

Conditions for the formation of the Lena gold-bearing area, southern Siberia, Russia

Nikolay A Goryachev* and Alexander E Budyak

North East Interdisciplinary Scientific Research Institute, Far East Branch Russian Academy of Sciences, Russian Federation, *e-mail, goryachev@neisri.ru

The Lena gold-bearing area is located in the southern margin of the Siberian continent and is localized in the Bodaibo synclinorium. Past production for 150 years was about 1500 tons of gold and about 2000 tons are remaining and concentrated in the largest deposits such as Sukhoi Log, Golets Vysochaishy, and Verninskoye. We distinguish four stages in the geological history of the region based on modern data. (1) Accumulation of gold-bearing strata in the passive continent margin and back-arc basins (Neoproterozoic-Cambrian). (2) Folding and concomitant metamorphism, formation of thrusts at the beginning of collision of the Muya superterrane with the Siberian Craton. (3) Final collision. Formation of the Mamsky granitic-metamorphic arc and transverse folding. Prograde metamorphism of the amphibolite facies and the appearance of syn-metamorphic granites, the conversion of thrusts into slips. (4) Introduction of post-folding granitoids of the Konkudero-Maimakan assemblage of the Angara-Vitim batholith and the formation of transverse fault zones. Perhaps it was the result of the middle Paleozoic plume or, alternatively, this is due to the closure of the Paleozoic Central Asian Ocean. Two main gold mineralization types are known in the region: veinlets-disseminated gold-sulfide type (Sukhoi Log type) and gold-quartz veins. They form belts of deposits, coinciding with the general direction of the host rocks and large faults and surrounding the Mamsky granitic-metamorphic area. Gold-bearing pyrite was formed in four stages: (1) catagenetic (630-570 Ma) sedimentary pyrite-1, (2) early metamorphism (550-500 Ma) - early metagenic pyrite-2, (3) Prograde granitic-metamorphic stage (500-420 Ma) - late metagenic pyrite-3 and veined pyrite-4 and (4) plutonic phase (about 320 Ma) with late pyrite-5. Four generations of gold-quartz veins were formed at this time also. Early metamorphic, slightly gold-bearing veins (~500 Ma), late metamorphogenic veins of the beginning of prograde metamorphism (~470 Ma), plutono-metamorphic veins of the final of prograde metamorphism (~420 Ma), and late plutonogenic veins (~320 Ma). An important role in the formation of mineralization, in addition to favorable black shale strata, were zones of sublatitudinal thrusts, in which the most significant mineralization formed in the hangingwalls of thrusts. The Pb isotope data demonstrate a crustal source for Sukhoi Log type ore. The formation of Lensky area is due three main factors. First, it is the accumulation of potentially gold-bearing black shales with a combination of the passive continent margin (of the shallow shelf facies at the foot of the large river coming from the Urinskii trough) and the deeper and younger back-arc basin with associated rifting. Secondly, there was a complex Caledonian collision with the formation of a granite-metamorphic area along the Siberian craton edge with late deformation of the folded host rocks and the migration of regional gold-bearing fluid flows along the early structures. Thirdly, there is the manifestation of the late Hercynian stage of a partial redistribution and, possibly, an addition of gold.