

Figure 1—Sampling area on the inner continental shelf off the Louisiana coast.

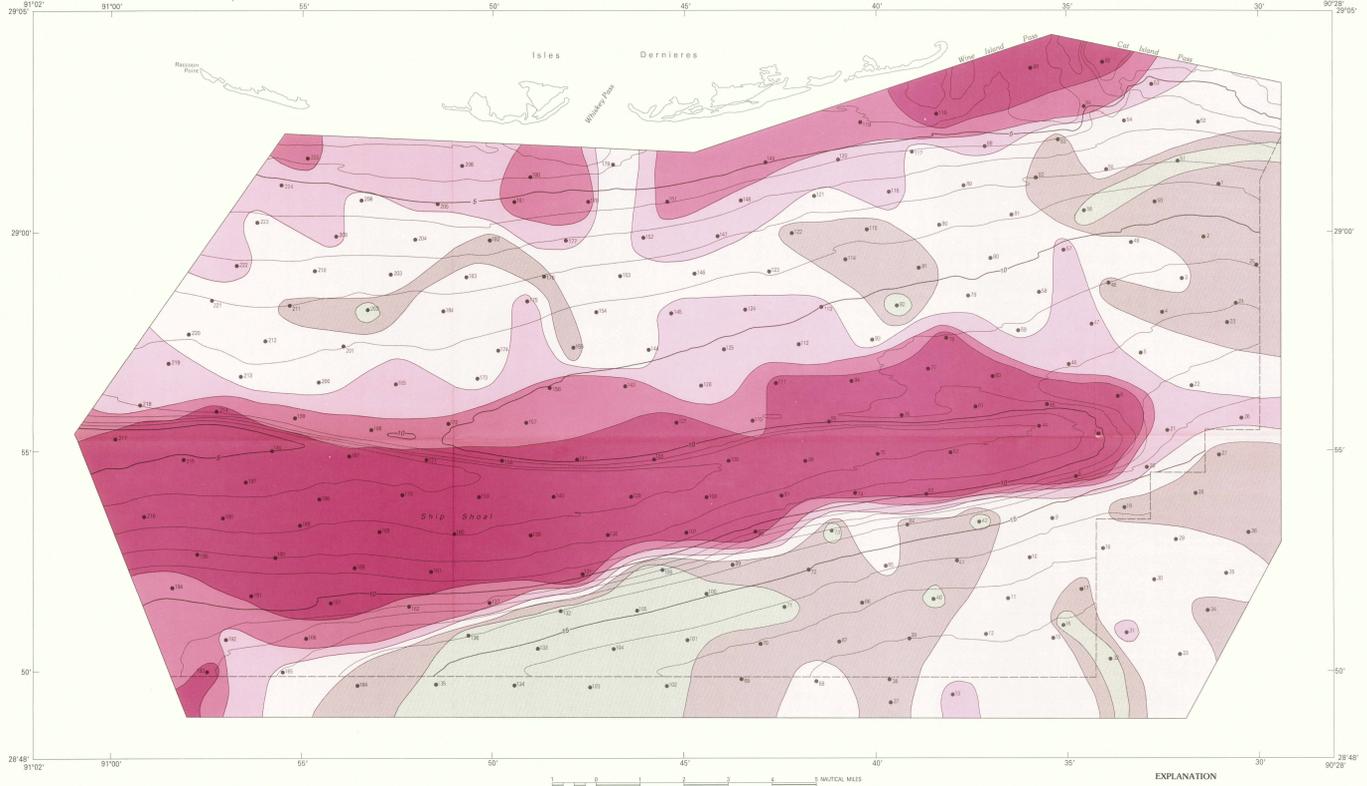


Figure 2—Isopleth map of sand on the inner continental shelf off the Louisiana coast.

