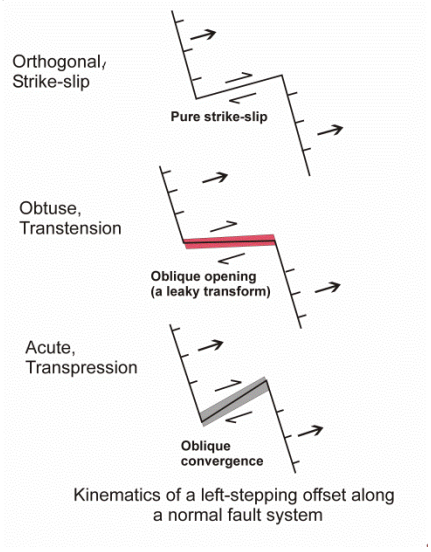
The UCERF depiction of Sierra Nevada Range-Front faults and Long Valley Caldera

David P. Hill
U.S. Geological Survey, Menlo Park, CA

Long Valley caldera lies at the base of the eastern escarpment of the Sierra Nevada coincident with a left-stepping offset between the Hilton Creek fault to the south and Hartley Springs fault to the north. Both faults strike to the NNW and accommodate local crustal extension with ENE directed normal-slip. The UCERF2 and UCERF3 fault models show both faults extending well into the caldera with overlapping, sup-parallel segments separated by ~ 10 km. Kinematically, an overlapping configuration for opposing tips of normal faults of the same dip puts the intervening crustal volume in a transpressional stress state. This is not consistent with presence of a major, 760-ka caldera occupying the intervening volume. Both the Hartley Springs and Hilton Creek faults offset pre-caldera basement rocks north and south of the caldera by hundreds of meters with post-glacial offset of 10s of meters. Syn- and post-caldera volcanic deposits within the caldera, however, show no evidence of down-to-the-east offsets along extrapolated extensions of either fault into the caldera. Crustal extension north of the caldera that is accommodated by normal slip on the Hartley Springs fault continues southward into the caldera in the form of dike intrusions that fed the 600- ybp Inyo Domes eruptions. The offset between the southern tip of the Inyo Domes volcanic chain and the northern tip of the Hilton Creek fault south of the caldera is oblique to both the fault strike and the trend of the Inyo Domes, which places the intervening crust in a transtensional stress state. Earthquake swarms accompanying ongoing caldera unrest are largely confined to linear trend along the south moat of the caldera with focal mechanisms consistent with the intervening transtensional deformation accommodated by oblique dextral slip on a leaky transform fault zone. This is supported by geodetic data showing cumulative 1.5 to 2 m of dextral offset across the south moat since measurements began in 1983. The episodic recurrence of south-moat swarm activity likely reflects upward pulses of magmatic fluids associated with resurgent dome inflation .



Kinematics of a left-stepping offset along a normal fault system