OCEAN ◆ DRILLING ◆ PROGRAM

News Release

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18 October 1996 **FOR IMMEDIATE RELEASE**

THE SWALLOWING OF EARTH'S OCEAN FLOORS
Ocean Drilling Program scientists probe recycling of oceanic crust beneath Costa Rica

SAN DIEGO -- An international team of scientists representing nine countries will board the *JOIDES Resolution* in San Diego to study the active continental margin off Costa Rica. The scientists will determine the ages and compositions of the rocks and sediments, their physical and chemical properties, and will use the newly developed logging tool called Logging While Drilling, or LWD. The LWD technique samples physical and chemical properties in place within the drill hole, while drilling is occurring simultaneously, and gives pristine results, unaffected by vertical movements of the drill in the hole.

The team is led by Dr. Eli Silver (Director of the Institute of Tectonics, University of California, Santa Cruz) and Dr. Gaku Kimura (Department of Earth Sciences, University of Osaka Prefecture, College of Integrated Arts and Sciences, Sakai-shi 593, Japan), along with scientists from the U.S., Japan, France, Germany, Great Britain, Canada, Italy, Norway, and Costa Rica. Silver noted that the Costa Rica margin is an important locator where one tectonic plate collides, forcing one plate to slide under the other plate creating subduction zones.

Subduction zones are the most dynamically active features on Earth. They control the movements of plates, produce most of the world's volcanic and seismic activity, and play a key role in recycling surface material to great depths within the Earth. These processes are interrelated, and the recycling of subducted material plays a major role in the production and regulation of both volcanic and seismic activity. With this study shipboard scientists hope to make major inroads into understanding the recycling process.

The theory of plate tectonics postulates that the amount of crust destroyed at subduction zones each year is balanced by the formation of new crust at spreading ridges. This expedition seeks to understand how much of the sediment being carried to subduction zones is scraped off the descending plate and how much goes down into the mantle with the plate. The problem is that many subduction zone trenches are flooded with sediment from the last million years of glacial climates, when abnormally high amounts of material washed off the land surfaces, making it difficult to determine this partitioning between downgoing and offscraped sediment. About a decade ago scientists discovered that Costa Rica may be one of the few places that enable this determination to be made.

Using three dimensional seismic imaging, a method of probing the subsurface with high energy sound waves in a very tightly spaced pattern, this part of the offshore margin of Costa Rica can be viewed in exquisitely fine detail. The images show that 400 m (1,300 feet) of sediment lie on the incoming Cocos Plate and about 80 m (250 feet) of the incoming sedimentary section is being scraped off at the base of the slope Another 80 m or so continue beneath the slope for some distance before being scraped off, and roughly 240 m continue to subduct.

There are two gaping holes of knowledge scientists would like to fill. Scientists don't know the age of the material and therefore can't determine the rates at which these scraping and subducting processes occur. The second

problem is determining how long this process has been occurring. Recent seismic studies using larger energy sources and receivers on the seafloor indicate that a large part of the margin may be underlain by old rocks which are not part of the present cycle of sediment accretion. If this is the case, it limits the amount of material that could have been scraped off the subducting plate.

In addition to determining the balance between accreted and subducted sediment, this team is interested in understanding why the seafloor off Costa Rica has some of the lowest heat flow measured on Earth. Measurements made in 1994 from the R/V Atlantis II and from the submersible ALVIN showed that this zone of low heat flow is widespread and probably indicates chilling of the crust by unusually strong flow of sea water through the oceanic crust. The heat flow through the accreted sediment is twice as great as that through the incoming plate to the west. Fluids flowing through the margin from deeper sources may provide one explanation for this increase. To determine how fluids flow through these rocks, intensive physical and chemical properties will be performed on the cores, and critical supplementary data will be obtained with the LWD system.

The Ocean Drilling Program is funded by the U.S. National Science Foundation, Canada, Australia, South Korea, the European Science Foundation Consortium, Germany, France, Japan, and the United Kingdom to investigate such topics as earth's history and evolution, climate change, and formation of the ocean crust.

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

Texas A&M University, science operator, operates and staffs the drill ship that retrieves core samples from strategic sites in the world's oceans. Lamont-Doherty Earth Observatory of Columbia University is responsible for downhole logging.

U.S. members of JOIDES 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. The European Science Foundation Consortium consists of Belgium, Denmark, Finland, Iceland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and Turkey.

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