THE LOWER CRETACEOUS MICROFAUNA FROM TRINIDAD AND ADJACENT AREAS

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Abstract

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Lower Cretaceous samples from Trinidad, the Gulf of Paria and Eastern Venezuela have yielded 206 species of foraminifera (87 of which are new) and 77 species of ostracods (37 new). These microfossils are described and illustrated, and the biostratigraphy of the Lower Cretaceous formations of Trinidad is discussed in detail. Analysis of the faunas reveals seven biozones based on the stratigraphic ranges of pelagic foraminifera.

From the pelagic faunas associated with the Lower Cretaceous limestone, it is possible to infer that the major Lower Cretaceous limestone build-up in both Eastern Venezuela and the Gulf of Paria is, at least in part, equivalent in age with the highly calcareous to marly shales of the Upper Cuche and Lower Maridale Formations of Trinidad, and that the Upper Maridale is represented by the interbedded calcareous shales and limestones above the main limestone body. The data presently available are not sufficient to correlate the lower limits of the limestones in Domoil #1 or P.O.S.A. #40-1 with the planktonic zonation of the Trinidad sediments, since no pelagic faunas have been found in association with the Lower part of the limestone.

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INTRODUCTION

This study of the Lower Cretaceous microfauna of Trinidad was started when the thick limestone section in Domion Oil's #1 Domoil well yielded a large fauna of ostracodes and shallow water foraminifera. Many of the ostracodes had not been described in the literature. With the encouragement of Mr. R. I. Levorsen and Mr. H. C. Potter, the former Resident Manager and Chief Geologist respectively, I started to prepare a paper to describe and illustrate this interesting ostracode fauna. As work progressed, it became obvious that, in order to place the limestone in its proper stratigraphic perspective and to show the relationship of the fauna, a complete review of the Trinidad Lower Cretaceous microfauna would be preferable. Therefore, the microfaunas from all of the Lower Cretaceous samples in the Dominion Oil paleontology laboratory in Port of Spain have been examined and described in an attempt to bring together as much information on the Trinidad faunas from this part of the section as is possible at the present time.

GEOGRAPHIC AND GEOLOGIC SETTING

The island of Trinidad is approximately ten miles east of the northeast coast of Venezuela and is at the southern end of the Antillean Island arc (text-figure 1). Its approximate geographic center is 10° 30' N. Latitude and 61° 15' W. Longitude. Trinidad is roughly rectangular in shape with promontories at the northwest and southwest corners. The average east-west width is 35 miles and the average length (north-south) is 50 miles; the land area is 1,863.8 square miles.

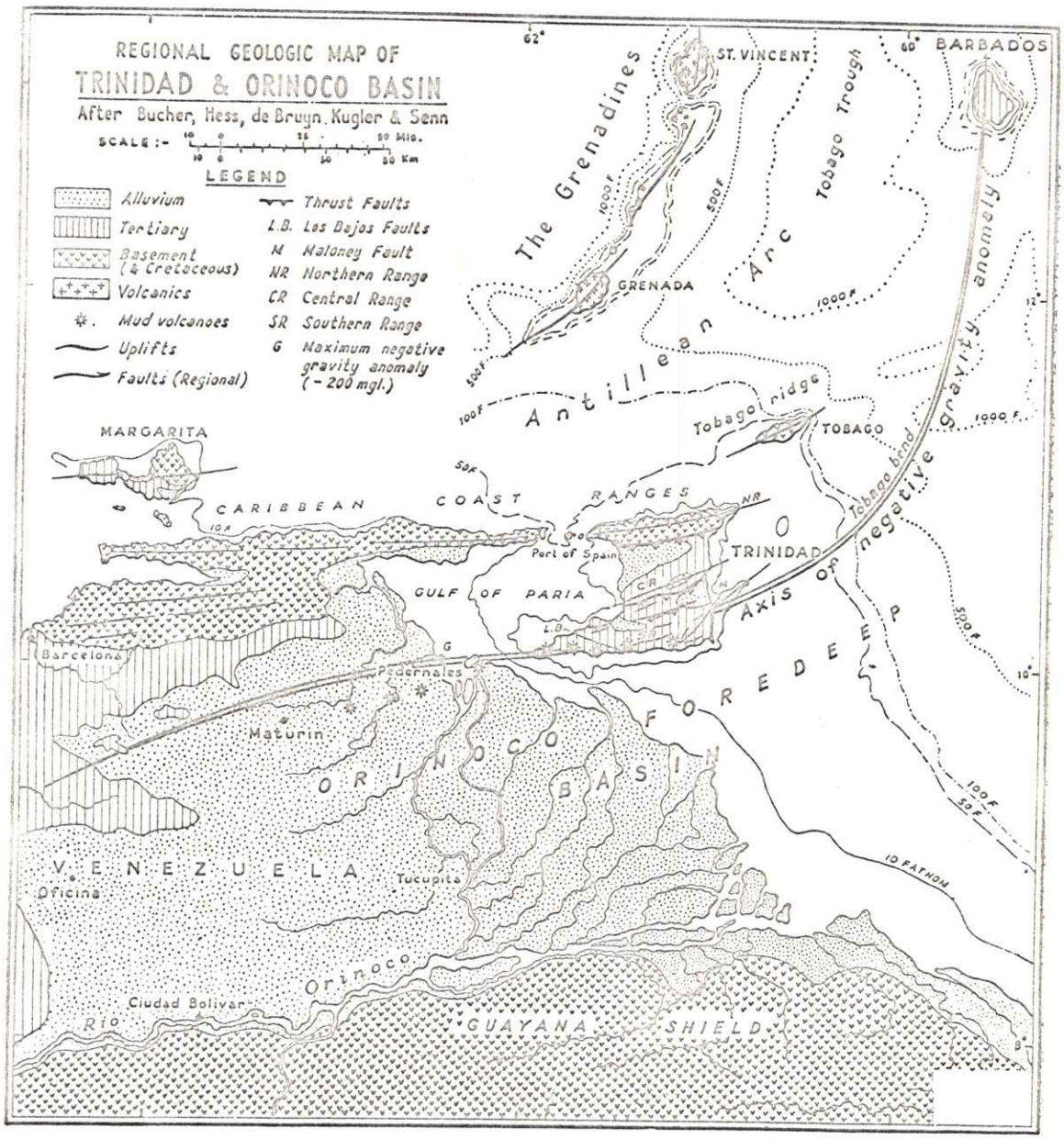

Fig. 1 Location and geologic map of the area. (from Suter, 1951)

The climate is tropical and seasonal with a rainy season, and a dry period extending from January through March. Topographically, the island is subdivided into three distinct and separate mountain ranges, with two undulating plains between.

The Northern Range fringes the Caribbean Sea and is an extension of the Paria Mountains of the Cordillera de la Costa in Venezuela. It is formed by the folding of Cretaceous and Jurassic sediments and is composed of thick limestones and weakly metamorphosed schists and phyllites. In general, these beds are unfossiliferous.

The Northern Basin, Central Range and the Northern Gulf of Paria are related geologically and tectonically to the Serrania del Interior of Venezuela, the band of deformed, but unmetamorphosed Cretaceous and Tertiary sediments south of the Cordillera de la Costa. In the Gulf several large horst blocks of Lower Cretaceous limestone have been elevated near the surface, and the Upper Cretaceous and Tertiary beds are missing locally, due either to non-deposition or subsequent erosion. The Northern Basin is covered by gently folded sediments of younger Tertiary to Recent talus derived from the Northern Range, and these overlie the more complexly folded and faulted beds of the Middle Tertiary. No Cretaceous outcrops are exposed in the Northern Basin. Some wells on the northern edge have penetrated the subsurface extension of the Northern Range Cretaceous complex.

The Central Range extends obliquely across the island in a northeast direction and has complex geologic structures of asymmetric folds and thrust faults. In contrast with the tightly contorted, metamorphosed sequence in the Northern Range, the sediments of the Central Range are not metamorphosed. This is probably due to less structural deformation, combined perhaps with a shallower depth of burial and the

fact that these shales were less competent than the shales and limestones that make up much of the sedimentary sequence of the Northern Range.

Most of the Lower Cretaceous sediments of the Central Range are fossiliferous and many of the samples described in the present paper came from this uplift.

The Southern Basin is composed of a complex series of low uplifts and low angle thrust faults involving the Tertiary and Upper Cretaceous sediments. The Southern Range is a series of en echelon, complex anticlinal folds of younger sediments, without Lower Cretaceous outcrops. No exploratory well as yet has penetrated below the Upper Cretaceous in the Southern Basin and Southern Range area.

STRATIGRAPHY AND FAUNAS

Because of the persistent and repeated orogenic activity, outcrops or subsurface sections where the stratigraphic succession can be determined by superposition are extremely rare. Most of the faunal sequences have to be pieced together from their occurence in rubble blocks in a younger matrix (wildflysch). This is one of the major problems that had to be faced by Kugler, Bronnimann, Bolli and others in the development of stratigraphic and faunal sequence for both the Tertiary and Cretaceous sediments of Trinidad.

The fossiliferous Lower Cretaceous of Trinidad (Baremian through Aptian) is represented by the Toco, the Cuche and the Maridale formations, in ascending order. It has been possible to date a few samples with ammonites (Renz, 1942; Barr, 1951; Imlay, 1954), molluscs (Cox, 1954) and corals (Trenchmann, 1955; Wells, 1948). Some foraminiferal

correlations have been made with the more accurately dated sediments in Germany (Bartenstein, Bettenstaedt and Bolli, 1957) and with Venezuela (Rod and Maync, 1954). In general, however, correlation with the standard stages is doubtful and it is not even possible to be sure that stratigraphic gaps and hiatuses have been recognized. It should be emphasized that the faunal ranges and successions presented here are developed from a number of isolated and unrelated outcrops, many from blocks in the Nariva wildflysch formation. Additional studies, particularly in areas with less orogeny, may modify or amend the ranges proposed in the present paper.

Toco Formation

Outcrops of the Toco Formation, the oldest of the fossiliferous Cretaceous sediments, occur in the northeastern tip of the Northern Range, at Toco Bay (Bartenstein, Bettenstaedt and Bolli, 1957). Lithologically, the Toco beds are composed of very hard, black to very dark grey, pyritic, slightly calcareous shales, with interbedded dense, dark grey limestones. Faunas from outcrops in this area are rare since only thin bands within the shales are fossiliferous. I have been unable to extract any microfossils from these samples. A foraminiferal fauna, similar in composition to that described from Toco was found in Dominion Oil #1 Laventille well and is believed to represent the same geologic interval. One isolated sample from the eastern end of the Central Range, near Pointe-a-Pierre, contained an assemblage that is suggestive of the fauna of the Toco Formation.

A Lower Barremian age has been assigned to the Toco Formation on the basis of an ammonite fauna found at Tompire Bay near Toco (Imlay,

1954). The main characteristics of the microfauna are the common occurrence of Globigerina kugleri and Lenticulina barri, with the lack of Hedbergella praewashitensis and Hedbergella bollii. The two latter species range throughout the overlying Cuche Formation, usually in some abundance, and their absence in the Toco Formation is considered significant. Where a shallow water limestone facies is developed in the Toco beds, Choffatella decipiens and Trocholina infragranulata become abundant locally, but no specimens of Orbitolina texana are present.

Cuche Formation

The dark grey to black, hard, slightly calcareous shales of the Cuche Formation of the Central Range have been divided into two faunal zones by Bolli (1959). His lower zone, which includes the Hedbergella bollii, Hedbergella infracretacas and Globigerinelloides blowi zones of the present study, is marked by the common and persistent occurrence of Epistomina carcolla and the varieties of Lenticulina ouachensis.

Sediments of the Upper Cuche are generally more calcareous and marly, and are a lighter grey than the underlying beds. The fauna from this part of the section is marked by the abundant occurrence of Schackoina spp. and Leupoldina protuberans. The subspecies of Lenticulina ouachensis and specimens of Epistomina carcolla were reported by Bolli from the lower part of the Upper Cuche sediments.

Maridale Formation

Lithologically, the Maridale Formation is a medium grey, very

calcareous shale to marl. The formation is subdivided into two zones on the basis of faunal occurrences. This was first noted by Bolli (1959) and his subdivision is confirmed by the present study. The lower, Biglobigerinella barri, zone is marked by the abundance of this species, which is apparently restricted to this stratum. Globigerinelloides maridalensis and Globigerinelloides saundersi, which first appear in the upper most part of the Cuche, extend through this zone, but do not occur above it.

The upper biozone of the Maridale, the Hedbergella rohri zone, Bolli noted, is marked by a sharp faunal change in the pelagic content. In addition to the extinction of Biglobigerinella barri, Globigerinelloides maridalensis, Globigerinelloides saundersi and Biglobigerinella cushmani, all of which occur in the lower beds, the upper zone is also distinguished by the first common appearance of Globigerinelloides eaglefordensis and Hedbergella rohri.

SYSTEMATIC DESCRIPTIONS

Order FORAMINIFIDA Eichwald

Suborder TEXTULARIINA Delage and Hérouard

Superfamily AMMODISCACEA Reuss

Family SACCAMMINIDAE Brady

Genus Proteonia Williamson 1858

Proteonina ampulla Stacy, new species

Pl. 1 fig. 1

Test free, small, flask-shaped. Single chamber with a long apertural neck, terminating with a simple, circular aperture. Wall finely arenaceous.

Size. Height, 0.37 mm.; diam. of chamber, 0.20 mm.

Remarks. The more globular chamber separates this species from P. fusiformis Williamson.

Type. Holotype UMMP 54162.

Proteonina cuchensis Stacy, new species

Pl. 1 fig. 2

Test free, small, flask-shaped. Single globular chamber, much broader than high. Simple, circular aperture at the end of a distinct neck. Wall finely arenaceous.

Size. Height, 0.22 mm.; diam. of chamber, 0.20 mm.

Remarks. The low, broad chamber separates this form from other Cretaceous species of Proteonia.

Type. Holotype UMMP 54163.

Proteonina magna Stacy, new species

Pl. 1 fig. 4

Test free, large, flask-shaped. Single globular chamber. Simple,

circular aperture at the end of a prominent, thick-walled, tapering neck. Some specimens have a similar, but smaller necklike protuberance at the base. Wall arenaceous.

Size. Height, 0.55 mm.; diam. of chamber, 0.48 mm.

Remarks. The tapering apertural neck separates this species from P. ampullecea (Brady).

Type. Holotype UMMP 54164.

Family AMMODISCIDAE Reuss

Genus Glomospira Rzehak 1885

Glomospira plexus Stacy, new species

Pl. 1 fig. 3

Test free, small. The tubular second chamber coils around the initial proloculum and then continues to wrap around the earlier coils without remaining in a regular plane of coiling. Wall very finely arenaceous.

Size. Largest diam., 0.26 mm.

Remarks. The much smaller diameter of the second chamber separates this species from G. watersi Loeblich.

Type. Holotype UMMP 54165.

Superfamily LITUOLACEAE deBlainville

Family HORMOSINIDAE Haeckel

Genus Reophax Montfort 1808

Reophax incompta Loeblich and Tappan

Pl. 1 fig. 5

Reophax incompta Loeblich and Tappan, 1946, p. 242, pl. 35, figs. 1a, b, text fig. 1 -- Frizzell, 1954, p. 57, pl. 1, figs. 10a, b.

Test free, small. Subglobular chambers arranged in a uniserial but not rectilinear series, increasing somewhat irregularly in size.

Sutures depressed, straight, not horizontal. Aperture terminal, rounded. Wall finely arenaceous and smooth.

Size. Height, 0.50 mm.; diam., 0.17 mm.

Reophax cf. pepperensis Loeblich

Pl. 1 fig. 7

Reophax pepperensis Loeblich, 1946, p. 133, pl. 22, fig. 1a, b. -- Frizzell, 1954, p. 58, pl. 1, figs. 12a, b.

Test free, small. Globular, uniserially arranged chambers increasing gradually in size becoming more flattened toward the apertural end; as many as nine chambers in larger specimens. Aperture simple, terminal with no apertural neck. Sutures slightly depressed, straight, horizontal. Wall finely arenaceous, smooth.

Size. Height, 0.50 mm.; diam., 0.21 mm.

Remarks. None of the Trinidad specimens have the tapering and conical apertural termination shown by Loeblich's species.

Reophax cf. pilulifera Brady

Pl. 1 fig. 24

Reophax pilulifera Brady, 1884, p. 292, pl. 30, figs. 18 - 20. -- Bartenstein and Brand, 1951, pp. 266, 267, pl. 12, figs. 344-346. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 15, pl.1 figs, 4a, b, 5, 9a, b.

Test free, small, composed of two globular chambers. Simple aperture at end of long, narrow neck. Suture wide, deeply depressed. Wall finely arenaceous, smooth.

Size. Height, 0.23 mm.; diam., 0.15 mm.

Remarks. This uncrushed specimen is referable to the distorted and crushed species illustrated by Bartenstein, Bettenstaedt and Bolli

(1957), although their form is more than twice as large.

Reophax constrictus Stacy, new species

Pl. 1 fig. 8

Test free, uniserial. Three to four globular chambers expand rapidly in size. Simple aperture at end of short apertural neck. Sutures deeply depressed, straight. Wall smoothly arenaceous.

Size. Height, 0.63 mm.; largest diam., 0.33 mm.

