



## **Core Penetrating Test to reveal past earthquakes along the Imperial Fault, California and inferred plate-boundary slip rate**

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We conducted a multi-disciplinary approach to study the paleoseismology and slip rate on the Imperial fault along the section that ruptured during the Mw7 1940 earthquake. We investigated a small pull-apart basin in the Imperial Valley, located about 2 km north of the US/Mexico border. The Imperial fault is the main plate boundary fault between the North American and Pacific lithospheric plates and has been attributed with a slip rate up to 35-40 mm/yr. We excavated trenches across the fault to a depth of 4 m to expose the past 500 years of stratigraphy, and used cone-penetrometer (CPT) soundings and continuous coring to extend the record to the middle Holocene at 25 m depth.

Post-earthquake aerial photos show that the 1940 earthquake (event E1) produced 6 m of lateral slip through the sag depression, and ~90 cm of subsidence within the sag. The penultimate earthquake (E2) in ca 1726 also produced ~90 cm subsidence, as did a fifth event (E5), whereas two other events (E3 and E4) produced only 0-6 cm of subsidence. We interpret these observations to imply that large 1940-type earthquakes activate the sag depression with about 90 cm of subsidence whereas smaller events, such as 1979, either do not reach as far south as the sag or produce only minor displacement.

Two cores and 26 CPTs were acquired across the sag that penetrated a succession of lake and deltaic deposits to ~25 m depth: the sediments west of the fault date to about 4500 years at the base of the core whereas in the sag itself, the sediments are about 2-2.2 ka at 25 m depth. Thus, the sag records about 8 m of vertical subsidence in the past 2.2 ka, which suggest about 9 events if the 1940 and 1726 events are used as a guide, resulting in an average recurrence interval for such events of about 230 years (considering the ~80 year open interval). If each of these larger events was produced by a similar amount of strike-slip as in 1940, then this implies a slip rate of about 26 mm/yr, which is consistent with recent InSAR and GPS studies that suggest a lower rate with additional slip on faults to the west.