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A Late Neogene record of density and porosity from the AND-1B core – implication for the glacial history in the McMurdo Sound region

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During austral summer 2006/07 the ANDRILL program successfully drilled the 1285 meters long AND-1B sediment core from beneath the McMurdo Ice Shelf. This core will provide a key reference record of climate and ice sheet variability from the Antarctic continental margin through the Late Neogene ($\sim$12 Ma to present). High-resolution measurements of whole-core wet-bulk densities (WBD) were carried out at the drill site laboratory using a Multi-Sensor Core Logger. WBD is mostly controlled by differences in porosity and grain density (GD). Whereas GD is sediment-specific, porosity carries combined information about sediment composition, sedimentary environment and post-depositional consolidation. GD values of about 1,200 discrete samples were determined ranging from 2.15 to 2.9 g/ccm in diatomites and volcanic debris, respectively. Based on GD an algorithm was established in order to calculate porosity from the entire WBD data. The porosity record reveals both a remarkable cyclicity between end-member types of lithology (diatomites and diamictites) suggesting Milankovitch forcing in the upper 650 m of the core, and an overall down-core trend due to overburden. Removing the overburden trend allows for detailed studies of the residual porosities in terms of regional environmental change related to ice shelf/ice sheet dynamics, in particular over-consolidation of diamictites through ice-loading. The data indicate moderate over-consolidation by grounded ice sheets during glacial times before about 2 Ma, and strong over-consolidation of diamictites thereafter. This suggests significant increase of ice-sheet thicknesses in the McMurdo Sound region during glacial times

of the last 2 Ma.