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San Andreas fault zone, Cholame-Carrizo section (Class A) No. 1g

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Compiled in cooperation with the California Geological Survey

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Synopsis	**General:** The 1,100-km-long San Andreas fault zone is the principal element of the San Andreas fault system, a network of faults with predominantly dextral strike-slip displacement that collectively accommodates the majority of relative N-S motion between the North American and Pacific plates. Major elements of the San Andreas fault system include the Bartlett Springs [29], Maacama [30], Rodgers Creek [32], Green Valley [37], Calaveras [54], Hayward [55], San Gregorio [60], San Jacinto [125], Elsinore [126], and Imperial [132] fault zones. In this compilation, the San Andreas fault zone is considered to be the

Holocene and historically active dextral strike-slip fault that extends along most of coastal California from its complex junction with the Mendocino fault zone [18] on the north, southeast to the northern Transverse Range and inland to the Salton Sea, where a well-defined zone of seismicity (the Brawley Seismic Zone [124]) transfers slip to the Imperial fault [132] along a right-releasing step. Two major surface-rupturing earthquakes have occurred in historic time: the 1857 Fort Tejon (Sieh, 1978 #5775) and 1906 San Francisco (Lawson, 1908 #4969) earthquakes. Additional historic surface rupturing earthquakes include the unnamed 1812 earthquake along the Mojave section [1h] (Jacoby and others, 1988 #4962; Sieh and others, 1989 #5779; Fumal and others, 2002 #5726) and the northern part of the San Bernardino Mountains section [1i] (Weldon and Sieh, 1985 #5806; Jacoby and others, 1987 #4961; 1988 #4962), and a large earthquake in the San Francisco Bay area that occurred in 1838 that was probably on the Peninsula section [1c] of the San Andreas fault (Toppozada and Borchardt, 1998 #5493; Bakun, 1999 #4790). Historic fault creep at rates as high as 32 mm/yr characterizes the 132-km-long Creeping section [1e] in central California (Burford and Harsh, 1980 #4806). The creep rate gradually tapers off to 0 mm/yr at the northwestern and southeastern ends of this section. The northern and southern ends of the Creeping section [1e] are transitional to the surface-rupture termination points of the 1906 earthquake to the north and 1857 earthquake to the south. Creep at rates as high as 4 mm/yr also has been measured on the Coachella section [1j] (Sieh and Williams, 1990 #5780). The San Andreas fault zone is the most extensively studied fault in California, and perhaps in the world. The fault zone first gained international scientific attention immediately following the great 1906 San Francisco earthquake. Lawson's 1908 report summarizing the investigation of the 1906 earthquake contained the first integrated description of the San Andreas fault, which was recognized as extending from Point Delgada in the north to Whitewater Canyon southeast of San Bernardino in the south, and formed the underlying basis for our modern studies of paleoseismology and earthquake geology (Prentice, 1999 #5755). More than 5,000 articles, maps, and publications describing various aspects of the San Andreas fault that have been produced since Lawson's pioneering work. In addition, there are about 1,000 site-specific fault rupture investigation reports (and maps) filed with the California Geological Survey in compliance with the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1997 #4856). For this compilation, 51 detailed paleoseismic study sites along the fault zone are summarized. The fastest, generally accepted Holocene slip rate for the San Andreas fault is along the Cholame-Carrizo section [1g], which lies in the medial portion of the 1,100-km-long fault zone. Here, Sieh and Jahns (1984 #5778) reported a preferred late Holocene dextral slip rate of 33.9±2.9 mm/yr. In and south of the San Francisco Bay area, a significant portion of dextral slip is partitioned onto several faults of the San Andreas fault system, including the San Gregorio [60] on the west, and the Calaveras [54] and Hayward [55] faults on the east. Hall and others (1999 #4954) reported a late Holocene slip rate of 17±4 mm/yr for the Peninsula section [1c]. North of the Golden Gate, dextral slip from the San Gregorio fault zone [60] may be transferred