NOTES ON MIOCENE BRYOZOA FROM NORTHWESTERN FLORIDA

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ILLUSTRATIONS

I. Abstract

Three species of cheilostome Bryozoa from two Miocene formations in northwestern Florida are described herein. *Discoporella umbellata depressa* (Conrad) and *Hippoporidra calcarea* (Smitt) are reported for the first time from the Red Bay Formation. The occurrence of *D. umbellata depressa* and *Cupuladria biporosa* Canu and Bassler represent the first report of Bryozoa from the Yellow River Formation. As these species are broad ecologic indicators, it is thought that the Red Bay and Yellow River formations were deposited in muddy, somewhat turbulent, warm temperate environments and under conditions adverse to the development of a large bryozoan community.

II. Introduction

The present report represents a portion of a larger study undertaken during 1964 as partial fulfillment of the requirements for the degree of Master of Science from the University of Florida. This study has been revised and additional material included during the author's tenure as a Postdoctoral Fellow at the University of Georgia.

The sparse bryozoan fauna of the Red Bay and Yellow River formations of northwestern Florida are discussed herein. Collections of the Red Bay fauna were taken: (1) from a spring head on W. D. McDaniel's farm, Red Bay, Walton County, Florida, 900 feet west of center of Sec. 19, T2N, R17W and (2) from a gully in a field on the east side of Florida Highway 81 across from the Red Bay Fire Tower, NE ¼, SW ¼, NW ¼, Sec. 15, T2N, R17W. The Yellow River fauna is represented by a single collection from a spring head on the C. H. Spence farm, Walton County, Florida, NE ¼, NE ¼, Sec. 17, T2N, R9W. All material was washed through sieves to insure that fragments of both encrusting and erect forms would be salvaged.

Synonymies of the species discussed herein are abbreviated; only the original citation and those references pertaining to fossil or Recent reports in the Gulf of Mexico and/or Caribbean region are given. The figured specimens have been deposited in the U. S. National Museum.

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III. Stratigraphic Setting

The stratigraphic nomenclature of the upper Miocene units in northwestern Florida has undergone considerable revision in recent years.

The *Arca* faunizone was named by Mansfield (*in* Cooke and Mossom, 1929: 140-142) for sediments exposed in the vicinity of Red Bay, Walton County, Florida, which had been originally designated in 1909 as the type locality of the Choctawhatchee Formation by Matson and Clapp. The *Yoldia* faunizone was proposed by Mansfield and Ponton (1932: 86) for sediments exposed at A. H. Cosson's farm, Walton County, Florida. They believed that these sediments represented the basal beds of the Choctawhatchee Formation.

Puri (1954: 27-28) changed the Choctawhatchee from formational to stage rank and the *Arca* and *Yoldia* faunizones together with the *Ecphora* and *Cancellaria* faunizones were considered facies subdivisions. Puri and Vernon (1964: 115) later revised this nomenclature in part by suggesting the names Red Bay Formation and Yellow River Formation for the *Arca* and *Yoldia* faunizones respectively. As this study is not intended to re-examine critically the stratigraphic nomenclature of this area, the suggestion by Puri and Vernon to use the names Red Bay and Yellow River formations is followed.

IV. Paleoecology

Bryozoa have been known to occur in the Red Bay Formation, but previously they have not been reported from the Yellow River Formation. Lagaaij (1963: 199, text-fig. 19) indicates the presence of *Cupuladria biporosa* Canu and Bassler [reported as *C. canariensis* (Busk)] in the Red Bay Formation. Lagaaij's material also comes from the type locality at McDaniel's farm. The Red Bay fauna is known to consist of *Cupuladria biporosa*, *Discoporella umbellata depressa* (Conrad), and *Hippoporidra calcarea* (Smitt); *D. umbellata depressa* and *C. biporosa* are reported for the first time from the Yellow River Formation. The paleoecology of both formations has been interpreted through the use of ecologic indicators among the mollusks, foraminifers, and ostracods. Although the number of bryozoan species is small, those present are ecologic indicators and provide broad information to supplement the present knowledge about both formations.

Red Bay Formation

Lagaaij (1963: 187-190), summarizing his studies on *Cupuladria canariensis* (sensu lato), noted that there is a definitive relationship between maximum depth and minimum temperature. The minimum temperature for survival appears to be about 12° C because this species has been found at variable depths in which the temperature is no colder than 12° C. Similarly, the maximum temperature is thought to be approximately 31°-32° C and to control the upper depth limit, ranging as shallow as five fathoms. The temperature tolerance of these species controls their geographic distribution, limiting them to waters between the 14° C surface isocrymes in the northern and southern hemispheres. Cook (1965b: 209) observed that *C. canariensis* and *C. biporosa* "have similar geographical distributions, live in similar depths, under the same ecologic conditions, and are thus frequently associated in Recent collections."

