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Operations Overview for the ANDRILL Southern McMurdo Sound Project, Antarctica

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Operations Overview for the ANDRILL Southern McMurdo Sound Project, Antarctica

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Abstract - During the austral spring of 2007-08, a 1138 metre (m)-long rock and sediment core (ANDRILL [AND]-2A) was recovered from beneath the land-fast sea-ice in southern McMurdo Sound (SMS) in 384 m of water. A custom-built drilling system comprising an UDR-1200 rig, jack-up platform, hot water drill, sea riser, and diamond-bit wireline coring string was set up on the sea-ice approximately 32 kilometres (km) from Scott Base (NZ) and McMurdo Station (USA). The drilling system employed technology developed to handle challenging environmental conditions, including drilling from an 8 metre-thick sea-ice 'platform' that moved both laterally and vertically, tidal currents, and high winds. Drill site set up commenced in early September 2007, and the first AND-2A core was recovered on 10 October 2007. Drilling operations continued until 5 December 2007. Science operations were conducted at the drill site, in both the borehole and a purpose-built laboratory complex, and at the Crary Science and Engineering Center (CSEC), McMurdo Station (USA). Drill site science operations involved downhole logging, which was carried out in the borehole casing and in parts of the open hole, fracture studies, and physical properties measurements. Core was transported by helicopter from the drill site to McMurdo Station, where it was split, scanned, described, and sampled for initial characterisation. Once initial studies were completed, the core was packed into crates for shipment to the Antarctic Research Facility (ARF; core repository) at Florida State University in the United States.

DRILLING OPERATIONS OVERVIEW

The ANDRILL SMS Project drilling and science operations occurred at two primary locations: the drill site and Crary Science and Engineering Center (CSEC), McMurdo Station. Table 1 summarises key operational events and data.

Tab. 1 - Summary drilling data for AND-1B.

Drill rig location (9 October 2007)	77.758141 S, 165.276765 E
Sea-ice thickness	~8-8.5 metres (m)
Freeboard	0.74-0.80 m
Ice-shelf lateral movement (from 9 Oct. to 4 Dec. 2007) .	~5.47 m @ 024.5°T
Depth to mean seafloor (from platform cellar floor)	383.57 m
Maximum sea ice tidal range (single diurnal cycle)	~1.33 m
Sea riser spud in	9 October 2007
Sea riser shoe set at	8.89 metres below seafloor (mbsf)
PQ coring started	10 October 2007 @ 8.81 mbsf
PQ coring ended	26 October 2007 @ 229.24 mbsf
PQ casing shoe (PQ3 bit) set	26 October 2007 @ 229.24 mbsf
HQ coring (HQT bit) started	29 October 2007 @ 229.24 mbsf
HQ coring ended	21 November 2007 @ 1011.04 mbsf
HQ casing shoe set	25 November 2007 @ 1011.87 mbsf
NQ coring (NQT bit) started	26 November 2007 @ 1011.87 mbsf
NQ coring ended	30 November 2007 @ 1138.54 mbsf
Sea riser cut	4 December 2007
Sea riser and float column recovered	5 December 2007

SEA-ICE THICKNESS

Multi-year ice at least seven metres thick was expected at the SMS site based on field reconnaissance in the 2006-07 season and monitoring of satellite imagery during the winter. Inspection of the sea-ice conducted by divers from the United States Antarctic Program on 27 September 2007 indicated that the ice was between 8 and 8.5 metres thick. An additional 5-6 m of dense platelet ice had also formed beneath the sea-ice.

During planning phases for the SMS Project, a sea-ice thickness of 1.75 m at day 250 was established as minimum for safe drilling operations (Falconer & Pyne, 2004). Due to the occurrence of substantially thicker multi-year sea-ice at the site, airbag flotation was not critical for safe operations. As deployment of the airbags would have been difficult for divers due to the substantial amount of platelet ice, it was decided not to deploy the airbag flotation.