

GEOPHYSICAL AND GEOCHEMICAL INVESTIGATION OF NEAR-SURFACE SEDIMENTS FROM BENEATH THE ROSS/MCMURDO ICE SHELF IN WINDLESS BIGHT, ANTARCTICA

F. Niessen, G. Kuhn

Alfred Wegener Institute of Polar and Marine Research, Bremerhaven, Germany

Within the context of ANDRILL (ANTarctic geological DRILLing Program), site-survey work was carried out to investigate sediments from a 950 m deep mould basin beneath the Ross/McMurdo Ice Shelf (RIS), a target for deep drilling in 2006. As part of a multi-national investigation we report on results obtained on up to 63 cm long sediment cores retrieved in 2003. The record comprises diamicton of LGM age (24ka BP) overlain by Late-Glacial/Holocene biosilicious and terrestrial muds intercalated with a unit of black reworked volcanic sands. The aim of this study was (i) to investigate the state of sediment consolidation with respect to grounding of the RIS during the LGM, and (ii) to identify changes in sediment composition between glacial and interglacial times with respect to provenance. We applied high-resolution multi-sensor core logging including shear strength measurements and XRF core scanning for physical and chemical analysis, respectively. The entire record is characterized by low densities (1.5 to 1.8 g cm⁻³) and low shear strength (2-30 kPa) indicative for normal consolidation. From LGM to Holocene there are distinctly different geochemical signatures exhibiting changes having sharp boundaries at the base and the top of the volcanic sand. Underlying units have high Ca-Ti, K/Ti and Fe/Ti ratios, overlying units have low Ca-Ti, K/Ti and Fe/Ti ratios. The signature of the volcanic sand is more similar to the overlying units but distinctly characterized by lowermost K-Ti ratios and highest magnetic susceptibilities. The trend is consistent with the petrography of the record indicating that a larger proportion of the underlying sediments is derived from the Transantarctic Mountains, whereas the volcanic sand and the overlying sediments are dominated by material from the McMurdo Volcanic Group. The major shift in geochemical composition occurs later than the first increase of diatoms and opal in a unit directly underlying the volcanic sand and overlying the diamicton, which is consistent with shifts in physical properties. The data clearly reflect changes in the proximity of the RIS grounding line with respect to the sampling location, but there is no evidence that the RIS has grounded in the mould basin during the LGM.