KINEMATIC CONNECTION BETWEEN THE GARLOCK AND PINTO MOUNTAIN FAULTS, MOJAVE BLOCK, SOUTHERN CALIFORNIA: A NEW PROPOSAL

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INTRODUCTION

Previous investigators recognized tectonic similarities between Garlock and Pinto Mtn faults suggesting they are kinematically linked:

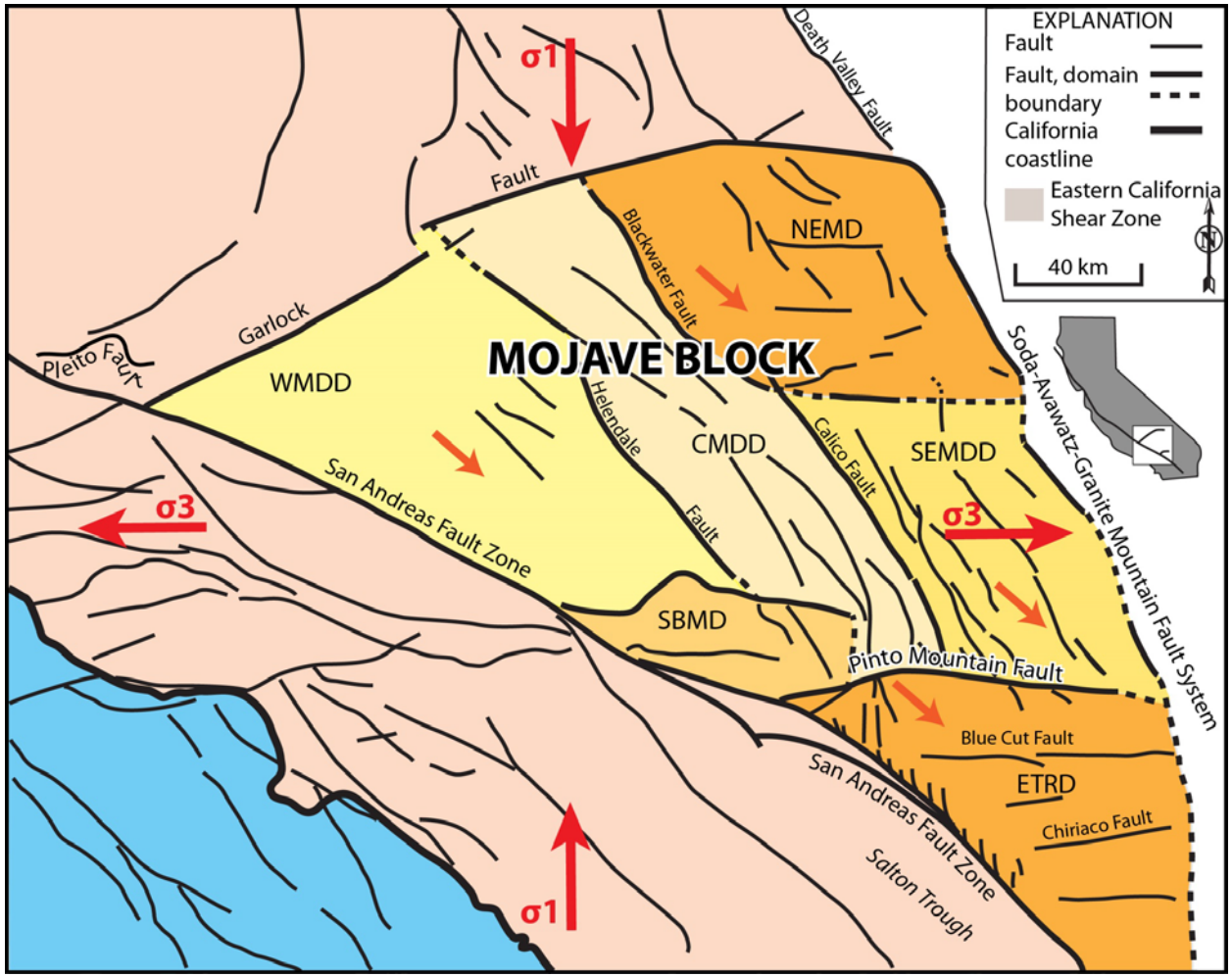
- Join San Andreas Fault (SAF) and intersect Eastern California Shear Zone (ECSZ)
- Distinctive concave south curves
- Structural boundaries that separate transtending terranes on north from CW-rotated terranes on south
- Subparallel and same sense of displacement

