



## Effects of CO<sub>2</sub> and their modulation by light in the life-cycle stages of the coccolithophore *Emiliana huxleyi*

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**ABSTRACT:** The effects of ocean acidification on the life-cycle stages of the coccolithophore *Emiliana huxleyi* and their modulation by light were examined. Calcifying diploid and noncalcifying haploid cells (Roscoff culture collection strains 1216 and 1217) were acclimated to present-day and elevated CO<sub>2</sub> partial pressures (P<sub>CO<sub>2</sub></sub>; 38.5 vs. 101.3 Pa, i.e., 380 vs. 1000 μatm) under low and high light (50 vs. 300 μmol photons m<sup>-2</sup> s<sup>-1</sup>). Growth rates as well as cellular quotas and production rates of C and N were measured. Sources of inorganic C for biomass buildup were determined using a <sup>14</sup>C disequilibrium assay. Photosynthetic O<sub>2</sub> evolution was measured as a function of dissolved inorganic C and light by means of membrane-inlet mass spectrometry. The diploid stage responded to elevated P<sub>CO<sub>2</sub></sub> by shunting resources from the production of particulate inorganic C toward organic C yet keeping the production of total particulate C constant. As the effect of ocean acidification was stronger under low light, the diploid stage might be less affected by increased acidity when energy availability is high. The haploid stage maintained elemental composition and production rates under elevated P<sub>CO<sub>2</sub></sub>. Although both life-cycle stages involve different ways of dealing with elevated P<sub>CO<sub>2</sub></sub>, the responses were generally modulated by energy availability, being typically most pronounced under low light. Additionally, P<sub>CO<sub>2</sub></sub> responses resembled those induced by high irradiances, indicating that ocean acidification affects the interplay between energy-generating processes (photosynthetic light reactions) and processes competing for energy (biomass buildup and calcification). A conceptual model is put forward explaining why the magnitude of single responses is determined by energy availability.

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