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FAUNA AND BATHYMETRY OF BANKS ON CONTINENTAL SHELF, NORTHWEST GULF OF MEXICO[1]

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ABSTRACT

Considerable new information has been obtained on the bathymetry and fauna of several calcareous banks on the continental shelf of the northwest Gulf of Mexico. A compilation of depths to tops and bases of 130 banks on the shelf revealed primary modes of depth occurrences at 9, 31, and 45 fathoms. These modes correspond with well developed terraces at the same depths on the banks studied in detail. Several of the banks were characterized by semi-ring depressions, steep central pinnacles, and flat terraces at several depths.

The fauna collected on these banks at depths of between 24 and 31 fathoms are characteristic of intertidal depths in the West Indies and Caribbean. Many of the mollusks from these banks exhibited sub-specific differences from the species which have been collected from their normal range in the West Indies. Despite the existence of dead reef coral, no living forms were collected. Living lithothamnioids were common on all banks. Evidence suggests that the tops of these banks were in shallow intertidal waters at a time when over-all water temperatures were warmer than at present, and when populations of these faunas were continuous to the West Indies. As sea-level and hydrographic conditions changed, the original fauna became isolated and the corals which appear to form the primary organic capping ceased their growth, leaving horizontal surfaces. The presence of large crystals of gypsum and inclusions of anhydrite from the flanks of one bank may have a bearing on the original topographic high at this place.

INTRODUCTION

A feature peculiar to the outer continental shelf of the northwest Gulf of Mexico is the series of pinnacle-like banks or topographic highs rising abruptly from the generally smooth, sediment-covered bottom. These banks, sometimes called coral heads, have been discussed by Shepard (1937), Mattison (1948), Carsey (1950), Williams (1951), Stetson (1953), Goedicke (1955), and others, but except for a short discussion of the corals and algae and a profile and description of Flower Garden Banks by Stetson (1953, pp. 20–21), no lists of fauna or detailed bathymetry have been published. The data presented in this paper represent recently obtained information on the bathymetry and fauna of these features which may be related to their origin.

BATHYMETRY

Contours of two banks (Fig. 1), known locally as Flower Garden Banks, were published by Carsey (1950, p. 377) and have been reproduced in subsequent

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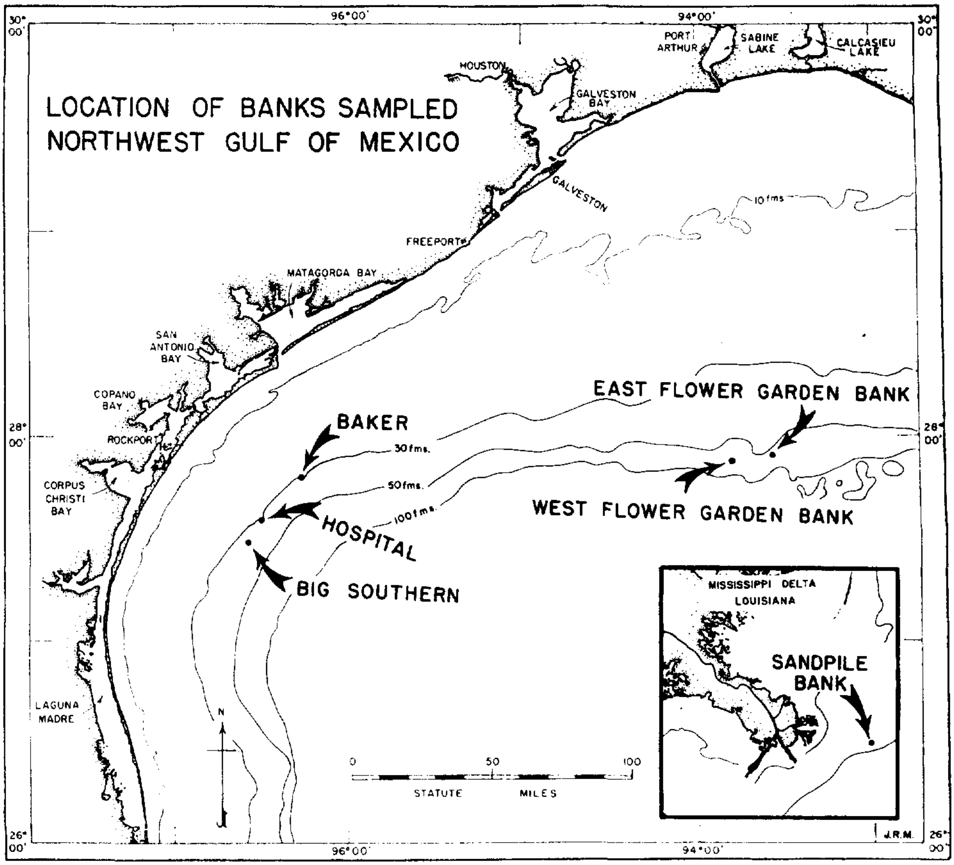


FIG. 1.—Locations of banks sampled, northwest Gulf of Mexico.

papers. In May, 1955, a bathymetric survey was made on the trawler *Neva J.*, and the sounding lines were combined with soundings from the U. S. Coast and Geodetic Survey unpublished *Chart 6291*. The topography of these two banks which lie on the break in slope between the continental shelf and the continental slope is shown in Figures 2 and 3. Features of West Flower Garden Bank (Fig. 2) include: major tops at about 11, 30, and 40 fathoms; a steep central pinnacle (greater than 20° slope) on the highest peak with a relatively flat top at 11 fathoms; well developed terraces at about 45 fathoms; a poorly developed terrace at about 25 fathoms; and a depression at the foot of the slope on the north and west sides. Features of East Flower Garden Bank (Fig. 3) include: a steep central pinnacle (greater than 20° slope) at the top with a relatively flat top at about 10 fathoms; a well developed terrace at about 30 fathoms; and a depression at the base of the slope on the east side.