PURPOSE

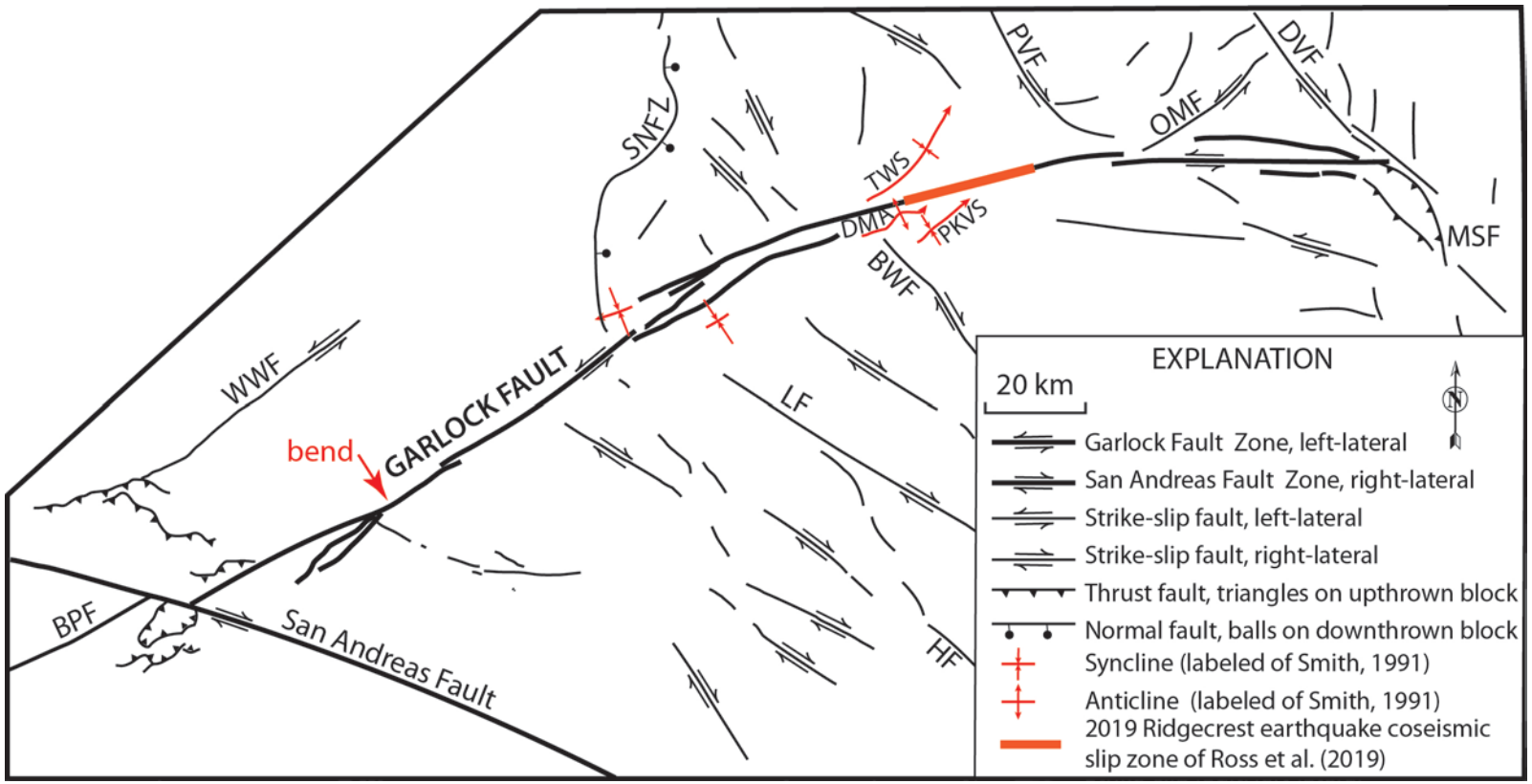
By building on the earlier work of Dixon & Xie (2018) and Hatem & Dolan (2018) my goal is to show how the Gf and PMf are kinematically linked:

