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Interactive comment on "Ocean acidification accelerates dissolution of experimental coral reef communities" *by* S. Comeau et al.

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Response to A. Tribollet comments:

Comment 1: " Dear Steve and co-authors,Your article is very interesting and I hope that it will be published soon in Biogeosciences. I have a few questions and comments though. 1/ M&M and Discussion: Could you please precise if rubble and dead reef/corals were present in flumes in addition to sediments and live coral colonies? Rubble and dead reef areas are indeed an important component in reefs (see comment below)."

Response 1: Dear Aline, thank you for your useful comments. Rubble was present in the flumes and represented $\sim$ 5% of the cover. This information is now included

in the revised manuscript, lines 87-89 " In addition to corals, 6% of the surface was covered by crustose coralline algae (66% Porolithon onkodes and 33% Lithophyllum flavescens), and 5% by rubble (dead coral skeletons)."

Comment 2: "Conclusion: Bioerosion process does not result solely from the mechanical activity of organisms. It does include biogenic dissolution by microborers (e.g. review by 2008) and sponges for instance (Zundelevich et al. 2007; Wisshak et al. 2012, 2013). Please be more precise in the discussion when reporting "dissolution vs bioerosion pro- cesses". What do you mean by "dissolution"? When measuring net dissolution rates at the scale of a reef community, chemical dissolution (derived from the bacterial activity and chemical conditions) and biogenic dissolution are quantified simultaneously. Note that biogenic dissolution by microborers concerns all carbonate substrates in- cluding sediments, shells, live and dead corals, live and dead CCA, etc... This process cannot be ignored and is especially efficient in hard reef substrates (compare to sand). Similarly the whole process of bioerosion (i.e. mechanical abrasion by grazers, dissolution and abrasion by worms, bivalves, sponges and dissolution by microborers) is more intense in hard dead substrates than in live substrates and sand. The main agents of biogenic dissolution in reefs are microborers and OA should increase rates of biogenic dissolution by 50% or more by 2100 (Tribollet et al. 2009). Recent studies confirmed this positive effect and others showed a similar effects on boring sponges (Wisshak et al. 2012, 2013). Thus, part of the process of CaCO3 dissolution is missing if no rubble/dead reef pieces were added in flumes. I suggest to precise in the discussion that (a) part of the process of [biogenic] dissolution was overlooked as dead reef/rubble were not studied (if considered, they would amplify net dissolution rates measured during the day and especially at night) and (b) the ratio between living coral cover, sand AND dead reef areas will influence greatly the carbonate budget under OA conditions. Hoping that these comments will help. Best, Aline"

Response 2: Thanks Aline for this useful comment. The discussion has been reformulated to take into account this comment, lines 272-290 " During a mesocosm

experiment, Dove et al. (2013) also demonstrated that a pH of 7.7 caused a change in sediment granularity to favor small-grained (i.e., $\leq$ 1 mm) sediments as a result of dissolution or increased bioerosion of larger grains. In this case, bioerosion was more likely than dissolution, as dissolution would favor a loss of the smallest grains as a result of their higher surface area to volume ratio. Size-frequency distribution of sediment grain was not different between treatments at the end of our incubations and therefore is unlikely to have affected the treatment effects we detected. Sensitivity of coral reef communities to dissolution has been shown previously for communities constructed in mesocosms in Hawaii, where dissolution (-3.6 mmol CaCO3 m-2 h-1) was detected at night under conditions of double ambient pCO2 (Andersson et al., 2009). In this case, dissolution was attributed to the thin layer of sediment that accumulated at the bottom of the mesocosms (Andersson et al., 2009). In addition to chemical dissolution occurring in the communities constructed in the present study, we cannot exclude the possibility that at least some of the apparent community dissolution was caused by enhanced bioerosion, which for example previously has been show to occur when blocks of Porites lobata are incubated under 750 μatm pCO2 for 3-month (Tribollet et al. 2009). In future work it will be important to census the fragments of coral and rock to quantify the presence of bioeroders and their relative contribution to dissolution under ambient and OA conditions.".

As indicated previously, rubble was actually present in the flumes.

Interactive comment on Biogeosciences Discuss., 11, 12323, 2014.