Hawaiian Volcano Observatory
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Introductory Note By Thomas L. Wright and Jennifer S. Nakata

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Summary 49
January, February, and March 1968
By Arnold T. Okamura, Robert Y. Koyanagi, and Willie T. Kinoshita

Summary 50
April, May, and June 1968
By Robert Y. Koyanagi, Arnold T. Okamura, and Willie T. Kinoshita

Summary 51
July, August, and September 1968
By Robert Y. Koyanagi, Howard A. Powers, and Willie T. Kinoshita

Summary 52
October, November, and December 1968
By Robert Y. Koyanagi, Howard A. Powers, and Elliot T. Endo

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INTRODUCTORY NOTE

The Hawaiian Volcano Observatory Summaries have been published in the current format since 1956. The Quarterly Summaries (1956 through 1973) and the Annual Summaries (1974 through 1985) were originally published as Administrative Reports. These reports have been compiled and published as U.S. Geological Survey Open-File Reports. The quarterly reports have been combined and published as one annual summary. All the summaries from 1956 to the present are now available as .pdf files at http://www.usgs.gov/pubprod.

The earthquake summary data are presented as a listing of origin time, depth, magnitude, and other location parameters. Network instrumentation, field station sites, and location algorithms are described. Tilt and other deformation data are included until Summary 77, January to December 1977. From 1978, the seismic and deformation data are published separately, due to differing schedules of data reduction.

There are eight quarters—from the fourth quarter of 1959 to the third quarter of 1961—that were never published. Two of these (4th quarter 1959, 1st quarter 1960) have now been published, using handwritten notes of Jerry Eaton (HVO seismologist at the time) and his colleagues. The seismic records for the remaining six summaries went back to California in 1961 with Jerry Eaton. Other responsibilities intervened, and the seismic summaries were never prepared.

Chronology

The following Kīlauea eruption chronology covers the two recent reports and the six missing quarters:

Location	Beginning Date	Ending Date	Comment
Kīlauea Iki crater (Kīlauea's summit)	11/14/1959	12/20/1959	19 eruptive episodes
Kapoho (lower east rift zone)	1/13/1960	2/18/1960	4 eruption stages
Halemaumau (Kīlauea's summit)	2/24/1961	2/24/1961	Intermittent activity during uninterrupted inflation following the 1960 eruption
Halemaumau (Kīlauea's summit)	3/22/1961	3/25/1961	Same as above.
Halemaumau (Kīlauea's summit)	7/10/1961	7/17/1961	Same as above.
Heiheiahulu (middle east rift zone)	9/22/1961	9/25/1961	First historical east rift eruption at this location

The 1959-1960 eruptions were among two of the most spectacular Kīlauea eruptions. The HVO staff was kept busy with acquisition of unusually high quantities of instrumental data and observations of the two sequences, which were separated by less than one month. Even with a year's interval before the beginning of the summit-east rift sequence in 1961, the staff never caught up, and the seismic records were set aside for later study.

A total of 1,672 earthquakes—1,106 for 1960 and 566 for 1961—are part of HVO's cataloged database. The annual listings have been appended to the 1st Quarter Report of 1960 and to the 4th Quarter Report for 1961. The number of earthquakes is probably low, biased toward the larger magnitudes. The entire HVO catalog, including 1960 and 1961, is accessible from the ANSS CATALOG SEARCH site at http://www.ncedc.org/anss/catalog-search.

Thomas L. Wright and Jennifer S. Nakata

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY

SUMMARY 49

January, February, and March 1968

By Arnold T. Okamura, Robert Y. Koyanagi

and Willie T. Kinoshita

Issued July 1969

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Tilting of the ground around Kilauea Caldera

Tilting of the ground around the summit of Kilauea is monitored daily by a short-base water-tube tiltmeter at Uwekahuna (table 1), and at irregular intervals it is measured on a regional scale by means of a network of field tilt-bases and a portable water-tube tiltmeter. The attitude of the ground surface at each tilt-base is reported in terms of north-south and east-west tilt coordinates. Both coordinates at each station were arbitrarily set equal to 500 when measurements at that station were begun. Increasing tilt coordinates correspond to northward and eastward tilting of the earth's surface; that is, to a relative subsidence toward the north and east. A one-unit change in coordinate corresponds to a tilting of 1 microradian (1 mm per km) in the direction indicated.

Location of and essential data on each tiltmeter station are listed in table 6, which is published only in the first quarter issue each year.

Table 1.--Tilt coordinates at Uwekahuna

January, February, and March 1968

Date (1968)	N-S	E-W	Date (1968)	N-S	E-W
Jan. 7	557	404	Feb. 18	554	402
14	557	403	25	556	404
21	556	403	Mar. 3	555	404
28	556	402	10	556	404
Feb. 4	556	401	17	556	402
11	555	402	24	556	400
			31	556	400

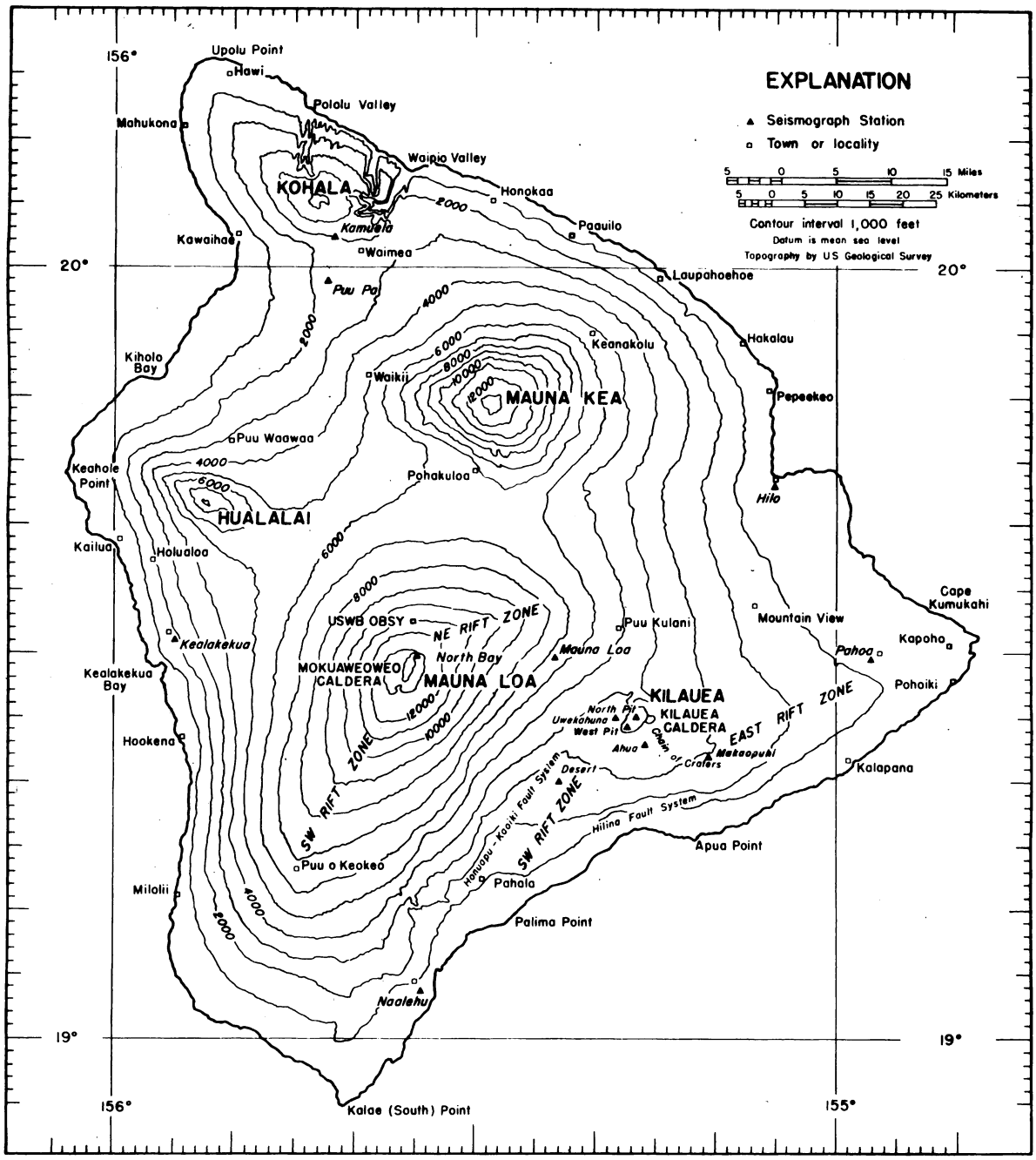

Figure 1.--Map of the Island of Hawaii showing seismograph stations operated by the U.S. Geological Survey, principal settlements, and selected geologic features. Epicenters of local earthquakes are given in table 4 in terms of geographic coordinates, which are indicated at the edges of the map.

1st Quarter, 1968

Table 2.--Tilt coordinates and changes at bases around Kilauea Caldera

(see fig. 2 and table 6)

Tilt base (location)	Date (1968)	Tilt coordinates		Rate (10^{-6} rad/mo) and direction of tilting since last reading		Date of last reading (1968)
		N-S	E-W			
Uwekahuna (U on fig. 2)	Feb. 13	598.1	395.7	2.8	N. 88.0° W.	Nov. 9
Tree Molds (TM)	21	481.1	500.2	2.1	N. 31.5° W.	8
Sand Spit (SS)	14	894.3	682.0	6.0	S. 89.2° W.	8
Keamoku (Kea)	14	546.4	372.0	4.3	S. 20.6° E.	8
Ahua Kamokukolau (Kam)	14	400.1	550.8	2.1	S. 67.4° W.	8
Kipuka Nene (KN)	14	299.7	308.5	0.02	N. 31.3° E.	7
Hilina Pali (HP)	14	455.1	502.6	0.17	S. 48.3° W.	June 28
Kapapala Ranch (Kap)	13	497.6	510.6	0.31	N. 56.5° E.	Nov. 8
Mehena (M)	21	574.8	578.8	1.1	N. 0.6° E.	8

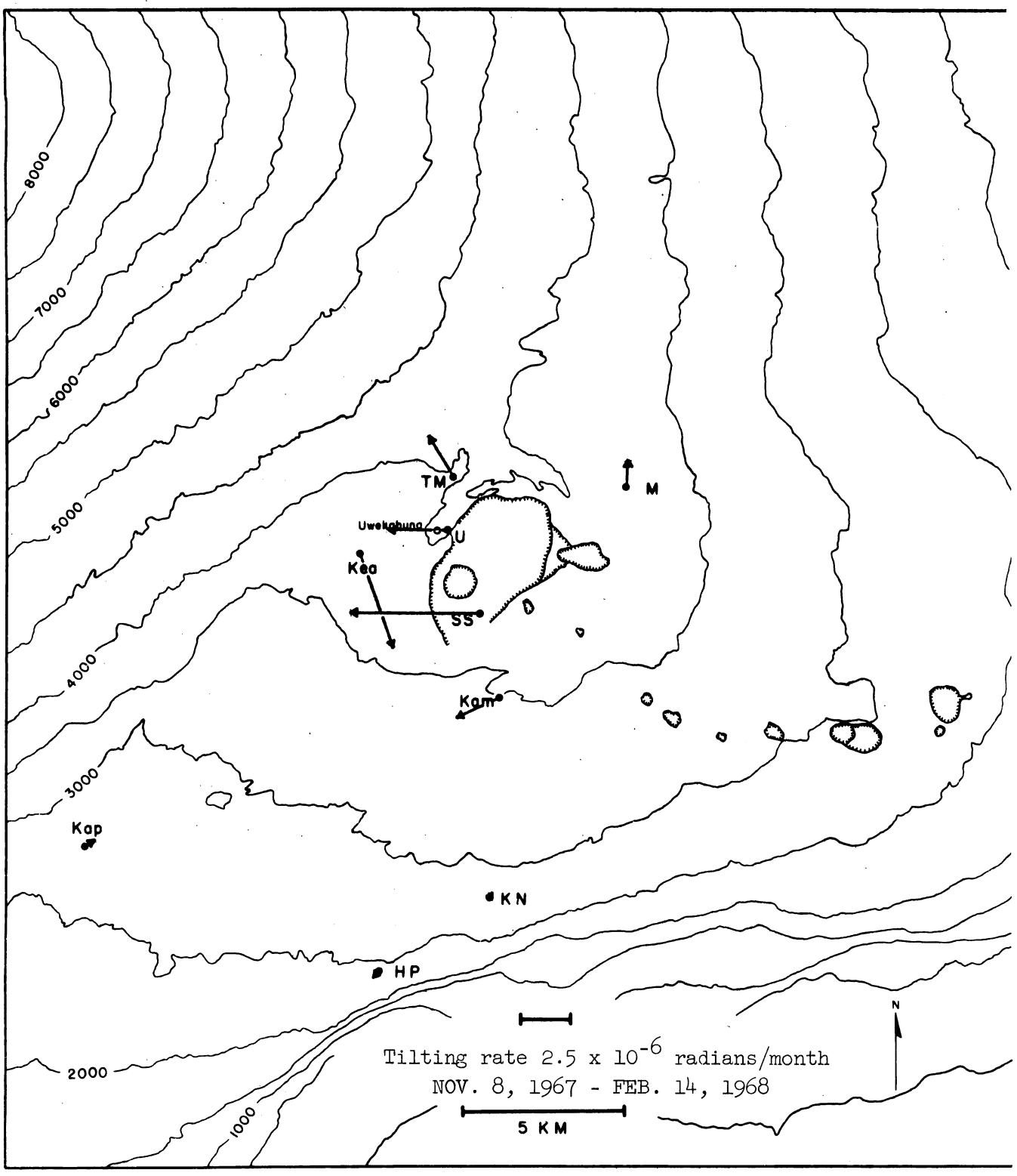

Figure 2.--Tilting of the ground around Kilauea Caldera between November 8, 1967, and February 14, 1968. The vector depicting tilting at a given tilt base points in the direction of maximum relative subsidence and has a length proportional to the rate of tilting during the measurement interval. Closed circles represent field tilt bases; open circle, short-base water-tube tiltmeter. See table 2 for explanation of abbreviations.

Seismic summary

Events recorded by the U.S. Geological Survey seismograph network in Hawaii fall into two categories: Local earthquakes and tremor originating in the region of the Hawaiian Islands (usually within 100 km of at least one seismograph), and distant earthquakes originating more than 3,000 km from Hawaii. As in index of seismic activity at Hawaiian volcanoes, daily counts of earthquakes and minutes of tremor recorded by seismographs in Hawaii are listed in table 3. The earthquakes are separated in groups on the basis of region of origin as determined by analysis of records obtained daily at the Observatory (U, M, M(2), A, D, N, WP, MP, K, O). Earthquakes of magnitude 2.0 or greater are generally sufficiently well recorded to be located with greater precision; they are listed individually in table 4.

Location of and essential data on each seismograph station are listed in table 5, which is published only in the first quarter issue each year.

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera

Tremor is separated into three categories: deep, intermediate, and shallow, on the basis of relative amplitudes on seismographs in the summit region. Unless otherwise stated, tremor is presumed to be associated with movement of magma within the central complex of Kilauea.

Earthquake categories are: Kilauea summit, 30 km earthquakes from a source about 30 km beneath the Kilauea summit region; long-period, earthquakes characterized by low-frequency waves that originate about 5 km beneath Kilauea summit; and shallow earthquakes in the Kilauea Caldera region; shallow earthquakes along the SW. rift zone of Kilauea and the adjacent portion of the Kaoiki fault system; earthquakes along the eastern half of Kilauea's east rift zone--detected largely on the Pahoa seismograph; earthquakes from the upper east rift zone and the adjacent fault systems of Kilauea's south flank; and earthquakes from other regions: west Hawaii, Mauna Kea, etc.

