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Age-strain analysis of synfaulting calcite: a tale of fault processes

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The use of synfaulting calcite dating for time constraint on fault activity is a fast growing field of research that can potentially unravel long-term faulting history. Kinematic indicators such as slickenlines are commonly used to infer the associated strain field during faulting. However, these indicators may overprint earlier rupture events, thereby obscuring reactivation behaviour. We use calcite absolute dating by laser-ablation U-Pb methods in conjunction with measurements of the mechanical twins in the same calcite grain to accurately determine the strain field during calcite precipitation. Our research also combines high-resolution U-Pb dating with isotopic and fluid inclusion analyses of multi-stage syntectonic vein.

Our research focused in two active fault systems: the North Anatolian Fault Zone (NAFZ) and the Dead Sea Transform (DST). Results from the NAFZ indicate that the system was activated at 43–41.5 Ma as normal fault and changed to its present dextral strike-slip style of deformation at/or before 11 Ma. Within the DST, high resolution age-strain analyses of a multi-stage vein from the southern DST indicate growth between 21-13 Ma. This 7 million years period of vein growth correlate exactly with the timing of fault activity as evident within 10 km long deformation zone (Nuriel et al., 2017). The results demonstrates that detailed age-strain analysis of multi-stage vein encompass the regional tectonic history of southern DST.