Variscan to Eoalpine tectono-metamorphic history of the Austroalpine Units south of the Tauern Window (Kreuzeck Mountains, Eastern Alps, Austria)

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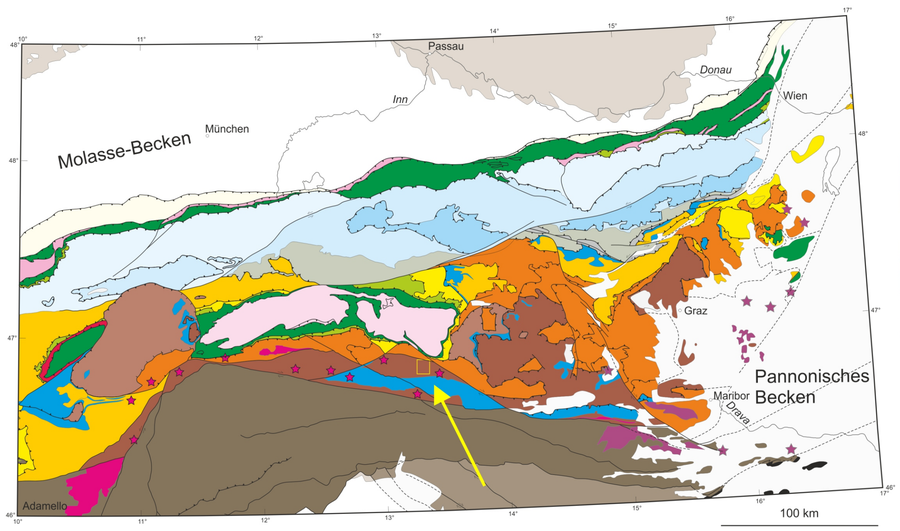
INTRODUCTION

The Austroalpine Units of the Eastern Alps are derived from the continental crust of the northern Adriatic continental margin. They consist of several basement and/or cover nappes, which were affected differently by Phanerozoic tectono-metamorphic events. This work presents new age and PT data from the Kreuzeck Mountains located to the south of the Tauern Window (Fig. 1).
The investigated area consists of the Koralpe-Wölz Nappe System (KWNS) in the footwall and the Drauzug-Gurktal Nappe System (DGNS) in the hanging wall separated by the several hundreds of meters wide newly defined Wallner Shear Zone, representing an Eoalpine (Cretaceous) south-dipping normal fault (Fig. 5 and 6).



Foreland of the Alpine orogen:
- Foreland Molasse
- European/Adriatic foreland

Alpine orogen:
- Allochthonous molasse/Neogene intramontane basins
- Pannonian magmatic rocks (Quaternary-Miocene, 1,7-19 Ma)
- Periadriatic magmatic rocks (Oligocene-late Eocene, 28-40 Ma)
- Gosau group

Penninic Nappes
- Upper Penninic Nappes
- Middle Penninic Nappes
- Lower Penninic Nappes

Helvetic Nappes
Subpenninic Nappes
Meliatia Unit, West-Vardar Zone
Southalpine units
External Dinarides

Eastern Alps
Eoalpine upper plate
- Drauzug-Gurktal Nappe System
- Ötztal-Bundschuh Nappe System

Eoalpine lower plate
- Juvavic Nappe System
- Tirolian-Norian Nappe System
- Bajuvarian Nappe System
- Veitsch-Silbersberg Nappe System
- Koralpe-Wölz Nappe System
- Silvretta-Seckau Nappe System

Lower Austroalpine

important faults and nappe boundaries

Figure 1: Geologic map of the Eastern Alps. The investigated area south of the Tauern Window is marked. Modified after Froitzheim et al. (2008).

Koralpe-Wölz Nappe System

The KWNS is composed of monotonous paragneiss with intercalations of mica schist and amphibolite (Prijakt-Polinik Complex). Eoalpine peak conditions reached eclogite-facies further in the North (Hoke, 1990) and amphibolite-facies in the study area. A Rb/Sr biotite age indicates cooling below c. 300 °C at 76 ± 1 Ma (Fig. 2).