Cupuladria biporosa is an abundant form in the Red Bay Formation and, therefore, it is likely that its survival and reproduction rates were high. The paleotemperatures indicated by the occurrence of this species, 12°-14° C to 31°-32° C, are similar to temperatures recorded in the adjacent part of the Gulf of Mexico today.

The small number of species in the Red Bay fauna may be attributable to a high rate of deposition and/or a soft, fine-grained substrate. Lagaaij (1963: 174) observed that the deposition of clay particles between 5 and 50 fathoms near the mouth of the Mississippi River limited the bryozoan types largely to lunulitiform Bryozoa.

At the type locality, at least 35 feet of sediments attributable to the Red Bay Formation are exposed. Puri (1954: 30-31) reported a minimum of 41 feet of Red Bay sediments in an auger hole drilled in the vicinity of the Red Bay Fire Tower. His interpretation of well sections in Okaloosa County indicates that the formation thickens downdip to about 230 feet. Exposures of the formation have been recorded in northeastern Walton County, western Washington County, and southwestern Holmes County. The total amount of sediment deposition was considerable, but the samples examined were collected from the updip segment of the formation, where the amount was not as great.

The second possible explanation for the small number of species is the lack of firm substrate. The majority of bryozoans require a stable substrate for attachment and subsequent growth. Large inorganic particles were not observed in the Red Bay Formation; the bulk of the sediments are fine-grained (clay- to silt-sized) marls intermixed with quartz sands. Living space for sessile organisms is limited to mollusk shells. Much of this material was not accessible in the paleoenvironment as many of the molluscan species were burrowing forms. Although shell fragments and non-burrowing mollusks are common, only a single specimen of an encrusting Bryozoa was recovered. The small particle size indicates a general lack of sediment "winnowing." Hence, suitable substrate material on the surface of the bottom would have been covered rapidly by fine-grained sediments, ultimately resulting in a depauperate encrusting epifauna.

The small bryozoan community probably is the result of both factors. Appreciable sedimentation in combination with a soft, muddy bottom having a paucity of suitable substrate for sessile organisms would have an inhibitive effect on the development of a bryozoan community.

Yellow River Formation

Two species reported herein occur only sparsely in the formation. Seventeen fragments of *Discoporella umbellata depressa* and one fragment of *Cupuladria biporosa* have been recovered from over 400 cc of sieved sediments.

The molluscan genus *Yoldia* occurs commonly in Recent cold water seas and is a dominant element in the Yellow River Formation. Thus Mansfield and Ponton (1932: 86) suggested that the Yellow River Formation possibly represented cold water deposits. This suggestion is doubtful inasmuch as *Yoldia solenoides* Dall, a Recent congener, occurs in the offshore muddy bottoms in the present day northern Gulf of Mexico.

Discoporella umbellata depressa, *Cupuladria biporosa* and *C. canariensis* occupy nearly the same ecologic niche. The presence of the first two species in the formation precludes a truly cold water paleoenvironment. It seems evident from Puri (1954) and Puri and Vernon (1964) that the Red Bay and Yellow River are more or less contemporaneous and that one is a facies of the other. Therefore, paleotemperatures in the Yellow River Formation probably would not differ significantly from those occurring in the paleoenvironment of the Red Bay Formation.

The absence of encrusting Bryozoa in the Yellow River Formation suggests adverse ecologic conditions for their development. The sediments of the formation are composed of sandy clays and marls with a sparse micro- and macrofauna and thus nearly devoid of suitable substrate for sessile organisms. Sand-sized particles are abundant, and all inhibiting factors excluded, lunulitiform Bryozoa should be abundant. However, this is not the case in the Yellow River Formation as only 17 small fragments of *Discoporella* were recovered.

The formation is exposed only at the type locality and at C. H. Spence's farm. Puri (1954: 29) reported at least 75 feet of Yellow River sediments from an auger hole drilled at the type locality. In view of the thickness of the sediments, the rate of sedimentation probably was appreciable. It is suggested that the absence of encrusting and the paucity of lunulitiform Bryozoa is related to the amount of particle deposition in the formation.

V. Systematic Paleontology

Order Cheilostomata Busk

Suborder Anasca Levinsen

Family Cupuladriidae Lagaaij

Genus Cupuladria Canu and Bassler

Cupuladria Canu and Bassler, 1919, Carnegie Inst. Washington, Publ. no. 291, p. 77.