Remarks. Somewhat similar to R. scorpiurus Montfort as illustrated in Bartenstein, Bettenstaedt and Bolli (1957), but can be separated easily on the basis of the short, distinct apertural neck and the more globular chambers.

Type. Holotype UMMP 54166

Reophax compsus Stacy, new species

Pl. 1 fig. 17

Test free, uniserial. Four or more gradually expanding chambers; chambers broader than high, circular in cross section. Final chamber terminating with a tapering, conical projection that becomes a short apertural neck. Aperture simple, terminal. Sutures depressed, straight. Wall finely arenaceous, very smooth.

Size. Height, 0.58 mm.; diam., 0.33 mm.

Remarks. The much smaller size and the distinct apertural neck separates this species from R. woodbinensis Tappan.

Type. Holotype UMMP 54167

Reophax styphelus Stacy, new species

Pl. 1 fig. 6

Test free, uniserial. Three to four subglobular, very rapidly ex-

panding chambers oval in cross section. Simple, circular aperture at end of broad, short apertural neck. Sutures depressed, straight. Wall finely arenaceous, smooth.

Size. Height, 0.80 mm.; largest diam., 0.48 mm.

Remarks. The much heavier wall, the broader, more tapering apertural neck and the larger size separate this species from R. compsus above.

Type. Holotype UMMP 54168

Reophax? grandis Stacy, new species

Pl. 1 figs. 22, 23

Test free, large. Initial stage broken off of all specimens so early chamber arrangement not observed; later chambers large, tapering, in a uniserial, rectilinear series of gradually increasing size. Chambers circular to oval in cross section. Aperture a simple, circular opening at end of a short, broad neck. Sutures depressed, straight. Wall coarsely arenaceous.

Size. Height, over 1.25 mm.; diam., 0.66 mm.

Remarks. In shape and outline, this species appears similar to Haplostiche texana (Conrad); however, the simple rather than complex aperture, the nonlabyrinthic chambers and the consistently smaller size separates this Trinidad form of Reophax from the Texas horizon marker.

Type. Holotype UMMP 54169

Family LITUOLIDAE

Genus Haplophragmoides Cushman 1910

Haplophragmoides concavus (Chapman)

Pl. 1 figs. 18, 19

Trochammina concava Chapman, 1892, p. 327, pl. 16, figs. 14a, b.

Haplophragmoides concava (Chapman). Tappan 1940, pp. 95, 96, pl. 14, figs. 7a, c. -- Tappan, 1943, p. 481, pl. 77, figs. 5a, b. Haplophragmoides concavus (Chapman). Bartenstein and Brand, 1951, p. 268, pl. 1, figs. 24, 25. -- Frizzell, 1954, p. 59, pl. 1, figs. 27a, c. -- Bartenstein, Bettenstaedt and Bolli, 1957, pp. 16, 17, pl. 2, figs. 36a, c.

Test free, planispiral, biumbilicate. Six subglobular chambers in final whorl increasing gradually in size. Periphery rounded, lobulate; sutures depressed, radial. Aperture a slit at base of the apertural face of the last chamber. Wall smoothly arenaceous.

Size. Diam., 0.44 mm.; thickness, 0.17 mm.

Haplophragmoides evolutus Stacy, new species

Pl. 1 figs. 15, 16

Test free, small, planispiral, biumbilicate, evolute. Test composed of about three and a half whorls of gradually increasing, globular chambers; seven chambers in final whorl. Periphery rounded, lobulate; sutures depressed, radial. Aperture a slit at the base of the last formed chamber. Wall finely arenaceous, smooth.

Size. Diam., 0.30 mm.; thickness, 0.07 mm.

Remarks. The distinctly evolute type of coiling separates this species from other Cretaceous Haplophragmoides.

Type. Holotype UMMP 54170

Haplophragmoides minutus Stacy, new species

Pl. 1 figs. 13, 14

Test free, small involute. Approximately five, gradually increasing chambers in final whorl. Periphery rounded; sutures depressed, obscure. Wall finely arenaceous, smooth.

Size. Diam., 0.25 mm.

Remarks. All specimens found were badly crushed and distorted, but the very gradual increase in chamber size and small chambers distinguish this form from other described species of Haplophragmoides.

Type. Holotype UMMP 54171

Haplophragmoides intermedius Stacy, new species

Pl. 1 figs. 9, 10

Test free, involute. Five to six, gradually increasing chambers in final whorl. Periphery rounded; sutures depressed, radial, somewhat obscure. Wall finely arenaceous, smooth.

Size. Diam., 0.43 mm.

Remarks. Similar to H. minutus above but consistently larger, and with no gradational sizes between.

Type. Holotype UMMP 54172

Haplophragmoides ~~gigas~~ magnus Stacy, new species

Pl. 1 figs. 20, 21

Test free, large, somewhat trochoid, partially evolute. About eight, gradually increasing chambers in final whorl. Periphery lobulate; sutures depressed, radial to slightly arched. Wall finely arenaceous, smooth.

Size. Diam., 0.63 mm.

Remarks. Similar to H. excavatus Cushman and Waters but differs by being larger, not truly planispiral nor completely involute.

Type. Holotype UMMP 54173

Genus Cyclammina Brady 1879

Cyclammina sp.

Pl. 1 figs. 25, 26

Test free, small, planispiral, involute. Chambers labyrinthic.

Periphery acutely rounded; sutures not visible on external surface. Aperture a slit at base of apertural face and pores on septal face. Wall finely arenaceous, smooth.

Size. Height, 0.39 mm.; thickness, 0.20 mm.

Remarks. Since only one specimen was found, no specific name is proposed.

Genus Choffatella Schlumberger 1905

Choffatella decipiens Schlumberger

Pl. 2 figs. 1-4

Choffatella decipiens Schlumberger, 1905, p. 763, pl. 18, figs. 1-6. -- Maync, 1949, pp. 539-541, pls. 11, 12. -- Jordan and Applin, 1952, p. 3, pl. 1, figs. 4-8. -- Maync, 1952, pl. 11, figs. 9, 10.

Test free, planispiral, involute to partially evolute, discoid. Narrow, curved, wedge-shaped chambers in three of four whorls, with about twenty chambers in final whorl. Chambers and septa of about same width; chambers simple, nonlabyrinthic, but septa and walls pierced by numerous fine canals. Canals of septa parallel, straight; canals of wall forming a netlike reticulum. Tendency to uncoil and form a uniserial series of final chambers evidenced by some specimens. Wall finely arenaceous, smooth.

Size. Height, 0.75 mm.; thickness, 0.02 mm.

Remarks. For discussions on the stratigraphic range of this species in the Caribbean region, see also Rod and Maync (1954, pp. 260-283), Maync (1955, pp. 269-273), Maync (1956, p. 92) and Barr (1960, p. 323).

Genus Pseudocyclammina Yabe and Hanzawa 1926

Pseudocyclammina pseudocoprolithiformis Stacy, new species

Pl. 2 figs. 21, 22, 30

Test free, medium to large. Four to five chambers in initial, planispiral coil, followed by uniserial series of rapidly increasing chambers; final chamber elongate. Cribrate aperture on septal face.. In section, chamber walls and septa showing thin, outer alveolar hypodermis and thicker, "spongy", finely labyrinthic inner portion. Sutures depressed, straight; outer wall surface smoothly arenaceous with scattered alveolar pits.

Size. (Trinidad specimen) Height, 1.47 mm.; diam., 0.85 mm.; (Texas specimen) height, 2.16 mm.; diam., 1.00 mm.

Remarks. The exterior appearance of this species seems to be identical with the type description and picture of Haplophragmium coprolithiforme Schwager 1868 (see Ellis and Messina, 1940 etc.) but not Ammobaculites coprolithiformis (Schwager) of American authors. A similar species with labyrithic chambers was described by Mohler in 1938 from the Upper Jurassic (L. Sequanian) of Switzerland as Ammobaculites coprolithiformis var. sequana (see Maync, 1952, p. 50).

Specimens of this species were found in many of the samples of the Domoil limestone and were also present in a sample of the Glen Rose Formation of Texas.

Type. Holotype UMMP 54174, Paratype UMMP 54175

Pseudocyclammina hedbergi Maync

Pl. 2 figs. 20, 25-29

Pseudocyclammina hedbergi Maync, 1953, pp. 101, 102, pl. 16, figs. 1-8.

Test free, medium sized. Planispiral coil of two or three whorls; with four or five, rapidly enlarging chambers in final whorl; sometimes followed by two or three chambers in a uniserial series. Chambers, elongate oval in cross section. Cribrate aperture on septal face. In

section, chamber walls and septa labyrinthic, thick, but not clearly divided into two zones as in P. pseudocoprolithiformis. Sutures depressed, straight to slightly curved; exterior wall surface arenaceous, with some alveolar pits.

Size. Length, 1.55 mm.; width, 0.80 mm.; thickness, 0.50 mm.

Remarks. Abundant juvenile specimens of this species are present, some of which apparently develop a premature uniserial stage and seem to be identical with Pseudocyclammina sp. Maync, 1953. Since there seems to be all gradations in size between these forms and the adult P. hedbergi, they are not considered to be a different species.

Genus Ammoastua Cushman and Bronnimann 1948

Ammoastuta? subcretacea Stacy, new species

Pl. 1 figs. 11, 12

Test free, low trochoid spire, spiral side evolute, umbilical side partially covered by elongate final chamber. Chambers elongate, curved, wedge-shaped, enlarging rapidly. Final chamber comprising almost half of the shell size. Periphery acutely angled, lobulate; sutures depressed, curved. Aperture and wall structure could not be determined from the present specimens.

Size. Length, 0.30 mm.; width, 0.17 mm.; thickness, 0.09 mm.

Remarks. Since only pyritized specimens have been found, it is not possible to tell whether the test wall is calcareous (Nonionella?) or arenaceous (Ammoastuta?). One specimen was found in the Lower Cuche surface sample (11998) and another in the well sample from 5410'-40' in Domoil #1 Laventille, which is from the same stratigraphic horizon.

Type. Holotype UMMP 54176

Genus Ammobaculites Cushman 1910

Ammobaculites subcretaceus Cushman and Alexander

Pl. 2 fig. 7

Ammobaculites subcretacea Cushman and Alexander, 1930, p. 6 pl. 2, figs. 9, 10.

Ammobaculites subcretaceus Cushman and Alexander. Albritton, 1937, p. 20, pl. 4, figs. 3, 4. -- Lozo, 1944, pp. 538-540, pl. 4, figs. 2, 3. -- Cushman, 1946, p. 23, pl. 3, figs. 18-20. -- Loeblich and Tappan, 1949, p. 251, pl. 46, figs. 9-13. -- Stead, 1951, p. 589, pl. 1, figs. 7-9. -- Frizzell, 1954, pp. 62, 63, pl. 2, figs. 27a, b, 28a, b. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 17, pl. 2, figs. 32a, b, 33. -- Simon, Bartenstein, et al., 1962 p. 251, pl. 35, fig. 1.

Test free, small. Four to six chambers in initial planispiral coil followed by two to five chambers in a straight, uniserial series. Chambers increasing very gradually in size in uniserial part, approximately as wide as diameter of coil, broader than high. Sutures depressed, distinct, straight; aperture simple, terminal. Wall arenaceous.

Size. Height, 0.50 mm.; diam, of largest chamber, 0.25 mm.

Ammobaculites torosus Loeblich and Tappan

Pl. 2 fig. 8

Ammobaculites torosus Loeblich and Tappan, 1949, p. 251, pl. 46, figs. 6, 7. -- Frizzell, 1954, p. 63, pl. 3, fig. 4.

Test free. Four chambers in initial planispiral whorl, followed by four or five gradually increasing, globular chambers in a straight uniserial series, broader than high. Sutures depressed, straight; simple aperture terminal on a very short apertural neck. Wall arenaceous.

Size. Height, 0.95 mm.; diam., 0.37 mm.

Ammobaculites trinidadensis Bartenstein, Bettenstaedt and Bolli

Pl. 2 fig. 13

Ammobaculites trinidadensis Bartenstein, Bettenstaedt and Bolli, 1957, p. 17, pl. 1, figs. 6, 7a, b, 8a, b.

Test free, small. Indistinct initial coil followed by two or three globular chambers in uniserial series. Sutures depressed, straight; simple aperture at end of well-developed apertural neck. Wall coarsely arenaceous, rough.

Size. Height, 0.65 mm.

Ammobaculites chalicodes Stacy, new species

Pl. 2 fig. 6

Ammobaculites sp. Bartenstein, Bettenstaedt and Bolli, 1957, pp. 17, 18, pl. 1, figs. 16, 17.

Test free. Initial planispiral whorl of six chambers followed by a straight, uniserial series of five to seven gradually increasing chambers, much broader than high. Sutures depressed, straight; aperture simple, circular, at end of short, narrow neck. Wall coarsely arenaceous.

Size. Height, 0.63 mm.; diam., 0.25 mm.

Remarks. Most specimens have crushed and distorted chambers suggesting that the wall is somewhat thinner than most species of Ammobaculites.

Type. Holotype UMMP 54177

Genus Flabellammina Cushman 1928

Flabellammina minor Stacy, new species

Pl. 2 fig. 10

Test free, small. After small, initial coil, chambers uniserially aranged; chambers of uniserial series increasing gradually in size, much wider than high and elongate rectangular in cross section; final two or three chambers chevron-shaped, equitant. Sutures slightly depressed, obscure; apertural terminal, an elongate slit. Wall finely arenaceous, smooth.

Size. Height, 0.69 mm.; width, 0.29 mm.; thickness, 0.02 mm.

Remarks. This species is consistently much smaller than other described forms of this genus.

Type. Holotype UMMP 54178

Family TEXTULARIIDAE Ehrenberg

Genus Spiroplectammina Cushman 1927

Spiroplectammina pannosa Stacy, new species

Pl. 2 fig. 9

Test free, moderate size. After initial, planispiral coil of aproximately six chambers, rest of the test composed of an irregularly arranged, biserial series; subglobular chambers of the biserial portion increasing very gradually in size, resulting in rounded, lobulate, subparallel sides. Sutures deeply depressed, angulate, slightly curved; aperture a slit at the base of the apertural face of the last-formed chamber. Wall arenaceous, smooth.

Size. Height, 0.57 mm.; width, 0.25 mm.

Remarks. Biserial portion similar to S. ammovitrea Tappan, but with a much smaller, less prominent, initial coil.

Type. Holotype UMMP 54179

Genus Textularia Defrance 1824

Textularia rioensis Carsey

Pl. 2 figs. 23, 24

Textularia rioensis Carsey, 1926, p. 24, pl. 7, fig. 2. -- Tappan, 1940, p. 98, pl. 15, figs. 1a, b, 2a, b. -- Tappan, 1943, pp. 485, 486, pl. 78, figs. 1-4. -- Lozo, 1944, pp. 551, 552, pl. 3, figs. 7, 9a, b. -- Loeblich and Tappan, 1949, pp. 254, 255, pl. 48, fig. 11. -- Stead, 1951, p. 591, pl. 2, figs. 5, 6. -- Frizzell, 1954, p. 68, pl. 4, fig. 37.

Test free, small, biserial, quadrate in cross section. Chambers increasing gradually in size; periphery rounded. Sutures slightly depressed, straight, at right angles to axis of growth; aperture a circular depression at base of apertural face of last-formed chamber. Wall finely arenaceous, smooth.

Size. Height, 0.40 mm.; width, 0.25 mm.; thickness, 0.17 mm.

Textularia cristata Stacy, new species

Pl. 2 figs. 14, 15

Test free, small, biserial, flaring. Chambers subglobular, increasing rapidly in size; periphery acute to subrounded. Sutures depressed, distinct, slightly arched; aperture a low slit at base of last-formed chamber. Wall finely arenaceous, smooth. Most specimens crushed due to thin chamber walls.

Size. Height, 0.40 mm.; width, 0.25 mm.; thickness, 0.17 mm.

Remarks. No other species of Cretaceous Textularia appears similar to this small, flaring, flattened form.

Type. Holotype UMMP 54180

Textularia informis Stacy, new species

Pl. 2 figs. 16, 17

Test free, small, irregularly biserial, circular in cross section. Globular chambers increasing gradually in size, succeeding chambers not

added exactly opposite previous chamber; periphery rounded, lobulate. Sutures slightly depressed, curved; aperture a low slit at base of last-formed chamber. Wall smoothly arenaceous.

Size. Height, 0.50 mm.; width and thickness, 0.24 mm.

Remarks. Chamber arrangement somewhat similar to T. adkinsi Loeblich, but the present species is rounded in cross section and has a more regular chamber size.

Type. Holotype UMMP 54181

Textularia pumila Stacy, new species

Pl. 2 figs. 18, 19

Test free, small, biserial, diamond-shaped in cross section. Wedge-shaped chambers increasing gradually in size; periphery subacute. Sutures slightly depressed, straight; aperture a slit at base of last-formed chamber. Wall finely arenaceous, smooth.

Size. Height, 0.30 mm.; width, 0.20 mm.; thickness, 0.12 mm.

Remarks. Similar in shape to Spiroplectammina semicomplanata Carsey, but much smaller and without the initial coil of Spiroplectammina.

