Global Cr-isotope distributions in surface seawater and incorporation of Cr isotopes into carbonate shells

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In this study we present the Cr-isotope composition of surface seawater from several locations worldwide. In addition to the samples from the oceans (Atlantic Ocean, Pacific Ocean, Southern Ocean and Artic Ocean) we analysed water samples from areas with a more limited water exchange (Mediterranean Sea, Baltic Sea, Øresund and Kattegat). The long residence time of Cr (7,000 to 40,000 years) [1-3] relative to the ocean mixing time (1,000 to 2,000 years) [4] could lead to the expectation that the Cr concentration and Cr-isotope distribution are homogeneous in the oceans. However, our seawater samples range from $d^{53}Cr$ = +0.33±0.06‰ in the Øresund to 1.24±0.2 in the Arctic Ocean. Together with recently published data from the Argentinian Basin (+0.41 to +0.66‰) and Southampton (+1.5‰) [5] our data show a rather heterogeneous distribution of Cr isotopes in the world's water masses. We have observed a negative correlation between the Cr-isotope composition and the Cr concentration. Exceptions are samples from the Baltic Sea/Øresund, which are isotopically light despite low Cr concentrations (~0.1-0.2 ppb).

In addition to the seawater data, we measured Cr isotopes in modern biologically produced carbonate shells (bivalves, gastropods) and corals. Our preliminary data set ranges approximately from $d^{53}Cr$ = -0.2 to +0.7‰. They are isotopically lighter than local seawater. This is in good agreement with [6], who measured a negative offset from seawater in corals. These offsets indicate some kind of biological fractionation of Cr most probalby dominated by reductive processes prior to incorporation of Cr into the carbonate lattices. Our aim is to identify species that either incorporate the Cr-isotope composition of ambient seawater or show a species-specific offset with a view to using Cr as a paleo-redox proxy in ancient fossils.

[1] Campell and Yeat (1984) *Science* **19**, 513-522. [2] Reinhard et al (2014) *EPSL* **407**, 9-18. [3] Van der Weijden and Reith (1982) *Mar. Chem.* **11**, 565-572. [4] Broecker (1963) [5] Bonnand et al (2013) *EPSL* **282**, 10-20. [6] Pereira et al (subm.) *Geobiology*.