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Magnetic and Geochemical Evidence of Late Pleistocene Oceanographic Shifts in the Ross Sea Continental Margin

JI YOUNG SHIN[1], MIN KYUNG LEE[2], YONGJAE YU[3], SUN KI CHOI[4], JONG KUK HONG[2], MOON SON[5] AND YOUNG JI JOO[6]

[1]Pukyong National University
[2]Korea Polar Research Institute
[3]Chungnam National University
[4]Korea Institute of Ocean Science & Technology
[5]Pusan National University
[6]Pukyung National university

The Antarctic continental margin preserves essential sedimentary archives of ice-ocean interactions in response to climate variability. This study combines sedimentological, geochemical, and magnetic proxies to investigate late Pleistocene oceanographic changes in the western Ross Sea. Magnetic and geochemical data indicate magnetite and manganese depletion under reducing conditions below ~365 cm core depth, evidenced by lower magnetic concentration and Mn/Fe, and higher Fe/magnetic susceptibility ratios. The magnetite dissolution significantly debilitated remanent magnetization intensity, underscoring the need for caution in paleomagnetic reconstructions in the Antarctic margin; this may also be the case in sediments straddling the redox boundary. Sedimentary features within the reducing interval include laminated contourites with elevated organic carbon content and C/N ratios, along with enhanced carbonate preservation, suggesting reworked shelf sediment deposition by stronger cross-slope currents and weakened Dense Shelf Water (DSW) outflows during ice sheet expansions. By contrast, the upper core section exhibits widespread oxic conditions, characterized by maghemitization and manganese precipitation, and diamictite facies with abundant ice-rafted debris. These findings suggest a significant transition in oceanographic conditions during the late Brunhes (~300 ka), driven by extensive retreat of the Ross Sea ice sheet and intensified DSW export.