Trona-Ridgecrest Earthquake Sequence and Fault Complex, San Bernardino County

Frank Jordan[1], Miles Wagner[2], and Dr. Kerry Cato[3]

[1] San Bernardino County Planning Department, Mining Division, Engineering Geologist
[2] San Bernardino County Fire Department, Office of Emergency Services, Emergency Services Officer
[3] California State University, San Bernardino, Geology Department

Abstract

On July 4th and 5th 2019, two large earthquakes struck the extreme northwest corner of San Bernardino County. The MW6.4 foreshock occurred along branches of a poorly mapped, northeast-striking fault in on the Naval Air Weapons Station (NAWS) China Lake. The next day, an MW7.1 earthquake ruptured a poorly mapped, northwest-striking fault that offset playa sediments underlying China Dry Lake and Paxton Ranch Playa. Both earthquakes, and much of the surface fault rupture, occurred on NAWS. San Bernardino County and the California Geological Survey applied the names of Salt Wells Valley to the initial northeast-striking fault zone and Paxton Ranch to the larger northwest-striking fault zone. Access to primary surface fault rupture on the NAWS base was restricted primarily to federal and state geologists. San Bernardino County personnel focused on mapping primary fault ruptures and secondary ground shaking, liquefaction, and landslide deformations within portions of the county, outside of NAWS. Damage in Trona and the West Searles Valley, including Searles Dry Lake, was particularly severe. UNAVCO recorded maximum GPS displacements near West End.

Mapping of surface ruptures confirmed the presence of east- and northeast-striking primary faults in the communities of Trona, Argus, Panorama Point, and Windy Acres, as well as at the Pinnacles. Additional northwest-striking fault ruptures have been mapped in the western Searles Valley associated with the “West Searles Valley” Fault Zone and along the “Miles” Fault at West End. Evidence of younger, additional surface fault rupture associated with the MW5.5 Spangler Hills aftershock was documented in the area near the Trona Railroad in West Searles Valley.

Primary fault ruptures were GPS mapped in Trona and the western Searles Valley based on review of phase gradient radar imagery provided by UCSD Institute of Geophysical & Planetary Physics and interferometry provided by the NASA Jet Propulsion Laboratory. Mapping identified 17 previously unmapped, en echelon surface traces extending up to 2 kilometers in length. Apparent senses of rupture are left-oblique along northeast-striking faults and right-oblique along northwest-striking faults. The ruptures display up to 4 cm of horizontal and vertical offsets. The faults display continued creep movement consistent with primary faulting. Mapping of these fault ruptures will result in new Alquist-Priolo Earthquake Fault Zones and/or County Fault Hazard Zones.

Figure 1: Miles Fault at the intersection of 1st Street and A Street in West End, CA. View West.

Figure 2: Southern portion of the Paxton Ranch Fault along the east edge of Pleistocene-age travertine outcrop near the Pinnacles. Miles Wagner, San Bernardino Co. OES. View North.

Figure 3: Southern portion of the Paxton Ranch Fault along the east edge of Pleistocene-age travertine outcrop near the Pinnacles. Trona Railroad for scale. View South.

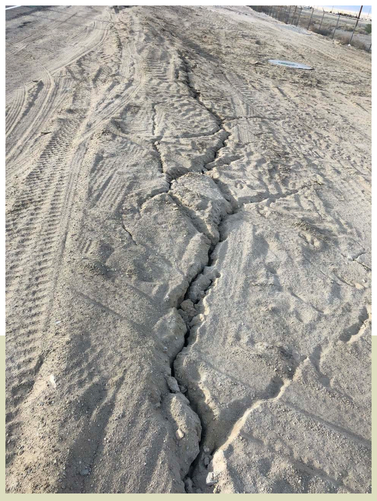

Figure 8: Trona Fault East of Trona Rd. View North-Northeast

Figure 7: Aguirre Ranch Fault West of Trona Road. Dylan Terry, Cal St. Univ. San Bernardino. View Northeast.

Figure 5: Southwestern portion of the Salt Wells Valley Fault north of Randsburg Road. View Northeast.

Figure 5: Southwestern portion of the Salt Wells Valley Fault north of Randsburg Road. View Southwest.

Figure 6: Kat Fault on Trona Road, South of Garlock Fault. Dr. Kerry Cato, Cal St. Univ. San Bernardino. View East.

Acknowledgements

We would like to acknowledge the help of the volunteers of the Searles Valley Working Group for their assistance mapping numerous en echelon surface fault breaks!