

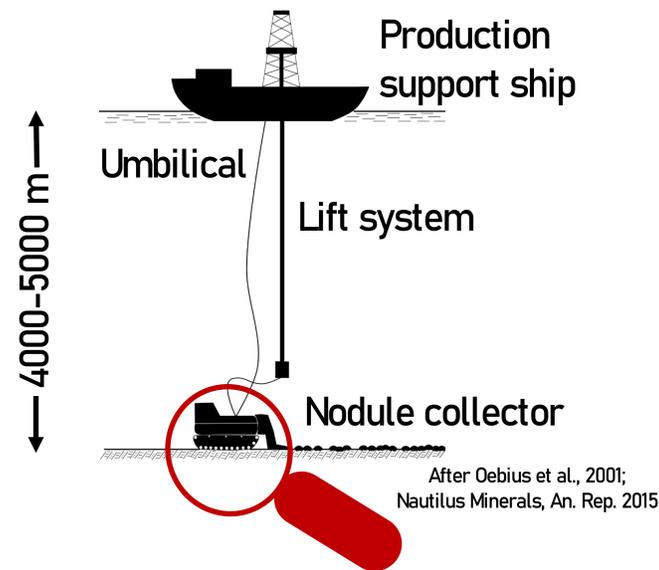


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Introduction

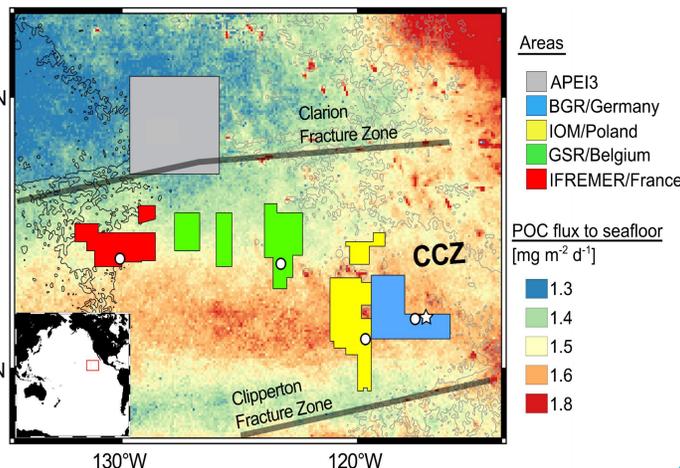
Concept of deep-sea mining



- What are the effects of deep-sea mining on sediment geochemistry?
- How long does it take to reach pre-mining geochemical conditions?

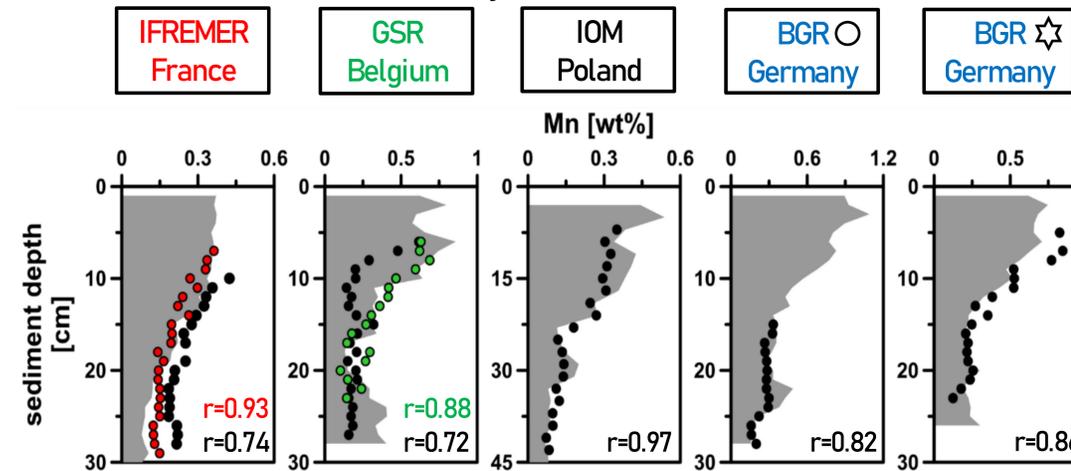
Material and methods

- R/V SONNE cruise S0239 to four European areas for polymetallic nodule exploration in the CCZ (see [video](#))
- Sampling of disturbance tracks of 1-d to 37-y-old small-scale mining simulations



