

$\delta^{11}\text{B}$ - B/Ca variations and calcifying fluid DIC and pH controls in a modern *Porites* coral from the Kimberley, northwest Australia

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Carbonate chemistry of the calcifying fluid (cf) in a *Porites* coral from thermally extreme Kimberley region in northwest Australia was studied on both seasonal and annual timescales using boron isotope and B/Ca ratios. Typical seasonal dynamics in internal carbonate chemistry was found to have enriched dissolved inorganic carbon (DIC_{cf}) with an ~ 2 -fold enrichment relative to ambient seawater. The calcifying fluid pH_{cf} is ~ 8.5 , an elevation of ~ 0.5 pH units above seawater. The elevated DIC_{cf} is attributed to the additional supply of metabolic CO_2 which combined with pH_{cf} up-regulation leads to elevated Ω_{cf} levels of ~ 16 to ~ 20 . Generally, for Kimberley coral the DIC_{cf} level tends to be lower and the pH_{cf} slightly higher than that observed in *Porites* from typical tropical reef environments.

In Kimberley region the period from 2013 to 2016 was characterised by intensified thermal stress with lower DIC_{cf} and subdued seasonal variability, probably the result of stress-induced decrease in metabolic performance in both the coral and its endosymbionts. However, pH_{cf} still remains at an elevated level and increases as DIC_{cf} draws down, hinting at the process of pH up-regulation being less affected by heat stress. Therefore, the aragonite saturation state Ω_{cf} in calcifying site remains relatively undisturbed since the increase in pH_{cf} largely offsets the effect of decreased DIC_{cf} on Ω_{cf} .

On annual scales the DIC_{cf} appears to be the primary driver for pH_{cf} as does on seasonal scales. We also find that the influence of DIC_{cf} on Ω_{cf} appears to be reduced during periods of thermal stress. In summary, as long as the interaction between coral and zooxanthellae remains intact we find that corals can manipulate its internal carbonate chemistry to facilitate calcification. However, under thermally stressed conditions this symbiosis breaks down which in turn makes corals relatively more susceptible to global warming than ocean acidification.