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September 30, 1993 COLLEGE STATION, TX -- A drill ship carrying an international group of scientists arrive in Reykjavik, Iceland, September 24 after drilling at the edge of the permanent floating ice fields of the Arctic. The two-month expedition marked the first time that a scientific drilling vessel recovered sediment cores from the Arctic Ocean's seafloor. *JOIDES Resolution*, the drill ship for the Ocean Drilling Program, also drilled the world's northernmost borehole, located 80.5 degrees North and 8 degrees East, about 570 miles from the North Pole. The hole reached more than 500 meters beneath the ice-infested waters.

Seafloor sediments, containing minerals and skeletons of Arctic marine organisms, are a natural archive that records the environmental conditions of the Arctic Ocean and surrounding continents. In times past, Arctic waters were warmer and free of ice. The dramatic changes in climate that brought frigid conditions to both poles left a signature deep in the ocean floor that can be reached only by a drill bit.

"The Norwegian-Greenland Sea and the eastern Arctic Ocean have developed during the past 55 million years due to seafloor spreading," Dr. Annik M. Myhre said, one of the co-chief scientists and professor of geology at the University of Oslo in Norway.

The North Atlantic's rift separated Greenland and Norway and opened gateways for the flow of cold, oxygen-rich deep waters from the Arctic to the temperate regions of the Atlantic.

"Northern hemisphere polar and subpolar deep-sea basins can be thought of as sensitive 'lungs' of the world ocean, which respond quickly and drastically to global climatic change," Myhre said.

"The Arctic ice pack has developed only in Earth's recent geologic history and is one of the expressions of the extreme modern climates in which we are living," explained Dr. Jørn Thiede, of the GEOMAR Research Center for Marine Geosciences in Kiel, Germany, and the other chief scientist.

"The Arctic seafloor deposits provide evidence of a formerly warm, ice free Arctic Ocean in a natural state. If the greenhouse effect continues, we may reach these same climate conditions in the future," Thiede said.

The Arctic acquired its ice cover between 5 and 15 million years ago. "During the past few million years, 26 gigantic glaciation events have affected northern polar seas and lands, making these regions one of the least accessible and explored on Earth," Thiede said.

During the last few million years the Arctic Ocean was never completely ice-free but always had an ice pack that received at times enormous quantities of debris-laden icebergs from huge icesheets on the adjacent continents and shelf regions.

"It is a wonder of natural evolution," Thiede said, "that faunas and floras including seals, polar bears and man were able to adapt over comparatively short time spans to one of the most hostile and rapidly changing environments on Earth."

JOIDES Resolution departed St. Johns, Newfoundland, July 29, and rendezvoused near Spitzbergen, an island east of northern Greenland, with the Finnish icebreaker, Fennica, which was chartered to protect the drill ship against the onslaught of the Arctic pack ice. Both ships, carrying 136 crew and scientists from 14 nations, proceeded to the Yermak Plateau, a volcanic structure to the north of Spitzbergen. The plateau is covered by undisturbed Arctic sediments. Warm ocean currents, an extension of the Gulf Stream system, keep the region partially ice free during the summer season.

The drill ship had to abandon drill sites several times because of unexpected advances of the ice edge; some planned locations could not be reached at all. Satellite images of sea ice interpreted by the Nansen Environmental Remote Sensing Center in Bergen, Norway, helped the vulnerable drill ship in navigating near the fast-moving ice pack.

For Myhre, Thiede and their multinational scientific party this expedition carries historic significance, coming exactly 100 years after the Norwegian explorer Fridtjof Nansen's first daring expedition to study the central Arctic ice pack.

"Having the capability to drill successful holes in such extreme environments--some of the most remote in the world-- enables us to retrieve the scientific evidence needed to understand better the processes of global climate change," said Dr. Philip D. Rabinowitz, director of the Ocean Drilling Program.

JOIDES Resolution 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, Germany, France, Japan and the United Kingdom.

Texas A&M University, science operator, operates and staffs the drill ship and retrieves cores from strategic sites around the world. 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, a nonprofit consortium of 10 major U.S. oceanographic institutions, manages the program.

Note: JOIDES members 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; European Science Foundation Consortium (Belgium, Denmark, Finland, Iceland, Italy, Greece, the Netherlands, Norway, Spain, Sweden, Switzerland and Turkey); France; Germany; Japan; and the United Kingdom. Co-chief scientists for the cruise were Dr. Annik Myhre of the University of Oslo, Norway, and Dr. Jørn Thiede of GEOMAR Research Center for Marine Geosciences, Kiel, Germany. Dr. John Firth of Texas A&M University, College Station, Texas, was staff scientist. Scientists participating were Dr. Naokazu Ahagon, Ocean Research Institute, University of Tokyo, Japan; Kevin Black; University of Wales, Bangor, United Kingdom; Jan Bloemendal, University of Liverpool, United Kingdom; Garrett Brass, University of Miami, Florida; James Bristow, University of Leicester, Leicester, United Kingdom; Nancy Chow, University of

Manitoba, Winnipeg, Canada; Michel Cremer, Universite de Bordeaux, France; Linda Davis, University of Texas, Austin; Benjamin Flower, University of California, Santa Barbara; Torben Fronval, University of Bergen, Norway; Julie Hood; University of Miami, Florida; Donna Hull, University of Texas at Dallas, Texas; Nalan Koc, University of Bergen, Norway; Birger Larsen, Geological Survey of Denmark; Mitchell Lyle, Boise State University, Idaho; Jerry McManus, Lamont Doherty Earth Observatory, Palisades, N.Y.; Suzanne O'Connell, Wesleyan University, Middletown, Conn; Lisa Osterman, Smithsonian Institution, Washington, D.C.; Frank Rack, University of New Brunswick, Fredericton, Canada; Tokiyuki Sato, Akita University, Japan; Reed Scherer, Byrd Polar Research Center, Ohio State University, Columbus; Dorothee Spiegler, GEOMAR, Kiel, Germany; Ruediger Stein; Alfred Wegener Institute, Bremerhaven, Germany; Mark Tadross, Scott Polar Research Institute, University of Cambridge, United Kingdom; Stephen Wells, Scott Polar Research Institute, University of Cambridge; David Williamson, CNRS/LUMINY, Marseille, France; Bill Witte, University of Alaska, Fairbanks, Alaska; Thomas Wolf-Welling, GEOMAR, Kiel, Germany.