to the North Coast section [1b] along a right-releasing step. Reported late Holocene slip rates for the North Coast section [1b] range from a minimum value of 16–18 mm/yr reported by Noller and others (1996 #5748) to a maximum value of 25.5±2.5 mm/yr reported by Prentice (1989 #5754). To the south, the San Andreas fault zone is delineated by an extremely complex zone of dextral strike-slip, reverse-oblique, and thrust faults in the southeastern Transverse Ranges. Fault nomenclature in the San Gorgonio Pass area is complex and different workers have assigned faults different names. West-northwest of San Gorgonio Pass Dibblee (1964 #1340; 1968 #4817; 1982 #4841) termed the principal active strand of the San Andreas fault located along the foot of the San Bernardino Mountains the South Branch San Andreas fault, which is referred to as the San Andreas fault by Allen (1957 #4787) and San Bernardino strand San Andreas fault by Matti and others (1992 #5735). For this compilation, this strand will be referred to as the San Andreas fault (South Branch). A fault that strikes sub-parallel located to the north was called the North Branch San Andreas fault by Dibblee (1964 #1340; 1968 #4817) and is referred to as the Mill Creek fault by Allen (1957 #4787), Matti and others (1992 #5735), and Jennings (1994 #2878). This strand will be referred to as the Mill Creek fault in this compilation. East-southeast of San Gorgonio Pass two principal dextral strike-slip faults comprise the Holocene active San Andreas fault zone. The southern trace has been referred to as the South Branch San Andreas fault by Dibblee (1967 #1345; 1981 #4840) and Jennings (1994 #2878); Matti and others (1992 #5735) refer to this trace as the Coachella Valley segment, Banning fault. This branch will be referred to as the South Branch San Andreas fault (Banning strand) in this compilation. The northern trace is referred to as the North Branch San Andreas fault by Dibblee (1967 #1345; 1981 #4840) and Jennings (1994 #2878); Mission Creek fault by Allen (1957 #4787); Matti and others (1992 #5735) named this trace the Coachella Valley segment, San Andreas fault and will be referred to as the North Branch San Andreas fault (Coachella strand) in this compilation. Refer to Matti and others (1992 #5735) for a detailed discussion of San Andreas fault nomenclature for the Mojave [1h], San Bernardino [1i], and Coachella [1j] sections. Weldon and Sieh (1985 #5806) reported a Holocene slip rate of 24±4 mm/yr at the northern end of the San Bernardino Mountains section [1i]. Harden and Matti (1989 #4955) reported a preferred Holocene slip rate of 14 mm/yr to 25 mm/yr near Yucaipa along the San Andreas fault (South Branch). Keller and others (1982 #4964) reported a preferred late Quaternary slip rate of 23 mm/yr to 35 mm/yr for the Coachella section [1j] near Biskra Palms. Surface-exposure age constraints (10Be-26Al) of the offset alluvial fan complex at Biskra Palms yields a better constrained late Quaternary dextral slip rate of 23.3±3.5 mm/yr (van der Woerd and others, 2001 #5800). Several average values of recurrence have been reported for the fault zone; in general they range from a little more than 100 to as much as 450 yr. The North Coast section [1b] ranges from 180–260 yr (Niemi and Hall, 1992 #5747) to 200≠400 yr for the past 2 k.y. (Prentice, 1989 #5754). The Santa Cruz Mountains section [1d] is 247-266 yr (Schwartz and others, 1998 #5771) and the Cholame-Carrizo section [1g] is 160–450 yr (Sieh and Jahns, 1984 #5778; Grant and Sieh, 1994 #4950; Sims, 1994 #5787; Stone and others, 2002 #5792). Recurrence intervals for the Mojave section [1h] are well-constrained based on paleoseismic studies by Sieh and others (1989 #5779), Biasi and others (2002 #5724) and Fumal and others (1993 #624; 2002 #5725). Sieh and others (1989 #5779) reported an average recurrence interval of 132 yr for the time interval AD 734 to 1857 at Pallett Creek, whereas Biasi and others (2002 #5724) refined the average recurrence interval at 135 yr. Fumal and others (2002 #5725) reported an average recurrence interval of 105 yr for the past 500 yr at Wrightwood. An average recurrence interval of 150–275 yr has been reported for the northern San Bernardino Mountains section by Weldon and Sieh (1985 #5806), Seitz and Weldon (1994 #5772), and Yule and others (2001 #4948). The Coachella section [1j] averages large earthquakes about 207–233 yr based on Sieh (1986 #5777).

