Compositional EMPA and Raman mapping of minor and trace elements in sphalerite from hydrothermal vein deposits

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The increasing demand for high tech-related trace elements and the high concentration of their supply on the world-market supports the need for systematic investigations on Ge, Ga and In potentials in ore deposits. Recently conducted quantitative trace element analysis using LA-ICP-MS indicated significantly varying metal concentrations in sphalerite and chalcopyrite samples from hydrothermal vein deposits dependent on physicochemical conditions of formation, structural controls and metal sources. However, transport, distribution, and incorporation processes are still poorly understood and widely under debate [1].

The concentration and mechanisms of incorporation of minor and trace metals reflects the sphalerite structure, formation conditions, and possible metal sources at the studied locations. The performed high-resolution compositional EMPA element maps of various sphalerite grains confirm coupled substitution processes as well as a crystallographic control on the enrichment of Ge, Cu, Ag, Sb in 111 planes (sector zoning) and Ga, In, Cu, Fe in 110 crystal faces (growth zoning) [2, 3].

The distribution of the minor and trace metals in sphalerite was additionally visualized by a mapping method using a Raman microprobe. The obtained maps clearly correlate with the EMPA maps, which supports the suggestion that intensity ratios of some Raman modes can be used for compositional analysis of sphalerite [4]. Moreover, information about degree of crystallinity and lattice expansion or contraction due to the incorporation of the metals was obtained.

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