Glass reefs thought extinct thrill scientists
By Tom Spears
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Ocean scientists have always studied the sea by lowering a bottle over the side of a boat, and coming back a month later for another bottle of water. If the ocean changed between these two samples, no one knew when it had changed, or how.

That's changed now that a dozen Canadian universities have laid hundreds of kilometres of fibre optic cable on the Pacific floor, and are attaching cameras, remote-control vehicles and sensors to tell them about the ocean at any time of day or night.

One of their first surprises: Enormous reefs made of glass, standing six storeys high, made by creatures that were believed to be extinct for 145 million years.

Yes, glass, made by sponges that absorb silica.

"These things were thought to have gone extinct in the Jurassic, so they've actually been quite a hit with the paleontologists (and) with the geologists," says **marine biologist Verena Tunnicliffe of the University of Victoria.**

She's the director of the underwater project called **VENUS**, which has 44 kilometres of cable running to and from instruments under the ocean near Victoria and Vancouver.

The glass sponges are gorgeous. They're fluted, delicate structures, and when they die they get infilled and they make a solid glass structure, and more glass sponges settle on top of them," she says.

These not-so-extinct reef creatures built their structure 18 metres tall, and just four kilometres from Vancouver's sewage treatment plant. Some of their reefs off the coast of B.C. cover up to 700 square kilometres and are 6,000 years old, but no one could explore them until VENUS.

VENUS is the smaller of two projects — the other is called **NEPTUNE** — run from the **University of Victoria**.

NEPTUNE has a vast cable covering 800 kilometres of the deeper ocean, running west from Vancouver Island to a point that's 2,200 metres deep. Its instruments will be installed in about a year.

Together these networks will cost about $110 million to build and $14 million a year to run — a megaproject by any science standards, and one in which Canada leads the world.

Wave sensors. Cameras. Lights. Seismic instruments. Sonar. Hydrophones. All linked by cable that carries constant power and transmits commands out, and data back.

Today's ocean scientist can run experiments from a Toronto high rise, or the Arizona desert.

“The idea is you don’t have to be out there now,” says **University of Victoria president and oceanographer Dave Turpin.**

With a steady stream of measurements coming in, he says, scientists will get a far greater appreciation for how ocean changes occur, and this in turn will lead to a better understanding of fish, earthquakes, underwater fuel reserves and just about anything else in the sea.

“Imagine being an agronomist and knowing what the weather was like on May 1, Aug. 2 and Sept. 12, and trying to figure out what happened in between,” he says. It just wouldn’t work, yet this is how limiting the lack of information from oceans has been.

The “ocean observatory” should change all that, even if we can’t yet imagine how.

“This is the equivalent to wiring your office building with fibre optics. What you plug into the end of it is up to you,” he notes.

“No one who wired Ottawa (years ago) knew you would be downloading video. The wonderful thing about this (NEPTUNE) is that the best experiments are probably going to be designed by people who are still in Grade 3 today.”

Japan, China and Europe have underwater cable systems planned or under way, but haven’t yet delivered anything of this scope.

The first Canadian data started flowing two years ago, from Saanich Inlet, near Victoria.

“I figure the place we really need to understand is the place at our doorstep,” says Ms. Tunnicliffe, who holds a Canada Research Chair in deep ocean research at Victoria.

“What we’re addressing is the real need for a waterway that turns out to be one of the most stressed places in the world.”

A recent global study surveyed 235 ocean regions and found the Vancouver area to be No. 2 on the most stressed list, after the Malacca Straits off Indonesia.

The scientists who wanted information have pushed VENUS to its technical limits. The demand is for information from places that are hard to reach because of very strong currents, poor visibility, steep slopes, or bits of ocean floor that are actually collapsing, such as the area near the mouth of the Fraser River.

“Incredibly hard to work in those conditions,” Ms. Tunnicliffe says. “And we’ve done it.”

Anyone who wants daily data on the state of the water — salinity, temperature and so on — can get it now. People can also see images and video clips, although those aren’t live because the camera lights aren’t on all the time.

“You can watch plankton migrating up and down,” says Ms. Tunnicliffe says.

There’s also a flood of data about noise in North American’s busiest shipping channel

now that researchers plugged in hydrophones to record the sound.

“For the first time we can get fulltime information on what it sounds like to be a creature living on the sea floor at 300 metres,” she says.

“And boy, is it one hell of a noisy place.

“This is a major whale migration route. It turns out that killer whales are beginning to have to ‘shout.’ The level at which they’re communicating is going up.”

Simon Fraser University has one experiment in which they anchored a pig on the bottom to simulate a human body. There’s a camera to show it, and the SFU scientists logged on every day to watch the rate of degradation of the corpse. The Mounties are interested, too.

Besides being bigger, the NEPTUNE network will ask more questions. **Martin Taylor, president of Ocean Networks Canada**, which administers both networks, divides NEPTUNE’s work into five themes:

• Climate change, and its effect on sea creatures (including salmon stocks).
• Seismic studies and earthquake prediction. “The Juan de Fuca plate is one of the most active tectonic plates on the planet.”
• Gas hydrate studies. Methane gas in frozen deposits could be a rich fuel source, but also threatens to make climate change worse if it escapes. Methane is a potent greenhouse gas.
• The diversity of deep-sea ecosystems. Jacques Cousteau’s glimpses “have given us a taste for things that boggle the mind,” he said. For instance, the life clustered around hot, sulphuric vents in the sea floor: “There shouldn’t be life there. The pressure, the temperature, the chemical composition of the water — and yet there are rich ecosystems. What’s going on there?”
• Finally, there’s a thrill a minute for the engineering and computer experts learning to send data and 10,000 volts of continuous power across the steep, rocky sea floor. What happens when a piece of equipment that weighs several tonnes it flips over on the sea bottom? Someone has to flip it back.

VENUS is two years behind schedule, entirely because of problems with the power supply underwater. It could have been worse.

“We have a good group of colleagues in California who have also tried to put in a cabled observatory. The same day we plugged in, they plugged in,” Ms. Tunnicliffe said. “And they were only able to stay alive for 20 minutes. Their connector blew out.”

The Californians hope to get started again next fall.

This will be a first for the Americans. The original plan was to have a network linking Canadian and U.S. Pacific waters down to California. But with the terrorist attacks of 2001, the American plans were put on hold while Canada’s end continued. Today, Canada’s networks are the only ones in the water, and they are “decoupled” from the American planned loop — able to stand alone.

The prospect of Americans, and others in the world, building or expanding underwater observatories pleases Dave Turpin no end.

“If they do go ahead — and they will eventually — where are they going to buy the technology?” he asks. “As we move on to wire the world’s oceans, Canada is going to be a leader in the technology.” Mr. Taylor puts it more strongly. “We are now developing the first, and by far the biggest, regional cable observatory anywhere. The eyes of the world are literally on us. I was at a meeting last week in Toulon (France), and everybody in Europe is looking to NEPTUNE and the VENUS to be the pioneers.”

The same happened at a meeting a few weeks ago in Japan, where there is a small, unfinished network.

“So don’t underplay the importance of NEPTUNE Canada especially on the world scene,” Mr. Taylor says.

“It’s never been done before. It’s unusual for Canada to be in first place, and that’s the position we’re in.”