Exhumation-related structures at the eastern margin of the Tauern Window (Eastern Alps, Austria)

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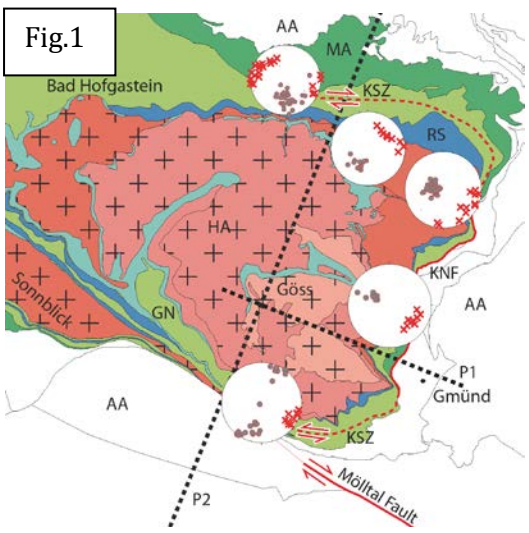
Cross sections across and correlations of tectonic units within the Tauern Window (Figs. 1-3) yield insight into its deformation history (Schmid et al., this vol.). This, together with structural analysis, reveals early subduction (D1) and thrusting accompanied by isoclinal folding (D2) of slices of oceanic lithosphere (Glockner Nappe, GN = Valais branch of Alpine Tethys) and continental crust (Rote Wand-Seidlwinkl Nappe = RS, Venediger Nappe Complex = VNC) derived from the distal European margin (Favaro et al., this vol.). N-directed thrusts (D3) led to the accretion of Europe-derived basement in a duplex ("Venediger Duplex"). Here we focus on exhumation (D4) during which these duplexes underwent further N-S shortening, contemporaneous with orogen-parallel normal faulting and strike-slip ductile shearing under retrograde amphibolite- to subgreenschist-facies conditions.

The Katschberg Shear Zone (KSZ, Figs. 1-3) is the key element of this D4 system of kinematically linked shearing and folding. In map view this 3-5 km thick belt of mylonites is associated with a penetrative (S4) foliation that swings around a series of simultaneously formed antiforms (Hochalm, Sonnblick) and a synform (Mallnitz). The eastern segment of the KSZ is a low-angle (25-30°, Fig. 2), SE-dipping, top-E to –SE ductile normal fault capped by a 10-100 m wide zone of cataclasites known as the Katschberg Normal Fault (KNF). At the northern and southern terminations of the KNF, the ductile KSZ curves into an orogen-parallel orientation and runs within calc-schist (Bündnerschiefer) of the GN. It lacks a cataclastic overprint and is characterized by moderately to steeply dipping mylonitic foliation (S4) with subhorizontal stretching lineations Ls4 (Fig. 1). The northern, E-W-trending branch exhibits dextral sense of shear, whereas the southern branch is sinistral and strikes NW-SE, i.e. subparallel to the brittle D5 Mölltal Fault with predominantly dextral shear-sense indicators that overprint D4 mylonite. The kinematic continuity of top-E to SE-directed normal faulting along the KNF with ductile dextral and sinistral strike-slip motion at its ends, combined with the coincidence of the KNF with the greatest amount of tectonic omission around the Hochalm Dome all indicate that N-S-shortening, strike-slip shearing and orogen-parallel normal faulting were broadly coeval.

The kinematics of the KSZ system indicates that units in the Tauern Window underwent exhumation by a combination of extensional unroofing and erosional denudation. The cooling history inferred from the literature constrains the KSZ to have formed between 28 and 17 Ma. Exhumation initiated with orogen-parallel extension, with initially rather flat-lying branches at the N and S ends of the KNF. As the amount of N-S shortening increased, these branches acquired progressively steeper orientations and finally accommodated predominantly strike-slip motion. The steepened parts of the KSZ represent stretching faults, such that the offset along them decreases from E to W. This coincides with an overall decrease in the intensity of D4 N-S shortening and E-W extension towards the central part of the Tauern Window. Dextral motion along the brittle Mölltal Fault occurred after the KSZ was deactivated at about 17 Ma. In summary, the KSZ at the eastern end of the Tauern Window may pre-date a substantial part of the N-S to NE-SW directed indentation of the Adriatic microplate that was accommodated by continued and more intense upright folding in the W part of the Tauern Window, as well as by strike-slip motions along the Periadriatic Line and the SEMP line (Schneider et al., this vol.).



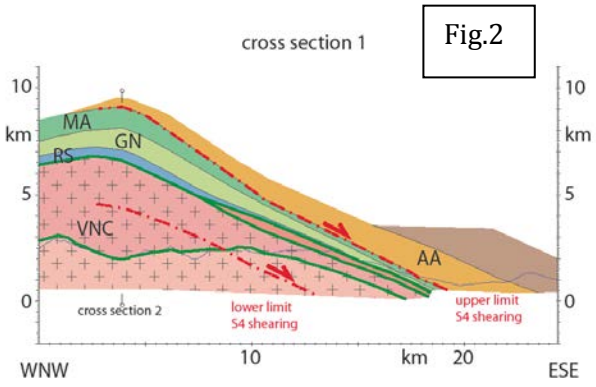


Fig.1: Simplified tectonic map (after Schmid et al., this vol.) showing traces of profiles in Fig.2 and Fig.3. Units: VNC = Venediger Nappe Complex, HA-Hochalm Nappe, RS-Rote Wand-Seidwinkl Nappe, GN-Glockner Nappe, MA-Matrei Unit, AA-Austroalpine Nappes. Equal area plots: Circles-poles to S4, Crosses - Ls4