



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Zhiqiang Liao	Project Number S1112
Project Title Is Variation of Caribbean Benthic Foraminiferal Shell Size Linked to Water Temperature?	
Abstract Objectives/Goals Although benthic foraminifera are very common in the world ocean, little is known about how the shell size of benthic foraminifera responds to the surrounding environment. Here, I study shell size variation of modern Caribbean benthic foraminifera with the purpose to better understand the environmental variables that control foraminiferal shell size distribution in Caribbean Sea. According to Bergmann's rule, terrestrial animals found at higher latitudes, and thus colder environments, have larger body sizes, whereas animals found in warmer regions tend to be smaller. In accordance with Bergmann's rule, I hypothesize that decreasing water temperature along an increasing water depth gradient in the Caribbean Sea will favor larger benthic foraminifera in the deep sea.	
Methods/Materials To test this hypothesis, I compiled biogeographic (latitude and longitude) data for modern benthic forams living in the Caribbean Sea. I measured the length, width and thickness of holotype (the ideal representative) of Caribbean foram specimens from a published compilation of monograph illustrations along with factors that might influence shell size distributions such as temperature, salinity, and dissolved oxygen concentration. To determine the environmental variables that best predict size, I used R to analyze my data set by applying linear regression models and an ANOVA analysis to test for statistical significance and fit a best-fit model.	
Results My results show that no one environmental variable predicts the size for all groups of benthic foraminifera. Water temperature does not significantly predict the shell size of benthic foraminifera, but latitude does. In addition, the shell size of each type of benthic foraminifera responds to marine environment in different ways.	
Conclusions/Discussion Therefore, my results did not support my hypothesis that Caribbean benthic forams will follow Bergmann's Rule. When latitude was analyzed to see how well it predicts size, latitude did prove to be statistically significant. However, since latitude represents a combination of variables, it is hard to determine which variable best predicts the shell size. A thorough analysis of the effect of each latitude-dependent factor on the shell size of benthic foraminifera will need to be further investigated.	
Summary Statement Here I study shell size variation of Caribbean benthic foraminifera with the purpose to better understand the environmental variables that control foraminiferal shell size distribution in Caribbean Sea.	
Help Received Used lab equipment at Stanford University under the supervision of Ms.Caitlin Keating-Bitonti, who is a graduate student of Department of Geological and Environmental Sciences.	