CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

S1196

Project Title

Ocean Catastrophe: An Analysis of the Effects of CO(2) on the Dissolution of CaCO(3) in Marine Organisms

Abstract

Objectives/Goals

Ocean acidification is the process of CO2 in the atmosphere reacting to ocean water to create carbonic acid, which then lower the pH of the water and results in the dissolution of calcium carbonate, the main component in shells and corals. The objective of the experiment is to prove that such a process can have harmful affects on marine organisms, and not only does the acidification affect the chemistry and environment of the water, but also prevents organisms from thriving in their natural habitat.

Methods/Materials

Materials used were a CO2 gas tank, 6 Erlenmeyer flasks, samples (a piece of calcium carbonate, coral, a small bivalve shell, a large bivalve shell, a small slipper shell, and a large slipper shell- 6 samples for every flask)and litmus paper, to check pH. Each flask had .500L of salt water; two flasks (A&B) had no CO2 bubbled through and had a pH of 7.5, the next two flasks (C&D) had enough CO2 released to have a pH of 6.26 (on average) and the last two flasks (E&F) had more CO2 released for a pH of 5.62 (on average). After 2 weeks, flasks A, D, and E were stopped and after 4 weeks flasks B, C, and F were stopped. Initial and final masses were recorded for every sample.

Results

For the samples that were in an environment of 6.26 pH (on average) had an average of .05 g of loss and a 1.749 % loss. The samples that were in a 5.62 pH (on average) environment had a .078 g of loss and a 2.696 % loss. The samples that were exposed to the acidic water for a longer period of time displayed more dissolution compared to the samples that only had two weeks of treatment. Lastly, the samples that were of smaller mass and size experienced more dissolution than larger samples.

Conclusions/Discussion

The smaller samples had a higher percentage of mass loss compared to the larger samples because of the ratio between mass and surface area, especially evident in shells. More area of the smaller samples were exposed to the carbonic acid compared to the larger samples, in correlation to mass. The experiment proves the relationship between CO2 dissolution and CaCO3 loss, which is crucial in the understanding of marine food webs. Many microscopic shelled organisms can be left vulnerable in these acidic environments, and - as in the case with phytoplankton and butterfly shells- are the main producers of said food webs, resulting into a collapse of ecosystems that are vital to marine and human life.

Summary Statement

Ocean acidifcation occurs when CO2 in the air reacts with water to form carbonic acid, which affects marine life as their main form of protection-their shells- dissolve, resulting in the collapse of food chains that humans are dependent on.

Help Received

I used lab equipment from University of California: Riverside under the supervision of UCR graduate Leanne Hancock