Investigating Cr Cycling on the Chukchi Shelf and in the Central Arctic Ocean using Cr stable isotopes

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Chromium (Cr) is a trace metal in seawater. The reduction of soluble Cr(VI) to particle-reactive Cr(III) in seawater renders residual total Cr isotopically heavy [1].

Here, we employ Cr stable isotopes to investigate Cr cycling in the Arctic Ocean. Cr isotope data associated with the Atlantic layer of Central Arctic stations (GN01/HLY1502: 43, 48) falls below the Rayleigh-like fractionation line previously observed by [2]. In contrast, other data of ours (Pacific layer of Arctic stations, SAFe station, Santa Barbara Basin) also falls squarely on this line. This indicates that Cr in the Atlantic layer of the Central Arctic is shaped by a previously unrecognized and yet to be identified process.

Furthermore, we will expand on previously presented work, which showed a significant modification of Cr in the surface Pacific layer along its flow path from the North Pacific Ocean, over the Arctic Chukchi Shelf, into the Central Arctic Ocean: Cr concentrations decreased, while $\delta^{53}Cr$ increased. This observation may be explained by biological uptake of isotopically light Cr in surface waters. We will investigate how crucial the highly-productive Chukchi Sea surface waters are in the modification of inflowing Pacific water by analyzing further stations of the 2015 Arctic US GEOTRACES GN01 expedition: station 1, which is south of the Bering Strait and represents the pure Pacific endmember, shelf stations (2 - 6, 66), and stations on/off the northern shelf slope (10, 57). This will also allow us to evaluate how prevalent the extremely heavy Cr isotope signatures ($\delta^{53}Cr$=3.85‰, 4.15‰) observed in the bottom waters of station 61 are on the Chukchi shelf as a whole. These isotope signatures are possibly caused by Cr reduction via reductants such as Fe(II) being released from the anoxic sediment pore waters of the Chukchi shelf. This is supported by the detection of high Fe(II) levels in the bottom water of station 61 (Maija Heller, pers. comm.). Although this Fe feature is seemingly reflected as a peak in total Fe concentrations in the Pacific Winter Water (PWW) layer at station 60 (Mariko Hatta, pers. comm.), the extremely heavy $\delta^{53}Cr$ signatures do not extend to the PWW layer of station 60.

[1] Moos & Boyle, Goldschmidt Abstract 2017. [2] Scheiderich *et al*. (2015) *Earth Planet. Sci. Lett*. **423**, 87–97.