Type. Holotype UMMP 54182

Textularia delicata Stacy, new species

Pl. 2 figs. 11, 12

Test free, very small, biserial, flaring. Low, narrow chambers curved and increasing gradually in size; periphery rounded; sides subparallel. Sutures depressed, distinct, curved; aperture a low slit at base of last-formed chamber. Wall finely arenaceous, very smooth.

Size. Height, 0.20 mm.; width, 0.19 mm.; thickness, 0.05 mm.

Remarks. This small, flaring, flattened form with low, curved

chambers is quite distinct from other Cretaceous species of Textularia.

Type. Holotype UMMP 54183

Family ATAXOPHRAGMIIDAE Schwager

Genus Verneuilinoides Loeblich and Tappan 1949

Verneuilinoides neocomiensis (Mjatliuk)

Pl. 3 fig. 1

Verneuilina neocomiensis Mjatliuk, 1939, p. 50, pl. 1, figs. 12, 13.

Verneuilinoides neocomiensis (Mjatliuk). Bartenstein and Brand, 1951, p. 276, pl. 4, figs. 77, 328. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 19, pl. 2, figs. 39, 40. -- Simon, Bartenstein, et al., 1962, p. 253, pl. 35, fig. 3.

Test free, small, triserial, elongate, tapering upward from pointed base, becoming parallel-sided in upper third. Subglobular chambers increasing gradually in size; chambers generally broader than high. Sutures slightly depressed; wall finely arenaceous, smooth.

Size. Height, 0.57 mm.; width, 0.20 mm.

Verneuilinoides subfiliformis Bartenstein

Pl. 3 fig. 2

Verneuilina schizea Cushman and Alexander, 1930, pl. 2, figs. 14a, b, only. -- Lozo, 1944, p. 550, pl. 3, fig. 6.

Not Verneuilina schizea Cushman and Alexander, 1930, p. 9, pl. 2, fig. 13.

Verneuilinoides schizeus (Cushman and Alexander). Frizzell, 1954, p. 69, pl. 5, fig. 8.

Not Verneuilinoides schizea (Cushman and Alexander). Loeblich and Tappan, 1949, p. 255, pl. 48, figs. 9, 10. -- Stead, 1951, p. 592, pl. 2, figs. 12, 13.

Verneuilinoides subfiliformis Bartenstein, 1952, p. 308, figs. 2, 3. -- Bartenstein, Bettenstaedt and Bolli, 1957, pp. 19, 20, pl. 2, figs. 4a, b. -- Simon, Bartenstein, et al., 1962, p. 271, pl. 36, fig. 8.

Test free, small, triserial, elongate; after a short, tapering base, sides become subparallel, lobulate. Globular chambers, about as high as broad, increasing gradually in size. Sutures deeply depressed, distinct; aperture a curved slit at base of last formed chamber. Wall finely arenaceous, very smooth.

Size. Height, 0.47 mm.; width, 0.21 mm.

Remarks. It appears that Cushman and Alexander illustrated two different species in their 1930 paper. V. schizea of Loeblich and Tappan (1949) and Stead (1951) compare favorably with the type illustration of fig. 13; however, the illustrations and descriptions of V. subfiliformis appears very similar to fig. 14, the designated holotype of V. schizea. A comparison of the actual type specimen of the Cushman and Alexander species with the type specimen of V. subfiliformis would be necessary in order to determine if V. subfiliformis is a synonym of V. schizea.

Genus Gaudryina d'Orbigny 1839

Gaudryina dividens Grabert, type A

Pl. 3 fig. 4

Tritaxia pyramidata Reuss. Bartenstein, Bettenstaedt and Bolli, 1957, p. 19, pl. 2, figs. 37a, b.

Gaudryina dividens Grabert, 1959, p. 9, pl. 1, figs. 3-5. -- Simon, Bartenstein, et al., 1962, p. 285, pl. 37, figs. 4a, b.

Test free, moderate size, triserial throughout, triangular in outline and section. Low, triangular chambers increasing gradually in

size; periphery acutely rounded, sides concave. Sutures slightly depressed, often obscure, curved; aperture terminal, toward center of test, at base of last-formed chamber. Surface very finely arenaceous, smooth.

Size. Height, 0.70 mm.; width, 0.43 mm.

Remarks. Aperture is of Gaudryina, rather than Tritaxia, type.

Gaudryina dividens Grabert, type B

Pl. 3 figs. 3, 9

Gaudryina dividens Grabert, 1959, p. 9, pl. 2, figs. 16-30. -- Simon, Bartenstein, et al., 1962, pp. 285, 286, pl. 37, figs. 5a, b, pl. 41, figs. 6a, b.

Test free, moderate size, initially triserial, followed by biserial stage. Triserial part, similar to type A, above, with three acutely rounded edges, concave sides and triangular in outline and section; however, usually much smaller and composed of fewer and somewhat smaller chambers. Biserial stage composed of gradually increasing, rectangular chambers sloping but not curving, toward the base; chambers much wider than high. Sutures limbate, flush or sometimes depressed, straight; aperture a slit, sometimes an enlarged opening, at base of last-formed chambers. Wall finely arenaceous, smooth.

Size. Height, 0.48 mm.; width, 0.28 mm.; height of triserial stage, 0.18 mm.

Remarks. These two forms are considered to be variations of one species by Grabert and his German colleagues. Although it is probably possible to separate them on the basis that the triserial part of type B is often much smaller than the "adult" form of type A, both of these types are usually found together in the same faunas and a clear sepa-

ration between the immature forms would be difficult and probably not stratigraphically significant.

Gaudryina characta Stacy, new species

Pl. 3 fig. 13

Test free, moderate to large size, initial triserial stage followed by biserial portion. Triserial stage small, with concave sides and acute, subrounded edges. Biserial part composed of flattened, globular chambers increasing gradually in size, forming a rounded, lobulate, subparallel periphery. Short uniserial stage of one or two globular chambers rarely present. Sutures depressed, distinct, straight; aperture, a low opening at base of last-formed chamber or, in case of uniserial development, a terminal, circular opening. Wall arenaceous.

Size. Height, 0.82 mm.; biserial stage: height, 0.64 mm.; width, 0.34 mm.; thickness, 0.20 mm.

Remarks. The globular chambers and lobulate periphery of the biserial portion separate this species from G. dividens.

Type. Holotype UMMP 54184

Gaudryina trapezia Stacy, new species

Pl. 3 fig. 5

Test free, moderate size, large initial triserial stage followed by a few chambers arranged in a biserial series. Triserial portion with acutely rounded edges and straight sides, triangular in cross section. Biserial stage composed of quadrate, gradually enlarging chambers forming four subparallel, rectangular sides. Sutures depressed, oblique; aperture, a low, circular opening at base of last-formed chamber. Wall finely arenaceous, smooth.

Size. Height, 0.90 mm.; width, 0.45 mm.; thickness, 0.34 mm.

Remarks. Appears most similar to G. laevigata Franke, but differs by having oblique, rather than horizontal sutures.

Type. Holotype UMMP 54185

Genus Gaudryinella Plummer 1931

Gaudryinella delrioensis Plummer

Pl. 3 figs. 7, 8

Gaudryinella delrioensis Plummer, 1931, p. 341, text fig. 1a, b. -- Plummer, 1931, p. 137, pl. 9, fig. 13. -- Tappan, 1940, pp. 99, 100, pl. 15, fig. 7. -- Frizzell, 1954, p. 72, pl. 5, fig. 38.

Test free, moderate to large, small initial triserial portion followed by a short biserial stage and terminating in a uniserial series comprising most of the total height. Triserial part triangular in section with acutely rounded edges and straight sides; biserial stage composed of a few quadrate chambers forming parallel sides and a rectangular cross section; chambers of uniserial portion circular in section and much larger in diameter than high, most of these chambers about the same size. Sutures in early portion slightly depressed, oblique; in the uniserial part, sutures deeply depressed, straight, forming a very lobate periphery; aperture terminal, round. Wall coarsely arenaceous.

Size. Length, 1.69 mm.; diam. of last chamber, 0.22 mm.; broken adult: length, 1.38 mm.; diam. of chamber, 0.42 mm.

Gaudryinella cf. irregularis Tappan

Pl. 3 fig. 26

Gaudryinella irregularis Tappan, 1943, p. 490, pl. 78, figs. 31, 32. -- Frizzell, 1954, p. 72, pl. 5, fig. 21.

Test free, small initial triserial portion followed by a short

biserial stage and terminating in an irregularly arranged uniserial series. Chambers globular, increasing rapidly in size during development of triserial and biserial portions, then remaining nearly constant throughout the uniserial development. Sutures deeply depressed, oblique, forming a lobate periphery; aperture terminal, circular without well-developed apertural neck. Wall finely arenaceous, smooth.

Size. Length, 0.46 mm.; width, 0.16 mm.

Remarks. Except for the lack of the terminal apertural neck shown by Tappan, the Trinidad specimens seem identical with this species.

Gaudryinella pseudoserrata Cushman

Pl. 3 fig. 6

Gaudryinella pseudoserrata Cushman, 1932, p. 99, pl. 11, figs. 20, 21. -- Cushman, 1946, p. 36, pl. 8, figs. 15-21. -- Frizzell, 1954, p. 72, pl. 5, figs. 30, 31.

Test free, large, small initial triserial portion followed by a well-developed biserial stage and terminating in an irregularly arranged uniserial series. Chambers increasing gradually in size, their diameter much greater than height; in the uniserial portion, chambers added acentrically to produce biserial appearance. Sutures deeply depressed, oblique, forming a very lobulate outline; aperture terminal, circular. Wall coarsely arenaceous, smooth.

Size. Height, 1.11 mm.; width, 0.52 mm.; diam. of last chamber, 0.39 mm.

Remarks. Only broken specimens were available for size measurement.

Gaudryinella maridalensis Stacy, new species

Pl. 3 fig. 12

Test free, large, quadrate in cross section, small initial triserial portion followed by well-developed biserial stage and terminated by a few chambers arranged in an irregular uniserial series. Quadrate chambers broader than high and increasing gradually in size. Sutures depressed, straight; periphery somewhat lobate; aperture terminal, circular. Wall coarsely arenaceous.

Size. Length, 1.54 mm.; width, 0.58 mm.; thickness, 0.45 mm.; diam. of last chamber, 0.44 mm.

Remarks. Somewhat similar to G. pseudoserrata Cushman, but without the well-developed, very lobulate uniserial stage.

Type. Holotype UMMP 54186

Genus Dorothia Plummer 1931

Dorothia cf. oxycona (Reuss)

Pl. 3 fig. 27

Gaudryina oxycona Reuss, 1860, p. 229, pl. 12, fig. 3.

Marssonella oxycona (Reuss). Bartenstein and Brand, 1951, p. 277, pl. 19a, figs. 14-17.

Not Marssonella oxycona (Reuss). Cushman, 1946, pp. 43, 44, pl. 12, figs. 3-5. -- Frizzell, 1954, p. 75, pl. 6, figs. 17a, b.

Marssonella cf. oxycona (Reuss). Bartenstein, Bettenstaedt and Bolli, 1957, p. 20, pl. 2, figs. 42.

Marssonella sp. 1 aff. M. oxycona (Reuss). Simon, Bartenstein, et al., 1962, p. 257, pl. 35, fig. 11.

Test free, conical, trochoid spire. Four to five chambers in early whorls reduced to three and finally to two chambers per whorl in adult portion. Chambers robust, high, wedge-shaped. Sutures depressed, straight; aperture a semicircular depression in base of inner margin of the final chamber. Wall arenaceous, smooth.

Size. Height, 0.54 mm.; diam., 0.37 mm.

Remarks. Simon, Bartenstein, et al., 1962, point out that Zedler described a similar form as M. kummi, but the writer has not had an opportunity to consult his 1961 publication.

Dorothia cf. trochus (d'Orbigny)

Pl. 3 fig. 28

Textularia trochus d'Orbigny, 1840, p. 45, pl. 4, figs. 25, 26.

Marssonella cf. trochus (d'Orbigny). Bartenstein, Bettenstaedt and Bolli, 1957, pp. 20, 21, pl. 3, figs. 44, 45. -- Simmon, Bartenstein, et al., 1962, p. 283, pl. 36, fig. 12.

Test free, conical, flaring, trochoid spire. Early spire of four or five chambers followed by triserial and finally biserial chamber arrangment. Chambers flattened, disc-shaped, not as high as D. cf. oxycona. Profile view shows sides continuing to flare outward, not becoming subparallel in adult, as in D. cf. oxycona. Sutures flush to slightly depressed; apertural face flat; aperture a small semicircular opening at base of inner margin of last-formed chamber. Wall finely arenaceous, smooth.

Size. Height, 0.39 mm.; diam., 0.35 mm.

Dorothia conara Stacy, new species

Pl. 3 fig. 21

Test free, conical, trochoid spire. Four or five chambers in early whorls becoming triserial and then biserial. Chambers expanding rapidly in both height and width, final chambers large, quadrate in outline and section, with rounded edges. Sutures deeply depressed, straight; aperture a low opening at base of inner margin of final chamber. Wall finely arenaceous.

Size. Height, 0.50 mm.; width, 0.45 mm.

Remarks. Differs from D. cf. trochus by higher chambers and much larger final chambers; from D. cf. oxycona by the rounded chamber periphery and by the continously expanding outline.

Type. Holotype UMMP 54187

Dorothia magna Stacy, new species

Pl. 3 figs. 14, 22

Test free, large, trochoid spire, quadrate in cross section. Four to five chambers in initial whorls followed by short triserial portion, then biserial; biserial stage comprising over two-thirds of test height. Chambers increasing gradually in size, becoming large, quadrate with rounded edges. Sutures deeply depressed, straight, forming a lobate, subrounded periphery; aperture a large deep depression at base of apertural face of last chamber. Wall coarsely arenaceous, rough surface.

Size. Height, 1.13 mm.; width, 0.65 mm.

Remarks. The gradually enlarging chambers which form a nonflaring test separate this species from D. conara above.

Type. Holotype UMMP 54188

Genus Cuneolina d'Orbigny 1839

Cuneolina trinitensis Stead subsp. pariaensis Stacy, n. subsp.

Pl. 3 figs. 15-20

Cuneolina trinitensis Stead, 1951, p. 592, pl. 2, figs. 14, 15. -- Frizzell, 1954, p. 75.

Test free, small, compressed, predominantly biserial, with a very small initial trochoid spiral. Chambers of biserial stage divided along long axis into chamberlets by perpendicular partitions (up to

eight in final chambers). Sutures slightly depressed, straight, forming a zig-zag margin between chambers along narrow edge of test; aperture a long narrow slit at base of inner margin of last-formed chamber. Wall finely arenaceous, smooth.

Size. Height, 0.72 mm.; width, 0.17 mm.; thickness, 0.12 mm.

Remarks. The Trinidad variety differs from the typical specimens of this species by not developing the very wide, flaring final chambers in the adult, but rather the outline of this variety remains narrow, with subparallel sides, and is somewhat more round in section. The varitial name is taken from the Gulf of Paria, where the first specimens were found.

Type. Holotype UMMP 54189, Paratype UMMP 54190

Suborder MILIOLINA Delage and Hérouard

Superfamily MILIOLACEAE Ehrenberg

Family MILIOLIDAE Ehrenberg

Genus Quinqueloculina d'Orbigny 1826

Quinqueloculina minima Tappan

Pl. 3 fig. 23

Quinqueloculina minima Tappan, 1943, pp. 490, 491, pl. 78, figs. 33a, b. -- Loeblich and Tappan, 1949, pp. 255, 256, pl. 48, figs. 12, 13. -- Frizzell, 1954, p. 77, pl. 6, figs. 33a, b.

Test free, very small. Periphery rounded; sides flattened, subparallel. Final chamber overlapping part of preceeding chamber. Sutures slightly depressed; aperture a simple opening at end of last chamber.

Size. Height, 0.30 mm.; width, 0.19 mm.; thickness, 0.10 mm.

Genus Pyrgo Defrance 1824

Pyrgo? fertilis Stacy, new species

Pl. 3 fig. 24

Test free, very small, somewhat globular in cross section. Final chamber fusiform in shape; preultimate chamber extends outward, forming an abrupt swelling, about half the height of final chamber. Last two chambers enclose preceding portion of test. Sutures faintly depressed; aperture terminal, obscure, appears to be radiate, rather than a toothed slit of a typical Pyrgo.

Size. Height, 0.25 mm.; width, 0.19 mm.; thickness, 0.16 mm.

Remarks. This minute form shows typical Pyrgo shape and chamber development.

Type. Holotype UMMP 54191

Family BARKERINIDAE Smout

Genus Barkerina Frizzell and Schwartz 1950

Barkerina barkerensis Frizzell and Schwartz

Pl. 4 figs. 3, 4

Barkerina barkerensis Frizzell and Schwartz, 1950, pp. 6-9, pl. 1, figs. 1-6. -- Frizzell, 1954, p. 60, pl. 2, figs. 4a, b.

Cribrostomoides frizzelli Stead, 1951, p. 588, pl. 1, fig. 5.

Test free, small, globular, planispiral, involute, biumbilicate. Chambers increasing gradually in size. Sutures flush, obscure; aperture a series of small, round openings along base of apertural face, connected by a low slit at base of face. Wall finely granular, smooth.

Size. Height, 0.37 mm.; width, 0.31 mm.

