Trace element distributions and phytoplankton colimitations on a full depth ocean section in the South Atlantic Ocean

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The distributions of trace elements (Co, Fe, and Mn) and macronutrients on a zonal section in the South Atlantic from the subtropical gyre to the Benguela Upwelling system were examined in November-December of 2007. Surface depletion of cobalt was observed across much of the section, demonstrating the importance of micronutrient processes on cobalt geochemistry in this region. In addition a large plume of cobalt was observed emanting from the Benguela Upwelling and spreading well into the South Atlantic basin, concurrent with a low oxygen tongue. Analyses of iron and manganese suggest that the source components and scavenging parameters are unique across these hybrid-type elements. Incubation experiments on this section found evidence for nitrogen-iron, nitrogen-cobalt, and iron-light colimitation in the South Atlantic, in a region generally considered to be nitrogen limited. Together these results demonstrate the value of high-resolution sectional analysis of trace metals, as well as pointing to the need for efficient biochemical assays for nutrient colimitation.

Formation conditions and stability of a toxic tridecameric Al polymer under a soil environment

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Aluminum ion and its hydrolytic species show phytotoxicity, especially the tridecameric Al polymer (Keggin type Al_{13} polycation, $[AlO_4Al_{12}(OH)_{24}(H_2O)_{12}]^{7+}$) has the strongest toxicity among them. Hunter and Ross[1] reported the evidence that the Al_{13} is present in the organic soil horizons in Forest. Therefore, it is important to study the formation conditions and the stability of the Al_{13}. The Al_{13} consists of twelve 6-coodinated Al that can not be detected and one 4-coordinated Al that gives a sharp peak around 60 ppm in the ^{27}Al NMR spectra. First the pH region where the peak around 60 ppm can be detected by ^{27}Al NMR spectroscopy was examined, corresponding to the pH region where the Al_{13} can be formed. The result suggests that Al_{13} can be formed at pH 3.6 – 5.7 in aqueous solution. Because of the seven positive charges on Al_{13}, it can be reasonably deduced that Al_{13} has high adsorption and coordination properties on the surface of soil and microbe covered with carboxylic groups. The adsorption behavior of Al_{13} on Chelex 100 with iminodiacetate groups, as a model compound of their surface, was examined. It was found that Al_{13} can be stably adsorbed onto the Chelex 100 by weak electrostatic interaction. Additionally, decomposition of the Al_{13} did not occur even after adsorption, and its pH stability region was wide compared to that in aqueous solution. The effects of silicic acid on the formation and stability of Al_{13} was also examined. When silicic acid coexsisted, the formation of Al_{13} was inhibited, on the other hand the reaction between the Al_{13} and silicic acid was extremely slow.

[1] Hunter D. and Ross D. (1991) *Science*, **251**, 1056-1058.