PHYSICOCHEMICAL CONDITIONS AND STAGES OF MINERAL FORMATION IN THE SAULYAK GOLD DEPOSIT (RAKHIV ORE DISTRICT, TRANSCARPATHIAN REGION)

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The results of integrated mineralogical-genetic analysis of ores, accompanied by thermobarochemical research of inclusions in minerals as well as the investigation of thermoelectric properties of minerals-semiconductors show that within the limits of the Saulyak deposit each delineated mineral assemblage was formed during the corresponding stages of ore formation characterized by mineral fluids, different portions of which entered into the ore body after intensive tectonic movements. Every portion of fluids that entered into the ore body can be characterized by its specific chemical composition and p-T conditions and can be delineated both spatially and chronologically.

Formation of ores of the Saulyak deposit took place during five stages within the pneumatolytic–hydrothermal process of mineral formation: 1) pyrrhotite–quartz stage (475–385 °C); 2) tourmaline–quartz stage (465–385 °C); 3) pyrite–quartz stage (410–250 °C); 4) gold–polysulphide stage (335–110 °C); 5) quartz–carbonate stage (150–80 °C). The overall temperature range of mineral formation was 475–80°C; the pressure of the gold-bearing system varied from 145–105 to 90–85 MPa; bulk density of the gold-bearing carbonic aqueous fluids was 0.815–0.770 g/cm^3. Temperature ranges of formation of paragenetic associations of the productive (gold-bearing) complex are as follows: 320–240 °C: quartz–pyrite–sphalerite with gold; 335–220 °C: sphalerite–galena with gold; 220–160 °C: gold–chalcopyrite; 170–110 °C quartz–carbonate with gold; overall temperature range of the productive mineral formation is 335–90 °C; the most part of native gold was formed in the temperature range of 280–120 °C.

As for the majority of deposits of gold-bearing provinces, Saulyak deposit is also characterized by a cyclic development of hydrothermal mineral formation processes. Based on the inverse-regressive variability of the p-T conditions, the cyclic character is detected in the succession of minerals (quartz → sulphides → carbonates) within each cycle.

Gold-bearing fluids were first of all medium-temperature carbonic aqueous ones and despite the complex polycyclic character of the gold-bearing ore formation, native gold precipitated from only one kind of fluid during the gold–polysulphide stage of mineral formation.

Results of comprehensive geological-genetic, mineralogical-physical and thermobarogeochemical analyses of ores of the Saulyak deposit enabled us to make a conclusion that the natural diversity of the gold-bearing sulphide-quartz mineralization of the Saulyak deposit is the result of the development of a uniform pneumatolytic-hydrothermal sequence, with discrete stages and inverse-regressive variability of p-T conditions of thermobaro-geochemical parameters in time as well as in space.