Silver Peak Range faults (SIL)

Plate or figure: Plate 1.

References: Y-238: Reheis and Noller, 1991 (pl. 1). Not shown by Dohrenwend and others, 1992 (Y-853).

Location: 142 km/305° (distance and direction of closest point from YM) at lat 37°35′N. and long 117°44′W. (location of closest point). SIL includes two faults in the Silver Peak Range: a northwestern fault west of and extending south of Red Mountain and a southeastern fault between Big Spring and Oasis Divide.

USGS 7-1/2′ quadrangle: Lida Wash SW, Mohawk Mine, Oasis Divide, Piper Peak, Rhyolite Ridge.

Fault orientation: The northwestern fault of SIL strikes north–northeast with individual fault traces striking north to northeast (Y-238). The southeastern fault generally strikes northwest with individual traces striking west–northwest or northeast (Y-238).

Fault length: The total length of both faults included in SIL is about 24 km as estimated from Y-238. The northwestern fault is about 16 km long; the southeastern fault is 8 to 9 km long (estimated from Y-238). Individual traces of the southeastern fault are 1 to 2 km long. A 5–km–long gap in surface expression separates the traces of the southeastern fault.

Style of faulting: No information.

Scarp characteristics: Short scarps associated with the northwestern fault are generally west–facing (Y-238). Scarps associated with the southeastern fault are north–facing, northeast–facing, or northwest–facing (Y-238).

Displacement: No information.

Age of displacement: Short sections of the northwestern fault of SIL are shown by Y-238 as weakly expressed lineaments or scarps on surfaces of Quaternary deposits. Most of the northern 8 km of this fault is portrayed by Y-238 as a topographic lineament along a linear front or in bedrock. Y-238 (p. 2) interpreted this lineament as suggesting Quaternary fault displacement. The southern 8 km of the northwestern fault is portrayed by Y-238 as a fault that is in Tertiary deposits and that was identified from previous mapping.

Traces of the southeastern fault of SIL are shown by Y-238 as weakly to moderately expressed lineaments or scarps on surfaces of Quaternary deposits.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000).

Relationship to other faults: The northwestern fault of SIL is approximately parallel to the McAfee Canyon fault (MAC) on the western side of the Silver Peak Range west of SIL, to the Clayton Valley fault (CV) east of SIL in Clayton Valley, and to the northeast–striking portion of the western fault of the Emigrant Peak faults (EPK) northwest of SIL in Fish Lake Valley. The southeastern fault of SIL is approximately parallel to the Palmetto Wash fault (PW) south of the Silver Peak Range south of SIL.

The southeastern fault nearly intersects the northeast–striking southern portion of CV.

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Six–Mile Flat fault (SMF)

Plate or figure: Plate 1.

References: Y-25: Ekren and others, 1977 (show some of the faults in the highland between Sixmile Flat and Pahrock Valley); Y-404: Tschanz and Pampeyan, 1970 (pls. 2 and 3); Y-1032: Schell, 1981 (pl. 9, name from his table A2, fault #91).

Location: 138 km/51° (distance and direction of closest point from YM) at lat 37°36′N. and long 115°12′W. (location of closest point). SMF is located in the northern part of Sixmile Flat (or Pahroc Valley) and in the unnamed highland that is directly north of Sixmile Flat. This highland trends eastward between the Hiko Range on the west and the North Pahroc Range on the east.

USGS 7-1/2′ quadrangle: Fossil Peak, Hiko, Hiko NE, Hiko SE.

Fault orientation: SMF generally strikes northeast (Y-1032). SMF includes two major fault traces so that SMF is about 5 km wide (Y-1032, table A2, p. A17).

Fault length: The length of SMF is noted to be 24 km by Y-1032 (table A2, p. A17).

Style of faulting: Displacement along fault traces in SMF for which type displacement has been noted is shown by Y-1032 (pl 9) as down to the southeast.

Scarp characteristics: Y-1032 (table A2, p. A17) reported a maximum scarp height of 2 m.

Displacement: No information.

Age of displacement: The probable age of the youngest displacement along SMF is noted by Y-1032 (table A2, p. A17) to be late Pleistocene (defined as >15 ka and <700 ka by Y-1032, p. 29). The youngest unit displaced is his intermediate–age alluvial–fan deposits (A5i, table A2, p. A17) with an estimated age of 15 ka to probably about 200 ka (table 3, p. 23). The oldest unit not displaced is his young–age alluvial–fan deposits (A5y, table A2, p. A17) with an estimated age of 15 ka or younger (table 3, p. 23). The oldest unit displaced is middle Tertiary volcanic rocks (Tv_2, table A2, p. A17) with an estimated age of 17 Ma to 34 Ma (table A1, p. A1).

Neither Y-25 nor Y-404 showed fault traces that displace Quaternary deposits in this area.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Aerial photographs (Y-404, p. 2, scale 1:60,000; Y-1032, p. 15, scales ~1:25,000 and ~1:60,000). Field reconnaissance (Y-1032, p. 17-18). Field mapping (Y-404, p. 2). Gravity analysis (Y-1032, p. 16). Magnetometer surveys (Y-1032, p. 16-17).

Relationship to other faults: SMF lies between two approximately north–striking faults: the Hiko fault (HKO) to the west and the Pahroc fault (PAH) to the east (Y-1032, table A2, p. A17). The structural relationships among these faults are not known.

Slate Ridge faults (SLR)

Plate or figure: Plate 1.

References: Y-238: Reheis and Noller, 1991 (pl. 2); Y-407: Albers and Stewart, 1972; Y-853: Dohrenwend and others, 1992.

Location: 87 km/308° (distance and direction of closest point from YM) at lat 37°20'N. and long 117°14'W. (location of closest point). SLR includes two faults at the eastern end of Slate Ridge (east of Gold Point). The northern fault is located along the northern side of Slate Ridge. The southern fault is located between Slate Ridge and Gold Mountain.

USGS 7-1/2' quadrangle: Gold Point, Gold Point SW, Scottys Junction SW.

Fault orientation: The faults in SLR strike east to east–northeast (Y-238; Y-853).

Fault length: The length of the northern fault is 13 km as estimated from Y-853; the length of the southern fault is 5 km as estimated from Y-853. The lengths of the northern and southern faults are about 12 km each as estimated from Y-238. The map by Y-407 shows the northern fault as connected by a concealed fault to faults to the west in the area south of Magruder Mountain.

Style of faulting: Major portions of both the northern and southern faults are shown by Y-238 as having down–to–the–north displacement.

Scarp characteristics: Short section of both the northern and southern faults are shown by Y-238 as scarps, all of which are north–facing.

Displacement: No information.

Age of displacement: Major portions of both faults in SLR are portrayed by Y-238 as faults that are in Tertiary deposits and that were identified from previous mapping. Both the northern and southern faults are portrayed by Y-853 as faults forming scarps and (or) prominent topographic lineaments on surfaces of Tertiary volcanic or sedimentary rocks. The faults of SLR are shown by Y-407 as concealed by Holocene alluvium, colluvium, and playa deposits (their Qal deposits).

A 0.6–km–long section at the western end of the northern fault is shown by Y-238 as a weakly expressed lineament or scarp on surfaces of Quaternary deposits. Part of the northern fault (from the central part to the eastern end) is shown by Y-853 as a fault–related lineament on Quaternary depositional or erosional surfaces.

The western end of the southern fault is shown by Y-238 as a lineament or scarp on surfaces of Tertiary deposits. SLR is shown by Y-407 as faults between Tertiary rocks and older rocks, within pre–Tertiary rocks, and within Tertiary rocks.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000; Y-853, scales 1:115,000 to 1:124,000 and 1:58,000).

Relationship to other faults: Faults in SLR have a slightly more easterly strike than that of the Gold Mountain fault (GOM) along the northern side of Gold Mountain. SLR and GOM could intersect near the eastern end of Slate Ridge. The two faults in SLR are approximately perpendicular to the north–northeast– and northeast–striking major range–bounding faults west of Cactus Flat, such as the Montezuma Range fault (MR) along the western side of the Montezuma Range northwest of SLR, the East Magruder Mountain fault (EMM) along the eastern side of Magruder Mountain west–northwest of SLR, the Lida Valley faults (LV) along the southeastern side of the Palmetto Mountains west–northwest of SLR, and part of the Grapevine Mountains fault (GM) along the western side of the Grapevine Mountains south of SLR.

Slate Ridge faults (SLR) — Continued

The two faults in SLR are at an oblique angle to northeast–striking faults within basins, such as the Stonewall Flat faults (SWF) within Stonewall Flat north of SLR, the Palmetto Mountains–Jackson Wash faults (PMJW) in the valley northeast of Palmetto Mountains northwest of SLR, and the Clayton–Montezuma Valley fault (CLMV) in the valley between Clayton Ridge and Montezuma Range northwest of SLR (Y-238; Y-853).

The two faults in SLR are perpendicular to the north–northwest–striking Sarcobatus Flat fault (SF) along the western edge of Pahute Mesa about 15 km east of SLR.

The structural relationships among all of these faults are not known.

Solitario Canyon fault (SC)

Plate or figure: Figure 3.

References: Y-26: Swadley and others, 1984 (SC includes their Solitario Canyon fault and their Fault H); Y-46: Maldonado, 1985; Y-55: Scott and Bonk, 1984 (name from their pl. 1); Y-58: Christiansen and Lipman, 1965 (show only the northern portion of SC north of lat 36°52′30″N.); Y-74: Hoover, 1989 (includes dates for stratigraphic units described in Y-26); Y-189: Lipman and McKay, 1965; Y-224: Frizzell and Shulters, 1990 Y-238: Reheis and Noller, 1991 (pl. 3); Y-396: Scott, 1990; Y-576: O'Neill and others, 1991; Y-700: Whitney, 1992; Y-1042: O'Neill and others, 1992; Y-1182: Simonds and Whitney, 1993; Y-1201: Ramelli and others, 1991; Y-1230: Bell and others, 1990.

Location: 0.5 km/297° (distance and direction of closest point from YM) at lat 36°51′N. and long 116°28′W. (location of closest point). SC bounds the western sides of the Yucca Crest and West Crest of Yucca Mountain along the western border of the potential repository site. It splits into three or four splays immediately south of West Crest as interpreted by Y-26 (p. 14), Y-396 (p. 259), and Y-1042 (pl. 1, p. 6).

USGS 7-1/2′ quadrangle: Busted Butte, Pinnacles Ridge.

Fault orientation: SC strikes generally north–northeast (Y-26, pl. 1; Y-55, pl. 1). Y-396 (p. 259) reported an average dip of 65°, which was computed from 31 measurements.

Fault length: Y-26 (p. 14) noted a minimum length of 12 km for SC. Y-1201 (p. 1-64) reported a length of 13 km for a prominent compound scarp on Quaternary surfaces along SC. A portion at the northern end of the West Crest, a part of SC that is shown by Y-55 (pl. 1) as displacing alluvium, is about 0.6 km long (estimated from Y-55, pl. 1). Y-26 (pl. 1, p. 14) noted that Quaternary/Tertiary debris–flow deposits are faulted against bedrock at several locations along SC over a total length of 4.5 km. Y-1182 (p. A-141) reported that Quaternary rupture has occurred along as much as 10 km of SC.

Style of faulting: SC is shown by Y-26 (pl. 1, p. 14) and Y-55 (pl. 1) as having down–to–the–west, dip–slip (normal) displacement. It is portrayed as having left–lateral oblique (down–to–the–west) displacement by Y-1042 (pl. 1). Y-700 and Y-1042 (pl. 1, p. 6) interpreted several types of evidence as indicating a significant left–lateral component of slip on SC. This evidence is (1) displaced streams, (2) a pattern of *en echelon* fault splays, (3) oblique slickenlines, and (4) a rhomboid–shaped zone that links two left–stepping traces of SC along Yucca Crest and that is similar in shape to that of a pull–apart graben.

Y-26 (p. 15, their Fault H) and Y-1042 (pl. 1, p. 6) noted that the northern end of SC north of Little Prow, dips east and has down–to–the–east displacement. This is in contrast to the apparent displacement along SC south of Little Prow. Y-1042 (p. 6) noted only minor displacement along SC directly west of Little Prow. They interpreted these changes in fault dip and type of displacement as indicating complex scissors displacement along SC (Y-1042, p. 6, 10).

Scarp characteristics: Y-1201 (p. 1-64) noted a prominent compound scarp that is 1 to 3 m high on Quaternary surfaces. Y-1201 (p. 1-65) and Y-1230 (p. [4]) interpreted lineations visible on low–sun–angle aerial photographs as fault scarps a few tens of centimeters high. Y-1230 (p. [7]) recognized subdued fault scarps along SC south to nearly the Stagecoach Road fault (SCR), which is farther south than SC is shown by Y-26 (pl. 1).

Displacement: Y-26 (p. 14, pl. 1) could not determine the amount of displacement of early Pleistocene or latest Pliocene deposits that were exposed in either their Trench 8 in the central part of SC or their Trench 10B located 3.3 km to the north of Trench 8. Y-1201 (p. 1-65) reported up to 1 m of vertical displacement on a late Pleistocene surface (their late Black Cone surface) at Trench 8 of Y-26 (pl. 1) and at other localities 2 km south of the trench. They also reported bedrock scarps about 3 m high (Y-1201, p. 1-65).

Y-396 (p. 259) noted a cumulative displacement of zero along the northern end of SC and a cumulative displacement of about 1 km along the fault's southern end. Y-396 (p. 273) reported that dip–slip displacement along the central portion of SC since 13.5 Ma has been 0.4 km, a maximum for faults in the Yucca Mountain area.

Solitario Canyon fault (SC) — Continued

Age of displacement: Evidence that might indicate Quaternary rupture has been reported by various workers. This evidence includes (1) topographic lineaments and drainage alignments of possible tectonic origin preserved along the fault (Y-1042, p. 6), (2) prominent scarps on Quaternary surfaces (Y-1201, p. 1-64), and (3) faulted contacts between Quaternary and (or) Tertiary alluvium or colluvium and older rocks (Y-26, pl. 1, p. 14-15; Y-55, pl. 1).

On the basis of an inferred age for a basaltic ash preserved in a fracture zone and on the presence of fracturing but no visible displacement of a K horizon developed in early Pleistocene or latest Pliocene alluvium, Y-26 (p. 14, pl. 1) interpreted tectonic features exposed in their Trench 8 in the central part of SC as recording an event that occurred about 1.2 Ma (Y-26, table 1, p. 5). Tectonic features exposed in their Trench 10B, located 3.3 km north of Trench 8, are inferred by Y-26 (table 1, p. 5) to be younger than 2 Ma.

Y-700 reported that displacement along SC has occurred during the last 500,000 yr. Sharp lineations noted by Y-1201 (p. 1-65) and Y-1230 (p. [4]) and interpreted by them to be small (a few tens of centimeters high) fault scarps are on surfaces thought to be Holocene or latest Pleistocene age (8,425 ± 70 yr, AMS radiocarbon date on rock varnish, for which they cite Dorn (1988, Y-308)). These are their Little Cones surfaces with bar and swale topography, weak desert pavement, cambic B horizon, and stage I carbonate development (Y-1201; Y-1230). Faulds and others (1991, Y-1196, p. 1-56) reported rock varnish ages of 6.6 ka to 11.1 ka for Little Cones surfaces in Crater Flat. Thus, Y-1201 (p. 1-65) concluded that the amount and age of the youngest rupture on SC are similar to those on the better–studied Windy Wash fault to the west (about 10 cm of displacement since 3 ka to 6 ka). Likewise, Y-700 suggested that if the scarp near the southern end of SC proves to have a tectonic origin, then displacement along this portion of SC probably occurred in the last 15,000 yr.

Y-1201 (p. 1-64) reported that the southern end of a prominent Quaternary scarp "is obliterated by late Holocene alluviation." On the basis of exposures in their Trench 10B in the central part of SC, Y-26 (p. 15) interpreted no displacement of either a K horizon developed in early Pleistocene and latest Pliocene alluvium or in overlying middle Pleistocene coarse fluvial deposits (their Q2c deposits) with an estimated age between 270 ka and 800 ka (Y-26, fig. 3, p. 9). Similarly, Y-26 (p. 15, table 1, p. 5) inferred no displacement since 270 ka on SC north of Little Prow (their Fault H) because middle Pleistocene fluvial deposits (their Q2c deposits with estimated ages of 270 ka to 800 ka) overlie SC.

Y-1201 (p. 1-65) reported that a late Pleistocene surface (their late Black Cone surface) was displaced vertically ≤1 m. Y-1196 (p. 1-56) noted rock varnish dates of 17.3 ka to 30.3 ka for this surface in Crater Flat.

Slip rate: Based on the maximum displacement of 1 m that was reported by Y-1201 (p. 1-65) for their late Black Cone surface with an age of 17.3 ka to 30.3 ka as noted by Y-1196 (p. 1-56), the maximum apparent vertical slip rate on SC is between 0.03 and 0.06 mm/yr since latest Pleistocene.

Y-396 (p. 273, table 2, p. 275) reported an apparent vertical slip rate of 0.19 mm/yr on SC between 13 Ma and 11.5 Ma. This rate assumes that 70% (about 0.3 km) of the total dip slip on SC occurred during this 1.5–million–yr interval.

Y-396 (p. 273-274, table 2, p. 275) reported an apparent vertical slip rate of 0.010 mm/yr on SC since 11.5 Ma. This rate was estimated by subtracting the dip slip that occurred between 13 Ma and 11.5 Ma from the total dip slip (this means that about 0.1 km of dip slip occurred since 11.5 Ma) and assumes a stepwise decreasing rate of Cenozoic deformation in which rates sharply decreased about 11.5 Ma.

Recurrence interval: No information.

Range-front characteristics: No information.

Solitario Canyon fault (SC) — Continued

Analysis: Compilation of published and unpublished information (Y-26, p. 1). Lineament analyses using low–sun–angle aerial photographs (Y-576, p. A119; Y-1042, p. 2, scale 1:12,000; Y-1230, p. [4]) or conventional aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000). Surficial mapping and field investigations (Y-26; Y-700; Y-1042, p. 2; Y-1201, p. 1-65). Interpretations of trench exposures (Y-26, trenches 8, 10A, and 10B across the central part of SC west of Yucca Crest, pl. 1, table 1, p. 5, 14-15; trenches 13, GA1A, and GA1B across the northern part of SC north of Little Prow; preliminary analysis). Y-700 noted that one trench was excavated across SC in the early 1980's, but that it has been difficult to interpret because SC at this locality is between bedrock and slope colluvium. Portions of SC that are obscured by alluvium have been located on the basis of aeromagnetic anomalies (Y-55, pl. 1, p. 8)

Relationship to other faults: At its southern end, SC splits into several traces. Y-1042 (pl. 1, p. 6) noted that the western trace of SC in this area appears to be tectonically linked to the Windy Wash fault (WW). Y-1182 (p. A-141) proposed that the three faults on the western side of Yucca Mountain (Fatigue Wash fault, SC, and WW) are interconnected along strike and possibly at depth. Y-1182 (p. A-141) speculated that Quaternary rupture along the Stagecoach Road fault (SCR) may be a continuation of either the Paintbrush Canyon fault (PBC) or an eastern splay of SC.

SC has been interpreted to be structurally linked to the Bow Ridge fault (BR) east of Yucca Mountain in the largest pull–apart zone in the area (Y-576, p. A119). Y-396 (p. 279) concluded that steep normal faults at Yucca Mountain, like SC, sole into a low–angle normal fault or faults at depths of 1 to 4 km.

Y-55 (pl. 1) mapped a series of small faults across a low ridge between Yucca Crest and West Crest of Yucca Mountain. Y-1042 (p. 10) suggested that these faults may connect SC with an unnamed fault along the western side of Middle Crest, although Y-1042 (pl. 1, p. 10) recognized no evidence for these faults on aerial photographs.

Y-1042 (p. 6) concluded that SC terminates south of the northwest–trending Yucca Wash. In contrast, Y-58 interpreted SC as crossing Yucca Wash and connecting with a major east–dipping fault to the north.

South Ridge faults (SOU)

Plate or figure: Plate 2.

References: Y-62: Barnes and others, 1982; Y-671: Guth, 1990; Y-813: Reheis, 1992 (pl. 3); Y-852: Dohrenwend and others, 1991.

Location: 55 km/109° (distance and direction of closest point from YM) at lat 36°40′N. and long 115°52′W. (location of closest point) for the fault along the northern side of South Ridge; 50 km/120° (distance and direction of closest point from YM) at lat 36°36′N. and long 115°58′W. (location of closest point) for the fault along the southern side of South Ridge. SOU includes two main faults: one along the northern side of South Ridge east of East Sandy Wash and the other along the southern side of South Ridge.

USGS 7-1/2′ quadrangle: Mercury, Mercury NE.

Fault orientation: The northern fault strikes east (Y-813; Y-852). The main trace of the southern fault, which is along the front of the South Ridge, varies in strike from east–northeast at the western end of the ridge, to northeast in the central part of the ridge, and to east at the eastern end of the ridge (Y-813). A fault that branches south from the main trace of the southern fault strikes primarily northeast. The western end of this branch fault strikes north–northeast.

Fault length: The northern fault includes a western trace that is 1 to 3 km long <1 km north of the front of South Ridge, a central trace that is 5 km long along the front of the ridge, and an eastern trace that is 2.5 km long at the very eastern end of South Ridge (Y-852).

The trace of the southern fault as shown by Y-813 is nearly continuous for 19 km. Y-852 portrayed the southern fault as two sections, each about 2 to 3 km long. The branch fault south of the southern fault is 7 km long (Y-813).

Style of faulting: The main trace of the southern fault is portrayed by Y-62 and Y-813 with variable types of displacement: down to the south on the eastern and western ends and left lateral along the central portion. Displacement on the branch fault south of the southern fault is down to the southeast.

Scarp characteristics: One section of the western trace of the northern fault is shown by Y-813 as a scarp, which is north–facing.

Displacement: No information.

Age of displacement: The northern fault juxtaposes Quaternary alluvium against bedrock (Y-852). Y-813 portrayed one section of the western trace of this fault as a prominent scarp on Tertiary surfaces.

Y-62 showed portions of the main trace of the southern fault as concealed by Quaternary and Tertiary alluvium. Y-813 portrayed much of the southern fault as a fault that is in Tertiary deposits and that was recognized from previous mapping.

A short section of the branch fault south of the southern fault is shown by Y-813 as a weakly expressed lineament or scarp on surfaces of Tertiary deposits.

Slip rate: No information.

Recurrence interval: No information.

South Ridge faults (SOU) — Continued

Range-front characteristics: The northern and southern faults have been shown by Y-852 as juxtaposing Quaternary alluvium against bedrock, but not as major range–front faults. The morphology of the fronts of South Ridge would be similar to that along a major range–front fault and may be characterized by "fault juxtaposition of Quaternary alluvium against bedrock, fault scarps and lineaments on surficial deposits along or immediately adjacent to range front, a general absence of pediments, abrupt piedmont–hillslope transitions, steep bedrock slopes, faceted spurs, wineglass valley, and subparallel systems of high–gradient, narrow, steep–sided canyons orthogonal to range front" (Y-852). However, the faults of SOU would be significantly less extensive and fault scarps would be substantially lower, shorter, and less continuous than those along a major range–front fault (Y-852).

About 5.3 km of the main trace of the southern fault and most of the branch fault are shown by Y-813 as topographic lineaments along linear range fronts.

Analysis: Aerial photographs (Y-813, p. 4, scales 1:62,500 to 1:80,000; Y-852, scale 1:58,000).

Relationship to other faults: A north–northeast–trending, down–to–the–west, 1–km–long scarp at the western end of South Ridge is shown by Y-852 to be on depositional or erosional surfaces that are possibly early to middle Pleistocene age (their Q1? surfaces with estimated ages between 130 ka and 1.5 Ma). However, the trend of this scarp is more northerly than the strike of the faults along South Ridge, so its relationship to SOU is not clear.

Faults in SOU may be the southwestern extension of the Spotted Range faults (SPR), which are about 3 km northeast of SOU. However, SOU strikes east, whereas SPR strikes north or northeast. In addition, SOU extends eastward of the possible intersection with SPR.

Faults in SOU have a more easterly strike than those of the faults in the Rock Valley fault (RV) 12 to 15 km north of SOU along the southern side of Frenchman Flat. The strike of SOU is similar to that of the Cactus Springs fault (CAC), which is about 5 km south of SOU. The structural relationships among these fault are not known.

Y-671 (p. 241) speculated that a normal fault along the northern side of South Ridge (the northern fault of SOU?) may reactivate the ramp of the Spotted Range thrust.

Southeast Coal Valley fault (SCV)

Plate or figure: Plate 1.

References: Y-25: Ekren and others, 1977 (show two faults that coincide with SCV as mapped by Y-1032; both of their faults are shown as displacing Quaternary deposits); Y-404: Tschanz and Pampeyan, 1970 (pl. 2; show faults in the same area of SCV as mapped by Y-1032, but only one of these faults, the one along the eastern side of Irish Mountain, is shown as displacing Quaternary deposits); Y-1032: Schell, 1981 (pl. 9; name from his table A2, fault #22).

Location: 132 km/48° (distance and direction of closest point from YM) at lat 37°37′N. and long 115°20′W. (location of closest point). SCV is located along the western side of an unnamed ridge at its junction with southeastern Coal Valley. A possible southern extension of SCV toward the Pahranagat Valley along the eastern side of Irish Mountain and through the North Pahranagat Range may include three approximately parallel north–northwest–striking fault traces (labeled SCV? on plate 1 of this compilation).

USGS 7-1/2′ quadrangle: Mail Summit, Mount Irish SE, Murphy Gap SE.

Fault orientation: The northern part of SCV strikes approximately north; faults in the southern part of SCV strike north–northwest (Y-1032).

Fault length: The length of SCV is noted to be 8 km by Y-1032 (table A2, p. A5). If SCV extends to the south to the Pahranagat Valley, then its length may be ≥19 km (Y-1032, table A2, p. A5).

Style of faulting: Displacement on fault traces along the unnamed ridge is shown as down to the west; displacement on fault traces at the southern end of SCV through the North Pahranagat Range is portrayed as both down to the east and down to the west (Y-25; Y-1032).

Scarp characteristics: No information.

Displacement: No information.

Age of displacement: The probable age of the youngest displacement along SCV is noted by Y-1032 (table A2, p. A20) as late Pleistocene (defined as >15 ka and <700 ka by Y-1032, p. 29). The youngest unit displaced is his intermediate–age alluvial–fan deposits (A5i, table A2, p. A5) with an estimated age of 15 ka to probably about 200 ka (table 3, p. 23). The oldest unit not displaced is his Bonneville–Lahontan–shoreline features (A4o, table A2, p. A5) with an estimated age of ≤15 ka (table 3, p. 23). The oldest unit displaced is his middle Tertiary volcanic rocks (Tv_2, table A2, p. A5) with an estimated age of 17 Ma to 34 Ma (table A1, p. A1).

Y-404 showed one fault trace along the eastern side of Irish Mountain as a faulted contact between Devonian rocks and older Quaternary alluvium (their Qol deposits with an estimated Pleistocene? age). Y-25 portrayed this same trace as a faulted contact between pre–Tertiary sedimentary rocks and Holocene to Pliocene alluvium and colluvium (their QTa deposits). They (Y-25) also showed a portion of a fault trace along the eastern side of the section labeled SCV? as a faulted contact between pre–Tertiary sedimentary rocks and Quaternary alluvium (their Qa deposits).

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Aerial photographs (Y-404, p. 2, scale 1:60,000; Y-1032, p. 15, scales ~1:25,000 and ~1:60,000). Field reconnaissance (Y-1032, p. 17-18). Field mapping (Y-404, p. 2). Gravity analysis (Y-1032, p. 16). Magnetometer surveys (Y-1032, p. 16-17). Compilation of structural and stratigraphic information (Y-25).

Southeast Coal Valley fault (SCV) — Continued

Relationship to other faults: SCV may extend southward from the unnamed ridge, through the North Pahranagat Range (labeled SCV? on pl. 1 of this compilation), and connect with late Pleistocene fault scarps in the Pahranagat Valley (Y-1032, table A2, p. A5).

Southern Death Valley fault (SDV)

Plate or figure: Plate 2.

