

Growth Process and Metal Accumulation of Hydrogenetic Ferromanganese Crusts: Joint Study in the NW Pacific Seamounts

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We have been conducting a joint program with geologists, mineralogists, geochemists, physical engineers, and microbiologists in order to characterize geochemical and mineralogical variations in space and time of the crusts which have proved most important for effective mineral exploration, resource evaluation, and paleoceanographic reconstruction studies. Our latest cruises including 16 dives using a Remotely operated vehicle (ROV) Hyper-Dolphin 3K of JAMSTEC included in-situ measurement of physico-chemical parameters and careful sampling of undisturbed and uncontaminated ferromanganese crusts at depths between 800-4500m water depths from three typical model seamounts in the NW Pacific. The collected samples were analyzed in two series; for a water-depth dependency taken at 500m depth intervals and a secular variation from the very surface to the substrate.

The geochemical and mineralogical analyses resulted in following conclusions.

- 1) The growth rates or accumulation rates of major elements are quite constant and growth has been continuous in wide ranges of regional areas and water depths. The growth started middle Miocene or much earlier. The rates are amazingly constant within and outside of the oxygen minimum zone (OMZ).
- 2) Dissolved oxygen profiles are quite similar to each other along the mapping lines. The chemical variability is quite dependent with water depth, which is probably due to stratified water structures.
- 3) The secular variations in element concentration are generally similar among three areas, indicating again similar pattern of oceanographic and geological history among those.
- 4) These well-correlated nature and compatible geochemical and mineralogical description may ascertain reliable evaluation and possible exploration of the crusts over the area and water depths.

Keywords: hydrogenetic, ferromanganese crust, manganese nodule, seamount, NW Pacific, rare metal