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INTRODUCTION

Great Pond and its associated reef and lagoon are located roughly midway along the southern coast of St. Croix (Fig. 1). The landward portion of the system is a mangrove-rimmed pond that is filled alternately by brackish and moderately hypersaline waters during the wet and dry seasons, respectively. Separating the pond from the more open-marine lagoon is a baymouth bar, likely deposited during the most recent Holocene rise in sea level. The reef and lagoon likewise have their origins tied to the Holocene sea-level rise. The reef forms a nearly continuous barrier between the lagoon and the open ocean, with the exception of small passes located on either end of the bay. Of particular interest is the rapid transition from primarily terrigenous deposits within the pond to open-marine, carbonate sediments within the lagoon. The scale of the area affords an excellent opportunity to examine this "typical" system at a scale that is manageable in one or two days.

The descriptions of the reef and lagoon are largely based on a WIL class project supervised by one of the authors (Hubbard). Participants are listed as authors in alphabetical order. Most of the descriptive and sedimentological information is derived from that project. Information on oceanographic processes was collected by H. H. Roberts, and most of this information is drawn from previous papers and an in-house report by the Coastal Studies Institute at Louisiana State University. Discussions of pond sedimentation borrow heavily from earlier descriptions of the area.

SEDIMENTARY ENVIRONMENTS

The Pond

The pond occupies approximately 0.5 km^2 along the south coast of the island. Water depth is shallow, averaging 30-50 cm. A narrow channel, up to 1.5-m deep, occurs in the southeastern corner of the pond. While tidal waters flow in and out of this channel, its origin is likely related to storm runoff during heavy rains in the fall and winter months. The pond is rimmed by black *(Avicenna nitida)* and red mangrove *(Rhizophora mangle)*, the latter occasionally trapping enough sediment to form small islets within the pond. This trapping is gradually causing the pond to infill.

Sediments are primarily mud with occasional stringers of shelly material. Pond sediments are derived from two sources, the most important being terrestrial runoff. During heavy rains, salinities within the pond are reduced to brackish levels and large quantities of primarily muddy material are delivered to and trapped within the pond. The second source is storm overwash. Deposition by this mechanism is confined to areas immediately behind the barrier and near the inner terminus of the tidal channel. It is unclear whether these deposits represent storm washover or are more related to migration of the tidal pass presently at the eastern end of the bar. For additional information, the reader is referred to Howard and Dorges (1974) and Muller (1974).

The Barrier Bar

Separating the restricted pond from the normal-marine waters of the lagoon is a vegetated bar that extends along the coast for a distance of approximately 1 km. The interior sediments of the bar are sand to cobble-sized clasts derived from an eroding headland to the east (Multer,