- Gf and PMf are linked by SAF and ECSZ
- SAF transfers strain to Gf and PMf by translating their intersections in right sense and conjugate slip
- ECSZ transfers strain to Gf and PMf by oroclinal bending, block rotation, and coseismic slip
- The prominent curve in PMf is a result of right-lateral shear across ECSZ

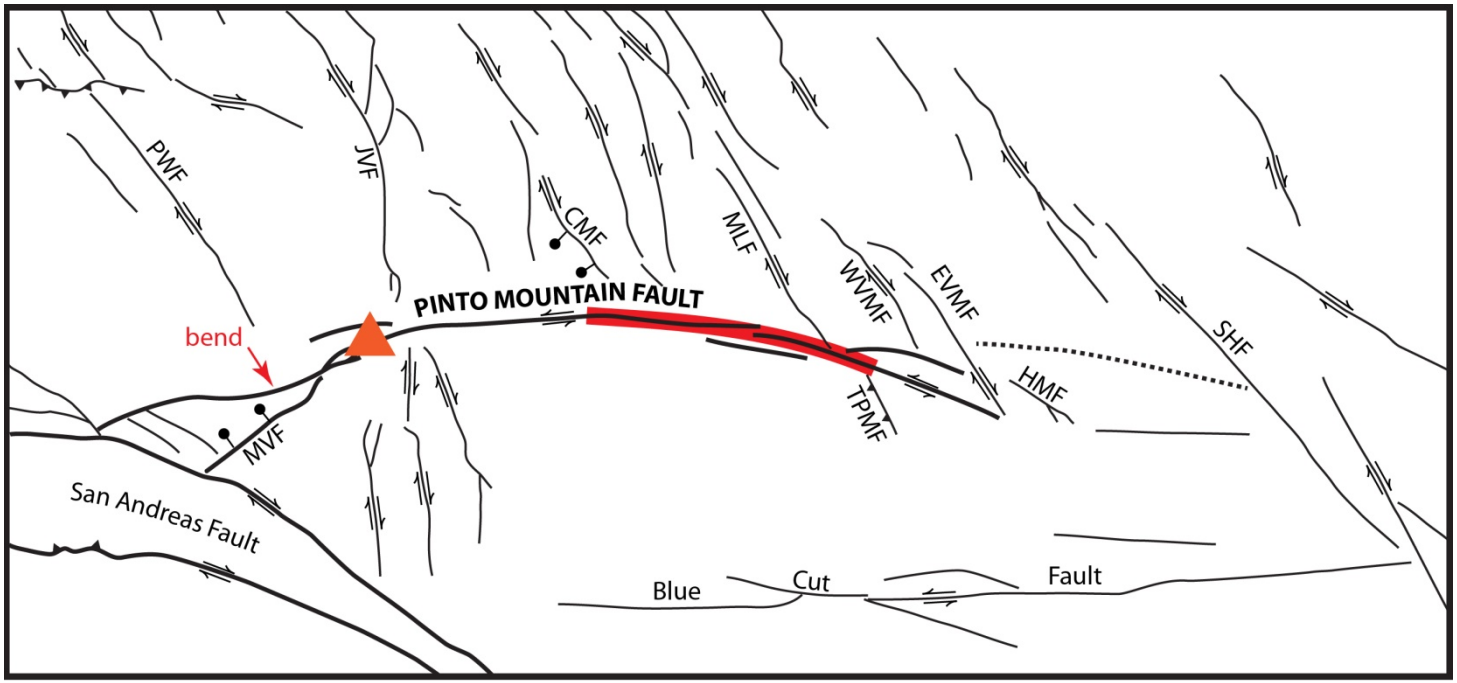
TECTONIC SETTING



GARLOCK FAULT



PINTO MOUNTAIN FAULT



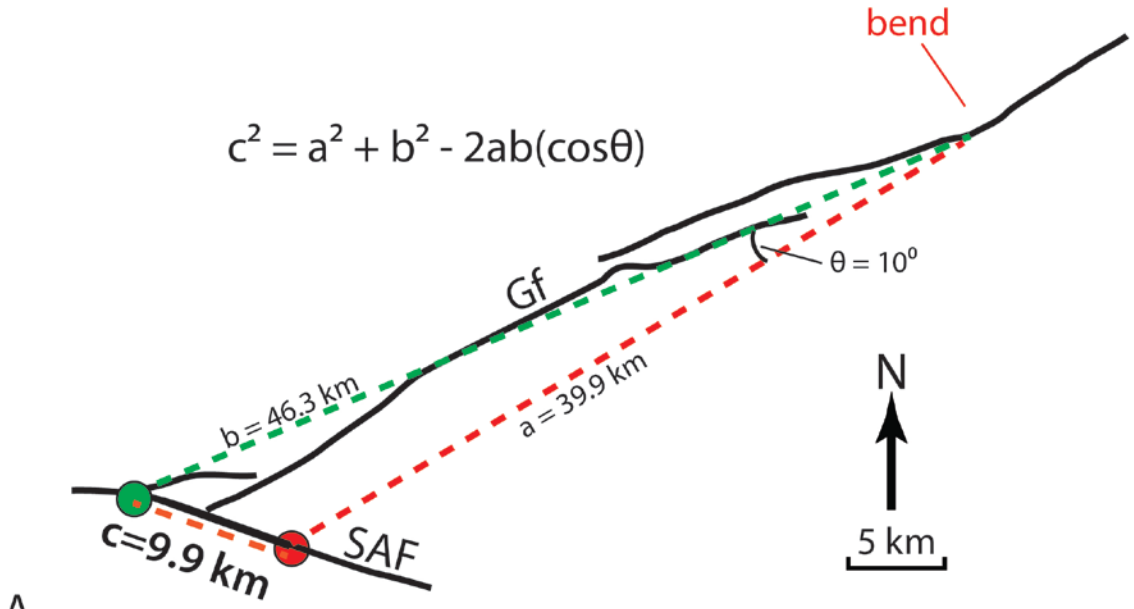
EXPLANATION

- Pinto Mountain Fault Zone, left lateral, lines and balls denote local downdropped block
- Abandoned Pinto Mountain Fault
- San Andreas Fault Zone, right-lateral, triangles denote local upthrown block
- Strike-slip fault, left-lateral
- Strike-slip fault, right-lateral
- Thrust fault, barbs on upthrown block
- Landers earthquake coseismic slip fractures
- Zone of contractional structures discussed in GSA talk

