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White Mountains fault zone, Montgomery section (Class A) No. 47a

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Compiled in cooperation with the California Geological Survey

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Synopsis	**General:** This major Basin and Range Holocene active dextral-normal and normal fault zone is located along the western front of the White Mountains and northern Inyo Mountains. The fault zone is divided into 4 sections in this compilation, principally based on by modified from sections delineated by dePolo (1989 #2456). From north to south the sections are Montgomery, Hammil, central, and Inyo-Waucoba. There have been no paleoseismic studies using trenching, but dePolo (1989 #2456) profiled several fault scarps along strands of the fault zone and reported evidence of late Holocene displacement. A late Holocene

	event that dePolo (1989 #2456) termed the Black Mountain paleoseismic rupture occurred at 3 ka (?2 k.y.), based on diffusion modeling. dePolo (1989 #2456) estimated a preferred latest Pleistocene to Holocene vertical slip rate of 0.8-1mm/yr for the northern part of the White Mountains fault zone, based on amounts of offset of alluvial-fan surfaces their soil profile development for age constraints. Slip rates for the southern part of the fault zone are not as well documented due to a significant, but poorly constrained dextral strike-slip component. dePolo (1989 #2456) estimated an average recurrence interval of 3-5 k.y. based on offset Holocene alluvium at Marble Creek and Orchard Springs (Montgomery section). **Sections:** This fault has 4 sections. There is insufficient data to delineate seismogenic segments. dePolo (1989 #2456) proposed that the White Mountains fault zone consists of 5 sections, based on geomorphic expression. From north to south the sections are Montgomery, Hammil, central, Waucoba, and Inyo. These sections are adopted in this compilation with the exception of the Waucoba section. dePolo stated that the boundary between the Waucoba and Inyo sections is arbitrary and so a combined Inyo-Waucoba section is used in this compilation.
Name comments	**General:** The White Mountains fault zone was first mapped in detail by Anderson (1933 #5595) and Taylor (1933 #5607). Anderson, who mapped the northern part of the fault zone, called this part the Montgomery fault zone. Crowder and others (1972 #5600) and Crowder and Sheridan (1972 #5594) first used the name White Mountains fault zone generally for bedrock faults in the Montgomery and Hammil sections of fault zone. Bryant (1984 #5589; 1984 #5597; 1984 #5598) called the fault zone south of Milner Canyon the White Mountains frontal fault zone, whereas dePolo (1989 #2456) proposed the name White Mountains fault system. The name White Mountains fault zone will be used in this compilation. It includes the Benton Valley fault, named by Smith (1984 #5606) and the Aberdeen fault, first named by dePolo (1989 #2456). **Section:** The Montgomery section, first proposed by dePolo (1989 #2456), extends from its intersection with the Northern Queen Valley fault zone (dePolo, 1989 #2456; part of the Coaldale fault zone of dePolo, 1998 #2845) in Queen Valley, Nevada, southeast to Pellisier Creek in California. The Montgomery section includes the northwest-striking Benton Valley fault, first mapped by Anderson (1933 #5595) and named

	by Smith (1984 #5606). **Fault ID:** Refers to numbers 204 (northern part of White Mountains fault and Benton Valley fault) of Jennings (1994 #2878), and faults MA10 (Benton Valley fault) and MA11A (White Mountains fault system) of dePolo (1989 #2456).
County(s) and State(s)	ESMERALDA COUNTY, NEVADA MINERAL COUNTY, NEVADA MONO COUNTY, CALIFORNIA
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:62,500 scale. *Comments:* Locations based on digital revisions to Jennings (1994 #2878) mapping. Original mapping by Crowder and others (1972 #5600), Crowder and Sheridan (1972 #5594), Bryant (1984 #5597; 1984 #5598), and dePolo (1989 #2456) is at 1:62,500 scale. Mapping by Bryant (1984 #5589) is at 1:48,000 scale; Smith (1984 #5606) and Hart (1984 #5603) is at 1:24,000 scale.
Geologic setting	The White Mountains fault zone is a major, north- to northwest-striking zone of normal and dextral strike-slip faults that extend about 115 km along the western front of the White Mountains and northern Inyo Mountains. The fault zone extends from Northern Queen Valley in Nevada along a somewhat arcuate southwest trend. The fault zones intersection of the Benton Valley fault marks a change in strike to generally north-south along the western front of the White Mountains. South of the Waucoba embayment, the fault changes to a southwest trend delineated by the Aberdeen fault, which may complexly link with the Owens Valley [51] fault zone. The White Mountains fault zone is in the western portion of the Basin and Range province, an area characterized by oblique extensional tectonics resulting in both dextral strike-slip and normal dip-slip displacement. Anderson (1933 #5595) estimated 2,433 m of total vertical displacement along the White Mountains fault. Gilbert (1938 #5602; 1941 #5604) reported 1,824-2,134 m of vertical displacement. Total dextral strike-slip displacement has not been documented. Surface fault ruptures of as much as 5 mm dextral-normal displacement occurred along the central section of the White Mountains fault zone [47c] in association with the July 21, 1986 Mw 6.1 Chalfant

