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ENVIRONMENTAL ASPECTS OF THE BIODEGRADATION OF ORES CONTAINING REFRACTORY GOLD FROM WESTERN CARPATHIANS

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Important potential source of gold in Western Carpathians is represented by gold-bearing Sb-Au sulphidic ores. This type of mineralization forms impregnations of fine-grained euhedral arsenopyrite and arsenian pyrite. The gold content in arsenopyrites is ranging usually from zero up to 250 ppm (crystals containing up to 0.6 wt% Au in point analyses were described only from the Trojárová deposit) and in pyrites from zero up to 100 ppm. Mössbauer spectroscopy showed that most of the invisible gold incorporated in sulphide minerals is chemically bound (András et al., 1995).

Gold-bearing sulphides exhibit strong zonation patterns. Two extreme types of growth zones can be distinguished, both with different compositional trends. The first one has high Sb and the second one high As and low Sb content. Progressive enrichment in As is generally in correlation with a decrease in the S and Sb content. As and S are strongly negatively correlated. The As-rich zones are considered to be the carriers of the substantial majority of chemically bound gold. Gold-bearing crystals with rims rich in Au-As are described from the Pezinok and Trojárová deposits (Malé Karpaty Mts.), while crystal cores rich in Au-As were found at the Dúbrava and Vyšná Boca deposits (Nízke Tatry Mts.).

From an environmental point of view, the industrial treatment of gold-bearing sulphidic ores has negative consequences for the landscape. It is difficult to find convenient technology for gold production from ores with invisible gold.. The biological-chemical oxidation of these ores is environmentaly satisfactory but usually very tedious.

Our study proved that the process of bacterial oxidation is a selective one, with preferential oxidation of arsenopyrite in As (Au) enriched zones. This process is followed by dissolution of As (Au) enriched zones of pyrite crystals preferentially along cracks, veins and growth zones of crystals, and, as a result, tunnels and various depressions form on the crystal surface. Their space orientation is directly related to the orientation of different crystal faces. The oxidation is also influenced by the galvanic interaction of crystal parts with different As content.

Our results have practical use in the industrial treatment of sulphidic ores. The preferential biochemical solving of the arsenopyrites, which contain about 80% of the gold, and the preferential oxidation of the As-rich zones of arsenopyrite and pyrite, which contain about 90% of the gold in each grain, substantially speed up the technological process of gold leaching and enable the use of the tedious biological-chemical technology for gold production from arsenopyrite-pyrite ores containing refractory gold in a convenient way from the environmental viewpoint.

References

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