Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30573

Timing and Kinematics of Mylonitic Deformation along a Terrain Boundary of Southern Mexico: Insights from the Sierra de Juárez Complex

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Shear zones play a fundamental role in lithospheric deformation and tectonic evolution. Often associated with major tectonic boundaries, these structures accommodate strain and host metamorphic reactions and fluid-rock interactions. To reconstruct Earth's crustal history, it is essential to constrain the timing and mechanisms of deformation.

The Sierra de Juárez Complex (SJC) in southern Mexico represents one of several fault-bounded crustal blocks (terrains) with a complex metamorphic and structural history. A key feature is its Mesozoic mylonitic fabric, which has been interpreted within two contrasting tectonic frameworks. One model links it to an Early to Middle Jurassic shear zone associated with the southward displacement of the Yucatán Block and the opening of the Gulf of Mexico. Another model proposes that it formed during Late Jurassic–Early Cretaceous crustal hyper-stretching and opening of the Chivillas Basin as a consequence of the onset of oblique subduction along the Pacific. These interpretations differ not only in age but also in kinematics, making it essential to establish precise deformation constraints to resolve this debate.

This study presents new muscovite Rb-Sr geochronology (ID-TIMS) from the northern SJC, yielding ages between 164.4 ± 6.0 Ma and 151.0 ± 8.0 Ma, corresponding to the Middle to Late Jurassic. While ID-TIMS Rb-Sr provides high-precision results, further exploration of alternative isotopic methods and mineral phases is needed to refine deformation ages and better constrain the tectonometamorphic evolution of the region. Additionally, microstructural and kinematic analyses using EBSD and optical microscopy are presented to elucidate deformation mechanisms. Together, these new geochronological and structural data provide a new perspective on the evolution of this shear zone.