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CO2 and HCO3- uptake in marine diatoms acclimated to different CO2 concentrations

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ABSTRACT: Rates of cellular uptake of CO₂ and HCO₃ during steady-state photosynthesis were measured in the marine diatoms *Thalassiosira weissflogii* and *Phaeodactylum tricornutum*, acclimated to CO₂ partial pressures of 36, 180, 360, and 1,800 ppmv. In addition, in vivo activity of extracellular (eCA) and intracellular (iCA) carbonic anhydrase was determined in relation to CO₂ availability. Both species responded to diminishing CO₂ supply with an increase in eCA and iCA activity. In *P. tricornutum*, eCA activity was close to the detection limit at higher CO₂ concentrations. Simultaneous uptake of CO₂ and HCO₃ was observed in both diatoms. At airequilibrated CO₂ levels (360 ppmv), *T. weissflogii* took up CO₂ and HCO₃ at approximately the same rate, whereas CO₂ uptake exceeded HCO₃ uptake by a factor of two in *P. tricornutum*. In both diatoms, CO₂:HCO₃ uptake ratios progressively decreased with decreasing CO₂ concentration, whereas substrate affinities of CO₂ and HCO₃ uptake increased. Half-saturation concentrations were always <=5 mM CO₂ for CO₂ uptake and <700 mM HCO₃ for HCO₃ uptake. Our results indicate the presence of highly efficient uptake systems for CO₂ and HCO₃ in both diatoms at concentrations typically encountered in ocean surface waters and the ability to adjust uptake rates to a wide range of inorganic carbon supply.

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