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 pCO2 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 pCO2 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 δ13B to estimate the pH of the calcification fluid (pHCF) at which skeletal precipitation occurs at each temperature. All corals increased pHCF above that of the culture seawater but the temperature increase was associated with relatively lower pHCF at low seawater pCO2 and with relatively higher pHCF at high seawater pCO2. The enzyme Ca-ATPase pumps H+ out of the coral calcification site, increasing pHCF. Enhancing the activity of this enzyme at higher temperature could explain the pHCF increase observed at high seawater pCO2 but it is unclear why this effect is not observed at low seawater pCO2. Our data demonstrate that coral calcification is not solely dependent on pHCF but is also influenced by other factors e.g. the availability of organic matrix for skeletogenesis.