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Quaternary Fault and Fold Database of the United States

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Helena valley fault, main range-bounding section (Class A) No. 678a

Last Review Date: 1993-04-22

Compiled in cooperation with the Montana Bureau of Mines and Geology

citation for this record: **Machette, M.N., compiler, 1993, Fault number 678a, Helena valley fault, main range-bounding section, 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 02:04 PM.**

Synopsis	**General:** This fault has been mapped as a bedrock structure for more than 20 years, but considerable doubt has existed about its sense and recency of movement. Stickney (1987 #251) was the first to find offset Quaternary deposits along two short parts of the fault, although the majority of its mapped trace seems to be represented by a fault-line scarp. **Sections:** This fault has 2 sections. The informally named sections consist of the (1) main range-bounding trace of the Helena valley fault and (2) the minor section containing two 1-

	km-long scarps that are on the piedmont south of the range. The piedmont scarps are clearly related to young movement, which may be associated with the main fault at depth.
Name comments	**General:** According to Schmidt (1986 #533), this fault was first mapped by Bregmen and Robinson (no reference given). The first name applied to the structure appears to be St. Mary's fault (Witkind, 1975 #317), which was a previously mapped fault to the northwest of Helena (Schmidt, 1986 #533). The name Helena valley fault, which is now preferred in the literature, has been applied to combinations of various faults in the Helena valley. However, recent mapping by Schmidt (1986 #533) and Stickney (1987 #251) support restricting the name to the range-bounding fault along the northern margin of the Helena valley. The part of the fault having demonstrable or suspected Quaternary movement extends from 5 km west of Interstate Highway 15 at the bedrock divide with Silver Valley to 3 km east of the southeastern shore of Lake Helena. **Section:** This section is informally named herein for its location along the northern margin of the Helena valley. **Fault ID:** Refers to fault 50 (St. Mary's fault) of Witkind (1975 #317), fault 121 (Helena Valley fault) of Johns and others (1982 #259), fault 20 (Helena valley fault) of Stickney (1987 #251) and Stickney and Bartholomew (1987 #85) (written commun. 1992 #556), and Thorton Ranch and East of I-15 segments of Helena valley fault of Stickney and Bartholomew (written commun. 1992 #556).
County(s) and State(s)	LEWIS AND CLARK COUNTY, MONTANA
Physiographic province(s)	NORTHERN ROCKY MOUNTAINS
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Shown on maps by Schmidt (1986 #533) and Stickney (1987 #251), the fault is either entirely within bedrock or bounds bedrock.
Geologic setting	High-angle, down-to-the-southwest, normal (?) fault along northern margin of the Helena valley (as restricted from previous usage). The fault extends from the bedrock divide with Silver

	Valley eastward to Lake Helena. Witkind (1975 #317) extended the fault farther west to Canyon Creek, and both Witkind (1975 #317) and Johns and others (1982 #259) extended the fault southeastward along the base of the Spokane Hills. Schmidt (1986 #533) mapped the fault (inferred trace) eastward into the Townsend Valley, although Stickney (1987 #251) found no evidence for Quaternary movement in the low divide between Lake Helena and Hauser Lake. The zone formed by the St. Marys fault, Helena valley fault, and its extension to the east are considered to be the northern boundary of the Lewis and Clark line, which is thought to be a Tertiary dextral-slip fault zone (Reynolds, 1979 #223). Reynolds (1979 #223) and Schmidt (1986 #533) reported several kilometers of Tertiary dextral movement on the Helena valley fault, although this amount of offset is not well documented.
Length (km)	This section is 20 km of a total fault length of 20 km.
Average strike	N65°W (for section) versus N65°W (for whole fault)
Sense of movement	Normal *Comments:* As reported by Stickney (1987 #251), although Reynolds (1979 #223) considered its recent (Tertiary) phase of movement to have primarily dextral slip.
Dip Direction	SW
Paleoseismology studies	
Geomorphic expression	Main fault is defined by the linear bedrock margin (fault-line scarp) at the northern edge of Helena valley. Neither Schmidt (1986 #533) nor Stickney (1987 #251) found scarps on unconsolidated sediments along this section.
Age of faulted surficial deposits	
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Inferred Quaternary movement based on age

	estimates (early Quaternary or late Tertiary) of Stickney and Bartholomew (1987 #85) and the fault's spatial association with nearby post-middle Pleistocene scarps [678b].
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* Inferred low slip rate based on absence of scarps on upper Quaternary deposits.
Date and Compiler(s)	1993 Michael N. Machette, U.S. Geological Survey, Retired
References	#259 Johns, W.M., Straw, W.T., Bergantino, R.N., Dresser, H.W., Hendrix, T.E., McClernan, H.G., Palmquist, J.C., and Schmidt, C.J., 1982, Neotectonic features of southern Montana east of 112°30' west longitude: Montana Bureau of Mines and Geology Open-File Report 91, 79 p., 2 sheets. #223 Reynolds, M.W., 1979, Character and extent of Basin-Range faulting, western Montana and east-central Idaho, *in* Newman, G.W., and Goode, H.D., eds., Basin and Range symposium and Great Basin field conference: Rocky Mountain Association of Geologists and Utah Geological Association, p. 41-54. #533 Schmidt, R.G., 1986, Geology, earthquake hazards, and land use in the Helena area, Montana—A review: U.S. Geological Survey Professional Paper 1316, 64 p., 3 pls., scale 1:48,000 and 1:25,000. #251 Stickney, M.C., 1987, Quaternary geologic map of the Helena valley, Montana: Montana Bureau of Mines and Geology Geologic Map 46, 1 pl., scale 1:50,000. #85 Stickney, M.C., and Bartholomew, M.J., 1987, Seismicity and late Quaternary faulting of the northern Basin and Range province, Montana and Idaho: Bulletin of the Seismological Society of America, v. 77, p. 1602-1625. #556 Stickney, M.C., and Bartholomew, M.J., 1992 written commun., Preliminary map of late Quaternary faults in western Montana (digital data): Montana Bureau of Mines and Geology (digital version of MBMG Open-File Report 186), 1 pl., scale

	1:500,000. #317 Witkind, I.J., 1975, Preliminary map showing known and suspected active faults in western Montana: U.S. Geological Survey Open-File Report 75-285, 36 p. pamphlet, 1 sheet, scale 1:500,000.