From Forearc to Transform: Sedimentary Record of Changing Tectonic Setting in the Central California Continental Margin

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Convergent continental margins are complex settings that characteristically juxtapose exhumed rocks adjacent to rapidly subsiding basins. Moreover, major transform margins can obscure paleogeographic relationships through lateral translation along strikeslip faults. While these structural and stratigraphic complexities are integrated over time as plate boundaries transition between these settings, careful analysis of provenance signals preserved in associated sedimentary basins can be used to decipher local and regional tectonic history.

This talk will explore the stratigraphic record of the Mount Diablo region, which has been located within a hypothesized persistent corridor for clastic sediment delivery to the central California continental margin over the past 100 million years. New detrital zircon U-Pb geochronology is integrated with previously established geologic and sedimentologic relationships to document how Late Cretaceous through Cenozoic trends in sandstone composition varied through time in response to changing tectonic environments and paleogeography. Petrographic composition and detrital zircon age distributions demonstrate systematic transitions in sediment supply from: (1) the Klamath Mountains and northwestern Sierran Foothills Belt; (2) Sierra Nevada batholith; (3) Idaho batholith and Challis volcanic field; (4) northeastern and west-central Nevada caldera belts; (5) Ancestral Cascade volcanism; and (6) recycled Mesozoic subduction complex and forearc basin strata. These provenance trends demonstrate a reorganization and expansion of the western continental drainage catchment in the California forearc during the late transition to flat-slab subduction of the Farallon plate, subsequent volcanism and southwestward migration of the paleodrainage divide during slab rollback, and ultimately the cessation of convergent margin tectonics and initiation of the continental transform margin in northcentral Calif. Additionally, this talk will address the long-term slip history of the San Andreas fault by comparing the provenance of previously hypothesized offset features in the La Honda and San Joaquin basins. Spatial relationships are best resolvedby restoring ~360 km of displacement on the San Andreas fault since early Miocene time. Disparity in this slip magnitude with the coeval ~315 km displacement of the Pinnacles–Neenach volcanic center is due to at least 45 km of net off-fault deformation along the margin. This new constraint removes the need for controversial Paleogene slip on the San Andreas or precursor faults and rectifies previous discrepancies between global plate rotations and estimates of total displacement across the continental transform margin.

Biography: Jared Gooley is a Research Geologist with the USGS Geology, Energy, and Mineral Science Center (GEMSC). Jared received a Ph.D. from Stanford University (2020), M.S. from the University of Utah (2010), and B.S. from Miami University (2008).

Prior to his doctoral studies, he worked for Chevron as a Development and Exploration Geologist. His current research investigates sedimentary basins using field and subsurface mapping, sediment provenance, and geochronology to reconstruct paleolandscapes and understand changing tectonic conditions.