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GROWTH STAGES IN THE MIDDLE DEVONIAN RUGOSE CORAL SPECIES *HEXAGONARIA ANNA* (WHITFIELD) FROM THE TRAVERSE GROUP OF MICHIGAN

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ERWIN C. STUMM*

ABSTRACT

Specimens of the Rugose coral species *Hexagonaria anna* (Whitfield) from the Bell Shale and the Ferron Point Formation show an interesting series of growth stages beginning with a single protocorallite. Serial sections show the developmental stages and method of budding.

CONTENTS

INTRODUCTION AND PREVIOUS WORK

THE COMPOUND CERIOID coral species *Hexagonaria anna* was first described by Whitfield (1882, p. 199) under the name *Stylastrea anna* from the "Blue" limestone member of the Silica Formation exposed in the bed of the Maumee River near Antwerp, Paulding County, Ohio. He redescribed the species and published the first illustrations a year later (1883, p. 420, Pl. 2, Figs. 1–5). Grace Anne Stewart (1938, p. 49, Pl. 9, Figs. 11–12) restudied and reillustrated Whitfield's types and made the first thin sections of them. Stumm (1947, pp. 25–26) confirmed that the stratigraphic range of the genus in northern Ohio extended from the upper part of the Dundee Limestone through the "Blue" limestone member of the Silica Formation.

* This paper is an expansion of a talk given at the coral colloquium at the annual meeting of the Paleontological Society, November, 1965.

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DESCRIPTION OF SPECIMENS

Studies of the genus *Hexagonaria* from the Traverse Group of northern Michigan show that *H. anna* is very prolific in the lower part of the group. Its established range is from the base of the Bell Shale through the lower part of the Genshaw Formation. In the limestone formations in this interval, the Rockport Quarry Limestone and the Genshaw Formation, only mature coralla have so far been found.

In the calcareous shales, the Bell Shale and the Ferron Point Formation, developmental stages of the species have been found. Specimens consist of the basal corallite with one to five buds. In different specimens the protocorallite has different growth habits. It can be free in the substrate. In this case it appears as a narrow, tapering cone (Pl. I, Figs. 16–18). Other specimens grow attached to other corals or to brachiopods (Pl. I, Figs. 19–21). The protocorallite in these specimens begins as a flat basal disc. In both cases the development of septa, tabulae, and dissepiments appears to be the same.

All the serial sections have been cut approximately 1 mm apart.

The basal disc is shown $\times$ 8 (Pl. I, Figs. 1 and 2). Figure 1 is cut just above the attachment to a brachiopod shell. It shows a pre-septal stage with very thick walls. Figure 2 approximately 1 mm higher shows the cardinal-counter septum extending all the way across the corallite.

Figures 3–14 are a set of serial sections cut from a free specimen similar to that illustrated in Figs. 16–18.

In Figure 3, which is $\times$ 4, the preseptal base can be seen. In Figure 4, also $\times$ 4, the cardinal-counter axis and one alar septum are visible.

A radical change begins with Figure 4 which is $\times$ 2. At this level the protosepta have become shortened and the major metasepta appear. All the septa are very thin and short, extending about 0.2 mm from the periphery. Radial symmetry is established at this stage, making it impossible in this and subsequent sections to distinguish the protosepta and the major metasepta. The first trace of tabulae appears in Figure 5. The one visible in the section seems to connect the axial ends of the septa.

The first dissepiments are found in Figure 8, and the first weak traces of carinae in Figure 14. At this level the septa begin to lengthen and minor septa begin at a slightly higher level.

Figure 15 shows a longitudinal section × 2 cut from the protocorallite of a specimen similar to that illustrated in Figures 15–18. These figures show a typical protocorallite and its first budding. It is important to note that at all stages of budding a wall separates the mother and daughter corallites. This method of budding is quite distinct from that shown in the *Heliophyllum-Billingsastrea* group where the septa of the mother and daughter corallites are either confluent or abutting at all stages and no wall is developed.

Figure 19 shows a small colony attached to a *Heterophrentis*. Figures 20 and 21 show two views of a small colony developing on the shell of an *Atrypa*.

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EXPLANATION OF PLATE I

FIG. 1. Transverse section of basal disc of corallite originally attached to the shell of an *Atrypa,* showing thick walls and preseptal stage. Hypotype No. 55032. Ferron Point Formation, abandoned quarry of the Kelley's Island Lime and Transport Company at Rockport, Alpena County, Mich. × 4.

FIG. 2. Transverse section of same specimen cut 1 mm above section 1. × 4.

FIGS. 3–14. Serial sections taken at 1 mm intervals showing growth stages explained in text. Hypotype No. 55033. Same occurrence as originals of Figs. 1–2. Figs. 3–4, × 4. Figs. 5–14, × 2.

FIG. 15. Longitudinal section of a protocorallite showing two of the major septa and the earliest developed tabulae. × 2. Hypotype No. 55034. Bell Shale, Quarry of the Michigan Limestone Division of the United States Steel Corporation, Rogers City, Presque Isle County, Mich.

FIGS. 16–18. Distal, proximal, and lateral views of a young colony showing protocorallite and earliest daughter corallites. Hypotype 55035. Same occurrence as original of Fig. 15. × 1.

FIG. 19. View of young colony attached to the side of a specimen of *Heterophrentis.* Hypotype No. 55036. Ferron Point Formation, same occurrence as original of Figs. 1–2.

FIGS. 20–21. Two views of a young colony attached to the shell of an *Atrypa.* Hypotype No. 55037. Same occurrence as original of Figs. 1–2. × 1.

PLATE I