Principle metallogenic features of the Sasa Pb-Zn deposit, Republic of Macedonia

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The Sasa Pb-Zn deposit has been localized in northeastern parts of the Republic of Macedonia or within the Serbo-Macedonian metallogenetic province. It formation is related with intrusion of Tertiary volcanics (27-24 Ma) into the crystalline fundament (Precambrian gneisses and Paleozoic schists) of the Serbo-Macedonian massif. Pb-Zn mineralization metasomathicaly is deposited into cipolins intercalated into the series of quartz-graphite schist. Genesis and spatial displacement of the Pb-Zn mineralization in the Sasa deposits represents a complex polyphase and timely lasting process directly related with the evolution of the Neogene magmatism and hydrothermal solutions in the deposits and its adjacent vicinity (Serafimovski and Aleksandrov, 1995). Magmatic activity started at the end of Eocene and lasted, through few phases, until the Pliocene. The mineralization is formed through several phases during Oligocene-Miocene. The ore mineralization spatially and genetically is related to the fault structures of NNW-SSE, NW-SE direction dipping to SW and its intersections with N-S structures dipping to the west, localized mainly in cipolins-marbles, cipolin-schists within quartz-graphite schists in zones of cataclization (in quartz-graphite schists, gneiss and rarely quartzlatites). Ore-bearing fault structures are of polygene character and its formation is directly related to reactivation of older fault dislocations, regional tectonic tensions under the influence of Neogene magmatic activities, while in the dykes was included influence of contractions due to their cooling.

Mineralization in the deposit is generated as a result of common action of numerous synhronous and consecutive factors that allowed deposit genesis, such are: host rocks conductive to change, grinding-brecciation-abrassion, which have created zones with an increased secondary porosity, intrusion of fluids (gaseous-liquid), common reaction between fluids and adjacent rocks, metasomathosis (thermal change-marlbeization and changes with componenet transfer), formation of calcic skarns (multiple skarn parageneses) and hydrothermal alterations: intermineralizing movements, mineralization-its deposition (polyphase), inter-ore movements and post-ore tectonics.

Genesis of the Svinja Reka deposit (as a synonym of Sasa deposit) was done in three separate phases of which especially is important the skarn phase when have been created condition for deposition of the Pb-Zn mineralization within the hydrothermal stage with additional three phases and few sub-phases (Aleksandrov, 1992). The mineralization has been deposited metasomathically in calcite skarns or by filling of cracks, brecciated zones and faults. In particular parts have been formed impregnation and stockwork-impregnation minerals as a products of polycentric metasomathic processes. The ore bodies have forms of pseudo-layers (tile-like), lenses, layers, oblique ore pillars, followed by impregnation and stockwork-impregnation mineralization in hangingwall and footwall of the ore bodies

Lead-zinc mineralization has been formed in the hydrothermal stage, which have started with manifestation of high-temperature pre-ore alterations of adjacent rocks (skarns), represented by intensive epidotization, chloritization, pyritization, silicification, calcitization that a little bit later continues into first high-temperature ore-bearing sulfide phase. Within that phase have been formed pentlantdite, pyrhotite, pyrite, chalcopyrite, bereite, bismuthinite, native bismuth, sphalerite, occasionally galena, bornite, arsenopyrite, hematite, siderite, quartz and clacite. Ore minerals were formed in the temperature range of 400-280^{o}C with simultaneous crystalization of colloidal dispersed solutions. With change of regime of ore-bearing solutions or decrease of temperature (interval of 375-220^{o}C), steep decline of pressure and increase of redox potential, results in deposition of ore minerals from main sulphide phase within hydrothermal stage. In this phase intensively are deposited sphalerite and galena, then chalcopyrite, pyrite, cubanite, valerite, bornite, tennantite, tetrahedrite, freibergite, enargite, altaite etc. With fluid inclusions analyses (in quartz) it was confirmed that this paragenesis was characterized by ore solutions with ph of 6.7 and following composition: 37.42 g/l Cl, 0.57 g/l F, 11.26 g/l SO^{2}_{4}, 11.90 g/l K, 10.68 g/l Na, 0.59 g/l NH_4, 0.46 g/l Mg, 5.24 g/l Ca, SiO-trace and B-trace. This points out that there dominated Ca and Na chlorides, which concentration could easily reach up to 65,00 g/l.

Effusive rocks quite often fill-up the cracks, faults and fualting structures with lower degree of resistivity. The contact parts between effusive and adjacent rocks are usually poorly mineralized, which is probably due to hydrothermal alterations.

The results from up to date numerous studies are pointing out to the fact that the Svinja Reka deposit has been formed at sub-volcanic level, while by the formation conditions it could easily be accounted into the group of skarn-hydrothermal-polymetallic deposits of metasomathic type.

Reference:

Aleksandrov, M., 1992. Metallogenetic features of the polymetalic ore field Sasa-Eastern Macedonia. Doctoral thesis, Faculty of Mining and Geology, Stip, 264 p. (in Macedonian)

Serafimovski, T and Aleksandrov, M., 1995. Lead and zinc deposits and occurrences in the Republic of Macedonia. Special edition of RGF, Stip. No 4, 387 p. (in Macedonian with extended summary in English).