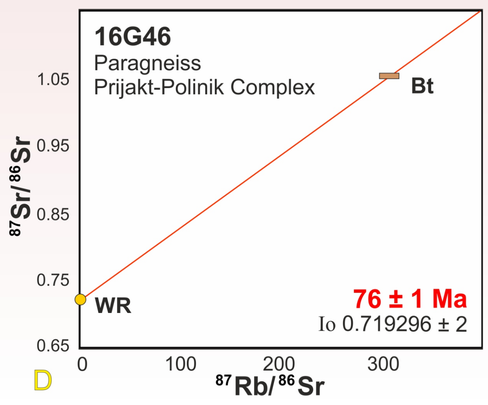


Figure 2: A) Quartzitic paragneiss of the Prijakt-Polinik Complex. A SCC´structure, which developed during the exhumation along the Wallner Normal Fault, is observable. 2 Euro for scale.
B, C) Thinsections of medium grained amphibolite containing amphibole, epidote, garnet, carbonate (most likely calcite), quartz and minor feldspar and chlorite (C: crossed polarisers).
D) Rb/Sr age diagram calculated from whole rock and biotite analyses. The calculation yields an age of 76 ± 1 Ma indicating late Cretaceous cooling below c. 300 °C.

Drauzug-Gurktal Nappe System

The DGNS consists of 3 complexes, which experienced different metamorphic conditions during the Variscan orogeny. The lowermost Strieden Complex consists of intensely folded mica shists and intercalated amphibolites recording Variscan upper epidote-amphibolite-facies conditions (Fig. 3B).

Structurally above, the Gaugen Complex is dissected by an EW trending, steep north-dipping Eoalpine thrust fault – the Lessnigbach Shear Zone – which is linked to the Wallner Shear Zone. The Gaugen Complex comprises mica schist and paragneiss and minor amphibolite (Fig. 3A).
A PT-pseudosection reveals peak conditions at 560 °C and 0.65 GPa for the grt + bt + hgl + pl + ilm assembledge.

Sm/Nd garnet isochron age suggest peak conditions around 306 ± 5 Ma. Rb/Sr biotite ages yield 292 ± 3 Ma and 273 ± 3 Ma in the area to the South of the Lessnigbach Shear Zone and 221 ± 2 Ma to the North of it (Fig. 4). These ages are interpreted to reflect Variscan cooling with a Cretaceous thermal overprint, which is very weak in the South and more intense in the northern block. They reflect the tectonic history of the northern block, which was exhumed from greater depths during the Late Cretaceous activity of the Wallner and Lessnigbach shear zones.

The uppermost Goldeck Complex, in contrast, consists of phyllite and marble, which only reached Variscan greenschist-facies conditions (Fig. 3C).

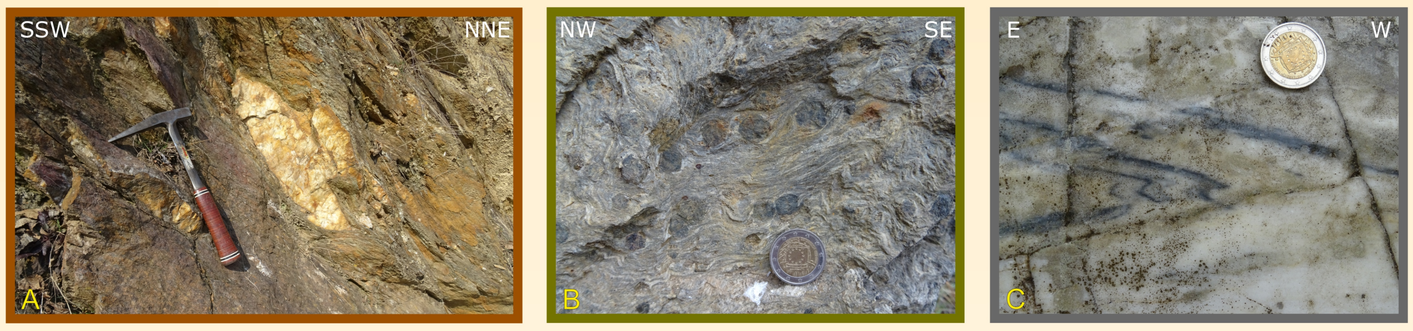


Figure 3: A) Paragneiss of the Gaugen Complex with large quartz mobilisate clast. The brownish weathering colour is very typical.
B) Garnet mica schist of the Strieden Complex. The schistosity is intensely folded and the garnets are up to 1 cm sized.
C) Folded marble of the Goldeck Complex.

Figure 5 (below): Map of the investigated area. Important shear zones are labeled (ArcGIS Project).

