CONDITIONS OF FORMATION OF GOLD DEPOSITS IN THE SOUTH GOBI ORE BELT (MONGOLIA)

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The South Gobiore belt is one of the largest ore belts of Mongolia. It occurs along the large lineament separating the Caledonian (Pre-Cambrian and lower Paleozoic) folded structures from Hercinides (Upper-Paleozoic) of the South Mongolia (Fig. 1). Magmatism, metamorphism and ore-forming processes, corresponding to three various age boundaries (Devonian-Cambrian, Permian-Triassic, and Upper-Jurassic – Lower-Cretaceous), occurred within the ore belt. Porphyry-Cu-Mo, gold, carbonatite rare-earth, and fluorite commercial deposits are established here.

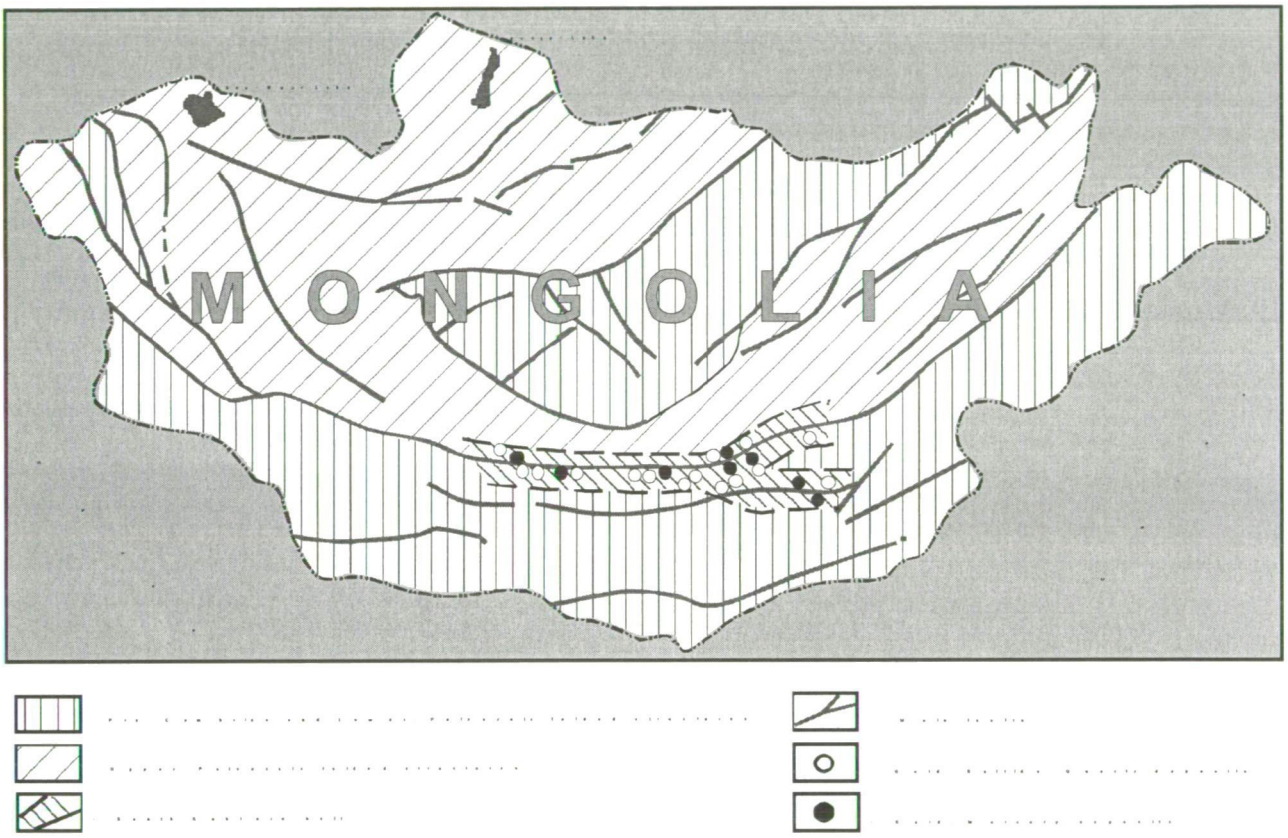

Fig.1. Scheme of location of gold deposits in South Gobi ore belt

In South Gobi ore belt two types of gold deposits predominate: gold-sulfide-quartz and gold – mercury deposits. The first is represented by quartz veins with pyrite, chalcopyrite, galena, sphalerite, tetrahedrite, Au, Ag and Hg tellurides, bismuthinite and gold with fineness from 730 up to 880. The isotope composition of sulfur of sulfide minerals varies from 0 up to +4.2 ‰. These deposits formed during Permian-Triassic period of tectonic-magmatic activity (246 Ma). Gold - mercury deposits are hosted in silicificated limestones, quartzites and silica-carbonate rocks. Hydrothermal altered rocks contain thin impregnation of pyrite, marcasite, arsenopyrite, cinnabar, stibnite, barite and disseminated Hg-gold (Hg content up to 5.2 wt. %) with fineness 900-980. Isotope composition of sulfur from sulfide minerals is +0.4 -19.6‰. The age of these deposits is J_3 - K_1, (Upper-Jurassic – Lower-Cretaceous) according to geological data. Fluid inclusion study shows that these types of deposits essentially differ one from another in PT - parameters, composition and salinity of ore-forming solutions (Table 1).

