The analysis of thermal interaction between the Biella pluton and Sesia-Lanzo Zone reveals an Oligocene Barrovian gradient in the Western Alps

Manuel Roda[1] and Davide Zanoni*[1]

[1]Dipartimento di Scienze della Terra 'A. Desio', Università degli Studi di Milano – Italie

Résumé

This works analyses the thermal interaction between the shallow Biella pluton and the post-eclogitic continental crust of the Sesia-Lanzo Zone in the western Austroalpine domain of the European Alps. The aim is contributing at the reconstruction the tectono-thermal setting in the post-metamorphic crust of the Western Alps during the mature collisional stage. The Biella pluton is part of the Periadriatic magmatic bodies and after the emplacement, at 30-31 Ma, was rotated about a shallow plunging axis subparallel to the Periadriatic Fault System. In the aureole the country rocks record decreasing effect of contact metamorphism with increasing distance from the pluton. Thermometric estimates based on mineral equilibria show that in general the contact metamorphic peak temperatures decrease as an inverse function of the ratio between distance from the pluton and depth. The results from a numerical model of cooling pluton intruded in country rocks under three regional geothermal gradients (30, 40, and 50∘C/km) highlights that the distribution of the thermometric estimates with depth and distance from the pluton matches the models with geothermal gradients > 40∘C/km. In the Sesia-Lanzo Zone, clear evidence of metamorphism related to this regional geothermal gradient is lacking because in the Oligocene rocks were already shallower than 10 km at the time of pluton emplacement. This geothermal gradient is comparable with that of the regional Barrovian metamorphism affecting the Central Alps between 34 and 27 Ma. A syn-collisional slab rollback is consistent with petrological, geochronological, and geochemical data from the Biella pluton, and the geothermal gradient within the country rock during the emplacement. We propose that the Oligocene Barrovian gradient, which is well recorded in the Lepontine dome, involved wider areas in the Western Alps than what has been documented so far. Thus, quantifying the thermal interaction between magma emplacement and country rocks can be a reliable method for disclosing regional thermal states of shallow orogenic crust.

Mots-Clés: Alpine collision, Barrovian metamorphism, Contact metamorphism, Numerical simulation, Magma cooling model, Sesia Lanzo Zone

*Intervenant