

**The Copper Basin fault, a newly recognized reverse fault in the lower Colorado River region, SE California: Implications for Miocene-Pliocene N-S shortening within the Eastern California Shear Zone**

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**ABSTRACT**

Located just south of Picacho State Recreation Area, SE California, a prominent E-W trending structure that has been referred to in the literature as an arcuate normal fault has been determined to be a reverse fault. We informally refer to this structure as the Copper Basin fault, after exposures near Copper Basin. At its type locality, the Copper Basin fault lies south of the well known Chocolate Mountains anticlinorium, and dips  $\sim 54^\circ$  to the south placing lower amphibolite grade Jurassic mylonitic orthogneiss above  $\sim 23$  Ma unmetamorphosed Quechan volcanics. Poorly to moderately preserved slickenlines in the fault core plunge down the dip of the fault surface. Additionally, a well developed fault zone,  $\sim 21$  meters thick, extends along the footwall block. Within the fault zone, the damage zone is comprised of highly bleached and fractured Quechan rocks, while the fault core is an  $\sim 0.4$  m thick of finely pulverized deep-red weakly cohesive and foliated gouge. Mass balance relationships suggest that development of the fault core involved an  $\sim 18\%$  to  $24\%$  change in bulk mass, and an  $\sim 38\%$  to  $40\%$  increase in volume.

At Picacho, the Copper Basin fault truncates the southern limb of the Chocolate Mountains anticlinorium, and thus must post-date units and structures wrapped about the fold; e.g., the  $\sim 50$ - $52$  Ma Chocolate Mountains fault, the early Miocene ( $\sim 23$  Ma) volcanic and epiclastic unit, the post- $23$  Ma Sortan fault, and the Bear Canyon

conglomerate. This latter unit is subdivided into three unconformably bound sequences that are designated, from oldest to youngest, I, II, and III. Sequences I and II were deposited and folded sometime between ~23 Ma and ~9-13 Ma. Sequence III was deposited and folded after ~9-13 Ma.

The Copper Basin fault is cut by the Taylor Lake fault system, a principal component of a conjugate set of NW and NE striking dextral and sinistral strike-slip faults, respectively, that occur throughout the Picacho and Indian Pass region. At Indian Pass, ~9 km to the west of Picacho, dextral faults of the conjugate set of strike-slip faults cut the axial trace of the Chocolate Mountains anticlinorium, and the ~9-13 Ma basalts of Black Mountain which are interstratified with sequence III of the Bear Canyon conglomerate. However, neither the Copper Basin fault nor the conjugate fault set deform Quaternary alluvial sediments, and thus NS shortening associated with these structures must have occurred sometime between ~9-13 Ma and ~1.8 Ma.

Within the above time frame, to the northwest of our study area within the margin of the North American plate, slip within the Eastern California Shear Zone initiated between about ~12 - 10 Ma to ~6 Ma. According to the literature, slip within the Eastern California Shear Zone was accompanied by formation of a set of E-W trending contractional structures, and/or such structures formed intermittently between periods of dextral shear. Hence, we conclude that structures identified in this study form part of a discontinuous network of E-W trending folds and reverse faults, and small-slip conjugate strike-slip faults that accommodated N-S shortening in an otherwise dextral shear environment as the margin of the North American plate evolved between ~12 – 10 Ma and ~1.8 Ma.