News Release

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Researchers Seek Clues to Submarine Quakes at Plate Collision Zone Offshore Japan

Austin, Texas - Seeking new clues to the cause of some of the Earth's most powerful earthquakes, an international group of scientists aboard the Ocean Drilling Program vessel *JOIDES Resolution* is using special technology to measure and monitor physical properties at a convergent plate margin offshore Japan. The researchers hope their findings improve risk assessment of catastrophic quakes, which also can trigger tsunamis (sometimes called tidal waves.)

The Ocean Drilling Program (ODP) is an international partnership of scientists and research institutions organized to explore the evolution and structure of earth.

The research team is exploring the Nankai Trough, a geologically active area where two of Earth's tectonic plates collide, producing major quakes. Referred to as a convergent margin, Japan's Nankai Trough is typical of such settings worldwide. It forms as the more buoyant (or lighter) continental crust of Japan overrides a denser, heavier oceanic plate sliding under the Japanese islands. At the same time, the continental crust pushes up a thick wedge of sediments called an accretionary prism.

"Imagine that Japan is the bulldozer scraping sediments off the seafloor of the Philippine Sea plate as it collides and dives beneath Japan at the Nankai Trough," explained Dr. Nathan Bangs, a UT Austin scientist who sailed on ODP Leg 196.

ODP Leg 196 (June 3 - July 3) is a two-part program of drilling, logging and installing long-term observatories to monitor geologic activity in the area. Scientists are seeking information about the connection between fluid-flow in

the sediments and deformation processes and when tectonic plates collide, and how this ultimately affects earthquake events.

"This knowledge is not only important scientifically, but also has great societal relevance," said Dr. Casey Moore, a geoscientist from the University of California at Santa Cruz and one of the three chief scientists heading the research project. "The great forces associated with convergent margin subduction and deformation can produce devastating earthquakes, trigger tsunamis, cause rapid subsidence and uplift in coastal areas and create lines of active volcanoes both on land and on the seafloor."

The earthquake research on the first part of Leg 196 (May 3- June 1, 2001) was conducted with special logging-while-drilling (LWD) technology developed by the petroleum drilling industry. To gather data, or logs, using traditional methods, tools are lowered through the boreholes drilled in the Earth after the core has been removed. With LWD, however, scientists simultaneously collect data from monitoring devices, or logging tools, located directly behind the drill bit as the hole is being drilled. The special tools used on Leg 196 were developed by the Schlumberger Technology Corporation, which is involved in executing ODP's logging program at sea.

"The dynamic deformation processes and high fluid pressures in the sediments of an accretionary prism make it extremely difficult to collect these data using conventional methods - because the holes collapse before the tools can be deployed", said Dr. David Goldberg, director of the Borehole Research Group at Columbia University's Lamont-Doherty Earth Observatory.

On the ODP Leg 196, scientists deployed three of Schlumberger's state-of-the-art LWD tools - the Azimuthal Density Neutron (ADN), Isonic and Resistivity-at-the-Bit (RAB) tools. The RAB allows scientists to collect 360 degree images of the geologic formation while the hole is being drilled, making it possible to identify borehole structures such as fractures, faults and stratigraphic contacts. Scientists can use the RAB, which has a resolution of 15-to-30 centimeters, to peer at structural information within a fault zone or an active tectonic area.

"During this cruise, the RAB tool provided us with the clearest and most dramatic images of borehole 'breakouts' that have ever been recorded in the Ocean Drilling Program," said Goldberg. "Breakouts are hole enlargements that indicate regional stress direction and magnitude, and are key to understanding the tectonics in this area."

Scientists also detected the invasion of borehole fluids into the borehole formations and collected information on porosity that helps define zones under high pressure that may contribute to fluid flow along fault lines.

Dr. Jack Baldauf, deputy director of ODP ship operations at Texas A&M University, said: "The goal of understanding the processes of earthquake cycles and fluid and their interrelationship at convergent margins not only requires detailed, immediate subsurface sampling to capture natural conditions, but also long-term, time-series, sub-seafloor observations."

During the second half of the Leg 196, which is taking place now, two drill holes are being sealed with special monitors called "advanced circulation obviation retrofit kits," or ACORKs. The monitors will track fluid flow and tectonic processes for a period of three to five years.

Dr. Keir Becker of the University of Miami's Rosenstiel School of Marine and Atmospheric Science, developed the ACORK's. "Instrumenting the two holes with ACORKs will begin a long-term program of observation of seismicity, fluid-flow parameters and fluid geochemistry at the Nankai Trough, a program that will involve future revisits by manned and unmanned submersibles," he said.

Moore said the Nankai Trough voyages are important not only for earthquake research, but can play a key role in climate studies.

ODP is managed by the Joint Oceanographic Institutions, headquartered in Washington D.C.