Formation of Fe-Mn crust in Western Pacific Magellan Seamount

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Redox reaction is a ubiquitous process in the formation of ferromanganese crust that may reflect one of formational conditions, particularly variations of Fe/Mn redox states and microbial diversity in the crust. Samples were dredged from the western Pacific Magellan Seamount (OSM11) to investigate the biotic/abiotic redox reaction in the formation of the crust that consists of five well-defined layers from the rim (layer 1) to the core (layer 5). Mineralogy, morphology and Fe oxidation state in each layer were determined by XRD, SEM, TEM, SAED pattern, EDX and EELS. Fe-rich vernadite was detected in all layers while quartz, feldspar and hematite only appeared in layer 1, and carbonate fluorapatite (CFA) was observed in layer 4 and 5. The oxidation states of Fe in Fe-rich vernadite measured by EELS showed distinct change between layers ranging 36 - 60 % of Fe^{3+}/Fe^{tot}. PCR analysis indicated the presence of functional gene (cumA; 1056bp & coxC; 810bp) association with Mn & Fe oxidizer suggesting that the biotic Mn & Fe oxidation may promote the formation of the Fe-Mn crust. Moreover, some organic-derived features and structures detected in all five layers through the SEM analysis suggested that there should be local biotic contributions when Fe-Mn crust formed.