In June, 1954, northeast-southwest echo-sounding profiles were run on some of the smaller banks located off Aransas Pass, Texas, along the 40-fathom con-

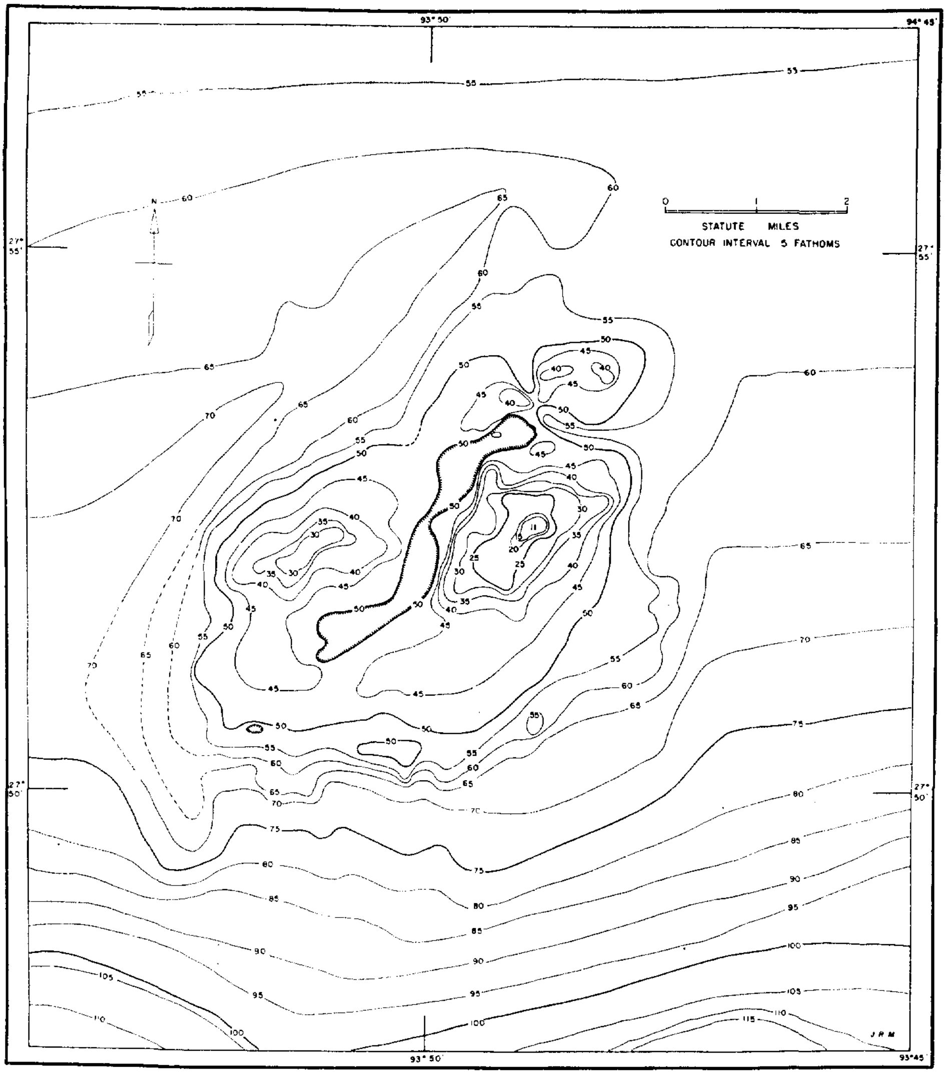


FIG. 2.—Bathymetry of West Flower Garden Bank, off Galveston, Texas.

tour (Fig. 1). Profiles of three of these banks, locally named Baker, Big Southern' and Hospital Banks (Fig. 4), show marginal depressions on both sides. There is also a suggestion of terraces on the flanks, although the existence of such features can not be established from single profiles.

A compilation of depths to the tops and bases of 130 banks was made from U. S. Coast and Geodetic Survey unpublished sounding charts between the Mississippi Delta and the Mexican border. Only banks with more than 2 fathoms

