



The role of DOC in the export of carbon to the deep ocean

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At 662 Pg C, approximating the inventory of carbon residing in atmospheric CO₂, marine dissolved organic carbon (DOC) is the largest bio-available pool of reduced carbon in the global ocean. A small fraction of the DOC produced daily is not immediately mineralized by microbial heterotrophs and thus accumulates in the surface ocean. This material can be circulated vast distances with the wind driven surface currents, eventually mixing to great ocean depths at high latitudes with the global ocean thermohaline circulation. Little detailed knowledge has existed on the export of DOC to the deep ocean because of a paucity of high quality data. Recently, though, the US Repeat Hydrography program occupied key sections spanning the oceans. The Atlantic (section A16) and Pacific (section P16), emphasized in this presentation, were sampled with high spatial resolution for DOC, resulting in an unprecedented view of the surface and deep ocean distributions and dynamics of DOC. As predicted, the deep ocean distribution is primarily impacted by the overturning circulation and net removal; where DOC-enriched surface waters serve as source waters of ventilation, DOC is enhanced in the deep layers. Here we evaluate the surface introduction and deep removal of DOC along isopycnal surfaces, finding that the North Atlantic and, more surprisingly, the Southern Ocean export DOC to the deep layers. We note the very slow removal of refractory DOC in the deepest layers of the Pacific (a few micromolar over hundreds of years), consistent with circulation and aging of those deep water masses. The removal is consistent with estimated rates of refractory DOC ad-

sorption onto suspended particles, perhaps explaining a part of the removal observed.