Type species: *Cupularia canariensis* Busk, 1859, Quart. Jour. Micros. Sci., v. 7, p. 66, pl. 23, figs. 6, 9 [*non* pl. 23, figs. 7, 8 = *C. biporosa* Canu and Bassler] (by original designation). Recent, Madeira and Canary Islands.

CUPULADRIA BIPOROSA Canu and Bassler

Text-fig. 1

Membranipora canariensis (Busk). SMITT, 1873, Kongl. Svenska Vetensk.-Akad. Handl., v. 11, pt. 4, p. 10, pl. 2, figs. 69-71.

Cupuladria canariensis (Busk). CANU AND BASSLER, 1919, Carnegie Inst. Washington, Publ. no. 291, p. 78, pl. 1, figs. 8-10; CANU AND BASSLER, 1920, U. S. Natl. Mus., Bull. 106, p. 103, text-fig. 24D; CANU AND BASSLER, 1923, U. S. Natl. Mus., Bull. 125, p. 28, pl. 1, figs. 7-9; CANU AND BASSLER, 1928, U. S. Natl. Mus., Proc., v. 72, art. 14, p. 15, text-fig. 2; MCGUIRT, 1941, Louisiana Geol. Survey, Bull. 21, p. 46, pl. 1, figs. 1-3, 5, 6, 8.

Cupuladria biporosa CANU AND BASSLER, 1923, U. S. Natl. Mus., Bull. 125, p. 29, pl. 47, figs. 1, 2.

Cupuladria biporosa Canu and Bassler. COOK, 1965, Bull. Brit. Mus. (Nat. Hist.), Zool., v. 13, no. 6, p. 203, pl. 1, figs. 2A, B, 3A, B, 4A, B, 5, 6A, B, text-figs. 1g-j.

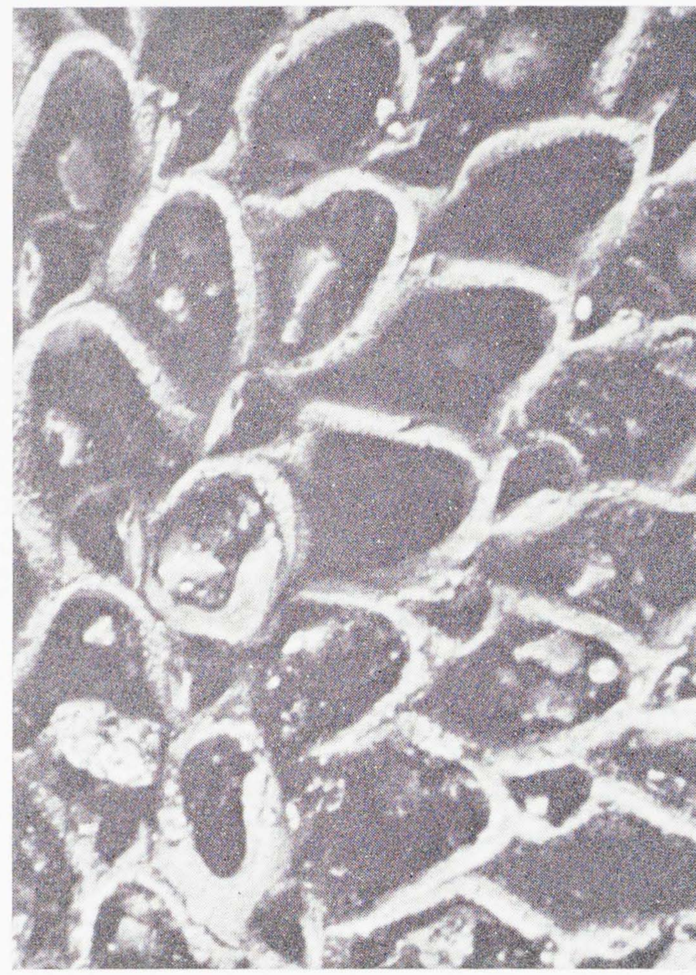
Cupuladria sp. CHEETHAM AND SANDBERG, 1964, Jour. Paleontology, v. 38, no. 6, p. 1021.

Description: Zoarium discoidal or saucer shaped, generally free in adult stage, Zooecia rhomboidal, closely packed, arranged in quincunx. Gymnocyst lacking; cryptocyst granular, generally narrow but may be moderately wide, widest proximally, narrowing laterally, descending sharply, and nearly lacking distally. Opesia rhomboid in shape, almost extending the entire length in frontal view. Zooecial walls vertical or sloping, obscured laterally and proximally by the cryptocyst; distally, where cryptocyst thinest, wall readily apparent, sloping downward. An auriform vibraculum distal to each zooecium; occasionally a much larger vibraculum found in the position of a normal zooecium. Basal surface divided into sectors, each bearing two to six pores.

