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BIOTIC ASSEMBLAGES SOUTH-CENTRAL TEXAS COAST

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ABSTRACT

Characteristic biotic assemblages of marginal marine environments of the inner shelf, barrier, tidal delta-tidal channel and lagoon-bay complexes of the south Texas coast are briefly discussed.

INTRODUCTION

Several important studies of the distribution of marine invertebrates, especially the mollusks and foraminifers of the Texas coast have been published in the last decade. It is beyond the scope of this brief paper to cite and discuss all of these publications. The distribution and ecology of the Foraminifera have been summarized by Phleger (1960a, 1960b, and 1964). Two excellent papers by Parker (1959, 1960) have greatly advanced our knowledge of macroinvertebrate assemblages along the Texas coast, along with ecological surveys by Breuer (1957) and Simmons (1957). These studies, in large part the result of Project 51 of the American Petroleum Institute, provide a framework for future studies.

ENVIRONMENTAL COMPLEXES

Several major environmental complexes are located along the south central Texas coast. Each of these has a distinctive facies tract, geometry, and association of closely related environments. The various environmental subdivisions of these complexes are differentiated on the basis of variations in sediment textures, primary sedimentary structures and biotic assemblages. considered useful, or even more diagnostic in many cases.
Emphasis on the latter aspect does not imply that other criteria are not considered useful, or even more diagnostic in many cases.

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INNER SHELF COMPLEX.—Seaward from Port Aransas (Mustang Island) the shelf slopes approximately 10 feet per mile for about six miles and then the gradient decreases to about 6 feet per mile. Our sampling has been limited to relatively shallow water (less than 200 feet). The sand-mud boundary in this area is approximately 4-50 feet deep, and corresponds to the barrier face-inner shelf boundary as used herein.

Inner shelf muds are characterized by mottled or homogeneous sedimentary structures as a result of activity of burrowing organisms. Dense local populations of infaunal irregular echinoids are common and nearly all sediment samples contain their spines or broken plates. Brittle stars are also common in this environment. Live mollusks are not abundant in samples taken from the inner shelf although most samples contain molluscan remains. Shells are well preserved, are not covered with encrusting epizooans, and may be broken but do not show signs of abrasion. Shell breakage appears to be due primarily to organic activity and or sample preparation. Species diversity, *i. e.* number of taxa per sample, is relatively high, but there is wide variation among samples.

Among the most common mollusks in depths from 80 to 120 feet are the gastropods *Anachis saintpariana*, *Nassarius glypta*, and *Nassarius ambiguus*, and the pelecypods *Varicorbula operculata*, *Nuculana concentrica*, and *Pitar cordata*. Pelagic pteropods such as *Cavolina trispinosa* occur in increasing numbers in sample traverses from 150 feet to deeper water. The micromollusks were not studied in detail but they are diverse and show promise of becoming useful environmental indicators with further study.

BARRIER COMPLEX.—The barrier face environment, characterized by fine sand or silty sand support a diverse macroinvertebrate assemblage dominated by the mollusks. Molluscan shells are usually well preserved, free from encrusting forms, and unbroken. The gastropods *Terebra dislocata*, *Polinices duplicata*, and *Oliva sayana* are common near the base of the barrier face, 30-50 feet deep, as are the pelecypods *Dinocardium robustum*, *Dosinia discuss*, and *Tellina tayloriana*.

The shallower portion of the barrier face (30-15 feet deep) and the wave-break point bars have large populations of echinoderms such as the sand dollar *Mellita quinquiesperforata*, the starfish *Luidia clathrata* and *Astropecten* sp., as well as the gastropods *Oliva sayana*, *Olivella mutica*, *Terebra cinerea*, *T. dislocata*, and *Polinices duplicata*. Pelecypods are also common, e. g. *Anadara* spp., *Mercenaria mercenaria*, *Tellina tayloriana*. Forms that are attached by a byssus, such as *Anomia simplex* and *Ana-*

dara transversa may be locally abundant in the presence of sea-whips (Alcyonaria).

The surf-zone assemblage is very characteristic and is dominated by forms adapted for active, rapid burrowing. The most abundant mollusk is the "coquina" clam *Donax variabilis.* Its predators suchs as *Terebra cinerea, Oliva sayana, Olivella mutica,* and *Polinices duplicatus* may commonly be found in this environment.

BARRIER ISLAND.—Emergent portions of the barrier island do not support large numbers of invertebrates that are potential fossils.

"Ghost crabs" (*Ocypode albicans*) are quite common on the back beach and seaward edge of foredunes. Trenches dug in these environments show sand-filled, cylindrical burrows of these crabs. *Ocypode* requires periodic gill-wetting, therefore the inland range is limited. Large diameter (1-2 in.) burrows of pocket gophers, ground squirrels, and other rodents dot the vegetated barrier flat.

Sparse marshes fringe the lagoonal side of the barrier islands at many places. Large populations of fiddler crabs (*Uca* spp.) live and burrow in these marshes. The lagoonal side of barrier islands are also marked by extensive wind-tidal flats. These areas are devoid of macro-invertebrates except during flooding by wind-generated tides. Generally, winds exert more control over tides in the lagoons than do the sun and moon.

