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Intertidal foraminifera (Protista) and carbon-nitrogen cycling: combined effects of temperature and diet quality

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Benthic foraminifera (eukaryotic protists) are to a large extent acting as detrivores, feeding on microalgal detritus. Phytodetritus constitutes a main component of the intertidal carbon (C) and nitrogen (N) pool, thus making foraminifera important players in intertidal nutrient fluxes. These fluxes are strongly dependent on interactions between biotic and abiotic environmental factors, as e.g. the energetic value or the quality of phytodetritus that depends on environmental nutrient availability. Increased inorganic C concentrations in coastal water bodies (e.g. due to increased atmospheric CO_2) can have a negative effect on the phytodetrital quality by increasing microalgal C:N ratios. Simultanous warming of the environment can cause increased metabolic rates of exposed heterotrophic organisms, like foraminifera. The combination of lower food quality and increased metabolic rates is supposed to cause cascading effects on organismic C cycling, potentially diminishing the role of detrivorous food as a C sink in marine food webs by increased discharge of excess C.

In this study, the above described scenario was tested in laboratory feeding experiments on a common and abundant intertidal foraminiferal species (*Haynesina germanica*, collected in the German Wadden Sea). Two batches of artificially produced and dual isotope labeled (^{13}C and ^{15}N) chlorophyte detritus (1.5 g_{DW} m^{-2}) with different C:N ratios (5.5 and 7.6) and one batch of isotopically labelled diatom detritus (C:N 5.6) were fed under controlled conditions at three different temperatures. Results were extrapolated to the *in situ* abundance of live *H. germanica* individuals in the sampling area (sediment core data), to estimate the magnitude of the effect on an areal basis within the natural habitat.

The study revealed significant, temperature induced variations in the carbon and nitrogen processing of *H. germanica*. The food source with an increased C:N ratio doubled the release of carbon from the *H. germanica* community at 20°C in relation to 15°C, causing a theoretical carbon loss of 1000 μg m^{-2} within 24 hours. The uptake of diatom detritus was higher relative to chlorophyte detritus uptake, though the carbon release did not differ from the chlorophyte food source of similar C:N (C:N 5.5). The results illustrate the impact of altered environmental factors on benthic nutrient fluxes in foraminiferal communities, an important but often overlooked component of intertidal microfauna associations.