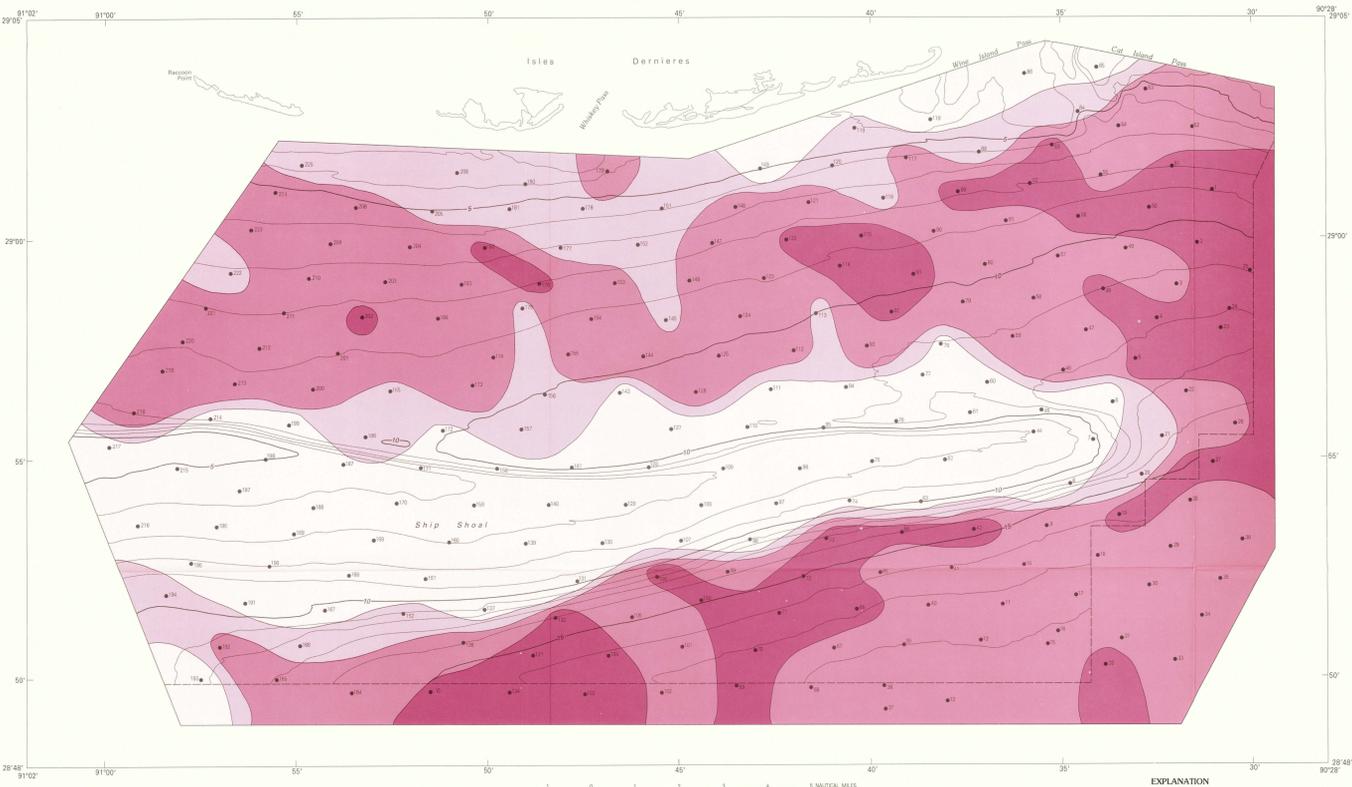


Figure 3—Isopleth map of silt on the inner continental shelf off the Louisiana coast.

