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Quaternary Fault and Fold Database of the United States

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Calawah fault (Class A) No. 550

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citation for this record: **Lidke, D.J., compiler, 2004, Fault number 550, Calawah 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 03:05 PM.**

Synopsis	The Calawah fault is a northwest-striking fault that occurs in the northern part of the Olympic Peninsula, where it commonly is expressed as a wide shear zone in Tertiary rocks and has been reported to offset Pleistocene and Holocene glacial and fluvial deposits. Interpretation of seismic-reflection and bathymetric data, suggest it extends farther to the northwest, offshore of the Peninsula, where it appears to locally offset Quaternary seafloor sediments and the seafloor. Based on its consistent northwest strike, its expression as a wide shear zone, and some apparent offsets in this region, it commonly is inferred to be principally a left-lateral strike-slip fault. Although both onshore and offshore evidence of Holocene activity has been reported for this fault, geologic maps of this region of the Olympic Peninsula consistently show this fault as buried or concealed where it's trace is shown in Pleistocene or Holocene deposits. Based on the reports of onshore and offshore Holocene deformation along this fault, however, it is herein assigned a latest Quaternary (<15 ka) age category for time of most recent prehistoric faulting.

	Information that specifically constrains recurrence interval or slip rate for this fault has not been reported, and herein it is assigned an unknown recurrence interval and conservative and relatively low slip-rate category of less than 0.2 mm/yr until more detailed studies are conducted and reported.
Name comments	The Calawah fault is a northwest-striking fault in the northwestern Olympic Mountains that also appears to extend farther northwest offshore of the Olympic Peninsula. Gower (1960 #6577) first showed part of the fault on his 1:62,500-scale geologic map of the Pysht quadrangle; he showed the fault as a wide shear zone and referred to the fault as the "Calawah River fault zone." More recent, mostly smaller-scale maps of this region, however, show and refer to this fault as the "Calawah fault" (Tabor and Cady, 1978 #6221; Snavely and Kvenvolden, 1989 #6575; Snavely and others, 1993 #6576; Dragovich and others, 2002 #5715). The name "Calawah fault" appears to be the name now accepted for this fault and this name is also used herein. The Calawah fault extends northwestward, from about 6 km south of Lake Crescent to about 1.5 km north of Portage Head along the west coast of the Olympic Peninsula (*e.g.*, Snavely and others, 1993 #6576; Dragovich and others, 2002 #5715). Based on aeromagnetic, gravity, and seismic-reflection data, the Calawah fault appears to continue northwestward, offshore of the peninsula (e.g., MacLeod and others, 1977 #6531; Snavely, 1979 #6579; Wagner and others, 1986 #5670; Snavely and others, 1993 #6576; Dragovich and others, 2002 #5715). The Calawah fault is not shown on the 1:2,000,000-scale map of known and suspected Quaternary faults in the Pacific Northwest by Rogers and others (plate 1, 1996 #4191). However, their map does show an offshore and onshore, northwest-striking fault that intersects the coast near Point of the Arches, about 8 km south of the trace of the Calawah fault. On their map, they reference Crosson and Frank (1975 #5662) for information concerning this fault near Point of the Arches, but the paper by Crosson and Frank (1975 #5662) addresses possible surface expression of the July 18, 1973, earthquake beneath the western flank of Mount Rainier and does not discuss faults in the Olympic Peninsula. The fault near Point of the Arches is not further discussed or shown herein. **Fault ID: >**
County(s) and State(s)	CLALLAM COUNTY, WASHINGTON

Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Fault trace is from the 1:250,000-scale geologic map compilation by Dragovich and others (2002 #5715); the trace was transferred directly onto a registered mylar overlay and digitized at 1:250,000 scale.
Geologic setting	The Calawah fault strikes northwest and occurs along the northern flank of the Olympic Mountains about 15 km south-southwest of the Straight of Juan de Fuca. The Olympic Mountains are comprised of complexly deformed Eocene and younger Tertiary rocks. Rocks in the core of the Olympic Mountains are part of the Olympic subduction complex that formed during Paleogene subduction of the Juan de Fuca plate to the west (Tabor and Cady, 1978 #6221; 1978 #6222; Dragovich and others, 2002 #5715). In map view, rock units of the Olympic Mountains now show a map pattern that suggests they define a large, east plunging anticline that is superimposed on earlier formed thrust faults and folds related to subduction. The origin of this anticlinal form and pattern of the deformed rock units and thrust faults and folds is not fully understood, but it may have resulted from Neogene isostatic rebound and doming of the structurally thickened subduction complex (Tabor and Cady, 1978 #6222). Regardless of the origin of the apparently younger anticlinal form, the result is an east-plunging antiformal core of underplated, more highly deformed deep-marine siliciclastic rocks that are bordered by an open-to-the-west, horseshoe-shaped fringe of basalt and marginal marine rocks. The Calawah fault occurs in the in the core rocks near their fault contact with basaltic rocks of the horseshoe-shaped fringe that includes numerous horseshoe-shaped thrust faults. The thrust faulted, basaltic, peripheral rocks overlie the core rocks along a prominent horseshoe-shaped thrust fault called the Hurricane Ridge and (or) Crescent fault. The Hurricane Ridge-Crescent fault and the other horseshoe-shaped thrust faults strike northwestward and dip northward along the northern flank of the Olympic Mountains. The Calawah fault also strikes northwestward, subparallel to these thrust faults, but is inferred to be principally a left-lateral fault that locally offsets the Hurricane Ridge-Crescent fault. Based on aeromagnetic, gravity, and seismic-reflection data, the Calawah

	fault appears to continue northwestward offshore of the peninsula (*e.g.*, MacLeod and others, 1977 #6531; Snavely, 1979 #6579; Wagner and others, 1986 #5670; Snavely and others, 1993 #6576; Dragovich and others, 2002 #5715). The inferred offshore trace of the Calawah fault appears to coincide with the northwestern flank of a northwest-striking magnetic high, which is referred to as the Prometheus high (Snavely and others, 1976 #6535; MacLeod and others, 1977 #6531). Although most of the faults and folds in the Olympic Mountains appear to be principally, or entirely Tertiary features, offshore seismic reflection data and some observations inland suggest Quaternary tectonic activity along the Calawah fault.
Length (km)	82 km.
Average strike	N64°W
Sense of movement	Left lateral, Thrust *Comments:* Sense of movement along the Calawah fault is not well constrained. Gower (1960 #6577) first mapped part of this fault in the Psyht quadrangle and he reported that this fault strikes consistently about N. 70° W. and is expressed by a wide shear zone that is as much as 600 m wide in Psyht quadrangle. He noted that the wide shear zone and consistent strike of this fault might indicate that it is principally a strike-slip fault and that, if so, relations in nearby areas indicate left-lateral movement. MacLeod and others (1977 #6531) also inferred left-lateral slip along the Calawah fault and reported that the fault separated Tertiary rocks of similar age but of different provenance. Smaller-scale geologic maps of this region also ornament this fault with symbology that implies the Calawah fault is a left-lateral, strike-slip fault (Tabor and Cady, 1978 #6221; Snavely and Kvenvolden, 1989 #6575; Snavely and others, 1993 #6576; Dragovich and others, 2002 #5715). The Calawah fault is not ornamented on the 1:125,000-scale geologic map by Tabor and Cady (1978 #6221); however, on sketch maps they show the fault as a north-dipping thrust fault (Tabor and Cady, 1978 #6221; Tabor and Cady, 1978 #6222); Stewart and Brandon (2004 #7626) also refer to the Calawah as a thrust fault. On a preliminary map of seafloor geology and structures of the continental shelf and upper continental slope of Washington, Wagner and others (plate 5, 1986 #5670) show a northwest-striking, offshore fault with some lense-forming fault strands; these faults appear to define the offshore continuation of the Calawah fault. Based principally on their interpretation of

