

Spatial distribution of metal-cycling microbial communities along geochemical gradients in sediments of polymetallic nodule fields, Eastern Pacific Ocean

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The rising demand for critical raw materials is encouraging the international interest to explore and eventually exploit alternative resources from the deep sea. For this, large deposits of deep-sea polymetallic nodules in the Clarion-Clipperton Zone (CCZ), eastern Pacific Ocean are attractive. However, due to the lack of large-scale industrial mining trials, only little is known about the environmental consequences of deep-sea mining activities. To evaluate the impact on benthic deep-sea ecosystems, a baseline understanding of microbial communities and biogeochemical processes is crucial. In light of an industrial mining trial by the Belgian company DEME-GSR in spring 2021, we provide baseline environmental sediment data from designated mining trial areas in the Belgian (GSR) and German (BGR) exploration areas in the CCZ before the mining test. Additionally, we have studied sediments from a nodule-free area in the western part of the BGR area. Here, we present the abundance, diversity and distribution of the microbial communities and metal-cycling microorganisms along geochemical gradients in the sediments. As the sediments in the GSR area are mostly oxic throughout the upper 5 m, microbial communities may be restricted to metal-oxidizing microorganisms. In comparison, the sediments in the BGR area reach suboxic conditions (free Mn^{2+}) below ~2 m sediment depth with an extensive suboxic zone at the nodule-free site, which may be associated with abundant metal- and nitrate-reducing microorganisms. Our results may provide new insights in the spatial variations of deep-sea microbial communities and will serve as baseline data for the impact assessment after the mining trial.

