Jump to Navigation

# 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.**

## Rampart Range fault (Class A) No. 2328

**Last Review Date: 1997-11-06**

## Compiled in cooperation with the Colorado Geological Survey

***citation for this record:*** **Widmann, B.L., compiler, 1997, Fault number 2328, Rampart Range fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 03:00 PM.**

| | |
|---|---|
| **Synopsis** | The Rampart Range fault trends north-south along the eastern margin of the Front Range, north of Colorado Springs. It is a range-front fault that had reverse movement during the Laramide, but normal movement during the late Cenozoic. The fault is marked by topographic breaks and vegetation lineaments. Approximately 8 m of down-to-the-west Quaternary displacement was reported by Scott (1970 #1141). Trenching by Dickson (1986 #2677) demonstrated that the fault offset Kansas or Yarmouth Douglass Mesa Gravel 29.3 m sometime between 600 ka and 30-50 ka. |
| **Name** | The north-trending Rampart Range fault forms the eastern margin |

| | |
|---|---|
| **comments** | of the Rampart Range north of Colorado Springs. The fault begins near Larkspur and continues south towards Colorado Springs, ending near Colorado Highway 24.<br><br>**Fault ID:** Fault 145 in Kirkham and Rogers (1981 #792), fault 143 in Witkind (1976 #2792), and fault number Q78 of Widman and others (1998 #3441). |
| **County(s) and State(s)** | DOUGLAS COUNTY, COLORADO<br>EL PASO COUNTY, COLORADO |
| **Physiographic province(s)** | SOUTHERN ROCKY MOUNTAINS<br>GREAT PLAINS |
| **Reliability of location** | Good<br>Compiled at 1:100,000 scale.<br><br>*Comments:* Wobus and Scott (1977 #2794) mapped the south part of the fault at a scale of 1:24,000. The fault was also mapped at a scale of 1:62,500 by Scott and Wobus (1973 #2738), 1:100,000 by Trimble and Machette (1979 #2760; 1979 #2761), 1:250,000 by Scott and others (1978 #2735) and Bryant and others (1981 #2645), 1:1,000,000 by Colman (1985 #1953) and 1:5,000,000 by Howard and others (1978 #312). The trace used herein is from Trimble and Machette (1979 #2760; 1979 #2761). |
| **Geologic setting** | The Front Range is defined by a 500- to 1,000-m-high, east-facing escarpment that is both a tectonic and erosional feature. Estimations of Neogene offset across the Front Range are as little as 30 m and as much as 2,200 m. Scott (1970 #1141), Epis and Chapin (1975 #2688), and Trimble (1980 #2759) suggested much of the topographic relief across the escarpment is related to Neogene fault activity. Jacob and Albertus (1985 #2702), Leonard and Langford (1994 #2715), and Steven and others (1997 #3477) indicated that Neogene fault activity only accounts for a minor amount of topographic relief across the escarpment. Steven and others (1997 #3477) noted anomalies in paleo- and modern, range-front stream flow directions which they interpreted to indicate tilting of the Front Range off the northeast flank of the Rio Grande rift during the Miocene, and regional uplift during the early Pliocene and possibly early Quaternary. Jacob and Albertus (1985 #2702) and Chapin and Kelley (1997 #2674) argued that the Front Range escarpment is primarily a product of differential erosion. The Rampart Range fault forms the east flank of the Rampart Range, which is part of the Colorado Front Range. It is a |