Sections: This fault has 10 sections. From north to south they are the Shelter Cove [1a], North Coast [1b], Peninsula [1c], Santa

	Cruz Mountains [1d], Creeping [1e], Parkfield [1f], Cholame-Carrizo [1g], Mojave [1h], San Bernardino Mountains [1i], and Coachella [1j] sections. Different behavior patterns along different parts of the San Andreas fault where first noticed when Steinbrugge and Zacher (1960 #5791) documented creep along the fault in central California. Since that time, other workers have proposed various segmentation models for the San Andreas fault including five segments by Allen (1968 #4788), eight segments by Wallace (1970 #1423), 12 segments by Sykes and Nishenko (1984 #5794), Petersen and others (1996 #4860), the Working Group on California Earthquake Probabilities (1988 #5494; 1995 #4945; 1999 #4946), and the Working Group on Northern California Earthquake Probabilities (1996 #1216). Some segment boundaries are well documented or constrained for the San Andreas fault zone, whereas others are not. For this compilation, boundaries generally are similar to those described in models adopted by the Working Group on California Earthquake Probabilities (1988 #5494; 1990 #549; 1995 #4945; 1999 #4946), the Working Group on Northern California Earthquake Probabilities (1996 #1216), and Petersen and others (1996 #4860).
Name comments	**General:** Traces of the San Andreas fault were first mapped in northern California by Lawson (1893 #4967) and were first named the San Andreas rift by Lawson (1895 #4968) after the type locality of the fault in the San Andreas Valley (San Mateo County, California). North of San Francisco, Anderson (1899 #4789) mapped traces of the fault on the Point Reyes Peninsula, but did not name the fault. Schuyler (1896–1897 #5769) described parts of the fault zone in southern California for a 200-mi (about 320-km) length through Kern, Los Angeles, and San Bernardino Counties and referred to the fault not as the San Andreas but as the "great earthquake crack", referring to surface fault ruptures associated with the 1857 Fort Tejon earthquake. The significance and extent of the San Andreas fault was not recognized until after the 1906 San Francisco earthquake. J.C. Branner and S. Tabor proposed the name Portola-Tomales for the fault zone, but A.C. Lawson (1908 #4969) preferred the term "San Andreas fault" (Hill, 1981 #4958). For this compilation, we use San Andreas fault zone owing to the complex nature and multiple strands (or faults) that comprise the structure. **Section:** The Cholame-Carrizo section of this compilation combines the Cholame and Carrizo segments described by the Working Group on California Earthquake Probabilities (1988

#5494) and adopted by Petersen and others (1996 #4860). The Carrizo segment originally was delineated based on the relatively large slip per event, the assumption that dextral slip associated with the 1857 Fort Tejon earthquake is characteristic, and the relatively long recurrence intervals necessary for the large displacement per event. The Cholame segment was established based on the assumed transition from large slip characterizing the Carrizo segment to low slip characterizing the Parkfield segment during the 1857 earthquake, based on observations by Sieh (1978 #920) that dextral slip associated with the 1857 earthquake was about 3.5 m along the northern half of the Cholame segment. However, Lienkaemper (2001 #5728) suggested that slip associated with the 1857 earthquake ranged between 5.4 m and 6.7 m along the northern part of the Cholame segment. Runnerstrom and others (2002 #5764) report that the total 1857 dextral displacement along the Cholame segment may be as large as 16.2±6 m, based on section-line monument surveys spanning a 2 km width about 28 km northwest of Highway 58. Recent paleoseismic investigations along the Cholame segment do not support the inference regarding shorter recurrence intervals for the Cholame segment and longer recurrence intervals for the Carrizo segment (Stone and others, 2002 #5792; Young and others, 2002 #5810). The Cholame-Carrizo section extends from the southern end of Cholame Valley southeast to the vicinity of Three Points. The location of the southern boundary of the section is based on a slip gradient in the 1857 earthquake along the Mojave section [1h] where slip decreased from an average dextral displacement of 7 m to an average dextral displacement of 3 m (Sieh, 1978 #920).

