Revisiting vertical variations in stoichiometry during oceanic organic matter decomposition

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Using the new global nutrient data set, we re-evaluate basin-wide stoichiometric ratios of remineralization estimated by Anderson and Sarmiento (1994) (hereinafter, AS94). For the same latitudinal ranges of the Atlantic, Indian and Pacific Oceans as in AS94, we construct one or two end-member mixing models on 14 neutral surfaces and estimate the stoichiometric ratios with a probabilistic approach. Unlike the results of AS94, significant vertical variations in the stoichiometry are found in the Atlantic and Pacific, while relatively constant stoichiometry with depth is found in the Indian Ocean, similar to AS94. The decreases in the C/P and $-O_2$/P ratios with depth in the Atlantic could be caused via dark DIC fixation by chemoautotrophs in the deep waters. In the Pacific, changes in organic matter composition with depth would be the most important factor in the increases in stoichiometry with depth. In all the basins, the N/P ratios are probably affected by benthic denitrification, as in AS94. The P/C/-O_2ratios (mean and $5^{th}$to 95^{th}percentile) are estimated to be 1/111(97 to 129)/155(149 to 163) in the depths below 2000 m of the Indian and Pacific Oceans, where DIC fixation and vertical change in organic matter composition have little influence on the stoichiometry estimates. We suggest that chemoautotrophic DIC fixation and the effect of change in organic matter composition with depth on the stoichiometry in waters above 2000 m should be considered for large-scale biogeochemical modeling and estimation of oceanic uptake of anthropogenic carbon from observational data.

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