



ANDRILL Targets Coulman High, Ross Sea, Antarctica, to Recover Early History of the West Antarctic Ice Sheet

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The international Antarctic Geological Drilling (ANDRILL) Program recently recovered long (> 1000 m) rock and sediment cores from two sites in McMurdo Sound, and now aims to recover new stratigraphic sections from sites beneath the Ross Ice Shelf east of Ross Island on the structural Coulman High. ANDRILL will utilize new drilling capabilities to operate from a fast moving ice shelf platform (~700 m/year northward) and complete two deep holes. The drilling target for the Coulman High Project is a Cretaceous (?) to lower Miocene section. Recovery of these strata will allow our team to investigate: (1) the behaviour of ice sheets in West Antarctica during periods of moderate to high greenhouse gas levels; (2) the Antarctic environment in warm greenhouse periods; and (3) tectonic processes within the West Antarctic Rift System.

In 2003 and 2004 a marine multichannel seismic grid was completed across Coulman High as close as 500 m from the front of the Ross Ice Shelf. The ice shelf has advanced 4 km north and now sits over several seismic lines providing a platform from which to drill into sites located on those lines. Selected drill sites target ~600 m of laterally continuous sediments underlain by a major regional unconformity and 350 – 850 m of faulted sediments and basement beneath it. Seismic correlation from Deep Sea Drilling Project Sites 272 and 273 to the Coulman High sites implies that the section proposed to be drilled predates 19 Ma.

Several new operational challenges exist at the Coulman High sites and work is underway to modify existing technology and develop new approaches to address them. Access to the sea-floor requires melting through 250 meters of ice shelf using the ANDRILL hot water drill, which has previously been used to maintain an open hole through 80 meters of ice. The amount of lateral deflection that ANDRILL's sea-riser can accommodate is limited by water column thickness (630 m) and amount of ice shelf movement of ~2 m/day. These parameters constrain drilling depth to a maximum of ~500 m sub seafloor at the sites using existing technology. To reach targets at > 1000 m below sea floor, two drilling options are being considered: pull out at ~500 m, move the rig back over the drill hole, re-occupy the hole via a re-entry cone, and commence coring; or pull out, allow the string to swing back to vertical, wash drill to ~500 m at the new offset site and commence coring below that depth.

An airborne radar survey has recently been completed over the Coulman High sites and will be augmented by satellite data and a ground-based radar survey to examine the ice shelf for basal and surface crevasses and identify brine-rich zones. Oceanographic moorings will be deployed in 2010/11 to obtain water current data from beneath the ice shelf to model deflection of the riser. In addition, the hot water drilling system will be used to make a series of 40 cm diameter holes through the ice shelf to deploy a remotely operated vehicle beneath it to obtain short sediment cores. Plans are being developed to acquire additional seismic and gravity data to improve seismic velocity control and enhance drilling depth estimates. A new international partnership for drilling in 2012-14 is currently being developed. Interested scientists are encouraged to get involved through their national Antarctic programs.