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High-precision geobarometry across the Plattengneiss shear zone in the Koralpe, Eastern Alps, Austria

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Eclogite-facies metamorphism is a common feature of crustal rocks in collisional orogens. The occurence of such rocks implies subduction of crustal material to mantle depths. However, questions still exist regarding the mechanisms by which eclogite facies rocks are exhumed. In many cases, erosion, buoyancy-driven wedge extrusion, crustal extension or exhumation as a core complex alone can not explain the process of exhumation. FROITZHEIM ET AL. (2003) introduced the model of an extracting slab as a new mechanism for the exhumation of the Adula nappe in the western Alps. This new model has been favoured for exhumation of the Pohorje-Massif in Slovenia, which once formed a single fragment of crust together with the Koralpe-Saualpe region further north.

The Koralpe region not only hosts the type locality for eclogites, but also one of the largest shear zones in the Alps, the Plattengneiss. This shear zone is between 250 and 600 meters thick and about 600 km^2 in areal extent. The shear zone is flat lying and eclogites occur as lenses and pods, above, below and within the shear zone. It is likely that the Plattengneiss played an important role in the exhumation of the high-pressure rocks and that it represents some kind of an "extraction-fault", which may have formed during downward extraction of a mantle wedge above the subducted Austroalpine crust.

In this study, metapelitic gneisses from selected locations in the hangingwall and the footwall of the Plattengneiss were collected for mineral chemical analysis in order to constrain the flattening of the shear zone using barometry. Petrographic investigations show peak metamorphic assemblages containing garnet + plagioclase + muscovite + biotite + quartz + rutile $\pm$ ilmenite $\pm$ kyanite in the metapelitic gneisses. The software THERMOCALC v3.33 (HOLLAND & POWELL, 1998) was used to perform detailed relative thermobarometric calculations on the sampled rocks according to the method of WORLEY & POWELL (2000). The investigations also include the evaluation of the effects of variable H_2O activities on average pressure calculations and constraints on the *P—T* paths via pseudosection modelling in the NCKFMASHTO system.

The results show that pressure differences between the hangingwall and the footwall are in the order of 1.5–2 kbar, suggesting volume loss. Investigations of the *P—T* path on a sample from the hangingwall of the Schwanberger synform suggest near-isothermal decompression from 18 kbar and 670°C to conditions of about 12 kbar and 700°C modelled using the metapelitic sample. The model calculations imply a subsequent decrease in both pressure and temperature to 8–9 kbar and 600–630°C. This assumption is supported by the late growth of staurolite in the metapelite.

The results can be interpreted to indicate: (a) removal of material during deformation; (b) diachronous metamorphic equilibration recorded in the hangingall and the footwall or; (c) a strong flattening component after equilibration. Removal of material is preferred in this study with or without diachronous metamorphism.

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