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The influence of labile and refractory C-org on benthic foraminifera: A laboratory mesocosm study

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The vertical distribution of benthic foraminiferal communities is believed to be controlled by food supply (C_{org} fluxes to the sea floor) and/or dissolved O_2 concentrations. However, the importance of quality or freshness of organic carbon has largely been neglected in previous studies. The C_{org} flux to the deep sea sediment is already degraded, as remineralisation begins immediately at the sea surface and continues through the water column. The extent of the degradation depends on several factors including O_2 exposure time, water column length and sedimentation rate (Hedges & Keil, 1995, and references within. *Marine Chemistry, 49*: 81-115). Therefore, even in locations where C_{org} concentrations are relatively high the nutritional value of organic matter may be low. This experiment is designed to explore whether benthic communities respond differently to varying qualities of organic matter.

A phytoplankton bloom was simulated using the diatom species *Thalassiosira pseudonana*. A 'labile' component consisted of fresh freeze dried algae, while a 'refractory' part was prepared by salinity shock treatment of diatoms with UHQ water. This process causes rupture of the diatom cells and releases labile carbon as CO_2. 39mg of either labile or refractory diatoms were added in the fed cores. In addition, blank (non-fed) cores were observed as a reference. The experiment was conducted under controlled laboratory conditions with stable oxygen concentrations.

In total the experiment ran for eight weeks after the feeding. Sampling was carried out at four time intervals: at experiment set up, before feeding, at four weeks and at eight weeks after feeding. Two cores were also collected from the field site for background information.

At each sampling time a replicate core was processed for foraminiferal studies. In addition, a core was sampled for geochemical analyses, including porewater and overlying water NO_3^-, NH_4^+ and DOC concentrations and fluxes, and bulk sediment C_{total}, C_{org} and N_{total} concentrations. The porewater oxygen concentrations were monitored periodically.

Bacterial potential activity is investigated in the different treatments and at each sampling time to ensure that the activity was consistent between the cores. Aerobic bacteria are quantified by plate counts whereas most probable number (MPN) technique is used to determine the activity of sulphate reducers and denitrifiers.

The results to date indicate that the microhabitat of benthic foraminifera deepens after feeding, as the oxygen content is not limiting and more C_{org} is available. This agrees with the predictions of the TROX model (Jorissen *et al.* 1995. *Marine Micropaleontology*, 26: 3-15). The initial assemblage is heavily dominated by *Melonis barleeanum*, however at four weeks after the feeding some species such as *Bolivina alata* and *Glomospira charoides* start to show higher relative abundances. In addition, in the high quality setting some living foraminifera show severe signs of dissolution, which may be related to CO_2 release from the degrading labile C_{org}. The porewater fluxes of NO_3^- and NH_4^+ become negative around 30 days after feeding, indicating that the breakdown of algae on the top of the cores has ceased. Highest fluxes of NO_3^- and NH_4^+ are observed in the high quality cores in proportion to the quantity of added carbon.