

Extensional and Transtensional Rift Basins in California and Mexico

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Abstract

Cenozoic volcanism and sedimentation in the western U.S. and Mexico occurred under extensional to transtensional strain regimes, resulting in excellent preservation of stratigraphy in deep, fault-controlled basins. At ~50-16 Ma, fallback of the subducting Farallon slab resulted in long-distance westward-migration of arc front volcanism across the southwest US and western Mexico, accompanied by E-W extension and basin development. Initially (pre-22 Ma), Farallon slab fallback caused asthenospheric upwelling, producing supervolcano silicic caldera fields in the east, including the Sierra Madre Occidental silicic large igneous province. Our new work there shows that extension accompanied the ignimbrite flareup and swept westward with it, producing the largest epithermal gold province on Earth.

Continued Farallon slab fallback at ~22-16 Ma produced stratovolcano/lava dome chains on thinner crust in the west, including the Sierra Nevada Ancestral Cascades arc and Comundú arc, in Alta and Baja California, respectively. By ~16-12 Ma, the Pacific/North America plate boundary lengthened, causing E-W extension over a broad arc/backarc region in the southwest U.S. and Mexico (northern and southern Basin and Range).

Thermal softening weakened the continent in the arc front, just inboard of a strong lithospheric block created by the Cretaceous batholith in Alta and Baja California. This became exploited by focused NNW-SSE transtension at ~12 Ma, in response to a change in Pacific plate motion, from more westerly to more northerly. Baja California was quickly rifted off of North America at 12-6 Ma, due to stalling of large Farallon microplates, but extension in Baja basins has continued during the “drift” phase.

California is calving off more slowly, following northward migration of the Mendocino triple junction (MTJ). The onset of transtension is marked by a burst of ~12-10 Ma high-K arc volcanism. The leading tip of the transtensional rift exploited a series of large arc volcanic centers localized at major transtensional stepovers (Sierra Crest-Little Walker, Ebbetts Pass), presently occurring at Mount Lassen; in its wake, the largest rift volcanic centers (Long Valley, Coso) are localized in transtensional stepovers.

This talk will focus on distinguishing sedimentary, volcanic and structural features of basins formed under the tectonic regimes described above.

