Sławomir Mederski

Characteristics of the hydrothermal base-metal mineralization of the Kizhnica ore field, Kosovo: Mineralogy, geochemistry and genesis

ABSTRACT

The Kizhnica-Hajvalia-Badovc ore field is located in central Kosovo and in the southern part of the Trepça Mineral Belt, which is part of the Serbo-Macedonian metallogenic province. The Serbo-Macedonian metallogenic province is known for numerous Pb–Zn–Ag deposits that have formed as a result of the late Oligocene to early Miocene post-collision extension and associated intermediate to felsic magmatic activity. The Kizhnica-Hajvalia-Badovc ore field exhibits metal zonation associated with volcanic center (concealed porphyry system) with three metal zones: Bi–Cu±Au zone, base-metal Pb–Zn–Sb±Ni zone, and distal sediment-hosted Sb–As–Tl–Hg zone. Individual metal zones show the presence of various styles of hydrothermal mineralization: veins, contact mineralization associated with hornfels, metasomatic ore bodies, epithermal veinlets in listvenites and volcanic rocks, and disseminated mineralization.

Studies using microprobe and LA-ICP-MS techniques have identified mineralogy, as well as minor and trace elements present in major ore minerals in the five newly discovered localities in the Kizhnica-Hajvalia-Badovc ore field: epithermal veinlets from the Kizhnica andesite quarry, Kizhnica Bi–Au–Cu–Te hornfels, Janjevo Cu–Bi–Ag±W deposit, Badovc Pb–Zn–Sb–Ni deposit, and Janjevo As–Sb–Tl–Pb±Hg±Au locality.

Polymetallic deposits and mineral occurrences associated with the Bi–Cu±Au zone (epithermal veinlets from the Kizhnica andesite quarry, Kizhnica Bi–Au–Cu–Te hornfels, and Janjevo Cu–Bi–Ag±W deposit) suggest proximity to intrusive rocks. Contact mineralization formed at higher temperatures (Kizhnica Bi–Au–Cu–Te hornfels), as well as younger epithermal veinlets are documented there. The mineralogy of these deposits consist mainly of sulfides (chalcopyrite and pyrite), sulfarsenides (arsenopyrite, rarely gersdorffite-cobaltite), varied sulfosalt groups: Bi–Pb±Cu±Ag paragenesis (members of bismuthinite-aikinite series + cosalite ± cannizzarite ± galenobismutite ± gustavite), Cu–Bi±Ag±As paragenesis (wittichenite ± pearceite ± cupropearceite ± $AgCuBiS_3$), and tetrahedrite group minerals + native Bi ± native Au. Bismuth sulfosalts paragenesis from the Kizhnica-Hajvalia-Badovc ore field are characteristic for deposits associated with volcanic rocks.

In the base-metal Pb–Zn–Sb±Ni zone, there are three Pb–Zn–Ag deposits documented: Kizhnica, Hajvalia, and Badovc. The dissertation documented the presence of two new styles of mineralization in this zone and Badovc area: listvenite Pb–Zn–Sb–Ni ores in hydrothermally altered mafic rocks - listvenites, and epithermal stibnite veins. Epithermal mineralization forms veins, veinlets, and disseminations in listvenites. The veins are mainly composed of sphalerite, Pb-Sb sulfosols, markasite, Mn-Fe carbonates, and stibnite. Mineralization hosted in listvenites is more diverse, and a geochemical signature associated with alteration of mafic surrounding rocks - listvenitization - is observed. The occurrence of sulfarsenides and Ni-Fe sulfides has been documented, which is represented by gersdorffite, ullmannite, Ni-Fe thiospinels and millerite. Sphalerite with Badovc Pb–Zn–Sb–Ni deposit deposit shows significant concentrations of many important trace elements: indium in listvenite ores, tin in massive-banded ores, and gallium, germanium, and silver in sphalerite from rhodochrosite-stibnite breccia.

Newly discovered distal sediment-hosted Sb–As–Tl–Hg zone in in the Kizhnica-Hajvalia-Badovc ore field carries diagnostic pathfinder elements for Carlin-type gold deposits such as Sb–As–Tl–Hg–Ba and occurs as veins, and irregular dolomitized metasomatic ore bodies associated with jasperoide rocks. Janjevo As–Sb–Tl–Pb±Hg±Au locality is one of the few rare localities with Tl sulfosalts. In addition, Pb–Sb±Tl±As sulfosalts from Janjevo exhibit advanced of $2Pb^{2+} \leftrightarrow Tl^{+} + (Sb, As)^{3+}$ substitution with the potential for document new mineral phases. Janjevo As–Sb–Tl–Pb±Hg±Au locality is the best-known manifestation to date of the crystallization of colloform As-Tl-Sb-Hg-rich pyrite under hydrothermal conditions unaffected by metamorphism. The presence of this zone shows potential potential for the exploration of sediment hosted gold deposits in the Kizhnica-Hajvalia-Badovc ore field, as well as in districts associated with volcanites.