Molluscan Taphonomy of Pigeon Creek Lagoon
San Salvador Island, Bahamas

Whitney L. Swift
Department of Geology
Washington and Lee University
Lexington, VA 24450

Introduction

Pigeon Creek Lagoon is a shallow, tidally-dominated basin which terminates in a tidal delta in Snow Bay, on San Salvador Island's southeastern coast. Pigeon Creek branches west and north from its tidal inlet, with both arms lined by dense stands of red mangrove. Each arm contains a tidal channel, ranging in depth from 3 to 10 feet (1 to 3 m), which is bordered by often lush subtidal grassbeds. In these grassbeds *Thalassia* is abundant, along with *Syringodium* and *Halodule*. Calcareous green algae is commonly found in the subtidal flats as well. In many areas, the grassbeds shallow to tidal flats, which contain the same marine grasses as well as extensive *Callianassa* shrimp mound development.

Taphonomy is the study of the processes of preservation. The various environments in Pigeon Creek result in an abundant and diverse molluscan fauna. In addition, these environs possess unique physical, biological and chemical attributes that can potentially affect the degree and style of post-mortem degradation. Thus, Pigeon Creek naturally lends itself to taphonomic study.

The overriding objective of the taphonomic study of Pigeon Creek Lagoon lies in establishing distinct "taphofacies" between the four basic depositional environments: tidal flat, subtidal grassbeds, tidal channel and tidal delta. To achieve this objective, various aspects of shell degradation will be analyzed for shell samples taken from Pigeon Creek's different environments. In theory, the different physical environments of the Pigeon Creek Lagoon subject shells to different modes of physical wear, each creating its own distinctive taphonomic signature. Analyses of the data obtained will determine whether or not this is the case.

Field Methods

The sampling undertaken for this taphonomic study occurred in the southern arm of Pigeon Creek Lagoon. A transect line was established in the Creek's tidal flats, eventually extending 850 meters through the various environments and terminating in the tidal delta in Snow Bay. The natural bend of the channel,

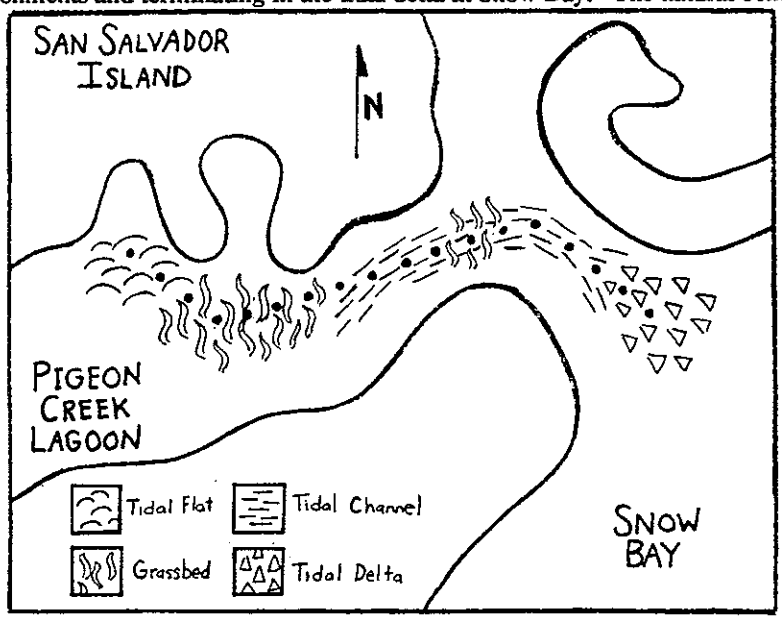

Figure One: Local map of Pigeon Creek Lagoon. Dots represent the 50-meter interval sample sites along the transect, from its origin in the tidal flats to point 850 on the tidal delta.