Suborder ROTALIINA Delage and Hérouard

Superfamily NODOSARIACEA Ehrenberg

Family NODOSARIIDAE Ehrenberg

Genus Nodosaria Lamarck 1812

Nodosaria cf. affinis Reuss

Pl. 4 fig. 2

Nodosaria affinis Reuss, 1845, p. 26, pl. 13, fig. 16. -- Cushman, 1946, pp. 70, 71, pl. 25, figs. 8-23. -- Frizzell, 1954, p. 89, pl. 10, figs. 3-7.

Test free, moderate size, uniserial. Globular chambers increasing gradually in size. Eight heavy, transverse costae continue across each chamber. Sutures deeply depressed, but not interrupting costae. Radiate aperture terminal at end of apertural neck. Wall calcareous, perforate.

Size. Length, 0.93 mm.; diam., 0.19 mm.

Remarks. The Trinidad specimens are much smaller than normal for this species.

Nodosaria bakeri Vieaux

Pl. 3 fig. 11

Nodosaria obscura Reuss. Tappan, 1940, p. 104, pl. 16, figs. 7, 8. -- Tappan, 1943, pp. 496, 497, pl. 80, figs. 1, 2.

Nodosaria aff. obscura Reuss. Lozo, 1944, pp. 557, 558, pl. 4, fig. 13.

Nodosaria bakeri Vieaux, 1941, p. 626, pl. 85, fig. 5. -- Frizzell, 1954, p. 90, pl. 10, figs. 10, 11.

Test free, small, uniserial. Subglobular chambers somewhat higher than broad, increasing gradually in size. Seven to nine sharp, narrow costae extending length of shell. Sutures depressed. Aperture radiate, terminal, at end of short apertural neck. Wall calcareous perforate.

Size. Length, 0.50 mm.; diam., 0.15 mm.

Nodosaria cf. sceptrum Reuss

Pl. 3 fig. 25

Nodosaria sceptrum Reuss, 1863, p. 37, pl. 2, fig. 3. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 35, pl. 7, figs. 150a, b.

Test free, small, uniserial. Chambers higher than broad, increasing gradually in size, surface ornamented by seven to eight, thin, low longitudinal ribs. Sutures not deeply depressed, somewhat obscure. Aperture radiate, small. Wall calcareous perforate.

Size. Length, 0.50 mm.; diam., 0.14 mm.

Nodosaria incompta Stacy, new species

Pl. 3 fig. 10

Test free, small, uniserial. Globular chambers increasing somewhat rapidly in size. Surface smooth, without ribs or costae. Sutures depressed, straight. Aperture small, radiate, at end of very short apertural neck. Wall calcareous perforate.

Size. Height, 0.32 mm.; diam., 0.14 mm.

Remarks. This species appears similar in form to Pseudonodsaria or Lingulina, but does not show any evidence of chamber overlap.

Type. Holotype UMMP 54192

Nodosaria pentagonalis Stacy, new species

Pl. 4 fig. 1

Test free, straight, uniserial. Chambers obscure, increasing very gradually in size. Five very strong, straight costae extending length of shell; surface between costae concave. Sutures straight, flush, obscure. Aperture radiate, terminal. Wall calcareous perforate.

Size. Length, 0.82 mm.; diam., 0.17 mm.

Remarks. No other species of Nodosaria has a pentagonal cross section similar to this form.

Type. Holotype UMMP 54193

Genus Citharina d'Orbigny 1839

Citharina acuminata (Reuss)

Pl. 4 fig. 17

Vaginulina acuminata Reuss, 1863, p. 49, pl. 4, fig. 1.

Citharina acuminata (Reuss). Bartenstein and Brand, 1951, p. 298. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 39, pl. 7, fig. 159. -- Simon, Bartenstein, et al., 1962, p. 271, pl. 38, fig. 13.

Test free, small, slender, uniserial. Chambers elongate, low, oblique, oval in cross section. Sutures oblique, flush, obscured by surface ornamentation. Surface covered by numerous, fine, perpendicular costae. Aperture terminal at dorsal edge of last chamber.

Size. Length, 0.86 mm.; width, 0.15 mm.; thickness, 0.07 mm.

Citharina aptiensis (Eichenberg)

Pl. 4 fig. 23

Vaginulina aptiensis Eichenberg, 1935, pl. 5, fig. 29. -- Simon, Bartenstein, et al., 1962, p. 283, pl. 41, figs. 8, 9.

Test free, moderate size, uniserial. Chambers elongate, oblique, sigmoid in side view, increasing gradually in size. Dorsal margin straight with ridge of clear shell material along edges; ventral margin lobate, ridge of shell material on the ventral edge of each chamber and extending into the depressed suture. Sutures depressed, sigmoid, oblique, with the ridge of shell material from ventral angles of the chamber projecting along middle of suture. Aperture terminal on dorsal margin of last chamber, short apetural neck formed by upper curving end of sigmoid chamber.

Size. Height, 1.00 mm.; width, 0.43 mm.; thickness, 0.15 mm.

Citharina arguta (Reuss)

Pl. 4 fig. 20

Vaginulina arguta Reuss, 1860, p. 202, pl. 8, fig. 4. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 38, pl. 5, fig. 104, pl. 6, fig. 136.

Test free, small, triangular in outline due to elongation of chambers, rectangular in cross section. Elongate, curved chambers expanding rapidly in size from large globular proloculum. Edges of shell and sutures limbate and marked by thin, low rows of clear shell material.

Size. Height, 0.56 mm.; width, 0.30 mm.; thickness, 0.12 mm.

Citharina intumescens (Reuss)

Pl. 4 fig. 15

Vaginulina intumescens Reuss, 1863, p. 49, pl. 4, fig. 2. -- Lozo, 1944, p. 559, pl. 4, fig. 10.

Citharina intumescens (Reuss). Loeblich and Tappan, 1949, p. 259, pl. 49, fig. 15. -- Frizzell, 1954, p. 94, pl. 11, figs. 608.

Test free, small, uniserial. Long, wedge-shaped chambers increasing very gradually in height, but lengthening rapidly, extending back almost to the small proloculum. Sides parallel. Sutures flush, limbate, very oblique, slightly curved. Surface covered with very faint, fine striae parallel to dorsal margin and approximately at right angles to the sutures.

Size. Height, 0.51 mm.; width, 0.27 mm.; thickness, 0.05 mm.

Citharina kochii (Roemer) var. kochii (Roemer)

Pl. 4 fig. 21

Vaginulina kochii Roemer, 1840, p. 96, pl. 15, fig. 10. -- Tappan, 1940, pp. 109, 110, pl. 17, figs.2-4. -- Tappan, 1943, pp. 500, 501, pl. 80, figs. 17, 18. -- Bartenstein and Brand, 1951, p. 293, pl. 6,

figs. 158, 159. -- Bartenstein, Bettenstaedt and Bolli, 1957, pp. 38, 39, pl. 5, fig. 105, pl. 6, fig. 124. -- Simon, Bartenstein, et al., 1962, pp. 261, 262, pl. 36, fig. 5.

Citharina kochii (Roemer) var. kochii (Roemer). Frizzell, 1954, p. 94, pl. 11, fig. 9.

Test free, moderate size, uniserial. From large, globular proloculum, slightly curved, wedge-shaped chambers increasing gradually in size. Chambers oblique, but not extending back to the proloculum; broader dorsally than at ventral margin. Sutures oblique, slightly curved, limbate, covered by ridge of clear shell material. Edges of the test marked by high ridges of clear shell material. Radiate aperture terminal at dorsal margin on short apertural neck.

Size. Length, 1.39 mm.; width, 0.43 mm.; thickness, 0.17 mm.

Citharina cf. kochii (Roemer) var. striolata (Reuss)

Pl. 4 fig. 11

Vaginulina striolata Reuss, 1863, p. 46, pl. 3, fig. 7.

Vaginulina kochii Roemer var. striolata Reuss. Cushman and Alexander, 1930, p. 4, pl. 1, figs. 10-16. -- Tappan, 1940, p. 110, pl. 17, fig. 5. -- Tappan, 1943, p. 501, pl. 80, figs. 19-21.

Citharina kochii (Roemer) var. striolata (Reuss). Frizzell, 1945, pp. 94, 95, pl. 11, figs. 10-16.

Test free, small, uniserial. From small, globular proloculum, slightly curved, oblique chambers increasing gradually in size. Sides of test subparallel, slightly convex. Sutures oblique, sigmoid, limbate, covered by low ridge of clear shell material. Peripheral edges rounded, also covered by low ridge of clear shell material. Surface covered with faint, fine, perpendicular striae.

Size. Length, 0.72 mm.; width, 0.20 mm.; thickness, 0.05 mm.

Remarks. The Trinidad forms are much smaller and less robust than the typical specimens of this variety, but except for this, they fit the description well.

Citharina recta (Reuss)

Pl. 4 fig. 22

Vaginulina recta Reuss, 1863, p. 48, pl. 3, figs. 14, 15. -- Tappan, 1940, pp. 110, 111, pl. 17, figs. 7a, b. -- Tappan, 1943, p. 501, pl. 80, figs. 22a,b. -- Cushman, 1946, p. 78, pl. 28, fig. 23. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 38, pl. 5, fig. 134, 135a, b.

Cytharina recta (Reuss). Frizzell, 1954, p. 95, pl. 11, figs. 19-21.

Test free, moderate size, uniserial. Low, elongate, oblique, slightly curved chambers enlarging gradually from the globular proloculum. Sides parallel. Sutures depressed, ventral third covered by thin rib of clear shell material. Peripheral edges marked by strong ridge of shell material. Radiate aperture terminal at dorsal margin.

Size. Length, 0.78 mm.; width, 0.35 mm.; thickness, 0.18 mm.

Citharina riedeli (Bartenstein and Brand)

Pl. 4 fig. 24

Vaginulina riedeli Bartenstein and Brand, 1951, p. 295, pl. 7, fig. 167, pl. 19a, figs. 31, 32. -- Simon, Bartenstein, et al., 1962, p. 262, pl. 35, fig. 21, pl. 38, fig. 4.

Test free, moderate size, uniserial. Oblique, quadrate chambers increasing very gradually in size; ventral margin lobate. Sides tapering toward the dorsum, periphery there about half as wide as the venter. Sutures depressed, oblique, curved. Peripheral edges sharp, covered by

thin ridge of clear shell material; the convex ventral walls of the chambers extend beyond the ridges. Radiate aperture terminal at the dorsal margin of the last-formed chamber.

Size. Length, 0.55 mm.; width, 0.27 mm.; thickness, 0.14 mm. (ventral), 0.07 mm. (dorsal).

Citharina ancyla Stacy, new species

Pl. 4 fig. 19

Test free, small, compressed, uniserial. Proloculum small, globular; succeeding chambers wedge-shaped, curved, enlarging rapidly. Sides parallel; dorsum curved, flat, with very thin ridges of clear shell material along edges. Sutures oblique, curved, depressed with thin strip of shell material in sutural depression. Radial aperture at dorsal margin of last-formed chamber.

Size. Height, 0.37 mm.; width, 0.17 mm.; thickness, 0.07 mm.

Remarks. This form is very similar to C. complanata (Reuss) complanata (Reuss) as described and illustrated by Tappan, 1940, but is much smaller and lacks the dorsal keel.

Type. Holotype UMMP 54194

Citharina astraba Stacy, new species

Pl. 4 fig. 10

Test free, moderate size, uniserial. Proloculum large globular; following chambers elongate, rectangular oblique, increasing gradually in size; dorsum flat, straight; ventral margin somewhat lobate, subparallel to dorsal margin. Peripheries strongly marked by sharp ridges of clear shell material. Suture depressed, oblique; sides tapering, so that dorsal periphery about half as wide as venter. Radiate aperture terminal on short apertural neck on dorsal edge of last-formed chamber.

Size. Length, 1.55 mm.; width, 0.37 mm.; thickness, 0.17 mm.; (ventral), 0.25 mm.; (dorsal).

Remarks. Similar to C. riedeli, but with more elongate, rather than quadrate, chambers and a less lobate ventral margin.

Type. Holotype UMMP 54195

Citharina lampra Stacy, new species

Pl. 4 fig. 13

Test free, moderate size, uniserial, triangular in side view. Long, low, oblique chambers expanding rapidly, curving back toward the globular proloculum. Sutures depressed, oblique, sigmoid. Dorsal edge curved to straight, flat, narrower than the venter. Narrow rim of clear shell material along the peripheral edge of the dorsum. Radiate aperture at end of short apertural neck at dorsal margin of last-formed chamber.

Size. Length, 1.05 mm.; width, 0.45 mm.; thickness, 0.08 mm.

Remarks. Differs from C. arguta by having depressed rather than limbate sutures.

Type. Holotype UMMP 54196

Citharina compsa Stacy, new species

Pl. 4 fig. 18

Test free, moderate size, uniserial. Rectilinear series of inverted "V" shaped (equitant) chambers, about as wide as high. Peripheries lobate, peripheral edges marked by thin ridge of clear shell material; ridges also extending down center of dorsal and ventral margins. Sides of the chambers depressed along midline. Sutures deeply depressed, chevron-shaped in side view, straight on margins. Apertural neck extending above last chamber near dorsal margin; aperture

obscure.

Size. Height, 0.58 mm.; width, 0.25 mm.; thickness, 0.13 mm.

Remarks. Only broken specimens of this species were found, so initial stages cannot be described. The acentric location of the aperture suggests that this species is properly placed in Citharina.

Type. Holotype UMMP 54197

Citharina sp.

Pl. 4 fig. 12

Test free, moderate size, uniserial. Chambers low, elongate, curved, oblique, increasing gradually in size. Dorsal margin concave, ventral margin lobate; peripheries acute, but not ridged by shell material. Sutures depressed, curved, oblique. Aperture, radiate, terminal on dorsal margin.

Size. Height, 0.67 mm.; width, 0.25 mm.; thickness, 0.10 mm.

Remarks. Inasmuch as only one broken specimen of this species was found, no specific name is proposed.

Genus Dentalina Risso 1826

Dentalina communis (d'Orbigny)

Pl. 4 fig. 16

Nodosaria (Dentalina) communis d'Orbigny, 1826, p. 254, no. 35. -- Carsey, 1926, p. 34, pl. 7, fig. 5.

Dentalina communis (d'Orbigny). Plummer, 1931, p. 149, pl. 11, fig. 4. -- Tappan, 1940, p. 102, pl. 16, fig. 1. -- Tappan, 1943, p. 495, pl. 79, figs. 28, 29. -- Lozo, 1944, pp. 554, 555, pl. 4, fig. 9. -- Bartenstein and Brand, 1951, pp. 308, 309, pl. 9, figs. 228, 231. -- Frizzell, 1954, p. 87, pl. 9, figs. 39, 40. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 34, pl. 7, figs, 144a, b, 145.

Test free, small to moderate size, straight. Chambers in uniserial series, oval, higher than wide. Sutures depressed, oblique; aperture radiate, terminal, acentric.

Size. Height, 0.55 mm.; width, 0.13 mm.

Dentalina debilis (Berthelin)

Pl. 5 figs. 3, 4

Marginulina debilis Berthelin, 1880, p. 35, pl. 3, fig. 28.

Dentalina debilis (Berthelin). Lozo, 1944, p. 555, pl. 4, fig. 17. -- Bartenstein and Brand, 1951, pp. 310, 311, pl. 10, figs. 239, 240. -- Frizzell, 1954, p. 88, pl. 9, figs. 149a, b.

Vaginulina debilis (Berthelin). Tappan, 1940, p. 108, pl. 16, figs. 26a, b. -- Tappan, 1943, p. 500, pl. 80, fig. 15.

Test free, small, straight. Uniserial series of "tear drop" shaped chambers; each chamber with long apertural neck forming a straight dorsal ridge along the back of next succeeding chamber. Ventral margin lobate. Sutures deeply depressed, oblique; aperture terminal, at end of long, dorsal apertural neck.

Size. Length, 0.57 mm.; width, 0.18 mm.; thickness, 0.13 mm.; (chamber), 0.05 mm.; (dorsal ridge).

Dentalina nana Reuss

Pl. 4 fig. 9

Dentalina nana Reuss, 1863, p. 39, pl. 2, figs. 10, 18. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 35, pl. 6, figs. 128a, b.

Test free, small, straight to slightly curved, elongate oval in cross section. Three or more oval chambers in a uniserial series; younger chambers broader than high; chambers expanding rapidly in size; last one or two chambers constituting about half of shell length.

Sutures slightly depressed, somewhat oblique in later stages. Radiate aperture terminal, acentric.

Size. Length, 0.39 mm.; width, 0.16 mm.; thickness, 0.11 mm.

Dentalina? sp.

Pl. 4 fig. 14

Test free, small, straight, uniserial. Chambers subglobular, slightly higher than wide, enlarging gradually. Sutures deeply depressed, radial, straight. Aperture terminal, acentric.

Size. Length, 0.41 mm.; diam., 0.12 mm.

Remarks. Because only one specimen has been found and since the apertural type cannot be determined due to pyritization, no specific name is proposed.

Genus Frondicularia Defrance 1862

Frondicularia trinidadensis Stacy, new species

Pl. 4 figs. 7, 8

Frondicularia sp. 1 Bartenstein, Bettenstaedt and Bolli, 1957, pp. 39, 40, pl. 5, fig. 107, pl. 6, figs. 137a, b.