Date (1968)	Tremor (minutes)			Earthquakes							
				Kilauea summit			SW. rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Others
	Deep	Inter-mediate	Shallow	30 km	Long period	Shallow					
Jan. 1	----	-------	-------	4	------	115	14	------	15	----	1 west Hawaii
2	18m	-------	-------	13	------	150	8	1	10	1	1 Kawaihae
3	14m	-------	-------	1	------	210	9	------	12	----	----------
4	30m	-------	-------	-----	------	105	16	1	76	----	----------
5	15m	-------	-------	-----	------	45	14	------	38	----	----------
6	10m	-------	5h	-----	------	75	21	1	48	----	----------
7	----	-------	12h	1	------	-------	13	1	315	16	----------
8	----	-------	-------	-----	------	180	15	------	142	3	1 southwest Hawaii
9	----	-------	6h	2	------	60	44	------	173	13	----------
10	----	-------	-------	2	------	140	31	------	27	----	1 Waikii
11	----	-------	6h	-----	------	135	29	------	26	13	1 Kawaihae
12	----	-------	16h	3	------	30	21	------	11	4	----------
13	----	-------	24h	4	------	------	23	------	10	2	1 Waipio Valley; 1 west Hawaii

Jan. 14	----	--------	24h	-----	------	-------	17	-------	17	4	----------
15	----	--------	24h	2	------	-------	11	-------	16	----	----------
16	----	--------	24h	1	------	-------	18	-------	16	----	----------
17	----	--------	24h	-----	------	-------	11	-------	7	----	----------
18	----	--------	-------	-----	------	195	10	-------	14	3	----------
19	----	--------	24h	1	------	20	20	-------	29	----	1 offshore west Hawaii
20	----	--------	24h	-----	------	-------	26	-------	22	6	----------
21	----	--------	24h	1	------	-------	13	-------	-----	----	----------
22	----	--------	24h	1	------	-------	8	-------	33	----	----------
23	----	--------	24h	-----	------	-------	12	-------	21	----	1 Kawaihae
24	----	--------	24h	1	------	-------	8	-------	38	----	----------
25	----	--------	20h	2	------	-------	12	1	29	----	----------
26	----	--------	24h	4	------	2	7	-------	13	1	----------
27	----	--------	24h	5	?	?	5	2	5	?	----------
28	----	--------	18h	5	------	30	8	1	24	----	2 west Hawaii
29	----	--------	22h	4	------	-------	8	-------	10	1	----------
30	----	--------	24h	-----	------	-------	6	-------	28	2	1 Naalehu
31	----	--------	24h	2	------	75	13	-------	34	5	----------
Feb. 1	----	--------	24h	2	------	30	16	-------	38	----	1 Keanakolu; 1 Waikii
2	----	--------	24h	2	------	90	6	-------	16	----	----------
3	----	--------	24h	2	------	------	10	-------	23	----	----------
4	----	--------	24h	2	------	28	13	-------	27	5	----------
5	----	--------	24h	5	------	75	11	-------	14	3	----------
6	----	--------	24h	1	------	------	14	-------	17	----	1 Keanakolu
7	----	7m	24h	5	------	30	18	-------	16	2	1 Waikii; 2 west Hawaii; 1 Naalehu
8	----	--------	24h	3	------	29	9	-------	39	----	1 west Hawaii; 2 Keanakolu
9	----	--------	24h	1	------	41	9	-------	15	----	1 Puu WaaWaa
10	----	--------	24h	2	------	41	14	-------	21	----	----------
11	34m	--------	24h	4	------	45	11	-------	29	----	----------
12	----	--------	24h	2	------	31	9	-------	25	----	----------
13	----	--------	24h	5	------	30	10	-------	25	5	----------
14	----	--------	24h	12	------	30	23	-------	62	----	----------
15	----	--------	24h	1	------	57	14	-------	48	----	1 west Hawaii

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera--Continued

Date (1968)	Tremor (minutes)			Earthquakes							
				Kilauea summit			SW. rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Others
	Deep	Inter-mediate	Shallow	30 km	Long period	Shallow					
Feb. 16	----	--------	24h	5	------	45	16	-------	30	1	1 west Hawaii
17	----	--------	24h	3	------	45	12	-------	5	----	----------
18	----	--------	24h	3	------	45	18	1	19	----	----------
19	----	--------	24h	8	------	30	6	-------	16	3	----------
20	----	--------	24h	2	------	45	12	1	26	2	1 west Hawaii
21	----	--------	24h	1	------	31	12	-------	31	----	----------
22	----	--------	24h	2	------	45	11	-------	20	3	1 offshore Milolii
23	26m	--------	24h	5	------	45	41	1	48	7	----------
24	----	--------	24h	5	------	55	57	-------	21	----	1 offshore Milolii
25	16m	--------	24h	2	------	60	117	-------	27	6	1 Mahukona; 1 offshore Maui
26	----	--------	24h	12	------	37	31	1	36	2	----------
27	10m	--------	10h	4	------	93	14	-------	37	2	----------
28	----	--------	24h	4	------	22	10	1	15	1	1 Mokuaweoweo Caldera
29	----	--------	24h	3	------	43	10	-------	20	2	1 Mokuaweoweo Caldera
Mar. 1	----	6m	24h	3	------	36	7	-------	28	5	1 Mokuaweoweo Caldera
2	4m	--------	24h	1	------	19	15	1	25	4	1 Mokuaweoweo Caldera; 1 west Hawaii
3	----	--------	24h	2	------	44	13	-------	?	5	----------
4	----	--------	24h	1	------	51	16	1	11	6	1 west Hawaii
5	----	--------	24h	1	------	180	16	1	15	----	----------
6	30m	--------	24h	2	------	12	5	-------	15	----	----------
7	----	--------	24h	2	------	73	7	-------	24	3	----------
8	----	--------	24h	2	------	25	14	-------	26	----	1 Hilo
9	30m	--------	24h	5	------	28	14	-------	20	----	1 Mokuaweoweo Caldera
10	----	--------	24h	7	------	49	15	-------	19	----	1 Naalehu
11	----	--------	24h	-----	------	47	11	-------	9	----	1 west Hawaii

Mar. 12	32m	--------	24h	1	-------	32	22	--------	24	3	----------
13	----	--------	24h	4	-------	51	15	1	18	3	1 west Hawaii
14	----	--------	24h	3	-------	21	4	--------	12	3	----------
15	----	--------	24h	2	-------	28	12	--------	14	8	----------
16	----	--------	24h	----	-------	44	6	--------	14	12	----------
17	----	--------	24h	3	-------	42	5	--------	15	9	1 Hilo; 2 Keanakolu
18	----	--------	24h	7	4	84	9	--------	10	8	----------
19	----	--------	24h	1	-------	26	9	--------	7	5	----------
20	----	--------	------	3	-------	12	11	--------	6	2	1 Keanakolu
21	14m	--------	24h	------	-------	50	8	--------	4	1	----------
22	----	--------	24h	4	-------	33	6	--------	16	3	----------
23	----	--------	24h	------	-------	120	5	--------	43	2	2 Mokuaweoweo Caldera
24	----	--------	24h	4	-------	24	12	--------	33	6	----------
25	----	--------	24h	------	-------	48	13	1	27	2	1 Mokuaweoweo Caldera; 1 Keanakolu
26	----	--------	24h	------	-------	94	7	--------	18	---	1 Naalehu
27	----	--------	24h	2	-------	45	4	--------	18	---	----------
28	----	--------	24h	2	-------	90	13	--------	35	5	----------
29	5m	--------	24h	3	-------	100	9	--------	12	5	----------
30	----	--------	24h	2	-------	105	9	--------	15	1	----------
31	----	--------	24h	3	-------	38	10	--------	15	4	1 offshore

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March 1968

Entries for a given quake are: date, origin time (Hawaiian Standard Time), magnitude, depth, edpicenter, and felt report. All earthquakes of magnitude 2.5 and larger, as well as many favorably located smaller ones, occurring on or near the island of Hawaii are included in the list.

Date (1968)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat N.	Long W.	Description	
Jan. 1	01	02	28.1	2.5	6	19°23.8'	154°55.8'	7 km NE. of Kalapana	----------
1	05	05	46.1	2.0	3	19°32.5'	156°00.2'	9 km NW. of Kealakekua	----------
1	09	50	53.0	2.3	8	19°20.5'	155°03.2'	12 km ESE. of Makaopuhi seismometer	----------
1	22	28	19.8	2.4	30	19°21.8'	155°16.3'	2 km SW. of Ahua seismometer	----------
2	04	43	37.0	2.5	8	20°05.1'	155°48.8'	5 km NNE. of Kawaihae	----------
2	16	32	29.0	2.2	6	19°25.4'	155°25.3'	10 km NNW. of Desert seismometer	----------
2	21	13	23.0	2.0	8	19°20.0'	155°08.8'	4 km SE. of Makaopuhi seismometer	----------
5	02	58	10.3	2.3	10	19°16.2'	155°07.2'	8 km ENE. of Apua Point	----------
5	10	47	32.7	2.2	8	19°20.2'	155°10.1'	3 km south of Makaopuhi seismometer	----------
6	06	28	41.8	2.7	10	19°15.8'	155°07.8'	7 km east of Apua Point	----------
6	12	17	17.5	2.0	10	19°13.7'	155°04.1'	14 km SE. of Apua Point	----------
6	18	25	15.0	2.6	40	19°14.0'	155°23.9'	12 km south of Desert seismometer	----------
6	23	10	22.8	3.0	6	19°11.2'	155°00.0'	22 km SE. of Apua Point	----------
7	04	21	49.4	3.1	26	19°21.1'	155°21.7'	3 km NE. of Desert seismometer	----------
7	14	24	33.0	2.4	27	19°24.2'	155°16.6'	South rim of Kilauea Caldera	----------
7	17	01	36.5	2.1	10	19°18.3'	155°15.1'	9 km NW. of Apua Point	----------
7	18	59	11.0	2.3	10	19°19.1'	155°03.3'	16 km NE. of Apua Point	----------
7	19	14	41.5	2.0	10	19°18.7'	155°08.0'	9 km NE. of Apua Point	----------
7	19	19	02.5	2.2	10	19°18.4'	155°13.1'	6 km NW. of Apua Point	----------
7	19	46	36.5	2.8	9	19°17.4'	155°13.0'	4 km NW. of Apua Point	----------
7	19	57	19.0	2.3	9	19°16.3'	155°13.7'	4 km NW. of Apua Point	----------
7	22	07	24.3	2.0	3	19°10.2'	154°50.0'	25 km SE. of Kalapana	----------
8	00	03	59.0	2.0	8	19°20.1'	155°49.1'	10 km SE. of Hookena	----------

Jan.	8	06	59	31.2	2.6	9	19°17.5'	155°13.1'	5 km NW. of Apua Point	----------
	8	11	39	56.8	2.0	10	19°18.1'	155°15.8'	9 km NW. of Apua Point	----------
	8	11	43	47.5	2.4	10	19°13.8'	155°08.8'	6 km SE. of Apua Point	----------
	8	13	36	44.0	2.0	8	19°19.5'	155°10.2'	5 km south of Makaopuhi seismometer	----------
	8	21	33	46.2	2.0	9	19°17.8'	155°14.6'	7 km NW. of Apua Point	----------
	9	02	39	54.2	2.0	9	19°17.7'	155°15.1'	7 km NW. of Apua Point	----------
	9	08	30	48.3	2.0	5	19°14.8'	155°21.5'	10 km SSE. of Desert seismometer	----------
	9	17	55	59.0	2.2	5	19°12.7'	155°21.6'	14 km SSE. of Desert seismometer	----------
	9	18	16	15.9	3.0	7	19°11.8'	155°20.8'	16 km SSE. of Desert seismometer	Pahala
	9	20	24	18.1	3.1	5	19°10.3'	155°20.8'	11 km ENE. of Palima Point	Pahala
	10	05	33	23.1	2.0	5	19°15.2'	155°22.5'	10 km south of Desert seismometer	----------
	10	10	29	36.1	3.6	8	19°11.3'	155°13.6'	8 km SW. of Apua Point	----------
	10	17	40	06.6	2.3	8	19°07.7'	155°09.8'	15 km south of Apua Point	----------
	10	17	40	57.6	2.3	8	19°09.2'	155°10.3'	12 km south of Apua Point	----------
	10	18	24	38.5	3.3	8	19°27.5'	155°23.7'	4 km SSW. of Mauna Loa seismometer	----------
	11	04	08	27.6	2.4	6	19°14.5'	155°21.2'	11 km SE. of Desert seismometer	----------
	11	23	51	11.1	2.0	8	20°06.8'	155°55.4'	13 km NW. of Kawaihae	----------
	13	07	43	38.1	2.0	8	19°09.9'	154°54.4'	22 km SSE. of Kalapana	----------
	13	10	37	38.8	2.5	8	19°22.7'	155°28.8'	11 km NW. of Desert seismometer	Pahala
	13	13	50	21.6	3.2	40	19°37'	156°07'	24 km WNW. of Kealakekua	----------
	15	07	10	47.7	3.0	10	19°21.3'	155°08.2'	4 km SE. of Makaopuhi seismometer	Hilo
	15	22	45	21.1	2.6	5	19°14.7'	155°20.2'	12 km SE. of Desert seismometer	----------
	16	02	35	06.7	2.0	6	19°20.0'	155°25.6'	4 km west of Desert seismometer	----------
	16	19	03	10.0	3.5	40	19°16.3'	155°22.2'	7 km SSE. of Desert seismometer	Pahala
	19	17	34	51.5	3.2	13	19°26'	156°21'	45 km WSW. of Kealakekua	----------
	19	18	43	30.7	2.2	35	19°23.2'	155°18.0'	3 km SW. of Uwekahuna seismometer	----------
	20	01	48	54.2	2.0	5	19°24.8'	155°26.8'	11 km SW. of Mauna Loa seismometer	----------
	20	13	14	25.3	2.0	13	19°19.7'	155°15.6'	5 km south of Ahua seismometer	----------
	20	16	26	33.2	2.5	10	19°21.2'	155°05.7'	8 km ESE. of Makaopuhi seismometer	----------
	21	12	33	11.9	2.2	8	19°13.8'	155°22.2'	12 km ENE. of Pahala	----------
	22	10	55	46.7	2.4	10	19°19.9'	155°09.4'	9 km NE. of Apua Point	----------
	22	23	55	57.7	2.0	5	19°24.0'	155°27.4'	10 km NW. of Desert seismometer	----------
	23	09	32	47.8	2.4	13	20°06.4'	155°54.3'	10 km NW. of Kawaihae	----------
	23	19	07	21.1	2.5	9	19°20.7'	155°10.0'	2 km south of Makaopuhi seismometer	----------
	23	23	31	22.6	2.1	9	19°21.8'	155°04.7'	10 km east of Makaopuhi seismometer	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March 1967--Continued

Date (1968)	Time			Magnitude	Depth	Epicenter			Felt Report
	h	m	s			Lat N.	Long W.	Description	
Jan. 24	08	57	57.5	2.4	9	19°17.9'	155°16.1'	9 km NW. of Apua Point	----------
24	14	48	44.3	3.7	8	19°21.2'	155°01.8'	5 km west of Kalapana	Kilauea summit area, Hilo, Pahoa, Pahala
24	14	53	31.2	2.2	9	19°21.6'	155°02.3'	6 km west of Kalapana	----------
24	14	53	56.4	2.3	10	19°21.3'	155°01.0'	4 km west of Kalapana	----------
24	14	57	15.9	2.5	9	19°19.8'	155°12.3'	5 km SW. of Makaopuhi seismometer	----------
24	16	59	36.1	2.4	5	19°26.2'	155°28.2'	11 km SW. of Mauna Loa seismometer	----------
25	06	34	05.9	2.1	9	19°20.2'	155°12.0'	5 km SW. of Makaopuhi seismometer	----------
25	19	14	09.1	2.2	10	19°22.7'	155°03.3'	9 km NW. of Kalapana	----------
27	18	58	52.6	2.2	10	19°19.6'	155°11.9'	8 km north of Apua Point	----------
28	17	40	41.7	2.6	5	19°23.8'	155°25.0'	7 km NW. of Desert seismometer	----------
28	18	19	07.5	3.3	30	20°05.1'	155°31.2'	5 km west of Honokaa	----------
29	08	47	51.2	2.4	28	19°23.2'	155°18.0'	4 km south of Uwekahuna seismometer	----------
30	21	11	00.0	2.0	9	19°20.4'	155°09.1'	3 km SE. of Makaopuhi seismometer	----------
31	05	28	25.4	2.0	9	19°20.2'	155°12.3'	5 km SW. of Makaopuhi seismometer	----------
31	17	06	56.2	2.0	9	19°20.8'	155°09.7'	2 km south of Makaopuhi seismometer	----------
Feb. 1	09	03	05.5	2.0	5	19°24.1'	155°26.1'	9 km NW. of Desert seismometer	----------
1	17	32	36.6	3.5	9	19°20.5'	155°07.5'	5 km SE. of Makaopuhi seismometer	Pahala
2	02	00	20.4	2.6	3	19°15.9	155°33.1'	11 km NW. of Pahala	----------
2	06	28	36.4	2.6	9	19°20.0'	155°08.6'	5 km SE. of Makaopuhi seismometer	----------
2	07	52	53.6	3.2	9	19°20.2'	155°09.3'	3 km SE. of Makaopuhi seismometer	Hilo
4	17	47	34.5	2.1	10	19°21.8'	155°05.2'	9 km east of Makaopuhi seismometer	----------
5	03	23	23.9	2.0	10	19°23.7'	155°24.8'	7 km NW. of Desert seismometer	----------
6	04	45	43.4	2.0	10	19°19.9'	155°15.4'	5 km south of Ahua seismometer	----------
6	04	52	41.3	2.7	8	19°25.0'	155°24.8'	9 km NW. of Desert seismometer	----------
6	06	30	35.1	2.2	10	19°21.8'	155°05.2'	9 km ESE. of Makaopuhi seismometer	----------
6	11	09	23.5	2.0	10	19°25.7'	155°22.9'	8 km south of Mauna Loa seismometer	----------

Feb.	6	16	22	32.7	2.0	13	19°23.5'	155°27.5'	10 km NW. of Desert seismometer	----------
	7	04	41	20.3	3.3	8	19°46.7'	155°40.7'	10 km SW. of Waikii	----------
	7	15	40	35.9	2.1	13	19°20'	156°17'	43 km SW. of Kealakekua	----------
	7	21	24	14.7	2.4	9	19°19.4'	155°12.0'	7 km north of Apua Point	----------
	8	13	23	31.6	2.8	0	19°19.3'	155°46.8'	14 km SE. of Hookena	----------
	8	19	20	11.3	2.2	8	19°59.8'	155°18.8'	7 km west of Laupahoehoe	----------
	9	07	29	38.0	2.5	0	19°46.8'	155°50.9'	Puu WaaWaa	----------
	9	14	34	22.0	2.1	8	19°23.6'	155°27.4'	10 km NW. of Desert seismometer	----------
	9	19	06	57.1	2.6	30	19°09.3'	155°25.7'	7 km SE. of Pahala	----------
	10	18	21	06.8	2.3	29	19°20.7'	155°14.6'	4 km SE. of Ahua seismometer	----------
	11	06	17	51.9	2.3	10	19°24.7'	155°25.2'	9 km NW. of Desert seismometer	----------
	11	14	29	35.1	2.8	40	19°19.1'	154°59.3'	6 km SW. of Kalapana	----------
	11	14	43	45.7	2.9	8	19°24.9'	155°27.6'	12 km SW. of Mauna Loa seismometer	----------
	13	21	15	15.7	2.3	9	19°19.7'	155°12.1'	8 km north of Apua Point	----------
	14	00	03	58.1	2.4	10	19°17.9'	155°13.2'	5 km NW. of Apua Point	----------
	14	15	16	10.4	2.8	9	19°23.2'	155°24.0'	6 km NNW. of Desert seismometer	Pahala
	14	22	37	07.9	2.1	6	19°25.7'	155°26.0'	9 km SW. of Mauna Loa seismometer	----------
	15	05	07	47.8	3.1	34	19°21.1'	155°18.9'	8 km SW. of Uwekahuna seismometer	Pahala
	15	12	04	01.4	2.3	10	19°17.7'	155°16.7'	10 km WNW. of Apua Point	----------
	15	17	26	33.2	2.7	0	19°34.8'	155°50.9'	10 km NE. of Kealakekua	----------
	16	01	58	56.1	2.0	0	19°26'	156°06'	20 km SW. of Kealakekua	----------
	16	19	59	30.4	2.1	10	19°19.2'	155°16.1'	6 km south of Ahua seismometer	----------
	17	15	54	39.8	2.3	13	19°21.3'	155°07.4'	5 km SE. of Makaopuhi seismometer	----------
	18	21	09	18.8	2.4	9	19°23.2'	155°03.2'	9 km NW. of Kalapana	----------
	19	08	11	47.7	2.8	28	19°23.2'	155°19.2'	5 km SW. of Uwekahuna seismometer	----------
	19	08	52	29.4	3.0	9	19°23.7'	155°26.8'	9 km NW. of Desert seismometer	----------
	19	20	53	44.7	2.2	29	19°22.0'	155°18.0'	4 km SW. of Ahua seismometer	----------
	20	02	52	50.8	3.3	40	19°08.8'	154°58.8'	5 km south of Kalapana	----------
	20	10	47	00.3	2.0	3	19°25.2'	155°16.5'	Kilauea Caldera	Kilauea summit area
	20	15	06	33.1	2.2	8	19°22.9'	155°00.0'	4 km NW. of Kalapana	----------
	20	20	31	38.9	2.2	3	19°24.2'	155°47.1'	19 km SE. of Kealakekua	----------
	21	19	14	54.1	2.0	10	19°20.2'	155°07.4'	5 km SE. of Makaopuhi seismometer	----------
	21	19	17	27.7	2.2	9	19°18.4'	155°13.4'	6 km NW. of Apua Point	----------
	21	23	11	39.9	2.3	9	19°19.5'	155°15.7'	10 km NW. of Apua Point	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March 1969--Continued

