Tykotlov gold-sulfide occurrence with unique Ga-bearing silicates, Subpolar Urals, Russia

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Tykotlov gold-sulfide occurrence is located in the Subpolar Urals and localized in the Early Ordovician acidic volcanites (rhyolites, rhyodacites) metamorphosed in the greenschist facies. The gold-sulfide mineralization is confined to the schistosity and secondary silification with superimposed sulfide mineralization of NW strike. The ore association is represented by sphalerite, pyrite, galenite with a subordinate quantity of chalcopyrite. Secondary ore minerals, usually represented by microinclusions in pyrite, are Ag-bearing bornite, tetrahedrite-tennantite, different Ag and Cu sulfides and sulfosalts, small amount of gold. The composition of gold (wt %): Au–72.59, Ag–26.41, Te–0.29, Se–0.04. Pyrite grains are characterized by a fine-scale oscillatory zoning resulted from variations of As-content (0.04–4.01 wt %). Vein minerals – quartz (strongly prevails), calcite, Zn-Mn carbonates, anhydrite or hypsum, epidote. Judging by the presence of chalcopyrite-sphalerite decomposition structures, the formation of the ores took place at temperatures not lower than 350-400°C. It is known that in the ore deposits sphalerite is a major host of gallium. However, for the first time in the world we confidently determined complex-zonal high-gallium silicate mineral phases of the epidote-allanite series with a unique composition (Ga up to 14.5 wt %) in the ores of Tykotlov occurrence. Typically these are inclusions in sulfides, mainly in sphalerite, less often in pyrite, 20-50 µm in size. Ga-enrichment was detected the sphalerite, contacting with Ga-epidote, (up to 0.05 wt %), none in other sulphides. In the crystalline structural Ga^{3+} substitutes Fe^{3+} completely in *M*I and *M*III octahedrical positions. According to the nomenclature of epidote-group minerals, the given phases can be referred to as epidote-(Ga) [1]. We conducted experiments on the synthesis of gallium analogues of natural minerals in Ca-Ga-Al-Fe-Si-O system (T=400-600°C and P=4-6 kbar).

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[1] Armbruster et al. (2006) *Eur. J. Mineral.*, **18**, 551-567.