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Effect of pCO_2 and temperature on the Boron isotopic composition of the zooxanthellate coral *Acropora* sp.

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We have used a unique coral culture technique, which allows the manipulation of seawater temperature and $p\mathrm{CO}_2$, in order to assess the effects of these variables on boron isotopic composition in corals. Corals are important archives for geochemical proxies such as oxygen, carbon isotopes, trace elements, and more recently, boron isotopes. Boron isotope uptake in carbonates is controlled primarily by pH. Since a decrease in ocean pH can be interpreted as an increase in $p\mathrm{CO}_2$, several studies sought to apply the boron isotope paleo-pH proxy to determinations of past atmospheric CO_2. Corals should provide an ideal material for recording the paleo-pH of surface water.

We cultured nubbins of a branching scleractinian coral *Acropora* sp. and 4 conditions have been simulated: 430 μatm-25.3˚C (referred as "normal $p\mathrm{CO}_2$, normal temperature"), 446 μatm-28.2˚C ("normal $p\mathrm{CO}_2$, high temperature"), 712 μatm-25.1˚C ("high $p\mathrm{CO}_2$, normal temperature") and 738 μatm-28.3˚C ("high $p\mathrm{CO}_2$, high temperature"). Since the seawater used in this experiment had a known and constant *TA* (2.604 $\pm$ 0.004 meq kg^{-1}), we only changed the seawater pH to get a fixed value of $p\mathrm{CO}_2$. The regulation obtained during this experiment mimicked the shift in $p\mathrm{CO}_2$ that would occur within one century.

Our results indicate that δ^{11}B in corals is primarily driven by changes in seawater pH and is not affected by temperature. For corals cultured at "normal $p\mathrm{CO}_2$", the δ^{11}B of the skeleton is 24.0 $\pm$ 0.2 ‰ at 25˚C and 23.9 $\pm$ 0.3 ‰ at 28˚C. The values of δ^{11}B

measured for corals cultured at higher pCO$_2$ were lower: 22.5 ± 0.1 ‰ and 22.8 ± 0.1 ‰ at 25 and 28˚C, respectively. The δ^{13}C values of the skeleton are also a function of the pCO$_2$ treatment. Corals exposed to normal pCO$_2$ exhibit higher δ^{13}C values (–2.81 ± 0.13 and –2.75 ± 0.16 ‰, respectively for normal and high temperature) than corals exposed to high pCO$_2$ (-4.21 ± 0.17 and -4.14 ± 0.14 ‰, respectively for normal and high temperature). We observed a positive δ^{13}C -δ^{11}B correlation in the samples.

Our major conclusion indicates a lack of buffering by the coral on this range of pCO$_2$. Although competing effects of respiration, photosynthesis, and carbonate ion effect could make the interpretation of the δ^{13}C-δ^{11}B co-variation difficult, this experiment should allow the use of corals for studying past changes in ocean chemistry. Changes in pH of surface ocean water that result from changes in atmospheric pCO$_2$ can be recorded in corals.