Metal distribution in sediments hosting manganese nodules in the Clarion Clipperton Fracture Zone (eastern equatorial Pacific Ocean)

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Manganese nodules in the Clarion Clipperton Fracture Zone (CCFZ) are rich in strategically important metals (Ni, Cu, Co, Mo) and represent a target for future mining operations. During nodule mining large-scale ecological and environmental impacts are expected as the sediments will be widely disturbed. For this reason, detailed knowledge of the sediment geochemistry, and the depositional and biogeochemical processes operating in this area, are essential.

In support of this, we collected sediment cores, up to 3 m long, during the RRS *James Cook* cruise JC120 to the CCFZ in 2015. Cores were taken from areas with different seafloor topography in an Area of Particular Environmental Interest (APEI-6) and from the UK claim area. In situ analyses of dissolved oxygen concentrations reveals that sediments from the UK claim area have a relatively low oxygen penetration depth (~1 m) compared to sediments from the APEI (>2 m).

Back onshore, variations in the chemical composition of the sediments was determined at high resolution using an XRF core scanner. For most elements, there is little difference in concentration between the APEI and the UK claim area. However, lower levels of some metals, in particular Fe, Mn, Cu, Ni, are found in association with beige 'ghost-like' elliptical features (~5 cm in diameter and 2 cm in height) in the sediments. These may represent the location of past oxic-suboxic boundaries and dissolution of Fe- and Mn-oxhydroxide phases, bioturbation or input of a material from a different source. The level of metal depletion in the sediment is highest in the UK claim area and correlates with the highest density of manganese nodules on top of the sediment, indiacting that metal mobilization from the sediment might have contributed to diagenetic Mn-nodule formation. Our results show that mining of Mn-nodules might have different environmental impacts in different areas of the CCFZ, depending on the redox-conditions and metal contents of the underlying sediments.