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Oxygen isotope study of vein type gold deposit at the Tsagaan Tsahir Uul in the Bayankhongor belt, Mongolia

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The Bayankhongor metallogenic belt, ~700 km southwest of the capital city, Ulaanbaatar, is the second productive gold-field in Mongolia. Production of this gold-field is not well known, but is estimated at about 50 kg/yr. Most gold is recovered from alluvial deposits, however primary sources of alluvial gold in the district are not well understood. The Tsagaan Tsahir Uul (TTU) gold deposit is located at the southeastern part of the Bayankhongor metallogenic belt, and is possible source of alluvial gold. The geology of the TTU deposit consists of Proterozoic tonalitic gneisses and marble-bearing schists, Proterozoic granitoid (647 Ma) and Permian small dioritic stocks (250 Ma) and Permian lamprophyre dikes (352 Ma). Gold mineralization in the TTU deposit is accompanied by quartz veins hosted in migmatized schist and granite.

There are two types of quartz veins. First group is 15 gold-bearing quartz veins that have NNW to NS direction with length of 0.2 to 2.8 km. The width of these veins is between 0.2 and 0.5 m. Quartz veins consist mostly of crustified bandings of milky quartz, with associated silver-black bands. The other vein is barren quartz-carbonate vein with ~4 km length and from 5 to 50 m width. This vein cuts quartz veins mentioned above. The veins composed of brecciated fragments of quartz and fracture filling carbonate-quartz matrix. Ore minerals in quartz vein are pyrite, chalcopyrite, galena, sphalerite, tetrahedrite, arsenopyrite and native gold. The fluid inclusions found in gold-bearing quartz veins were two-phase and some of them contain CO_2, with homogenization temperature range from 160-290^{o}C. Oxygen isotope of quartz veins were analyzed by CO_2-laser ablated BrF_5 fluorination technique. The delta^{18}O values of quartz vein range between 11.3 to 17.9 per mil, compared to -9.4 to -6.4 per mil for the quartz-carbonate vein. Calculated delta^{18}O values of fluid from the delta^{18}O of quartz using fractionation factor between quartz and water and homogenization temperatures (200 and 125^{o}C, respectively) of fluid inclusion are 1.3 to 6.2 per mil for gold-bearing quartz veins and -27.3 to -24.2 per mil for quartz-carbonate vein. These data suggest two veins were formed completely different processes. Oxygen isotopic values of fluid suggest, the origin of gold-bearing fluid is metamorphic fluid from deep crust and migrated along the big fault system. Fluid responsible for quartz-carbonate vein was dominated by meteoric water, and this vein was probably formed at shallow level.

Based on the tectonic setting of the deposit, the TTU deposit possibly belongs to orogenic type gold deposit (Groves. 1998). The geological, mineralogical and geochemical features of TTU deposit are similar to those of worldwide orogenic gold deposits.

Keywords: orogenic gold, oxygen isotope, Tsagaan Tsahir Uul