Iron isotope fractionation in a hydrothermal plume above the Nifonea vent field, Vanuatu

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Iron (Fe) is an essential micronutrient and a limiting factor in regulating primary production in parts of the world's oceans, thereby influencing the global carbon cycle and hence climate. Fe stable isotopes hold great potential as a tool to investigate the biogeochemical redox cycle of Fe, but may also be used to constrain the individual contributions that each of the multiple Fe sources adds to the marine dissolved Fe budget. Several studies have attempted to define characteristic Fe isotope 'fingerprints' for these sources, including hydrothermal discharge [1]. However, high priority should also be given to understanding any fractionation processes that may occur when Fe enters the ocean as they may alter the Fe isotopic signature.

For hydrothermal input, two previous studies, based on Fe isotope analyses of plume particles, have resulted in controversial findings. One has suggested preservation of the end-member fluid's Fe isotope signature in the plume [2] while the other suggests a significant shift towards a heavier isotopic composition [3]. The opposing results are mainly attributed to different Fe/S ratios in the end-member fluids of the respective hydrothermal plumes.

In this study, hydrothermal plumes above the newly discovered Nifonea vent field in the New Hebrides arc in Vanuatu, were sampled and analyzed for their Fe isotope compositions. Utilizing new protocols for trace metal preconcentration and separation from seawater, in combination with double spiking procedures and multiple-collector ICP-MS, we have determined the isotopic composition of dissolved Fe in a hydrothermal plume for the first time. Preliminary results indicate preservation of the end-member isotopic signature and only minor formation of Fe-sulfides despite low Fe/S ratios in the vent fluids.

[1] Radic et al. (2011), *EPSL* **306**, 1-10. [2] Bennet et al. (2009), *GCA* **73**, 5619-5634. [3] Severmann et al. (2004), *EPSL* **225**, 63-76