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Fracture Logging of the AND-2A Core, ANDRILL Southern McMurdo Sound Project, Antarctica

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Abstract - Fractures in AND-2A drillcore were documented in this study. Over 4100 fractures of all types were logged. A population of 510 steeply-dipping, petal, petal-centreline and core-edge induced fractures is present, reaching a maximum density of *c.* 10 fractures/metre. Subhorizontal induced extension fractures are also abundant. There are 1008 natural fractures in the core, including faults, brecciated zones, veins and sedimentary intrusions. Kinematic indicators document dominant normal faulting, although reverse faults are also present. The natural fractures occur in strata ranging in age from the Miocene to the Plio-Pleistocene.

INTRODUCTION

The characterisation of fractures in drillcore provides important information on the structural and tectonic evolution of rift basins. The type and orientation of natural fractures in cores and borehole walls, together with age constraints provided by dating the strata they cut, can be used to constrain faulting history and paleostress directions associated with rifting in the western Ross Sea. Drilling-related fracturing, including borehole breakouts and tensile fractures in borehole walls and petal-centreline and disc fractures in core, provide a means to determine the orientations of the contemporary stresses in the crust surrounding the boreholes.

The Core Structure Measurements Group worked at the ANDRILL Southern McMurdo Sound Drill Site Lab and was responsible for obtaining core imagery and data needed to orientate the core to *in situ* coordinates, and for characterisation of natural and drilling-induced fractures in the core. Here we provide a summary of data acquired for core orientation and other applications, and an inventory of the fracture types documented by macroscopic logging of the AND-2A core.

METHODS

CORE ORIENTATION

Whole-Core Scanning

Whole-round core segments were scanned using the CoreScan II™ instrument manufactured by DMT, Germany. Segments up to one metre in length were scanned by revolving the core on rollers as a digital line scanner traversed the length of the core. Scan resolution is 10 pixels/mm. A few selected core segments were scanned at 20 pixels/mm. Each whole-core scan file is named based on the depth in metres below sea floor (mbsf) of the top of the core segment. Poorly indurated or highly fractured intervals of core could not be scanned because they would not maintain their integrity on the rollers. We were able to obtain whole-core images of 73% of PQ3 core (between 0-229.24 mbsf), 88% of HQ core (between 229.4 and 1011.87 mbsf), and 97% of NQ core (between 1011.87 and 1138.54 mbsf). A table providing file names and depths of each whole-core scan entitled "Whole Core Scans.pdf" is provided online at the SMS Project science drive (http://www.andrill.org), a secure site. Data will be available to the broader scientific community at the end of the SMS Project data moratorium period. Whole-core scans can also be viewed in the *Corelyzer* core visualization application.

Intact Intervals of Core

Intact core intervals are continuous lengths of core where no internal relative rotation has occurred. Boundaries of these intervals are either breaks between core runs, where the core ends could not be fitted together, or are fractures within a core run where rotation occurred during coring (Fig. 1). In the PQ core, 44% of core runs could be fitted together end to end, and intact core intervals reached a maximum of 12.91 m in length. In the HQ core, 66% of the core runs could be fitted at their ends, and intact core intervals up to 75.62 m-long were found. In the NQ core, 54% of the core runs could be fitted at their ends, and intact core intervals up to 16.87 m-long were found. A table listing intact intervals of core [≥ 1m

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