

Isotopic Fractionation of Free Living Corals of the Dominican Republic

Student: Sean Murray (C03709708), a junior majoring in the Geological Sciences

Project Advisor: Dr. James Klaus (GSC & MGG)

Project Background

Free living corals are a small group of Caribbean corals identified by the fact they live free or unattached to the underlying substrate. This free living mode of life is unlike most common reef corals which are permanently fixed to the reef substrate. Not more than two million years ago there were twenty-six identified free living coral species in the Caribbean. There are only two surviving members of this group inhabiting modern reefs. These two species, *Manicina areolata* and *Meandrina brasiliensis*, are characterized as colonial animals that live in shallow waters (less than 2-3 meters) and photosynthetic symbionts (live with zooxanthellae). Because these are the only living relatives of this once abundant group, it has been assumed that the twenty four extinct members possessed a similar mode of life.

The justification for this assumption is weak and the details of this group's living behaviors needs to be explored in greater detail. Around the time these corals went extinct, the Earth was undergoing a major climatic shift with the closing of the Isthmus of Panama and the onset of the northern hemisphere ice ages. Because of this, corals reefs at the time experienced a pulse of both elevated origination and extinction as the waters they lived in changed. The water in the Atlantic became saltier, the Gulf Stream was forming and rerouting water north, and there was intense sea level change as the growth of glaciers pulled water from the oceans. The corals that survived this event to dominate the shallow Caribbean reefs were the modern reef corals that also have zooxanthellate symbionts. This brings up the question of why such a successful group as the free living corals, whose surviving members are equipped with zooxanthellae, would have been wiped out? The postulation for this project is that the corals that went extinct were not like their surviving members, and did not utilize zooxanthellae to the extent as their living counterparts, and were removed as a result.

Proposed Research

Using a technique established by Stanley & Swart in their 1995 paper, *Evolution of the Coral Zooxanthellae Symbiosis During the Triassic: A Geochemical Approach*, I will be testing fossilized specimens of extinct free living corals from the Dominican Republic to see if they used zooxanthellae or not (Image 1). Dr. Klaus and I have selected six samples out of a pool of thirty that represent the best preserved fossils from the collection which are most likely to contain original aragonitic skeletal material which is essential for the testing process. These samples will be cut to specific parameters and then tested for original material using x-ray diffraction using a Phillips XRG-3000. Once the geochemical integrity of the samples has been established the samples will undergo about thirty trials of isotopic fractionation each in a Finnigan-MAT 251, looking for the ratio of Carbon-13 to Oxygen-18 (Image 2). By looking at this ratio, I can determine whether these corals utilized zooxanthellae or not.

This research will help scientists understand the extinction event that took place two million years ago amongst the coral community. This will further our knowledge of free living corals, and it also has implications on our knowledge of reef corals which have been suffering as of late because of our current climate shift. If my sample corals used zooxanthellae, we will know that zooxanthellae might not have such a large impact on the survival rates of corals and can look at other factors, but if they did not, we will be able to narrow our focus as to save living coral species.

Justification of Cost

I have already begun the process of cutting the samples to specified dimensions for testing using available equipment at the University of Miami. In order to continue the project, I will need to travel to the Rosenstiel School to have access to their equipment, their lab, and lab technicians. To further the research, thin sections of some of the samples will be created to get a better look at the structures of the extinct corals.

Use of XRG-3000	\$15 per sample x 6 samples	\$90.00
Use of Finnigan-MAT 251	\$10 per trial x 30 trials x 6 samples	\$1800.00
Thin Section Slides	\$29.95 per case x 1 case	\$30.00
Stipend/Work Study	\$3.60 per hour x 160 hours	\$576.00
		Total: \$2496.00

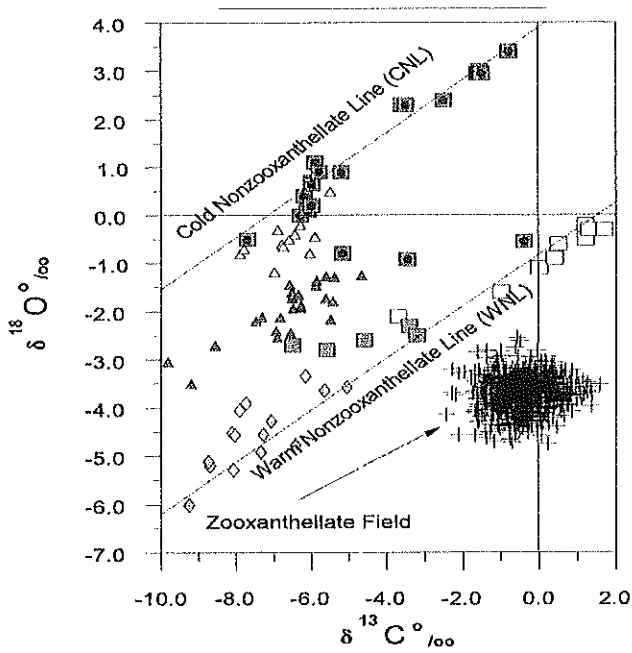


Image 1

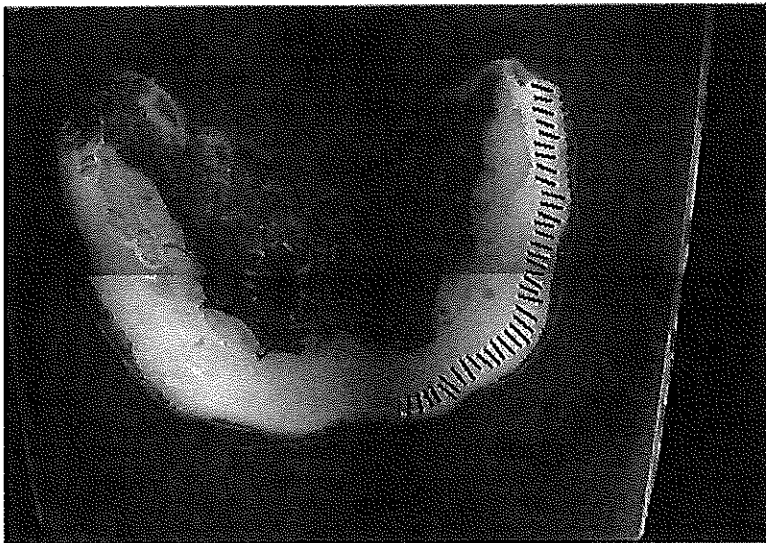


Image 2