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Thermal history modeling of intrusions in the Tatarka-Ishimba suture zone at the Late Neoproterozoic evolution stage of the Yenisey Ridge orogen

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During computational modeling of cooling intrusions thermal regimes in collisional orogens, which are regions with thickened continental crust and heightened radioactive heat sources concentration, the main factors are the morphology and sizes of igneous bodies, emplacement depths, heat conductivity of igneous and host rocks and the heat flow in the crust. The purpose of this modeling is to reconstruct the thermal history of the events caused by successive intrusion of igneous rock masses in the Tatarka-Ishimba suture zone. This zone was emplaced in the Neoproterozoic during the formation of the Yenisey Ridge orogen (western framing of the Siberian craton).
In the thermal models we imposed a heat flow of up to 0.05 W/m2 which is higher than the average for the Yenisey Ridge (0.03 W/m2). The intrusion of collisional granitoid plutons at 760-720 Ma led to additional heating of the crust in the Tatarka-Ishimba suture zone (1). Our calculations for the zone showed that in the middle part of the crust at depths of 10–20 km where most plutons were emplaced the temperature increased insignificantly by 80–100°C on most of its extent.
Beginning with the final stage of collision and on the next stage of the orogens evolution (730–630 Ma) – in an active continental margin setting, various igneous rocks formed in the suture zone including Penchenga complex carbonatites that were, in turn, intruded by A-type Tatarka complex granitoids.
We performed a detailed computational modeling of the thermal regimes of a specific area of the suture zone (15x15 km) on which igneous activity occurred repeatedly during 100 m.y. We reconstructed the thermal history of a successive intrusion of igneous rock masses in this area, including basic dykes, their alkaline variations as well as Nb-enriched rocks – carbonatites and A-type granitoids. We find a similarity of the carbonatites complex under study with the idealized process of alkaline-silicate-carbonatite complex formation. We established that the thermal effect of dykes (basic rocks including the carbonatites) was repeated but short-lived. The thermal effect of recurrent basic and subsequent acid intrusions manifested in the formation of a local thermal anomaly, which became a mantle components concentration space.

1. Vernikovsky V.A., Vernikovskaya A.E., Polyansky O.P., Laevsky Yu.M., Matushkin N.Yu., Voronin K.V. A tectonothermal model for the formation of an orogen at the post-collisional stage (by the example of the Yenisei Ridge, Eastern Siberia) // Russian Geology and Geophysics, 2011, V. 52, P. 32-50.