Critical influence of biogenic sulfur in the genesis of giant VHMS, Iberian Pyrite Belt

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During the late Devonian-early Carboniferous, the Iberian Pyrite Belt was the loci of widespread hydrothermal activity and formation of volcanogenic massive sulfide deposits, making it the largest concentration of massive sulfides in the earth's crust [1, 2]. The formation of these massive sulfides is currrently associated to subseafloor to seafloor precipitation by mixing of sulfur-depleted, metal-rich deep hydrothermal fluids of likely basinal derivation with seawater rich in biogenically derived reduced sulfur [2, 3]. Exhalative massive sulfides are better formed and preserved in anoxic oceanic bottoms, mainly three order basins filled with hydrothermal brines, i.e., brine pools [4]. The sulfides will result from the interaction of H_2S, being produced through biogenic sulfur reduction, and the exhalated cations ($H_2S + M^{2+} \rightarrow MS$). This process demands reduced sulfur that can be mediated through Sulfur Reducing Bacteria. However, several questions remains unasked as the electron donor which would drive the reduction from $SO_4^{=}$ to H_2S. The combination of several evidences as the presence of organics (including pristane and phytane), mineral association to siderite and microbial structures and the low $\delta^{34}S$ values suggest that the massive sulfides were produced by microbial activity as proposed in [3] and can shed light in those biogeochemical processes involved in the sulfide production.

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Cosmogenic-based physical and chemical denudation rates in the Idaho Batholith

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Chemical weathering plays a prominent role in many biogeochemical and geomorphological processes, supplying nutrients to soils and streams, promoting soil production, and drawing down atmospheric carbon dioxide. Rates of chemical weathering and physical erosion are thought to be coupled to one another, because rates of chemical weathering may depend on the rate at which physical erosion supplies fresh minerals to the soil, and rates of physical erosion may depend on the rate at which chemical weathering weakens bedrock and aids soil production. Several studies have found that chemical weathering rates are positively correlated with physical erosion rates, although the relationship varies substantially between studies.

Along two elevation transects in the deep, steep canyon of the South Fork of the Salmon River in the granitic Idaho Batholith, we have measured total denudation rates using ^{10}Be concentrations in soil-borne quartz, and have split these rates into their physical and chemical components based on concentrations of chemically immobile zirconium in soil and parent rock. These rates are averaged over the long timescale of ^{10}Be accumulation in soil-borne quartz, which at our field sites ranges from 5,000 to 26,000 years. Across our field sites chemical denudation rates (W) range from -5 ± 8 to 30 ± 4 t km^{-2} yr^{-1} and physical erosion rates (E) vary by more than a factor of four from 49 ± 4 to 218 ± 19 t km^{-2} yr^{-1}. Most of our measurements are consistent with a power-law relationship between W and E, but several of the more rapidly eroding sites have slower chemical denudation rates than this relationship would predict, suggesting that chemical denudation rates at these sites may be damped by non-erosional factors (e.g., climate, vegetation) or that chemical denudation rates may in fact decrease as physical erosion rates approach limiting rates of soil production.