

MEMOIR 1: MIAMI GEOLOGICAL SOCIETY

A SYMPOSIUM OF RECENT SOUTH FLORIDA FORAMINIFERA

by

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Diagnosis. Test slightly longer than broad; early chambers irregularly triloculine, becoming somewhat loosely coiled, chambers indistinct; wall smooth, thick; aperture terminal, elongate, narrow, with thickened lip.

Discussion. This species occurs at only four stations, usually in low frequencies.

Articulina mucronata (d'Orbigny), 1839 (Plate 13, Fig. 4)

Vertebralina mucronata d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminifères", p. 52, Pl. 7, Figs. 16-19.

Articulina mucronata Cushman, 1944, Spec. Publ. No. 10, Cush. Lab. Foram. Res., pp. 1-21.

Diagnosis. Test variable in shape, much compressed; early stages triloculine, last-coiled chamber expanding at outer end, followed by one to four uniserial chambers, gradually or rapidly expanding in width; sutures depressed; wall ornamented by longitudinal costae; aperture narrow, elongate, with thin flaring lip projecting well beyond body of chamber.

Discussion. The variability in test shape of Articulina mucronata occurs in the uniserial chambers. The initial triloculine chambers are quite similar in all specimens. The shape of the uniserial chambers ranges from fairly narrow to widely flaring. Specimens with narrow chambers are elongate with each succeeding chamber being only slightly wider than the preceding one. Specimens with widely flaring chambers are fan-shaped with each succeeding chamber expanding rapidly in width. The number of uniserial chambers present in specimens is also variable, ranging from one to four. In the area under investigation most specimens possess two uniserial chambers.

Articulina mucronata occurs at 23 stations in medium to high frequencies. Although there is no apparent reason for the distribution of this species it is most abundant at stations 44 through 57, which is an area of shallow mud flats located towards the center of Florida Bay.

Articulina multilocularis Brady, Parker and Jones, 1888 (Plate 13, Fig. 5)

Articulina multilocularis Brady, Parker and Jones, 1888, Trans. Zool. Soc., vol. 12, p. 215, Pl. 40, Fig. 10.

Diagnosis. Test oval, compressed, composed of numerous segments arranged in spiroloculine fashion, lateral faces of segments flat or hollow; sutures distinct; wall ornamented with exceedingly fine costae; aperture broad, very elongate, with everted lip.

Discussion. This species occurs at 10 stations in very low frequencies. Its distribution is apparently random.

Articulina pacifica Cushman, 1944 (Plate 13, Fig. 6)

Articulina sulcata Brady (not Reuss), 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 183, Pl. 12, Figs. 12, 13.

Articulina conico-articulata (Batsch), Cushman, 1917, U.S. Nat. Mus., Bull. 71, pt. 6, p. 58, Pl. 22, Fig. 6.

Articulina sagra d'Orbigny, Cushman, 1921, U.S. Nat. Mus., Bull. 100, vol. 4, p. 488.

Articulina pacifica Cushman, 1944, Cush. Lab. Foram. Res., Spec. Publ. no. 10, p. 17, Pl. 14, Figs. 14-18.

Diagnosis. Test somewhat longer than broad; chambers triloculine, close-coiled, may have a single uniserial chamber; sutures distinct; wall ornamented with numerous, fine longitudinal costae; aperture terminal, elongate, extending somewhat beyond chamber.

Discussion. All the specimens of this species examined did not possess a uniserial chamber, but had only the tightly coiled triloculine stage.

Articulina pacifica occurs at 34 stations, usually in medium frequencies. It is most abundant in the shallow mud flats in the middle of Florida Bay, and in the shallow-water inshore areas around the lower Florida Keys.

Articulina sagra d'Orbigny, 1839 (Plate 13, Fig. 7)

Articulina sagra d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 160, Pl. 9, Figs. 23-26.

Diagnosis. Test elongate, slightly arcuate; early portion triloculine, later chambers uniserial, one to four in number; wall ornamented by longitudinal costae; aperture broadest part of test, terminal, circular or elliptical, with everted lip.

Discussion. Articulina sagra exhibits variability in the number and shape of the uniserial chambers. The number of uniserial chambers ranges from one to four with two or three being the most common. The shapes of the uniserial chambers vary in the relative lengths of the individual chambers. They do not increase uniformly in length in all specimens, but range from short, squat chambers to elongate chambers, in no definite sequence. The last-formed chamber is always the most elongate. The short, squat chambers may represent periods of arrested growth.

Articulina sagra differs from Articulina lineata in the shape of the uniserial portion of the test, and in the type of apertural lip. The uniserial chambers are narrower in the former, and the apertural lip is everted and stands well out beyond the width of the test, forming a wide base for the next chamber, whereas the apertural lip of the latter extends very slightly beyond the width of the chamber and constricts the base of the following chamber.

This species occurs at 18 stations in low to medium frequencies, and appears to be randomly distributed.

FAMILY SORITIDAE Ehrenberg, 1839

SUBFAMILY PENEROPLINAE Schultze, 1854

GENUS PENEROPLIS Montfort, 1808

Peneroplis bradyi Cushman, 1930 (Plate 13, Fig. 8)

Peneroplis bradyi Cushman, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, Pl. 40, Pl. 14, Figs. 8-10.

Diagnosis. Test small, very greatly compressed; early portion planispiral, usually partially evolute, later portion broadening, flaring, becoming uniserial; chambers distinct, undivided; aperture a series of pores in central line of apertural face.

Discussion. This species occurs at only five stations, usually as a single specimen.

Peneroplis carinatus d'Orbigny, 1839 (Plate 13, Fig. 9)

Peneroplis carinatus d'Orbigny, 1839, Voy. Amer. Merid., vol. 5, pt. 5, "Foraminiferes", p. 33, Pl. 3, Figs. 7, 8.

Diagnosis. Test close-coiled, completely involute; chambers undivided; sutures distinct, not limbate; wall smooth; aperture consists of series of pores in central portion, toward base of apertural face.

Discussion. This species occurs at 70 stations, usually in medium frequencies. It is absent only from those stations in the more restricted parts of Florida Bay adjacent to the mainland and from the deeper-water stations.

