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Brittle deformation and exhumation mechanisms in the core of the Eastern Alps, The Tauern Window

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The Tauern Window (TW) is a Tertiary structural and thermal dome located in the core of the Eastern Alpine orogen and in front of the Dolomite indenter. The Penninic basement and cover units within the TW attained their thermal peak about 30 Myr ago (e.g., Selverstone et al., 1992) followed by cooling and exhumation from Early Oligocene to late Miocene time (e.g., Grundmann and Morteani, 1985). Most exhumation was partly accommodated by two normal faults at the western and eastern ends of the TW (Brenner and Katschberg faults, respectively).

Although these normal faults are well described in the literature, their roles in the exhumation of the TW are still under debate: Exhumation accommodated primarily by folding and erosion (e.g., Rosenberg et al., 2004) versus exhumation mainly accommodated by Brenner and Katschberg normal faulting (e.g., Selverstone, 1988; Ratschbacher et al., 1989). New fault-slip data from the TW allow us to reconstruct paleostress axes by inversion and to constrain the relative roles of the folding and orogen-parallel extension during the late deformation history of the TW, in the brittle-field.

Our results show little evidence of compression and a clear zoning of the paleostress field in the TW. In the central part of the TW, the σ_1 direction is sub-horizontal N-S to NE-SW (strike-slip), whereas it is steep in the footwall of the Brenner and the Katschberg normal faults. Local variability of the σ_3 direction are observed; indeed, the σ_3 direction varies from E-W to WNW-ESE along the Brenner fault, to NW-SE along the Jaufen fault, the inferred southern continuation of the Brenner fault (Schneider et al., this session).

Along the Katschberg fault, the σ_3 direction is mainly NNW-SSE oriented, which is consistent with extension in front of a triangular dead zone shape induced by the WSW-striking Dolomites indenter. Nearly no evidence of a stress field compatible with upright folding (D2 phase of deformation) was found in the brittle domain.

Taken together, our results suggest that the brittle crust of the TW was mostly affected by a strike-slip state of stress, which grades into extension at the eastern and western margins of the dome. This suggests that the inverse regime associated with the upright folds terminated before these structures entered the brittle field. Hence, the strike-slip regime postdates in a short time-span the reverse one. The brittle crust of the TW affected by the pure-compressional regime may have been eroded or perhaps there was never any compression after the crust was exhumed to above the ductile-brittle transition.

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