Preservation of the Seismic Cycle in a Continental Low-Angle Normal Fault: West Salton Detachment Fault, USA

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Importance of pseudotachylyte from LANFs
- Tectonic pseudotachylyte (rapidly quenched frictional melt formed during earthquakes) has been documented along faults from a variety of protoliths and tectonic settings (Sibson, 1975; Sibson and Tapponnier, 2006; Lin, 2008; Kirkpatrick et al., 2009; and many others).
- Pseudotachylyte is the only convincing evidence for ancient seismicity from fault zones exhumed from the seismogenic zone (e.g., Cowan, 1999).
- Identification of pseudotachylyte along exhumed LANFs is an effective test of the hypothesis that LANFs are seismically active in the brittle crust.

Field locality and tectonic setting
Geologic map of the western Salton Trough, CA (Doney et al., 2005). Field area includes the WSDF and Cretaceous Santa Rosa shear zone (brown). Based on regional and local structural relationships, the WSDF is interpreted to have reactivated the low-angle, thrust-sense Santa Rosa shear zone (D, C). The map also shows the distribution of different rock types and structures along the WSDF.

Evidence for low-angle slip
1) Sub-parallelism between the WSDF and Cretaceous Santa Rosa shear zone (brown), suggesting reactivation of low-angle, thrust slip during extension.
2) WSDF cross-cuts tertiary conglomerates in the hanging wall, at a low-angle (<30°).
3) Cataclastic fault rocks in the fault zone of the WSDF include fault breccia, cataclasite, and ultracataclasite. Multiple generations of cataclasite (C1, C2) and reworked ultracataclasite (U, C3) have been observed.

Fault zone model
Schematic block diagram of West Salton detachment fault zone at Yaqui ridge where both the hanging wall and footwall of the detachment are composed of crystalline rock illustrating key fault zone components and structural relationships.

Conclusions
1) Previous work along the WSDF documents slip at a low-angle (Schultejann, 1984; Asea and Fletcher, 1998; Steely et al., 2000; Dorsey et al., 2012).
2) Well-preserved tectonic pseudotachylyte (frictional melt) in the footwall and hanging wall of the WSDF is consistent with seismicity along a LANF (Kairouz et al., 2003; Janeway et al., 2006).
3) Pervasive brittle deformation associated with the WSDF and reworking of pseudotachylyte suggests that melt formed in the brittle crust.
4) Thick accumulations of pseudotachylyte, multiple generations of cataclastic rocks and brittle reworking of pseudotachylyte is consistent with multiple seismic events along the detachment.
5) These conclusions have important implications regarding the seismic potential of LANFs and fault mechanics.