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The large Bugdaya Au-rich W-Mo-porphyry deposit (Eastern Transbaikalia, Russia): Fluid evolution and formation conditions

V. Kovalenker, G. Kiseleva, T. Krylova, and A. Avdeenko

IGEM RAS, Sector mineragraphy, Lab.of Ore deposits geology, Moscow, Russian Federation (kva@igem.ru, +7 495 954 46 12)

The large Bugdaya Au-rich W–Mo- porphyry deposit (Eastern Transbaikalia, Russia), is located in the central part of volcanic dome within in the Variscan Undinsky granitic pluton. This is a Climax-type deposit, but differs in that it is Au-enriched. For studies of deposit formation conditions, PT-parameters, composition and sources of fluids, mineralogy and paragenetic sequence of minerals formation, fluid inclusions (FI) (microthermometry, Raman-spectroscopy, ICP MS), isotope composition of oxygen in quartz and sulfur in sulfides were investigated. It is established, that: (1) ores of a deposit were formed during Pre-ore, Quartz-molybdenite, Gold-base metal and Post-ore stages of hydrothermal process; (2) Mo-W-porphyry ores have simple composition (quartz, molybdenite, scheelite, pyrite, magnetite, wolframite) typical for Climax-type Mo deposits; (3) Au-bearing quartz–sulfide veins and veinlets with native gold, base-metal sulfides, and various Ag–Cu–Pb–Bi–Sb sulfosalts of the gold–base-metal stage, basing on the mineralogical and geochemical characteristics, textural and structural features, have close similarity to deep parts of the so-called (Sillitoe, 1993) sub-epithermal veins; (4) gold enrichment of deposit was caused by telescoping on Mo-W-porphyry ores of sub-epithermal Au-base-metal vein mineralization which was formed after change of the structural plan of deformations from NE to NW. Fluids of the Pre-ore and Quartz -molybdenite stages had 560-350 temperatures, chloride composition, and contained significant amount bivalent cations. Salts concentration of fluids reached up 73 wt. %.NaCl-eq. The mineralization of the Gold -base metal stage was formed at temperature up to 360 by fluids of Na-(Mg? Ca?)-chloride-bicarbonate (sulphate?) composition. During precipitation of late mineral associations of this stage salinity of fluids varied from 0.5 up to 25 wt. % NaCl-eq. The concentration of the main components (g/kg H_2O): CO_2 (145.3-3.9), CH4 (0.8-0.05), Cl-(129.8-5.0), SO42- (28.0-2.7), HCO_3 (-) (1378.2-17.3), Na (64.3-2.3), Ca (256.1-0.8), K (133.4-9.5) and Mg (85.3-1.3), strongly varied, with the maximal values of many of them for fluids of early associations of Pre-ore and Quartz-molybdenite stages. K/Rb changes from 90 up to 173, what corresponds, at least, for early associations, to values of the magmatic fluid connected with granitoids (Irber, 1999), and testifies to the mixed source of a fluid for late associations. High concentration of some metals, their essential variations and clear evolution from early to late stages of ore-forming process are determined in the same samples by the bulk ICP-MS analysis of fluid inclusions.
Estimation of oxygen isotope composition of fluids shows, those δ18O values of Pre-ore and Quartz - molybdenite stages correspond to values of a magmatic fluid. At the same time, fluids of Au-base metal stage were formed as a result of mixture of magmatic and meteoric waters in different proportions.
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