is disarmed and one's expectations based on the title must be altered on discovering that, "I wrote the book while convalescing in Vermont with no access to libraries, entirely from memory." The book is not a critical treatise, but instead is a set of closely connected speculative essays from one of the major contributors to analytical ecology. The references are limited to a few recent papers (seven of the references were published before 1950) that report data in a form compatible with MacArthur's ideas. Few authors outside of the Ivy League are cited more than once.

This is less provincialism than evidence of how little the practice of analytical ecology has spread since Hutchinson's "Homage to Santa Rosalia" made the field respectable. Analytical ecology has, in my mind, achieved its greatest successes in the areas covered in this book.

The first chapter is a concise and interesting explanation of the factors determining climates. This is followed by a Gaussian treatment of predation and competition. These two sections supposedly form the basis for the discussions of island colonization and extinction that follow. A variety of interesting ways for accounting for diversity are explained, and the last chapter takes up the tantalizing problem of the differences between tropical and temperate areas. The analysis and interpretation of these phenomena are rather independent of the rest of ecology, hence the failure to refer to ecosystem analysis or community structure is no oversight. The short shrift given to the modern Darwinists, such as D. Janzen and C. Smith, is obviously due to the difficulty of relating their data to intrinsic rates of increase (r) and carrying capacity (K).

The point of the book and its great value would be missed by carping at the oversights, which are as numerous as they are irrelevant. What is relevant is that the complexities of ecology do not need to force each of us to specialize and, thus, prevent general theory from emerging. General explanations always require great ingenuity and insight, while complex explanations generally require little more than a good memory for facts. There is no reason to fall back on complex explanations until the simpler ones have been exhausted. Not all problems can be reduced to formulae and the middle part of the book shows MacArthur to be as much a phenomenologist as Joseph Grinnell. This unexpected lapse into old-fashioned zoogeography shows the validity of much earlier work, but it may also suggest that analytical ecologists may soon attempt a synthesis of natural history with analytical ecology.

At the moment there is little effort to synthesize, which may be due to the fact that there have been great thrusts in a series of directions in ecology during the last twenty years, thrusts which have not yet run their course. MacArthur has had a hand in much of what has developed in analytical ecology and this book is an excellent review of the search for the causes of the patterns of distribution in space and time. It deserves sympathetic reading by any ecologist who wishes to try to understand the field and any person, having done this, should thoughtfully consider the successes and failures of analytical ecology, and reflect on how analytical ecology fits into other areas of ecology and where it might go in the next twenty years.

RODGER MITCHELL