LATE QUATERNARY STRATIGRAPHY OF A SOUTH TEXAS BARRIER ISLAND COMPLEX

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ABSTRACT

Continuous cores were obtained from 7 sites distributed throughout southern Mustang Island, northern Laguna Madre, southern Corpus Christi Bay, and the adjacent mainland (Fig. 1). Coring at most sites attained a depth of 60 m, and average recovery was 74 percent; a total of 250 meters of cores was acquired in unconsolidated to poorly consolidated coastal sediments. The core hole data are supplemented by geophysical well logs and by approximately 75 kilometers of high-resolution seismic-reflection profiles.

The penetrated stratigraphic section ranges in age from late Pleistocene to Holocene. The Pleistocene-Holocene boundary is characterized as a prominent unconformity of considerable relief, which greatly influenced the depositional thickness of Holocene sediments. The thickness of the Holocene section varies from zero on the mainland (Encinal Peninsula-Oso Bay shoreline area) where the Pleistocene Beaumont Formation crops out, to a maximum of 36 m within a pre-Holocene channel beneath southern Mustang Island. During the late Pleistocene-Holocene time interval, the ancestral Nueces River system underwent multiple episodes of channeling and valley infilling, indicating complex transgressive-regressive facies relationships resulting from glacio-eustatic changes. The oldest observed channeling appears to reflect a Wisconsin low stand of sea level. Younger channeling occurring within the Holocene section suggests that the Holocene transgression was not continuous, but included one or more minor stillstand or regressive phases. The modern Mustang Island barrier appears to have begun developing approximately 8,500 yrs B.P.

Paleoenvironmental analyses indicate that the cored sediments represent a wide spectrum of paralic environments. On the basis of observed ostracode death assemblages (virtually all extant species), the following five major paleosalinity regimes/paleoenvironments were recognized: 1. A limnic (0 to 0.5 ppt) fresh-water/fluvial environment characterized by an ostracode assemblage composed exclusively of fresh-water taxa, 2. An oligohaline (0.5 to 5 ppt) upper-bay environment characterized by an assemblage composed of mixed fresh-water and bay taxa, 3. A mesohaline (5 to 18 ppt) mid-bay environment characterized by an assemblage composed exclusively of bay taxa, 4. A polyhaline (16 to 30 ppt) lower bay/inlet environment characterized by an assemblage composed of mixed bay and marine taxa, and 5. An euhaline (30 to 36 ppt) sublittoral environment characterized by an ostracode assemblage composed exclusively of marine taxa. Throughout the cored sediments, major changes in ostracode assemblages indicate fluctuations in salinity and water depth that appear to reflect transgressive-regressive events associated with glacio-eustatic changes.

Lithologically, the cored section is composed predominantly of alternating mud and sand layers and contains a few layers of molluscan shell gravel. The mud layers are multicolored and variably consolidated. Textural and petrographic characteristics of the sand units suggest the presence of at least two genetically distinct sand facies. Very fine-grained sands having a low detrital matrix content (a trace to 5 percent) represent barrier/strandplain deposits such as those that compose modern Mustang Island and the Pleistocene Ingleside sand body. In contrast, medium-grained sands having a relatively high detrital matrix content (average of 10 percent) appear to represent fluvial deposits of the ancestral Nueces River system. The detrital matrix of these sand facies appears to have been derived from the dissaggregation of fine-grained rock fragments, as indicated by evidence of fragment deformation. The framework grains of the sand facies consist of a wide variety of components that include monocrystalline and polycrystalline quartz, orthoclase, microcline, plagioclase, and rock fragments (chert, limestone, siltstone, shale, and sandstone). Quartz varies from 58 to 92 percent, feldspar from 1 to 22 percent, and rock fragments from 2 to 36 percent. The barrier/strandplain sand facies generally contains more quartz and less rock fragments than the fluvial sand facies. Cementing agents of both sand facies are rare. Observed calcite appears to be both allogenic and authigenic. Gypsum and halite, which are highly variable in occurrence, probably are late precipitates resulting from pore-water evaporation during coring operations.

