

Aluminum Oxide In Submarine Hydrothermal Sulfide From East Pacific Rise Near 13°N

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Seafloor hydrothermal activity is a window into the subseafloor ocean. Studying hydrothermal products aids in understanding the deep processes of hydrothermal circulation. Aluminium (Al) is highly enriched in hydrothermal vent fluids compared to seawater (10–20 $\mu\text{mol/kg}$ versus 10 nmol/kg) [1]. Al in seafloor hydrothermal sulfides is also common both in deposits in mid-ocean ridges and in back-arc basins or volcanic arcs. The Al concentration of seafloor hydrothermal sulfide deposits has received only cursory attention. Previous geochemical studies had shown Al to be present to varying concentration (from 52.8 ppm at North Fiji basin to 4396 ppm at East Pacific Rise (EPR)) in seafloor hydrothermal sulfides, which are believed that Al may be present in clay minerals [2, 3].

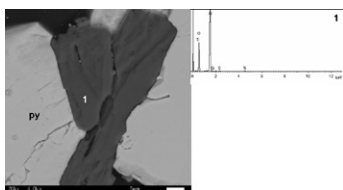


Figure 1: Backscattered electron microprobe images of Al oxide microcrystallite in pyrite from the EPR near 13°N. 1 and Py represent Al-oxide and pyrite, respectively. 1. Energy dispersive X-ray spectrum of Al-oxide microcrystallite.

We report data on the concentration of aluminum in sulfide from EPR near 13°N is from 13.7 ppm to 1071 ppm, which Al is present in Al-oxide. A positive correlation exists between Al and Ti, Zr, Nb, Sr, Ni, Y, and REEs in the sulfides of the EPR near 13°N, which means REEs, Y, Ti, Sr, Ni, Zr, and Nb occur in the minor Al-oxide of the sulfides from the EPR near 13°N.

[1] Von Damm (1995) In: Humphris *et al.* (Eds.), *AGU*, Washington, D.C., pp. 222–247. [2] Fouquet *et al.* (1988) *Marine Geology* **84**, 145–178. [3] Kim *et al.* (2006) *Chemical Geology* **233**, 257–275.

Response Of The Global Nitrogen Cycle To The Great Oxidation Event

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Nitrogen isotope values in kerogens from the ~2.32 Ga Rooihoogete and Timeball Hill formations (R-TH), South Africa, record a reorganization in global nutrient cycling in response to changes in ocean chemistry during the Great Oxidation Event. These units were deposited immediately after the disappearance of sulfur isotope mass-independent fractionation, indicating that atmospheric O₂ levels rose to greater than 1ppm level. The shales of the R-TH document a dramatic swing in the $\delta^{15}\text{N}$ values of marine organic matter from -14 to +13‰, unprecedented in sedimentary records. The extremely ¹⁵N-depleted values and associated geochemical signatures of iron and carbon preserve evidence for a redox-stratified ocean with primary productivity dominated by anoxygenic photoautotrophs utilizing a large pool of bioavailable ammonium as a nitrogen source. An increase in $\delta^{15}\text{N}$ across the formation boundary represents titration of this ammonium by continued assimilation and nitrification utilizing newly available marine oxidants. In the upper part of this succession, the $\delta^{15}\text{N}$ values settle to around modern values (~+5‰) in both deep- and shallow-water sediments, where they remain for much of the rest of Earth history. We propose that this trend records a change in the dominant form of nitrogen available for global primary productivity, from ammonium to nitrate, as a direct consequence of changes in ocean chemistry. We will present a box model of marine nitrogen concentrations and isotopes to test this hypothesis.