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Quaternary Fault and Fold Database of the United States

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Grogan fault (Class A) No. 11

Last Review Date: 1999-05-11

Compiled in cooperation with the California Geological Survey

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Synopsis	The Grogan fault is shown by Jennings (1994 #2878) as a relatively linear, right-lateral Quaternary fault that extends at least 100 km NNW from the Humboldt-Trinity County boundary almost to the Pacific Ocean. His work is based on data from Kelsey and Carver (1988 #4094), Carver (1989, unpublished), and Wagner and Saucedo (1987 #4893). Jennings (1994 #2878) also shows the fault to extend discontinuously an additional 30 km offshore as a northeast-dipping Quaternary thrust fault, based on Clarke and Field (1989 #4137), Clarke (1992 #4092), and Kelsey and Carver (1988 #4094). However, the Grogan fault is poorly exposed and most parts have been mapped only in reconnaissance fashion. Moreover, there are conflicting data on the fault. In the Blue Lake quadrangle, the fault was mapped (and

	named) by Manning and Ogle (1950 #4903) as a northeast-dipping reverse fault that offsets Franciscan sedimentary rock over Kerr Ranch Schist. Irwin (1960 #4900) shows this same segment to be a relatively linear fault. Farther south, in the Willow Creek quadrangle, the fault is not mapped (Young, 1978 #4906) and the schist/Franciscan contact is shown to dip to the west. Still farther south the fault was mapped as a somewhat linear feature within the Franciscan Complex by Aalto and others (1988 #4898). Cashman and others (1995 #4899) show the central 45-50 km part of the fault as a linear transition zone as much as 1 km wide that is locally offset by a cross fault. To the north, Aalto and others (1981 #4897) map the fault as a fairly straight feature juxtaposing contrasting rocks units of the Franciscan Complex and locally show it to offset Pliocene-Pleistocene sedimentary rocks with the west side down. Based on limited mapping of small-scale structures in the Pliocene-Pleistocene sedimentary rocks adjacent to the fault, Kelsey and Cashman (1983 #4093) inferred that the Grogan fault is a right-lateral, high angle fault with a reverse component. Kelsey and Carver (1988 #4094) state that the Grogan fault appears to be a reactivated Mesozoic feature with "upward of 75 km of right slip in the Tertiary" (Kelsey and Hagans, 1982 #4902). However, they point out that the one locality where the Grogan fault is exposed in Pliocene-Pleistocene sands near its northern end (near Orick), the fault has a strike of N28? W and dip of 54? NE. According to Cashman and others (1995 #4899), cumulative vertical offset of the Prairie Creek Formation by the Grogan and nearby parallel Lost Man fault [147] is 300 m. Farther south, the fault is not overlain by young sedimentary rocks that would indicate its activity or sense of displacement. Although the Grogan fault is generally expressed by fault line features, none of the workers indicate geomorphic evidence suggestive of significant late Quaternary offset (e.g., Smith, 1981 #4904; Kelsey and Hagans, 1982 #4902; Kelsey and Carver, 1988 #4094; Cashman and others, 1995 #4899). Clarke (1992 #4092) shows the Grogan fault to extend northwest about 50 km into the offshore as a zone of northeast-dipping thrust and reverse faults, based on seismic reflection profiling. His figure 9 shows about 0.5 sec of vertical offset at the contact between upper Cenozoic sedimentary strata and Franciscan basement. According to McCrory (based on S. Clarke, 1996 written commun., 1996 #1217) offset is about 1,250 m.
Name	Manning and Ogle (1950 #4903) first mapped and named the

