The role of calcification fluid pH in the precipitation of coral aragonite under future climate change scenarios

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Understanding how rising seawater pCO_2 and temperatures in combination affect coral aragonite accretion is essential for predicting the future of reef ecosystems. In a long term culture study of massive *Porites* spp. corals, increasing seawater temperature enhanced calcification in almost all corals, but the magnitude of the effect was seawater pCO_2 dependent [1]. The 3°C temperature increase enhanced calcification rate by 3% at 180 µatm, by 35% at 260 µatm and by 300% at 750 µatm. We used skeletal $\delta^{11}B$ to estimate the pH of the calcification fluid (pH_{CF}) at which skeletal precipitation occurs at each temperature. All corals increased pH_{CF} above that of the culture seawater but the temperature increase was associated with relatively lower pH_{CF} at low seawater pCO_2 and with relatively higher pH_{CF} at high seawater pCO_2. The enzyme Ca-ATPase pumps H^+ out of the coral calcification site, increasing pH_{CF}. Enhancing the activity of this enzyme at higher temperature could explain the pH_{CF} increase observed at high seawater pCO_2 but it is unclear why this effect is not observed at low seawater pCO_2. Our data demonstrate that coral calcification is not solely dependent on pH_{CF} but is also influenced by other factors e.g. the availability of organic matrix for skeletogenesis.

[1] Cole et al., Coral Reefs, https://doi.org/10.1007/s00338-018-1672-3, 2018.