

Sulphide mineralization from Djurkovo Pb-Zn deposit, south Bulgaria: minor and trace element composition

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The growing demand for critical raw materials due to the rapid development of high-tech industries had led to the enforcement of reevaluation of the mineral resources in Europe. Base metal deposits in the Central Rhodopean metallogenic province, south Bulgaria are known for their significant Pb-Zn ore accumulations with economic importance which are exploited in two mines located in the Laki region. Ore bodies, predominantly of the vein type are typical for the Djurkovo deposit, hosted by a high-grade metamorphic complex. The hydrothermal mineralization is dominated by sphalerite and galena with minor chalcopyrite, pyrite and marcasite.

Ore samples from 400, 572 and 778 mine level were studied prior to LA-ICP-MS analyses. Iron-rich sphalerite shows stable average substitutions of thousands of ppm of Cu, Cd, tens of ppm of Co, Hg, In, Ag. Later low-Fe cleiophane reveals increased Cd, and moderate Co, Cu, Hg, In, Ag enrichment. Isomorphic Ag is typical for chalcopyrite, while detected Zn and Cd are attributed to sphalerite microinclusions. Pyrite crystals associated with the main polymetallic paragenesis are generally devoid of trace elements, except for tens of ppm of Co, Ni, occasionally As, Pb and Sb. Relatively steady values of Mn are common in all studied minerals. Porous and colloform textures resulting from marcasite/pyrite transformation are indicative for precipitation of later As-rich Au-bearing pyrite. Thousands of ppm Sb and hundreds of ppm Tl positively correlate in marcasite, containing also low amounts of Mn, Ag, Ni, Pb and Hg. Colloform pyrite has significant As, Sb and Tl incorporation (wt. %), and minor Zn, Cu, Ni, Co, Pb, Ag, Hg contents. The composition of the As-bearing pyrite replacing marcasite reveals tens of ppm of Au and Ag, and lower Sb, Se, Tl. Trace element geochemical signatures of pyrite, sphalerite, chalcopyrite from the main ore paragenesis and later cleiophane and marcasite/pyrite aggregates indicate compositions with increased incorporation of several important elements in different orders of magnitude.

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