The distribution of some soft metals of biological and paleoceanographic importance in the eastern Pacific Ocean

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A stated goal of the GEOTRACES program is to better understand the large-scale distribution of trace metals in the marine environment [1]. A characteristic feature of the soft Lewis acid metals like copper (Cu), zinc (Zn), silver (Ag) and cadmium (Cd) is their correlation with the major algal nutrients [2]. These correlations imply that the proximate control on the distribution of these metals is microbial uptake at the ocean surface, sinking associated with particulate organic matter and subsequent remineralization in the ocean interior. Combined with sedimentary records of past metal concentrations such correlations can provide much needed information on water mass circulation and nutrient cycling in the paleo-ocean [3-5]. Today, as trace nutrients and/or toxins these metals help shape microbial community composition and influence productivity [6]. Here we present depth profiles through the low dissolved oxygen waters of the north Pacific which show decoupling of trace metal- macronutrient relationships driven by depletion anomalies of trace metal concentrations in the broad, low oxygen layer. Similar anomalies have been previously reported in permanently anoxic layers (e.g. fjords) or in waters in contact with suboxic sediments and attributed to sulfidic removal of soft trace metals [7]. The observed trace metal behavior and trace metal-macronutrient relationships in the oxygen minimum layer in the northeastern Pacific is consistent with the possibility of sulfidic scavenging of soft metals and the formation of insoluble metal sulfides in the water column. Implications of this influence on the basin scale distribution of soft metals like Cu, Zn, Ag, Cd through scavenging in the spreading low oxygen layer in the northeastern Pacific are discussed.