Long-term impacts of a manganese nodule mining experiment on sediment and pore water geochemistry

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Deep-sea mining has again been receiving increased attention in recent years. This development calls for action in the assessment of baseline geochemistry and possible impacts on the seafloor ecosystem caused by mining disturbances. In 2015, we revisited the DISCOL experimental area at 4100 m water depth in the Peru Basin 26 years after the DISCOL disturbance experiment mimicking manganese nodule mining had been carried out. Long-term impacts on the sediment and pore water geochemistry were studied in plough tracks and compared to undisturbed sites adjacent to the plough tracks and two reference sites.

Samples from multi-cores and ROV push cores were analyzed for major and trace elements with ICP-OES and ICP-MS. Pore water analyses of DOC, amino acids and $\delta^{15}N$ offered insights into degradation processes and completed the picture of the disturbance impact.

The results indicate that the pore water seems to have largely regained its equilibrium with respect to the major elements and trace metals (Mn, Fe, Cu, Cr, Mo, and V) after 26 years but slight variations in DOC, amino acids and $\delta^{15}N$ concentrations remain between the disturbed and undisturbed sites. Increased degradation and DOC release was discovered in a plough track. The solid sediment phase shows some differences between plough tracks and reference sites in the top 20-30 cm. Especially the upper layer, typically rich in manganese oxides and associated metals such as Mo, Co, Ni, and Cu, seems to be removed, mixed, turned or blanketed in disturbed sites and has not yet returned to the original layered structure.