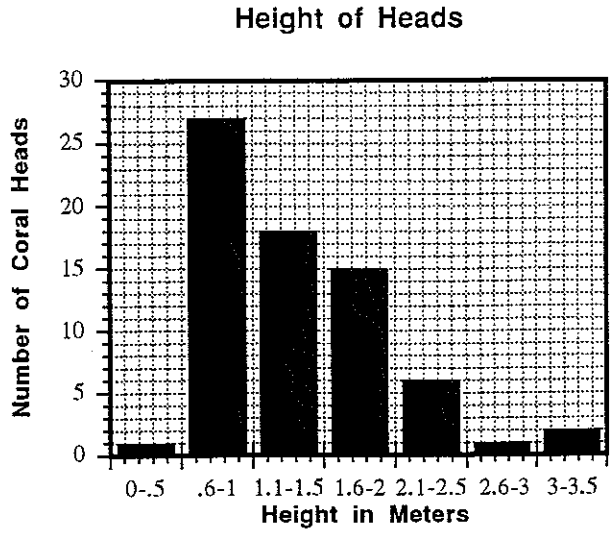

FIGURE 2. Frequency histogram showing heights of coral heads.

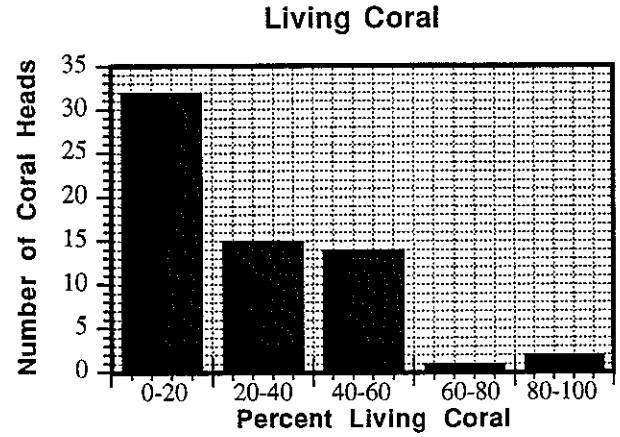

FIGURE 3. Frequency histogram showing percent living coral on coral heads.

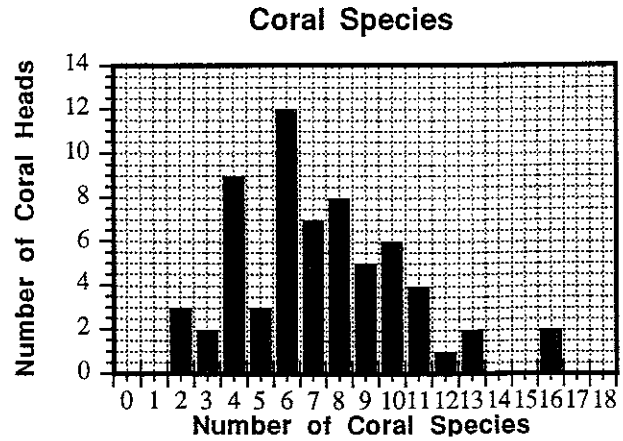

FIGURE 4. Frequency histogram showing number of coral species on coral heads.

as well as the desire to sample shells from all of Pigeon Creek's depositional environments, led to the transect's winding its way out of the channel in what can best be described as a zigzag pattern [Figure One].

Shell samples were taken every 50 meters along the transect line, starting with point 0 in the tidal flats. To establish the sample locations, one member of the team would walk or swim in the desired direction holding one end of a 50-meter tape, with another team member noting their directional heading with a compass. Once the appropriate site had been reached, the team member would mark it by anchoring a small buoy in the Creek's bottom.

At each sample location, shells and shell fragments were gathered by processing bottom sediment. On the exposed tidal flats, and, later, the tidal delta, sediment was shoveled from the bottom and placed in a 5 mm mesh bag and sifted in the Creek's waters. This process was repeated in the Creek's grassbeds and tidal channel, using a two-person team with scuba equipment. At each site a generally uniform volume of sediment was processed to promote consistency in sample size. Along with shell samples, at each site along the transect a sediment sample was taken, depth was measured and marine grass density was recorded. These data will be used in further establishing potentially preservable differences between Pigeon Creek's various environments (Miller, 1988).

Laboratory Methods

In analyzing the physical condition of the shells, the samples were first divided by taxon. Gastropods were counted if the spire was present, while a recordable bivalve required a beak (Staff & Powell, 1990). At the same time, the number of unidentifiable shell fragments from each sample site was recorded in hopes of gaining insight into the effects of the different environments' energy levels.

