

## Permian orogenic gold deposits of Eastern Kazakhstan and Western Siberia

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In eastern Kazakhstan and western Siberia, orogenic gold deposits are widespread and usually formed in Permian. In eastern Kazakhstan all orogenic gold deposits are localized within the West-Kalba metallogenic belt. The largest reserves are recognized in the region of the Kyzyl project, which includes the Bakyrchik and Bolshevik deposits and a number of minor gold occurrences total reserves 7.3 Moz and inferred resources 3.1 Moz, with average grade 6.8 g/t). The Permian age were confirmed for the Suzdal, Jerek, Zhaima, Balazhal, and Daubai deposits using  $^{40}\text{Ar}/^{39}\text{Ar}$  (sericite) and U-Pb (SHRIMP) methods for ores and rocks, respectively. Measurements for the age of mineralization at the Zherek deposit are  $287.9 \pm 2.8$ ;  $286.7 \pm 3.4$ , and  $282.5 \pm 2.7$  Ma. The age of the same type of mineralization at the Bolshevik deposit is  $285.6 \pm 3.3$  Ma., and the age of the main ore stage of the Suzdal deposit is  $281 \pm 3.3$  Ma. In the Kuluzhun region (Balazhal stockwork gold deposit), the age of the disseminated pyrite-arsenopyrite mineralization in a hydrothermally altered gabbro-diorite massif is  $276.1 \pm 2.7$  Ma. In the same area, at the Daubai gold occurrence, quartz-sericite metasomatic gold-bearing rock is dated as  $254.3 \pm 3.1$  Ma. Possibly this younger age is caused by overprinting from contact metamorphism during emplacement of a Late Permian granitoid on the primary gold-arsenic ores. The Zhaima gold deposit is located in the northwestern part of the West Kalba gold belt and shows argon ages for three sericite samples from ore veinlets of  $279 \pm 3.3$ ,  $275.6 \pm 2.9$ , and  $272.2 \pm 2.9$  Ma. The Akzhal, Boko, Vasilevskoe, and other orogenic gold deposits of the region likely also have Permian ages.

In western Siberia, there are a few orogenic gold occurrences within the Kolyvan-Tomsk fold belt (Baturinskoe, Larinskoe, Semiluzhenskoe) and at the junction of the Kolyvan-Tomsk fold belt and Salair ridge (Legostaevskoe, Elbashinskoe). For the Baturinskoe occurrence, the  $^{40}\text{Ar}/^{39}\text{Ar}$  age of sericite from a quartz-sericite vein was determined as  $279.2 \pm 3.1$  Ma. The age of the productive stage of the Legostaevskoe deposit obtained by  $^{40}\text{Ar}/^{39}\text{Ar}$  dating of sericite is  $246.8 \pm 3.1$  Ma. The data were confirmed by preliminary results on the model lead isotopic age for arsenopyrite, galena, and feldspar.

In both regions, eastern Kazakhstan and western Siberia, orogenic gold deposits are accompanied by antimony mineralization separated in time from main gold ore stage. For example, at the Suzdal deposit, within a zone of early metasomatic Au-As mineralization, younger antimony mineralization is dated at  $248.3 \pm 3.4$  Ma. This correlates with the time of formation of the trachybasalt-trachyrhyolite association in the Semeitau volcano-plutonic structure ( $248.2 \pm 0.5$  Ma), which is in the area of this deposit.

Our data indicate a similar metallogeny for the two gold-bearing regions and a single trend of evolution of magmatism and ore-forming systems. These regions correlate in magmatism and

metallogeny with similar structurally hosted ores in NW China (Saerbulake deposit:  $285.9 \pm 2.8$  Ma) and other central Asian provinces, where giant orogenic gold deposits, such as Muruntau and Kumtor, are situated.