Leg 131

June 29, 1990 COLLEGE STATION, TX -- Scientists for the Ocean Drilling Program recently took to the sea to study the geologic processes that formed a mountain range in Japan and contribute to the high number of earthquakes that afflict the region.

The scientists on board the drill ship *JOIDES Resolution*, operated by Texas A&M University, drilled eight holes in water depths up to three miles to learn what can occur when ocean and continental crust collide. The drill sites lie off southeastern Japan in a deep submarine valley called the Nankai Trough.

When plates carrying ocean crust collide with more buoyant continental crust, the ocean crustal plate slips beneath, often leaving behind tremendous amounts of sediment. In southern Japan, just north of the Nankai Trough region, the build-up has created the Shimanto belt, which originated far offshore and emerged above water to form the mountain ranges that crinkle the Japanese landscape.

Scientists call this massive sediment accumulation an accretionary prism.

The prism's development, say earth scientists, is analogous to piling dirt onto a descending conveyor belt. As the belt slides beneath the metal plate, it carries some dirt with it. But a large portion of the dirt mounds up where the belt slides under. As the belt continually cycles, the wedge keeps getting higher.

In ocean environments, the sediments overlying ocean crust are pushed against the prism, where they are squeezed, folded and broken into blocks that slide along a series of slanted faults -- fractures in the rock. This movement stacks layers of sediment and crust like a chain of toppled dominoes.

Another fault -- a giant, slightly dipping plane -- separates the two converging plates. The scientific team drilled through this giant fault as well as a smaller, more steeply angled fault to learn if and how water circulated along these horizons.

How sediments deform between two converging plates depends

on the types of sediments and how water moves along the faults and fractures. At another convergence site off Barbados, for instance, water flows relatively freely along the fault plane.

Scientists working at the Nankai site, however, discovered--

no evidence that the water had traveled along the smaller fault during the past 10,000 years--

the sheared and broken sediments composing the large fault were almost bone dry.--

pore waters below the large fault were quite abundant.

Scientists believe that although water may have flowed along this large fault in the past, it now appears to cap the waters beneath. Because the water does not appear to escape along the narrow paths of the diagonal faults, scientists theorize that it percolates up throughout the sandy, porous sediments.

Drilling results from this cruise have given scientists more information about water flow and deformation processes that occur at accretionary prisms. This information will also help in comparing this kind of convergence zone, and its related earthquake activity, with other convergence zones where water appears to flow more freely.

Scientists on this cruise also deployed an extensive suite of special tools to measure temperature, pressure, stress and porewater chemistry deep inside the drill holes. The data collected from these tools supplement that gleaned from the sediments and rocks in the recovered cores. Scientists will use this information to better explain the processes underlying the geologically active regions in the world.

Dr. Asahiko Tairo of the Ocean Research Institute at the University of Tokyo, Japan, and Dr. Ian Hill of the University of Leicester, United Kingdom, were co-chief scientists for the cruise. Dr. John Firth, Texas A&M University, College Station, was staff scientist.

Twenty-seven scientists from the United States, Canada, China, Federal Republic of Germany, France, Italy, Japan, Sweden, and the United Kingdom sailed on the drill ship JOIDES Resolution,

which left Guam on March 31, 1990, and arrived in Pusan, South Korea, on June 2.

JOIDES Resolution, registered as SEDCO/BP 471, is the research vessel for the ODP, which is funded by the United States National Science Foundation, the Canada/Australia Consortium for the ODP, the European Science Foundation Consortium for the ODP, the Federal Republic of Germany, France, Japan and the United Kingdom.

The 470-foot-long drill ship's derrick towers 200 feet above the waterline. A seven-story laboratory stack provides facilities for on board examination of sediment and hard-rock cores. Laboratories contain space and equipment for studies in chemical, gas and physical properties, paleontology, petrology, paleomagnetics and sedimentology. Marine geophysics research is conducted while the ship is under way.

Texas A&M University, as science operator, operates and staffs the drill ship and retrieves cores from strategic sites around the world. The science operator also ensures that adequate scientific analyses are performed on the cores. To do this, Texas A&M maintains shipboard scientific labs and provides logistical and technical support for shipboard scientific teams. On shore,in the Texas A&M University Research Park, the science operator manages post-cruise activities, curates the cores and publishes the scientific results.

Lamont-Doherty Geological Observatory of Columbia University is responsible for downhole logging.

Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES), an international group of scientists, provides scientific planning and program advice. Joint Oceanographic Institutions (JOI, Inc.), a nonprofit consortium of 10 major U.S. oceanographic institutions, manages the program.

"JOIDES Resolution is currently on its second engineering cruise where it is testing new drilling tools," said Dr. Philip D. Rabinowitz, director of the ODP. "The next scientific cruise will be off the northeast coast of Australia during September and October.

Note: JOIDES Institutions are: University of California at San Diego; Columbia University; University of Hawaii; University of Miami; Oregon State University; University of Rhode Island; Texas A&M University; University of Texas at Austin; University of Washington; and Woods Hole Oceanographic Institution.

Non-U.S. members are Canada and Australia Consortium for the ODP, European Science Foundation Consortium for the ODP: Belgium, Denmark, Finland, Iceland, Italy, Greece, the Netherlands, Norway, Spain, Sweden, Switzerland and Turkey; Federal Republic of Germany; France; Japan; and the United Kingdom.

The scientific party for Leg 131 was: Asahiko Taira, co-chief scientist, Ocean Research Institute, University of Tokyo, Japan; Ian Hill, co-chief scientist, University of Leicester, United Kingdom; John Firth, staff scientist, Ocean Drilling Program, Texas A&M University, College Station; Ulrich Berner, Bundesanstalt fur Geowissenschaften und Rohstoffe, Federal Republic of Germany; Warner Bruckmann, Center for Marine Geoscience Research, F.R.G.; Tim Byrne, Brown University, Providence, Rhode Island; Thierry Chabernaud, Lamont-Doherty Geological Observatory, Palisades, New York; Andy Fisher, Ocean Drilling Program, Texas A&M Universty; Jean-Paul Foucher, IFREMER, France; Toshitaka Gamo, Ocean Research Institute, University of Tokyo, Japan; Joris Gieskes, Scripps Institution of Oceanography, La Jolla, Calif.; Roy Hyndman, Pacific Geoscience Centre, Canada; Daniel Karig, Cornell University, Ithaca, N.Y.; Miriam Kastner, Scripps Institution of Oceanography; Yukihiro Kato, Maritime Safety Agency, Japan; Siegfried Lallemant, Ecole Normale Superieure, Paris, France; Ran Lu, University of Minnesota, Minneapolis; Alex Maltman, University College of Wales, U. K.; Greg Moore, Hawaii Institute of Geophysics, University of Hawaii, Honolulu; Kate Moran, Geological Survey of Canada, Dartmouth, Nova Scotia; Gunnar Olafsson, University of Stockholm, Sweden; Bill Owens, University of Birmingham, U.K.; Kevin Pickering, University of Leicester, U.K.; Franca Siena, University of Ferrara, Italy; Elliott Taylor, University of Washington, Seattle; Michael Underwood, University of Missouri, Columbia; Craig Wilkinson, Lamont-Doherty Geological

Observatory; Makoto Yamano, University of Tokyo, Japan, and Jiaxiang Zhang, State University of New York, Stony Brook.