2008

Sedimentology and Stratigraphy of the AND-2A Core, ANDRILL Southern McMurdo Sound Project, Antarctica

Christopher R. Fielding
University of Nebraska-Lincoln, cfielding2@unl.edu

C. B. Atkins
Victoria University of Wellington

K. N. Bassett
University of Canterbury

G. H. Browne
GNS Science

G. B. Dunbar
Victoria University of Wellington

See next page for additional authors

Terra Antartica
2008-2009, **15**(1), 77-112

Sedimentology and Stratigraphy of the AND-2A Core, ANDRILL Southern McMurdo Sound Project, Antarctica

C.R. Fielding[1*], C.B. Atkins[2], K.N. Bassett[3], G.H. Browne[4], G.B. Dunbar[2], B.D. Field[4], T.D. Frank[1], L.A. Krissek[5], K.S. Panter[6], S. Passchier[7], S.F. Pekar[8], S. Sandroni[9^], F. Talarico[9] & the ANDRILL-SMS Science Team[10]

[1]Department of Geosciences, University of Nebraska-Lincoln, 214 Bessey Hall, Lincoln, NE 68588-0340 - USA
[2]Antarctic Research Centre, Victoria University of Wellington, P.O. Box 600, Wellington - New Zealand
[3]Department of Geological Sciences, University of Canterbury, Private Bag 4800, Christchurch - New Zealand
[4]GNS Science, P.O. Box 30368, Lower Hutt - New Zealand
[5]School of Earth Sciences and Byrd Polar Research Center, The Ohio State University, Columbus, OH 43210 - USA
[6]Department of Geology, Bowling Green State University, Bowling Green, OH 43403 - USA
[7]Department Earth & Environmental Studies, Montclair State University, 1 Normal Avenue, Montclair, NJ 07043 - USA
[8]School of Earth & Environmental Sciences, Queen's College, City University of New York, 65-30 Kissena Boulevard, Flushing, NY 11367 - USA
[9]Department of Earth Sciences, University of Siena, Via Laterina 8, I-53100, Siena - Italy
[10]http://andrill.org/projects/sms/team.html
^now at: Museo Nazionale dell'Antartide, Università di Siena, Via del Laterino 8, 53100 Siena - Italy

**Corresponding author* (cfielding2@unl.edu)

Abstract - During the 2007 – 2008 austral spring season, the ANDRILL Southern McMurdo Sound Project recovered a core 1138 metres long (AND-2A) from a location in the southern McMurdo Sound near the Dailey Islands. This core contains a range of lithologies, including various types of terrigenous clastic diamictite, conglomerate and breccia, sandstone and mudrocks, volcanic lava, pyroclastic and reworked volcanic sedimentary rocks, and diatomite. The succession is divided into fourteen lithostratigraphic units (LSUs), two of which (LSUs 1 and 8) are further subdivided into three and four sub-units, respectively, based on changes in abundance of lithologies. Thirteen lithofacies are recognized, ranging from diatomite and bioturbated, fossil-bearing mudrocks (representing most ice-distal environments) through interlaminated sandstone-mudrock facies and sandstone with varying dispersed gravel components, to diamictite and conglomerate (representing most ice-proximal environments), and also lava, volcanic breccia and volcanic sedimentary rocks representing extrusion, fragmentation, fallout and reworking of material from basaltic volcanic activity. Three distinct types ('motifs') of vertical facies stacking patterns are recognized, recording glacial advance-retreat-advance cycles with varying degrees of facies preservation. Carbonate, pyrite and zeolites are the principal secondary mineral phases in the core. The pyrite overprint is particularly prominent in the lower half of the core, where it typically obscures stratification and sediment texture. Studies of modern aeolian sediment deposition onto McMurdo Sound sea-ice reveal that between 7600 and 24 000 kg km^{-2} of terrigenous clastic material is being stored on the sea-ice in this region.

INTRODUCTION AND OVERVIEW

This paper presents the results of sedimentological description and interpretation, and lithostratigraphic subdivision of the AND-2A core. The detailed core descriptions at 4 m/page will be available on the ANDRILL drive at http//:sms.andrill.org, following the end of the moratorium period. Summary logs, at a scale of 100 m/page, are included here in 11 images as figure 1 (A-K).

The core is divided into 14 lithostratigraphic units (LSUs) on the basis of major changes in lithology recognized during core description (Tab 1). This division emphasizes the relative importance of diamictite and associated lithologies, relative to other terrigenous clastic and volcanogenic lithologies. Criteria used to define LSUs included diamictite abundance, sandstone/mudstone abundance, volcanogenic component in lithologies, biogenic silica abundance, and abundance of conglomerate within diamictite-dominated intervals. Two of these LSUs were further subdivided, LSU 1 into three sub-units (1.1, 1.2, 1.3) and LSU 8 into four sub-units (8.1, 8.2, 8.3, 8.4).

Thirteen recurring lithofacies are recognized, and interpreted in terms of a spectrum of depositional environments ranging from possibly subglacial, through ice-contact proglacial and glacimarine, to less ice-influenced, shallow marine settings.

A preliminary analysis of stratigraphic stacking patterns reveals three distinct "stratigraphic motifs" or sequence styles, each bounded at the base by a diamictite recording glacial advance, and overlying, better-sorted terrigenous clastic facies recording glacial retreat, transgression and sea-level highstand. Differences between the three motifs are in the character of the diamictites, in each case, and the relative thickness and lithological diversity of overlying,