

## **Evolution of the Mantle Lithosphere Beneath the Southern Sierra Nevada–San Joaquin Valley Region and its Geological Expression, California**

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Petrogenetic studies of mantle xenoliths entrained in Neogene-Quaternary volcanics in conjunction with seismic data constrain the evolution of the mantle lithosphere beneath the southern Sierra-San Joaquin Valley (SJV) region. Critical to this analysis is a profound change between xenoliths carried in mid-Miocene versus Plio-Pleistocene eruptives. The mid-Miocene suites were derived from mantle lithosphere that formed in conjunction with the Sierra Nevada batholith (SNB). This sub-SNB mantle section was conductively cooled to a lithospheric geotherm at the end of the Cretaceous by Laramide flat slab subduction, but deep enough to preserve its ~125 km thickness as recorded by thermobarometry. In the southernmost Sierra and adjacent Mojave Desert, such flat slab subduction shallowed abruptly along a lateral ramp and sheared off the sub-batholith mantle lithosphere, subsequently underplating the Rand and Pelona schists. The geologic expression of these events resembles active features in the Andes where shallow slab segments are descending in association with the subduction of aseismic ridges. North of the Laramide-age lateral ramp, the sub-SNB lithosphere remained in a gravitationally metastable state until Pliocene time, when it was perturbed by high-magnitude extension to the east. This caused the lithosphere to convectively mobilize westward into a large drip which has descended to a depth of ~250 km beneath the western Sierra and adjacent SJV. Much of the sub-SNB lithosphere was replaced by asthenospheric mantle. Upper mantle xenoliths entrained in Pliocene-Quaternary eruptives from the region carry only modern age asthenospheric peridotites whose thermobarometry records an upper mantle adiabat extending to the base of the felsic crust. There currently is no mantle lithosphere beneath the greater SNB, it has thin crust, and its high elevations are supported by the underlying mantle. In contrast, the crust thickens in the western Sierra and adjacent San Joaquin Valley over the drip. The lowest elevations of the range here correspond to the thickest SNB crust. Such dynamic subsidence is further reflected in the SJV by the Plio-Pleistocene development of the Tulare Lake sub-basin.