Fault ID: Refers to Jennings (1994 #2878) numbers 87 (San Andreas fault (SAF) Shelter Cove), 116 (SAF splays), 119 (SAF Fort Ross to Manchester), 145 (SAF offshore), 147 (SAF offshore Bolinas), 162 (SAF boundary faults), 194 (SAF San Francisco to Watsonville), 217 (SAF 1989 ground fractures), 234 (SAF San Juan Bautista to Priest Valley), 240 (SAF historic creep), 278 (SAF Priest Valley to Cuyama), 311 (SAF Cuyama to Palmdale), 358 (SAF Palmdale to Cajon Canyon), 360 (SAF 1812 rupture), 427 (Mill Creek), 427A (SAF Cajon Canyon to Burro Flats), 452 (SAF South Branch), 453 (SAF North Branch), 472 (SAF Indio to Salton Sea), 477 (SAF Bombay Beach and vicinity), 452 (SAF South Branch), 449 (Banning fault western part), and 450 (Mission Creek fault), and numbers A1 (SAF 1906 rupture), A2 (SAF Peninsula), A3 (SAF Santa Cruz Mountains), and A7 (SAF

	creeping section) of the Working Group on Northern California Earthquake potential (1996 #1216).
County(s) and State(s)	MONTEREY COUNTY, CALIFORNIA LOS ANGELES COUNTY, CALIFORNIA KERN COUNTY, CALIFORNIA SAN LUIS OBISPO COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER BASIN AND RANGE
Reliability of location	Good Compiled at 1:62,500 scale. *Comments:* Location based on digital revisions to Jennings (1994 #2878) 1:750,000-scale map using original mapping by Vedder and Wallace (1970 #486), Manson (1985 #5732), Ross (1969 #487), Vedder (1970 #5802), and Sims and Hamilton (1991 #5788) at 1:24,000 scale, mapping by Barrows and others (1985 #4796) at 1:12,000 scale, and mapping by Dibblee (1971 #4824, 1972 #4825, 1972 #4826, 1974 #4830) at 1:62,500 scale.
Geologic setting	The San Andreas fault zone is a major dextral strike-slip fault zone that extends for about 1,100 km along the western side of California. It is near the coast in northern California, but stays entirely inland to the south of San Francisco, extending all the way to the northern Gulf of California in Mexico. The San Andreas fault zone is the principal element of a network of dextral strike-slip faults that constitute the San Andreas fault system that collectively accommodates the majority of relative N-S motion between the Pacific and North American plates (Wallace, 1990 #5804). Wilson (1965 #4947) first proposed that the San Andreas fault was a transform fault connecting two spreading oceanic ridges between the Pacific and North American plates. The San Andreas fault zone extends from the Salton Trough near Bombay Beach northwest to its complex junction with the Mendocino fault zone [18] near Punta Gorda. At the southern end of the fault zone near Bombay Beach, dextral slip is transferred to the Imperial fault [132] along a right-releasing step-over delineated by a zone of seismicity referred to as the Brawley Seismic Zone [124]. The San Andreas fault traverses the length of the Coast Ranges geomorphic subprovince and forms the boundary between the Transverse Range and Mojave Desert geomorphic subprovinces as well as the boundary between the Salton Trough and Mojave Desert geomorphic subprovinces.

