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IMPACT OF GLACIAL RETREAT AND WEATHERING ON NORTH ATLANTIC ND ISOTOPES

Emily N. An

Ellen E. Martin

Kelly M. Deuerling

Jonathan B. Martin

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AN, Emily N.[1], MARTIN, Ellen E.[2], DEUERLING, Kelly[3] and MARTIN, Jonathan B.[2], (1)Department of Geological Sciences, University of Florida, 241 Williamson Hall, Gainesville, FL 32611, (2)Department of Geological Sciences, University of Florida, 241 Williamson Hall, Gainesville, FL 32611-2120, (3)Department of Natural & Applied Sciences, University of Wisconsin Green Bay, Green Bay, WI 54311

Interpretation of Nd isotopes ($^{143}Nd/^{144}Nd$, represented as εNd) as a geochemical tracer for ocean circulation in the North Atlantic requires knowledge of endmember compositions of potential source waters. During early interglacials, glacial terminations, and Dansgaard-Oeschger cycles (rapid warming events), seawater εNd values derived from marine archives in the NW Atlantic are less radiogenic than modern North Atlantic Deep Water (NADW), indicating a change in circulation or in the isotopic value of northern sourced deep water during intervals of warming and ice sheet retreat. Given that few water masses have εNd values lower than modern NADW, it is difficult to attribute low εNd values to changes in water mass circulation. Instead, the data suggest inputs to the North Atlantic lowered the εNd composition of northern sourced deep waters. Early work suggested chemical weathering produces dissolved Nd isotopes similar to bulk bedrock values; however, recent investigations indicate Nd isotopes can fractionate during weathering, much like Sr and Pb isotopes. We compare Nd isotopes from stream water and bedload sediment from one glacial and five non-glacial streams across a transect from the ice sheet (Kangerlussuaq) to the coast (Sisimiut) in southwestern Greenland, a region underlain by relatively uniform geology. Solute chemistry in these watersheds, as well as a decrease in the offset between dissolved and bedload $^{87}Sr/^{86}Sr$ values, documents an increased extent of chemical weathering toward the coast, likely due to longer exposure ages and higher precipitation. Nd isotopes produce a similar but inverted pattern of decreasing offset toward the coast. Dissolved Nd from streams in freshly comminuted sediment near the ice sheet have Nd isotopes that are 8 εNd units lower on average than bedload values, while stream waters are 1 εNd unit lower on average than bedload near the coast. These data indicate that preferential weathering of low Sm/Nd accessory minerals exposed during ice retreat can produce weathered εNd values much lower than bulk rock values. This unradiogenic Nd could be delivered to the deep ocean by streams draining into deep water formation areas in the North Atlantic or by chemical reactions between seawater or porewater and abundant fresh sediment delivered to the ocean during glacial retreat.

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