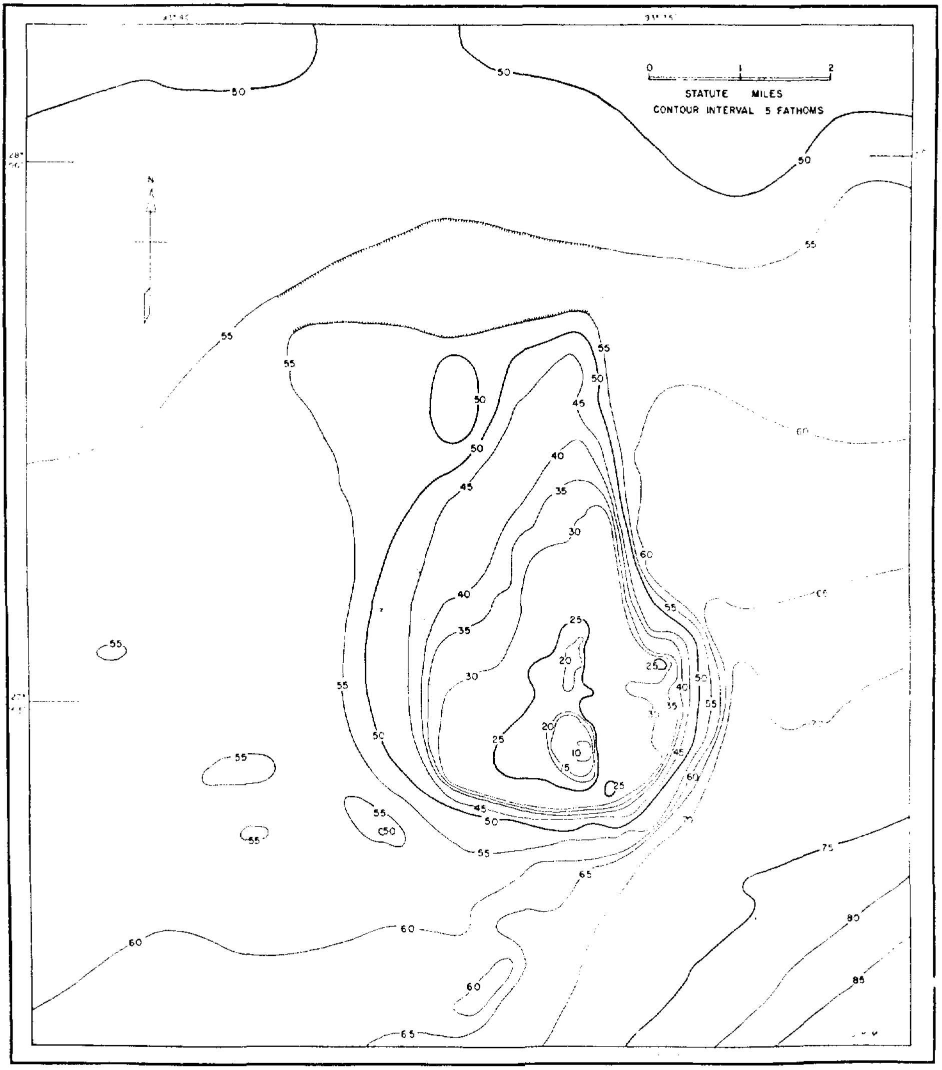


FIG. 3.—Bathymetry of East Flower Garden Bank, off Galveston, Texas.

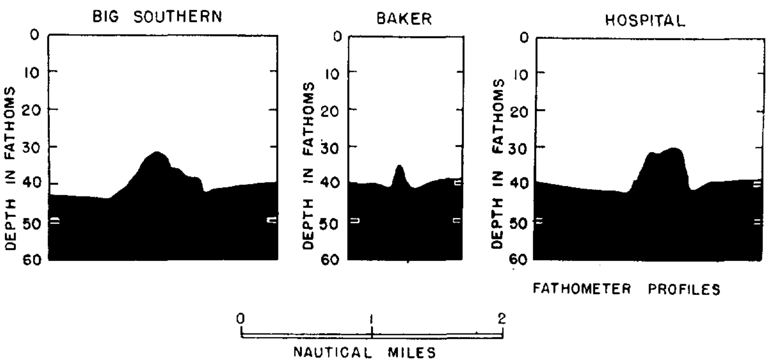


FIG. 4.—Profiles of banks off Aransas Pass, Texas. Locations on Figure 1.

relief which rise above 100 fathoms and have bases in more than 10 fathoms were considered. This tabulation, therefore, includes some low sediment- and shell-covered mounds on the continental shelf as well as the so-called coral heads which are concentrated on the outer shelf. A histogram (Fig. 5) showing the distribution of depths to the tops of these banks has three principal modes of the most commonly occurring depths. These modes are nine fathoms, about 31 to 34 fathoms, and about 45 to 48 fathoms. It is significant that the modes on this histogram very closely approximate the depths of the best developed terraces on the banks studied in detail (Flower Garden Banks), namely, about 30 and 45 fathoms; and the tops of these banks are in the nine-fathom mode.

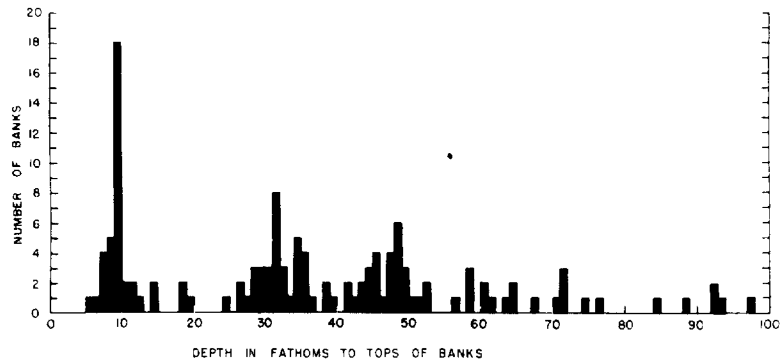


Fig. 5.—Histogram showing depth in fathoms to tops of 130 banks on continental shelf, northwest Gulf of Mexico.

