MÖSSBAUER (NGR), XRD, TEM/SAED AND ESR INVESTIGATIONS ON SOME SULPHIDES FROM COSTEŞTI, VALEA LUI STAN AND JIDOŞTIȚA GOLD ORES (SOUTHERN CARPATHIANS, ROMANIA)

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In the metamorphic rocks of the Getic Realm in the Southern Carpathians (Romania) there are several shear-zone related gold ores/mineralizations, *i.e. Valea lui Stan*, near Brezoi and *Costeşti*, near Horezu, both in Vâlcea county, and *Jidoştiţa*, near Drobeta-Turnu Severin, in Mehedinţi county. Although quite similar, these occurrences show some peculiarities as concerns the main elements and the related protores, as summarized by UDUBAŞA (2004). Gold is commonly associated with, or included in, arsenopyrite, pyrite, chalcopyrite and sometimes quartz. "Invisible" gold has been identified in arsenopyrite by using EPMA, showing gradual decrease of concentration around optically visible gold inclusions.

In the frame of a research project (CERES C4-209/2004) the investigations have been continued by using extensive XRD, Mössbauer and TEM/SAED techniques, in co-operation with physicists. Powdered samples have been investigated at room temperature by using all the techniques.

^{57}Fe Mössbauer spectra of arsenopyrite have been registered and analyzed. Spectral parameters revealed that the dominant FeAsS phase represent 74%, 70% and 47% for the sample from Costeşti, Valea lui Stan and Jidoştiţa, respectively. The accompanying phases were identified in all the investigated samples. (Co, Fe)AsS and traces of $FeAs_2$ (~4%) have been found in the sample from Valea lui Stan. Pyrite and a larger quantity of loellingite (~28%) have been found in the sample of Jidoştiţa. In all the phases the Mössbauer spectra show an octahedral oxygen arrangement and a fractional ionic valence (~+2) low spin. The Mössbauer spectra of chalcopyrite and pyrrhotite exhibit the magnetic ordering and coexistence of the main phase with pyrite and/or marcasite.

Preliminary XRD analysis of arsenopyrite evidenced quartz as accompanying phase for all the investigated samples and cupride of gold (Cu_3Au) for the Valea lui Stan and Jidoştiţa ores. Cupride of gold was also recognized in the XRD spectra of chalcopyrite at Costeşti.

Hyperfine interactions of isolated Mn^{2+} were observed by ESR technique. Spectral parameters suggest Ca carbonate as host matrix. A more significant signal of manganese ion in calcite (axial symmetry) is observed in chalcopyrite. Also two distinct signals of Fe^{3+} probe (g_{ef} = 2.0 corresponding to the orthorhombic symmetry and g_{ef} = 3.78, only for the Valea lui Stan sample) were evidenced in the spectra).

SAED analyses carried out on powdery samples have shown nanometric "precipitates" of Au or an (Au, Ag) alloy on arsenopyrite grain surfaces, showing a great diversity of morphologies, *i.e.* from isolated gold nanoparticles, some tens of nanometers in size, up to "coral-like" aggregates. Such nanograins or aggregates have also been identified (although more rarely) on pyrrhotite and chalcopyrite. This is the third mode of occurrence of gold in/on sulphides, called "nano-minerals" by UDUBAŞA G. *et al.* (2006).

Moreover, in addition to metallic gold, further gold-bearing minerals have been identified, *i.e.* uytenbogaardtite, Ag_3AuS_2, closely associated with pyrrhotite at Costeşti, and auricupride, Cu_3Au, associated with arsenopyrite at Valea lui Stan and Jidoştiţa. During the investigations, some other new minerals for these ores have also been identified: cobaltite, CoAsS, in arsenopyrite samples from Valea lui Stan and Jidoştiţa and in sphalerite samples from Jidoştiţa, as well as loellingite, $FeAs_2$, in sphalerite samples from Jidoştiţa, maghemite in sphalerite samples from Jidoştiţa, moganite (monoclinic SiO_2) in arsenopyrite samples from Costeşti and Jidoştiţa, and CuO in chalcopyrite samples from Valea lui Stan.

Acknowledgements

The financial support of the Ministry of Education and Research of Romania through the research grant CERES C4-209/2004-2006 is gratefully acknowledged.

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