The elemental stoichiometry and composition of an iron-limited diatom

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Limnol. Oceanogr., 50(4), 2005, 1159-1171 | DOI: 10.4319/lo.2005.50.4.1159

ABSTRACT: We grew *Thalassiosira weissflogii* to steady state over a range of Fe-limiting conditions with nitrate or ammonium as the N source. Nitrate-dependent cells had faster Fe-uptake rates, contained significantly higher intracellular Fe quotas, and grew faster than cells cultivated with NH_4^+ when Fe was most limiting. Under these conditions, carbon (C) : chlorophyll a ratios and the minimum fluorescence yield per chlorophyll a increased, but N source had no effect on either parameter. The ratio of variable to maximum fluorescence ($F_v F_m^{-1}$) declined little with Fe limitation m even when *T. weissflogii* was grown at 25% of its maximum rate (μ_{max}). C:N ratios were higher in nitrate than in ammonium-grown cells and were constant at all Fe levels. Protein was independent of Fe and N, and amino acids were lowest in cells using NO_3^-. The P content of *T. weissflogii* (mol P L^{-1} cell volume) increased by 1.5 times as Fe became most limiting to growth, causing N: P and C: P ratios to decline significantly. The elemental stoichiometry for Fe-limited new production of *T. weissflogii* ($0.25\mu_{max}$) was thus 70C : 10N : 5.9Si : 1P : 0.00074Fe (by mols) compared with 97C : 14N : 4.7Si : 1P : 0.029Fe for nutrient-replete conditions. Uptake rate ratios of NO_3^- : PO_4^{3-} showed the same dependence on Fe as the cellular N: P quotas, decreasing as [Fe] decreased. Iron limitation influenced the elemental composition of this marine diatom and will alter the assimilation ratios of C, N, and P in the high nitrate, low chlorophyll regions of the sea.

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