FAUNA

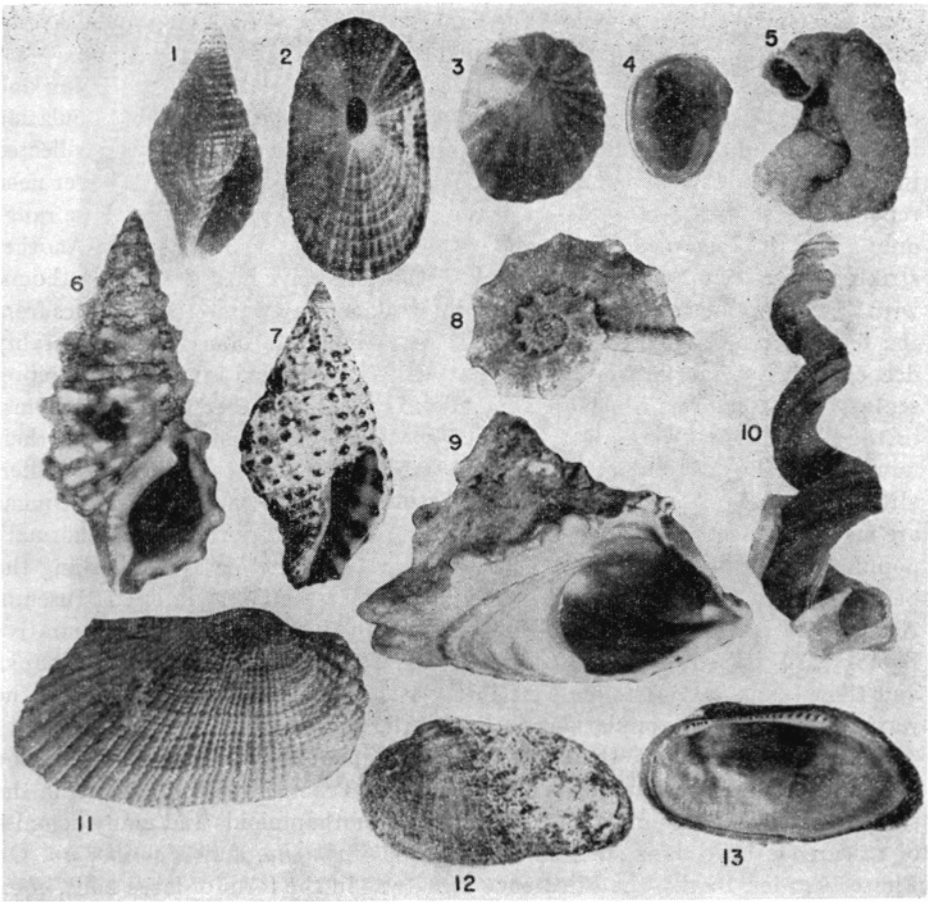
Biological dredge samples were taken from Baker, Big Southern, West and East Flower Garden banks, and from one bank off the Mississippi Delta in 48 fathoms, Sandpile Bank, shown in the inset on Figure 1. A total of 137 species of mollusks was obtained from all of the banks in the northwestern Gulf, and one species of living coral was taken from East Flower Garden Bank. There were fragments and small colonies of dead corals obtained from the other banks which have not yet been identified. Stetson obtained five species of reef corals from the Flower Garden Banks as cited in Table I. Several species of pelecypods were contained in the material taken by Stetson from these banks, which were checked by the senior writer at the Department of Mollusks, Museum of Comparative Zoology, Harvard University, and included in Table I. One large ophiuroid (brittle star), tentatively identified as *Ophioderma rubicundum* Lütken, 1856, was taken on West Flower Garden Bank. A tabulation of all fauna from four of the banks in the northwestern Gulf of Mexico, with notes on other localities where these species have been taken, appears in Table I. A large number of the same mollusk species was also taken on Sandpile Bank, which is outside of the area under discussion. The surface of this bank, unlike the others, is composed

