EGU21-7433
https://doi.org/10.5194/egusphere-egu21-7433
EGU General Assembly 2021

Documenting isobaric cooling in the lower crust using cordierite breakdown textures (Mont Mary nappe, Western Alps)

Michel Ballèvre[1], Marc Poujol[1], Selim Rousseau[1], and Paola Manzotti[2]
[1]CNRS, Géosciences Rennes, Tectonique-Terre-Temps-Traçage, Rennes, France (michel.ballevre@univ-rennes1.fr)
[2]Department of Geological Sciences, Stockholm University, 106 91 Stockholm, Sweden

Intracrystalline diffusion is an efficient mechanism in high-grade rocks. Therefore, growth zoning in garnet is erased and the evidence for prograde path is lost. However, information recorded by the textures may store significant clues for deciphering part of the P-T path. An example is provided here from the migmatitic paragneisses from the Mont Mary nappe (Western Alps).

The latter is made of a pre-Alpine basement consisting of an upper and a lower unit. The upper unit is made of paragneisses, marbles and amphibolites similar to those of the Valpelline Unit and of the Ivrea Zone. The lower unit displays granitic orthogneisses, paraschists (with muscovite, biotite, garnet with local occurrences of staurolite, kyanite and andalusite) (Dal Piaz et al. 2015). In this unit, we discovered a hectometre-sized volume with no Alpine overprint, preserving migmatitic paragneisses, the topic of this study.

The paragneisses display quartzo-feldspathic leucocratic layers interpreted as crystallized melts. The leucosomes are separated by biotite- and sillimanite-rich layers, with conspicuous garnet porphyroblasts. In addition, fresh cordierite crystals are found in these layers. Sillimanite included in garnet rims has the same orientation than the one in the matrix. There, the foliation is defined by the shape fabric of biotite and sillimanite, wrapping both garnet and cordierite crystals.

Such textures may be used to propose a P-T path. A sequence of prograde reactions, including dehydration-melting of muscovite, then biotite, result in the production of a large amount of sillimanite. Garnet growth was continuing during incongruent melting. However, intracrystalline diffusion has erased the prograde chemical zoning, as well as the distribution and shape of mineral inclusions. The late replacement of garnet and cordierite by biotite and sillimanite indicates near-isobaric cooling, also recorded by chemical zoning along garnet rims.

Chemical data on coexisting minerals will be used to provide quantitative constraints on the P-T path. In addition, preliminary geochronological data suggest that detrital zircons grains were significantly reset during the HT metamorphism, which could have taken place c. 270 Ma ago. To conclude, the studied paragneisses offer another example of Permian near-isobaric cooling in the middle crust of the Adriatic plate.

Dal Piaz G.V., Bistacchi A., Gianotti F., Monopoli B., Passeri L., Schiavo A. & collaboratori (2015) –

Note illustrative della carta Geologica d'Italia alla scala 1:50.000. Foglio 070, Monte Cervino. ISPRA, Servizio Geologico d'Italia, 070, 1-431.