Material examined: USNM 651283, figured specimen, Red Bay Formation, Red Bay Fire Tower, Florida. USNM 651284, specimen not figured, Yellow River Formation, C. H. Spence Farm, Florida.

Fossil distribution: Miocene: Anahuac and Upper Frio formations, Texas; Catahoula Formation, Louisiana; Chickasawhay Formation, Mississippi and Alabama; Shoal River, Chipola, Red Bay, Yellow River, and Jackson Bluff formations, Florida; Bowden Formation, Jamaica; Cercado Formation, Dominican Republic; Gatun Formation, Costa Rica. Pliocene: Caloosahatchee Formation, Florida; Minnitimmi Creek, Bocas Island, Panama.

Remarks: Cook (1965b: 203, 209) has summarized succinctly the morphologic distinctions between *C. canariensis* and *C. biporosa*. Cook (p. 207) noted from McGuirt's published figure (1941: pl. 1, fig. 8) that the cryptocyst appeared to be unusually narrow and may have been worn. The Red Bay specimens also have a number of zooecia that bear a narrow cryptocyst, although in this case no wear is evident.



Text-figure 1. *Cupuladria biporosa* Canu and Bassler, USNM 651283, frontal view showing vicarious vibraculum in lower left, × 50.

A single, badly worn fragment was found in the sievings from the Yellow River Formation. The frontal surface has been abraided away and identification was made on the basis of the characteristic porous basal surface.

Genus DISCOPORELLA d'Orbigny

Discoporella D'ORBIGNY, 1852, Paléontologie francaise, terrains crétacés, v. 5, p. 472.

Type species: *Lunulites umbellata* DEFRANCE, 1823, Dictionnaire des sciences naturelles, v. 27, p. 361, pl. 47, figs. 1, 1a, b (subsequent designation by Hastings, 1930). Miocene, France.

DISCOPORELLA UMBELLATA DEPRESSA (Conrad)

Text-fig. 2

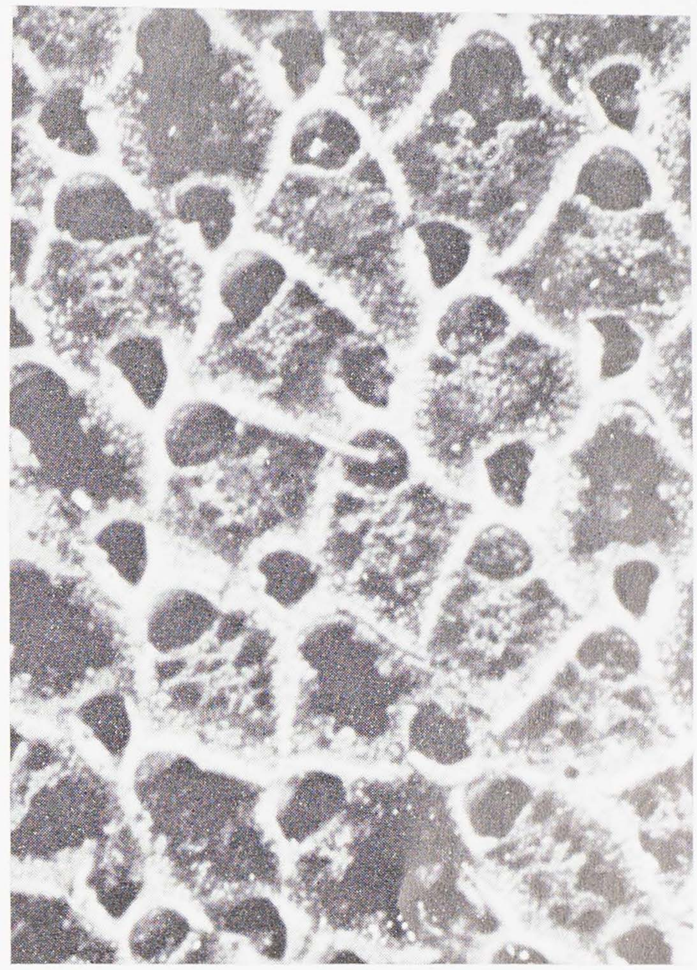
Lunulites depressa CONRAD, 1841, Amer. Jour. Sci., ser. 1, v. 41, p. 348.

