

# Leg 185

## An Expedition to a Subduction Factory

**8 April 1999** This first Ocean Drilling Program expedition dedicated to subduction factory studies will be completed at the Mariana Trench and the Izu-Bonin Arc. Subduction of oceanic plates can cause cataclysmic events such as earthquakes and tsunamis but may also produce many beneficial products such as ore deposits. The subduction factory is a dynamic process in which raw materials from the subducting seafloor and overlying mantle are recycled and new products on the upper plate are created. The study of sediment and crustal recycling in these unique settings are critical for understanding this slow, but very large Earth process.

The geochemical and physical evolution of Earth's crust and mantle is largely influenced by the physical and chemical processes associated with these recycling margins. The mass balance can be determined from studying the input and output of chemicals cycled through the factory.

The scientific goal of this expedition is to complete the currently missing gaps in the recycling system along the Izu-Bonin Arc. These gaps include an incomplete understanding of the aging process of the uppermost layer of the solid Earth, the flow of materials through the zone between deep sea trenches and volcanic arc, and the fluid circulation at active margins. The Mariana Trench and Izu-Bonin Arc are ideal for subduction recycling studies because the two sites are part of the same subducting plate, yet have distinct geochemical signatures. Studies of the relative amounts of several important components in the subducted plate (e.g., water, carbon dioxide, uranium and lead) will be used to determine whether the chemical differences between the two arc systems are the result of different crust or due to some other mechanism.

The Izu-Bonin Arc was selected because much is already known of this system from previous ODP drilling on both sides of the trench during Legs 125, 126 and 129.

**Science Strategy** Two deep-water sites are planned for Leg 185: an existing ODP Hole (801C) located seaward of the Mariana Trench will be deepened, and a new site (BON-8A) will be drilled east of the Izu-Bonin Arc. Several aspects of the recycling process have been well studied in the trench region, thus a return to the site will help determine the missing inputs &ndash; from altered oceanic crust at the Mariana Trench (801C) and from sediment and oceanic crust at the Izu-Bonin Arc (BON-8A).

The research team will drill, sample and measure the *in situ* conditions of the upper alteration zone at the Marianas Trench site and the entire sedimentary section into basement at the Bonin site. These critical drilling results will be used with, seismic reflection images, and material balance calculations to determine the mass balance of this dynamic subduction factory. Dr. Terry Plank of the University of Kansas and Dr. John Ludden of the Centre de Recherches Petrographiques et Geochimiques (CNRS) in France are the Leg 185 co chief scientists.

**Challenges of the Deep** During Leg 185, ODP will drill in the deepest part of the world's ocean. The sites are located in water depths ranging from 5.7 to 6 km. These water depths push the state-of-the-art deep water drillship, *JOIDES Resolution*, to its technical limits. The ship's derrick is designed to carry the load of 9,000 m of steel drill pipe. So, for this leg, the ship will be working at its maximum capacity. In addition, this deep water puts additional stresses on the drill pipe itself. During the port call prior to sailing, the drillstring will be tested for strength to ensure its competence for these challenges of the deep. **ODP** The Ocean Drilling Program, an international partnership of scientific institutions and governments, explores the Earth's history and evolution. The Ocean Drilling Program is funded principally by the U.S. National Science Foundation, with substantial contributions from its international partners. These include the Federal Republic of Germany, Japan, the United Kingdom, the Australia/Canada/Chinese Taipei/Korean Consortium for Ocean Drilling, the European Science Foundation Consortium for Ocean Drilling (Belgium, Denmark, Finland, Iceland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland), France and the People's Republic of

China. The program is managed by Joint Oceanographic Institutions, a consortium of 11 U.S. institutions, with Texas A&M responsible for science operations. Lamont Doherty Earth Observatory is the manager of logging operations.

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In addition, the ODP Web Site includes information on this leg (Leg 185 Scientific Prospectus) and will carry weekly reports on progress as the leg proceeds. <http://www-odp.tamu.edu>