Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.12322

Reconstructing detailed P-T-t paths of kyanite-bearing, migmatitic metapelites through combined petrochronology and garnet diffusion modelling

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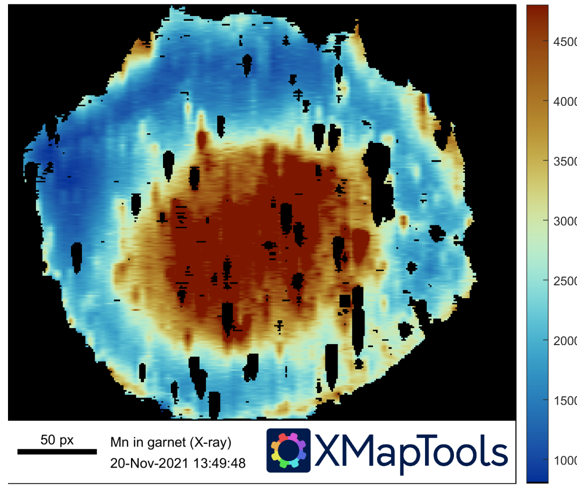

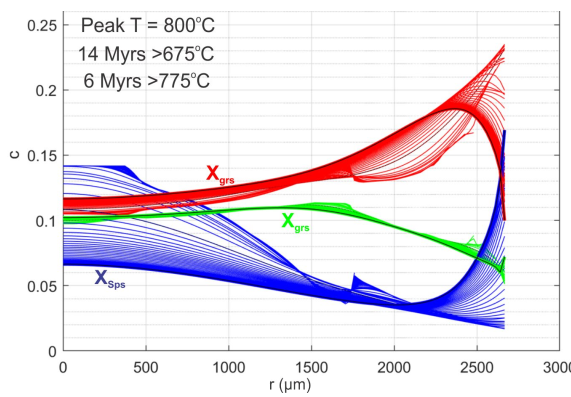

This contribution presents new results of multi-component garnet diffusion modelling (with the software CZGM[1]) for well-studied kyanite-bearing migmatitic metapelites from the northern Monashee Complex in the southeastern Canadian Cordillera. In the immediate footwall of the Monashee décollement, a controversial tectonic boundary, garnet with diameters >2.5 mm preserve prograde zoning defined by bell-shape X_{sps} (Mn end-member in garnet), saddle-shape X_{prp} (Mg end-member) and inverse saddle -shape X_{grs}(Ca end-member). In contrast, zonation for all garnet end-members in grain examined from the immediate hanging wall of the shear zone is flat irrespective of grain size. Plausible Pressure-Temperature-time (P-T-t) paths are well-documented in three published petrochrological studies based on phase equilibria modelling and U(-Th)-Pb geochronology on zircon and monazite. This timing information demonstrates that only the garnet diffusion-parameters derived from Chu&Ague (2015[2]) are able to model the preservation of the observed X_{sps} profiles in the footwall. The diffusion modelling results indicate a maximal T of <800°C and implies that the shortest T-t path (<10 Myrs at T >700°C), plausible within the uncertainties of the petrochronological data, is required to preserve the observed X_{sps}, X_{prp} profiles. Diffusion modelling of hanging wall garnet, in contrast, indicates that a thermal history including peak T = 900°C, 40 Myrs at T >700°C and 28 Myrs at T>800°C are required to completely flatten X_{grs} zoning. The differential results demonstrate that the Monashee décollement juxtaposes rocks with completely different T-t histories, and, therefore, constitutes a major tectonic discontinuity. Results presented herein further demonstrate that diffusion modelling and petrochronolgy provide the complementary information required to derive a complete P-T-t path of migmatitic metapelites.

[1]Faryad&Jezek (2019), Lithos 332-333, 287-295.

[2]Chu&Ague (2015), Contrib. Mineral. Petrol. 170:25.