Discoporella denticulata (Conrad). Gabb and Horn, 1862, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, v. 5, p. 142, pl. 20, fig. 25.
Cupularia umbellata (Defrance). Smitt, 1873, Kongl. Svenska Vetensk.-Akad. Handl., v. 11, pt. 4, p. 14, pl. 3, figs. 75-80; Canu and Bassler, 1919, Carnegie Inst. Washington, Publ. no. 291, p. 85, pl. 1, figs. 5-7, pl. 2, figs. 17-21; Canu and Bassler, 1923, U. S. Natl. Mus., Bull. 125, p. 80, pl. 2, figs. 15-19, text-fig. 10G; Canu and Bassler, 1928, U. S. Natl. Mus., Proc., v. 72, art. 14, p. 64, pl. 7, figs. 1-3.
Cupularia lowei Busk. Osburn, 1914, Carnegie Inst. Washington, Publ. no. 182, p. 194.
Cupularia robertsoniae Canu and Bassler, 1923, U. S. Natl. Mus., Bull. 125, p. 82, pl. 34, figs. 5-7.
Discoporella umbellata (Defrance). McGuirt, 1941, Louisiana Geol. Survey, Bull. 21, p. 65, pl. 1, figs. 4, 7, 9-11.
Discoporella umbellata depressa (Conrad). Cook, 1965, Bull. Brit. Mus. (Nat. Hist.), Zool., v. 13, no. 5, p. 180, pl. 3, figs. 2, 4.

Description: Zoarium discoidal to saucer-shaped, generally free in adult stage. Zooecia rhomboid, somewhat regularly arranged. Gymnocyst absent; finely tuberculated proximal and lateral cryptocyst descends gently to a horizontal cryptocyst that bears 8-12 peripheral pores and frequently, scattered central pores; development of horizontal cryptocyst may vary from delicate lacework to a complete lamina with peripheral openings. Opesia small, nearly semicircular, the proximal border curved. Auriform vibraculum distal to each zooecium. Basal surface bears closely spaced coarse tubercles and divided into radial sectors by short discontinuous grooves.

Material examined: USNM 651285, figured specimen, Red Bay Formation, Red Bay Fire Tower, Florida. USNM 651286, specimen not figured, Yellow River Formation, C. H. Spence Farm, Florida.

Fossil distribution: Miocene: Shoal River, Chipola, Oak Grove, Red Bay, Yellow River, and Jackson Bluff formations, Florida; Bowden Formation, Jamaica; Cercado Formation, Dominican Republic; Duplin Marl, North and South Carolina; subsurface of Louisiana. Pliocene: South Carolina and Florida. Pleistocene: California.



Text-figure 2. *Discoporella umbellata depressa* (Conrad), USNM 651285, frontal view, × 50.

Suborder Ascophora Levinsen

Family Cleidochasmatidae Cheetham and Sandberg

Genus Hippoporidra Canu and Bassler

Hippoporidra Canu and Bassler, 1927, U. S. Natl. Mus., Proc., v. 69, art. 14, p. 8.

Type species: *Cellepora edax* Busk, 1859, Palaeontogr. Soc. Mon. (1857), p. 59, pl. 9, fig. 6; pl. 22, fig. 3 (by original designation). Pliocene, England.

Hippoporidra calcarea (Smitt)

Lepralia edax forma *calcarea* Smitt, 1873, Kongl. Svenska Vetensk.-Akad. Handl., v. 11, pt. 4, p. 63, pl. 11, figs. 220-223.
Hippoporidra janthina (Smitt). Cheetham and Sandberg, 1964, Jour. Paleontology, v. 38, no. 6, p. 1033, text-fig. 36.

Description: Zoarium encrusting, often forming distinct irregular erect branches. Zooecia irregularly oriented, shape varying with degree of zooecial crowding. Frontal generally thickened, bearing one to two rows of marginal pores. Orifice nearly semicircular, bearing prominent, proximally placed condyles; proximal lip broadly curved. Medial suboral umbo commonly present.

Material examined: USNM 651287, specimen not figured, Red Bay Formation, Red Bay Fire Tower, Florida.

Fossil distribution: Miocene: Red Bay Formation, Florida. Quaternary: subsurface of Louisiana.

Remarks: A single small specimen was recovered in the collections taken from the site near the Red Bay Fire Tower. The significance of this occurrence is not clear at this time.

The heavily calcified specimen appears to lack avicularia and no ovicells are present.

The following supplementary description is from Cheetham and Sandberg (1964: 1033): "avicularia small, pointed, frontal, having cross bars, locally on umbonate process; ovicells globular, coarsely granular, displaying large area of secondary calcification."

VI. Acknowledgments

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