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GEOPHYSICAL INVESTIGATIONS
PRELIMINARY MAP

48-26

RECONNAISSANCE GRAVITY SURVEY IN THE GULF OF MEXICO

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(Gravity Map by Tidelands Exploration Company)

The accompanying map shows variations in gravity over an area extending seaward 70 to 75 miles from the shore of the Gulf of Mexico between Sabine Pass, Tex. and Grand Chenieres, La. It is based on a regional marine gravity-meter survey made during the period July to October, 1947, by the U. S. Geological Survey in cooperation with the Office of Naval Research. The objectives of the survey, and of accompanying geologic and oceanographic investigations, were to obtain information on regional geologic structure, on bottom sediments, and on the salinity and thermal structure of the water, especially in offshore areas and at depths beyond those where exploration is at present considered economically feasible.

The investigations were carried out on the U. S. Navy research vessel MENTOR, operated under contract by Woods Hole Oceanographic Institution. The MENTOR is a diesel-powered ship of 178 tons displacement, 127-foot length, 21-foot beam, and 5½-foot draft. Special winches, a boom, and a stern platform were installed to handle the diving chamber used for underwater gravity observations. The ship was also equipped with radar for locating stations, tackle for anchoring bow and stern, and a light winch for handling samplers, a bottom camera and similar equipment.

The underwater gravity measurements were made by Tidelands Exploration Company, under contract to the U. S. Geological Survey. Gravity observations were made at each station shown on the accompanying map by lowering to the floor of the Gulf an enclosed steel diving chamber containing a North American gravity meter and a meter operator, together with telephone, oxygen supply, air-purifying devices, and auxiliary equipment. The greatest water depth at which stations were occupied was 125 feet, but the equipment was designed to operate at much greater depths.

Simultaneously with the gravity observations, samples of bottom sediments and of the water near the bottom and surface were collected, and bathythermograms and bottom photographs were taken. About 10 minutes were required to obtain a complete set of gravity and oceanographic observations at each station. Under favorable weather conditions about one hour was required for a complete cycle of operations. Each cycle included bringing the ship to position, anchoring bow and stern, retrieving anchors after completing the observations, and proceeding to the next station. Considerable time was lost, however, because of unfavorable weather, when it was impossible to hold the ship over a station or when target buoys were carried away because of high winds and rough seas.

All gravity observations were tied to a main base station on shore, either directly, or through auxiliary base stations established at sea. Closing errors of the gravity loops ranged between 0 and 0.35 milligal, while the mean closing error of all loops was about 0.1 milligal. Preliminary analysis indicates that the maximum error at any station is less than 0.2 milligal, while the mean error is less than 0.1 milligal.

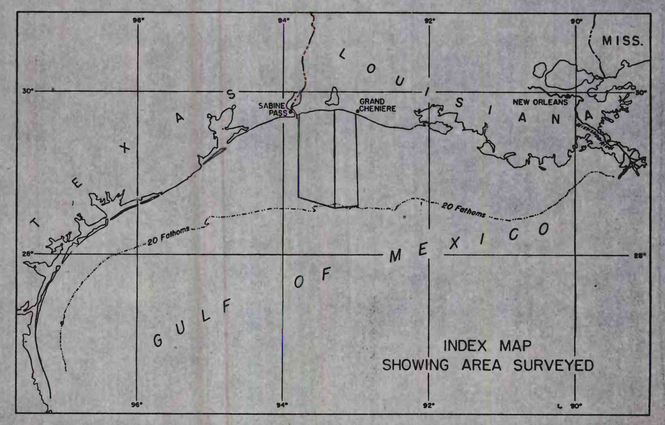
Stations were located by triangulation, using 3 centimeter radar and radar reflector targets mounted on buoys. The initial base line of targets for each of the three lines was located by transit triangulation from U. S. Coast and Geodetic Survey triangulation stations on shore. Because of the low precision of radar triangulation compared with optical triangulation the position errors of stations are relatively large, especially at the seaward ends of the lines. Preliminary analysis indicates that the maximum uncorrected longitude errors are approximately 2 miles, and the corresponding latitude errors are about one-quarter mile. These errors have been partially eliminated on the accompanying map by adjusting station positions on the basis of closing errors of triangulation traverses, run between the south ends of the three main traverses. Theoretical studies to evaluate position errors more critically are also being undertaken.

A number of significant deviations from normal gravity were disclosed by the investigation. Referring to the map, a pronounced positive southward gradient is observed in the northern part of the area, followed on the south by a gravity high and a pronounced reversal in gradient, and finally by an area characterized by a number of prominent gravity lows.

The positive southward gradient may reflect either decreasing depths southward to relatively dense crystalline rocks, decreasing thickness of salt beds within the sedimentary formations, or structural anomalies whereby the older and denser sedimentary rocks were brought closer to the surface in the area of high gravity. Insufficient area was covered to determine whether the gravity high is a regional or a comparatively local feature. On the basis of available information it may indicate the existence of a major positive feature separating two synclinal areas, or merely a local positive feature. In either case it is likely that a second gravity high, marking the southern boundary of a major synclinal area, will be found farther seaward near the edge of the continental shelf.

The negative gravity anomalies in the southern and eastern part of the area are similar in extent and magnitude to those associated with many salt domes in the Gulf coastal region. Insufficient information is available, however, to compute the probable depth or shape of the anomalous masses, consequently it is not possible to postulate with any assurance that the anomalies are associated with piercement type rather than with deeper-seated domes.

It should also be pointed out that the configuration of the anomalies shown on the map would doubtless be altered considerably by a more detailed survey and that additional negative anomalies may exist in the area.



INDEX MAP
SHOWING AREA SURVEYED

EXPLANATION

Contour interval one milligal

Datum mean sea level

Latitude, free air and Bouguer corrections applied

52 −0.39
Gravimeter station (52) and relative gravity value (−0.39)

RECONNAISSANCE GRAVITY MAP OF PART OF GULF OF MEXICO

Nautical Miles

1947

Gulf of Mexico. gravity. 1:167,000. 1947.
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