Testing the direct effect of CO2 concentration on a bloom of the coccolithophorid Emiliania huxleyi in mesocosm experiments

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ABSTRACT: We studied the direct effects of CO_2 and related changes in seawater carbonate chemistry on marine planktonic organisms in a mesocosm experiment. In nine outdoor enclosures (~11 m³ each), the partial pressure of CO_2 (pCO_2) in the seawater was modified by an aeration system. The triplicate mesocosm treatments represented low (~190 parts per million by volume (ppmV) CO_2), present (~410 ppmV CO_2), and high (~710 ppmV CO_2) pCO_2 conditions. After initial fertilization with nitrate and phosphate a bloom dominated by the coccolithophorid *Emiliania huxleyi* occurred simultaneously in all of the nine mesocosms; it was monitored over a 19-day period. The three CO_2 treatments assimilated nitrate and phosphate similarly. The concentration of particulate constituents was highly variable among the replicate mesocosms, disguising direct CO_2-related effects. Normalization of production rates within each treatment, however, indicated that the net specific growth rate of *E. huxleyi*, the rate of calcification per cell, and the elemental stoichiometry of uptake and production processes were sensitive to changes in pCO_2. This broad influence of CO_2 on the *E. huxleyi* bloom suggests that changes in CO_2 concentration directly affect cell physiology with likely effects on the marine biogeochemistry.