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Quaternary Fault and Fold Database of the United States

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

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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:** This section was defined by Piety and others (1992 #538) as extending from about Palisades Creek south to Dry Creek, which is south of the section boundary as we show it. The northern boundary is arbitrarily taken to be midway between Palisades Creek and Sheep Creek, as explained in section 726a; the southern boundary is at right step in the fault trace at the Greys River instead of further to the south as shown by Piety and others (1992 #538). **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)	LINCOLN COUNTY, WYOMING BONNEVILLE 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 fault location is approximately 1:40,000 scale (plate 1 of Piety and others, 1986 #55), fault is designated as poorly located because of the absence of scarps.
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 24 km of a total fault length of 136 km.
Average strike	N29°W (for section) versus N22°W (for whole fault)
Sense of movement	Normal *Comments:* (Piety and others, 1992 #538)
Dip	25°-55° SW *Comments:* Fault dips 55? at surface and decreases to 25? at a depth of 2.8 km (Anders and others, 1989 #408) based on seismic reflection data; the fault is inferred to be listric (Dixon, 1982 #4382).
Paleoseismology studies	
Geomorphic expression	There are no fault scarps or other geomorphic evidence for surface ruptures along this section of the fault. There is also no evidence of discernable tectonic tilt of rocks belonging to the Long Spring Formation, and this part of the fault coincides with the lowest part of the range front.
Age of faulted surficial deposits	The trace of the fault along the Grand Valley section is at the contact between Mesozoic or Paleozoic sedimentary rocks of the Snake River Range and Cenozoic basin fill (Anders and others, 1989 #408).
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Although Piety and others (1992 #538) noted the presence of a scarp on a 15-30 ka terrace near Alpine, Wyoming, they concluded that it is a fluvial not tectonic feature, based on the absence of shear fabric along a terrace edge contact that dips about 45? (Piety and others, 1992 #538, fig. 4.4). Furthermore, they inferred that only a small amount of Quaternary displacement has occurred along this part of the fault. Mason

	(1992 #463) suggested that the time of the most recent movement is less that 30 ka; however, this must reflect his interpretation of data presented earlier by Piety and others (1986 #55) and subsequently reinterpreted (Piety and others, 1992 #538). Anders and others (1989 #408) indicated that no evidence for latest Quaternary surface faulting exists north of Prater Canyon, which we use as the southern boundary of section 726c. The existing data suggest the age assignment for this part of the fault should be Quaternary. 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. Mason's (1992 #463) interpretation that the most recent event occurred between 15-30 ka (or 23?8 ka in table 2) is obviously too young in light of Piety and others (1992 #538) study of the few scarps along this section.
Recurrence interval	*Comments:* 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, and thus, is not cited in above field.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Piety and others (1992 #538) stated that the "Quaternary displacement rate on the Grand Valley segment has been lower than the downcutting rate of the Snake River" and indicated that the displacement rate is lower than that on the adjacent sections. Anders and others (1990 #409) suggested that based on the tilt of Miocene and younger basin fill, there was significant pre-latest Quaternary movement on this part of the fault. However, most of the activity appears to have ceased in the Quaternary. Piety and others (1986 #55) suggested that the potential for surface faulting on this part of the fault is very low. 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 0.013 mm/yr, or about half the rate on the section to the north [726a]. 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.) also suggest the slip rate during this period is probably very low. Although there is no published slip rate for this section of the fault, the <0.2 mm/yr slip-rate category is assigned herein based on the absence of scarps on Quaternary deposits.
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
References	#3912 Anders, M.H., 1990, Late Cenozoic evolution of Grand and Swan Valleys, Idaho, *in* Roberts, S., ed., Geologic field tours of western Wyoming: Geological Survey of Wyoming Public Information Circular 29, p. 15-25. #408 Anders, M.H., Geissman, J.W., Piety, L.A., and Sullivan, J.T., 1989, Parabolic distribution of circumeastern Snake River Plain seismicity and latest Quaternary faulting—Migratory pattern and association with the Yellowstone hotspot: Journal of Geophysical Research, v. 94, no. B2, p. 1589-1621. #409 Anders, M.H., Rodgers, D.W., McCalpin, J.P., and Haller, K.M., 1990, Late Tertiary and Quaternary faulting north and south of the eastern Snake River Plain, *in* Roberts, S., ed., Geologic field tours of western Wyoming: Geological Survey of Wyoming Public Information Circular 29, p. 1-38. #4382 Dixon, J.S., 1982, Regional structural synthesis, Wyoming salient of Western Overthrust belt: American Association of Petroleum Geologists Bulletin, v. 66, p. 1560-1580. #463 Mason, D.B., 1992, Earthquake magnitude potential of active faults in the Intermountain seismic belt from surface parameter scaling: Salt Lake City, University of Utah, unpublished M.S. thesis, 110 p. #538 Piety, L.A., Sullivan, J.T., and Anders, M.H., 1992, Segmentation and paleoseismicity of the Grand Valley fault, southeastern Idaho and western Wyoming, *in* Link, P.K., Kuntz, M.A., and Platt, L.B., eds., Regional geology of eastern Idaho and western Wyoming: Geological Society of America Memoir 179, p. 155-182. #55 Piety, L.A., Wood, C.K., Gilbert, J.D., Sullivan, J.T., and

Anders, M.H., 1986, Seismotectonic study for Palisades Dam and Reservoir, Palisades Project: Bureau of Reclamation Seismotectonic Report 86-3, 198 p., 2 pls.

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#160 Smith, R.B., and Sbar, M.L., 1974, Contemporary tectonics and seismicity of the Western United States with emphasis on the Intermountain seismic belt: Geological Society of America Bulletin, v. 85, p. 1205-1218.

#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.

#4484 Wong, I., Olig, S., and Dober, M., 2000, Preliminary probabilistic seismic hazard analyses—Island Park, Grassy Lake, Jackson Lake, Palisades, and Ririe Dams: U.S. Department of the Interior, Bureau of Reclamation Technical Memorandum D8330-2000-17.