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Seafloor Sediments of the Gigante Seamount Complex, Mid-Atlantic Ridge: Insights into Mineralogy, Geochemistry, and Possible Signatures of Hydrothermal Activities

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The Gigante Seamount Complex (GSC), located in the western part of the Mid-Atlantic Ridge, is formed by fissural volcanism along the central ridge and transform faults. On its eastern slope, it was recently discovered the Luso hydrothermal field, characterized by low-temperature chimneys formed by Fe(-Mn) oxyhydroxides (OH) and amorphous Si (Opal A). The seafloor sediments in the area are characterized by a range of fine to coarse particles. Finer sediments are composed mostly of biogenic material and are located on the central ridge, ~2.2 km southwest of the Luso field. This work presents the mineralogy and geochemistry of the GSC surficial seafloor sediments, including those from proxy and distal areas of the Luso HF, using techniques such as XRD, ICPMS, and INAA. In general, the sediments are characterized by a mixture of detritic fractions from different origins: biogenic (carbonated bioclastic fragments), lithogenic (volcanic) and variable proportions of amorphous OH precipitates. Sequential extraction using sodium acetate buffer and Loss on Ignition (LOI) and XRD analysis revealed a variable percentage of carbonate phases (calcite and aragonite; TCC = ~15-80%) but a more constant organic component (LOI= ~10-20%). The sediments located around the mounts are dominated by volcanic lithoclasts (feldspar, pyroxene and glass), while those located in the western part of the studied area are mainly composed of bioclastic carbonates (>60%). A principal component analysis (PCA) reveals that 90% of the variance in the total elemental composition can be explained by two components that include the concentrations in Fe, Mn, Co, Si, Mg, Ca, Ti, and rare earth elements (REEs). PCAs performed separately for major and minor elements indicate that Si, Al, and Ca explain a large percentage of the variance for major elements, while Ba, Co, Pb, V, Zn, and Zr contribute significantly to explain the variance for minor elements. Discriminatory diagrams and geochemical data (e.g., positive Eu anomaly, enrichment in metals) reveal hydrothermal signatures in some of the sediments, indicating possible additional hydrothermal activities in this area.

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