Gold-sulfide-quartz deposits are characterized by higher temperatures of formation (340-135°C), salinity of ore-forming fluids (16.1-4.9 wt. % NaCl eq) and presence of high-density carbon dioxide in gas phase. Compositions of gas phase CO_2 > N_2 > CH_4 have been identified using cryometry and Raman spectroscopy. Carbon dioxide is homogenized in liquid phase at 14-31°C. The pressure estimated on CO_2 and CO_2-H_2O inclusions is 0.6-1.1 kbar. Measurements of eutectic temperature in fluid inclusions show that NaCl and $CaCl_2$ prevail among salt components.

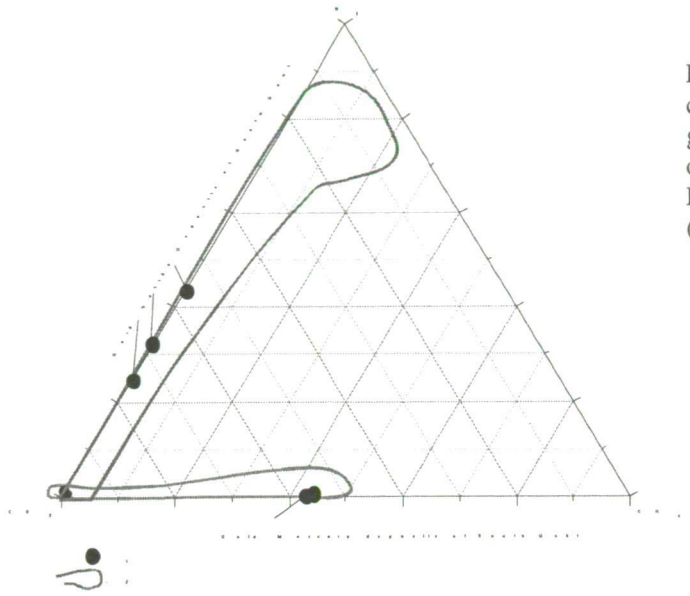

Fig. 2. Ternary plot showing the gas phase composition of fluid inclusions from South Gobi gold deposits (1) and field of gas phase composition of fluid inclusions from epithermal gold deposits of Russia (2).
(Raman-spectroscopy data)

Gold - mercury deposits show lower temperatures of formation (270-145°C) and lower salinity of ore-forming fluids (5.1-2.6 wt.% NaCl eq.). There is no any high-density carbon dioxide in gas phase of fluid inclusions that indicates low pressure. CO_2 and CH_4 were determined in gas phase (Fig. 2). Thus, PT-conditions together with the presence of widespread minerals such as chalcedony, barite and Hg-minerals in the ore testify near-surface environment of gold - mercury deposits formation and their similarity to the Carlin-type deposits.

Table 1. Results of fluid inclusion studies at gold deposits of South Gobi ore belt

Gold-sulfide-quartz vein deposits				
Deposit	T h °C	T eut °C	T ice °C	Salinity (wt. % NaCl eq)
Ortsog-1	220-180	--	-6	7.6
Dayangar, quartz-1	275-175; 250-240	-54 / -48	-4 / -3.6	6.4 – 6
Dayangar, quartz-2	190-180	-68/ -64	1.8	12.8 – 7.8
Khurimt-Khudug, quartz-1	240-230	-66 / -48	-3	4.9
Khurimt-Khudug, quartz-2	180-155	-49 / -42	-6	9.2
Dioritovi, quartz-1	340-335	-37	-10 / -8	14 – 11.7
Dioritovi, quartz-2	170-135	-49 / -44	3,4	5.6
Itgel, quartz-1	195-170	-50 / -49	-10 / -8	14 – 11.7
Itgel, quartz-2	190-185	-64 / -54	-12 / -8	16.1 – 11.7
Gold-mercury deposits				
Unegen-Del	150-175	-21 / -23	-1.6 / -3.1	2.6 – 5.1
Khara-Noion	145-150	-21 / -50	-2.0 / -2.4	3.4 – 3.9
Ortsog-2	160-210	--	-2.0 / -2.5	3.4 – 4.0
Toromkhon-Sair	270-225	-40 / -34	-6.5 / -4.5	9.8 – 7.2

Combined investigations of mineral composition of ore and fluid inclusions allow us to distinguish two types of gold deposits in South Gobi ore belt, which differ in PTX - conditions and mineral assemblages.

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