

# **Weathering and hydrochemistry associated with the old mine workings at Fonte Santa (NE of Portugal)**

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The quartz veins from the Fonte Santa mine consist of scheelite, pyrite, pyrrhotite, sphalerite, chalcopyrite, arsenopyrite, galena, iron oxides, Al, Fe and Pb hydrated phosphates and Fe sulphates. Scheelite has a homogeneous composition, but their fractures are filled with stolzite and ferritungstite. The area was mined for W between 1942 and 1982 and 2784 tonnes of tungsten were produced. Since then there has not been any development. Most waters from Fonte Santa are of mixed type, some are of Na-Mg and HCO<sub>3</sub>-SO<sub>4</sub> 2-type. They are poorly mineralized. However, most parameters and element contents show an increase from outside to inside the mine influence due to the effect of abandoned old mining activities. There is no significant acid drainage associated with the old mine workings, which can mainly be attributed to the presence of calcium carbonates in country rocks that probably neutralized the waters and decreased metal concentrations. The most acid waters with the highest SO<sub>4</sub> 2- and metal contents are from the mine lagoons, which received waters from fine-grained tailings and waste rock. The environmental impact of the Fonte Santa mine area is essentially related to a flooding event that carried a suspended contaminated load, increasing the Fe and Al contents in natural stream waters inside the mine influence. Most waters associated with the mineralized veins and old mine activities have Fe and Mn concentrations that forbid their uses for human consumption and agriculture. Some waters present concentrations above parametric Portuguese values for other contaminants (SO<sub>4</sub> 2-, NO<sub>2</sub>-, Mg, Zn, Al, Ni and Co) and must not be used for human consumption. The alteration of albite, chlorite and muscovite from country rock is responsible for Na, Mg and K contents in the waters, whereas the weathering of carbonates and scheelite are probably the sources of Ca. The weathering of rockforming minerals and ores caused the precipitation of secondary phases (halloysite, ferritungstite and Fe sulphates).