Carbonic anhydrase contribution in benthic foraminiferal calcification

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Fossil fuel burning is rapidly increasing atmospheric and oceanic CO_2 concentrations. The resulting pH decrease of the sea surface (ocean acidification) potentially affects marine calcifiers, although the relationship between dissolved CO_2 biomineralization remains elusive. Foraminifera are responsible for almost 25% of the total marine calcium carbonate production and understanding their response to ongoing ocean acidification is crucial in predicting the future of marine inorganic carbon cycling. Inorganic carbon uptake by foraminifera, an important step in the process of biomineralization, may include seawater vacuolization, active pumping through ions channels and/or passive diffusion of dissolved CO_2.

In order to better understand their carbon uptake mechanism, large benthic foraminifera *Amphistegina lessonnii* were cultivated with the addition of acetazolamide, a membrane-impermeable inhibitor, that targets the enzyme carbonic anhydrase (CA). Measurements of alkalinity and DIC of the seawater account for the amount of calcite precipitated by the foraminifera and allow us to assess the role of CA. Results indicate that carbonic anhydrase plays an important role in biomineralization of benthic foraminifera, likely by promoting cell-inward CO_2 diffusion. This may explain the observed modest response of foraminifera to increased dissolved carbon dioxide levels.

In addition to this observation, experiments showed that the photosynthetic activity of symbionts promotes calcification. This suggest that the energy supplied by photosynthesis eclipses a potential competition for inorganic carbon between photosynthesis and biomineralization.