

Researchers probe undersea earthquake zone

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Over the next five years, an international team of scientists will drill deep into the Earth's crust off the shore of Japan to understand how undersea earthquakes are generated and to establish a series of permanent undersea observatories on the plate boundary.

The scientists, part of the International Ocean Drilling Program's Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) aboard the specially built Japanese vessel, Chikyu, began their expedition in September. The project will eventually include between 150 to 200 scientists from Japan, Europe, China, South Korea and the United States.

The Nankai Trough, located off the southwest coast of Japan, has been the site of large earthquakes and tsunamis for millions of years, including events in 1944 and 1946 that measured 8.1 and 8.3, respectively.

"We want to understand what happens at the transition from one tectonic plate to another," said Demian Michael Saffer, associate professor of geosciences, Penn State. "We would like to be able to apply what we learn there to other parts of the world."

In the Nankai Trough, the Philippine Plate is moving under the Eurasian Plate. Subduction occurs when two plates meet and one slides beneath the other. This causes volcanic activity inland from the plate edge. The Japanese islands sit on the edge of the Eurasian plate. Subduction causes Japanese volcanoes including Mt. Fuji.

"The Pacific Northwestern coast in the United States is similar to the southwestern portion of Japan," said Saffer, who will join the expedition at the end of October.

He is an expert on water and rock mechanical properties and the specialty coordinator in these disciplines for all of the planned expeditions on NanTroSEIZE, which is the largest single project in the history of marine science. He will arrive at the end of the first drilling expedition and begin the second, serving as a bridge for the other expedition participants. Saffer is also the lead scientist on the first shallow seabed observatory that will be installed later in the project.

The ultimate aim of NanTroSEIZE is to drill 3.75 miles into the fault zone to establish permanent monitoring of the area. While deep drilling is the ultimate goal, the initial phase of the project, currently under way, is surveying drilling sites and shallowly probing locations in the study area. They will drill seven holes up to the leading edge of the plate taking measurements as they go, but not collecting any materials. These holes will be a half-mile deep. The second group will also drill shallow holes but will collect the rock for laboratory studies in the coming years.

"Another goal of the project is to try to understand what happens when an earthquake generates a tsunami," said Saffer. "We think that direct observation of the earthquake zone will help us understand exactly where and what is happening."

The second phase of drilling, set to begin next fiscal year, focuses on using riser drilling for the first time in scientific deep-sea drilling. The hole will be about two miles deep and will penetrate a major fault that the team believes ruptured in the 1944 earthquake. Riser drilling, unlike methods used in the past that used water in the drilling process, creates a pipe leading from the hull of the ship into the borehole, allowing the use of drilling muds and pressure control during drilling.

Next, the researchers will drill 3.75 miles into the subducting plate boundary and install temporary monitoring equipment. Finally, the scientists will install a long-term observatory system into two ultra-deep boreholes. The subsea bed observatory would record seismology, strain, tilt, water pressure and temperature within the hole. The researchers also plan to establish a number of shallow observatory bore holes to add to the data collected.

"The Japanese have funded a cabled network," said Saffer. "We hope our observatory will be connected to this network and that by 2010-2011, scientists may be able to see real-time data on their computer anywhere in the world."

The IODP is a marine research initiative jointly funded by Japan's Ministry of Education, the U.S. National Science Foundation, a consortium of European Countries, the People's Republic of China and South Korea.

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