GEOLOGY OF THE GULF OF MEXICO[1]

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Abstract by
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While the time and manner of the origin of the Gulf basin are still undetermined, present evidence favors the existence of an ancient shallow Gulf. Assuming that Llanoria extended into the Gulf, its submergence may have been completed by late Jurassic time, thus providing for the invasion by the Cretaceous seas. Post-Cretaceous downwarping tilted the Cretaceous deposits Gulfward, but, in general, the Gulf remained a shallow sea during most of the early Tertiary. During late Tertiary the basin of the Gulf further subsided, possibly both by downwarping and faulting along the basin margins. The escarpment along the west edge of the Florida shelf undoubtedly has its origin in faulting, and similar conditions seem to exist at the outer edge of the Campeche Banks. Other areas along the continental slope suggest fault scarps. The basin of the Gulf may well have been deeper than the present 12,425 feet, with post-mid-Tertiary sediments filling the basin to its present depth.

Stratigraphic and geophysical evidence can be shown for the existence of a geosyncline in the Gulf Coast of Texas and Louisiana. Geophysical calculations indicate a horizontal increase in the density of the basement rocks from the Sabine uplift to near the middle of the Gulf of Mexico. From this, it can be concluded that a geosyncline must occur in the basement surface with its trough axes slightly landward from the present coast line. Further evidence is the great thickening of the Upper Cretaceous and Tertiary beds as they dip Gulfward, with the Tertiary beds reaching a stratigraphic thickness of more than 25,000 feet near the coast. Knowing that the deepest part of the Gulf of Mexico is 12,500 feet and assuming that the thickness of the Upper Cretaceous-Tertiary sedimentary deposits in the great depths of the Gulf are 10 per cent or less of their thickness in the Gulf Coast, it can be concluded that "the basement of the Upper Cretaceous-Tertiary beds must be downwarped 6,000 to 16,000 feet in reference to the depth of that basement under the Sigsbee Deep."

The geosynclinal trough is a well-marked feature indicating considerable subsidence. Its westward limit is not definitely known, but some thinning of formations is noted in the longitude of Matagorda County, Texas. It is further complicated by transverse structures, such as the Rio Grande syncline, the San Marcos arch, the Houston syncline, the Sabine uplift, and the Mississippi River syncline.

The continental shelf forms an almost continuous terrace around the margin of the Gulf of Mexico. The shelf is not an expressionless plain lacking in interesting physiographic features as may be suggested by some maps with a contour interval too great to properly present the smaller features. This terrace or shelf has numerous depressions, troughs, ridges, minor knobs, coral heads, escarpments, and two known submarine canyons. The continental

[1] Fishery Bulletin 89, 1954, pp. 67-86.

slope, in general, constitutes one of the great relief features of the earth. The edge of the continental shelf is only very roughly parallel to the shore line as is shown by the varying width of the shelf. The continental shelves of the Gulf of Mexico seem to have a close geologic and physiographic relationship with the adjacent land. Broad shelves lie in front of broad coastal plains, and narrow shelves lie between steep continental slopes and rugged near-shore terrain. An examination of the maps of the topography of the outer shelf and slope of the northern Gulf of Mexico shows many features which suggest an origin due to density currents and the deposition of the mass of mud. Also, continental shelf fauna dredged from the Mexican Basin may have been transported from the shelf by turbidity currents. Furthermore, these currents may have carried sediment to the central Gulf and, therefore, aided in developing the rather flat floor of the Mexican Basin.

The near-shore sediments, at least, should be expected to be closely related to the sediments of the adjacent coastal plain except near the mouths of major rivers. Studies have shown that each formation varies widely in its composition as it curves around the Gulf from Florida to Mexico. In general, the Gulf coastal area may be divided into intergrading depositional areas as follows: Rio Grande Embayment, East Texas Basin, Mississippi Embayment, the Gulf coastal region of Alabama, Georgia, and North Florida, and South Florida. The Rio Grande may have been the major source of sediments from the late Cretaceous through early Miocene time with the Mississippi River contributing little sediment during that time. The sediments brought to the Gulf of Mexico are probably not carried far from shore (See Plate 37).

Interest in the gulf has been greatly accelerated in the past decade, and there is much evidence that this interest will continue, which should result in the eventual solution of many of the present riddles of the Gulf of Mexico.

