Thermal history the lower crust of the central part of the Siberian craton

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Garnet granulite xenoliths from kimberlites from the Archean Anabar province in Siberia underwent multistage metamorphic transformations at various pressure and temperature conditions, reaching at some point a temperature of ~900 °C. At present, the temperature at the Moho beneath kimberlite fields is in the range of 380-580 °C, according to Cherepanova and Artemieva (2015). Therefore, to understand when present-day conditions have been attained and to compare the geological history of the upper and lower crust we need to know their thermal histories.

We have compiled available age and thermobarometric data for lower crustal xenoliths from Devonian kimberlites in Siberia: the Alakit, Daldyn and Muna fields near northwestern boundary of the Markha terrane, and the Nakyn field in the central part of the terrane. Relic magmatic cores of zircon grains have Archean ages: 2.7-3.2 Ga. The granulite-facies association (Grt+Cpx+Pl+Rt±Ilm) was formed at 750-850 °C and 1.0-1.4 GPa in dry conditions. Its age is 1.87-1.85 Ga for xenoliths from the Daldyn field as follows from the age of metamorphic zircon equilibrated with garnet and ≥1.88 Ga for xenoliths from the Nakyn field. The appearance of titanite replacing rutile, pargasite, scapolite, and the growth of new Ca-rich garnet requires fluid influx. These minerals were formed at 600-650 °C, 0.9-1.0 GPa. The results of titanite dating show that this event occurred at 1.85 Ga. Rutiles from these samples have discordant ages with the upper intersection with the Concordia at 1.48 Ga that can be related to a slow cooling in the lower crust or another thermal pulse. Our data show that granulite-facies associations exist metastably in the lower crust and that fluid flux events can drive the associations to re-equilibration in conditions approaching those in stable lower crust beneath Precambrian terranes.

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