FAUNA FROM CALCAREOUS BANKS OFF TEXAS AND LOUISIANA

Species	*Baker Bank (31 fms.)*	*Big Southern (30 fms.)*	*West Flower Garden (24 fms.)*	*East Flower Garden (30 fms.)*	*Other Occurrences (Depth)*
MOLLUSKS					
Abra lioica Dall 1881		D			North Carolina to West Indies—3–6 fms.
Acmaea pustulata Heilbling 1779			D		Florida Keys to W. I.—Shallow water.
Acteon, new species		D			
Aequipecten muscosus Wood 1828	D				North Carolina to W.I.—Shallow water.
Anachis translirata Ravenel 1861	D	D			Mass. to N.E. Florida—Shallow water.
Anachis, new species	D				
Anomia simplex Orbigny 1842	D				New York to West Indies—Shallow water.
Antigona strigillina Dall 1902	D	D	D		SE. Florida to W. I.—20 to 70 fms.
Arca umbonata Lamarck 1819	D				North Carolina to W. I.—Shallow water.
Arca zebra Swainson 1833	A	D			North Carolina to W. I.—Shallow water.
Arcopsis adamsi E. A. Smith 1888	A	D	A		North Carolina to Brazil—Shallow water.
Arcopsis a. conradiana Dall 1886	D	D			North Carolina to Florida—25 fms.
Arene gemma Toumey and Holmes 1856	D		D		North Carolina to Brazil—12–22 fms.
Astraea caelata Gmelin 1789			A		SE. Florida to W. I.—Shallow water.
Barbatia cancellaria Lamarck 1819	D		A	A*	S. Florida to W. I.—Shallow water.
Barbatia candida Gmelin 1790	D	D			North Carolina to Brazil—Shallow water.
Barbatia domingensis Lamarck 1819	D	D	A*	A*	N. C. to West Indies—Rocks at low tide.
Barbatia tenera C. B. Adams 1845	D		D		Florida to West Indies—Shallow water.
Botula fusca Gmelin 1792			A*	A*	S. C. to West Indies—Shallow on rocks.
Bulla eburnea Dall 1881?	D				N. Carolina to W. I.—103–337 fms.
Calliostoma jujubinum rawsoni Dall 1889	D		D		Lower Keys to W. I.—1 to 10 fms.
Calyptraea centralis Conrad 1841		D			North Carolina to W. I.—Shallow water.
Cerithiopsis exile C. B. Adams 1850		D			Jamaica—Littoral Zone (1–5 fms.).
Cerithiopsis flavum C. B. Adams 1850			A		Jamaica—Littoral Zone (1–5 fms.).
Cerithiopsis greeni C. B. Adams 1839		D			Mass. to West Indies—3 to 10 fms.
Cerithiopsis latum C. B. Adams 1850			A		Jamaica—Shallow water.
Cerithiopsis subulatum Montagu 1808	A	A	A		West Indies—2 to 15 fms.
Cerithium literatum Born 1780			A	A	S. Florida to W. I.—Shallow water.
Cerodrillia thea Dall 1883		D			S. Florida—Sand bars in inside waters.
Chama congregata Conrad 1833	A	D	A		North Carolina to W.I.—1 to 7 fms.
Chama macerophylla Gmelin 1792	D	D	D		Florida to W. I.—Shallow, protected.
Chione grus Holmes 1858	D				North Carolina to Yucatan—12 to 63 fms.
Chlamys benedicti Verrill and Bush 1897	D	D			West Indies—25 to 72 fms.
Conus stearnsi Conrad 1869	D		D		Florida to Yucatan—4 to 6 fms.
Corbula aequivalvis Philippi 1836		D			Porto Rico—Shallow water.
Corbula cymella Dall 1881	D	A			Florida Keys—Shallow water.
Corbula dietziana C. B. Adams 1852			D		North Carolina to W. I.—2 to 18 fms.
Corbula swiftiana C. B. Adams 1852	D				North Carolina to W. I.—6 to 100 fms.
Crassinella martinicensis Orbigny 1842	D	D			Mass. to West Indies—Shallow water.
Crenella divaricata Orbigny 1842				A	North Carolina to W. I.—20 to 50 fms.
Crepidula plana Say 1822			D		Canada to Texas—1 to 3 fms.
Cuspidaria ornatissima Orbigny 1842	D				North Carolina to W. I.—2 to 100 fms.
Cuspidaria perrostrata Dall 1881		D			Mass. to West Indies—58 to 500 fms.
Cyclocardia armilla Dall 1903		D			NW. Florida to Texas—24 to 169 fms.
Cyclostrema amabilis Dall 1889			A		Cuba, West Indies—Shore to 150 fms.
Cythara bartletti Dall 1889	D				Key West to W. I.—16 to 450 fms.
Dentalium laqueatum Verrill 1885		D			North Carolina to W. I.—10 to 193 fms.
Dentalium, species		D			
Diodora cayenensis Lamarck 1822	D	D			Maryland to Brazil—½ to 3 fms.
Distorsio clathrata Lamarck 1816	D	D			N. C. to Colombia, S. A.—22 to 124 fms.
Drillia acestra Dall 1889?	D				Florida Straits, W. I.—Over 400 fms.
Drillia detecta Dall 1881?	D	D			Gulf of Mexico—339 fms.
Drupa didyma Schwengel 1943	D		A		SE. Florida—5 to 35 fms.
Emarginula phrixodes Dall, 1927	D		D		North Carolina to W. I.—20 to 129 fms.
Emarginula sicula Gray 1825	D				Mediterranean, West Indies—8 to 250 fms.
Erato maugeriae Gray 1832	D				Florida to West Indies—2 fms.
Glyphostoma gratula Dall 1881		D			Florida to W. I.—227 to 247 fms.
Gouldia cerina C. B. Adams 1845	A	A			Florida to W. I.—Shallow water.
Haminoea succinea Conrad 1846?		D			Florida—Shores to 2 fms.
Hiatella arctica Linné 1767	D	D			Greenland to W. I.—1 to 100 fms.
Lemintina decussata Gmelin 1791	D	D			S. Florida to W. I.—Low tide to 3 fms.
Lima pellucida C. B. Adams 1846	A	A			N. C. to West Indies—Shallow water.
Lima tenera Sowerby 1846	D	D	D		S. Florida to W. I.—Shallow at low tide.
Liotia bairdi Dall 1889	D	A			N. C., Fla. Keys, Yucatan—15 to 127 fms.
Liotia, new species			A		Taken only off Texas
Lithophaga aristata Dillwyn 1817			A*		S. Florida to West Indies, La Jolla to Peru in coral in shallow water.
Lithophaga bisulcata Orbigny 1842				A*	N. C. to West Indies—Shallow water.
Litiopa melanostoma Rang 1829		D			Pelagic in warm seas.
Lucapina sowerbii Sowerby 1835			A		Florida Keys to Brazil—Under rocks at low tide.
Macoma extenuata Dall 1900	D	D			Gulf of Mexico in 32 fms.
Mangelia psila Bush 1885?	D	D			North Carolina to W. I.—16 fms.
Mangelia, species	D				Taken only off Texas
Mathilda scitula Dall 1889	D	D			North Carolina to W. I.—49 to 294 fms.
Melanella arcuata C. B. Adams 1850	D				North Carolina to W. I.—Shallow water.
Melanella bilineata Alder 1848			D		North Carolina to W. I.—No depth given.
Melanella patula Dall & Simpson 1900		D			Georgia to Porto Rico—Shallow water.