Test free, moderate size, subtriangular in shape. Large, globular proloculum; subsequent chambers equitant, recurved, partially embracing proloculum, so that base forms a curved, broad, obtuse angle of about 160°; chambers narrow to a point at base. Sutures faintly depressed; aperture terminal, in center of last-formed chamber.

Size. Height, 0.50 mm.; width, 0.34 mm.; thickness, 0.05 mm.; diam. of proloculum, 0.18 mm.

Type. Holotype UMMP 54198

Frondicularia cuchensis Stacy, new species

Pl. 4 figs. 5, 6

Frondicularia sp. 2 Bartenstein, Bettenstaedt and Bolli, 1957, p. 40, pl. 5, fig. 109, pl. 6, figs. 138a, b.

Test free, moderate size, diamond-shaped. Large, globular proloculum; subsequent chambers equitant, recurved but not reaching proloculum; base forming an acute angle of approximately 80°; chambers broaden and thicken toward base. Sutures faintly depressed; aperture terminal, in center of last chamber.

Size. Height, 0.06 mm.; width, 0.36 mm.; thickness, 0.07 mm.; diam. of proloculum, 0.15 mm.

Type. Holotype UMMP 54199

Genus Lenticulina Lamarck 1804

Lenticulina barri Bartenstein, Bettenstaedt and Bolli

Pl. 5 figs. 15, 16

Lenticulina (L.) barri Bartenstein, Bettenstaedt and Bolli, 1957, pp. 28, 29, pl. 5, figs. 97a, b, pl. 6, figs. 118a, b.

Test free, small, planispiral, involute but with final whorl not completely embracing preceding one. Ten to fifteen chambers in final whorl. Periphery acute. Sutures deeply depressed, radial becoming curved toward periphery; large comma-shaped umbilical boss; radiate aperture at peripherial margin of apertural face.

Size. Height, 0.50 mm.; thickness, 0.15 mm.

Lenticulina eichenbergi Bartenstein and Brand

Pl. 5 figs. 19, 20

Lenticulina (L.) eichenbergi Bartenstein and Brand, 1951, pp. 285, 286, pl. 5, figs. 118, 119. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 27, pl. 3, figs. 51a, b, pl. 4, figs. 72-75.

Test free, medium to large, planispiral, involute. Approximately

ten chambers in final whorl. Periphery acute, with well-developed, sharp, high keel. Sutures slightly curved, raised and coarsely beaded, the last one or two sutures may be heavily limbate without beads. Aperture at peripheral margin of apertural face of last chamber, radiate.

Size. Height, 1.20 mm.; thickness, 0.58 mm.

Lenticulina cf. kugleri Bartenstein, Bettenstaedt and Bolli

Pl. 5 figs. 1, 2, 7, 8

Lenticulina (L.) cf. kugleri Bartenstein, Bettenstaedt and Bolli, 1957, p. 28, pl. 5, figs. 119a, b.

Test free, small, planispiral with final whorl tending to uncoil. Five to seven rapidly enlarging chambers in final whorl; chambers swelling abruptly from the depressed sutures, then tapering gradually to a narrow apertural face; ridge of clear shell material on widest part of chamber parallel to the curved suture. Periphery acute, often with a thin, sharp keel. Sutures deeply depressed, very curved, clearly marked by the anterior ridge of shell material and chamber swelling. Apertural face narrow, triangular, with aperture at peripheral edge.

Size. Height, 0.35 mm.; width, 0.25 mm.; thickness, 0.20 mm.

Lenticulina muensteri (Roemer)

Pl. 5 figs. 17, 18

Robulina muensteri Roemer, 1839, p. 48, pl. 20, fig. 29.

Robulus muensteri (Roemer). Cushman, 1946, p. 53, pl. 17, figs. 3-9. -- Frizzell, 1954, p. 81, pl. 8, figs. 1-4.

Lenticulina (L.) muensteri (Roemer). Bartenstein and Brand, 1951, p. 283, pl. 5, fig. 109. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 22, pl. 3, figs. 54a, b, pl. 4, figs. 80, 81.

Test free, moderate size, planispiral, involute. Nine to twelve gradually expanding chambers in the final whorl. Periphery acute, with low, rounded keel. Sutures limbate, almost flush, slightly curved; large umbilical plug. Radiate aperture at peripheral margin of last chamber.

Size. Height, 0.58 mm.; thickness, 0.33 mm.

Lenticulina nodosa (Reuss)

Pl. 5 figs. 5, 6, 9, 10

Robulina nodosa Reuss, 1863, p. 78, pl. 9, fig. 6.

Lenticulina (L.) nodosa (Reuss). Bartenstein and Brand, 1951, p. 281, pl. 4, fig. 103. -- Bartenstein, Bettenstaedt and Bolli, 1957, pp. 24, 25, pl. 3, figs. 49a, b, pl. 4, figs. 66, 67. -- Simon, Bartenstein, et al., 1962, pp. 256, 257, pl. 35, fig. 10.

Test free, small to medium size, planispiral, involute. About nine, gradually increasing chambers in final whorl. Periphery acute, nodose. Sutures limbate, flush with wall, radial, straight; sutures at periphery thickened into large node protruding beyond rim. Large umbilical plug. Some specimens with narrow keel and raised sutures. Radiate aperture at peripherial angle of apertural face, swollen, forming sutural node of next chamber.

Size. Height, 0.62 mm.; thickness, 0.30 mm.

Lenticulina ouachensis ouachensis (Sigal)

Pl. 5 figs. 13, 14

Cristellaria ouachensis Sigal, 1952, p. 16, fig. 10.

Lenticulina (L.) ouachensis ouachensis (Sigal). Bartenstein, Bettenstaedt and Bolli, 1957, p. 25, pl. 3, figs. 50a, b, pl. 4, figs. 71, 76. -- Simon, Bartenstein, et al., 1962, p. 270, pl. 38, fig.

11.

Test free, moderate size, planispiral, involute. Seven to nine gradually increasing chambers in final whorl. Periphery acute, strongly keeled. Sutures slightly curved, limbate, highly raised. Umibilical margin of chambers limbate, raised, forming a strong ring around the umbilical area. Aperture radiate at peripherial angle of apertural face of last chambers.

Size. Height, 0.78 mm.; thickness, 0.45 mm.

Lenticulina ouachensis (Sigal)

multicella Bartenstein, Bettenstaedt and Bolli

Pl. 6 figs. 19, 20

Lenticulina (L.) ouachensis multicella Bartenstein, Bettenstaedt and Bolli, 1957, p. 26, pl. 3, figs. 47a, b, pl. 4, figs. 68, 69.

Test free, moderate to large, planispiral involute with tendency of final whorl to uncoil. Chambers increasing gradually in size, eleven to sixteen in final whorl. Periphery acute, keeled. Sutures limbate, raised, straight, radial; sutures of final few chambers limbate but not raised; spiral suture raised, forming a ring around umbilical area. Early chambers thicker than final chambers. Radiate aperture at peripheral angle of apertural face of last chamber.

Size. Height, 1.12 mm.; width, 0.88 mm.; thickness, 0.50 mm. (umbilical), 0.26 mm. (final chamber).

Lenticulina ouachensis (Sigal) wissilmanni Bettenstaedt

Pl. 6 figs. 5, 6

Lenticulina (L.) wisselmanni Bettenstaedt, 1952, p. 269, pl. 1, fig. 6.

Lenticulina (L.) ouachensis wisselmanni (Bettenstaedt). Bartenstein, Bettenstaedt and Bolli, 1957, p. 26, pl. 4, fig. 70. -- Simon,

Bartenstein, et al., 1962, p. 270, pl. 38, fig. 15.

Test free, moderate size, planispiral, involute. Approximately ten chambers in final whorl; chambers increasing rapidly in height, not as thick as L. o. ouachensis. Final whorl with some tendency to uncoil. Periphery acute, keeled. Sutures slightly curved, limbate, raised; spiral suture limbate, raised, forming a spiral around umbilical area, rather than a ring, because of uncoiling of final whorl. Radiate aperture at peripheral margin of apertural face.

Size. Height, 0.70 mm.; width, 0.54 mm.; thickness, 0.26 mm.

Lenticulina praegaultina Bartenstein, Bettenstaedt and Bolli

Pl. 6 figs. 11, 12

Lenticulina (L.) praegaultina Bartenstein, Bettenstaedt and Bolli, 1957, p. 24, pl. 3, figs. 48a, b, pl. 4, figs. 63-65.

Test free, moderate size, planispiral, involute. Approximately ten rapidly increasing chambers in final whorl. Periphery acute, with high, sharp keel. Sutures limbate, nearly flush; large, clear umbilical plug. Radiate aperture at peripheral angle of last chamber.

Size. Height, 0.50 mm.; thickness, 0.23 mm.

Lenticulina roemeri (Reuss)

Pl. 6 figs. 17, 18

Cristellaria roemeri Reuss, 1863, p. 75, pl. 8, fig. 9.

Lenticularia (L.) roemeri (Reuss). Bartenstein, Bettenstaedt and Bolli, 1957, p. 26, pl. 5, fig. 93.

Test free, moderate size, planispiral, involute. Nine to ten gradually increasing chambers in final whorl. Periphery acute, faintly keeled. Sutures slightly curved, limbate, strongly raised; large, raised umbilical plug. Aperture radiate at peripheral angle of aper-

tural face.

Size. Height, 0.51 mm.; thickness, 0.21 mm.

Lenticulina cf. spisso-costatus (Cushman)

Pl. 6 figs. 1, 2

Robulus spisso-costatus Cushman, 1938, p. 32, pl. 5, fig. 2. -- Cushman, 1946, pp. 52, 53, pl. 16, figs. 11-14, pl. 17, fig. 1. -- Frizzell, 1954, p. 81, pl. 8, figs. 9a, b.

Test free, moderate size, planispiral, involute. Nine chambers increasing gradually in size in the final whorl. Periphery acute, sharply keeled. Sutures curved, limbate, fused in umbilical area to form a thick pseudoumbilical boss. Sutures also extend into the peripheral keel, forming a small node on the periphery. Aperture radial on the peripheral margin of last chamber.

Size. Height, 0.63 mm.; thickness, 0.25 mm.

Remarks. Trinidad specimens differ from the typical species by the node-like extension of the sutures onto the periphery, and by the development of a sharp keel.

Lenticulina fragosa Stacy, new species

Pl. 6 figs. 13, 14

Test free, moderate size, planispiral, mostly involute, becoming somewhat uncoiled in final stage. About twelve chambers in final whorl. Periphery acute, keeled. Sutures straight, radial, limbate in early stage, becoming depressed in last half of final whorl. Large umbilical boss, not covering the umbilical area of last chamber. Radiate aperture at peripheral angle of narrow, rounded apertural face of last chamber.

Size. Height, 0.50 mm.; thickness, 0.20 mm.

Remarks. Somewhat similar to L. barri, but differs by having a sharp keel, a large umbilical boss and limbate sutures in early part of coil.

Type. Holotype UMMP 54200

Lenticulina hadra Stacy, new species

Pl. 6 figs. 3, 4, 7, 8

Test free, small to moderate size, planispiral, slightly evolute, showing a small portion of inner whorl, umbilicate. Chambers low, broad, increasing gradually in size, about eight in final whorl. Periphery acutely rounded, not keeled. Sutures curved, deeply depressed. Aperture radiate at peripheral angle of broad apertural face of last chamber.

Size. Height, 0.36 mm.; thickness, 0.18 mm.

Remarks. Somewhat similar to L. kugleri s.s. of Bartenstein, Bettenstaedt and Bolli, 1957, but without the ridge of shell material on chamber swelling and without the sharp, acute periphery of that species.

Type. Holotype UMMP 54201, Paratype UMMP 54202

Lenticulina angella Stacy, new species

Pl. 5 figs. 11, 12

Lenticulina (L.) sp. 1 Bartenstein, Bettenstaedt and Bolli, 1957, p. 23, pl. 3, figs. 53a, b, pl. 4, figs. 78, 79.

Test free, moderate to small, planispiral, involute. Chambers increase rapidly in height, so that test appears to be uncoiling; approximately ten chambers in final whorl. Periphery acute, but not keeled, edges of chambers straight causing periphery of test to show a series of angulations rather than a smooth curve. Sutures straight,

radial, limbate; both sutures and umbilical boss flush with surface. Radiate aperture at peripheral angle of last chamber.

Size. Height, 0.47 mm.; width, 0.32 mm.; thickness, 0.19 mm.

Remarks. The angulate periphery and the rapidly increasing height of the chambers separate this form from the other species.

Type. Holotype UMMP 54203

Lenticulina copha Stacy, new species

Pl. 6 figs. 15, 16

Test free, moderate size, planispiral, involute. Chambers increasing very gradually in size, fifteen or more in final whorl. Periphery rounded, some specimens show evidence of a blunt keel, most without keel. Sutures slightly curved, limbate; both sutures and large umbilical plug flush with surface. Aperture radiate at peripheral angle of triangular apertural face.

Size. Height, 0.55 mm.; thickness, 0.25 mm.

Remarks. The numerous chambers in the final whorl and the rounded periphery separate this species from similar forms.

Type. Holotype UMMP 54204

Lenticulina acer Stacy, new species

Pl. 7 figs. 14, 15

Test free, medium size, planispiral, almost completely involute, umbilicate. About ten gradually increasing chambers in final whorl; in some cases, last two or three chambers failing to reach the umbilicus, giving the impression of uncoiling. Periphery sharply angulate with high, narrow keel. Sutures curved, limbate, raised, those between final chambers depressed in some cases. Open, shallow umbilicus. Radiate aperture at peripheral margin of curved apertural face.

Size. Height, 0.72 mm.; thickness, 0.25 mm.

Remarks. The sharp, high keel and curved, raised, limbate sutures distinguish this species.

Type. Holotype UMMP 54205

Lenticulina anfracta Stacy, new species

Pl. 8 figs. 13, 14

Test free, large, planispiral, involute, umbilicate; some specimens tend toward asymmetric coiling (Darbyella-like). Eight to nine gradually increasing chambers in final whorl; final chambers not completely covering previous whorl at open, shallow umbilicus. Periphery acute, with large keel. Sutures deeply depressed, curved. Aperture radiate at peripheral angle of rounded apertural face.

Size. Height, 1.52 mm.; thickness, 0.34 mm.

Remarks. The large size, open umbilicus, deeply depressed sutures and large, sharp keel distinguish this form from other Trinidad species of Lenticulina.

Type. Holotype UMMP 54206

Lenticulina inflata Stacy, new species

Pl. 7 figs. 5, 6

Test free, large, planispiral, involute, umbilicate. Chambers increase rapidly in size with seven in the last whorl. Periphery angulate with rounded, low keel. Umbilicus open, narrow. Sutures curved, slightly depressed, obscure. Radiate aperture on periphery of rounded, narrow apertural face.

Size. Height, 1.20 mm.; thickness, 0.55 mm.

Remarks. The low, rounded keel and obscure, slightly depressed sutures appear to separate this form from L. anfracta above; however,

further studies may show that these are just juvenile specimens of the latter species.

Type. Holotype UMMP 54207

Lenticulina turgida Stacy, new species

Pl. 7 figs. 19, 20

Test free, large, planispiral, involute, tending to uncoil in final stage, umbilicate, Chambers enlarging rapidly in height, with nine chambers in final whorl; chambers failing to close open umbilicus, but rather form swellings at corners projecting into the umbilicus. Periphery acute, heavily keeled. Sutures curved, deeply depressed, not reaching periphery. Large, radiate aperture at peripheral angle of rounded, narrow apertural face.

Size. Height, 2.00 mm.; width, 1.35 mm.; thickness, 0.52 mm.

Remarks. The enlarged, swollen projections at corners of the chambers extending into the umbilical region appears to be unique.

Type. Holotype UMMP 54208

Genus Marginulina d'Orbigny 1826

Marginulina paucicosta Tappan

Pl. 7 figs. 11, 12

Marginulina paucicosta Tappan, 1943, p. 494, pl. 79, figs. 16, 17. -- Frizzell, 1954, p. 85, pl. 9, fig. 9.

Test free, small, uniserial, curved. Chambers increasing rapidly in size, much higher than broad. Sutures deeply depressed, oblique, straight. Ventral periphery lobate. Faint vertical striae ornamenting test surface continuing across sutures. Aperture terminal on swelling at the dorsal margin of the rounded apertural face of last chamber.

Size. Height, 0.48 mm.; width, 0.15 mm.

Marginulina planitesta Tappan

Pl. 7 figs. 21, 22

Marginulina planitesta Tappan, 1943, p. 495, pl. 79, figs. 18a, b. --
Frizzell, 1954, p. 85, pl. 9, fig. 10.

Test free, small to moderate size, uniseral with curved initial stage. Chambers increasing very rapidly in size, higher than wide; final chamber making up almost half the total height. Sutures depressed, oblique, straight. Ventral periphery lobate. Suggestion of five, very faint, vertical striae on final chambers. Aperture terminal at dorsal margin.

Size. Height, 0.72 mm.; width, 0.25 mm.

Marginulina trinidadensis Stacy, new species

Pl. 7 figs. 16, 17

Test free, small, partially enrolled initial stage, then straight, uniserial series. Chambers increasing rapidly in size, higher than wide and somewhat compressed in early portion, oval in later section. Sutures depressed, oblique, straight. Dorsal periphery acute, curved to straight; ventral periphery slightly lobate. Aperture radiate, terminal, on short neck at dorsal margin of rounded apertural face.

