Jump to Navigation

Quaternary Fault and Fold Database of the United States

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Ka'oiki seismic zone (Class A) No. 2606

Last Review Date: 2006-09-16

citation for this record: **Cannon, E.C., and Burgmann, R., compilers, 2006, Fault number 2606, Ka'oiki seismic zone, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 01/04/2021 10:24 AM.**

Synopsis	The Ka'oiki seismic zone is below the southeastern flank of Mauna Loa Volcano and is one of the most active seismic zones in Hawai'i (Okubo, 1995 #6967). The 1974, 1983, and possibly the 1962 Ka'oiki earthquakes are responsible for surface fault ruptures, a series of en echelon left-stepping fractures (Endo, 1985 #6941; Jackson and others, 1992 #6946; Wolfe and Morris, 1996 #6977).
Name comments	The Ka'oiki seismic zone is located on sheet 3 of 3 of the 1:100,000-scale geologic map compiled by Wolfe and Morris (1996 #6977).
County(s) and State(s)	HAWAII COUNTY, HAWAII
Physiographic province(s)	HAWAIIAN-EMPEROR ISLAND-SEAMOUNT CHAIN

Reliability of location	Good Compiled at 1:100,000 scale. *Comments:* Based on the 1:100,000-scale geologic map compiled by Wolfe and Morris (1996 #6977) utilizing fault mapping from Jackson and others (1992 #6946).
Geologic setting	The Ka'oiki seismic zone has a complex faulting history due to the nearby active Mauna Loa and Kilauea Volcanoes (see Jackson and others, 1992 #6946). Earthquakes indicate low-angle thrust faulting events, probably related to seaward displacement of the Mauna Loa volcanic edifice, especially prior to Kilauea's development (Lipman, 1980 #6950). Additionally, the similar focal mechanisms for the 1962, 1974, and 1983 Ka'oiki earthquakes are interpreted to represent right-lateral strike-slip motion on northeast-trending faults (Endo, 1985 #6941; Jackson and others, 1992 #6946). To the southwest in the adjacent Ka'oiki-Honu'apo fault system [2607], the deep canyons of the Ninole Hills on the southeast flank of Mauna Loa are thought to represent rapid incision into headwall landslide scarps related to the movement offshore of the Punalu'u slump (Lipman and others, 1990 #6954; Moore and Chadwick, 1995 #6959).
Length (km)	9 km.
Average strike	N. 61° E.
Sense of movement	Right lateral *Comments:* Endo (1985 #6941) and Jackson and others (1992 #6946) interpret focal mechanism solutions from the 1962, 1974, and 1983 Ka'oiki earthquakes and ground fractures from the 1974, 1983, and possibly the 1962 Ka'oiki earthquakes to conclude that right-lateral strike-slip movement occurred on faults in the Ka'oiki seismic zone.
Dip	Vertical to 60° SE. *Comments:* Focal mechanism solutions by Endo (1985 #6941) and Jackson and others (1992 #6946) from the 1962, 1974, and 1983 Ka'oiki earthquakes and ground fractures from the 1974, 1983, and possibly the 1962 Ka'oiki earthquakes suggest that right-lateral strike-slip fault planes are vertical to subvertical. The attitude of the nodal plane interpreted as the fault plane for the

	1974 Ka'oiki earthquake is N. 59? E., 60? SE. (Jackson and others, 1992 #6946).
Paleoseismology studies	
Geomorphic expression	The surface fractures are located in basalt lava flows located on the southeast flank of Mauna Loa Volcano.
Age of faulted surficial deposits	Surface lava flows as young as the 1880-1881 lava flow and as old as 5,000 to 10,000 yr B.P. are cut by fractures (Wolfe and Morris, 1996 #6977).
Historic earthquake	Ka'oiki earthquake M6.7 1983 Ka'oiki earthquake ML6.6 1974 Ka'oiki earthquake 1962 Ka'u earthquake 1868
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Jackson and others (1992 #6946) interpret ground fractures in the Ka'oiki seismic zone area as having been formed by the November 16, 1983, ML6.6 Ka'oiki, November 30, 1974, ML5.5 Ka'oiki, and possibly by the June 27, 1962, Ms6.1 Ka'oiki earthquakes (Wyss and Koyanagi, 1992 #6981). Jackson and others (1992 #6946) do not report ages of prehistoric faulting events.
Recurrence interval	
Slip-rate category	Greater than 5.0 mm/yr *Comments:* Jackson and others (1992 #6946) do not estimate a slip rate. Delaney and others (1998 #6939) summarize the contraction and extension that occurred along the northwest-trending baseline Strip-Uwekahuna detected in trilateration data collected between November 1975 and 1995. Between the magma reservoir inflation events of September 1977 and August 1981, the baseline contracted approximately 3 cm/yr. For the time period beginning with the November 1983 Ka'oiki earthquake through 1995, the baseline extended 2.4?0.3 cm/yr. However, the Strip-Uwekahuna baseline may exhibit deformation from the Ka'oiki-Honu'apo fault system [2607] and Kilauea Volcano [2608]. Miklius and others (1995 #6957) determine from Global Positioning System (GPS) surveys of Mauna Loa's southeastern

