Leg 145

October 29, 1992 COLLEGE STATION, TX -- The 45th expedition of the Ocean Drilling Program (ODP) has given scientists new evidence concerning the initiation of massive ice buildup in the Northern Hemisphere. Leg 145 represents the first drilling cruise to document successfully how the North Pacific responded to the climatic deterioration resulting from a series of events that coalesced 2.6 million years ago.

Leg 145's scientific success was aided by the drilling crew, which pushed a coring tool to almost 400 meters, recovering the longest sections of undisturbed core ever obtained. The ship also recovered 4,321 meters (almost three miles) of core, making it the fifth highest recovery for the ODP. The integrity of the core coupled with the amount recovered will enable scientists to complete high-resolution measurements of the geochemical and biological signatures, providing a 50-million record of the North Pacific Ocean's response to climate and tectonic changes.

Circulation pattern

Scientists had previously thought that little or no bottom waters flowed in the North Pacific. By drilling into a formation called the Meiji Drift -- a sediment deposit more than 1,000 kilometers long -- scientists discovered that bottom water flowing south from the Bering Sea has been churning the ocean floor for at least 35 million years. The deep and active currents, never before documented in the North Pacific, correlate to similar patterns found in the North Atlantic, suggesting a corresponding oceanographic and climatic setting for the two bodies of water.

Biologic activity

Changes in biologic production also appear to coincide with what scientists know about similar events in other parts of the world. The world enjoyed a relatively warm period between 6 and 3 million years ago, a time when the North Pacific experienced a tremendous spike in biologic productivity. The flux in silica,

secreted by single-celled diatoms, increased severalfold. Correspondingly high rates also occurred at this time in the equatorial Pacific, and the Indian and Southern oceans. Evidence of increased biologic activity indicates a common climate at that time in the Northern and Southern hemispheres.

Worldwide changes at 2.6 million years

Although scientists knew that glaciation had occurred worldwide 2.6 million years ago, they did not how the Northern Pacific had responded to a colder climate. Drilling recovered five markers indicating massive glaciation: sediment deposition, dropstones, continental debris, dust and volcanoes.

Deposition -- Scientists also did not know when bottom currents began to distribute sediments in the Northwest Pacific. Seismic profiles of a deep basin showed flattened layers of sediment overlying a rougher strata. Most oceanic sediments drape over the seafloor and mimic its topography, which was true of the second layer. The smooth top layer attests to the strong bottom currents' ability to flatten the topography. When the ship drilled through the horizontal layers into the older strata, they discovered that the transition occurred at 2.6 million years. The timing, therefore, denotes when the Northwest Pacific changed from a basin characterized by sluggish circulation to one with more vigorous bottom-water movement.

Dropstones -- The ship also recovered a tremendous amount of dropstones, which are pebbles dropped by icebergs as they make their long journey to the sea. In the Northwest Pacific, dropstones appear in abundance at 2.6 million years. The scientific party also found more dropstones than they expected in the Gulf of Alaska, indicating that the onset of significant continental glaciation in western North America coincides with that of northeastern Asia.

Continental debris -- During the rapidly changing climate, rivers eroding the land masses of what are now Siberia, Alaska and Canada dumped large amounts of sediment into the northern ocean. This cruise was able for the first time to document a

three- to five-fold increase in fine-grained sediments coming into the North Pacific at the onset of glaciation.

Dust -- Scientists recovered evidence that five times as much windblown dust settled in the water column at the 2.6-million-year benchmark, again signifying a critical climate change in the dustsource regions of China and Mongolia.

Volcanic activity -- Massive amounts of volcanic ash deposits beginning 2.6 million years old are a fifth important occurrence in the initiation of the Pliocene-Pleistocene Ice Age. Scientists have debated for decades the cause-and-effect relationship between increased volcanism and the onset of glaciation. Drilling results indicate that volcanic activity starting at 2.6 million years dwarfed earlier events in the region's geologic history. The sudden abundance of ash at this critical juncture may cause scientists to reconsider the effect of volcanic eruptions on Northern Hemisphere temperatures. Contrary to previous theory, massive and widespread volcanism may, in fact, trigger glaciation.

Quantifying and refining these initial results will allow scientists to contribute a considerable amount of new information concerning our knowledge of the history of ocean circulation and evolution of Northern Hemisphere climate.

Dr. David K. Rea, University of Michigan, Ann Arbor, and Dr. Ivan A. Basov of the Institute of the Lithosphere, Moscow, Russia, were the co-chief scientists for the cruise. Dr. Tom Janecek, Texas A&M University, College Station, was the staff scientist.

About the Ocean Drilling Program

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, United Kingdom and Russia (inactive).

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.

Texas A&M University, as science operator, operates and staffs the drill ship and retrieves cores from strategic sites around the world. 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.

"This cruise more than met its objectives by recovering material that allows a new look at the paleoceanography of the North Pacific," said Dr. Philip D. Rabinowitz, director.

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 Russia (inactive).

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