

# **U-Pb carbonate dating for constraining the timing of shear zone reactivation in Northeast Brazil**

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U-Pb dating of carbonates using LA-ICP-MS has emerged as a powerful tool in structural geology, particularly for constraining the timing of previously unrecognized brittle deformation events. When integrated with structural analysis, this technique provides a comprehensive framework for assessing the chronological evolution of brittle deformation within shear zones.

The Borborema Province in Northeast Brazil presents an exceptional geological setting to explore this question. This region comprises a complex network of shear zones with a multi-phase evolutionary history, initially shaped during the Neoproterozoic as part of the Western Gondwana Orogen. The Transbrasiliiano-Kandi Lineament, a transcontinental structure spanning approximately 4,500 km, has played a crucial role in shaping the Cambro-Ordovician Jaibaras Basin and the Paleozoic Parnaíba Basin. This lineament has undergone multiple reactivation phases, ranging from ductile-brittle to purely brittle deformation regimes.

In this study, we present the first U-Pb carbonate dating of the reactivation of the Transbrasiliiano-Kandi Lineament, combined with structural analysis, to elucidate the timing of reactivation events and their relationship with the formation and deformation of the Paleozoic and Cretaceous basins of Northeastern Brazil.

The reactivation of shear zones has facilitated fluid migration along fault slickensides, leading to the formation of carbonate and quartz-feldspar veins within the Precambrian basement and the Jaibaras Basin. These structures are closely associated with NNE-directed horizontal compressional stresses that generate reverse faults, with carbonate infillings dated between ca. 480 Ma and 380 Ma. A comparable cluster of ages (ca.  $465 \pm 3$  Ma,  $446 \pm 7$  Ma, and  $314 \pm 15$  Ma) was previously reported in granite dikes adjacent to the Transbrasiliiano-Kandi Lineament. Additionally, vertical carbonate veins cross-cutting the Parnaíba basin rocks represent the final evidence of deformation, with ages between ca. 124 Ma and 113 Ma.

Our findings indicate two primary clusters of reactivation ages for the Transbrasiliiano-Kandi Lineament: (i) during the Ordovician-Devonian, associated with NE-directed horizontal compressional stresses whose the origin remains uncertain but may reflect far-field stresses from the Variscan orogeny; and (ii) during the Cretaceous, characterized by structures subjected to predominantly vertical stress, related to the early stages of South Atlantic rift.