

# Linking observational and modelling approaches of elemental, isotopic and speciation analysis to understanding dissolved and particulate trace metal cycling in the oceans

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Many trace metals are essential for living organisms and are a crucial component of many metabolic processes. Iron (Fe) for example is necessary for photosynthesis, but due to its low solubility in seawater, dissolved Fe (DFe) concentrations in the ocean are exceedingly low, limiting phytoplankton growth in about 20% of the world's ocean and making it very important to understand the biogeochemical cycling in the ocean. Recently, it was shown that hydrothermal venting provides a significant source of DFe to the oceans<sup>1</sup>. A coherent modelling approach using site-specific field data and global hydrothermal DFe inputs placed new constraints on submarine Fe vent fluxes worldwide, including an indication that the majority of Fe supplied to hydrothermal plumes may come from entrainment of diffuse flow. The model further indicates that scavenging of carbon in association with Fe-rich hydrothermal plume particles should play a significant role in the delivery of particulate organic carbon to deep ocean sediments, worldwide<sup>2</sup>.

Recent Fe-isotopic studies have furthermore enabled us to better understand the processes involved in the biogeochemical cycling of iron under different oceanographic conditions, e.g. at hydrothermal vents and plumes, under anoxic sulfide rich environments and during microbial recycling in the photic zone<sup>3-5</sup>. We will integrate these new findings into Fe-speciation observations as a further step towards a holistic understanding of the oceanic Fe-Cycle.

<sup>1</sup>Sander, S. G., Koschinsky, A., *Nature Geoscience* 4 (3), 145-150 (2011).

<sup>2</sup>German, C. R., Legendre, L. L., Sander, et al., *Earth and Planetary Science Letters* 419, 143-153 (2015).

<sup>3</sup>Ellwood, M. J., Hutchins, D. A., Lohan, M. C., et al., *Proceedings of the National Academy of Sciences* 112 (1), E15-E20 10.1073/pnas.1421576112 (2015).

<sup>4</sup>Nasemann P., PhD thesis, University of Otago, 2015

<sup>5</sup>Rolison, J.M., PhD thesis, University of Otago, 2016