Origin of the Scotia Sea Magnetic Susceptibility Signal Across the MIS6-MIS5 Transition


Patterns of variability in Pleistocene magnetic susceptibility (k) from deep-sea sediment cores from the Scotia Sea show a striking similarity to patterns of dust flux recorded in the EPICA Dronning Maud Land (EDML) ice core. Antarctic marine k records broadly reflect the interplay of lithogenic sediment provenance, biological productivity, sediment transport processes, and post-depositional diagenesis. Here we explore the origin of the Scotia Sea k record via a detailed rock magnetic study across the transition from MIS 6 to MIS 5. We analyzed bulk sediment and grain size separates in order to construct magnetic signatures of iceberg rafted debris (IBRD), sortable silt, and eolian input. The MIS 6-MIS 5 transition consists of three lithologies, a high k silty-clay-rich diatomaceous mud deposited during the glacial interval, an IBRD-rich but low k silty clay that marks the onset of deglaciation, and a low k diatomaceous ooze in which IBRD decreases forward through time. The high k glacial sediment is characterized by multi-domain hysteresis parameters, low \( \chi_{ARM}/\chi \) values, S ratios near 1, and thermomagnetic curves indicative of low-Ti titanomagnetite. The absence of k peaks in the IBRD-rich silty-clay and IBRD rich diatomaceous ooze likely reflects the weakly magnetic lithogenic detritus supplied by Weddell Sea Embayment (WSE) ice streams,
such as sandstone, quartzite, metasedimentary lithologies, phyllite and schist observed in lateral moraines adjacent to ice streams of the eastern WSE. The deglacial interval is characterized by elevated $M_{IR}/M_S$, $\chi_{ARM}/\chi$, and HIRM values, and decreased S-ratios in the bulk sediment, suggesting a greater proportion of high coercivity minerals such as hematite or goethite in the iron oxide assemblage. Preliminary data from grain size separates indicates that the clay mass fraction is > 0.5 in all three lithologies. Clay is also the dominant size fraction in the EDML ice core dust, with particle sizes generally < 5 μm. The Scotia Sea clay fraction k values are a factor 1.5 to 5 weaker than the silt fraction k values, and therefore are not the main carrier of the bulk k signal. The rock magnetic signatures of Scotia Sea sediment will be compared to those of terrestrial till and bedrock from the WSE, and to those of potential dust sources in South America to identify the sediment sources and environmental processes responsible for the k signal.

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