SEDIMENTATION ON A SEMIARID, WAVE-DOMINATED COAST (SOUTH TEXAS) WITH EMPHASIS ON HURRICANE EFFECTS

by

Miles Oren Hayes

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ABSTRACT

The Coastal Bend Area of south Texas is a wave-dominated coast in a semiarid climate. Although wave action is the dominant coastal process in the area, catastrophic storms (primarily hurricanes) play an important role in nearshore sedimentation. Tropical storms cross the Texas Coastline with a frequency of 0.67 storms per year. Greatest geological effects of these storms are produced by wind-driven waves and by storm surges.

The comparison of a part of the nearshore environmental complex of the study area before and after hurricane Carla (1961) shows the effects of the storm. The bottom of the inner neritic zone was both a contributor and a receiver of hurricane deposits. As the storm moved landward, it picked up mollusc shells, rock fragments, coral blocks, and other materials from depths as great as 50 to 80 feet and deposited them on the barrier island. After the storm passed inland, strong currents spilled out of the numerous hurricane channels cut into the island by the storm-surge flood. These currents deposited a thin layer (0.5- to 1.5-in.) of sand over what was previously sandy mud bottom, out to depths of 60 feet, and a graded layer of fine sand, silt and clay (a turbidite) further out on the shelf. The storm removed a belt of foredunes 20 to 50 yards wide from the seaward side of Padre Island, and let the foredune ridge with wave-cut cliffs up to 10 feet high. The formation of a broad, flat "hurricane beach" drastically altered the beach profile. The landward side of the barrier island (wind-tidal flats) received much washover material containing surf zone and beach molluscs. The storm also submerged high-level mud flats along the landward side of Laguna Madre and covered them with a fresh layer of mud. A much milder storm (Cindy) passed through the area in September, 1963, and a small swash bar was deposited over the seaward edge of the pre-existing "hurricane beach" where no interim change had taken place.

Beach and dune samples of central Padre Island cannot be differentiated on the basis of statistical parameters of grain size. This is due to the mixing of a "coarse" mode (2.2 to 2.3ø), contributed by the Rio Grande, with a "Fine" mode (2.9 to 3.0ø), contributed by rivers to the north, which obliterates any small variations in the grain size distributions that may be related to environmental processes. These grain size modes are remarkably constant through the area, even though they are only 0.6 phi units apart on the grain size scale.

Mixing of source materials (two modes) also affects the grain size properties of sediments of the eolian sand plain, producing some negatively skewed dune sand. The grain size modes remain constant with regard to size but change volumetrically in transport, thus producing much unusual features of the sediments as increasing standard deviation in the direction of transport.

Some unusual results from studies of the inner neritic zone include: (1) the best sorting of any samples analyzed, including beach and dune samples, occurs in the sediments of the barrier shoreface (12 to 40 ft. depths); (2) muddy sediments contain significant amounts of flaky carbonate silt, which is thought to be derived from shell abrasion on Padre Island beach; (3) submerged sand ridges in depths of 40 to 100 feet are thought to be relic extensions of the eolian sand plain; and (4) the maximum occurrence of silt is offshore from hurricane-channels, in areas of deposition of hurricane generated turbidites.