The use of lithium and its isotopes in foraminifera as proxies for the past ocean DIC

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Experiments on the benthic foraminifera *Amphistegina lobifera* and *A. lessonii*, demonstrate that Li/Ca and δ^7Li in their shells allow good estimates of the seawater dissolved inorganic carbon [1]. The chemical and isotopic behaviour of these proxies are inherently connected to the biomineralization mechanisms of these organisms. Ca^{2+} is obtained directly by endocytosis (vacuolization) of seawater while the CO_3^{2-} is obtained by a carbon concentrating mechanism (CCM). This CCM involves pH elevation in the vacuoles mediated by Na^+/H^+ transporter and $CO_{2(aq)}$ diffusion into the alkaline vacuoles. Li^+ follows Na^+ and when DIC is low this transporter brings more Li with low δ^7Li into the vacuoles. At higher DIC levels the Li/Ca decreases and δ^7Li is higher. These proxies are thus recorded in the foraminiferal shells according to the DIC levels in the seawater.

Using both δ^{11}B and δ^7Li we can now estimate both the DIC level of the past ocean and its pH and calculate $CO_{2(aq)}$ and atmospheric pCO_2. Existing records of δ^7Li in foraminifera agree with our pCO_2 estimates.

[1] Vigier Nathalie, Claire Rollion-Bard; Yael Levenson; Jonathan Erez, (2015) Lithium isotopes in foraminifera shells as a novel proxy for the ocean dissolved inorganic carbon (DIC), **CR Geoscience**