

Vertical and spatial distribution of the iron-humic complex during the TONGA GPpr14 expedition

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The bioavailability of dissolved iron (dFe), an essential chemical element for marine life, depends on its chemical form. We will present the first results on the vertical and spatial distribution of the iron-humic complex in the oligotrophic Western Tropical South Pacific (WTSP). Samples were collected during the TONGA expedition^[1] conducted in the framework of the GEOTRACES program (GPpr14). The dissolved iron-humic complex (FeHS) was measured using a cathodic stripping voltammetry method based on the oxidation of the iron-humic complex at a mercury drop electrode. By comparing FeHS to the total dFe concentrations the contribution of FeHS to the dFe pool was determined. We will present full depth profiles representative of open ocean conditions and shallow stations of the Tonga Arc where a shallow hydrothermal system could impact the distribution dFe. In particular we will focus on the role of humic-type ligand in the stabilization of hydrothermal dFe. Preliminary results show that the humic-type ligands (0.05-2.43 nmol-Fe L⁻¹ equivalent) were mainly produced in the euphotic layer. In the mesopelagic zone these ligands were partially remineralized and their persistence in the deeper layer indicate that part of these ligands are refractory to microbial degradation. Several bottom enrichments were observed and could indicate a secondary benthic source of this iron ligand by sediment remobilization. These ligands were never saturated with iron and the contribution of FeHS to dFe globally increased with depth, reaching 70% in open sea stations. This result highlights the importance of the humic-type ligands in the deep oceanic dFe cycle. At shallow stations, FeHS inputs were depicted at bottom depths, suggesting that dFe hydrothermal inputs were partially stabilized by humic-type ligands. No significant contribution of humic-type ligands has been identified in the distal hydrothermal plume and preliminary results indicate that even when dFe exceed the concentrations of humic-type ligands, the latter were not saturated. This result suggests that most of hydrothermal dFe may be in a chemical form that does not enable its complexation by humic ligands. Laboratory experiments conducted on the solubilization of Fe oxy-hydroxides by humic type ligands (SRFA) support this hypothesis.

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