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# Quaternary Fault and Fold Database of the United States

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## Fairview fault zone (Class A) No. 1690

**Last Review Date: 1999-03-24**

## *citation for this record:* Sawyer, T.L., compiler, 1999, Fault number 1690, Fairview fault zone, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 02:26 PM.

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| **Synopsis** | This well-defined, historical, normal-oblique fault zone has: (1) range-front faults bounding east front of Fairview Peak range from Bell Canyon north-northeast to north end of range, bounding entire length of less prominent east front of Slate Mountain, and locally bounding east and west flanks of Chalk Mountain; (2) piedmont faults crossing piedmont slope of Slate Mountain, in southwest part of Bell Flat, and crossing piedmont slopes of Chalk Mountain; (3) intra basin faults extending continuously along western margin of Stingaree Valley (a half graben) between Fairview Peak range and Chalk Mountain, and distributed throughout much of central and eastern Bell Flat; and (4) short intermontane faults bounding northwest shoulder of Fairview Peak, on range-front escarpment east-southeast of Dromedary Hump, and near crest of Chalk Mountain. The 1954 rupture pattern suggests that this fault is related the faults to the south [1313] and to the West Gate fault [1692], Louderback Mountains fault [1689], Gold King fault [1691], and Dixie Valley fault [1687] to the north. The 1954 Fairview Peak earthquake ($M_S$7.2) |

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| | produced a complex pattern of surface ruptures along entire length of the fault including the intermontane faults. Virtually all faults in the zone are clearly marked by 1954 scarps, many have distinct free faces, that represent as much as approximately 2.9 m of right-lateral and 3.8 m of vertical separation. In addition to reconnaissance and detailed photogeologic mapping of the fault and detailed geologic mapping in the region, detailed studies of fault offsets and trenches are the sources of data. |
| **Name comments** | Refers to faults mapped by Slemmons (1957 #154, Slemmons, 1968, unpublished Reno 1:250,000-scale map), Larson (1957 #310), Slemmons and others (1979 #157), Bell (1984 #105), Greene and others (1991 #3487), Caskey (1996 #2437), Caskey and others (1996 #2439), Henry (1996 #3710), and Bell and Ramelli (1999 #4330) along east side of Fairview Peak range and Slate Mountain, east and west sides of Chalk Mountain, and in Stingaree Valley and Bell Flat. Slemmons (1957 #310) is an early reference to the "Fairview fault zone" name and subsequent investigators have referred to it as the Fairview fault. Extent of the zone described herein follows Caskey (1996 #2437) and Caskey and others (1996 #2439).<br><br>**Fault ID:** Refers to fault numbers R34A, R34B, and R34C (Fairview Peak fault system) of dePolo (1998 #2845). |
| **County(s) and State(s)** | CHURCHILL COUNTY, NEVADA<br>MINERAL COUNTY, NEVADA |
| **Physiographic province(s)** | BASIN AND RANGE |
| **Reliability of location** | Good<br>Compiled at 1:100,000 scale.<br><br>*Comments:* Fault locations are predominantly based on 1:48,000-scale map of Caskey (1996 #2437), reproduced in Caskey and others (1996 #2439). Mapping based on detailed photogeologic analysis of 1:10,000- to 1:12,000-scale vertical, low-sun-angle aerial photography, transferred by inspection to 1:24,000-scale mylar orthophotos and directly to 1:24,000-scale topographic maps, that were then reduced to 1:48,000-scale; mapping also based on detailed field mapping and hundreds of measurements of fault offsets along the fault zone. Selected fault traces on west flank of Chalk Mountain, south of Slate Mountain, and in central and eastern Bell Flat are based on 1:250,000-scale map of Bell |

