Bioirrigation impacts on sediment respiration and microbial metabolic activity.

Background

- On of the key processes, regulating carbon sequestering in the lake sediment is environmental respiration.
- It was shown that sediment respiration rate is dependent on several external factors like water temperature, organic matter content, primary production and bioirrigation.
- Bioirrigation defines as fluid transport in the sediment matrix, induced by animals activity.

Research questions

- What is the influence of bioirrigation activity (of the chironomid larvae) on the sediment respiration?
- Is the density of bioturbators correlates with alteration in sediment respiration?
- Can resazurin bioactive tracer become a new, viable method for measuring environmental respiration in the lakes?

Methods

- Assessment of the oxygen consumption with bioactive tracer resazurin (Raz).
- Raz is serving as intermediate electron-acceptor in aerobic electron-transport chains. Raz transformation into fluorescent product resorufin (Rru) is well correlated with aerobic oxygen consumption in the system (r=0.8-0.986).
- Raz turnover rate (ln(Rru/Raz+1)*Δt) is a good proxy of respiration in the system.

Results

- Chironomids prescens has increased sediment respiration up to 2.5 time in comparison with sediment without animals (Fig. 3).
- Increase of the respiration, Raz turnover rate and Rru accumulation are proportional to the density of animals in the sediment (Figs. 4 A-C).
- Relationships between animals density and respiration increase are not linear, due to metabolic depression (MD). MD is decreasing organisms activity in the overpopulated sediment (Fig. 4 D).
- Raz reduction is well correlated with respiration of the sediment, but not the animals in the respiration chamber (Figs 5 A, B).

Conclusions

- Sediment respiration is increasing proportionally to the amount of bioirrigation
- MD is decreasing effects of bioirrigation on respiration of the overpopulated sediment
- Raz is allowing to separate microbial respiration from the respiration of the bioirrigators (chironomids).
- Raz is allowing to measure the sediment respiration in the systems with constant oxygen influx.
- Raz respiration assay is new promising method for environmental respiration measurement

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