	Noble (1926 #1592) was the first to suggest a large amount of dextral slip (38 km) on the San Andreas fault. Hill and Dibblee (1953 #923) postulated that as much as 560 km of dextral slip has occurred on the basis of proposed correlation of Mesozoic basement rocks. Post-early Miocene cumulative dextral slip is approximately 315 km, based on correlation of the Neenach Volcanic Formation (22.5–24.1 Ma minimum K-Ar age reported in Sims, 1993 #5786) on the east side of the fault zone with early Miocene Pinnacles Formation (24.2±0.5 Ma average K-Ar age reported in Sims, 1993 #5786) on the west side of the fault (Matthews, 1976 #931). Stanley (1987 #5790) reported 325–330 km of post late Oligocene dextral slip and 320–325 km of post-early Miocene dextral slip. Further discussions of the displacement history the San Andreas fault zone are included in Powell (1993 #5753), Weldon and others (1993 #5807), and Matti and Morton (1993 #5737).
Length (km)	This section is 201 km of a total fault length of 1082 km.
Average strike	N66°W
Sense of movement	Right lateral *Comments:* Well-defined geomorphic expression of dextral strike-slip faulting (Ross, 1969 #487; Vedder, 1970 #5802; Barrows and others, 1985 #4796; Manson, 1985 #5732; Davis and Duebendorfer, 1987 #4814) and dextral displacement associated with the 1857 Fort Tejon earthquake (Sieh, 1978 #920). Several detailed studies (Sieh and Jahns, 1984 #5778; Grant and Sieh, 1993 #4949; 1994 #4950; Sims, 1994 #5787) have documented amounts of dextral offset of stream channels.
Dip Direction	V *Comments:* Vertical dip based on linear geomorphic expression of fault. Well-defined seismicity to the north in the Parkfield section [1f] and in the northern part of this section shows vertical fault zone at depth (Hill and others, 1990 #4957). A vertical to near vertical fault zone expressed in trench exposures by Sieh and Jahns (1984 #5778), Sims (1994 #5787), Grant and Sieh (1993 #4949; 1994 #4950), and Davis and Duebendorfer (1982 #4813).
Paleoseismology	This section of the San Andreas fault is one of the best studied.

studies	Since 1984, ten sites have been investigated. Smith Flat site (1-2). Davis and Duebendorfer (1982 #4813) excavated two trenches at the Smith Flat site. Apparent vertical separation of 5.5 m of deposits exposed in the trenches suggested four to nine 1857-sized paleoearthquakes, assuming that vertical separation was similar in all events. No dateable material was recovered, so timing of events was not determined. San Emigdio Creek (Mil Potrero) site (1-3). Davis and Duebendorfer (1982 #4813) excavated one trench at the San Emigdio Creek site; this site has also been referred to as the Mil Potrero site by Grant and Sieh (1994 #4950) and Arrowsmith and others (1997 #5816). One trench was excavated across a terrace remnant in the San Emigdio Creek drainage where three surface-rupturing earthquakes, including the 1857 event, were identified. Cuddy Valley site (1-4). Davis and Duebendorfer (1982 #4813) excavated two trenches at the Cuddy Valley site. The trench site, located on an alluvial fan surface, showed evidence of 3 major surface-rupturing earthquakes, but lacked datable material and an event chronology. Three Points (site 1-5). Studies by Rust (1982 #5765) involved the excavation of three trenches at two sites in the vicinity of Three Points. One trench was excavated in ponded alluvial deposits at the mouth of Garden Gulch, exposing a succession of four discrete faulting events, including the 1857 Fort Tejon earthquake. Landslide deposits were trenched at the Oak Flat site, where a dextrally offset stream channel and ponded alluvial deposits yielded potential slip-rate information. Wallace Creek site (1-8). Studies by Sieh and Jahns (1984 #5778) involved the excavation of seven fault normal and three fault parallel trenches at the Wallace Creek site. Wallace Creek is a dextrally displaced Holocene stream channel. Detailed trenching, stratigraphic interpretation, and reconstruction of stream channel and related landforms allowed Sieh and Jahns (1984 #5778) to calculate Holocene and late Holocene slip rates and recurrence intervals for the Carrizo section. Phelan Creek site (1-20). Sims (1994 #5787) excavated 11 trenches and conducted detailed geomorphic and geologic mapping at the Phelan Creek site in order to identify individual surface fault rupturing earthquakes. Phelan Creek is characterized

by dextrally offset drainages, an older, abandoned and in-filled stream channel, and beheaded drainages. Sims (1994 #5787) developed a stream depositional model assuming that progressive dextral displacements of stream channels during large surface rupturing earthquakes are large enough to cause perturbations in stream channel deposition that should be recognizable by unconformity-bounded sedimentary units, thus constraining timing of large surface rupturing events. Sims (1994 #5787) used this model to identify five and possibly six late Holocene earthquakes.

Phelan Creek site (1-25). Studies by Grant and Sieh (1993 #4949) involved the excavation of three fault parallel and two fault normal trenches at the Phelan fan site. The site is characterized by a dextrally offset stream channel that has incised into an alluvial fan. The principal goal of this study was to accurately determine the amount of dextral slip associated with the 1857 earthquake at the site. They reported a preferred 1857 dextral slip of 6.6–6.9 m.

