Geophysical Research Abstracts
Vol. 18, EGU2016-6812-1, 2016
EGU General Assembly 2016

A novel approach to the assess biotic oxygen consumption in marine sediment communities

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Bioturbation , the mixing of the sediment matrix by burrowing animals impacts sediment metabolism, including respiration through redistribution of particulate organics, changes in bacterial biota diversity and acitivity, as well as via burrowing fauna's own metabolism. Bioturbation, reflecting faunal activity, is also a proxy for the general sedimentary ecosystem health, and can be impacted by many of emerging marine environmental issues such as ocean acidification, warming and the occurrence of heat waves. Sedimentary oxygen consumption is often taken as a proxy for the activity of bioturbating fauna, but determining baselines can be difficult because of the confounding effects of other fauna and microbes present in sediments, as well as irnorganic processes that consume oxygen. Limitations therefore exist in current methodologies, and numerous confounding factors are hampering progress in this area.
Here, we present novel method for the assessment of sediment respiration which is expected to be affected only by the biogenic oxygen consumption (namely aerobic respiration). As long as tracer reduction "immune" to inorganic oxygen consumption, so that measurements using this method can be used, alongside traditional methods, to decouple biological respiration from inorganic oxygen consumption reactions. The tracer is easily detectable, non-toxic and can be applied in systems with constant oxygen supply. The latter allow for incubation without the need to to work with unsealed experimental units, bringing procedural advantage over traditional methods. Consequently assessed bioturbating fauna is not exposed to hypoxia and additional stress. Here, we had applied system for the first time to investigate impacts of a common North-Atlantic bioturbator, the brittle star Amphiura filiformis, - on respiration of marine sediments. Two series of experiments were conducted with animals and sediment collected from Cawsand Bay, Plymouth, UK
Preliminary results show that tracer reduction was about 30% higher in bioturbated sediment than in defaunated controls, and the correlation between tracer reduction and oxygen consumption was high (r=0.92). This study allowed us to calculate the actual amount of oxygen consumed by organisms in the tanks excluding inorganic oxygen consumption, and access the effects of bioturbation on respiration of the marine muds. We believe that this tracer system can be successfully used for respiration assessment in the marine environment and to improve the assessment of respiration in burrowing infauna.