OCEAN ◆ DRILLING ◆ PROGRAM

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Scientists confirm that sea level controls the architecture of continental margins

College Station, Texas -- Deep drilling on the margin of the Great Bahama Bank by Ocean Drilling Program scientists has revealed the numerous high-frequency sea-level changes over the past 25 million years. Fifteen of these sea-level changes resulted in significant erosion in the shallow-water areas creating unconformities in the depositional sequence. The timing of these fluctuations and their amplitudes support the theory that sea level is the master variable controlling continental margin construction in the Bahamas and in other areas throughout the world.

Twenty years ago, Exxon Production Research laboratory proposed the "Sequence Stratigraphic Concept" which states that global sea level changes create characteristic packages of sedimentary deposits on the margins of continents. By understanding of these packages, geologists could understand the Earth's stratigraphic record, predict the location of petroleum resources, and target them for exploration. The fact that Exxon's conclusions were based on proprietary data gave rise to controversy regarding the age, magnitude and mechanism of sea level changes.

Using the scientific drill ship, *JOIDES Resolution*, ODP scientists from eight countries studied the sequence of marine carbonate sediments off the Bahamas. By drilling five sites as deep as 4200 ft (1300 m) below the sea floor, in water depths as great as 2200 ft (660 m), scientists pieced together the geologic history of the shallow Great Bahama Bank and its adjacent seaway which indicates the growth of the bank during periods when sea level was high. When the shallow platform is flooded, as it is today, sediments made of calcium carbonate accumulate and excess sediment is transported off-bank onto the slopes. When sea level dropped, carbonate production decreases as the platform became exposed and the platform margin partially eroded. This change in deposition marks the sequence boundary which in cores can be distinguished on the basis of differences in the sediment type or hardness of the sediment.

Drilling through these sediments enables scientists to recover core material and age date the sediments using micro fossils and thereby correlate these sequences between the holes. The dating of the sea-level controlled sedimentary sequences in the Bahamas produced a long-awaited data set for the documentation of global synchrony of sea level changes as the ages off the Great Bahama Bank compare well with other sedimentary deposits around the world. The resulting pattern of sea level change helps scientists to understand the mechanisms controlling sea level, the Earth's sedimentary deposits and effects produced by human activity.

ODP scientists also found thick sequences of organic-rich sediments, precursors of petroleum. The shipboard party conjectures that the pumping of seawater through the sediments enhances the oxidation of organic material, not only preventing the buildup of organic material to the point at which oil deposits, but also promoting the dissolution and cementation of the carbonate rocks.

"This drilling of the carbonate sediments on the margin of Great Bahama Bank will not only help understand timing and magnitude of sea level changes and validate the concept of sequence stratigraphy, but also provides new insights into the circulation of seawater through carbonate platforms," said co-chiefs Drs. G. Eberli and P. Swart.

The Ocean Drilling Program is funded by the U.S. National Science Foundation, Canada, Australia, 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.

Note: 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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