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| | (1984 #105), which were check against fault locations on 1:250,000-scale maps of Slemmons (1957 #310) and Greene and others, (1991 #3487). Mapping of Bell (1984 #105) is from photogeologic analysis of 1:40,000-scale low sun-angle aerial photography, supplemented with 1:12,000-scale aerial photography of selected areas, several low-altitude aerial reconnaissance flights, and field reconnaissance of major structural and stratigraphic relationships. |
| **Geologic setting** | This well-defined, historical, normal right-oblique fault zone has: (1) range-front faults bounding east front of Fairview Peak range from Bell Canyon north-northeast to north end of range, bounding entire length of less prominent east front of Slate Mountain, and locally bounding east and west flanks of Chalk Mountain; (2) piedmont faults crossing piedmont slope of Slate Mountain, in southwest part of Bell Flat, and crossing piedmont slopes of Chalk Mountain; (3) intra basin faults extending continuously along western margin of Stingaree Valley (a half graben, Caskey, 1996 #2437) between Fairview Peak range and Chalk Mountain and distributed throughout much of central and eastern Bell Flat; and (4) short intermontane faults bounding northwest shoulder of Fairview Peak, on range-front escarpment east-southeast of Dromedary Hump, and near crest of Chalk Mountain (Slemmons, 1957 #154, 1968, unpublished Reno 1:250,000-scale map; Larson, 1957 #310; Slemmons and others, 1979 #157; Bell, 1984 #105; Greene and others, 1991 #3487; Caskey, 1996 #2437; Caskey and others, 1996 #2439; Henry, 1996 #3710). Approximately 1800 m of post-caldera (<18.5 Ma) normal slip on the Fairview fault has tilted Fairview Peak block about 20° westward (Henry, 1996 #3710); as much as an additional about 52° of tilting is caldera-related deformation. The location and geometry of the fault are strongly influenced by caldera-related structures (Henry, 1996 #3710) and by differences in footwall lithology (Caskey, 1996 #2437). Fault is related to faults [1313] to the south and to the West Gate fault [1692], Louderback Mountains fault [1689], Gold King fault [1691], and Dixie Valley fault zone [1687] to the north. Although the 1954-ruptures exhibit significant, at many sites dominant, right-lateral displacement, this sense of movement is not characteristic of the sense of late Cenozoic movement (Caskey, 1996 #2437; Henry, 1996 #3710); sense of late Cenozoic movement based on projections of three petrographically distinct, east-west-striking, subvertical dikes of early Miocene age correlated across the Fairview fault permit only a modest amount of lateral offset; up to several hundred |

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| | meters is possible but none is required (Caskey, 1996 #2437, fig. 19; Henry, 1996 #3710, fig. 2). This suggests that the large component of right-slip observed for the 1954 ruptures does not mimic the long-term slip history of the fault (Caskey, 1996 #2437; Henry, 1996 #3710). |
| **Length (km)** | 31 km. |
| **Average strike** | N23°E |
| **Sense of movement** | Normal<br><br>*Comments:* Caskey (1996 #2437) and Caskey and others, (1996 #2439) make numerous measurements of offsets that suggests normal right-oblique movement predominated during the 1954 Fairview Peak earthquake. However, the local sense of movement was highly variable including many location dominated by or having exclusively dextral or normal slip, a few sites with sinistral or sinistral-normal slip, and one site with possible reverse slip is a left (restraining ?) stepover. Slemmons (1957 #310) also reported a few minor reverse faults that were noted by E.R. Larson. Other investigator have also indicated dextral and (or) normal offset along the fault zone (Larson, 1957 #310; Slemmons, 1957 #154; 1968 unpublished Reno 1:250,000-scale map; Larson, 1957 #310; Slemmons and others, 1979 #157; Greene and others, 1991 #3487; Henry, 1996 #3710. |
| **Dip** | 65–80° E.<br><br>*Comments:* Caskey (1996 #2437) and Caskey and others (1996 #2439) reported faults dipping: 72° E. at alluvial-bedrock contact exposed in stream cut on southeast flank of Slate Mountain; 65° E. in upper piedmont-slope deposits exposed in an exploratory trench (site 1690-2); 70° E. in piedmont-slope deposits in channel cut; and shallowing upwards from 80–70° within a few meters of the ground surface in alluvium exposed in a vertical mine shaft on southeast flank of Chalk Mountain. Bell and Ramelli (1999 #4330) reported a 70° E.-dipping fault in an older alluvial deposit in their trench (site 1690-1) east of Fairview Peak. |
| **Paleoseismology studies** | Four backhoe trenches have been excavated across the Fairview fault, three in the Bell Canyon area and one on east flank of Fairview Peak by Caskey (1996 #2437) and Bell and Ramelli (1999 #4330). Tentative age control is provided by tephra-rich |

