GEOCHEMISTRY OF HYDROTHERMAL DEPOSITS FROM THE SUMMIT REGION OF LOIHI SEAMOUNT, HAWAI'I

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ABSTRACT

Mineralogical composition, major, minor and rare earth element chemistry, and uranium-series radionuclides were determined for hydrothermal iron-rich deposits from five hydrothermal vent fields on the summit of Loihi Seamount, Hawai'i. The mineralogy and the major and trace element distribution in the deposits were compared to, and are in general agreement with, other works on intra-plate submarine hydrothermal deposits. Elemental ratios, R- and Q-mode factor analysis reveal two distinct geochemical regimes in the study area represented by materials from Pele's Vents and Thousand Fingers Field respectively. Hydrothermal deposits from Pele's Vents hydrothermal field on the summit cone of the volcano are relatively enriched in iron oxyhydroxides and elements that are readily scavenged by them. Materials from the Thousand Fingers Field, located about 1.5 km to the northeast of Pele's Vents, consist of amorphous iron oxides and a substantial fraction of hyaloclastics. Mineralogical and statistical analysis identified an additional fraction of amorphous silica. Authigenic smectites could not be indentified by x-ray diffraction but statistical analysis resolved one major component consistent with a fraction of such clays. Shale-normalized rare earth element patterns indicate that deposits from Pele's Vents form in an environment dominated by hydrothermal fluid whereas the Thousand Fingers Field deposits are heavily influenced by seawater during formation. Determination of growth rates via excess ^{210}Pb profiling yields high metal accumulation rates compared to metalliferous sediments from various Pacific regions, in particular with respect to Fe which accumulates at rates between 0.2 and 23 g cm^{-2} kyr^{-1}. ^{238}U profiles of cores taken by submersible suggest that hydrothermal activity in the Thousand Fingers Field region may be subject to periodic changes in intensity and/or chemical character. These changes may occur on intervals of the order of hundreds of years.