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Radiocarbon and chemical structure correlations from marine DOC

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The average radiocarbon age of marine dissolved organic carbon (DOC) in the deep ocean is between 4000-6000 radiocarbon years. Elevated radiocarbon values in surface waters and recent compound specific measurements confirm that in surface waters, components of the DOC reservoir are of modern origin ($<$50 years old). Here we consider two hypotheses that have been proposed to model the observed vertical distribution of radiocarbon within DOC. The first hypothesis proposes that marine DOC is composed of varying contributions from two discrete end member components, older refractory DOC and modern DOC. The second hypothesis suggests that the average radiocarbon content of DOC results from a radiocarbon continuum spanning the entire range from refractory to modern. To test these two hypotheses we determined the radiocarbon content and chemical characteristics of DOC components in the surface ocean. DOC was isolated from the Southern California Bight on a solid phase support and chemically fractionated using aqueous and organic solvents. Our data show that isolated fractions are chemically and isotopically distinct, and the initial results support the first hypothesis above. The most prominent relationship is that polar fractions are enriched in radiocarbon, which is supported by compound specific radiocarbon analyses that identify modern carbohydrates in these DOC fractions. The same method of isolation and characterization was applied to samples collected along the Delaware River and at another oceanic site where active methane seeps were present. The data obtained from each of these sites for both bulk fractions and compound specific measurements (including carbohydrates and lignin) will be discussed and evaluated in the context of the two hypotheses discussed above.