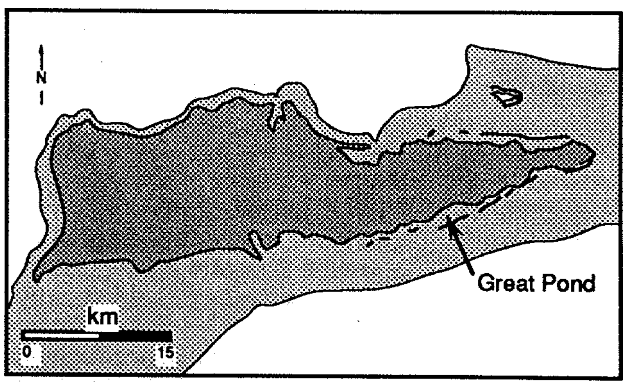

***Figure 1**. Map showing the location of Great Pond Bay on the south coast of St. Croix.*

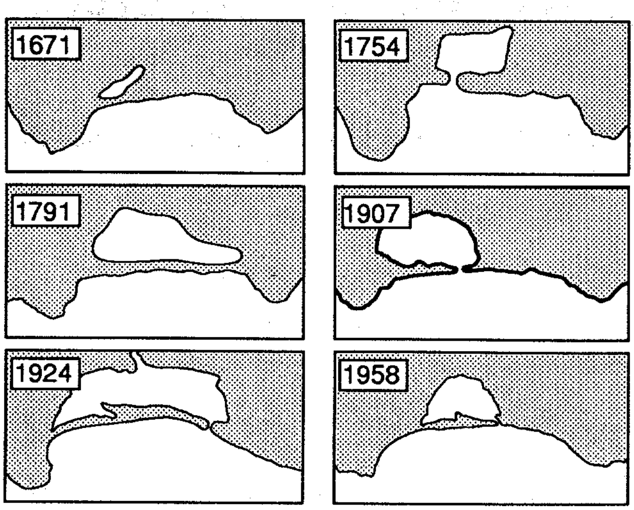

Figure 2. Variations in channel position through time. After Lu et al. *(1972).*

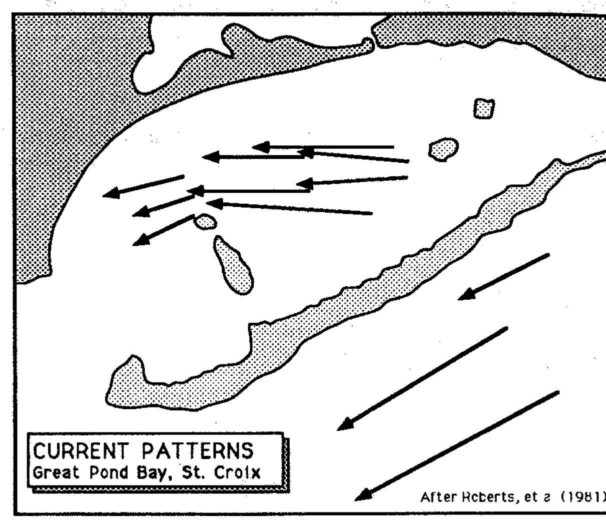

Figure 3. Current patterns near Great Pond. For more detail, see Roberts (this volume).

1974). The present-day surface of the feature supports a thick community of mangrove, manchineel and sea grape along with occasional stands of other trees and shrubs.

The origin of this feature is likely tied to the most recent slowing of the Holocene sea-level rise 2,000-5,000 years ago. With the stabilization of sea level, tidal and wave-transported sediments gradually formed a permanent strip of land between the two headlands on either side of the pond. Such features are common around the island, with Great Pond being among the largest of these brackish or saline ponds remaining in the U.S. Virgin Islands. Muller (1974) invoked channel migration and storm processes as important mechanisms tied to the depositional history of the bar. This is supported by the active channel migration documented by old maps and aerial photographs. At various times throughout the history of the area, the narrow channel that presently occupies the eastern end of the beach has also occurred further to the west or has been completely closed (Fig 2).

Great Pond Bay

Great Pond Bay is a roughly 2-km long embayment confined on its landward side by the baymouth bar and to seaward by a continuous coral-algal reef. The bay is open to both the east and west, allowing unrestricted, shore-parallel flow of open-marine waters. Currents within the bay are generally less than 10 cm/sec and flow is toward the west (Fig. 3). Figure 4 is a map of the dominant subenvironments of the bay, identified by the Coastal Studies Institute at Louisiana State University, using side-scan sonar and aerial photographs of the area. Figure 5 summarizes the benthic environments, based on data from the WIL class studies.

The inshore (30-100 m) portion of the lagoon is floored by a carpet of seagrass (mostly *Thalassia testudinum*, with lesser amounts of *Syringodium filiforme).* Seaward of that, the majority of the lagoon is floored by open sand, with numerous mounds produced by the burrowing shrimp *Callianassa* sp. Scattered patches of *Syringodium* occur along with the algae *Dictyota* and *Penicillus.*

The ubiquitous shrimp population has had a profound impact on sediment transport within the lagoon (see discussion in Roberts, this volume, and his Figure 7). Based on average densities of 6.7 mounds per m^2 in the open sandy area of the lagoon, the rate and volume of sediment ejection from each mound, measurements of local currents and the physical characteristics of the lagoon sediments, Roberts *et al.* (1981) determined that over 200 kg/day of sandy sediment could be moved to the west by the resident shrimp population. While low by comparison with transport rates on exposed beaches, this mechanism likely represents the major form of sediment transport in this and other carbonate lagoons around the island (Hubbard *et al.,* 1982).