layers and pods exposed in the trenches and correlated to dated deposits, a radiocarbon date, and soil development.

Site 1690-1. Mouth of north fork of Bell Canyon. Trench BCN of Caskey (1996 #2437) was excavated at mouth of north fork of Bell Canyon several meters south of the modern channel, a westward-flowing drainage, across a 0.8 m high east-facing scarp on late Holocene upper piedmont-slope deposits that represents approximately 1.2 m of vertical separation from the 1954 Fairview Peak earthquake. The trench exposed a stratified sequence of fluvial and alluvial deposits containing pods of volcanic ash (~1.2 ka), a main fault associated with the 1954 scarp, and several fractures in a 3-m-wide zone. The apparent shortening of strata across the near-vertical fault zone possibly reflects a lateral component. Stratigraphic relations for a near-surface deposit require about 1.0 m of vertical separation in 1954, which is generally consistent with the 1954-vetical offset determined from the height of the 1954 scarp. A stratigraphic unit near bottom of trench exposure represents a total of about 2.0 m of vertical separation, providing evidence for a minimum of one pre-1954 faulting event with a vertical separation of about 0.8 m (Caskey, 1996 #2437).

Site 1690-2. Mouth Bell Canyon. Trench BCS of Caskey (1996 #2437) was excavated several meters south of modern channel at mouth of Bell Canyon, a westward-flowing drainage. The trench crossed a 15-m-wide, well-defined graben bounded by east- and west-facing 1954 scarps on upper Holocene piedmont-slope deposits; east-facing scarp represents about 1.2 m of vertical separation of the ground surface and the net-1954 separation across the graben is on the order of 0.5-1.0 m. Exposed was a stratified sequence of fluvial and alluvial deposits containing a layer rich in volcanic ash (~1.2 ka), disseminated charcoal in a bioturbated zone that was dated at 3,670+50 yr B.P., and paleosols. The stratigraphically lowest (oldest) unit exhibits strong argillic soil development. The trench also exposed a 25-m-wide zone of steeply east- and west-dipping faults and fractures. Stratigraphic relations, upward terminations of faults at different stratigraphic levels, and scarp-derived colluvium provide evidence for a minimum of four surface-faulting events, three prior to the 1954 event. A minimum of 5.2 m of vertical separation resulted from three of the four events, with about 2.5 m attributable to the two most recent events (including the 1954 event). Vertical deformation associated with these events occurred

