

17-3 - TECTONIC AND MAGMATIC CONSTRUCTION OF LOWER CRUST IN THE SOUTHERN CALIFORNIA BATHOLITH



Wednesday, 15 May 2024



2:15 PM - 2:35 PM



Maple Ballroom (Davenport Grand Hotel)

Abstract

We explore the growth of lower-continental crust by examining the root of the Southern California Batholith, a ~500-km-long, paleo-arc segment of the Mesozoic California arc that lies between the southern Sierra Nevada batholith and northern Peninsular Ranges Batholith. We focus on the Cucamonga and San Antonio terranes located in the eastern San Gabriel Mountains where the deep root of the Mesozoic arc is exhumed by the Quaternary Cucamonga thrust fault. This lower- to mid-crustal cross section of the arc allows us to investigate: 1) the timing and rates of Mesozoic arc construction, 2) mechanisms of sediment incorporation into the lower crust, and 3) the interplay between mantle input and crustal recycling during arc magmatic surges. We use detrital zircon geochronology of 4 quartzites and paragneisses to investigate the origin of the lower-crustal Cucamonga paragneiss sequence, and U-Pb petrochronology of 26 orthogneisses to establish the timing of arc magmatism and granulite-facies metamorphism. We find that the Cucamonga paragneisses share broad similarities to Sur Series metasedimentary rocks in the Salinia terrane, suggesting that both were deposited in a Late Paleozoic to Early Mesozoic forearc or intra-arc basin. This basin was progressively underthrust beneath the arc during the Middle Jurassic to Late Cretaceous and was metamorphosed during two high-grade (>750°C) migmatization events at ca. 124 and 89–75 Ma. These metamorphic events were associated with 100 m.y. of arc magmatism that lasted from 175 to 75 Ma and culminated in a magmatic surge from ca. 90–75 Ma. Field observations and petrochronology analyses indicate that partial melting of the underthrust Cucamonga metasedimentary rocks was triggered by emplacement of voluminous, mid-crustal tonalites and granodiorites. Partial melting of the metasedimentary rocks played a subsidiary role relative to mantle input in driving the Late Cretaceous magmatic flare-up event. Our observations demonstrate that tectonic incorporation of sediments into the lower crust led to structural, compositional and rheological changes in the architecture of the arc including vertical thickening. These structural changes created weak zones that preferentially focused deformation and promoted present-day reactivation along the Cucamonga thrust fault.

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Author

**Joshua Schwartz**

California State University Northridge

Authors

**Elena Miranda**

California State University Northridge

**Keith Klepeis**

University of Vermont

**Gabriela Mora-Klepeis**

University of Vermont

**Jade Star Lackey**

Pomona College



Alina Tibaldi
Universidad Nacional de Río Cuarto

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