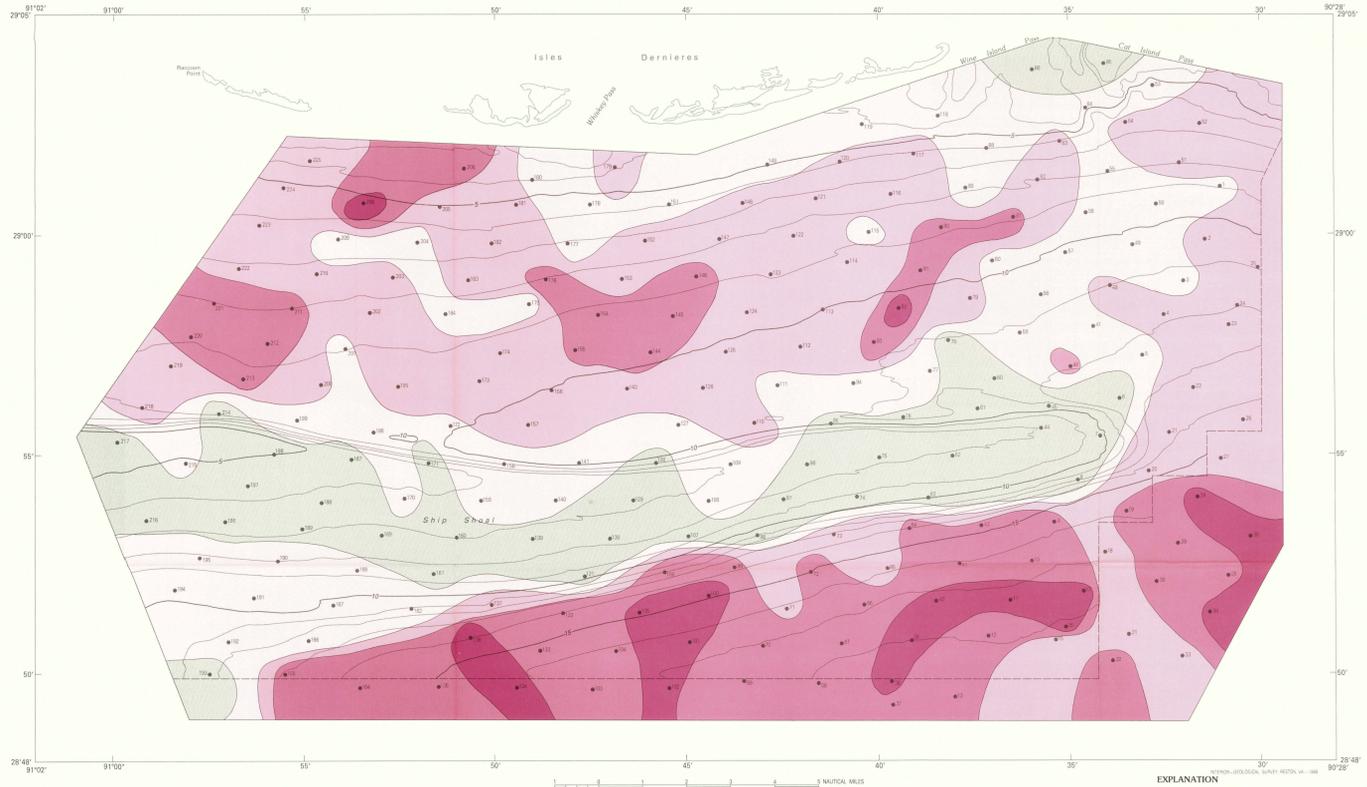


Figure 4—Isopleth map of clay on the inner continental shelf off the Louisiana coast.

INTRODUCTION

The data in this report were obtained as part of an ongoing cooperative effort between the U.S. Geological Survey and the Louisiana Geological Survey (Chalenger and others, 1987). A major effort of this study concerns the erosional processes of barrier islands of Louisiana; in particular, the Isles Dernieres barrier island chain. This report describes the general textural composition of surficial sediments on the inner continental shelf offshore of Isles Dernieres.

Study Area

The study area is located in the northern Gulf of Mexico and between lat 28°48' N and 29°24' N and long 90°30' W and 91°00' W (fig. 1). The area extends offshore approximately 27 km from Isles Dernieres to a maximum water depth of 18 m. The major physiographic feature in the study area is Ship Shoal, an elongate (approx 43 km), bathymetric structure, 2.7 to 7.4 km wide. The top of the shoal is delineated approximately by the 9-m isobath, although it rises to a depth of 5 m at the western end of the study area.

The coast adjacent to the study area is marked by the low-relief Isles Dernieres barrier islands which average about 1 m high. Three main passes in this area subdivide the barrier island chain and connect the bay and lagoonal waters landward of the islands to the Gulf of Mexico (fig. 1). Cat Island Pass and Wine Island Pass are located at the eastern end of Isles Dernieres, whereas Whiskey Pass is found near the western end.

Methods

In May, 1987, 217 surficial-sediment samples were collected in the study area (fig. 1). The samples were obtained by using a U.S. Army Corps of Engineers bed-material sampler (model no. US BM-54). The sample volume averaged 236 cc and the maximum penetration of the sampler into the bottom was 5.5 cm. Water collected with each sample was retained so that any suspended sediments could settle out.

Navigation during the field work was provided by a Northstar 6000 Receiver and a Texas Instruments Silent 700 data logger. The samples were collected about 1.8 km apart at the intersection of the Exxon and Exxon-LOBAN lines.

In the laboratory, samples were wet-sieved with a 5 percent solution of sodium hexametaphosphate (Calgon) through a #10 and a #20 sieve (-1.0 and -.85, respectively). The silt-clay fraction was analyzed on a Model TAIL Coulter Counter using techniques described by Shideler (1976).

The sand fraction was washed and dried, it was then analyzed with a Rapid Sediment Analyzer (RSA) (Schluter, 1966; Poppe and others, 1985). Each grain-sized component was computed as a percentage of the total dry weight of the sample.

RESULTS

Sand

Using the classification scheme of Folk (1974), the sediment samples were divided into classes on the basis of their sand content. These classes, the number and percentage of samples in each class, and the mean ϕ value for each class, are listed in table 1.

Quartzose sand is the major component of late Quaternary sediments on the continental shelf of central Louisiana (Mazullo, 1986). Within the study area, the average sand content in the samples was 54.03 percent. Across the entire study area, the sand content varied from a low of 0.5 percent (station 100) to a maximum of 99.76 percent (station 171). Figure 2 shows the sample locations and the distribution of the sand over the study area. Samples with greater than 90 percent sand accounted for only 38 percent of all the samples collected.

