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Metalliferous Sediments Associated with Presently Forming Volcanogenic Massive Sulfides: The SuSu Knolls Hydrothermal Field, Eastern Manus Basin, Papua New Guinea

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Abstract

Short sediment cores were examined from the active SuSu Knolls hydrothermal field in the eastern Manus back-arc basin, Papua New Guinea, in order to explain the origin of the currently accumulating metalliferous sediments. The mineralogy and geochemistry of the sediments were studied by X-ray diffraction, scanning electron microscopy, energy dispersive X-ray fluorescence, and instrumental neutron activation analysis. Sediments of the Suzette site originated from the deposition of volcaniclastic material with the addition of a hydrothermal component from the mass wasting of old oxidized chimneys. A strong mass wasting event was recognized at the base of the studied sedimentary succession from the occurrence of chalcopyrite, pyrite, and barite aggregates, similar to those found in chimneys, as well as the presence of atacamite. The metalliferous component is characterized by high concentrations of Cu (up to 2.3%) and Au (up to 3.5 ppm), elevated concentrations of As, Ba, Zn, and Fe, as well as a positive Eu anomaly. The material derived from eroded chimneys was deposited together with abundant glass fragments eroded from the volcanic edifice. The mass wasting was succeeded by deposition of volcaniclastic sediment containing dacite fragments, Ca plagioclase, pyroxene, glass shards, cristobalite, Si-rich amorphous material, alunite, pyrite, barite, and magnetite. The volcaniclastic sediment may have originated from hydrothermal eruptions at North Su and South Su. The present-day plume at Suzette is a likely source of rare barite aggregates, amorphous Cu-containing aggregates, and Cu-Fe sulfides creating geochemical anomalies of Ba and Cu in the uppermost sediments at Suzette. Interbedded volcaniclastic and hemipelagic sediments were retrieved east and west of SuSu Knolls. The enrichment of Mn in these sediments is considered to be a result of settling of Mn oxides from a hydrothermal plume.

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