Dear Anonymous Referee #1

We thank Referee #1 for your valuable comments, which have certainly helped us to improve our paper. We are glad the referee found our study helpful and significant to increase our understanding on how coralline algae can be affected by future climate conditions. Below we address his/her comments in full:

Comment: *1. In your introduction you mentioned that the CCA could contain dolomite and in your discussion you briefly mention brucite. Since XRD analyses were run, did you find evidence of either of these in your samples to help elucidate cement re-precipitation? Would SEM work perhaps help determine the presence of re-precipitation to support statements in the discussion?*

Answer: The main purpose of XRD analyses was to quantify the mol%$MgCO_3$ in CCA with the aim of using this information to calculate the saturation state of seawater with respect to high magnesium calcite. We did not use the XDR analysis to identify or quantify dolomite in these experimental CCAs, as this would have required further and more detailed analyses (Diaz-Pulido et al., 2014; Nash et al., 2012; Nash et al., 2011), which were not the purpose of our study. Certainly SEM will be useful to determine cement reprecipitation in coming manuscripts, but again, assessing potential reprecipitation processes under future climatic conditions was outside the scope of this study.

Comment: *2. I, like Mr. Wisshak in his short comments, wondered about the contribution of non-photosynthesizing microborers. If no quantification was made of these organisms, perhaps address this in the discussion and what future work could be done to estimate their influence.*

Answer: Referee#1, as well as Dr Wisshak, makes an interesting point. We have added some text at the end of paragraph 7 in the Discussion section to address this issue (also partly addressed in the reply to Dr Wisshake comments in the previous section). We did not quantify the biomass of samples in dark tanks because our study did not aim to separate every single eroding component in which case we would have had to use a totally different experimental approach and inhibitors to prevent bacterial/fungal growth for instance. Further, a different methodology to estimate such biomass would be necessary since after few trials with dark samples using the "scrapping off method" we identified that almost no organic matter could be recovered.

Discussion P7: Exposure to full dark conditions revealed that dissolution of CCA skeletons within the reef matrix, thus without photosynthetic microborers, is largely mediated by changes in seawater Ω_{HMC} across all CO_2-T treatments. Since CCA exposed to seawater supersaturated with respect to high-Mg calcite ($\Omega_{HMC} > 1$ for preindustrial, present-day and medium scenarios) also dissolved, this suggests that acidic and undersaturated interstitial seawater were likely generated by heterotrophic microbial metabolism (Dupraz et al., 2009; Andersson and Gledhill, 2013). Processes such as microbial respiration and/or sulfide oxidation have been related to the dissolution of reef carbonate sediments, with a preferential dissolution of the more soluble high-Mg calcite and aragonite phases (Burdige et al., 2010; Rao et al., 2012). Our results also indicated that CCA high-Mg calcite skeletons might undergo persistent environmental and/or heterotrophic metabolic dissolution across a range of CO_2-T levels. Given that coral skeletons may experience no dissolution under dark conditions, as aragonite undersaturation was neither chemically nor metabolically reached even under the "business-as-usual" scenario (Reyes-Nivia et al., 2013), this suggests that alterations in seawater saturation state of different carbonate phases play a critical role in the susceptibility to dissolution of major reef

components. **Future work should quantify the metabolic microenvironmetal control by non-phototrophic microborers and their potential relative contribution to the dissolution processes under changing climatic conditions.**

Comment: *3. At the top of page 3006 (line 1-2) you state that the environmental effect of seawater has a minor role in dissolution of skeletons with endolithic algae (referring to the HMC saturation state from the line before this statement). Then on page 3007 (line 1-2) you state that the HMC saturation state of seawater largely mediates dissolution of skeletons under all CO2 treatments. Based on what you show in your results, it might be good to clarify on 3007 which skeletons you are referring to (skeletons with or without photosynthesizing microborers). The difference(s) could be made clearer as you transition between topics.*

Answer: We have clarified the issue as suggested by adding (in bold style) we are referring to samples without photosynthesizing microborers:

Discussion P7: Exposure to full dark conditions revealed that dissolution of CCA skeletons within the reef matrix, **thus without photosynthetic microborers**, is largely mediated by changes in seawater Ω_{HMC} across all CO_2-T treatments.

References:

Andersson, A. J., and Gledhill, D.: Ocean acidification and coral reefs: effects on breakdown, dissolution, and net ecosystem calcification, Ann. Rev. Mar. Sci., 5, 321-348, doi:10.1146/annurev-marine-121211-172241, 2013.

Burdige, D. J., Hu, X., and Zimmerman, R. C.: The widespread occurrence of coupled carbonate dissolution/reprecipitation in surface sediments on the Bahamas Bank, Am. J. Sci., 310, 492-521, doi:10.2475/06.2010.03, 2010.

Diaz-Pulido, G., Nash, M. C., Anthony, K. R. N., Bender, D., Opdyke, B. N., Reyes-Nivia, C., and Troitzsch, U.: Greenhouse conditions induce mineralogical changes and dolomite accumulation in coralline algae on tropical reefs, Nat. Commun., 5, 3310, 2014.

Dupraz, C., Reid, R. P., Braissant, O., Decho, A. W., Norman, R. S., and Visscher, P. T.: Processes of carbonate precipitation in modern microbial mats, Earth-Sci Rev, 96, 141-162, doi:10.1016/j.earscirev.2008.10.005, 2009.

Nash, M. C., Troitzsch, U., Opdyke, B. N., Trafford, J. M., Russell, B. D., and Kline, D. I.: First discovery of dolomite and magnesite in living coralline algae and its geobiological implications, Biogeosciences, 8, 3331-3340, doi:10.5194/bg-8-3331-2011, 2011.

Nash, M. C., Opdyke, B. N., Troitzsch, U., Russell, B. D., Adey, W. H., Kato, A., Diaz-Pulido, G., Brent, C., Gardner, M., Prichard, J., and Kline, D. I.: Dolomite-rich coralline algae in reefs resist dissolution in acidified conditions, Nat. Clim. Change, 3, 268-272, doi:10.1038/nclimate1760, 2012.

Rao, A. M., Polerecky, L., Ionescu, D., Meysman, F. J., and De Beer, D.: The influence of pore-water advection, benthic photosynthesis, and respiration on calcium carbonate dynamics in reef sands, Limnol. Oceanogr., 57, 809, doi:10.4319/lo.2012.57.3.0000, 2012.

Reyes-Nivia, C., Diaz-Pulido, G., Kline, D. I., Hoegh-Guldberg, O., and Dove, S.: Ocean acidification and warming scenarios increase microbioerosion of coral skeletons, Glob. Change Bio., 19, 1919-1929, doi:10.1111/gcb.12158, 2013.