Geologic and geophysical framework of Mount Diablo

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This talk is based on the upcoming paper "Structural and seismic hazard implications of geologic map and potential field geophysical observations at Mount Diablo, California" (GSA Memoir 217)

Mount Diablo has been characterized as a large overturned anticline, but its actual structure is more complex. Offset geologic units and gravity/magnetic anomalies show the mountain is bisected by the reverse-oblique right-lateral Greenville–Diablo–Concord fault zone (GDCFZ) with 15–20 km of Pliocene and younger strike-slip offset. Thus the mountain is formed of two structural blocks with different stratigraphy and structural style. The western block is characterized by a thin (<1 km) Paleogene section and thick (>4 km) Neogene section, with a broad active fold and thrust belt formed in response both to a restraining bend in the GDCFZ and to regional fault-normal compression. The uplifted eastern block is characterized by a locally thick (~3 km) Paleogene section and a thin (<1 km) exposed Neogene section, with a Paleogene normal fault system forming a stepped graben tilted up by Neogene compression. The Neogene compression has also formed roughly fault-parallel folds, including the Mount Diablo anticline on the uplifted eastern block near the GDCFZ. At the peak of Mount Diablo, intense deformation in the restraining stepover has distorted the fold axes and maximized basement uplift, so that the basement rocks of the Franciscan Complex and Coast Range ophiolite are only exposed at the highest parts of the mountain. The elongate gravity high associated with the Mount Diablo anticline is offset 2–3 km to the east of the fold axis, reflecting either a fault detachment between the basement and overlying strata or the prefolding basement geometry. Lack of appreciable offset on the gravity high precludes significant strike-slip offset on faults directly east of Mount Diablo. Some earlier workers have included the Mount Diablo anticline in a fold and thrust belt rooted in a blind Mount Diablo Thrust extending beneath the mountain and ~20 km to the east. This neglects the 15 km strike-slip offset on the GDCFZ, however, and there is significantly less compressive deformation to the east. The model proposed here is that the Mount Diablo Thrust roots into the GDCFZ at depth, and the fold and thrust belt lies entirely to the west, limiting the area of fault rupture (and maximum earthquake) on the Mount Diablo Thrust. The Late Cretaceous and Paleogene stratigraphy at Mount Diablo shows that there is now a mountain where once was the depocenter of the Great Valley forearc basin.

Biography: Russ Graymer received his B.S. from Caltech in 1985, followed by a Ph.D. in 1992 from UC Berkeley (Structural Evolution of the Central Part of the Foothills Terrane, Sierra Nevada, California), a postdoc in 1992–1994 at UC Berkeley (Is the Mission Fault the Calaveras-Hayward fault connection?), and various teaching and consulting assignments from 1994 to 1996. He has been at USGS since 1996, working on various topics including SF Bay region geologic mapping, NorCal Landslide Hazards Working Group, Bay Area 3D geologic map, San Andreas Fault 3D/4D geologic map, Delta 3D geologic map and seismic velocity model, and the Central California Coast Ranges 3D geologic map and seismic velocity model.