Study of tetrahedrite-tennantite ($Cu_6[Cu_4(Fe,Zn_2)]Sb_4S_{13}$ - $Cu_6[Cu_4(Fe,Zn_2)]As_4S_{13}$) weathering products in mine wastes from abandoned waste rock piles, Špania Dolina, Slovakia

ANEŽKA BORČINOVÁ RADKOVÁ[1], HEATHER JAMIESON[1], MARTIN ŠTEVKO[2], JURAJ MAJZLAN[3], BRONISLAVA LALINSKÁ-VOLEKOVÁ[2] AND MARTIN CHOVAN[2]

[1]Department of Geological Sciences and Geological Engineering, Queen's University, Miller Hall, 36 Union Street, Kingston, K7L 3N6, Ontario, Canada(anezka.radkova@queensu.ca, jamieson@queensu.ca)
[2]Department of Mineralogy and Petrology, Faculty of Natural Sciences, Comenius University, 6 Mlynska dolina G, SK-842 15 Bratislava, Slovakia
[3]Institute of Geosciences, Burgweg 11, Friedrich-Schiller University, D–07749 Jena, Germany

The sulphosalt solid solution tetrahedrite-tennantite is the primary source of antimony (Sb) and arsenic (As) contamination of waste rock, soil and streams at the historical mining site Špania Dolina. We have studied the association of Sb in the tetrahedrite oxidation products characterized in the field by a bright to olive green colour. Synchrotron-based μ-XRD, μ-XRF, and μ-XANES combined with electron microprobe analyses have been used to determine the mineralogy, chemical composition, element distribution and Sb speciation in the tetrahedrite oxidation products. Our results show that the mobility of Sb is limited by the formation of tripuhyite ($FeSbO_4$) and romeite-group minerals present as a microcrystalline mixture with average Sb concentration of 38.06 wt%. Significant concentrations of Cu (average of 18.9 wt%), As (14.11 wt%) and Fe (17.2 wt%) were also detected. Antimony *K* edge μ-XANES spectra of these oxidation products indicate that the predominant Sb oxidation state is 5^+. Arsenic is preferably enriched in the amorphous phases (average As concentration of 26.27 %) closely associated with tripuhyite and romeite. Other elements in the amorphous phases associated with tetrahedrite weathering are Cu (average of 28.9 wt%), Sb (8.27 wt %) and Fe (12.02 wt%). The variable solubility of the secondary minerals that have been identified is expected to influence mobility of As and Sb in the near surface environment.