Detailed fracture and stress-field analyses of two low-angle normal faults in southern California
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Slip on misoriented faults, such as low angle normal faults (LANF’s) and the San Andreas Fault, cannot be modeled or explained by typical fault mechanic theory. Misoriented faults are at too high angle to the regional maximum stress direction and are defined as weak. Some studies suggest that a rotation of the stress field near the fault core allows slip on such faults. Detailed fracture mapping of well-exposed footwall of LANFs can be used to model the stress field at the time of faulting. One implicit assumption of paleostress analyses is that stress is parallel to strain, which is tested using different types of analyses.

The West Salton Detachment system (WSDS) and the Whipple detachment fault (WDF) are two LANF’s in southern California that vary in degree of deformation and age, but have similar footwall lithologies. Fracture and paleostress analyses of the footwalls of these two faults are being studied and compared to improve our understanding of LANF slip. Preliminary data suggest that a stress rotation does occur in some locations in space and time. In the footwall of the WDF, stress directions are variable in regions of sub-parallel faults referred to as “mini-detachments.” Mini-detachments are thought to have been slipping very early in detachment fault history. The footwalls of these structures have shallower sigma 1 values than the main detachment. Plunges of sigma 1 from 2 different independent analyses are about 45 degrees, which is comparable to a stress field in the ductile or granular flow regime. Plunges of sigma 1 elsewhere in the detachment fault are much steeper and are comparable to typical andersonian normal fault stress fields. Additionally, fracture sets which are thought to be older based on cross-cutting relationships have a shallower sigma 1 values. Both of these sets of data suggest that the stress field may have steepened over time, so that slip may have initiated on a misoriented plane early in the history.
Amy Luther: Bio

Amy Luther grew up in Aurora, Illinois and completed her bachelor’s degree in geology at the University of Illinois in 2003. She then headed west to do a Master’s degree in structural geology at the University of New Mexico, which she completed in 2006. Amy has been working with Gary Axen and Jane Selverstone on fault mechanics of low-angle normal faults since 2007.