

NEW CARBONATE SYSTEM PROXIES: Sr/Ca and U/Ca in foraminiferal calcite

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Global climate change is one of the most pressing challenges our society is facing. In combination with temperature reconstructions, accurate atmospheric paleo-CO₂ estimates are necessary to validate models that aim at predicting global temperature rise as a consequence of anthropogenic CO₂ emissions. Reconstructing the carbonate system of seawater is challenging due to the inter-dependency of the carbonate system parameters (e.g. CO₂ concentration and pH). Based on field and experimental data it has been suggested that foraminiferal U/Ca and Sr/Ca reflect changes in the carbonate system of seawater. Here we present results from a combination of modeling and laboratory experiments, to show the isolated impact of the different parameters of the carbonate system. We show that Sr/Ca is primarily influenced by DIC and bicarbonate ion concentration and that U/Ca is mainly governed by carbonate ion concentration. The former of the two is particularly promising since the impact of additional parameters (salinity, temperature, etc) is relatively well constrained for Sr and hence, carbonate system parameter reconstructions based on Sr/Ca may provide a relative high accuracy. In addition, Sr/Ca is known to be relatively similar within and between species, so that existing calibrations may be transferred relatively easily between species. Finally, we explore how our results can be used to advance conceptual understanding of the foraminiferal biomineralization mechanism.