Geophysical Research Abstracts
Vol. 12, EGU2010-13949-3, 2010
EGU General Assembly 2010

Dating the Duration and Termination of Sinistral Shear in the Western Tauern Window: Implications for Indentation and Exhumation in the Eastern Alps

Susanne Schneider, Konrad Hammerschmidt, and Claudio Luca Rosenberg
Freie Universität Berlin, Geology/Geochemistry, Berlin, Germany (sanne5@web.de)

The internal structure of the Tauern Window (TW) consists of parallel sets of upright antiforms, striking ENE in the west and ESE in the east. The long axes of the upright folds are parallel to shear zones (SZ), which are generally sinistral in the west and dextral in the east. The formation of these structures has been interpreted as the result of a coeval, conjugate system, forming in response to south-Alpine indentation (Rosenberg et al., 2004), or as a change in the regional shortening direction through time (Polinski and Eisbacher, 1992; Neubauer et al., 2000; Mancktelow et al., 2001). The latter models suggested an Oligocene age for sinistral displacements, followed by Miocene dextral ones. Therefore, determining the timing of these different shear zones is a key to understand the tectonic significance of the structures described above.

We analysed the kinematics and determined the formation age of the mylonitic foliation of two sinistral shear zones in the western TW (Ahorn SZ, Olperer SZ). In addition to left lateral displacements, kinematic indicators in the YZ plane for both shear zones point to differential vertical displacements, namely S-side up. We performed absolute age determinations of deformation by dating syn- and on post-kinematically grown minerals, the latter overprinting the former ones microstructurally on the microscopic scale. For this purpose we selected syn-kinematic phengites of mylonites and ultra-mylonites from shear bands, strain caps and also from overprinting statically grown phengites overprinting the mylonitic foliation. The Ar/Ar In-situ UV-laser ablation method was applied using a noble gas mass spectrometer. For comparison micas of an undeformed host rock were also dated using the same method.

The obtained age values of syn-kinematic phengites vary between 12-24 Ma. This age variation is commonly found within single grains. Postkinematic, phengites overgrowing the syn-kinematic grains yield the youngest age values, namely 5-12 Ma. We observe a systematic relationship between the ages of the postkinematic grains and the age spread of the syn-kinematic ones. The age of the post-kinematic grains always coincides with the youngest age determined within the syn-kinematic grains. We interpret this relationship as indicating that the growth of post-kinematic minerals followed almost instantaneously the termination of deformation. As a consequence, the age of phengites overprinting the mylonitic foliation yields a precise age for the termination of deformation.

The spread in age variation of phengites goes together with a spread in Si content, consequently the postkinematic phengites have a higher Si content compared to the overprinted syn-kinematic ones. Therefore the metamorphic pressure conditions of the post-kinematic phengites were lower, indicating continuous deformation during exhumation within a time interval of approximately 12 Ma. We interpret these ages as formation ages during or after shearing, respectively. Muscovite blasts of the undeformed sample yield age values varying between 22 and 34 Ma. We interpret these ages as cooling ages, following the metamorphic peak temperatures.

To conclude, sinistral shear in the western TW started at least 24 Ma ago and terminated at 12 Ma. Therefore, these shear zones do not predate dextral displacements or lateral extrusion within the eastern Tauern sub-dome, which are also Miocene (Inger & Cliff, 1994, Frisch et al., 1998, Glodny et al., 2008). This conclusion suggests that they formed as part of an orogen-scale conjugate system, accommodating Miocene shortening due to South-Alpine indentation. Since these shear zones are transpressive, showing a component of vertical displacement, their age may also constrain exhumation of the Tauern dome.