# Multi-species coccolithophore response to an anthropogenically-modified ocean

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Coccolithophores are one of the most important pelagic calcifying organisms in the present ocean to contribute to the organic carbon and carbonate pump of $pCO_2$ from the atmosphere into the deep ocean. As a major primary producer in the ocean, coccolithophores are responsible for fixation and drawdown of dissolved inorganic carbon into the deep ocean *via* the biological pump. Coccolithophores also calcify, and the production and export of calcium carbonate releases $CO_2$. The net influence of coccolithophores on $pCO_2$ depends partly on the particulate inorganic:organic carbon ratio (PIC/POC).

Major questions surround the species-specific nature of coccolithophore calcification in response to rising atmospheric $CO_2$ levels and the likely biogeochemical feedback on future climate. Here we investigate the assemblage - wide coccolithophore response to anthropogenically elevated $pCO_2$ using both culture experiments and field evidence from a North Atlantic core. The particle volume distribution data from the coccolith size-fraction of a rapidly accumulating North Atlantic sediment core appear to indicate that coccoliths produced by the larger coccolithophore species present at this location increase in mass in parallel with anthropogenic $CO_2$ release, in contrast to those of the smaller size, which decrease in mass. This contrasting behaviour is consistent with the results of our culture experiments of different species under conditions of carbonate chemistry which is decoupled from $pCO_2$. A divergence between the calcification response of these two coccolithophore size-groups could reflect contrasting physiological controls and evolutionary adaptation to $pCO_2$. This has significant implications for the realistic representation of an assemblage-wide $CO_2$-calcification response in numerical models.