The influence of Arctic Fe and Atlantic fixed N on summertime primary production in Fram Strait, North Greenland Sea.

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Abstract: Climate change has led to a?~?40% reduction in summer Arctic sea-ice cover extent since the 1970s. Resultant increases in light availability may enhance phytoplankton production. Direct evidence for factors currently constraining summertime phytoplankton growth in the Arctic region is however lacking. GEOTRACES cruise GN05 conducted a Fram Strait transect from Svalbard to the NE Greenland Shelf in summer 2016, sampling for bioessential trace metals (Fe, Co, Zn, Mn) and macronutrients (N, Si, P) at?~?79°N. Five bioassay experiments were conducted to establish phytoplankton responses to additions of Fe, N, Fe?+?N and volcanic dust. Ambient nutrient concentrations suggested N and Fe were deficient in surface seawater relative to typical phytoplankton requirements. A west-to-east trend in the relative deficiency of N and Fe was apparent, with N becoming more deficient towards Greenland and Fe more deficient towards Svalbard. This aligned with phytoplankton responses in bioassay experiments, which showed greatest chlorophyll-a increases in?+?N treatment near Greenland and?+?N?+?Fe near Svalbard. Collectively these results suggest primary N limitation of phytoplankton growth throughout the study region, with conditions potentially approaching secondary Fe limitation in the eastern Fram Strait. We suggest that the supply of Atlantic-derived N and Arctic-derived Fe exerts a strong control on summertime nutrient stoichiometry and resultant limitation patterns across the Fram Strait region.

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