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Camp Rock-Emerson-Copper Mountain fault zone, Camp Rock section (Class A) No. 114a

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Compiled in cooperation with the California Geological Survey

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Synopsis	**General:** Major historically active dextral strike-slip fault zone located in the central Mojave Desert. Sections included in this compilation include: Camp Rock section, Emerson section, Copper Mountain section. Most of the Camp Rock and the northern half of the Emerson fault ruptured in the 1992 Landers earthquake (Hart and others, 1993 #3356; Sieh and others, 1993 #3406). The southern half of the Emerson fault and entire Copper Mountain fault did not rupture in 1992 (Hart and others, 1993 #3356; Sieh and others, 1993 #3406). Maximum 1992 surface rupture (4.9–5.3 m) occurred on the Emerson fault (Hart and

	others, 1993 #3356; Sieh and others, 1993 #3406; McGill and Rubin, 1999 #6652). Detailed reconnaissance-level geologic and geomorphic mapping for the fault zone includes Bader and Moyle (1960 #6644), Dibblee (1964 #1249; 1964 #6639; 1967 #1342; 1967 #6614; 1968 #6708; 1970 #6640), Hawkins (1976 #6650), Morton and others (1980 #6636), Manson (1986 #6651), and Bryant (1986 #6645; 1994 #6646). Rubin and Sieh (1997 #6655) excavated a trench across 1992 surface ruptures delineating the central part of the Emerson fault. Rubin and Sieh reported that two large surface-rupturing earthquakes have occurred prior to 1992 and after 15 to 24 ka, indicating a recurrence interval of 7.4–12 k.y. for the Emerson fault. The most recent paleoevent on the Emerson fault occurred about 9 ka (Rubin and Sieh, 1997 #6655). Rubin and Sieh (1997 #6655) estimated a Holocene slip rate of between 0.2 mm/yr and 0.7 mm/yr, based on observed vertical components of displacement from the 1992 Landers earthquake and the most recent paleoevent. C. Rubin (figure 14 in Rockwell and others, 2000 #6654) observed evidence of 3 events prior to the 1992 Landers earthquake along the Camp Rock fault at the Camp Rock graben site. Rockwell and others (2000 #6654) estimated an average late Pleistocene recurrence interval of 5–7 k.y. for the Camp Rock fault. **Sections:** This fault has 3 sections. There is insufficient data to delineate seismogenic segments. The separately named Camp Rock, Emerson, and Copper Mountain faults are grouped as a single fault zone in this compilation. The section names are Camp Rock, Emerson, and Copper Mountain. The section boundary between the Camp Rock and Emerson faults is generally located at the approximately 2-km-wide right-releasing step-over about 4 km northwest of Bessemer Mine. The section boundary between the Emerson and Copper Mountain faults is located near Sand Hill where the Emerson fault changes from a northwest to a north-south strike. It is possible to further section the Emerson fault into two sections: the northern approximately half of the fault that ruptured in the 1992 Mw7.3 Landers earthquake, and the southern half of the fault zone that did not rupture in 1992. However, the Emerson fault will be designated as one section for this compilation.
Name comments	**General:** The Camp Rock, Emerson, and Copper Mountain faults here are grouped into the Camp Rock-Emerson-Copper Mountain fault zone. The Camp Rock and Emerson faults were first mapped by Gardner (1940 #6648) and named by Dibblee (1964 #6639). The Copper Mountain fault was first mapped by Dibblee (1967

