

Quaternary Fault and Fold Database of the United States

As of January 12, 2017, the USGS maintains a limited number of metadata fields that characterize the Quaternary faults and folds of the United States. For the most up-to-date information, please refer to the [interactive fault map](#).

Sawatch fault, northern section (Class A) No. 2308a

Last Review Date: 1997-12-31

Compiled in cooperation with the Colorado Geological Survey

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Synopsis

General: The Sawatch fault is a range-front fault on the east side of the Sawatch Range from about Leadville south to the South Arkansas River. The faults comprise the western boundary of the upper Arkansas Valley graben, a Neogene west-tilted structure that forms the northernmost topographically prominent expression of the Rio Grande Rift. The graben developed along the axial crest of the Laramide Sawatch anticline. Trenching investigations on the southern part of the fault indicated six surface ruptures since about 150 ka, suggesting a recurrence interval of 10–0 k.y.; the most recent faulting event occurred less than 4 k.y. ago

(Ostenaar and others, 1981 #2730).

Sections: This fault has 2 sections. Ostenaar and others (1981 #2730) described the Sawatch fault as bounding two coeval grabens, which they referred to as the north Arkansas graben and the south Arkansas graben. Unruh and others (1992 #2776) used these physiographic divisions to define their north and south segments of the Sawatch fault. Fault segments described by Unruh and others (1992 #2776), and Lettis and others (1996 #4453) are herein referred to as sections. Subdued scarps are present on Bull Lake deposits along the northern section of the fault. Along the southern section, scarps up to 10 m high are present on Bull Lake deposits, and scarps average about 2 m high on Pinedale deposits.

**Name
comments**

General: The Sawatch fault is expressed as a series of more than 16 generally north-trending fault scarps along eastern margin of the Sawatch Range between Leadville and Salida. Until recently, the south section of the fault was known as the Sawatch fault (e.g. Witkind, 1976 #2792; Kirkham and Rogers, 1981 #792), and the faults comprising the north section of the fault were as yet unnamed. Ostenaar and others (1981 #2730) described the Sawatch fault as bounding the upper Arkansas Valley, which they further subdivided into the north Arkansas graben and the south Arkansas graben. Unruh and others (1992 #2776) used these physiographic divisions to define their north and south segments of the Sawatch fault, which they termed the Northern Sawatch fault and the Southern Sawatch fault. Although this fault has been described in the literature as segmented (Unruh and others, 1992 #2776; Lettis and others, 1996 #4453), studies are not extensive enough on each section of the fault to warrant designation as a segmented fault. The fault is therefore herein described as a sectioned fault.

Section: Unruh and others (1992 #2776) used the term Northern Sawatch fault to describe that part of the Sawatch fault that extends north from the Twin Lakes area. Herein this section of the fault is simply referred to as the northern section of the Sawatch fault. The northern section of the Sawatch fault extends from near Leadville to Quail Mountain, south of the Twin Lakes area.

Fault ID: Fault number Q56b of Widman and others (1998 #3441); fault 159 in Kirkham and Rogers (1981 #792); fault 'G' in Knepper (1974b #2714); faults 148, 149, 151 and 357 in Witkind (1976 #2792).

County(s) and State(s)	LAKE COUNTY, COLORADO CHAFFEE COUNTY, COLORADO
Physiographic province(s)	SOUTHERN ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:250,000 scale. <i>Comments:</i> The northern section of the Sawatch fault was mapped by Tweto (1974 #2766) and Tweto and Reed (1973 #2772) at a scale of 1:62,500, by Tweto and Case (1972 #2769) at a scale of 1:125,000, and by Tweto and others (1978 #2770) and Unruh and others (1992 #2776) at a scale of 1:250,000. The trace used herein is from Tweto and others (1978 #2770) and Lettis and others (1996 #4453).
Geologic setting	The Sawatch fault is a high-angle, down-to-the-east normal fault. It lies on the eastern margin of the Sawatch Range between Leadville and Salida and forms the western boundary of the upper Arkansas Valley graben, a Neogene west-tilted structure that forms the northernmost topographically prominent expression of the Rio Grande rift. The graben developed along the axial crest of the Laramide-age Sawatch anticline. The fault is one of the larger faults in the northern Rio Grande rift.
Length (km)	This section is 34 km of a total fault length of 84 km.
Average strike	N3°W (for section) versus N3°W,N3°W (for whole fault)
Sense of movement	Normal
Dip	72° E <i>Comments:</i> A dip of 72° E. was measured from a cross section by Tweto (1974 #2766).
Paleoseismology studies	
Geomorphic expression	Minor scarps are present on Bull Lake deposits at the south end of the northern section of the Sawatch fault (Ostenaar and others, 1981 #2730). No scarps or lineaments were found to indicate late Pleistocene activity along the north end of this section (Unruh and others, 1992 #2776).

