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A new geological slip rate estimate for the Calico Fault, eastern California: Implications for geodetic versus geologic rate estimates in the Eastern California Shear Zone

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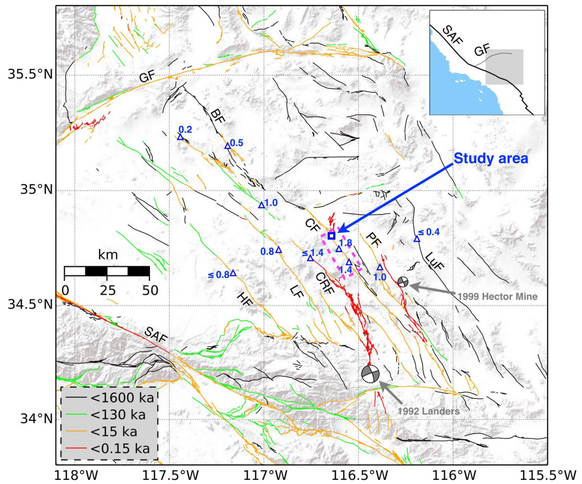
Abstract:

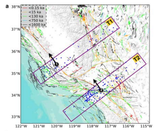
1. Previous studies have suggested a discrepancy between short-term geodetic and long-term geologic slip rate estimates in the ECSZ, Mojave Desert.
2. We measured offsets in alluvial fans along the Calico Fault near Newberry Springs, California, and used exposure age dating based on the cosmogenic nuclide ^{10}Be to date the offset landforms, and determine a slip rate.
3. Our preferred estimate of slip rate is 3.4±0.5 mm/yr, significantly faster than previous estimates.



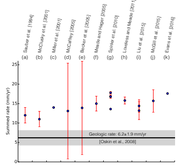
In the Mojave ECSZ, previous studies have suggested geodetic (~12 mm/yr) » geologic (6.2 mm/yr) slip rate estimates.

Possible causes:

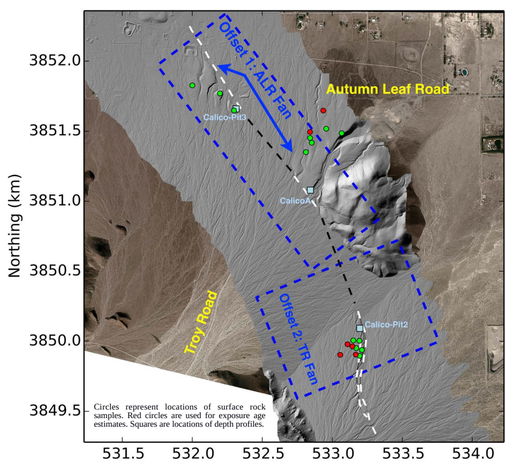
1) Off-fault deformation.
2) On-going acceleration of ECSZ faults.
3) Post-seismic motion.
4) Earthquake clustering.

