GROWTH AND DEVELOPMENT OF HOLOCENE OYSTER REEFS, SOUTHWEST FLORIDA

DANA DERICKSON
Geosciences Dept., Trinity University
Sponsor: Dr. Edward C. Roy Jr., TU

INTRODUCTION

An estuary is defined as "a semi enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage" (Shier 1969). They are one of the world's most productive and delicate ecosystems. Estuarine environments, like the Ten Thousand Islands in southwest Florida, display a balance between wave, tidal, and fluvial processes. Human influences, as well as millennial scale fluctuations of sea level, threaten this balance.

Oyster reefs are an essential part of estuarine ecosystems, especially in the Ten Thousand Islands area. Oysters filter the water, thus raising water quality and lowering turbidity, they provide food and habitat for the numerous aquatic species, and they provide stable ground for the roots of mangrove trees. Knowing how and where oyster reefs develop is key to the preservation of the reefs, and it also provides useful information for any restoration effort that may be attempted in the future.

The watersheds of southwest Florida are currently endangered because of urban, agricultural, and coastal development. For example, Faka Union canal to the southeast and Henderson Creek to the northwest of the study area have been drastically altered as a result of human influence. This study will help to decide if oyster reefs can survive rapid changes of environment and then persist in a more marine setting. Knowing the preferred substrate on which oyster reefs develop could also help in restoration efforts that are currently underway in that area. By understanding the sedimentology of oyster reefs, new reefs could be planted in bays and have a better chance of survival.

METHODS

Field Work

The area seaward of the Blackwater River in Ten Thousand Islands was chosen for the study because it is an area of low human influence (see Figure 1). The control reef, located in Blackwater Bay, is an optimal environment for a healthy oyster reef. Three other reefs were chosen in the outer fringe coastal environment just south of Blackwater Bay. They are all influenced by marine surroundings because they are exposed to the Gulf of Mexico.

Using a vibracore and three-inch diameter aluminum tubes, a core was extracted from each reef. The sediments were described and stratigraphic columns were drawn. Oyster shells and sediments were sampled at selected intervals throughout each core.

Laboratory Work

Sediments from five to ten centimeter intervals were wet sieved into the following size fractions; <1Φ, 1Φ to 2Φ, 2Φ to 3Φ, 3Φ to 4Φ, and >4Φ. Each fraction was dried and

weighed. Each fraction was then evaluated for its percentage of shell, quartz, mud and root hairs. The ratio of sand to mud was also calculated and graphed. Stratigraphic columns were prepared and a fence diagram was constructed. Oysters were individually examined and each received a taphonomic grade so that comparisons could be made vertically within each core as well as from core to core. A bar graph was constructed comparing the oyster's grade compared to its depth.

RESULTS

Sediment

The sand-mud ratio varied between cores but the three fringe reef cores displayed similar ratios between 40cm and about 150cm. Overall there was an average of about 60% sand in this section.

According to weight percents, a general pattern shows that the percent coarse sand and gravel (<1_) in each core was high in the upper 20-30 cm and diminished with depth. It also shows the 2_ to 3_ sized fractions at a low percent in the upper sections and an increased percent with depth. However, the sediments do not show a characteristic mean grain size.

Microscopic analysis shows that the sediment less than 1_ was mostly broken oyster shells along with gastropod and bivalve shells. The 1_ to 2_ fraction contained varying amounts of carbonate mud lumps, oyster shells, foraminifera and some angular to sub-angular quartz. The 2_ to 3_ sized sediments were mostly angular to sub-angular quartz with minor carbonate amounts. The 3_ to 4_ range consisted mostly of sub-angular quartz as well as sponge spicules and a few carbonates. Anything greater than 4_ was considered to be carbonate mud.

Stratigraphy

The stratigraphic sections of the three outer reefs have very similar units that correlate well (See Figure 2). At all three outer reef locations, the reefs began to develop on a shelly wackestone. The cores that were drilled deeper show that the wackestone formed on a mangrove peat layer. The oysters that make up the control reef in the inner bay developed on top of mangrove peat. The fact that peat was found in the cores of the outer reefs suggests that the area was once in an inner bay where