10 km

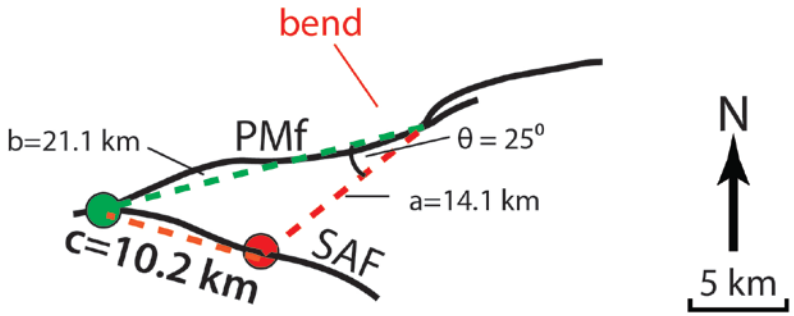
N

DISCUSSION

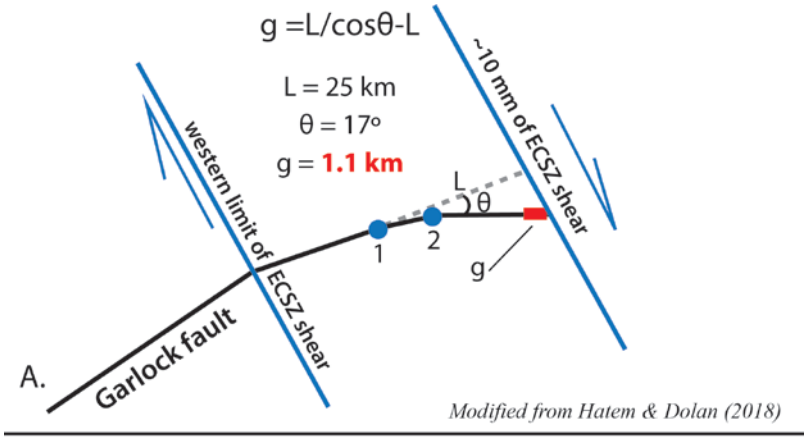


A.

B.



DISCUSSION



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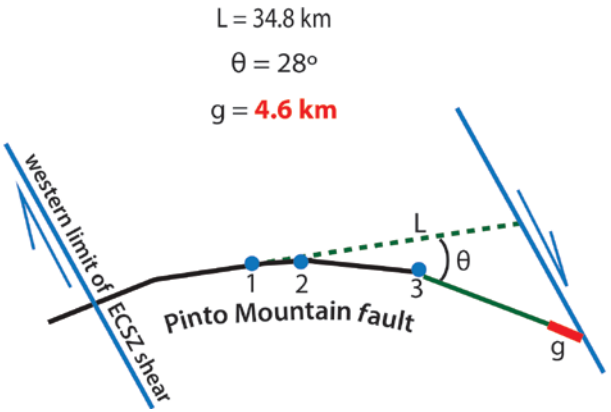
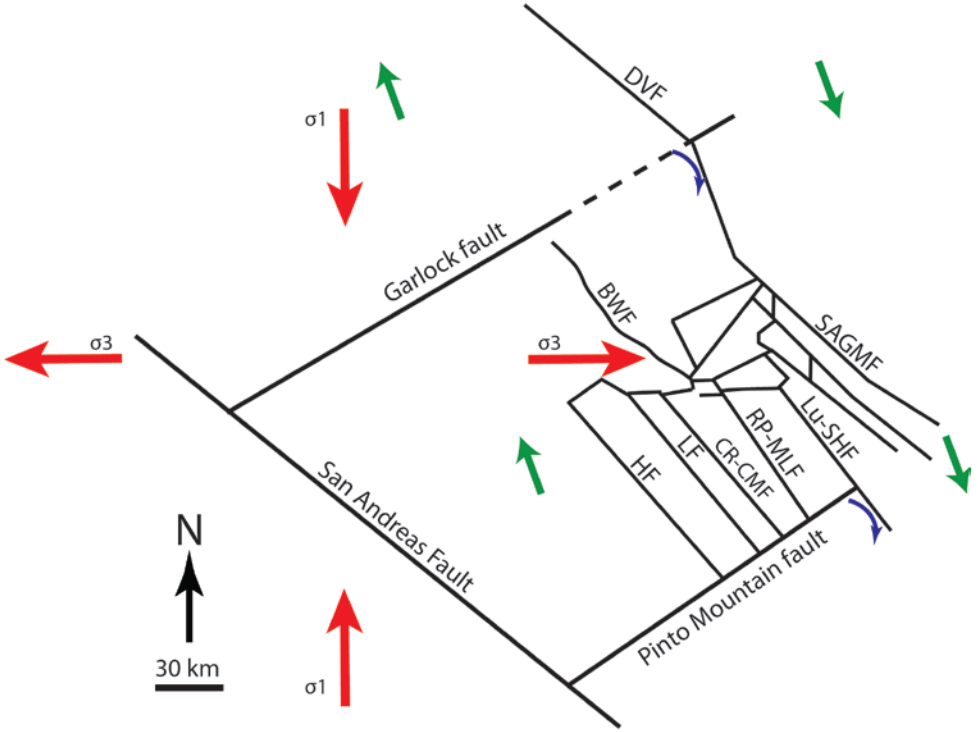