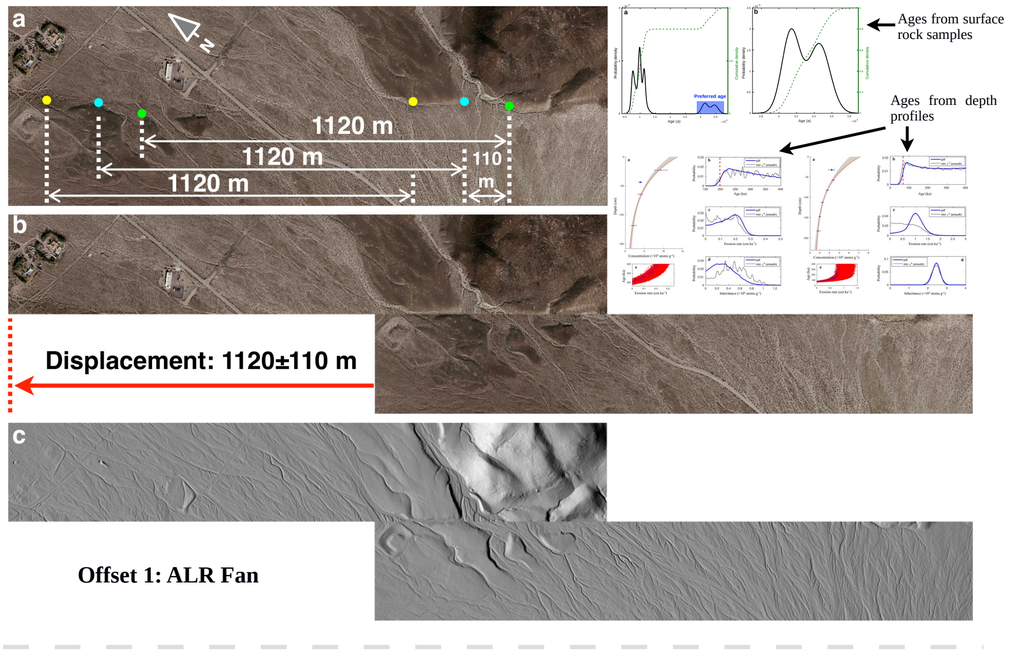


GPS profile

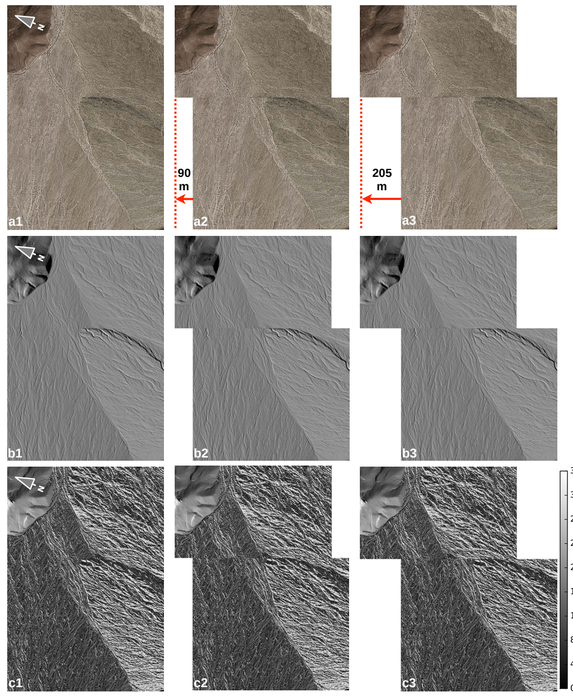


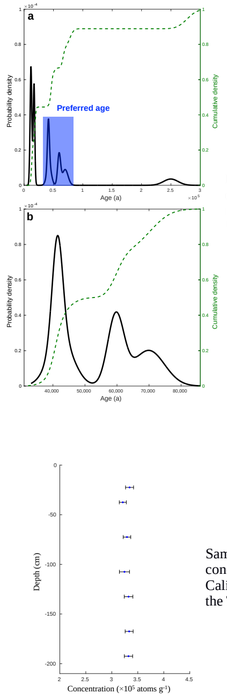
Summed geodetic and geologic rates





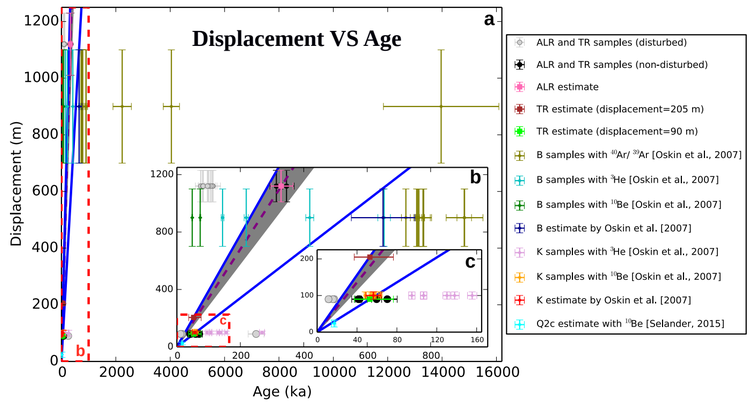
Offset 2: TR Fan

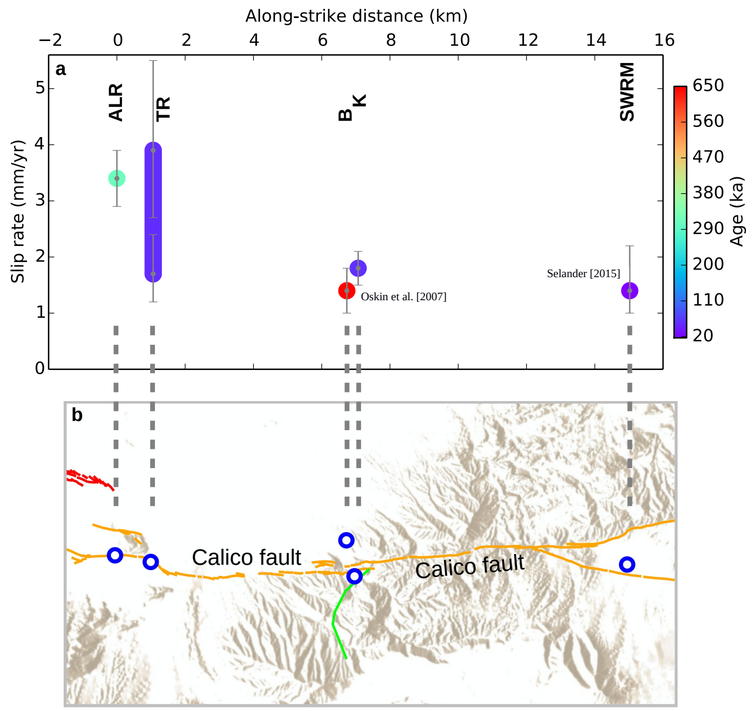




Exposure ages by dating surface rock samples with ^{10}Be method

Sample depth VS ^{10}Be concentration for the Calico-Pit2 trench from the TR alluvial fan.





Conclusions:

- Some geologic fault slip rates in the Mojave Desert may have been underestimated.
- The difference in geologic slip rate estimates based on different geomorphic markers may reflect the immaturity and corresponding structural complexity: slip may not manifest as simple surface displacements, and could be missed by using some surface offsets.
- It is premature to claim a geologic versus geodetic “discrepancy” for the ECSZ.
- More data are needed to provide a statistically meaningful assessment of the geologic rates for faults comprising the ECSZ.

Acknowledgements

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