Bidart fan site (1-28). Grant and Sieh (1994 #4950) excavated three fault normal trenches across the historically active Cholame-Carrizo section at the Bidart fan site in order to better constrain the timing of past large surface rupturing earthquakes in this section. Prentice and Sieh (1989 #5757) previously had excavated a trench at this same site. Trenching at the Bidart fan site, located on an aggrading alluvial fan, exposed evidence of at least seven late Holocene surface-rupturing earthquakes. The interpretation of evidence at the Bidart fan paleoseismic study site lead Grant and Sieh (1994 #4950) to challenge the concept of that the Carrizo segment is an unusually strong segment characterized by long recurrence intervals and large displacements.

LY4 site (1-46). Studies by Stone and others (2002 #5792) involved the excavation of one fault normal trench on the distal end of an alluvial fan at the LY4 site, exposing evidence for three and possibly four surface-rupturing earthquakes, although 14C dates only constrain the age of a paleosol about 50 cm below the oldest event horizon, indicating there have been at least three surface rupturing events since 1058-1291 A. D. The study by Young and others (2002 #5810) involved the excavation of five fault normal and two fault parallel trenches at the LY4 site in order to document event chronology and measure dextral displacement associated with the 1857 earthquake.

	Frazier Mountain site (1-47). Studies by Lindvall and others (2002 #5729) involved the excavation of one fault normal trench within a closed depression at the Frazier Mountain site in order to document event chronology. They exposed faulted late Holocene sediment with evidence of two surface-rupturing earthquakes.
Geomorphic expression	The Cholame-Carrizo section is delineated by well-defined geomorphic features characteristic of Holocene dextral offset such as dextrally deflected and offset drainages, dextrally offset ridges, linear drainages and ridges, aligned saddles and benches, closed depressions, linear scarps on alluvium, linear troughs, sidehill benches, shutter ridges, and linear vegetation contrasts (Ross, 1969 #487; Vedder and Wallace, 1970 #486; Barrows and others, 1985 #4796; Manson, 1985 #5732; Davis and Duebendorfer, 1987 #4814).
Age of faulted surficial deposits	The San Andreas fault at the Wallace Creek site offsets latest Pleistocene to late Holocene fluvial and colluvial deposits. Using radiocarbopn dating Sieh and Jahns (1984 #5778) documented ages (calendric age) of offset alluvium that range from 19,340±1,000 14C yr BP to 1,035±235 14C yr BP. Faulted late Holocene alluvial fan and fluvial deposits at the Bidart fan site were dated using AMS radiocarbon dating of detrital charcoal, charred grasses, and a shell (Grant and Sieh, 1994 #4950). Calendar year dates ranged from AD 1465 to AD 1029.
Historic earthquake	Fort Tejon earthquake 1857
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* The most recent event on the Cholame-Carrizo section is the 1857 Fort Tejon earthquake. Young and others (2002 #5810) observed silt-filled fractures that post-date the 1857 earthquake, suggesting that a ground shaking event or triggered slip occurred after 1857. The most recent paleoevent (event before 1857) on this section may correlate with event V (AD 1465–1495) reported on the Mojave section [1h] at Pallet Creek by Sieh and others (1989 #5779). Young and others (2002 #5810) identified the penultimate event as occurring between 1,030 and 1,460 cal yr BP at the LY4 site. Sims (1994 #5787) identified the most recent paleoevent at the Phelan Creek site as occurring about AD 1505, based on radiocarbon dating and assumptions based on stream depositional modeling. Grant and Sieh (1993 #4949) reported that the most recent paleoevent at the Phelan fan site

