

THE COPPER ARSENIDES OCCURRENCE FROM INTREGALDE, METALIFERI MOUNTAINS (ROMANIA)

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Abstract: The copper-arsenides occurrence, (domeykite, alodonite) unique in Romania, was formed by the selective oxidation of Fe and S from the hydrothermal solutions in the cretaceous sandstones and by the hipogene oxidation of the enargite. The mineralisation is made up by a veinlet consisting only in metallic minerals, without any trace of hidrothermal alteration, localised on a NE-SW fracture. The copper arsenides were determined by X-ray, chemical, spectral analyses and microscopic studies.

Key words: domeykite, alodonite, low temperature neogene metallogenesis

The copper arsenides mineralization from Intregalde village occurs in the Diesa Hill, at the spring of a small left tributary of the Galda valley, about 10 km east from the Bucium deposit. This belongs to the neogene metallogenetic district of the Metaliferi Mountains. Sulfides, telurides and Cu minerals (chalcopyrite, chalcocine, covelite, enargite and luzonite) are main metallic minerals of the Arama group veins.

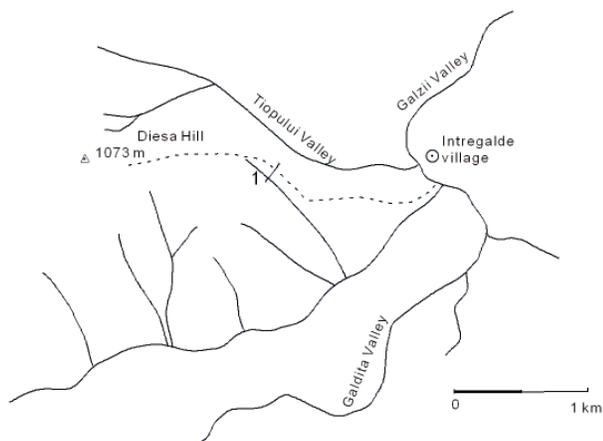
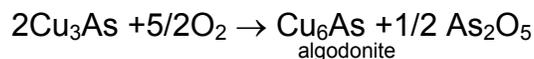


Fig.1 Schetch map of the copper arsenides occurrence
1. Copper arsenides veinlet

Socolescu and Superceanu (1960) studied the copper-arsenides occurrence from the Diesa Hill for the first time.

They have considered the copper-arsenides mineralization as a result of the selective oxidation of iron and sulphur from the hydrothermal solutions in the cretaceous sedimentary rocks and the hypogene oxidation of the enargite according to the following reactions:



Microscopic studies, etching test on polished section, X-ray powder diagrams and chemical assay made by Socolescu and Superceanu show the presence of the minerals like domeykite and algodonite; other two minerals, whitneyite and huntelite, were identified by microscopic studies and spectrographical assay.

That occurrence was found again by the authors in 1997.

Microscopic studies, X-ray powder diagram, chemical and spectral analyses made by the authors confirm the presence of domeykite and algodonite, which represent 90% of the mineral assemblage.

A small vein, consisting only of metallic minerals (domeykite, algodonite, whitneyite, huntelite, chalcocine, covelite, and minerals belonging to weathering zone), without any trace of hydrothermal alteration, forms the entire mineralization. The vein thickness varies from 1 to 3 cm. The vein is developed in the middle cretaceous flysch gray color sandstone on a NE SW fracture. Ten

meters westward films of malachite and diopside are observed, but on Tiopului Valley, about 100 m below the Diesa Hill level, no signs of mineralization were observed.

The vein is made of parallel or transversal and oblique bands, predominant of domeykite and algodonite. The main mineral, domeykite (α and β modifications), is forming monomineral veinlets or it is intimately intermixed with algodonite. Sometime it surrounds the algodonite, in nests elongated on the fracture plane. Domeykite is gray in color, but tarnishes readily yellowish and subsequently iridescents and it has a high reflectivity (Socolescu, Superceanu, 1960).

