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The response of *Calcidiscus leptoporus* and *Coccolithus pelagicus* to changing carbonate chemistry of seawater

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Uptake of half of the fossil fuel CO_2 into the ocean causes gradual seawater acidification (1). This has been shown to slow down calcification of major calcifying groups, such as corals, foraminifera and coccolithophores (2-4). Here we show that two of the most productive marine calcifying species, the coccolithophores *Coccolithus pelagicus* and *Calcidiscus leptoporus*, do not follow the CO_2 related calcification response previously found. The two investigated species respond differently to changes in the seawater carbonate chemistry highlighting the need to consider species-specific effects when evaluating whole ecosystem responses.

In *C. leptoporus* particulate inorganic carbon (PIC) changes with increasing CO_2 concentration in a non-linear relationship. A PIC-optimum curve is obtained, with a maximum value at present day surface ocean pCO_2 levels ($\sim$360 ppm CO_2). With particulate organic carbon (POC) remaining constant over the range of CO_2 concentrations, the PIC/POC ratio also shows an optimum curve. In the *C. pelagicus* cultures neither PIC nor POC changes significantly over the CO_2 range tested, yielding a stable PIC/POC ratio. Since growth rate in both species did not change with pCO_2, POC- and PIC-production show the same pattern as POC and PIC. Changes of calcification rate (PIC-production) were highly correlated to changes in coccolith morphology. Since our experimental results suggest altered coccolith morphology (at least in the case of *C. leptoporus*) in the geological past, coccoliths originating from sedimentary records of periods with different CO_2 levels were analysed. Analysis of sediment samples was performed on six cores obtained from location well above the lysocline and covering a range of latitudes throughout the Atlantic Ocean. Scanning electron micrograph anal-

ysis of coccolith morphologies did not reveal any evidence for significant numbers of incomplete or malformed coccoliths of *C. pelagicus* and *C. leptoporus* in last glacial maximum and Holocene sediments. The discrepancy between experimental and geological results might be explained by adaptation to changing carbonate chemistry.

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