Monazite Th-Pb dating reveals eo-Alpine evolution in the Eastern Alps during brittle deformation

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The timing of multiple active brittle deformation is complex to unravel. Brittle structures in Austroalpine areas east of the Tauern Window, Austria, belong to this type [1, 2]. Inside damage zones of brittle-hydrothermal faults located at the border of the Grauwackenzone, different types of cavities have been found, which are mineralized with dolomite ± calcite ± quartz and monazite. High precision isotope dating of monazites from theses cavities yields ^{232}Th-^{208}Pb crystallization ages providing insights into the evolution of such cavities at low-grade metamorphic conditions and related brittle deformation.

The age data yields two age groups. A first group gives ages of ~90 Ma, and a second age group gives ages around ca. 80-75 Ma. The spatial distribution of age spots in the analyzed monazites, combined with chemical zoning, indicate stepwise growth likely linked with dissolution reprecipitation processes.

Surprisingly, the investigated breccia zones preserve the eo-Alpine evolution, despite their proximity to the Salzach-Ennstal-Mariazell-Puchberg fault (SEMP) showing dominantly Neogene activity [3]. Our older ages overlap in time with the nappe stacking in the area. Renewed monazite crystallization occured during transtensional movements [2] in association with sedimentation of the Cretaceous Gosau Group. However, the faults investigated link the SEMP with the Mur-Mürz fault system, and sedimentary basins document also in the latter case Neogene activity. This suggests multiple activity of these fault zones.

The dating of minerals preserved within cavities in hydrothermal-brittle systems provides a promising tool to reconstruct such multiphase evolution.

[1] Nemes *et al* (1995) *Jb. Geolog. Bundesanstalt* **138**, 349-367 [2] Dallmeyer *et al* (1996) *Eclogae geol. Helv.* **89**, 203-227. [3] Wölfler *et al* (2011) *Tectonics* **30**, TC4006