

# Geochemistry and U/Pb geochronology of the eastern-most Peninsular Ranges batholith of southern California and northern Baja California; implications for magmatism and tectonics at the onset of the Laramide orogeny

**Robert E. Moniz**

## **ABSTRACT**

There are numerous models explaining the widely debated Laramide orogenic event that occurred in western North America from ~80-40 Ma. The shallowing of the subduction slab, or more likely a section of the slab, may have created the compressional regime that was expressed well inboard of the trench. Geologic evidence of this contraction has been documented from Canada down into Sonora, Mexico and includes the under-thrusting of the amphibolite facies Rand-Orocopia-Pelona schists, uplift of the continental interior and the “migration” of magmatism reaching ~1000 km inboard of the arc. Despite the abundant geologic data for Laramide and pre-Laramide orogenies, the initial magmatic units remain poorly understood. The characterization of these units may bring a better understanding of the transition to shallow slab subduction.

Using zircon U/Pb geochronology, a new suite of latest Cretaceous early Tertiary (i.e. 86-70 Ma) granitic intrusives has been characterized in the eastern-most Peninsular Ranges batholith. Previously, a small group of granitoids in the eastern Santa Rosa Mountains in southern California were the only characterized units of this age found in the Jurassic-Cretaceous Peninsular Ranges. This suite is sparsely exposed for at least 300 km along strike and likely comprises >200 km<sup>2</sup> in surface outcrop exposure. The units lie within three geographically distinct areas. The youngest truly Laramide in age units (i.e. 80-70 Ma) were found in the Sierra Cucapas just south of the California-Baja California border whereas “transitional” aged units (i.e. 86-81 Ma) were identified in the Sierra Cucapa and further south in the Sierra San Felipe. Transitional aged units were also confirmed in the Santa Rosa Mountains of central southern California. Both the Laramide and transitional units in Mexico are found to be in cross-cutting relationship with the older La Posta-type plutonic rocks that comprise the main phase (100-90 Ma) of the eastern Peninsular Ranges batholith. The transitional units in the Santa Rosa Mountains appear to be distinctly to the east of La Posta aged units which are separated by the eastern Peninsular Ranges mylonite zone.

Major and minor elemental geochemistry from 54 samples indicate that although the majority of granitics in the eastern Peninsular Ranges are, as previously documented, part of the La Posta suite, many do not follow the typical documented deep crustal root signature defined by high Sr/Y ratios. The Laramide and transitional aged samples were found to overlap almost completely with the La Posta aged suite of this study on a regional and local scale, making characterization difficult.

The eastern batholith has been described as a “migrating” arc representing the initial stage of inboard migration of Laramide Cordilleran magmatism. The new data however, suggests that following the voluminous La Posta magmatic flare-up at 100-90 Ma, magmatism stalled but continued intermittently until ~70 Ma in the eastern Peninsular Ranges batholith. With numerous examples of Late Cretaceous magmatism as far inland as Colorado and New Mexico, it now appears that magmatism did not simply “migrate” inboard and that current models of shallow subduction inadequately account for the proximal Laramide intrusions of this

study. This suite therefore provides a unique area that records the tectonics and magmatism associated with this major transition in Cordilleran geology.