Peneroplis pertusus (Forskål), 1775 (Plate 13, Fig. 10)

Nautilus pertusus Forskål, 1775, Descr. Anim., p. 125, no. 65.

Peneroplis pertusus Jones, Parker and Brady, 1865, Foram. Crag., p. 19.

Diagnosis. Test typically close-coiled throughout, compressed, biumbilicate, coils not completely involute; chambers undivided; sutures distinct; wall ornamented with fine striae parallel to periphery; aperture consists of numerous pores along middle line of apertural face.

Discussion. This species occurs at 17 stations, usually in low frequencies. There is no discernible pattern to its distribution.

Peneroplis proteus d'Orbigny, 1839 (Plate 13, Fig. 11)

Peneroplis protea d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 60, Pl. 7, Figs. 7-11.

Peneroplis proteus Cushman, 1921, Proc. U.S. Nat. Mus., vol. 59, p. 75, Pl. 18, Figs. 13-19.

Diagnosis. Test with early portion close-coiled, completely involute, later portion variously flaring, even becoming uncoiled; chambers undivided; sutures distinct; wall smooth; aperture consists of row of pores along median line of apertural face.

Discussion. Peneroplis proteus exhibits variability in the shape of chamber arrangement in the flaring and uncoiled portion of the test. Most specimens have a simple flaring portion, in which each chamber becomes slightly wider than the preceding one, but some have a buildup of regular uniserial chambers with the few last-formed chambers becoming much wider than the preceding ones. The width of the uncoiled portion in different specimens varies greatly.

This species occurs at 67 stations, usually in medium frequencies. This is another species that is absent only from the more restricted parts of the bay and from those stations with the deepest water.

GENUS MONALYSIDIUM Chapman, 1900

Monalysidium politum Chapman, 1900 (Plate 13, Fig. 12)

Peneroplis (Monalysidium) polita Chapman, 1900, Linn. Soc. London, Journ. Zool., vol. 28, p. 179, p. 4, Pl. 1, Fig. 5.

Monalysidium politum (Chapman), Heron-Allen and Earland, 1915, Trans. Zool. Soc. London, vol. 20, p. 603.

Diagnosis. Test in early stages close-coiled, later uncoiled portion elongate, arcuate, chambers globular; wall imperforate, smooth; aperture circular, terminal.

Discussion. This species occurs as single specimens at stations 37 and 59.

GENUS SPIROLINA Lamarck, 1804

Spirolina acicularis (Batsch), 1791 (Plate 13, Fig. 13)

Nautilus (Lituus) acicularis Batsch, 1791, Conch. See., p. 3, Pl. 6, Fig. 16.

Spirolinites cylindricus Lamarck, 1804, Ann. Mus., vol. 5, p. 245.

Peneroplis cylindricus Brady, 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 205, Pl. 13, Figs. 20, 21.

Spirolina acicularis Cushman, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, p. 42, Pl. 15, Figs. 1-3.

Diagnosis. Test with earliest chambers close-coiled, making up only small portion of test, later portion uniserial; chambers circular in transverse section, as high as broad; wall ornamented by very fine longitudinal striae; aperture consists of one or more pores in middle of terminal face.

Discussion. This species occurs at eight stations in low frequencies.

Spirolina arietinus (Batsch), 1791 (Plate 13, Figs. 14)

Nautilus (Lituus) arietinus Batsch, 1791, Conch. See., p. 4, Pl. 6, Fig. 15.

Peneroplis arietinus Parker, Jones and Brady, 1865, Ann. Mag. Nat. Hist., ser. 3, vol. 16, p. 26, Pl. 1, Fig. 18.

Peneroplis pertusus (Forsk.) var. arietinus Cushman, 1917, U.S. Nat. Mus., Bull. 71, pt. 6, p. 88, Pl. 36, Fig. 5.

Spirolina arietinus Cushman, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, p. 43, Pl. 15, Figs. 4, 5.

Diagnosis. Test close-coiled in early portion, but not completely involute, somewhat compressed, later portion becomes uncoiled; chambers broadly elliptical in transverse section; sutures distinct; wall longitudinally striate; aperture consists of series of independent pores in central portion of apertural face.

Discussion. This species occurs at only three stations in very low frequencies.

SUBFAMILY MEANDROPSININAE Henson, 1948

GENUS BROECKINA Munier-Chalmas, 1882

Broeckina orbitolitoides (Hofker), 1930 (Plate 13, Fig. 15)

Praesorites orbitolitoides Hofker, 1930, Sigboda-Expedite, pt. 2, p. 149, Pl. 55, Figs. 8, 10, 11, Pl. 57, Figs. 1-5, Pl. 61, Figs. 3, 14.

Diagnosis. Test discoid; periphery bluntly rounded; early stage planispiral becoming flaring, later stage series of annular chambers, all chambers divided into chamberlets; sutures pronounced, depressed, curved; wall smooth; aperture a series of peripheral pores.

Discussion. This species occurs at only seven stations, in low to medium frequencies.

SUBFAMILY ARCHAIASINAE Cushman, 1927

GENUS ARCHAIAS Montfort, 1808

Archaias angulatus (Fichtel and Moll), 1803 (Plate 14, Figs. 1-3)

Nautilus angulatus Fichtel and Moll, 1803, Test. Micr., p. 112, Pl. 21, 2nd. ed.

Nautilus aduncus Fichtel and Moll, 1803, Test. Micr., p. 115, Pl. 23.

Nautilus orbicularis Fichtel and Moll, Test. Micr., p. 112, Pl. 21.

Archaias spirens Montfort, 1808, Conch. Syst., p. 190, 48^e genre.

Helenis spatousus Montfort, 1808, Conch. Syst., p. 195, 49^e genre.

Ilotus rotalitus Montfort, 1808, Conch. Syst., p. 199, 50^e genre.

Orbulina adunca Lamarck, 1816, Tabl. Encycl. Meth., Pl. 468, Figs. 2a-c.

Orbiculina angulata Lamarck, 1822, Anim. sans Vert., vol. 7, p. 609, no. 2.

