P-T-t-EVOLUTION OF VARISCAN REMNANTS IN THE EASTERN ALPS: THE KAINTALECK METAMORPHIC COMPLEX

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Introduction

The Eastern Greywacke Zone is composed of three Alpine nappes. From bottom to top these are (1) the Veitsch nappe (Early Carboniferous to Permian molasse), (2) the Silbersberg nappe with intercalated slivers of the Kaintaleck Metamorphic Complex and Permian phyllites and conglomerates as cover, and (3) the Noric nappe (mainly Ordovician to Devonian shelf sediments and Permian cover). All units experienced Eo-Alpine lower greenschist facies metamorphism. Due to the development of ductile shear zones during Alpine nappe stacking, the Kaintaleck Complex was dismembered and emplaced as lens-shaped bodies of 10-100m thickness that stretch from West (Kalwang, Upper Styria) to East (Gloggnitz, Lower Austria) below the Noric nappe of the Eastern Greywacke Zone (Fig. 1). Lithologically, the **Kaintaleck Complex is represented by a mafic suite**, comprising amphibolite, garnet-amphibolite, greenschist and serpentinite, **and a felsic suite** that consists mostly of gneiss and mica-schist (some of them garnet-bearing). The felsic suite corresponds to metamorphosed clastic sediments and granitoids, whereas the mafic suite represent most likely a former oceanic crust. This work tries to constrain the **P-T-t path of the Kaintaleck Metamorphic Complex** by applying U-Th/Pb monazite and U/Pb zircon dating and geothermobarometry.

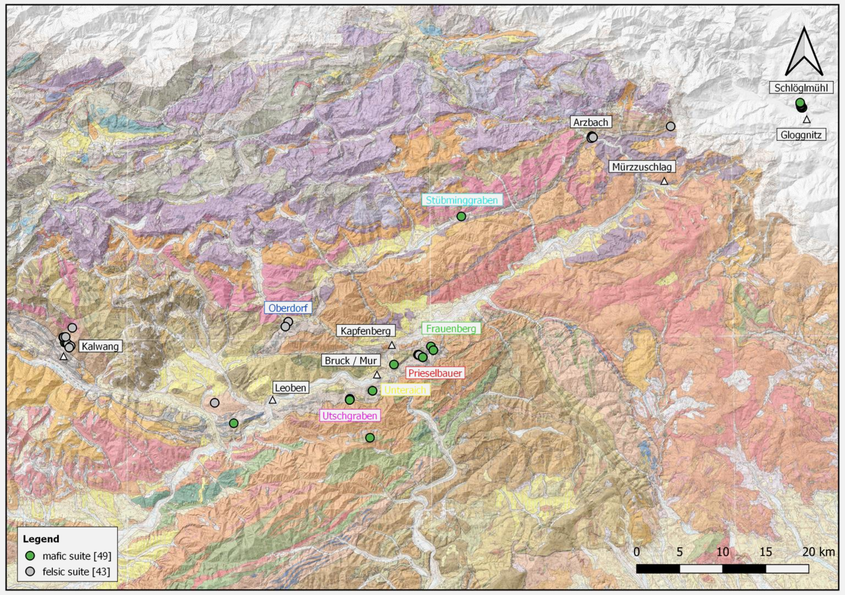


Fig. 1: Geological map of the Eastern Greywacke Zone and adjacent units redrawn from maps provided by the Austrian Geological Survey (https://www.geologie.ac.at/). Green dots represent mafic samples, grey dots represent felsic samples.

Geochemistry

Based on whole rock geochemistry, amphibolites from the locality of Frauenberg represent **tholeiitic basalts with an E-MORB affinity**, whereas garnet-amphibolites, amphibolites and greenschists from the localities of Prieselbauer, Oberdorf, Unteraich, Kalwang, Arzbach and Schlöglmühl show a **T-MORB signature**. Samples from the localities of Stübminggraben and Utschgraben have a **N-MORB affinity** (Fig. 2).

