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# Tracking the evolution of the “Tin corridor” at the Neves Corvo deposit (Iberian Pyrite Belt) through metasomatism of phosphate minerals

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The Neves Corvo Cu-Zn-(Sn) deposit in the Iberian Pyrite Belt is unique in terms of size, Cu-Zn grades and tonnages, and the notable occurrence of Sn mineralization. The mineralization is hosted by felsic volcanic rocks and black shales. Three major stages have been defined: (1) stringer and massive cassiterite, (2) stringer and massive sulfide, and (3) remobilized massive sulfide mineralization. The Sn mineralization is structurally controlled and mainly occurs along the “tin corridor” (Corvo orebody).

We report the first occurrence of phosphate minerals (apatite, florencite [$LREEAl_3(PO_4)_2(OH)_6$], and xenotime) associated with the tin mineralization at Neves Corvo and present a comprehensive set of in-situ measurements (microprobe and LA-ICP-MS) of these phases. Apatite is the dominant phosphate mineral and occurs in the stockwork, associated with quartz and/or cassiterite. It typically develops aggregates of anhedral, heterogeneous grains that show dissolution rims, high porosity, and fracturing, often filled by Na-sericite, chlorite and/or florencite. Apatite may also contain minute inclusions of cassiterite and pyrite. Florencite occurs as inclusions in apatite and/or in late veinlets that crosscut the cassiterite ore stage veins. In the latter, florencite is associated with chlorite, sericite, chalcopyrite, and pyrite. Xenotime is rare, and its relationship with the other phosphates is unclear. The apatite crystals analyzed are fluorapatites with excess Ca and a P deficiency. Raman spectroscopy showed the presence of $CO_3$ replacing $PO_4$, suggesting a shift from the fluorapatite towards the carbonate-fluorapatite endmember. Apatite generally has low trace element contents except for Y, Sr, S, and MREE (100-1000s ppm). In fact, chondrite normalized REE patterns show strong depletion of LREE, enrichment in MREE, and an intermediate depletion in HREE (Fig.1). The intense deformation of the samples, the textural relationships observed, and REE patterns are indicative of fluid-induced metasomatism. In particular, the depleted LREE patterns suggest that apatite was altered in the presence of Al-rich and NaCl-bearing hydrothermal fluids to form florencite, possibly related to overprint by the distal Na-metasomatic alteration halo associated with the stringer and massive sulfide stage (Lower Corvo feeder system), or to the 320-300 Ma tectonic-metamorphic event that is also responsible for extensive Cu remobilization at Neves Corvo.

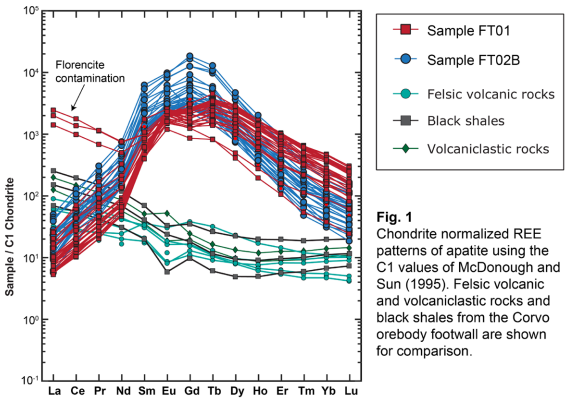


**Fig. 1**
Chondrite normalized REE patterns of apatite using the C1 values of McDonough and Sun (1995). Felsic volcanic and volcaniclastic rocks and black shales from the Corvo orebody footwall are shown for comparison.