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On the deep fate of the SEMP Fault along the TRANSALP seismic section (Eastern Alps)

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The Tauern Window ontains the only large-scale exposure of Tertiary middle- to lower crust in the Eastern Alps. The eastern and western margins of the Window are marked by pronounced jumps in the metamorphic grade. These coincide with extensional faults which are generally considered to be the major cause of exhumation. We present some new data from the northern margin of the Window, where a similarly sharp metamorphic gradient takes place within a major ductile branch of the SEMP Fault. This sinistral shear zone, which marks the northern boundary of the Zentral Gneiss along the TRANSALP seismic section has a width of approximately 2 km. It strikes E to ENE, dips sub-vertically, and is characterized by subhorizontal stretching lineations. These mylonites form the axial plane foliation of large-scale, ENE-striking upright folds in the western Tauern Window.

In spite of the subhorizontal lineations along the steep foliation of this shear zone, S-side up kinematic indicators in the Y-Z fabric plane and a pronounced southward increase in the temperature of sinistral shearing are observed within the shear zone. Microstructural observations, indicate that deformation of quartz at the northernmost boundary of the Zentralgneiss occurred by dislocation glide with only incipient dynamic recrystallization, suggesting a temperature of about 300˚ C. Further south, temperatures greater than 300 ˚C are inferred because all samples are affected by dynamic recrystallization of quartz, with a southward increase of grain size and typical evidence for grain-boundary migration at the southern boundary of the shear zone. These findings point to transpressive deformation accommodating a significant component of south-side-up displacement.

From the above above we suggest the following: (1) the SEMP Fault extends beyond

the brittle-ductile transition to a depth where temperatures exceed 500˚ C ($>$ 20 km ?). Due to its vertical orientation, the SEMP was not imaged as a reflector along the recent TRANSALP seismic line. Nevertheless, the fault should be included in the seismic interpretation profiles as a major crustal discontinuity; (2) The large-amplitude, upright folds of the Tauern Window formed at the same time as the sinistral mylonites, and hence during south-side up differential displacement; (3) Part of the pronounced lateral displacement of the SEMP fault is transferred into a vertical displacement at its western end. (4) The sharp increase of metamorphic grade across the shear zone contrasts to the gradual, increasing grade observed along the southern margin of the western Tauern Window. These features are similar, but symmetrically opposite to the the Central Alps, where the sharpest metamorphic gradient and vertical displacement are localized along the southern side of the Lepontine dome. We speculate that this change in polarity results from the change in the direction of lower crustal subduction, from S-directed in the Central Alps to symmetric or N-directed further East, as suggested by recent tomographic interpretations.