Orbulina numismalis Lamarck, 1822, Hist. Anim. sans Vert., vol. 7, p. 609.

Archaias angulatus Cushman, 1928, Spec. Publ. No. 1, Cush. Lab. Foram. Res., p. 218, Pl. 31, Fig. 9.

Diagnosis. Test compressed, early portion close-coiled, in later portion becoming widely flaring, annular, or uniserial; periphery truncate; early chambers simple, later ones divided into series of chamberlets; wall imperforate except for proloculus and following chamber which are perforate; aperture consists of pore series on apertural face.

Discussion. This is the most highly variable species encountered in this investigation. The greatest variability is exhibited in specimens with annular or uniserial adult stages. The types of adult chamber arrangements consist of specimens possessing broadly flaring chambers, chambers arranged in annual series, and those with chambers arranged in a uniserial sequence. Atypical growth occurs among these three types. In some forms with uniserial stages the apertural faces may be thickened so that the aperture appears to be multiple areal instead of a linear series of pores, or the uniserial stage may be twisted giving the whole test an undulating surface. Both uniserial and annular stages may show division into a three-pronged arrangement. The axis of coiling between the planispiral and subsequent stages may change to such a degree that the adult stage may partially or completely envelope the planispiral stage.

Adult specimens of Archaias angulatus with annular chambers are similar to Archaias compressus, the latter, however, is much more compressed and the periphery is not truncate.

Archaias angulatus is the most abundant species encountered in this investigation. It occurred at 95 stations, usually in high frequencies. It is absent from only a few of the stations in the most restricted part of the bay adjacent to the mainland, and from those stations with the greater depths.

Archaias compressus (d'Orbigny), 1839 (Plate 14, Fig. 4)

Orbiculina compressus d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 73, Pl. 8, Figs. 4-7.

Archaias compressus Cushman, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, p. 48, Pl. 17, Figs. 1, 2.

Diagnosis. Test circular in outline, early portion with several layers of chamberlets, chambers much thicker than in later growth which is annular, chamberlets in later portion in single or double layer, greatest thickness of test formed by early involute portion; wall calcareous, imperforate, except in proloculus and second chamber; aperture in adult formed by marginal row of pores, single or double.

Discussion. This species resembles adult specimens of Archaias angulatus with annular chambers but is more compressed and does not possess a truncate periphery.

Archaias compressus occurs at 73 stations usually in fairly high frequencies. It is absent from the more restricted parts of the bay and from the deeper-water stations.

SUBFAMILY SORITINAE Ehrenberg, 1839

GENUS SORITES Ehrenberg, 1839

Sorites marginalis (Lamarck), 1816 (Plate 14, Figs. 5, 6)

Orbulites marginalis Lamarck, 1816, Syst. Anim. sans Vert., vol. 2, p. 196.

Orbitolites marginalis Carpenter, 1883, Philos. Trans., vol. 174, p. 560, Fig. 1.

Sorites marginalis Cushman, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, p. 49, Pl. 18, Figs. 1-4.

Diagnosis. Test thin much compressed, circular in outline; whole test composed of single layer of chambers each with single layer of chamberlets throughout; early chambers spiral, later extending back, finally meeting; sutures distinct; chambers, chamberlets clearly

visible; aperture consists of single row of pores along periphery of test.

Discussion. Sorites marginalis occurs at 41 stations in low to medium frequencies. Its distribution appears to be centered around the middle of the bay and the lower Florida Keys.

FAMILY ALVEOLINIDAE Ehrenberg, 1839

GENUS BORELIS Montfort, 1808

Borelis pulchra (d'Orbigny), 1839 (Plate 14, Fig. 7)

Alveolina pulchra d'Orbigny, 1839, in De la Sagra, Hist. Fis. Nat. Cuba, "Foraminiferes", p. 70, Pl. 8, Figs. 19, 20.

Alveolina melo (part) (not Fichtel and Moll), Brady, 1884, Rep. Voy. Challenger, Zool., v. 9, p. 223, Pl. 17, Figs. 14, 15.

Borelis pulchra Cushman, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, p. 55, Pl. 15, Figs. 9, 10.

Diagnosis. Test small, completely involute, globular or slightly fusiform; chambers distinct, usually four in coil, divided into elongate chamberlets, chamberlets not subdivided, growing edge low, connecting two umbilici; wall imperforate, milky-white; apertures consisting of single row of rounded pores, one to each chamberlet, in apertural face.

Discussion. This species is represented by single specimens at only three stations.

SUBORDER ROTALIINA Delage and Herouard, 1896

SUPERFAMILY NODOSARIACEA Ehrenberg, 1838

FAMILY NODOSARIIDAE Ehrenberg, 1838

SUBFAMILY NODOSARIINAE Ehrenberg, 1838

GENUS NODOSARIA Lamarck, 1812

Nodosaria albatrossi Cushman, 1923 (Plate 14, Figs. 8, 9)

Nodosaria vertebralis (Batsch) var. albatrossi Cushman, 1923, U.S. Nat. Mus., Bull. 104, pt. 4, p. 87, Pl. 15, Fig. 1.

Diagnosis. Test elongate, gradually tapering, often slightly curved, proloculus often with greater width than those immediately following; chambers numerous, distinct, not inflated, except those near apertural end; sutures broad, of clear shell material, not depressed except near apertural end; wall ornamented by numerous longitudinal costae, typically 15-18 in adult, continuous from one chamber to another, sharp at periphery, broader at base; initial end of test with short stout spine; aperture slightly extended, radiate.

Discussion. This species is represented at only two stations in very low frequencies.

Nodosaria flintii Cushman, 1923 (Plate 14, Fig. 11)

Nodosaria obliqua Brady (part) (not Linnaeus), 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 513, Pl. 64, Figs. 20-22.

Nodosaria flintii Cushman, 1923, U.S. Nat. Mus., Bull. 104, p. 85, Pl. 14, Fig. 1.

