EVALUATING DIATOM-ASSOCIATED ORGANIC CARBON AS A PROXY FOR PALEOPRODUCTIVITY

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ABSTRACT

The carbon stable isotopic composition of organic matter associated with diatom frustules was measured to evaluate its usefulness as a proxy for paleoproductivity. Published methods for purifying the frustule-bound fraction failed to yield consistent and repeatable results for diatom cells grown in continuous and batch culture. More vigorous oxidation techniques were applied to diatom frustules separated from sediment core material collected from the Gulf of Alaska. The frustule-bound organic matter showed large enrichments in ^{13}C in diatom ooze samples compared to samples composed primarily of silt and clay. The total range in $\delta^{13}C$ values of the frustule-bound organic matter was over 20‰, far greater than the 5‰ range reported for bulk organic matter from this core. This suggests that frustule-bound organic carbon is a far more sensitive indicator of carbon dynamics in ancient oceans than bulk organic carbon. However, without knowledge of the isotopic fractionation associated with the formation of frustule-bound organic matter, it is difficult to interpret the observed $\delta^{13}C$ values in terms of growth rate, $[CO_2(aq)]$ or changes in cell geometry. Since diatoms play a major role in the export of organic carbon from the surface ocean, further work on frustule-bound organic matter is warranted.