The relevance of epilithic foraminifera in ecological studies

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This study aims to emphasize the ecological importance of foraminifera contained within the > 1000 µm sediment fraction. Stones and gravel offer a habitat for diverse and rich epilithic foraminiferal communities. However, gravel-rich sediments > 1000 µm are usually not the subject of quantitative benthic foraminifera studies, because most foraminifera species used as proxies or bioindicators are sediment-dwelling and found within smaller sediment size fractions. Therefore, there is a current lack of knowledge about the biology and ecology of epilithic foraminifera, specifically about agglutinated species.

During a cruise at the Gullmarfjord/Sweden in September 2018, we retrieved a core at a station at 7 m water depth, which contained organic-rich material and a relatively large portion of gravel and shell fragments, which were densely populated by monothalamus, agglutinated foraminifera.

A faunal analysis of foraminifera in the > 1000 µm sediment fraction showed, that the most abundant species (> 85 %, 54 ind. 10 cm⁻³) in > 1000 µm consisted of Tholosina vesicularis, an unicellular agglutinated species that can reach up to 4 mm diameter. SEM-analysis revealed, that large quantities of partially decomposed diatom frustules were embedded within the protoplasm of T. vesicularis individuals, which were supposedly the remains of the foraminiferal diet. The sediment fraction of 125 - 1000 µm was dominated by Ammonia species (58 %, 190 ind. 10 cm⁻³), a genus known for its fast turnover of diatom-derived carbon and as key-players in benthic nutrient fluxes. Preliminary biovolume analysis of the two genera (T. vesicularis: n = 74, Ammonia spp.: n = 110) resulted in far higher values for T. vesicularis (853 ± 944 µm³ 10 cm⁻³, med. = 506 µm³ 10 cm⁻³), than for Ammonia spp. (117 ± 56 µm³ 10 cm⁻³, med. = 96 µm³ 10 cm⁻³), within the uppermost sediment layer of 0 - 1 cm. Therefore, T. vesicularis could be a main driver of benthic carbon turnover in gravel-dominated sediments. We hypothesize, that the epilithic fauna, when present is at least as relevant as sediment-dwelling species.

Additionally, biodiversity indices (species diversity, Shannon-Index, Evenness), show a slightly higher diversity and a more even distribution within the softer substrate, compared to the stones. This is most likely due to the motility of the free-living forms of the smaller size fraction, which
allows them a flexible response to spacial competition. However, niche separation between hard and soft-substrate allows the co-existence of the opportunistic species *T. vesicularis* and *Ammonia* spp..

In conclusion, this study shows, that if present, the > 1000 µm fraction can contain important information for the interpretation of ecological studies on the communities of live foraminifera and their role in marine ecosystems.