



## **Beyond the Edge of the Sea: Diversity of Life in the Deep-Ocean Wilderness**

Starting on February 28, the EMS Museum & Art Gallery will host two new exhibits. *Beyond the Edge of the Sea: Diversity of Life in the Deep-Ocean Wilderness*, funded by the NASA Astrobiology Institute (NAI) and National Science Foundation (NSF), explores and investigates hydrothermal vents on the bottom of the ocean, at times many miles down. The exhibition at the EMS Museum & Art Gallery will be only the second viewing of this show by the public.

*Beyond the Edge of the Sea* is an exhibition of watercolor illustrations by artist Karen Jacobsen, who is interested in deep-ocean landscapes and the exquisite animals that live in this alien environment. Jacobsen's sketchbooks contain more than 400 illustrations and are an important body of original work. *Beyond the Edge of the Sea* is the product of a fifteen-year collaboration between the artist and deep-sea explorer and scientist Dr. Cindy Lee Van Dover, Director of the Duke University Marine Laboratory. Dr. Van Dover has led diving expeditions to deep-sea locations in the Atlantic, Pacific, and Indian Oceans, where she has discovered dozens of new kinds of animals. Her work has helped to change the way we think about life in the abyss. Jacobsen accompanied Dr. Van Dover on many of these expeditions.

Karen Jacobsen's deep-sea art includes large-scale paintings and sketchbooks with more than 400 pages of water-color illustrations undertaken during expeditions to hot springs of the East Pacific Rise, Pacific Antarctic Ridge, and Mid-Atlantic Ridge, as well as to Florida Escarpment seeps, whale-feeding areas in the Bering Sea, and dead whale falls in Sagami Bay. Jacobsen is an independent artist based in Ketchum, Idaho. Her first expedition to deep-sea hot springs in 1991 was in the eastern Pacific, on the research vessel *Atlantis II*, with the deep-submergence research vehicle *Alvin*.

## **Life in the Dark**

*Life in the Dark* is a complementary exhibit on research by PSU scientists on organisms and ecosystems that exist in totally dark environments. For most people, life in the dark is unknown and may even be hard to fathom. But complex ecosystems exist in environments without light. The basis for their existence is chemosynthesis (in contrast to photosynthesis). Microbes use chemical reactions to create energy and food – they are at the base of the food chain of these aphotic ecosystems.

This research can be placed under the broad umbrella of Astrobiology. The Penn State Astrobiology Program (PSARC) is a collaboration of more than 19 scientists and their affiliated laboratories from a variety of disciplines. PSARC research focuses on recognition of signatures of life on the early Earth, in extreme environments, and in extraterrestrial settings. PSARC is affiliated with NASA's Astrobiology Institute (NAI).

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Dr. Chuck Fisher (Department of Biology) and his colleagues are studying life at hydrothermal vents in the Lau Basin between Tonga and Fiji in the South Pacific. Without light, these animals are dependent upon microbes and chemosynthesis instead of sunlight (photosynthesis). In some cases, the microbes live within the tissues of other animals in a symbiotic relationship. These environments are composed of super-heated water and toxic chemicals. Hence these animals and others like them that live in harsh habitats are known as extremophiles.

The Fisher lab is also working with coral reef ecosystems that persist in total darkness in contrast to the more familiar light flooded reefs of the Caribbean and Pacific. Again, the base of the food chain is microbes. These microbes subsist on natural seeps of oil and gas in the Gulf of Mexico. It takes thousands of years for these reefs to grow but in some areas they are now endangered by trawling for fish.

Caves are also totally dark and in some cases where they contain sulfides (i.e., sulfuric acid), they provide hostile environments for life. Again, an ecosystem of extremophiles is supported by microbes that are chemosynthesizers. Dr. Jenn Macalady (Department of Geosciences) and her colleagues are studying such a system in the Frasassi Caves in central Italy. Using technical caving methods, they explore the cave and collect samples. Elaborate scientific techniques like DNA extraction, stable isotope labeling, mass spectrometry and Scanning Electron Microscopy (SEM) as well as fluorescence microscopy, are used in these studies.

Extremophiles are also found on, and in, deep sea sediments and massive ice sheets (Greenland and Antarctica). Dr. Christopher House's (Department of Geosciences) and Dr. Jean Brenchley's (Department of Biochemistry and Molecular Biology) laboratories study organisms from these respective environments. Collections of these samples require elaborate equipment like sea-going ships, airplanes, helicopters, massive drilling rigs, highly technical field and campus laboratories and scientifically trained laboratory assistants. Most of these organisms are not visible to the naked eye and those from ice sheets may be tens to hundreds of thousands of years old. But again they form diverse ecosystems.

From 1-3 pm on February 28, PSU scientists from these laboratories as well as the Marine Science and Science Diving programs will be available to discuss their research and various aspects of the exhibits. Activities and exhibits are open to families, students, lovers of art, science geeks, and just plain inquisitive folks. Admission is free.

*Beyond the Edge of the Sea: Diversity of Life in the Deep-Ocean Wilderness* and *Life in the Dark* begin February 20 and run through August 2010. Admission is free. *Beyond the Edge of the Sea* was created with funding from NSF and NAI and organized by the Muscarelle Museum of Art at The College of William & Mary. *Life in the Dark* was organized by the EMS Museum & Art Gallery with collaboration from PSARC and their affiliated scientists.

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Other College of Earth and Mineral Sciences news is available at [www.ems.psu.edu](http://www.ems.psu.edu).

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