



## **First insights into the mineralogy of the tailings dump of the Lojane Sb-As(-Cr) deposit, FYR of Macedonia**

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The abandoned Sb-As(-Cr) deposit Lojane in north-east Macedonia was mined for realgar, stibnite, and chromite until 1979. The mine site and associated waste and tailings dumps, located close to a school and some small villages, are a substantial source of antimony, arsenic, and chromium pollution and represent one of the major environmental problems for the country. More than one million tons of tailings containing As, Sb, and other hazardous substances are located in an open dumpsite for flotation waste. The tailings dam is completely unprotected and its orange colour (clearly visible from satellite images) suggests a high concentration of arsenic sulphides (Alderton et al., 2014).

We have performed some preliminary characterization of waste samples from the tailings dump near Vaksince village using single-crystal and powder X-ray diffraction techniques which showed that the porous samples are comprised mostly of well crystallized realgar (70 vol.%), quartz (16 %), gypsum (11 %), and minor amounts of chromite, calcite, and sulphur. Additional SEM-EDS and Raman spectroscopic studies of selected polished sections confirmed that the majority of the dump material consists of realgar fragments about 50-150  $\mu\text{m}$  in size, which are invariably coated by thin crusts of an As-Sb-Fe-oxide/hydroxide (with traces of S, Ca, Na, K, and Al) in which the As:Sb ratio varies from ca. 2:1 to 1:2.2, Fe contents being variable. This generally inhomogeneous oxide appears to be microcrystalline but may in part be amorphous; crystalline forms probably belong, at least in part, to the roméite group. Besides forming < 10  $\mu\text{m}$  crusts (mostly As-dominant) around realgar and stibnite grains, Sb-dominant variants of this oxide also form larger homogeneous grains up to 500  $\mu\text{m}$ , characterised by broad dehydration cracks and suggesting original formation as a gel. Very rare relic chromite and, less commonly, magnesiochromite are always Al-bearing and occur as anhedral, unaltered fragments (up to  $\sim 50 \mu\text{m}$ ) which are chemically homogeneous but show minor variations of the Cr:Al and Fe:Mg ratios among different grains. Also confirmed were, in approximate order of decreasing abundance, gypsum, quartz, stibnite (superficially corroded grains between 1 and 100  $\mu\text{m}$  in size, partly embedded in either quartz or realgar), pyrite (tiny euhedral crystals in quartz; always As-bearing, with up to  $\sim 5$  at.% pfu), gersdorffite, scorodite, limonite, kaňkite(?), vaesite, magnetite, As-bearing sulphur, muscovite to illite, kaolinite-group representatives, fluorapatite, albite, rutile, and annabergite.

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Alderton, D., Serafimovski, T., Burns, L., Tasev, G. (2014): Distribution and mobility of arsenic and antimony at mine sites in FYR Macedonia. *Carpath. J. Earth Environ. Sci.*, 9, 43-56.