

## The Salado River fault: reactivation of an Early Jurassic fault in a transfer zone during Laramide deformation in southern Mexico

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The Salado River fault (SRF) is a prominent structure in southern Mexico that shows evidence of reactivation at two times under different tectonic conditions. It coincides with the geological contact between a structural high characterized by Palaeozoic basement rocks to the north, and an ~2000 m thick sequence of marine and continental rocks that accumulated in a Middle Jurassic–Cretaceous basin to the south. Rocks along the fault within a zone up to 150 m across record crystal-plastic deformation affecting the metamorphic basement of the Palaeozoic Acatlán Complex. Later brittle deformation is recorded by both the basement and the overlying Mesozoic sedimentary rocks. Regional features and structural textures at both outcrop and microscopic scale indicate two episodes of left-lateral displacement. The first took place under low-to medium-grade P-T conditions in the late Early Jurassic (180 Ma) based on the interpretation of <sup>40</sup>Ar/<sup>39</sup>Ar ratios from muscovite within the fault zone; the second occurred under shallow conditions, when the fault served as a transfer zone between areas with differing magnitudes of shortening north and south of the fault. In the southern block, fold hinges were dragged westward during Laramide tectonic transport to the east, culminating in brittle deformation characterized by strike-slip faulting in the Mesozoic sedimentary rocks. North of the fault, folds are not well defined, and it is clear that the fold hinges observed in the southern block do not continue north of the fault. Although the orientation and kinematics of the SRF are similar to major Cainozoic shear zones in southern Mexico, our new data indicate that the fault had become inactive by the time of Oligocene volcanism.

**Keywords:** fault reactivation; transfer fault; strike-slip fault; Laramide deformation; southern Mexico

### Introduction

The geological structures and sequence of events related to the opening of the Gulf of Mexico have been a matter of intense discussion and revision (Pindell *et al.* 1988, 2006; Salvador 1991; Marton and Buffler 1994; Bird *et al.* 2005). Several inferred structures connected with this process in continental Mexico have been proposed on the basis of stratigraphic constraints for the Mesozoic sequences and chronological constraints in pre-Mesozoic basement segments (Anderson and Schmidt 1983; Pindell *et al.* 1988; Keppie 2004). However, detailed descriptions and dating of fault structures has been hampered by the scarcity of shear zone exposures.

The occurrence of large-scale lateral faults in southern Mexico is significant not only for the recognition of reactivated structures related to its Mesozoic tectonic evolution, in particular, the opening of the Gulf of Mexico but also for the understanding of the Cainozoic tectonic evolution of this region. Several Cainozoic faults and shear zones, both confirmed and inferred, have been identified and

mapped in different parts of southern Mexico (Figure 1B), particularly in the states of Oaxaca and Guerrero (Ratschbacher *et al.* 1991; Morán-Zenteno 1992; Riller *et al.* 1992; Meschede *et al.* 1997; Torres-De León 2005; Corona-Chávez *et al.* 2006; Tolson 2007). Although various attempts have been made to place the Cainozoic lineaments and faults of southern Mexico in a regional tectonic framework (Meschede *et al.* 1997; Nieto-Samaniego *et al.* 2006; Cerca *et al.* 2007), many issues are still unresolved. The WNW-striking Salado River fault (SRF), located in southern Mexico, displays a history that began in Early Jurassic time, if not before, and continued until the early Cainozoic and can provide information on tectonic scenarios for different periods. The orientation and characteristics of the SRF present an excellent opportunity to analyse the reactivation history of large structures in this region, especially their role during Late Cretaceous Laramide orogenic deformation, and determine whether all the ~WNW lineaments in southern Mexico were active in the Cainozoic.

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