Size. Height, 0.43 mm.; width, 0.12 mm.

Remarks. In spite of the compressed early chambers, this species is placed in Marginulina, rather than Vaginulina, because of the rounded final chambers.

Type. Holotype UMMP 54209

Genus Marginulinopsis Silvestri 1904

Marginulinopsis callitoecha (Tappan)

Pl. 7 figs. 13, 23, 24

Saracenaria callitoecha Tappan, 1943, p. 498, pl. 80, figs. 7, 8. -- Frizzell, 1954, p. 83, pl. 8, fig. 23.

Test free, small. Small, initial planispiral coil followed by gradually expanding, uniserial chambers. Cross section of chambers varying from rounded triangular (in early stages of all specimens) to oval final chambers in some specimens. Sutures depressed, oblique, slightly curved. Dorsal periphery keeled, at least in early stages. Two longitudinal ribs separating the ventral area from the sides. One or two fainter ribs parallel to ventral ribs on the sides and on the ventral surface, but usually not extending onto the final chamber. Radiate aperture terminal on the dorsal periphery of the rounded apertural face, at end of short apertural neck.

Size. Height, 0.50 mm.; width, 0.15 mm.

Remarks. The development of oval to round cross sections of the final chambers of many of these specimens suggest Marginulinopsis rather than Saracenaria.

Marginulinopsis gracilissima (Reuss)

Pl. 7 figs. 3, 4

Cristellaria gracilissima Reuss, 1863, p. 64, pl. 6, figs. 9, 10. Lenticulina (Marginulinopsis) gracilissima (Reuss). Bartenstein and Brand, 1951, p. 288, pl. 6, fig. 139. -- Simon, Bartenstein, et al., 1962, p. 256, pl. 38, fig. 2.

Test free, small. Initial small planispiral coil, later chambers in a straight, uniserial series. Chambers increasing gradually in size, wider than high. Sutures depressed, oblique, slightly curved. Dorsal periphery acute, at least in early stages; ventral periphery rounded, lobate. Aperture terminal at dorsal periphery.

Size. Height, 0.35 mm.; width, 0.13 mm.

Marginulinopsis formosus Stacy, new species

Pl. 7 figs. 7, 8

Test free, medium size. Large initial planispiral involute coil followed by gradually increasing, oblique chambers in a uniserial series. Periphery acute; sutured depressed, oblique, straight. Coiled portion with open umbilicus. Radiate aperture on short apertural neck at dorsal angle of rounded apertural face.

Size. Height, 0.46 mm.; width, 0.30 mm.; thickness, 0.15 mm.

Remarks. Final chambers of some specimens are round in cross section, which suggests that this form is correctly identified as Marginulinopsis, rather than Vaginulinopsis. It is similar to Vaginulinopsis arctus but does not have the umbilical plug and limbate sutures in the coiled portion of the test.

Type. Holotype UMMP 54210

Marginulinopsis maridalensis Stacy, new species

Pl. 7 figs. 1, 2

Test free, small to medium size. After very small, planispirally coiled initial stage, chambers enlarging very rapidly in a uniserial series, higher than broad, circular in cross section. Periphery of coil acute. Sutures depressed, slightly oblique. Short, perpendicular costae (ten to fifteen on final chamber) on the upper margin of each chamber, but not extending below the upper third of each chamber. Radiate aperture on the dorsal margin of the last formed chamber.

Size. Height, 0.58 mm.; width, 0.25 mm.

Remarks. The development of short, numerous costae along the upper margin of the chambers separate this species from M. gracilissima.

Type. Holotype UMMP 54211

Genus Palmula Lea 1833

Palmula limbata Loeblich and Tappan

Pl. 7 fig. 18

Palmula limbata Loeblich and Tappan, 1941, p. 12, pl. 1, figs. 6-10. -- Vieaux, 1941, p. 625, pl. 85, figs. 2a, b. -- Frizzell, 1954, p. 97, pl. 12, figs. 2, 3.

Test free, moderate size, elliptical in outline, widest centrally. Planispirally coiled initial stage followed by uniserial, chevron-shaped (equitant) chambers. Later chambers do not reach early coiled portion. Sutures limbate, raised. Radiate aperture terminal, in center of last formed chamber.

Size. Height, 0.46 mm.; width, 0.30 mm.; thickness, 0.10 mm.

Genus Planularia Defrance 1826

Planularia crepidularis Roemer

Pl. 8 figs. 11, 12, 19, 20

Planularia crepidularis Roemer, 1842, p. 273, pl. 7B, fig. 4. Lenticulina (Astracolus) crepidularis (Roemer). Bartenstein and Brand, 1951, p. 282, pl. 5, figs. 106-108. -- Bartenstein, Bettenstaedt and Bolli, 1957, pp. 29, 30, pl. 3, figs. 55a, b, pl. 4, figs. 82, 83.

Test free, medium size, evolute. After small coil, rapidly enlarging, wedge-shaped, elongate chambers tending to uncoil, final chambers curving back and reaching initial coil. Curved dorsal periphery acutely rounded with low keel; in some, two smaller ridges parallel to keel on the dorsum. Low, shallow depression between chambers with curved raised, limbate suture developed in the center of this depression. Radiate aperture at end of short apertural neck on dorsal

margin of long, narrow apertural face.

Size. Height, 0.62 mm.; width, 0.35 mm.; thickness, 0.10 mm.

Remarks. One large specimen was found in which the sides of the chambers are swollen and the specimen appears to be a Lenticulina, yet still retains the other features of P. crepidularis.

Planularia schreiteri (Eichenberg)

Pl. 8 figs. 21, 22

Elphidium schreiteri Eichenberg, 1935, p. 398, pl. 13, fig. 11.

Lenticulina d'orbignyi scheriteri (Eichenberg). Bartenstein and Brand, 1951, pp. 281, 282, pl. 4, figs. 104, 105.

Lenticulina (Lenticulina) schreiteri (Eichenberg). Simon, Bartenstein, et al., p. 255, pl. 36, figs. 13, 14.

Test free, medium size, evolute. Large initial, planispiral coil, later chambers tending to uncoil, becoming somewhat uniserial in some cases. Chambers enlarging gradually, oval in section and much wider than high. Periphery acute, often keeled. Sutured depressed, slightly curved, obscured by surface ornamentation. Surface covered by numerous, thin, curved, subparallel, branching ridges more-or-less following the axis of growth; some short, transverse ridges connecting the parallel ridges to form an incomplete, cell-like network. Radiate aperture terminal on dorsal margin of the narrow, rounded apertural face.

Size. Height, 1.00 mm.; width, 0.70 mm.; thickness, 0.30 mm.

Planularia? sigali Bartenstein, Bettenstaedt and Bolli

Pl. 8 figs. 7, 8

Marginulinopsis djaffaensis Sigal, 1952, p. 15, fig. 9.

Lenticulina (Marginulinopsis) sigali Bartenstein, Bettenstaedt and Bolli, 1957, pp. 32, 33, pl. 5, fig. 99, pl. 6, figs. 130, 131a, b.

Test free, small to moderate size. Planispiral initial coil present in some specimens, in others early chambers curved or enrolled. Later chambers in curved, uniserial series, elongate oval in section and wider than high. Sutures faintly depressed, somewhat oblique, obscured by surface ornamentation. Test covered by series of sub-paralled ridges following the direction of growth, connected by cross ridges encircling the test and dividing the surface into rectangular pits; the horizontal rings, formed by the cross ridges, not necessarily coinciding with sutures. Radiate aperture at end of short neck on the dorsal margin of the apertural face.

Size. Height, 0.60 mm.; width, 0.25 mm.; thickness, 0.18 mm.

Planularia tricarinella (Reuss)

Pl. 8 figs. 5, 6, 9, 10

Cristellaria tricarinella Reuss, 1963, p. 68, pl. 7, fig. 9, pl. 12, figs. 2-4.

Lenticulina (Astacolus) tricarinella (Reuss). Bartenstein, Bettenstaedt and Bolli, 1957, p. 30, pl. 3, figs. 56a, b, pl. 4, figs. 84, 85.

Lenticulina (Planularia) tricarinella (Reuss). Simon, Bartenstein, et al., 1962, pp. 155, 188, pl. 21, fig. 17.

Lenticulina (Planulari) crepidularis (Roemer). Simon, Bartenstein, et al., 1962, p. 260, pl. 36, fig. 7.

Not Planularia tricarinella (Reuss). Cushman, 1932a, p. 334, pl. 50, figs. 5, 6. -- Cushman, 1946, pp. 57, 58, pl. 20, figs. 2, 3. -- Frizzell, 1954, p. 83, pl. 8, figs. 26, 27a, b.

Test free, moderate size, evolute, curved. After small initial planispiral coil or globular proloculum, the curved elongate, wedge-shaped chambers increasing rapidly in size, becoming somewhat uniserial.

Sides of test parallel. Two ridges of shell material marking the angulation between sides and dorsal margin; a strong keel down the center of the dorsum between these ridges. Sutures curved, strongly limbate, raised. Radiate aperture on short projection at dorsal edge of long, narrow apertural face.

Size. Height, 0.36 mm.; width, 0.36 mm.; thickness, 0.12 mm.

Planularia inornata Stacy, new species

Pl. 8 figs. 17, 18

Test free, moderate to large size, evolute. After small initial planispiral coil, or small globular proloculum, elongate, somewhat curved, wedge-shaped chambers increasing very rapidly in size. Ventral edges of final chambers touching initial stage and partly enclosing it. Dorsal periphery acutely rounded, curved; sides flattened, parallel. Sutures depressed, slightly curved, very oblique. Radiate aperture on dorsal margin of long, narrow, rounded apertural face.

Size. Height, 1.05 mm.; width, 0.60 mm.; thickness, 0.16 mm.

Remarks. The depressed sutures combined with elongate chambers that reach the initial stage on the ventral side separate this form from other species of Planularia.

Type. Holotype UMMP 54212

Genus Pseudonodosaria Boomgaart 1949

Pseudonodosaria humilis (Roemer)

Pl. 7 fig. 9

Nodosaria humilis Roemer, 1841, p. 95, pl. 15, fig. 6.

Pseudoglandulina humilis (Roemer). Bartenstein and Brand, 1951, p. 315, pl. 10, figs. 266-271. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 37, pl. 7, figs. 153, 155.

Test free, small to moderate size, uniserial. Chambers increase gradually in size, circular in section, much wider than high, partly overlapping preceeding chamber. Sides nearly parallel in later chambers. Sutures depressed, straight. Aperture radiate, terminal, at end of very short neck.

Size. Height, 0.42 mm.; diam., 0.23 mm.

Pseudonodosaria mutabilis (Reuss)

Pl. 7 fig. 10

Glandulina mutabilis Reuss, 1863, p. 58, pl. 5, figs. 7-11.

Pseudoglandulina mutabilis (Reuss). Tappan, 1940, p. 105, pl. 16, fig. 15. -- Loeblich and Tappan, 1946, p. 258, pl. 49, figs. 9, 10. -- Bartenstein and Brand, 1951, pp. 315, 316. -- Frizzell, 1954, p. 92, pl. 10, fig. 36. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 37, pl. 7, fig. 156.

Test free, moderate to small, uniserial. Subglobular chambers increasing very rapidly in size, broader than high, circular in cross section. Outline very lobate; sutures deeply depressed, straight. Aperture terminal, at end of short, broad neck. Surface smooth, porcelainous, finely perforate.

Size. Height, 0.56 mm.; diam. of last chamber, 0.39 mm.

Genus Saracenaria Defrance 1824

Saracenaria frankei ten Dam

Pl. 9 figs. 3, 4

Saracenaria frankei ten Dam, 1946, p. 573, pl. 88, fig. 1.

Lenticulina (Saracenaria) frankei Dam. Bartenstein, Bettenstaedt and Bolli, 1957, p. 33, pl. 3, figs. 60a, b.

Test free, moderate size. Small initial coil, later chambers in

curved uniserial series, triangular in cross section, much broader than high. Peripheral edges acute but not keeled. Sutures depressed, slightly curved, oblique. Radiate aperture at dorsal angle of broad, triangular apertural face, at end of short neck.

Size. Height, 0.52 mm.; width, 0.25 mm.; thickness, 0.22 mm.

Saracenaria? sp.

Pl. 8 figs. 15, 16

Test free, medium size, planispiral, involute, with final chambers beginning to form a uniserial series. Chambers increasing rapidly in size, narrowly triangular in section. Periphery acute; sutures depressed, straight, radial. Large boss covering umbilicus of initial coils. Radiate aperture at dorsal angle of narrow, triangular apertural face.

Size. Height, 0.50 mm.; thickness, 0.20 mm.

Remarks. Because specimens of this form are rare and are pyritized, no specific name is proposed.

Saracenaria producta Stacy, new species

Pl. 9 figs. 24-27

Test free, medium size. After small initial, planispiral coil, chambers enlarging very rapidly, forming a curved uniserial series, much broader than high, triangular in cross section. Dorsal periphery very acute, sharp, but not keeled; edges of ventor acute, covered by ridge of shell material. Sutures depressed, sigmoid, oblique. Radiate aperture at dorsal angle of broad, triangular apertural face, on end of well-developed neck. Apertural face flat to gently rounded, sometimes appearing excavated due to the raised ridges on the edges.

Size. Height, 0.88 mm.; thickness, 0.40 mm.

Remarks. This form is somewhat similar in outline to S. cushmani Tappan, but differs in that the final chambers are not as high and they do not extend back to, nor embrace the initial whorl.

Type. Holotype UMMP 54213

Saracenaria cuchensis Stacy, new species

Pl. 9 figs. 9, 10, 16, 17

Test free, small to medium size, planispiral, involute, with final chambers in a curved, uniserial series. Wedge-shaped chambers increasing rapidly in size, much broader than high, triangular in section. Periphery acute with low, rounded keel. Sutures curved, limbate, raised; small clear umbilical plug in initial coil. Aperture radiate, at dorsal angle of very broad, curved, triangular apertural face.

Size. Height, 0.40 mm.; width, 0.25 mm.; thickness, 0.21 mm.

Remarks. This species can be distinginshed from S. triangularis (d'Orbigny) by the raised, limbate sutures and the umbilical plug; and from S. cushmani by the lower, less oblique chambers and the raised, limbate sutures.

Type. Holotype UMMP 54214, Paratype UMMP 54215

Saracenaria triquetra Stacy, new species

Pl. 9 figs. 18, 19

Test free, small, triangular in cross section. From a very small initial coil, low, wedge-shaped, oblique chambers increasing gradually in size, forming a straight to slightly curved uniserial series, much wider than high. Sutures depresssed, slightly curved, very oblique; edges of test acute, but not keeled. Aperture terminal, at the dorsal margin of the long, triangular apertural face.

Size. Height, 0.52 mm.; width, 0.12 mm.

Remarks. Most closely resembles S. bononiensis striatolipa Tappan, but with much lower, very oblique chambers and without any keel along the peripheral angles.

Type. Holotype UMMP 54215

Saracenaria densa Stacy, new species

Pl. 8 figs. 3, 4

Test free, small, planispiral, involute with final chambers beginning to uncoil in a curved, uniserial series. Wedge-shaped, triangular chambers expanding rapidly in size, final chambers reaching and partly embracing initial coil. Periphery acute, not keeled. Sutures oblique, straight, flush to slightly depressed. Radiate aperture at dorsal margin of broad, curved, triangular apertural face.

Size. Height, 0.33 mm.; width, 0.22 mm.; thickness, 0.20 mm.

Remarks. Very similar to S. triangularis (d'Orbigny), but with lower chambers, all of which extend to and partially embrace the initial coil.

Type. Holotype UMMP 54216

Saracenaria leva Stacy, new species

Pl. 8 figs. 1, 2

Test free, small, triangular in cross section. From a small initial planispiral coil, wedge-shaped, triangular chambers increasing rapidly in size, forming a curved, uniserial series. Dorsal periphery acute, not keeled. Sutures oblique, straight, flush. Radiate aperture at end of short neck on dorsal margin of curved triangular apertural face.

Size. Height, 0.35 mm.; width, 0.20 mm.; thickness, 0.18 mm.

Remarks. This species can be distinguished from S. triangularis

by the straight, rather than curved, sutures and the more narrow apertural face; and from S. densa, above, by the more narrow final chamber that does not reach the initial coil.

Type. Holotype UMMP 54217

Genus Astacolus deMontfort 1808

Astacolus incurvatus (Reuss)

Pl. 10 figs. 28, 29

Cristellaria incurvata Reuss, 1863, p. 79, pl. 7, fig. 14.

Lenticulina (Astacolus) incurvata (Reuss). Bartenstein, Bettenstaedt and Bolli, p. 30, pl. 3, figs. 57a, b, pl. 4, fig. 86.

Test free, moderate size, curved, uniserial. Wedge-shaped chambers increasing gradually in size, much wider than high, oblique. Test triangular in cross section; dorsal periphery acute. Sutures slightly depressed, curved, oblique. Aperture terminal, at dorsal angle of elongate, triangular apertural face.

Size. Height, 0.74 mm.; width, 0.32 mm.; thickness, 0.20 mm.

