

Heavily disturbed seafloor shows recolonization by *Paleodictyon nodosum* within 26 years

Lilian Boehringer^{1,2}, Autun Purser¹, Yann Marcon³, Antje Boetius¹

¹Alfred-Wegener-Institute Helmholtz Center for Polar and Marine Research, Bremerhaven, Germany

²University of Bremen (Faculty 2, Biology/Chemistry), Bremen, Germany

³MARUM Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany



lilian.boehringer@awi.de



Timeline

- **1989 DISCOL experiment**
 Disturbance 26 yrs ago
 First visit of the DEA (DISCOL Experimental Area)
 Disturbance by plough-harrow
- **2015 Revisit of DEA**
August Disturbance 6 weeks ago
 Disturbance by Epi-Benthic Sledge
- **2015 Revisit of DEA**
September Survey
 Recolonization survey with advanced camera system (Ocean Floor Observation System – OFOS)

Polymetallic nodules

- Occur on abyssal plains as lumps of aggregated minerals rendering their collection under commercial consideration
- Provide hard substrate for sessile fauna and influence distribution of local infauna and bacterial communities¹

DISCOL experiment

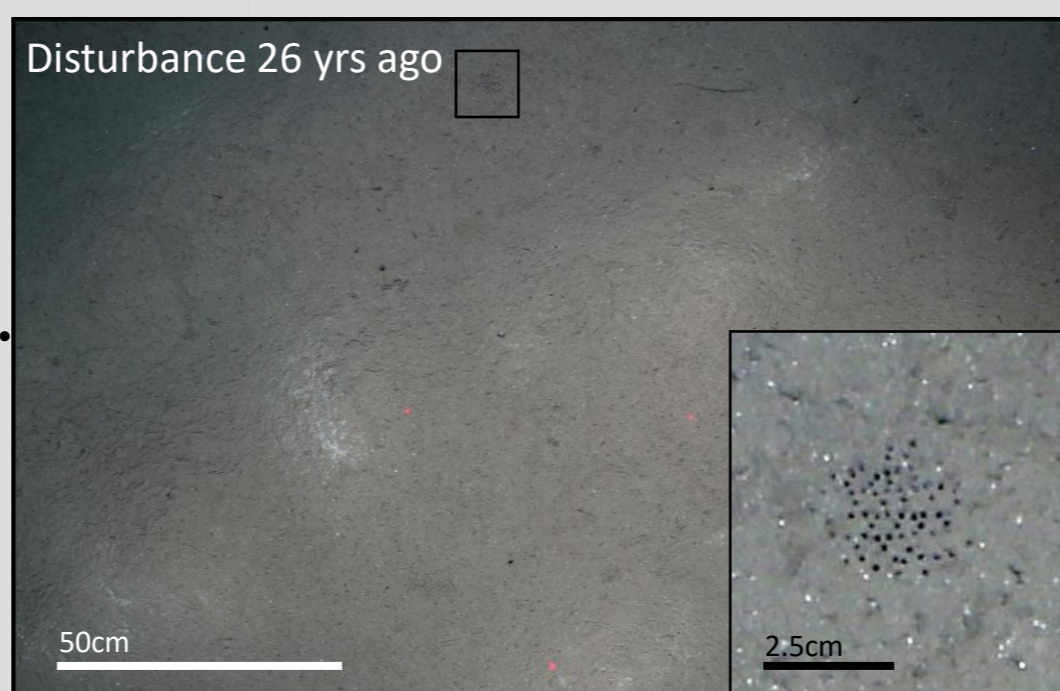
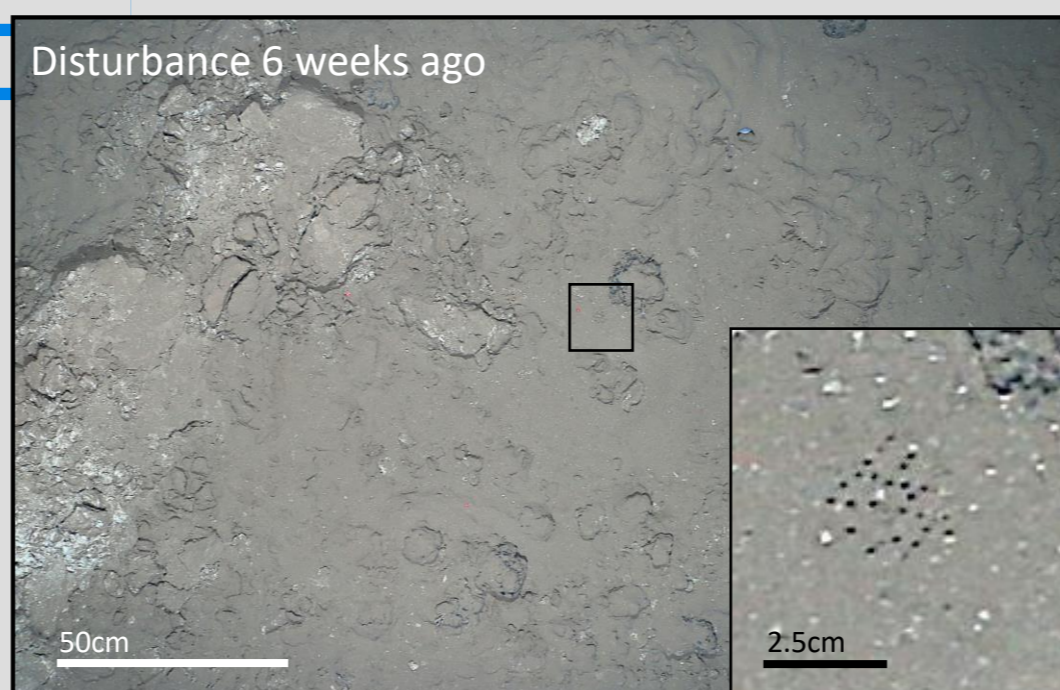
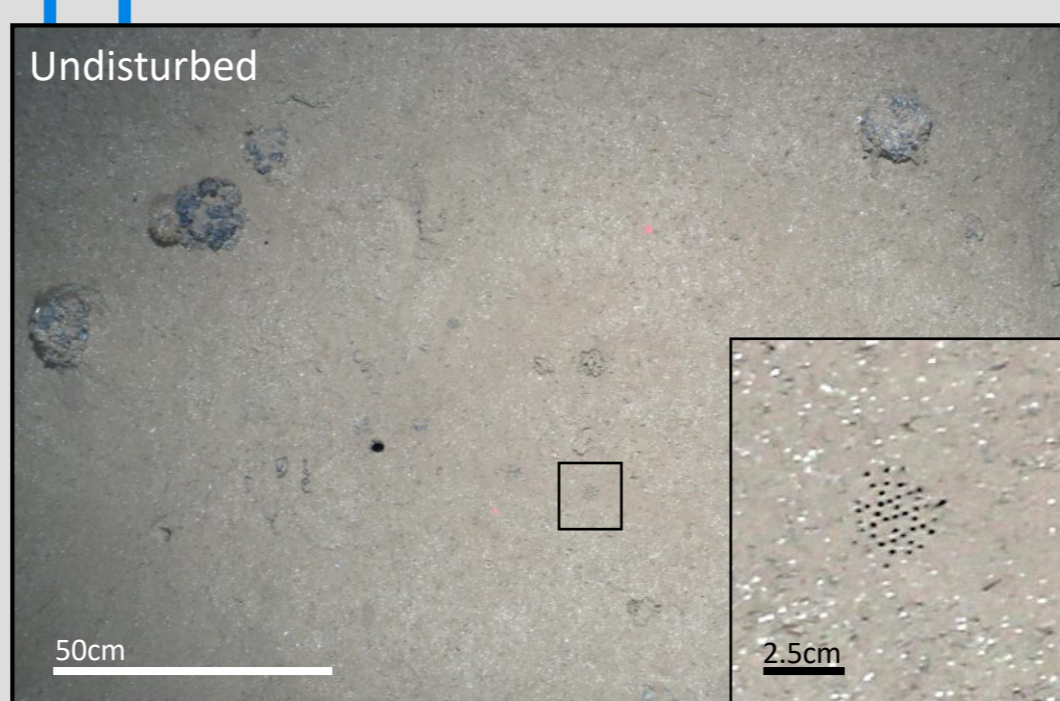
- Dis-turbance and Re-Col-onization (DISCOL) experiment in the Peru Basin in 1989 to assess environmental impact of nodule removal²

Background

- Nodules were buried into the sediments or pushed to the sides of the tracks using a plough-harrow
- Additional disturbance by Epi-benthic Sledge and recolonization survey 26 years later

