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# 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.**

## Idaho rift systems fault (Class B) No. 3501

**Last Review Date: 2003-06-04**

## Compiled in cooperation with the Idaho Geological Survey

***citation for this record:*** **Crone, A.J., compiler, 2003, Fault number 3501, Idaho rift systems 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 02:51 PM.**

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| **Synopsis** | All of the faults described here are related to volcanogenic processes associated with the young volcanism in the Snake River Plain. As a result, they are categorized as Class B features because, even though the features are latest Pleistocene or Holocene in age, and even though some of them are associated with scarp-like morphology at the surface, they probably do not extend to sufficient depth in the crust to generate highly damaging earthquakes. The surface extension that produces these is related to the emplacement of shallow igneous dikes in the underlying crust. Thus, the formation of these fault-like features is directly associated with episodes of dike emplacement in the Snake River Plain. The northwest-southeast orientation of the intruding dikes |

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| | and the associated fissures and scarps is related to the overall northeast-southwest extension direction in this part of eastern Idaho (Kuntz and others, 1992 #437). Based on the recent mapping of Kuntz and others (1988 #439; 1994 #1277), most of the features described by Prinz (1970 #6336) and Witkind's fault #66 (1975 #320) do not have scarp-like morphology and are mapped as non-eruptive fissures. Only some of the structures southeast of Arco, Idaho, are mapped as having scarp-like morphology (Kuntz and others, 1994 #1277). |
| **Name comments** | This name was first used by Prinz (1970 #6336) and subsequently followed by Witkind (1975 #320) and later by others. Prinz (1970 #6336) restricted his usage of this term to a set of generally aligned, northwest-trending faults that extend from the southern end of the Pioneer Mountains southeastward across the Snake River Plain. As defined by Prinz (1970 #6336), the Idaho rift system consists of four unidirectional rift sets, which he named, from northwest to southeast, the Great Rift Set, the Open Crack Rift Set, the King's Bowl Rift Set, and the Wapi Rift Set. For the purpose of this compilation, we use an even broader definition of fault-like features for the "Idaho rift system." In addition to the rift sets described by Prinz (1970 #6336), we include other north- to northwest-trending features identified by Witkind (1975 #320), all of which have a similar volcanogenic origins and are located along the northern margin of the Snake River Plain in eastern Idaho. These include a network of small faults and fissures (and associated monoclines) adjacent to the Big Lost River southeast of Arco, Idaho, that were mapped by Kuntz and others (1994 #1277), and the unnamed fault #66 reported by Witkind (1975 #320) on the northwestern flank of Hells Half Acre, which was subsequently mapped in detail by Kuntz and others (1994 #1277). |
| **County(s) and State(s)** | BINGHAM COUNTY, IDAHO<br>BLAINE COUNTY, IDAHO<br>BONNEVILLE COUNTY, IDAHO<br>POWER COUNTY, IDAHO<br>BUTTE COUNTY, IDAHO |
| **Physiographic province(s)** | COLUMBIA PLATEAU |
| **Reliability of location** | Good<br>Compiled at 1:100,000 scale.<br><br>*Comments:* Traces of these faults were obtained from the |

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| | mapping of Kuntz and others (1988 #439; 1994 #1277). |
| **Geologic setting** | The Idaho rift system faults (as broadly defined here) form a network of fractures, tensional fissures, fault-scarp-like features and monoclines that are all associated with the intrusion of shallow igneous dikes in the underlying crust (Kuntz and others, 1992 #437; Smith and others, 1994 #6337). All of these scarps and associated features are located in the eastern Snake River Plain, which is a relatively flat, 50- to 100-km-wide depression in southeastern Idaho. The eastern Snake River Plain is underlain by basaltic lava flows and pyroclastic deposits, all of which are younger than about 730 ka (Kuntz and others, 1992 #437), and many of which are Holocene in age. These volcanic rocks are widely exposed in many parts of the Snake River Plain but elsewhere, are buried by thin deposits of loess and dune sand. The eastern Snake River Plain is flanked on the north and south by typical Basin and Range topography in which the mountain ranges are composed of extensively folded and thrust faulted Precambrian through Mesozoic rocks and the adjacent basis are filled with Tertiary and Quaternary sedimentary and volcanic rocks. The ranges are typically bounded on one side by range-front normal faults, several of which show evidence of Quaternary and Holocene movement. The Ms 7.3 Borah Peak earthquake occurred in 1983 on the nearby Lost River fault. The contemporary stress field in the region is dominated by northeast-southwest extension, which is reflected in the orientation of many of the nearby mountain ranges, the associated range-bounding faults, and the orientation of structures in the Idaho rift system (Kuntz and others, 1992 #437).<br><br>The fault-like structures described here as part of the Idaho rift system do not extend to significant depths in the crust, probably 5 km or less (Smith and others, 1994 #6337; Smith and others, 1996 #6338), and therefore do not pose a serious seismic threat; the historical seismicity in volcanic rift zones suggests that earthquakes induced by dike intrusions have maximum magnitudes of about 4 or less (Smith and others, 1996 #6338). |
| **Length (km)** | 88 km. |
| **Average strike** | N30°W |
| **Sense of movement** | Normal<br><br>*Comments:* The scarp-like features in the Idaho rift system are |

