

Peritectic mineral transport and coalescence in migmatites change the rheology of the lower crust

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The degree of loss of melt in fertile rocks (such as metapelites) experiencing partial melting depends on the effectiveness of strain during the melting event, with the formation of cm-sized melt channels along shear bands or dilatant fractures resulting from the connection of mm-sized melt pockets [1]. During this process, peritectic minerals are transported along in the anatectic melt but can behave differently, being dissolved within it (as in the case of feldspar, [2]) or coalescing (as in the case of garnet [3]). Here we show how garnet coalescence occurs in migmatitic metapelites from two different levels of the Variscan lower crust of the Serre Massif in Calabria (southern Italy), one shallower and one deeper, using electron backscatter diffraction (EBSD) data. Phase equilibrium thermodynamic modelling of melt extraction events considering peritectic mineral coalescence vs extraction during nearly isobaric heating from ~700 °C to peak temperatures of 800–840 °C allows determining the degree of densification and the enthalpy budget along these horizons. Our results highlight how the rheology of the lower crust of orogens is particularly conditioned along critical horizons where melting occurs and melt extraction is localized, leaving behind a hard residue.

References

- [1] Brown (2007), *J Geol Soc London* 164, 709–730.
- [2] Taylor & Stevens (2010), *Lithos* 120, 277–292.
- [3] Festa, Spiess & Tursi (2024) *Lithos* 472–473, 107581.