In the mid-lagoon region, a series of very low-amplitude bedforms occur that can be detected only by a fathometer, side scan, or similar device. These sand waves average nearly 100 m in length and are less than 50 cm high. They occur within the open-sandy portion of the bay and are generally oriented toward the west.

Sediments within the lagoon are dominantly medium-fine sand (1.5-2.5 phi; Fig. 6a). The best-sorted sediments occur within the central portion of the lagoon, with sorting dropping off toward the reef and the beach (Fig. 6b). The dominant sedimentary constituents are coral, coralline algae and terrigenous fragments. Of secondary importance are molluscs and *Halimeda* sp. (Fig. 7). The major differentiation in grain types is between carbonate and non-carbonate sediment. Terrigenous material is important only within 100 m of shore; beyond that, abundance drops to below 10%. Coral and coralline algal fragments are predictably most important in the immediate backreef and forereef. In general, carbonate-sediment type

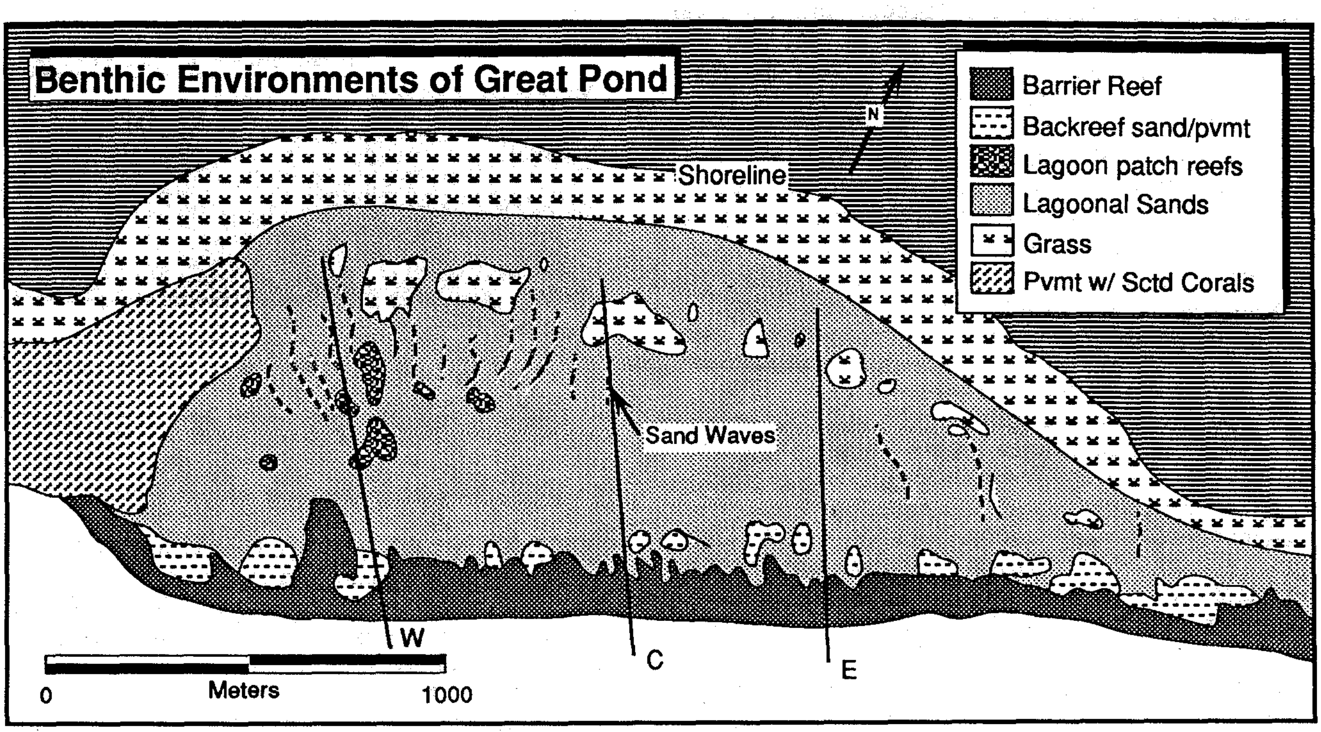

Figure 4. *Depositional environments of Great Pond Lagoon. After Roberts et al. (1981).*

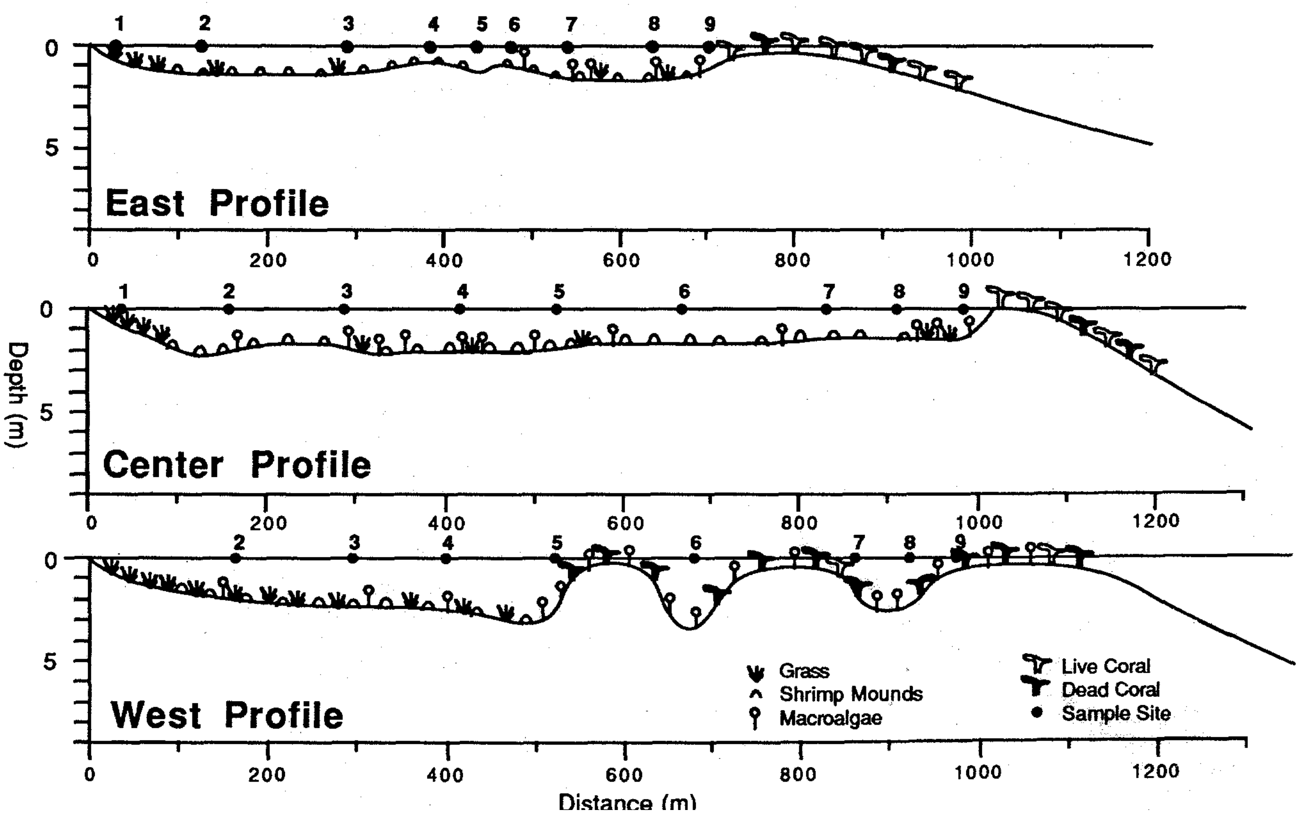

Figure 5. *Benthic environments along three transects. See Figure 4 for locations.*

is well mixed within the lagoon, and no clear environmental trend in grain origin beyond that just discussed is obvious.

