



Future research on the effects of ocean acidification on marine calcifiers: a guide

J. Kleypas (1), R. Feely (2), V. Fabry (3), C. Langdon (4), C. Sabine (2), L. Robbins (5)

(1) National Center for Atmospheric Research, Boulder, CO, USA, (2) NOAA Pacific Marine Environmental Lab, NOAA, Seattle, WA, USA, (3) California State University – San Marcos, San Marcos, CA, USA, (4) Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL, (5) Center for Coastal and Watershed Studies, USGS, St. Petersburg, FL (kleypas@ucar.edu / Phone: 303-497-8111)

Evidence from a variety of scientific disciplines indicates that calcification rates are likely to decrease (and dissolution rates increase) in response to decreasing CaCO_3 saturation state by up to 60% within this century. However, these estimated rates often do not include other environmental and biological effects (e.g., rising temperature, adaptation); nor do they address the effects on organism fitness, community structure, and ecosystem functioning.

The St. Petersburg Workshop, a meeting sponsored by NSF, NOAA, and USGS, was designed to take the next step toward understanding the response of marine calcification to increasing atmospheric CO_2 concentration. Participants worked toward developing a consensus on what the most pressing scientific issues are, and to lay out the various research avenues for tackling these questions, and there was a satisfying convergence on the major scientific issues that should be pursued. These include:

1. Increased and improved monitoring of the carbonate system and calcification rates in both coastal and open-ocean carbonate environments, and of the distributions and abundances of calcifying organisms.
2. Better understanding of the biomechanisms of calcification within the major taxa.
3. Continued laboratory experiments that test

- (a) a broader array of taxa,
 - (b) manipulations that include other variables that affect calcification, and
 - (c) adaptation.
4. Field-based manipulation experiments.
 5. Strong engagement with the modeling community in all of these activities.

Some of these research tracks require technological development but others can be tackled immediately. While much work remains toward answering the fundamental question: “How will marine calcification rates respond to increasing atmospheric concentrations,” we need to begin investigations that look forward to answer the question: “What are the consequences of reduced calcification in both planktonic and marine calcifying communities and ecosystems,” and we should not wait until we answer the former question before tackling the latter.

We will outline the main recommendations of this report, which is designed to serve as a guide toward designing research that addresses these important questions.