The large area at the seaward entrances to Cat Island and Wine Island Passes, where the sand fraction exceeded 90 percent, may be the result of a combination of effects including (1) dumping of dredged material, and (2) contributions from an ebb-tide delta. Cat Island Pass is periodically dredged to maintain minimum depth requirements for ship traffic into and out of the Houma Navigation Canal, which connects to the Intracoastal Waterway at Houma, Louisiana. Wine Island Pass and Whiskey Pass, on the other hand, are not subject to maintenance dredging. Large areas of higher sand content (>75 percent sand by weight) also are found at the seaward openings to these two passes. The occurrence of these bodies of high sand content may be readily explained by ebb-tide delta processes at each of these passes.

Silt

All samples were divided into four classes on the basis of their silt content. Class distributions were made at the 25 percent and 67 percent levels (Folk, 1974); the 10 percent level was used to delineate two additional classes. Statistics for the four classes are presented in table 1.

An isopleth map of silt content was constructed for the study area (fig. 3) on the basis of the four classes. The silt content of the samples ranged from a minimum of 0.09 percent (station 171) to a maximum of 96.05 percent (station 56). Sediments with high silt composition (>67 percent) were concentrated in two regions: (1) a large zone to the east and northeast of Ship Shoal, and (2) a discontinuous zone seaward of the central part of Ship Shoal (water depth >14 m). Murray (1976) described a generally westward-trending "highly turbid coastal belt" parallel to the coast. This zone of turbid water may contribute sediment not only to these two regions of high silt concentration, but also to the smaller, isolated patches of silt concentration located between Isles Dernieres and Ship Shoal. In the area of Wine Island and Cat Island Passes, the silt content was less than 10 percent. As previously mentioned, this is probably due to the dumping of sandy dredged materials in this area. Additionally, the winnowing of silty sediments by tidal currents in the passes could be a factor. Along the shoreline of Isles Dernieres, the silt content of the sediment did not exceed 33 percent, except near Whiskey Pass where it increased to 50.76 percent (station 179).

Clay

The clay fraction (<0.0039 mm, ϕ_{80}) of the sediments was low throughout the area; 72 percent of the samples contained less than 10 percent clay. The clay content ranged from a minimum of 0.11 percent (station 62) to a maximum of 56.92 percent (station 101). Size classes for the clay fraction were defined at the 1, 5, 10, and 25 percent levels. Table 1 gives the statistics for these classes.

Figure 4 is an isopleth map of the study area showing the distribution of clay on the basis of the five classes. Samples with high clay content (>25 percent) were located primarily in a series of patches seaward of Ship Shoal. Only two isolated patches with clay content exceeding 25 percent were found landward of Ship Shoal. The patchiness of clay in the study area reflects the reworked nature of the surficial sediments. Currents and waves have winnowed the clay-sized sediments on the Louisiana inner continental shelf from abandoned pre-modern deltas. This reworking of the surficial sediment has resulted in the formation of shoals and barrier islands (Penland and Boyd, 1985; and Mazullo, 1986).

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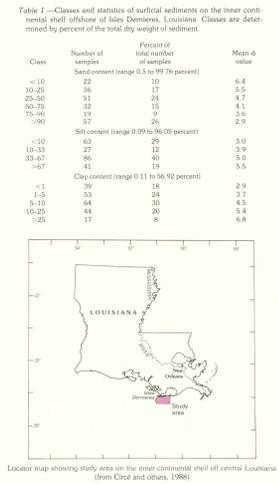
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TABLE 1.—Classes and statistics of surficial sediments on the inner continental shelf offshore of Isles Dernieres, Louisiana. Classes are determined by percent of the total dry weight of sediment.

Class	Number of samples	Percent of total number of samples	Mean ϕ value
Sand content (range 0.5 to 99.76 percent)			
<10	22	10	6.4
10-25	86	39	5.5
25-50	51	24	4.7
50-75	12	6	4.1
75-90	19	9	3.6
>90	27	13	2.9
Silt content (range 0.09 to 96.05 percent)			
<10	63	29	3.0
10-33	27	12	3.9
33-67	86	40	5.0
>67	41	19	5.5
Clay content (range 0.11 to 56.92 percent)			
<1	18	8	2.9
1-5	53	24	3.7
5-10	68	31	4.8
10-25	24	11	5.4
>25	17	8	6.8



SURFICIAL SEDIMENT ISOPLETH MAPS OF SAND, SILT, AND CLAY, OFFSHORE THE ISLES DERNIERES BARRIER ISLANDS, LOUISIANA

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