Date (1968)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat N.	Long W.	Description	
Feb. 22	08	13	46.9	2.2	9	19°20.0'	155°08.5'	10 km NE. of Apua Point	----------
22	09	20	40.0	4.5	8	19°15'	156°19'	43 km ENE. of Milolii	----------
22	12	06	45.1	2.4	32	19°18.9'	155°16.0'	7 km south of Ahua seismometer	----------
23	04	32	46.9	2.4	13	19°19.9'	155°11.2'	8 km north of Apua Point	----------
23	09	24	36.3	3.2	9	19°20.3'	155°08.2'	4 km SE. of Makaopuhi seismometer	----------
23	10	36	37.1	3.0	10	19°18.2'	155°13.9'	7 km NW. of Desert seismometer	----------
23	20	24	04.3	2.5	10	19°21.0'	155°03.6'	9 km west of Kalapana	----------
23	23	54	48.4	2.0	10	19°19.0'	155°14.3'	8 km NE. of Apua Point	----------
24	04	44	23.1	2.3	8	19°24.6'	155°25.3'	9 km NW. of Desert seismometer	----------
24	05	19	28.9	2.0	8	19°25.1'	155°26.9'	11 km NW. of Desert seismometer	----------
24	05	31	44.1	2.0	5	19°25.0'	155°26.3'	10 km NW. of Desert seismometer	----------
24	05	45	58.8	3.2	7	19°24.7'	155°26.7'	10 km NW. of Desert seismometer	----------
24	06	41	26.1	2.6	8	19°24.9'	155°25.8'	10 km NW. of Desert seismometer	----------
24	11	31	37.6	3.0	7	19°24.7'	155°26.2'	10 km NW. of Desert seismometer	----------
25	03	10	22.9	2.8	8	19°24.9'	155°24.9'	9 km NW. of Desert seismometer	----------
25	08	56	07.6	2.0	7	19°15.7'	155°21.9'	9 km SE. of Desert seismometer	----------
25	09	11	30.9	3.3	13	20°13'	156°47'	85 km SW. of Haleakala, Maui	----------
25	10	58	38.9	2.8	3	19°24.8'	155°24.8'	9 km NNW. of Desert seismometer	----------
25	12	52	54.8	2.2	5	19°14.8'	155°23.3'	10 km south of Desert seismometer	----------
25	15	09	35.9	3.1	3	20°13.0'	155°55.8'	4 km NW. of Mahukona	----------
26	18	00	18.6	2.9	9	19°19.7'	155°09.2'	9 km NE. of Apua Point	----------
26	19	10	56.5	2.0	9	19°20.1'	155°15.8'	4 km south of Ahua seismometer	----------
26	23	24	25.1	2.0	6	19°22.6'	155°26.8'	8 km NW. of Desert seismometer	----------
27	06	01	00.9	2.2	6	19°22.3'	155°26.8'	7 km NW. of Desert seismometer	----------
28	16	53	12.9	2.7	5	19°13.7'	155°32.7'	8 km NW. of Pahala	----------
28	17	04	40.6	2.4	3	19°14.3'	155°33.8'	10 km NW. of Pahala	----------
28	19	56	41.9	2.4	3	19°14.1'	155°36.8'	7 km SW. of Mokuaweoweo Caldera	----------
29	01	16	59.7	2.4	3	19°23.0'	155°35.9'	10 km SSW. of Mokuaweoweo Caldera	----------

Feb.	29	03	08	16.7	2.0	8	19°22.8'	155°03.8'	9 km NW. of Kalapana	----------
	29	03	29	00.2	2.0	8	19°25.9'	155°26.0'	9 km SW. of Mauna Loa seismometer	----------
	29	12	37	07.3	2.1	8	19°20.0'	155°10.7'	4 km south of Makaopuhi seismometer	----------
Mar.	1	00	51	02.4	2.4	2	19°23.3'	155°36.0'	8 km south of Mokuaweoweo Caldera	----------
	2	04	02	59.6	2.4	3	19°27.5'	155°46.2'	17 km ESE. of Kealakekua	----------
	2	05	00	28.4	2.2	9	19°20.7'	155°03.7'	9 km west of Kalapana	----------
	2	07	55	24.9	2.8	10	19°24.4'	155°35.2'	7 km south of Mokuaweoweo Caldera	----------
	2	15	00	14.4	2.0	9	19°18.4'	155°16.3'	7 km south of Ahua seismometer	----------
	4	02	32	36.9	2.2	0	19°20.0'	155°50.7'	8 km SE. of Hookena	----------
	4	05	14	55.6	2.0	8	19°25.1'	155°26.2'	10 km SW. of Mauna Loa seismometer	----------
	5	04	14	20.2	2.4	8	19°25.0'	155°26.5'	10 km SW. of Mauna Loa seismometer	----------
	5	17	30	54.1	2.2	9	19°20.7'	155°07.2'	6 km SE. of Makaopuhi seismometer	----------
	6	04	40	28.9	2.2	8	19°25.7'	155°25.2'	8 km SSW. of Mauna Loa seismometer	----------
	6	05	04	23.2	2.2	9	19°19.4'	155°11.3'	5 km SW. of Makaopuhi seismometer	----------
	6	12	29	07.8	2.0	10	19°21.7'	155°06.1'	7 km ESE. of Makaopuhi seismometer	----------
	9	01	42	12.8	2.0	0	19°29.0'	155°36.3'	Mokuaweoweo Caldera	----------
	9	13	52	12.4	2.3	31	19°22.0'	155°14.7'	3 km SE. of Ahua seismometer	----------
	9	16	58	09.0	2.1	9	19°19.8'	155°08.7'	5 km SE. of Makaopuhi seismometer	----------
	10	08	00	32.6	2.2	8	19°12.4'	155°31.0'	15 km NE. of Naalehu	----------
	10	12	01	48.5	2.0	10	19°17.7'	155°05.3'	12 km NE. of Apua Point	----------
	12	16	18	32.4	2.0	8	19°16.9'	155°23.1'	6 km south of Desert seismometer	----------
	17	05	17	01.4	2.7	8	19°56.3'	155°28.2'	14 km WNW. of Keanakolu	----------
	17	09	28	58.9	2.2	40	19°39.8'	155°13.7'	16 km SW. of Hilo	----------
	17	13	49	29.6	2.8	8	19°56.4'	155°27.4'	13 km WNW. of Keanakolu	----------
	17	17	00	03.9	2.0	9	19°22.0'	155°02.8'	7 km WNW. of Kalapana	----------
	18	01	42	17.2	2.2	29	19°21.7'	155°19.0'	6 km SW. of Kilauea Caldera	----------
	19	20	12	15.5	2.0	8	19°16.8'	155°28.2'	11 km SW. of Desert seismometer	----------
	23	05	29	18.0	2.4	5	19°23.2'	155°25.7'	7 km NW. of Desert seismometer	----------
	23	05	32	03.5	2.0	27	19°23.7'	155°17.6'	2 km SE. of Kilauea Caldera	----------
	23	06	47	11.1	2.5	3	19°30.7'	155°42.1'	12 km WNW. of Mokuaweoweo Caldera	----------
	23	13	57	13.2	2.5	3	19°33.2'	155°42.2'	15 km WNW. of Mokuaweoweo Caldera	----------
	24	02	45	02.6	2.7	9	19°19.9'	155°12.7'	8 km NNW. of Apua Point	----------
	25	14	50	53.3	2.5	40	19°46.0'	155°19.3'	25 km WNW. of Hilo	----------
	25	16	57	36.7	2.3	3	19°23.8'	155°37.4'	9 km SW. of Mokuaweoweo Caldera	----------
	26	03	27	54.8	2.4	9	19°20.0'	155°10.8'	4 km SW. of Makaopuhi seismometer	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March 1968--Continued

Date (1968)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat N.	Long W.	Description	
Mar. 26	09	41	27.6	2.3	3	19°13.2'	155°36.3'	17 km NNW. of Naalehu	----------
28	00	30	01.6	2.6	10	19°22.7'	155°23.7'	5 km north of Desert seismometer	----------
29	03	51	19.8	2.2	6	19°26.2'	155°27.1'	9 km SW. of Mauna Loa seismometer	----------
29	12	11	40.8	2.0	10	19°21.8'	155°16.1'	1 km south of Ahua seismometer	----------
30	03	37	14.3	2.1	8	19°24.0'	155°26.0'	8 km NW. of Desert seismometer	----------
30	23	21	18.1	2.0	9	19°20.2'	155°08.0'	5 km SE. of Makaopuhi seismometer	----------
31	00	56	15.0	4.2	13	21°45'	156°56'	60 km north of Molokai	----------
31	01	22	07.8	3.0	13	21°50'	156°51'	137 km NW. of Haleakala, Maui	----------
31	15	00	37.7	2.2	13	19°34.1'	155°20.0'	10 km NE. of Mauna Loa seismometer	----------
31	20	58	56.1	2.0	13	19°33.2'	155°21.3'	7 km NE. of Mauna Loa seismometer	----------

Table 5.--U.S. Geological Survey seismograph stations in Hawaii

[On island of Hawaii unless otherwise stated]

Station	Symbol	Location		Altitude (m) above sea level	Equipment (Z, vertical; N, north-south; E, east-west)
		Lat N.	Long W.		
Uwekahuna (Hawaiian Volcano Observatory)	U	19°25.4'	155°17.6'	1,240	Long-period Press-Ewing: N, E, Z. (Seismometer and galvanometer periods are 15 and 90 seconds, respectively.) Short-period Sprengnether: E, Z. HVO-1: Z[1] Short-base liquid-level tiltmeter
Mauna Loa	M	19°29.8'	155°23.3'	2,010	Remote recording HVO-2: Z[2]
Ahua	A	19°22.4'	155°15.9'	1,070	Do.
Mauna Loa (2)	M(2)	19°27.6'	155°20.7'	1,475	Remote recording 1.0 sec. EV-17 Z.
Desert	D	19°20.2'	155°23.3'	815	Do.
North Pit	N	19°24.9'	155°17.0'	1,115	Do.
West Pit	WP	19°24.7'	155°17.5'	1,115	Do.
Makaopuhi	MP	19°21.8'	155°10.7'	885	Do.
Kealakomo	K	19°18.5'	155°09.6'	201	Do. (installed Sept. 28, 1966)
Outlet	O	19°23.4'	155°16.8'	1,084	Do.
Kipuka Nene	KN	19°20.1'	155°17.4'	924	Do. (installed Sept. 21, 1967)
Cone Peak	CP	19°23.7'	155°19.7'	1,038	Do. (installed Nov. 8, 1967)
Hilo	Hi	19°43.2'	155°05.3'	20	HVO-1: Z Wood-Anderson: N, E. Operated by Joseph De Mello at St. Joseph's School.
Kipapa, Oahu	Kip	21°25.4'	158°00.9'	76	HVO-1: Z. Operated by U.S. Coast and Geodetic Survey.
Pahoa	Pa	19°29.7'	154°56.8'	205	HVO-1: Z. Operated by Kongo Kimura at Pahoa School.

Table 5.--U.S. Geological Survey seismograph stations in Hawaii--Continued

Station	Symbol	Location		Altitude (m) above sea level	Equipment (Z, vertical; N, north-south; E, east-west)
		Lat N.	Long W.		
Haleakala, Maui	Ha	20°46.0'	156°15.0'	2,090	HVO-1: Z. Wood-Anderson: N, E. Operated by the staff of Haleakala National Park, Maui.
Naalehu	Na	19°03.8'	155°35.2'	205	1.0 sec. EV-17 seismometer, 0.5 sec. galvanometer: Z. Operated by Mrs. E. Elarionoff at Naalehu School.
Kamuela	Ka	20°01.9'	155°42.0'	740	1.0 sec. EV-17, 0.286 sec. galvanometer. Operated by Michael Foster at H.P.A., Kamuela.
North Bay	NB	19°29.7'	155°34.8'	4,005	1.0 sec. EV-17: Z. with helicorder. Operated by U.S. Weather Bureau.
Kealakekua	Ke	19°31.2'	155°55.3'	505	1.0 sec. EV-17, 0.286 sec. galvanometer: Z, EW, and NS. Operated by Henry Nelson at Kona County Hospital.

1/ HVO-1 is a moving-coil, hinged, vertical-component seismograph with seismometer and galvanometer periods of 0.5 second. Overdamping of both seismometer and galvanometer is used to control the strong galvanometer reaction. This seismograph has a peak magnification of about 20,000 at a period of 0.25 second. Recording is optical, on photographic paper.

2/ HVO-2 is a moving-coil, vertical-component seismograph with a seismometer period of 0.8 second. Its signal is transmitted over telephone wires to the Hawaiian Volcano Observatory, where it is recorded on smoked-paper recorders.

Table 6.--U.S. Geological Survey tiltmeter stations in Hawaii

Station	Symbol	Location		Frequency of reading	Base length M	Description
		Lat N.	Long W.			
Tree Molds	TM	19°26.3'	155°17.3'	Quarterly	50.79	NS. and EW.
Sand Spit	SS	19°24.1'	155°16.8'	---do----	25.40	Equilateral triangle
Keamoku	Kea	19°25.1'	155°19.0'	---do----	47.55	Do.
Ahua Kamokukolau	Kam	19°22.7'	155°16.6'	---do----	50.79	Do.
Kipuka Nene	KN	19°19.4'	155°16.7'	---do----	50.79	Do.
Hilina Pali	HP	19°18.2'	155°18.6'	---do----	47.73	Do.
Kapapala Ranch	Kap	19°20.5'	155°23.8'	---do----	50.79	Do.
Mehana	M	19°26.2'	155°14.3'	---do----	25.00	Do.
Uwekahuna	U	19°25.5'	155°17.4'	---do----	50.79	Do.
Uwekahuna Vault		19°25.4'	155°17.6'	Daily	3.48	NS. and EW.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY

SUMMARY 50

April, May, and June 1968

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Summary of activities

The eruption on the summit crater continued throughout this quarter except for a 2-hour period on May 5th when fountaining and tremor ceased. This short period of inactivity separated the 29th and 30th phases. By the end of June the depth of new lava to the 1961 floor in Halemaumau was 360 feet. Levees around the central, active portion of the lake are 405 to 420 feet above the pre-eruption floor.

Levels were run on the benchmarks in the summit area and the upper east rift in early April and early June. The leveling generally shows small inflation during the quarter. In early April the summit benchmarks were still about 0.1 foot below their pre-eruption levels. By June the summit was at about the pre-eruption level. Inflation along the upper east rift came into prominence during this period as uplift in the Alae-Makaopuhi crater area nearly matched uplift in the summit area in April. In June the upper east rift area showed slight deflation, but it still remained at a fairly high level.

There were slight extensions along all of the geodimeter lines in the summit area when their lengths as measured in May were compared with their October 1968 (pre-eruption) lengths.

In addition to several bursts of shallow caldera quakes several tens of earthquakes were recorded daily from sources beneath Kilauea's southwest and southeast flanks. The largest quake from the shallow caldera source region registered magnitude 4 on May 29. A swarm of several hundred "30-km deep" Kilauea summit quakes occurred in late April. The largest event, a 4-1/2 magnitude shock at $04^h\ 09^m$, April 28, appeared to have initiated this deep episode.

