Plio-Quaternary subsidence and exhumation of the southeastern San Joaquin Basin, CA, in response to mantle lithosphere removal

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1. Introduction and Motivation

Thermomechanical models of mantle Lithosphere removal from beneath the southern Sierra Nevada region, California, predict a complex spatio-temporal pattern of vertical surface displacements. We evaluate these models by using (U-Th)/He thermochronometry, together with other paleothermometry estimates, to investigate such topographic transients. We target strata of the Kern arch, a crescent-shaped uplift located in the SE San Joaquin Basin. Kern arch stratigraphy provides a unique record of subsidence and exhumation in a sensitive region immediately adjacent to the delaminating mantle lithosphere at depth.

2. Delamination and vertical surface displacements

Comparisons of vertical displacement of the eastern Sierra crest and Tulare Basin center seen in a tilted view are prodigious by a factor of more than 200. The model predicted by Saleeb et al. predicts a maximum uplift of 4.8 km uplift at the Sierra crest and 60% uplift in the Tulare Basin 6 Ma sub. (m).

3. The Kern Arch

The Kern arch is a crescent-shaped uplift located along the low western flank of the southern Sierra Nevada. It is adjacent to the Tulare Basin, an area of modern anomalous subsidence believed to be typeof an area of residual crustal attachment of the delaminating arclogite at depth. Basinal deposits of the Kern arch and Tulare Basin positions relative to the overlying plate.

4. Cryptic subsidence in the Kern Arch

Apatite (U-Th)/He age

5. Thermal history simulations

Dated apatite He ages can only be explained by a positive -6 Ma heating event, which we assign a potential origin in the SE San Joaquin Basin. This event was identified in the thermal history models. The model preferred by the authors is the one in which the Kurro 4 subsea well shows a heating event with positive age of - 6 Ma and a low thermal gradient which is associated with a diastrophic event in the Tulare Basin.

6. Forward modeling of detrital apatite (U-Th)/He ages

7. Surface transients in the Kern arch - Tulare Basin region

8. References


Thomsen et al., 2009. Apatite (U-Th)/He thermochronology in the Sierra Nevada. In R.G. Smoot et al., eds., Geothermal. S.R. 

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