Age of faulted surficial deposits	Quaternary Bull Lake deposits are displaced on the south end of the northern section of the Sawatch fault (Ostenaa and others, 1981 #2730). Much of the fault is concealed by Holocene and Pleistocene alluvium and glacial drift. About 30 percent of the fault lies in Precambrian and Miocene bedrock, and the remainder of the fault lies in or beneath Quaternary deposits.
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) <i>Comments:</i> Bull Lake deposits (approximately 100-140 ka) are offset at the south end of the northern section of the Sawatch fault, but 10 ka to 40 ka Pinedale deposits are not offset, indicating this section of the fault has not been active during the late Pleistocene and Holocene (Ostenaa and others, 1981 #2730). Howard and others (1978 #312), Kirkham and Rogers (1981 #792), and Colman (1985 #1953) indicated late Quaternary movement on the north end of this section of the fault.
Recurrence interval	10 to 40 k.y. (<150 ka) <i>Comments:</i> Ostenaa and others (1981 #2730) calculated a recurrence interval of 10-40 k.y. for both sections of the Sawatch fault based on trenching investigations on the southern section, which revealed six surface ruptures since about 150 ka.
Slip-rate category	Less than 0.2 mm/yr <i>Comments:</i> Slip rates for the northern section of the Sawatch fault have not been published. Quaternary displacement on the northern section is less than or comparable to that of the southern section (Ostenaa and others, 1981 #2730). A low slip rate is indicated by 2 m of offset of 10-40 ka Pinedale deposits.
Date and Compiler(s)	1997 Beth L. Widmann, Colorado Geological Survey
References	#1953 Colman, S.M., 1985, Map showing tectonic features of late Cenozoic origin in Colorado: U.S. Geological Survey Miscellaneous Geologic Investigations I-1566, 1 sheet, scale 1:1,000,000. #312 Howard, K.A., Aaron, J.M., Brabb, E.E., Brock, M.R., Gower, H.D., Hunt, S.J., Milton, D.J., Muehlberger, W.R.,

Nakata, J.K., Plafker, G., Prowell, D.C., Wallace, R.E., and Witkind, I.J., 1978, Preliminary map of young faults in the United States as a guide to possible fault activity: U.S. Geological Survey Miscellaneous Field Studies Map MF-916, 2 sheets, scale 1:5,000,000.

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#2730 Ostenaar, D.A., Losh, S.L., and Nelson, A.R., 1981, Evidence for recurrent late Quaternary faulting, Sawatch fault, upper Arkansas Valley, Colorado, *in* Junge, W.R., ed., Colorado tectonics, seismicity and earthquake hazards—Proceedings and field trip guide: Colorado Geological Survey Special Publication 19, p. 27-29.

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#2769 Tweto, O., and Case, J.E., 1972, Gravity and magnetic features as related to geology in the Leadville 30-minute quadrangle, Colorado: U.S. Geological Survey Professional Paper 726-C, 31 p.

#2772 Tweto, O., and Reed, J.C., Jr., 1973, Reconnaissance geologic map of the Mount Elbert 15-minute quadrangle, Lake Chaffee, and Pitkin Counties, Colorado: U.S. Geological Survey Open-File Report 73-5279.

#2770 Tweto, O., Moench, R.H., and Reed, J.C., 1978, Geologic map of the Leadville 1° x 2° quadrangle, northwestern Colorado: U.S. Geological Survey Miscellaneous Geologic Investigations I-999.

#2776 Unruh, J.R., Sawyer, T.L., and Lettis, W.R., 1992, Seismotectonic evaluation of Green Mountain Dam, Shadow Mountain Dam, Grandby Dam, and Willow Creek Dam, Colorado-Big Thompson Project: Technical report to U.S. Bureau of Reclamation, Denver, Colorado, 78 p.

#3441 Widmann, B.L., Kirkham, R.M., and Rogers, W.P., 1998, Preliminary Quaternary fault and fold map and database of Colorado: Colorado Geological Survey Open-File Report 98-8, 331 p., 1 pl., scale 1:500,000.

#2792 Witkind, I.J., 1976, Preliminary map showing known and suspected active faults in Colorado: U.S. Geological Survey Open-File Report 76-154.

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