Biogeosciences Discuss., 12, C8112–C8113, 2015
www.biogeosciences-discuss.net/12/C8112/2015/

Biogeosciences
Discussions

Interactive comment on "Skeletal mineralogy of coral recruits under high temperature and $p\mathrm{CO_2}$" *by* T. Foster and P. L. Clode

Anonymous Referee #2

Received and published: 30 November 2015

The paper by Foster & Clode focuses on skeletal mineralogy of juvenile skeletons of scleractinian corals (Acropora spicifera) grown under high temperature (elevated by +3°C) and high pCO2 levels (~900 μatm). The main rationale for using this experimental setting was to check if "modern aragonitic corals, like their ancestors, are able to produce calcite in response to changing seawater chemistry". Aragonite has higher solubility than calcite hence if corals would have plasticity to adapt and produce calcite skeleton under high pCO2 they would be less vulnerable to anthropogenic ocean acidification. There are two aspects that should be better commented in the paper:

(1) It is not clearly explained what are the values of pCO2 and the temperature that could - theoretically - induce inorganic calcite precipitation at modern 5.1 mol/mol Mg/Ca seawater ratio. Noteworthy, the experiments with inorganic calcium carbon-

ate precipitation (with noticable effects on CaCO3 polymorphism) were performed by Lee & Morse (2010: Geology 38:115-118) at different pCO2 levels but at really low Mg/Ca values (1.2 mol/mol and 1.7 mol/mol). Also Balthasar and Cusack (2015: Geology 43:99–102) showed that none of the carbonic acid parameters had a noticeable systematic influence on CaCO3 polymorph proportions, thus suggesting that these influences were overprinted by Mg/Ca and temperature. In turn, Fine & Tchernov (2007: Science 315:1811) showed that in highly acidic waters (pH values of 7.3 to 7.6 for 12 months) skeleton of Oculina patagonica was completely dissolved but polyps maintained basic life functions as skeleton-less ecophenotypes. This experiment points to a lack of strong functional significance of the skeleton for the animal in experimental, aquarium conditions (opposite to real reef environment) and suggests that corals in highly acidic waters will rather lose the skeleton (skeleton will be dissolved) than they will keep it inducing it's mineralogical change. The experiment would be perhaps more interesting if the authors would test Mg/Ca and pCO2 values as in Lee & Morse (2010) experiments that in "inorganic world" promote calcite over aragonite precipitation.

(2) Even if skeletal mineralogy of solitary Cretaceous coral Coelosmilia described by Stolarski et al. (2007: Science 318: 92-94) was originally calcitic, there is no reason to believe that all corals share "ancient ability (...) to produce entirely calcitic skeleton". Especially Acropora which is phylogenetically very distant from Cretaceous solitary "caryophyliid" Coelosmilia. There are many coral lineages that in the Cretaceous formed aragonitic skeletons under highly reduced Mg/Ca ratio conditions (e.g., Sorauf 1999: J Paleontol 73:1029–1041); it is therefore more likely that coral response to environmental change is taxon-specific. Such taxon-specific response to ocean acidification (skeleton dissolution not mineralogical change) was actually showed by Rodolfo-Metalpa et al. (2011: Nature Climate Change 1:308–312): Cladocora caespitosa (large parts of the skeleton exposed) showed clear marks of dissolution, whereas Balanophyllia europaea (skeleton completely covered in tissue) was unaffected.

Interactive comment on Biogeosciences Discuss., 12, 12485, 2015.