This project aims to characterize outcrop- to grain-scale textures and fabrics of uppermost footwall fault-core rocks from two sites along the West Salton detachment fault (WSDF), a low-angle normal fault that bounds the Peninsular Ranges (footwall) against the Salton Trough and "Desert Ranges" (hanging wall). The footwall, made of quartzo-feldspathic rocks at both sites, was exhumed directly by WSDF slip from depths in the upper part of the seismogenic zone; slip ended ~1 Ma.

One site, at Powder Dump Wash (PD), has abundant evidence for paleoseismic slip, and lies near the center of the fault length, so presumably the WSDF has roughly the maximum displacement (~10 km) along the fault at PD. There, the fault has an inner core of random-fabric ultracataclasite and pseudotachylyte, underlain by an outer core of random-fabric cataclasite, which is underlain gradationally by a fractured damage zone. The other site is near the south end of the fault at Agua Caliente Hot Springs County Park. There, the WSDF footwall shows a very thin ultracataclasite layer underlain by moderately well-developed cataclastically foliated fault core, underlain by random-fabric cataclasites.

From these differences we infer that the WSDF slipped by at least some creep at AC (in spite of having very low percentages of phyllosilicate minerals). We qualitatively describe the fault-rock textures from both sites at the outcrop to ~10 micron scales, and qualitatively and quantitatively studied the grain-size distribution and grain shapes at the two sites.

We conclude that differences found support the assertion that the WSDF mainly crept at AC and slipped seismogenically at PD. In particular, fault-rock grains are qualitatively more angular at PD, whereas larger grains are more rounded at AC, with small grains remaining angular (but many are below the resolution of BSE imaging). In addition, the deeper fault-core rocks at PD, as well as macroscopically intact protoliths, are pulverized, with average size of pulverized grains increasing with depth below the fault. Several recent publications suggest that puverization textures record the passage of seismic waves or supershear "mach fronts". We infer that the pulverization process reduced mean and median grain size at PD relative to AC, where the mean and median sizes are significantly larger (grains up to protolith grain size are present at AC). Unfortunately, we were not able to separate confidently the fault-rocks from the two sites using a variety of plots based upon quantitative measures of grain shape and/or grain size (it should be noted that we are not aware of robust quantitative measures of angularity versus rounding; fortunately, this difference remains relatively easy to recognize qualitatively). Minor differences in grain shape are present at both sites when plagioclase is compared to quartz.

These results indicate that fault-rock textures can be used to infer significantly different paleo-slip rates (creep versus seismogenic), and that presence of frictionally weak and velocity strengthening minerals (e.g., clays or other phyllosilicates) are not *required* for fault creep. They do not support previously published assertions that fault rocks evolve from more angular to more rounded with increasing slip, because the net slip at AC (more rounded fault rocks) is arguably lower than that at PD (more angular).

We infer that rolling of grains and chipping of their corners was the dominant, late comminution mechanism at AC, but that tensile cracking dominated at PD. However, fault-rocks from both sites yield D-values of their grain-size distributions indicative of constrained comminution (which is dominated by tensile cracking) overprinted by shearing. This result suggests that fault rocks from both sites may have been deformed by cracking early in their histories, with rolling/chipping evolving later at AC, possibly in lower confining-pressure conditions.

We intended to study the effects of zeolite mineralization on cataclastic processes, because zeolite minerals are abundant at site AC, especially in the lower part of the upper plate. Various calcic zeolites were identified at both sites in XRD analyses of powdered fault-rock separates, but were never identified in thin section or BSE images (also with spot analyses). From this, we conclude that the zeolite minerals were precipitated post-tectonically in pores of the cataclasites and "plucked" during thin-section preparation, consistent with a previous study nearby along the WSDF that imaged (with SEM) euhedral zeolite minerals that grew in pores of cataclasites. Hence, the zeolite research direction was not followed further. In addition, our results suggest that fluid-related alteration was not significant during cataclasis at either site, suggesting that the WSDF is a good fault for study of the effects of natural mechanical comminution processes independently of alteration processes.

This research forms the basis for the M.S. thesis of Katrina Soundy. Her thesis is in second-draft phase; the third draft will (hopefully) be defended in December, 2018 after the Fall AGU meeting, and will form the first of our SCEC publications. In January-February 2019 (assuming a successful defense) we will revise it as a manuscript, probably for submission to Journal of Structural Geology.