

Paleoseismology of the Clan Alpine fault, west-central Nevada in Basin and Range Province, U.S.A.

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USGS NEHRP is conducting an integrated geological and geodetic studies of the Basin and Range Province to better characterize short-term and long-term spatial and temporal variations in deformation throughout the area. In geological studies, Quaternary fault mapping and paleoseismological survey are being carried out in western Utah, Nevada, northeastern California and eastern Oregon. The integration of geological data with geodetic data will provide an answer to fundamental questions about the characteristics, scales, and rates of deformation in continental-scale extensional provinces as well as directly contribute to a better assessment of seismic hazards in the region.

We recently trenched the southern part of the Clan Alpine fault (CAF) about 5 km NW of Cold Springs Station. The fault bounds the east margin of the Clan Alpine Mtns., which has an impressive front that suggests recent tectonism. A slip rate of 0.15 mm/yr has been reported for the CAF. Conversely, conspicuous fault scarps mark only a fraction of the range front.

Although most of the CAF is in a BLM Wilderness Study Area (WSA), we trenched a 7-8 m high partly buried scarp on the main fault and a largely buried (less than 3 m high) antithetic fault scarp 1.6 km downslope, adjacent to the WSA. Exposures of the main fault revealed two colluvial wedges above alluvial-fan deposits that we estimate to be ca. 130 ka. The faulting produced ca. 4 m offset (5-6 m high scarp) on a nearby same-age alluvial fan. The penultimate fault-scarp colluvium gave a preliminary luminescence (OSL) age of 31.1 \pm 2.3 ka, which suggests that the penultimate event was about 30-35 ka. Indirect evidence of older faulting is recorded by more than 7 m of surface offset in the next older sequence of alluvial-fan deposits (ca. 250 ka).

The antithetic fault shows direct evidence for 3 faulting events (ca. 6 m offset). The penultimate fault-scarp colluvium gave a preliminary OSL age of 27.3 \pm 1.9 ka, which suggests that the penultimate event was ca. 25-30 ka. The upthrown block is mantled by a relict Bt/Bk soil (100 k.y.?) in coarse debris-flow deposits that directly overly distal fan deposits, which we estimate to be about 130 ka. The antithetic fault records more events than the main fault; thus it may be a transitional, intravalley link between the southern, east-dipping CAF and the northern, west-dipping Desatoya fault.

Although cosmogenic exposure dating will help date the faulted landforms, we suspect that the CAF has a low slip rate (0.03-0.05 mm/yr) and long recurrence intervals (longer than 10,000 yrs). Thus, the range front's expression may be an artifact of lithology and/or faster slip earlier in the Quaternary or Pliocene. A 3-5 x lower slip rate on the CAF has important implications for the general activity rate of many of the major normal faults in the Basin and Range province.