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Quaternary Fault and Fold Database of the United States

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Grand Valley fault, Swan Valley section (Class A) No. 726a

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Compiled in cooperation with the Idaho Geological Survey

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Synopsis	**General:** This long fault extends from eastern Idaho into western Wyoming along the western base of the Snake and Salt River Ranges. **Sections:** This fault has 4 sections. Detailed mapping and limited trenching suggest that the fault is composed of four segments and has an additional poorly characterized part. These different parts of the fault suggest that it has different rates of Quaternary displacement and apparently different paleoseismic histories.

	Those segments are herein considered as informally named sections in accordance with this compilation. From north to south they are: the Swan Valley section [726a], the Grand Valley section [726b], the Prater Mountain section [726c], and the Star Valley section [726d]. The southernmost section is the youngest and most active part of the fault. The northern part of the fault is outside the Intermountain Seismic Belt and surface ruptures are less frequent than on those parts to the south.
Name comments	**General:** Name of fault and its sections are modified from Piety and others (1992 #538). Earlier workers in the area restricted the use of "Grand Valley fault" to that part of the structure in Idaho; the southern extension in Wyoming was known as the "Star Valley fault." The use of a single name as utilized by Piety and others (1992 #538) is followed here. The Grand Valley fault extends from about 26 km southeast of Pocatello, Idaho, south to about 22 km south of Afton, Wyoming. **Section:** As defined by Piety and others (1992 #538), this section extends from a point about 10 km south from the southern edge of the Snake River Plain (approximately 26 km southeast of Pocatello, Idaho), south to somewhere within the 5-km-long "zone" between Palisades Creek and Sheep Creek. We arbitrarily place the southern boundary of the section midway between these two known geographic locations. Anders (1990 #3912) stated that there is a 400 m drop in the elevation of the basin fill surfaces from southeast to northwest in this area. Anders (1990 #3912) further subdivided this part of the fault into sections (northwestern, central, and southeastern sections) based on geology and physiography, but this finer subdivision is not warranted herein because neither the timing of faulting nor the slip rates seem to vary between his subsections. **Fault ID:** Refers to number 22 (Grand Valley fault, Idaho) of Witkind (1975 #320) and numbers 20 and 21 (Star Valley fault, Wyoming) of Witkind (1975 #819).
County(s) and State(s)	BONNEVILLE COUNTY, IDAHO MADISON COUNTY, IDAHO
Physiographic province(s)	MIDDLE ROCKY MOUNTAINS
Reliability of location	Poor Compiled at 1:250,000 scale.

	Comments: Although the source map for the location of the fault is approximately 1:40,000 scale (plate 1 of Piety and others, 1986 #55), the fault is shown as poorly located because of the absence of scarps. Location of the northern part of fault (shown as dotted line) is from general location given in figure 2B in Piety and others (1992 #538) and should also be considered as poorly located. Fault is similarly depicted by Oriel and Moore (1985 #4385), but mapped higher in the range front by Albee and Cullins (1975 #4384).
Geologic setting	Down-to-the-west range-front normal fault that extends from near the Snake River Plain southward along the western base of the Snake and Salt River Ranges. Basin fill is estimated to be 2- to 3-km thick based on seismic reflection data (Royse and others, 1975 #4391; Dixon, 1982 #4382).
Length (km)	This section is 49 km of a total fault length of 136 km.
Average strike	N41°W (for section) versus N22°W (for whole fault)
Sense of movement	Normal *Comments:* (Piety and others, 1986 #55; Piety and others, 1992 #538)
Dip Direction	SW *Comments:* Piety and others (1992 #538) suggested that the Grand Valley fault is a listric normal fault because it has a curvilinear trace and maintains a uniform distance from the Absaroka thrust--a major regional thrust fault (Armstrong and Oriel, 1965 #4389). On seismic reflection profiles, the Grand Valley fault appears to merge with a ramp of the Absaroka thrust in the subsurface (Royse and others, 1975 #4391; Dixon, 1982 #4382).
Paleoseismology studies	
Geomorphic expression	One scarp exists along this part of the fault at Pine Creek; the mountain front is subdued.
Age of faulted surficial	1.5?0.8 Ma Pine Creek basalt (Anders and others, 1989 #408)

