

EGU2020-18090

<https://doi.org/10.5194/egusphere-egu2020-18090>

EGU General Assembly 2020

© Author(s) 2020. This work is distributed under the Creative Commons Attribution 4.0 License.



Understanding the role of seawater vacuolisation in the biomineralisation of planktonic foraminifera using confocal microscopy

David Evans¹, Jonathan Erez², and Wolfgang Müller¹

¹Institute for Geosciences, Goethe University Frankfurt, Germany (evans@em.uni-frankfurt.de)

²Institute of Earth Sciences, The Hebrew University, Jerusalem, Israel

The calcite shells of planktonic foraminifera are a key archive for palaeoceanic reconstruction and represent one of the largest sinks of carbon from the surface ocean. Therefore, understanding the biomineralisation process of these organisms, and how responsive it is to ocean acidification, is an important part of accurately predicting the carbon cycle response to past and future climate change events. To date, the majority of the direct observational evidence on which foraminifera biomineralisation models are based comes from shallow-dwelling benthic species. Whilst this has provided a large amount of important information, it is not known how applicable these models are to the low-Mg planktonic foraminifera. In particular, key questions regarding the relative importance of seawater vacuolisation (SWV) versus calcium transmembrane transport (TMT) remain unresolved. We present the results of fluorescent labelling experiments on intact, decalcified planktonic foraminifera (*Globigerinoides ruber* and *Globigerinella siphonifera*) using the cell-impermeable dyes calcein, FITC-dextran, and SNARF-dextran, enabling direct observation of seawater vacuoles within the cell via confocal microscopy. Our results indicate that seawater endocytosis plays a dominant role in the calcification process. Seawater vacuoles can make up a large proportion of the intracellular volume, with a residence time on the order of hours. Moreover, we show that the skeleton is labelled with fluorescent dyes such that seawater derived from these vacuoles must be present at the calcification site. Along with inferences based on geochemical data [Evans *et al.*, 2018], our results strongly argue that biomineralisation models centred on seawater endocytosis are applicable to the planktonic foraminifera.

Evans, D., Erez, J., Müller, W. [2018] Assessing foraminifera biomineralisation models through trace element data of cultures under variable seawater chemistry. *GCA* **236**:198.