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Geochemical record of Miocene continental weathering and sediment provenance in the McMurdo Sound, ANDRILL AND-2A, Ross Sea, Antarctica

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The Neogene evolution of the Antarctic cryosphere is characterized by a pronounced warming period during the middle Miocene Climate Optimum (15-17 Ma). Since then gradual cooling has induced growth of the present extensive ice sheet of Antarctica.

In the austral summer 2007 ANDRILL's Southern McMurdo Sound Project (SMS) completed the AND-2A drill-core on the western flank of the Victoria Land Basin, Ross Sea. The AND-2A core with a total length of 1138mbsf comprises an almost undisturbed ∼600m thick section of the middle Miocene Climatic Optimum (800-223mbsf).

Bulk rock geochemistry is a widely applied technique to determine the influence of climate changes on rock composition. In this context we are presenting a continuous record of continental weathering from the AND-2A core. During the drilling campaign samples for bulk rock analysis were taken from each meter of the core. The large amount of samples allows us to analyse the bulk rock composition in a high frequency of intervals downcore. We analysed major elements with a conventional X-ray fluorescence spectrometer (XRF) at the University of Göttingen to calculate different weathering indices. The extremely high salt content in the pore water below ∼225mbsf requires the removal of salt by washing. With this procedure, incorrect values for the most of the weathering indices could be excluded. In addition, the split core was measured with a non-destructive Avaatech XRF Core Scanner (XRF-CS). The calibration of the XRF-CS high resolution dataset with conventional geochemistry analysis provides the opportunity to identify paleoclimate changes in very short time intervals.

The results show strong cyclic variations of weathering indices within the middle Miocene Climatic Optimum section (800-223mbsf) of the AND-2A core along with an overall significantly enhanced degree of chemical weathering. In contrast, the chemical weathering decreases without any clear cyclicity during the Pliocene to Recent interval (223-0mbsf) of the core. Beyond the variation in chemical weathering, trace element analysis with ICP-MS will allow the identification of changes in sediment provenance.