Astacolus lensus Stacy, new species

Pl. 9 figs. 13, 14

Test free, slender, uniserial, straight with small, curved initial stage. Chambers enlarging gradually, subtriangular in section, oblique. Dorsal periphery acute; venter rounded, lobate sutured deeply depressed, straight, oblique. Radiate aperture terminal, at end of short neck on dorsal margin of rounded apertural face.

Size. Height, 0.70 mm.; width, 0.16 mm.

Remarks. Similar to Vaginulina lineraris (Reuss) as illustrated by Tappan 1940, but the present species has a straight dorsal margin throughout most of the shell length and the chambers are not as high.

Type. Holotype UMMP 54218

Astacolus ancylus Stacy, new species

Pl. 9 figs. 1, 2

Test free, small, curved, uniserial. Wedge-shaped, oblique chambers increasing rapidly in size, much wider than high. Test subtriangular in cross section. Dorsal periphery acute. Sutures curved, oblique, flush with surface. Aperture terminal, at dorsal margin of rounded, narrowly triangular apertural face.

Size. Height, 0.41 mm.; width, 0.19 mm.; thickness, 0.10 mm.

Remarks. The elongate chambers and strongly curved dorsum separates this form from other described species of Astacolis.

Type. Holotype UMMP 54219

Astacolus flexus Stacy, new species

Pl. 9 figs. 5, 6

Test free, medium size, curved, uniserial, oval-triangular in cross section. Chambers increasing gradually in size, somewhat broader than high. Dorsal periphery acute, venter rounded. Sutures depressed. Aperture at angle of rounded apertural face.

Size. Height, 0.52 mm.; width, 0.25 mm.; thickness, 0.24 mm.

Remarks. Similar in outline to Marginulina curvatura Cushman, but without the initial coil and more compressed chambers.

Type. Holotype UMMP 54220

Astacolus? porrectus Stacy, new species

Pl. 9 figs. 7, 8

Test free, slender, slightly curved, uniserial, oval in cross section. Chambers expanding very gradually in size, wider than high.

Dorsal margin narrowly rounded, venter rounded, lobate. Sutures depressed, straight, oblique. Radiate aperture on dorsal margin of rounded apertural face, at end of short neck.

Size. Height, 0.88 mm.; width, 0.20 mm.; thickness, 0.16 mm.

Remarks. This species has been assigned to Astacolus rather than Dentalina because of the compressed chambers. The combination of compressed chambers, oblique sutures and almost straight dorsal margin has not been recorded for any similar species.

Type. Holotype UMMP 54221

Astacolus blothrus Stacy, new species

Pl. 9 figs. 22, 23

Test free, large, curved, uniserial, oval to subtriangular in cross section. Chambers increasing gradually in size, much wider than high. Dorsal periphery acutely rounded, venter rounded, slightly lobate. Sutures slightly depressed, oblique, straight. Aperture terminal at dorsal margin of rounded apertural face.

Size. Height, 1.58 mm.; width, 0.38 mm.; thickness, 0.25 mm.

Remarks. Somewhat similar to Marginulina cf. recta (d'Orbigny) of Cushman 1944, but without an initial planispiral coil and less lobate periphery.

Type. Holotype UMMP 54222

Astacolus astrabus Stacy, new species

Pl. 10 figs. 18, 19

Test free, slender, uniserial, straight, after short curved initial stage, oval in section. Chambers increase gradually in size, almost as high as wide. Dorsal periphery round, straight; venter round, lobate. Sutures depressed, straight, oblique. Aperture terminal at

dorsal angle of rounded apertural face.

Size. Height, 0.90 mm.; width, 0.22 mm.; thickness, 0.20 mm.

Remarks. This species has fewer, larger chambers and a more rounded periphery than A. porrectus above.

Type. Holotype UMMP 54223

Genus Vaginulinopsis Silvestri 1904

Vaginulinopsis cf. primus (d'Orbigny)

Pl. 10 figs. 32, 33

Cristallaria prima d'Orbigny, 1849, p. 242, no. 266.

Lenticulina (Vaginulinopsis) prima (d'Orbigny). Bartenstein, Bettenstaedt and Bolli, 1957, p. 31, pl. 3, figs. 59a, b, figs. 89, 90.

Test free, small, oval to subtriangular in cross section. Initial planispiral, involute coil with clear umbilical boss followed by straight uniserial series. Uniserial chambers increasing gradually in size, wider than high. Dorsal periphery acute; ventral margin rounded, lobate. Sutures deeply depressed, straight, oblique. Aperture terminal, radiate, at dorsal angle of rounded apertural face.

Size. Height, 0.73 mm.; width, 0.20 mm.; thickness, 0.14 mm.; diam. of coil, 0.23 mm.

Remarks. The present specimens have a more rounded, lobate ventral margin than is typical for this species.

Vaginulinopsis cf. pseudomarcki (Cushman)

Pl. 10 figs. 30, 31

Marginulina pseudomarcki Cushman, 1937, p. 94, pl. 13, figs. 19, 20. -- Cushman, 1946, p. 60, pl. 20, figs. 27, 28. -- Frizzell, 1954, p. 85, pl. 9, fig. 20.

Test free, large, oval in cross section. Large initial, plani-

spiral, involute coil of about ten chambers in final whorl, with clear umbilical boss covering umbilicus; periphery of coil acute but not keeled. Curved, uniserial series of wedge-shaped chambers, much wider than high, increasing gradually in size. Dorsal periphery acutely rounded, venter narrowly rounded. Sutures slightly curved, oblique, flush with surface, obscure. Aperture radiate, at the dorsal periphery of the curved apertural face.

Size. Height, 1.80 mm.; width, 0.75 mm.; thickness, 0.45 mm.; diam. of coil, 0.62 mm.

Remarks. Trinidad specimens compare very favorably with this Upper Cretaceous species although none of them are more than half the size given for the Gulf Coast specimens. The compressed chambers suggest a generic assignment of Vaginulinopsis rather than Marginulina.

Vaginulinopsis arctus Stacy, new species

Pl. 9 figs. 11, 12

Test free, medium size, oval to subtriangular in cross section. Initial coil planispiral, involute, with clear umbilical boss. Curved uniserial stage of moderately increasing chambers, wider than high. Dorsal periphery acute, ventral periphery rounded, somewhat lobate. Sutures depressed, straight,oblique. Aperture terminal, at dorsal margin of rounded, subtriangular apertural face.

Size. Height, 0.48 mm.; width, 0.17 mm.; thickness, 0.12 mm.; diam. of coil, 0.21 mm.

Remarks. This form appears closely related to V. cf. prima above but has a very curved, rather than straight uniserial stage.

Type. Holotype UMMP 54224

Genus Lingulina d'Orbigny 1826

Lingulina praelonga ten Dam

Pl. 10 fig. 11

Lingulina praelonga ten Dam, 1946, p. 576, pl. 88, fig. 12. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 38, pl. 7, figs. 157, 158.

Test free, small, uniserial, oval in cross section. Chambers much wider than high, compressed; initial few chambers enlarging rapidly, later chambers about same size making sides of test almost parallel. Peripheries rounded. Sutures depressed, curved, horizontal. Aperture terminal, at end of short neck.

Size. Height, 0.44 mm.; width, 0.20 mm.; thickness, 0.15 mm.

Lingulina cyrtoma Stacy, new species

Pl. 10 fig. 20

Test free, large, uniserial, elongate oval in cross section. Chambers much wider than high, compressed, enlarging gradually, Peripheral edges acute with low, rounded keel. Sutures deeply depressed, straight. Radiate aperture terminal, on short, thick apertural neck.

Size. Height, 0.91 mm.; width, 0.55 mm.; thickness, 0.25 mm.

Remarks. This form is much larger and more robust than other species of Cretaceous Lingulina.

Type. Holotype UMMP 54225

Family POLYMORPHINIDAE d'Orbigny

Genus Globulina d'Orbigny 1839

Globulina exseta (Berthelin)

Pl. 10 fig. 16

Polymorphina exserta Berthelin, 1880, p. 52, pl. 4, figs. 22, 23.

Pyrulina cf. exserta (Berthelin). Bartenstein, Bettenstaedt and Bolli,

1957, p. 41, pl. 7, figs. 165a, b.

Globulina exserta (Berthelin). Tappan, 1943, pp. 504, 505, pl. 80, figs. 36, 37. -- Frizzell, 1954, p. 104, pl. 14, figs. 19a, b.

Test free, fusiform, elongate oval in cross section. Early chambers triserial, later chambers apparently biserial, overlapping earlier chambers, increasing rapidly in size. Sutures depressed, distinct. Aperture radiate, terminal.

Size. Height, 0.46 mm.; width, 0.25 mm.

Globulina cf. prisca Reuss

Pl. 10 fig. 17

Globulina prisa Reuss, 1863, p. 79, pl. 9, fig. 8.

Globulina cf. prisca Reuss. Bartenstein, Bettenstaedt and Bolli, 1957, p. 41, pl. 7, figs. 166a, b.

Test free, slender, fusiform, oval cross section. Elongate chambers added at less than 180°, partly overlapping earlier chambers, increasing rapidly in height. Sutures very slightly depressed, obscure. Radiate aperture terminal, at end of long neck.

Size. Height, 0.48 mm.; width, 0.17 mm.

Remarks. As noted by Bartenstein, Bettenstaedt and Bolli, 1957, the Trinidad specimens are more slender than the type species from Germany.

Genus Guttulina d'Orbigny 1839

Guttulina subcretacea Stacy, new species

Pl. 10 fig. 10

Test free, moderate size, elongate oval in side view, subcircular in cross section. Chambers added at about 120° in a high trochoid spiral, increasing gradually in size and partly embracing earlier

chamber. Sutures faintly depressed, obscure. Aperture radiate, terminal.

Size. Height, 0.48 mm.; width, 0.29 mm.

Remarks. Very similar to G. vandenboldi Bartenstein, Bettenstaedt and Bolli, but without the deeply depressed sutures and test is elongate oval, rather than diamond-shaped, in side view.

Type. Holotype UMMP 54226

Guttulina apoxya Stacy, new species

Pl. 9 fig. 15

Test free, small, fusiform outline, oval in cross section. Rapidly enlarging chambers added at about 120° to form a high trochoid spiral, partly embracing earlier chambers. Sutures depressed. Aperture radiate, terminal.

Size. Height, 0.38 mm.; width, 0.17 mm.

Remarks. Differs from both G. vandenboldi and G. subcretacea by having much more slender chambers and a more tapering outline.

Type. Holotype UMMP 54227

Genus Polymorphina d'Orbigny 1826

Polymorphina turgida Stacy, new species

Pl. 10 fig. 24

Test free, moderate size, quadrate in outline, twisted biserial. Chambers enlarge rapidly, added at approximately 180°, partly embracing preceeding chambers. Periphery rounded; sutures very slightly depressed, obscure. Aperture radiate, terminal.

Size. Height, 0.40 mm.; width, 0.26 mm.; thickness, 0.17 mm.

Remarks. This form is separated from other described Cretaceous species of Polymorphina by the large and inflated final chamber.

Type. Holotype UMMP 54228

Genus Pseudopolymorphina Cushman and Ozawa 1928

Pseudopolymorphina roanoakensis Tappan

Pl. 9 fig. 20

Pseudopolymorphina roanoakensis Tappan, 1940, p. 113, pl. 17, figs. 22, 23, 25. -- Tappan, 1943, p. 506, pl. 81, figs. 4, 5. -- Frizzell, 1954, p. 105, pl. 14, figs. 35, 37.

Test free, small to moderate size. Chamber arrangement irregular, varying from triserial to uniserial. Final chamber fistulose and covered with irregular, tapering tubes (mostly broken). Sutures slightly depressed, obscure. Aperture hidden by fistulose growth.

Size. Height, 0.48 mm.; width, 0.20 mm.

Remarks. Individual specimens vary a great deal in the number and arrangement of chambers and in size, but are consistent in the development of the fistulose, tubular growth over the aperture.

Genus Ramulina Jones 1875

Ramulina globulifera Brady

Pl. 9 fig. 21

Ramulina globulifera Brady, 1884, p. 587, pl. 76, figs. 22-28. -- Tappan, 1940, p. 114, pl. 18, fig. 3. -- Tappan, 1943, p. 506, pl. 81, figs. 8, 9. -- Frizzell, 1954, p. 106, pl. 14, fig. 46.

Test free, globular. Irregularly placed hollow tubes (broken) extend from globular central body in various planes. Surface of test pustulose to finely hispid.

Size. Diam. of central body, 0.38 mm.

Genus Washitella Tappan 1943

Washitella typica Tappan

Pl. 10 fig. 26

Genus (?) species (?) Tappan, 1940, p. 124, pl. 18, figs. 17, 18. Washitella typica Tappan 1943, p. 515, pl. 63, figs. 11-16. -- Frizzell,

1954, p. 107, pl. 15, fig. 4.

Test free, irregularly branching. Two to three large chambers in center of test; from central chambers, irregular branches formed by smaller chambers in a uniserial series. Sutures depressed, straight, obscure in some specimens.

Size. Length, 0.78 mm.

Family GLANDULINIDAE Reuss

Genus Tristix Macfadyen 1941

Tristix acutangula (Reuss)

Pl. 10 fig. 21

Rhabadogonium acutangulum Reuss, 1863, p. 55, pl. 4, fig. 14.

Tristix acutangula (Reuss). Bartenstein and Brand, 1951, p. 314, pl. 10, figs. 257, 261. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 37, pl. 5, fig. 111, pl. 6, fig. 139.

Test free, medium to large size, uniserial, triangular in cross section. Chambers increasing gradually in size, broader than high. The three peripheral angles acute, covered by ridge of clear shell material, slightly lobate. Sutures depressed, curved downward at periphery. Aperture circular, terminal, at end of large apertural neck.

Size. Height, 0.88 mm.; width, 0.29 mm.

Tristix euthemon (Loeblich and Tappan)

Pl. 10 figs. 22, 23

Quadratina euthemon Loeblich and Tappan, 1949, pp. 254, 260, pl. 49, fig. 14. -- Frizzell, 1954, p. 120, pl. 17, figs. 46a, b.

Test free, medium size, uniserial, quadrate in cross section. Chambers enlarging gradually, somewhat wider than high, partly overlapping preceeding chamber, widest in middle. Test angulate at the

four edges; sides flat. Sutures deeply depressed, arched on sides, pointing downward at corners. Aperture terminal, circular.

Size. Height, 0.56 mm.; width, 0.24 mm.

Superfamily BULIMINACEAE Jones

Family TURRILINIDAE Cushman

Genus Praebulimina Hofker 1953

Praebulimina pygmaea Stacy, new species

Pl. 10 fig. 15

Test free, small, high trochoid spiral with three chambers in final whorls. Globular chambers enlarging rapidly in early stage, then remaining almost the same size in final two to three whorls. Sutures deeply depressed. Aperture large, comma-shaped, on flattened apertural face of final chamber.

Size. Height, 0.26 mm.; width, 0.16 mm.

Remarks. Most similar to Bulimina ovulum navarroensis Cushman and Parker, but final chambers do not continue to increase steadily in size; instead, the chambers of the final two or three whorls are all about the same height.

Type. Holotype UMMP 54229

Genus Neobulimina Cushman and Wickenden 1928

Neobulimina minima Tappan

Pl. 10 figs. 34, 35

Neobulimina minima Tappan, 1940, p. 117, pl. 19, figs. 5, 6. -- Tappan 1943, pp. 507, 508, pl. 81, figs. 16a, b. -- Loeblich and Tappan, 1949, pp. 263, 264, pl. 51, figs. 1, 2. -- Stead, 1951, p. 597, pl. 3, figs. 17, 18. -- Frizzell, 1954, p. 116, pl. 17, figs. 13a, b.

Test free, small, slender, twisted along axis of growth. Initially

triserial, becoming biserial in final stage. Subglobular chambers enlarging rapidly in size. Sutures faintly depressed, often obscure. Loop-shaped aperture at base of last-formed chamber.

Size. Height, 0.27 mm.; width, 0.14 mm.

Family BOLIVINITIDAE Cushman

Genus Bolivina d'Orbigny

Bolivina cf. textilarioides Reuss

Pl. 10 figs. 7, 8

Bolivina textilarioides Reuss, 1863, p. 81, pl. 10, figs. 1a, b.

Bolivina cf. textilarioides Reuss. Tappan, 1940, p. 118, pl. 18, figs. 18a, c. -- Lozo, 1944, p. 501, pl. 4, figs. 11a, b. -- Frizzell, 1954, p. 118, pl. 17, figs. 26a, b.

Test free, medium size, biserial, twisted along axis of growth. subrectangular in cross section. Subglobular chambers expanding rapidly. Periphery lobate. Sutures depressed, straight, oblique. Aperture a narrow, elongate opening along median line of last-formed chamber.

Size. Height, 0.44 mm.; width, 0.23 mm.; thickness, 0.14 mm.

Remarks. The Trinidad specimens, like the Gulf Coast forms found by Tappan and Lozo, show twisting along the long axis of the shell, which was not found by Reuss in the German type species.

Bolivina castigata Stacy, new species

Pl. 10 figs. 13, 14

Test free, small, slender, twisted slightly along axis of growth Chambers oval, broader than high, increasing moderately in size. Periphery round, deeply lobed. Sutures deeply depressed, straight, oblique. Aperture a narrow slit along midline of apertural face of last chamber.

