Controls on cold-water coral mineralization through manipulation of separate carbonate chemistry parameters in culture

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Scleractinian cold-water corals are valuable archives of environmental change. They are of particular interest for developing baseline records of ocean acidification in the recent past and for reconstructing ocean carbonate chemistry during glacial interglacial cycles. However, there are two major obstacles in the development of carbonate system proxies in scleractinian coral skeletons. First, carbonate system parameters co-vary in natural seawater, making it difficult to identify controlling properties. Second, the mechanisms responsible for biomineralization in scleractinian cold water corals, as well as the relationship between biomineralization and geochemical proxies, still remain to be understood. We cultured both juvenile and adult *Balanophyllia elegans* – an asymbiotic cold water coral species native to the western coast of the United States – under conditions with decoupled carbonate chemistry parameters. Specifically, (1) pH was held constant while varying DIC and carbonate ion, (2) carbonate ion was help constant while varying pH and DIC, and (3) DIC was held constant while varying pH and carbonate ion.

We find that calcification rates in *B. elegans* are predominantly controlled by aragonite saturation state or carbonate ion concentrations – not pH or DIC. In addition, we observe that calcification rates are positive in *B. elegans* even when saturation state is less than 1, supporting previous studies showing pH up-regulation in corals using pH sensitive dyes and boron isotopes (Venn et al. 2013; McCulloch et al. 2012). Samples generated as part of this study also provide material for understanding the mechanistic underpinnings of carbonate system proxies in coral - including boron isotopes as a proxy for seawater pH and U/Ca as an indicator of carbonate ion concentration.

References:

McCulloch, M.T., et al. (2012) GCA **87**, 21-34.
Venn, A. A., et al. (2013) PNAS **110,** 1634-1639.