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Atmospheric input of trace elements to the ocean; Dust to ashes?

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Abstract

Trace elements are effectively transported by the atmosphere and delivered to large aquatic systems such as the surface ocean. Most major ocean basins are surrounded by continents with significant sources of arid material (dust) and anthropogenic emissions (ash). Many of these trace elements (e.g. Fe, Mn, Zn, Cu, Co) are bioactive; hence the impact of their atmospheric input depends significantly on the source (natural vs anthropogenic), chemical form (primary vs altered) and mode of deposition (dry vs wet). Long term climatic variations over the North Atlantic strongly influence the relative proportions of wet and dry deposition from year to year. For several trace elements, wet deposition by rain comprises a large fraction of labile atmospheric components. The contrasting nature of desert and combustion aerosols modulates the magnitude and solubility of these trace element inputs. For instance, a small proportion of combustion aerosol contributes a relatively large proportion of soluble trace elements to the surface ocean. Indeed for many trace elements elements this relationship may determine the potential fertility or toxicity of atmospheric deposition to marine phytoplankton proximate to upwind continental sources. Remarkably Ni and V sourced from unrefined oil combustion are characteristic tracers of ship emissions that may be impacting the surface ocean. Thus changes in climatology that carry emissions from the land to the sea, as well as economic development based increasingly on marine transport may both have important implications for the health of the future ocean.

Biography

Thomas M. Church completed his PhD 1970 in chemistry at the University of California; San Diego supervised by Edward D. Goldberg at Scripps Institution of Oceanography. He then received an NSF-CNRS Postdoctoral Fellowship at the University of Paris supervised by Claude Allegre. He has been a faculty member at the University of Delaware since 1973 and currently appointed the E.I. Professor of Marine Studies with over 160 publications. Since then he has held visiting faculty appointments at Caltech with Clair Patterson, Aix-Marseilles and Pau in France, and as a fellow at the HWK Institute in Delmenhorst, Germany.