Taxonomic classification completed, the physical condition of each individual shell was examined, largely following the techniques used in a previous taphonomic study of Smuggler's Cove, St. Croix, U.S.V.I. (Parsons, 1988). A 10X hand lens and 20X microscope were used to highlight the often fine-scale degradation characteristics. For each gastropod, size and whether the mollusc was alive or dead was noted, followed by a visual inspection and judgement of the degree of abrasion, gastropod borings, root etchings, sponge borings and shell chalkiness. In addition, the degree of breakage and whether it was fresh or worn was studied, as well as the degree and types of epibionts, or encrusting bioeroders, which had become attached to the shell. Bivalves were examined for the previous characteristics, along with the shell's state of articulation and whether ligament remains were present. The taphonomic attributes of bivalve molluscs were further differentiated by the need to distinguish between the conditions of shells' interior and exterior.

During the actual physical analysis of the shells, numeric values were used to code the presence/absence or degree of a condition and entered on worksheets. These worksheets were subsequently entered into computer spreadsheets, with an individual spreadsheet for each taxon at each sample site. These spreadsheets are to be used in the multivariate statistical analysis of the recorded data, from which the bulk of the conclusions of this taphonomic study will arise.

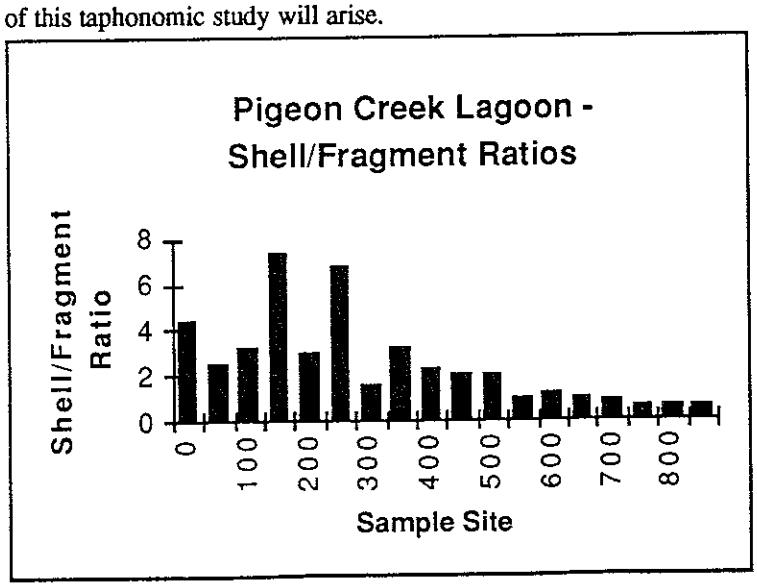

Figure Two: Shell/Fragment Ratios at the sample sites on the Pigeon Creek transect. The ratios for the high-energy tidal channel and delta prove lower than the ratios for the grassbeds and tidal flats.

Results and Further Investigations

Though little in-depth statistical analysis of the collected and recorded data has been undertaken at this point, preliminary results reveal differences in the taphonomic signatures that the different environments place on mollusc shells. The energy of the environment is one key to these differences, as shells from the strong current, high-energy tidal channel appear more highly abraided and broken than those in the more stable grass beds or tidal flats. Evidence of this pattern is revealed in Figure Two, which charts the ratio of shells to unidentifiable shell fragments at the various sample locations. Sample sites 0 and 50 are in the tidal flats, sites 100 through 250 are in thick grassbeds, 300 through 750 are tidal channel sites, and samples 800 and 850 were taken from the tidal delta. The ratio is lower, as a result of the greater numbers of shell fragments, at sites in the tidal channel and the tidal delta.

Continued laboratory investigation should further the distinctions between the tidal flat, subtidal grassbeds, tidal channel and tidal delta, and the results of the taphonomic processes undergone by shells in each environment will be made evident. The results of this study should provide a useful tool for paleoenvironmental reconstruction, particularly based on taphonomic attributes.

References

Miller, A.I., 1988, Spatial Resolution in Subfossil Molluscan Remains: Implications for Paleobiological Analyses: *Palaeobiology*, v 14, 91 - 103.

Parsons, K.M., 1988, Taphonomy as Indicator of Environment: Smuggler's Cove, St. Croix, U.S.V.I., 135 - 143.

Staff, G.M., and Powell, E.N., 19 90, Local Variability of Taphonomic Attributes in a Parautochtonous Assemblage: Can Taphonomic Signature Distinguish a Heterogeneous Environment: *Journal of Paleontology*, v 64 no 4, 648 - 658.