Strontium and sulfur isotopes reveal the complex evolution of the Sotiel-Migollas VMS deposit (Iberian Pyrite Belt)

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The SIMS $\delta^{34}S$ study of pyrite from the late Devonian shale-hosted volcanogenic massive sulfide deposit of Sotiel-Migollas (Iberian Pyrite Belt) combined with the $^{87}Sr/^{86}Sr$ ratio of the intergrown carbonates [1] track the complex evolution of the seafloor hydrothermal system. SIMS $\delta^{34}S$ of pyrite showing different textures exhibit a wide range in values from -35.8±4.6‰ in the primary framboidal morphologies to -0.9±1.3‰ in the late recrystallized euhedral crystals. The $^{87}Sr/^{86}Sr$ ratios vary between 0.70846 and 0.70983, being the less radiogenic values close to those of the coeval seawater, estimated by [2] in the 0.70750-0.70850 range.

There is a strong linear correlation between these two isotope systems, with the most negative $\delta^{34}S$ values of the pyrite being intergrown with carbonates with the lowest $^{87}Sr/^{86}Sr$ ratios. Extremely ^{34}S-depleted values can only be interpreted as reflecting the biogenic reduction of the seawater sulfate with a large isotopic fractionation in an open system [3]. This is consistent with a strontium seawater signature, suggesting that these samples correspond to the external parts of the exhalative system in contact with seawater and with bacterial sulfate reduction taking place on the seawater-massive sulfides interface. In contrast, the other endmember is interpreted as reflecting the late maturation of the system inside the ore lens with input of deep sulfur -likely derived from TSR processes or leached from the basement- accompanied by ^{87}Sr-enriched fluids.

We propose a model for the growth of biogenic mounds on the seafloor with alternating carbonate-sulfide bands that were gradually buried by subsequent growth. The isotope signatures changed due to the later maturation of mound and the input of deep hydrothermal fluids.

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[1] Velasco-Acebes (2014) Master´s thesis, 49 pp. [2] Veizer et al. (1999) *Chem. Geol.* **161**, 59-88. [3] Ohmoto (1996) *Ore Geol. Rev.* **10**, 135-177.