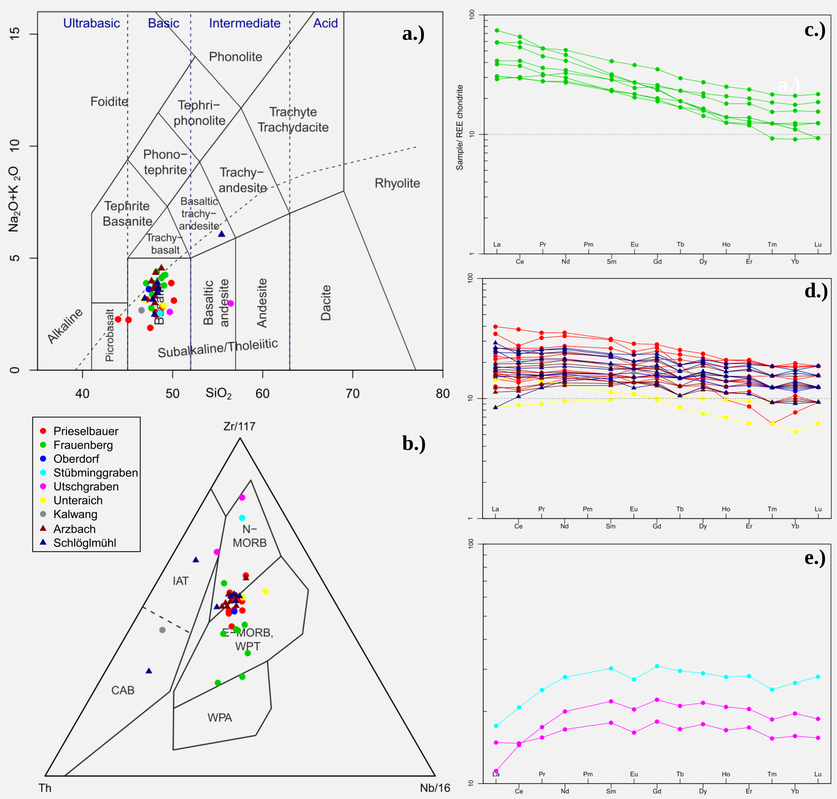


Fig. 2 (a): TAS classification diagram (Le Bas et al., 1986) for amphibolites and greenschists **(b)** Zr-Th-Nb discrimination diagram after Wood (1980) for amphibolites and greenschists **(c)** Amphibolites from the locality of Frauenberg show E-MORB affinity **(d)** Garnet-amphibolites, amphibolites and greenschists from the localities of Prieselbauer, Oberdorf, Unteraich, Kalwang, Arzbach and Schlöglmühl show T-MORB affinities **(e)** Garnet-amphibolites from Stübminggraben and Utschgraben show N-MORB affinities. Chondrite-normalized REE plots after Boynton (1984).

U-Th/Pb monazite and U/Pb zircon dating

Monazite dating by EPMA in garnet-mica-schists from the localities of Prieselbauer, Arzbach, Schlöglmühl and Oberdorf, revealed **weighted average U-Th-total Pb ages of 351 ± 4 Ma, 358 ± 16 Ma, 349 ± 3 Ma and 362 ± 6 Ma**, which are interpreted as reflecting **peak Variscan metamorphism**. Monazite in these samples is partly replaced by an apatite-allanite-epidote-corona, related to monazite-breakdown due to Alpine lower grade metamorphic overprint (Fig. 4).

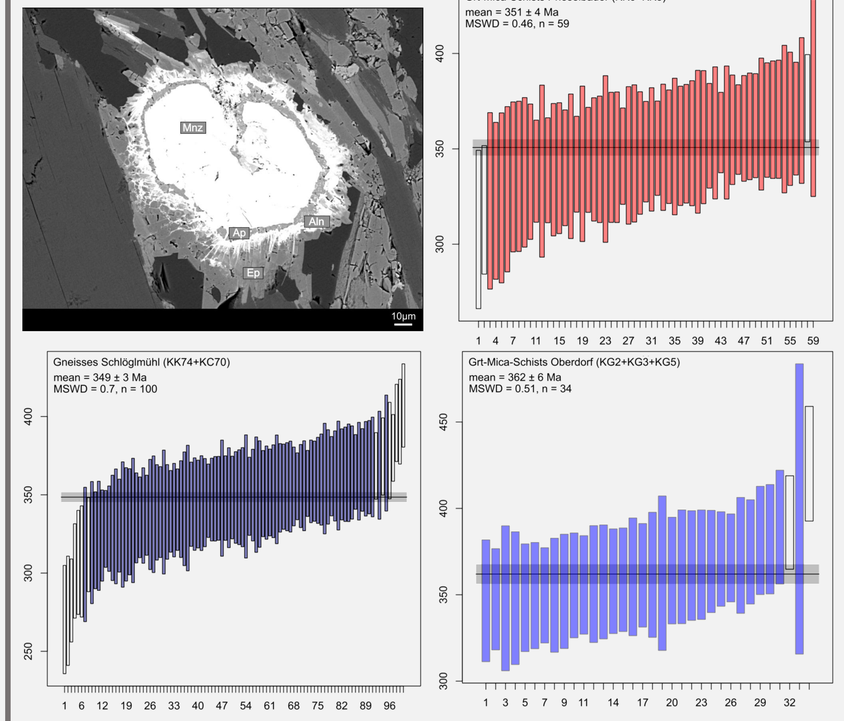


Fig. 4: BSE-image of a monazite grain mantled by a corona of apatite, allanite and epidote and weighted average U-Th-total Pb ages of samples from the localities of Prieselbauer, Oberdorf and Schlöglmühl (IsoplotR).