DISCUSSION

Prefaulting Configuration of Mojave Block Faults at 12 to 10 Ma

- Gf and PMf straight and oriented NE
- Gf oriented N60°E (Hatem & Dolan, 2018)
- PMf oriented N44°E
- SAF oriented N46°W (Dickinson, 1996)
- Started out as conjugate (Hatem & Dolan, 2018; Hill & Dibblee, 1953)

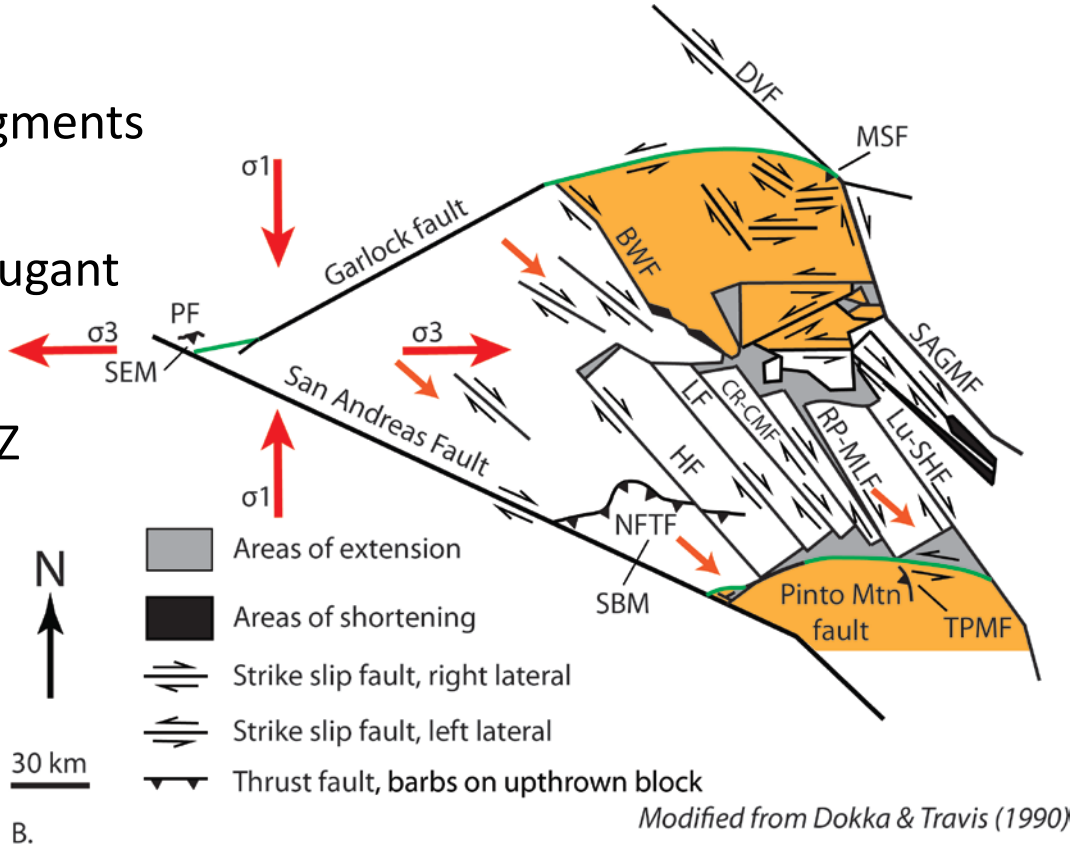


Modified from Dokka & Travis (1990)

