CHANGES IN THE MOLECULAR AND STABLE CARBON ISOTOPIC COMPOSITIONS OF MARINE PHYTOPLANKTON DURING PROLONGED *IN SITU* IRON FERTILIZATION

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ABSTRACT

Photosynthetic isotopic fractionation (ε_P) models were tested in the context of a mesoscale open-ocean iron fertilization experiment conducted in the eastern equatorial Pacific Ocean. The addition of Fe (in the form of $FeSO_4$) produced large changes in phytoplankton growth rate (μ; 3-fold increase), chlorophyll *a* concentration (> 10-fold increase), and aqueous carbon dioxide concentration (C_e; 17% decrease). These changes were associated primarily with increased pennate diatom biomass. Comparison of lipid and pigment biomarkers with carbon biomass estimates for specific algal taxa showed that two sterols, cholesta-5,22E-dien-3β-ol and 24-methylcholesta-5,22E-dien-3β-ol, were associated predominantly with diatoms throughout the experiment. Compound specific stable carbon isotopic analysis showed that ε_P values for the total phytoplankton community and for diatoms were similar to those expected based on an established ε_P - μ/C_e relationship for a diatom (*Phaeodactylum tricornutum*) grown in chemostat culture (Laws et al., 1995), implying that average surface area to cell carbon ratios (SA:C) were similar in field and laboratory conditions. Isotopically-based growth rate estimates for alkenone producing algae (*Emiliania huxleyi* and *Gephyrocapsa oceanica*) based on a laboratory ε_P - μ/C_e relationship were consistent with those expected for these species, but *in situ* growth rate data are not available for verification. These results strengthen the foundation for isotopically based reconstructions of P_{CO_2} and phytoplankton growth rates in ancient oceans.