COMPARATIVE ANALYSIS OF GEOCHEMICAL PECULIARITIES OF GOLD BEARING DEPOSITS

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Geochemical features of major associated elements of gold deposits as well as their role in gold mineralization were studied. Within Ukrainian territory the following most typical gold ore formations are known: a) the pre-Quaternary (Carpathians and Precarpathians); b) the pre-Cretaceous (Crimea); c) the pre-Jurassic (Dobrudzha); d) the pre-Mesozoic (Ukrainian Shield, Volin–Podolia). Among them the Carpathian region is worth particular attention, being the most perspective one. Such gold ore objects as gold-quartz, gold-adular-quartz, gold-quartz-beresite and gold-silver-argillitized formations are found to have formed as individual segregations. Complex gold- and gold-silver-polymetallic, barite-quartz and gold-quartz-sulphide objects may be combined to a special group. Laser mass spectrometry (LMS) and secondary ion mass spectrometry (SIMS), both of high sensitivity, locality and precision, were used for a determination of accompanying elements within the ore zones.

Three groups of deposits have been distinguished in this way. They are related to greenstone (the Ukrainian Shield), metamorphic (Donbass), terrigenous and volcanic rocks (Carpathian region), all characterized by quite definite geological and geochemical parameters. The characteristic elements for the first group are Pt, Ni, Co, V, Fe, Se and Te, for the second one W, Mo, Zn, Pb and Hg, whereas ore zones in the Carpathian deposits have the following characteristic element associations: Zn-Pb-Sb-Ag-Se, Cu-Bi-Hg-Te and Ba-Sr-As. The Ag/Au ratio varies from 0.4 to 20. Silver is a typical typomorphic element of the Carpathian gold ore deposits.

An indicative role of the $^{109}Ag/^{107}Ag$ isotope ratio is also defined. It is found to be regularly changing in vertical direction within ore zones. Thermal conditions of crystallization, which promote formation of sulfide bearing inclusions, influence the ratio considerably. When temperature of ore formation increases, the enrichment of native silver in the light isotope ^{107}Ag takes place, whereas sulfide bearing inclusions are enriched in heavier isotope ^{109}Ag. This process is more intense at elevated temperatures. Due to the prevailing bonding of sulphur atoms to one of the Ag isotopes, there are differences in $^{107}Ag^+$ and $^{109}Ag^+$ energy spectra that causes additional errors in the automatic registration of isotopic ratio in samples with different sulphur contents. An increase of the $^{109}Ag/^{107}Ag$ ratio is typical for upper ore zones. This factor can be a search indication for the mineralization prognosis on the depth and for the assessment of an ore body and to separate them by the degree of erosional truncation, and in the search for blind ore bodies. Zones with the stable and high Au/Ag ratio are typical for objects with a small vertical range of mineralization. Maximum Ag(total) and ^{109}Ag isotope concentrations are determinated in horizons making fluids.

According to our data the Muzhievske, Beganske, Berehivske, Sauljak, Kvasivske, and Kupljanske deposits are the most long range objects in the Carpathians.