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Macro- to micro-scale dating of structures along the Dead Sea Transform: implications for continental transform evolution

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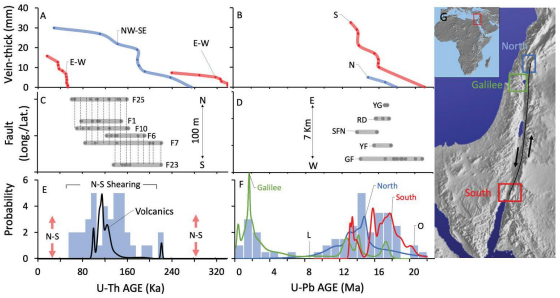

Reconstructing the evolution and deformation history of active plate boundaries is necessary for better understanding on how strain is accumulated, distributed, and released, through both space and time. Continental transforms are some of the most tectonically active structures on earth and large effort is dedicated towards constraining the accumulation and distribution of strain in these systems. This contribution presents insights from a decade-long study in the Dead Sea Transform (DST), where we developed a methodological approach for dating fault-related precipitates such as calcite to provide a deformational history from thousands (U-Th; Ka; [1]) to millions (U-Pb; Ma; [2-3]) of years. The combined dataset allows for the reconstruction of (i) strain accumulation rates at the micro-scale (mm) from high-resolution dating of crack-seal veins, indicating non-uniform strain accumulation rates in both time scales (Ka and Ma); (ii) strain distribution at the meso-scale (m), demonstrating periods of peak activity and 10 Ka period for reoccurrences on specific structure; and (iii) strain evolution at the macro-scale, based on distribution of dated faulting events along 500 km-long fault segments (n=65), demonstrating changes in deformation style in the past 500 Ka (n=40), and key stages in the evolution of the DST, from initiation (21 Ma), to the establishment of a 500-km long transform (18 Ma), and the transition to a more localized deformation style (13 Ma). The results of the study contribute to our understanding on continental transforms evolution, including processes such as initiation, propagation, reorganization, reactivation, reoccurrences, and faults interactions. These processes are only partially and inconsistently constrained along active fault systems.

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