

The Department of Earth & Environmental Sciences, CSU Fresno Association of Environmental and Engineering Geologists, and Associated Students Inc. presents:

Tephrochronology & Basin Evolution in Death Valley

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Death Valley is the original pull-apart basin having developed in the right step of the Furnace Creek and Southern Death Valley fault zones. The basin has a lazy-Z morphology indicating extreme basin extension. A number of both model and field studies document that as extensional basins develop, the fault system evolves and inverts parts of the basin; however, determining the timing of basin inversion and fault zone evolution is difficult. In this study, we use a combination of tephrochronology, paleomagnetism and $^{40}\text{Ar}/^{39}\text{Ar}$ dating to document the post-Pliocene evolution of the Death Valley pull-apart basin. We use glass shard composition to correlate 22 different tephra layers or tephra layer families in ten separate sedimentary basins in Death Valley that range in age from ~3.6 Ma to ~0.51 Ma. The uplifted sedimentary sequences that contain these tephra layers indicate that basin inversion is post-Pliocene and are frequently synchronous. The Black Mountain fault zone stepped basinward at Ashford Mill, Mormon Point and Copper Canyon after 3.1 Ma. At ~1.7 Ma, the Death Valley basin reorganized with the Black Mountain fault zone extending ~40 km northward and disrupting the southeastern Furnace Creek basin, development of the Artists Drive graben and tilting of the Confidence Hills. This northerly extension of the Black Mountain fault zone cut off slip transfer to the Furnace Creek fault zone and resulted in the Northern Death Valley fault zone. The Northern Death Valley fault zone is a cross-valley fault that indicates basin extinction and uplifts the north-propagating Kit Fox Hills. This dynamic, basinward stepping fault system has continued into the Pleistocene with uplift of the 0.77 Ma Bishop Ash bed and the 0.66 Ma Lava Creek B ash bed.



Fig. 6. Funeral Formation breccias and conglomerates interbedded with the 3.35 Ma lower Mesquite Spring tuff (LMS), 3.28 Ma Nomlaki Tuff (N), and ~3.1 Ma upper Mesquite Spring tuff (UMS) in Hunt Canyon at Artists Drive. LMS is approximately 1 m thick.