Diagnosis. Test very elongate, slender, gracefully tapering, somewhat curved, initial end with stout spine; chambers numerous, early ones indistinct, last-formed ones much more distinct; sutures of early portion often indistinct, not depressed; surface ornamented by longitudinal costae, increasing in number as diameter of test increases, earlier ones spirally twisted, reaching to or onto terminal spine, later ones straight, in adult 15-20, running to apertural end, ends forming tooth-like crown about aperture, costae with peripheral portion

rounded, often broadest in central portion of chamber, narrowing over sutures; aperture with tapering neck, usually eccentric.

Discussion. This species is represented at only three stations in very low frequencies.

Nodosaria pyrula d'Orbigny, 1826 (Plate 14, Fig. 12)

Nodosaria pyrula d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 253, no. 13.

Diagnosis. Test elongate, very slender, composed of numerous chambers, either in straight or slightly curved line, pyriform in shape, with long tapering necks; surface smooth, chambers varying little in size; proloculus extended backward in long drawn out point.

Discussion. This species is represented at only one station by a few specimens.

Nodosaria sp. (Plate 14, Fig. 13)

Diagnosis. Test short, blunt, straight, initial end with minute, blunt spine; composed of three chambers with middle chamber of lesser diameter than other two, last-formed chamber tapering toward apertural end; surface ornamented by numerous, fine, longitudinal costae; aperture with tapering neck.

Discussion. Only one specimen of this species occurred, at station 101.

GENUS AMPHICORYNE Schlumberger, 1881

Amphicoryne hirsuta (d'Orbigny), 1826 (Plate 14, Fig. 14)

Nodosaria hirsuta d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 252, no. 7.

Nodosaria hispida d'Orbigny, 1846, For. Foss. Bass. Tert. Vienne, p. 35, Pl. 1, Figs. 24, 25.

Amphicoryne hirsuta Parr 1929, B.A.N.Z. Ant. Res. Exped., Ser. B. vol. 1, no. 2, p. 328.

Diagnosis. Test tapering, elongate, composed of few chambers, globular, surface covered with spines of varying coarseness, chambers close-set or separated by stolon-like connections; aperture at end of tubular neck.

Discussion. This species is represented at only four stations usually in low frequencies.

Amphicoryne scalaris (Batsch), 1791 (Plate 14, Fig. 15)

Nautilus (Orthoceras) scalaris Batsch, Conch. des Seesandes, no. 4, Pl. 2, Fig. 4.

Nodosaria scalaris Parker and Jones, 1865, Phil. Trans., vol. 155, p. 340, Pl. 16, Fig. 2.

Diagnosis. Test straight; segments comparatively few, generally from 3-6 in adult, never more than 8, inflated or subglobular, increasing rapidly, though not always regularly, in size; final chamber drawn out at apertural end into tube of some length with terminal phialine lip, opposite extremity of test commonly mucronate; superficial costae vary in number and thickness.

Discussion. This species is represented by single specimens at only two stations.

GENUS DENTALINA d'Orbigny, 1839

Dentalina communis d'Orbigny, 1826 (Plate 14, Figs. 16, 17)

Nodosaria (Dentalina) communis d'Orbigny, 1826, Ann. Sci. Nat., Vol. 7, p. 254, no. 35.

Dentalina communis d'Orbigny, 1840, Mem. Soc. Geol. France, vol. 4, p. 13, Pl. 1, Fig. 4.

Diagnosis. Test elongate, slender, tapering, straight or slightly curved, composed of numerous chambers, slightly inflated toward apical end, later ones becoming more inflated; sutures oblique; aperture radiate, somewhat eccentric, somewhat elongate; surface smooth.

Discussion. This species is represented by single specimens at only two stations.

Dentalina filiformis (d'Orbigny), 1826 (Plate 15, Fig. 1)

Nodosaria filiformis d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 253, no. 14.

Dentalina filiformis Parker, Jones and Brady, 1871, Ann. Mag. Nat. Hist., ser. 4, vol. 8, p. 156, Pl. 9, Fig. 48.

Diagnosis. Test elongate, slender, arcuate, chambers numerous, elliptical or ovate, elongate, tumid; sutures usually oblique, chambers increasing in length toward apertural end; aperture radiate, slightly eccentric; wall smooth.

Discussion. This species is represented at only three stations by very few specimens.

GENUS FRONDICULARIA DeFrance, 1824

Frondicularia sagittula van den Broeck, 1876 (Plate 15, Fig. 2)

Frondicularia alata d'Orbigny var. sagittula van den Broeck, 1876, Soc. Belge Micr., Ann., Tome 2, pp. 113, 115, Pl. 2, Figs. 12, 14.

Diagnosis. Test triangular, lanceolate in front view, terminated abruptly behind on level of initial chamber; chambers prolonged in uniform manner, terminated following line perpendicular to grand axis of test on level of initial chamber; wall vitreous, transparent, chambers white, material between chambers clear; aperture terminal, radiate.

Discussion. This species is represented by a single specimen at station 103.

GENUS LAGENA Walker and Boys, 1784

Lagena striata (d'Orbigny), 1839 (Plate 15, Fig. 3)

Oolina striata d'Orbigny, 1839, Foram. Amer. Merid., p. 21, Pl. 5, Fig. 12.

Lagena striata Reuss, 1862; Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, p. 237, Pl. 3, Figs. 44, 45; Pl. 4, Figs. 46, 47.

Diagnosis. Test flask-shaped, nearly circular in cross section, body of test subglobular, neck variable in length, usually rather abruptly contracted from body of test at base; surface ornamented with numerous rather fine costae running entire length of test, apical end typically broadly rounded, occasionally slightly tapering to point.

Discussion. This species is represented by a single specimen at station 107.

Lagena sp. (Plate 15, Figs. 4, 5)

These single specimens of two species of Lagena were found at station 106. Due to the extreme small size and slightly eroded condition of the specimens specific identification was not attempted.

GENUS LENTICULINA Lamarck, 1804

Lenticulina calcar (Linnaeus), 1767 (Plate 15, Fig. 7)

Nautilus calcar Linnaeus, 1767, Syst. Nat., 12th ed., p. 1162, no. 272.

Cristellaria calcar Parker, Jones and Brady, 1871, Ann. Mag. Nat. Hist., ser. 4, vol. 8, p. 241, 242, Pl. 10, Figs. 91, 93, 94.

