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## Isotopic evidence for changes in the origin and cycling of nitrogen in the Labrador Sea during the last 8,000 years

**Markus Kienast**<sup>1</sup>, Sam Davin<sup>1,2</sup>, Kristin Doering<sup>1</sup>, Dierk Hebbeln<sup>3</sup>, Stephanie Kienast<sup>1</sup>, Nadine Lehmann<sup>1</sup>, Ralph Schneider<sup>4</sup>, Owen Sherwood<sup>5</sup>, and Jens Weiser<sup>3</sup>

<sup>1</sup>Dept. Oceanography, Dalhousie University, Halifax, Canada (markus.kienast@dal.ca)

<sup>2</sup>GEOTOP Centre de recherche en géochimie et géodynamique, Université du Québec à Montréal, Montreal, Canada

<sup>3</sup>MARUM – Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany

<sup>4</sup>Institute of Geoscience, Christian Albrecht's University Kiel, Kiel, Germany

<sup>5</sup>Dept. Earth and Environmental Sciences, Dalhousie University, Halifax, Canada

Subsurface nitrate in the Labrador Sea (NW Atlantic) and Baffin Bay is provided by North Pacific water flowing through Bering Strait and the Canadian Arctic as well as by advection from the North Atlantic. Both these nitrate sources are distinct in their isotopic signature ( $\delta^{15}\text{N}$ ), owing to benthic denitrification on the Bering, Chukchi and east Siberian shelves and nitrogen fixation in the North Atlantic, respectively. Accordingly, water column profiles of  $\delta^{15}\text{N}_{(\text{nitrate})}$  collected off Greenland in the eastern Labrador Sea show low  $\delta^{15}\text{N}_{(\text{nitrate})}$  which mixes with more  $^{15}\text{N}$ -enriched nitrate flowing through Baffin Bay into the northern Labrador Sea. The Labrador Current carries this mixture southward along the western Labrador Sea, toward Newfoundland. The  $\delta^{15}\text{N}$  of surface sediments in the Labrador Sea closely mirrors these water column signals, suggesting that sediments can be used to trace changes in both the source signature of Atlantic versus Pacific-derived nitrate as well as in the admixture of the two source waters.

Two downcore sedimentary  $\delta^{15}\text{N}$  records from the NE and NW Labrador Sea coast both show high  $\delta^{15}\text{N}$  values of ca. 7‰ during the early Holocene (9-7 kyrs BP). In the NE Labrador Sea, this is followed by a long-term decrease toward  $\delta^{15}\text{N}$  of ca. 4.5‰ at the core top, in contrast to a much more subtle decrease in the NW Labrador Sea (surface sediment  $\delta^{15}\text{N}$  of ca. 6.5‰). The decreasing  $\delta^{15}\text{N}$  values along the eastern Labrador Sea are consistent with a Holocene increase in nitrogen fixation in the North Atlantic or an increasing advection of isotopically light nitrate. In turn, an increasing admixture of North-Pacific-derived nitrate, or intensified denitrification on the Bering Shelf would be required to explain the much subdued Holocene  $\delta^{15}\text{N}$  decrease in the NW Labrador Sea.