

Geochemical Fractions of Heavy Metals in Bottom Sediments of the Pobeda Hydrothermal Field, Mid-Atlantic Ridge (17°07'–17°08' N) [†]

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Abstract: We examined the distribution of Fe, Mn, Cu, Zn, and Pb in one core of metalliferous, and one core of non-mineralized (background) carbonate sediments (located 69 km northwards), from the Pobeda hydrothermal field. Mechanisms of metal accumulation in sediments (12 samples) were evaluated based on sequential extraction of geochemical fractions, including mobile (exchangeable complex, authigenic Fe-Mn hydroxides, and sulfides), and lithogenic (fixed in crystalline lattices) forms. Maps of element distribution in sediment components were obtained using a scanning electron microscope equipped with an energy-dispersive spectrometry detector. In metalliferous sediments, according to X-ray diffraction data, the main Fe mineral phase was goethite FeOOH (37–44% on a carbonate-free basis). The contents of Fe and Mn reached 31.6 and 0.18%, respectively, whereas concentrations of Cu, Zn and Pb were 0.98, 0.36, and 0.059%. The coefficient of metal enrichment relative to background values varied from 16 to 125 times. The exception was Mn, for which no increased accumulation was recorded. Essential mass of Fe (up to 70% of total content) was represented by the residual fraction composed of crystallized goethite, aluminosilicates, the minerals derived from bedrock destruction processes. Among geochemically mobile fractions, 90–97% of total Fe was found in the form of authigenic oxyhydroxides. The same fraction was the predominant host for Mn in both metalliferous and background sediments (55–85%). A total of 40–96 % of Cd, Cu, Zn, and Pb were associated with these Fe and Mn fractions. The sulfide fraction amounted to roughly 10% of each metal. In metalliferous sediment core, the maximum concentrations of metals and their geochemically mobile fractions were recorded in deeper core intercepts, an observation that might be attributed to influence of hydrothermal diffused fluids. Our data suggested that metals are mostly accumulated in carbonate sediments in their contact zone with the underlying serpentinized basalts.

Keywords: hydrothermal field Pobeda; Mid-Atlantic Ridge; metalliferous sediments; biogenic carbonates; ore metals; minerals; geochemical fractions

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