An Experimental Study of Trace Metal Regeneration and Implications for the Amazon River Estuary

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The Amazon River basin is an important source of trace metals and organic matter to the Atlantic Ocean, but this input and the processes during mixing with seawater in the estuary and spreading plume have not been fully quantified. Furthermore, trace metal distributions in the global oceans are influenced both by 1-dimensional processes of export and regeneration, and 3-dimensional processes of circulation and mixing. To understand the influence of these processes along the salinity gradients in the Amazon River estuary and plume, samples were collected on the M147 Amazon GEOTRACES cruise and analysed for dissolved trace metals. Trace metal profiles from selected stations were then compared to recent results from laboratory regeneration experiments. The regeneration experiments were conducted using five sets of Gulf of Mexico phytoplankton incubations: three of mixed assemblages and monocultures of the diatom *Pseudo-nitzschia dolorosa* and dinoflagellate *Karenia brevis*. Each incubation was transferred to the dark to simulate the process of regeneration that naturally occurs in the water column. Over six months, the incubations were monitored for dissolved trace metals (Mn, Fe, Co, Cu, Ni, Zn, Cd, and Pb), macronutrients, chlorophyll *a*, and particulate organic carbon and nitrogen. Trends in trace metal regeneration over time were then compared to water column depth profiles. Some trace metals (e.g., Cd) displayed a nutrient-type regeneration similar to phosphate, whereas others (e.g., Mn, Pb) followed scavenged-type profiles, and others (e.g., Fe, Cu) were a hybrid. Coupling the results from the regeneration experiments with water column profiles provide insight into the relative contributions of export and regeneration versus ocean circulation to depth distributions of trace metals in the Amazon River estuary system and Atlantic Ocean.