Species	*Baker Bank (31 fms.)*	*Big Southern (30 fms.)*	*West Flower Garden (24 fms.)*	*East Flower Garden (30 fms.)*	*Other Occurrences (Depth)*
Microcardium transversum Rehder & Abbott 1951	D	D	A		Gulf of Mexico—20 to 60 fms.
Mitra nodulosa Gmelin 1790	D	D	A		N. C. to West Indies—Low tide, under rocks.
Mitrella lunata, new subspecies	D	D			*M. lunata* is a bay form.
Murex, juvenile	D		D		Taken only off Texas.
Musculus coralliophagus Gmelin 1790			A*		Florida to W. I.—2 to 7 fms.
Musculus opifex Say 1822	A	D			North Carolina to Brazil—Shallow water.
Nassarina glypta Bush 1885	D	D			N.C. to Florida Keys—14 to 63 fms.
Nassarius ambiguus Pultney 1794	D	D			N.C. to West Indies—Low tide line to 6 fms.
Natica canrena Linné 1758	D	D			N.C. to West Indies—Low tide line.
Nucula crenulata A. Adams 1856	D				N.C. to West Indies—30 to 250 fms.
Nuculana jamaicensis Orbigny 1842	D				N.C. to West Indies—54 to 640 fms.
Odostomia seminuda C. B. Adams 1839	D				Nova Scotia to Fla.—Shore to 12 fms.
Papyridea soleniformis Bruguiere 1784		D			S. Florida to Brazil—Low tide to 4 fms.
Pecten papyraceus Gabb 1873	D	D			Gulf of Mexico to W. I.—30 to 60 fms.
Peristichia toreta Dall 1889	D	D			N. C. to Florida—2 to 22 fms.
Peristichia, species		D			Taken only off Texas.
Pilar fulminata Menke 1830	D	D			N. C. to Brazil—1 to 6 fms.
Plicatula gibbosa Lamarck 1801	D	D		A*	N. C. to West Indies—Intertidal—20 fms.
Pododesmus rudis Broderip 1834	D				Florida to W.I.—Intertidal to 3 fms.
Polinices, species	D				Taken only off Texas.
Prunum, species			D		Taken only off Texas.
Pteria colymbus Röding 1798	D				N. C. to W. I.—Intertidal to 4 fms.
Pycnodonta hyotis Linné 1758		D			Florida to W. I.—20 to 50 fms.
Pyramidella crenulata Holmes 1859			D		S. Carolina to W. I.—1 to 6 fms.
Pyramidella, species	D				Taken only off Texas.
Pyrunculus caelatus Bush 1885	D	D			North Carolina to Florida—15 to 43 fms.
Rhizorus acutus Orbigny 1841	D	D			North Carolina to W. I.—15 to 124 fms.
Rimula aequisculpta Dall 1927		D			S. Florida to W. I.—1 to 25 fms.
Ringicula semistriata Orbigny 1842	D				North Carolina to W. I.—34 to 107 fms.
Rissoina browniana Orbigny 1842			D		North Carolina to W. I.—Grassy bottom in littoral zone.
Rissoina cancellata Philippi 1847	D	D	D		Florida to W. I.—Eel grass, 1–2 fms.
Rissoina chesneli Michaud 1832	D	D			North Carolina to W. I.—Shallow intertidal.
Rissoina elegantissima Orbigny 1842			D		Cuba to West Indies—Shallow water.
Rissoina multicostata C. B. Adams 1850		D			Florida to West Indies—Intertidal.
Rocellaria hians Gmelin 1790	D	D			N. C. to W. I.—Coral in shallow water.
Scaphander watsoni Dall 1881	D				N. C. to Cuba—63 to 324 fms.
Seila adamsi H. C. Lea 1845	D	D			Mass. to West Indies—1 to 6 fms.
Spondylus americanus Herman 1781				A*	Florida to W. I.—5 to 24 fms.
Teinostoma, new species		D			Taken only off Texas
Teinostoma, new species			A		Genus found S. Fla. to W. I.—Shallow water under rocks.
Trinostoma, new species			D		
Tellina promera Dall 1900	D				Fla. to Trinidad—Shallow, intertidal.
Tellina radiata Linné 1758		D			S. Carolina to W. I.—Shallow sandy.
Tellina versicolor Dekay 1843	D				Rhode Island to W. I.—1 to 10 fms.
Tenagodus squamatus Blainville 1827		D			Florida to W. I.—20 to 160 fms.
Thyasira trisinuata Orbigny 1842	D				Nova Scotia to W. I.—15 to 90 fms.
Trachycardium magnum Linné 1758		D		A*	Lower Keys to W. I.—Shallow water.
Triphora intermedia C. B. Adams 1850	D	D	A		Jamaica—Shallow water.
Triphora melanura C. B. Adams 1850	D		A		N. C. to West Indies—Shallow water.
Triphora pulchella C. B. Adams 1850	D		D		Florida to W. I.—1 to 40 fms.
Triphora turristhomae Orbigny 1842			A		N. C. to West Indies—Shallow water.
Triphora, species	D		A		Taken only off Texas.
Trivia suffusa Gray 1832	D				S. Florida to W. I.—1 to 14 fms.
Turbonilla incisa Bush 1849		D			SW. Florida—No depth given.
Turritella exoleta Linné 1758	D	A			S. Florida to W. I.—5 to 7 fms.
Varicorbula operculata Philippi 1848	D	A			N. C. to West Indies—5 to 250 fms.
Vermicularia spirata Philippi 1836	D	D	A		S. Florida to W. I.—1 to 14 fms.
Vitrinella multistriata Verrill 1884	D				N. C. to West Indies—3 to 142 fms.
Williamia krebsi Mörch 1877	D		A		Fla. Keys to W. I.—10 to 30 fms.
Yoldia solenoides Dall 1881	D	D			Gulf of Mexico—20 to 118 fms.
Zeidora biglowei Farfante 1947			D		S. Cuba—175 to 225 fms. (dead) only taken once.
ECHINODERM					
Ophioderma rubicundum Lütken 1856			A		Cape Florida, Bahamas and W. I.—0-12 fms.
CORALS					
Madracis mirabilis Duchassaing and Michelotti, 1861			D*	A*	Florida Keys to West Indies—0-400 fms.
Porites astroeoides Lamarck 1816			D*		Bermuda, S. Florida, W. I. to Brazil—0-20 fms.
Montastrea annularis Ellis and Solander, 1786			D*		Florida to West Indies, C. America—Outer edges of reefs.
Manicina gyrosa Ellis and Solander 1786			D*		Florida and Caribbean—0-10 fms.
Diploria strigosa Dana 1846			D*		Bermuda, Florida, West Indies—Massive reef builder.