	occurred between AD 1350 and AD 1623 . Grant and Sieh (1994 #4950) identified the most recent paleoevent at the Bidart fan site as sometime after AD 1405 to AD 1510. Davis and Duebendorfer (1982 #4813) identified two paleoearthquakes in addition to the 1857 earthquake at the San Emigdio Creek (Mil Potrero) site. The oldest was radiocarbon dated at AD 1584±70 and probably correlates with Sieh and others (1989 #5779) event V. A younger event was radiocarbon dated at AD 1760 (+9/-50 yr). This event may correlate with Sieh and others (1989 #5779) event X, which is thought to be the 1812 earthquake. Lindvall and others (2002 #5729) reported that the most recent event at the Frazier Mountain site was the 1857 earthquake and the penultimate event occurred between AD 1460 and AD 1600. Lindvall and others (2002 #5729) were not able to confirm that surface rupture associated with the 1812 event extended as far north as the Frazier Mountain site, but they could not conclusively rule it out either.
Recurrence interval	100–450 yr (late Holocene) *Comments:* Stone and others (2002 #5792) estimated an average recurrence interval of 236 yr at the LY4 site, based on a maximum of 4 earthquakes since AD 1058. Sieh and Jahns (1984 #5778) reported an inferred average recurrence interval of 240–450 yr for the past three large earthquakes, based on dextrally displaced gullies south of Wallace Creek and assumptions that these earthquakes were characterized by 9.6 to 12.3 m of surface offset. Sims (1994 #5787) reported that late Holocene paleochannel deposits record five, and possibly six large surface faulting earthquakes in the last 1,150 yr at the Phelan Creek site, suggesting an average recurrence interval between 150–300 yr. Grant and Sieh (1994 #4950) reported that five earthquakes (including 1857) have occurred since AD 1218., yielding an average recurrence interval of 160 yr at the Bidart fan site. However, radiocarbon dates indicate that actual intervals have varied: the interval between 1857 and the penultimate event is 350-400 yr, whereas the earlier intervals average about 100 yr.
Slip-rate category	Greater than 5.0 mm/yr *Comments:* Sieh and Jahns (1984 #5778) reported a preferred late Holocene dextral slip rate of 33.9±2.9 mm/yr for the Wallace Creek paleoseismic site. This slip rate is based on 128±1 m dextral offset of the most recent entrenchment of Wallace Creek,

	which is 3,680±155 yr BP from radiocarbon dates of deposits of abandoned high channel (this is considered to be a maximum age). Dextral offset of 475 m of a 13,250 yr BP alluvial-fan apex yields a Holocene slip rate of 35.8 (+5.4, -4.1) mm/yr. Sims (1994 #5787) calculated a Holocene slip rate of about 34 mm/yr at the Phelan Creek site. This slip rate is based on 238±1.5 m cumulative dextral displacement of older abandoned channel over a period of 7 k.y. Rust (1982 #5765) reported that a gully developed in a landslide complex is dextrally offset 44±3 m at the Oak Flat site. Detrital charcoal sampled from the lower part of a trench excavated in the toe of a landslide was used to constrain timing of the gully formation, yielded a date of 1,065±60 yr BP. Rust (1982 #5765) calculated a late Holocene slip rate of 50 mm/yr, and reported that the toe of another large landslide may be dextrally offset about 120±10 m. A closed depression developed by assumed displacements on the San Andreas fault is located on this landslide deposit. Detrital charcoal sampled from ponded alluvium in this closed depression yielded a minimum age for the landslide of between 2,370±120 and 2,010±80 yr BP, allowing Rust to calculate a slip rate of 48±10 mm/yr. Rust used a slip value of 113±10 m, which is the dextral displacement of the landslide toe (120±10 m) minus 7 m of slip from the 1857 earthquake. The unusually high dextral slip rates reported by Rust (1982 #5765) for the southern Cholame-Carrizo section are suspicious. Relating the displaced features (dextrally offset gullies in the landslide deposits near Oak Flat and the dextrally displaced landslide toe) to the timing of the displacements is not well constrained. The detrital charcoal at the base of the closed depression dates the formation of the closed depression, but it does not necessarily constrain timing of the total offset measured for the landslide toe. The landslide near Oak Flat was originally mapped by Kahle and Barrows (1980 #4963) as an inferred, ancient landslide. It is not certain how the timing indicated by the radiocarbon date of detrital charcoal relates to the displacement indicated by the dextrally offset drainages.
Date and Compiler(s)	2002 William A. Bryant, California Geological Survey Matthew Lundberg, California Geological Survey
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