	Valley earthquake (Kahle and others, 1986 #5605; dePolo and Ramelli, 1987 #3339; Lienkaemper and others, 1987 #3371).
Length (km)	This section is 27 km of a total fault length of 109 km.
Average strike	N2°W (for section) versus N7°W (for whole fault)
Sense of movement	Normal *Comments:* Principal sense of displacement along the Montgomery section is down-to-west normal (Crowder and others, 1972 #5600; Hart, 1984 #5603; Smith, 1984 #5606; dePolo, 1989 #2456). At Marble Creek, dePolo (1989 #2456) observed a dextrally displaced terrace riser located between two vertically offset terrace trends, indicating a vertical to horizontal slip ratio of between 3:1 and 3:2. The Benton Valley fault has an unknown component of dextral strike-slip offset (Smith, 1984 #5606; dePolo, 1989 #2456).
Dip Direction	W *Comments:* Dip angle is not well constrained, but fault zone generally dips to the west at a steep angle. Geophysical survey suggests a major, relatively simple fault zone bounding the western border of the White Mountains (Pakiser and others, 1964 #1596; Oliver and Robbins, 1978 #5647). Gravity data indicates the fault zone dips steeply west and locally may be vertical (Oliver and Robbins, 1978 #5647).
Paleoseismology studies	
Geomorphic expression	The Montgomery section is characterized by a very prominent west-facing range-front escarpment that exhibits well developed faceted spurs, and has fault scarps on latest Pleistocene and Holocene alluvium at the mouths of several canyons (Hart, 1984 #5603; Smith, 1984 #5606; dePolo, 1989 #2456).
Age of faulted surficial deposits	Fault offsets Mesozoic crystalline basement rocks, Pliocene basalt, late Quaternary alluvium, and latest Pleistocene to Holocene alluvium. Faulting at Marble Creek offsets latest Pleistocene alluvium estimated to be about 60 ka, based on soil profile development (Hart, 1984 #5603). Offset Holocene alluvium is considered to be 4-10 ka, based on soil profile development (Hart, 1984 #5603).

Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of the most recent paleoevent is not well constrained. Hart (1984 #5603) reported Holocene vertical displacement at Marble Creek, as evidenced by a suite of offset nested alluvial fans. A middle to early Holocene time (4-10 ka) of displacement was estimated based on soil profile development of a displaced alluvial fan surface (Hart, 1984 #5603). Two lower, younger terraces are not displaced, indicating no late Holocene displacement.
Recurrence interval	3-5 k.y. (0-60 ka) *Comments:* dePolo (1989 #2456) estimated the recurrence interval for the Montgomery section, based on measured late Pleistocene and Holocene displacements and assumptions regarding slip per event. At Marble Creek a late Pleistocene alluvial terrace (about 60 ka) is vertically displaced 48 m and, assuming that a single event scarp indicates 2.6 m vertical displacement per event, this offset indicates an average interseismic interval of about 3,333 yrs. At Orchard Creek a single event scarp indicates possible slip per event offset of 2.5 m. A nearby early Holocene surface is vertically displaced 8.3 m, suggesting that the scarp likely formed during 3 events. If the most recent event is 4 ka, this suggests an interseismic interval of at 3,000 yrs or less (2-3 complete intervals between 4 ka and 10 ka). Using the Holocene slip rate of 0.5 mm/yr to 1 mm/yr derived from the Marble Creek site and vertical slip indicative of a Mw 7.2 earthquake, dePolo (1989 #2456) estimated an interseismic period from 3-5 k.y. Wesnousky (1986 #5305) estimated a recurrence interval of about 3 k.y. for the entire White Mountains fault zone, based on a preferred vertical slip rate of 0.8 mm/yr and an assumed Mw 7.1 earthquake.
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Hart (1984 #5603) estimated that the Montgomery section at Marble Creek had a Holocene dip-slip rate of about 0.5 mm/yr. The 0.5 mm/yr slip rate was estimated based on a 4 m to 4.5 m high scarp in alluvium estimated to be between 4 ka and 10 ka, based on soil profile development, and the assumption that the fault dips 60? (Hart, 1984 #5603). dePolo (1989 #2456)