References: Y-216: Brogan and others, 1991 (pl. 4; their South Ashford Mill section and possibly their Gregory Peak and North Ashford Mill sections may be part of SDV); Y-246: Troxel, 1986; Y-247: Butler, 1986; Y-248: Troxel and Butler, [1986]; Y-338: Butler, 1988; Y-339: Brady, 1988 (tentatively correlated SDV with faults along the Avawatz Mountains, in the Soda Mountains, and in the northern Bristol Mountains); Y-389: Drewes, 1963 (his Confidence Hills fault zone; fig. 2, p. 5); Y-390: Hunt and Mabey, 1966 (their Confidence Hills fault zone; fig. 71, p. A100); Y-401: Noble, 1941 (pls. 3 and 4); Y-413: Jennings and others, 1962 (Trona sheet; their Death Valley fault zone); Y-424: Wright and Troxel, 1984 (show SDV between north of Cinder Hill and the Confidence Hills, between lat 35°52′30″N. and lat 36°00′N.); Y-427: Hart and others, 1989 (included SDV in their Death Valley fault zone); Y-429: Wills, 1989 (included SDV in his Death Valley fault zone, the portion south of Shore Line Butte); Y-468: Noble and Wright, 1954; Y-471: Burchfiel and Stewart, 1966 (their Death Valley fault zone); Y-472: Butler and others, 1988 (subdivided the portion of SDV between the Confidence Hills and the southern Owlshead Mountains into a western subzone along the eastern side of the Owlshead Mountains and an eastern subzone within southern Death Valley); Y-473: Hill and Troxel, 1966; Y-478: Stewart, 1983 (his Death Valley fault zone); Y-479: Wright and Troxel, 1967; Y-550: Butler and others, 1986; Y-592: Davis, 1977 (his Death Valley fault zone, which he noted is south of lat 36°00′N.); Y-593: Davis and Burchfiel, 1973; Y-599: Butler, 1984; Y-600: Stewart, 1967 (his Death Valley fault zone); Y-602: Brady, 1986 (his southern Death Valley fault zone); Y-603: Butler, 1984 (subdivided the portion of SDV between the Confidence Hills and the southern Owlshead Mountains into a western subzone along the eastern side of the Owlshead Mountains and an eastern subzone within southern Death Valley); Y-612: Hamilton and Myers, 1966; Y-746: Wright and Troxel, 1954 (map 8, p. 34); Y-764: Brady, 1991; Y-955: Brady, 1986 (discussed the portions of SDV in the Noble Hills and in the Avawatz Mountains); Y-990: Beratan and Murray, 1992 (stratigraphy of the Confidence Hills); Y-991: Gomez and others, 1992 (geology of the Confidence Hills); Y-992: Pluhar and others, 1992 (paleomagnetics of sediments that compose the Confidence Hills); Y-1020: Jennings, 1992 (part of his Death Valley fault zone, fault #248).

Location: 105 km/193° (distance and direction of closest point from YM) at lat 35°56′N. and long 116°43′W. (location of closest point). SDV is located between at least Cinder Hill and the Avawatz Mountains in southern Death Valley.

USGS 7-1/2′ quadrangle: Anvil Spring Canyon East, Avawatz Pass, Confidence Hills East, Confidence Hills West, East of Owl Lake, Old Ibex Pass, Shore Line Butte.

Fault orientation: SDV strikes approximately northwest (Y-216, p. 13; Y-472, p. 402). Y-429 (p. 4, 8) suggested that the strike of SDV is generally N. 30° W., but it is N. 40° W. along the southeastern side of the Confidence Hills. The western subzone of Y-472 (p. 404) and Y-603 (p. 25), where it is exposed in six deeply incised drainages, strikes between N. 15° E. and N. 30° W.; dips vary between 35° to 65° to the east or northeast. Their eastern subzone strikes between N. 40° W. and N. 50° W.; the dip is inferred to be vertical or near–vertical on the basis of the fault's straight trace (Y-472, p. 404; Y-603, p. 25).

Fault length: Estimates of the length of SDV range between about 50 km and greater than 300 km as described below. SDV is about 3 to 6.5 km (2 to 4 miles) wide in southern Death Valley between the Owlshead and Avawatz mountains (Y-468, p. 157). It is nearly 2.5 km wide in the northern Avawatz Mountains (Y-602, p. 123).

The length of SDV is at least 51 km between Cinder Hill in southern Death Valley to the northeastern side of the Avawatz Mountains in the Silurian Valley as estimated from Y-413. It may extend 12 km farther if a concealed fault trace shown by Y-413 along the northeastern side of the Avawatz Mountains is included in SDV.

Y-602 (p. 180-181) and Y-955 (p. 1, 10-11) suggested that SDV extends at least 20 km south of the Avawatz Mountains beneath Holocene sediments in Silver Lake Valley to the southern Halloran Hills. If true, then the total length of SDV would be about 85 km.

Y-479 (p. 934) speculated that SDV may extend >160 km (100 miles) southeast from the Avawatz Mountains through a series of aligned valleys. This interpretation would make SDV about 200 km long.

Southern Death Valley fault (SDV) — Continued

Y-612 (p. 530-531) proposed that SDV extends about 250 km southeast of the Avawatz Mountains along northwest–striking faults to the Big Maria, Little Maria, and Riverside mountains, which are just north of Blythe, California, along the Colorado River. If true, SDV would be about 300 km long. However, Y-592 (p. 27, 31) concluded that subsequent work has revealed that the northwest–striking faults southeast of the Avawatz Mountain are overlain by latest Miocene and Pliocene sediments (Bouse Formation) and are, thus, too old to be correlative with SDV, which has had recurrent Quaternary displacement. For example, Y-592 noted that Grose (1959, Y-1360) portrayed SDV as joining the Soda–Avawatz fault zone in the Soda Mountains west of Baker, California. However, Y-592 (p. 29) concluded that SDV is not related to this fault zone because of differences in age, inferred displacement history, and geologic relationships. He (Y-592, p. 29) further concluded that SDV cannot correlate to northwest–striking faults in the Bristol Mountains farther to the southeast, because late Tertiary or early Quaternary fanglomerates unconformably overlie these faults, which are expressed as sheared granite and Tertiary sedimentary and volcanic rocks. These northwest–striking faults, instead, may be a southeastern extension of the Soda–Arrastre Spring fault zone (Y-592, p. 29). On the basis of these observations and similar ones on faults to the southeast to the Colorado River, Y-592 (p. 31) concluded that SDV does not extend southeast of the southern Death Valley area and that SDV "dies out beneath Quaternary deposits north of Silver Lake."

SDV may extend north of Cinder Hill along the front of the Black Mountains south of Mormon Point. Y-216 (p. 17-18, pl. 4) recognized little geomorphic evidence for lateral displacement between Mormon Point and Cinder Hill (their Gregory Peak and North Ashford Mill sections). However, Y-473 (p. 436) reported striations that plunge about 30° NW. on fault surfaces along this section of the Black Mountains and interpreted these striations as indicating right–lateral displacement. In addition, Y-429 (p. 8, fig. 3e, locality 11) noted that a drainage about 9 km south of Mormon Point has been right–laterally deflected about 170 m. If SDV does extend to near Mormon Point, then the length of the fault would be increased by about 12 km.

Style of faulting: Displacement on SDV has been predominantly right–lateral (Y-473, p. 436). Y-468 (p. 157) interpreted displaced streams as indicating right–lateral displacement. Y-216 (p. 17-18, pl. 4) suggested that the *en echelon*, left–stepping pattern of some fault scarps near the Amargosa River north of Ashford Mill between Cinder Hill and Shore Line Butte (their South Ashford Mill section) indicates a component of right–lateral displacement. Y-248 (p. 25) reported that the two strands of SDV that bound the Confidence Hills appear to be left–stepping, right–lateral faults and concluded that the folds in the Confidence Hills are a result of transpression between these two strands. However, Y-992 (p. 14) found, on the basis of paleomagnetic data, that the lake sediments that compose the Confidence Hills have not undergone net tectonic rotation. Y-429 (p. 4) suggested that SDV has a minor vertical component of displacement.

Displacement on the western subzone of SDV of Y-472 (p. 402) between the Confidence Hills and the southern Owlshead Mountains has been predominantly right–lateral strike–slip. Displacement on the eastern subzone of Y-472 (p. 407) has been both lateral and vertical.

Scarp characteristics: Y-429 (p. 9, fig. 3f, locality 15) reported that a scarp at the southern end of the Confidence Hills is 1.8 m high and has a maximum slope angle of 28°.

Displacement: Estimates of right–lateral displacement on SDV range between 1.2 m and about 50 km. These estimates are based on a variety of stratigraphic and structural markers of different ages, as discussed in the following paragraphs in order of decreasing age of the displaced unit.

Y-468 (p. 157) interpreted the distribution of Precambrian Pahrump Series as indicating a minimum of about 19 km (12 miles) of right–lateral displacement on SDV.

Y-389 (p. 56) thought that the distribution of the Precambrian Pahrump Series on opposite sides of Death Valley suggested right–lateral displacement of 24 to 48 km (15 to 30 miles) on SDV.

Y-602 (p. 130, 191) estimated that the total lateral displacement across the Noble Hills is less than 10 to 12 km.

Southern Death Valley fault (SDV) — Continued

Y-479 (p. 947) inferred that the total right–lateral displacement on the northern part of SDV could be no more than 8 km (5 miles). This was based on trends of formational contacts (e.g., the intersection of the lower contact of the Precambrian Kingston Peak Formation with an unconformity at the base of the overlying Noonday Dolomite) and isopach data. However, Y-592 (p. 29) pointed out that of the eight stratigraphic sections used by Y-479, only one is west of SDV, so that in general "the trend and therefore the offset of isopachs west of the fault zone is indeterminate."

Y-612 (p. 530-531) recontoured the isopach data used by Y-479 and concluded that SDV had experienced 50 km of right–lateral displacement and that single faults have displacements of 2 to 15 km each (*cited in* Y-472 (p. 404) and *in* Y-592 (p. 27, 29)).

On the basis of bedrock exposures in the area between SDV and the east–striking Garlock fault, Y-593 (p. 1413) found no evidence for large lateral displacement at the eastern end of the Garlock fault where it crosses SDV; they estimated that the displacement of the Garlock fault by SDV has been limited to about 8 km.

Y-592 (p. 29, 31) concluded that "considerable geologic evidence" suggests that the maximum lateral displacement on SDV has been about 8 km.

On the basis of observations on faults southeast of the Avawatz Mountains to the Colorado River, Y-592 (p. 31) concluded that SDV "diminishes in lateral displacement southeast of the northeastern corner of the Avawatz Mountains."

Y-955 (p. 2) concluded, on the basis of structural and sedimentological evidence, that the minimum right–lateral displacement across SDV during the Pliocene and Pleistocene is 20 km. He also concluded that the amount of deformation increases from northwest to southeast along the Noble Hills and that the greatest displacement in this area is on the eastern traces of SDV (Y-955, p. 2).

Y-602 (p. 130, 191) estimated that one trace of SDV on the eastern side of the Noble Hills has had at least 8 km of right–lateral displacement during the Quaternary.

Y-472 (p. 406) concluded that about 35 km of right–lateral displacement has occurred at the southern end of the Owlshead Mountains along their western subzone. This was estimated by matching remnants of alluvial–fan deposits (their QTf unit; fig. 4, p. 404-405) with their source to the northwest. Gravel clasts in the alluvial–fan deposits are composed of two rock types (pebble conglomerate of the late Precambrian Kingston Peak Formation and Paleozoic carbonate rocks) for which the closest source is Warm Spring Canyon. (They ruled out sedimentary processes alone as explaining the configuration of the remnants that they observed.) They could not determine the age of the alluvial–fan deposits (Y-472, p. 406). An earlier estimate by Y-603 (p. 26, 92-93), made on the basis of these same alluvial–fan deposits, was 20 to 35 km of lateral displacement for the western subzone of SDV. He (Y-603, p. 28) suggested that this displacement had occurred between about 10.7 Ma and slightly less than 1 Ma. An amount of right–lateral displacement that was estimated geometrically by Y-603 (p. 93-94, fig. 25) using a pull–apart model of Y-471 agreed with the value estimated using the alluvial–fan deposits.

Y-955 (p. 4, 10) reported that clasts in a granite–bearing conglomerate on the eastern side of the Noble Hills were derived from the Owlshead Mountains 8 km to the northwest. The conglomerate was moved to its present position by right–lateral displacement on SDV, so that 8 km is the minimum amount of right–lateral displacement on an eastern trace of SDV at Denning Spring Wash in the Noble Hills since the clasts were deposited (Quaternary?).

Y-603 (p. 27) reported lateral displacement of about 4 to 13 km along a trace in the western subzone of SDV. This amount of displacement is based on the correlation of alluvial–fan deposits that contain volcanic debris.

Y-401 (p. 989) noted right–lateral displacement of "several hundred feet" on a fault trace that parallels the Confidence Hills anticline along the crest of the Confidence Hills. This amount of displacement was interpreted from northeastward–draining stream channels that are sharply deflected in a right–lateral direction where they cross the fault (Y-401, p. 989). Y-401 (p. 989) noted vertical as well as right–lateral displacement on this trace.

Southern Death Valley fault (SDV) — Continued

Y-472 (p. 407) noted that right–lateral displacement across two fault traces at the northern end of their eastern subzone has been "on the order of a few hundred meters." This estimate is from a small cinder cone (called Cinder Hill by Y-424), whose conical structure has been displaced by these traces (Y-424, p. 9). Y-603 (p. 30, 99) estimated about 200 m of right–lateral displacement of Cinder Hill. Y-603 (p. 26) reported a maximum lateral displacement of "on the order of several hundred meters" for their eastern subzone and a maximum vertical displacement of about 100 m for this subzone. These displacements have occurred since 700 ka to 900 ka.

Y-401 (p. 988-989) concluded that northwest–striking fault traces in southern Death Valley between Shore Line Butte (his Shoreline Hill) and Ashford Mill displace (laterally?) Quaternary alluvium commonly not more than 15 m (50 ft), which is much less than the amounts of displacement he noted in the underlying Funeral Formation.

Y-955 (p. 9-10) estimated that late Pleistocene–early Holocene (8 ka to 15.5 ka; table 1, p. 5) alluvial–fan deposits (his Qf2 unit) near Pipeline Wash in the Noble Hills in the northern Avawatz Mountains have a cumulative lateral displacement of <0.5 km on western traces of SDV. This estimate is based on the inference that "dioritic" clasts included in the deposits were probably derived from the eastern Avawatz Mountains.

Y-429 (p. 9, fig. 3f, locality 14) reported that a drainage along the southwestern side of the Confidence Hills adjacent to Contact Canyon in the Owlshead Mountains (the western subzone of Y-472 and Y-603) has been displaced right–laterally 360 m. Y-429 also noted that a smaller drainage at this same locality is displaced right–laterally 30 m.

Y-429 (p. 9, fig. 3g, locality 16) noted that a drainage along a trace of SDV with southern Death Valley (the eastern subzone of Y-472 and Y-603) has been displaced right–laterally 1.2 m in each of two surface ruptures. Directly east of this locality on another trace of SDV, Y-429 (p. 9, fig. 3g, locality 17) reported 27 m of right–lateral deflection of an entrenched drainage and 3 m of right–lateral displacement of a smaller drainage.

Age of displacement: The youngest displacement on at least part of SDV may be Holocene. Y-1020 portrayed displacement on some traces as Holocene (<10 ka) as indicated by sag ponds, uneroded scarps, displaced stream channels, and shutter ridges, some of which are on surfaces thought to be Holocene. Y-427 (table 1, p. 18) described SDV as "moderately to well defined by side–hill troughs, benches, and right–laterally deflected drainages." Displacement on other traces are shown by Y-1020 as late Quaternary (<700 ka) or Quaternary (<1.6 Ma).

Y-602 (p. 127) reported that the eastern branch of SDV between Pipeline Wash and Cave Spring Wash in the northern Avawatz Mountain cuts Quaternary alluvial–fan deposits (his Qf2 unit with an estimated age of early Holocene to late Pleistocene, 8 ka to 15.5 ka; table 1, p. 101) and is expressed as a series of right–stepping shutter ridges. Although Y-602 recognized that this displacement could be as young as 8 ka, he (Y-602, p. 130) speculated that most of the displacement in this area occurred between 1 Ma and 2 Ma.

Y-401 (p. 960) reported that alluvial–fan deposits east of Sheep Creek Spring at the base of the northeastern side of the Avawatz Mountains are displaced by "recent faults."

Y-429 (p. 9) interpreted a maximum angle of 28° on a 1.8–m–high scarp preserved on an alluvial surface as suggesting Holocene displacement on SDV at the southern end of the Confidence Hills.

Y-429 (p. 10, fig. 3f, locality 20) reported that SDV along the northeastern side of the Noble Hills is expressed as scarps and tonal lineaments on young alluvial surfaces, indicating some Holocene displacement on this part of the fault.

Along the eastern side of the southern Avawatz Mountains, bedrock is faulted over late Pleistocene or early Holocene (8 ka to 15.5 ka) alluvial–fan deposits (his Qf1 and Qf2 units; Y-955, p. 6).

Y-429 (p. 8, fig. 3e, locality 13) reported fault scarps and a side–hill trough in the basalt on Shore Line Butte that are "considerably sharper and "fresher" than adjacent Pleistocene shorelines and may truncate those shorelines." These geomorphic features align with scarps on late Pleistocene alluvial surfaces south of Shore Line Butte (Y-429, p. 8).

Southern Death Valley fault (SDV) — Continued

Quaternary displacement on the northern end of the eastern subzone of Y-472 and Y-603 is recorded by uplifted and tilted basalt flows on Shore Line Butte and by right–lateral displacement of Cinder Hill about 2 km north of Shore Line Butte (Y-401, p. 989; Y-472, p. 407; Y-473, p. 436). The basalt flows on Shore Line Butte have been radiometrically (K–Ar) dated at 1.5 Ma (Y-424, p. 5, *citing* R. Drake, personal commun., 1979). The andesite that forms Cinder Hill yielded a date (K–Ar) of 0.69 Ma (Y-424, p. 5, *citing* R. Drake, personal commun., 1979).

Y-955 (p. 5) noted that the Pleistocene (>15.5 ka) alluvial fans (his Qf1 unit) on the eastern and northern sides of the Avawatz Mountains have been deformed and uplifted, as well as deeply dissected. The fans have also prograded northward, partially burying the Saddleback and Ibex Hills and deflecting the course of the Amargosa River. He (Y-955, p. 6) attributed these characteristics to uplift of the Avawatz Mountains that occurred during and shortly after deposition of the alluvial fans.

Y-472 (p. 406) speculated that all displacement on their western subzone occurred between about middle Miocene and 1 Ma. The older estimate is based on two dates (K–Ar) on volcanic rocks (10.66 ± 0.28 Ma and 12.66 ± 1.04 Ma; *they cite* R.E. Drake, written commun., 1982) and an assumption that the onset of faulting and volcanism are coeval (Y-472, p. 406). The younger estimate is based on relationships that suggest that faulting ceased before old alluvial–fan gravels (their Qf2 unit) were deposited and a tephra just below the gravels that has been radiometrically (K–Ar) dated at 0.62 ± 0.52 Ma (*they cite* R.E. Drake, written commun., 1983) and that is magnetically reversed (0.73 Ma to 0.90 Ma or 0.97 Ma to 1.14 Ma) (Y-472, p. 407). Y-602 (p. 130) concluded that displacement on SDV was probably initiated at the same time that Death Valley began to form.

Folding and faulting of the lake beds that compose the Confidence Hills also indicate Quaternary displacement on SDV, because these lake beds are thought to be 2 Ma (Y-246), 1.5 Ma (Y-424), or younger (Y-248, p. 25). Detailed work utilizing paleomagnetics and tephrochronology led Y-991 (p. 3) to conclude that these lake sediments were deposited between at least 2.2 Ma and <1.5 Ma.

Y-424 portrayed SDV across Shore Line Butte and in the northern Confidence Hills (the eastern subzone(?) of Y-472) as displacing Quaternary gravel, their Qg1 deposits, which are deeply dissected and slightly deformed, and their Qg2 deposits, which are moderately dissected and undeformed. The Qg1 gravels were probably deposited between <1.5 Ma and >0.69 Ma, because Qg1 gravels abut a basalt tentatively correlated with the basalt on Shore Line Butte (1.5 Ma) and because tephra from the eruption forming Cinder Hill (0.69 Ma) overlies the eroded surface of the Qg1 gravels. Y-424 also showed SDV in this area as also displacing older deposits, Pliocene and Pleistocene Funeral Formation (their QTfc and QTfs units) and the volcanic rocks at Shore Line Butte and Cinder Hill. The map by Y-424 shows traces of SDV in this area as concealed by younger Quaternary gravels (their Qg3 unit), which are undeformed and relatively undissected. North–northwest–striking fault traces north of the Amargosa River are portrayed by Y-424 as displacing the Qg3 gravels.

Y-955 (p. 2) reported that SDV along the Noble Hills consists of six main branches along which Cenozoic sediments have been tectonically juxtaposed against crystalline basement rocks. Displacement on these branches has formed the Noble Hills, with the youngest displacement on the eastern branches (Y-955, p. 8).

Because Y-602 (p. 130) thought that the age of Death Valley is constrained by the age of the Furnace Creek Formation, which is suggested by Y-390 (p. A59) to have a maximum age of 5 Ma, he speculated that initial displacement on SDV occurred about 5 Ma.

Slip rate: Y-603 (p. 29) concluded that the average apparent right–lateral slip rate on the western subzone of SDV adjacent to the Owlshead Mountains is about 2 to 3 mm/yr based on 20 to 35 km of displacement that he thought occurred between about 10 Ma and 1 Ma.

Y-603 (p. 30) inferred an average apparent right–lateral slip rate on the eastern subzone of SDV of about 0.3 mm/yr based on his estimate of a maximum lateral displacement of 200 m at Cinder Hill, which has been dated at about 700 ka.

Using the observations by Y-955 (p. 9-10, table 1) that early Holocene to late Pleistocene (8 ka to 15.5 ka) alluvial–fan deposits are displaced laterally <0.5 km, a maximum apparent lateral slip rate of 32 to 63 mm/yr can be estimated for SDV in the Noble Hills.

Southern Death Valley fault (SDV) — Continued

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Compilation of published and unpublished literature (Y-427, p. 8). Summary of published and unpublished data (Y-427, p. 8; Y-429, p. 1-5). Interpretation of aerial photographs (Y-427, p. 8; Y-429, p. 5, scales 1:12,000 for low–sun–angle photographs, 1:20,000, and 1:24,000 for vertical aerial photographs; Y-599, p. 108, scale 1:18,000; Y-602, p. 3, scale ~1:14,500; Y-991, p. 5). Geologic mapping at a scale of 1:24,000 (Y-429, p. 5; Y-472, p. 402; Y-602, p. 3; Y-991, p. 5). Reconnaissance geologic mapping or field checking (Y-429, p. 5-6; Y-592, p. 27, 29). Geologic mapping (Y-602, p. 3-4). Detailed cross sections and longitudinal profiles of the Amargosa River and associated terraces using a Leitz B-4 level and tape (Y-599, p. 108). Paleomagnetic sampling and measurements (Y-992, p. 12-14). Detailed surveying (Y-603, p. 5). Gravity profiles (Y-602, p. 4). Seismic refraction data (Y-602, p. 4).

Relationship to other faults: Y-600 (fig. 1, p. 132, 135) portrayed SDV (his Death Valley fault zone) as joining his Furnace Creek fault zone at the northern end of the Black Mountains and becoming what he called the Death Valley–Furnace Creek fault zone (the Furnace Creek fault (FC) of this compilation).

Y-471 (p. 440) proposed that right–lateral displacement on both SDV (their Death Valley fault zone) and the northwest–striking Furnace Creek fault (FC; their Death Valley–Furnace Creek fault zone) to the north has resulted in tension that caused the two sides of Death Valley to pull apart along a north trend forming the deep trough of the present Death Valley.

Y-468 (p. 159) suggested that SDV intersects the left–lateral, east–striking Garlock fault just west of Sheep Creek in the northeastern corner of the Avawatz Mountains. Because the area of their intersection is covered by alluvium and their angle of intersection is acute, "it is impossible to be certain whether one fault zone is cutting the other or whether they are contemporaneous" (Y-468, p. 159). In contrast, Y-593 (p. 1,413-1,415) proposed that the Garlock fault must cross SDV and continue to the east, either terminating beneath Quaternary alluvium in Kingston Wash or merging with what they called the Nopah Range frontal fault. Y-602 (p. 188) concluded that SDV most likely steps eastward at the Garlock fault (specifically the Mule Spring fault zone) and is buried beneath alluvium. These relationships are discussed in detail in Y-602 (primarily p. 185-188).

Y-472 (p. 410) postulated that the differences in type and age of displacement that are noted on their two subzones of SDV between Cinder Hill and the southern end of the Owlshead Mountains may be related to interactions between SDV and the Garlock fault to the south. Y-472 (p. 410) suggested that, as the Avawatz Mountains are thrust eastward along a branch of the Garlock fault, SDV is deflected eastward such that the most recent activity on SDV would shift from the western subzone to the eastern subzone.

Spotted Range faults (SPR)

Plate or figure: Plates 1 and 2.

References: Y-671: Guth, 1990; Y-813: Reheis, 1992 (pl. 3); Y-852: Dohrenwend and others, 1991.

Location: 59 km/104° (distance and direction of closest point from YM) at lat 36°42'N. and long 115°48'W. (location of closest point). SPR is located primarily along the western side of Spotted Range. SPR also includes a fault along the western side of an unnamed ridge about 3 km west of the western front of the Spotted Range and two relatively short faults within the range.

USGS 7-1/2' quadrangle: Indian Springs NW, Mercury NE, Quartz Peak NW, Quartz Peak SW.

Fault orientation: The fault along the range front strikes generally north at the northern end of the Spotted Range and strikes generally north–northeast at the southern end of the range. The fault along the unnamed ridge west of the Spotted Range strikes slightly more easterly than does the range–front fault (Y-813). Faults within the Spotted Range curve but generally strike north–northeast or north (Y-813).

Fault length: The range–front fault is 20 km (Y-852) to 30 km (Y-813) long. The fault along the unnamed ridge is 9 km (Y-852) to 12 km (Y-813) long. The two faults within the range are 4 km and 7 km long.

Style of faulting: Displacement on portions of the faults within the range is portrayed by Y-813 as down to the west.

Scarp characteristics: Major portions of all faults of SPR are shown by Y-813 as scarps. These are primarily west–facing.

Displacement: No information.

Age of displacement: The range–front fault is portrayed by Y-852 as juxtaposing Quaternary alluvium against bedrock. Portions of this fault are shown by Y-813 as scarps on both Quaternary and Tertiary surfaces.

The fault along the unnamed ridge is portrayed by Y-813 as scarps on Quaternary surfaces (primarily) and on Tertiary surfaces.

The faults within the Spotted Range are shown by Y-813 both as faults that are in Tertiary deposits and that were identified from previous mapping and as lineaments along a linear front or in bedrock. These faults are indicated by Y-852 to be faults that juxtapose Quaternary alluvium against bedrock.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: The range–front fault has been shown by Y-852 as juxtaposing Quaternary alluvium against bedrock, but not as a major range–front fault. The morphology of the western front of the Spotted Range would be similar to that along a major range–front fault and may be characterized by "fault juxtaposition of Quaternary alluvium against bedrock, fault scarps and lineaments on surficial deposits along or immediately adjacent to range front, a general absence of pediments, abrupt piedmont–hillslope transitions, steep bedrock slopes, faceted spurs, wineglass valley, and subparallel systems of high–gradient, narrow, steep–sided canyons orthogonal to range front" (Y-852). However, SPR would be significantly less extensive and fault scarps would be substantially lower, shorter, and less continuous than those along a major range–front fault (Y-852). Portions of this fault, as well as the faults in the range, have been shown by Y-813 as topographic lineaments along a linear range front.

Analysis: Aerial photographs (Y-813, p. 4, scales 1:62,500 to 1:80,000; Y-852, scale 1:58,000).

Relationship to other faults: The relationship of SPR to the northeast–striking Rock Valley fault (RV) west of SPR; to the north– and north–northwest–striking West Pintwater Range fault (WPR) and the East Pintwater Range fault (EPR) east of SPR; and to the northeast– and east–striking Mercury Ridge faults (MER), Crossgrain Valley faults (CGV), South Ridge faults (SOU), or Cactus Springs fault (CAC), all south of SPR, is not clear.

Spotted Range faults (SPR) — Continued

The southern end of the Spotted Range (along with the southern end of the Pintwater Range to the east) bends to the southwest as it approaches the east-striking faults (e.g., CAC, CGV, MER, SOU). These east–striking faults have been interpreted by Y-813 (p. 5) to be part of the Las Vegas shear zone, which was inferred by Stewart (1988, Y-888) to separate two sections of the Walker Lane: the Spotted Range–Mine Mountain section on the north from the Spring Mountains section on the south. SPR, as a range–bounding fault, correspondingly bends and appears to merge with either the east–striking faults or perhaps with the northeast–striking, left–lateral faults (e.g., RV), which have been interpreted by Y-813 (p. 5) to be part of the Spotted Range–Mine Mountain section.

Stagecoach Road fault (SCR)

Plate or figure: Figure 3.

References: Y-9: Fox and Carr, 1989; Y-26: Swadley and others, 1984 (possibly their Fault I); Y-31: Scott and Whitney, 1987; Y-46: Maldonado, 1985 (shows SCR as a concealed fault from west of Yucca Mountain to possibly extending northeast across Jackass Flats and correlating with a fault in Tertiary volcanic rocks in the Calico Hills); Y-55: Scott and Bonk, 1984; Y-189: Lipman and McKay, 1965 (show SCR as concealed except for a trace in Tertiary volcanic rocks along the eastern side of Busted Butte; extend SCR northeast to Fortymile Wash; neither section is shown on fig. 3 of this compilation); Y-194: McKay and Sargent, 1970; Y-224: Frizzell and Shulters, 1990; Y-238: Reheis and Noller, 1991 (pl. 3); Y-396: Scott, 1990; Y-575: Whitney and Muhs, 1991 (their Paintbrush Canyon–Stagecoach Road fault system, which they subdivided into five segments); Y-1042: O'Neill and others, 1992 (name from their pl. 1); Y-1182: Simonds and Whitney, 1993.

