Trace metal distribution in iron manganese oxyhydroxide crusts from a Tasmantid Seamount

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Iron-manganese oxyhydroxide crusts (Fe-Mn crusts) are common on hard-rock substrates through the ocean basins and can form in a variety of ways, including slow precipitation of metals from seawater, mobilisation of Mn from the sediment column followed by precipitation at the sediment/water interface, hydrothermal fluids, or biogenic processes [1]. Trace metal signatures may be an indicator for different processes involved in Fe-Mn crust formation. We investigated the distribution of trace metals and structures in two laminated Fe-Mn crusts from the west and southwestern flanks of South Recorder Guyot, one of the Tasmantid Seamounts, using X-ray fluorescence microscopy (XFM) and scanning electron microscopy. Microbial fossils were common within the Fe-Mn crusts. The main Mn minerals were identified by Raman spectroscopy and X-ray diffraction as todorokite and birnessite and there was an Fe-rich quartz and clay phase throughout the crusts. Synchrotron XFM provided detailed, high-resolution images of trace metal distribution in the crusts and revealed textures and elemental associations that were not distinguishable using energy dispersive spectroscopy. Ni tended to preference the Fe-Mn oxide phase compared to Fe-rich clay and quartz regions. Other biologically relevant trace metals, i.e., Zn and Cu, were either not detected or showed no preference for either phase in the crusts. Co had an affinity for the Fe and silica phase, in contrast to first order electrochemical predictions that favour association of Co with Mn, thus there may be a secondary diagenetic component in formation of these Fe-Mn crusts. Our results suggest that a variety of processes, including secondary diagenesis and biological processes are involved in formation of these Fe-Mn crusts.

[1] Hein, Koschinsky, Bau, Manheim, Kang & Roberts (1999) in *Handbook of Marine Mineral Deposits*, Cronan (ed), 239-280, CRC Press, Boca Raton.