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ANDRILL (Antarctic geological DRILLing): Stratigraphic drilling for climatic and tectonic history with the MIS and SMS projects

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During the austral summers of 2006 and 2007 the ANtarctic geological DRILLing Program (ANDRILL) will drill from ice shelf and sea-ice platforms in the McMurdo Sound region to obtain new information about the Neogene Antarctic cryosphere and evolution of Antarctic rift basins. Target strata for the McMurdo Ice Shelf Project (MIS) are Pliocene to Recent sediments deposited in a subsiding basin created by volcanic loading immediately south of Ross Island. Target strata for the Southern McMurdo Sound Project (SMS) are middle Miocene to Quaternary in age (˜17 Ma to present) deposited in a subsiding half-graben on the margin of the Victoria Land Basin. Both projects span several key steps in the evolution of Antarctic climate. Fault- and flexure-related subsidence associated with rifting and volcanic loading provided accommodation space adjacent to the rising Transantarctic Mountains (TAM) that archived a sediment history of this important region, which is also influenced by three significant components of the Antarctic cryospheric system: the East Antarctic Ice Sheet (EAIS), Ross Ice Shelf (RIS)/West Antarctic Ice Sheet (WAIS), and Ross Embayment sea-ice. The proposed drillcores will also record a tectonic history of the Antarctic Rift system (Victoria Land Basin - VLB), the TAM and the Erebus Volcanic Province. The key aim of the MIS Project is to determine past ice shelf responses to climate forcing, including variability at a range of timescales. To achieve this aim, one drillhole will sample a 1200 meter-thick body of Plio-Pleistocene glacimarine, ter-

rigenous, volcanic and biogenic sediment that has accumulated in the Windless Bight region of a flexural moat basin surrounding Ross Island in approximately 900 m water depth. The key aim of the SMS Project is to establish a robust history of Neogene Antarctic ice sheet variation and climate evolution that can be integrated into continental and global records toward a better understanding of Antarctica's role in the past, present and future global system. To achieve this aim, two drillholes (~500 m and ~700 m) will sample a sequence of strata identified on seismic lines and inferred to represent a middle Miocene to upper Miocene sequence of seismic units that expand basinward. The two drillholes will recover a composite thickness of >1000 m of strata that lie stratigraphically above the lower Miocene section recovered at the top of the nearby Cenozoic Investigations in the Western Ross Sea (CIROS)-1 drillcore, and above the 1400 m composite section recovered by the Cape Roberts Project (CRP) (~34 to 17 Ma). Drilling technology will utilize a sea-riser system and continuous wire-line diamond-bit coring to ensure high-percentage core recovery similar to that obtained by the CRP (e.g. 98% of 939 m in the CRP-3 drillhole). Specific scientific objectives are to: (a) document the initial onset and subsequent history of ice shelf and sea-ice presence/absence; (b) document the evolution and demise of Neogene terrestrial vegetation; (c) establish a local Late Neogene sea-level and bottom water record; (d) test whether stable cold-polar climate conditions persisted for the last 15 m.y.; (e) document melt-water discharge events from the adjacent Dry Valley/TAM system; (f) construct a composite event history of glacial and interglacial events across a coastal to deep basin transect; (g) provide chronostratigraphic control for the regional seismic framework in the VLB and western Ross Sea; (h) feed new paleoclimatic data into ice sheet and climate models; and (i) develop a Neogene subsidence and fault history for the Victoria Land Basin. All of these objectives will lead toward a better understanding of Antarctica's Neogene climatic and tectonic history. The background, scientific rationale and details regarding the targeted sequences for the MIS and SMS projects are described in two Prospectus documents available at http://andrill.org.