Mineralogy and weathering of Pb-Zn slags from Příbram (Czech Republic)

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This study is part of a program aimed at understanding heavy metal behaviour in vitrified waste material exposed to weathering. At Příbram, 100-year-old Pb/Ag pyrometallurgical slag was sampled and studied for its similarity with such material. The slag occurs as massive (30 × 30 cm) casts of glassy material mainly composed of silicates; a metallic fraction is present as spherical inclusions, a centimeter to a few microns in size, derived from the separation of a sulphide matte at the liquid stage. A large amount of the metallic fraction is often observed at the bottom of the casts.

The mineralogical study shows that the three main components of the silicate fraction are olivine-type minerals [with the general formula $(Fe,Ca,(Mg))SiO_4$], Ca-rich clinopyroxene [$(Ca,Fe)_2Si_2O_6$], and melilite-family minerals [$(Ca)_2(Fe,Mg,Al^{VI})(Si,Al^{IV})_3O_7$]. Fe-Al-Zn spinels are also observed. Dendritic Fe-poor sphalerites are very common in the silicate phase. A glass phase forms chilled borders to the slag and fills interstices of the silicate crystals. Electron-probe analyses show Pb enrichment in the glass. The metallic fraction is an intergrowth of sulphides with minor alloys, arsenides and oxides, the most common species being pyrrhotite, galena, sphalerite, bornite, and lead, present as rounded inclusions. As is associated with Fe, mostly as Îllingite. Sb and Sn are found as alloys with minor Cu.

Evidence of weathering has been observed, such as a wash out (to 100 μm depth) of the chilled glass borders of the slag, which leaves a framework of untouched silicates with no *in situ* redeposition of the mobilized material. Another weathering feature comprises 10–20 μm banded layers of secondary minerals deposited at the surface of the slag. These minerals, very finely crystallized and difficult to identify. are composed of Pb, Zn and Fe sulphates and oxidesñhydroxides. The solution precipitating the minerals probably results from leaching nearby metallic inclusions at the surface.