Lenticulina calcar, Thalmann, 1932, Eclog. geol. Helvet., vol. 25, no. 2, p. 304.

Diagnosis. Test biconvex or lenticular, more or less carinate, armed with number of radiating peripheral teeth or spines; sutures sometimes slightly limbate, otherwise exterior smooth, without ornamentation.

Discussion. This species is represented only at station 106, but there it is one of the most abundant. This location has the second greatest depth of any of the sites investigated, 95 m. It is quite probable that this is a species which lives in considerably deeper water than most of those present throughout the area.

Lenticulina iota (Cushman), 1923 (Plate 15, Fig. 7)

Cristellaria cultrata Brady (not Montfort), 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 550, Pl. 70, Figs. 4-6.

Cristellaria iota Cushman, 1923, U.S. Nat. Mus., Bull. 104, p. 111, Pl. 29, Fig. 2; Pl. 30, Fig. 1.

Lenticulina iota Thalmann, 1932, Eclog. geol. Helvet., vol. 25, no. 2, p. 304.

Diagnosis. Test close-coiled, compressed, umbonate, periphery with thin, broad keel, nearly transparent, 13-15 chambers in last-formed coil, narrow; sutures slightly curved, very slightly limbate, but not raised above general outline of test, umbonal region occupied by large, thickened, transparent knob; wall smooth, thin; aperture radiate, at peripheral angle of test, those of early chambers distinct throughout last-formed coil.

Discussion. Like Lenticulina calcar this species is only present at station 106, but is also quite abundant. It, like all the species of Lenticulina observed during this investigation, is probably indicative of deeper water than is normally found in the area.

Lenticulina peregrina (Schwager), 1866 (Plate 15, Fig. 8)

Cristellaria peregrina Schwager, 1866, Wien Geol. Theil. vol. 2, p. 245, Pl. 7, Fig. 89.

Lenticulina peregrina Thalmann, 1932, Eclog. geol. Helvet., vol. 25, no. 2, p. 304.

Diagnosis. Test oblong, elliptical in outline, moderately inflated in middle, some deposits on sides; four chambers of last coil visible, slightly inflated, increasing rapidly in size, almost at right angle to earlier portion of test; broad, thin flange extends over entire test, of clear material, distinct part of each individual chamber; aperture simple tube, small, at top of last-formed chamber, raised above outline of test, sometimes highly fistulose; shell thin, vitreous.

Discussion. This species, like all the species of Lenticulina in this area, is only present at station 106, where it is common.

Lenticulina sp. (Plate 15, Fig. 9)

Diagnosis. Test close-coiled, compressed, periphery with broad keel, nearly transparent; sutures curved, slightly limbate, even with surface of test; wall smooth thin; aperture radiate, with median slit extending down onto apertural face, at peripheral angle of test, earlier apertures visible throughout last-formed coil.

Discussion. This species is represented by a few specimens at stations 106 and 107. Formerly species with the apertural slit were placed in the genus Robulus, but Loeblich and Tappan (1964) relegated the later as a synonym of Lenticulina. Their findings are followed here.

GENUS MARGINULINA d'Orbigny, 1826

Marginulina planata Phleger and Parker, 1951 (Plate 15, Fig. 10)

Marginulina planata Phleger and Parker, 1951, Mem. 46, G.S.A., pt. 2, p. 9, Pl. 4, Figs. 21, 22; Pl. 5, Figs. 1-3.

Diagnosis. Test large, compressed; periphery rounded on inner side, with thin, plate-like keel on outer side which sometimes is not present along last-formed chambers in adult; 7 or 8 chambers in uniserial portion, distinct, often inflated on inner side of test; sutures distinct, limbate, flush with surface, showing as darkened areas, curving downward toward inner side of test; wall with about 7 thin, plate-like costae on each side, often broken to produce nodular effect in initial part of test, otherwise smooth, finely perforate.

Discussion. This species occurs at seven stations, all located in the somewhat deeper waters of the part of the Gulf of Mexico adjacent to Florida Bay, in low to medium frequencies.

Marginulina sp. (Plate 15, Fig. 11)

Diagnosis. Test laterally compressed, periphery almost truncate, lacking keel; 6 or 7 chambers in uniserial portion of test; sutures distinct, limbate, flush with surface, curving downward toward inner side of test; wall with about ten regular costae on each side, smooth, transparent; aperture produced.

Discussion. This species differs from Marginulina planata in being smaller, having an almost truncate periphery, having one or two less chambers in the uniserial portion of the test, in having more costae which are elongate and not broken, and in being completely transparent. It occurs at only two stations: 103 where it is rare, and 107 where it is common.

GENUS PSEUDONODOSARIA Boomgaard, 1949

Pseudonodosaria comatula (Cushman), 1923 (Plate 14, Fig. 10)

Nodosaria comatula Cushman, 1923, U.S. Nat. Mus., Bull. 104, pt. 4, p. 83, Pl. 14, Fig. 5.

Diagnosis. Test short, stout, composed of few chambers, initial end broadly rounded, sometimes with a small central spine, apertural end slightly tapering; chambers inflated, giving somewhat lobulate appearance to periphery; sutures distinct, somewhat depressed; surface ornamented by numerous low, rounded, longitudinal costae, close together, 35-45 in last-formed chamber of adult, continuous from one chamber to another, apertural end of last-formed chamber sometimes smooth in adult; apertural central, terminal, cribrate.

Discussion. This species is represented by rare specimens at stations 101, 102 and 103.

Pseudonodosaria rotundata (Reuss), 1850 (Plate 15, Fig. 12)

Glandulina rotundata Reuss, 1850, Akad. Wiss. Wien. v. 1, p. 366, Pl. 46, Fig. 2.

Nodosaria (Glandulina) rotundata Brady, 1884, Rep. Voy. Challenger, Zool., v. 9, p. 491, Pl. 61, Figs. 17-19.

Pseudoglandulina rotundata Chapman and Parr, 1937, Aus. Ant. Exped., Ser. C, v. 1, pt. 2, p. 62.

