UCLA Oceanographer Suggests New Way to Test How Global Warming Impacts Endangered Corals

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July, 2013 – I was scrambling across the face of a remote mountain range in Montana, mapping the region with thirty other geology students. Each of us carried the same equipment: a hammer, a compass, a magnifying glass . . . and a small bottle of hydrochloric acid, which can help distinguish limestone from other types of minerals. When HCl is applied to this calcium-heavy rock, it fizzes and bubbles; the acid is breaking the chemical bonds that hold it together.

The same thing is happening—on a much larger scale—to many of the world's coral reefs.

Prior to the Industrial Revolution, atmospheric levels of carbon dioxide ranged from 200 to 280 parts per million; by 2004, they approached 380.[1] Around a third of the CO_2 seeps into the Ocean, reacting with the water to form carbonic acid. Since corals' skeletons are made of calcium, much like the limestone my peers and I mutilated, acidic environments are detrimental to their health. As concentrations of acid

A dive site off Aqaba, Jordan in the Red Sea. Different species of coral exhibit varied responses to climate change: while some thrive in low-pH waters, most prefer more basic conditions. Photo Credit: Carly Schulman

increase, reefs have more and more trouble growing; at a certain saturation, they may even begin to dissolve. While the exact numbers are up for debate, scientists agree that ocean acidification is occurring at an unprecedented rate – faster than at any other time in the last 300 million years, according to one estimate,[2] causing the calcium carbonate content of the Ocean to decrease by a projected nine to 30 percent in the next 85 years.[3] Accordingly, the future of the world's corals is dire: along with a host of other human activities, from pollution to dredging, acidification threatens to destroy *all* reefs by the end of the century.[4]

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[1] Feely, Richard A. et al. (2004). "Impact of Anthropogenic CO_2 on the $CaCO_3$ System in the Oceans." *Science* **305** (5682): 362-366.

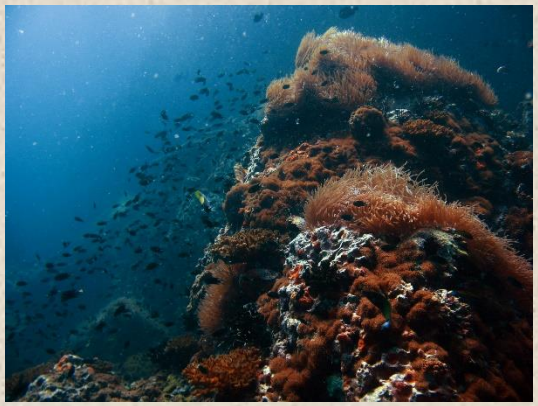
[2] Hönsich, Bärbel et al. (2012). "The Geological Record of Ocean Acidification."

[3] Gattuso, Jean-Pierre et al. (1999). "Photosynthesis and Calcification at Cellular, Organismal and Community Levels in Coral Reefs: A Review on Interactions and Control by Carbonate Chemistry." *American Zoology* **39**: 160-183.

[4] "Climate Accord loopholes could spell 4.2°C rise in temperature and end of coral reefs by 2100." *Institute of Physics, Press Release, 29 September 2010.*

Because of coral reefs' immense ecological and economic benefits, a significant amount of scientific work is being conducted in order to understand the extent of their vulnerability to environmental change. Doctors Robert Eagle and Aradhna Tripati, at the University of California, Los Angeles, study the chemical fingerprints that shifts in climate leave in the rock record. While their work has myriad implications—from the duration and timing of Ice Age to the internal body temperatures of dinosaurs—the pair received a National Science Foundation award in July of last year to study corals' calcifying fluid, the glue with which they build their skeletons. Corals can self-regulate the pH of this liquid, chemically arranging free-floating carbon molecules into a usable configuration; Doctors Eagle and Tripati will measure how calcifying fluid responds in a controlled, acidic environment. According to Dr. Eagle's proposal, this research will help scientists understand exactly how acidification affects the growth of corals, which species are most susceptible to acidification, and why they exhibit such varied responses to fluctuations in pH and climate.

Even outside of the lab, Dr. Tripati cultivates discussion on the impacts of ocean acidification; she teaches undergraduate oceanography courses at UCLA, and her group hosts hands-on demonstrations to expose middle and high school students to the physical sciences.



Sail Rock, a dive site and popular tourist destination near Koh Tao, Thailand. Coral reefs are hotbeds of biodiversity as well as significant sources of income for coastal nations. Photo Credit: Carly Schulman

Last December, her efforts won her the E.O. Wilson Award for Outstanding Science in Biodiversity Conservation from The Center for Biological Diversity, a nonprofit dedicated to the protection of endangered species. In her acceptance speech, she reiterated her advocacy for reduced carbon emissions, given "how much is at stake as global warming begins to alter our world. My great hope," she continued, "is that science can help us preserve a livable climate."