NURP "Hot Item" for NOAA web site

Effect of Nepheloid Layers on Ocean Chemistry (and Climate?)

Methane and nitrous oxide in the oceans are of particular interest because both are greenhouse gases, and because methane is part of carbon cycling in the oceans. Methane and nitrous oxide are apparently produced within the upper water column; evidence is the presence of supersaturated levels of methane (CH_4) and nitrous oxide (N_2O) in the upper water column. The most likely site for this production is the nepheloid layers, which are thin, particle-rich microlayers within the upper water column. The organic-rich particles seem to serve as suboxic/anoxic microenvironments for bacterial activity involving methane, nitrous oxide, and probably iron, dimethyl sulfide, and other biologically important compounds.

However, the nepheloid layers have received little attention as a possible site for biogeochemical processing on a scale large enough to affect ocean chemistry. One reason is that the nepheloid layers have been difficult to sample. Conventional water sampling gear, i.e. a rosette of sampling bottles lowered on a wire, is not appropriate for studying nepheloid layers because it churns the layers as it heaves with the ship.

Frank Sansone (Univ of Hawaii) and Mary Silver (Univ of Calif. Santa Cruz) have conducted fine-scale sampling of nepheloid layers in the upper 1250 m of Monterey Bay using the remotely operated vehicle *Ventana* (operated by the Monterey Bay Aquarium Research Institute). Their project is supported by the West Coast & Polar Regions Undersea Research Center (NURP). The *Ventana* was equipped with a nephelometer, a transmissometer, and a structured light source with HDTV video, in addition to water sampling gear. With their initial field results, Sansone and Silver have demonstrated for the first time that the nepheloid layers have a direct effect on the chemistry of the water around them: particle concentration correlated positively with alkalinity and correlated negatively with ^{13}C, i.e. the carbon isotope composition of the methane. The wide range of ^{13}C values (-60 to -30 per mil) indicates biogenic methane production within the layers and biogenic oxidation of methane outside of the layers. Interestingly, overall concentrations of methane do not correlate with the particles or the carbon isotopes. The effect of nepheloid layers on ocean chemistry appears to be complex but potentially very significant.