Geophysical Research Abstracts
Vol. 12, EGU2010-12592, 2010
EGU General Assembly 2010

Glacial Extent During the Late Early Miocene (18-16 Ma): Results from the ANDRILL AND-2A Drillcore, Southern McMurdo Sound Project, Antarctica

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Litho- and sequence stratigraphic results from the ANtarctic Geological DRILLing Program (ANDRILL) Southern McMurdo Sound (SMS) AND-2A drill hole indicate that glacial conditions varied widely in the western Ross Sea between the two isotopic Mi events (i.e., inferred glacioeustasy) Mi1b (17.7 Ma) and Mi2 (16.2 Ma). Most of this interval had not been previously recovered from the Antarctic continental margin providing the first opportunity to use direct evidence in understanding the evolution of the ice sheet during this time. During the 2007 austral spring/summer, the SMS drill hole cored 1138 meters of sediments, with ∼98% recovery. The section between 700 and 400 mbsf has high sedimentation rates (180 m/ my) and excellent age control, based on radiometric ages and magnetostratigraphy, providing an exceptional record of glacial advances and retreats deposited in a shallow water environment in Antarctica between 18 and 16 Ma.

Approximately twenty sequences within this interval were identified. Each sequence is bounded by distinct surfaces characterized by a pronounced shift in lithofacies, with typically more ice distal facies below (e.g., characteristic of open marine to iceberg influenced depositional environments), and more proximal facies above (e.g., sandy massive diamictites and conglomerates). Lithofacies and grain size analysis suggest that these cycles are controlled by a combination of water depth and ice proximity. A surface at 648.74 mbsf contains a hiatus that spans 18.0-17.6 Ma and correlates to the isotopic event Mi1b. This surface separates a prolonged interval of glacial advance over this site below, based on extensive sediment deformation and more ice distal environments above. A sharp surface at 436.13 mbsf (∼16.3 Ma), interpreted to represent glacial maximum extent, contains a possible short hiatus and is correlated to the Mi2 event. In contrast, although the lithofacies indicates a glacial advance, evidence of ice grounding at 436 mbsf is equivocal, suggesting a smaller advance than for the one at the Mi1b event. Between these two ice advances, the lithofacies indicates generally more distal ice environments and therefore less ice volume and correlates to the early Miocene Climatic Optimum (17.2-16.4 Ma).