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A new high-resolution, glacimarine stratigraphic record of Antarctic glacial and climate history for the last 10 million years: (1) A preliminary stratigraphic framework and cyclostratigraphy for the ANDRILL McMurdo Ice Shelf Project drill core.

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In the austral summer of 2006-2007 the ANDRILL Program undertook its first drilling project on the McMurdo Ice Shelf in the northwest part of Ross Ice Shelf where it has been pinned by Ross Island for the last ∼8ka. The drillsite was situated above flexural moat basin adjacent to Ross Island that had formed in response to Quaternary volcanic loading of the crust, superimposed on more regional subsidence associated with Neogene extension of the Terror Rift. Multichannnel seismic reflection surveys linked to a regional stratigraphic framework implied accumulation of a 1km-long record spanning the last 5-10Ma. The site was above an 85m-thick ice shelf over an 840m-depp water column. The drill system employed a wire-line diamond coring system through a sea-riser, which was kept free from the ice shelf, by a hot-water over-reamer. The drilling recovered 1285m-thick succession of probable Late Miocene to Recent, cyclic glacimarine sediment with interbedded volcanic sediments, lava and tuffs contributed from the surrounding alkalic volcanoes of the McMurdo Volcanic Group. The core recovery was better than 98%.

An integrated chronostratigraphy based on Ar40/Ar39 numeric ages on primary volcanic deposits, a paleomagnetic stratigraphy, and a diatom biostratigraphy provides a robust age model for the upper 500m, and implies a detailed record spanning of Middle and Late Pliocene, and Middle to Late Pleistocene. Below this the age model is still being developed with Ar40/Ar39 geochronology and paleomagnetism likely

to provide the major contribution as diatoms become rare below 600m due to burial diagensis. Our seismic stratigraphic correlations imply an late Miocene age for the bottom of the drillcore.

The stratigraphic architecture of the core is strongly cyclic, with 3 dominant cycle motifs reflecting oscillations in glacial proximity. Repetitive vertical successions of facies bounded by sharp glacial erosion surfaces show regular fluctuations between subglacial, ice proximal and ice distal open marine environments. Late Miocene and Middle-Late Pleistocene cycles are characterised by a thick interval subglacial massive diamictite passing up into a thin interval of grounding-line proximal interstratified mudstone, sandstone and volcanic sandstone. Early-Middle Pliocene cycles display subglacial to ice proximal massive and stratified diamictites in their lower parts passing up into proglacial interstratified sandstone and mudstone followed by open water, ice distal mudstone. The Middle to late Pliocene is dominated by strongly cyclic alternations between diamictite and diatomite of probable Milankovitch duration. A $\sim$100m-thick Early-Middle Pliocene interval of diatomite shows no apparent glacial cyclicity and represents an extended period of ice-free conditions.