Scavenging of hydroxide dominated elements: Insights from dissolved Titanium in the South Pacific Gyre and Southern Ocean

P.L. CROOT[1,2], S. NICHOLAS[1,2] A. GRASSIE[1], A. WIECZOREK[1], M.I. HELLER[3], G. KLOCKGETHER[4], G. LAVIK[4] AND T.G. FERDELMAN[4]

[1]Earth and Ocean Sciences, NUI Galway, Galway, Ireland (peter.croot@nuigalway.ie)
[2]iCRAG (Irish Centre for Research in Applied Geosciences), , NUI Galway, Galway, Ireland.
[3] Ifremer, Laboratoire des Cycles Géochimiques, CS 10070, F-29280, Plouzané, France.
[4] MPI for Marine Microbiology, Celsiusstr. 1, D-28359, Bremen, Germany.

The marine biogeochemistry of the three major metallic crustal elements, Al, Fe and Ti are strongly dominated by hydrolysis reactions, resulting in strong hydroxide complexation and low solubility in seawater. Strong scavenging/uptake by particles in the water column further leads to low concentrations of these elements in open ocean seawater (Al: 0.3 – 90 nM, Fe: 50 – 3000 pM, Ti: 3- 300 pM). Despite the similarities there are distinct kinetic and thermodynamic differences between the 3 elements, most importantly Fe is the only one found at concentrations above the inorganic solubility in seawater (~200 pM) due to the presence of organic complexing ligands produced by biota (e.g. siderophores). Presently there is little evidence for organic complexation of Al or Ti in seawater and neither element has a known function in marine organisms. Differences in organic compelxation may explain why can Fe can is found extensively in the colloidal phase while Al and Ti are not [1]. Differences in scavenging of these elements is related then to active uptake by biota, colloidal pumping and/or passive uptake into silicate structures of diatoms.

This presentation will focus on recent results for dissolved Titanium from GEOTRACES work across the South Pacific Gyre (SO245) and in the Southern Ocean (Zero & Drake) and examine the influence of scavenging processes such as low dust deposition, an oxygen minimum zone, hydrothermal vent activity at the EPR and deep water masses have on the distribution of dissolved Ti in the water column. The implications of these findings for the use of Ti, Fe and Al as dust tracers will also be discussed.

[1]Dammshäuser, A. and P.L. Croot. 2012.*Geochimica et Cosmochimica Acta*, 96: 304-318.