Geophysical Research Abstracts
Vol. 19, EGU2017-8714, 2017
EGU General Assembly 2017

Pressure variations in the Monte Rosa nappe, Western Alps

Cindy Luisier, Joshua Vaughan-Hammon, Lukas Baumgartner, and Stefan Schmalholz
Institute of Earth Sciences, University of Lausanne, Switzerland (Cindy.Luisier@unil.ch)

The Monte Rosa nappe is part of the Penninic nappe stack of the Western Alps. It represents the southern-most European continental basement involved in the alpine orogeny. It consists of a pre-Variscan basement complex, made of mostly metapelites and paragneisses, which were intruded by a Permian-age granitic body (Pawlig, 2001). The nappe is heterogeneously deformed, with localized high strain domains separating low strain domains. The metamorphic record is tightly linked to deformation. Different thermodynamic data bases and approaches were used in the past to estimate the peak alpine metamorphic conditions. They range from 1.2 to 2.7 GPa and 490 to 650°C, based on metagranite, metapelite, metamafic and whiteschist assemblages.
The peak alpine metamorphic assemblage of zoisite, phengite and albite symplectites pseudomorphing magmatic plagioclase is preserved only in the less deformed portions of the nappe. Phengite, garnet and titanite coronas surrounding biotite, quartz and igneous K-feldspar make up the rest of the rock. The metagranite locally grades into 10 to 50 meters whiteschist bodies, consisting of talc-chloritoid-kyanite-phengite-quartz, which can contain carbonate and garnet. Their chemistry is interpreted as a metasomatic product of the late magmatic hydrothermal alteration of the granite, whereas their mineralogy results from the alpine high pressure metamorphism (Pawlig and Baumgartner, 2001; Luisier et al., 2015).
We performed a phase petrology and textural study to consistently estimate peak alpine metamorphic conditions in the granite and the related whiteschists. Textural observations were used to select the best-preserved high-pressure metagranite samples. Inherited magmatic feldspar textures indicate that jadeite was never formed in these granites, confirmed independently by Si in phengite barometer (1.2 to 1.5 GPa). Note that the granite contains the phengite buffer assemblage of Massonne and Schreyer (1987). Thermodynamic calculations using internally consistent thermodynamic database on whiteschists result in a minimum P of 2.2 GPa at T of 550 to 570°C and a water activity close to 1, unlike previous water activities proposed (Le Bayon et al., 2006).
Peak alpine pressures and temperatures calculated for the metagranite and associated whiteschists hence result in significant different pressure estimates, corroborating previous results from the literature. The possible explanations for such pressure variations are i) slight underestimation of the metagranite peak pressure, due to water-undersaturation conditions, however a pressure as high as 2 GPa is unlikely, or ii) heterogeneous stress conditions, due to rheologically contrasting lithologies, consisting of weak whiteschist inclusions within strong, undeformed metagranites.

References

Le Bayon et al., 2006: Contrib. Mineral. Petrol. 151, 395-412
Luisier et al., 2015: GSA conference abstract
Massonne and Schreyer, 1987: Contrib. Mineral. Petrol. 96, 212-224
Pawlig, S. 2001: PhD thesis, University of Mainz (Germany)
Pawlig and Baumgartner, 2001: SMPM 81,329-346