

The unrealistic stoichiometry concept for metal composition in marine plankton

Tung-Yuan Ho (何東垣)

Research Center for Environmental Changes, Academia Sinica

The study on the elemental and metal composition in the size-fractionated plankton collected in the offshore South China Sea site (SEATS) revealed that the relatively small algae carried overwhelming amounts of extracellular metals and the extracellular metals were not from the lithogenic particles, but from the authigenic ones adsorbed on the plankton surface. The pulse Mongolian dust storm during the winter season has been considered to be the major source of abiotic particles to the western Pacific marginal seas, including the South China Sea. However, more recent studies found that the all year long anthropogenic aerosols contacted with strong acids are actually a more important aerosol source in the Yellow Sea and East China Sea. In the South China Sea area, the results of the satellite images (Lin et al. unpubl.) and the aerosol dissolution experiments (Hsu et al. unpubl.) both support a strong anthropogenic influence on the aerosol composition. I hypothesize that the anthropogenic aerosols containing significantly high amount of dissolved trace metals are the major source for the algal extracellular metals. Under low pH condition, Fe and other trace metals in the aerosols in the atmosphere would be remobilized to become metal salts eventually, once the aerosols contact the surface seawater or are brought into the ocean by precipitation, the metal salts would be dissolved, precipitated, and re-adsorbed on particles, presumably the biogenic ones, mainly the smaller phytoplankton. Associated with the extensive use of fossil fuel and combusted biomass on Earth, it would be expected that overwhelming extracellular metal adsorption from anthropogenic aerosols metal source would be common, especially for the oceanic areas close to strong anthropogenic activity. This study suggests that the stoichiometry concept for trace metal composition in marine plankton assemblages is unrealistic in the field. Although, conceptually, it is still possible to observe a fairly consistent 'intracellular' trace metal composition in marine plankton assemblages, the total trace metal quotas would largely depend on the amount of extracellular pools and likely vary from site to site.