Rectoglandulina rotundata Barker, 1960, S.E.P.M. Spec. Publ. 9, p. 61, Figs. 17-19.

Diagnosis. Test oval or subovate, broadest in middle, composed of few chambers, apical end broadly rounded, without spines, apertural end more elongate; aperture radiate; last-formed chamber occupying one-half or more of visible test.

Discussion. This species is represented by a single specimen at station 106.

Pseudonodosaria torrida (Cushman), 1923 (Plate 15, Fig. 13)

Nodosaria laevigata Flint (not d'Orbigny), 1897, Rep. U.S. Nat. Mus., p. 308, Pl. 55, Fig. 3.

Nodosaria (Glandulina) laevigata d'Orbigny var. torrida Cushman, 1923, U.S. Nat. Mus., Bull. 104, pt. 4, p. 65, Fig. 10.

Rectoglandulina torrida Barker, 1960, S.E.P.M., Spec. Publ. 9, Pl. 61, Figs. 20-22.

Diagnosis. Test short, tumid, initial end very acute, often with spine in microspheric form, obtuse in megalospheric form, circular in cross section; chambers inflated, very strongly overlapping, arranged at first in biserial series, abruptly becoming uniserial in microspheric form, entirely uniserial in megalospheric form; sutures not depressed, distinct; wall smooth, rather thick; aperture radiate.

Discussion. This species is represented by a single specimen at station 106.

GENUS SARACENARIA Defrance, 1824

Saracenaria latifrons (Brady), 1884 (Plate 15, Fig. 14)

Cristellaria latifrons Brady, 1884, Rep. Voy. Challenger, Zool., vol. 9, p. 544, Pl. 68, Fig. 19, Pl. 108, Figs. 11a, b.

Saracenaria latifrons Thalmann, 1932, Eclog. geol. Helvet., vol. 25, no. 2.

Diagnosis. Test spiral, elongate, trihedral, broadest near middle, tapering towards ends; dorsal margin acutely angular, carinate; ventral face broad, oval, somewhat curved, with partially carinate lateral edges; oral extremity pointed, aboral end thin, carinate; early segments small, involute; later chambers long, narrow, slightly curved, obliquely set or almost erect.

Discussion. This species is represented by a single specimen at station 106.

GENUS ASTACOLUS Montfort, 1808

Astacolus crepidulus (Fichtel and Moll), 1803

Nautilus crepidula Fichtel and Moll, 1803, Test. Micr., p. 107, Pl. 19, Figs. g-i.

Cristellaria crepidula d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 64, Pl. 8, Figs. 17, 18.

Astacolus crepidulus Thalmann, 1932, Eclog. geol. Helvet., vol. 25, no. 2, p. 305.

Diagnosis. Test elongate, compressed, early chambers close-coiled, later ones becoming uncoiled, elongate; sutures slightly depressed; wall smooth; periphery rounded, without keel.

Discussion. This species is represented by a single specimen at station 103.

Astacolus reiniformis (d'Orbigny), 1846 (Plate 15, Fig. 15)

Cristellaria reiniformis d'Orbigny, 1846, For. Foss. Vien., p. 88, Pl. 3, Figs. 39, 40.

Astacolus reiniformis Thalmann, 1932, Eclog. geol. Helvet., vol. 25, no. 2, p. 305.

Diagnosis. Test oval, very compressed, with strongly carinate edge at periphery; wall smooth, polished; composed of 11 chambers, narrow, oblique, not convex, from which complete coil is built, every chamber reaches center; aperture small, radiate; perforate.

Discussion. This species is represented by a single specimen at station 106.

FAMILY POLYMORPHININAE d'Orbigny, 1839

SUBFAMILY POLYMORPHININAE d'Orbigny, 1839

Polymorphinidae, Formae fistulosae (Plate 16, Fig. 1)

Discussion. A few specimens of this form occur at station 104.

GENUS GUTTULINA d'Orbigny, 1839

Guttulina australis (d'Orbigny), 1839 (Plate 16, Fig. 2)

Globulina australis d'Orbigny, 1839, Voy. Amer. Merid., vol. 5, pt. 5, p. 60, Pl. 1, Figs. 1-4.

Polymorphina australis Brady, Parker and Jones, 1869, Trans. Linn. Soc., vol. 27, p. 239, Pl. 41, Figs. 27a, b.

Polymorphina regina Cushman, 1921, U.S.G.S. Prof. Paper 129, p. 194, Pl. 18, Fig. 4.

Diagnosis. Test fusiform, initial end rounded, apertural end acute, margin slightly lobulate; chambers clavate, but little embracing, arranged in counter-clockwise, quinqueloculine series, each succeeding chamber removed from base; sutures depressed, distinct; wall ornamented with fine longitudinal costae, generally well developed on lower half of test; aperture radiate.

Discussion. This species is represented by only a few specimens at station 104.

Globulina sp. (Plate 16, Fig. 3)

This species of Globulina is represented by a single specimen at station 104. It differs from most species of the genus in having the early chambers greatly reduced in size leaving the greater portion of the test made up by the last-formed chamber.

GENUS PYRULINA d'Orbigny, 1839

Pyrulina cylindroides (Roemer), 1838 (Plate 16, Fig. 4)

Polymorphina cylindroides Roemer, 1838, Neues Jahrb., p. 385, Pl. 3, Fig. 26.

Polymorphina fusiformis Cushman (not Roemer), 1926, Bull. A.A.P.G., vol. 10, p. 604, Pl. 20, Fig. 14.

Diagnosis. Test elongate, fusiform to cylindrical, acuminate toward both extremities, almost circular in cross section; chambers elongate, not much embracing, arranged in early triserial series, tending to become biserial, each succeeding chamber farther removed from base; sutures but little depressed; wall smooth; aperture radiate.

Discussion. This species is represented by a few specimens from station 1, which is located in 587 meters of water and is far deeper than any of the other stations.

FAMILY GLANDULINIDAE Reuss, 1860

SUBFAMILY OOLININAE Loeblich and Tappan, 1961

GENUS FISSURINA Reuss, 1850

Fissurina submarginata (Boomgaard), 1949 (Plate 16, Figs. 5, 6)

Vermiculum marginatum Montagu, 1803, Test. Brit., p. 524.