| | |
|---|---|
| | west-dipping, high-angle, range-front, Laramide reverse fault with renewed late Cenozoic normal displacement (Dickson, 1986 #2677). Scott (1970 #1141) reported down-to-the-east movement in early Tertiary time, and down-to-the-west movement in Quaternary time. Overall stratigraphic offset indicates down-to-the-east reverse movement, whereas offset in Quaternary deposits indicates down-to-the-west, normal displacement. |
| **Length (km)** | 46 km. |
| **Average strike** | N9°W |
| **Sense of movement** | Normal<br><br>*Comments:* Late Cenozoic normal movement was reported by Witkind (1976 #2792), Dickson (1986 #2677), and Unruh and others (1994 #2778). Scott (1970 #1141) indicated reverse movement in early Tertiary time and normal movement in Quaternary time. |
| **Dip** | 50° W<br><br>*Comments:* A dip of 50° W. was measured from a cross section by Harms (1959 #2696). Dickson (1986 #2677) and Dickson and others (1986 #2685) reported fault dips of 45°-80° W. in trenches excavated near the U.S. Air Force Academy. |
| **Paleoseismology studies** | Dickson (1986 #2677) excavated and logged two trenches, which he labeled AF-1 and AF-2, on the section of the fault that extends through the southwest corner of U.S. Air Force Academy property, south of the Colorado Springs filtration plant. Trenching investigations indicated that the last displacement on this fault occurred between 600 ka and 30-50 ka.<br><br>AF-1 site (2328-1). This 152-m-long trench revealed slip surfaces dipping 45–80° W. in the Douglass Mesa Gravel. The gravel was offset 29.3 m in a dip-slip manner.<br><br>AF-2 site (2328-2). This 23-m-long trench exposed slip surfaces in the Douglass Mesa Gravel that are overlain by an unfaulted paleosol estimated to be 30-50 ka. |
| **Geomorphic expression** | Discontinuous topographic breaks and vegetation lineaments mark the trace of this fault (Scott, 1970 #1141; Unruh and others, |

| | |
|---|---|
| | 1994 #2778). A well developed fault-line scarp is visable along much of the fault trace (Kirkham and Rogers, 1981 #792). |
| **Age of faulted surficial deposits** | The majority of the fault extends through Precambrian and early Tertiary rock. Scott (1970 #1141) described about 8 m of offset in the Douglass Mesa Gravel, which is considered to be Kansan or Yarmouth in age (both middle Pleistocene) . Epis and Chapin (1975 #2688) suggested 450 m of Neogene offset as evidenced discordant elevations of the Oligocene Wall Mountain Tuff. Taylor (1975 #2757) suggested 370 m of Neogene offset across the fault. Trimble (1980 #2759) described as much as 700 m of offset on this fault based on stratigraphic offset of the late Eocene surface and the Wall Mountain tuff. Jacob and Allbertus (1985 #2702) indicated less than 230 m of Neogene offset across this fault. Trenching investigations by Dickson (1986 #2677) demonstrated that Quaternary dip-slip displacement in the Douglass Mesa Gravel amounts to nearly 30 m, and that there has not been any movement on the Rampart Range fault during the past 30-50 k.y. Leonard and Langford (1994 #2715) suggested only 90-95±60 m of of post-Eocene displacement across the Front Range based on contouring of paleo-surfaces and the base of the Wall Mountain tuff and Castle Rock conglomerate on either side of the range front faults. |
| **Historic earthquake** | |
| **Most recent prehistoric deformation** | middle and late Quaternary (<750 ka)<br><br>*Comments:* Scott (1970 #1141) described offset Kansan or Yarmouth deposits (middle Pleistocene). Trenching investigations by Dickson (1986 #2677) indicated the latest movement on the fault was between 600 ka and 30-50 ka. Airphoto analysis and aerial reconnaissance by Unruh and others (1994 #2778) revealed no evidence for Holocene fault activity. |
| **Recurrence interval** | |
| **Slip-rate category** | Less than 0.2 mm/yr<br><br>*Comments:* Based on offset of 8 m (Scott, 1970 #1141) and a paleoevent between 600 ka and 30 ka (Dickson, 1986 #2677), a slip rate of <0.2 mm/yr was estimated for this fault by Widmann and others (1981 #3441). Jack Benjamin and Associates and |

