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Miners eye subsea vents

By Hugh Westrup

This summer Dr. Steven Scott will plunge again into the deep, dark world of undersea vents, a world that may give birth to a new industry — undersea mining.

Dr. Scott, a geologist from the University of Toronto, will dive to the bottom of the Pacific Ocean. There, on the sea floor, he will watch gastric eruptions from the bowels of the earth, as they form deposits of commercially important metal compounds containing iron, copper, silver and zinc.

The voyage will provide Dr. Scott with a window on the past, showing him how the metallic deposits that we mine on land were first laid down billions of years ago. Some day, this research may lead to commercial undersea mining.

Dr. Scott will take his voyage in a Canadian-made mini-submarine, named the *Pisces IV*. Last year, he made nine deep-sea dives in *Pisces* to a huge underwater volcano that lies 500 kilometres off the B.C.-Washington coast.

Two thousand metres under the sea, Dr. Scott and his crew cruised along the crater of the volcano, marvelling at the ropy, glassy surface of the freshly formed lava. (The volcano is still active and could have erupted at any time.) Then suddenly, the ground beneath them dropped away. The *Pisces* had come to the edge of a wide crevasse — a split in the crater floor.

As the *Pisces'* tape deck played Nana Mouskouri singing "Valley of Love and Desire", the tiny submarine disappeared into the crack. Penetrating deeper and deeper, the *Pisces* encountered a world rarely seen before by humans. There, in the valley, living among the rocks, was a menagerie of strange creatures — large, spindly-legged crabs, giant clams, worms that looked like palm trees, and clumps of free-floating bacteria.

To geologist Scott, the most exciting discoveries of all were the hydrothermal vents at the bottom of the crevasse. These are small openings in the ocean floor, which spew hot, acidic water, heated by molten lava deep underground, into the sea.

As Dr. Scott explains, the water that gushes from these vents is saturated with metal compounds, containing iron, copper, silver, zinc and manganese, which settle on the ocean floor. A build-up of these compounds over a period of many hundreds of years eventually forms metallic deposits like those found on land.

Inside the crevasse Dr. Scott located three vents, which he named Chambers, Shepherd and Taylor, after the pilots of the *Pisces IV*. All three were relatively cool vents — the temperature of the water was only 35 degrees C.

The water flowing from a hydrothermal vent can sometimes be as hot as 350 degrees C. Scientists call these very hot vents "black smokers", because they belch thick, dark clouds of metal-rich water that look like plumes of smoke. "The hotter the water, the more metals it contains," says Dr. Scott.

Though Dr. Scott didn't find any active black smokers, he did find remnants of dead ones. These remnants were towering columns of deposited metal, which Dr. Scott named the "Lamphere chimneys", after a colleague, Karen Lamphere, who "smokes like a chimney".

Eager to analyze one of these chimneys, Dr. Scott used the *Pisces'* manipulator arm to knock a small one over and pick it up; the submarine then carried it to the surface. Dr. Scott is now examining it in his lab in Toronto.

Scientists believe that many of the ore deposits on land were created long ago by hydrothermal vents when the continents were under water. (The ore deposits of the Canadian Shield date back 2.6 billion years.)

Dr. Scott says, "If we know what an underwater metallic deposit looks like when it's first made — when it's in its pristine state — then we may have a guide that helps us map out deposits on land."

The cool vents found by the *Pisces* expedition are among the most northerly vents ever discovered. Other expeditions have found black smokers off the coast of California and near the Galapagos Islands. A metallic deposit surrounding the Galapagos vents is believed to contain 20 million tons of metal compounds.

Several mining companies have already provided funding for Dr. Scott's research. As yet, it is too early to tell whether undersea mining will be a commercially viable enterprise.

The *Pisces* expedition was also funded by two federal departments, Fisheries and Oceans, and Energy, Mines and Resources, and by the Natural Sciences and Engineering Research Council.

(Canadian Science News)

Ponds pool heat

A McGill University engineer is engaged in a long-term study of the possibility of using solar ponds to supply heat for Canadian industries.

A solar pond is the name given to a man-made salt-water pool capable of trapping the sun's energy for the purpose of supplying heat and hot water to industrial plants and homes.

Dr. David Crevier has been studying the use of solar ponds for three years. His own research company, Coreco Inc., has built a 700-square-metre test pond, two metres deep, in Varennes, Quebec. The pond's heat goes to a grain-drying plant nearby.

As Dr. Crevier explains, a solar pond is unusual in that it contains two layers of water: a layer of fresh water on the top and a layer of salt water on the bottom.

The pond works as a heat collector; energy from the sun penetrates to the bottom of the pool, heating the salt water. Because the salt water on the bottom is denser (due to the salt) than the fresh water on the top, it does not rise to the surface and lose its heat as would happen in a normal uniform body of water.

Temperatures in a solar pond can soar above 100 degrees C, Dr. Crevier says.

Dr. Crevier says a solar pond is easily built and costs about 25 per cent of what it takes to make a conventional heating apparatus.

Dr. Crevier is now studying four different designs for solar ponds to see which one is most suitable for the Canadian climate.

Dr. Crevier's research contract was negotiated by the federal Department of Supply and Services on behalf of the National Research Council's solar energy project.

(Canadian Science News)