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EMS Museum exhibit explores ocean acidification's impact on microscopic sea life

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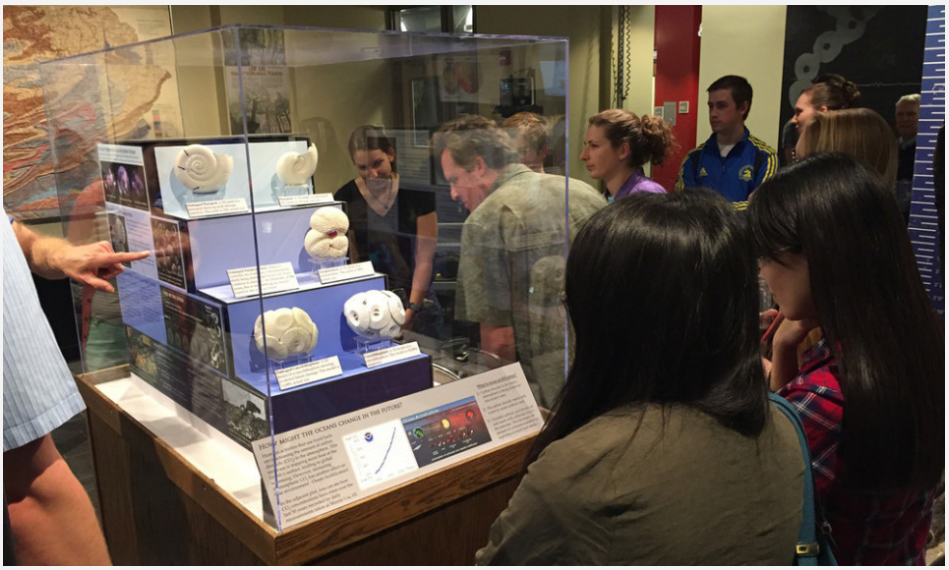

Photo credit: Kristen McAuley (Penn State)

On a mission to show how increased atmospheric carbon dioxide can impact microscopic creatures at the base of the food chain in the ocean, a group of geosciences graduate students chose a communication tool that is uncommon for many students: a museum exhibit.

The exhibit, "Ocean Acidification and its Effect on Marine Life," was unveiled on May 2 and is now on display at the College of Earth and Mineral Sciences' (EMS) Museum & Art Gallery. It features a variety of hands-on and interactive components to educate visitors on how the ocean acidification that results from increased levels of atmospheric carbon dioxide affects tiny marine animals.

"Many of us look at the effect of carbon dioxide on the ocean," said Rosie Oakes, geosciences graduate student who is one of the project's leaders. "Carbon dioxide reacts with water in the ocean and increases the concentration of hydrogen ions, which means the pH will decrease and the acidity increases. This also decreases the concentration of carbonate ions, which some microscopic organisms, like foraminifera, use for their shells."

Without the carbonate needed to form their protective shells, the microscopic creatures become vulnerable, and the students and faculty who research this topic wanted to inform people about the vulnerability of these creatures. The rising levels of carbon dioxide in the atmosphere today could decrease the population or lead to extinction of organisms that are at the bottom of the ocean's food chain — which could have dire consequences for the rest of the ocean food chain as well as humans.

"The marine food web is critical to human society. Fisheries have a human economic role both in their food supply and as employment and income for people around the world," said Nick Holschuh, geosciences graduate student and another leader of the project. "What we wanted to show was that, by changing the levels of carbon dioxide in the atmosphere, you're directly impacting the food chain. Higher carbon dioxide concentrations in and of themselves are harmful to ecosystems, and that's not a discussion that comes up frequently when we talk about climate change."

How the exhibit was created

The students came up with the idea to create the exhibit in early 2015 and refined their concept through a seminar course taught in fall 2015 by Russell Graham, director of the EMS Museum & Art Gallery; Julianne Snider, assistant director of the EMS Museum & Art Gallery; and John Simmons, adjunct curator of collections for the EMS Museum & Art Gallery.

"Our seminar was focused on how to communicate science through museums, and we worked together on the design of the exhibit and what message they wanted to get across," said Graham.

Several student theses have evolved into exhibits on display in the EMS Museum today. Snider, Graham and Simmons were interested in teaching the seminar course to get more students thinking about how their work can fit into the educational mission of museums.

"Part of the course dealt with how scientists work with museums," said Snider. "You can use a collection to provide a lot of useful information, but the conundrum with ocean acidification is that the subject is microscopic."

To address this, the students turned to computerized tomography (CT) scanning, working with GE Technology Solutions Center in Lewistown, Pennsylvania, and to 3D printing, working with Penn State's Maker Commons.

"I use CT scanning for my research, which gives us an amazing three dimensional data set of these microscopic shells, which is a neat technique. But we realized that we could do a 3D printing as well to magnify the effects of ocean acidification," said Oakes.

The focal point of the exhibit is a set of 6-inch reconstructions of three microscopic organisms — pteropods, coccolithophores, and foraminifera — in both a neutral pH

environment and then in a projected future environment. Each is enlarged to hundreds or even thousands of times its original size so that visitors can examine how shells and other structures begin to deteriorate as a result of ocean acidification. The display also includes details about how microscopic animals may respond to a more acidic environment, (for example, by building thinner protective shells) as well as information about how they fit in at the base of the ocean's food chain.

Visitors can also watch videos highlighting how Penn State research fits into the broader theme of ocean acidification. Working with Timothy Robinson, instructor and Media Commons consultant, the students produced videos of researchers describing the many ways ocean acidification is studied at Penn State. For example, Lee Kump, head of the Department of Geosciences, studies the effect that increasing carbon dioxide has on ocean chemistry using complex computer models.

To further connect visitors with the microscopic creatures and the exhibit in general, the students included supplementary videos on the creatures, such as how pteropods glide through the water, as well as a touch component of the exhibit, spearheaded by graduate student Claire Cleveland, so that visitors can feel the size of these tiny organisms that are difficult to see with the naked eye.

In addition to Oakes, Holschuh and Cleveland, graduate students Garett Brown, Kim Foecke, Ashley Grey, Heather Jones and Judi Sclafani helped create the exhibit.

The exhibit features research from Kump; Tim Bralower, professor of geosciences; and Andrea Chan, biology graduate student.

Visitors can see the new exhibit in the EMS Museum and Art Gallery in 16 Deike Building from 9 a.m. to 5 p.m. Monday through Friday.

Liam Jackson, *Penn State News*, 9 may 2016. Article.

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