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Effects of an iron-light co-limitation on the elemental composition (Si, C, N) of two marine diatoms

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Iron and light partly control oceanic primary production, the structure of phytoplanktonic communities, and the coupling of the major biogeochemical cycles (silicon, carbon, nitrogen). Indeed, they play a key role in regulating the degree of silicification of oceanic diatoms (Claquin et al., 2002; Takeda, 1998), and these siliceous microalgae contribute to 40% of the global oceanic primary production (Nelson et al., 1995). The effects of an iron-light co-limitation on the elemental composition of diatoms are however still poorly known. To better investigate this topic, we conducted batch cultures of two species of diatoms, *Thalassiosira oceanica* (an oceanic species, cell volume $\sim 80\ \mu m^3$) and *Ditylum brightwellii* (a coastal species, cell volume $\sim 16000\ \mu m^3$), at different concentrations of inorganic iron (from 0 pM to 700 pM) and at two irradiances (high light: 75 μE, low light: 7.5 μE). Specific growth rate, cell volume, and elemental C, N and Si composition were measured during the exponential phase of growth. Both species reduced their growth rate under an iron-light co-limitation. Under mild limitation ($\sim$ 60 % of the maximum specific growth rate) they showed a 2-fold increase in the ratios Si:C and Si:N. However, under more severe limitation, these ratios tend to decrease. These experiments showed that elemental ratios do not systematically increase when specific growth rate decreases. These results may have important biogeochemical consequences on the understanding and the modeling of the oceanic biogeochemical cycles.