Evolution of the Southern Gulf of California: Thermochronology of rift-related extensional faults

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The Gulf of California is the type locale for young, highly oblique rifting of continental crust. Over the past 12 m.y., ca. 450 km of displacement has occurred between the southernmost Los Cabos margin of the Baja California and the Tres Marias margin of mainland Mexico. Seismic and other geophysical data indicate that most separation between Baja and mainland Mexico, at the Los Cabos block-Tres Marias rift segment, was accommodated by the generation of new oceanic crust. The best understood example of crustal extension involves a large, E-dipping normal fault developed between the Sierra Laguna and the Neogene Santiago basin. Coupled K-feldspar $^{40}Ar/^{39}Ar$, and zircon and apatite fission track and (U-Th)/He thermal history results indicate ca. 12 km of vertical displacement (24 km of overall slip) between 8-2 Ma. The magnitude and style of deformation changes dramatically across the Tomayo Fracture Zone (TFZ). North of the TFZ, continental crust along the margins of the Alarcon ridge is highly attenuated and largely submerged. Several extensional faults have developed on either side of the Alarcon ridge. Along the eastern Baja coast, a large W-dipping normal fault along the Sierra La Gata and Isla Cerralvo formed the San Juan de Los Planes-La Ventana basin. Combined $^{40}Ar/^{39}Ar$ and (U-Th)/He results record a similar timing and smaller magnitude of slip (8-5 Ma and ca. 6 km, respectively) of the Sierra La Gata and Isla Cerralvo footwall rocks. Sparse thermal history information indicates 5-6 km of exhumation and limited basement erosion of the southeastern gulf islands during the late Miocene-early Pliocene. Limited footwall denudation is indicated by preservation of Pliocene sediment and Miocene welded tuff that caps an erosional unconformities developed on Isla Cerralvo and Isla San Jose. Most crustal extension occurs further offshore. To enhance our understanding of how strain is partitioned in highly oblique rift systems, we are currently examining ROV-collected samples obtained along and adjacent to normal fault scarps along the margins of the Alarcon ridge.