Reefs

Two types of reefs exist within the bay. In the seaward half of the lagoon, scattered patch reefs can be seen (Fig. 4). Cover by live coral is generally poor, but where found consists of *Acropora palmata, A. cervicornis, Montastrea annularis* and *Porites porites.* Bioerosion is heavy on these reefs, and most of the dead corals are in an advanced state of deterioration. While coral cover rarely exceeds 10 percent, it generally increases in abundance on the more seaward patch reefs (Table 1).

The barrier reef is a continuous feature that effectively blocks most of the incoming wave energy. Figure 2 in Roberts (this volume) illustrates the dampening effect of the reef on incoming waves. On the day of record, wave height in the forereef varied from 30 to 75 cm; periods were in the 4-6 second range. As the waves shoaled on the reef crest, smaller waves were filtered out and the crests of the larger waves heightened and became more

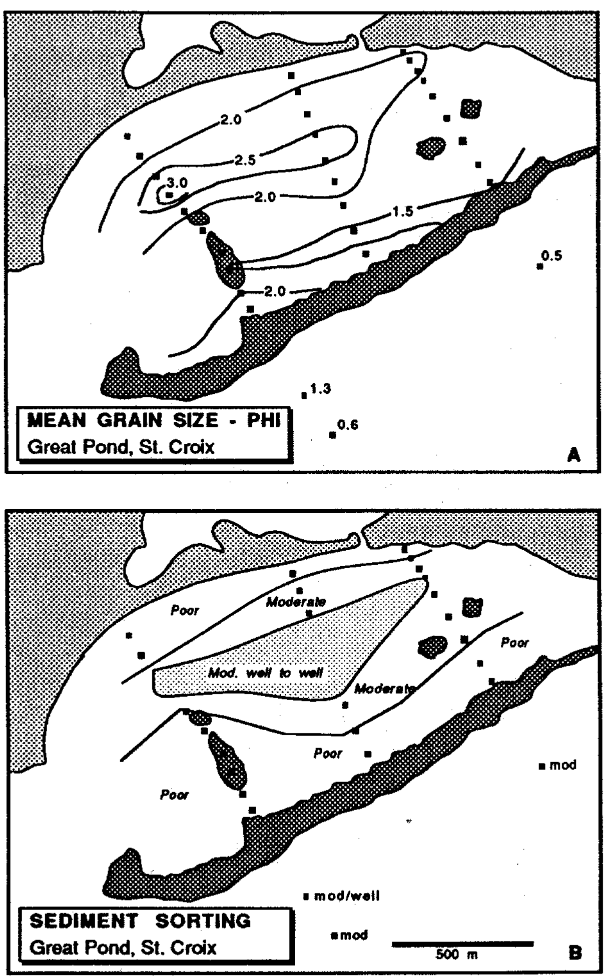

Figure 6. *Sediment size and sorting in the Great Pond reef-lagoon complex.*

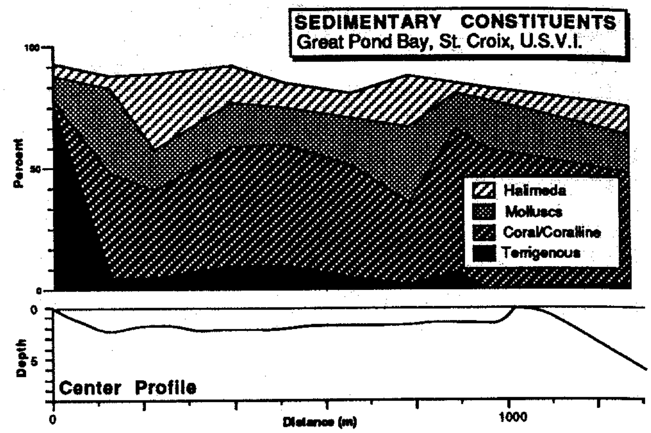

Figure 7. Sediment constituents of central Great Pond Bay.