Location: 10 km/180° (distance and direction of closest point from YM) at lat 36°44′N. and long 116°27′W. (location of closest point). SCR is located along the northwestern side of unnamed hills south of the Middle Crest of Yucca Mountain and southwest of Busted Butte.

USGS 7-1/2′ quadrangle: Lathrop Wells, Busted Butte.

Fault orientation: SCR strikes generally northeast (Y-189; Y-224; Y-396; Y-1042) or north–northeast (Y-1042, p. 13). It is the only major northeast–striking fault in the immediate vicinity of Yucca Mountain (Y-1042, p. 8). SCR where it is exposed north of Old Stage Coach Road dips west (Y-1042, p. 13).

Fault length: The length of SCR is 12 km as estimated from Y-55. It is about 9 km long as estimated from Y-189, but SCR extends to the southern edge of their map area at lat 36°45′N. The portion of SCR that is shown by Y-46 as a concealed trace from west of Yucca Mountain to the western edge of Jackass Flats is about 13 km long. Y-46 continued SCR northeastward another 7 km across Jackass Flats as a concealed trace and an additional 11 km northeast of that as both a fault in volcanic rocks in the Calico Hills and as a concealed trace in the basin north of the hills. Thus, the total length of SCR as portrayed by Y-46 is 31 km.

Y-1182 (p. A-141) reported that the length of Quaternary rupture along SCR is 4.3 km. The length of SCR as shown by Y-1042 (pl. 1) and determined from the fault's expression on aerial photographs is about 4.5 km, but SCR extends to the southern edge of their map area. Fault I of Y-26, which may correspond with SCR, is nearly 3 km long as estimated from their plate 1.

Style of faulting: Y-46, Y-55, and Y-189 all portrayed displacement on SCR as down to the southeast. Y-46 also noted that SCR has left–lateral displacement. Y-575 (p. A119) and Y-1042 (p. 17) both noted slickenlines with rakes as great as 47°. These slickenlines are exposed on Tertiary fault breccia and are interpreted by them to indicate left–lateral–oblique slip on SCR. Y-575 (p. A119) and Y-1042 (p. 20) both recognized deflected and displaced stream channels that suggest left–lateral–oblique displacement.

Scarp characteristics: No information.

Displacement: Y-31 (p. 332) noted that drainages on Quaternary bedrock pediments and on Quaternary surfaces are displaced 10 m to 30 m across SCR. They also identified as much as 1 km of left–lateral displacement of ridges formed on a 13–Ma tuff (Y-31, p. 332).

On the basis of tectonic tilt of volcanic units (Paintbrush Tuff of 13.5 Ma to 13 Ma and Timber Mountain Tuff of 11.5 Ma), Y-396 (table 2, p. 275) indicated 6.7 km of vertical displacement on SCR between 13 Ma and 11.5 Ma, 3.3 km of vertical displacement since 11.5 Ma, and 4.6 m of vertical displacement since some time after 1.7 Ma.

Stagecoach Road fault (SCR) — Continued

Age of displacement: Several features suggest Quaternary displacement on SCR. Y-1042 (p. 8, 10) noted that SCR is not well defined on aerial photographs, but identified topographic lineaments and linear tonal changes along Old Stage Coach Road. These lineaments are continuous with well–developed scarps further south. Y-31 (p. 332) recognized displaced drainages on surfaces of Quaternary bedrock pediments and Quaternary deposits. Y-26 (table 4, p. 21) inferred that the youngest rupture on their Fault I (part of SCR?) occurred between 700 ka and 2 Ma because early Pleistocene and latest Pliocene alluvium with an estimated age of 1.1 Ma to 2 Ma (their QTa deposits, fig. 3, p. 9) is displaced, but middle Pleistocene eolian sand with an estimated age of 700 ka to 750 ka (their Q2e deposits, fig. 3, p. 9) is not displaced.

Slip rate: Y-396 (table 2, p. 275) estimated an apparent vertical slip rate of >0.003 mm/yr for SCR during all or part of the Quaternary (some time after 1.7 Ma).

Using the maximum 1 km of left–lateral displacement of ridges of 13–Ma volcanic tuff, which was noted by Y-31 (p. 332), the apparent lateral slip rate on SCR since 13 Ma is 0.08 mm/yr.

Y-396 (table 2, p. 275) calculated an apparent vertical slip rate on SCR of 0.45 mm/yr between 13 Ma and 11.5 Ma. This rate assumes that 6.7 km of vertical displacement occurred during this 1.5–million–yr interval. Y-396 (table 2, p. 275) also reported an apparent vertical slip rate of 0.029 mm/yr since 11.5 Ma. This rate assumes that 3.3 km of vertical displacement occurred since 11.5 Ma and that Cenozoic displacement rates occurred in a step–wise manner in which rates sharply decreased about 11.5 Ma (Y-396, p. 273).

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Compilation of published and unpublished information (Y-26, p. 1). Lineament analyses using low–sun–angle aerial photographs (Y-1042, p. 2, scale 1:12,000) and conventional aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000). Surficial mapping and field investigations (Y-26, p. 3; Y-1042, p. 2). Analysis of stream patterns (Y-575, p. A119).

Relationship to other faults: The northeast strike of SCR contrasts with the predominant north strike of faults in the Yucca Mountain area. SCR may merge on the north with the north–striking Paintbrush Canyon fault (PBC) north of Busted Butte (Y-31, p. 332, their Busted Butte–Paintbrush Canyon normal fault zone; Y-575, p. A119; Y-1042, p. 8; Y-1182, p. A-141). Y-1042 (p. 8) noted tonal contrasts on alluvial surfaces directly north of Old Stage Coach Road. These lineaments trend northeastward between SCR and the west side of Busted Butte, so that Y-1042 (p. 8) suggested that the lineaments may reflect buried fault traces that link SCR and PBC. Y-9 (fig. 3, p. 41) and Y-575 (p. A119) also inferred a connection between SCR and PBC (the Paintbrush Canyon–Stagecoach Road fault system of Y-575). Y-396 (p. 265) reported that his detailed mapping suggests that SCR probably projects to the east–northeast along the west side of Busted Butte and connects with PBC. The above interpretations contrast with interpretations of previous workers (Y-46, Y-189, and Y-194) in which SCR was extended to the northeast along southern side of Busted Butte.

Y-1042 (p. 10) suggested that PBC may continue southward and connect to a reverse fault cutting Busted Butte. Y-1182 (p. A141) speculated that SCR could be a continuation of an eastern splay of the Solitario Canyon fault (SC).

Y-31 (p. 332) suggested that the combined fault zone of PBC and SCR may form an arcuate breakaway zone related to a detachment fault underlying the Yucca Mountain area. They noted that the steep, west–dipping, north–striking normal faults in the upper plate of this detachment die out along SCR on the south and against northwest–striking, right–lateral strike–slip faults near Yucca Wash on the north (Y-31, p. 332).

Y-1042 (p. 17) reported that slickenlines along SCR plunge more steeply than those along PBC, which they interpreted to indicate a larger component of dip slip along SCR than along PBC. Y-396 (p. 269) concluded that extension progressively increases to the south in the Yucca Mountain area, which is apparently supported by the field observations of Y-1042 (p. 17).

State Line fault (SL)

Plate or figure: Figure 1.

References: Y-415: Jennings, 1985 (his fault #7, p. 144-145, Kingman sheet, information from Y-893); Y-742: Hewett, 1954; Y-743: Hewett, 1954 (pl. 1, shows an unnamed fault along the border between Nevada and California; Y-893: Hewett, 1956 (name from his pl. 2); Y-1020: Jennings, 1992; Y-1105: MIT Field Geophysics Course, 1985.

Location: 130 km/155° (distance and direction of the closest point from YM) at lat 35°40'N. and long 115°30'W. (location of closest point). SL is approximately parallel with the border between Nevada and California, and extends from the southern end of Mesquite Valley, across State Line Pass, and along the northeastern side of Ivanpah Valley.

USGS 7-1/2' quadrangle: Desert, Nipton, Ivanpah Lake, Mesquite Lake, Roach, Stateline Pass.

Fault orientation: SL has a northwest, but slightly curving, strike (Y-893, pl. 1). Y-893 (p. 55-56) noted that SL in State Line Pass strikes N. 55° W. and dips 70° SW.

Fault length: The length of SL between State Line Pass and near Nipton, California, is 32 km as estimated from Y-743 (pl. 1) and Y-893 (pl. 1).

Style of faulting: Displacement along SL is shown as down–to–the–southwest dip slip (Y-743, pl. 1; Y-893, pl. 1, p. 106). This style of displacement is thought to be the reverse of that of older displacements along SL (Y-893, p. 105). Y-893 (p. 55-56, fig. 15) noted that "local features suggest that [SL] was originally a steep thrust fault along which later movement in the reverse direction has exceeded the original displacement." Y-1105 (p. 8685, 8689) inferred a large component of strike–slip displacement along SL on the basis of (1) the linearity of the fault, (2) its expression on aerial photographs, and (3) the apparent continuity between an inferred escarpment on the northeastern side of Mesquite Valley and the northwest–striking, right–lateral Pahrump fault (PRP).

Scarp characteristics: No information.

Displacement: Y-893 (p. 105) noted that the youngest displacements downdropped the southwestern side of SL nearly 610 m (2,000 ft). Apparent vertical separation of pre–Tertiary rocks across the steep escarpment along the northeastern side of Mesquite Valley and interpreted by Y-1105 to be an extension of SL is >3,500 m (Y-1105, p. 8689). This estimate is based on a maximum depth of 2 to 3 km to pre–Tertiary rocks beneath Mesquite Valley as interpreted from geophysical data and the elevations of the surrounding mountains (Y-1105, p. 8689).

Age of displacement: Y-742 (p. 18) concluded that normal faults bounding Ivanpah Valley (1) are younger than an upland surface in the eastern Mojave region (which he calls the "Ivanpah upland"), and (2) are probably younger than basalt flows overlying this upland. He inferred that the upland was eroded and that the basalts were extruded during the middle Pleistocene (Y-742, p. 18), so that displacement on SL would be younger than this. Y-893 (pl. 2) showed SL, along with other faults in and near Ivanpah Valley, as a "late Tertiary and Recent [Holocene] normal fault." Y-893 (p. 106) suggested that displacement along SL possibly coincided with downwarping of Mesquite Valley, which he thought occurred recently. A 2.5–km–long section at the northern end of SL is shown by Y-893 (pl. 1) as a faulted contact between pre–Tertiary (Mississippian and Pennsylvanian) rocks and Quaternary alluvium (his Qal deposits). Y-1020 noted that SL shows some evidence of displacement during the Quaternary (since 1.6 Ma as defined by him).

In contrast, the map of Y-893 (pl. 1) shows most of SL as concealed by Quaternary alluvium (his Qal deposits). Y-1105 (p. 8689) concluded that the "absence of obvious topographic expression of this [range–bounding] fault in Mesquite Valley [an inferred extension of SL] suggests that most of the slip probably occurred before Holocene or even late Quaternary time."

Slip rate: No information.

Recurrence interval: No information.

State Line fault (SL) — Continued

Range-front characteristics: No range front is associated with most of SL. Y-743 (pl. 1) portrayed the southern 24 km of SL as a "fault inferred from aligned range fronts that are discordant with structural features in hard rocks within the ranges."

Analysis: Field examination (Y-743, p. 15; Y-893). Interpretation of aerial photographs (Y-743, p. 15). Analyses of gravity data (Y-1105, p. 8685). Electrical resistivity profiles (Y-1105, p. 8685, 8688). Magnetotelluric measurements (Y-1105, p. 8689).

Relationship to other faults: Ivanpah Valley, along which part of SL is located, is bounded by the northwest–striking, down–to–the–northeast Ivanpah fault on the southwest and by the north–striking McCullough fault on the east (Y-893, p. 105). SL approximately parallels the Ivanpah fault within Ivanpah Valley and is located about 11 km to the northeast of this fault (Y-893, pl. 1). Y-743 (p. 18) suggested that the floor of Ivanpah Valley approximately coincides with a block that has been downdropped about 6,100 m (about 20,000 ft). The dip–slip displacement along the Ivanpah fault is estimated to be 2,440 m (8,000 ft) or greater at its southern end, and the dip–slip displacement along the McCullough fault is estimated to be 6,100 m (20,000 ft) (Y-893, p. 18, 105). Y-893 (p. 8) noted that a physiographic or structural change occurs in Ivanpah Valley. This change, which is approximately coincident with the Ivanpah fault, is expressed as a transition from nearly north–trending linear ranges and valleys typical of the Basin and Range province to the northeast to isolated, generally variously trending mountains and ridges of diverse form to the southwest. The coincidence of this change with the Ivanpah fault implies that the fault is a major geologic structure in the region. The structural relationship between the Ivanpah fault and SL is not known.

The northwest–trending Mesquite Valley located just northwest of Ivanpah Valley is not bounded by faults as is the Ivanpah Valley. However, Y-893 (p. 103, 106) noted that Mesquite Valley coincides with a downwarp, which is indicated by the trace of the Mesquite thrust fault and the attitude of the Resting Spring Formation (late Pliocene and Pleistocene). Y-1105 (p. 8685) suggested that "no clearly active, range–bounding normal faults" exist in Mesquite Valley and that "the surrounding topography is more subdued than in regions farther west or north." SL aligns with the axes of both the Mesquite and Pahrump valleys (Y-1105, p. 8685). SL is presumed by Y-1105 (p. 8685, 8689) to have formed a steep, buried escarpment on the northeastern side of Mesquite Valley. The buried escarpment, which probably slopes at least 45° and could be vertical, is inferred by Y-1105 (p. 8685) from a steep gradient in gravity data at this location.

Stonewall Flat fault (SWF)

Plate or figure: Plate 1.

References: Y-238: Reheis and Noller, 1991 (pl. 1); Y-853: Dohrenwend and others, 1992. Not shown by Albers and Stewart, 1972 (Y-407) nor by Cornwall, 1972 (Y-232).

Location: 101 km/322° (distance and direction of closest point from YM) at lat 37°34'N. and long 117°08'W. (location of closest point). SWF is located primarily along the northwestern side of Stonewall Flat southeast of its junction with the Goldfield Hills. The southern portion of SWF is located along the northwestern side of the Cuprite Hills.

USGS 7-1/2' quadrangle: East of Goldfield, Goldfield, Montezuma Peak SE, Ralston, Stonewall Spring.

Fault orientation: SWF strikes generally northeast (Y-238; Y-853).

Fault length: The total length of SWF is about 22 km as estimated from Y-238. This length includes a section of SWF in Stonewall Flat that is about 13 km long and a section along the northwestern side of the Cuprite Hills that is 9 km long. The length of SWF is 5 km as estimated from Y-853 with individual traces that are 1 to 2 km long.

Style of faulting: Displacement on several fault traces at the eastern side of SWF is shown by Y-238 to be both down to the northwest and down to the southeast.

Scarp characteristics: Scarps associated with SWF are shown as primarily southeast–facing by Y-853 and as both northwest– and southeast–facing by Y-238.

Displacement: No information.

Age of displacement: The youngest portions of SWF are portrayed by Y-853 as scarps on depositional or erosional surfaces of latest Pleistocene and (or) Holocene age (their Q_{2-3} surfaces with estimated ages of 30 ka or younger). Other portions of SWF are shown by Y-853 to be on depositional or erosional surfaces of early to middle and (or) late Pleistocene age (their Q_{1-2} surfaces with estimated ages between 10 ka and 1.5 Ma). SWF is shown by Y-238 as weakly expressed to prominent lineaments and scarps on surfaces of Quaternary deposits and as fault traces that are in Quaternary deposits and that were recognized from previous mapping.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No range front is associated with most of SWF. The southern 9 km of SWF bounds the northwestern side of the Cuprite Hills. The characteristics of this front are not known. Y-238 (pl. 1) shows part of SWF as a topographic lineament bounding a linear range front or within bedrock.

Analysis: Aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000; Y-853, scales 1:115,000 to 1:124,000 and 1:58,000). Limited field reconnaissance (Y-238, p. 3).

Relationship to other faults: SWF is approximately parallel to other north–northeast– or northeast–striking major range–bounding faults west of Cactus Flat, such as the Montezuma Range fault (MR) along the western side of the Montezuma Range northwest of SWF, the Clayton Ridge–Paymaster Ridge fault (CRPR) along the western sides of Clayton and Paymaster ridges northwest of SWF, the Bonnie Claire fault (BC) bounding a highland west of Bonnie Claire Lake south of SWF, the East Magruder Mountain fault (EMM) along the eastern side of Magruder Mountain southwest of SWF, and the Lida Valley faults (LV) along the southeastern side of the Palmetto Mountains southwest of SWF. SWF is also approximately parallel to northeast–striking faults within basins, such as the Clayton–Montezuma Valley fault (CLMV) within an unnamed valley between Clayton Ridge and the Montezuma Range northwest of SWF, the Palmetto Mountains–Jackson Wash faults (PMJW) within an unnamed valley northeast of the Palmetto Mountains west of SWF, and the Clayton Valley fault (CV) within Clayton Valley northwest of SWF (Y-238; Y-853). The structural relationships among all these faults are not known.

Stonewall Flat fault (SWF) — Continued

SWF has a slightly more northerly strike than does the Stonewall Mountain fault (SWM) along the northern side of Stonewall Mountain east of SWF. SWF has a more easterly strike than the Mud Lake–Goldfield Hills fault (MLGH) along the northern end of the Goldfield Hills and across Mud Lake directly north of SWF. The structural relationships among these faults are not known.

Stonewall Mountain fault (SWM)

Plate or figure: Plate 1.

References: Y-10: Reheis and Noller, 1989; Y-232: Cornwall, 1972; Y-238: Reheis and Noller, 1991 (pl. 1); Y-813: Reheis, 1992 (pl. 1); Y-853: Dohrenwend and others, 1992; Y-1071: Weiss and others, 1993.

Location: 92 km/330° (distance and direction of closest point from YM) at lat 37°33'N. and long 116°58'W. (location of closest point). SWM is located along the northwestern end of Stonewall Mountain. It extends east of Stonewall Mountain to east of Civet Cat Canyon.

USGS 7-1/2' quadrangle: Civet Cat Cave, Pack Rat Canyon, Ralston, Stonewall Spring.

Fault orientation: SWM strikes northeast and east–northeast (Y-238; Y-813; Y-853). At the southwestern end of SWM, exposed fault traces dip 65° NW. (Y-232) and 70° NW. to 90° (Y-10, p. 58).

Fault length: The length of SWM is shown as 10 km (Y-232), 13 km (Y-853), and 22 km (Y-238; Y-813). Y-238 and Y-813 portrayed SWM as three overlapping traces. The northern one is 11 km long; the central one is 4 km long; and the southern one is 18 km long. The southern trace has a north branch about 4 km long. Short traces, each 1 to 1.5 km long, are also mapped by Y-813, especially at the northeastern end of SWM.

Style of faulting: Displacement on most of SWM is down to the northwest; a few short sections (1 to 1.5 km long) are shown as down to the southeast (Y-238; Y-813; Y-853). Y-813 (p. 8) reported slickenlines that indicate dip–slip displacement, but Y-10 (p. 58) noted crenulations and slickenlines within bedrock shear zones that suggest left–lateral oblique displacement at the southwestern end of SWM. Y-10 (p. 58) suggested that high–angle (70°) reverse movement may have also occurred along part of SWM, because Tertiary rhyolite tuff has apparently been thrust over alluvium at one locality.

Scarp characteristics: No information.

Displacement: No information.

Age of displacement: A short portion of SWM is portrayed by Y-853 as abrupt and well–defined scarps on Quaternary depositional or erosional surfaces of late Pleistocene age (their Q_2 surfaces with estimated ages between 10 ka and 130 ka). Another section is shown by Y-853 to have scarps on depositional or erosional surfaces of early to middle and (or) late Pleistocene age (their $Q_{1\text{-}2}$ surfaces with estimated ages between 10 ka and 1.5 Ma). The rest of SWM is shown by both Y-232 and Y-853 as a fault juxtaposing Quaternary alluvium against bedrock. Portions of SWM is portrayed by Y-238 and Y-813 as weak to prominent lineaments or scarps on surfaces of Quaternary deposits. Y-813 (p. 7) noted that faults and scarps are abrupt and that some scarps occur on surfaces of late Quaternary deposits.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Stonewall Mountain along SWM is noted by Y-853 to have characteristics (e.g., a general absence of pediments, abrupt piedmont–hillslope transitions, steep bedrock slopes, faceted spurs, wineglass valleys, subparallel systems of high–gradient, narrow, steep–sided canyon perpendicular to range front) similar to those along major range–front faults except that SWM is less extensive. Short sections of SWM are shown by Y-813 to be expressed as topographic lineaments bounding a linear range front.

Analysis: Aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000; Y-813, p. 4, scales 1:62,500 to 1:80,000; Y-853, scales 1:115,000 to 1:124,000 and 1:58,000).

Stonewall Mountain fault (SWM) — Continued

Relationship to other faults: SWM is one of several northeast–striking fault west of Cactus Flat and east of Fish Lake Valley (Y-238; Y-813). Most of these faults bound the northwestern sides of ranges, such as the Grapevine Mountains fault (GM) along the western side of the Grapevine Mountains south of SWM, the Bonnie Claire fault (BC) that bounds the hills west of Bonnie Claire Flat south of SWM, the Gold Mountain fault (GOM) along the western side of Gold Mountain southwest of SWM, and the southeastern fault in Lida Valley (LV) along the northwestern side of Magruder Mountain west of SWM (Y-238, p. 4). Some of the northeast–striking faults bound the southeastern sides of ranges, such as the East Magruder Mountain fault (EMM) along the eastern side of Magruder Mountain and the northwestern fault in Lida Valley (LV) along the southeastern side of the Palmetto Mountains, both west of SWM (Y-238, p. 4). Faults with this orientation are also present within valleys, such as the Clayton Valley fault (CV) northwest of SWM, the Stonewall Flat fault (SWF) directly west of SWM, and the Palmetto Mountains–Jackson Wash faults (PMJW) west of SWM (Y-10, p. 58; Y-238, p. 3).

Y-238 (p. 4) speculated that the northeast–striking faults in the area surrounding SWM could be conjugate shears to the northwest–striking Furnace Creek fault (FC). However, on the basis of the limited field work completed by them and others, Y-238 (p. 3) noted that the evidence for the left–lateral displacement that would be expected if the northeast–striking faults are conjugate shears has not been documented. Alternatively, Y-238 (p. 3) suggested that these faults could be an expression of dip–slip displacement perpendicular to a northwest direction of least principal stress. On the basis of the fairly consistent down–to–the–northwest displacement along the northeast–striking, range–bounding and intrabasin faults east of the FC and west of Pahute Mesa, Y-10 (p. 60) inferred that these fault could be rooted in a detachment fault at depth.

SWM is perpendicular to the Sarcobatus Flat fault (SF), which is along the western side of Stonewall Mountain and Pahute Mesa south of western end of SWM (Y-238; Y-853). Y-238 (pl. 1) shows the southwestern end of the east–northeast–striking SWM as curving to a nearly north strike and aligning with SF. Both SF and SWM correlate with a boundary that was noted by Y-1071 (fig. 2, p. 355) to separate a western area that has undergone marked deformation since middle Miocene (includes Death Valley) and an eastern area that has undergone little deformation since middle Miocene (includes the southwestern Nevada volcanic field). Y-1071 (p. 362) noted that the "prominent west–facing scarps south of Stonewall Mountain, forming the west edge of Pahute Mesa [SF], mark the eastern limit of [a] period of faulting [that occurred after deposition of the 7.6–Ma Spearhead Member of the Stonewall Flat Tuff] and define the eastern margin of the Sarcobatus Flat structural basin." The western half of SWM bounds the northern side of the Stonewall Mountain volcanic center (Y-1071, fig. 2).

Stumble fault (STM)

Plate or figure: Plate 1.

References: Y-25: Ekren and others, 1977 (name from their pl. 3; show a single, concealed fault trace that approximately corresponds with STM as portrayed by Y-813); Y-404: Tschanz and Pampeyan, 1970; Y-813: Reheis, 1992 (pls. 1 and 2).

Location: 74 km/47° (distance and direction of closest point from YM) at lat 37°18'N. and long 115°50'W. (location of closest point). STM is located along the western side of the Groom Range at its junction with northern Emigrant Valley.

USGS 7-1/2' quadrangle: Cattle Spring, Groom Mine, White Blotch Springs, White Blotch Springs SE.

Fault orientation: The southern half of STM (south of about Cattle Spring) is a single trace that strikes north–northeast (Y-813). The northern half of STM is curving, is composed of four strands, and strikes generally north to north–northwest (Y-813).

Fault length: The length of STM is about 31 km as estimated from Y-813 and about 33 km as estimated from Y-25. The length of STM is only about 21 km as estimated from Y-404 (pl. 3), but their map shows only the southern part of the fault.

The width of the northern half of STM, where it is composed of four strands, is nearly 8 km as estimated from Y-813.

Style of faulting: Displacement on STM has been down to the west (Y-25; Y-404; Y-813).

Scarp characteristics: Scarps associated with STM are west–facing (Y-813).

Displacement: No information.

Age of displacement: STM is portrayed by Y-813 primarily as faults that are in Quaternary deposits and that were identified by previous mapping. Parts of the fault are also shown by Y-813 to be weakly to moderately expressed lineaments and scarps on surfaces of Quaternary deposits. In contrast, STM is shown by Y-25 as concealed by Holocene to Pliocene alluvium and colluvium (their QTa deposits) and by Y-404 as inferred in or concealed by Quaternary and Tertiary gravel and alluvium (their QT deposits).

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Parts of STM are shown by Y-813 as topographic lineaments bounding a linear range front.

Analysis: Aerial photographs (Y-404, p. 2, scale 1:60,000; Y-813, p. 4, scales 1:62,500 to 1:80,000). Field mapping (Y-404, p. 2). Compilation of structural and stratigraphic information (Y-25).

Relationship to other faults: STM is approximately parallel to faults along the eastern side and within the Groom Range (the Groom Range East fault (GRE) and the Groom Range Central fault (GRC), respectively). STM is also parallel to the fault that bounds the western side of the Jumbled Hills southeast of the Groom Range (the Jumbled Hills fault (JUM)).

STM is nearly perpendicular to the northeast–striking southern end of the Penoyer fault (PEN) directly north of STM. STM is oblique to the east–northeast–striking Tem Piute fault (TEM) northeast of STM and the northeast–striking fault traces in northern Emigrant Valley (the Emigrant Valley North fault (EVN)) west of STM. The strikes of fault traces at the northern end of STM change from north–northwest adjacent to Cattle Spring to north–northeast or northeast at the northern end of the Groom Range. This change in strike could be the result of influence by the southern part of PEN and perhaps TEM, both of which are along the southeastern edge of Sand Spring Valley immediately north of the Groom Range.

Stumble fault (STM) — Continued

Y-813 (p. 6) suggested that fault traces in northern Emigrant Valley (EVN of this compilation) transfer displacement from the north–striking Yucca fault (YC) in Yucca Flat northeastward across Emigrant Valley to faults along the Groom Range (STM of this compilation).

Sylvania Mountains fault (SYL)

Plate or figure: Plate 1.

References: Y-238: Reheis and Noller, 1991 (pl. 2). Not shown by Dohrenwend and others, 1992 (Y-853).

Location: 111 km/300° (distance and direction of closest point from YM) at lat 37°22'N. and long 117°30'W. (location of closest point). SYL is located within the Sylvania Mountains between Cucomungo Spring at the head of Cucomungo Canyon on the west and the mouth of Tule Canyon on the east.

USGS 7-1/2' quadrangle: Last Chance Mountain, Magruder Mountain, Sylvania Mountains, Tule Canyon.

Fault orientation: SYL strikes generally east, but the trace curves slightly so that portions of SYL strike either northeast or northwest (Y-238).

Fault length: The length of SYL is about 14 km as estimated from Y-238.

Style of faulting: No information.

Scarp characteristics: A portion of SYL is shown by Y-238 as north–facing scarps.

Displacement: No information.

Age of displacement: SYL is shown by Y-238 as weakly to moderately expressed scarps or lineaments on surfaces of Quaternary deposits.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Parts of SYL are portrayed by Y-238 as lineaments along a linear highland.

Analysis: Aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000).

Relationship to other faults: SYL is in an area of the Sylvania Mountains where Y-238 (pl. 2) shows possible tectonic lineaments in granitic rocks. SYL has a more easterly strike than the trends of these lineaments. In addition, SYL is the only lineament in the area that is shown by Y-238 to exhibit scarps or lineaments on surfaces of Quaternary deposits (and thus is the only one shown on pl. 1 of this compilation). These lineaments are interpreted by Y-238 (p. 4), on the basis of field observations, to represent compressional shear zones. It is not known if SYL has a similar origin.

