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Foraminiferal K incorporation: new insight from species with different biomineralization mechanisms.

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Element incorporation in foraminiferal shells has been studied for decades and was shown very useful, especially in paleoceanographic reconstructions were these ratios are used as so-called proxies. Even though such proxies have been demonstrated useful, most lack a mechanistic understanding. In addition, the incorporation of an element can be affected by more than one environmental parameter. For example, Mg/Ca is primarily used as a proxy for temperature, but changes in past salinity and saturation state may also affect downcore records of Mg/Ca. Simultaneously, an environmental parameter usually affects the incorporation of more than one element. This realization calls for the use of multiple elements (and isotopes) in foraminiferal calcite to reconstruct multiple environmental parameters simultaneously. This requires an extension beyond the traditionally well-studied proxies, including new elements to be studied. Potassium is one of the most abundant elements in seawater that has hardly been studied in foraminiferal shells. Knowing the dependency of K incorporation as a function of seawater temperature, pH, etc. may provide an important addition to a multiple element / multiple parameter reconstruction calibration.

In this study we compare K incorporation in two different groups of benthic foraminifera, low Mg-Rotaliida, and Nodosariida, collected from the Gulf of Mexico, and results from a controlled growth experiment with varying temperatures. Results show that K incorporation seems to not be affected by temperature, or inorganic carbon chemistry parameters. Furthermore, potassium incorporation is strikingly similar between foraminiferal species, even when there are considerable differences between species in the concentrations of Mg, Na, Li, and Sr incorporated, which are most likely related to fundamental differences in their biomineralization pathways. Previous studies have demonstrated that K/Ca could be used as a proxy for [Ca_{sw}], this study supports this hypothesis by showing no interferences with other environmental parameters or biomineralization mechanisms and thereby providing a robust conservative constraint for a multi element calibration.