The α -domeykite is metastable, izotrope and more susceptible to etching with an acid solution $[(\text{NH}_4)_2\text{S}_2\text{O}_3 - 12\% \text{ and } \text{HNO}_3 - 2n-]$ compared with the β -domeykite. During the oil immersion the α -domeykite has bluish reflections.

The α -domeykite occurs as veinlets (0.5-2 mm) or irregular or elongated films, usually intergrown with the algodonite and is partial substituted by the β -domeykite, chalcocite and cuprite. It is developed too like lamella or acicular shapes, sometime lenticular when it was resulted from the algodonite decomposition, according with the reaction:



This variety can be observed only after etching test, when it forms triangle or leaf shapes structures in the algodonite ground mass.

β -domeykite (hexagonal phase) is bluish color and it has a weak anisotropy. It is more resistant to etching than the α -domeykite. Within Cu-As system the β -domeykite is the stable phase, resulting from the α -domeykite at a temperature below 225° (Hansen, Anderco, 1958), conversion considered as a geothermometer (Skinner et al. 1963; Rhamdohr 1974). Below 689° the algodonite is decomposed in domeykite and whitneyite, process observed and by TDA analyses (Socolescu and Superceanu, 1960) but in fact the algodonite is stable even at the room temperature, that is explained by self annealing and solid solution diffusion processes.

The α - and β -domeykite were identified by X-ray analyses (Socolescu and Superceanu, 1960) and the authors of this paper [d-2.074 Å (I), 1.949 Å (F,I), 1,848 Å (i); d-2,215 Å, 1,187 Å, 1,180 Å (I)].

The primary domeykite was produced probably by the high hypogene oxidation of the enargite.

The algodonite (Cu_{6-7}As) is gray to silver white and it shows a weak anisotropy after the treatment of the polished section with nitric acid that clear away the CuAs film. In the compact ore the algodonite is intimate associated with the α and β -domeykite that they are the dominant minerals. On the contrary, in the impregnation zone from the border of the vein the algodonite is the dominant mineral.

By the decomposition of the algodonite was created lamella like domeykite, or needlelike with triangle structures or leaf aspects and whitneyite, both enclosed in the algodonite ground mass.

On the contrary with the occurrence from Mechernich (Germany), of hypogene genesis, the algodonite from Intregalde has a hypogene-telethermal feature.

RX powder diagrams revealed the presence of the algodonite [2.215 Å, 1.187 Å, 1.180 Å (I)].

The whitneyite (CuAs) is a solid solution, pink color and occur sporadically, as a algodonite decomposition product, especially in the impregnation zone, where it surround the algodonite grains.

The huntelite ($\alpha\text{-Ag}_3\text{As}$) was identified by Socolescu and Superceanu basis on the microscopic studies (weak bluish color, high reflection, anisotropy, and polysynthetic twins) and on the presence of silver, spectrographically identified.

The chemical assay of the raw ore showed the following composition: 61.15-70.23 % Cu, 9.02-12.62 As (Socolescu, Superceanu, 1960) and 74,76 Cu %, 12,32 % As, 2,80 % S, 8.8 % C (LAG Prospectiuni SA, 2000).

The spectrographic assay, made up in the same company laboratory indicated the following element grades (ppm):

As	Cu	Sb	Pb	Cr	Ni	Bi	Ag	Mo	B
>3000	>3000	100	25	25	3	3	20	10	10

Hg, Tl, Sn, Ga, Ge, In, Cd, Be, Zn, Co and Ba showed values below the detection limit.

The supergene alteration generated colomorphe cuprite around the arsenides, and malachite, coveline, crisocola, diopase.

The copper arsenides mineralization from Intregalde has a similar paragenesis like those from Chile (Coquimbo) and it was formed by the hypogene oxidation of iron and sulphur. It represents a late, low temperature phase of the metallogenesis related to the neogene volcanism.

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