The eastern end of SYL nearly intersects both the southern end of the northeast–striking East Magruder Mountain fault (EMM) north of SYL and the northern end of the north–striking Tule Canyon fault (TLC) south of SYL. SYL is oblique to the northwest–striking Furnace Creek fault (FC) in the Last Chance Range southwest of SYL. SYL is approximately parallel to and approximately aligns with the east–striking Slate Range faults (SLR), which are located about 15 km east of SYL across Lida Valley. The structural relationships among these faults are not known.

Tem Piute fault (TEM)

Plate or figure: Plate 1.

References: Y-25: Ekren and others, 1977 (show a concealed fault trace to the north of the one shown on plate 1 of this compilation, which is taken from Y-1032; trace of Y-25 has a more westerly strike than the one of Y-1032 and it nearly intersects the Penoyer fault (PEN)); Y-404: Tschanz and Pampeyan, 1970 (name from their pl. 3); Y-1032: Schell, 1981 (pl. 9; table A2, fault #94, his Tempiute fault).

Location: 101 km/35° (distance and direction of closest point from YM) at lat 37°34'N. and long 115°45'W. (location of closest point). TEM is located along the northern side of the western Timpahute Range.

USGS 7-1/2′ quadrangle: Monte Mountain, Mount Irish, White Blotch Springs NE.

Fault orientation: TEM strikes generally east–northeast (Y-25; Y-404).

Fault length: The length of TEM is 8 km as estimated from Y-404 and 22 km as estimated from Y-25 and as noted by Y-1032 (table A2, p. A18).

Style of faulting: Displacement on TEM is shown as left–lateral, strike slip by Y-25 and as down–to–the–north dip slip by Y-404 (pl. 3).

Scarp characteristics: No information.

Displacement: No information.

Age of displacement: The probable age of the youngest displacement along TEM as noted by Y-1032 (table A2, p. A18) is indeterminate, but suspected of being Quaternary. Scarps are prominent, but the age of youngest displacement along TEM could not be determined by him because of the lack of young stratigraphic units along the fault (Y-1032, table A2, p. A18). The youngest unit that he noted as being displaced is Paleozoic rocks (Y-1032, table A2, p. A18). The oldest unit not displaced is his intermediate–age alluvial–fan deposits (Y-1032, table A2, p. A18) with an estimated age of 15 ka to probably about 200 ka (table 3, p. 23).

Y-25 portrayed one short (about 1.5–km–long) section of TEM as juxtaposing pre–Tertiary sedimentary rocks against Holocene to Miocene older gravels (their QTg deposits), but showed a 16–km–long section along the western end of TEM as concealed by these gravels. Y-404 portrayed TEM as a post–Laramide structure and showed a 2.5–km–long section as a faulted contact between Devonian or Pennsylvanian rocks and Pliocene(?) and Pleistocene(?) older gravels (their QTg deposits). They also showed a 6–km–long section as concealed by QTg deposits.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Aerial photographs (Y-25; Y-404, p. 2, scale 1:60,000; Y-1032, p. 15, scales ~1:25,000 and ~1:60,000). Field reconnaissance (Y-1032, p. 17-18). Field mapping (Y-404, p. 2). Gravity analysis (Y-1032, p. 16). Magnetometer surveys (Y-1032, p. 16-17). Compilation of structural and stratigraphic information (Y-25).

Relationship to other faults: TEM may be the surface expression of the east–trending Timpahute lineament. The eastern end of TEM may include two east–northeast–striking fault traces, a northern one with left–lateral displacement (Y-25; Y-404) and a southern one with right–lateral displacement (Y-25). The relationship between these two fault traces and TEM is not known.

The western end of TEM nearly intersects the curving, northeast–striking Penoyer fault (PEN) located along the eastern and southeastern sides of Sand Spring Valley immediately north of TEM and the north– to north–northeast–striking Groom Range Central fault (GRC) located within the Groom Range south of TEM. The structural relationships among these faults are not known.

Three Lakes Valley fault (TLV)

Plate or figure: Plate 1.

References: Y-404: Tschanz and Pampeyan, 1970 (pls. 2 and 3, show only the northwestern 4 km of TLV); Y-813: Reheis, 1992 (pl. 2, shows only the northwestern portion of TLV west of the eastern edge of her map area at long 115°30′W.). Not shown by Dohrenwend and others, 1991 (Y-852), but TLV as mapped by Y-813 is north of their map area, which does not extend north of lat 37°N. However, a straight portion of the Desert Range front suggests that TLV could continue south of this latitude and into the area mapped by Y-852. TLV is not shown by Ekren and others, 1977 (Y-25).

Location: 84 km/68° (distance and direction of closest point from YM) at lat 37°07′N. and long 115°34′W. (location of closest point). TLV is located along the eastern side of northern Three Lakes Valley and along part of the western side of the Desert Range.

USGS 7-1/2′ quadrangle: Desert Hills SW, Fallout Hills NE, Southeastern Mine.

Fault orientation: TLV strikes northwest (Y-404; Y-813).

Fault length: The length of TLV is 9 km as estimated from Y-813, but the fault intersects the eastern edge of her map area at long 115°30′W. The continued linearity of the range front east of this point suggests that TLV may extend southeastward of its location as shown on plate 1 of this compilation. The length of this additional linear section is about 18 km, so that the total length of TLV could about 27 km.

TLV consists of two traces, each about 4 km long and separated by 1–km–long zone that lacks surficial expression (Y-813).

Style of faulting: Displacement along TLV is shown by Y-813 as down to the southwest.

Scarp characteristics: No information.

Displacement: No information.

Age of displacement: The northwestern 4 km of TLV is shown by Y-813 as a fault that is in Tertiary deposits and that was identified by previous mapping. Y-404 portrayed this portion of TLV as a post–Laramide structure that displaces pre–Tertiary rocks. The southeastern 4 km of TLV is shown by Y-813 as a lineament along a linear range front or within bedrock. This lineament is interpreted by Y-813 (p. 4) to suggest Quaternary fault displacement.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: A portion of the western side of the Desert Range adjacent to Three Lakes Valley and TLV is portrayed by Y-813 as linear.

Analysis: Aerial photographs (Y-404, p. 2, scale 1:60,000; Y-813, p. 4, scales 1:62,500 to 1:80,000). Field mapping (Y-404, p. 2).

Relationship to other faults: The northwestern end of TLV nearly intersects the north– to northeast–striking North Desert Range fault (NDR). Y-813 (pl. 2) suggests that a 0.5–km–long, concealed section of TLV continues northwestward to NDR. The southeastern end of TLV nearly intersects a north–striking fault in pre–Tertiary or Tertiary rocks within the Desert Range. This fault is tentatively included with the Tikaboo fault (shown as TK? on pl. 1 of this compilation). The structural relationships among these faults are not known.

Tikaboo fault (TK)

Plate or figure: Plate 1.

References: Y-25: Ekren and others, 1977 (show only one short trace at the southern end of TK); Y-404: Tschanz and Pampeyan, 1970 (pls. 2 and 3; show only one 5–km–long trace near the southern end of TK); Y-813: Reheis, 1992 (pl. 2); Y-1032: Schell, 1981 (pl. 9; name from his table A2, fault #136; does not show all the fault traces that are shown by Y-813 along the western side of Tikaboo Valley).

Location: 92 km/62° (distance and direction of closest point from YM) at lat 37°13′N. and long 115°32′W. (location of closest point). TK is located in central and western Tikaboo Valley.

USGS 7-1/2′ quadrangle: Crescent Reservoir, Cutler Reservoir, Desert Hills NW, Fallout Hills NE, Groom Range, Groom Range NE, Groom Range SE.

Fault orientation: TK strikes north–northwest (Y-813; Y-1032). Individual fault traces strike between north–northeast and northwest (Y-813; Y-1032).

Fault length: The length of TK is 33 km as estimated from Y-25 and Y-813. The length of TK is noted to be 10 km by Y-1032 (table A2, p. A25). TK is composed of several subparallel or branching strands. TK is up to 10 km wide (Y-813; Y-1032).

Style of faulting: Displacement along several traces of TK are shown by Y-25 and Y-813 as primarily down to the east.

Scarp characteristics: Scarps associated with TK are shown by Y-813 primarily as east–facing. A few scarps are portrayed by her as west–facing.

Displacement: No information.

Age of displacement: The probable age of the youngest displacement along TK is noted by Y-1032 (table A2, p. A25) as Holocene and late Pleistocene (defined as <700 ka by Y-1032, p. 29). This is probably along a fault trace in the central part of Tikaboo Valley. The youngest units displaced are his young–age and intermediate–age alluvial–fan deposits, undifferentiated (A5y/A5i; Y-1032, table A2, p. A25) with an estimated age of probably about 200 ka or younger (table 3, p. 23). However, Y-1032 (table A2, p. A25) noted that the age of the displaced units is uncertain. The oldest unit not displaced by TK is his young–age alluvial–fan deposits (A5y; Y-1032, table A2, p. A25) with an estimated age of 15 ka or younger (table 3, p. 23). The oldest unit displaced is his intermediate–age alluvial–fan deposits (A5i; Y-1032, table A2, p. A25) with an estimated age of 15 ka to probably about 200 ka (table 3, p. 23).

Traces in TK are shown by Y-813 as weakly expressed scarps and lineaments on surfaces of Quaternary deposits, as lineaments bounding linear range fronts or within bedrock, as weakly to moderately expressed lineaments or scarps on surfaces of Tertiary deposits, and as faults that are in Quaternary and Tertiary deposits and that were identified from previous mapping. Y-25 portrayed a 3.5–km–long fault trace at the southern end of TK (east of long 115°30′W.) as cutting Holocene to Pliocene alluvium and colluvium (their QTa deposits). The 5–km–long section of TK shown by Y-404 is portrayed either as displacing older Quaternary alluvium (their Qol deposits) or as displacing this alluvium against younger Tertiary volcanic rocks (their Tvy unit). Y-404 (p. 85) noted that because faults in Tikaboo Valley (includes TK?) cut Pliocene and early Quaternary valley fill, they are some of the youngest normal faults in Lincoln County.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No information.

Tikaboo fault (TK) — Continued

Analysis: Aerial photographs (Y-404, p. 2, scale 1:60,000; Y-813, p. 4, scales 1:62,500 to 1:80,000; Y-1032, p. 15, scales ~1:25,000 and ~1:60,000). Field reconnaissance (Y-1032, p. 17-18). Field mapping (Y-404, p. 2). Gravity analysis (Y-1032, p. 16). Magnetometer surveys (Y-1032, p. 16-17). Compilation of structural and stratigraphic information (Y-25).

Relationship to other faults: The map by Y-25 shows a north–northwest–striking fault trace immediately south of Tikaboo Valley in the Desert Range. This trace crosses the divide between Tikaboo Valley and Three Lakes Valley and is shown by Y-25 as concealed by Holocene to Pliocene alluvium and colluvium (their QTa deposits). Y-813 also shows a fault trace at this location. She portrayed this trace as a fault that was recognized from previous mapping and as a lineament suspected of signaling Quaternary fault displacement. Displacement on this trace is shown as both down to the east and down to the west. It is not known whether or not this trace (labeled TK? on pl 1 of this compilation) is part of TK. The southern end of this trace nearly intersects the northwest–striking Three Lakes Valley fault (TLV) in northern Three Lakes Valley.

TK is approximately parallel to other north– to northwest–striking faults in the region, such as the North Desert Range fault (NDR) along the western side of the northern Desert Range immediately west of TK; the Jumbled Hills fault (JUM) along the western side of the Jumbled Hills west of TK; the Groom Range East fault (GRE), the Groom Range Central fault (GRC), and the Stumble fault (STM) along the sides of and within the Groom Range west of the northern part of TK; and the East Pintwater Range fault (EPR), the Central Pintwater Range fault (CPR), and the West Pintwater Range fault (WPR) along the sides of and within the Pintwater Range southwest of TK.

Short (<2 km long) lineaments and scarps have been mapped by Y-813 and Y-1032 to the east of TK in the central part of the Tikaboo Valley. The relationship between these lineaments and scarps and TK is not known.

Tin Mountain fault (TM)

Plate or figure: Plates 1 and 2.

References: Y-216: Brogan and others, 1991 (pl. 1C); Y-238: Reheis and Noller, 1991 (pl. 2); Y-239: Reheis, 1991 (pl. 1; name from this reference); Y-697: Zhang and others, 1990.

Location: 90 km/275° (distance and direction of closest point from YM) at lat 36°55′N. and long 117°27′W. (location of closest point). TM is located along the western side of the Cottonwood Mountains between Ubehebe Crater on the north and Lost Burro Gap on the south.

USGS 7-1/2′ quadrangle: Dry Mountain, Last Chance Range SE, Teakettle Junction, Tin Mountain, Ubehebe Crater, White Top Mountain.

Fault orientation: TM strikes north to north–northeast. TM is shown by Y-238 and Y-239 as several subparallel traces generally at the base of the range front, but also as short traces extending into the unnamed valley west of the front.

Fault length: The length of TM is about 29 km as estimated from Y-238 and Y-239.

Style of faulting: Displacement along TM is shown by Y-239 (pl. 1) as down to the west. Displacements have apparently been dip–slip only (Y-239, p. 3).

Scarp characteristics: Scarps associated with TM are portrayed by Y-238 and Y-239 as primarily west–facing.

Displacement: No information.

Age of displacement: Most of TM is portrayed by Y-239 as relatively prominent scarps or lineaments on surfaces of Quaternary deposits. Scarps or lineaments at the northern end of TM are shown as weakly to moderately expressed on surfaces of Quaternary deposits (Y-238). The central part of TM is portrayed by Y-239 as a fault that is in Quaternary deposits and that was identified from previous mapping.

TM cuts one landslide along the front of the Cottonwood Mountains southwest of Tim Mountain and is concealed by another large landslide along the range front near Quartz Spring (Y-239, pl. 1, p. 3).

Fault scarps that are mapped by Y-216 (pl. 1C) southwest of Ubehebe Crater and that may be associated with TM are noted by Y-216 to be mantled by unfaulted ash deposits.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Short portions of TM are shown by Y-239 as topographic lineaments bounding a linear range front.

Analysis: Aerial photographs (Y-216, p. 3, scale ~1:12,000 (low–sun–angle photographs); Y-238, p. 2, scales 1:24,000 to 1:80,000; Y-239, p. 2, scales 1:24,000 and 1:80,000).

Relationship to other faults: TM extends northward from and has a strike similar to that of the fault along the eastern side of Racetrack Valley (part of the Racetrack Valley faults (RTV) of this compilation). TM could be related to, possibly an extension of, this fault. TM is separated from the eastern fault of RTV by an *en echelon* right step at Lost Burro Gap just north of Racetrack Valley. TM and the eastern fault of RTV together extend from the northwest–striking Hunter Mountain fault (HM) on the south to the northwest–striking Furnace Creek fault (FC) on the north. The northern end of TM nearly intersects FC in northern Death Valley.

Tolicha Peak fault (TOL)

Plate or figure: Plate 1.

References: Y-813: Reheis, 1992 (pl. 2). Not shown by Cornwall, 1972 (Y-232) nor by Dohrenwend and others, 1992 (Y-853).

Location: 42 km/320° (distance and direction of closest point from YM) at lat 37°08'N. and long 116°45'W. (location of closest point). TOL is located along the southwestern side of Pahute Mesa and Tolicha Peak.

USGS 7-1/2' quadrangle: Springdale, Springdale NE, Tolicha Peak.

Fault orientation: TOL strikes generally north–northwest.

Fault length: The total length of TOL is about 22 km as estimated from Y-813. This length includes overlapping traces that are about 8 km long at the northern end of TOL along Tolicha Peak. These traces are separated from traces to the southeast by a 7–km–long gap in surficial expression. The southeastern end of TOL consists of three traces that have a total length of 7 km.

Style of faulting: Displacement on one trace at the southern end of TOL is portrayed by Y-813 as down to the southwest. One trace of TOL that crosses Tolicha Peak is shown by Y-813 to have right–lateral, oblique displacement.

Scarp characteristics: Scarps associated with TOL are shown by Y-813 as primarily west–facing. One scarp at the southern end of TOL is shown by her to be east–facing.

Displacement: No information.

Age of displacement: TOL is shown by Y-813 as moderately expressed to prominent lineaments or scarps on surfaces of Quaternary deposits, especially along the southwestern side of Tolicha Peak. Traces at the southeastern end of TOL are portrayed by Y-813 as weakly to moderately expressed lineaments or scarps on surfaces of Quaternary deposits. Y-813 (p. 7) concluded that the subdued character of north–northwest– and northwest–striking fault traces that bound the western edge of Pahute Mesa (includes TOL?) suggests that little to no Quaternary displacement has occurred on these faults.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Characteristics of the western edge of Pahute Mesa adjacent to TOL are not reported.

Analysis: Aerial photographs (Y-813, p. 4, scales 1:62,500 to 1:80,000).

Relationship to other faults: TOL is parallel to and overlaps the southern end of the Sarcobatus Flat fault (SF) that bounds the northwestern edge of Pahute Mesa. TOL has a slightly more westerly strike than the north–striking faults on Pahute Mesa (the Pahute Mesa faults (PM) of this compilation) north of TOL and in Oasis Valley (the Oasis Valley faults; OSV) south of TOL. The structural relationships among these faults are not known.

Towne Pass fault (TP)

Plate or figure: Plate 2.

References: Y-29: Hamilton, 1988; Y-222: Streitz and Stinson, 1974; Y-239: Reheis, 1991 (pls. 1 and 2); Y-390: Hunt and Mabey, 1966 (pl. 1); Y-427: Hart and others, 1989; Y-458: Hall, 1971 (shows only the southern 13 km of TP, that part west of long 117°15′W.; name from this reference, pl. 1, p. 57); Y-763: Bryant, 1989; Y-906: MIT 1985 Field Geophysics Course and Biehler, 1987; Y-916: Wernicke and others, 1986; Y-1020: Jennings, 1992 (his fault #245).

Location: 76 km/244° (distance and direction of closest point from YM) at lat 36°33′N. and long 117°12′W. (location of closest point). TP is located along the western sides of Tucki Mountain and Pinto Peak in the Panamint Range between Death Valley on the north and Panamint Valley on the south.

USGS 7-1/2′ quadrangle: Emigrant Canyon, Emigrant Pass, Nova Canyon, Panamint Butte, Stovepipe Wells.

Fault orientation: TP strikes north–northeast (Y-239). Y-222 indicated two traces of TP that are separated by an *en echelon* left step near Towne Pass. Y-458 (p. 57) noted dips of 45° W. to 80° W. on TP near Towne Pass.

Fault length: The length of TP is 38 km as estimated from Y-239 (pls. 1 and 2) from north of about Wildrose Canyon in Panamint Valley to north of Tucki Mountain along Emigrant Wash in Death Valley.

Style of faulting: Displacement along TP is shown by Y-239 and noted by Y-390 (p. A114) and Y-458 (p. 57) as down to the west. Y-458 (p. 57) reported that he observed no evidence for lateral displacement on TP.

Scarp characteristics: Scarps associated with TP are portrayed by Y-239 as west–facing.

Displacement: Y-390 (p. A114) reported displacement on TP of at least 153 m (500 ft). Y-458 (p. 57-58) noted at least 2,380 m (7,800 ft) of displacement on TP and concluded that displacement on TP has accounted for most of the elevation of the Panamint Range southeast of Towne Pass. This amount of displacement is also reported by Y-427 (table 1, p. 22) and by Y-763 (p. 13).

Age of displacement: Most of TP is portrayed by Y-239 as prominent lineaments or scarps on surfaces of Quaternary deposits where a fault in Quaternary deposits was identified from previous mapping. The map by Y-458 (pl. 1) shows a 4–km–long section of TP near Towne Pass as a faulted contact between Ordovician or Mississippian rocks on the east and one of the following on the west: Quaternary alluvium (his Qal deposits), Quaternary alluvial–fan deposits (his Qf1 deposits), or Quaternary and Tertiary alluvial–fan deposits (his QTf2 deposits). Y-427 (table 1, p. 22) noted beheaded drainages, which he thought suggested latest Pleistocene to Holocene displacement on TP. Y-1020 showed one short section of TP as Holocene, but the rest as having Quaternary displacement (since 1.6 Ma as defined by him). Y-763 (p. 13) reported that TP juxtaposes Paleozoic bedrock against Pliocene–Pleistocene fanglomerates and, locally, Holocene alluvium.

Y-222 showed the northern part of TP as juxtaposing Holocene alluvium on the west against Pliocene and (or) Pleistocene nonmarine rocks on the east. The northern end of TP east of Emigrant Wash along Tucki Mountain is shown by Y-390 (pl. 1) as being concealed by upper Pleistocene alluvial–fan gravel (their Qg_3 deposits).

Y-222 indicated that the southern end of TP north of Wildrose Canyon is concealed by Pliocene and (or) Pleistocene nonmarine rocks and juxtaposes Pliocene nonmarine rock against Pliocene and (or) Pleistocene nonmarine rocks. The very southern part of TP that is shown by Y-458 (pl. 1; just west of long 117°15′W.) is portrayed by him as displacing Pliocene alluvial–fan deposits (his Tf3 unit) against Quaternary and Tertiary alluvial–fan deposits (his QTf2 deposits). In contrast, Y-427 portrayed the southern end of TP as having Holocene displacement.

The map by Y-458 (pl. 1) shows additional north–northwest–striking faults near Nova Canyon west of the Panamint Range front (part of TP?). These faults displace Pliocene alluvial–fan deposits (his Tf3 deposits) and Quaternary and Tertiary alluvial–fan deposits (his QTf3 deposits).

Towne Pass fault (TP) — Continued

Y-458 (p. 58) suggested that most of the displacement on TP is older than an overlying, unfaulted late Pliocene basalt.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: A 7–km–long, north–striking section south of Towne Pass has been portrayed by Y-239 (pl. 2) as a topographic lineament bounding a linear range front.

Analysis: Aerial photographs (Y-239, p. 2, scales 1:24,000 to 1:80,000). Compilation of existing data (Y-763). Field examination (Y-458).

Relationship to other faults: Y-29 and Y-239 (p. 2; *citing* Y-916) suggested that TP along the western side of Tucki Mountain may be a northern continuation of the Panamint Valley fault (PAN). Y-458 (p. 58) stated that TP extends about 48 km (30 miles) south of Towne Pass, through Wildrose graben, and along the eastern side of Panamint Valley to the Slate Range, an extension that would include PAN.

The north–striking Emigrant fault (EM) as shown by Y-239 appears to intersect TP along the northern side of Tucki Mountain.

TP in the vicinity of Nova Canyon parallels the Nova fault of Y-458 (pl. 1). This fault is about 13 km (8 miles) long, dips 45° W. to 85° W., has dip–slip (normal) displacement, has an estimated 610 m (2,000 ft) of west–side–down displacement, displaces Pliocene through Quaternary alluvial–fan deposits (his Tf3, QTf3, and Qf1 deposits), and is concealed by Holocene alluvium (Y-458, p. 58).

The structural relationships among these faults are not known.

Tule Canyon fault (TLC)

Plate or figure: Plate 1.

References: Y-216: Brogan and others, 1991 (pl. 1B; show scarps and lineaments that may be a southern extension of TLC east of Sand Spring in Death Valley); Y-238: Reheis and Noller, 1991 (pl. 2); Y-853: Dohrenwend and others, 1992. Not shown by Albers and Stewart, 1972 (Y-407).

Location: 104 km/295° (distance and direction of closest point from YM) at lat 37°14'N. and long 117°30'W. (location of closest point). TLC is located at the western end of Slate Ridge, and along and east of Tule Canyon. Its southern end may extend into Death Valley.

USGS 7-1/2' quadrangle: Gold Point SW, Lida, Magruder Mountain, Tule Canyon.

Fault orientation: TLC strikes generally north–northeast (Y-238; Y-853). The southern end of TLC strikes north to north–northwest.

Fault length: The length of TLC is 10 km as estimated from Y-853 and about 14 km as estimated from Y-238. These lengths are for the north–northeast–striking fault traces north of the mouth of Oriental Wash at the eastern edge of Death Valley. If the north– and north–northwest–striking traces in Death Valley south of Oriental Wash are included, the length of TLC would be about 26 km as estimated from Y-238 and Y-853.

Style of faulting: Displacement along traces of TLC is shown by Y-238 (pl. 2) as primarily down to the west.

Scarp characteristics: Scarps associated with TLC are shown by Y-216, Y-238, and Y-853 as both east–facing and west–facing.

Displacement: No information.

Age of displacement: TLC is portrayed by Y-853 as scarps on depositional or erosional surfaces of early to middle and (or) late Pleistocene age (their Q_{1-2} deposits with estimated ages between 10 ka and 1.5 Ma). TLC is shown by Y-238 as weakly expressed to prominent lineaments and scarps on surfaces of Quaternary deposits. At its southern end, TLC is shown by Y-238 as fault traces that are in Quaternary deposits and that were identified from previous mapping.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Part of TLC is portrayed by Y-853 as a fault juxtaposing Quaternary alluvium against bedrock and adjacent to a range front that is characterized by "fault scarps and lineaments on surficial deposits along or immediately adjacent to range front, a general absence of pediments, abrupt piedmont–hillslope transitions, steep bedrock slopes, faceted spurs, wineglass valleys, and subparallel systems of high–gradient, narrow, steep–sided canyons orthogonal to range front." This part of TLC is associated with a range front that is less extensive and fault scarps that are lower, shorter, and less continuous than those along a major range–front fault (Y-853).

Analysis: Aerial photographs (Y-216, p. 3, scale about 1:12,000 (low–sun–angle photographs); Y-238, p. 2, scales 1:24,000 to 1:80,000; Y-853, scales 1:115,000 to 1:124,000 and 1:58,000). Field reconnaissance (Y-216, p. 3).

Relationship to other faults: If TLC extends south of the mouth of Oriental Wash into Death Valley, then it nearly intersects the northwest–striking, right–lateral Furnace Creek fault (FC). Y-238 (p. 3-4) speculated that north– and north–northeast–striking, dip–slip faults east of both FC (includes TLC) and the northwest–striking Fish Lake Valley fault (FLV) in Fish Lake Valley may be related to displacement on both FC and FLV. The (Y-238, p. 4) suggested that the spatial relationship between, the orientations of, and the types of displacement on these north–striking and northwest–striking fault in these areas "are consistent with an east–west direction of least principal stress and a north–south direction of greatest principal stress."

Wahmonie fault (WAH)

Plate or figure: Plate 2.

References: Y-104: Ekren and Sargent, 1965; Y-181: Carr, 1974; Y-182: Carr, 1984 (name from his fig. 7); Y-226: Swadley and Huckins, 1990 (show fault traces along the northwestern side of Skull Mountain some of which align with WAH as mapped by Y-104); Y-232: Cornwall, 1972; Y-238: Reheis and Noller, 1991 (pl. 3); Y-314: Ekren, 1968; Y-1107: Carr, 1974.

Location: 22 km/108° (distance and direction of closest point from YM) at lat 36°47′N. and long 116°13′W. (location of closest point). WAH is located along the northwestern side of Skull Mountain at its junction with Jackass Flats, in Wahmonie Flat, and along both sides of an unnamed ridge that extends south from Lookout Peak.

USGS 7-1/2′ quadrangle: Skull Mountain.

Fault orientation: WAH strikes generally northeast, but its trace curves so that the strike of WAH ranges between north and northeast (Y-232).

Fault length: The length of WAH is about 14 km as estimated from Y-104 and about 15 km as estimated from Y-232. Individual fault traces as mapped by Y-226 range in length between 0.2 and 2 km.

Style of faulting: Displacement on WAH is shown by Y-226 as down to the northwest. Displacement on the southwestern end of WAH is portrayed by Y-232 as down to the northwest; displacement on the northeastern end is shown as down to the southeast. Y-104 and Y-238 both portrayed WAH as down to the northwest along Skull Mountain and along the northwestern side of the unnamed ridge south of Lookout Peak and as down to the southeast along the southeastern side of the unnamed ridge.

Scarp characteristics: Northwest–facing scarps were mapped by Y-226 at the southwestern end of WAH along Skull Mountain. The heights of these scarps range between <1 to 3 m (Y-226).

Displacement: No information.

Age of displacement: The youngest displacement along WAH is probably Pleistocene. The youngest scarps that are shown by Y-226 are on surfaces of late and middle Pleistocene deposits (their Q2c/QTa deposits with an estimated age between 270 ka and 740 ka). Scarps and lineaments are also shown by Y-226 on surfaces of early Pleistocene and Pliocene? deposits (their QTa deposits with an estimated age of >740 ka) and on surfaces of Tertiary rocks or deposits (their Tr unit). Fault traces are portrayed by Y-226 as concealed by both Holocene alluvium (their Q1c and Q1ab deposits; ≤10 ka) and late and middle Pleistocene alluvium (their Q2bc and Q2c deposits with estimated ages between 160 ka and 740 ka).

