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Conditions of formation, substitutions and trace element geochemistry in unusual sphalerite and wurtzite from Gonianitoviy Site, Pai-Khoi Range, Yukorskii Peninsula, Nenetskiy Autonomous Okrug, Russian Federation

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Natural zinc sulfides – cubic sphalerite and hexagonal wurtzite are widespread minerals and significant indicators of mineral formation conditions. Due to the simplicity of the crystal structure and diversity of formation mechanisms in a large number of rock types, it can accumulate a lot of trace elements (Ag, Au, As, Bi, Cd, Co, Cu, Fe, Ga, Ge, Hg, In, Mn, Ni, Pb, Sb, Se, Sn, Tl). In some cases, these admixtures are primarily mined from sphalerite- and wurtzite-bearing ores (e.g. Ga, Ge, Tl, Cd). These chemical elements can exist in different chemical states: (1) penetrate into the structure of sphalerite in “invisible” form as isomorphic admixture (Fe, Mn, Cd, Hg) or as nanoparticles (Ag, Au, Cu); (2): be a part of microinclusions of specified minerals (e.g. chalcopyrite, tennantite-tetrahedrite, petzite) in the matrix of zinc sulfides (e.g. As, Bi, Sb).

In this study, we investigated the chemical composition and formation conditions of unusual Mn- and Cd-rich V-bearing ZnS from Pay-Khoy region of Russia studied by EPMA, LA-ICP-MS, XRD and EBSD methods. Our results shows that high concentrations of Ge, Ga, As, Sb, Bi and even V in zinc ores may be associated with microinclusions of sulvanite and colusite group minerals with the similar sphalerite type of structure. The results of fluid inclusions and empirical LA-ICP-MS geothermometer study are in a good agreement in the cases where the samples do not contain elevated contents of vanadium and the above-mentioned impurity elements. These data complement ideas about the chemical forms of admixtures in sphalerite ores, which is important for the processes of their extraction, especially for such critical metals as Ge, Ga, In.