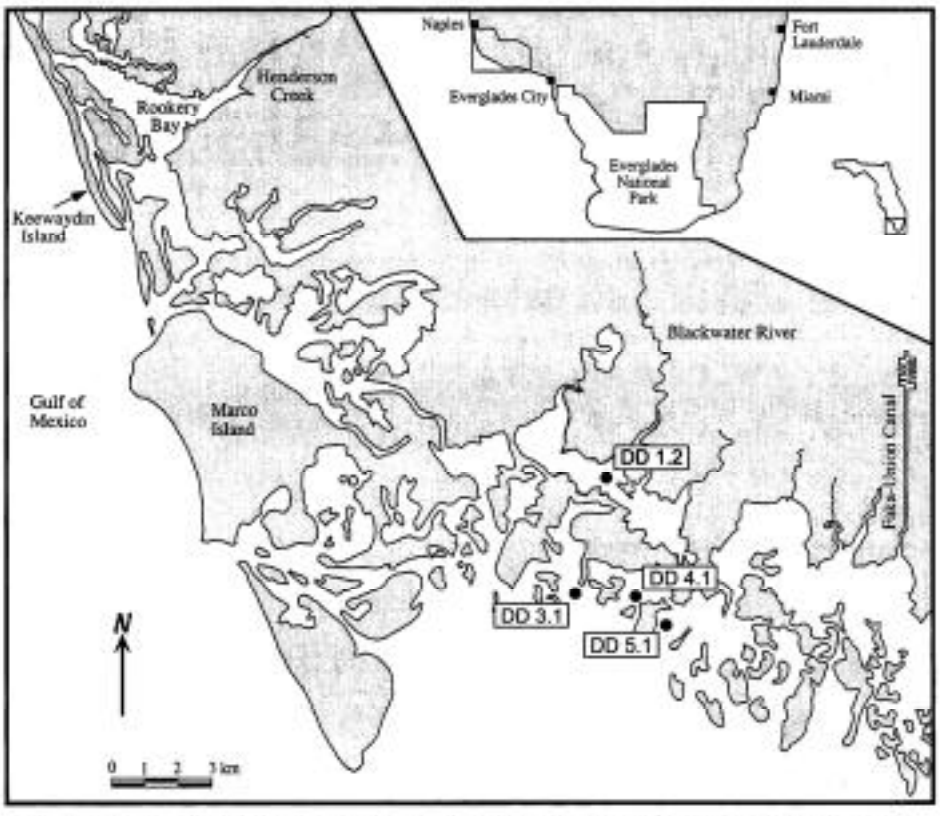

Figure 1. Map of southern and Southwestern Florida. Location of cores labled and marked

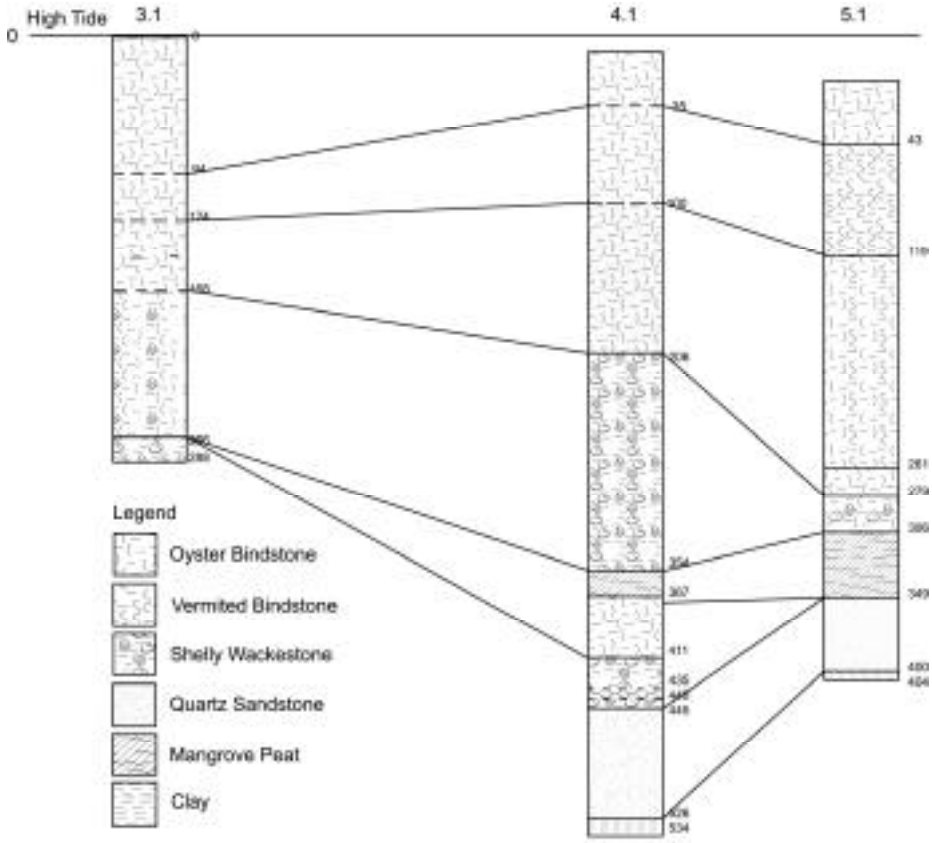

Figure 2. Fence diagram of the three outer reef cores

mangrove trees grew. The oysters appear in the core either directly above the peat or above a shelly wackestone layer deposited on the peat. It is therefore probable that the reef first formed while the environment was still estuarine.

Taphonomic Grading

In theory, there should be a low degree of oyster shell fragmentation, disarticulation and corrosion for a shell that is in a lower energy environment and the physical characteristics of the shell should worsen as the environment becomes more unprotected. To prove that the more marine oyster reefs had in fact developed in a protected bay environment there should be a pattern present that shows better preserved oyster shells in the older section of the oyster reef, and a progressively worse grade as the reef gets younger.

After examining the results there seems to be no apparent patterns at all. Individual cores do not display the theoretical pattern, and no two cores exhibit similar results. This does not prove or disprove the theory that the reefs developed in an estuarine setting.

CONCLUSION

By comparing an oyster reef that has always been located in a protected inner bay to three reefs in the outer fringe of the islands, it can be suggested that the more marine reefs actually developed in an inner bay of an estuary and then persisted through the transgression into a more marine environment. This was confirmed by analyzing each reef's stratigraphy along with the oysters themselves and the sediment surrounding them. Studies from Chester (1979) and Shier (1969) use different techniques but also agree that oyster reefs in the Ten Thousand Islands area developed on either peat or a clastic layer overlying the peat.

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