Weakly expressed to prominent scarps or lineaments on surfaces of Quaternary deposits are shown by Y-238 along the southwestern end of WAH on the northwestern side of Skull Mountain. The traces along the unnamed ridge south of Lookout Peak at the northeastern end of WAH are shown by Y-238 as faults in Tertiary deposits identified from previous mapping.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Only one trace of WAH parallels the northwestern front of Skull Mountain (Y-104; Y-226). No information on the morphology of this range front was noted.

Analysis: Aerial photographs (Y-226; Y-238, p. 2, scales 1:24,000 to 1:80,000).

Wahmonie fault (WAH) — Continued

Relationship to other faults: WAH is one of four main faults that have been grouped into the 30–to–60–km–wide Spotted Range–Mine Mountain fault zone (SRMM), which is characterized by northeast–striking, left–lateral faults that have experienced relatively small amounts of displacement (Y-181, p. 9; Y-182, p. 56). The other faults in SRMM are the Cane Spring fault (CS), the Mine Mountain fault (MM), and the Rock Valley fault (RV). These faults have been interpreted by Barnes and others (1982, Y-62, *citing* Y-1107) to be "first–order structures that form a conjugate system with the northwest–[striking] right–lateral faults of the Las Vegas Valley shear zone." Y-314 (p. 16-17) suggested that left–lateral displacement along faults in SRMM resulted from what he called rotary slippage during right–lateral displacements along the Las Vegas Valley shear zone (LVS). However, Y-182 (p. 63) noted that neither the LVS nor the northwest–trending La Madre shear zone crosses SRMM and that significant curving or bending of faults in SRMM, which would be required if such rotation had occurred, is lacking. In contrast, northwest–striking faults and flexure zones with right–lateral displacement or bending north of LVS (e.g., the Frenchman flexure; Y-181, fig. 11, p. 34) and faults of SRMM are probably related because faults in the two zones mutually displace one another as indicated by field relationships (Y-181, p. 9, *citing* W.J. Carr, unpub. data, 1967) and because both zones are locally active as indicated by associated seismicity (Y-181, p. 9).

Displacements on faults in SRMM are thought by Y-182 (p. 62) to have been conjugate to displacements on faults in the northwest–trending Walker Lane.

The similarity in types displacement and alignment of surficial expression both suggested to Y-182 (p. 62) that SRMM may be connected to the Pahranagat fault (PGT) to the northeast (the Pahranagat shear zone of Y-182). However, 70 km separates the SRMM and PGT and no northeast–trending structures have been recognized in the Paleozoic rocks that are exposed in numerous places within the gap, which includes the north– and north–northwest–trending Spotted, Pintwater, and Desert ranges (Tschanz and Pampeyan, 1970 (Y-404); Ekren and others, 1977 (Y-25); Y-182, p. 62).

Weepah Hills fault (WH)

Plate or figure: Plate 1.

References: Y-238: Reheis and Noller, 1991 (pl. 1). Not shown by Dohrenwend and others, 1992 (Y-853) nor by Albers and Stewart, 1972 (Y-407).

Location: 145 km/320° (distance and direction of closest point from YM) at lat 37°51′N. and long 117°30′W. (location of closest point). WH is located along the southern side of the Weepah Hills and the northern side of Clayton Valley.

USGS 7-1/2′ quadrangle: Goat Island, North of Silver Peak, Silver Peak, Weepah.

Fault orientation: WH strikes generally west–northwest (Y-238).

Fault length: The length of WH is 15 km as estimated from Y-238.

Style of faulting: Displacement on traces of WH is shown by Y-238 as primarily down to the southwest. Displacement on one trace at the northwestern end of WH is shown by Y-238 as down to the northeast.

Scarp characteristics: No information

Displacement: No information.

Age of displacement: One 3–km–long trace of WH is portrayed by Y-238 as a fault that is in Quaternary deposits and that was identified from previous mapping.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Most of WH is portrayed by Y-238 as lineaments along a linear range front or in bedrock. They (Y-238, p. 2) suspected that these lineaments suggest Quaternary fault displacement.

Analysis: Aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000).

Relationship to other faults: The west–northwest strike of WH is markedly different from the north and northeast strikes of faults that dominate the area along range fronts and within basins. WH is approximately perpendicular to and its eastern end nearly intersects with the north–northeast–striking Clayton Ridge–Paymaster Ridge fault (CRPR) along the western sides of Clayton and Paymaster ridges. The western end of WH is oblique to the northeast–striking Lone Mountain fault (LMT) in Big Smoky Valley.

WH is approximately parallel to and overlaps with faults in Tertiary deposits and lineaments on Tertiary surfaces along the northern side of the Silver Peak Range south of WH. These faults and lineaments are mapped by Y-238 (pl. 1), but are not shown on plate 1 of this compilation because of their expression is entirely within deposits or on surfaces of Tertiary age.

West Pintwater Range fault (WPR)

Plate or figure: Plates 1 and 2.

References: Y-25: Ekren and others, 1977; Y-671: Guth, 1990 (WPR may include his curving, north–striking, down–to–the–west Pintwater fault, which he shows only in pre–Tertiary rocks (p. 240-241)); Y-813: Reheis, 1992 (pls. 2 and 3); Y-852: Dohrenwend and others, 1991. Not shown by Tschanz and Pampeyan, 1970 (Y-404).

Location: 76 km/87° (distance and direction of closest point from YM) at lat 36°53'N. and long 115°35'W. (location of closest point). WPR is located along the western side of the Pintwater Range at its junction with Indian Springs Valley.

USGS 7-1/2' quadrangle: Fallout Hills, Heavens Well, Indian Springs NW, Quartz Peak, Quartz Peak NW, Quartz Peak SW, Southeastern Mine, Tim Spring.

Fault orientation: WPR strikes generally north, but its trace curves, so that the southern end of WPR strikes north–northeast and the northern portion strikes north–northwest (Y-852). WPR has been portrayed by Y-852 as composed of curving, overlapping, and branching traces with strikes ranging between north–northwest and northeast.

Fault length: WPR has a length of about 60 km as estimated from both Y-852 (south of lat 37°N.) and from Y-813 (north of lat 37°N.). Scarps west of the range front at two localities are up to 1 km long (Y-852).

Style of faulting: Displacement on short sections of WPR is shown by Y-813 as down to the west.

Scarp characteristics: Scarps associated with WPR are portrayed by Y-813 and Y-852 as primarily west–facing.

Displacement: No information.

Age of displacement: The youngest scarps recognized by Y-852 are on depositional or erosional surfaces of early to middle and (or) late Pleistocene age (their Q_{1-2} surfaces with estimated ages between 10 ka and 1.5 Ma). WPR is shown by Y-813 as weakly expressed to prominent lineaments and scarps on surfaces of Quaternary (primarily) and Tertiary deposits and as faults that are in Quaternary and Tertiary (primarily) deposits and that were identified from previous mapping. Y-25 portrayed two sections at the very northern end of WPR as faulted contacts between pre–Tertiary rocks and Holocene to Pliocene alluvium and colluvium (their QTa deposits).

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: Most of WPR is noted by Y-852 to bound a tectonically active front of a major mountain range that is characterized by "fault juxtaposition of Quaternary alluvium against bedrock, fault scarps and lineaments on surficial deposits along or immediately adjacent to range front, a general absence of pediments, abrupt piedmont–hillslope transitions, steep bedrock slopes, faceted spurs, wineglass valleys, and subparallel systems of high–gradient, narrow, steep–sided canyons orthogonal to range front." Portions of WPR have been shown by Y-813 (pl. 3 mainly) as a topographic lineament bounding a linear range front.

Analysis: Aerial photographs (Y-25; Y-671; Y-813, p. 4, scales 1:62,500 to 1:80,000; Y-852, scale 1:58,000). Compilation of structural and stratigraphic information (Y-25).

West Pintwater Range fault (WPR) — Continued

Relationship to other faults: WPR is one of several north–striking faults bounding range fronts east of Yucca Mountain and north and northwest of Las Vegas. Other north–striking faults in this area are the East Pintwater Range fault (EPR) east of WPR, the Central Pintwater Range fault (CPR) within the Pintwater Range directly east of WPR, the Sheep–East Desert Ranges fault (SEDR) along the eastern sides of the Desert Range and the southern Sheep Range, the Sheep Basin fault (SB) along the western side of the Sheep Range east of WPR, the Sheep Range fault (SHR) along the eastern side of the Sheep Range east of WPR, the Indian Springs Valley fault (ISV) along the western side of Indian Springs Valley immediately west of WPR, and the Spotted Range faults (SPR) along the western side of the Spotted Range west of WPR. Y-671 (p. 242) suggested that these faults were related to an inferred major detachment system (his Sheep Range detachment), but that the style of displacement changes between SEDR and his inferred Dog Bone Lake fault (not shown on pls. 1 and 2 of this compilation) along the western side of the Desert Range. Faults west of this change have caused less rotation of rocks than faults to the east, have been localized by Mesozoic structures, and have developed along the western edges of ranges to define structural blocks that include the next range to the west (Y-671, p. 242), which is the Spotted Range for WPR.

The strike of WPR is similar to those of faults within and adjacent to the Pintwater Range. These faults are shown by Y-813 (pl. 3) as faults that are in Tertiary deposits and that were identified by previous mapping. One of these may be the Pintwater fault shown by Y-404 (pl. 3) and Y-671 (fig. 3, p. 240).

The southern end of the Pintwater Range (along with the southern end of the Spotted Range to the west) bends to the southwest as it approaches east–striking faults from the east, such as the Cactus Springs fault (CAC) and the South Ridge faults (SOU). These east–striking faults have been interpreted to be part of the Las Vegas shear zone by Y-813 (p. 5). WPR, as a range–bounding fault, correspondingly bends. Y-813 (p. 5) suggested that WPR appears to merge with northeast–striking, left–lateral faults that have been interpreted by her to be part of the Spotted Range–Mine Mountain section of the Walker Lane.

The northern end of WPR extends north of the northeast–striking southern end of the North Desert Range fault (NDR). Y-25 suggested that the northern end of WPR may connect with a fault along the western side of the Jumbled Hills, the Jumbled Hills fault (JUM) of this compilation, as shown by the dotted line between the two faults. The structural relationships among these faults are not known.

West Railroad fault (WR)

Plate or figure: Plate 1.

References: Y-813: Reheis, 1992 (pl. 1); Y-853: Dohrenwend and others, 1992; Y-1032: Schell, 1981 (pls. 7 and 8; name from his table A2, fault #101). Not shown by Cornwall, 1972 (Y-232) nor by Ekren and others, 1971 (Y-5).

Location: 112 km/15° (distance and direction of closest point from YM) at lat 37°49'N. and long 116°07'W. (location of closest point). WR is located along the eastern side of the Reveille Range at its junction with Railroad Valley.

USGS 7-1/2' quadrangle: Freds Well, Reveille Peak, Reveille Peak NW, Reveille Peak SE.

Fault orientation: WR curves but has a general north strike. WR north of Fang Ridge strikes north–northwest; WR south of the ridge strikes north–northeast (Y-813; Y-853).

Fault length: The length of WR is noted as 42 km by Y-1032 (table A2, p. A19), who extends WR from the southern end of the Reveille Range to the southern end of the Pancake Range (north of the area of plate 1 of this compilation). The length of WR is 19 km as estimated from Y-853 and 23 km as estimated from Y-813. However, WR intersects the northern edges of both map areas at lat 38°N.

Style of faulting: No information.

Scarp characteristics: Scarps associated with WR are shown primarily as east–facing by Y-813, Y-853, and Y-1032. Y-1032 (table A2, p. A19) noted a maximum scarp height of 10 m along WR and a maximum scarp–slope angle of 12.5°.

Displacement: No information.

Age of displacement: The probable age of the youngest displacement along WR is noted by Y-1032 (table A2, p. A19) as late Pleistocene (defined as >15 ka and <700 ka by Y-1032, p. 29). The youngest unit displaced along WR is his intermediate–age alluvial–fan deposits (A5i; Y-1032, table A2, p. A19) with an estimated age of 15 ka to probably about 200 ka (table 3, p. 23). The oldest unit not displaced is his young–age alluvial–fan deposits (A5y; Y-1032, table A2, p. A19) with an estimated age of 15 ka or younger (table 3, p. 23). The oldest unit displaced is latest Tertiary volcanic rocks (Tv_4; Y-1032, table A2, p. A19) with an estimated age of 1.8 Ma to 6 Ma (table A1, p. A1).

The youngest scarps along WR that are shown by Y-853 are on depositional or erosional surfaces of late Pleistocene age (their Q_2 surfaces with estimated ages between 10 ka and 130 ka). Scarps are also noted by Y-853 on depositional or erosional surfaces of early to middle and (or) late Pleistocene age (their Q_{1-2} surfaces with estimated ages between 10 ka and 1.5 Ma). WR is shown by Y-813 as weakly expressed to prominent lineaments and scarps on surfaces of Quaternary deposits. One section of WR is portrayed by Y-853 as a fault juxtaposing Quaternary alluvium against bedrock.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Aerial photographs (Y-813, p. 4, scales 1:62,500 to 1:80,000; Y-853, scales 1:115,000 to 1:124,000 and 1:58,000; Y-1032, p. 15, scales ~1:25,000 and ~1:60,000). Field reconnaissance (Y-1032, p. 17-18). Gravity analysis (Y-1032, p. 16). Magnetometer surveys (Y-1032, p. 16-17).

West Railroad fault (WR) — Continued

Relationship to other faults: WR is approximately parallel to other north–northeast– and north–northwest–striking faults along major ranges and within basins in the area. These faults west of WR include the East Reveille fault (ERV) along the western side of the Reveille Range; the Central Reveille fault (CR) within Reveille Valley; the Hot Creek–Reveille fault (HCR) along the eastern side of the Kawich Range, the Kawich Range fault (KR) along the western side of the Kawich Range; the Cactus Flat fault (CF), the East Stone Cabin fault (ESC), and the Cactus Flat–Mellan fault (CFML) all within Cactus Flat; the Monitor Hills East fault (MHE) and the Monitor Hills West fault (MHW) along the eastern and western sides of the Monitor Hills. These faults east of WR include the Monotony Valley fault (MV) southeast of Railroad Valley; the Freiburg fault (FR) and the Penoyer fault (PEN) along the eastern and western sides of the Worthington Mountains; and the Groom Range East fault (GRE), the Stumble fault (STM), and the Groom Range West fault (GRW) along the eastern and western sides of and within the Groom Range. The East Belted Range fault (EBR) and the Belted Range fault (BLR), which are along the eastern and western sides of the Belted Range, are immediately south of WR. The structural relationships among these faults are not known.

West Spring Mountains fault (WSM)

Plate or figure: Plate 2.

References: Y-161: Burchfiel and others, 1983; Y-182: Carr, 1984 (his Grapevine fault, fig. 7, p. 16); Y-232: Cornwall, 1972 (shows only the northwestern end of WSM within Nye County, that part that is west of about long 115°55′W.); Y-238: Reheis and Noller, 1991 (pl. 4); Y-696: Hoffard, 1991 (name from her pl 1, p. 3); Y-706: Wright, 1989; Y-806: Hoffard, 1990 (her Spring Mountains range front fault zone); Y-813: Reheis, 1992 (pl. 3); Y-845: Malmberg, 1967; Y-852: Dohrenwend and others, 1991.

Location: 53 km/136° (distance and direction of closest point from YM) at lat 36°30′N. and long 116°02′W. (latitude and longitude of closest point). WSM bounds the western side of the northern Spring Mountains at their junction with Pahrump Valley. The southern end of WSM may extend into Pahrump Valley.

USGS 7-1/2′ quadrangle: Hidden Hills Ranch, Horse Spring, Mound Spring, Mount Schader, Mount Stirling, Pahrump, Pahrump NE, Wheeler Well.

Fault orientation: The general strike of WSM is N. 12° W., but WSM is arcuate and the strike of individual traces ranges between N. 10° E. and N. 50° W. (Y-696, p. 83). Much of WSM is shown by Y-696 and Y-813 as a single trace along the range front, but WSM about 10 km north of Wheeler Wash includes short traces subparallel to the range front (Y-696; Y-813; Y-852).

Fault length: WSM is about 30 km long, which includes a nearly continuous, 12–km–long section along the range front (Y-696, p. 83). WSM is about 36 km long as estimated from Y-238 and Y-813. If north–trending traces in Pahrump Valley between Hidden Hills and Manse, Nevada, are considered part of WSM, then WSM would extend another 25 km to the south for a total length of about 60 km as estimated from Y-238 and Y-813.

WSM is about 15 km long, including the north–trending traces in Pahrump Valley, as estimated from Y-852, but WSM extends to the southern and western edges of their map area.

Style of faulting: Y-696 (p. 86-87) noted that dip–slip (normal) and down–to–the–west displacement on WSM is indicated by bedrock relationships in the Spring and Montgomery mountains (the Grapevine fault of Y-161) and by scarps (Y-696, p. 86-87; Y-813; Y-852). Y-696 (p. 84-85) suggested that sharp bends in the fault's trace preclude a significant lateral component of displacement. Y-813 (p. 9) noted that the pattern of fault traces indicates that WSM has been "predominantly dip slip with little or no strike slip." Several grabens are preserved along the range front (Y-696, pl. 1; Y-852), but no compressional features have been noted by Y-696 (p. 85-86).

WSM generally follows the range front, but scarps are also preserved 2 to 3 km west of the front, especially near the northern end of the fault (Y-238; Y-696; Y-852). These scarps are subparallel to WSM, exhibit both down–to–the–east and down–to–the–west displacement, and are 8 km long (Y-852).

Fault traces in Pahrump Valley between Hidden Hills and Manse exhibit dip slip, but a left–stepping fault pattern suggests some right–lateral displacement (Y-696).

Scarp characteristics: Y-696 (p. 85) noted that scarps appear to remain similar in height across bends in the fault's trace. Scarps are dissected at several localities (e.g., Hidden Springs, Stump Springs, Brown Spring) by southwest–trending arroyos up to 15 m deep (Y-845). One graben near the mouth of Wheeler Wash has an minimum surface displacement of 12 m (Y-696, p. 86-87). Scarps on Younger Quaternary alluvium of Y-845 (his Qya deposit with estimated ages of 120 ka? or >730 ka?) are noted by Y-696 as >20 m high. Older surfaces along WSM have higher scarps (Y-696, p. 86). Scarps in Pahrump Valley between Hidden Hills and Manse exhibit as much as 12 m of dip slip (Y-696, p. 87, 89).

Displacement: On the basis of the relationships of stratigraphic units between the Spring Mountains and the Montgomery Mountains to the west along their Grapevine fault, which may be an extension of WSM, Y-161 suggested at least 3,500 m of west–side–down (Montgomery Mountains side) displacement.

A graben just north of Wheeler Wash has a minimum displacement of 12 m (Y-696, p. 87-88, loc. 23, pl. 1).

West Spring Mountains fault (WSM) — Continued

Age of displacement: Traces in WSM have strong geomorphic expression (Y-238; Y-696; Y-813; Y-852). Y-813 and Y-238 portray much of WSM as prominent (mainly) to weakly expressed lineaments and scarps on surfaces of Quaternary deposits. The youngest geomorphic surfaces with scarps along the western front of the Spring Mountains have morphologic characteristics that are similar to those of a surface at Kyle Canyon on the eastern side of the Spring Mountains estimated to be about 120 ka by Y-894 (Sowers, 1986). However, the surfaces along WSM have been eroded into a ballena topography that is present only on an older surface at Kyle Canyon with an estimated age of >730 ka (Y-696, p. 86). Consequently, Y-696 (p. 86) concluded that the youngest surfaces displaced by WSM may be older than 120 ka.

The youngest scarps along the Spring Mountains range front noted by Y-852 are on depositional or erosional surfaces of late Pleistocene age (their Q_2 surfaces with estimated ages between 10 ka and 130 ka). Other scarps are shown by them on depositional or erosional surfaces of early to middle and (or) late Pleistocene age (their $Q_{1\text{-}2}$ surfaces with estimated ages between 10 ka and 1.5 Ma).

The youngest scarps 2 to 3 km west of the front near the northern end of WSM are noted by Y-852 to be on depositional or erosional surfaces of late Pleistocene age (their Q_2 surfaces with estimated ages between 10 ka and 130 ka). Scarps are also preserved on depositional or erosional surfaces of early to middle Pleistocene age (Y-852, their Q_1 surfaces with estimated ages between 130 ka and 1.5 Ma). The northern end of WSM is shown by Y-232 (pl. 1) to displace Quaternary alluvium.

Some fault traces in Pahrump Valley between Hidden Hills and Manse cut possibly paludal sediments of probable late Pleistocene to Holocene age (<130 ka?; Y-696, p. 91, loc. 30, pls. 1 and 3). Fault scarps on alluvial fans in this same area "have steep faces and appear young" (Y-696, p. 94).

Slip rate: Y-696 (p. 87) estimated an average apparent vertical slip rate on WSM of 0.06 mm/yr, assuming an age of 200 ka for a surface containing a graben near the mouth of Wheeler Wash and a minimum of displacement of 12 m across the graben. Y-696 (p. 87) also estimated an apparent vertical slip rate of 0.02 to 0.2 mm/yr for WSM at this same locality, using a range of 50 ka to 500 ka for the age of the displaced surface.

Recurrence interval: No information.

Range-front characteristics: The western front of the Spring Mountains adjacent to WSM is shown by Y-852 as a tectonically active front that is characterized by "fault juxtaposition of Quaternary alluvium against bedrock, fault scarps and lineaments on surficial deposits along or immediately adjacent to the range front, a general absence of pediments, abrupt piedmont–hillslope transitions, steep bedrock slopes, faceted spurs, wineglass valleys, subparallel systems of high–gradient narrow steep–sided canyons orthogonal to the range front."

Analysis: Conventional aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000; Y-696, p. 83, scale 1:80,000; Y-813, p. 4, scales 1:62,500 to 1:80,000). Field examination (Y-161; Y-696). Analysis of seismic reflection lines (Y-696). Topographic scarp profiles (Y-696, p. 86-87, fig. 36, p. 89).

Relationship to other faults: WSM is part of the Pahrump fault system as defined by Y-696 (p. 3), along with the East Nopah fault (EN) and the Pahrump fault (PRP; the Pahrump Valley fault zone of Y-696). WSM was previously called the Spring Mountains range front fault zone by Y-806.

WSM strikes toward and is likely an extension of the northwest–striking Grapevine fault (not shown on pl. 2 of this compilation), which is inferred by Y-161 to separate the Spring Mountains from the Montgomery Mountains to the west. The northern end of WSM along the front of the Spring Mountains is a mineralized zone at the contact between bedrock and alluvial–fan deposits. This zone has been interpreted by Y-696 (p. 84) to possibly be the Grapevine fault. Displacement on the Grapevine fault may have coincided with displacement on the north–striking Paddys fault of Y-161 (not shown on pl. 2 of this compilation).

West Spring Mountains fault (WSM) — Continued

It is not clear if north–striking fault traces in Pahrump Valley between Hidden Hills and Manse are indeed part of WSM. Y-696 (p. 91) suggested that the scarps in this area have characteristics similar to those associated with both WSM and of PRP. Thus, the north–trending scarps in Pahrump Valley may be related to a fault that is transitional between WSM to the north and PRP to the south. Seismic reflection lines and gravity data have been interpreted by Y-696 to suggest that the locus of deposition for a basin within Pahrump Valley has been against the Spring Mountains and that the western boundary of this basin is the eastern side of a horst block that coincides with PRP.

Wilson Canyon fault (WIL)

Plate or figure: Plate 2.

References: Y-413: Jennings and others, 1962; Y-415: Jennings, 1985 (Trona sheet); Y-1020: Jennings, 1992 (name from his map); Y-1110: Roquemore, 1981; Y-1112: Walter and Weaver, 1980; Y-1122: von Huene, 1960 (his Wilson fault, p. 49).

Location: 140 km/214° (distance and direction of closest point from YM) at lat 35°48′N. and long 117°20′W. (location of closest point). WIL extends from the western side of the Coso Basin on the west, across the Argus Range, to Searles Lake in Searles Valley on the east. In the Argus Range, WIL is in or near two canyons, both named Wilson Canyon. One canyon drains west into Indian Wells Valley; the other drains east into Searles Valley (Y-1122, p. 49).

USGS 7-1/2′ quadrangle: Airport Lake, Burro Canyon, Mountain Springs Canyon, Trona East, Trona West.

Fault orientation: WIL strikes generally northwest (Y-413; Y-1020). The southeastern end of WIL strikes north–northwest (Y-1020). Y-1122 (p. 49) reported that WIL is nearly vertical.

Fault length: WIL is about 42 km long as estimated from Y-1020. Of this length, the western 7 km in the Coso Basin and the eastern 21 km north and east of Searles Lake in Searles Valley are shown as concealed (Y-1020). The eastern portion of WIL has been inferred from geophysical evidence (Y-415, p. 191, note #16, *citing* G.I. Smith, U.S. Geological Survey, personal commun., 1973). Y-1122 (p. 49) noted that WIL is about 29 km (18 miles) long.

Style of faulting: Y-1110 (p. 79) noted that displacement on WIL has been left lateral.

Scarp characteristics: No information.

Displacement: No information.

Age of displacement: Y-1020 portrayed the entire 42 km of WIL as having Quaternary (he defined as <1.6 Ma) displacement. Y-413 showed the western end of WIL in the Coso Basin as displacing Holocene alluvium (their Qal deposits). WIL is noted by Y-415 (p. 191, note #27, *citing* Y-1122) to cut Pleistocene volcanic rocks. The eastern portion of WIL north and east of Searles Lake is not exposed at the ground surface but is reported to affect Quaternary sediments at depth as inferred from geophysical data (Y-415, p. 191, note #16, *citing* Moyle, (1967, Y-1361) and G.I. Smith, (U.S. Geological Survey, personal commun., 1973)).

Y-1110 (p. 79, *citing* Y-1112) noted that WIL is seismically inactive. Y-1110 (p. 79) concluded that WIL has not been active during the Quaternary.

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No information.

Analysis: Compilation of published and unpublished literature (Y-415; Y-1020). Aerial photographs (Y-1122, p. 8, scale 1:12,000). Detailed geologic mapping (Y-1122, p. 8). Gravimetric data (Y-1122, p. 8).

Relationship to other faults: The western end of WIL appears to terminate at north–striking fault traces of the Airport Lake fault (AIR). The southeastern end of WIL has a more northerly strike than the rest of the fault and this end parallels the Tank Canyon fault, a curving north– and northeast–striking fault with recognized Holocene displacement (Y-1020, his fault #268; shown, but not labeled by name, on pl. 2 of this compilation). The very northern end of the Tank Canyon fault only is shown near the southern edge of plate 2 of this compilation along the western side of the Slate Range near long 117°15′W.

Windy Wash fault (WW)

Plate or figure: Figure 3.

References: Y-12: Whitney and others, 1986; Y-19: Swadley and Hoover, 1983; Y-26: Swadley and others, 1984 (their northern Fault N is a splay of WW along the West Ridge as mapped by Y-1042; their Faults P and Q (with Trenches CF-2 and CF-3) correspond to part of the western splay of Y-1042; their Fault M (with Trench CF-1) corresponds to part of the central splay of Y-1042; their Fault J corresponds to a short section of the eastern splay of Y-1042); Y-55: Scott and Bonk, 1984 (name from their pl. 1; show only the northern part of WW, the part along the West Ridge, and a short section of the central splay of Y-1042; include only that part of WW east of long 116°30′W.); Y-113: Harding, 1988; Y-224: Frizzell and Shulters, 1990; Y-238: Reheis and Noller, 1991 (pl. 3); Y-396: Scott, 1990; Y-576: O'Neill and others, 1991; Y-701: Whitney, 1992; Y-1042: O'Neill and others, 1992 (show WW north of about lat 36°45′N. as consisting of three splays: east, central, and west); Y-1182: Simonds and Whitney, 1993; Y-1196: Faulds and others, 1991 (include only that portion of WW west of long 116°30′W., which includes part of WW along West Ridge, the southern section of the eastern splay of Y-1042, the northern and southern sections of the central splay of Y-1042, and the western splay of Y-1042); Y-1201: Ramelli and others, 1991 (primarily discuss what they call the southern Windy Wash fault, which is the portion of WW south of Windy Wash that includes Trenches CF-2 and CF-3 of Y-26).

Location: 3 km/283° (distance and direction of closest point from YM) at lat 36°51′N. and long 116°31′W. (location of closest point). According to Y-1042 (p. 4, 10), WW is a single trace in the southern Yucca Mountain area, but it splits into at least three splays north of about lat 36°45′N.

USGS 7-1/2′ quadrangle: Big Dune, Busted Butte, Crater Flat, East of Beatty Mountain, Pinnacles Ridge.

Fault orientation: The southern end of WW strikes north (Y-1042, p. 4). Of the three splays of northern WW, the western one strikes north–northwest, the central one strikes north to north–northwest, and the eastern one strikes northeast (Y-1042, pl. 1, p. 4). WW dips 48° W. to 72° W. (Y-55, pl. 1; Y-1196 for the southern portion of WW along West Ridge). Y-396 (p. 259) reported an average dip of 59° for WW. This was calculated from twelve measurements.