	#6657; 1968 #6708) and named by Morton and others (1980 #6636). **Section:** Section name proposed in this compilation is based on extent of Camp Rock fault. Section extends from the northern end of the Camp Rock fault (about 10 km southwest of the Barstow-Daggett County airport) southeast to the right-releasing step-over to the Emerson fault [114b], about 4 km northwest of Bessemer Mine. **Fault ID:** Refers to numbers 380 (Camp Rock fault), 416 (Galway Lake fault), 420 (Emerson fault), and 423 (Copper Mountain fault) of Jennings (1994 #2878).
County(s) and State(s)	SAN BERNARDINO COUNTY, CALIFORNIA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:62,500 scale. *Comments:* Locations are based on digital revisions to Jennings (1994 #2878) using original mapping by Dibblee (1964 #1249; 1964 #6639; 1970 #6640) at 1:62,500; mapping by Morton and others (1980 #6636) and Manson (1986 #6651) at 1:24,000.
Geologic setting	Historically active, predominantly dextral strike-slip fault zone located in the central Mojave Desert. The north to northwest-striking Camp Rock-Emerson-Copper Mountain fault zone is part of a series of subparallel dextral strike-slip faults in the central Mojave Desert. Camp Rock-Emerson-Copper Mountain fault zone is part of the eastern California shear zone (Dokka and Travis, 1990 #3188). The Camp Rock fault extends from about 10 km southwest of the Barstow-Daggett county airport southeast along the southwestern side of the Rodman Mountains, steps right across an approximately 2 km right releasing step to the Emerson fault about 5 km west of Bessemer Mine. The Emerson fault extends southwest bordering the western side of Emerson Lake (dry) to the vicinity of Sand Hill. Here the strike of the fault changes to a more southerly direction and slip transfers to the Copper Mountain fault. The Copper Mountain fault extends south to southeast along the southwestern side of Copper Mountain and terminates near the sinistral Pinto Mountain fault zone [118].

	Estimates of total dextral slip along the Camp Rock fault vary from 0.95 km (Manson, 1986 #6651) to 3.75 km (Miller, 1980 #6653). Dokka and Travis (1990 #3188) reported 1.5 to 4.0 km of dextral slip for the Camp Rock-Emerson fault zone. Cumulative offset for the Copper Mountain fault is not known.
Length (km)	This section is 30 km of a total fault length of 93 km.
Average strike	N50°W
Sense of movement	Right lateral *Comments:* Geomorphic expression of the fault is consistent with dextral strike-slip displacement (Morton and others, 1980 #6636; Manson, 1986 #6651). Historic dextral slip associated with the 1992 Mw7.3 Landers earthquake occurred on the Camp Rock fault (Hart and others, 1993 #3356; Sieh and others, 1993 #3406).
Dip Direction	V
Paleoseismology studies	Site (114-2). Rockwell and others (2000 #6654).
Geomorphic expression	The Camp Rock fault is delineated by moderately to well-defined geomorphic features characteristic of latest Pleistocene to Holocene dextral strike-slip offset such as linear scarps, linear drainages, and dextrally deflected drainages (Morton and others, 1980 #6636; Manson, 1986 #6651). Locally pre-1992 traces of the fault are concealed by Holocene alluvium.
Age of faulted surficial deposits	Prior to the 1992 Landers earthquake, age of youngest geologic units offset ranged from 80 ka to 125 ka, based soil profile development (Shlemon, 1980 #6656; Manson, 1986 #6651). Fault traces locally overlain by unfaulted Holocene alluvium.
Historic earthquake	Landers earthquake 1992
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of the most recent paleoevent is not well constrained. Geomorphic features indicate Holocene displacement, but trench data from Shlemon (1980 #6656 cited in Manson, 1986 #6651) is suggestive of latest Pleistocene to early Holocene age for most recent paleoevent. Rubin (figure 14 in Rockwell and others, 2000 #6654) identified three events prior to the 1992 Landers earthquake.

Recurrence interval	5–7 k.y. (<20 ka) *Comments:* C. Rubin (figure 14 in Rockwell and others, 2000 #6654) identified four events (includes the 1992 Landers earthquake) in the past 20 ka at the Camp Rock graben site (114-2). Rockwell and others (2000 #6654) indicated an average late Pleistocene recurrence interval of 5,000 to 7,000 yr.
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Petersen and Wesnousky (1994 #6024) estimated a long term slip rate of 1.0 mm/yr +1.0mm/yr, -0.92 mm/yr, based on 1.6 km to 4.0 km dextral displacement of Kane Springs fault, a Miocene transform structure, reported by Dokka and Travis (1990 #3188). Timing of displacement is assumed by Petersen and Wesnousky (1994 #6024) to be initiation of faulting between 2 and 20 Ma. Hawkins (1976 #6650) estimated a slip rate of about 1.0 mm/yr, based on dextrally deflected stream channels. Slip rate assigned by Petersen and others (1996 #4860) for probabilistic seismic hazard assessment for the State of California was 0.6 mm/yr (with minimum and maximum assigned slip rates of 0.2 mm/yr and 1.0 mm/yr, respectively).
Date and Compiler(s)	2000 William A. Bryant, California Geological Survey
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