Deep-ocean researchers target tsunami zone near Japan

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Rice University Earth scientist Dale Sawyer and colleagues last month reported the discovery of a strong variation in the tectonic stresses in a region of the Pacific Ocean notorious for generating devastating earthquakes and tsunamis in southeastern Japan.

The results came from an eight-week expedition by Sawyer and 15 scientists from six countries at the Nankai Trough, about 100 miles from Kobe, Japan. Using the new scientific drilling vessel "Chikyu," the team drilled deep into a zone responsible for undersea earthquakes that have caused tsunamis and will likely cause more. They collected physical measurements and images using new rugged instruments designed to capture scientific data from deep within a well while it is being drilled.

The Nankai Trough is known as a subduction zone, because it marks the place where one tectonic plate slides beneath another. Tectonic plates are pieces of the Earth's crust, and earthquakes often occur in regions like subduction zones where plates grate and rub against one another. For reasons scientists don't yet understand, plates that should move smoothly relative to each other sometimes become locked. In spite of this, the plates continue moving and stress builds at the points where the plates are locked. The stored energy at these sites is eventually released as large earthquakes, which occur when the locked area breaks and the the plates move past one another very rapidly, creating a devastating tsunami like the one in Sumatra and the Indian Ocean three years ago.

"Earthquakes don't nucleate just anywhere," Sawyer said. "While the slip

zone for quakes in this region may be hundreds of kilometers long and tens of kilometers deep, the initiation point of the big quakes is often just about five to six kilometers below the seafloor. We want to know why."

Sawyer said scientists with the Integrated Ocean Drilling Program (IODP) plan to return to the Nankai Trough aboard the Chikyu each year through 2012, with the ultimate goal of drilling a six-kilometer-deep well to explore the region where the quakes originate. If they succeed, the well will be more than three times deeper than previous wells drilled by scientific drill ships, and it will provide the first direct evidence from this geological region where tsunami-causing quakes originate.

The drilling done by Sawyer and colleagues marked the beginning of this massive project, which IODP has dubbed the Nankai Trough Seismogenic Zone Experiment, or NanTroSEIZE. In addition to the objective of drilling across the plate boundary fault, NanTroSEIZE scientists also hope to sample the rocks and fluids inside the fault, and they want to place instruments inside the fault zone to monitor activity and conditions leading up to the next great earthquake.

"The Chikyu is a brand new ship -- the largest science vessel ever constructed -- and it uses state-of-the-art drilling technology," Sawyer said.

The Chikyu is the first scientific drill ship to incorporate riser drilling technology. Pioneered by the oil industry, a riser system includes an outer casing that surrounds the drill pipe to provide return-circulation of drilling fluid to maintain balanced pressure within the borehole. The technology is necessary for drilling several thousand meters into the Earth.

Source: Rice University