Fault length: Y-701 reported a length of about 14 km for WW. The length of WW is about 25 km as estimated from the map by Y-396 (p. 256). Scarps are discontinuous on alluvial surfaces along a section about 2.4 km long as portrayed by (Y-55, pl. 1). WW is shown as concealed over much of its length by Y-224 and Y-396 (fig. 3, p. 256-257).

Style of faulting: Displacement on WW is shown by Y-12 and Y-701 as dip slip (normal) with a left–lateral component of an undetermined amount. A left–lateral component of displacement has also been interpreted by Y-1042 (p. 17, 20) from observed geomorphic features (e.g. offset streams, pressure ridges, changes in apparent displacement along strike, and rhomboid–shaped fault patterns). Y-1042 (p. 17) also reported slickenlines that plunge 43° to 47°, which they interpreted as indicating a component of left–lateral slip. Displacement on WW is shown by Y-55 (pl. 1) and Y-224 as down to the west.

Y-1042 (p. 17, 20) suggested that the western splay has experienced scissor–type displacement (down to the west on the south and down to the east on the north). They based this conclusion on field examination that revealed subtle surface displacements of different types.

Scarp characteristics: Y-1042 (p. 4) reported that the central splay of WW is a series of right– and left–stepping, *en echelon* scarps on alluvial surfaces. Y-26 (p. 15) noted that a scarp on their Fault M (the central splay of Y-1042, pl. 1) is 1.5 m high and has a maximum slope angle of 7° on early Pleistocene and (or) latest Pliocene alluvial surfaces (their QTa deposits with an estimated age of 1.1 Ma to 2 Ma; fig. 3, p. 9). Y-26 (p. 15) reported a second scarp to the south along their Fault M. This scarp has a surface displacement of 1 m and a maximum slope angle of 9°.

Windy Wash fault (WW) — Continued

Y-1042 (p. 4) noted that the western splay of WW is expressed as aligned scarps, tonal contrasts, and linear drainage segments. The southern end of the western splay is a wedge–shaped area bounded on the east and west by linear scarps (Y-1042, p. 4). At Trench CF-2 along their Fault Q (the western splay of Y-1042, pl. 1), Y-26 (p. 16) measured a scarp height of 4 m, a surface offset of 1.5 m, and a maximum scarp–slope angle of 12°.

Displacement: On the basis of exposures in Trenches CF-2.5 and CF-3 (on the western splay of Y-1042, pl. 1), Y-12 (p. 787) interpreted an apparent vertical displacement of about 40 cm of a 270–ka gravel and an apparent vertical displacement of <10 cm in a 6.5–ka to 3–ka (Holocene) silt that records the youngest event. The maximum cumulative displacement observed in Trench CF-3 for the last four events (since about 300 ka) is 1.5 to 2.0 m (Y-701). On the basis of exposures in Trench CF-1 (on the central splay of Y-1042, pl. 1), Y-26 (p. 15) concluded that the soil developed in early Pleistocene and (or) latest Pliocene alluvium (their QTa deposits with an estimated age of 1.1 Ma to 2 Ma; fig. 3, p. 9) has been displaced 2.5 m down to the west.

Y-1201 (p. 1-64) reported a topographic separation of about 40 m in Pliocene basalts (2.5 Ma to 3.7 Ma) along their southern Windy Wash fault (the western splay? of Y-1042, pl. 1). Y-1201 (p. 1-64) concluded that this separation is a minimum vertical displacement since the Pliocene because the basalts may dip eastward. On the basis of the tectonic tilt of volcanic units (Paintbrush Tuff of 13.5 Ma to 13 Ma and Timber Mountain Tuff of 11.5 Ma), Y-396 (table 2, p. 275) estimated that a vertical displacement of 140 m occurred between 13 Ma and 11.5 Ma and that a vertical displacement of 260 m occurred between 11.5 Ma and the present.

Age of displacement: On the northern portion of WW, along the western side of West Ridge, Y-26 (p. 15; their Fault N) noted that early Pleistocene and (or) latest Pliocene alluvium (their QTa deposits) was faulted against Tertiary volcanic rocks and that early Holocene alluvium (their Q1c deposits with an estimated age of 7 ka to 9 ka; Y-26, fig. 3, p. 9) overlies WW. Y-55 (pl. 1) showed this same portion of WW as cutting alluvium and colluvium of Quaternary or Tertiary age.

Y-12 (p. 787) interpreted exposures in Trench CF-2 to indicate that at least seven Quaternary faulting events have occurred on the southern portion of WW (western splay of Y-1042, pl. 1). They concluded that three of these events occurred before 300 ka (age based on a basaltic ash that occurs in fractures and that is correlated to a basaltic cone dated (K–Ar) at 300 ka). Y-701 speculated, on the basis of rock varnish dates on faulted surfaces, that the oldest faulted surface is <700 ka. Y-12 (p. 787) suggested that event 4 exposed in Trench CF-2 occurred around or just before 300 ka. On the basis of uranium–trend analyses on alluvial deposits exposed in Trench CF-3, Y-12 (p. 787) concluded that event 5 occurred between 270 ka and 190 ka, that event 6 occurred between 190 ka and 40 ka, and that event 7 occurred after 40 ka. Thermoluminescence (TL) age determinations indicate that the youngest faulted unit, an eolian silt, was deposited between 6.5 ka and 3 ka, so that event 7 occurred during the last several thousand years.

The map by Y-1196 implies late Pleistocene or Holocene displacement along their southern WW (the western splay? of Y-1042, pl. 1), because fault traces are shown on middle and late Pleistocene surfaces (their late Black Cone surfaces with ages of 17.3 ka to 30.0 ka on rock varnish). Fault traces are also shown on middle Pleistocene surfaces (their early Black Cone surfaces with ages of 130 ka to 190 ka on rock varnish; Y-1196).

On the basis of relationships between volcanic ash and fractures exposed in Trench CF-1 along the southern portion of WW (their Fault M; the central splay of Y-1042, pl. 1), Y-26 (p. 15-16) concluded that displacement of early Pleistocene and (or) latest Pliocene alluvium (their QTa deposits with an estimated age of 1.1 Ma to 2 Ma; fig. 3, p. 9) occurred about 1.2 Ma.

Slip rate: Y-1201 (p. 1-67) estimated average vertical slip rates of 0.001 to 0.03 mm/yr for their southern WW (western splay of Y-1042, pl. 1) for the late Pleistocene and Holocene, using the interpretations of Y-12 for exposures in Trenches CF-2 and CF-3 (40 cm of vertical displacement in 270–ka deposits and 10 cm of vertical displacement in 3–to–6–ka deposits). Y-396 (table 2, p. 275) listed a vertical slip rate of 0.0015 mm/yr on WW since 270 ka; this rate was calculated on the basis of the 40 cm of vertical displacement interpreted by Y-12 from Trench CF-2.

Windy Wash fault (WW) — Continued

Y-1201 (p. 1-67) concluded that the topographic separation of Pliocene basalts (2.5 Ma to 3.7 Ma) along their southern WW (western splay? of Y-1042, pl. 1) suggests a Quaternary apparent vertical slip rate "on the order of 0.01 mm/yr." Using estimates of 25 to 100 m of vertical displacement of the Pliocene basalts, Y-1201 (p. 1-67) concluded that long–term apparent vertical slip rates on the southern WW range between 0.01 to 0.04 mm/yr and are probably about 0.02 mm/yr. Y-396 (p. 273, table 2, p. 275) reported an apparent vertical slip rate of 0.07 mm/yr on WW between 13 Ma and 11.5 Ma. This rate assumes that about 0.14 km of vertical displacement occurred during this 1.5–million–yr interval. In addition, Y-396 (p. 274, table 2, p. 275) reported an apparent vertical slip rate of 0.026 mm/yr since 11.5 Ma. This rate assumes that about 0.26 km of vertical displacement has occurred since 11.5 Ma and that Cenozoic displacement rates have varied in a step–wise manner in which rates sharply decreased about 11.5 Ma (p. 273).

Recurrence interval: On the basis of four faulting events since 300 ka (interpreted from exposures in Trench CF-3), Y-12 (p. 787) and Y-701 noted an average recurrence interval between surface–rupturing events of 75,000 yr.

Range-front characteristics: No information.

Analysis: Compilation of published and unpublished information (Y-26, pl. 1). Lineament analyses using low–sun–angle aerial photographs (Y-1042, p. 2, scale 1:12,000) and conventional aerial photographs (Y-238, p. 2, scales 1:24,000 to 1:80,000). Field examination (Y-1042, p. 2). Interpretation of trenches CF-2, CF-2.5, and CF-3 (Y-12, p. 787; Y-19; Y-26, p. 3, table 1, p. 5). Measurement of topographic scarp profiles (Y-26, p. 6).

Relationship to other faults: Y-1042 (p. 4, 10, pl. 1) speculated that the eastern splay of WW is structurally linked to the Solitario Canyon fault (SC) by left–stepping, *en echelon* fault scarps and by a rhomboid–shaped breccia zone. Y-1042 (p. 4, pl. 1) also noted that the Fatigue Wash fault (FW) appears to merge northward with WW west of West Ridge. Y-1182 (p. A-141) proposed that the three faults on the western side of Yucca Mountain (FW, SC, and WW) are interconnected along strike and possibly at depth. Y-396 (p. 279) concluded that steep dip–slip (normal) faults at Yucca Mountain, like WW, sole into a low–angle normal fault or faults at depths of 1 to 4 km.

Yucca fault (YC)

Plate or figure: Plate 1.

References: Y-50: Barnes and others, 1963; Y-60: Colton and McKay, 1966; Y-181: Carr, 1974 (name from his fig. 7); Y-182: Carr, 1984; Y-224: Frizzell and Shulters, 1990; Y-232: Cornwall, 1972; Y-526: Swadley and Hoover, 1990; Y-688: Fernald and others, 1968; Y-690: Ekren and others, 1968; Y-693: Barosh, 1968 (included the Butte fault as part of YC); Y-813: Reheis, 1992 (pl. 2); Y-853: Dohrenwend and others, 1992; Y-961: Fernald and others, 1968; Y-1106: Shroba and others, 1988.

Location: 40 km/65° (distance and direction of closest point from YM) at lat 37°00'N. and long 116°03'W. (location of closest point). YC is located in central Yucca Flat.

USGS 7-1/2' quadrangle: Oak Spring, Yucca Flat.

Fault orientation: YC strikes generally north and dips east (Y-813, p. 6). Y-693 (p. 210) portrayed YC as a series of north–northwest–striking and north–northeast–striking traces. YC is shown as branching by Y-60 and Y-526 or as a single, slightly sinuous strand by Y-50, Y-181 (fig. 7), Y-224, Y-813 (pl. 3, p. 7), and Y-853. YC splits into several traces on Quaternary alluvial fans at its northern end near Oak Spring Butte (Y-224; Y-813, pl. 3, p. 7; Y-853). YC dips 75° E. to 80° E. at the surface and probably flattens to dips of 55° to 65° at depth (Y-181, p. 26). Y-181 (p. 32) noted dips of 50° E. to 60° E. on the southern half of YC.

Fault length: The total length of YC is about 22 km as estimated from Y-813 (pl. 2) and from Y-853, about 25 km as estimated from Y-526, and at least 24 km and possibly as much as 32 km as noted by Y-181 (p. 26). The longest values include the Butte fault (BT) as part of YC. BT is located in bedrock north of Yucca Flat. Y-232 and Y-693 (p. 209) concluded that YC is continuous with BT, which is shown as part of the Oak Spring Butte faults (OAK) on plate 1 of this compilation. Similarly, Y-693 (p. 209) inferred a length of about 34 km (21 miles) for YC and reported that the total length of YC may be about 40 km (25 miles) if the 6.5–km–long (4 miles) BT is included with YC.

A prehistoric fault scarp associated with YC is about 20 km long as estimated from Y-224. Its length is reported by Y-1106 (p. 2) to be 21 km and by Y-181 (p. 26) to be at least 24 km long and probably 32 km. Underground nuclear testing may have caused displacement along an additional 4.5 km of the fault at the southern end of YC (Y-224) or along a northeast–striking splay fault, or both (Y-181, fig. 7).

Style of faulting: Displacement on YC is shown by Y-50, Y-60, Y-224, and Y-526 to be dip slip (normal) and down to the east. Y-693 (p. 215) concluded that displacements on YC that have resulted from underground explosions have been almost entirely vertical but that the resulting pattern of fractures indicates a "very slight right–lateral component" of displacement. Y-181 (p. 27) speculated that "minor departures from the nearly vertical displacements caused by explosions are * * * due to shoving and jostling of the alluvium by ground motion." Y-182 suggested that YC belongs to a set of north–striking faults with right–oblique displacement. Y-181 (p. 27-28, fig. 9A) concluded that the left–stepping, *en echelon* pattern of scarps associated with YC suggests right–lateral displacement. Y-181 (p. 26) noted that erosion has probably destroyed any evidence for lateral displacement.

Scarp characteristics: Y-693 (p. 201) noted that YC is "marked for most of its length by a low scarp." This scarp is noted to be "several hundred feet east of older buried parts of the fault zone" (Y-181, p. 26). A scarp on an alluvial surface at the fault's northern end is noted by Y-693 (p. 209) to be more than 12 m (40 ft) high and by Y-688 (p. 50) to be about 15 m (50 ft) high. The height of the scarp associated with YC is reported by Y-693 (p. 209) to be commonly 1.5 to 6 m (5 to 20 ft). Y-181 (p. 26) did not find any evidence for multiple ruptures on at least the southern 16 km of the scarp associated with YC. Y-693 (p. 209) reported low, east– and west–facing secondary scarps adjacent to the main scarp along YC at a few places in central Yucca Flat.

Cracks and scarps that formed during underground explosions are also preserved on YC and branch faults adjacent to YC on the east (Y-693, p. 210-211). These scarps slope 70° E. or are vertical (Y-693, p. 211).

Yucca fault (YC) — Continued

Displacement: Y-181 (p. 27) reported a vertical displacement of ≥200 m in Tertiary volcanic tuff. Y-688 (p. 50) recognized displacement of about 15 m (50 ft) of an alluvial surface at the northern end of YC. Y-688 (p. 50) and Y-693 (p. 209) noted that surface displacement progressively decreases to the south along YC until the fault disappears near Yucca Lake. In Yucca Flat, alluvium in the south–central part of the basin and east (the lower side) of YC is >610 m (2000 ft) thick (Y-688, p. 50). Similarly, Y-693 (p. 201) reported that alluvial and lacustrine deposits in Yucca Flat are 305 to 610 m (1,000 to 2,000 ft) thick on the downthrown side of YC as determined from geophysical studies and drilling. Y-693 (p. 214) noted that displacements along fractures produced by underground explosions vary between 0 and 3 to 5.5 m (10 to 18 ft), with the higher amounts occurring immediately adjacent to the explosion site.

Y-181 (p. 29) reported that Paleozoic rocks may be displaced laterally "several thousand feet" on YC. He (Y-181, p. 27) also noted that the lateral component of displacement in Tertiary volcanic tuff may be equal to or greater than the amount of vertical displacement (≥200 m). YC may account for 150 m of horizontal extension, assuming that the fault dips 60° (Y-181, p. 32). Y-813 (p. 6) concluded that relative amounts of the different types of displacement on YC are unknown, but that the "persistence of the fault in a valley–floor position suggests that the amount of lateral offset must be at least as much as the amount of vertical offset, if not more."

Age of displacement: Y-181 (p. 26) called YC "the youngest natural fault scarp in the test site region." Y-693 (p. 201, 216) concluded that the low scarp along YC "demonstrates the very recent age of the fault and there is no reason not to consider it an active fault." Y-688 (p. 50) reported that drainage development in Yucca Flat has been disrupted by displacement on YC, which they concluded is still active. Y-181 (p. 26) noted that the scarp associated with YC has been modified by erosion, but concluded on the basis of a comparison of the scarp associated with YC to 100–yr–old scarps in Owens Valley that it probably formed between 1 ka and 10 ka.

Y-853 portrayed YC as fault scarps on depositional or erosional surfaces of possible late Pleistocene age (their Q2? surfaces with estimated ages between 10 ka and 130 ka) suggesting a late Pleistocene or Holocene age for surface rupture. Y-1106 (p. 2) reported a minimum age of 35 ka for one of the younger events on YC. This age was estimated by Knauss (1981, Y-1242, *cited in* Y-1106, p. 5) on the basis of uranium–series analyses on a carbonate–rich fracture filling along YC (Y-1106, p. 2). Y-526 noted that YC displaces their Qap deposits (~160 ka to 800 ka) and their QTa deposits (>740 ka) along most of YC. Displacement at the southern end of YC has been induced by underground nuclear testing (Y-181; Y-224). Y-526 showed short portions of YC as concealed by Holocene alluvium (≤10 ka). They also portrayed Holocene alluvium as deposited against two scarps on surfaces of their Qap deposits (Y-526).

The formation of Yucca Flat, which may be related, at least partially, to displacement on YC, occurred after extrusion of Timber Mountain Tuff (~11.5 Ma) and before deposition of Thirsty Canyon Tuff (~8 Ma; Y-690). However, Timber Mountain Tuff does not thicken in depressions beneath Yucca Flat, as do alluvial deposits, suggesting that the depressions formed after the tuff was deposited (Y-181).

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: No range front is associated with YC. YC lies near the center of and bisects Yucca Flat, a structural basin (Y-182, p. 21). Within Yucca Flat, as in other basins in southern Nevada, the rate of subsidence has apparently nearly balanced the rate of alluviation so that only moderate relief is present on the bordering mountain fronts (Y-182, p. 25).

Analysis: Compilation and summary of published and unpublished work (Y-181, p. 1-2; Y-182, p. 4). Aerial photographs (Y-526; Y-813, p. 4, scales 1:62,500 to 1:80,000; Y-853, scales 1:115,000 to 1:124,000 and 1:58,000). Limited field examination (Y-526).

Yucca fault (YC) — Continued

Relationship to other faults: Y-1106 (p. 15) suggested that seismic shaking associated with YC may have triggered one or more episodes of minor displacement on the Carpetbag fault (CB), which is located about 3.5 km west of YC. YC may also be related to other right–oblique faults within Yucca Flat: the Area Three fault (AT) to the east, the Eleana Range fault (ER) to the west, and short, unnamed faults (Y-182, p. 21; Y-813, p. 6). All of these faults may have contributed to the formation of Yucca Flat (Y-182, p. 21). Y-182 (p. 21) concluded that formation of the Yucca Flat is the result of a combination of faulting and subsidence of small areas that have sagged more than adjacent parts of the basin. He (Y-182, p. 25) further suggested that fault displacement resulted in formation of a fairly young structural basin medial to an existing basin.

Y-693 (p. 201) reported that YC joins the Butte fault (BT) at the northern end of Yucca Flat (*see* Fault length).

Yucca Lake fault (YCL)

Plate or figure: Plate 1.

References: Y-181: Carr, 1974 (shows two northwest–striking, buried faults approximately parallel to, but probably east of, YCL as mapped by Y-232); Y-182: Carr, 1984 (his Yucca–Frenchman shear zone (figs. 7 and 8, p. 16, 17) that may coincide with the northwestern end of YCL as mapped by Y-232); Y-232: Cornwall, 1972. Not shown by Reheis and Noller, 1991 (Y-238, pl. 3), by Reheis, 1992 (Y-813, pl. 2; does show several short faults east of YCL as mapped by Y-232 and west of the Yucca fault), nor by Swadley and Hoover, 1990 (Y-526)

Location: 36 km/67° (distance and direction of closest point from YM) at lat 37°01′N. and long 116°05′W. (location of closest point). YCL is located along the southwestern side of Yucca Flat between Syncline Ridge on the north and the CP Hills on the south.

USGS 7-1/2′ quadrangle: Tippipah Spring, Yucca Flat, Yucca Lake.

Fault orientation: YCL strikes generally north–northwest (Y-232).

Fault length: The total length of YCL is about 17 km as estimated from Y-232 (pl. 1). This includes a 4–km–long section at the southeastern end of YCL that is shown as concealed by Y-232. This section is not shown on plate 1 of this compilation.

Style of faulting: Displacement along YCL is portrayed by Y-232 as down to the northeast.

Scarp characteristics: No information.

Displacement: No information.

Age of displacement: About 13 km of YCL (all but the concealed portion) is shown by Y-232 (pl. 1) as displacing Quaternary alluvium (his Qal deposits). Y-181 (p. 14) stated that "the Yucca fault is the only youthful–appearing pre-nuclear testing fault scarp in the test site area." This statement implies that a similar scarp is not preserved along YCL, which is only 3 km southwest of the Yucca fault (YC).

Slip rate: No information.

Recurrence interval: No information.

Range-front characteristics: YCL is not associated with a range front.

Analysis: Aerial photographs (Y-232).

Relationship to other faults: The relationships between YCL and other faults within and around Yucca Flat, such as the Carpetbag fault (CB) to the north, the Yucca fault (YC) to the northeast, and the Boundary fault (BD) to the north, are not known. If both the north–striking YC and the northwest–striking YCL are extended southward, then they would nearly intersect southwest of Yucca Lake (Y-232, pl. 1). A northwest–striking, concealed fault that is east of and parallel to YCL as mapped by Y-232 is about 30 km long. This fault is shown by Y-181 (fig. 7) as terminating at a concealed, north–striking, southern section of CB.

APPENDIX 3: LIST OF ABBREVIATIONS FOR FAULT NAMES

The following abbreviations for faults are used in this compilation. Most faults are shown on plates 1 and 2 and have description sheets in appendix 2. There are a few exceptions. Faults noted by * are included with other faults as indicated; they are shown on the plates, but do not have separate description sheets. Faults marked with ** are faults within about 5 km of the potential nuclear waste repository at Yucca Mountain (site faults); these faults are shown only on figure 3. The State Line fault (SL) and the Cedar Mountain fault (CM), indicated by ***, are shown only on figure 1.

Abbreviation	**Fault Name**
AH	Ash Hill fault
AIR	Airport Lake fault
AM	Ash Meadows fault
AR	Amargosa River fault
ARM	Arrowhead Mine fault* (part of PGT)
AT	Area Three fault
AW	Abandoned Wash fault* (part of GD)
BC	Bonnie Claire fault
BD	Boundary fault
BDG	Badger Wash faults
BH	Buried Hills fault
BLK	Black Cone fault* (part of ECR)
BLR	Belted Range fault
BM	Bare Mountain fault
BR	Bow Ridge fault**
BS	Beatty scarp
BT	Butte fault* (part of OAK)
BUC	Buckhorn fault* (part of PGT)
BUL	Bullfrog Hills faults
CAC	Cactus Springs fault
CB	Carpetbag fault
CEN	Central Valley fault* (part of SAL)
CF	Cactus Flat fault
CFML	Cactus Flat–Mellan fault
CGV	Crossgrain Valley faults
CHR	Chert Ridge faults
CHV	Chicago Valley fault
CLK	Chalk Mountain fault
CLMV	Clayton–Montezuma Valley fault
CM	Cedar Mountain fault***
CP	Checkpoint Pass fault
CPR	Central Pintwater Range faults
CR	Central Reveille fault
CRPL	Cockeyed Ridge–Papoose Lake fault

Abbreviation	Fault Name
CRPR	Clayton Ridge–Paymaster Ridge fault
CRWH	Cactus Range–Wellington Hills fault
CS	Cane Spring fault
CSM	Central Spring Mountains faults
CV	Clayton Valley fault
DS	Deep Springs fault
DV	Death Valley fault
EBR	East Belted Range fault
ECR	East Crater Flat faults**
EM	Emigrant fault
EMM	East Magruder Mountain fault
EN	East Nopah fault
EPK	Emigrant Peak faults
EPR	East Pintwater Range fault
ER	Eleana Range fault
ERV	East Reveille fault
ES	East Side fault* (part of SAL)
ESC	East Stone Cabin fault
EURE	Eureka Valley East fault
EURW	Eureka Valley West fault
EVN	Emigrant Valley North fault
EVS	Emigrant Valley South fault
FC	Furnace Creek fault
FH	Fallout Hills faults
FLV	Fish Lake Valley fault
FM	Frenchman Mountain fault
FR	Freiburg fault
FW	Fatigue Wash fault**
GD	Ghost Dance fault**
GG	Golden Gate faults
GM	Grapevine Mountains fault
GOL	Gold Flat fault
GOM	Gold Mountain fault
GRC	Groom Range Central fault
GRD	Garden Valley fault
GRE	Groom Range East fault
GTH	General Thomas Hills fault
GV	Grapevine fault
HCR	Hot Creek–Reveille fault
HKO	Hiko fault
HM	Hunter Mountain fault
HSP	Hiko–South Pahroc faults
HVSF	Hidden Valley–Sand Flat faults
ISV	Indian Springs Valley fault
JUM	Jumbled Hills fault

Abbreviation	Fault Name
KR	Kawich Range fault
KV	Kawich Valley fault
KW	Keane Wonder fault
LEE	Lee Flat fault
LL	Little Lake fault
LMD	La Madre fault
LMT	Lone Mountain fault
LV	Lida Valley faults
MAC	McAfee Canyon fault
MAY	Maynard Lake fault* (part of PGT)
MER	Mercury Ridge faults
MHE	Monitor Hills East fault
MHW	Monitor Hills West fault
MLGH	Mud Lake–Goldfield Hills fault
MM	Mine Mountain fault
MR	Montezuma Range fault
MV	Monotony Valley fault
NDR	North Desert Range fault
OAK	Oak Spring Butte faults
OSV	Oasis Valley faults
OWV	Owens Valley fault
PAH	Pahroc fault
PAN	Panamint Valley fault
PBC	Paintbrush Canyon fault**
PEN	Penoyer fault
PGT	Pahranagat fault
PM	Pahute Mesa faults
PMJW	Palmetto Mountains–Jackson Wash fault
PRP	Pahrump fault
PV	Pahrock Valley faults
PVNH	Plutonium Valley–North Halfpint Range fault
PW	Palmetto Wash faults
QC	Quinn Canyon fault
RM	Ranger Mountains faults
RTV	Racetrack Valley faults
RV	Rock Valley fault
RWBW	Rocket Wash–Beatty Wash fault
SAL	Saline Valley faults
SB	Sheep Basin fault
SC	Solitario Canyon fault**
SCR	Stagecoach Road fault**
SCV	Southeast Coal Valley fault
SDV	Southern Death Valley fault
SEDR	Sheep–East Desert Ranges fault
SF	Sarcobatus Flat fault

Abbreviation	Fault Name
SHR	Sheep Range fault
SIL	Silver Peak Range fault
SL	State Line fault***
SLR	Slate Ridge faults
SMF	Six–Mile Flat fault
SNV	Sierra Nevada fault
SOU	South Ridge faults
SPR	Spotted Range faults
SPS	Seaman Pass fault
STM	Stumble fault
SWF	Stonewall Flat fault
SWM	Stonewall Mountain fault
SYL	Sylvania Mountains fault
TEM	Tem Piute fault
TK	Tikaboo fault
TLC	Tule Canyon fault
TLV	Three Lakes Valley fault
TM	Tin Mountain fault
TOL	Tolicha Peak fault
TP	Towne Pass fault
WAH	Wahmonie fault
WF	West Frontal fault* (part of SAL)
WH	Weepah Hills fault
WIL	Wilson Canyon fault
WL	West Lava fault* (part of ECR)
WPR	West Pintwater Range fault
WR	West Railroad fault
WSM	West Spring Mountains fault
WW	Windy Wash fault**
YC	Yucca fault
YCL	Yucca Lake fault

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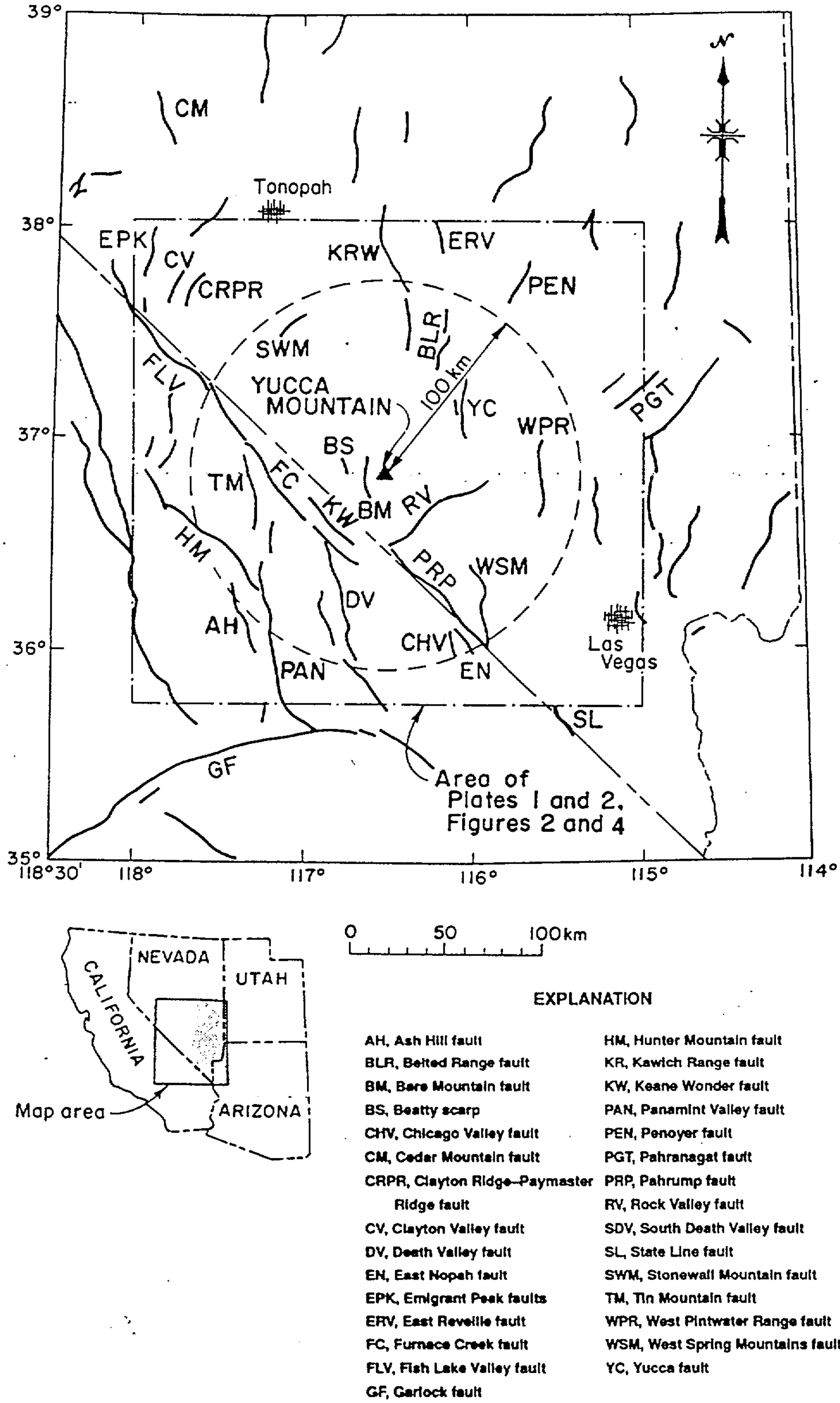


Figure 1. Major known or suspected Holocene and late Pleistocene (≤130 ka) faults in southern Nevada and southeastern California in the region surrounding Yucca Mountain. Faults have been compiled from Stewart and Carlson, 1978; Nakata and others, 1982; Zhang and others, 1990; Dohrenwend and others, 1991, 1992; Hoffard, 1991; Reheis, 1991a, 1992; Reheis and McKee, [1991]; Reheis and Noller, 1991.

