Scientists finding sink holes in Great Lakes

May 4 2009, By James Janega

Scientists studying submerged sinkholes in the Great Lakes off the coast of northern Michigan have stumbled onto something they never expected to find: life forms akin to those found in some of Earth's most extreme environments.

As groundwater leaks upward into Lake Huron, it re-dissolves an ancient seabed and creates a salty underwater environment that is supporting mats of primitive purple microbes -- cousins to bacteria that live in deep-sea hydrothermal vents and ice-locked Antarctic lakes.

The discovery in Huron's Thunder Bay underscores how little is known about the forms that life takes on Earth, or even where they might be found.

In this case, scientists wonder if the microbes may be truly primordial. Researchers found that the purple bacteria can photosynthesize as easily in sulfur-rich water as they can in fresh water, an ability suited to the dim and sulfur-rich conditions of shallow, primeval seas that existed billions of years ago.

"We see this as a peek into the ancient world," said research ecologist Bopaiah Biddanda of Grand Valley State University in Michigan. "This sort of life was not supposed to be occurring in the Great Lakes."

The exposed limestone bedrock at the bottom of the lake -- a landform called karst -- was once the floor of a Silurian sea that 300 million years ago blanketed what would become North America.

The Great Lakes were formed by glaciers, and most of the water in them now comes from rain and snowfall. But the sinkholes in the lake bed are filled with groundwater rich in salts and dissolved sulfur.

The source of those dissolved minerals is unknown, but scientists hope to find clues by trying to determine the age of the groundwater more accurately this summer. Certainly, say scientists, it is very old.

"The question is whether it's several tens of thousands of years old, or several hundreds of thousands of years old," said Wayne State University geology professor Mark Baskaran.

The science community learned about the microbial ecosystems in Lake Huron's Thunder Bay National Marine Sanctuary when archaeologists from the Institute for Exploration were searching in 2001 for uncharted shipwrecks in the sinkholes.

Instruments on the group's remote-controlled, deep-water submersible robot found unexpected pockets of very salty, slightly warmer water in the holes, which pockmark the limestone bedrock that straddles northern Michigan between Lake Michigan's Grand Traverse Bay and northern Lake Huron.

Cameras on the submersible recorded something divers had seen and talked about for years -- vast purple carpets mottling the bottom of the shallower sinkholes, where dim surface light still reaches. In deeper, darker water, the submersible found white microbial mats similar to those around deep-ocean heat vents.

"The more they saw them, the more they brought in other folks with particular expertise to look at this stuff," said Cathy Green, education coordinator at the national marine sanctuary. In the nearby industrial town of Alpena, Mich., residents who once talked about shipwrecks

offshore now talked about the scientists who returned each summer.

One thing the researchers tried to figure out was what on Earth those purple colonies were.

They found that the single-celled microbes banded together to form filaments that in turn joined to form mats. When debris fell on the mats, the bacteria got on top of it by crawling toward the light. The sticky ooze could climb a pebble in a laboratory water tank in a few hours, and crawled up the sides of beakers.

The bacteria also could eat sulfur, a primitive metabolic ability mostly abandoned when bacteria figured out how to use oxygen for photosynthesis billions of years ago.

Last spring, gene sequencing produced a startling result, said University of Wisconsin-Stout biologist Stephen Nold. When the DNA sequence was fed into a computer to compare with other species, the closest match was Phormidium autumnale, a rare bacterium found on an Antarctic lake floor.

The implication was that this kind of bacteria had once been everywhere but now survives only in pockets of inhospitable, salty, dim water -- what the world was like before plants.

Researchers will return to the unusual ecosystem again this summer, hoping to determine the age of the water source, how the sinkholes can be safely explored by divers in the marine sanctuary and how many more sinkhole ecosystems may exist elsewhere in the limestone-rich lower Great Lakes.

"Here we have this example of what early Earth must have looked like -- 70 feet down," Nold marveled. "It's not even that deep."
