Foraminiferal Species Diversity on the Beaches of San Salvador Island

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Figure 1. Location of San Salvador

Introduction

This study was conducted on foraminifera species collected along various beaches of San Salvador Island. This island is located in the Bahamas, south-east of Florida and north-east of Cuba, as seen in Figure 1. The island is approximately 12 miles long and 7 miles wide and has a variety of reef environments surrounding it.

Foraminifera, single-celled organisms with calcitic shells, are known to live in very-specific environments, often ranging within a 10-20 degree change of water temperature. This makes them very good indicators of environment. The wide variety of the many foraminifera species makes them easy to differentiate and track in both living and death assemblages.

This research project focused primarily on the ratio of certain foraminiferal species in different beach environments around the island. The research focused on sites A and D, which are located in Figure 2.

Figure 2. Location of beach sites

Study

The project was completed with sand samples that were previously collected at Sites A and D on the island. Sample A was collected from the beach, while Sample D was collected from the foreshore, a subsection of the beach which is located close to the water. The samples were divided using a grain-separator, since not all of the sample was required to separate the foraminifera species needed. Sample A had a higher percentage of foraminifera than Sample D, and was therefore easier to collect samples from. The foraminifera were collected on glue slides by each researcher for a total of 60 foraminifera per slide.

After the foraminiferal samples were collected, the researchers identified and counted the number of foraminifera species using a low-power microscope. This information was then collected in a table and was used to create the pie charts in Figures 3-6 as well as to interpret the death assemblages found in the samples. The researchers also had the opportunity to image some of the collected foraminifera in a Scanning Electron Microscope, to get a closer and more detailed image of samples as well as erosion happening on the samples.

Site A Results

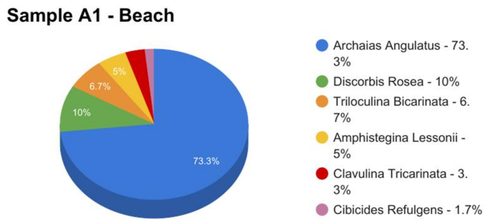

Figure 3.

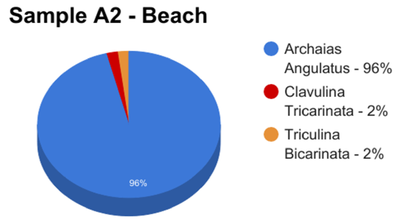

Figure 4.

Samples of foraminifera collected from sites A1 and A2 have a larger percentage of the species Archaias Angulatus; 73.3 percent and 96 percent, respectively. Compared to the research of Lewis (1), this species is found in living offshore assemblages no higher than 55 percent in a range of environments, from nearshore reefs with a water depth of around 3 to 5 feet to platform-margin reefs with an average depth of approximately 40 to 50 feet. This is approximately 20 to 40 percent lower than the results found during this project.

Both samples from site A had a small percentage of less-common foraminifera, primarily Discorbis Rosea at 10 percent, Triloculina Bicarinata at a combined 8.7 percent, Clavulina Tricarinata at a combined 5.3 percent, Amphistegina Lessonii at 5 percent, and Cibicides Refulgens at 1.7 percent.

While this site had a major percent of ooids and peloids (both coated types of sand grains), there were few coated foraminifera.

Foraminifera in the Scanning Electron Microscope

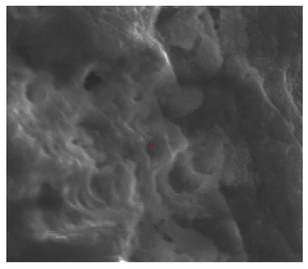

Figure 7. Test erosion

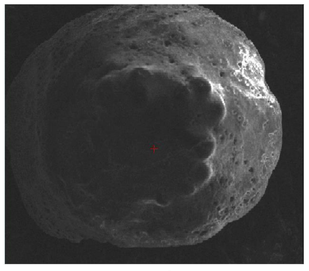

Figure 8. Discorbis Rosea

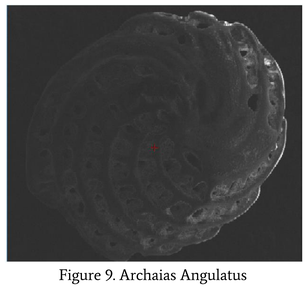

Figure 9. Archaias Angulatus

Site D Results

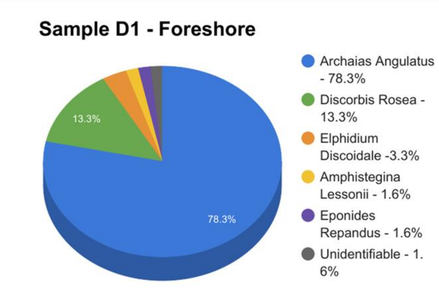

Figure 5.