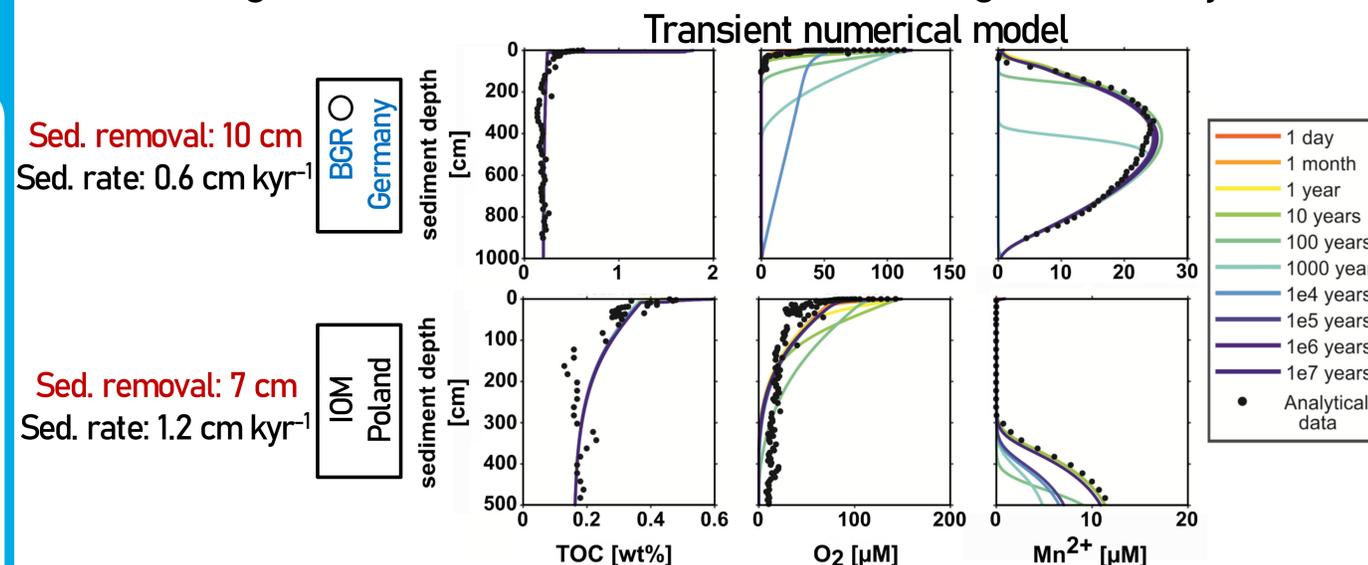
Results

Sediment removal by small-scale disturbances



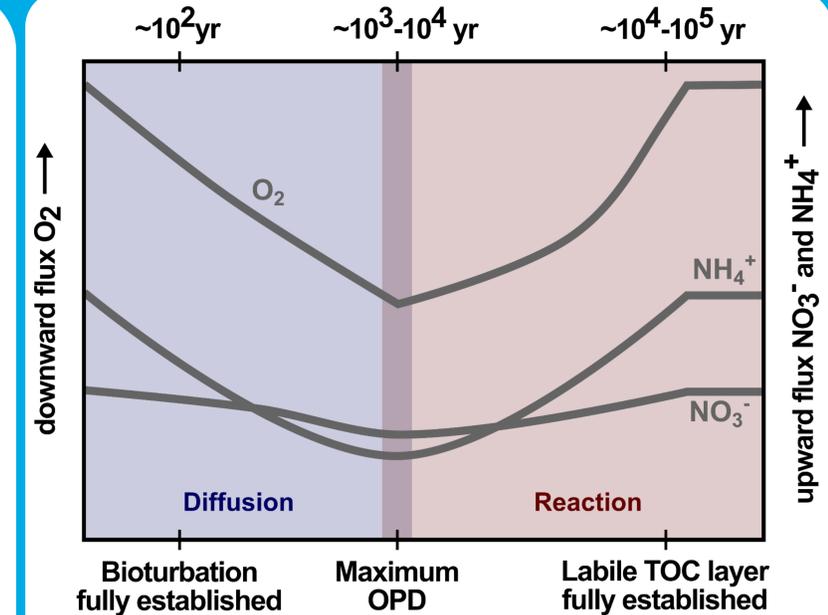
- Solid-phase Mn contents in surface sediments decrease with depth
- Pearson correlation r between undisturbed (grey) and disturbed (black and coloured dots) sediments used to determine sediment removal
- **5-15 cm sediment removal** by small-scale disturbances
- Sediment removal means **loss of labile total organic carbon (TOC) layer**
- Labile TOC: easily and rapidly degradable TOC fraction

Long-term effects of sediment removal on geochemistry



Loss of labile TOC layer → Lower consumption rates during aerobic respiration: **extension of oxic zone**, compression of suboxic zone (Mn²⁺) → Due to low **POC fluxes of < 2 mg m⁻² d⁻¹** to the seafloor and low **sedimentation rates of < 1.2 cm ky⁻¹**, recovery of the labile TOC layer is slow

Conclusions



- Diffusion-driven system for <10,000 y after disturbance until maximum oxygen penetration depth (OPD) is reached
- **Onset of biogeochemical reactions once removed labile TOC layer is partly re-established**
- Fully established labile TOC layer allows to **reach 'pre-mining' geochemical conditions <100,000 y after disturbance**

Further information

This study is published here: [Volz, J.B., Haffert, L., Haeckel, M., Kasten, S., 2020. Impact of small-scale disturbances on geochemical conditions, biogeochemical processes and element fluxes in surface sediments of the eastern Clarion-Clipperton Zone, Pacific Ocean. Biogeosciences, 17, 1113-1131.](#)

Acknowledgements

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