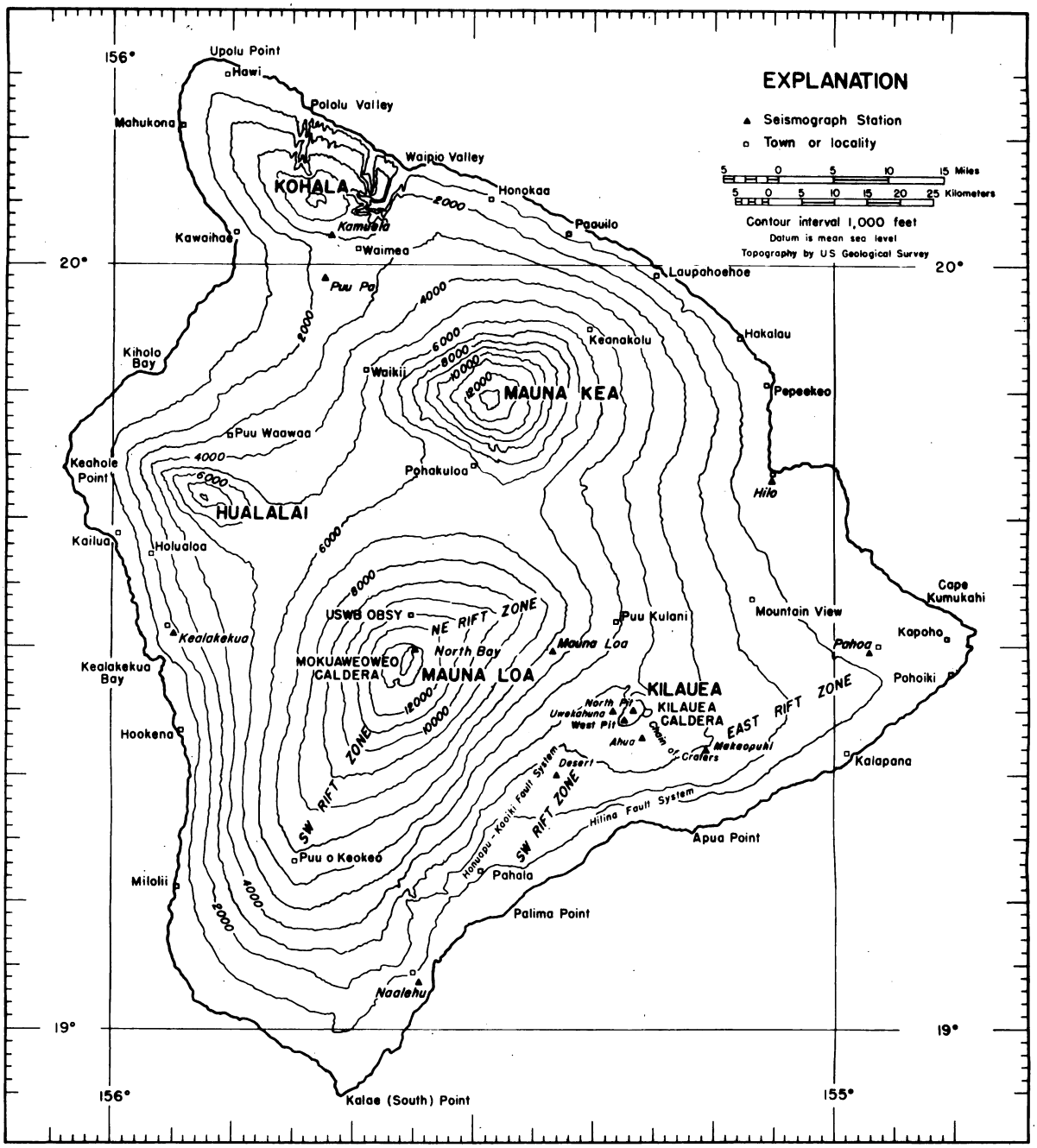

Figure 1.--Map of the Island of Hawaii showing seismograph stations operated by the U.S. Geological Survey, principal settlements, and selected geologic features. Epicenters of local earthquakes are given in table 4 in terms of geographic coordinates, which are indicated at the edges of the map.

Tilting of the ground around Kilauea Caldera

Tilting of the ground around the summit of Kilaeua is monitored daily by a short-base water-tube tiltmeter in Uwekahuna Vault, and at irregular intervals it is measured on a regional scale by means of a network of field tilt-bases and a portable water-tube tiltmeter. The attitude of the ground surface at each tilt-base is reported in terms of north-south and east-west tilt coordinates. Both coordinates at each station were arbitrarily set equal to 500 when measurements at that station were begun. Increasing tilt coordinates correspond to northward and eastward tilting of the earth's surface; that is, to a relative subsidence toward the north and east. A one-unit change in coordinate corresponds to a tilting of 1 microradian (1 mm per km) in the direction indicated.

Location of and essential data on each tiltmeter station are listed in table 6, which is published only in the first quarter issue each year.

Table 1.--Tilt coordinates at Uwekahuna vault

April, May, and June 1968

Date (1968)		N-S	E-W	Date (1968)		N-S	E-W
April	7	556	402	May	19	555	399
	14	556	399		26	555	402
	21	556	399	June	2	555	402
	28	556	398		9	555	402
May	5	555	400		16	556	395
	12	556	399		23	555	394
					30	556	397

Table 2.--Tilt coordinates and changes at bases around Kilauea caldera. (See fig. 2)

Tilt base	Date (1968)	Tilt N-S	Coordinates E-W	Rate (10^{-6} rad/mo) and direction of tilting since last reading	Date of last reading (1968)
Uwekahuna (U on fig. 2)	11 Jun	613.4	364.2	8.8 N64.1°W	Feb 13
Tree Molds (TM)	10 Jun	489.3	499.8	2.3 N3.8°W	Feb 21
Sand Spit (SS)	13 Jun	903.4	657.2	6.6 N69.9°W	Feb 14
Keamoku (Kea).	19 Jun	556.2	361.3	3.4 N47.5°W	Feb 14
Ahua Kamokukolau (Kam).	13 Jun	391.2	538.5	3.8 S54.2°W	Feb 14
Kipuka Nene (KN)	10 Jun	299.4	308.5	0.1 S3.9°W	Feb 14
Hilina Pali (HP)	(ND)				
Kapapala Ranch (Kap).	11 Jun	492.5	509.8	0.9 S11.4°E	Feb 13
Mehena (M)	12 Jun	579.9	586.0	2.4 N54.8°E	Feb 21

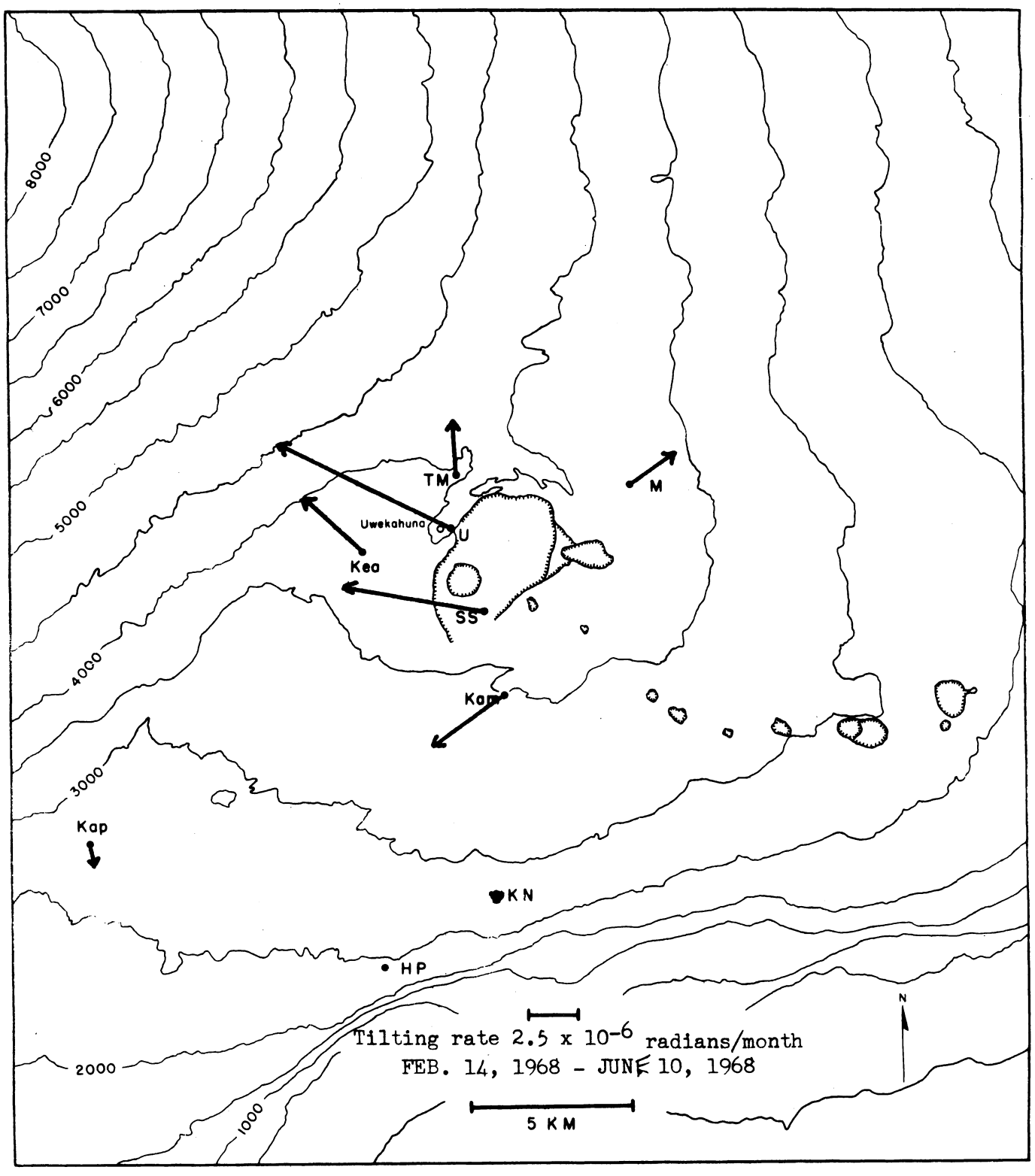

Figure 2.--Tilting of the ground around Kilauea caldera. The vector depicting tilting at a given tilt base points in the direction of maximum relative subsidence and has a length proportional to the rate of tilting during the measurement interval. Closed circles represent field tilt bases; open circles, short-base water-tube tiltmeters. See table 2 for explanation of abbreviations.

Seismic summary

Events recorded by the U.S. Geological Survey seismograph network in Hawaii fall into two categories: Local earthquakes and tremor originating in the region of the Hawaiian Islands (usually within 100 km of at least one seismograph), and distant earthquakes originating more than 3,000 km from Hawaii. As an index of seismic activity at Hawaiian volcanoes, daily counts of earthquakes and minutes of tremor recorded by seismographs in Hawaii are listed in table 3. The earthquakes are separated in groups on the basis of region of origin as determined by analysis of records obtained daily at the observatory (U, M, Mx, A, D, N, WP, MP, Kx, O,). Earthquakes of magnitude 2.0 or greater are generally sufficiently well recorded to be located with greater precision; they are listed individually in table 4.

Location of and essential data on each seismograph station are listed in table 5 in the first-quarter issue each year.

Acknowledgments

Several people or agencies reported "felt" earthquakes during the 2nd quarter, 1968. Their assistance is gratefully acknowledged.

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera

Tremor is separated into three categories: deep, intermediate, and shallow, on the basis of relative amplitudes on seismographs in the summit region. Unless otherwise stated, tremor is presumed to be associated with movement of magma within the central complex of Kilauea.

Earthquake categories are: Kilauea summit, 30 km earthquakes from a source about 30 km beneath the Kilauea summit region; long-period, earthquakes characterized by low-frequency waves that originate about 5 km beneath Kilauea summit; and shallow earthquakes in the Kilauea Caldera region; shallow earthquakes along the SW. rift zone of Kilauea and the adjacent portion of the Kaoiki fault system; earthquakes along the eastern half of Kilauea's east rift zone--detected largely on the Pahoa seismograph; earthquakes from the upper east rift zone and the adjacent fault systems of Kilauea's south flank; and earthquakes from other regions: west Hawaii, Mauna Kea, etc.

Date (1968)	Tremor (m = minutes h = hours)			Earthquakes							
				Kilauea Summit			SW rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Other
	Deep	Inter-mediate	Shallow	30KM	Long Period	Shallow					
April 1	.	.	24h	4	.	40	8	.	10	3	
2	.	.	24h	3	.	80	14	.	24	3	
3	.	.	24h	2	.	325	7	.	17	8	
4	.	.	24h	1	.	60	11	.	13	3	3
5	.	.	24h	2	.	105	3	.	15	3	1
6	.	.	24h	instruments off							1
7	.	.	24h	8	.	120	4	.	13	2	
8	.	.	24h	.	.	45	8	.	14	3	
9	6m	.	24h	6	.	60	7	.	16	6	2
10	.	.	24h	.	.	120	instruments off				
11	.	.	24h	3	.	60	4	.	14	5	
12	.	.	24h	5	.	120	9	.	4	2	

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera--Continued

Date (1968)	Tremor (m = minutes h = hours)			Earthquakes							
				Kilauea Summit			SW rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Other
	Deep	Inter-mediate	Shallow	30KM	Long Period	Shallow					
April 13	.	.	24h	.	.	60	9	.	22	5	2
14	.	.	24h	2	.	150	10	.	17	6	1
15	.	.	24h	.	.	45	22	.	19	5	
16	.	.	24h	2	.	105	9	.	21	10	
17	.	.	24h	1	.	45	7	.	21	10	1
18	14m	.	.	2	.	30	5	.	14	8	
19	.	.	24h	2	.	45	12	.	17	4	
20	.	.	24h	.	.	120	5	.	18	1	
21	.	.	24h	.	.	75	.	.	27	5	
22	.	.	24h	2	.	135	8	.	27	7	
23	.	.	24h	.	.	111	4	.	23	2	
24	.	.	24h	4	.	75	13	.	28	5	
25	.	.	24h	2	.	45	11	.	22	2	
26	.	.	24h	.	.	45	11	1	22	5	
27	.	.	24h	106	.	120	6	.	24	.	
28	.	.	24h	62	.	45	34	.	15	3	1
29	.	.	24h	25	.	45	8	.	6	3	
30	.	.	24h	15	.	9	11	.	26	4	2
May 1	.	.	24h	14	.	15	10	.	10	5	
2	.	.	24h	5	.	1	11	.	5	1	
3	.	.	24h	3	.	.	15	1	3	.	
4	.	.	24h	4	.	4	7	.	10	1	
5	.	.	22h	3	.	.	5	.	10	2	
6	.	.	24h	7	.	7	34	1	17	5	1
7	.	.	24h	5	.	.	19	.	22	6	

May	8	.	.	.	4	.	43	9	.	16	.	
	9	.	.	24h	9	.	5	12	.	34	6	
	10	.	.	24h	4	.	.	9	.	24	4	
	11	.	.	24h	2	.	.	7	.	7	1	
	12	.	.	24h	.	.	4	7	1	13	8	1
	13	.	.	24h	5	.	21	12	.	9	4	
	14	.	.	24h	3	.	3	16	1	16	7	
	15	.	.	24h	4	.	5	14	.	9	5	
	16	.	.	24h	5	.	24	13	.	17	17	
	17	.	.	24h	3	.	5	18	.	15	6	
	18	.	.	24h	3	.	22	18	.	12	4	
	19	.	.	.	15	.	122	16	.	15	4	2
	20	.	.	.	13	.	6	10	.	15	6	
	21	.	.	24h	7	.	4	14	.	13	2	
	22	.	.	24h	2	.	23	9	.	14	7	
	23	.	.	.	4	.	15	8	1	15	4	
	24	53m	.	.	9	.	160	6	.	16	3	
	25	65m	.	24h	5	.	69	9	.	63	5	
	26	20m	.	24h	6	.	10	2	.	14	6	
	27	.	.	24h	2	.	48	4	.	16	2	
	28	19m	.	24h	7	.	34	8	.	27	5	
	29	.	.	24h	1	.	190	4	1	18	6	
	30	.	.	24h	1	.	14	6	.	12	5	
	31	.	.	24h	6	.	4	9	.	29	8	2
June	1	.	.	24h	4	.	28	4	.	33	10	
	2	.	.	24h	2	.	16	7	1	26	2	
	3	.	.	24h	5	.	25	9	1	19	7	1
	4	.	.	24h	.	.	43	11	.	15	14	
	5	.	.	24h	1	.	36	3	.	18	28	
	6	.	.	24h	3	.	21	7	.	14	13	
	7	.	.	24h	2	.	58	8	1	20	5	1
	8	.	.	24h	1	.	65	9	.	9	.	1
	9	.	.	24h	2	.	13	17	.	11	.	
	10	10m	.	24h	7	.	38	20	.	16	3	
	11	.	.	24h	2	.	46	16	.	22	.	
	12	.	.	24h	6	.	21	30	.	24	.	
	13	.	.	24h	2	.	.	18	.	15	1	
	14	.	.	24h	3	.	48	8	.	15	17	

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera--Continued

Date (1968)	Tremor (m = minutes h = hours)			Earthquakes							
				Kilauea Summit							
	Deep	Inter-mediate	Shallow	30KM	Long Period	Shallow	SW rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Other
June 15	.	.	24h	1	.	15	9	--	28	19	
16	42m	.	.	3	.	69	6	1	20	19	
17	.	.	24h	10	.	19	31	.	36	13	1
18	.	.	24h	12	.	66	27	.	30	26	
19	.	.	24h	2	.	27	5	1	67	5	
20	.	.	24h	10	.	43	45	.	206	1	1
21	.	.	24h	6	.	25	15	.	52	4	1
22	.	.	24h	4	.	150	26	.	38	13	1
23	.	.	24h	3	.	70	43	.	63	20	
24	.	.	24h	3	.	44	28	.	58	9	
25	.	.	24h	7	.	57	20	.	72	26	
26	.	.	24h	9	.	72	23	.	45	43	
27	.	.	24h	7	.	35	21	.	18	14	
28	30m	.	.	11	.	24	26	.	50	44	
29	22m	.	24h	7	.	51	.	.	50	39	1
30	18m	.	24h	8	.	29	23	.	14	3	1

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Entries for a given quake are: date, origin time (Hawaiian Standard Time), magnitude, depth, epicenter, and felt report. All earthquakes of magnitude 2.5 and larger, as well as many favorably located smaller ones, occurring on or near the island of Hawaii are included in the list.

