Geochemistry constraints on diverse growth and calcification responses of multiple coccolithophore species to ocean acidification

YI-WEI LIU[1]*, SEBASTIAN ROKITTA[2], BJÖRN ROST[2], ROBERT EAGLE[3,4]

[1] Institute of Earth Sciences, Academia Sinica, 128, Sec. 2, Academia Road, Nangang, Taipei 11529, Taiwan (*Correspondence: liuyiwei@earth.sinica.edu.tw)

[2] Alfred Wegener Institute - Helmholtz-Centre for Polar- and Marine Research, Am Handelshafen 12, D-27570 Bremerhaven, Germany (Sebastian.Rokitta@awi.de; Bjoern.Rost@awi.de)

[3] Institute of the Environment and Sustainability, UCLA, LaKretz Hall, 619 Charles E Young Dr E #300, Los Angeles, CA90024, USA (robeagle@g.ucla.edu)

[4] Atmospheric and Oceanic Sciences Department, UCLA, Maths Science Building, 520 Portola Plaza, Los Angeles, CA90095, USA

There are growing concerns on the potential impacts of CO_2-induced ocean acidification (OA) on marine life. Coccolithophores are a major group of primary producers, accounting for about half of the calcium carbonate production in the ocean and playing an important role in the carbon cycle and ocean food webs. Culture experiments and observations have shown that the calcification and photosynthesis responses of coccolithophores under OA are complex and diverse. It has been postulated that coastal coccolithophores regulate the pH in their calcification vesicles and switch the carbon source to sustain growth under acidic experimental treatments. However, it is still unknown, whether pH regulation at the calcification site or utilization of different inorganic carbon species controls the diverse photosynthesis and calcification responses of different coccolithophore species to OA. Here we combined $\delta^{11}B$, $\delta^{13}C$, $\delta^{18}O$, trace elemental ratios (B/Ca, Mg/Ca, and Sr/Ca), and PIC/POC ratios to investigate the impact of OA on three species of coccolithophores that were reported to exhibit diverse growth rates, and different responses to OA with regard to photosynthesis and calcification. Preliminary results show distinct isotopic compositions and/or fractionation patterns of the three species, suggesting different strategies of pH regulation and inorganic carbon utilization. The combination of isotope analyses with conventional elemental analyses allows us to describe, evaluate and better understand kinetic effects of changing environmental parameters on the element incorporation and the isotopic fractionation of the coccolithophores.