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Depositional setting of the deep-sea sediments from an area of high nodule occurrence in the Clarion-Clipperton Fractures Zone, NE Pacific

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Deep-sea sediments from an area bearing high nodule occurrence in the eastern part of the Clarion-Clipperton Fractures Zone, NE Pacific were collected from 4,300–4,500-m depth during the 2019 Interoceanmetal cruise. Box-core samples from six stations were studied to assess their natural variability.

The on board processing documented light brown siliceous silty clay down to 45-cm with a semiliquid dark brown clay variety (7–12 cm thickness) on the top denoted as geochemically active layer (GAL). The GAL Eh ranged between +462 and +545 mV and decreased with depth. The respective pH data varied in short span (7.01–7.52).

Bulk sample analysis indicate very fine sandy fine silts. The sediments are predominantly poorly sorted and show polymodal particle size distribution. The silt (50–84%) and sandy (9–31%) fractions show opposite trends, whereas the clayey fraction increases with depth.

An amorphous phase (84–88%) predominates, representing biogenic opal, authigenic Fe-Mn (hydr)oxides and clay minerals. This phase composition defines the sediments as clayey siliceous ooze. The crystalline phases illite, kaolinite, chlorite, quartz, andesine represent a detrital component, as halite, cristobalite and barite are of authigenic origin.

The chemical composition corresponds to pelagic sediments having higher concentration of Na, S, Sr, Ba, Sc, Ge, Cu, W, Y, MREE, HREE and lower concentration of Al, Si, Fe, Mn, P, V, Zr, Nb, Pb, As, Mo, Ce. The sediments have high Al/(Al+Fe+Mn) ratio (0.57) and should be considered non-metalliferous. Manganese content (0.16–0.70%) and the Mn/Fe ratio (0.03–0.16) are the highest in the surface layer and decrease in depth. Cobalt, Ni and Cu reveal their highest concentrations in the GAL. The different ternary diagrams classify samples as hydrothermal/ hydrogenetic metalliferous sediments. NASC and PAAS-normalized REE patterns show MREE and HREE enrichment with strong negative Ce and weak positive Eu and Y anomalies. Chondrite-normalized REE patterns bear negative Ce and Eu anomalies.

The studied sediments reveal polygenic origin. The negative Ce anomaly is in agreement with Eh values, redox sensitive oxides and barite presence, all reflecting the oxidizing environment of formation.

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