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| | as both discrete fault offsets and as warping and folding of near-surface deposits (Caskey, 1996 #2437).<br><br>Site 1690-3. Southeast flank, Fairview Peak. Trench was recently excavated by Bell and Ramelli (1999 #4330) across a 4-m-high scarp produced by 1954 faulting, approximately at the maximum surface offset in 1954 (Caskey, 1996 #2437). The trench exposed a strongly developed argillic (Bt) soil and a tephra bed tentatively correlated with Wilson Creek bed 19 (35.4 ka) offset across a more than 9-m-wide fault zone; the main fault rupture in 1954 dips 70° E. Trench exposures suggest that prior to the 1954 event, the fault had not ruptured since deposition of the Wilson Creek bed 19, i.e., since 35 ka (Bell and Ramelli, 1999 #4330).<br><br>Site 1690-4 at Bell Canyon adjacent to the previous trench of Caskey (1996 #2437). Bell and others (2004 #7208) report 7.9 m of oblique slip; the prehistoric coseismic surface rupture occurred between 35.4 and about 100 ka |
| **Geomorphic expression** | The 1954 Fairview Peak earthquake (Ms 7.2) produced a complex pattern of surface ruptures along entire length of the fault including along the intermontane faults. Virtually all faults in zone are clearly marked by 1954 scarps, many have distinct free faces (Slemmons, 1957 #154; Caskey, 1996 #2437). About 2 km south of Fairview Peak maximum 1954 offset is represented by a scarp produced by approximately 2.9 m of right-lateral and 3.8 m of vertical separation (Caskey, 1996 #2437). In northern Bell Flat, there are 2- to 3-m-high 1954 scarps that locally are superimposed on a compound 5-m-high paleoscarp on mid to late Pleistocene alluvial-fan deposits; paleoscarp was produced during penultimate event (Bell and Ramelli, 1999 #4330). In addition to scarps, 1954 surface deformation is exhibited by left-stepping echelon fissures, a possible pressure ridge with 1 m of relief in a left (restraining ?) stepover east-northeast of Gold Coin Mine, right-lateral offsets and deflections of streams, and right-lateral offset of ridge lines (Caskey, 1996 #2437; Caskey and others, 1996 #2439). Faults are also expressed by paleoscarps and abrupt range-front escarpments along Fairview Peak range and Slate Mountain (Slemmons, 1957 #154; Caskey, 1996 #2437); paleoscarps of late Pleistocene age occur in the Bell Flat area but are not obvious to the north (Caskey, 1996 #2437). dePolo (1998 #2845) reports a maximum preferred basal fault facet height of 171 m (146-195 m). |
| **Age of faulted** | Holocene; late Quaternary; Quaternary; Tertiary. There is general |

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| **surficial deposits** | agreement that Holocene, late Quaternary, and Quaternary piedmont-slope and valley-fill deposits are faulted along the entire fault zone (Slemmons, 1957 #154, 1968; unpublished Reno 1:250,000-scale map; Larson, 1957 #310; Slemmons and others, 1979 #157; Bell, 1981 #2875; Bell, 1984 #105; Greene and others, 1991 #3487; Caskey, 1996 #2437; Caskey and others, 1996 #2439; Henry, 1996 #3710). Slemmons (1957 #310) reported offset of U.S. Highway 50 and road in Bell Flat associated with the 1954 Fairview Peak earthquake. Along front of Fairview Peak range, Slate Mountains, and Chalk Mountain Quaternary piedmont-slope are juxtaposed against Tertiary bedrock (Bell, 1981 #2875; Bell, 1984 #105; Greene and others, 1991 #3487; Caskey, 1996 #2437; Caskey and others, 1996 #2439; Henry, 1996 #3710). |
| **Historic earthquake** | Fairview Peak earthquake 1954 |
| **Most recent prehistoric deformation** | late Quaternary (<130 ka)<br><br>*Comments:* Although timing of most recent paleoevent is not well constrained, a late Quaternary time (>36 ka) is suspected based ongoing trench investigations by Bell and Ramelli (1999 #4330). |
| **Recurrence interval** | <br><br>*Comments:* Bell and Ramelli (1999 #4330) suggest that 35 k.y. or more may have elapsed between the 1954 event and the previous paleoearthquake, suggesting tens of thousands years between events. This is supported by map relationships in northern Bell Flat that bracket the penultimate event between 100 and 35 ka. |
| **Slip-rate category** | Less than 0.2 mm/yr<br><br>*Comments:* Oblique rate suggested by data presented by Bell and others (2004 #7208) suggest slip rates that fall within the assigned category. Earlier estimates by Bell and Ramelli (1999 #4330) include<<0.1, but a higher rate is suggested by their mapping and profiling of a 5-m-high scarp on 100 and 35 ka alluvial-fan deposits in northern Bell Flat. dePolo (1998 #2845) assigned a reconnaissance vertical slip rate of 0.312 mm/yr for most of the fault based on an empirical relationship between his preferred maximum basal facet height and vertical slip rate. The size of the facets (tens to hundreds of meters, as measured from topographic maps) indicates they are the result of many seismic cycles, and |

