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Supply and cycling of micronutrients in Greenlandic fjords traced by Cu and Zn isotope ratios

KEYU LU[1], SUSAN H LITTLE[1], TINA VAN DE FLIERDT[2], DR. DAVID J WILSON[1] AND KATHARINE R HENDRY[3]

[1]University College London
[2]Imperial College London
[3]British Antarctic Survey

Presenting Author: keyu.lu.18@ucl.ac.uk

Trace metals including copper (Cu) and zinc (Zn) can act as limiting nutrients for biological productivity, directly regulating oceanic carbon sequestration. Glaciated environments are important yet poorly constrained sources of these critical micronutrients to the ocean [1]. Their stable isotope compositions (δ^{65}Cu and δ^{66}Zn) are useful tools to provide vital constraints on nutrient cycling [2] and to disentangle different biogeochemical processes [3], which may ultimately help elucidate the importance of glacial nutrient supply for the global carbon cycle.

Here, we present the first (to our knowledge) Cu and Zn isotopic measurements for glacial fjord waters. Two fjords from Greenland were sampled in July 2018 and September 2019, at the beginning and end of the melt season respectively. Ameriliksfjord is influenced by a land-terminating glacier, while Nuup Kangerlua is fed by several inputs including major marine-terminating glaciers, and the two fjords exhibit distinct hydrographic and ecosystem characteristics [4]. A total of 32 dissolved phase samples were analysed to characterise the biogeochemical gradients along the fjords and to begin to characterise their temporal variability. Contrasting patterns observed in δ^{65}Cu and δ^{66}Zn imply different controlling mechanisms and downstream impacts. For example, δ^{65}Cu values decrease from 0.99‰ at the fjord head to 0.23‰ at the mouth of Ameriliksfjord, whereas only a minimal δ^{65}Cu shift (0.70-0.84‰) is found along Nuup Kangerlua. The range in Zn isotope compositions measured to date is smaller than for Cu, at 0.17-0.50‰. Overall, the trace metal concentration and isotope ratio data will be combined to provide first estimates of the role of glacial meltwater input in the global oceanic budgets of Zn and Cu, and their isotopes, as well as tracing and fingerprinting the fate of glacially derived nutrients in the fjords.

References:

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