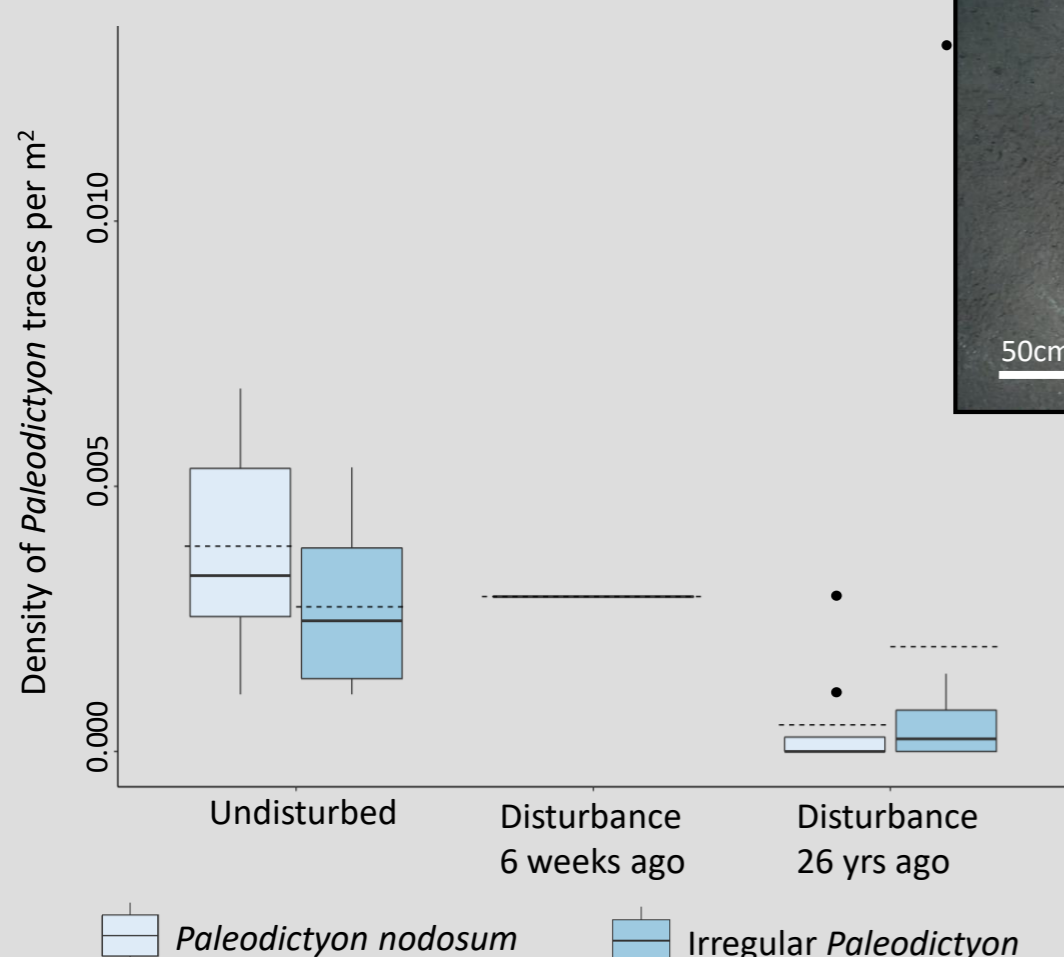
Paleodictyon nodosum

- Strikingly hexagonal hole arrays on sediment surface
- Holes penetrate into the sediment where they interconnect with a horizontal tube network³
- The responsible organism and its formation process was never identified



Results

- Regular and irregular *Paleodictyon* traces were found on all three substrate categories
- On substrate disturbed 26 yrs ago the density was significantly less compared to undisturbed substrate
- Maximum density of *Paleodictyon* traces on undisturbed substrate was much lower compared to other regions (e.g. Clarion-Clipperton Zone)⁴



Conclusions

- *Paleodictyon nodosum* can colonize disturbed habitat
- *P. nodosum* can produce the regular seafloor trace in less than 6 weeks
- However, after 26 years *P. nodosum* abundances have not recovered to pre-disturbance levels
- *Paleodictyon* traces on undisturbed substrate adjacent to disturbed areas may have been covered by resuspended sediments following disturbance

- ➔ The lifeform responsible for *Paleodictyon* traces is prone to disturbance
- ➔ Inhabiting fauna in areas adjacent to the disturbance might still suffer from sediment accumulation
- ➔ Crucial to gather more knowledge about nodule ecosystem functioning and inhabiting fauna

References

- ¹Vonnahne TR, Molari M, Janssen F, Wenzhöfer F, Haeckel M, Titschack J, Boetius A (2020) Effects of a deep-sea mining experiment on seafloor microbial communities and functions after 26 years. *Science Advances* 6
- ²Thiel H, Schriever G (1990) Deep-Sea Mining, Environmental Impact and the DISCOL Project. *Ambio* 19:245-250.
- ³Rona PA, Seilacher A, de Vargas C, et al (2009) *Paleodictyon nodosum*: A living fossil on the deep-sea floor. *Deep Res II* 56:1700-1712
- ⁴Durden JM, Simon-Lledó E, Gooday AJ, Jones DOB (2017) Abundance and morphology of *Paleodictyon nodosum*, observed at the Clarion-Clipperton Zone. *Mar Biodivers* 47:265-269