DISCUSSION

Present-day Configuration of Mojave Block Faults

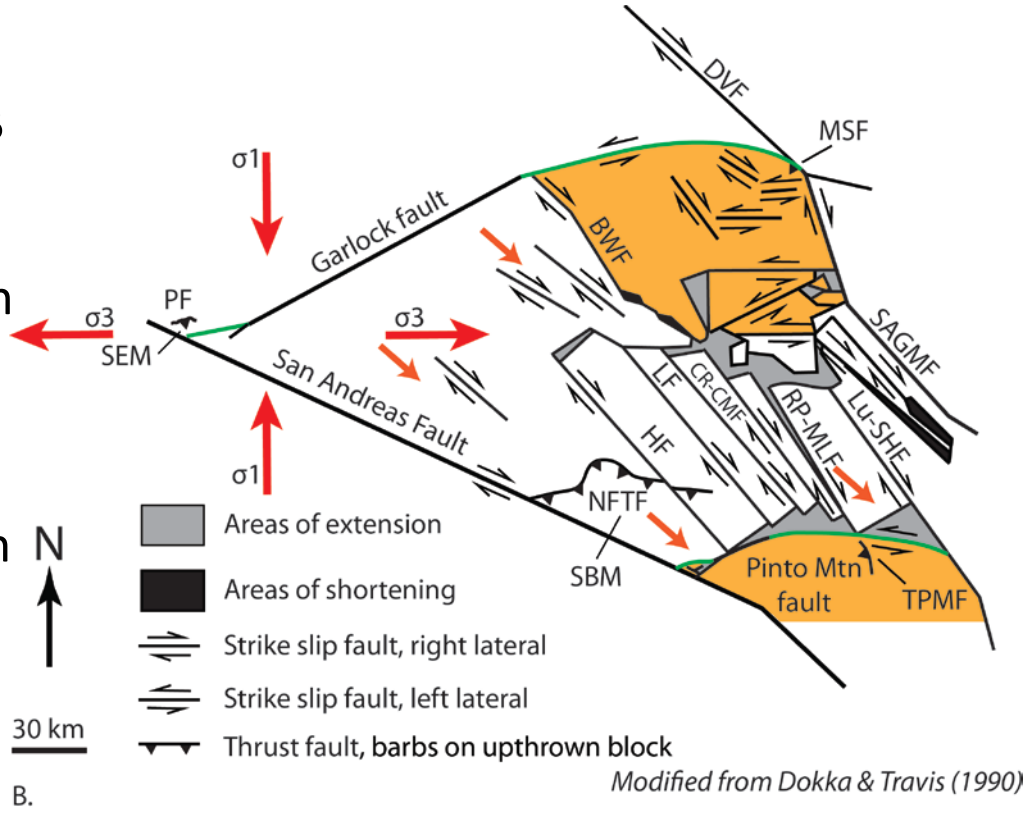
- SAF deflected westward to present orientation
- Westernmost and eastern segments of Gf and PMf rotated out of orientation favorable for conjugant slip
- Right lateral shear across ECSZ oroclinally bent Gf and PMf
- NEMD and ETRD rotated CW to accommodate bending



DISCUSSION

Present-day Configuration of Mojave Block Faults

- N-S compression of MB results in uplift of SEMM and SBMD and forces a component of MB crust to “escape” to SSE
- Right slip of SAF bends western parts of Gf and PMf and translates them ~10 km to NW
- Transtension and transpression zones formed in response to block rotations



CONCLUSIONS

How are Gf and PMf kinematically linked?

1) SAF transfers strain to the Gf and PMf by…
   a) conjugate slip
   b) shifting the west ends of these faults right laterally
2) ECSZ transfers strain to Gf and PMf by…
   a) oroclinal bending and block rotation
   b) coseismic slip

REFERENCES

AVAILABLE UPON REQUEST

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Dixon, T.H. and Xie, S., 2018, A kinematic model for the evolution of the Eastern California Shear Zone and Garlock Fault, Mojave Desert, California: Earth and Planetary Science Letters, V. 494, p. 60–68.

Hatem, A. E., and Dolan, J. F., 2018, A model for the initiation, evolution, and controls on seismic behavior of the Garlock fault, California. Geochemistry, Geophysics, Geosystems, V. 19, p. 2166–2178. https://doi.org/10.1029/2017GC007349