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Geochemical Variability and Enrichment of Critical Metals in Ferromanganese Crusts from the Louisville Seamount Chain (Southwest Pacific)

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Ferromanganese crusts represent promising archives and resources for critical metals, including Co, Ni, Pt, and rare earth elements (REE). They form on seamounts in pelagic environments through the slow precipitation of Fe-oxyhydroxides and Mn-oxides over millions of years [1]. Due to their exceptionally low accretion rates, these crusts preserve long-term records of seawater chemistry, making them invaluable for paleooceanographic reconstructions [2]. Despite their importance, the formative processes and subsequent diagenetic alterations remain subjects of active debate.

During Cruise SO313, three seamounts of the Louisville Ridge (Southwest Pacific) were sampled across a broad bathymetric range (1114 to 4048 m water depth) to assess the region's economic potential. This study integrates bulk compositional data with high-resolution geochemical analyses of individual growth layers to evaluate chemical variability in relation to water depth and geomorphological position. Our findings identify key geochemical indicators that serve as proxies to constrain prospective targets, providing a framework for future exploration. Preliminary results highlight significant cobalt enrichment (>2 wt% Co) at seamount summits, followed by a descending trend in Co content with increasing water depth.

References:

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