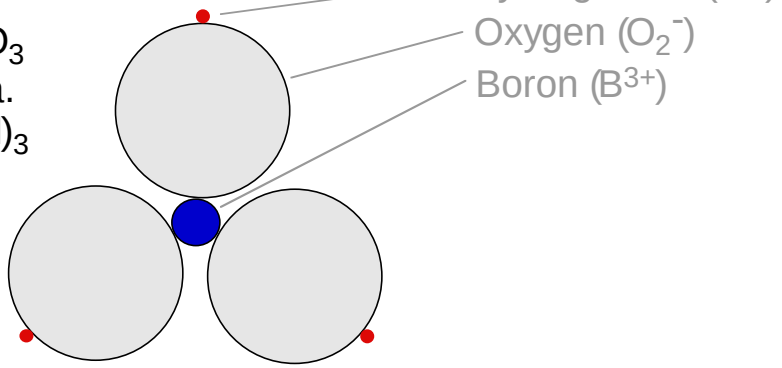
Boron in marine calcite as an indicator of ancient P_{CO_2}

This page provides a qualitative linkage of boron concentration in fossil marine $CaCO_3$ with CO_2 content of the ancient atmosphere. For more details and for data yielding actual P_{CO2} results, see Yu et al. (2007, *Paleoceanography* v. 22) and Tripati et al. (2009, *Science*).

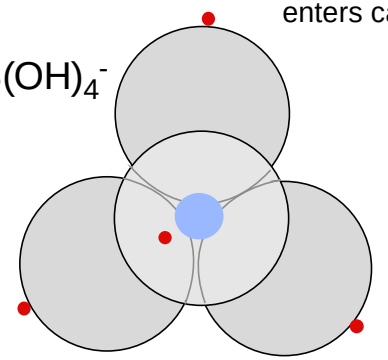
Dominant forms of dissolved boron and carbon in seawater at different values of pH:

H_3BO_3 a.k.a. $B(OH)_3$



Isotopic data ($\delta^{11}B$ values) indicate that this is the form of boron that enters calcite.

$B(OH)_4^-$



pH conditions:	Lower pH (less OH^- present)	Higher pH (more OH^- present)
	(remembering that H_2O <-> H^+ + OH^- and thus that pH + pOH = 14)	
Relative abundance of solutes:	Smaller $[B(OH)_4^-]/[HCO_3^-]$ ratio	Larger $[B(OH)_4^-]/[HCO_3^-]$ ratio
Parameter measured in calcite $CaCO_3$:	Smaller B/Ca ratio	Greater B/Ca ratio
Linkage of pH and P_{CO_2}:	Because most acidity in seawater comes from $CO_2 + H_2O$ –> H_2CO_3 (carbonic acid),	
	More CO_2	Less CO_2