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EMPA-dating of monazites from the Brixen granodiorite contact aureole: correlating age data and petrographical evidence to decipher the polymetamorphic history of the adjacent northern margin of the Southalpine quartzphyllite basement

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Within the Permian Brixen granodiorite and the surrounding Variscan Brixen quartzphyllites, monazite is very common and provides an opportunity to obtain not age data about the age of the intrusion, but also provides geochemical evidence for the extent of contact metamorphism in the surrounding quartzphyllite basement. Therefore samples were taken along a profile from the granodiorite intrusion into the adjacent quartzphyllites from the Southalpine basement, near the village Franzensfeste/Fortezza in South-Tyrol (Italy).

Dating monazites by electron microprobe analyses (EMPA) is a fast, reliable method to determine ages within a thin section. The application of this method strongly depends on the whole rock composition and the uplift rate of the samples. The typical REE-bearing prograde mineral sequence is monazite – allanite – monazite (Wing et al., 2000) and hence a lack of allanite for instance implies rapid uplift of this area after the intrusion of the granodiorite (Krenn et al., 2006). The analytical conditions were 150-200nA and 15 kV with long counting times of 400 seconds for the peak and 300 seconds for background. For the standardization of the elements of interest, REE-phosphates and U-, Th-, Pb- bearing glasses were used.

The Variscan country rocks were sampled near Waidbruck and contain the mineral

assemblage muscovite + chlorite + albite + biotite + garnet + quartz $\pm$ K-feldspar. Approaching the granodiorite, three different zones can be discerned within the contact aureole. The rocks from the first zone are characterized by two texturally and chemically different generations of micas. The second zone is characterized by the first appearance of cordierite, while the Variscan garnet breaks down. Rocks from the third zone contain the mineral assemblage biotite + andalusite + cordierite + plagioclase + K-feldspar + muscovite $\pm$ spinel and corundum.

Two different generations of monazites were analysed in the samples from the second zone. An older generation of monazites shows Variscan ages of 330 $\pm$ 15 Ma and low amounts of yttrium of about 1.0 wt.% Y_2O_3. The second monazite generation shows high contents of yttrium of about 2.6 wt.% $Y_2O_3$and Permian ages of 277 $\pm$ 17 Ma. The high yttrium contents correlate with the breakdown of the Variscan garnet during the contact metamorphic overprint. This breakdown of garnet to Y-rich monazite $\pm$ xenotime is common in the thin sections and hence a modal increase of monazite can be observed towards the contact. The high Y-content also indicates temperatures of $>$600°C which is in agreement with $P-T$ data from the hornfels since two feldspar thermometry yields temperatures of 550 – 620°C for the second and third zone of this contact aureole. Further monazite EMPA dating is planned along the traverse, to correlate detailed petrological data with geochemical informations about the spatial extent of this contact metamorphic overprint.

References:

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