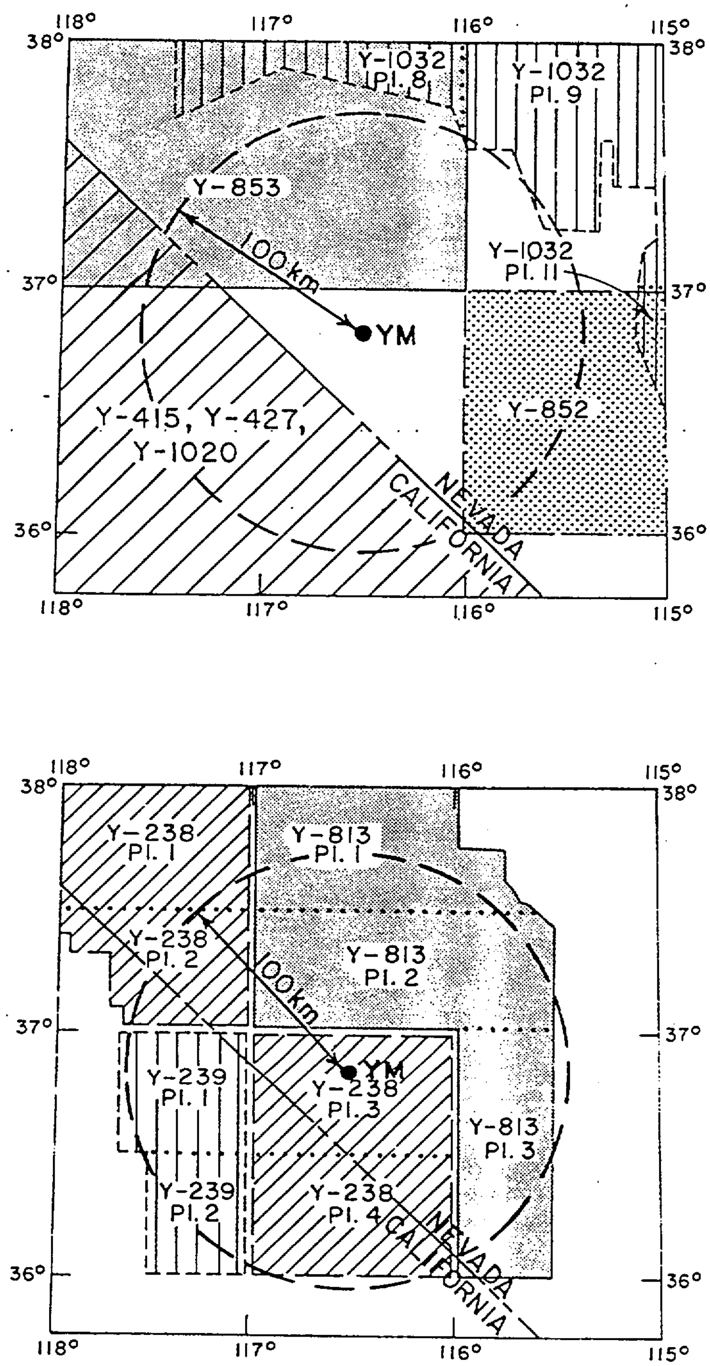
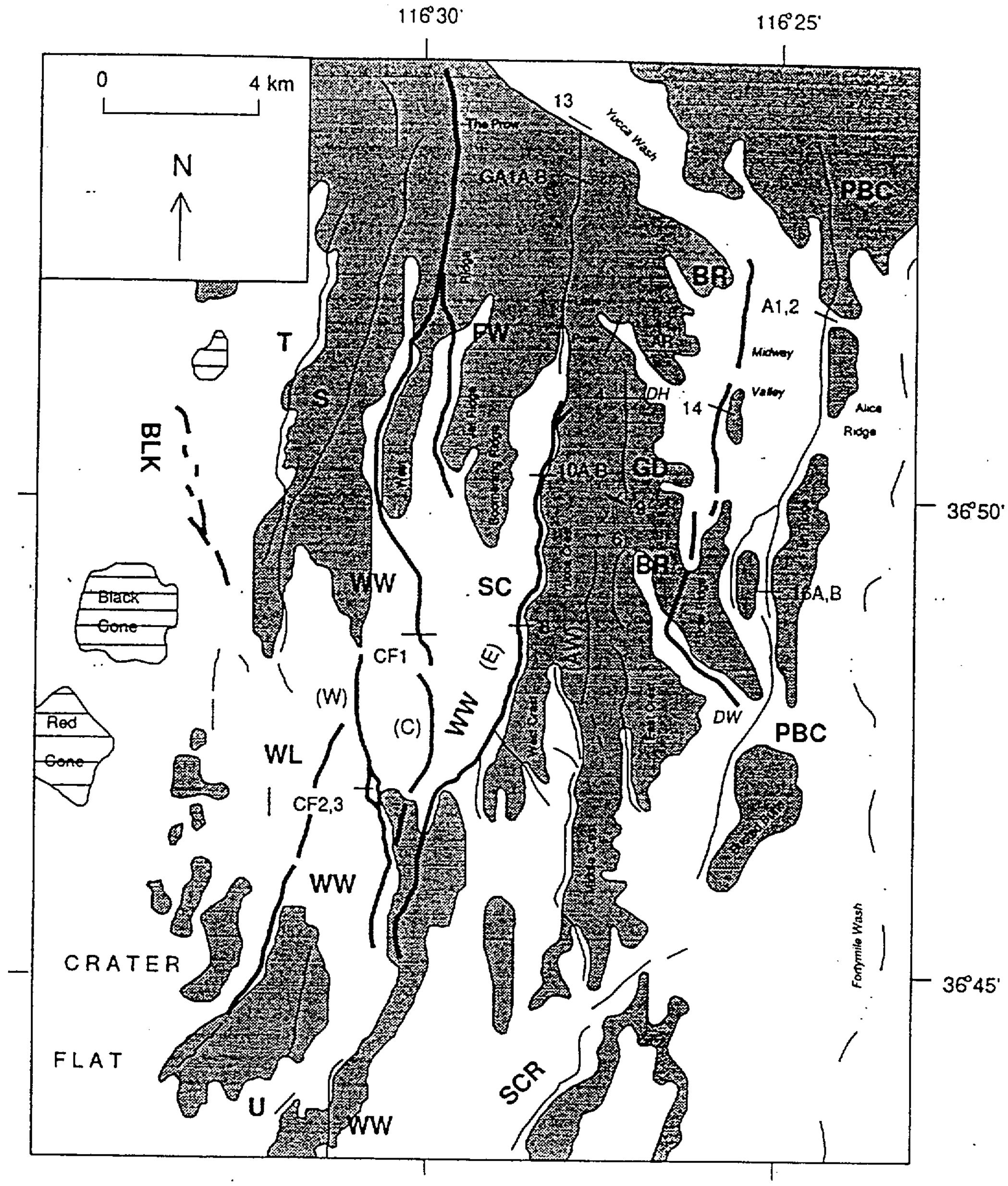


Figure 2. Extent of previous studies that evaluated Quaternary activity along faults in the area covered by plates 1 and 2. Numbers indicate the references, which are listed by number in appendix 4. For the upper drawing, references are Y-415 (Jennings, 1985), Y-427 (Hart and others, 1989), Y-852 (Dohrenwend and others, 1991), Y-853 (Dohrenwend and others, 1992), Y-1020 (Jennings, 1992), and Y-1032 (Schell, 1981). For the lower drawing, references are Y-238 (Reheis and Noller, 1991), Y-239 (Reheis, 1991a), and Y-813 (Reheis, 1992). Numbers preceded by "Pl." show the plate numbers within these references. YM indicates the location of the potential nuclear waste repository at Yucca Mountain.



EXPLANATION

Valleys or basins filled chiefly with Quaternary and Tertiary sedimentary deposits.

Quaternary volcanic rocks.

Mountains or highlands of primarily Tertiary volcanic rocks.

Faults for which late Pleistocene or Holocene (<130 ka) displacement is documeted or suspected.

Faults for which older Quaternary displacement is documented or suspected, or for which the age of displacement is unknown but is thought to be Quaternary.

Portions of the Ghost Dance fault that are shown by Swadley and others (1984), but not by O'Neill and others (1992).

Trenches across faults. Labels are those of previous workers. Many of these trenches are discussed in Swadley and others (1984)

Abbreviations for topographic features are as follows:

AR Azreal Ridge
DH Drill Hole Wash
DW Dune Wash

(AW) indicates the Abandoned Wash fault, which may be an extension of the Ghost Dance fault

Letters in bold type indicate faults as follows:

BLK Black Cone fault
BR Bow Ridge fault
FW Fatigue Wash fault
GD Ghost Dance fault
PBC Paintbrush Canyon fault
SC Solitario Canyon fault
SCR Stagecoach Road fault
WL West lava fault
WW Windy Wash fault

(BLK, WL, and faults labeled with S, T, and U are grouped into the East Crater Flat faults (ECR) elsewhere in this compilation.)

Splays of the Windy Wash fault are as follows: (E), east; (C), central; (W), west.

Figure 3. Known and suspected Quaternary faults near the site of the potential nuclear waste repository at Yucca Mountain. The potential waste repository is located on Yucca Crest south of Drill Hole Wash (*DH*). Figure has been adapted from O'Neill and others (1992, pl. 1), Faulds and others (1991), Scott and Bonk (1984, pl. 1), and Swadley and others (1984, pl. 1).

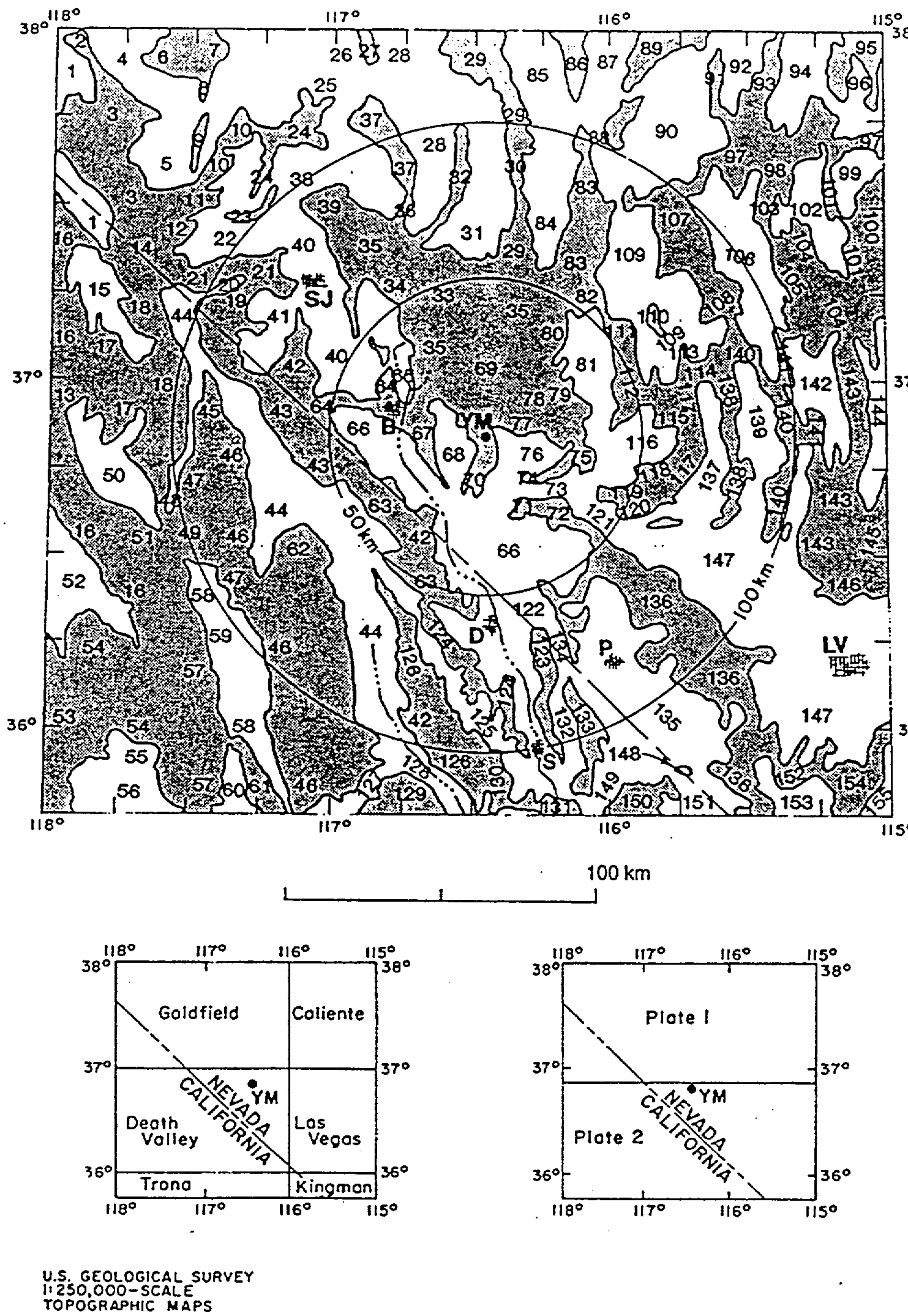


Figure 4. Physiographic features in the area covered by plates 1 and 2. Features have been taken from U.S. Geological Survey 1:250,000–scale topographic maps as shown by the inset map. Two features that have the same number indicate that the two features are too close to separate at the scale of this map.

The numbered physiographic features are listed both alphabetical and numerically on the following pages. The numbers and letters in parentheses in these two lists give the general location of the feature. The number refers to the radius circle in which the feature is located (e.g., 50 means the feature is within 50 km, 100 means the feature is between 50 and 100 km, and >100 means the feature is outside of the 100–km circle). If a feature spans more than one circle, the closest location is noted. The letters give the quadrant of the area where the feature can be found. The area was subdivided into quadrants using "YM" as a center point. Two sets of letters separated by a dash mean that the feature spans more than one quadrant.

Letters show the locations of towns as follows: B, Beatty; D, Death Valley Junction; LV, Las Vegas; P, Pahrump; S, Shoshone; SJ, Scottys Junction. YM indicates the approximate location of the proposed nuclear waste repository at Yucca Mountain. The dot–dash line shows the channel of the Amargosa River. This river flows south from near Beatty to the southern edge of the map area and then flows north into Death Valley.

Physiographic features shown on Figure 4 listed alphabetically:

Amargosa Desert – 66 (50 SW-SE)
Amargosa Range – 42 (50 SW-NW)
Argus Range – 57 (>100 SW)
Ash Hill – 59 (>100 SW)
Ash Meadows – 122 (100 SE)

Bare Mountain – 67 (50 NW-SW)
Belted Range – 83 (100 NE)
Big Smoky Valley – 4 (>100 NW)
Bird Spring Range – 152 (>100 SE)
Black Butte – 148 (>100 SE)
Black Mountain – 33 (50 NW)
Black Mountains – 126 (100 SW-SE)
Bonnie Claire Lake – 41 (100 NW)
Bullfrog Hills – 64 (50 NW)
Buried Hills – 115 (100 NE)

Cactus Flat – 28 (100 NW)
Cactus Range – 37 (100 NW)
Calico Hills – 77 (50 NE)
California Valley – 149 (>100 SE)
Cathedral Ridge – 30 (100 NE)
Chert Ridge – 113 (100 NE)
Chicago Valley – 132 (100 SE)
Clayton Ridge – 9 (>100 NW)
Clayton Valley – 5 (>100 NW)
Coal Valley – 94 (>100 NE)
Cockeyed Ridge – 111 (100 NE)
Confidence Hills – 128 (>100 SW)
Coso Basin – 55 (>100 SW)
Coso Range – 54 (>100 SW)
Cottonwood Mountains – 47 (100 SW)
Coyote Spring Valley – 144 (>100 NE-SE)
Crater Flat – 68 (50 NW-SW)
Cuprite Hills – 23 (>100 NW)

Death Valley – 44 (50 SW-NW)
Deep Springs Valley – 13 (>100 NW)
Desert Range – 140 (100 NE-SE)
Desert Valley – 142 (>100NE-SE)

East Desert Range – 141 (100 NE-SE)
East Pahranagat Range – 104 (>100 NE)
Eldorado Valley – 155 (>100 SE)
Eleana Range – 80 (50 NE)
Emigrant Peak – 2 (>100 NW)
Emigrant Valley – 109 (100 NE)
Eureka Valley – 15 (>100 NW)

Fallout Hills – 114 (100 NE)
Fish Lake Valley – 1 (>100 NW)
Freiburg Range – 91 (>100 NE)
Frenchman Flat – 116 (50 NE-SE)
Funeral Mountains – 63 (50 SW)

Garden Valley – 92 (>100 NE)
Gass Peak – 146 (>100 SE)
General Thomas Hills – 7 (>100 NW)
Gold Flat – 31 (100 NW-NE)
Gold Mountain – 19 (100NW)
Gold Mountain – 32 (100 NW)
Golden Gate Range – 93 (>100 NE)
Goldfield Hills – 24 (>100 NW)
Grapevine Mountains – 43 (100 NW-SW)
Greenwater Range – 124 (100 SW-SE)
Greenwater Valley – 125 (100 SW-SE)
Groom Range – 107 (100 NE)

Halfpint Range – 112 (50 NE)
Hiko Range – 101 (>100 NE)
Hunter Mountain – 49 (100 SW)

Ibex Hills – 130 (>100 SE)
Indian Spring Valley – 137 (100 NE-SE)
Indian Wells Valley – 56 (>100 SW)
Inyo Mountains – 16 (>100 NW-SW)
Ivanpah Valley – 153 (>100 SE)

Jackass Flats – 76 (50 SE-NE)
Jumbled Hills – 108 (100 NE)

Kawich Range – 29 (100 NE-NW)
Kawich Valley – 84 (100 NE)
Kingston Range – 150 (>100 SE)

Las Vegas Range – 145 (>100 SE)
Las Vegas Valley – 147 (100 SE)
Last Chance Range – 18 (100 NW)
Lida Valley – 22 (100 NW)
Little Skull Mountain – 74 (50 SE)
Long Valley – 127 (>100 SW)

Magruder Mountain – 12 (>100 NW)
McCullough Range – 154 (>100 SE)
Mercury Ridge – 119 (50 SE)
Mercury Valley – 121 (50 SE)
Mesquite Valley – 151 (>100 SE)
Mine Mountain – 79 (50 NE)
Monitor Hills – 27 (>100 NW)
Monotony Valley – 88 (100 NE)
Montezuma Range – 10 (>100 NW)
Mount Helen – 36 (100 NW)
Mount Irish – 98 (>100 NE)
Mount Jackson Ridge – 23 (>100 NW)
Mud Lake – 25 (>100 NW)

Nelson Range – 51 (>100 SW)
Nopah Range – 133 (100 SE)
North Pahranagat Range – 103 (>100 NE)
North Ridge – 120 (50 SE)

Oak Spring Butte – 82 (100 NE)
Oasis Valley – 65 (50 NW)
Oriental Wash – 20 (100 NW)
Owens Valley – 52 (>100 SW)
Owlshead Mountains – 129 (>100 SW)

Pahranagat Range – 105 (>100 NE)
Pahranagat Valley – 102 (>100 NE)
Pahroc Valley – 99 (>100 NE)
Pahrock Valley – 96 (>100 NE)
Pahrump Valley – 135 (100 SE)
Pahute Mesa – 35 (50 NW-NE)
Palmetto Mountains – 11 (>100 NW)
Panamint Range – 46 (100 SW-NW)
Panamint Valley – 58 (100 SW)
Papoose Range – 110 (100 NE)
Paymaster Ridge – 8 (>100 NW)
Pintwater Range – 138 (100 NE-SE)

Quinn Canyon Range – 89 (>100 NE)

Racetrack Valley – 48 (100 SW)
Railroad Valley – 87 (>100 NE)
Ralston Valley – 26 (>100 NW)
Ranger Mountains – 118 (50 SE)
Resting Spring Range – 123 (100 SE)
Reveille Range – 86 (>100 NE)
Reveille Valley – 85 (>100 NE)
Rock Valley – 73 (50 SE)

Saline Range – 17 (>100 NW)
Saline Valley – 50 (>100 SW-NW)
Sand Spring Valley – 90 (100 NE)
Sarcobatus Flat – 40 (50 NW)
Seaman Range – 95 (>100 NE)
Searles Valley – 60 (>100 SW)
Sheep Range – 143 (>100 NE-SE)
Shoreline Butte – 128 (>100 SW)
Shoshone Mountain – 78 (50 NE)
Sierra Nevada – 53 (>100 SW)
Silver Peak Range - 3 (>100 NW)
Sixmile Flat – 99 (>100 NE)
Skeleton Hills – 71 (50 SE)
Skull Mountain – 75 (50 SE)
Slate Range – 61 (>100 SW)
Slate Ridge - 21 (100 NW)
South Pahroc Range – 100 (>100 NE)
South Ridge – 120 (50 SE)
Specter Range – 72 (50 SE)
Sperry Hills – 131 (>100 SE)
Spotted Range – 117 (100 NE-SE)
Spring Mountains – 136 (100 SE)

Stewart Valley – 134 (100 SE)
Stonewall Flat – 38 (100 NW)
Stonewall Mountain – 39 (100 NW)
Striped Hills – 71 (50 SE)
Sylvania Mountains – 14 (>100 NW)

Three Lakes Valley – 139 (100 NE-SE)
Tikaboo Valley – 106 (100 NE)
Timber Mountain – 69 (50 NW-NE)
Timpahute Range – 97 (>100 NE)
Tin Mountain – 45 (100 NW)
Tolicha Peak – 34 (100 NW)
Tucki Mountain – 62 (100 SW)

Weepah Hills – 6 (>100 NW)
Worthington Mountains – 91 (>100 NE)

Yucca Flat – 81 (50 NE)
Yucca Mountain – 70 (50 SW-SE)

Physiographic features shown on Figure 4 listed numerically:

1 – Fish Lake Valley (>100 NW)
2 – Emigrant Peak (>100 NW)
3 – Silver Peak Range (>100 NW)
4 – Big Smoky Valley (>100 NW)
5 – Clayton Valley (>100 NW)
6 – Weepah Hills (>100 NW)
7 – General Thomas Hills (>100 NW)
8 – Paymaster Ridge (>100 NW)
9 – Clayton Ridge (>100 NW)
10 – Montezuma Range (>100 NW)

11 – Palmetto Mountains (>100 NW)
12 – Magruder Mountain (>100 NW)
13 – Deep Springs Valley (>100 NW)
14 – Sylvania Mountains (>100 NW)
15 – Eureka Valley (>100 NW)
16 – Inyo Mountains (>100 NW-SW)
17 – Saline Range (>100 NW)
18 – Last Chance Range (100 NW)
19 – Gold Mountain (100NW)
20 – Oriental Wash (100 NW)

21 – Slate Ridge (100 NW)
22 – Lida Valley (100 NW)
23 – Cuprite Hills (>100 NW)
23 – Mount Jackson Ridge (>100 NW)
24 – Goldfield Hills (>100 NW)
25 – Mud Lake (>100 NW)
26 – Ralston Valley (>100 NW)
27 – Monitor Hills (>100 NW)
28 – Cactus Flat (100 NW)
29 – Kawich Range (100 NE-NW)
30 – Cathedral Ridge (100 NE)

31 – Gold Flat (100 NW-NE)
32 – Gold Mountain (100 NW)
33 – Black Mountain (50 NW)
34 – Tolicha Peak (100 NW)
35 – Pahute Mesa (50 NW-NE)
36 – Mount Helen (100 NW)
37 – Cactus Range (100 NW)
38 – Stonewall Flat (100 NW)
39 – Stonewall Mountain (100 NW)
40 – Sarcobatus Flat (50 NW)

41 – Bonnie Claire Lake (100 NW)
42 – Amargosa Range (50 SW-NW)
43 – Grapevine Mountains (100 NW-SW)
44 – Death Valley (50 SW-NW)
45 – Tin Mountain (100 NW)
46 – Panamint Range (100 SW-NW)
47 – Cottonwood Mountains (100 SW)
48 – Racetrack Valley (100 SW)
49 – Hunter Mountain (100 SW)
50 – Saline Valley (>100 SW-NW)

51 – Nelson Range (>100 SW)
52 – Owens Valley (>100 SW)
53 – Sierra Nevada (>100 SW)
54 – Coso Range (>100 SW)
55 – Coso Basin (>100 SW)
56 – Indian Wells Valley (>100 SW)
57 – Argus Range (>100 SW)
58 – Panamint Valley (100 SW)
59 – Ash Hill (>100 SW)
60 – Searles Valley (>100 SW)

61 – Slate Range (>100 SW)
62 – Tucki Mountain (100 SW)
63 – Funeral Mountains (50 SW)
64 – Bullfrog Hills (50 NW)
65 – Oasis Valley (50 NW)
66 – Amargosa Desert (50 SW-SE)
67 – Bare Mountain (50 NW-SW)
68 – Crater Flat (50 NW-SW)
69 – Timber Mountain (50 NW-NE)
70 – Yucca Mountain (50 SW-SE)

71 – Skeleton Hills (50 SE)
71 – Striped Hills (50 SE)
72 – Specter Range (50 SE)
73 – Rock Valley (50 SE)
74 – Little Skull Mountain (50 SE)
75 – Skull Mountain (50 SE)
76 – Jackass Flats (50 SE-NE)
77 – Calico Hills (50 NE)
78 – Shoshone Mountain (50 NE)
79 – Mine Mountain (50 NE)
80 – Eleana Range (50 NE)

81 – Yucca Flat (50 NE)
82 – Oak Spring Butte (100 NE)
83 – Belted Range (100 NE)
84 – Kawich Valley (100 NE)
85 – Reveille Valley (>100 NE)
86 – Reveille Range (>100 NE)
87 – Railroad Valley (>100 NE)
88 – Monotony Valley (100 NE)
89 – Quinn Canyon Range (>100 NE)
90 – Sand Spring Valley (100 NE)

91 – Freiburg Range (>100 NE)
91 – Worthington Mountains (>100 NE)
92 – Garden Valley (>100 NE)
93 – Golden Gate Range (>100 NE)
94 – Coal Valley (>100 NE)
95 – Seaman Range (>100 NE)
96 – Pahrock Valley (>100 NE)
97 – Timpahute Range (>100 NE)
98 – Mount Irish (>100 NE)
99 – Pahroc Valley (>100 NE)
99 – Sixmile Flat (>100 NE)
100 – South Pahroc Range (>100 NE)

