



**Ocean Drilling Program
Public Information**
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Scientists mark time

with atolls and guyots

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ODP Leg 143: Western Pacific

COLLEGE STATION, Tx -- Rings of coral atolls lace the Pacific Ocean, remnants of volcanic eruptions, biologic construction and subsequent subsidence of the volcanic island.

Oceanographers today study these ancient formations because their composition marks the passage of geologic time, recording millions of years of changes in sea level, climate and evolution.

Charles Darwin proposed 150 years ago how coral atolls originate and develop. Ocean Drilling Program has returned to some the same Western Pacific areas visited by H.M.S. *Beagle* to devote four months to refining and elaborating on the naturalist's theory.

ODP's drilling ranges over a 1,400-mile sweep from the Marshall Islands to just off the coast of Japan. During the first

cruise of the two-part effort, ODP's research vessel *JOIDES Resolution* drilled the deepest hole ever penetrated during a single scientific cruise. Scientists on board also reaffirmed Darwin's observations from drilling results at one site, and retrieved evidence at another site that opened new avenues of inquiry.

From his observations during the *Beagle's* voyage, Darwin postulated in 1842 that when a young volcanic island emerges above sea level, a perimeter reef constructed by corals grows on the side of the volcanic island. As the volcano slowly subsides, the reef keeps growing and easily keeps pace with the sinking island. The combination of submergence and reef growth produces an increasing central lagoon with a decreasing inner island. The end product is a ring-shaped reef with a central lagoon.

These now-dead coral formations record the cycles of uplift and submergence of the atolls, thus serving as "dip sticks" that record changes in the sea-level fluctuations and climate through time.

ODP's first part of the expedition concentrated on drilling two guyots—flat-topped submarine seamounts—in the Western Pacific seafloor. The guyots were formed during the Cretaceous, between 120 to 100 million years ago, when the entire planet basked in a much warmer, homogeneous climate with no glaciation to interfere with determining total volume of seawater. The Cretaceous also marked a period of extreme volcanism, especially in the seafloor of the Pacific, the "mother" ocean at that time.

Allison Guyot, the first drilled, proved a classic example of Darwin's original model. From the drilling record, geologists now have the material to analyze small-scale changes (on the order of thousands of years) in climate and sea levels going back several million years of Earth's history.

Huevo, the second guyot to be drilled, yielded a much more complicated story. One of its sites marks a technological milestone: ODP drilled to a depth of 1,743 meters, the deepest scientific subsea borehole ever drilled on one cruise. Drilling results yielded only a few pieces of coral and other indicators of

a classic reef formation. Scientists did recover, however, evidence of small mounds of calcareous sponges and rudist bivalves (the latter are found only in the Cretaceous). From these fossils and from other evidence, Huevo does not appear to have been a classical Darwinian atoll. Rather it appears to be a somewhat different kind of carbonate platform that developed on and around a volcanic island.

Scientists will use the results from both guyots as well as drilling records from the second cruise to help construct a paleoceanographic history of the Pacific Ocean. Results from these two cruises contribute to a better understanding of volcanic processes and the rises and falls of relative sea level.

Co-chief scientists for the cruise were Dr. Edward L. Winterer from Scripps Institution of Oceanography, La Jolla, Calif., and Dr. William W. Sager, Texas A&M University, College Station. Dr. John Firth of Texas A&M University was the staff scientist.

JOIDES Resolution, registered as *Sedco/BP 471*, is the

research vessel for the ODP, which is funded by the United States National Science Foundation, Canada and Australia, the European Science Foundation Consortium for the Ocean Drilling Program, Federal Republic of Germany, France, Japan, Russia and the United Kingdom.

The 470-foot-long drill ship's derrick towers 200 feet above the waterline. Seven levels of laboratories provide 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, paleomagnetism and sedimentology.

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.

"ODP has identified sea-level changes through time and the tectonic history of the lithosphere as two of its primary scientific objectives," said Dr. Philip D. Rabinowitz, director.

"Results from the two expeditions help contribute significantly to our reaching these objectives."

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.

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; the United Kingdom and the U.S.S.R.

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