Entosolenia submarginata Boomgaard, 1949, Smaller foraminifera from Bodjonegoro (Java): Utrecht Univ., doct. diss., p. 107.

Fissurina submarginata (Boomgaard) Barker, 1960, S.E.P.M. Spec. Publ. 9, p. 124, Pl. 59, Figs. 21, 22.

Diagnosis. Test more or less compressed, rounded in front view; wall smooth, bordered by peripheral keel of greater or less width, solid or with radiating tubuli; aperture usually fissurine.

Discussion. This species is represented by a single specimen at station 103.

Fissurina wiesneri (Walker and Boys), 1784 (Plate 16, Figs. 7, 8)

Serpula (Lagena) Marginata Walker and Boys, 1784, Test. Min., p. 2, Pl. 1, Fig. 7.

Vermiculum marginatum Montagu, 1803, Test. Brit., p. 524.

Entosolenia marginata Williamson (part), 1848, Ann. Mag. Nat. Hist., ser. 2, vol. 1, p. 17, Pl. 2, Figs. 15-17.

Lagena marginata Brown, 1827, Illus. Conch. Gt. Brit., Pl. 1, Figs. 30, 31.

Fissurina wiesneri Barker, 1960, S.E.P.M., Spec. Publ. no. 9, p. 124, Pl. 59, Fig. 23.

Diagnosis. Test more or less compressed, rounded in front view; wall smooth, bordered by peripheral keel of greater or less width, solid or with radiating tubuli; aperture usually fissurine.

Discussion. This species is represented by a single specimen at station 4.

SUPERFAMILY BULIMINACEA Jones, 1875

FAMILY TURRILINIDAE Cushman, 1927

SUBFAMILY TURRILININAE Cushman, 1927

GENUS BULIMINELLA Cushman, 1911

Buliminella elegantissima d'Orbigny, 1839 (Plate 16, Fig. 9)

Bulimina elegantissima d'Orbigny, 1839, Voy. Amer. Merid., vol. 5, pt. 5, p. 51, Pl. 7, Figs. 13, 14.

Diagnosis. Test elongate spiral; spiral sutures distinct; chambers 3 or more to whorl, twisted; wall calcareous, finely perforate, translucent; aperture flaring, loop-shaped, slightly twisted.

Discussion. This species occurs at four stations in low to medium frequencies.

FAMILY BOLIVINITIDAE Cushman, 1927

GENUS BOLIVINA d'Orbigny, 1839

Bolivina of B. barbata Phleger and Parker, 1951 (Plate 16, Fig. 10)

Bolivina barbata Phleger and Parker, 1951, Mem. G.S.A., vol. 46, pt. 2, p. 13, Pl. 6, Figs. 12a, b, 13.

Diagnosis. Test small, two and one-half to three times as long as broad, broadest near apertural end, tapering gradually, compressed, with narrow carina broken at basal portion of each chamber into sharp, down-curving projection; chambers somewhat inflated, increasing gradually in size as added, distinct, maximum of fourteen pairs; sutures distinct, narrow, strongly curved, showing as clear, dark lines, slightly depressed; wall smooth, finely perforate, with transparent imperforate area curving across top of inner part of each chamber; aperture very narrow, elongate slit.

Discussion. This species is represented by a single specimen at station 31.

Bolivina fragilis Phleger and Parker, 1951

Bolivina fragilis Phleger and Parker, 1951, Mem. G.S.A., vol. 46, pt. 2, p. 13, Pl. 6, Figs. 14, 23, 24.

Diagnosis. Test about three times as long as broad, compressed, slightly tapering, usually with short spine at initial end, periphery acute, usually carinate, with keel; numerous chambers, gradually increasing in size; wall with five or less low costae extending from initial end, otherwise smooth, rather coarsely perforate; aperture narrow.

Discussion. This species is represented by single specimens at only three stations.

Bolivina goesii Cushman, 1922 (Plate 16, Fig. 11)

Bolivina goesii Cushman, 1922, Bull. 104, U.S. Nat. Mus., pt. 3, p. 34, Pl. 6, Fig. 5.

Diagnosis. Test rhomboid, tapering toward initial end to blunt point, apertural end angular, much compressed, periphery slightly, if at all, lobulated; chambers fairly numerous, distinct, narrow, at inner end usually with ventral-pointing projection, somewhat rounded; sutures distinct, very slightly depressed, irregular due to peculiar shape of inner end of chambers; wall smooth, finely punctate; aperture narrow, slightly elongate.

Discussion. This species is represented by a single specimen at station 103.

Bolivina hastata Phleger and Parker, 1951

Bolivina hastata Phleger and Parker, 1951, Mem. G.S.A., vol. 46, pt. 2, p. 13, Pl. 6, Figs. 18, 19.

Diagnosis. Test small, compressed, tapering, initial end subacute, apical end ovate, periphery acute, often with narrow keel extending two-thirds distance up test from initial end; wall usually with several low costae extending from initial end about one-third up test, otherwise smooth, finely perforate; aperture narrow.

Discussion. This species is represented by a single specimen at station 19.

Bolivina inflata Heron-Allen and Earland, 1913 (Plate 16, Fig. 12)

Bolivina inflata Heron-Allen and Earland, 1913, Royal Irish Acad. Proc., vol. 31, pt. 64, p. 68, Pl. 4, Figs. 16-19.

Diagnosis. Test wedge-shaped, consisting of five to nine pairs of chambers rapidly increasing in breadth and thickness, terminal portions of test inflated; marginal edges rounded; sutures slightly depressed; wall coarsely punctate, surface hyaline; aperture somewhat variable, usually bolivine, at extremity of terminal chamber.

Discussion. This species is represented by a single specimen at station 92.

Bolivina lanceolata Parker, 1954 (Plate 16, Fig. 13)

Bolivina lanceolata Parker, 1954, Bull. Comp. Zool., vol. 111, no. 10, p. 514, Pl. 7, Figs. 17-20.