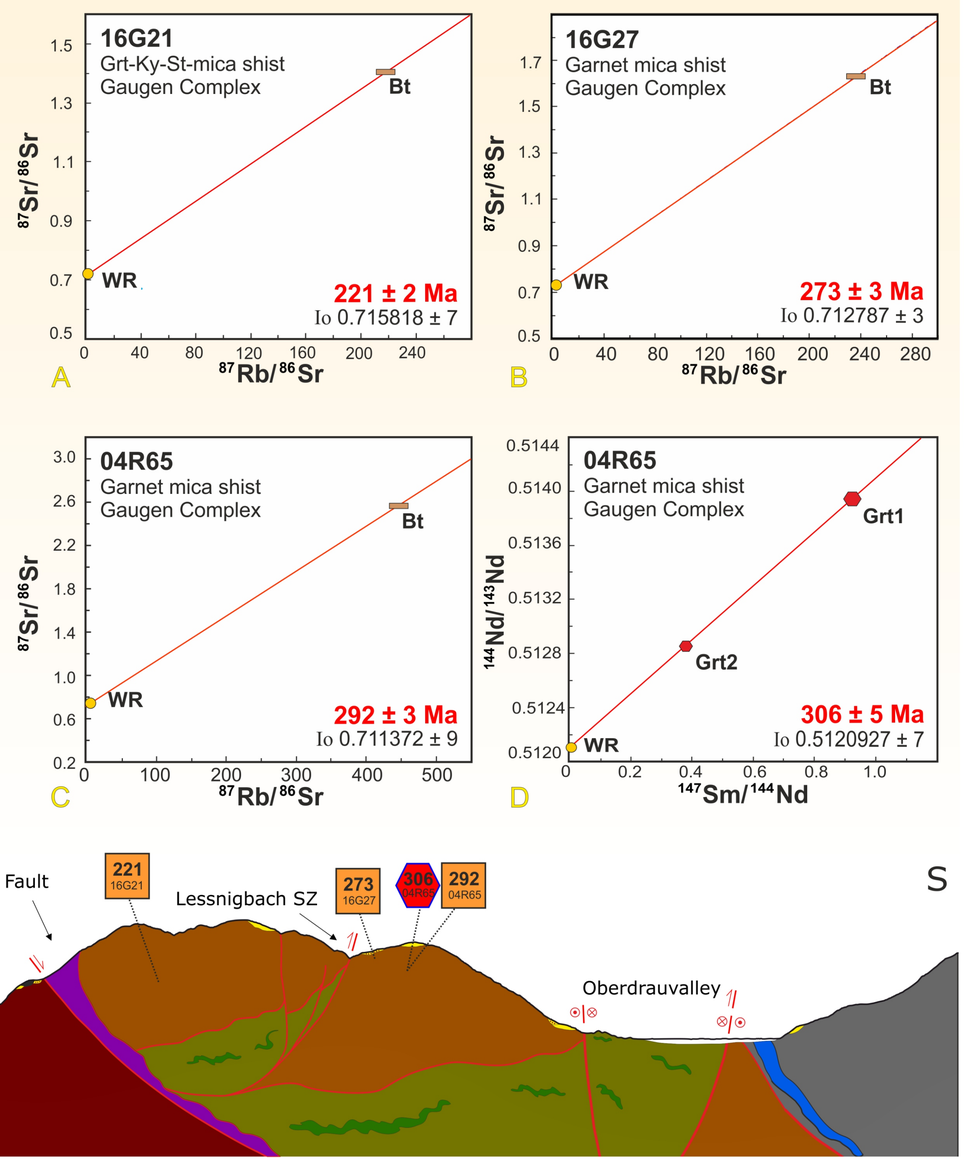


Figure 4 (right side): Rb/Sr and Sm/Nd age diagrams calculated from whole rock, garnet and biotite analysis.
A) A Grt-Ky-St-mica shist north of the Lessnigbach SZ yields an age of 221 ± 2 Ma.
B and C) Garnet mica shists south of the Lessnigbach SZ yield ages of 273 ± 3 Ma and 292 ± 3 Ma, respectively. The variety is interpreted to result from grain size differences.
D) A Garnet mica shist south of the Lessnigbach SZ yields an Sm/Nd isochron age of 306 ± 5 Ma. This is interpreted to reflect the time of garnet growth at peak P-T conditions.

Figure 6: Transect across the investigated area form N to S. Age data are plotted. For legend see Figure 5.

CONCLUSIONS

- **During the Variscan event the units of the Drauzug-Gurktal Nappe System experienced different metamorphic grades.**
- **The Gaugen Complex reached amphibolite facies conditions of 560 °C and 0.65 GPa at about 306 Ma.**
- **The Gaugen Complex is divided into two blocks, separated by the Lessnigbach Shear Zone. As indicated by Rb-Sr Biotite ages the northern block was exhumed from greater depth by the activity of the Lessnigbach shear zone in the Upper Cretaceous.**
- **The Drauzug-Gurktal and Koralpe-Wölz nappe systems came in contact during the Eoalpine event (Late Cretaceous) along the Wallner Shear Zone. This shear zone is responsible for the exhumation of the Cretacous eclogites in the Prijakt-Polinik Complex.**

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