

Contamination of waters related to abandoned W-Sn mines (Murçós, NE Portugal)

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The mining activity contributed well to the Portuguese economy. Although about ninety Portuguese abandoned mining areas are known to be contaminated, only a few of them have received environmental remediation.

The Murçós mining area is located at Galiza-Trás-os-Montes Zone, northeastern Portugal. The W-Sn mineralization is of stockwork type. The main W-Sn quartz veins intersect Silurian schists and the Variscan biotite granite. The W-Sn quartz veins contain mainly scheelite, cassiterite, wolframite, pyrite, arsenopyrite, sphalerite, chalcopyrite, galena, rare pyrrhotite, stannite, native bismuth, joseite, bismuthinite, matildite, anglesite, scorodite and roosveltite. The exploitation of scheelite and cassiterite took mainly place at the surface in four open pit areas between 1948 and 1976 and produced 335 tons of W and 150 tons of Sn. Three lakes were formed as a result of the mine exploitation. Remediation processes were performed between 2005 and 2007 and included the confinement and control of tailings and rejected materials and fitoremediation with macrophytes. This abandoned mining area is located close to a rural area and some of the waters are used for agriculture and others for human consumption. Ten sampling points were selected, three in the pit lakes and seven in the surface waters. Waters from the pit lakes are acid (pH = 4.03 - 5.88), have the highest electrical conductivity value (343 $\mu\text{S}/\text{cm}$) and SO_4

²⁻ (194 ppm), Ca (44 ppm), Mg (15 ppm), Mn (2.6 ppm), Al (8.6 ppm), Zn (0.6 ppm), Ni (0.1 ppm) and Co (0.1 ppm) contents, but with a low metal content. The surface waters are near-neutral with a low metal content. Most waters are of mixed type and some of calcium-sulfatated type. Most waters from Murçós area must not be used for human consumption and agriculture due to their high As, Fe and NO_2

contents. Those from the open pit lakes also have contents of Mn, Al, Zn, Cd, Ni and SO_4

²⁻, which show that they must not be used for human consumption and agriculture.