Diagnosis. Test regularly tapered, initial end sometimes with very short spine, compressed, periphery acute, sometimes with narrow keel; chambers numerous, uninflated, narrow, increasing gradually in height as added; wall with medium-size perforations except on clear areas on inner, upper portion of earlier chambers; aperture narrow.

Discussion. This species is randomly distributed, occurring at 18 stations, usually in low

frequencies.

Bolivina lowmani Phleger and Parker, 1951 (Plate 16, Fig. 14)

Bolivina lowmani Phleger and Parker, 1951, Mem. G.S.A., vol. 46, pt. 2, p. 13, Pl. 6, Figs. 20, 21.

Diagnosis. Test small, very slightly tapering to subacute or somewhat rounded initial end, periphery rounded, slightly lobulate; chambers numerous, slightly curved; wall smooth, with medium-sized perforations, often transparent; aperture loop-shaped.

Discussion. This species occurs at only six stations in very low frequencies.

Bolivina paula Cushman and Cahill, 1932 (Plate 16, Fig. 15)

Bolivina paula Cushman and Cahill, 1932, Bull. Fla. State Geol. Surv., vol. 9, p. 84, Pl. 12, Fig. 6.

Diagnosis. Test small, compressed, tapering regularly throughout; chambers increasing gradually in size as added, ten pairs in adult; sutures limbate; wall smooth, perforate; aperture narrow slit.

Discussion. This species occurs at 21 stations in low to medium frequencies. All the stations at which it occurs are in very shallow water.

Bolivina pulchella var. primitiva Cushman, 1930 (Plate 17, Fig. 1)

Bolivina pulchella (d'Orbigny) var. primitiva Cushman, 1930, Bull. Fla. State Geol. Surv., vol. 4, p. 47, Pl. 8, Fig. 12.

Diagnosis. Test small; chambers comparatively few, increasing rapidly in size as added, terminating in sharp downward projections, ornamented by series of short, longitudinal costae; wall translucent, very finely punctate; aperture elongate, narrow opening running width of last-formed chamber.

Discussion. This species is represented by few specimens at only four stations.

Bolivina striatula Cushman, 1922 (Plate 17, Fig. 2)

Bolivina striatula Cushman, 1922, Carnegie Inst. Wash., Publ. 311, p. 27, Pl. 3, Fig. 10.

Diagnosis. Test elongate, gradually tapering from somewhat rounded initial end to broad apertural end; chambers numerous; early portion of test with numerous longitudinal striations occupying about half length of test, final chambers smooth; wall finely perforate; aperture narrow slit.

Discussion. This species occurs at six stations in low frequencies.

Bolivina subaenariensis var. mexicana Cushman, 1922 (Plate 17, Fig. 3)

Bolivina subaenariensis Cushman, var. mexicana Cushman, 1922, U.S. Nat. Mus., Bull. 104, pt. 3, p. 44, Pl. 8, Fig. 1.

Diagnosis. Test elongate, much compressed, abruptly tapering especially towards apex of test, periphery acute, often carinate, surface ornamented by numerous costae running nearly to apertural end of test; chambers distinct, curved, widest near center; sutures distinct, slightly depressed; wall finely punctate, translucent; aperture semicircular.

Discussion. This species occurs at only two stations in very low frequencies.

Bolivina subspinescens Cushman, 1922 (Plate 17, Fig. 4)

Bolivina subspinescens Cushman, 1922, U.S. Nat. Mus., Bull. 104, pt. 3, p. 48, Pl. 7, Fig. 5.

Diagnosis. Test minute, elongate, tapering, apical end bluntly pointed, apertural end angular, periphery lobulate; chambers distinct, angular, concave, ventral, outer portion smooth, lower angle finely spinose; sutures distinct, depressed; wall calcareous, outer part smooth, remainder covered with short close-set spines, in early portion granular, roughened; aperture rounded.

Discussion. This species occurs at three stations in very low frequencies.

Bolivina sp.

Diagnosis. Test elongate, tapering towards both ends, periphery rounded; chambers slightly inflated, widest near center, distinct; sutures distinct, slightly depressed; wall smooth, calcareous, finely punctate; aperture narrow slit.

Discussion. This species is represented by single specimens at only three stations.

GENUS RECTOBOLIVINA Cushman, 1927

Rectobolivina advena (Cushman), 1922 (Plate 17, Fig. 5)

Siphogenerina advena Cushman, 1922, Carnegie Inst. Wash., Publ. 311, p. 35, Pl. 5, Fig. 2.

Rectobolivina advena Hofker, 1951, Monograph 4a, Vitkom. Zool., Bot. Oceanogr., Geol. Geb., Nederlandsch., p. 116, 232.

Diagnosis. Test elongate, somewhat compressed, early portion either twisted or biserial; later portion, which makes up larger portion of test, uniserial; chambers numerous, distinct, inflated; sutures somewhat depressed, early portion and part of uniserial portion with fine, longitudinal costae, more or less broken, followed by two or three chambers slightly spinose, after which remaining chambers are smooth, very finely punctate; aperture elliptical, each one connecting with preceding one by internal funnel-shaped tube.

Discussion. This species is represented by a single specimen at station 1, in 587 meters of water.

FAMILY ISLANDIELLIDAE Loblich and Tappan, 1964

GENUS CASSIDULINOIDES Cushman, 1927

Cassidulinoides bradyi (Norman), 1880 (Plate 17, Fig. 6)

Cassidulina bradyi (Norman) Wright, 1880, Proc. Belfast Nat. Field Club, p. 152.

Cassidulinoides bradyi Cushman, 1930, Fla. Geol. Surv., Bull. 4, p. 58.

Diagnosis. Test spiral, compressed; oval, reniform, or crosier-shaped; lateral faces convex, peripheral edge thin, sharp or slightly rounded; early segments planispiral, embracing, arranged on normal cassiduline plan; later segments oblique, alternating, forming straight or curved biserial line; aperture loop-shaped, situated on inner face of terminal chamber.

Discussion. This species is represented by a single specimen at station 103.

FAMILY BULIMINIDAE Jones, 1875

SUBFAMILY BULUMININAE Jones, 1875

GENUS BULIMINA d'Oribigny, 1826