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Impacts of ocean acidification on benthic foraminifera growth and calcification

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Foraminifera are expected to be particularly susceptible to future changes in the ocean carbonate chemistry as a function of increased atmospheric CO_2. Studies in an experimental recirculating seawater system were performed with a benthic foraminifer collected from intertidal mudflats on the Eden Estuary, N.E. Scotland. We investigated the experimental impacts of ocean acidification on survival, growth/calcification, morphology and the biometric features of Elphidium williamsoni. Specimens were exposed for 6 weeks to four different pH treatments that replicated future scenarios of a high CO_2 atmosphere and low seawater pH. In this study, experimental evidence revealed that declining seawater pH significantly affected foraminiferal survival rate, growth/calcification (mainly through test weight and thickness) and test morphology. SEM image analysis of live specimens at the end of the experimental period show significant changes in foraminiferal morphology with clear signs of dissolution and cracking processes on the test surface, septal bridges, sutures and feeding structures of specimens exposed to the lowest pH conditions.
These findings suggest that the morphological changes observed in shell feeding structures may serve to alter: (1) foraminiferal feeding efficiency and their long-term ecological competitiveness, (2) the energy transferred within the benthic food web with a subsequent shift in benthic community structures and (3) carbon cycling and total $CaCO_3$ production, both highly significant processes in coastal waters. These experimental results open-up the possibility of forward modelling the impacts of OA on both calcification and dissolution in benthic foraminifera within mid-latitudes intertidal environments.