PTt history from kyanite-sillimanite migmatites and garnet-staurolite schists from the Bayankhongor area, Mongolia indicates suprasubduction switching from extension to compression during Rodinia assembly

Pavla Štípská1, Vít Peřestý2, Igor Soejono2, Karel Schulmann4, Andrew R. C. Kylander Clark5, Carmen Aguilar6, Martin Racek3, Nikol Novotná2, Pavel Hanžl2, and Ondrej Lexa3

1Center for Lithospheric Research, Czech Geological Survey, 11821 Praha 1, Czech Republic
2Regional Geology of Crystalline Complexes Department, Czech Geological Survey, 11821 Praha 1, Czech Republic
3Institute of Petrology and Structural Geology, Charles University in Prague, Albertov 6, Praha 2, 12800, Czech Republic
4EOST, IPGS – CNRS UMR7516, Université de Strasbourg, 1 rue Blessig, F-67084, Strasbourg Cedex, France
5Department of Earth Science, University of California, Santa Barbara, CA 93106, United States
6Department of Mineralogy, Petrology and Applied Geology, Faculty of Earth Science, University of Barcelona, 08028 Barcelona

The tectonometamorphic evolution of the peri-Siberian tract of the Central Asian Orogenic Belt is mainly characterized by Baikalian Late Proterozoic – Early Cambrian cycle related to amalgamation of Proterozoic oceanic and continent fragments to Siberain landmass. Here we present in-situ monazite geochronology linked to $P-T$ modelling of micashischsts and migmatite gneisses at the northern part of the Precambrian Baydrag block (central Mongolia) previously considered as a part of Baikalian metamorphic belt. Garnet-sillimanite-kyanite gneiss records first burial to the sillimanite stability at ~725 °C and 6.5 kbar, followed by burial to the kyanite stability at ~650 °C and ~8 kbar. The garnet-staurolite schist records burial to the staurolite-stability at ~620 °C and 6 kbar, followed by a nearly isothermal burial to ~580 °C and 9 kbar. The monazite data yield a continuum of $^{207}$Pb-corrected $^{238}$U/$^{206}$Pb dates of c. 926–768 Ma in the Grt–Sil–Ky gneiss, and c. 937–754 Ma in the Grt-St schist. Based on monazite textural positon and internal zoning, the time of prograde burial and peak under a thermal gradient of 28–32 °C/km is estimated at c. 870–890 Ma. It is not clear whether such high grade conditions prevailed until a phase of further burial under a geothermal gradient of 18–22 °C/km and dated at 800–820 Ma. Additionally, monazite with dates of c. 568–515 Ma occurs as whole grains or as rims with sharp boundaries on Grenvillian monazite in Grt-St schist testifying for minor Baikalian overprint. Metamorphic zircon rims with Th/U ratio ~0.01–0.06 in Grt–Sil–Ky gneiss with 877 ± 7 Ma age, together with lower intercepts of zircon discordia lines in both Grt-Sil-Ky gneiss and Grt-St schist further support the Tonian age of high grade metamorphism. The $P-T$ and geochronology data show anticlockwise $P-T$ evolution from c. 930 to 750 Ma which is interpreted as a result of thickening of suprasubduction extensional and hot edifice – probably of back arc or arc type. This kind of prograde metamorphism was so far described only on the northern part of the Tarim block and interpreted...
as a result of initiation of peri-Rodinian subduction of Mirovoi Ocean. Here, we further discuss geodynamic consequences of a unique discovery of Tonian metamorphism in term of tectonic switch related to initiation of peri-Rodinian oceanic subduction during supercontinent assembly followed by strong mechanical coupling potentially related to onset of Rodinia splitting.