Impact of day/night light cycle on trace metal uptake in the carbonate shells of symbiont-bearing benthic foraminifera

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The stable oxygen and carbon isotopic and elemental composition of foraminiferal shell calcite are popular tools to reconstruct past seawater conditions, including sea surface temperature and sea water carbonate chemistry. For example, Mg/Ca in foraminiferal shells is often used to estimate past temperatures. However, incorporation of Mg in foraminiferal calcite is not only a function of temperature, but also depends on other factors such as salinity and carbonate chemistry of the sea water (REF). Quantification of these controls and mechanistically understanding incorporation of magnesium (and that of other minor and trace elements) in shell carbonate is necessary to improve reliability of climate reconstructions based on these proxies.

Here we present results of controlled growth experiments, showing the influence of light on foraminiferal calcification and elemental composition of the resulting calcite. Day/night cyclicity may play an important, but so far largely ignored, role in foraminiferal biomineralization. In symbiont-bearing foraminifera, light enables photosynthesis which in turn modifies conditions (e.g. [O_2], pH, saturation state) in the foraminifers' micro-environment. Since the uptake of elements may be strongly dependent on conditions in these micro-environments, light may have an indirect impact on e.g. Mg/Ca. Cultured foraminifers of the species *Amphistegina lessonii* suggest a ~25% reduction in Mg/Ca when grown under constant light conditions compared to growth with a more natural (12h/12h) day/night light cycle. A similar reduction in incorporation is observed for (other) carbonate ion sensitive proxies such as Zn/Ca. These first results underscore the necessity to test day/ night cycles as well as light intensity on the incorporation of paleoceanographically relevant elements.