Nanoparticles and Ocean Optics

Abstract

Viruses and marine aggregates are the most abundant nanoparticles in the sea. We propose experiments that assess the role of these nanoparticles on ocean optical properties. In one set of experiments, field host assemblages will be subjected to increased titers of *naturally-occurring* viruses, such that the multiplicity of infection is elevated in a highly controlled fashion. Using "dilution-type" experiments[1,2,3], we will monitor increases in chromophoric dissolved organic matter (CDOM) associated with changes in virus abundance (using Syber Green staining) [4], as well as changes in absorption, scattering, fluorescence and particle size distribution (as measured with flow field-flow fractionation[5]). These dilution experiments are now possible due to the commercial availability of high-through-put "ultra" filters with effective pore sizes of ~0.02 μm; such ultra-filters retain 99.99% of viruses, bacteria and protozoa at flow rates over 200X faster than typical small-pore membrane filters. The advantage of this experimental design is that it provides us with the opportunity to experiment with naturally-occurring viruses and hosts, such that the optical results, and rates, would have direct applicability to nature. We also propose experiments on the optical properties of polymer aggregates in which raw seawater would be ultra-filtered into sterile containers, and it's absorption and scattering properties followed as aggregation occurs. Controls with formalin will allow us to control for biologically-related aggregation phenomena while controls with EDTA will allow us to inhibit polymer aggregation. ^{14}C-calcification estimates will allow us to examine whether non-biogenic calcification is occurring inside polymer aggregates as suggested from earlier work of Chin et al. [6]. If we affirm the presence of non-biogenic calcification within aggregates, as our preliminary experiments demonstrate, then this will have important implications on a major source of light scattering in the sea.