Bicarbonate transport and extracellular carbonic anhydrase activity in Bering Sea phytoplankton assemblages: Results from isotope disequilibrium experiments

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ABSTRACT: We used a ^{14}C isotope disequilibrium technique to provide quantitative estimates of both direct HCO_3^- transport and extracellular CA activity in Bering Sea phytoplankton assemblages. The method revealed that direct HCO_3^- transport was the dominant mechanism of inorganic C uptake in both coastal and open ocean waters, accounting for more than half of the total C flux to the phytoplankton. The relative importance of HCO_3^- transport was not related to phytoplankton biomass, productivity, or ambient CO_2 concentrations at individual sampling stations. However, HCO_3^- transport and total inorganic C uptake rates decreased in response to elevated CO_2 in direct manipulation experiments. Kinetic analysis of the ^{14}C time-course data revealed low levels of extracellular carbonic anhydrase activity at most stations. This activity was related to phytoplankton taxonomic compositions and/or CO_2 concentrations, but was relatively unaffected by direct CO_2 manipulations.