Transformation of buried nodules under suboxic conditions within sediments of the central Pacific

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Nodules from the Clarion - Clipperton Zone (CCZ) of the Pacific Ocean show high concentrations of economically relevant metals (e.g., Ni, Cu, Co, Mo) and are therefore of high interest for research and industry. In general, nodules form on the sediment surface or within the upper few cm of the sediments in water depths up to ~6km. High resolution side-scan sonar images indicate that there are deeper layers of nodules within the sediment, which are probably widely distributed within the CCZ. Up to now, buried nodules are only known from the Peru Basin.

Buried nodules differ in their mineralogy and chemistry from surface nodules. Surface nodules consist mineralogically of phyllomanganates whereas buried nodules consist mainly of todorokite. The Ni content of buried nodules is lower than of surface nodules, which is related to the transformation of phyllomanganates into todorokite due diagenesis. In contrast, the Co content of buried nodules is up to three times higher than of surface nodules. Co *K-edge* EXAFS for buried nodules indicate that Co^{3+} is completely incorporated within the octahedral-sheets of the Mn-phases of suboxic-diagenetic growth structures (GS) and not of hydrogenetic GS, as it is common in surface nodules. Here we propose that the Co enrichment of suboxic-diagenetic GS is due to dissolution of hydrogenetic GS after nodules become buried under suboxic conditions. Co is incorporated belated into the more stable Mn-phases. Nickel and Cu are in both nodule types mainly incorporated within the octahedral-sheets of the Mn-phases of suboxic-diagenetic GS.