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

Burkhardt, Steffen, Gabi Amoroso, Ulf Riebesell, Dieter Sültemeyer

Limnol. Oceanogr., 46(6), 2001, 1378-1391 | DOI: 10.4319/lo.2001.46.6.1378

ABSTRACT: Rates of cellular uptake of CO_2 and HCO_3^- during steady-state photosynthesis were measured in the marine diatoms *Thalassiosira weissflogii* and *Phaeodactylum tricornutum*, acclimated to CO_2 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 CO_2 availability. Both species responded to diminishing CO_2 supply with an increase in eCA and iCA activity. In *P. tricornutum*, eCA activity was close to the detection limit at higher CO_2 concentrations. Simultaneous uptake of CO_2 and HCO_3^- was observed in both diatoms. At air-equilibrated CO_2 levels (360 ppmv), *T. weissflogii* took up CO_2 and HCO_3^- at approximately the same rate, whereas CO_2 uptake exceeded HCO_3^- uptake by a factor of two in *P. tricornutum*. In both diatoms, CO_2 :HCO_3^- uptake ratios progressively decreased with decreasing CO_2 concentration, whereas substrate affinities of CO_2 and HCO_3^- uptake increased. Half-saturation concentrations were always <=5 mM CO_2 for CO_2 uptake and <700 mM HCO_3^- for HCO_3^- uptake. Our results indicate the presence of highly efficient uptake systems for CO_2 and HCO_3^- 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.

Article Links

Download Full-text PDF

Return to Table of Contents