UVic knowlEDGE

Fire and ice

UVic researchers explore a potential energy source on—and under—B.C.'s seafloor

by Valerie Shore

Is an answer to Canada's future energy needs lying under the seafloor off the B.C. coast?

It's very possible, says UVic marine geophysicist Dr. Ross Chapman, who has spent the last 10 years studying peculiar ice-like formations on the seafloor known as methane hydrates. Everything he learns about them brings Canada one step closer to tapping into a plentiful source of clean-burning fuel—methane gas.

Using the research submersible known as ROPOS—the Remotely Operated Platform for Ocean Science operated out of Sidney, B.C.—Chapman and his team are exploring the depths of Barkley Canyon, 80 km off Vancouver Island, where in 2002 they found the largest methane hydrate deposit ever discovered on the seafloor in Canadian waters.

Methane hydrates are molecules of methane encased in "cages" of frozen water. They're formed during offshore subduction events—when the ocean plate of the Earth's crust slides beneath the continental plate—and hot fluids containing gas seep up the sediment column to the cooler ocean floor, where they freeze.

The Barkley Canyon deposits, which look like giant chunks of brie cheese, are about 850 metres below the ocean surface and span an area the size of a football stadium.

Methane hydrates are believed to be twice as numerous as the world's known coal and natural gas deposits. Hundreds of deposit sites have been identified beneath the seafloor off the coasts of Japan, India and Costa Rica, among others, although the technology to tap into them doesn't yet exist.

"We know from previous research that there are deposits under the seafloor all along the B.C. coast," says Chapman, who uses acoustic techniques such as sonar to "see" what lies beneath. "These Barkley Canyon deposits are the largest visible ones we've found. Learning all we can about them will help us figure out whether the gas can be extracted economically and safely."

Studying methane hydrates isn't easy. Chunks decompose into gas and water when they reach the ocean surface. Like a huge Bromo Seltzer, they bubble, fizz and vaporize when exposed to surface-level air pressures.

So, Chapman and his team put ROPOS and its sophisticated instrumentation to work on the ocean floor. One device cuts off pieces of hydrate and stores them at pressure so they can be brought up to the surface. Another scoops up water samples to measure the concentration of dissolved gases. Yet another presses little pieces of plastic pipe into the sediment to collect core samples.

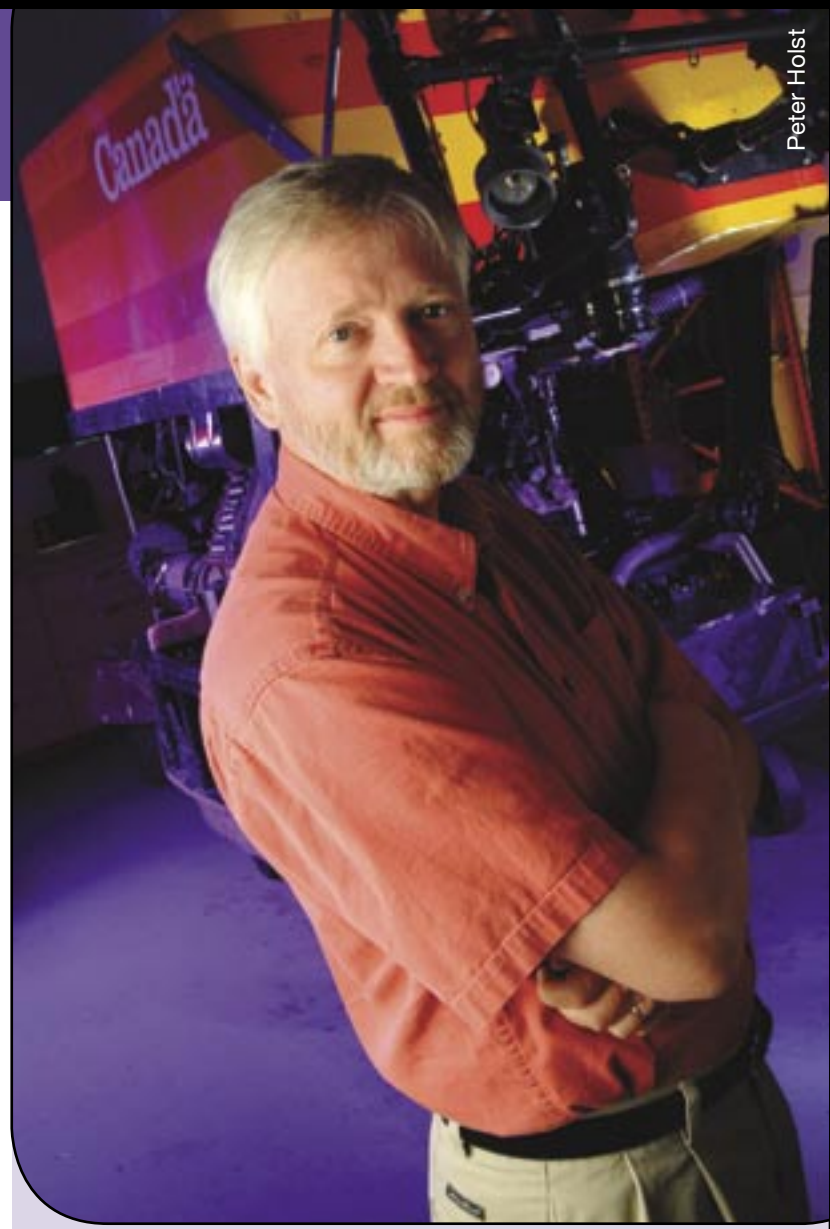
Chapman has already determined that the hydrocarbons contained within the hydrates are thermogenic in origin. "They're made deep in the sediment in hot reservoirs where they're 'cooked' over a long period of time," he says. "It's the same process that makes conventional petroleum and natural gas."

In fact, these are the first known thermogenic hydrates on the west coast, and are similar to hydrates in the oil-rich Gulf of Mexico. That raises even more questions for Chapman. How are the sites similar? How are these types of hydrates formed? And are they always associated with conventional petroleum resources?

"We know there's oil in the sediment near the Barkley Canyon hydrates," says Chapman "This is a strong indication that there's a deep reservoir down there that contains natural gas or oil. But where or how big it is, we don't know."

Chapman's next step is to use seismic systems—small airguns and research arrays—to explore the geological structure several hundred metres below the seafloor. "There has to be a conduit somewhere that connects the reservoir with what we're seeing on the seafloor," he says. "Finding it will help us understand how the hydrates are formed and how much natural gas may be out there."

UVic is recognized internationally for its excellence in earth, ocean and atmospheric systems research and education. Chapman's research is funded by the Natural Sciences and Engineering Research Council, the Canada Foundation for Innovation, the B.C. Knowledge Development Fund and the B.C. Innovation Council.



Peter Holst

Chapman and the ROPOS submersible.

EDGEwise

- Gas hydrates occur abundantly in nature in marine sediments and in Arctic regions.
- The worldwide amounts of carbon bound in gas hydrates is believed to total twice the amount of carbon found in all known fossil fuels on Earth.
- Researching methane hydrates may provide valuable insight into the Earth's past. Some organisms that use the hydrates for food resemble lifeforms that populated the Earth billions of years ago.
- Methane hydrates may be contributing to global warming. Hydrates that decompose due to earthquakes or changes in water temperature can discharge huge amounts of methane—a greenhouse gas 21 times more potent than carbon dioxide.
- Ross Chapman is director of UVic's Centre for Earth and Ocean Research (CEOR), which conducts and promotes interdisciplinary research in earth, ocean and atmospheric sciences. Visit CEOR online at: web.uvic.ca/ceor/