

Microbes influence the mobilization and re-precipitation of Ag in gossans

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The Volcanic Hosted Massive Sulfide deposits of Iberian Pyrite Belt comprise the largest known concentration of metal in Earth's crust [1]. The common surface expressions of massive sulfide deposits are highly oxidized, acid-leached gossans created by the hydration and oxidation of metal sulfide minerals such as pyrite by bacteria. This type of system is commonly referred to as an acid rock drainage environment. While silver is generally considered to be a mobile element from a geochemical perspective, and its mobility is enhanced within acidic environments, gossan outcrops have been traced and surveyed at least since Roman times in order to exploit the concentrated accumulation of this metal. What mechanism (s), therefore, concentrate Ag in gossan deposits? The analysis of samples from several volcanic hosted massive sulfide deposits in the IPB have revealed significant silver concentrations of Ag-bearing jarosite and argentojarosite in Fe-sulfate/oxyhydroxide gossan deposits. The role of *Acidithiobacillus ferrooxidans* in the formation of jarosite-group minerals [2, 3] and the ability of bacteria, and exopolymers derived from bacteria have also been shown to enhance the nucleation of metallic silver nanoparticles [4] suggested that they may play a role in silver mobilisation via biooxidation and immobilisation via secondary mineral formation. Cultures of naturally occurring acidophilic iron and sulfur oxidising bacterial consortia including *Acidithiobacillus ferrooxidans* demonstrated a significant role in the immobilization and precipitation of Ag in an *in vitro* model of these acidic gossan systems. Cultures treated with variable amounts of AgNO₃ promoted the precipitation of Ag-bearing jarosite and argentojarosite compared to abiotic controls. Argentojarosite in the precipitates of the *A. ferrooxidans* cultures was detected in tubes treated with as little as 10 ppm Ag. Argentojarosite became more dominant over hydronium jarosite at silver concentrations of 1000 ppm Ag.

[1] Tornos (2006) *Ore Geology Rev.* **28**, 259–307. [2] Sasaki *et al.* H. (1995) *Can. Min.* **33**, 1311–1319. [3] Sasaki & Konno (2000.) *Can. Min.* **38**, 45–56. [4] Lengke *et al.* (2007) *Langmuir* **23**, 2694–2699.

Mineral composition and morphology of magnetic particles in industrial dust

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Mineral composition and morphology of highly magnetic particles in dust samples collected from coal-burning power plants and coking factories in southern Poland were examined using analytical scanning electron microscope and X-ray powder diffraction. The aim of the study was to determine whether morphological features of dust particles and their mineral composition can be used to trace the origin of magnetic particles commonly found in air and soils.

The industrial region of Poland has been chosen for the study because 341 industrial emitters there produce 38.5 Mg of dust annually.

The majority of magnetic minerals observed in all samples from coal burning power plants consist of magnetite, magnesioferrite and maghemite. In addition to those minerals abundant metallic iron together with metallic nickel and minor iron sulphides were observed in samples derived from the coking process. On rare occasions spinels including franklinite were detected in dust particles from power plants.

Magnetic minerals generated during coking processes commonly occur as densely packed aggregates of well developed crystals, whereas particles related to coal combustion are usually spherical with skeletal morphology or they are coated by non-magnetic particles, e.g. aluminosilicates. Hematite observed in products of coal combustion and coking processes differs in magnetic susceptibility from its natural counterpart.

Morphology of dust particles formed during various technological processes can be used to distinguish between different sources of individual dust particles polluting atmosphere and soils.

This work was supported by research project N523 07432/2889 of the Polish Ministry of Science and Higher Education.