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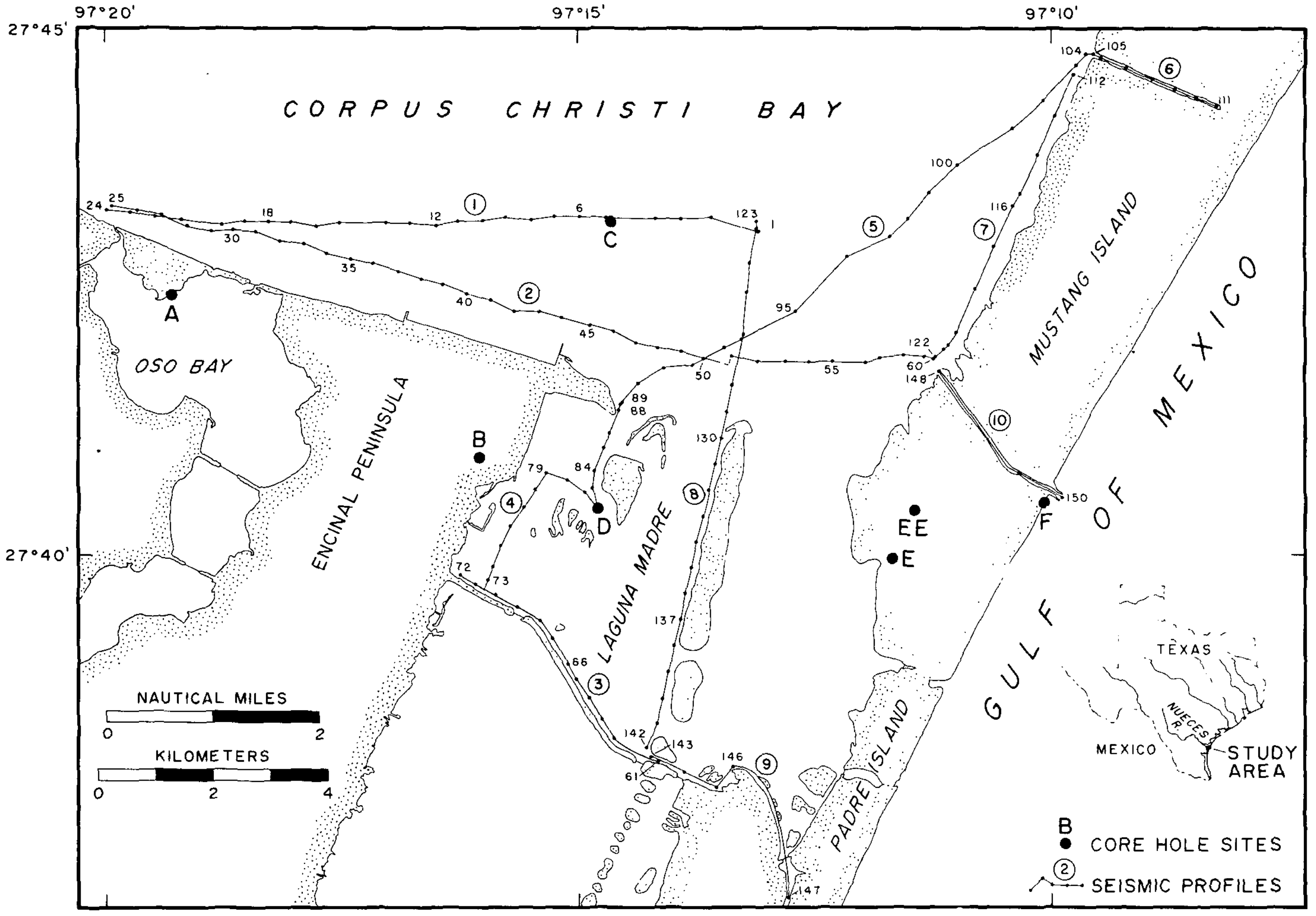

Figure 1. Location map of study area showing core hole sites and seismic profile network. .