



New tectonic data constrain the mechanisms of breakup along the Gulf of California

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The Gulf of California is resulting from an oblique-rift system due to the separation of the Pacific and the North American plates in the \sim N110E to \sim N125E trend. The age, nature and orientation of strain which ended with continental break-up and incipient oceanization at \sim 3.6 Ma, is largely misunderstood. It is generally proposed that early stages of extension began at around 12 Ma with strain partitioning into two components: a pure ENE directed extension in the Gulf Extensional Province (which includes Sonora and the eastern Baja California Peninsula in Mexico) and a dextral strike-slip displacement west of the Baja California Peninsula along the San Benito and Tosco-Abreojos faults. This evolution would have lasted \sim 5-6 Ma when a new transtensional strain regime took place. This regime, with extension trending \sim N110E \pm 10°, led to the final break-up and the subsequent individualization of a transform-fault system and subordinated short oceanic ridges.

This two-steps interpretation has recently been challenged by authors suggesting a continuous transtensional extension from 12 Ma in the trend of the PAC-NAM plates Kinematic. We question both of those models in term of timing and mode of accommodation basing ourselves on field investigations in Baja California Sur (Mexico). The volcano-sedimentary formations of the Comondù group dated 25 to 20 Ma exhibit clear examples of syn-sedimentary and syn-magmatic extensive deformations. This extension, oriented N65°E \pm 15°, is proposed to initiate during the Magdalena Plate subduction. It would be related to the GOC initialization. In addition to this finding, we present tectonic and dating evidences of complex detachment-faulting tectonics varying in trend and kinematics with time and space for the development to the south of Baja California Sur. The extension associated with the early detachment-fault system trended \sim N110E. From \sim 17 Ma to, probably, \sim 7-8 Ma, this extension controlled the early development of the San Jose del Cabo and the coeval footwall exhumation of large Cretaceous basement blocks (such as the Sierra Laguna). This detachment tectonics is overprinted by a more recent detachment-type tectonic evolution, localized alongshore the GOC, with coeval development of Pliocene basins. At this stage, extension was trending N75°E \pm 10°, i.e. close to GOC-normal. We discuss the geodynamical interpretation of all those new results in terms of forces driving the obliquity of rifts.