comments	Grogan fault in the Blue Lake 15-minute quadrangle where they mapped it as an east-dipping reverse fault. **Fault ID:** Refers to numbers 32 (Grogan fault) and 14 (offshore Grogan fault) of Jennings (1994 #2878).
County(s) and State(s)	HUMBOLDT COUNTY, CALIFORNIA TRINITY COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Poor Compiled at 1:750,000 scale. *Comments:* Locations based on digital revisions to Jennings (1994 #2878) using original mapping by Clarke and Field (1989 #4137) (offshore), Wagner and Saucedo (1987 #4893) at 1:250,000 scale, and Kelsey and Carver (1988 #4094) at approximately 1:815,000.
Geologic setting	The Grogan fault is a major tectonic feature that juxtaposes contrasting rock units of the Franciscan Complex over a distance of at least 90 km (Irwin, 1960 #4900; Jennings, 1977 #4901; Aalto and others, 1988 #4898; Wagner and Saucedo, 1987 #4893). Based on its general linearity and an offset schist unit, Kelsey and Hagans (1982 #4902) infer about 75 km of dextral offset during the Tertiary. On-land, the northern end of the fault offsets rocks of the Prairie Creek Formation of Pliocene-Pleistocene age, indicating Quaternary activity (Kelsey and Carver, 1988 #4094). Here, the fault is considered to be dominantly a high-angle dextral fault with a reverse (down-to-the-west) component. The fault may extend to the NNW another 50 km offshore, where it is mapped as a zone of northeast-dipping thrust and reverse faults that offset upper Cenozoic sedimentary strata of the eastern margin of the Eel River basin (Clarke, 1992 #4092). Although there is no direct evidence of the recency of faulting south of Orick, Jennings (1994 #2878) classified the fault as "Quaternary active" as far south-southeast to the Trinity County boundary and to extend farther to the south-southeast as the pre-Quaternary Grogan-Red Mountain fault.
Length (km)	154 km.
Average strike	N23°W
Sense of	Right lateral

movement	*Comments:* Kelsey and Carver (1988 #4094) suggest dominant dextral slip with a reverse component; Clarke (fig. 9., 1992 #4092) interprets dominant reverse or thrust movement offshore.
Dip	65°-90° E, W *Comments:* Reported for onshore dips are 65?-90? to the E and W (Kelsey and Hagans, 1982 #4902; Cashman and others, 1995 #4899) and 25-90? NE for offshore (Clarke, 1992 #4092).
Paleoseismology studies	
Geomorphic expression	Not well expressed near its northern end, except in a clearcut (deforested) area near Orick, based on 1:90,000-scale air photos (Smith, 1981 #4904). Does not systematically offset drainages. Generally follows Redwood Creek over most of its length, where it has cut an imposing linear canyon (Cashman and others, 1995 #4899).
Age of faulted surficial deposits	Pliocene-Pleistocene sedimentary rocks are offset (Aalto and others, 1981 #4897); these are the same as Prairie Creek Formation of Kelsey and Carver (1988 #4094).
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* Jennings (1994 #2878), McCrory (1996 #1217).
Recurrence interval	
Slip-rate category	Between 0.2 and 1.0 mm/yr *Comments:* Part of fault may lack Quaternary activity.
Date and Compiler(s)	1999 Earl W. Hart, California Geological Survey
References	#4897 Aalto, K.R., Cashman, P.H., Cashman, S.M., and Kelsey, H.M., 1981, Geology of the Coast Ranges, Del Norte and northern Humboldt Counties, California: Unpublished report and maps for California Division of Mines and Geology Data Base

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#4094 Kelsey, H.M., and Carver, G.A., 1988, Late Neogene and Quaternary tectonics associated with northward growth of the San Andreas transform fault, northern California: Journal of Geophysical Research, v. 93, no. B5, p. 4797–4819.

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#1217 McCrory, P.A., 1996, Evaluation of fault hazards, northern coastal California: U.S. Geological Survey Open-File Report 96-656, 87 p., 2 pls.

#4860 Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., Frankel, A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P., 1996, Probabilistic seismic hazard assessment for the State of California: California Department of Conservation, Division of Mines and Geology Open-File Report 96-08 (also U.S. Geological Open-File Report 96-706), 33 p.

#4904 Smith, T.C., 1981, Big Lagoon, Bald Mountain, Grogan, Lost Man, Surpur Creek and related faults, northern Humboldt and southern Del Norte Counties, California: California Division of Mines and Geology Fault Evaluation Report FER-139, 15 p.

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