	seismic-reflection data they ornament this offshore fault and splays with symbology that appear to indicate both normal and reverse offsets along these offshore faults. However, strike-slip offsets commonly are not apparent in seismic-reflection data.
Dip Direction	NE; SW *Comments:* Specific dip measurements of the Calawah fault have not been reported. Inferred left-lateral, strike-slip offset along the fault, which might imply that the fault is vertical to steeply dipping. On some tectonic sketch maps (Tabor and Cady, 1978 #6221; 1978 #6222) the Calawah fault is shown as a north-dipping thrust fault, which would imply that the fault dips gently to moderately to the north. Based on interpretation of seismic-reflection data, Wagner and others (plate 5, 1986 #5670) show a northwest-striking fault and fault strands that appear to be an offshore continuation of the Calawah fault; they ornament these faults with symbology that implies mostly moderate to steep northeast and southwest dips along these faults. Locally, however, they show a few symbols along parts of these faults that indicate low-angle dips.
Paleoseismology studies	
Geomorphic expression	Snavely (1979 #6579) reported that the inferred offshore continuation of the Calawah fault offsets seafloor sediments and locally has bathymetric expression. Waqner and others (plate 5, 1986 #5670) similarly show on their preliminary, offshore, geologic and structure map that seismic-reflection and bathymetric data indicate some seafloor offsets along the apparent offshore continuation of the Calawah fault northwest of the Olympic Peninsula. MacLeod and others (1977 #6531) and Snavely (1979 #6579) report offset Quaternary sediments along the Calawah fault in onshore localities of the Olympic Peninsula, but do not discuss possible geomorphic expression of the fault in these sediments or in bedrock.
Age of faulted surficial deposits	MacLeod and others (1977 #6531) reported that upper (?) Pleistocene outwash and till are intensely deformed where the Calawah fault crosses Beaver Creek near Sappho, Washington. Waqner and others (plate 5, 1986 #5670) indicate that seismic reflectors, which they correlated with Holocene and Pleistocene units, are offset along parts of some faults that appear to mark the

	offshore continuation of the Calawah fault. Their map also shows some localities where parts of these faults appear to offset the seafloor, based on interpretation of seismic-reflection and bathymetric data. Snavely (1979 #6579) reported that the inferred offshore continuation of the Calawah fault offsets seafloor sediments and locally has bathymetric expression. He further reported that onshore, in the Cape Flattery area, the fault cuts Holocene stream terrace deposits and upper Pleistocene drift. However, he did not note a specific locality, or localities, where these relations were observed and Cape Flattery is located about 11 km north-northwest of the nearest part of the inferred, onshore trace of the Calawah fault. Snavely and Wells (1991 #6583), Snavely and others (1993 #6585), and Snavely (1996 #4290) also reported deformation of Quaternary sediments along unspecified faults in two localities in the western part of the Olympic Peninsula, one of these localities being north of Lake Ozette. For more information on their other locality of Quaternary deformation in the western Olympic Peninsula, they cite Snavely (1983 #6582). We were unable to find any discussion of that other site in Snavely (1983 #6582) and it is not clear if the two sites mentioned in Snavely and Wells (1991 #6583), Snavely and others (1993 #6585), and Snavely (1996 #4290) might be located along the Calawah fault. However, Lake Ozette is located relatively near the inferred trace of the Calawah fault, about 6-7 km to the south. Conversely, on the 1:48,000-scale geologic map of this region, Snavely and others (1993 #6576) show the trace of the Calawah fault as dotted everywhere it is mapped in Holocene or Pleistocene sediments, implying that these sediments bury or otherwise obscure the fault. Other geologic maps of this region similarly show the Calawah fault as dotted (buried or obscured) where it's trace is shown in Holocene or Pleistocene sediments (Gower, 1960 #6577; Tabor and Cady, 1978 #6221; Snavely and Kvenvolden, 1989 #6575; Dragovich and others, 2002 #5715; Schasse, 2003 #7624, 2003 #7625).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Wagner and others (plate 5, 1986 #5670) and Snavely (1979 #6579) show and report seismic-reflection and bathymetric data, which suggest the inferred offshore continuation of the Calawah fault offsets Pleistocene and Holocene sediments and the surface of the seafloor. MacLeod and others (1977 #6531) report

	that upper (?) Pleistocene outwash and till are deformed along the Calawah fault where it crosses Beaver Creek north of Sappho, Washington. Snavely (1979 #6579) reported that Holocene terrace deposits and upper Pleistocene drift are cut by the Calawah fault at an unspecified locality in the Cape Flattery area. Based on these reports, the Calawah fault is assigned herein a latest Quaternary (<15 ka) age category for time of most recent prehistoric faulting.
Recurrence interval	*Comments:* At this time, there is no data on prehistoric surface-rupturing earthquakes or recurrence interval for the Calawah fault.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Existing data and interpretations do not specifically address or constrain slip-rate(s) of the Calawah fault. Based mostly on this lack of information, a conservative less than 0.2 mm/yr slip-rate category is assigned herein for possible Quaternary slip along this zone. Data and interpretations presented by Wagner and others (plate 5, 1986 #5670) and Snavely (1979 #6579), which suggest Holocene movement and offset of the seafloor surface along the inferred offshore continuation of this fault, might also imply a slip rate that exceeds the amount assigned.
Date and Compiler(s)	2004 David J. Lidke, U.S. Geological Survey
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