Hurricanes periodically breach the barrier islands, forming whasover fans and channels. The high storm-surge tides transport and displace many open Gulf forms, scattering them over the surface of the barrier island. Such displaced faunal assemblages can present problems in the interpretation of ancient sediments. These displaced forms are not broken and pelecypod valves are often articulated, showing little evidence of transportation. In fact, immediately after Hurricane *Carla* (September 1961), the Gulf beach was littered with dying *Astropecten, Atrina,* and *Dosinia* that had been ripped from their habitat by storm waves and deposited on the beach.

Semi-permanent storm channels that cut below the water table form ponds which temporarily support marine invertebrates. One example, approximately 30 miles south of the northern end of Padre Island, observed in August 1964, contained many clumps of two to three inch specimens of *Crassostrea virginica,* obviously grown in place. Articulated *Tagelus* and *Ensis* valves were also common in the channel. All were dead, but it was apparent that these animals could thrive for spans as long as three months.

TIDAL DELTA AND TIDAL INLET.—Tidal channels breach the barrier islands of the Texas coast in many places. Before the stabilization of some of the channels by stone jetties, their positions moved as a response to longshore drift.

Sediments in tidal channels are coarse due to relatively high current velocities; placers of shell are common. The highest species diversity of living invertebrates on the Texas coast is bound in these channels because of the mixing of open-sea and lagoonal assemblages with the distinctive indigenous fauna. Dead shells are characteristically riddled by boring clionid sponges, encrusted by epizoans such as serpulid worms, corals, oysters and bryozoa, and are commonly broken and abraded. Representatives of almost all shallow water assemblages may be found in tidal channels. However, certain taxa seem to be especially common in this environment, e. g. *Astrangea astreiformis*, *Crepidula*, *Thais*, and *Dentalium texasianum*.

Where tidal channels enter lagoons or bays, the species diversity drops in direct proportion to distance within the lagoon. The transitional zone of tidal inlet influence varies considerably, depending upon annual rainfall and runoff. Its boundaries can only be defined arbitrarily. Previously published studies such as those of Parker (1959, 1960) represent samples taken during an extensive drought. Studies in these same areas during years of heavy rainfall will provide useful comparative data.

Low, emergent portions of the tidal delta are *Spartina-Salicornia* marshes intricately dissected by small meandering tidal channels. Clumps of oysters are common in the channels and the marshes have large populations of the snails *Littorina irrorata*, *Neritina reclivata*, and *Bulla striata*. Because of the high salinity the marsh clam *Rangia* is not present. Fiddler crabs, *Uca*, and their burrows are exceedingly common on the natural levees of the tidal channels. Shells of many large gastropods such as *Polinices*, *Busycon*, and *Thais* are carried into the marshes by the hermit crab, *Pagurus*. The most diagnostic marsh faunule is the foraminiferal assemblage, which is characterized by a low species diversity (5-7 species), and a preponderance of arenaceous tests (80-90%).

LAGOON-BAY COMPLEX.—Bay center sediments are soft, silty muds containing varying amounts of shell material. Samples from open bay centers with variable salinities (25-35 0/00) have large numbers of molluscan shells. Relatively small (1-5 mm) and thin shelled forms predominate. The shells are well preserved, unbroken, and free of encrusting epizoans. Among the pelecypods, the deposit feeders *Nuculana acuta* and *N. concentrica* and the filter feeders *Mulinia lateralis* and *Pandora trilineata* are the most common.

The gastropods *Retusa caniculata, Cantharus cancellarius, Nassarius acutus,* and *Polinices duplicatus* are also present.

Soft mud poses a problem for most large, heavy-shelled mollusks. These forms tend to sink below the soupy interface. Several mollusks have morphologic adaptations for this environment. *Pandora* has a thin, leaflike shell and lives on its side, exposing a large surface area to the sediment. *Nuculana* burrows through the interface, ingesting large amounts of sediment and does not maintain constant contact with the water through siphons. The globular shape and thin shell of *Mulinia* also prevents this form from sinking into the soft sediment. Many of the gastropods, e. g. *Polinices,* have an exceptionally large foot to aid in burrowing or traversing soft sediments.

Soft, well laminated mud is deposited in enclosed hypersaline bay centers. Samples from this facies in Baffin Bay are almost totally devoid of shelly remains.

The bottom topography of the Texas bays and lagoons resemble broad, shallow soup plates. The bay center facies is essentially flat, with only minor irregularities and depths averaging about 9 to 12 feet are common. The margins of the bays slope gradually out from shore to a depth of about five to six feet where they drop off sharply. The width of this bay margin facies varies with local conditions from about 50 feet to over quarter of a mile. Sediments of the bay margin facies are sandy mud to sand are locally derived from erosion of Pleistocene deposits bordering the bays.

