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Tectono-metamorphic evolution of the Zone briançonnaise (Western Alps) in Eocene-Oligocene times using thermodynamical modelling and RSCM methods

Pierre Lanari, Stéphane Guillot, Stéphane Schwartz, Olivier Vidal, Pierre Tricart, and Nicolas Riel
University of Grenoble, ISTerre, OSUG, Grenoble, France (pierre.lanari@ujf-grenoble.fr / + 33 (0) 4 76 51 40 58)

Pressure-Temperature estimates in metamorphic belts are crucial to build consistent kinematic reconstructions through time, and to constrain the tectono-metamorphic evolution of orogens. However detailed P-T-t paths are difficult to achieve in low-grade metamorphic terrains, which have a poor mineralogical content including detrital minerals.
A thermodynamic modelling involving K-white mica and chlorite combined with RAMAN study of carbonaceous material (RSCM) allows to constrain the P-T evolution of the "Zone houillère", located in the Briançonnais zone of the western Alps. Pressure was estimated from the composition of K-white mica with the model of Dubacq et al. (2010) that includes the variation of hydration with P-T conditions, while temperature was estimated using the model of Vidal et al. (2005) on chlorite. A 2D picture of the metamorphic evolution in relation with deformation was obtained from P-T estimates made from X-ray maps of composition. Different P-T conditions were evidenced for the alpine and pre-alpine Chl-mica assemblages. Two types of carbonaceous material leading to different Tmax were characterized in the same area. In the upper part of the Zone houillère, the Alpine metamorphic peak was found at 6 kbar and 275°C. This result is consistent with low-alpine Tmax estimates, recording a west to east increase from 220°C to 300°C across the Zone houillère.
This result contrasts with the higher (from 340°C to 390°C) Tmax previously estimated further north by Gabalda et al., (2009). Our study associated with previous zircon fission track (ZFT) results allows now to distinguish alpine and hercynian Tmax. Low-alpine Tmax occurs in this part of the Zone houillère, which exhibits a west to east increase from 220°C to 300°C. Hercynian Tmax was obtained in sandstone levels, when carbonaceous material is included in detrital minerals.
According to these results and to previous works in the more internal part of the briançonnais zone, a new kinematic reconstruction has been realized. This model proposes a diachronous evolution of the briançonnais zone, which was involved in the continental subduction at different times. Indeed, metamorphic gradients could be estimated during continental subduction phase between 50 and 30 Ma using available P-T-t data. The metamorphic gradient changes from 8°C/km, related to early continental subduction, to 40°C/km during the collision event. The intermediate metamorphic gradient of 15°C/km, estimated in the Zone houillère, suggests that this unit was buried later that the more internal briançonnais units, after 40 Ma. This new time-relative vision, according to previous results, enables us to precise the Western-Alps evolution in Eocene-Oligocene times.

Dubacq et al., (2010) Contrib. Mineral. Petrol., 159(2):159-174.
Gabalda et al., (2009) Terra Nova., 21(1):28-34.
Vidal et al., (2005) Am. Mineral., 90(2-3):347-358.