	flank in 1993 and 1994-1995 that the Ka'oiki seismic zone had 1 microstrain/yr contraction and left-lateral shear. Based on active seismicity and flank deformation observed from geodetic surveys, the slip rate is assigned to be greater than 5 mm/yr.
Date and Compiler(s)	2006 Eric C. Cannon, none Roland Burgmann, University of California at Berkeley
References	#6939 Delaney, P.T., Denlinger, R.P., Lisowski, M., Miklius, A., Okubo, P.G., Okamura, A.T., and Sako, M.K., 1998, Volcanic spreading at Kilauea, 1976-1996: Journal of Geophysical Research, v. 103, no. B8, p. 18,003-18,023. #6941 Endo, E.T., 1985, Seismotectonic framework for the southeast flank of Mauna Loa volcano, Hawaii: Seattle, University of Washington, unpublished Ph.D. dissertation, 349 p. #6946 Jackson, M.D., Endo, E.T., Delaney, P.T., Arnadottir, T., and Rubin, A.M., 1992, Ground ruptures of the 1974 and 1983 Kaoiki earthquakes, Mauna Loa Volcano, Hawaii: Journal of Geophysical Research, v. 97, no. B6, p. 8775-8796. #6950 Lipman, P.W., 1980, The southwest rift zone of Mauna Loa: Implications for structural evolution of Hawaiian volcanoes: American Journal of Science, v. 280-A, p. 752-776. #6954 Lipman, P.W., Rhodes, J.M., and Dalrymple, G.B., 1990, The Ninole Basalt-Implications for the structural evolution of Mauna Loa Volcano, Hawaii: Bulletin of Volcanology, v. 53, no. 1, p. 1-19. #6957 Miklius, A., Lisowski, M., Delaney, P.T., Denlinger, R.P., Dvorak, J.J., Okamura, R.T., and Sako, M.K., 1995, Recent inflation and flank movement of Mauna Loa Volcano, *in* Rhodes, J.M., and Lockwood, J.P., eds., Mauna Loa revealed. Structure, composition, history, and hazards: American Geophysical Union Geophysical Monograph, v. 92, p. 199-205. #6959 Moore, J.G., and Chadwick, W.W., Jr., 1995, Offshore geology of Mauna Loa and adjacent areas, Hawaii in Rhodes, J.M., and Lockwood, J.P., eds., Mauna Loa revealed-Structure, composition, history, and hazards: American Geophysical Union Geophysical Monograph, v. 92, p. 21-44.

	#6967 Okubo, P.G., 1995, A seismological framework for Mauna Loa Volcano, Hawaii, *in* Rhodes, J.M., and Lockwood, J.P., eds., Mauna Loa revealed. Structure, composition, history, and hazards: American Geophysical Union Geophysical Monograph, v. 92, p. 187-197. #6976 Trusdell, F.A., Wolfe, E.W., and Morris, J., 2006, Digital database of the geologic map of the island of Hawai'i: U.S. Geological Survey Data Series 144 supplement to Miscellaneous Investigations Series Map I-2524-A, 18 p, 1 sheet, scale 1:100,000. #6977 Wolfe, E.W., and Morris, J., 1996, Geologic map of the island of Hawaii: U.S. Geological Survey Miscellaneous Investigations Series Map I-2524-A, 18 p., 3 sheets, scale 1:100,000. #6981 Wyss, M., and Koyanagi, R.Y., 1992, Isoseismal maps, macroseismic epicenters, and estimated magnitudes of historic earthquakes in the Hawaiian Islands: U.S. Geological Survey Bulletin 2006, 93 p.