101 – Hiko Range (>100 NE)
102 – Pahranagat Valley (>100 NE)
103 – North Pahranagat Range (>100 NE)
104 – East Pahranagat Range (>100 NE)
105 – Pahranagat Range (>100 NE)
106 – Tikaboo Valley (100 NE)
107 – Groom Range (100 NE)
108 – Jumbled Hills (100 NE)
109 – Emigrant Valley (100 NE)
110 – Papoose Range (100 NE)

111 – Cockeyed Ridge (100 NE)
112 – Halfpint Range (50 NE)
113 – Chert Ridge (100 NE)
114 – Fallout Hills (100 NE)
115 – Buried Hills (100 NE)
116 – Frenchman Flat (50 NE-SE)
117 – Spotted Range (100 NE-SE)
118 – Ranger Mountains (50 SE)
119 – Mercury Ridge (50 SE)
120 – North Ridge (50 SE)
120 – South Ridge (50 SE)

121 – Mercury Valley (50 SE)
122 – Ash Meadows (100 SE)
123 – Resting Spring Range (100 SE)
124 – Greenwater Range (100 SW-SE)
125 – Greenwater Valley (100 SW-SE)
126 – Black Mountains (100 SW-SE)
127 – Long Valley (>100 SW)
128 – Confidence Hills (>100 SW)
128 – Shoreline Butte (>100 SW)
129 – Owlshead Mountains (>100 SW)
130 – Ibex Hills (>100 SE)

131 – Sperry Hills (>100 SE)
132 – Chicago Valley (100 SE)
133 – Nopah Range (100 SE)
134 – Stewart Valley (100 SE)
135 – Pahrump Valley (100 SE)
136 – Spring Mountains (100 SE)
137 – Indian Spring Valley (100 NE-SE)
138 – Pintwater Range (100 NE-SE)
139 – Three Lakes Valley (100 NE-SE)
140 – Desert Range (100 NE-SE)

141 – East Desert Range (100 NE-SE)
142 – Desert Valley (>100NE-SE)
143 – Sheep Range (>100 NE-SE)
144 – Coyote Spring Valley (>100 NE-SE)
145 – Las Vegas Range (>100 SE)
146 – Gass Peak (>100 SE)
147 – Las Vegas Valley (100 SE)
148 – Black Butte (>100 SE)
149 – California Valley (>100 SE)
150 – Kingston Range (>100 SE)

151 – Mesquite Valley (>100 SE)
152 – Bird Spring Range (>100 SE)
153 – Ivanpah Valley (>100 SE)
154 – McCullough Range (>100 SE)
155 – Eldorado Valley (>100 SE)

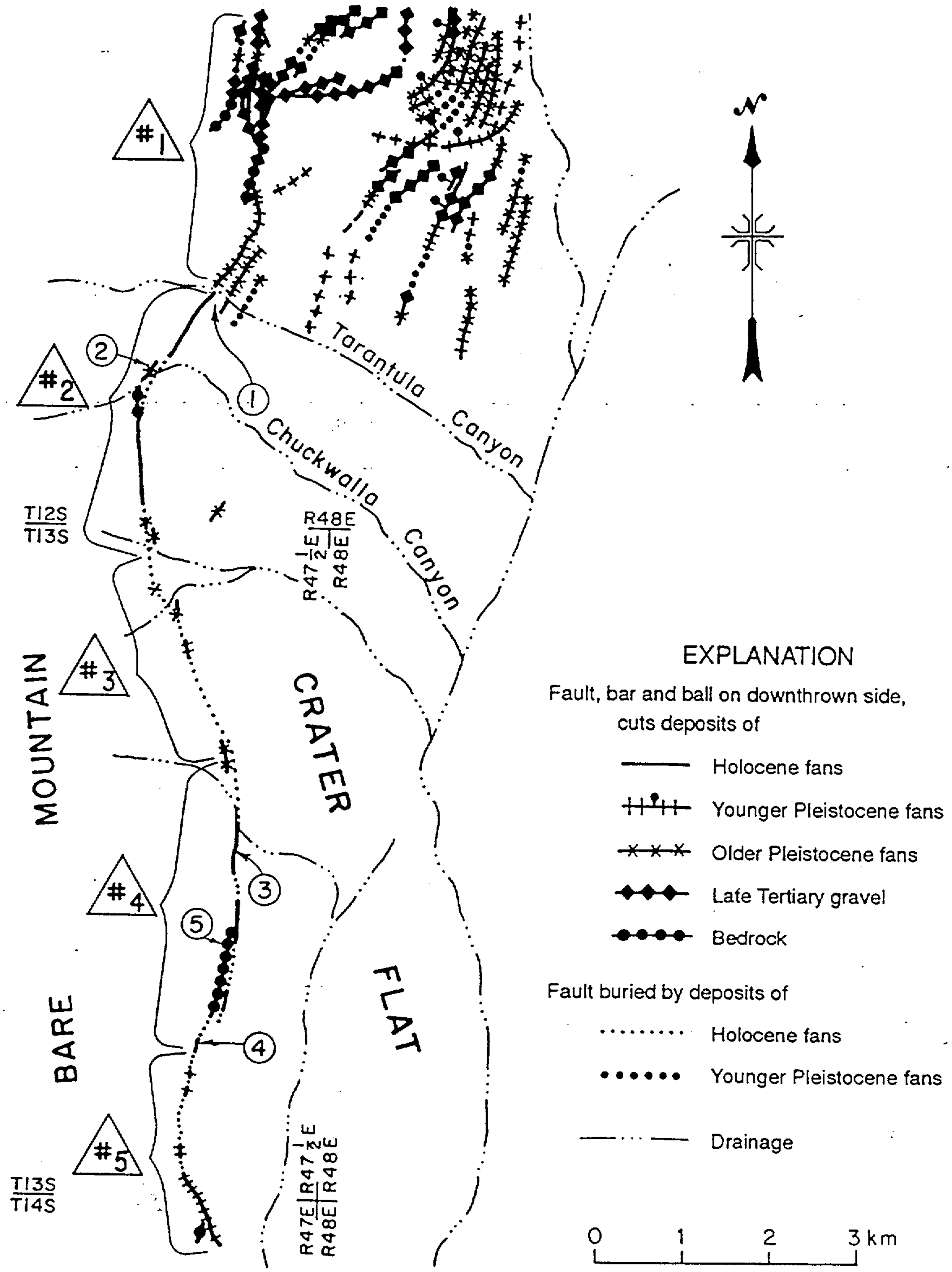


Figure 5. Bare Mountain fault along the eastern side of Bare Mountain. Numbers in triangles indicate fault segments defined by Reheis (1988). Numbers in circles refer to sites noted in Reheis (1988) and discussed in the description sheet. Figure is adapted from Reheis (1988, fig. 8.1, p. 104).

Table 1. Data for known and suspected Quaternary faults within 50 km of Yucca Mountain

[Detailed data are on tables in appendix 1 and on description sheets in appendix 2. Displacement rates are usually apparent slip rates and are for late Quaternary (≤130 ka) or shorter (younger) time periods unless otherwise indicated; F, indicates that fracturing has been recognized but no significant fault displacement; leaders (--), no information was noted during the literature review]

Fault or faults [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Amargosa River fault (AR)	P2	40	--	--	--	
Area Three fault (AT)	P1	44	--	--	--	
Ash Meadows fault (AM)	P2	34	--	--	--	
[Northern section]	P2	--	--	--	--	
[Central section]	P2	--	--	0.04	--	Donovan, 1991
[Southern section]	P2	--	--	--	--	
Bare Mountain fault (BM)	P1, P2	14	--	--	--	
[Section #1]	F5	--	--	--	--	
[Section #2]	F5	--	--	--	--	
[Section #3]	F5	--	--	--	--	
[Section #4]	F5	--	20 to 25	0.19	--	Reheis, 1988a
[Section #5]	F5	--	--	--	--	
Beatty scarp (BS)[1]	P1, P2	26	--	--	--	
Bow Ridge fault (BR)	F3	1	--	0.001	--	Menges and others, 1993
Bullfrog Hills faults (BUL)	P1	38	--	--	--	
Cane Spring fault (CS)	P1, P2	36	--	--	--	

Table 1. Data for known and suspected Quaternary faults within 50 km of Yucca Mountain--Continued

Fault or faults [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Carpetbag fault (CB)	P1	43	[2]25	F	--	Shroba and others, 1988a, 1988b
Checkpoint Pass fault (CP)	P2	44	--	--	--	
Crossgrain Valley faults (CGV)	P2	48	--	--	--	
[North Ridge front fault]	P2	--	--	--	--	
[Northeast valley faults]	P2	--	--	--	--	
[Southwest valley fault]	P2	--	--	--	--	
East Crater Flat faults (ECR)	F3					
Fault S	F3	4	--	--	--	
Fault T	F3	5	--	--	--	
Black Cone fault (BLK)	F3	7	--	0.03 to 0.06	--	Ramelli and others, 1991
West lava fault (WL)	F3	7	--	--	--	
Fault U	F3	16	--	--	--	
Eleana Range fault (ER)	P1	37	--	--	--	
Fatigue Wash fault (FW)	F3	2	--	--	--	
Furnace Creek fault (FC)	P1, P2	50	[3]1.7 to 2.5	--	[4]2.3	Reynolds, 1969; Bryant, 1988; Brogan and others, 1991
Ghost Dance fault (GD)	F3	0	--	--	--	

Table 1. Data for known and suspected Quaternary faults within 50 km of Yucca Mountain--Continued

Fault or faults [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Keane Wonder fault (KW)	P2	43	--	--	--	
Mercury Ridge faults (MER)	P2	--	--	--	--	
[Northwest fault]	P2	48	--	--	--	
[Southeast fault]	P2	51	--	--	--	
Mine Mountain fault (MM)	P1	19	--	--	--	
Oasis Valley faults (OSV)	P1	--	--	--	--	
[Eastern faults]	P1	24	--	[5]0.001 to 0.005	--	
[Western faults]	P1	30	--	--	--	Hoover and others, [1981]; Reheis and Noller, 1989
Pahute Mesa faults (PM)	P1	48	--	--	--	
Paintbrush Canyon fault (PBC)	F3	3	[6]117 to140; 10^3 to 10^4	[7]≤0.01	[8]0.0083	Swan and others, 1993; Whitney and Muhs, 1991
Plutonium Valley-North Halfpint Range fault (PVNH)	P1	46	--	--	--	
Ranger Mountains faults (RM)	P2	49	--	--	--	
[North faults]	P2	--	--	--	--	
[South faults]	P2	--	--	--	--	
Rock Valley fault (RV)	P2	[9]24; 27; 32; 65	--	[10]0.003 to 0.01	--	Yount and others, 1987

Table 1. Data for known and suspected Quaternary faults within 50 km of Yucca Mountain--Continued

Fault or faults [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Rocket Wash-Beatty Wash fault (RWBW)	P1	19	--	--	--	
Solitario Canyon fault (SC)	F3	0.5	--	0.03 to 0.06	--	Faulds and others, 1991; Ramelli and others, 1991
Stagecoach Road fault (SCR)	F3	10	--	--	--	
Tolicha Peak fault (TOL)	P1	42	--	--	--	
Wahmonie fault (WAH)	P2	22	--	--	--	
Windy Wash fault (WW)	F3	3	[11]75	[12]0.0015	--	Scott, 1990; Whitney and others, 1986
			--	[13]0.001 to 0.03	--	Ramelli and others, 1991
Yucca fault (YC)	P1	40	--	--	--	
Yucca Lake fault (YCL)	P1	36	--	--	--	

[1]Although a tectonic origin for the Beatty scarp is not clear, a non-tectonic origin for the scarp has not been verified. Therefore, the feature is included in this compilation, which is based on published literature and other readily available data for known and suspected Quaternary faults.

[2]This recurrence interval is for episodes of fracturing during the last 130,000 years.

[3]This recurrence interval assumes four to six ruptures on FC since 10 ka.

[4]This rate is for FC in northern Death Valley since about 20 ka.

[5]This rate is based on displacement of deposits with an estimated age of 730 ka to 3 Ma.

[6]The first entry is the average recurrence interval for surface-faulting events since 117 ka to 140 ka. The second entry is the estimated intervals between three and five middle and late Pleistocene surface-faulting events on a western splay of PBC.

Table 1. Data for known and suspected Quaternary faults within 50 km of Yucca Mountain--Continued

[8]This is an oblique slip rate for PBC at Busted Butte since about 700 ka.

[9]The variation in the length of RV reflects different interpretations of the ends of the fault. The longest value assumes that RV extends from Frenchman Flat southwestward across the Amargosa Desert.

[10]This rate is for the central part of the fault at the trench sites of Yount and others (1987).

[11]This is the average recurrence interval that was estimated on the basis of four faulting events since 300 ka.

[12]This rate is based on an interpretation that 40 cm of vertical displacement has occurred since 270 ka.

[13]This is an average apparent vertical slip rate for the southern Windy Wash fault during the late Pleistocene and Holocene.

Table 2. Data for known and suspected Quaternary faults between >50 and 100 km of Yucca Mountain

[Detailed data are on tables in appendix 1 and on description sheets in appendix 2. Slip rates are usually apparent slip rates and are for late Quaternary (≤130 ka) or shorter (younger) time periods unless otherwise indicated; leaders (--), no information was noted during the literature review]

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Belted Range fault (BLR)	P1	55	--	--	--	
Bonnie Claire fault (BC)	P1	74	--	--	--	
Boundary fault (BD)	P1	51	--	--	--	
Buried Hills faults (BH)	P1, P2	53	--	--	--	
Cactus Flat fault (CF)	P1	84	--	--	--	
Cactus Flat-Mellan fault (CFML)	P1	80	--	--	--	
Cactus Range-Wellington Hills fault (CRWH)	P1	87	--	--	--	
Cactus Springs fault (CAC)	P2	59	--	--	--	
Central Pintwater Range faults (CPR)	P1	79	--	--	--	
Central Spring Mountains faults (CSM)	P2	76	--	--	--	
[Northwest fault]	P2	--	--	--	--	
[Northeast fault]	P2	--	--	--	--	
[Southeast fault]	P2	--	--	--	--	
Chalk Mountain fault (CLK)	P1	87	--	--	--	
Chert Ridge faults (CHR)	P1	65	--	--	--	
[Eastern faults]	P1	--	--	--	--	
[Western faults]	P1	--	--	--	--	

Table 2. Data for known and suspected Quaternary faults between >50 and 100 km of Yucca Mountain--Continued

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Chicago Valley fault (CHV)	P2	90	--	--	--	
Cockeyed Ridge-Papoose Lake fault (CRPL)	P1	53	--	--	--	
Death Valley fault (DV)	P2	55	0.65	[1]0.08 to 11.5; 0.15 to 2.5	--	Brogan and others, 1991
East Belted Range fault (EBR)	P1	80	--	--	--	
East Nopah fault (EN)	P2	85	--	[2]0.006 to 0.06	--	McKittrick, 1988; Hoffard, 1991
East Pintwater Range fault (EPR)	P1, P2	81	--	--	--	
Emigrant fault (EM)	P2	73	--	--	--	
Emigrant Valley North fault (EVN)	P1	60	--	--	--	
Emigrant Valley South fault (EVS)	P1	66	--	--	--	
Fallout Hills faults (FH)	P1	70	--	--	--	
Gold Flat fault (GOL)	P1	65	--	--	--	
Gold Mountain fault (GOM)	P1	90	--	--	--	
Grapevine fault (GV)	P1, P2	58	--	--	--	
Grapevine Mountains fault (GM)	P1	--	--	--	--	
[Southern trace]	P1	67	--	--	--	
[Northern trace]	P1	70	--	--	--	
Groom Range Central fault (GRC)	P1	82	--	--	--	

Table 2. Data for known and suspected Quaternary faults between >50 and 100 km of Yucca Mountain--Continued

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Groom Range East fault (GRE)	P1	85	--	--	--	
Hidden Valley-Sand Flat faults (HVSF)	P2	87	--	--	--	
[Fault along the eastern sides of Hidden Valley/Ulida Flat]	P2	--	--	--	--	
[Fault along the southern sides of Ulida Flat/Sand Flat]	P2	--	--	--	--	
[Fault along the southeastern side of Sand Flat]	P2	--	--	--	--	
[Fault along the northeastern side of Sand Flat]	P2	--	--	--	--	
[Fault along the western side of Ulida Flat]	P2	--	--	--	--	
Hunter Mountain fault (HM)	P2	95	--	--	--	
Indian Springs Valley fault (ISV)	P1, P2	67	--	--	--	
Jumbled Hills fault (JUM)	P1	77	--	--	--	
Kawich Range fault (KR)	P1	57	--	--	--	
Kawich Valley fault (KV)	P1	61	--	--	--	
La Madre fault (LMD)	P2	82	--	--	--	
North Desert Range fault (NDR)	P1	61	--	--	--	
Oak Spring Butte faults (OAK)	P1	57	--	--	--	
Pahrump fault (PRP)	P2	70	--	--	--	

Table 2. Data for known and suspected Quaternary faults between >50 and 100 km of Yucca Mountain--Continued

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Panamint Valley fault (PAN)	P2	95	--	--	--	
[Fault south of Ballarat]	P2	--	[3]0.7 to 2.5; 0.86 to 2.36	--	[4]1.74±0.65; 2.36±0.79; 1 to 2; 2.5	Smith and others, 1979; Ellis and others, 1989; Zhang and others, 1990
[Fault north of Ballarat]	P2	--	--	--	--	
Penoyer fault (PEN)	P1	97	--	--	--	
Racetrack Valley faults (RTV)	P2		--	--	--	
[Eastern fault]	P2	97	--	--	--	
[Western fault]	P2	102	--	--	--	
Sarcobatus Flat fault (SF)	P1	52	--	--	--	
Slate Ridge faults (SLR)	P1	87	--	--	--	
[Northern fault]	P1	--	--	--	--	
[Southern fault]	P1	--	--	--	--	
South Ridge faults (SOU)	P2	--	--	--	--	
[Northern fault]	P2	55	--	--	--	
[Southern fault]	P2	50	--	--	--	
Spotted Range faults (SPR)	P1, P2	59	--	--	--	
[Range-front fault]	P1, P2	--	--	--	--	
[Fault along unnamed ridge]	P1, P2	--	--	--	--	

Table 2. Data for known and suspected Quaternary faults between >50 and 100 km of Yucca Mountain--Continued

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
[Faults within the range]	P1, P2	--	--	--	--	
Stonewall Mountain fault (SWM)	P1	92	--	--	--	
Stumble fault (STM)	P1	74	--	--	--	
Three Lakes Valley fault (TLV)	P1	84	--	--	--	
Tikaboo fault (TK)	P1	92	--	--	--	
Tin Mountain fault (TM)	P1, P2	90	--	--	--	
Towne Pass fault (TP)	P2	76	--	--	--	
West Pintwater Range fault (WPR)	P1, P2	76	--	--	--	
West Spring Mountains fault (WSM)	P2	53	--	[5]0.02 to 0.2; 0.06	--	Hoffard, 1991

[1]The first range of vertical slip rates is for DV south of Furnace Creek Wash and is based on the maximum vertical displacement of deposits with an estimated age between 0.2 ka to 2 ka. The second range of vertical slip rates is based on the maximum vertical displacement of deposits with an estimated age of 2 ka to 10 ka.

[2]This rate was estimated from a 3-m-high fault scarp on surfaces with an estimated age of 50 ka to 500 ka.

[3]The first entry is the average recurrence interval for a 20-km-long section of PAN between Ballarat and Goler Wash Canyon assuming that all events produced 1.4 to 2.6 m of right-lateral displacement so that a displacement of 20 m represents eight to fourteen events since 10 ka to 20 ka. The second entry is the average recurrence interval for the Holocene and latest Pleistocene assuming single-event displacements of about 3 m and a right-lateral slip rate of 2.36±0.79 mm/yr.

[4]The first slip rate is a minimum rate for PAN near Manly Peak during the Holocene and latest Pleistocene. The second slip rate is a minimum rate for the fault near the southern extent of fault scarps at Goler Wash Canyon (5.3 km south of Manly Peak) during the Holocene and latest Pleistocene. The third rate is based on displaced deposits that have an estimated age of 10 ka to 20 ka at the mouth of Goler Wash Canyon. The fourth slip rate is for the southern portion of the fault since 15 ka.

[5]The first slip rate was estimated for WSM near the mouth of Wheeler Wash using displacement of a surface with an estimated age of 50 ka to 500 ka. The second rate was estimated for the fault in the same area using displacement on a surface with an estimated age of 200 ka.

Table 3. Data for known and suspected Quaternary faults greater than 100 km from Yucca Mountain

[Detailed data are on tables in appendix 1 and on description sheets in appendix 2. Slip rates are usually apparent slip rates and are for late Quaternary (≤130 ka) or shorter (younger) time periods unless otherwise indicated; leaders (--), no information noted during the literature review]

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Airport Lake fault (AIR)	P2	138	--	[1]0.03 to 0.07	--	Roquemore, 1981
Ash Hill fault (AH)	P2	105	--	--	--	
Badger Wash faults (BDG)	P1	111	--	--	--	
Cedar Mountain fault (CM)	F1	200	([2])	--	[3]0.05; 0.1	Bell and others, 1988
Central Reveille fault (CR)	P1	108	--	--	--	
Clayton-Montezuma Valley fault (CLMV)	P1	126	--	--	--	
Clayton Ridge-Paymaster Ridge fault (CRPR)	P1	126	--	--	--	
Clayton Valley fault (CV)	P1	132	--	--	--	
Deep Springs fault (DS)	P1	148	--	[4]0.24; 0.3	--	Bryant, 1989; Reheis and McKee, [1991]
East Magruder Mountain fault (EMM)	P1	113	--	--	--	
East Reveille fault (ERV)	P1	112	--	--	--	
East Stone Cabin fault (ESC)	P1	115	--	--	--	
Emigrant Peak faults (EPK)	P1	166	--	[5]0.16; 0.5 to 1	--	Reheis, 1988b, 1991b
Emigrant Valley East fault (EURE)	P1	110	--	--	--	
Emigrant Valley West fault (EURW)	P1	140	--	--	--	
Fish Lake Valley fault (FLV)	P1	135	[6]1.1±0.6	[7]0.1 to 0.3; [8]0.8 to 1.6	[7]0.4 to 0.6; [9]0.6 to 0.8	Sawyer, 1990, 1991

Table 3. Data for known and suspected Quaternary faults greater than 100 km from Yucca Mountain--Continued

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Freiburg fault (FR)	P1	133	--	--	--	
Frenchman Mountain fault (FM)	P2	146	([10])	--	--	Anderson and O'Connell, 1993
Garden Valley fault (GRD)	P1	126	--	--	--	
General Thomas Hills fault (GTH)	P1	137	--	--	--	
Golden Gate faults (GG)	P1	144	--	--	--	
Hiko fault (HKO)	P1	131	--	--	--	
Hiko-South Pahroc faults (HSP)	P1	130	--	--	--	
Hot Creek-Reveille fault (HCR)	P1	103	--	--	--	
Lee Flat fault (LEE)	P2	113	--	--	--	
Lida Valley faults (LV)	P1	115	--	--	--	
Little Lake fault (LL)	P2	163	[11]0.02	--	[12]0.6 to 1.8; 1.1 to 4.9; 3	Duffield and Bacon, 1981; Roquemore, 1981, 1988; Wills, 1988
Lone Mountain fault (LMT)	P1	165	--	--	--	
McAfee Canyon fault (MAC)	P1	155	--	--	--	
Monitor Hills East fault (MHE)	P1	125	--	--	--	
Monitor Hills West fault (MHW)	P1	124	--	--	--	
Monotony Valley fault (MV)	P1	103	--	--	--	
Montezuma Range fault (MR)	P1	121	--	--	--	
Mud Lake-Goldfield Hills fault (MLGH)	P1	113	--	--	--	

Table 3. Data for known and suspected Quaternary faults greater than 100 km from Yucca Mountain--Continued

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Owens Valley fault (OWV)	P2	126	3.3 to 5; 5 to 10.5	--	[13]0.4 to 1.3; 0.7 to 2.2; 2±1; 3; 3 to 7	Lubetkin and Clark, 1988; Hart and others, 1989; Beanland and Clark, 1993
Pahranagat faults (PGT)	P1	106	--	--	--	
[Arrowhead Mine fault (ARM)]	P1	--	--	--	--	
[Buckhorn fault (BUC)]	P1	--	--	--	--	
[Maynard Lake fault (MAY)]	P1	--	--	--	--	
Pahroc fault (PAH)	P1	144	--	--	--	
Pahrock Valley faults (PV)	P1	155	--	--	--	
Palmetto Mountains-Jackson Wash fault (PMJW)	P1	112	--	--	--	
Palmetto Wash faults (PW)	P1	131	--	--	--	
Quinn Canyon fault (QC)	P1	127	--	--	--	
Saline Valley faults (SAL)	P2	108	--	--	--	
[Fault along the front of the Inyo Mountains (WF)]	P2	--	--	--	--	
[Fault along the eastern side of Saline Valley (ES)]	P2	--	--	--	--	
[Fault in central Saline Valley (CEN)]	P2	--	--	--	--	
Seaman Pass fault (SPS)	P1	153	--	--	--	
Sheep Basin fault (SB)	P1, P2	112	--	--	--	

Table 3. Data for known and suspected Quaternary faults greater than 100 km from Yucca Mountain--Continued

Fault or fault [Segment or individual fault]	Plate (P) or figure (F)	Closest approach (km)	Recurrence interval (10^3 yr)	Vertical slip rate (mm/yr)	Lateral slip rate (mm/yr)	References
Sheep-East Desert Ranges fault (SEDR)	P2	104	--	--	--	
Sheep Range fault (SHR)	P1, P2	122	--	--	--	
Sierra Nevada fault (SNV)	P2	154	--	0.1 to 0.8	--	Beanland and Clark, 1993
Silver Peak Range faults (SIL)	P1	142	--	--	--	
Six-Mile Flat fault (SMF)	P1	138	--	--	--	
Southeast Coal Valley fault (SCV)	P1	132	--	--	--	
Southern Death Valley fault (SDV)	P2	105	--	--	[14]0.3; 32 to 63	Butler, 1984; Brady, 1986
State Line fault (SL)	F1	130	--	--	--	
Stonewall Flat fault (SWF)	P1	101	--	--	--	
Sylvania Mountains fault (SYL)	P1	111	--	--	--	
Tem Piute fault (TEM)	P1	101	--	--	--	
Tule Canyon fault (TLC)	P1	104	--	--	--	
Weepah Hills fault (WH)	P1	145	--	--	--	
West Railroad fault (WR)	P1	112	--	--	--	
Wilson Canyon fault (WIL)	P2	140	--	--	--	

[1]This is the rate for the Southern segment of Roquemore (1981) estimated using displaced alluvium with an estimated age of 50 ka to 126 ka.

[2]On the basis of the subdued scarps older than the 1932 rupture, a recurrence interval of possibly tens of thousands of years for surface-rupturing events was inferred.

[3]The first rate is since 135 ka. The second rate is since 20 ka.

[4]These are minimum slip rates estimated using different amounts of displacement of deposits containing Bishop ash (740 ka).

[5]Both slip rates are for the westernmost fault of EPK. The first rate is a minimum rate calculated using deposits containing Bishop ash (740 ka). The second rate is a maximum late Holocene rate estimated using displacement of deposits with an estimated age of 2 ka.

[6]This is the average recurrence interval between three ruptures that have occurred since 2.5 ka. The interval could be as long as 3,000 yr or as short as 500 yr.

[7]These rates were estimated for deposits with an estimated age of 5 ka to 8 ka for a single trace of FLV in northern Fish Lake Valley.

[8]This slip rate was estimated for deposits with an age of 150 ka across the entire FLV in northern Fish Lake Valley.

[9]This rate was estimated for deposits with an estimated age of 150 ka for a single trace of FLV in northern Fish Lake Valley.

[10]The recurrence interval for surface-rupturing events since 500 ka was estimated to be tens to possibly thousands of years.

[11]This recurrence interval is based on the occurrence of earthquakes of magnitude $\geq$5 every 20 years for the past 60 years.

[12]The first rate was based on displacement of an Owens River channel that is cut into a basalt dated at 400 ka and that is filled by a basalt dated at 140 ka. The second rate was estimated for deposits with an estimated age of 51 ka to 229 ka. The third rate is a Holocene rate that was estimated for deposits with an estimated age of $\leq$10 ka.

[13]These rates are for various time intervals. The first rate is since latest Pleistocene. The second rate is an average Holocene rate at Lone Pine. The third rate is an average Holocene net slip rate. The fourth rate is for the late Quaternary. The fifth rate is an average Historical right-lateral slip rate that was measured geodetically.

[14]The first rate is an average right-lateral slip rate for one set of traces of SDV that displaces a volcanic cone (Cinder Hill) that has been dated at 700 ka. The second rate is a maximum apparent lateral slip rate that was estimated for SDV in the Noble Hills on the basis of displacement of alluvial-fan deposits with an estimated age of 8 ka to 15.5 ka.