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Long-term faulting history of the Central Taurides based on U-Pb dating of syn-tectonic calcites

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ABSTRACT

The Central Taurides, located along the southern margin of the Central Anatolian Plateau (CAP), form a distinctive physiographic unit characterized by a steep mountain belt, high fault density, and diverse kinematic structures. It represents a key geological archive of subduction and the initial stages of collision in the Eastern Mediterranean. Although the geological evolution and origin of high-relief mountain development in this area remain extensively debated, the faulting history is poorly constrained due to a lack of direct isotopic age data. To comprehend the link between brittle deformation, uplift and plateau margin development, we investigate faulting history using kinematic and microstructural analyses combined with U-Pb dating of syn-tectonic calcites. U-Pb dating of forty-one syn-tectonic calcites indicate three faulting phases from the Late Cretaceous to the Quaternary. Thrust/reverse faulting occurred in the Late Cretaceous, followed by strike-slip faulting from the Early Eocene to the Early Miocene. Normal faulting became prevalent from the Early Miocene to the Quaternary. This study confirms compressional control on faulting during the Late Cretaceous in southern Türkiye. We also identify a previously unrecognized strike-slip faulting phase between the Early Eocene and the Early Miocene and demonstrate that extensional deformation in the Central Taurides began in the Early Miocene, rather than in the Middle/Late Miocene as suggested by earlier studies. Our results suggest that post-Oligocene structural patterns have been shaped by extensional processes. This study provides new constraints on multiple tectonic phases along the southern CAP margin, offering key insights into the geodynamic evolution of the Eastern Mediterranean.

1. Introduction

The study of the history of crustal deformation and the kinematic development of orogenic belts provides further insights into how the Earth's surface is shaped under the complex interactions between different tectonic plates. In particular, reconstructing the faulting history of such orogenic systems helps clarify feedback mechanisms between mantle dynamics, surface processes, and crustal deformation (Strecker et al., 2009; Yıldırım et al., 2011; T.F. Schildgen et al., 2014; Aykut et al., 2025).

One such region where these interactions are well-preserved is the Central Taurides, located on the southern margin of the Central Anatolian Plateau (CAP). This area, forming the southwestern part of the Anatolide-Tauride tectonic block (Okay and Tüysüz, 1999), stands out due to its 2 km high topography. The Central Taurides exhibit a diverse array of tectono-geomorphic markers, cross-cutting poly-phase tectonic lineaments, and variable brittle structures that reflect a prolonged and multi-stage deformation history. This deformation results from a combination of geodynamic processes, including the convergence of the African and Eurasian plates, collision along the Cyprus Trench, slab deformation, slab roll-back, and mantle flow beneath the Anatolian Plateau (Şengör and Yılmaz, 1981; Okay and Tüysüz, 1999; Andrew and Robertson, 2002; Schattner, 2010; T.F. Schildgen et al., 2014; Aykut et al., 2023, 2025). Although the belt exhibits a high density of faults

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