LA-MC-ICP-MS U/Pb age dating of zircon grains from a garnet-amphibolite from the locality of Prieselbauer yield a Devonian mean age of **414.2 ± 5.6 Ma**, ascribed as age of protolith formation. The younger zircon grains are interpreted to be overprinted by metamorphism (Fig. 5).

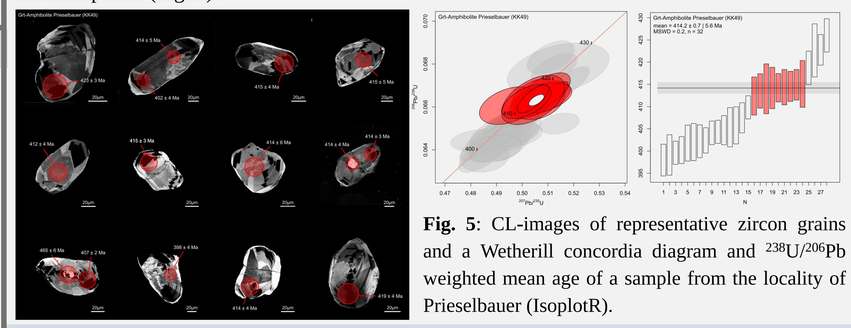


Fig. 5: CL-images of representative zircon grains and a Wetherill concordia diagram and $^{238}U/^{206}Pb$ weighted mean age of a sample from the locality of Prieselbauer (IsoplotR).

Petrology and Geothermobarometry

Garnet-amphibolites from the localities of Prieselbauer and Stübminggraben show distinct plagioclase-epidote-rich symplectitic coronae, which are indicative of decompression from former eclogite-facies metamorphic conditions. P-T estimations from geothermobarometric calculations yield about **525°C and 11,4 kbar** for the felsic suite, and **610°C** and minimum pressures of **12 kbar** for the mafic suite (Fig. 3). These estimates might indicate **retrograde metamorphic conditions**. Results of Zr-in-rutile thermometry and phengite barometry yield up to **680°C and 18 kbar for the felsic suite** and **740°C and 22 kbar for the mafic suite**, interpreted as **peak metamorphic conditions.**

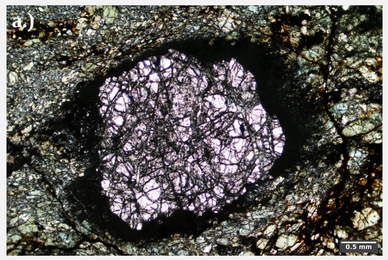
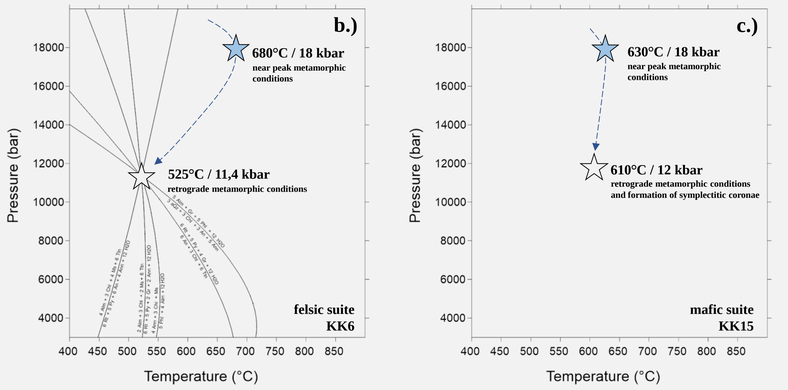


Fig. 3 (a): Photomicrograph of a garnet grain showing a plagioclase-epidote-rich corona. **(b)** PT estimation of a grt-mica-schist. Results were calculated with winTWQ version 2.34 (Berman, 2007). **(c)** PT estimation of a grt-amphibolite. Results were calculated with Mathematica-based software PET (Dachs, 2004).



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