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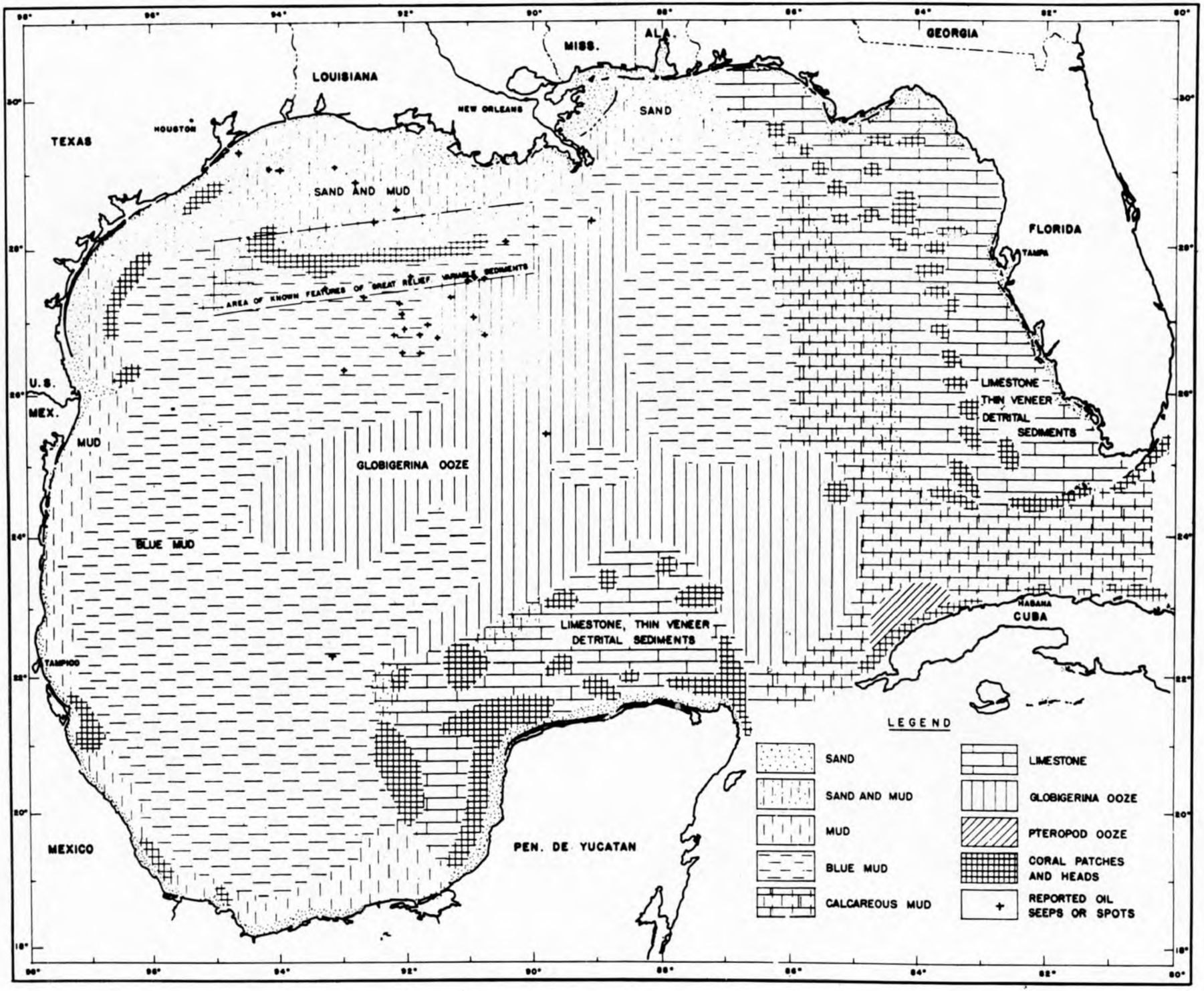
PLATE 37

Sediment Distribution Gulf of Mexico.
Reporduced from Bull. 89, U. S. Bureau
of Fisheries, 1954.


LOUISIANA
MISS.
ALA.
GEORGIA
TEXAS
HOUSTON
NEW ORLEANS
SAND
SAND AND MUD
FLORIDA
TAMPA
AREA OF KNOWN FEATURES OF GREAT RELIEF VARIABLE SEDIMENTS
U.S.
MEX.
MUD
GLOBIGERINA OOZE
LIMESTONE
THIN VENEER
DETRITAL
SEDIMENTS
BLUE MUD
HABANA
CUBA
LIMESTONE, THIN VENEER
DETRITAL SEDIMENTS
TAMPICO
MEXICO
PEN. DE YUCATAN
LEGEND
SAND
SAND AND MUD
MUD
BLUE MUD
CALCAREOUS MUD
LIMESTONE
GLOBIGERINA OOZE
PTEROPOD OOZE
CORAL PATCHES AND HEADS
REPORTED OIL SEEPS OR SPOTS