RECENT MARINE SEDIMENTS AND ENVIRONMENTS OF NORTHWEST GULF OF MEXICO[1]

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Abstract by
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This report is based on the megascopic study of 85 cores taken by the Woods Hole Oceanographic Institution in the northwest Gulf of Mexico in 1947. The cores varied from three to ten feet in length and averaged seven feet. Fourteen cores (16-1/2%) are from the continental shelf; 48 (56-1/2%) are from the slope; and 23 (27%) are from the Sigsbee Deep.

Recent sediments are accumulating in five major marine environments: shelf, rise, upper slope, lower slope, and Sigsbee Deep. Shelf sediments show a two-fold zonation, and sediments from the other environments show a three-fold zonation. The depth ranges and sediment types of each are summarized in Table 1. Rises are isolated topographic highs at the outer edge of the shelf and upper part of the slope. They are thought to be either salt domes or volcanic necks, but their origin is still doubtful. Rise sediments are similar to those of shelf but contain less clay. Shelf sediments show the widest variation in type.

A brief summary of characteristics of late Pleistocene-Recent history will help clarify sediment distribution and location of Pleistocene-Recent contact:

1. Pleistocene epoch, latest (Wisconsin) glacial stage.

   Growth of ice caps; lowering of sea level at least 450 feet; most of shelf exposed; shoreline between present 350-400 foot contours; weathering intensified; rivers rejuvenated; valleys entrenched; coarser sediments carried; continuous deposition on slope and in deep which were still under water.

2. Recent epoch, rising sea level.

   Ice caps started recession about 20,000 years ago; rivers filled their entrenched valleys; progressively finer sediments were carried; streams were braided.

3. Recent epoch, standing sea level.

   Sea reached present level about 5,000 years ago; meandering streams migrate over flood plains; the Mississippi River began building its complex delta with various lobes built and abandoned as the river changed courses; Recent surface deposits of coastal plain formed.

[1] Bull. Amer. Assoc. Petrol. Geol., vol. 40 (May 1956), pp. 813-847.

ENVIRONMENT		STRATIGRAPHIC POSITION IN CORE			MINOR LITHOLOGIES	COARSE COMPONENTS (SHELLS, SD., SILT)
		UPPER ZONE	INTERMEDIATE ZONE	LOWER ZONE		
Shelf (0'-600')		Sand Silty clay Clay w/silt pockets & lenses Shell clay Grn-gray to brn-gray homogeneous clay	Blue-gray to brn-gray laminated clay Interlaminated silt & olive-gray clay Sand Red-brn clay	- - -	- - -	Common
Rise		Sdy & silty glauc. foram. ooze Calc. biostromal deposits Grn-gray patchy silty & sdy shell clay Grn-gray to brn-gray homogeneous clay	Interlaminated sd & silt & dark olive-gray clay Dark olive-gray clay mottled w/sdy glauc. foraminiferal ooze Reddish-brn patchy silty & sdy shell clay	Sandy glauconitic foraminiferal ooze Green-gray silty clay	- - -	Common
Upper Slope (600'-3,000')	Central & West	Green-gray to brn-gray homogeneous clay	Reddish-brown clay Dark olive-gray clay	Green-gray to brown-gray homogeneous clay	Foraminiferal ooze Grn-gray mottled clay Lt. yellow-brn mottled clay Nonshrinking clay	Minor
	East	Green-gray to brn-gray homogeneous clay	Dark olive-gray to purple clay	Dark bluish-purple laminated clay w/ red-brn bands	- - -	Minor
Lower Slope (3,000-6,000)	Cent. & West	Light yellow-brn mottled clay, blk strk at or near top	Reddish-brn clay Dark olive-gray clay Grn-gray homogeneous clay	Lt.yellow-brn to grn-gray to reddish-brn mottled clay	Nonshrinking clay Interlaminated dark brn & reddish-brn gypsif. clay Red clay	Minor
	East	Grn-gray homogeneous clay Cyclic color-graded clay	Dark olive-gray clay w/red to reddish brn bands & lenses	(Not penetrated by cores)	- - -	Absent
Sigsbee Deep (6,000'-12,900')	West	Lt Yellow-brn mottled clay, black-streaked at or near top	Red or red-streaked clay	Dark olive-gray clay and/or grn-gray mottled clay interlayered w/sand & silt	Lt white to cream-gray clay Nonshrinking clay	Minor in upper zone Absent in intermediate zone Common in lower zone
	East	Foraminiferal ooze	Red or red-streaked clay	Dark olive-gray clay interlaminated w/silt	Lt white to crm-gray clay Cyclic colored graded clay Calcarenite Nonshrinking clay	Minor in upper zone Absent in intermediate zone Common in lower zone

TABLE I. SEDIMENT TYPES IN NORTHWEST GULF CORES After Greenman & LeBlanc, Bull.AAPG, Vol.40, No. 5, (1956) p.820.

