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Geochronological Evidence for Lower Ordovician Magmatism in the Crystalline Nappes North of the Tauern Window

S. Gangl (1), A. Piber (1), P. Tropper (1), U. Klötzli (2), F. Finger (3), P. W. Mirwald (1)

(1) Department of Earth- and Atmospheric Sciences, Institute of Mineralogy and Petrography, University of Innsbruck, Innrain 52, A-6020 Innsbruck, Austria, (2) Institute of Geological Sciences, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria, (3) Department of Geography, Geology and Mineralogy, University of Salzburg, Hellbrunnerstrasse 54, A-5020 Salzburg, Austria

In the frame of the TRANSALP project, this investigation addresses the Eo-Alpine metamorphic evolution of the crystalline basement nappes northwest of the Tauern Window. The units to be studied show a polymetamorphic evolution with a pre – Alpine metamorphic overprint (Variscan and/or Permian) and a pervasive Eo–Alpine overprint under low – to high greenschist facies conditions. The Kellerjochgneiss (Schwazer Augengneis) is a part of the Austroalpine basement napes north of the Tauern Window and extends from Schwaz in the West to Wörgl in the East. Tectonically it is emplaced bewteen the Innsbruck Quartzphyllite underneath and the Greywacke Zone on top.

Microscopical observations imply that the Kellerjochgneiss is a shallowly intruded porphyroid. Embayed phenocrysts of quartz and simple twins of potassium feldspar phenocrysts with diameters up to more than 1.5 cm are the major hints of the gneisses nature. Remnants of the magmatic paragenesis are represented through K-feldspar + albite + Ti – rich biotite. Ti – rich biotites show recrystallization (Varisca or Eo-Alpine?) to Ti – poor biotite and a Ti phase (rutile, ilmenite, titanite). The Eo – Alpine paragenesis consists of muscovite + biotite + albite + chlorite $\pm$ stilpnomelane. Accessories are zircon, apatite, ilmenite, titanite, epidote and monazite. Petrological investigations imply a greenschist-facies event which can be attributed to the Eo-Alpine metamorphic circle due to microstructural evidence. Thermobarometric calculations

yield pressures of 4.5 to 6.5 kbar at temperatures of 290 to 350˚C for the majority of all samples (Piber & Tropper, 2002).

Based on geochemical investigations of the major-, minor- and trace elements of 18 samples with XRF and ICP-MS a peraluminous granitic to granodioritic assembly could be obtained (A/CNK = 1.26 – 1.97). The SiO_2 content ranges from 66 – 72 wt.% and $Na_2O + K_2O$ is 6.8 – 8.4 wt.%. A definite S- or I-type granite classification is not possible, however data show a trend to S-type origin of the gneiss.

Single zircon U/Pb analyses yield isochron ages of 486±1 Ma and 469±2 Ma for the Kellerjochgneiss. Isochron ages of a metapegmatite with the mineral assemblage $garnet_1$ (alm-rich) + $garnet_2$ (grs-rich) + chlorite + stilpnomelane + albite + quartz, crosscutting the Kellerjochgneiss, yield a slightly younger age of 462±1 Ma. The adjacent Stengelgneiss is a strongly mylonitizised gneiss and similar to the Kellerjochgneiss and a single zircon U/Pb age of this gneiss reveals a definitely higher age of 479±2 Ma. The most common accessory minerals in the orthogneiss ar monazite, allanite, apatite, zircon and xenotime. Based on textural investigations, two generations of monazite can be distinguished. Primary monazite occurs as xenomorphic crystals with diameters of 40 μm. Occasionally, these monazites are replaced by a corona of apatite and allanite, thus indicating an influx of Ca during a later metamorphic event. Secondary monazites occur as small scale grains with a diameter of 5 – 10 μm 1.) within the cleavage of muscovite and biotite, 2.) intergrown with rutile or ilmentite and 3.) together with apatite. Occasionally, secondary monazites coexist with xenotime. U-Th-Pb dating of primary monazite with the electron microprobe, yielded ages of 465±22 Ma and 469±34 Ma. Due to the low Th-contents, it was not possible to date the small, secondary monazites. Despite the high 2σ af the electron microprobe ages, the data are in good agreement with the zircon U-Pb isochron ages mentioned above.

These ages are representative for an acidic, magmatic event during lower Ordovician, which is widespread in the Eastern Alps. These ages are not only reported from the Northern Greywacke Zone (Area of Kitzbühel, Zeller Furche, Radmer, Blasseneck Ratschengraben, Area of Eisenerz and Hohe Veitsch) but also from nappes south of the Tauern Window namely the Thurntaler Quartzphyllite, Marteller Quartzphyllite, Brixner Quartzphyllite and the Comelico Area (Heinisch, 1981).

References:

Heinisch, H. (1981): Jahrb. Geol. B.-A., Bd. 124.

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