deposits	
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Piety and others (1986 #55) indicated the time of the most recent surface rupture on this section of the Grand Valley fault is Quaternary. The only clearly recognized fault scarp (0.6 km long) along the Swan Valley section is on the 1.5?0.8 Ma Pine Creek Basalt (Anders and others, 1989 #408) at Pine Creek (Piety and others, 1992 #538). Elsewhere the fault is buried by 10-70 ka loess. Scarps are absent on upper Pleistocene (<30 ka) deposits (Piety and others, 1986 #55). Anders (1990 #3912) cited Witkind (1975 #320) as indicating that this part of the fault is Holocene; Witkind (1975 #320) labeled the trace of the fault as Holocene, but indicated that it is late Cenozoic in the documentation accompanying the map. A 20-m-high fault scarp south of Rainy Creek (Piety and others, 1986 #55; Anders, 1990 #3912) is covered by unfaulted late Quaternary loess and is probably fluvial in origin. Mason (1992 #463) reinterpreted data presented by Piety and others (1986 #55) to suggest that the most recent event occurred between 15-30 ka (shown as 23?8 ka in table 2 of Mason, 1992, #463). Obviously this age is too young in light of Piety and others (1992 #538) study of the few scarps along this section.
Recurrence interval	100 k.y. (1.5 Ma) *Comments:* Piety and others (1992 #538) estimated that the recurrence of 2-m surface faulting events is 100 k.y. (14 in past 1.5 Ma). However, in an earlier publication they suggested that the recurrence interval may be 50-120 k.y. for the same time interval (Piety and others, 1986 #55). Furthermore, "higher displacement rates indicated by the paleomagnetic data for the 2 m.y. interval before deposition of Pine Creek Basalt may suggest that the events recorded by the 28-m-high scarp at Pine Creek occurred more frequently early in the interval following deposition of the basalt . . ." (Piety and others, 1992 #538). Based on data presented by Piety and others (1986 #55), Mason (1992 #463) suggested that repeat time between earthquakes on this section is greater than the time since the last event (or >23?8 ka). This interval appears to be too short in light of more recent interpretation of the scarps along this section.

Slip-rate category	Less than 0.2 mm/yr *Comments:* Piety and others (1986 #55) stated that the average Quaternary displacement (slip) rate is 0.019 mm/yr based on the presence of a 28-m-high scarp on 1.5?0.8 Ma Pine Creek basalt. Anders (1990 #3912) and Piety and others (1986 #55) indicated the rate is 0.014 mm/yr for the past 2 m.y. Clearly both sources suggest that the rate would fall within the lowest slip-rate category (<0.2 mm/yr) that we define herein. Piety and others (1986 #55) further suggested that the upper bound for the 2 m.y. slip rate could be 0.32 mm/yr because the Pine Creek basalt could be as young as 0.7 Ma (Anders and others, 1989 #408). However, this rate is not considered to be representative of the latest Quaternary history of the fault, since one would expect to observe scarps as much as 5 m high on deposits of 15 ka age along the fault. Wong and others (2000 #4484) suggested fault slip rates ranging from 0.002 to 1.5 mm/yr, with maximum weighting of 60% on a value of 0.026 mm/yr. These reported slip rates are model dependent and do not represent actual measured values. The late Quaternary characteristics of this fault (overall geomorphic expression, continuity of scarps, age of faulted deposits, etc.) suggest the slip rate during this period is probably similar to their median value, as is Piety and others (1986 #55) average Quaternary rate. Accordingly, the <0.2 mm/yr slip-rate category has been assigned to this fault.
Date and Compiler(s)	1994 James P. McCalpin, GEO-HAZ Consulting, Inc. Michael N. Machette, U.S. Geological Survey, Retired Kathleen M. Haller, U.S. Geological Survey
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	#320 Witkind, I.J., 1975, Preliminary map showing known and suspected active faults in Idaho: U.S. Geological Survey Open-File Report 75-278, 71 p. pamphlet, 1 sheet, scale 1:500,000. #819 Witkind, I.J., 1975, Preliminary map showing known and suspected active faults in Wyoming: U.S. Geological Survey Open-File Report 75-279, 35 p. pamphlet, 1 sheet, scale 1:500,000.