Recorded microstructures and mechanical behavior in a quartz-garnet aggregate in ultra-high temperature migmatites.

LOBJOIE C.[1], TRAP P.[1], OLIOT E.[2], WEI L.[3], GONCALVES P.[1] & MARQUER D.[1]

[1] UMR 6249 Chrono-environnement, Université de Bourgogne-Franche-Comté, 25030 Besançon, France
[2] UMR 5243 Geosciences Montpellier, Université de Montpellier, 34095 Montpellier, France
[3] State Key Laboratory of Lithosphere Evolution, Institute of Geology and Geophysics, Beijing 100029, China

In partially molten rocks, melt is commonly (or usually) considered as the weakest phase that controls the bulk rock strength, especially when melt fraction exceed 7%. Within migmatites, peritectic garnet is known as a strong phase that forms relatively undeformed porphyroblasts that are inferred to be a rheologically passive phase. In this study, we document highly elongated garnet grains (axial ratio exceeding 1:5) within migmatites from the UHT Khondalite Belt (North China Craton). Petrological investigation and thermo-barometric modelling suggest that the migmatites have been deformed at temperatures between 850°C and 1050°C for pressure between 0.6 GPa and 0.8 GPa. Microstructural and EBSD analyses argue for a strong plasticity of garnet and highlight the need to consider strength competition between the polymineralic aggregate and the melt when dealing with partially molten rock strength. Within our samples, garnet occurs within grt-sil-bt rich layers and as garnet-quartz aggregates surrounded by a quartzo-felspathic matrix. Application of power flow laws calculated to the garnet-quartz aggregate confirm that garnet can be the weakest phase at temperature above 850°C. These results, considering the rheological behavior of a two-phase aggregates in HT/UHT partially melted rocks, show that during deformation the solid framework could be plastically deformed, promoting large crustal flow.