The top sediments of the Recent are zoned in the five environments by water depth and, to less degree, by lateral distribution. The sediments of the eastern Sigsbee Deep are calcareous; the balance of northwest Gulf of Mexico sediments are clastic. Absence of clastics, rather than greater Foraminifera production, accounts for the calcareous foraminiferal ooze of the eastern deep and the thinner Recent interval. Distribution of clastic sediments is a result of the several major and many minor rivers contributing a huge volume of clastics and of a prevailing surface current moving from east to west. Because of this current the non-clastic ooze facies terminates southwest of the Mississippi River delta instead of immediately south. The east-to-west current, together with a general seaward movement of sediments, causes a seaward bulge in the distribution of upper slope homogeneous clay southwest of the Mississippi delta. The sediment load of the rivers and the surface current also control the thickness of the Recent, which decreases from shelf to deep and from west to east within the deep. A tongue of lower slope-western Sigsbee Deep mottled clay facies extends into the eastern deep and may be due to a west-to-east return current or to the effect of the sediment load contributed by the Rio Grande.

Distribution of the red and reddish-brown clay facies of the intermediate zones of the deep and slope is a function of geographic location rather than depth of water. The clay has a low calcium carbonate content. Three theories have been advanced to explain the red clay: (1) the water was colder and undersaturated in calcium carbonate; therefore calcareous tests were dissolved, and the sediments were low in calcium carbonate and colored red by residual iron. This theory is not supported by faunal evidence and fails to explain why such sediments are not being deposited in cold deep water today. (2) The reddish-brown clays are from the Brazos, Colorado, and Rio Grande rivers and the red clay from the Red River as at present. This fails to explain why such clays are not being deposited now. (3) Waves eroded the exposed and oxidized shelf deposits; as sea-level rose the rivers filled their channels instead of dumping large sediment loads in the Gulf; the rising sea overrode and reworked the oxidized deposits. The low calcium carbonate content is a result of increased sediment loads and relatively decreased Foraminifera.

The Recent-Pleistocene contact was not penetrated by shelf cores; the fauna is of the warm-water type as at present; core-to-core correlation is poor on the shelf. Presence of the Recent-Pleistocene contact in rise cores is uncertain; evidence is contradictory or inconclusive; faunal information is also inconclusive, although in one rise core the warm-water fauna was in upper light-colored sediments and the cold-water in lower dark sediments; core-to-core correlation is poor. On both the upper and lower slopes core-to-core correlation is fair to good; the Recent-Pleistocene contact is placed at the base of the intermediate zone or at the top of the dark olive-gray clay in the intermediate zone. A general statement with regard to fauna of the upper slope, lower slope, western Sigsbee Deep, and eastern Sigsbee Deep is that the warm-water type is found in the upper zones, transitional faunas in the intermediate zones, and cold-water type in the lower zones. Both parts of the Sigsbee Deep exhibit excellent core-to-core correlation. The Recent-Pleistocene contact is placed at the base of the intermediate zone in deep cores.

TABLE II
Thickness of Recent

Environment	Range (inches)	Average (inches)	Sedimentation Rate (years per inch)
Upper slope	5-91	56	360
Lower slope	9-84	42	480
Western Sigsbee Deep	0-72	37	540
Eastern Sigsbee Deep	0-60	20	1,000

There is no indication of turbidity current action or deposits. The coarse sediments of the lower zone of the Sigsbee Deep are not graded; correlation is good; the deposits are Pleistocene and therefore may be shallow water sediments; there are no coarse Pleistocene deposits on the slope which could have initiated turbidity currents. Pleistocene and Recent sediments are the same lithologic type on the slope but different in the deep. The Pleistocene of the deep and the Recent of the shelf are similar. Therefore it is likely that the deep did not exist in Pleistocene time. It is postulated that the coarse deposits of the deep accumulated in a shelf environment and were downfaulted to the present position during late Pleistocene or early Recent. The bottom topography shows scarps off the west coast of Florida and off the north and west coasts of Yucatan. Relief off Florida is about 6,000 feet, off Yucatan from 5,000 to 10,000 feet. These figures agree fairly well with the 9,000 to 11,000 feet necessary if the faulted shelf hypothesis is correct. Pleistocene deposition would have taken place 500 $\pm$ feet below Pleistocene sea-level or 1,000 feet below present sea-level; the cores are from 10,000 to 12,000 feet. Faunal evidence suggests a displacement of 9,000 to 10,000 feet. An alternative hypothesis is that the coarse sediments of the deep were deposited at the edge of the present shelf during the last glacial stage when rejuvenated streams were vigorously eroding the land and present shelf areas and contributing larger and coarser sediment loads to the Gulf. This hypothesis limits faulting to less than 3,500 feet and fails to explain why there are no coarse Pleistocene deposits on the slope, which was closer to shore than the deep.