Size. Height, 0.34 mm.; width, 0.13 mm.; thickness, 0.10 mm.

Remarks. No other small species of Bolivina has the very lobate periphery found on this form.

Type. Holotype UMMP 54230

Family UVIGERINIDAE Haeckel

Genus Pseudouvigerina Cushman 1927

Pseudouvigerina sp.

Pl. 10 fig. 12

Test free, small, triserial becoming somewhat biserial in final whorl. Subglobular chambers increasing rapidly in size. Sutures depressed, straight. Aperture terminal, circular, at end of very short apertural neck. Surface finely pustulose.

Size. Height, 0.30 mm.; width, 0.15 mm.

Remarks. Only one, imperfectly preserved specimen has been found, but the appartent triserial condition, rather than biserial, suggests that it belongs to Pseudouvigerina, instead of Eouvigerina, the more common Lower Cretaceous genus. No specific name is proposed for this single specimen.

Family BULIMINIDAE Jones

Genus Bulimina d'Orbigny 1826

Bulimina evexa Loeblich and Tappan

Pl. 10 fig. 25

Bulimina nannina Tappan, 1943, p. 507, pl. 81, fig. 15 (not of Tappan, 1940).

Bulimina evexa Loeblich and Tappan, 1949, p. 263, pl. 51, figs. 5a, b.

-- Frizzell, 1954, p. 114, pl. 16, figs. 47a, b.

Test free, very small, triserial. Globular chambers increasing very rapidly in size; final chambers constituting about half the total

height. Sutures depressed, distinct. Aperture a small, low arch at base of last chamber.

Size. Height, 0.15 mm.; width, 0.14 mm.

Bulimina nannina Tappan

Pl. 10 fig. 27

Bulimina nannina Tappan, 1940, pp. 116, 117, pl. 19, figs. 4a, b. -- Frizzell, 1954, p. 115, pl. 16, figs. 53a, b.

Not Bulimina nannina Tappan, 1943, p. 507, pl. 81, figs. 15.

Test free, very small, triserial. Chambers expanding rapidly in size, higher than wide; final chambers making up about half of shell height, not globular. Sutures depressed, distinct. Aperture loop-shaped at base of apertural face of last chamber.

Bulimina cf. reussi Morrow

Pl. 10 fig. 9

Bulimina ovulum Reuss, 1845, p. 37, pl. 8, fig. 57, pl. 13, fig. 73, (not B. ovula d'Orbigny 1839).

Bulimina reussi Morrow, 1934, pp. 195, 196, pl. 29, fig. 12. -- Cushman 1946, pp. 120, 121, pl. 51, figs. 1-5.

Test free, small to moderate size, triserial. Subglobular chambers enlarging rapidly, final chambers about half of shell height. Sutures slightly depressed, somewhat obscure. Aperture loop-shaped at base of last-formed chamber.

Size. Height, 0.39 mm.; width, 0.27 mm.

Remarks. The Trinidad specimens expand a little more rapidly and are not as pointed as the forms described from the Upper Cretaceous of Kansas.

Superfamily DISCORBACEA Ehrenberg

Family DISCORBIDAE Ehrenberg

Genus Discorbis Lamarck 1804

Discorbis floscula Loeblich and Tappan

Pl. 11 figs. 15-17

Discorbis floscula Loeblich and Tappan, 1949, p. 265, pl. 51, figs. 9-11. -- Stead, 1951, p. 597, pl. 3, figs. 22-24. -- Frizzell, 1954, p. 122, pl. 18, figs. 28a, c.

Test free, small, trochoid. Four to five rapidly expanding chambers in final whorl; final chamber large, inflated. Periphery rounded. Spiral side with low spire; slightly curved, oblique, depressed sutures. Umbilical side with open umbilicus partly covered by last chambers, sutures slightly curved, depressed, radial. Aperture a low slit at base of last chamber.

Size. Diam., 0.26 mm.; thickness, 0.15 mm.

Remarks. The Trinidad specimens are not as high spired as the forms illustrated from the Walnut Formation of Texas; except for this, they seem to be identical.

Discorbis minima Vieaux

Pl. 11 figs. 22-24

Discorbis minima Vieaux, 1941, p. 627, pl. 85, figs. 10a-c. -- Tappan, 1943, p. 511, pl. 82, figs. 7, 8. -- Frizzell, 1954, p. 122, pl. 18, figs. 29a, b.

Discorbis cf. minima Vieaux. Loeblich and Tappan, 1949, p. 265, pl. 51, figs. 12, 13.

Test free, medium size, trochospiral, convex spiral side, umbilical side concave. Chambers increasing rapidly in height, eight to ten in final whorl, compressed laterally. Periphery subacute, lobate. Sutures

depressed, slightly curved, radial. Umbilicus usually open, shallow, but in some specimens partly filled by umbilical plug. Aperture a low slit at base of inner face of last chamber.

Size. Diam., 0.40 mm.; thickness, 0.14 mm.

Discorbis minutissima Tappan

Pl. 10 figs. 4-6

Discorbis minutissima Tappan, 1943, p. 511, pl. 82, figs. 5, 6. --

Frizzell, 1954, p. 122, pl. 18, figs. 30a, b.

Test free, very small, trochospiral, convex spiral side, umbilical side concave. Chambers increasing rapidly in height, five in final whorl, somewhat laterally compressed. Periphery acutely rounded, slightly lobate. Sutures depressed, slightly curved on spiral side, straight on umbilical side. Open, shallow umbilicus. Aperture at base of last chamber, on ventral side.

Size. Diam., 0.19 mm.; thickness, 0.10 mm.

Discorbis asymmetria Stacy, new species

Pl. 10 figs. 1-3

Test free, medium size, trochoid spiral of three whorls, spiral side flat, umbilical side convex. Chambers increasing gradually in size, about seven in final whorl. Periphery acute, lobate. Sutures on spiral side depressed, slightly curved, oblique; ventral sutures depressed, radial, straight. Narrow, open umbilicus. Aperture a low slit on ventral side at base of last chamber. Surface finely pustulose.

Size. Diam., 0.33 mm.; thickness, 0.08 mm.

Remarks. The flat spiral side and the finely pustulose surface are not found in other Cretaceous species of Discorbis.

Type. Holotype UMMP 54231

Genus Conorbina Brotzen 1936

Conorbina conica Lozo

Pl. 11 figs. 34-36

Conorbina conica Lozo, 1944, p. 562, pl. 2, figs. 6, 7. -- Loeblich and Tappan, 1949, p. 264, pl. 51, figs. 7, 8. -- Stead, 1951, p. 597, pl. 3, figs. 19-21. -- Frizzell, 1954, p. 112, pl. 18, figs. 27a-c.

Test free, small, arched trochoid spiral of about four whorls, planoconvex. Chambers of initial whorls globular becoming low, elongate and trapezoidal in surface shape in final coil; four to five chambers in final whorl. Periphery rounded, slightly lobate. Sutures depressed, curved, oblique. Aperture a narrow, slit at base of last chamber on umbilical side. Comma-shaped opening extending onto the apertural face from the slit; this apertural re-entrant present only in some specimens, but often recognizable on the apertural surface of the preultimate chambers in cases where it is developed.

Size. Diam., 0.24 mm.; height, 0.20 mm.

Remarks. The development of a secondary, comma-shaped re-entrant of the aperture onto the apertural face of some specimens has not been recorded in the other descriptions for this species. It is present in most, but not all, of the Trinidad specimens.

Conorbina hofkeri (Bartenstein and Brand)

Pl. 11 figs. 9-11

Conorbis hofkeri Bartenstein and Brand, 1951, pp. 325, 326, pl. 11, fig. 320.

Test free, moderate size, low trochospiral with three whorls, convex spiral side, umbilical side concave. Five to six, rapidly

expanding, laterally compressed chambers in final whorl. Periphery acute, rimmed with clear shell material. Sutures on spiral side mostly limbate, raised, curved, extending to the periphery, there forming the peripheral rim; those of final few chambers may be depressed instead of limbate. Sutures of the umbilical side depressed, curved, radial. Umbilicus sometimes open, often partly closed by small umbilical plug. Aperture a low slit at base of final chamber on umbilical side with comma-shaped re-entrant developed on apertural face.

Size. Diam., 0.43 mm.; height, 0.15 mm.

Remarks. This species and C. valendisensis, below, were originally placed in the genus Conorbis by Bartenstein and Brand. They are considered to be species of Conorbina by the present author on the basis of the apertural re-entrant of the chamber margin and the development of umbilical covering (see Loeblich and Tappan, 1964, pp. C575 and C769).

Conorbina valendisensis (Bartenstein and Brand)

Pl. 11 figs. 28-30

Conorbis valendisensis Bartenstein and Brand, 1951, p. 362, pl. 11, figs. 321, 322, 342, 343.

Conorboides valendisensis (Bartenstein and Brand). Simon, Bartenstein, et al., p. 253, pl. 35, fig. 5.

Test free, medium size, high trochoid spiral of the three whorls, planoconvex. Chambers enlarging rapidly in size, five to six in final whorl, trapezoidal on spiral side. Periphery acute with rounded keel formed by extension of limbate sutures. Sutures on spiral side limbate, raised, oblique; on umbilical side depressed, slightly curved, radial. Umbilicus closed, in some specimens by an umbilical plug, in the majority by overlap of chambers. Aperture often obscure, a low slit

with loop-shaped or comma-like re-entrant developed on apertural face.

Size. Diam., 0.44 mm.; height, 0.24 mm.

Conorbina subcretacea Stacy, new species

Pl. 11 figs. 12-14

Test free, moderate to small, trochoid spiral of three whorls, planoconvex. Chambers enlarging gradually in size, approximately six in final whorl. Periphery acutely rounded. Sutures on spiral side limbate, flush to slightly depressed, curved, oblique; on umbilical side depressed, radial. Umbilical plug sometimes present. Aperture obscure, with small loop-shaped re-entrant present on apertural face.

Size. Diam., 0.33 mm.; height, 0.15 mm.

Remarks. This species is most similar to C. conica, but differs in the much lower spire and fewer chambers in the early whorls. It also lacks the well-defined, depressed sutures on the spiral side.

Type. Holotype UMMP 54233

Conorbina pulchera Stacy, new species

Pl. 11 figs. 19-21

Test free, medium size, trochoid spire of about three and a half whorls. Gradually enlarging chambers, five to seven in last whorl, trapezoidal on spiral side. Periphery acute, faintly lobed. On dorsal side the spiral suture limbate, flush; radial sutures depressed, slightly curved, oblique. Ventral sutures depressed, curved. Umbilicus closed by overlapping chambers; outline of umbilical surface low convex, not flat. Aperture a low slit at base of umbilical side of last chamber with comma-shaped re-entrant. Small, triangular chamberlet formed on the umbilical side of the periphery between each chamber.

Size. Diam., 0.36 mm.; height, 0.21 mm.

Remarks. Most similar in shape and outline to C. valendisence but with depressed, rather than strongly raised sutures on the spiral side. The development of the small triangular chamberlets on the ventral periphery is unique and further study may show that this species is not a true Conorbina.

Type. Holotype UMMP 54234

Genus Valvulineria Cushman 1926

Valvulineria cf. astigerinoides Plummer

Pl. 11 figs. 37-39

Valvulineria astigerinoides Plummer, 1931a, p. 190, pl. 14, fig. 6. -- Tappan, 1940, p. 120, pl. 19, figs. 9a-c. -- Tappan, 1943, pp. 511, 512, pl. 82, figs. 10, 11. -- Frizzell, 1954, p. 123, pl. 18, figs. 43a-c.

Test free, medium size, low trochoid spiral of about three whorls, planoconvex. Seven, rapidly expanding, flattened chambers in final whorl. Periphery acutely rounded, slightly lobate. On dorsal side, spiral suture depressed, radial sutures limbate, flush, slightly curved; ventral sutures curved, limate, flush. Umbilicus partly closed by overlapping umbilical flaps. Aperture near umbilicus, under posterior flap of last chamber.

Size. Largest diam., 0.51 mm.; thickness, 0.21 mm.

Remarks. Only one, poorly preserved specimen was found in the Trinidad fauna and the umbilical flaps do not appear to be as prominent as those on the Texas species. This variation could be due to preservation rather than a genetic difference.

Valvulineria illustra Stacy, new species

Pl. 11 figs. 25, 31-33

Test free, small, flattened trochoid spiral of three whorls. Chambers subglobular, wider than high, increasing rapidly in size, eight to ten in final whorl. Final chamber inflated, large, overhanging umbilical area. Spiral side evolute, flat, in some specimens; final whorl higher than earlier coil. Imbilical side involute, concave. Periphery broadly rounded, lobate. Sutures depressed, curved. Aperture a low slit at base of chamber, covered by small flap.

Size. Height, 0.30 mm.; thickness, 0.16 mm.

Remarks. This species is somewhat similar to V. plumerae Loetterle, 1937, but differs by having much more inflated chambers and a much smaller apertural flap which does not completely cover the umbilicus.

Type. Holotype UMMP 54235

Superfamily SPIRILLINACEA Reuss

Family SPIRILLINIDAE Reuss

Genus Spirillina Ehrenberg 1843

Spirillina minima Schacko

Pl. 11 figs. 26, 27

Spirillina minima Schacko, 1892, p. 159, pl. 1, fig. 4. -- Tappan, 1940, p. 119, pl. 19, fig. 8. -- Tappan, 1943, p. 510, pl. 82, figs. 1a, b. -- Bartenstein and Brand, 1951, p. 325, pl. 11, fig. 318. -- Frizzell, 1954, p. 122, pl. 18, fig. 24. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 44, pl. 1, figs. 18-20.

Test free, small, plainspiral, evolute, discoidal. Globular proloculum followed by tubular, undivided second chamber coiling in one plane, about six volutions in well-developed specimens. Spiral suture distinct, slightly depressed. Aperture simple, circular. Surface smooth.

Size. Diam., 0.31 mm.; thickness, 0.05 mm.

Genus Turrispirillina Cushman 1927

Turrispirillina subconica Tappan

Pl. 11 figs. 5-7

Turrispirillina subconica Tappan, 1943, p. 510, pl. 82, figs. 2, 3. -- Loeblich and Tappan, 1949, p. 264, pl. 51, fig. 6. -- Frizzell, 1954, p. 122, pl. 18, figs. 25a, b.

Test free, small, conical, evolute. Small globular proloculum followed by elongate, coiled, tubular chamber, forming a very low, hollow, conical spire of about five volutions. Spiral suture slightly depressed, somewhat obscure. Aperture a simple circular opening at end of second chamber. Surface smooth.

Size. Diam., 0.23 mm.; thickness, 0.06 mm.

Genus Patellina Williamson 1858

Patellina subcretacea Cushman and Alexander

Pl. 11 figs. 1-3

Patellina subcretacea Cushman and Alexander, 1930, p. 10, pl. 3, figs. 1a, b. -- Tappan, 1943, p. 511, pl. 82, figs. 4a, b. -- Lozo, 1944, p. 561, pl. 4, fig. 8. -- Loeblich and Tappan, 1949, p. 264, pl. 51, fig. 3. -- Bartenstein and Brand, 1951, p. 325, pl. 11, fig. 319. -- Frizzell, 1954, p. 122, pl. 18, figs. 26a, b. -- Bartenstein, Bettenstaedt and Bolli, 1957, p. 45.

Test free, small, conical, dorsal side convex, ventral side slightly concave. Early portion of test formed by elongate, spiral, undivided, tubular chamber of several coils; later chambers narrow, elongate, two to a whorl. Chambers of later whorls divided by numerous, incomplete septa. Aperture a low arch in center of umbilical side of test.

Size. Diam., 0.26 mm.; height of spire, 0.15 mm.

Superfamily GLOBIGERINACEA Carpenter, Parker and Jones

Family HETEROHELICIDAE Cushman

Genus Guembelitria Cushman 1933

Guembelitria harrisi Tappan

Pl. 11 figs. 22, 23

Guembelitria harrisi Tappan, 1940, p. 115, pl. 19, figs. 2a, b. -- Tappan, 1943, p. 507, pl. 81, figs. 13, 14. -- Frizzell, 1954, p. 110, pl. 15, figs. 46a, b.

Test free, small, triserial. Globular chambers expanding very rapidly. Sutures deeply depressed; periphery lobate. Aperture a low, curved opening at base of last chamber. Surface smooth.

Size. Height, 0.22 mm.; width, 0.20 mm.

Genus Heterohelix Ehrenberg 1843

Heterohelix? minor Stacy, new species

Pl. 11 fig. 24

Test free, very small, biserial with very small initial, planispiral coil, quadrate in cross section. Subrectangular chambers wider than high, increasing gradually in size. Peripheries straight, marked by low, thin ridges of clear shell material. Sutures straight, oblique, hylanine and flush in young, becoming depressed in final chambers. Aperture a narrow opening on lower half of apertural face of last chamber. Surface covered by thin, perpendicular ridges crossing sutures without interruption.

Size. Height, 0.29 mm.; width, 0.17 mm.; thickness, 0.14 mm.

Remarks. Although the general shape and method of growth is typical of Heterohelix, the aperture is more of a Bolivina type. This small form has not been recorded in other Cretaceous faunas.

Type. Holotype UMMP 54236