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The mineralogy of regenerated sulfide ores of Pb-Zn deposits

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Mineral suites of regenerated ores show a broad spectrum of ore and vein minerals. Their composition is essentially determined by the composition of initial ore concentrations that had undergone metamorphism and regeneration. In the majority of cases, it includes traditional mineral forms of Pb-Zn ores. At the same time, specific features of primary ore compositions are also reflected in the mineral suites of regenerated ores. In particular, fluorite is present in regenerated ores of the deposits of Tekeliyskaya group, where primary ores are rich in F, and the contamination of ores of Zn-Pb-barite deposits in Kazakhstan with Hg, Ge, Tl and other elements is also manifested in the occurrence of corresponding minerals in regenerated ores of these deposits. In the Zhairem deposit, where Zn-carbonates play a significant part in the composition of primary ores, up to 20% Zn occurs in regenerated ores in the form of Zn-oligonite.

At the same time, regenerated ores appear to contain a number of minerals that are typically absent from primary hydrothermal-sedimentary ores. This fact may be caused by extensive extraction of dispersed elements from primary ores, where they occur in the form of isomorphic or mechanogenic impurities in fine-dispersed ore and nonmetallic minerals and their subsequent concentration. These elements are represented by Ag, Cu, Sb, As All of them, except for Cu, do not form their own minerals in primary ores. In regenerated ores, they are incorporated in tennantite, tetrahedrite, gudmundite, geocronite and other minerals.

Another factor that favours the occurrence of large amounts of rare minerals in regenerated ores is the supply of some of the elements by fluids, which are involved in the invasion of dike and intrusive masses and in contact and regional metamorphic processes (regressive branch) that, rather commonly, result in certain changes in the metallogenic specialization of the deposits in question because of the formation of minerals that are atypical to them. Such processes are responsible for the occurrence of Au, Bi and Tl minerals in the ores of the Karagayli deposit, electrum, Te-containing Ag sulfosalts in the Akzhal deposit, breithauptite, ulmanite in Tekeli ores, molybdenite and stannine in Uralian and Japanese deposits. Similar effects are observed in the Voznesenskoye deposit (where Mo, W and Hg are supplied by fluids).

The formation of regenerated ores is accompanied by redistribution of isomorphic impurity elements in minerals in accordance with new thermodynamically conditions. Finally they are concentrated in those minerals, with which they may form iso- and homeostructural phases: Fe, Cd, Mn in sphalerite, Bi and Ag in galena etc. Besides, there occur some impurities (Mo, Sn, W, RE) that are atypical to Pb-Zn ores. Regenerated ores show a more homogeneous sulfide sulphur isotope composition as compared to primary ores. They exhibit a higher proportion of light S isotope, which is in a good agreement with experimental data on hydrothermal redeposition of sulfides.