Discerning effects of trace elements on marine surface-water ecosystems — a perspective

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The effects of iron on primary production in the ocean -- especially high-nutrient, low-chlorophyll (HNLC) regions -- is well established both in laboratory culturing and in the field. Other trace elements also influence marine surface-water ecosystems [1]—positively and negatively, but their influence is often more subtle.

We have studied several trace elements in the Southern Ocean, probably the most important HNLC region globally. These have included selenium, a micronutrient routinely in microalgal culture media; and arsenic, a purported micronutrient, but more renowned for being a toxicant.

In a meridional transect of the Southern Ocean (CLIVAR I9, Jan-Feb 2005), selenium distribution and speciation was not indicative of a limiting micronutrient. These observations seem consistent with Se being a "protective" micronutrient (via glutathione peroxidase, etc.); it is more associated with cellular integrity and viability than metabolic processes. We shall also present preliminary results from field incubations, a rationale for laboratory culturing experiments (redefining limitation studies to cover cellular viability), and consider possible effects of Se on phytoplankton community structure.

The distribution of dissolved arsenic species were made in an earlier study of the Subantarctic Zone of the Southern Ocean (SAZ Project, Mar 1998). Here, it was reasoned that the phosphate-replete waters, low temperatures and limited primary production resulted in the scant biological conversion of As species. It is only when P becomes limiting, and As:P molar concentration ratios approach 0.1, that As speciation has a pronounced biological imprint; and conversely, As begins to influence phytoplankton community structure [2]. We have indications of such under summertime P-depleted conditions in a temperate coastal water, where just one species of diatom (from the genus *Pseudonitzschia*) in a mixed community was dominant in the biological processing of arsenic.

References

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