The deeper portions of the bay margin facies in two to five feet of water are commonly devoid of rooted vegetation, or may be covered with turtle grass *(Thalassia).* The bay margin is inhabited by several large infaunal forms such as the burrowing pelecypods *Mercenaria mercenaria campechensis, Tagelus divisus, Cyrtopleura costata, Ensis minor,* and *Macoma brevifrons.* Several predatory gastropods, including *Busycon* and *Polinices,* prey upon the pelecypods.

Seasonal variations in the composition of bay margin assemblages are striking. Many of the epifaunal and mobile invertebrates migrate from the shallow bay margins into deeper water in the bays centers and tidal channels during periods of extreme low or high temperatures and/or salinities. The infaunal species, buffered by the surrounding sediments against rapid fluctuations in environmental conditions, maintain more consistent population levels in these areas.

Shallow (one to three feet deep) areas of the bay margins are commonly covered by dense growths of "Shoal grass" *(Diplanthera wrightii).* A diverse molluscan assemblage is associated with these grass flats. The most characteristic aspect of these assemblages in high salinity areas is a large number of small gastropods, e. g. *Cerithium variabile, Cerithidea pliculosa, Vermicularia fargoi,* and *Modulus modulus.* Among the infaunal pelecypods, *Anomalocardia cuneimeris* and *Tellina tampaensis* are abundant in areas of high salinity; *Phacoides, Laevicardium,* and representatives of the deeper bay margin biofacies may also be common. In addition to the burrowing pelecypods, *Amygdalum papyria* may be found attached to blades of grass by byssal threads.

The grassflat is a "low energy" environment. The sediment interface is stabilized by the rooted vegetation, and current velocity across this interface is low. Samples of mollusks and sediments from grassflats contain many shell fragments which are a result of feeding habits of the black drum *(Pogonias cromis)* and other bottom feeding fish. Interpretation of "high energy" conditions based upon the presence of shell hash and broken shells is not reliable. Shell are also commonly broken by predators suchs as rays and crab.

Dead serpulid worm reefs are found along the margins of Baffin and Alazan Bays and Laguna Madre in the vicinity of Baffin Bay. Serpulid tubes, barnacles, and *Brachidontes citrinus* are the most common potential fossils of these reefs.

Oyster reefs are common in many of the low salinity bays and lagoons along the Texas coast. These low salinity reefs are composed mostly of *Crassostrea virginica,* along with barnacles and *Brachidontes.* High salinity (30-35 0/00) oyster reefs contain *Ostrea equestris* and several stenohaline predators such as *Thais haemostoma.* The preferred orientation of oyster reefs perpendicular to currents has been noted by many workers. Detailed studies of variations in associated organisms and reef orientation may prove useful in the interpretation of the paleoecology and paleogeographic setting of fossil oyster reefs.

VEGETATION.—Subaerial regions of the barrier island bear weed-like vegetation; trees are now here present. The constantly moving sand of the forebeach prevents rooting of plants. In the more stable back beach, the railroad vine *(Ipomoea pas-caprae)* becomes established, along with glasswort *(Salicornia).* Croton, cordgrass *(Spartina),* and sea oats *(Uniola paniculata)* appear on the back beach and are abundant in the foredunes. Croton seems responsible for holding the permanent dunes in position; when the vegetational cover is removed, either by climate, storm, or man, dunes become migratory.

On Mustang Island, the barrier flat is thickly covered with sunflower

(Helianthus), which may or may not be indigenous. It, along with cordgrass, covers the higher reaches of the flat, while *Salicornia* is the only large plant that can tolerate the salt-soaked soil of the wind-tidal flats and each clump of glasswort has a wind-shadow (leeward) sand dune. Red and blue-green algae grow profusely in mats on these flats when they are wet, and form thin white calcareous or black clay laminae in the sediment. Gas bubbles and gas heave structures are occasionally seen in association with these mats.

Salicornia and *Spartina* are the most common marsh plants in the Port Aransas area although many other species are present. Roots of this vegetation penetrate the soil to a depth of several inches, disrupt primary sedimentary structures, and form vertical brown or black streaks in the sediment. Mangroves *(Rhizophora mangle)* have been reported on Harbor Island but have not been observed in the past few years, although they are abundant on the Yucatan coast as well as the eastern Gulf Coast.

Some shallows of the lagoons are covered by a luxuriant growth of marine "grass", and are commonly called grass-flats. *Diplanthera wrightii* is common in the shallowest grass-flats (about 1-3 feet deep) in areas of high salinity. Widgeongrass *(Ruppia maritima)* is found in somewhat deeper water, less saline, and particularly in sheltered coves with a silty bottom. Turtlegrass *(Thalassia testudinum)* occurs in the deeper portions of the bays. Some maxing of species has been seen, especially that of *Diplanthera* and *Ruppia*. Salinity, in a large part, controls occurrence and growth of these angiosperms. Shoalgrass can tolerate salininty to 60 0/00; widgeongrass to 45 0/00, and turtlegrass is least tolerant to high salinity.

Acetabularia, a calcareous green alga, is common in the grass-flats and attaches to serpulid reef masses in the high saliminty Laguna Madre. *Penicillus*, another calcareous alga, has been reported from southern Laguna Madre in Texas.

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