distinct. In the backreef, wave heights were lowered to less than 10 cm, reflecting the energy lost as the waves broke over the reef crest. Elsewhere in the Caribbean, it has been shown that barrier reefs similar to the one at Great Pond can remove in excess of 97% of the incident wave energy (Roberts *et al.,* 1975) .

The backreef is dominated by sand and rubble with a scattered benthic cover consisting primarily of *Halimeda* sp., *Penicillus* sp., *Syringodium,* and *Dictyota sp.* Scattered head corals, including *Montastrea annularis, Diploria strigosa* and *Siderastrea* sp. occur in the backreef (abundance = 2-10%) which is dominantly a barren pavement in between.

Along the reef crest, the main cover is by live and dead *A. palmata* and *Millepora* sp. On the forereef, corals are dominantly flattened or hemispherical colonies of *Siderastrea* sp, *Diploria* sp. and *Porites astreoides. Millepora* sp. also occurs, along with locally important macroalgae and soft corals. At one time, this reef front was dominated by *A. palmata* as evidenced by the nearly continuous pavement of broken and cemented clasts derived from this prolific branching coral. It is likely that these colonies were destroyed by hurricanes David and Frederic as has been documented elsewhere along the south shore of St. Croix by Rogers *et al.* (1982). Based on pre-storm data in adjacent Robin Bay, live coral cover likely exceeded 25% with more than half of this being *A. palmata.*

Forereef sediments are much coarser than those in the lagoon. Sediments range in size from medium to coarse sand and are moderately sorted. As would be expected, coral and coralline algal fragments dominate the constituents of the sand fraction.

WHERE TO GO

The best access to the pond and the inshore environments of the lagoon is along the eastern end of the pond. A broad tidal flat provides firm parking during the dry season, but some care should be exercised during wet

***Table 1**. Benthic cover along the three Great Pond transects in Figure 5. Brf = backreef.*

West Transect

					<--Patch reefs-->			Brf	<--Forereef-->		
Station	Wi	W2	W3	W4	W5	W6	W7	W8	W10	F20	F30
Sand	60	60	15	-	13	17	14	14	24	2	5
Flora	40	40	85	100	40	35	35	46	49	26	51
Dead coral	-	-	-	-	26	21	49	17	15	61	33
Live coral	-	-	-	-	15	21	2	22	12	11	11
Corallines	-	-	-	-	6	7	-	-	-	-	-

Center Transect

				Lagoon					Brf
Station	Cl	C2	C3	C4	C5	C6	C7	C8	C9
Sand	-	99	90	90	90	100	99	32	99
Flora	100	<1	10	10	10	-	1	68	<1
Live coral	-	-	-	-	-	-	-	<1	<1

East Transect

				Lagoon					Brf	Forereef	
Station	El	E2	E3	E4	E5	E6	E7	E8	E9	F20	F30
Sand	26	92	84	99	99	99	99	92	95	67	89
Flora	74	8	16	1	1	1	1	6	2	-	2
Dead coral	-	-	-	-	-	-	-	2	2	23	-
Live coral	-	-	-	-	-	-	-	-	1	10	9

periods. For those wishing to stay dry, access to the baymouth bar is through the Howard Wall Boy Scout Camp to the west. Permission should be secured ahead of time. The backreef and reef environments can be reached from shore, but it is a very long swim. The forereef is best visited by boat, although it is a long trip from most points on the north shore of the island. There is a primitive boat launch along the eastern end of the pond, and the best way to organize a trip to the area is by a small boat on a trailer.

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