Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03693, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03693
EGU General Assembly 2008

Ion microprobe U-Pb dating of gold mineralization and low-grade metamorphism (the Sukhoi Log gold deposit, Russia)

M. Yudovskaya (1,3), V. Distler (1), N. Rodionov (2), A. Mokhov (1), S. Sergeev (2)
(1) IGEM RAS, Moscow, Russia, (2) CIR VSEGEI, Sankt-Petersburg, Russia, (3) Now at University of Witwatersrand, South Africa (marina.yudovskaya@wits.ac.za)

Lode gold mineralization of the Sukhoi Log deposit is localized in Middle-Late Riphean black shale metamorphosed to greenschist facies. Dating of mineralization event has been hampered by fine size and scarcity of suitable minerals, as well as an absence of correlated magmatic complexes. We show here that absolute ages for the low-grade metamorphism and gold mineralization can be provided by SIMS U-Th-Pb analyses of metamorphic and hydrothermal monazites coupled with SIMS U-Th-Pb analyses of detrital and hydrothermal zircons.

Among accessory minerals, monazite and zircon are common in the ore, whereas scheelite, wolframite, baddeleyite, xenotime are rare. Metamorphic monazite-I forms rounded porphyroblasts up to 0.2 mm saturated with numerous matrix inclusions and is most abundant in sericite layers rich in carbonaceous matter. Monazite-I apparently represents an authigenic mineral of the black shale transformed by metamorphism. Hydrothermal monazite-II is observed within rich gold ore zone as euhedral translucent crystals up to 100 μm in pyrite in association with microinclusions of native gold, pyrrhotite, galena, quartz, pyrite, sericite and albite. In addition, the hydrothermal monazite occurs as translucent rims and separate domains within coarser grains of the earlier metamorphic monazite. Both monazites are characterized by variable concentrations of REE. The metamorphic monazite crystals have low Th (less then 0.3 wt %) and U contents, clearly different from the hydrothermal crystals enriched in Th up to 7 wt %.

The results of SIMS U-Pb analysis provide distinct ages for two generations of monazite. Most of analyses give discordant ages with sometimes very high analytical errors due to heterogeneous composition of the grains and small size of the homogeneous domains. All monazite ages form a continuous row close to a concordia between 430 and 730 Ma. Five metamorphic monazite grains provide a concordant ^{206}Pb /^{238}U age of 637±19 Ma which can be considered as a peak of metamorphism. One monazite domain gives a concordant ^{206}Pb /^{238}U age of 728±26 Ma and is interpreted as an inherited detrital phase. One grain of hydrothermal monazite provides a concordant ^{206}Pb/^{238}U age of 437±15 Ma.

A set of detrital zircons (n=51) from an ore zone of the deposit contains few age populations within an interval of 720 - 2300 Ma. Some of detrital zircons have hydrothermal outgrowths and some of zircons seem to be hydrothermal in origin and have younger U-Pb age. Ages for zircons with the outgrowths are scattered between 450 and 670 Ma with two overlapping maximums around 580 and 650 Ma, that may be reflects hydrothermal growth of zircon and disturbing of U-Th-Pb isotope system during the regional metamorphism. Two U-Pb discordia data have lower intercepts with a concordia at 466±29 Ma (MSWD = 0.43) and 447±32 Ma (MSWD = 0.38) and upper intercepts at 1742±57 and 2513±34 Ma, respectively. A youngest zircon in the set has a ^{206}Pb /^{238}U age of 448 ± 19 Ma. Its age is very close to the youngest age for the hydrothermal monazite and is well consistent with a Rb-Sr age of 447±6 Ma which has been found for bulk ore samples from the Sukhoi Log deposit (Laverov et al., 2007).

A new data confirm a superimposed character of gold-quartz-sulfide mineralization of the Sukhoi Log deposit. The mineralization event is separated from the metamorphic event by almost 200 Ma gap. Hercynian granitization (310 Ma) did not affect on U-Th-Pb isotope system and likely could not be a source of fluid flow and ore matter.

The study is supported by RFBR, grant N 05-05-65344.

Laverov N.P., Chernychev I.V., Chugaev A.V., Bairova E.D., Golzman Y.V., Distler V.V., Yudovskaya M.A. 2007. Doklady Earth Sci., 415, 236-214.