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UCSB Scientists Retrieve Important Ocean Acidification Data from Antarctic Waters

A research team led by a scientist from UC Santa Barbara and supported by the National Science Foundation (NSF) has retrieved data from a sensor in Antarctic waters that survived the harsh polar winter. The information it gathered will provide critical baseline data on the changes in chemistry, or acidification, of those remote seas.

An all-woman team of graduate and undergraduate students and a postdoctoral fellow –– led by Gretchen Hofmann, a professor of ecology, evolution, and marine biology at UCSB –– retrieved the sensor intact earlier this month near McMurdo Station, NSF's logistics hub in Antarctica.

Hofmann's team includes Pauline Yu who works in Hoffman's lab at UCSB's EEMB and is an NSF-funded postdoctoral research fellow with UCSB's Marine Science Institute; Amanda Kelley, a graduate student at Portland State University; Lydia Kapsenberg, a Ph.D. student with EEMB at UCSB; and Olivia Turnross, an undergraduate in UCSB's College of Creative Studies.

Deployed by divers under the sea ice and left in place at the end of the 2011-12 Antarctic research season, the sensor gathered data through the month of June, which is the height of winter in the Southern Hemisphere. Data gathering ended

when the instrument's battery failed in the frigid waters.

The successful recovery will provide the first data of its kind about the relative acidity –– expressed as the pH –– of the waters in McMurdo Sound. While ship-borne sensors in Antarctic waters have made some pH measurements, the data logged by this instrument is the first continuous record of pH in a coastal region under sea ice in the winter –– data that, combined with the data collected in the summer, provides a fuller picture of seasonal variations in pH.

The acidification of the oceans is a global concern to scientists, as increasing amounts of atmospheric carbon find their way into the seas, changing the water chemistry. Estimates are that 30-40 percent of the carbon dioxide (CO2) released into the atmosphere dissolves into the world's oceans, rivers, and lakes, changing the chemical balance of the water.

This change in ocean chemistry, driven by increases of CO2 in the atmosphere, will have effects on marine life, making it difficult for some creatures to make protective shells, to reproduce, and to grow. These impacts on individual species may then cascade to alter food chains and how species interact with one another, potentially altering entire ecosystems.

While Hofmann's Antarctic work was funded by NSF's Office of Polar Programs independently from the agency's Ocean Acidification program, numerous individual research projects such as hers led the scientific community to understand the need to measure scope and effect of the acidification phenomenon globally, and provided the impetus for the agency's broader support for acidification research.

Acquiring the data on Antarctic pH is crucial to understanding the current state of the ecosystem in order to place future measurements of the pH of the region's oceans in context, Hofmann noted.

Having a pH baseline will provide an important benchmark for scientists to begin to test whether certain species have the physiological and genetic characteristics to adapt to projected change.

"One of our central research challenges is to forecast whether species will be able to adapt to a rapidly changing environment," Hofmann said. "It is critical to obtain current measurements of pH to help understand the environment that organisms will face in the future."

The team was successful in gathering the data during the winter by deploying an ocean pH sensor called a SeaFET, which was developed through an NSF award from the Division of Ocean Sciences to Todd Martz, of the Scripps Institution of Oceanography at the University of California, San Diego. SeaFET development was also supported by funding from the David and Lucile Packard Foundation to Kenneth Johnson, of the Monterey Bay Aquarium Research Institute (MBARI).

"Returning the first pH time series from such a remote and harsh environment is a true victory for all of the scientists involved; it represents a great example of technology developed through one NSF program (OTIC) enabling the research of another (OPP)," said Martz.

NSF's Office of Polar Programs manages the United States Antarctic Program, through which it coordinates all U.S. research on the southernmost continent and in the Southern Ocean.

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† Bottom image: (Left to right) Pauline Yu, a postdoctoral research fellow at UCSB; Amanda Kelley, a graduate student at Portland State University; and Lydia Kapsenberg, a graduate student at UCSB, haul the sensor from McMurdo Sound.

Credit: Olivia Turnross, UCSB

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