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| | thus the derived slip rate reflects a long-term average. However, the lack of evidence for surface faulting younger than 35-100 ka except in 1954 suggests the slip rate during the late Quaternary is of a lesser magnitude. Accordingly, the less than 0.2 mm/yr slip-rate category has been assigned to this fault. |
| **Date and Compiler(s)** | 1999<br>Thomas L. Sawyer, Piedmont Geosciences, Inc. |
| **References** | #2875 Bell, J.W., 1981, Quaternary fault map of the Reno 1° by 2° quadrangle, Nevada-California: U.S. Geological Survey Open-File Report 81-982, 62 p., http://pubs.er.usgs.gov/publication/ofr81982.<br><br>#105 Bell, J.W., 1984, Quaternary fault map of Nevada—Reno sheet: Nevada Bureau of Mines and Geology Map 79, 1 sheet, scale 1:250,000.<br><br>#4330 Bell, J.W., and Ramelli, A.R., 1999, Paleoseismic studies in the Central Nevada Seismic Belt: Technical report to U.S. Geological Survey, Reston, Virginia, under Contract 1434-HQ-97-GR-03164, March 31, 1999, 16 p.<br><br>#2437 Caskey, S.J., 1996, Surface faulting, static stress changes, and earthquake triggering during the 1954 Fairview Peak (M (sub s) = 7.2) and Dixie Valley (M (sub s) = 6.8) earthquakes, central Nevada: Reno, University of Nevada, Mackay School of Mines, unpublished Ph.D. dissertation, 144 p.<br><br>#2439 Caskey, S.J., Wesnousky, S.G., Zhang, P., and Slemmons, D.B., 1996, Surface faulting of the 1954 Fairview Peak (Ms 7.2) and Dixie Valley (Ms 6.8) earthquakes, central Nevada: Bulletin of the Seismological Society of America, v. 86, no. 3, p. 761-787.<br><br>#2845 dePolo, C.M., 1998, A reconnaissance technique for estimating the slip rate of normal-slip faults in the Great Basin, and application to faults in Nevada, U.S.A.: Reno, University of Nevada, unpublished Ph.D. dissertation, 199 p.<br><br>#3487 Greene, R.C., Stewart, J.H., John, D.A., Hardyman, R.F., Silberling, N.J., and Sorensen, M.L., 1991, Geologic map of the Reno 1° by 2° quadrangle, Nevada and California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2154-A, scale 1:250,000. |

#3710 Henry, C.D., 1996, Geologic map of the Bell Canyon quadrangle, western Nevada: Nevada Bureau of Mines and Geology Field Studies Map 11, scale 1:24,000.

#310 Larson, E.R., 1957, Minor features of the Fairview fault, Nevada: Bulletin of the Seismological Society of America, v. 47, no. 4, p. 377-386.

#154 Slemmons, D.B., 1957, Geological effects of the Dixie Valley-Fairview Peak, Nevada, earthquakes of December 16, 1954: Bulletin of the Seismological Society of America, v. 47, no. 4, p. 353-375.

#157 Slemmons, D.B., Van Wormer, D., Bell, E.J., and Silberman, M.L., 1979, Recent crustal movements in the Sierra Nevada-Walker Lane region of California-Nevada—Part I, Rate and style of deformation: Tectonophysics, v. 52, no. 1-4, p. 561-570.