The possible future of coccolithophores in an acidifying ocean

N. DELEBECQUE[1*], M. BOYE[1,5], PROBERT[2], J.N. SUTTON[1], E. PONZEVERA[3], G. LANGER[4], M-A. SICRE[5]

[1] LEMAR CNRS/UBO/IRD/IFREMER, Plouzané, France (*correspondence: nina.delebecque@univ-brest.fr)

[2]CNRS-UPMC, FR2424, Roscoff Culture Collection, Station Biologique de Roscoff, Roscoff, France

[3]Unité de Recherche Géosciences Marines, Ifremer, 29280, Plouzané, France

[4]The Marine Biological Association of the United Kingdom, The Laboratory, Citadell Hill, Plymouth, Devon PL1 2PB, UK

[5]LOCEAN, Sorbonne Universités, UPMC, 75252 Paris, France

About 30% of the carbon dioxide produced by human activities is absorbed by the ocean leading to a decrease of seawater pH and saturation state of calcium carbonate ($CaCO_3$). The subsequent ocean acidification will likely result in profound changes in marine ecosystems, in particular among the marine calcifiers. Coccolithophores, together with foraminifera, produce more than 90% of pelagic carbonate in the modern ocean. Culture experiments have shown that the response of coccolithophores to ocean acidification varies between and within species, complicating our understanding of the overall impact on the carbon cycle and feedback on climate. Indeed, different sensitivities to increases in dissolved CO_2 and decreases in seawater pH, and their consequences on calcification exist among coccolithophores, but they are still not fully described nor quantified. Calcareous coccoliths are formed inside the cell in an internal vesicle called the coccolith vesicle. The pH inside the coccolith vesicle is a central parameter determining calcite precipitation and therefore coccolith formation. Currently coccolith vesicle pH cannot be accurately measured and thus estimates have to be based on indirect geochemical evidence. The capacity to regulate pH in the coccolith vesicle under seawater pH < 8 allows for calcite precipitation, potentially explaining the resilience of some coccolithophores to ocean acidification. To further explore this hypothesis, two strains of *E. huxleyi* and of *C. leptoporus* morphotypes were grown in batch cultures under three different pH conditions to assess their response to changing seawater pH. Physiological parameters including growth rate, particulate inorganic carbon, and particulate organic carbon were examined, in addition to assessing changes in vesicle pH by measuring B/Ca and $\delta^{11}B$ in coccolith calcite.