D—Indicates dead occurrences.
A—Indicates taken alive.
* —Taken by Stetson, Feb. to March, 1947.



PL. I.—Typical mollusk fauna from calcareous banks, continental shelf off Texas.

FIG. 1.—*Mitra nodulosa* Gmelin, 1790, aperture view. Size —7 mm.×3.5 mm., Station J-325.

FIG. 2.—*Lucapina sowerbii* Sowerby, 1835, dorsal or exterior view. Size—13 mm.×7 mm., Station J-325.

FIGS. 3 and 4.—*Williamia krebsi* Morch, 1877, Fig. 3 exterior or dorsal view, Fig. 4 interior view. Size—2 mm.×5 mm., Station J-325.

FIG. 5.—*Lemintina decussata* Gmelin, 1791, side view (fragment). Size—15 mm.×12 mm., Station J-169.

FIG. 6.—*Cerithium literatum* Born, 1780, aperture view. Size—32 mm.×16 mm., Station J-325.

FIG. 7.—*Drupa didyma* Schwengel, 1943, aperture view. Size—9 mm. ×4.5 mm., Station J-325.

FIG. 8.—*Cyclostrema amabilis* Dall, 1889, top, or dorsal view. Size—3 mm. ×7 mm., Station J-325.

FIG. 9.—*Astraea caelata* Gmelin, 1789, aperture view. Size—5 mm.×10 mm., Station J-325.

FIG. 10.—*Vermicularia spirata* Philippi, 1836, side view. Size—30 mm.×10 mm. Station GM-728.

FIG. 11—*Barbatia candida* Gmelin, 1790, exterior view. Size—17 mm.×9 mm., Station J-169.

FIGS. 12 and 13—*Barbatia cancellaria* Lamarck, 1819, Fig. 12 exterior view, Fig. 13 interior view. Size—18 mm.×9 mm., Station, J-325.

primarily of silty sand rather than calcareous débris. Plate I shows some of the more common mollusks found on the banks, and most of the living mollusks. All specimens illustrated are in the collection at Scripps Institution.

Interpretation of fauna.—It is significant that practically all the living and dead species of animals are either restricted to or have their centers of population in the West Indies or the Bahamas and many have not been previously collected in the Gulf of Mexico. Of the 137 species of mollusks taken, 52 have bever neen reported north of the central part of the Florida coast, and most of these range only along the east coast rather than along the west coast of Florida. Another striking observation is that 71 of the species normally live in less than 12 fathoms, with a large proportion usually living in intertidal or bay waters. All samples from the banks were taken in depths between 24 and 31 fathoms, or considerably deeper than their normal depth range. It was also observed that the bank representatives of the forms which are generally found in shallow water (0–5 fathoms) in the West Indies were almost all sub-specifically different, at least in their morphology. For example, most of these bank forms were considerably smaller, although they appeared to be mature specimens. Many of the bank specimens are more spinose and have somewhat different ornamentation than the "normal" populations in the West Indies. These comparisons were made by checking the bank specimens with all available representatives in the U. S. National Museum, Academy of Natural Sciences of Philadelphia, and the Museum of Comparative Zoology at Harvard. From these observations it might be inferred that the banks and their fauna were at some time in the past connected ecologically with the warm, shallow-water populations on the south.

Besides the mollusks, the other prominent inhabitants of the banks are the abundant living lithothamnioids and bryozoans. Practically all the débris in the samples was composed of small fragments of lithothamnioids and many colonies of calcareous bryozoans such as *Smittina*, *Schizoporella*, and *Mamillopora*. On Flower Garden Banks, the calcareous algae was in the form of large balls, composed of many concentric layers as shown in Figure 6. These lithothamnioid balls are identical with those taken by Stetson (1953, pp. 21–22) on the same banks and Challenger Bank off Bermuda. They are also very similar to the algal mats observed on Alexa Bank in the South Pacific, north of the Fiji Islands, which was explored by Scripps Institution vessels on the "Capricorn" expedition in 1952–53 (Roger R. Revelle, personal communication, and Capricorn Shipboard Report, pp. 42–43). These three widely separated banks (Flower Garden, Challenger, and Alexa) have several features in common. There are no large masses of living reef-forming corals; the platforms of these banks are below the depths where corals usually form the largest reef masses; and each is characterized by the presence of rounded lithothamnioid balls or mats.