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
April 1	14-34-22.7	2.0	9	19°27.2'	155°27.4'	9 km SW of Mauna Loa seismometer	
3	15-06-11.1	3.7	8	19°23.1'	155°27.1'	8 km NW of Desert seismometer	Pahala, Hilo, Kilauea Summit Area
4	16-56-16.4	2.5	3	19°33.2'	155°50.8'	9 km NE of Kealakekua	
4	18-20-57.7	2.4	28	19°03.8'	155°23.8'	20 km E of Naalehu	
4	23-16-53.2	2.0	3	19°23.0'	155°36.1'	10 km S of Mokuaweoweo Caldera	
5	04-58-33.1	2.4	8	19°57.3'	155°29.8'	17 km WNW of Keanakolu	
5	07-11-40.6	2.0	8	19°25.6'	155°24.3'	8 km SSW of Mauna Loa seismometer	
6	00-30-15.7	2.5	35	19°19.5'	154°59.5'	3 km SW of Kalapana	
6	09-36-22.7	2.7	3	19°13.7'	155°31.0'	5 km NW of Pahala	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
April 7	20-25-15.7	2.0	27	19°22.3'	155°16.8'	2 km W of Ahua seismometer	
9	00-38-37.0	2.0	3	19°11.2'	155°39.6'	16 km NW of Naalehu	
9	01-14-56.7	2.6	13	20°00'	156°25'	90 km S of Haleakala, Maui	
10	01-00-24.8	3.7	27	19°23.9'	155°16.9'	South rim of Kilauea Caldera	Kilauea Summit Area, Pahala
10	04-59-48.6	2.0	2	19°25.5'	155°16.9'	Kilauea Caldera	
10	09-18-17.2	2.1	5	19°25.1'	155°26.0'	10 km SW of Mauna Loa seismometer	
11	14-45-20.9	2.2	9	19°19.5'	155°13.4'	7 km NW of Apua Point	
12	20-24-01.8	2.4	45	19°15.6'	155°12.9'	2 km W of Apua Point	
13	05-06-05.5	2.1	15	19°27.7'	155°38.8'	5 km SW of Mokuaweoweo Caldera	
13	11-13-00.6	2.4	3	19°43.2'	155°43.8'	30 km NE of Kealakekua	
14	08-25-25.1	2.2	9	19°19.0'	155°11.8'	6 km N of Apua Point	
14	10-45-57.3	2.5	0	20°02.1'	155°59.7'	17 km W Kawaihae	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
April 15	10-30-25.5	3.0	10	19°15.0'	155°25.2'	8 km NE of Pahala	Pahala
15	10-53-10.5	2.2	5	19°14.5'	155°27.7'	13 km SW of Desert seismometer	Pahala
16	20-16-17.0	2.2	35	19°20.1'	155°09.6'	3 km SE of Makaopuhi seismometer	
17	00-39-37.8	2.1	8	19°15.0'	155°26.7'	11 km SW of Desert seismometer	Pahala
17	04-58-06.3	2.4	8	19°48.3'	155°37.4'	6 km SE of Waikii	
17	12-38-56.5	2.0	8	19°25.3'	155°25.5'	9 km SW of Mauna Loa seismometer	
18	20-09-42.8	3.2	29	19°22.0'	155°16.8'	2 km SW of Ahua seismometer	Kilauea Summit Area, Pahala, Hilo
21	08-27-46.4	2.1	9	19°19.8'	155°11.7'	4 km SW of Makaopuhi seismometer	
21	20-27-52.1	2.3	8	19°19.4'	155°10.2'	5 km S of Makaopuhi seismometer	
28	04-08-59.0	4.5	30	19°22.5'	155°17.9'	4 km W of Ahua seismometer	Island-wide, possibly Oahu, too

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
April 28	04-16-24.8	2.1	30	19°22.8'	155°17.4'	3 km WNW of Ahua seismometer	Kilauea Summit Area
28	04-52-13.3	3.2	30	19°21.8'	155°18.4'	5 km SW of Ahua seismometer	Kilauea Summit Area
28	05-19-12.8	3.6	30	19°22.5'	155°16.9'	2 km W of Ahua seismometer	Kilauea Summit Area
28	05-59-13.0	2.2	30	19°22.9'	155°16.2'	1 km NW of Ahua seismometer	
28	06-44-47.3	2.0	29	19°21.8'	155°17.8'	3 km SW of Ahua seismometer	
28	08-35-25.0	3.4	8	19°24.9'	155°26.8'	11 km SW of Mauna Loa seismometer	Pahala
28	08-39-47.9	2.4	30	19°22.0'	155°17.3'	3 km SW of Ahua seismometer	
28	08-55-36.8	2.3	31	19°23.2'	155°17.0'	2 km S of Kilauea Caldera	
28	11-28-25.3	2.5	30	19°22.2'	155°17.2'	3 km W of Ahua seismometer	
28	19-45-05.1	2.1	30	19°22.0'	155°17.7'	3 km W of Ahua seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
April 28	21-23-40.4	2.1	8	19°21.8'	155°24.3'	3 km NW of Desert seismometer	Pahala
29	02-22-50.0	2.1	30	19°22.8'	155°16.7'	1 km NW of Ahua seismometer	
29	05-02-26.9	2.2	8	19°23.1'	155°27.1'	9 km NW of Desert seismometer	Pahala
29	08-07-05.9	2.3	31	19°22.5'	155°16.3'	1 km W of Ahua seismometer	
29	15-58-52.8	2.8	31	19°23.3'	155°17.0'	3 km NW of Ahua seismometer	
29	20-35-29.1	2.6	30	19°23.3'	155°16.2'	2 km NW of Ahua seismometer	
29	23-17-21.7	2.3	10	19°11.9'	155°27.7'	2 km E of Pahala	
30	01-30-51.6	2.2	3	19°26.9'	155°46.7'	17 km SE of Kealakekua	
30	03-21-12.1	2.0	30	19°22.8'	155°17.7'	3 km W of Ahua seismometer	
30	08-27-36.7	1.9	30	19°23.3'	155°16.9'	3 km NW of Ahua seismometer	
30	12-12-43.5	2.5	8	19°51.4'	155°33.6'	10 km E of Waikii	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
April 30	19-13-00.0	2.6	30	19°22.3'	155°17.2'	2 km W of Ahua seismometer	Pahala
30	23-27-19.4	2.4	30	19°23.0'	155°16.8'	2 km NW of Ahua seismometer	Pahala
May 1	03-33-07.7	2.4	30	19°22.2'	155°17.3'	2 km W of Ahua seismometer	
1	11-09-04.3	2.1	8	19°25.7'	155°24.2'	8 km SSW of Mauna Loa seismometer	
3	19-10-14.1	2.6	8	19°25.3'	155°24.8'	9 km SW of Mauna Loa seismometer	
3	19-39-12.0	3.2	30	19°21.7'	155°15.8'	2 km S of Ahua seismometer	
6	02-42-49.5	2.5	8	19°54.8'	155°38.8'	6 km N of Waikii	
7	12-51-19.6	2.1	31	19°22.9'	155°17.7'	3 km NW of Ahua seismometer	
8	07-18-02.5	2.6	32	19°22.8'	155°16.0'	1 km NW of Ahua seismometer	Pahala
8	10-01-13.3	2.7	9	19°20.3'	155°06.8'	7 km SE of Makaopuhi seismometer	
10	17-23-39.6	2.0	9	19°19.2'	155°16.2'	6 km S of Ahua seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
May	11	06-23-53.2	2.1	9	19°18.4'	155°16.3'	8 km S of Ahua seismometer	
	12	04-54-05.1	2.0	8	19°23.0'	155°24.0'	5 km NNW of Desert seismometer	
	12	10-06-52.9	3.6	0	19°20.2'	155°44.8'	17 km SE of Hookena	Kawaihae, Kealakekua
	13	14-24-11.2	2.1	9	19°20.5'	155°06.9'	6 km SE of Makaopuhi seismometer	
	14	13-21-06.8	2.4	8	19°24.7'	155°26.2'	11 km SW of Mauna Loa seismometer	
	14	17-57-39.6	2.0	8	19°25.8'	155°25.5'	8 km SW of Mauna Loa seismometer	
	16	09-38-00.9	2.0	9	19°20.3'	155°06.8'	6 km SE of Makaopuhi seismometer	
	17	21-43-11.0	2.2	7	19°23.8'	155°14.9'	3 km NE of Ahua seismometer	
	18	19-17-28.4	2.0	9	19°19.0'	155°12.7'	7 km NW of Apua Point	
	18	16-18-43.2	2.8	5	19°23.8'	155°23.7'	7 km N of Desert seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
May	19	06-29-42.6	2.7	5	19°24.5'	155°35.5'	6 km S of Mokuaweoweo Caldera	
	19	09-02-13.5	3.0	5	19°23.8'	155°36.5'	6 km SSW of Mokuaweoweo Caldera	
	20	01-30-07.5	2.0	10	19°21.8'	155°05.9'	8 km E of Makaopuhi seismometer	
	21	03-07-29.5	2.7	35	19°21.8'	155°01.9'	6 km WNW of Kalapana	
	22	17-51-49.4	2.0	10	19°21.2'	155°03.9'	9 km W of Kalapana	
	23	01-58-02.3	2.1	9	19°20.6'	155°06.7'	6 km SE of Makaopuhi seismometer	
	23	10-23-43.3	2.4	40	19°15.3'	155°06.4'	9 km E of Apua Point	
	23	19-56-39.6	2.2	9	19°21.2'	155°00.8'	4 km W of Kalapana	
	23	21-11-52.3	2.3	7	19°23.2'	155°23.8'	6 km N of Desert seismometer	
	26	04-26-02.3	2.3	30	19°23.0'	155°17.3'	2 km SSW of Kilauea Caldera	
	28	04-43-13.0	2.0	9	19°19.8'	155°08.5'	5 km SE of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
May	28	10-23-52.7	2.1	30	19°23.8'	155°14.5'	2 km SE of Kilauea Caldera	
	28	16-54-40.1	2.3	10	19°15.6'	155°27.0'	11 km SW of Desert seismometer	Pahala
	29	11-42-34.3	3.7	3	19°25.2'	155°16.3'	Kilauea Caldera	Kilauea Summit Area
	29	21-54-40.1	2.5	9	19°19.7'	155°08.7'	5 km SE of Makaopuhi seismometer	
	31	03-08-16.0	2.2	9	19°20.7'	155°08.7'	4 km SE of Makaopuhi seismometer	
	31	08-53-18.1	2.5	5	19°29.9'	155°48.8'	12 km ESE of Kealakekua	
	31	20-28-14.2	2.7	8	19°24.0'	155°46.8'	20 km SE of Kealakekua	
June	1	03-04-55.7	2.1	9	19°20.6'	155°07.1'	6 km SE of Makaopuhi seismometer	
	2	21-17-25.4	3.1	9	19°20.8'	155°07.2'	6 km SE of Makaopuhi seismometer	Kilauea Summit Area, Hilo, Pahala
	2	21-19-43.5	2.3	10	19°20.4'	155°05.4'	8 km SE of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
June	3	06-29-58.8	2.0	30	19°22.2'	155°17.4'	3 km W of Ahua seismometer	
	3	12-04-02.1	2.0	13	18°44'	155°28'	30 km SE of Kalae Point	
	3	13-06-39.9	2.4	8	19°21.8'	155°29.0'	10 km WNW of Desert seismometer	
	6	16-08-57.6	2.4	30	19°23.1'	155°17.2'	2 km S of Kilauea Caldera	
	7	04-22-36.3	2.0	5	19°11.8'	155°40.2'	17 km NW of Naalehu	
	8	04-25-25.6	2.1	8	20°00.0'	155°18.7'	8 km W of Laupahoehoe	
	8	05-27-58.9	3.0	30	19°22.1'	155°17.8'	4 km SW of Kilauea Caldera	Kilauea Summit Area, Pahala
	8	19-08-53.4	2.8	4	19°24.8'	155°16.7'	Kilauea Caldera	Kilauea Summit Area
	9	10-22-58.4	2.1	10	19°18.9'	155°13.3'	7 km NW of Apua Point	
	10	13-54-53.2	2.3	8	19°25.8'	155°27.2'	10 km SW of Mauna Loa seismometer	
	11	11-25-28.5	2.1	5	19°25.3'	155°26.3'	10 km SW of Mauna Loa seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
June 16	17-08-26.5	2.4	10	19°21.7'	155°14.7'	3 km SE of Ahua seismometer	
16	22-10-36.6	2.3	10	19°20.5'	155°07.8'	5 km SE of Makaopuhi seismometer	
17	22-33-12.0	2.6	8	19°33.3'	155°48.5'	12 km ENE of Kealakekua	
18	14-47-14.6	2.0	10	19°20.8'	155°08.1'	4 km SE of Makaopuhi seismometer	
19	04-36-18.9	3.0	5	19°24.0'	155°17.3'	SW rim of Kilauea Caldera	Kilauea Summit Area
19	22-44-57.9	2.0	10	19°19.2'	155°13.3'	8 km NW of Apua Point	
20	04-20-09.8	3.0	13	20°44'	157°05'	105 km W of Haleakala, Maui	
20	23-07-57.7	3.1	30	19°22.0'	155°17.0'	2 km SW of Ahua seismometer	
21	05-03-29.9	2.0	3	19°22.7'	155°46.1'	14 km E of Hookena	
21	16-11-02.4	2.3	30	19°22.9'	155°16.7'	2 km NW of Ahua seismometer	
21	17-58-44.7	2.6	30	19°22.9'	155°17.0'	2 km S of Kilauea Caldera	Pahala

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
June 22	16-08-36.1	2.4	8	19°12.0'	155°33.8'	9 km W of Pahala	
23	09-08-51.0	2.5	5	19°21.0'	155°12.3'	4 km SW of Makaopuhi seismometer	
23	10-44-00.9	2.0	8	19°22.2'	155°24.8'	4 km NW of Desert seismometer	
24	18-10-19.0	2.7	8	19°25.2'	155°28.1'	11 km SW of Mauna Loa seismometer	
24	20-22-16.4	2.0	10	19°23.0'	155°26.9'	8 km NW of Desert seismometer	
25	02-40-12.0	2.7	5	19°23.2'	155°29.4'	12 km NW of Desert seismometer	
25	15-41-27.1	2.6	9	19°20.7'	155°11.6'	4 km SW of Makaopuhi seismometer	
27	03-28-19.4	2.1	8	19°22.2'	155°30.4'	13 km NW of Desert seismometer	
28	08-01-18.7	2.1	9	19°19.7'	155°12.7'	8 km NW of Apua Point	
29	08-49-41.9	2.4	8	19°12.0'	155°28.7'	Pahala	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

April, May, June 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
June 29	14-13-46.6	2.2	8	19°53.8'	155°44.0'	10 km NW of Waikii	
29	18-50-54.5	2.5	9	19°19.7'	155°11.2'	8 km NNE of Apua Point	
30	09-05-50.6	2.5	8	19°15'	156°23'	54 km WNW of Hookena	

UNITED STATES
DEPARTMENT OF THE INTERIOR
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HAWAIIAN VOLCANO OBSERVATORY

SUMMARY 51

July, August, and September 1968

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Summary of activities

The eruption of Halemaumau that began on November 5, 1967, ended on the 13th of July. About 109 x 10^6 cubic yards of new lava was erupted into the pit during the 31 phases of this eruption. The final depths of filling, measured from the 1961 floor are: high lava marks 363-375 feet; inner levee, 420 $\pm$ 10 feet; highest cone, 470 feet. Following the end of the eruption, lava drained out of the inner lake, leaving about a 50 foot depression in the center.

The volcano, however, did not remain quiet very long as it began erupting again at 0248 HST on August 22 along the Upper East Rift. It began erupting at Hiiaka crater, about 2 miles east of Ahua seismometer, and eventually extended to fissures up to 10 miles to the east. This eruption continued until early morning of August 26. An estimated 130,000 cubic yards of lava was erupted of which only about 17,500 cubic yards remain on the surface.

The lava erupted from the main fissures in Hiiaka contains only olivine and spinel phenocrysts and so must have been hot, an interpretation supported by several optical pyrometer measurements of 1145°C. Large olivine phenocrysts are abundant (8-14 per cent) and commonly occur in clots. Many of the larger olivine crystals are strained. The lava from the Escape Road is similar to that in Hiiaka lake.

The lava that erupted from the small fissure on the southwest wall of Hiiaka is much more crystalline, with numerous aligned plagioclase and clinopyroxene microlites as well as 10 or so per cent olivine phenocrysts. This lava flowed slowly and quickly turned into aa, suggesting, together with its crystallinity, that the lava either was simply cooler lava of Hiiaka lake-type or that it is a more viscous, and also cooler, differentiate.

Several new cracks were formed before and during the eruptions along the Hilina Pali, Chain of Craters and Escape roads where they cross the Koae fault system. Some of these cracks reached widths of 2 to 3 inches. A few of the cracks showed right-lateral displacement, but the dominant horizontal displacement was tensional.

