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Vesicle Dynamics In Foraminifera

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The calcium carbonate produced by foraminifera contains a wealth of information (so called ”proxies”) for paleoceanographical studies. The environmental conditions, under which they calcified, such as temperature, salinity, productivity and the ocean carbonate chemistry, are recorded in the geochemical composition of their shells (isotopic signature, trace metals concentrations). However, foraminifera maintain their own distinct (trace) metal homeostasis, which results in characteristic and species specific elemental ratios as well as in particular isotope fractionation (”vital effect”), which is offset from inorganic-thermodynamic equilibrium. In order to improve the predictive capability of the proxies it is important to identify the physiological processes controlling the chemical and isotopic composition of foraminiferal calcite.
Foraminifera precipitate calcite from modified seawater vacuoles, which are incorporated via the process of endocytosis (Erez 2003). We studied this vacuolisation process on juvenile foraminifera using fluorescent dyes (FITC-Dextran and Calcein) and confocal imagery. Specimens of the shallow, benthic foraminifer Ammonia tepida were incubated for various periods (ranging from 2-10 hrs) in seawater labelled with fluorescent dyes. After incubation the Petri dishes containing the foraminifera were carefully washed with seawater to remove the dye. Once the dishes were filled with fresh, unlabelled seawater the dynamics of the formed endocytosis vesicles were followed by means of confocal microscopy until chamber formation occurred. Depending on the length of the incubation period and the physiological status of the cell (prior/ after chamber formation) different patterns of vesicle cycling could be observed.

Keywords: foraminifera, cytology, biomineralization