| | |
|---|---|
| | Geomatrix Consultants (1994 #2703) calculated slip rates of 0.01 to 0.07 mm/yr based on dip-slip values of 8.8 to 43 m as determined from trenching investigations by Dickson (1986 #2677). |
| **Date and Compiler(s)** | 1997<br>Beth L. Widmann, Colorado Geological Survey |
| **References** | #2645 Bryant, B., McGrew, L.W., and Wobus, R.A., 1981, Geologic map of the Denver 1° x 2° quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Geologic Investigations I-1163.<br><br>#2674 Chapin, D.E., and Kelley, S.A., 1997, The Rocky Mountain erosion surface in the Front Range of Colorado, *in* Bolyard, D.W., and Sonnenberg, S.A., eds., Geologic history of the Colorado Front Range—Field trip 7: American Association of Petroleum Geologists, Rocky Mountain Section, p. 101-113.<br><br>#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.<br><br>#2677 Dickson, P.A., 1986, Investigation of the Rampart Range fault at the Air Force Academy trench site, Colorado Springs, Colorado, *in* Rogers, W.P., and Kirkham, R.M., eds., Contributions to the Colorado tectonics and seismicity—A 1986 update: Colorado Geological Survey Special Publication 28, p. 211-227.<br><br>#2685 Dickson, P.A., Kewer, R.P., and Wright, J.E., 1986, Regional fault study—Central Front Range, Colorado, *in* Rogers, W.P., and Kirkham, R.M., eds., Contributions to Colorado tectonics and seismicity—A 1986 update: Colorado Geologic Survey Special Publication 28, p. 172-185.<br><br>#2688 Epis, R.C., and Chapin, C.E., 1975, Geomorphic and tectonic implications of the post-Laramide, late Eocene erosion surface in the southern Rocky Mountains, *in* Curtis, B.F., ed., Cenozoic history of the southern Rocky Mountains: Geological Society of America Memoir 144, p. 45-74.<br><br>#2696 Harms, J.C., 1959, Structural geology of the eastern flank of the southern Front Range, Colorado: Boulder, Colorado, |

University of Colorado, unpublished Ph.D. dissertation, 165 p.

#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.

#2703 Jack Benjamin & Associates and Geomatrix Consultants, 1996, Probabilistic seismic hazard assessment for the U.S. Army chemical disposal facility, Pueblo Depot Activity, Colorado: Technical report to Science Applications International Corporation, Maryland, under Contract JBA 148-130-PU-002.

#2702 Jacob, A.F., and Albertus, R.G., 1985, Thrusting, petroleum seeps, and seismic exploration, Front Range south of Denver, Colorado, *in* Macke, D.L., and Maughan, E.K., eds., Rocky Mountain Section field trip guide: American Association of Petroleum Geologists, p. 77-96.

#792 Kirkham, R.M., and Rogers, W.P., 1981, Earthquake potential in Colorado: Colorado Geological Survey Bulletin 43, 171 p., 3 pls.

#2715 Leonard, E.M., and Langford, R.P., 1994, Post-Laramide deformation along the eastern margin of the Colorado Front Range—A case against significant faulting: The Mountain Geologist, v. 31, p. 45-52.

#1141 Scott, G.R., 1970, Quaternary faulting and potential earthquakes in east-central Colorado: U.S. Geological Survey Professional Paper 700-C, C11-C18 p.

#2738 Scott, G.R., and Wobus, R.A., 1973, Reconnaissance geologic map of Colorado Springs and vicinity, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-482.

#2735 Scott, G.R., Taylor, R.B., Epis, R.C., and Wobus, R.A., 1978, Geologic map of the Pueblo 1° x 2° quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Geologic Investigations I-1022.

#3477 Steven, T.A., Evanoff, E., and Yuhas, R.H., 1997, Middle and late Cenozoic tectonic and geomorphic development of the Front Range of Colorado, *in* Bolyard, D.W., and Sonnenberg, S.A., eds., Geologic history of the Colorado Front Range: Rocky Mountain Association of Geologists, American Association of Petroleum Geologists Field Trip 7, Rocky Mountain Section, p. 115-189.

#2757 Taylor, R.B., 1975, Neogene tectonism in south-central Colorado, *in* Curtis, B.F., ed., Cenozoic history of the southern Rocky Mountains: Geological Society of America Memoir 144, p. 211-226.

#2759 Trimble, D.E., 1980, Cenozoic tectonic history of the Great Plains contrasted with that of the southern Rocky Mountains, a synthesis: The Mountain Geologist, v. 17, no. 3, p. 59-69.

#2760 Trimble, D.E., and Machette, M.N., 1979, Geologic map of the greater Denver area, Front Range urban corridor, Colorado: U.S. Geological Survey Miscellaneous Geologic Investigations I-856-H.

#2761 Trimble, D.E., and Machette, M.N., 1979, Geologic map of the Colorado Springs-Castle Creek area, Front Range urban corridor, Colorado: U.S. Geological Survey Miscellaneous Geologic Investigations I-857-F.

#2778 Unruh, J.R., Wong, I.G., Hitchcock, C.S., Bott, J.D.J., Silva, W.J., and Lettis, W.R., 1994, Seismotectonic evaluation, Pueblo Dam, Fryingpan-Arkansas Project, south-central Colorado: U.S. Bureau of Reclamation, 134 p.