

Was it really chemistry all along? Resolving the factors that influence profiles and distributions of nutrient- like metals (Zn, Ni, Cu and Cd) in the South Pacific Ocean

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Nutrients and nutrient-like trace metals (i.e. Zn, Cu, Ni and Cd) in marine systems have a vital and foundational role in supporting marine productivity. Redfield theory purports that nutrient-like trace metal accompany macronutrients distributions. Likewise, distributions of nutrient-like metals are thought to be determined by biological uptake into the particulate phase in surface waters and release from particles via remineralization processes within deep waters. Nevertheless, trace metal interactions with organic matter, in particulate or dissolved form, are fundamentally different than those of the macronutrients. Trace metals form coordinate bonds with organic compounds, which are influenced by ambient conditions such as temperature and pH, whilst macronutrients are covalently bound during biomass synthesis and can only be released upon degradation. As such, profiles of nutrient-like metals are not consistent with those of the macronutrients, and the extent that physico-chemical conditions affects distributions remains unknown.

The South Pacific Ocean (SPO) is vast and oligotrophic, and acts as a key interlink for transport between the Southern Ocean and North Pacific. The strong physico-chemical and biological gradients in the region provide an opportunity to examine the relative importance of biological and chemical processes which underpin distributions and partitioning between dissolved and particulate nutrient-like trace elements. Potential influence of chemical processes are explored by considering competitive adsorption/binding of trace metals to dissolved organic matter, particulate organic matter and lithogenic material across the GP21 GEOTRACES transect in the SPO. Key trace metal speciation and parameterization results from GP21 will also be noted and discussed. Binding to organic matter was parameterized via the NICA-Donnan model, and adsorption to lithogenic material via a simple two-layer adsorption model based on hydrous oxides. Our overall aim is to improve the understanding of how *chemistry* controls chemical factors in the ocean, as this is essential to understanding how (future) changes in ocean physico-chemical states could influence trace metal biogeochemistry. These results have important implications for macro- and micro- nutrient cycling for the SPO and beyond.