Leg 182

What happens on the seafloor when it's too cold for corals?

December 1998 The international Ocean Drilling Program (ODP) recently completed a two-month expedition in the Great Australian Bight investigating changes in climate, sea level, and ocean circulation in the Southern Ocean and the dramatic development of extensive cool-water reefs on the Australian continental margin. Aboard the scientific research drill ship, *JOIDES Resolution*, geologists used evidence found in deep-sea sediment to investigate how sea-water temperature variations have influenced the type of carbonate organisms growing off South Australia, a relatively unexplored area. The cores were drilled in water depths between 200 m and 3.5 km.

One exciting discovery was a band of cool-water reefs, occurring between 200-500 m below sea level and 150-200 km from the coast, extending more than 300 km east-west along the shelf edge. Co-chief scientist Dr. David Feary of the Australian Geological Survey Organization noted, "Geologists had previously recognized cool-water biological reefs in the rock record. However, this discovery will provide us with the opportunity to examine modern examples and understand the processes that control these build-ups." Scientists will use the results to develop models of how these cool-water reefs form and assist with hydrocarbon and mineral deposit exploration.

Another significant discovery of the expedition is the presence of high salinity brines within the sediments. Dr Al Hine, the other co-chief scientist from the University of South Florida, suggests "The most likely explanation for the origin of these brines is that they formed over the last million years when changes in sea level periodically exposed the vast Eucla Shelf in the Great Australian Bight." During times when sea level was low, large evaporative high salinity lakes formed and the water in these lakes drained into the underlying sediments. The high salinity fluids recovered during the expedition were also important in that they, along with organic material in the sediments, provided

the raw materials for sulfate-reducing bacteria to produce large amounts of hydrogen sulfide gas trapped within the sediments.

One of the key events in the history of Earth's climate over the past 65 million years was the growth of large ice sheets on Antarctica. These ice sheets developed and expanded after the Antarctic Circumpolar Current began to isolate the Antarctic continent about 35 million years ago. This event dramatically changed Earth's climate from a warm "greenhouse" world, prior to 35 million years ago, to the present "icehouse" world dominated by repeated glaciations. The Antarctic Circumpolar Current, which isolated Antarctica from warm waters flowing south from the low-latitudes, was only able to develop after northwards movements of the Australian and South American continents opened a continuous seaway around Antarctica.

The recovered sediments deposited in the Great Australian Bight contain a record of the evolution of this important current, and the dramatic changes in climate which accompanied its formation. Post-cruise analyses of the sediments deposited during these dramatic oceanographic changes will provide essential information to help scientists better understand how the Earth's climate system responds to re-organizations in ocean circulation and ice-volume.

The *JOIDES Resolution* sailed into Fremantle, Western Australia concluding the expedition on December 9. Now the scientific crew begins a 2-3 year process of scientific analysis of the enormous amount of data collected resulting in a vastly enhanced understanding of how cooler water "reefs" respond to major changes in the Earth's climate, sea-level, and oceanography.

The Ocean Drilling Program, an international partnership of scientific institutions and governments, explores the history and evolution of Earth's history. The Ocean Drilling Program is funded principally by the National Science Foundation, with substantial contributions from its international partners. These include the Federal Republic of Germany, France, Japan, the United Kingdom, the Australia/ Canada/ Chinese Taipei/ Korea Consortium for Ocean Drilling, the European Science Foundation Consortium for Ocean Drilling (Belgium, Denmark, Finland,

Iceland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and Turkey) and the People's Republic of China. The program is managed by Joint Oceanographic Institutions, a consortium of 10 U.S. institutions, with Texas A&M;University responsible for science operations. Lamont-Doherty Earth Observatory is the operator for downhole logging.

Additional information can be obtained from the Leg 182 Scientific Prospectus or Dr. Mitch Malone.