

November 2002

From Frost to Fire: Where is a woman's place? Everywhere, if you are ocean explorer Annelie Skoog

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Recommended Citation

Van_Patten, Margaret (Peg) A. Ms., "From Frost to Fire: Where is a woman's place? Everywhere, if you are ocean explorer Annelie Skoog" (2002). *Wrack Lines*. 28.
<http://digitalcommons.uconn.edu/wracklines/28>

From Frost to Fire:

Annelie Skoog Takes on the World

Where is a woman's place? Everywhere, if you are ocean explorer Annelie Skoog.

By [Peg Van Patten](#)

Connecticut Sea Grant Communications Director

Scandinavian folklore tells of the *sjøra*, water-sprites and mer-people who were human personifications of the stormy sea. Could that description of legends fit [Annelie Skoog](#)? As a marine chemist, Skoog's scientific quests have led her, like the sea, to traverse the globe from Pole to Pole, from the forbidding frozen ice floes of the Arctic and Antarctic, to the hottest spots on Earth-the steaming hydrothermal vents beneath the ocean floor.

Skoog, a native of Sweden, is a faculty member at the University of Connecticut Marine Sciences Department at Avery Point in Groton, Connecticut. On the wall of her university office are colorful certificates, complete with mythical beasts, commemorating her initiation into the circles of intrepid investigators who have crossed the Equator, and those who explored the icy polar regions. She's proud of these and rightly so.

Fortunately, Skoog is not always ensconced in extreme environments. She's equally comfortable in her well-equipped UCONN Marine Sciences laboratory. It is there that she is working with doctoral student Elizabeth Svenson, (coincidentally also a Swedish native), student Tyong Guen Chen, and post-doctoral associate Penny Vlahos. They have developed new methods to detect certain organic matter - amino acids, sugars, and low molecular weight acids - in seawater.

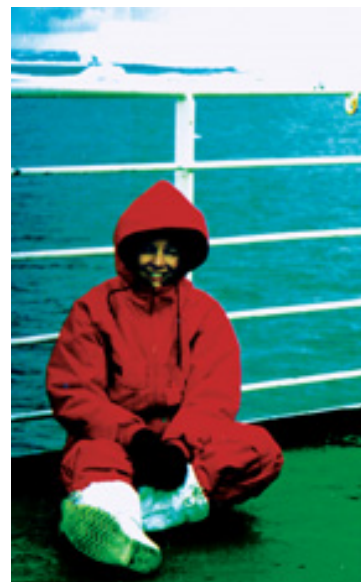
She Seeks Sugars in Seawater

Skoog's specialty is the study of organic compounds. This dissolved material, too small to see with human eyes, is important to the ocean food web and climate change as well.

"Global warming affects the Arctic before any other area in the world," said Skoog. "To predict what changes might occur due to global warming, we need to understand how the system works now." While studying the global carbon cycle from so many perspectives, Skoog has found many similarities as well as many differences, in the ocean systems of the Arctic and the Antarctic. Dissolved in seawater, the carbon-containing compounds are a rich energy source for microbes. This dissolved organic matter is particularly abundant in the icy Arctic Ocean, yet much remains to be learned about it and



Dr. Annelie Skoog, marine chemist, in her University of Connecticut Marine Sciences laboratory.



how it behaves under various conditions. So Skoog and her graduate students strive to learn more about the importance of these molecules and how they move through rivers into the ocean or are generated within the ocean itself.

But performing such investigations is not an easy task. Most existing analytical detection methods are not sensitive enough to discern concentrations of specific molecular compounds in seawater, and are also easily contaminated. Thus Skoog and her graduate students are putting a lot of effort into developing new, improved methods. The new method should also help to more accurately quantify the organic matter.

"Method development can be both tedious and frustrating," said Skoog, "but nevertheless essential because it provides scientists with the tools to do their research." She has developed a method to detect certain sugars, called aldoses. Much of her work is currently supported by the National Science Foundation's Office of Polar Programs.

Nothing stops Skoog. There was a time when being female was a great impediment to the pursuit of science, -and being a female scientist could be an impediment to family life, but Skoog has never experienced either difficulty in her career. In fact, amidst the brooding polar ice that symbolizes desolation to most, Skoog met her husband, marine ecologist Paul Renaud, aboard the Polarstern. (This 17,300 ton vessel, a double-hulled German icebreaker, is equipped with modern research laboratories and technology. It can function at -50°C.)

Fire and Ice

Skoog can move from frost to fire. She has sampled the superheated waters from undersea hydrothermal vents, hot springs on the ocean floor that occur along active volcanic ridges when magma explosively escapes to the surface in steaming plumes.

With colleague Jan Amend, she has recently started work offshore of the island of Sicily, Italy. The Sicilian vents are part of an unusually shallow vent system that can be sampled by SCUBA diving. She has also sampled deep-sea vents, where black smoker "chimneys" arise from the seabed, like the ones shown in the photos. In this not-so-cordial environment, Skoog studies the organic matter in the superheated fluid that enters the ocean as a result of volcanic activity, and serves as the energy source to diverse bacteria that can survive the most extreme conditions.

While trolls have not yet been discovered there, other bizarre life forms such as seep worms and giant tube worms are supported by the bacteria in these inhospitable places. New life forms -at least ones that have never been seen or described - are still being discovered in these mysterious vents. Skoog's vent work may help to change the existing scientific paradigm, i.e., that hydrothermal bacteria mainly use inorganic matter for energy. Skoog believes it's likely that they utilize the organic matter that she's found in her samples.

Cold feet? Likely, but just in the boots; not in reference to her scientific mission or career path

Yet another research area of interest to Skoog is the study of sonoluminescence, a phenomenon in which a gas bubble excited by ultrasound waves expands and contracts until it collapses and emits part of the sound energy into light and heat energy. The bubbles are coated with organic matter, which is where she and Vlahos enter the picture.

They hope to find out what impacts the energy conversion has on the organic matter. Sonoluminescence is a new and somewhat controversial scientific pursuit at the moment, but Skoog and Vlahos think it may play a role in many marine environments on Earth, including hydrothermal vents.

In short, there's nothing too far flung or too strange for Annelie Skoog to investigate. Seaworthy youth who feel akin to the sjøra, or who are intrigued by the extreme and might channel their curiosity into scientific careers, would do well to follow in her footsteps.

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