

TRACE ELEMENT MINERALOGY IN THE MASSIVE SULFIDE ORE FORMATION

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Many minor or trace elements (Au, Ag, As, Sb, Bi, Hg, Cd, Se, Te, Sn, Ge, Cr, V, In, U, P, REE, etc.) are found in the massive sulfide deposits in addition to the constitutional ore-forming elements (Fe, Cu, Zn, Pb, S, Ba). Some of them appear to be of economic or subeconomic significance in individual massive sulfide deposits. All these elements either are isomorphically dispersed in the main ore-forming minerals or form their own (proper) usually tiny mineral grains identified by means of optical microscopy in combination with X-ray microanalysis. The list of trace element minerals found by the authors in many massive sulfide deposits of different types, age, and metamorphic transformations belonging to different metallogenic provinces includes various native elements, tellurides and sulfotellurides, arsenides, antimonides and sulfoantimonides, sulfides of cobalt, nickel, silver and other metals, arsenic, antimony, and bismuthic sulfosalts of silver, copper and lead, silicates of barium, oxides of vanadium and uranium, phosphates of calcium, and rare earth elements. The appearance of specific trace element mineral associations in the massive sulfide deposits depends on the type of these deposits, the kind of their ores, the degree and the type of metamorphic transformations, and the geochemical features of individual metallogenic provinces. The typomorphic associations of the minerals under consideration comprise, for example, sulfides and sulfoarsenides of cobalt and nickel (Cyprus-type), tellurides and sulfotellurides (Urals-type), sulfides and sulfosalts of silver and bismuth (Kuroko-type), etc.