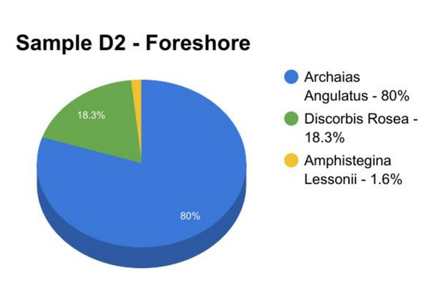

Figure 6.

The results of Samples D1 and D2 again show a high percentage of Archaias Angulatus, at 78.3 percent and 80 percent, respectively. These samples also include a higher overall percentage of the species Discorbis Rosea at 13.3 percent, Elphidium Discoidale at 3.3 percent, Amphistegina Lessonii at a combined 3.2 percent, Eponides Repandus at 1.6 percent, and unidentifiable foraminifera at 1.6 percent. The foraminifera that were not able to be identified were heavily coated and had no distinguishing features aside from the overall shape which suggested the foraminifera was in a carbonate-rich environment for a long period of time. Other foraminifera from this site were coated as well, although not as heavily as the unidentifiable foraminifera, and most were still able to be identified. Most heavily-coated foraminifera were identified primarily by their shape or other identifying characteristics, such as the chamber sutures and chamber arrangements.

One species identified in this sample, Eponides Repandus, is generally not found in the Bahamas. They are, however, found in the Florida Keys, the Georgia Shelf, and other areas surrounding the Bahamas. This suggests these two foraminifera may have traveled or been carried a sizeable distance from where they were young. However, juvenile foraminifera of this species were found by Cockrell and Kruske (2) suggesting this species lives around San Salvador Island. Alternatively, this species may have been misidentified, given that the researchers had limited previous knowledge of foraminiferal species.

Interpretation

The high percentage of the species Archaias Angulatus in both samples is most likely due to the higher resistivity of their tests to breakdown and dissolution. The tests of this species are made from calcium carbonate, and have been shown in previous research to be more resistant to erosion than other species', in addition to the thicker test wall relative to other foraminifera. Alternatively, these may simply be a more dominant species in the regions offshore of San Salvador, although this is not suggested by previous research into living assemblages offshore (Lewis, 1). The most common foraminifera species that was found off shore alive was the Planorbulina acervalis at 60% (Lewis, 1), which was not identified in any of the on-shore samples in these locations.

Samples D1 and D2 had foraminifera that ranged from heavily-coated with carbonate material to no coating. Coating on the samples is caused by a carbonate-rich environment, thus the higher level of coating is most likely representative of the foraminiferal dying and its test remaining in this environment for a longer period of time.

The amount of carbonate coating on the samples can give an indication of the environment. At Site A, the majority of foraminifera were not coated, but there was also a presence of peloids and ooids. Peloids indicate a protected shallow seawater that had a large amount of fauna, around which the peloids nucleate. Ooids indicate a supersaturation of calcium carbonate with agitated water. Since the foraminifera were mostly not coated, this would indicate that the waters were relatively calm. These species do not correlate, indicating that 1) this beach was a place where different types of species washed up from other areas, and 2) there was a change in the environment in terms of energy. Therefore, Site A is most likely a wash zone where ooids are already forming from the wave action while peloids and foraminifera are being carried here from other origin locations.

At Site D, most of the foraminifera species were coated to heavily coated. This indicates that water was agitated and there was an abundance of calcium carbonate. These foraminifera were most likely washed up on shore some time ago and have since been pushed back and forth in the waves. This location is most likely more protected than Site A and contains foraminiferal species wash up from big storm events.

Future Work and References

Future work for this project would include investigating more sites around the island to have more data to extrapolate. Different offshore environments will contain different species of foraminifera. While this is represented in the findings, a better understanding of how foraminifera death assemblages correlate to living assemblages would be easily understood with more data.

[1] Lewis, Ronald D. "Foraminiferal Assemblages And Reef-Sediment Petrographic Criteria As Evidence For Relative Distance From Shore For Pleistocene Reefs, San Salvador, Bahamas: Preliminary Results". *Proceedings Of The 11Th Symposium On The Geology Of The Bahamas And Other Carbonate Regions*. Auburn, Alabama: Copycat Production Center, 2004. Print.

[2] Cockrell, Jay, and Kruske, Montana. "Triangle Pond Micropaleontology With Relation To Storm Events". 2017. Presentation.

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