Multiple sulfur isotope evidence for distinct sulfur sources in the 3.30 Ga Mundo Novo Greenstone Belt VMS deposits

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Models for the deposition of volcanogenic massive sulfide (VMS) deposits and their sulfur isotope systematics are generally explained by the interplay of distinct sulfur sources: from the reduction of seawater sulfate, remobilization of sedimentary sulfur and from volcanic sources (magmatic fluids and wall rocks). In the last few years, multiple sulfur isotope analysis has been used in several Archean VMS deposits to fingerprint sulfur and metal sources, evaluate metallogenetic potential, and to constraint the seawater sulfate concentration in the Archean oceans.

The 3.30 Ga Mundo Novo Greenstone Belt, in the São Francisco Craton (Brazil), hosts the Fazenda Coqueiro Zn-Cu-Pb deposit and other smaller occurrences of massive sulfide lenses within a sequence of metavolcanic, clastic and chemical metasedimentary rocks. In order to evaluate the relative contributions of magmatic and atmospheric sulfur in the Fazenda Coqueiro deposit, we have determined the ^{32}S, ^{33}S, ^{34}S and ^{36}S isotope composition of base metal sulfides by *in-situ* analysis using the SHRIMP-SI.

Massive sulfide and stringer samples exhibit similar MIF signatures ($\Delta^{33}S$ and $\Delta^{36}S$ averaging 2.10 and -1.30‰, respectively), whereas $\Delta^{33}S$ and $\Delta^{36}S$ of disseminated sulfides in the hangingwall average 1.59 and -1.12‰, respectively. Footwall sulfides have distinct compositions, which may reflect the mixing of sulfur from a magmatic source and seawater sulfate ($\Delta^{33}S$ and $\Delta^{36}S$ averaging -0.20 and 0.24‰, respectively). All samples exhibit restricted values of $\delta^{34}S$ (between -2.2 and 3.2‰), which would suggest a purely magmatic sulfur source if taken into account alone. In contrast with other Neoarchean and Paleoarchean VMS deposits, magmatic sulfur and seawater sulfate were minor components during the formation of the Fazenda Coqueiro deposit. Nevertheless, fingerprints of dissolved sulfate in the Mundo Novo basin are recorded by pyrite grains in other smaller massive sulfide lens, which are close to the multiple sulfur isotope composition of Paleoarchean barite.