A comparison of the level and tilt data taken at the end of the Halemaumau eruption and after this eruption shows summit deflation of a little less than 0.8 foot and inflation

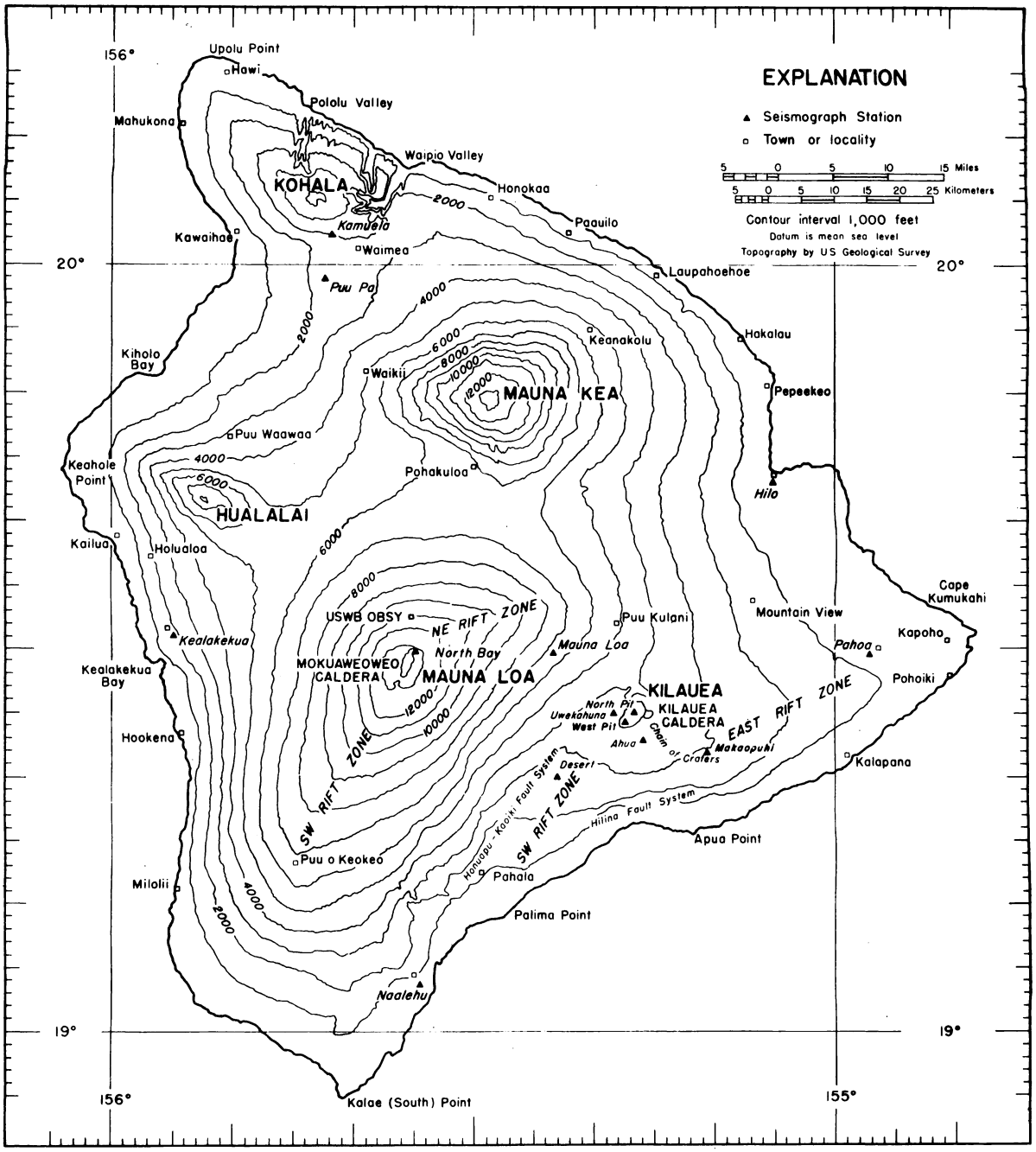

Figure 1.--Map of the Island of Hawaii showing seismograph stations operated by the U.S. Geological Survey, principal settlements, and selected geologic features. Epicenters of local earthquakes are given in table 4 in terms of geographic coordinates, which are indicated at the edges of the map.

near Hiiaka crater of about 0.9 foot. Horizontal distance changes over roughly the same span of time showed general contraction lines in the summit area up to 66 parts per million and general extension along lines in the Upper East Rift area up to 130 parts per million.

The count for shallow caldera quakes was low throughout most of the Halemaumau eruption. This was partly due to the lower gains the seismometers were operated at in the summit area, necessitated by the continuous harmonic tremor associated with the fountaining. The count of East Rift quakes picked up slightly after the end of the Halemaumau eruption. The August eruption was preceded by a swarm of several hundred small quakes at or near the site of eruption.

Tilting of the ground around Kilauea caldera

Tilting of the ground around the summit of Kilauea is monitored daily by a short-base water-tube tiltmeter in Uwekahuna Vault, and at irregular intervals it is measured on a regional scale by means of a network of field tilt-bases and a portable water-tube tiltmeter. The attitude of the ground surface at each tilt-base is reported in terms of north-south and east-west tilt coordinates. Both coordinates at each station were arbitrarily set equal to 500 when measurements at that station were begun. Increasing tilt coordinates correspond to northward and eastward tilting of the earth's surface; that is, to a relative subsidence toward the north and east. A one-unit change in coordinate corresponds to a tilting of 1 microradian (1 mm per km) in the direction indicated.

Location of and essential data on each tiltmeter station are listed in table 6, which is published only in the first quarter issue each year.

Table 1.--Tilt coordinates at Uwekahuna vault, July, August, and September, 1968.

Date (1968)	N-S	E-W	Date (1968)	N-S	E-W
July 7	557	395	Aug. 18	559	401
14	558	399	25	542	440
21	558	402	Sept. 1	539	435
28	559	402	8	542	423
Aug. 4	558	401	15	544	417
11	558	402	22	545	414
			29	545	408

Table 2.--Tilt coordinates and changes at bases around Kilauea caldera. (See fig. 2)

Tilt base	Date (1968)	Tilt N-S	Coordinates E-W	Rate (10^{-6} rad/mo) and direction of tilting since last reading		Date of last reading (1968)
Uwekahuna (U on fig. 2)	28 Aug	572.2	400.6	21.2	S41.5°E	Jun 11
Tree Molds (TM)	10 Oct	444.2	511.4	11.5	S14.4°E	Jun 10
Sand Spit (SS)	9 Sept	893.8	688.6	11.2	S73.0°E	Jun 13
Keamoku (Kea).	2 Sept	544.6	391.2	12.9	S68.8°E	Jun 19
Ahua Kamokukolau (Kam).	6 Sept	449.7	541.7	20.6	N3.1°E	Jun 13
Kipuka Nene (KN)	2 Sept	302.8	308.0	1.2	N8.0°W	Jun 10
Hilina Pali (HP)	16 Oct	456.1	499.1	0.45	N74.7°W	Feb 14
Kapapala Ranch (Kap).	28 Aug	492.5	509.8	0.01	S31.7°W	Jun 11
Mehena (M)	2 Sept	572.5	579.4	2.7	S41.4°W	Jun 12

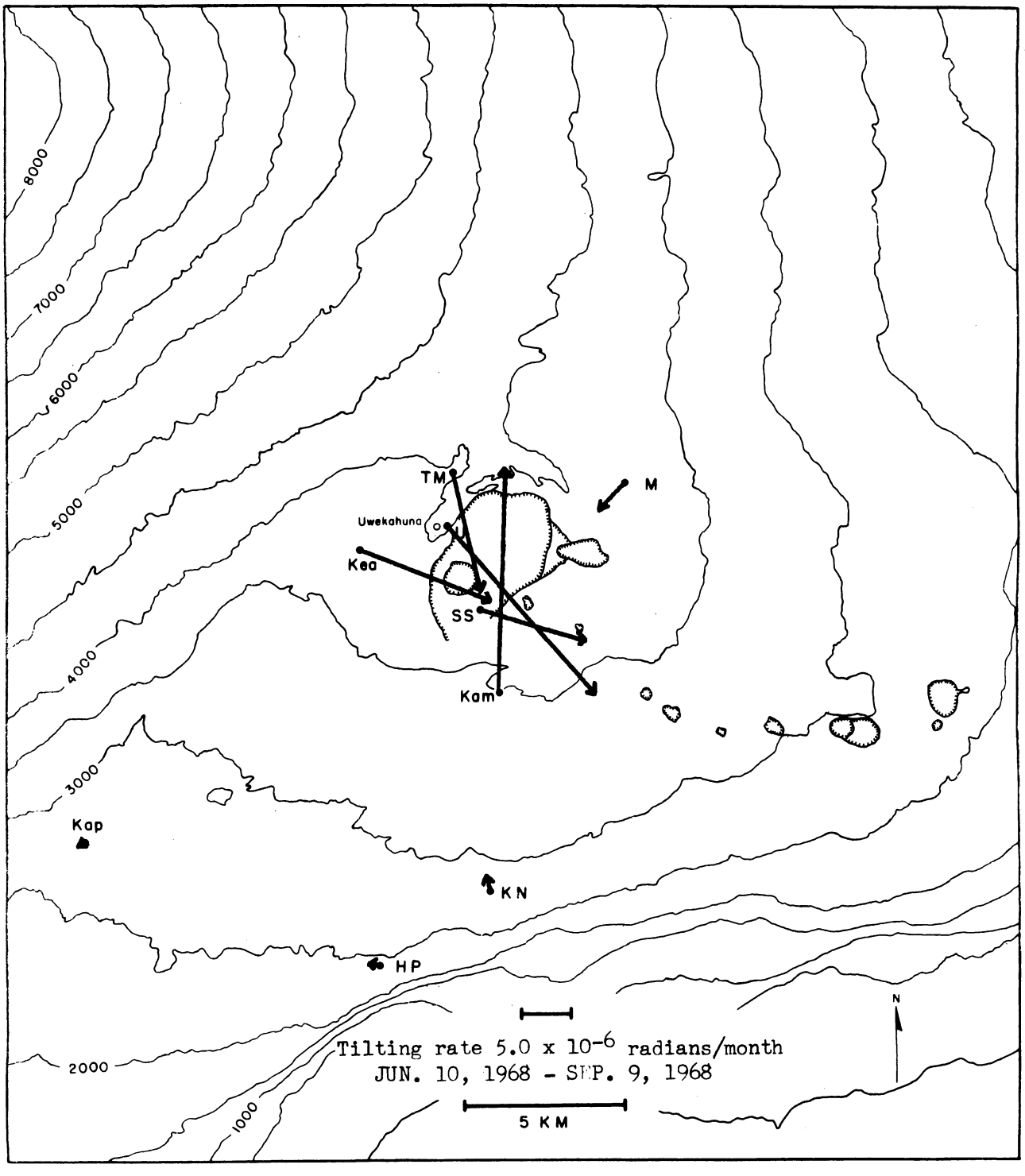

Figure 2.--Tilting of the ground around Kilauea caldera. The vector depicting tilting at a given tilt base points in the direction of maximum relative subsidence and has a length proportional to the rate of tilting during the measurement interval. Closed circles represent field tilt bases; open circles, short-base water-tube tiltmeters. See table 2 for explanation of abbreviations.

Seismic summary

Events recorded by the U.S. Geological Survey seismograph network in Hawaii fall into two categories: Local earthquakes and tremor originating in the region of the Hawaiian Islands (usually within 100 km of at least one seismograph), and distant earthquakes originating more than 3,000 km from Hawaii. As an index of seismic activity at Hawaiian volcanoes, daily counts of earthquakes and minutes of tremor recorded by seismographs in Hawaii are listed in table 3. The earthquakes are separated in groups on the basis of region of origin as determined by analysis of records obtained daily at the observatory (U, M, Mx, A, D, N, WP, MP, Kx, O,). Earthquakes of magnitude 2.0 or greater are generally sufficiently well recorded to be located with greater precision; they are listed individually in table 4.

Location of and essential data on each seismograph station are listed in table 5 in the first-quarter issue each year.

Acknowledgments

Several people or agencies reported "felt" earthquakes during the 3rd quarter, 1968. Their assistance is gratefully acknowledged.

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera

Tremor is separated into three categories: deep, intermediate, and shallow, on the basis of relative amplitudes on seismographs in the summit region. Unless otherwise stated, tremor is presumed to be associated with movement of magma within the central complex of Kilauea.

Earthquake categories are: Kilauea summit, 30 km, earthquakes from a source about 30 km beneath the Kilauea summit region; long-period, earthquakes characterized by low-frequency waves that originate about 5 km beneath Kilauea summit; and shallow earthquakes in the Kilauea Caldera region; shallow earthquakes along the SW. rift zone of Kilauea and the adjacent portion of the Kaoiki fault system; earthquakes along the eastern half of Kilauea's east rift zone--detected largely on the Pahoa seismograph; earthquakes from the upper east rift zone and the adjacent fault systems of Kilauea's south flank; and earthquakes from other regions: west Hawaii, Mauna Kea, etc.

Date (1968)		Tremor (m = minutes h = hours)			Earthquakes							
					Kilauea Summit			SW rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Other
		Deep	Inter-mediate	Shallow	30KM	Long Period	Shallow					
July	1	24m	.	24h	10	.	9	37	.	20	4	
	2	.	.	24h	4	.	5	21	1	16	6	2
	3	.	.	24h	2	.	18	12	.	39	.	
	4	.	.	24h	2	.	2	15	.	31	9	
	5	.	.	24h	1	.	5	10	.	37	2	
	6	.	3m	.	3	.	1	7	1	33	4	
	7	22m	.	24h	2	.	5	42	1	13	3	
	8	.	2m	.	2	.	1	45	2	59	2	1
	9	.	.	.	10	.	2	36	2	21	.	1
	10	.	.	.	5	.	.	41	2	25	.	1
	11	.	.	.	2	.	1	25	1	47	1	
	12	.	.	.	3	.	.	29	2	46	.	2
	13	.	.	.	9	.	3	48	4	48	.	
	14	.	.	.	3	.	2	41	2	4	.	

July	15	.	.	.	5	.	4	22	--	62	1	
	16	6m	.	.	4	.	1	5	--	67	.	
	17	.	.	.	1	.	23	17	.	71	.	
	18	.	.	.	2	.	24	.	11	75	.	
	19	.	.	.	1	.	16	4	23	47	1	
	20	.	.	.	3	.	38	14	22	36	2	
	21	8m	.	.	3	.	35	16	21	29	.	1
	22	.	.	.	1	.	23	15	2	64	.	
	23	2m	.	.	3	.	39	19	6	47	.	
	24	.	.	.	2	.	51	8	1	41	.	
	25	.	.	.	6	.	48	18	1	66	.	
	26	38m	.	.	4	.	28	12	5	68	.	
	27	17m	.	.	.	.	35	15	4	49	.	
	28	.	.	.	3	.	32	12	6	56	3	
	29	.	.	.	.	.	41	10	5	86	.	
	30	4m	.	.	.	.	53	16	4	45	2	4
	31	.	.	.	3	.	39	9	3	81	.	
August	1	30m	.	.	2	.	43	18	7	42	.	2
	2	6m	.	.	1	.	56	7	1	36	3	1
	3	.	.	.	5	.	79	18	.	34	.	
	4	.	.	.	2	.	47	13	2	50	.	
	5	5m	.	.	3	.	43	18	7	44	.	1
	6	.	.	.	3	.	94	16	2	53	.	1
	7	.	.	.	2	.	57	12	3	60	.	4
	8	7m	.	.	1	.	74	21	3	51	.	
	9	.	.	.	1	.	39	19	1	38	.	1
	10	.	.	.	.	.	38	7	6	42	.	
	11	.	.	.	1	.	50	26	7	58	.	
	12	.	.	.	.	.	53	12	3	28	.	1
	13	.	.	.	.	.	88	12	4	59	.	
	14	.	.	.	1	.	73	9	2	46	.	1
	15	19m	.	.	2	.	83	4	2	60	.	2
	16	30m	.	.	8	.	50	10	7	52	4	3
	17	.	.	.	4	.	60	16	4	28	2	
	18	.	.	.	1	.	102	14	14	56	.	
	19	.	.	.	2	.	68	12	3	60	.	
	20	.	3m	.	5	.	53	25	3	124	.	
	21	.	.	.	.	.	.	.	.	.	.	2

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera--Continued

Date (1968)	Tremor (m = minutes h = hours)			Earthquakes							
				Kilauea Summit			SW rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Other
	Deep	Inter-mediate	Shallow	30KM	Long Period	Shallow					
August 22	.	.	.	.	.	.	.	.	.	.	
23	.	.	24h	.	.	7	.	.	.	8	
24	.	.	24h	4	.	.	25	1	.	.	1
25	.	.	24h	4	.	6	14	.	20	1	
26	11m	.	24h	2	.	6	14	.	24	.	
27	33m	.	24h	4	.	22	17	.	15	17	
28	.	.	24h	.	.	40	28	.	20	.	
29	.	.	5m	1	.	59	7	.	36	5	
30	.	.	.	2	.	27	8	.	31	5	
31	.	.	.	4	.	21	12	.	36	6	
	Aug. 22-26, a small eruption occurred at Hiiaka Crater on the east rift zone along the Chain of Craters road. The Makaopuhi seismograph line to the observatory was temporarily cut by fire from the eruption.										
September 1	.	.	.	2	.	23	6	.	27	3	1
2	.	.	.	2	.	100	32	.	57	9	
3	.	.	.	2	.	104	17	.	32	8	
4	.	.	.	.	.	102	20	.	20	.	1
5	.	.	.	1	.	57	8	.	13	1	3
6	.	.	.	1	.	58	13	.	24	.	1
7	.	.	.	4	.	55	25	--	22	1	1
8	.	.	.	4	.	80	15	--	38	7	
9	1m	.	.	.	.	101	16	--	37	4	
10	.	.	.	1	.	123	9	--	23	3	2
11	4m	.	.	5	.	122	28	--	30	2	

September 12	.	.	.	1	.	67	16	--	50	17	
13	.	.	.	1	.	49	14	--	26	5	
14	35m	.	.	3	.	75	2	--	28	4	
15	3m	.	.	2	.	31	8	--	22	7	
16	26m	.	.	3	.	91	27	--	35	6	
17	.	.	.	2	.	66	8	--	28	3	
18	5m	.	.	1	.	50	2	--	48	2	
19	.	.	.	4	.	67	8	--	24	4	
20	.	.	.	1	.	104	28	--	22	8	
21	.	.	.	2	.	166	29	--	27	3	2
22	.	.	.	7	.	127	11	.	27	6	
23	.	.	.	2	.	102	22	.	37	8	2
24	7m	.	.	2	.	67	15	.	23	9	2
25	.	.	.	2	.	101	11	.	40	11	1
26	.	.	.	4	.	76	10	.	19	3	
27	.	.	.	.	.	124	21	.	20	10	1
28	.	.	15m	2	.	105	18	1	42	3	1
29	.	.	.	7	.	94	5	1	39	3	
30	4m	.	.	3	.	196	27	.	47	4	1

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Entries for a given quake are: Date, origin tim (Hawaiian Standard Time), magnitude, depth, epicenter, and felt report. All earthquakes of magnitude 2.5 and larger, as well as many favorably located smaller ones, occurring on or near the island of Hawaii are included in the list.