The only living corals taken from any of the Gulf of Mexico banks by the Scripps Institution field parties were large numbers of small colonies of *Madracis mirabilis* (Dushassaing and Michelotti, 1861) (Fig. 6). This coral is considered

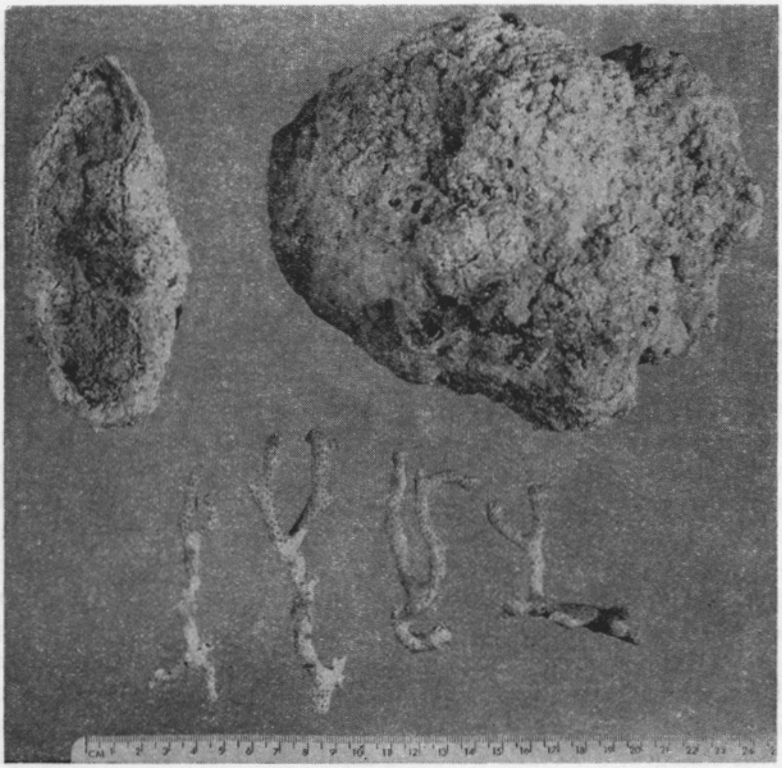


FIG. 6.—Lithothamnion balls from 24 fathoms, West Flower Garden Bank, and coral, *Madracis mirabilis*, from 30 fathoms, East Flower Garden Bank.

an encrusting species and apparently does not grow rapidly enough or abundantly enough to form large reef complexes. Smith (in Galtsoff, 1954, p. 294) gives the depth range of the genus *Madracis* as 0 to 800 meters and temperature range from 10° to 27°C. *Madracis mirabilis* occurs most abundantly in the West Indies and in sparse numbers in the Florida Keys, and has been found in the Pleistocene of Florida and lower Miocene of Cuba (Vaughan, 1919, p. 345). Although Stetson (1953, p. 21) reported several reef-forming corals such as *Montastrea*, *Manicina*, and *Porites* from the Flower Garden Banks, examination of these specimens now in the Museum of Comparative Zoology indicated that they had been collected dead. Neither from the literature nor from personal communication with workers in the northwestern Gulf have the writers been able to substantiate reports of living reef corals on these banks.

DISCUSSION

Several investigators have offered explanations for the origin of these banks, dating from Shepard (1937) who suggested that these banks may be related to salt-dome structures. Others have explained them on the basis of biohermal structures which have kept pace with changing sea-levels (Stetson, 1953), while recently Goedicke (1955, p. 152) came to the conclusion "that the pinnacles are mainly due to tectonic activity [controlling the location of salt domes] and partially due to differential erosion." Although direct evidence of the origin of the banks (emplacement of the rocks) awaits seismic studies and additional geological studies, there are clues in the data presented here as to shaping of the banks subsequent to their formation. The fact that the tops of the banks fall into distinct modes, and that the tops of deeper banks correlate well with terraces on those banks with more relief and shoaler tops, suggests erosion at various stands of sea-level, although it can not be stated when these stands might have occurred.

The faunal evidence on the banks studied intensively suggests that at one time the tops of the banks were in very shallow, almost intertidal water, at a time when the over all average water temperature was considerably warmer than at the present. This fauna certainly represents a population now isolated from the main centers of abundance in southeast Florida to the West Indies. It is also distinctly different from the fauna of the surrounding level-bottom communities. Both the assemblage of mollusks found on the banks and the presence of dead reef-forming corals suggest that the growth of the organic capping of the banks started during a much lower stage of sea-level when the water was considerably warmer. The populations of bank mollusks were then continuous around the Gulf edge to the West Indies. As the sea-level and hydrographic conditions changed, the corals were not able to maintain their colonies close to sea-level, and in some cases died off completely. Many of the mollusks which were originally living in very shallow water became isolated from the parent stock, and, in adapting to the changing conditions, exhibited morphological changes. The lithothamnioids, on the other hand, are far more resistant to temperature and depth changes, and became the primary surviving contributors to the organic capping.

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