Release and turn-over of carbon, nitrogen and metals under oxic and suboxic conditions in long-term incubations of Skagerrak sediments

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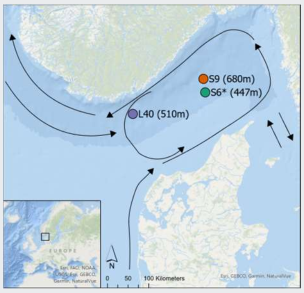
Introduction: The Skagerrak as study area



Currents[1], sampling stations and water depths in the Skagerrak.

- depot center for organic matter (OM) and contaminants due to mixing of water masses from the North Atlantic, North Sea and Baltic Sea[2, 3]
- sediment redox zones are spatially heterogeneous (depending on OM supply, currents, deep-water renewal)[2]

→ when eutrophication and currents change, the O_2 supply might change as well

[1] **Brückner & Mackensen**, 2006, *The Holocene* [2] **Canfield** *et al.*, 1993, *Marine Geology* [3] **Logemann** *et al.*, 2022, *Environmental Pollution*

What's this poster about?

Research questions

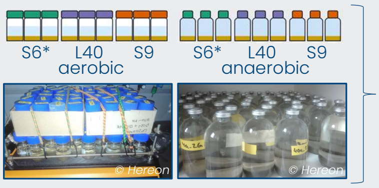
- how do remineralization pathways change with O_2 conditions?
- is $\delta^{98/95}$Mo a helpful tool to track changes in redox conditions?
- will legacy-pollutants be remobilized with changing O_2 conditions?

Methodology

- long-term (one year) sediment incubations
- $\delta^{98/95}$Mo as a redox tracer
- combined evaluation of nutrient and metal results

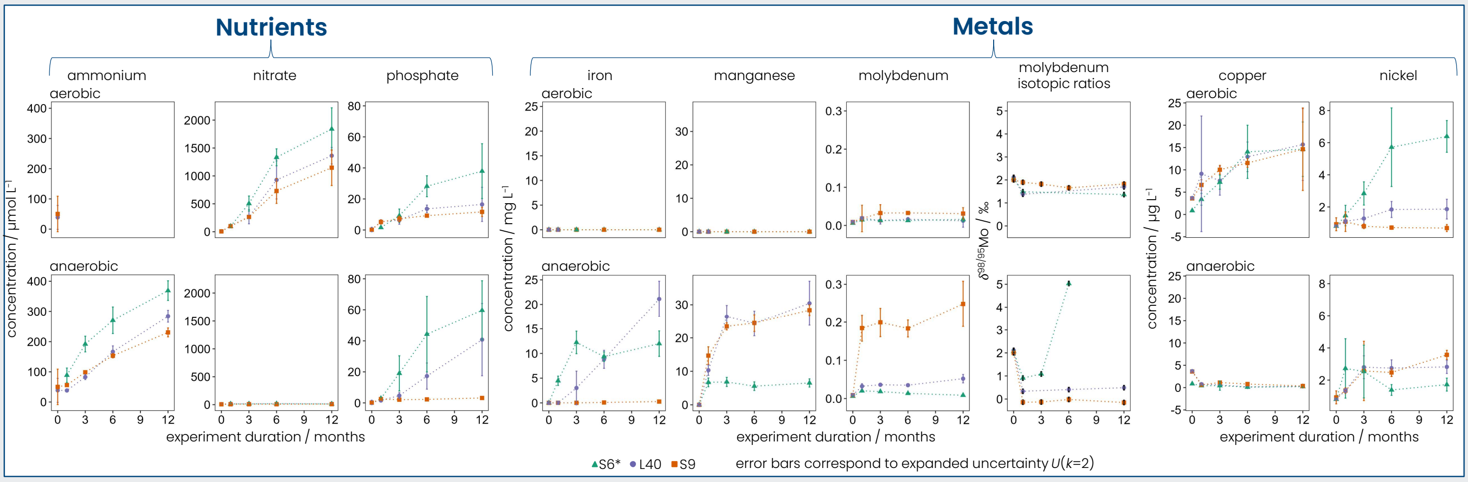
Approach: Long-term incubations

- sediment samples were taken at three stations (S6*, L40, S9) in the Skagerrak (HE586; October 2021)
- well-mixed sediments (0-10 cm) were incubated under aerobic and anaerobic conditions with low-nutrient seawater
- after 1, 3, 6, 12 months, the water from triplicate bottles from each core and condition were analyzed for metals (sea*FAST* ICP-MS[4]), $\delta^{98/95}$Mo (MC ICP-MS[5]) and nutrients (photometric)



[4] **Ebeling** *et al.*, 2022, *Geostandards and Geoanalytical Research* [5] **Mayer & Wieser**, 2014, *Journal of Analytical Atomic Spectrometry*

Results water



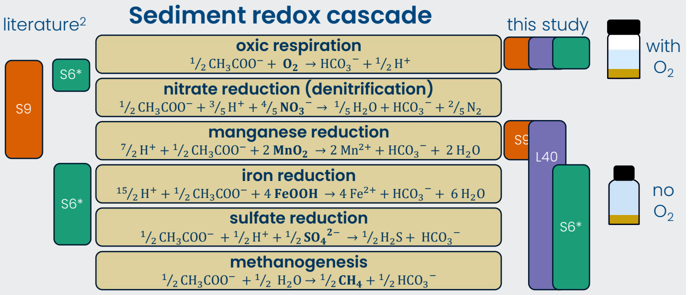
- strong differences between stations due to water depth, supplied OM and initial redox conditions
- stronger remineralization in aerobic than in anaerobic incubations
- under anaerobic conditions, only S6* (▲) and L40 (●) released phosphate

- S6* (▲)→ Fe and Mn reduction with desorption of light Mo isotopes in months 1-3
  → quantitative removal of Mo after month 3 (sulfidic), leading to high dissolved $\delta^{98/95}$Mo values
- L40 (●)→ initial Mn reduction with decreasing $\delta^{98/95}$Mo is followed by Fe reduction
- S9 (■) → Mn reduction and desorption of light Mo isotopes within the first three months
  → stagnating redox processes despite ongoing remineralization? Mn carbonate precipitation?
- release of Cu and Ni from aerobic sediments → re-pollution
- high variability between replicates for Ni release under anaerobic conditions
- Cu burial under anaerobic conditions

Summary & Outlook

- Mo isotopes can help to distinguish equilibration processes from secondary processes, but further analyses are needed
- long-term incubations are important to show trends beyond natural variability
- first DNA results reveal distinct differences between microbial communities
- first gas chromatographic results reveal methanogenesis in S6* and L40 incubations
- in future studies, further parameters should be included, e.g. sequential extraction, sulfide/sulfate, alkalinity

Sediment redox cascade



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