

Petrologic and Geochemical Composition of the AND-2A Core, ANDRILL Southern McMurdo Sound Project, Antarctica

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Abstract – The compositional record of the AND-2A drillcore is examined using petrological, sedimentological, volcanological and geochemical analysis of clasts, sediments and pore waters. Preliminary investigations of basement clasts (granitoids and metasediments) indicate both local and distal sources corresponding to variable ice-volume and ice-flow directions. Low abundance of sedimentary clasts (e.g., arkose, litharenite) suggests reduced contributions from sedimentary covers while intraclasts (e.g., diamictite, conglomerate) attest to intrabasinal reworking. Volcanic material includes pyroclasts (e.g., pumice, scoria), sediments and lava. Primary and reworked tephra layers occur within the Early Miocene interval (1093 to 640 metres below sea floor mbsf). The compositions of volcanic clasts reveal a diversity of alkaline types derived from the McMurdo Volcanic Group. Finer-grained sediments (e.g., sandstone, siltstone) show increases in biogenic silica and volcanic glass from 230 to 780 mbsf and higher proportions of terrigenous material c. 350 to 750 mbsf and below 970 mbsf. Basement clast assemblages suggest a dominant provenance from the Skelton Glacier - Darwin Glacier area and from the Ferrar Glacier - Koettlitz Glacier area. Provenance of sand grains is consistent with clast sources. Thirteen Geochemical Units are established based on compositional trends derived from continuous XRF scanning. High values of Fe and Ti indicate terrigenous and volcanic sources, whereas high Ca values signify either biogenic or diagenic sources. Highly alkaline and saline pore waters were produced by chemical exchange with glass at moderately elevated temperatures.

INTRODUCTION

Data are presented following the subdivision into 14 lithostratigraphic units (LSUs) on the basis of major changes in lithology recognised during core description by Fielding et al. (this volume). Following a multi-disciplinary approach, this chapter comprises a summary of compositional data that were provided by investigations involving sedimentological, petrological and geochemical methodologies and techniques, including:

- (a) logging of all clasts with diameter larger than 2 millimetres (mm) and preliminary description of basement clasts (S. Sandroni, F. Talarico);
- (b) preliminary petrographic analysis of sedimentary clasts larger than 2 mm (G. Cornamusini);

- (c) logging and petrographic analysis of volcanic and dolerite clasts (P. Del Carlo, K. Panter);
- (d) sand petrology (K. Bassett) and smear slide analysis (B. Field);
- (e) compositional characterisation of bulk sediments by continuous XRF core scanning (G. Kuhn, S. Hoffmann, H. von Eynatten, L. Reichelt); and
- (f) composition of volcanic clasts by XRF measurements on fused single whole-rock samples (L. Bracciali, S. Rocchi).

These key letters (a) through (f) in the above list of investigations are inserted within the text (at the beginning of the pertinent paragraph) to enhance immediate identifications of specific contributions and analytical approach. Data are presented in order of successive Lithostratigraphic Units (LSU), but following