Hydrothermal fluxes of trace metals (such as Zn and Fe) into surface waters along the Kermadec Intraoceanic Arc

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Compared to mid-ocean ridges, hydrothermal vent systems at intraoceanic arcs are located in much shallower water depth. Therefore, their hydrothermal plumes may reach surface waters and directly supply essential micronutrients into the photic zone, such as Fe and Zn, which are usually strongly depleted in surface waters.

The active hydrothermal vent system *Macauley*, located in ~350 m water depth at the Kermadec intraoceanic arc, was sampled in 2016/2017 during expedition SO253. Plume surveys indicated strong plume signals for dissolved Fe, Mn, Cu and Zn (up to 1.2 µM, 1 µM, 160 nM, 150 nM, respectively) close to the source in 300 m water depth. With distance from the vent, the metal concentrations decrease, as to be expected, however, Zn/Fe ratios increase (from 0.12 close to the source to ~ 2.3 in a few km distance). It is known that hydrothemal Fe is stabilized in its dissolved form by organic and inorganic ligands or in nanoparticular form and may thereby be transported over long distances, contributing to the global oceanic Fe cycle. At *Macauley*, the persistence of a distinct Zn plume signal with distance from the source may be due to higher solubility of Zn and possible additional stabilization through organic complexes. Similar trends for Fe and Zn were observed at *Brothers Volcano*, another active vent system located along the Kermadec Arc, but in ~1600 m water depth.

Our study highlights the importance of shallow arc hydrothermalism for fluxes and the biogeochemical cycle of trace metals as potential micronutrients or toxins into the ocean.