	recognized a dextral component to the offset alluvial terraces at Marble Creek and estimated a net dextral-normal slip rate (maximum) of greater than 0.9 mm/yr.
Date and Compiler(s)	2000 William A. Bryant, California Geological Survey
References	#5595 Anderson, G.H., 1933, Geology of the north half of the White Mountains quadrangle, California: Pasadena, California Institute of Technology, unpublished Ph.D. dissertation, 237 p. #5589 Bryant, W.A., 1984, Evidence of recent faulting along the Owens Valley, Round Valley, and White Mountains fault zones, Inyo and Mono Counties, California: California Division of Mines and Geology Open-File Report 84-54SAC, 4 p. #5597 Bryant, W.A., 1984, Northern Owens Valley, Fish Slough, and White Mountains frontal faults, Inyo and Mono Counties: California Division of Mines and Geology Fault Evaluation Report FER-153, microfiche copy in California Division of Mines and Geology Open-File Report 90-14, scale 1:62,500. #5598 Bryant, W.A., 1984, Owens Valley and White Mountains frontal faults, Big Pine area, Inyo County: California Division of Mines and Geology Fault Evaluation Report FER-159, microfiche copy in California Division of Mines and Geology Open-File Report 90-14, 22 p. #5594 Crowder, D.R., and Sheridan, M.F., 1972, Geologic map of the White Mountain Peak quadrangle, Mono County, California: U.S. Geological Survey Geologic quadrangle Map GQ-1012, scale 1:62,500. #5600 Crowder, D.R., Robinson, P.T., and Dahl, L.H., 1972, Geologic map of the Benton quadrangle, Mono County, California, and Esmeralda and Mineral Counties, Nevada: U.S. Geological Survey Geologic quadrangle Map GQ-1013, scale 1:62,500. #2456 dePolo, C.M., 1989, Seismotectonics of the White Mountains fault system, east-central California and west-central Nevada: Reno, University of Reno, unpublished M.S. thesis, 354 p. #2845 dePolo, C.M., 1998, A reconnaissance technique for

estimating the slip rate of normal-slip faults in the Great Basin, and application to faults in Nevada, U.S.A.: Reno, University of Nevada, unpublished Ph.D. dissertation, 199 p.

#3339 dePolo, C.M., and Ramelli, A.R., 1987, Preliminary report on surface faulting along the White Mountains fault zone associated with the July 1986 Chalfant Valley earthquake sequence: Bulletin of the Seismological Society of America, v. 77, p. 290-296.

#5602 Gilbert, C.M., 1938, The Cenozoic geology of the region southeast of Mono Lake, California: Berkeley, University of California, unpublished Ph.D. dissertation, 180 p.

#5604 Gilbert, C.M., 1941, Late Tertiary geology of Mono Lake, California: Geological Society of America Bulletin, v. 52, p. 781-816.

#5603 Hart, E.W., 1984, Northern segment of the White Mountains fault zone, Mono County, California: California Department of Conservation, Division of Mines and Geology Fault Evaluation Report FER-161, microfiche copy in Division of Mines and Geology Open-File Report 90-11, 5 p., scale 1:24,000.

#2878 Jennings, C.W., 1994, Fault activity map of California and adjacent areas, with locations of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map 6, 92 p., 2 pls., scale 1:750,000.

#5605 Kahle, J.E., Bryant, W.A., and Hart, E.W., 1986, Fault rupture associated with the July 21, 1986 Chalfant Valley earthquake, Mono and Inyo Counties, California: California Geology, v. 39, no. 11, p. 243-245.

#3371 Lienkaemper, J.J., Pezzopane, S.K., Clark, M.M., and Rymer, M.J., 1987, Fault fractures formed in association with the 1986 Chalfant Valley, California, earthquake sequence—Preliminary report: Bulletin of the Seismological Society of America, v. 77, p. 297-305.

#5647 Oliver, H.W., and Robbins, S.L., 1978, Mariposa sheet: California Division of Mines and Geology Bouguer Gravity Atlas of California, scale 1:250,000.

#1596 Pakiser, L.C., Kane, M.F., and Jackson, W.H., 1964, Structural geology and volcanism of Owens Valley region, California—A geophysical study: U.S. Geological Survey Professional Paper 438, 68 p., 5 pls., scale 1:96,000.

#4860 Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., Frankel, A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P., 1996, Probabilistic seismic hazard assessment for the State of California: California Department of Conservation, Division of Mines and Geology Open-File Report 96-08 (also U.S. Geological Open-File Report 96-706), 33 p.

#5606 Smith, T.C., 1984, Northern segment of the White Mountains fault zone and the Benton Valley and Black Mountains faults, Mono County, California: California Division of Mines and Geology Fault Evaluation Report FER-161, microfiche copy in Division of Mines and Geology Open-File Report 90-14, 10, scale 1:24,000.

#5607 Taylor, G.F., 1933, Quaternary fault structure of the Bishop region, east-central California: Pasadena, California Institute of Technology, unpublished Ph.D. dissertation, 161 p.

#5305 Wesnousky, S.G., 1986, Earthquakes, Quaternary faults, and seismic hazards in California: Journal of Geophysical Research, v. 91, no. B12, p. 12,587-12,631.