

Leg 201

Ocean Drilling Expedition Captures Life Beneath the Seafloor

May 2002 A team of scientists from seven nations has just finished the first ocean drilling expedition ever to be dedicated to the study of the deep biosphere. One of the leaders of the voyage, Steven D'Hondt, University of Rhode Island (USA), remarked, "This cruise was a tremendous success. It taught us a great deal about life beneath the seafloor."

The Ocean Drilling Program (ODP) drillship *JOIDES Resolution* left San Diego for this expedition, known as ODP Leg 201, in late January and returned to shore in Valparaiso, Chile at the end of March 2002. The shipboard scientists were led by co-chief scientists D'Hondt and Bo Barker Jorgensen, from the Max Planck Institute for Marine Microbiology (Germany), and staff scientist Jay Miller, from Texas A&M University (USA). The ship worked in water depths ranging from 150-5300 meters to drill into oceanic sediments and the underlying rocky crust. These sediments ranged in temperature from 0°C to 25°C and in age from 0 to almost 40 million years. The sites were selected to represent the general range of subsurface environments that exists in marine sediments throughout most of the world's oceans.

Earlier studies of marine sediments, led primarily by Leg 201 scientist John Parkes of the University of Bristol (UK), had found microbial cells to be ubiquitous in deep-sea sediments. However, almost nothing was known about the nature of those deeply buried cells, the extent of their activity, and their relationship to life on Earth's surface.

Jerry Dickens, a geochemist from Rice University who participated on the cruise, explained, "We have known the background information on microbes for awhile. By focusing this leg on microbiology, we were able to change the way we sample and study cores, which radically altered both the way we approach sediment-rock interactions and our understanding of them."

The recent expedition found evidence of active life in all of the explored marine sediments. The shipboard scientists also discovered that the life buried in these sediments is fueled by chemicals that migrate down from the overlying ocean, by chemicals released by the degradation of the surrounding sediment, and by chemicals that migrate up from the underlying rocky crust. To the extent that this microbial life relies on degradation of the sediment that surrounds it, its ongoing activity depends on the oceanographic conditions that prevailed when the sediment was deposited, millions of years ago.

During the leg, scientists found microbial abundances and activity to be much higher in sediments buried on the continental shelf of Peru than in sediments of the open Pacific Ocean. The open Pacific sites with the lowest rates of deeply buried microbial activity contained the lowest average microbe concentrations ever observed in deep-sea sediments. In contrast, some of the sediments recovered on the Peru Shelf contained the highest concentrations of microbes ever observed beneath the seafloor. At one Peru Shelf site, microbes were actually less abundant at the seafloor than in a narrowly focused zone of high activity tens of meters beneath the seafloor.

The microbes will be studied further to document the genetic relationships between the life forms of Earth's surface and subsurface worlds. The recovered sediments and fluids will also be studied further to determine how biogeochemical processes deep beneath the seafloor affect Earth's surface world.

The Ocean Drilling Program (ODP) is an international partnership of scientists and research institutions organized to study the evolution and structure of the Earth. It is funded principally by the US National Science Foundation, with substantial contributions from its international partners. The Joint Oceanographic Institutions manages the program. Texas A&M University is responsible for science operations, and Lamont-Doherty Earth Observatory of Columbia University is responsible for logging services.

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Photos showing life on board the drillship during this leg, both at work and play, are available on the web at <http://www-odp.tamu.edu/public/life/leg201.html>