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
July 1	02-03-23.4	2.0	30	19°22.7'	155°14.9'	2 km NE of Ahua seismometer	
1	16-24-13.7	2.1	30	19°22.0'	155°16.8'	2 km SW of Ahua seismometer	
1	20-49-55.5	2.0	8	19°23.1'	155°29.2'	12 km NW of Desert seismometer	
2	04-23-09.4	2.0	8	19°26.2'	155°25.2'	7 km SW of Mauna Loa seismometer	
2	10-55-06.3	3.4	8	20°00.2'	155°49.3'	4 km SSE of Kawaihae	Honokaa, Kamuela
2	12-11-10.6	3.5	8	20°03.8'	155°50.2'	3 km NW of Kawaihae	Honokaa, Kamuela
2	12-31-59.0	2.0	20	19°24.8'	155°17.0'	Kilauea Caldera	
2	12-58-03.7	2.0	10	19°21.8'	155°05.3'	8 km E of Makaopuhi seismometer	
3	00-56-21.5	2.1	10	19°23.1'	155°03.8'	11 km E of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
July 3	02-38-23.1	2.0	33	19°25.2'	155°16.1'	Kilauea Caldera	
3	20-07-54.2	2.1	10	19°19.9'	155°09.9'	4 km S of Makaopuhi seismometer	
4	05-54-41.1	2.0	5	19°20.3'	155°07.8'	5 km SE of Makaopuhi seismometer	
4	07-34-18.3	2.1	10	19°19.8'	155°12.1'	18 km NNW of Apua Point	
5	02-17-21.5	2.7	32	19°23.2'	155°17.1'	2 km S of Kilauea Caldera	
5	02-21-59.0	2.2	30	19°22.2'	155°17.1'	2 km W of Ahua seismometer	
6	18-25-32.0	2.6	8	19°25.3'	155°23.1'	8 km S of Mauna Loa seismometer	Pahala
7	18-51-47.4	2.2	8	19°23.2'	155°29.3'	12 km NW of Desert seismometer	
8	04-13-08.8	2.9	13	20°04'	156°16'	45 km W of Kawaihae	
8	04-35-40.2	2.3	10	19°23.4'	154°58.7'	4 km N of Kalapana	
8	18-55-40.6	2.1	3	19°24.0'	155°25.2'	7 km NW of Desert seismometer	
8	20-08-50.5	2.1	8	19°23.2'	155°25.0'	6 km NW of Desert seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
July 8	20-23-32.0	2.0	5	19°23.4'	155°25.7'	7 km NW of Desert seismometer	
8	20-59-23.5	2.1	7	19°23.7'	155°25.5'	7 km NW of Desert seismometer	
8	23-44-54.2	2.1	10	19°19.8'	155°13.3'	9 km NW of Apua Point	
9	00-40-11.4	2.0	10	19°20.9'	155°07.1'	5 km SE of Makaopuhi seismometer	
9	03-50-51.1	2.5	8	19°55.9'	155°44.0'	11 km SSW of Kamuela	
9	19-24-57.3	2.5	30	19°22.3'	155°16.8'	2 km W of Ahua seismometer	
9	21-32-15.2	3.5	13	19°19.2'	155°13.7'	8 km NW of Apua Point	Hilo, Kilauea Summit Area, Pahala
10	11-14-27.3	2.0	10	19°21.2'	155°06.2'	8 km SE of Makaopuhi seismometer	
10	11-54-51.5	2.0	10	19°21.8'	155°02.8'	7 km NW of Kalapana	
10	18-45-23.4	3.3	40	18°51.7'	155°08.5'	45 km SSE of Apua Point	
10	21-41-23.7	2.0	9	19°22.4'	155°26.9'	8 km NW of Desert seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
July 10	22-49-53.2	2.0	8	19°26.2'	155°28.5'	11 km SW of Mauna Loa seismometer	
11	12-57-08.0	2.2	8	19°20.4'	155°09.0'	3 km SE of Makaopuhi seismometer	
12	05-53-55.4	2.0	5	19°24.9'	154°59.0'	10 km SW of Pahoa	
12	09-47-07.1	2.7	8	20°10.0'	155°36.2'	5 km NW of Waipio Valley	
12	11-00-58.9	2.5	8	20°07.5'	155°34.0'	Waipio Valley	
12	13-17-56.1	2.0	9	19°20.9'	155°04.9'	9 km SE of Makaopuhi seismometer	
12	20-20-31.2	2.0	10	19°20.0'	155°15.5'	5 km S of Ahua seismometer	
13	01-32-57.0	2.4	9	19°22.0'	155°06.4'	6 km ESE of Makaopuhi seismometer	
13	15-42-39.5	2.4	20	19°25.1'	155°17.1'	Kilauea Caldera	
15	13-00-54.2	2.4	8	19°24.7'	155°25.8'	10 km SW of Mauna Loa seismometer	
15	21-58-54.1	2.1	10	19°21.3'	155°06.8'	6 km SE of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
July 15	21-59-22.1	2.3	10	19°20.7'	155°07.2'	6 km SE of Makaopuhi seismometer	Pahoa
16	04-19-14.4	2.1	9	19°18.1'	155°14.2'	7 km NW of Apua Point	
16	04-20-02.4	2.0	9	19°18.3'	155°14.7'	7 km NW of Apua Point	
17	05-44-49.0	2.1	8	19°26.9'	155°25.8'	7 km SW of Mauna Loa seismometer	
17	12-34-04.0	2.4	40	19°15.5'	155°06.7'	9 km E of Apua Point	
17	16-51-36.2	2.2	9	19°21.8'	155°05.7'	8 km ESE of Makaopuhi seismometer	
18	07-45-03.4	2.0	15	19°24.5'	155°17.0'	Kilauea Caldera	
18	16-59-16.6	2.0	10	19°21.4'	155°05.2'	8 km E of Makaopuhi seismometer	
18	23-20-27.2	2.5	9	19°21.2'	155°06.5'	7 km SE of Makaopuhi seismometer	
19	17-38-05.5	2.0	8	19°25.3'	155°24.8'	8 km SW of Mauna Loa seismometer	
20	15-52-42.4	2.1	6	19°28.0'	154°55.2'	4 km SE of Pahoa	Pahoa

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
July 21	08-29-27.9	2.5	7	19°10.2'	155°37.1'	12 km NW of Naalehu	Pahoa
21	13-25-27.5	2.2	10	19°24.7'	155°03.3'	13 km NE of Makaopuhi seismometer	
21	16-46-38.4	2.3	6	19°26.8'	154°53.8'	7 km SE of Pahoa	
21	21-15-24.0	3.3	10	19°22.8'	155°03.2'	8 km NW of Kalapana	Kilauea Summit Area, Mt. View, Hilo
22	19-59-14.6	2.0	10	19°19.4'	155°10.9'	8 km NE of Apua Point	
23	04-49-31.7	2.0	30	19°23.7'	155°15.8'	1 km S of Kilauea Caldera	
23	08-15-02.7	2.5	5	19°27.0'	154°55.7'	5 km SSE of Pahoa	
24	15-56-30.5	2.1	10	19°21.3'	155°11.3'	3 km SW of Makaopuhi seismometer	
26	01-53-23.4	2.3	10	19°20.9'	155°08.3'	3 km SE of Makaopuhi seismometer	
26	18-42-45.6	2.1	10	19°25.6'	155°00.0'	8 km NNW of Kalapana	Hilo
27	06-58-58.5	2.3	30	19°22.8'	155°17.2'	2 km S of Kilauea Caldera	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
July 28	05-45-51.4	2.5	9	19°19.3'	155°13.3'	7 km NW of Apua Point	
29	06-21-11.9	3.3	9	19°23.2'	155°05.6'	8 km ENE of Makaopuhi seismometer	Hilo, Keaau, Kilauea Summit Area
29	06-45-16.0	2.0	9	19°21.1'	155°06.7'	6 km SE of Makaopuhi seismometer	
29	09-37-47.9	2.0	9	19°20.8'	155°11.7'	4 km SW of Makaopuhi seismometer	
29	19-35-44.7	3.7	10	19°21.0'	155°06.7'	7 km SE of Makaopuhi seismometer	Hilo, Mt. View, Pahala, Kilauea Summit Area
29	19-41-24.9	2.1	10	19°21.0'	155°06.8'	6 km SE of Makaopuhi seismometer	
30	01-06-47.7	2.1	8	19°15.9'	155°29.1'	7 km N of Pahala	
30	04-39-35.8	2.0	31	19°24.1'	155°46.0'	14 km ENE of Hookena	
30	05-34-33.9	2.4	0	19°25.1'	155°53.6'	4 km NNE of Hookena	
30	15-40-55.6	2.0	7	19°28.2'	154°54.2'	4 km SE of Pahoa	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
July 30	22-34-02.9	3.3	30	19°27.1'	155°31.7'	7 km SE of Mokuaweoweo Caldera	
30	23-57-41.4	2.2	5	19°26.6'	154°53.8'	8 km SE of Pahoa	
31	00-39-25.2	2.7	8	20°03.0'	155°45.9'	7 km NW of Kamuela	Kealakekua
31	04-22-50.8	2.3	5	19°27.4'	154°55.8'	5 km SE of Pahoa	
31	09-34-58.0	2.0	8	19°22.8'	155°03.0'	8 km NW of Kalapana	
31	10-42-59.5	2.3	10	19°20.0'	155°08.7'	3 km SE of Makaopuhi seismometer	
31	14-41-56.0	2.5	5	19°26.9'	154°54.5'	7 km SE of Pahoa	
August 1	00-03-57.6	2.0	10	19°24.2'	155°02.7'	9 km NW of Kalapana	
1	00-34-37.8	4.0	10	19°20.0'	155°06.8'	7 km SE of Makaopuhi seismometer	Island-wide
1	00-47-41.5	2.0	10	19°21.0'	155°06.7'	6 km SE of Makaopuhi seismometer	
1	01-15-29.9	2.3	10	19°20.8'	155°06.9'	6 km SE of Makaopuhi seismometer	
1	01-48-22.4	2.3	8	19°55.7'	155°42.8'	10 km NW of Waikii	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
August	1	07-21-22.9	2.2	9	19°28.1'	154°55.2'	4 km SE of Pahoa	
	1	22-50-14.3	2.0	10	19°19.7'	155°11.7'	5 km SW of Makaopuhi seismometer	
	2	12-19-34.6	2.6	20	19°26.0'	154°57.2'	7 km S of Pahoa	Pahoa
	2	12-59-17.2	2.7	8	19°23.9'	155°28.8'	12 km NW of Desert seismometer	
	2	18-36-55.4	3.8	40	19°51.9'	155°55.1'	Kiholo Bay	Kealakekua, Paauilo
	2	18-41-18.8	2.0	10	19°20.3'	155°08.9'	4 km SE of Makaopuhi seismometer	
	3	06-32-22.4	2.3	8	19°22.8'	155°23.8'	5 km N of Desert seismometer	Pahala
	3	17-03-41.1	2.0	9	19°25.1'	155°26.9'	11 km NW of Desert seismometer	
	4	05-18-44.1	2.2	9	19°20.0'	155°08.5'	5 km SE of Makaopuhi seismometer	
	5	08-38-09.6	2.6	5	19°26.4'	154°54.1'	8 km SE of Pahoa	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
August	5	10-30-38.3	2.0	8	19°25.9'	155°23.1'	7 km S of Mauna Loa seismometer	
	5	10-37-18.0	3.1	5	19°54.1'	155°53.1'	7 km NE of Kiholo Bay	Kealakekua
	5	17-24-34.6	2.2	9	19°23.2'	155°02.2'	7 km NW of Kalapana	
	6	10-39-07.2	2.2	8	19°12.5'	155°33.9'	9 km W of Pahala	
	6	16-34-42.8	2.0	13	20°09.5'	155°53.5'	3 km SE of Mahukona	
	6	23-14-51.3	3.0	10	19°19.8'	155°13.1'	9 km NW of Apua Point	
	7	01-44-08.1	2.3	8	20°02.0'	155°51.0'	2 km SW of Kawaihae	
	7	09-12-43.6	2.5	5	19°23.0'	155°29.0'	11 km NW of Desert seismometer	
	7	10-58-25.0	4.4	3	19°19.1'	155°48.2'	12 km SE of Kookena	Hakalau, Pahala, Kilauea Summit Area, Naalehu
	7	12-05-01.0	3.7	3	19°23.0'	155°45.2'	15 km E of Hookena	
	7	23-25-19.4	2.6	8	19°52.1'	155°33.2'	10 km E of Waikii	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
August 9	00-06-20.1	2.3	8	20°02.0'	155°51.9'	4 km SW of Kawaihae	Kilauea Summit Area, Pahala, Hakalau, Hilo, Pahoa, Mt. View
9	01-04-53.4	3.7	30	19°23.4'	155°17.0'	1 km S of Kilauea Caldera	Island-wide
10	11-09-21.2	2.5	10	19°20.4'	155°12.1'	9 km N of Apua Point	
10	15-59-43.8	2.6	9	19°22.4'	155°03.7'	12 km E of Makaopuhi seismometer	
12	04-07-12.7	3.5	13	19°00'	156°21'	53 km SW of Milolii	
12	06-32-23.5	2.0	9	19°20.1'	155°12.8'	6 km SW of Makaopuhi seismometer	
12	06-37-04.9	2.7	5	19°27.4'	154°55.4'	5 km SE of Pahoa	
13	17-05-03.7	2.2	5	19°25.2'	155°01.7'	9 km NW of Kalapana	
14	04-57-08.9	2.4	10	19°26.0'	155°03.5'	12 km NW of Kalapana	
14	10-39-23.8	2.4	3	19°27.2'	155°48.6'	14 km SE of Kealakekua	
15	16-27-34.4	2.3	8	18°59'	156°17'	45 km SE of Milolii	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
August 15	19-21-21.3	2.2	8	19°25.8'	155°56.0'	10 km S of Kealakekua	
16	01-52-49.3	2.2	5	19°23.4'	154°59.5'	4 km N of Kalapana	Pahala, Mt. View
16	02-05-41.6	2.6	5	19°26.3'	155°00.2'	8 km SW of Pahoa	
16	12-30-13.9	2.8	13	20°08.4'	155°53.5'	5 km S of Mahukona	
16	13-14-00.4	3.2	15	19°24.1'	155°17.0'	S rim of Kilauea Caldera	Pahala, Kilauea Summit Area, Mt. View
16	16-23-37.6	4.1	8	19°53.2'	155°22.9'	5 km SW of Keanakolu	Island-wide
16	16-47-19.9	2.4	8	19°52.4'	155°25.2'	10 km SW of Keanakolu	
17	13-15-25.1	2.3	10	19°21.7'	155°05.1'	9 km ESE of Makaopuhi seismometer	
17	22-38-49.6	2.3	10	19°24.2'	155°03.2'	10 km NW of Kalapana	
20	16-29-40.9	3.3	8	19°23.2'	155°25.1'	7 km NW of Desert seismometer	Pahala, Mt. View, Kilauea Summit Area
21	11-28-56.2	3.0	8	19°11.2'	155°36.7'	14 km NNW of Naalehu	Pahala

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
August 21	22-21-57.0	2.7	8	20°01.5'	155°59.6'	17 km W of Kawaihae	
22	03-21-59.0	2.5	5	19°22.8'	155°15.3'	1 km NE of Ahua seismometer	
22	03-31-02.0	2.6	5	19°22.7'	155°14.2'	3 km E of Ahua seismometer	
22	03-57-39.9	2.0	4	19°22.5'	155°14.0'	3 km E of Ahua seismometer	
22	04-09-56.0	3.0	4	19°22.4'	155°14.1'	3 km E of Ahua seismometer	Kilauea Summit Area
22	04-22-29.3	2.0	3	19°22.7'	155°14.6'	3 km E of Ahua seismometer	Kilauea Summit Area
22	04-46-21.3	3.0	3	19°21.2'	155°13.0'	5 km SE of Ahua seismometer	
22	05-06-54.2	3.1	2	19°22.8'	155°14.4'	3 km ENE of Ahua seismometer	
22	05-25-45.5	2.7	2	19°22.4'	155°14.5'	3 km E of Ahua seismometer	Kilauea Summit Area
22	05-45-02.0	2.8	2	19°21.7'	155°15.0'	2 km SE of Ahua seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
August 22	05-53-26.4	2.8	4	19°22.3'	155°15.1'	2 km E of Ahua seismometer	
22	06-01-07.5	2.7	9	19°20.9'	155°09.4'	2 km SE of Makaopuhi seismometer	Kilauea Summit Area
22	06-05-35.1	2.1	3	19°22.8'	155°14.7'	3 km NE of Ahua seismometer	
22	06-29-16.6	2.2	3	19°22.7'	155°14.3'	3 km E of Ahua seismometer	
22	10-07-44.7	2.0	10	19°21.2'	155°07.1'	5 km ESE of Makaopuhi seismometer	
22	16-36-47.0	2.3	30	19°23.2'	155°15.2'	2 km NE of Ahua seismometer	
23	06-37-35.0	2.9	8	19°25.1'	155°25.8'	10 km SW of Mauna Loa seismometer	
23	15-00-27.6	2.6	9	19°21.4'	155°08.8'	2 km SE of Makaopuhi seismometer	
24	14-13-59.5	2.8	8	19°54.8'	155°29.9'	17 km W of Keanakolu	
24	19-31-42.4	2.3	10	19°18.2'	155°07.7'	9 km NE of Apua Point	
25	10-15-35.2	2.0	10	19°19.8'	155°13.4'	7 km SW of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
August 25	20-12-15.7	2.6	34	19°24.8'	155°10.2'	5 km N of Makaopuhi seismometer	
26	05-32-11.2	2.4	8	19°23.1'	155°26.9'	8 km NW of Desert seismometer	
26	13-43-28.3	2.2	10	19°20.0'	155°08.7'	4 km SE of Makaopuhi seismometer	
29	22-36-21.6	2.3	9	19°20.1'	155°07.8'	5 km SE of Makaopuhi seismometer	
30	19-09-38.7	2.5	8	19°20.8'	155°26.3'	5 km NW of Desert seismometer	
31	08-59-00.5	2.2	10	19°20.6'	155°07.1'	5 km SE of Makaopuhi seismometer	
September 2	04-44-46.9	2.4	10	19°22.3'	155°02.0'	6 km NW of Kalapana	
2	14-58- 3.4	3.1	8	19°21.3'	155°27.1'	7 km NW of Desert seismometer	Kilauea Summit Area, Pahala, Hilo, Kealakekua
3	10-45-11.5	2.0	8	19°20.7'	155°26.8'	6 km W of Desert seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
September	3	11-29-39.6	2.6	8	19°24.5'	155°28.5'	12 km NW of Desert seismometer	
	4	22-58-08.9	2.1	13	20°01.5'	155°17.0'	7 km NW of Laupahoehoe	
	4	23-04-00.5	2.3	8	19°24.0'	155°23.8'	12 km N of Desert seismometer	
	5	03-58-06.2	2.2	8	19°59.0'	155°25.0'	12 km NW of Keanakolu	
	5	03-59-40.2	2.8	8	19°58.1'	155°23.9'	9 km NW of Keanakolu	
	5	06-12-43.7	3.2	8	19°57.8'	155°23.8'	8 km NW of Keanakolu	Hilo
	6	10-31-52.6	2.0	8	19°58.6'	155°50.2'	7 km S of Kawaihae	
	7	05-52-45.1	2.1	8	19°22.6'	155°25.0'	5 km NW of Desert seismometer	
	7	14-41-20.1	2.1	3	19°18.7'	155°39.7'	20 km SW of Mokuaweoweo Caldera	
	7	17-08-44.3	3.7	20	19°26.0'	155°16.7'	Kilauea Caldera	Kilauea Summit Area, Hilo, Kealakekua, Keaau
	7	17-17-25.9	2.6	20	19°25.3'	155°16.5'	Kilauea Caldera	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
September 8	07-59-47.3	2.3	25	19°24.9'	155°15.8'	Kilauea Caldera	
10	15-22-42.3	2.3	10	20°02.7'	155°34.2'	13 km ENE of Kamuela	
10	19-53-28.3	2.0	0	19°28.1'	155°47.9'	14 km SE of Kealakekua	
10	22-32-00.7	2.5	8	19°25.9'	155°24.1'	7 km S of Mauna Loa seismometer	Kilauea Summit Area
12	09-12-48.8	2.0	8	19°21.3'	155°24.5'	3 km NW of Desert seismometer	Pahala
21	02-13-34.1	3.0	8	19°13.0'	155°38.1'	17 km NW of Naalehu	
21	20-37-50.5	2.2	8	19°21.1'	155°26.7'	6 km NW of Desert seismometer	
21	23-44-01.9	2.4	50	19°47.8'	156°01.9'	8 km NE of Keahole Point	
22	14-42-36.8	2.0	3	19°23.2'	155°11.4'	3 km NW of Makaopuhi seismometer	
23	18-11-53.3	4.1	8	20°10.3'	155°48.5'	20 km NW of Kamuela	Waipio Valley, Kawaihae, Waimea, Hilo, Kamuela, Kilauea Summit Area

