Q & A with Ana Christina Ravelo, PhD ’91

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Christina Ravelo enjoys a sunset on the Bering Sea during the expedition she co-led in 2009.

Ana Christina Ravelo is a professor of ocean sciences at the University of California in Santa Cruz (UCSC), where she uses stable isotope geochemistry to learn about conditions of the oceans and climate millions of years ago. She received her PhD from Columbia in 1991, studying the chemical composition of planktonic foraminifera to determine past ocean temperatures. After graduating, Ravelo came to UCSC, where she has continued to pursue related research questions, publishing extensively while teaching and mentoring dozens of graduate students. In January of 2012, the American Geophysical Union (AGU) named Ravelo among its 2012 class of Fellows, an honor given to members who have made exceptional scientific contributions and attained acknowledged eminence in the Earth and space sciences.

From 2005 to 2011, you were director of the Santa Cruz branch of the University of California’s Institute of Geophysics and Planetary Physics (IGPP), a research initiative designed to foster collaboration among eleven academic departments. What are some of the successes that have come from working outside of the traditional boundaries of science, mathematics, and engineering?

The most rewarding thing about being director was promoting and supporting the interdisciplinary work at UCSC. The IGPP-UCSC branch was instrumental in fostering interactions between departments in physical, biological, and social sciences and engineering. Much of my more far-reaching service has been working across the geoscience subdisciplines within the Integrated Ocean Drilling Program (IODP). There is a large community of scientists who rely on ocean drilling to explore some of the most prominent research questions in the geosciences.

What is Foraminifera geochemistry, and why does it matter to an ocean scientist?

Planktonic foraminifers are marine microorganisms whose shells are preserved in deep-sea sediments. Because most Earth system processes select for one isotope of an element over another, the chemical composition of foraminifer shells can be analyzed to diagnose past environmental conditions. Using such geochemical analysis, my research has found that the tropical Pacific was in a permanent El Niño-like state during the Pliocene warm period, 3 to 5 million years ago.

During the summer of 2009, you were co-chief scientist on an expedition to the Bering Sea aboard the R/V *JOIDES Resolution* to retrieve sediments as old as 4.5 million years. What insights has this record of ancient climate yielded?

We found that, during the early Pliocene warm period 3.5 to 4.5 million years ago, prior to the onset of large Northern Hemisphere ice ages, temperatures in the Bering Sea were about 5 degrees Celsius warmer than today, and free of sea-ice. There was also enhanced biological productivity during this period and possibly better-ventilated deep water compared to today. Once the ice ages began, there were dramatic fluctuations in sea-ice coverage, sea surface conditions, and deep and intermediate water oxygen concentrations. The alternating massive and laminated sediment textures we found in the Bering Sea are indicative of such changes in oceanic conditions. At this point, we are trying to understand how regional changes in the Bering Sea are related to basin-wide changes in the North Pacific, and to global climate change. The Bering Sea data is providing unique insight into how the North Pacific is affected by and plays a role in global climate change.

NASA marked 2011 as the ninth-warmest year on record. What does this, and projections of rapid warming over coming years, mean for the Bering Sea in particular?

At this point, it is clear that sea-ice distribution and concentration is decreasing in and around the Arctic, including the Bering Sea, and that there have been (and will be) ecosystem changes as global climate, and Bering Sea climate, warms. But, detailed projections are not possible without more research.

Considering the abundance of climate skeptics and misinformation, effective communication of your research is arguably very important. What can scientists do to help a broader audience better understand their work?

I think scientists are obligated to share their findings with the public and decision makers, and I feel I can do my part through teaching and mentoring students, giving public talks, and serving on panels and committees that promote scientific communication and education. The Internet also provides informal yet effective tools for real-time communication and outreach. I kept a Twitter feed from the Bering Sea in 2009, which was a really fun way for my friends and family to follow me, but lots of other people started getting involved, too.

What is your fondest memory of your time as a graduate student at Lamont-Doherty?

My fondest memories are of the time I spent with fellow graduate students and friends. I also have great memories of being inspired by the world-class scientists that taught classes, advised me, and came through to give seminars. I feel so well-connected to the oceanographic community because of my time at LDEO and all the people I met and worked with when I was there.