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Background to the ANDRILL Southern McMurdo Sound Project, Antarctica

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INTRODUCTION

During the austral spring of 2007, the Southern McMurdo (SMS) Project recovered a 1138.54 meter long drill core (AND-2A) from a 8.5 m thick floating sea-ice platform (~8.5 meters thick) over approximately 380 meters of water (77°45.488S; 165°16.613E) (Fig. 1). This demonstrated the ANDRILL Program's continuing success in recovering high quality marine and glacial marine sedimentary drill core (> 98% core recovery) from high latitude ice-covered areas. A primary goal of the SMS Project, the second drillhole of the McMurdo Sound Portfolio (Harwood et al., 2006), was to recover an Antarctic marine sediment record deposited during the middle Miocene, which has long been held as one of the fundamental time intervals in development of the modern Antarctic ice sheets (e.g., Zachos et al., 2001; Shevenell et al., 2004). Deep-sea stable isotope records suggest the middle Miocene encompassed a change from the warm Mid-Miocene Climatic Optimum (MMCO), approximately 17.5 to 14.5 million years ago (Ma), to the onset of major cooling between approximately 14.5 to 13.5 Ma, which is commonly interpreted as the major cause of the formation of a quasi-permanent ice sheet in East Antarctica (e.g., Haywood et al., 2008, and references contained therein).

The AND-2A drill core, Pleistocene to early Miocene in age (e.g., Acton et al., this volume), confirms its potential 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. In particular, the recovery of middle Miocene Antarctic stratigraphic sequences will greatly improve the evaluation of global proxy records that invoke a change from a warm climatic optimum to the onset of major Miocene cooling. The uppermost section of AND-2A core, Pliocene to Pleistocene in age, shows a similar importance in providing an original record

that will complement and build on coastal and fjord sediment records from previous drillcores west of the drill site (Dry Valley Drilling Project (DVDP) - 10, -11 and Cenozoic Investigation in the Western Ross Sea Project (CIROS) -2), and on the deeper water sedimentary record from the AND-1B drillcore in the McMurdo Ice Shelf area, all interpreted to reflect repeated Late Neogene alternation between 'interglacial' and 'glacial' conditions (Barrett, 2007; Naish et al., 2007, Naish et al., 2009).

In addition to their paleoclimatic implications, the ongoing study of the drilled strata, with their variable clast compositions reflecting an evolving provenance, high content in Cenozoic volcanic detritus and fall-out products, abundant structures related to brittle deformation, and a rich paleontological resource, have already demonstrated that they will provide important new information about the glacial history of the Ross Embayment, the volcanic evolution of the Erebus Volcanic Province and the tectonic evolution of both the Antarctic Rift system (Victoria Land Basin - VLB) and the adjacent sector of the Transantarctic Mountains (TAM).

This volume presents the initial science results of the AND-2A drill-hole. It derives from the Web-based On-Ice Report and includes the results of core-characterization activities conducted by science team members off-ice, prior to the core workshop held at Florida State University, Antarctic Marine Geology Research Facility, 30 April - 4 May 2008, where nearly 95 individuals presented their ongoing research on the AND-2A recovered material. This contribution provides background on the geological setting, site surveys, and stratigraphic prognosis prior to drilling. The rest of the volume contains 11 chapters and provides an operational overview of the drilling operations, the curation and management of the cores, ANDRILL's education and outreach program, and the initial characterization of the drill core set out under major discipline areas.