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| | caused by the intrusion of shallow dikes, which produces tensional features. |
| **Dip Direction** | NE; SW<br><br>*Comments:* Dips on the fault-like features are not reported, but are likely steeper than 45° because the features form because of extension in competent basaltic rocks. Smith and others (1989 #6352) reported that "the faults are exposed as steep scarps..." but did not specify dip angles. |
| **Paleoseismology studies** | |
| **Geomorphic expression** | In his compilation, Witkind (1975 #320) reports two late Quaternary faults in the eastern Snake River Plain: (1) the Idaho rift system (#55) described by Prinz (1970 #6336), and (2) an unnamed fault (his #66) at the northwestern edge of the Hells Half-acre lava field. Subsequent mapping of these features by Kuntz and others (1988 #439; 1994 #1277) show that the features in these two areas are not actually fault scarps, but are noneruptive fissures in the lava flows.<br><br>The only features that have characteristics of fault scarps are those that are located southeast of Arco, Idaho, where the Big Lost River flows onto the northern edge of the Snake River Plain. Smith and others (1989 #6352) described this area as the Arco rift zone. Within this rift zone, scarps are as much as 10 m high (Smith and others, 1989 #6352), form a broad, poorly organized graben about 2- to 4-km wide, and individual scarps commonly merge into monoclines along strike. Individual faults are short, less than 5 km long (Kuntz and others, 1992 #437). Because the vertical throw on these scarps is the result of tension induced by dike injection, slickensides are rarely found on the rock surfaces, indicating that the deformation is entirely dilatational (Kuntz and others, 1992 #437; Smith and others, 1996 #6338). |
| **Age of faulted surficial deposits** | Holocene |
| **Historic earthquake** | |
| **Most recent** | latest Quaternary (<15 ka) |

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| **prehistoric deformation** | *Comments:* The fault scarps are formed in latest Pleistocene and Holocene basaltic lava flows. |
| **Recurrence interval** | *Comments:* Movement on these faults is controlled by the emplacement of dikes in the underlying crust; therefore, it is inappropriate to apply the concept of a tectonically driven earthquake recurrence interval. Earthquake recurrence on these faults is dictated by the recurrence of volcanic cycles (Smith and others, 1996 #6338) rather than by the rate of tectonically driven strain accumulation on an individual fault. |
| **Slip-rate category** | Insufficient data<br><br>*Comments:* Movement on these faults is controlled by the emplacement of dikes in the underlying crust; therefore, it is inappropriate to apply the concept of a tectonically driven slip rate. Movement on these faults is controlled by the recurrence of volcanic cycles (Smith and others, 1996 #6338) rather than by the rate of tectonically driven strain accumulation on an individual fault. |
| **Date and Compiler(s)** | 2003<br>Anthony J. Crone, U.S. Geological Survey, Emeritus |
| **References** | #439 Kuntz, M.A., Champion, D.E., Lefebvre, R.H., and Covington, H.R., 1988, Geologic map of the Craters of the Moon, Kings Bowl, and Wapi lava fields, and the Great Rift volcanic rift zone, south-central Idaho: U.S. Geological Survey Miscellaneous Investigations Map I-1632, 1 sheet, scale 1:100,000.<br><br>#437 Kuntz, M.A., Covington, H.R., and Schorr, L.J., 1992, An overview of balsaltic volcanism of the eastern Snake River Plain, Idaho, *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. 227-267.<br><br>#1277 Kuntz, M.A., Skipp, B., Lanphere, M.A., Scott, W.E., Pierce, K.L., Dalrymple, G.B., Champion, D.E., Embree, G.F., Page, W.R., Morgan, L.A., Smith, R.P., Hackett, W.R., and Rodgers, D.W., 1994, Geologic map of the Idaho National Engineering Laboratory and adjoining areas, Idaho: U.S. Geological Survey Miscellaneous Investigations Map I-2330, 1 |

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| | sheet, scale 1:100,000.<br><br>#6336 Prinz, M., 1970, Idaho rift system, Snake River Plain, Idaho: Geological Society of America Bulletin, v. 81, p. 941-948.<br><br>#6352 Smith, R.P., Hackett, W.R., and Rodgers, D.W., 1989, Surface deformation along the Arco rift zone, eastern Snake River Plain, Idaho: Geological Society of America Abstracts with Programs, v. 21, no. 5, p. 146.<br><br>#6337 Smith, R.P., Jackson, S.M., and Hackett, W.R., 1994, Paleoseismology in extensional volcanic terrains: U.S. Geological Survey Open-File Report 94-568, p. 174-176.<br><br>#6338 Smith, R.P., Jackson, S.M., and Hackett, W.R., 1996, Paleoseismology and seismic hazard evaluations in extensional volcanic terrains: Journal of Geophysical Research, v. 101, no. B3, p. 6277-6292.<br><br>#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. |