European Mineralogical Conference
Vol. 1, EMC2012-49-1, 2012
European Mineralogical Conference 2012

Metamorphic, thermal, and tectonic evolution of the Yenisey Ridge, Russia: evidence of the Grenville-age orogenic events along the western margin of the Siberian craton

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We report new petrological and geochronological data on the evolution of the Yenisey Ridge, which allowed us to constrain major stages in the Precambrian history of the study area.
The late Paleoproterozoic and mid-Mesoproterozoic evolution of the Yenisey Ridge was not marked by the prominent tectonic events except for the rift-related bimodal magmatism at ∼1380 Ma. The closure of this basin was accompanied by the orogeny with deformation and metamorphism of the Riphean successions. The early stage is marked by the formation of two linear belts of the granitic and gneiss domes and LP/HT metamorphic complexes of the And-Sil type (T=400-650°C at P=3.3-5.2 kbar), indicating a normal metamorphic field gradient with dT/dH of about 25-35°C/km The relationship between these processes and the Grenville-age orogeny was supported by the U-Pb and 40Ar-39Ar dating of metapelites from the Teya complex (∼970 Ma). These LP/HT assemblages structurally overlie mid-crustal rocks of the Garevka complex that underwent medium-pressure (MP) metamorphism in the range from upper-amphibolite- to granulite facies conditions of T=580-630ºC at P=7.7-8.6 kbar at depths of ca. 27-28 km.
Regionally metamorphosed LP rocks closest to the thrusts in the vicinity of the deep fault underwent the MP metamorphism of Ky-Sil type. A number of specific features and low metamorphic field gradient with dT/dH < 14°C/km are typical of collisional metamorphism during overthrusting of continental blocks, and are evidence of near-isothermal loading in accordance with the transient emplacement of thrust sheets and subsequent rapid exhumation. Based on geothermobarometry and 40Ar-39Ar mica ages, the proposed model suggests that, given an estimated exhumation rate of 0.368 mm/yr, peaks of collision-related metamorphic conditions occurred at 849-862 and 798-802 Ma.
The 849-862 Ma collisional evens are contemporaneous with the emplacement of low-alkali granite plutons responsible for the heating of LP rocks over a wide range of temperatures (450-650°C) at a constant pressure of 2.5-3.5 kbar, indicating a high gradient with dT/dH >100°/km. Approximately at the same time (900-880 Ma) the mid-crustal amphibolite-facies rocks have experienced exhumation to a 14-16 km depth of upper-crustal structural levels. D2-blastomylonites, which localized in narrow strike-slip fault zones were re-equilibrated under LP conditions at 3.9-4.9 kbar associated with a low metamorphic field gradient with dT/dH $\leq$ 10°C/km and equally steep exhumation P-T paths. The late Neoproterozoic rifting and within-plate magmatism (780-650 Ma) may be attributed to mantle plume activity that caused the Rodinia breakup and the ensuing opening of the Palaeoasian Ocean along the western Siberian craton margin.
The first occurrence of Siberian equivalents of the mid-Mesoproterozoic event, coupled with evidence of the Grenville-age orogenic events in the Yenisey Ridge, provide the basis for any paleoreconstructions showing a tight connection between Laurentia and Siberia in Rodinia configuration.