San Andreas Fault Transition Zone: Where Large, Small, Coseismic, and Aseismic Slip Occurs: Parkfield-Cholame

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Intro
A Caltrans highway improvement project has afforded us the opportunity to investigate the paleoseismology of the Parkfield/Cholame SAF segment transition. The Parkfield segment has experienced six ~M6.0 earthquakes since 1857, with the most recent breaking the ground at our site in 1966. At the site, the most recent earthquake in 1966 resulted in ~4 cm coseismic dextral slip, with afterslip amounting to 13 cm. Geomorphic offsets suggest that 1857 slipped 2.5-3.5 m (Sieh, 1978, Lienkaemper, 2001), with post-1857 slip (creep plus M6 PKF events) resulting in ~1 m offsets.

We investigated two cross-fault zone trenches that were located on an abandoned floodplain. The 1966 surface rupture was mapped in detail by the USGS in 1966, and the recently paved Highway 46 just south of the site shows creep-related cracking at the same location.

Evidence for the 1966 surface rupture in the trench exposures is challenging to recognize. The topographic surface is slightly raised, (~0.1 m) along the fault near T1 with no clear evidence of the most recent rupture or creep-related cracking.

Discussion
- The character of deformation at a site repeats over several earthquakes.
- Mounded areas T1 are uplifted.
- Down warped troughs, T2 subsides.
- The larger Ev-2 and Ev-4 event horizons are at the tops of soils.
- The uppermost large event occurs near the base of the overbank deposits, indicating that major incision post dates the earthquake. The ~3 m deep incised channel runs between T1 and T2 as seen on the lidar figure.
- Land use changes, cattle grazing or major storm periods 1860s may be cause of incision
- Creep deformation is expressed as isolated patches of shear fabric associated with main faults. The extent of creep modifying the large event deformation appears to be minor.
- We are in the process of developing a chronology with C-14, OSL and pollen.

Preliminary Conclusions
- MRE 1966 would be very difficult to recognize without prior knowledge.
- 4 events, 2 of which show significantly more deformation than 1966.
- At the 1966 rupture (Ev-1) location the deformation increases incrementally down-section expressed most prominently by folding and growth strata.
- We recognize two larger events: Event 2 and Event 4.
- An additional smaller event Event 3 is stratigraphically slightly below Event 2.
- It appears that the larger magnitude meter-scale displacement events can be distinguished from smaller M6 Parkfield earthquakes.
- These "targets of opportunity" paleoseismic records offer valuable constraints and greatly leverage our research resources.

Informed Speculation
- The two larger events are the results of E-2: 1857 AD and E-4: 1550 AD, and E-3: a lesser displacement event.
- An alternative scenario E-2: 1877, E4: 1857. There is no obvious known earthquake candidate for E-3 in this scenario.