2358, HANSEL VALLEY FAULT

Structure number: 2358.
Comments: Hecker's (1993) fault number 6-1.
Structure name: Hansel Valley fault.
Comments: McCalpin and others' (1992) Hansel Valley southwestern margin fault.
Synopsis: Range-front fault along the southwestern margin of Hansel Valley. The fault produced Utah's only historical surface-faulting earthquake in 1934 and shows evidence for multiple late Pleistocene events.
Date of compilation: 10/99.
Compiler and affiliation: Bill D. Black and Greg N. McDonald (Utah Geological Survey), and Suzanne Hecker (U.S. Geological Survey).
State: Utah.
County: Box Elder.
1° x 2° sheet: Brigham City.
Province: Basin and Range.
Reliability of location: Good.
Comments: Mapped or discussed by Walter (1934), McCalpin (1985), Robison (1986), dePolo and others (1989), Doser (1989), and McCalpin and others (1992). Mapping from Robison (1986).
Geologic setting: North-trending east-dipping normal fault in southwestern Hansel Valley. Hansel Valley is in an aggregation of low, north-trending ranges and narrow valleys in northern Utah between Curlew Valley on the west and the Malad River Valley on the east. The ranges show few outcrops of bare rock, which is typical of weathering and erosion of the Permian Oquirrh Formation; valleys show great accumulations of gravel and sand along Lake Bonneville shorelines.
Sense of movement: N or NS.
Comments: The 1934 event appears to have had a strike-slip focal mechanism (Doser, 1989), although only secondary amounts of strike-slip motion (0.25 meters at one location) were seen at the surface (dePolo and others, 1989; Walter, 1934).
Dip: Near vertical (Doser, 1989).
Comments: Based on focal mechanism from inversion of regional and teleseismic body waveforms (Doser, 1989). Scarp at surface was also near vertical.
Dip direction: Down to the east.
Geomorphic expression: Northeast-trending scarps several kilometers east of the Hansel Mountains range front. The northern half of the fault is a single continuous trace, whereas the southern half is a wide zone of several short, en-echelon fault traces. The most recent prehistoric event on the fault produced a total displacement of 2.2-2.6 meters; the 1934 earthquake produced a maximum vertical displacement of 0.5 meters (Walter, 1934; dePolo and others, 1989).
Age of faulted deposits: Late Pleistocene.
Paleoseismology studies: McCalpin (1985) logged a gully exposure (West Gully; site 2358-1) near the northern end of the Hansel Valley southwestern margin fault scarp (results summarized in McCalpin and others, 1992). Stratigraphy, sedimentology, ostracode assemblages, and thermoluminescence dating provide a framework within which to interpret faulting events within the context of pluvial lake cycles. The exposure

reveals complex faulting patterns indicating multiple events of unknown displacement since about 140 ka. These include one or more events between 13 and 15 ka (based on dating of deformed lake deposits, interpreted as probable lateral spreads) and an event shortly before deposition of Bonneville transgressive gravels about 26 ka. Post-Bonneville alluvium truncates all exposed faults at the West Gully site, indicating no Holocene events, including the 1934 earthquake, have induced surface rupture at this location.

Timing of most recent paleoevent: (1) Historical.

Comments: The Hansel Valley fault produced an historical surface-faulting event in 1934, and two prehistorical events between about 10-15 ka and around 26 ka. Fault activity between 26 and 58 ka is unclear; no evidence exists for events between 58 and 72 ka.

Recurrence interval: 10-16 ky (<26 ka).

Comments: Recurrence and displacement data suggest clustering of large events when deep lakes occupied the Bonneville Basin, and less frequent smaller events during times of shallow or no lakes.

Slip rate: (D) <0.2 mm/yr.

Comments: 0.14-0.22 millimeters/year, based on a 10-16 ky recurrence and prehistoric displacement of 2.2-2.6 meters. The slip rate based on displacement in the 1934 event (and a recurrence of 10-15 ky) would be much lower.

Length: End to end (km): 13
Cumulative trace (km): 22

Average strike (azimuth): N8ºE

REFERENCES

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