Marine Geophysicists probe sea floor

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A team from U of T's marine geophysics group is participating in a joint project to create the world's largest cable-linked sea floor observatory on the Pacific Ocean floor.

Located in the northeast Pacific off the coasts of British Columbia, Washington and Oregon, the active Juan de Fuca tectonic plate is one of the smallest of the dozen major plates that make up the Earth's crust.

"The idea of this project is we can observe a whole array of different phenomena that are associated with plate tectonics and other processes in the ocean with this reasonably small -- by earth-scale standards -- sea floor laboratory," said Eleanor Willoughby, a research associate in marine geophysics at U of T.

Known as the North-East Pacific Time-Series Undersea Networked Experiments, or NEPTUNE, the project will allow scientists to monitor biological, oceanographic and geological processes over a period that could stretch to more than two decades, depending on the long-term impacts on equipment from the immense water pressure and the corrosive effects of salt water.

NEPTUNE is a joint U.S.-Canada venture led by the University of Victoria in Canada and the University of Washington in the United States. In addition to the University of Toronto, 11 Canadian universities as well as other Canadian scientific institutions and governmental organizations are participating in the project. (Visit www.neptunecanada.ca for more information.)

"We know very little about three-quarters of the world's surface -- what's underneath the sea floor of the ocean," said Reza Mir, a PhD candidate in exploration geophysics at U of T whose doctoral research will be largely devoted to NEPTUNE.

The first stage of NEPTUNE is scheduled to start in summer 2008. Six unmanned sea floor nodes, each roughly the size of a sport utility vehicle and each hosting an array of instruments, equipment and video cameras will be installed on the ocean floor in Canadian waters. These sea floor laboratories will then be connected to each other and to land via 800 kilometres of fibre optic cable, allowing scientists to conduct experiments and collect a wide range of data about this area of ocean.

U of T's contribution includes designing and assembling the instrumentation required for two research projects at one of the nodes. One of these experiments involves designing an electromagnetic transmitter that will be used to study methane as it vents from the sea floor and where it exists in the form of gas hydrates (crystals containing methane found among sea floor sediments). The second experiment will use a gravity meter and a differential pressure gauge to measure the elastic properties of sea floor sediments and how the sea floor reacts relative to surface wave action.

Willoughby said methane deposits beneath the sea floor represent an untapped resource, a potential hazard and a source of greenhouse gas.

"Gas hydrates help hold the sea floor together and if they're disassociated because of pressure or temperature changes there could be slump or a slide and these in turn can trigger tsunamis, so we need to know about their long-term stability," Willoughby said. "And because hydrates store methane very compactly, it's a potential energy source. It's estimated there's more than twice as much organic carbon trapped in gas hydrates than all other sources combined -- oil, gas, coal, anything else."

Members of the NEPTUNE research team at U of T are Willoughby and Mir; Professor Nigel Edwards, project supervisor; Carsten Scholl, post-doctoral fellow, data modelling and interpretation; Andrei Swidinsky, PhD candidate, computer modelling.

Source: University of Toronto