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## Multi-Stage Jurassic Rifting in Eastern Mexico and Implications for Gulf of Mexico Opening

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### ABSTRACT

The Gulf of Mexico is a major petroliferous basin and a key piece in the tectonic evolution of North America. The architecture and stratigraphy of early Mesozoic rift basins in Mexico have been related to the break-up of Pangea and the opening of the Gulf of Mexico. In the Sierra Madre Oriental of eastern Mexico, early Mesozoic marine and continental strata are exposed in the Huayacocotla Uplift that are structurally juxtaposed against Mesoproterozoic Oaxaquian (Grenville) basement by normal faults—subsequently reactivated as thrust faults within the Mexican Orogen. New stratigraphic, petrographic provenance and detailed detrital zircon (DZ) U-Pb geochronology data illuminate the stratigraphic and structural evolution of these syn-rift strata and their relationship to the Gulf of Mexico. The Huayacocotla Uplift exposes Permian turbidite deposits of the Tuzancoa Formation that are overlain by Lower Jurassic marine syn-rift deposits of the Huayacocotla Formation. These syn-rift strata are unconformably overlain by fluvial sandstone and conglomerate of the Upper Jurassic Cahuwasas Formation. The lithologies and angular unconformities between these formations document two discrete Early to Middle Jurassic rift pulses. The petrography suggests progressive unroofing of extensional fault blocks composed of volcanic and crystalline basement rocks. The DZ U-Pb data point to initial unroofing of a Permian volcanic arc rocks—likely associated with the E Mexican Arc—during the early the Huayacocotla Fm, transitioning to more dominant sourcing from Mesoproterozoic rocks during progressive footwall exhumation. More diverse Paleozoic and early Mesozoic DZ grains characterize the Cahuwasas Formation. The maximal depositional ages for the rocks in the Huayacocotla Uplift document an Early Jurassic Huayacocotla rift pulse associated with subduction rollback and back-arc extension during the Sinemurian-Pliensbachian. In contrast, Cahuwasas Formation deposition during late Callovian-Oxfordian rifting appears to correspond to Gulf of Mexico opening and Yucatan Block translation. These new detailed data

indicate a multi-phase rift evolution with distinctly different tectonic drivers and that early syn-rift strata are not associated with Gulf of Mexico opening.