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
September 23	18-18-12.2	3.2	30	20°09.2'	155°48.0'	10 km SE of Hawi	
23	19-44-29.2	2.5	8	19°25.0'	155°25.5'	9 km NW of Desert seismometer	
24	15-08-48.8	2.3	50	19°53.5'	155°58.0'	5 km NW of Kiholo Bay	
24	15-58-52.3	2.2	0	19°39.0'	155°53.9'	10 km E of Kailua	
25	05-00-01.8	2.5	8	20°20.9'	155°47.2'	10 km NE of Upolu Point	
25	08-01-49.2	2.0	8	19°26.8'	155°26.1'	7 km SW of Mauna Loa seismometer	
25	16-04-54.7	2.0	20	19°25.2'	155°15.9'	Kilauea Caldera	
25	20-49-50.6	2.0	9	19°20.8'	155°07.8'	5 km SE of Makaopuhi seismometer	
26	13-01-15.2	2.0	9	19°20.2'	155°08.5'	4 km SE of Makaopuhi seismometer	
27	17-40-09.2	2.8	7	19°28.5'	155°46.2'	17 km SE of Kealakekua	
28	06-28-53.8	2.9	10	19°18.7'	155°14.4'	8 km NW of Apua Point	
28	11-50-08.6	2.3	9	19°17.9'	155°13.1'	5 km NW of Apua Point	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

July, August, September 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
September 28	19-12-09.8	2.7	20	19°28.6'	155°15.8'	5 km NE of Kilauea Caldera	
29	14-59-43.5	2.1	8	19°54.2'	155°29.0'	9 km N of Mauna Kea Summit	
29	15-31-22.9	2.2	9	19°21.0'	155°08.0'	4 km SE of Makaopuhi seismometer	
30	04-01-12.3	2.3	8	19°22.3'	155°25.8'	6 km NW of Desert seismometer	Pahala
30	12-15-35.4	2.0	30	19°23.2'	155°15.9'	2 km S of Kilauea Caldera	
30	13-34-51.2	2.3	45	18°51.9'	155°17.0'	39 km SE of Naalehu	

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY

SUMMARY 52

October, November, and December 1968

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Summary of activities

After a sharp reinflation at Kilauea summit following the August eruption a new eruption broke out on the Upper East Rift at Kilauea. Strong harmonic tremors that began at 1037 October 7 at the Makaopuhi seismograph was followed by the sighting of fume clouds at 1435. Although fountaining was not sighted at this time, we believe that this was the beginning of the eruption. The eruption began at Kane Hui o Hamo, a low cone about 1 mile north of Makaopuhi seismometer, and eventually erupted from vents up to 3 miles further to the east. Fountaining continued intermittently until October 16. On October 22 activity renewed for a short time but the eruptive activity from this date until November 19 consisted mostly of low level harmonic tremor, fuming and occasional bursts of spatter. A downrift migration of vents that occurred during the August eruption, did not characterize this eruption; eruptive centers shifted at random between Napau Crater and 2 miles downrift. About 7 million cubic meters of new lava finally remained on the surface near and within Napau Crater as a result of the October eruption.

The volume of lava above ground may be higher than the guess given here, for we suspect the average thickness of new lava outside of Napau has been underestimated. The amount of lava that was erupted to the surface but drained back may be as much as 50% of the amount remaining on the surface.

Levels were run in the summit and Upper East Rift area on October 9-10 and again on November 25-26. A comparison with the August 25-26 (Post August eruption) level data shows that the summit area subsided about 0.4 feet and the Upper East Rift area near Makaopuhi seismometer showed an uplift of about 0.6 feet. Most of this deformation probably took place in the earliest stages of the eruption, judging from the behavior of the tiltmeter in Uwekahuna vault; it showed sharp deflation tilt beginning at about 1130 October 7 and leveling out about 1300 October 9.

Although intermittent eruptive activity continued until October 22 and harmonic tremor and dense fumes continued until November 19, the tilt evidence shows that reinflation began a few days after the start of the eruption. By November 25-26 the summit had uplifted about 0.2 foot above its October 9-10 level. The Upper East Rift area uplifted an additional 0.13 foot above its October 9-10 level.

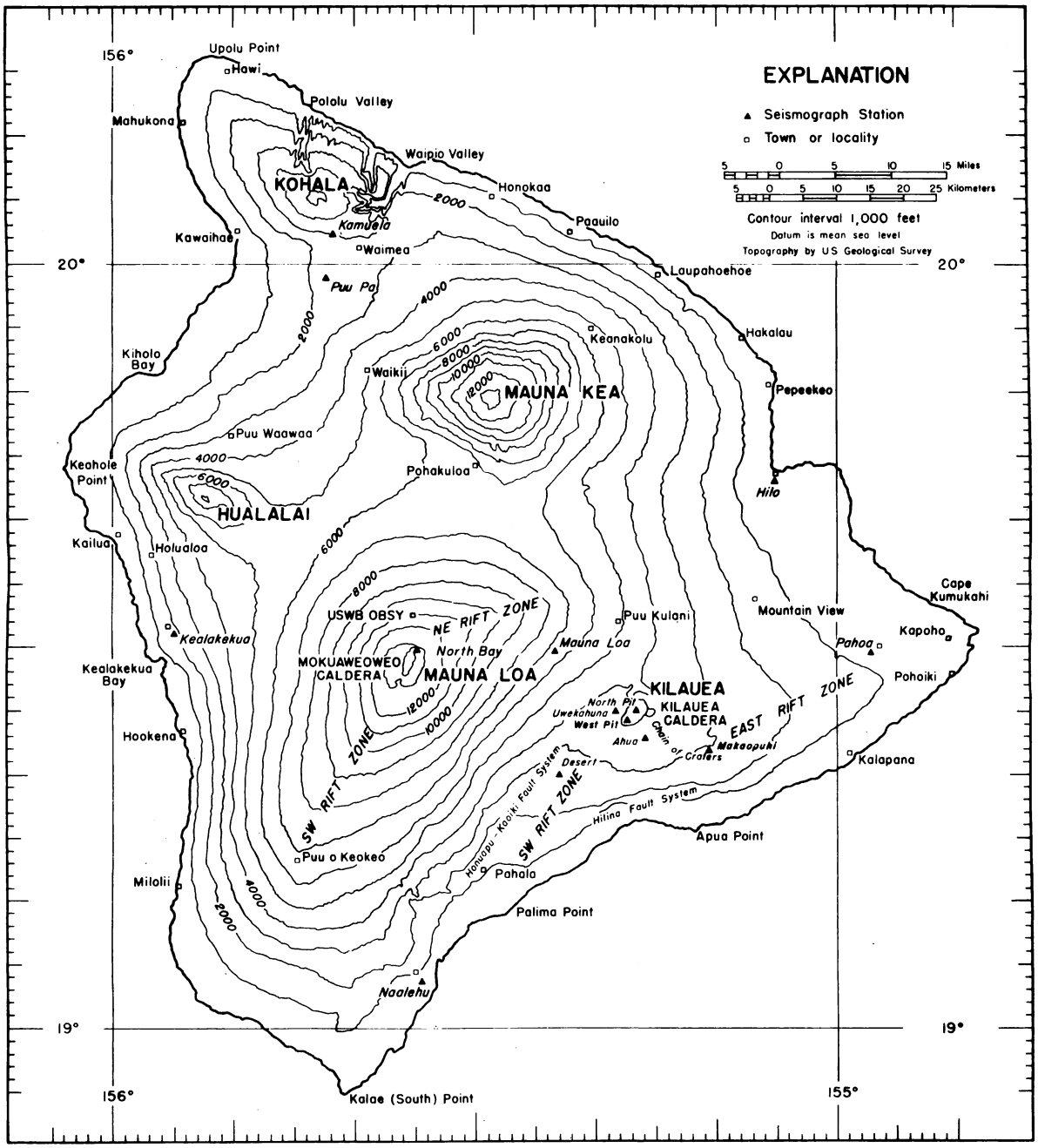

Figure 1.--Map of the Island of Hawaii showing seismograph stations operated by the U.S. Geological Survey, principal settlements, and selected geologic features. Epicenters of local earthquakes are given in table 4 in terms of geographic coordinates, which are indicated at the edges of the map.

Tilt was measured at the summit stations 6 times between the August and October eruptions. The total tilt for the period covered by the leveling verified the level data except at outlet vault a tilt direction almost 180° opposite from the direction that was inferred from the leveling. The reason for this is unknown.

The short base water tube tiltmeter in Uwekahuna vault showed rapic inflation beginning on August 25. It showed an inflation direction and it averaged about 1.13 x 10^{-6} radians/day until October 2nd, when inflation ceased abruptly. Between October 2nd and the beginning of the eruption there was little or not tilt change.

Distance measurements between stations in the summit and Upper East Rift areas showed contraction strains at the summit and slight extension along the Upper East Rift. The maximum linear strain occurred along east-west lines just south of Halemaumau; they were as high as 7.4 x 10^{-5} in the August-October (after eruption) period.

Seismic activity associated with the October Upper East Rift eruption started at 1037, October 7. Harmonic tremor and large numbers of south flank and summit earthquakes characterized the early period followed by weak harmonic tremor and moderate numbers of quakes for the remainder of the month. During October 7-10, more than 3,000 quakes were recorded; 300 of these events between 0.5 to 3.0 magnitude were read and located.

Tilting of the Ground Around Kilauea Caldera

Tilting of the ground around the summit of Kilauea is monitored daily by a short-base water-tube tiltmeter in Uwekahuna Vault, and at irregular intervals it is measured on a regional scale by means of a network of field tilt-bases and a portable water-tube tiltmeter. The attitude of the ground surface at each tilt-base is reported in terms of north-south and east-west tilt coordinates. Both coordinates at each station were arbitrarily set equal to 500 when measurements at that station were begun. Increasing tilt coordinates correspond to northward and eastward tilting of the earth's surface; that is, to a relative subsidence toward the north and east. A one-unit change in coordinate corresponds to a tilting of 1 microradian (1 mm per km) in the direction indicated.

Location of and essential data on each tiltmeter station are listed in table 6, which is published only in the first quarter issue each year.

Table 1.--Tilt coordinates at Uwekahuna vault, October, November, and December, 1968

Date (1968)	N-S	E-W	Date (1968)	N-S	E-W
Oct. 6	539	421	Nov. 17	523	427
13	517	454	24	524	423
20	516	452	Dec. 1	524	421
27	516	440	8	520	423
Nov. 3	519	436	15	520	420
10	520	432	22	521	418
			29	524	417

Table 2.--Tilt coordinates and changes at bases around Kilauea caldera. (See fig. 2)

Tilt base	Date (1968)	Tilt N-S	Coordinates E-W	Rate (10^{-6} rad/mo) and direction of tilting since last reading	Date of last reading (1968)
Uwekahuna (U on fig. 2)	3 Dec.	558.2	399.5	4.3 S4.6°W	Aug. 28
Tree Molds (TM)	3 Dec.	460.6	503.7	10.1 N25.2°W	Oct. 10
Sand Spit (SS)	27 Nov.	866.8	701.2	11.5 S25.0°E	Sept. 9
Keamoku (Kea).	2 Dec.	521.5	412.5	10.4 S42.7°E	Sept. 2
Ahua Kamokukolau (Kam).	27 Nov.	493.1	531.9	16.3 N12.7°W	Sept. 6
Kipuka Nene (KN)	5 Dec.	305.0	308.5	0.7 N11.8°E	Sept. 2
Hilina Pali (HP)	N/D				
Kapapala Ranch (Kap).	N/D				
Mehena (M)	2 Dec.	569.6	576.8	1.3 S42.0°W	Sept. 2

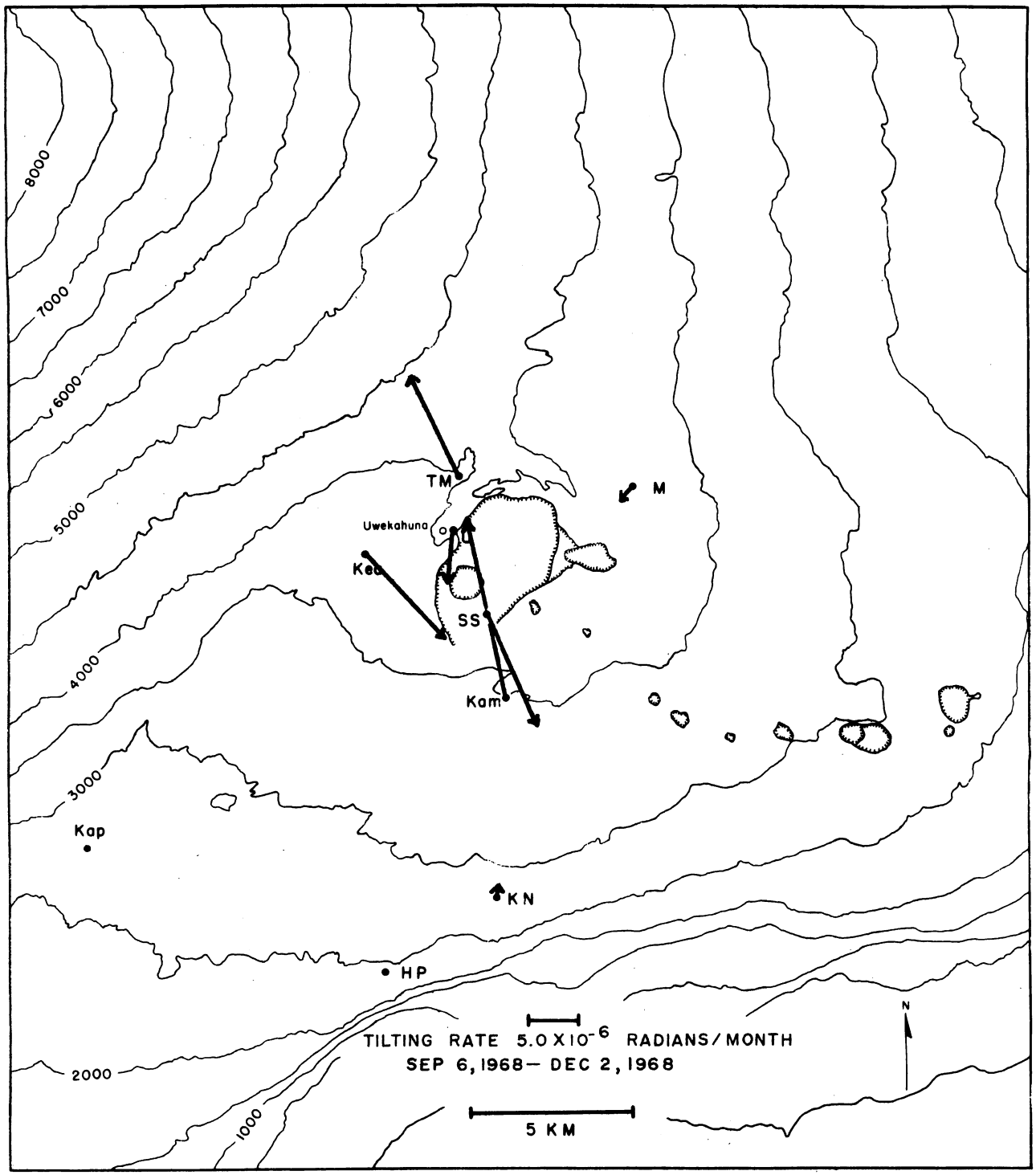

Figure 2.--Tilting of the ground around Kilauea Caldera between September 6, 1968, and December 2, 1968. The vector depicting tilting at a given tilt base points in the direction of maximum relative subsidence and has a length proportional to the rate of tilting during the measurement interval. Closed circles represent field tilt bases; open circle, short-base water-tube tiltmeters. See table 2 for explanation of abbreviations.

Seismic summary

Events recorded by the U.S. Geological Survey seismograph network in Hawaii fall into two categories: Local earthquakes and tremor originating in the region of the Hawaiian Islands (usually within 100 km of at least one seismograph), and distant earthquakes originating more than 3,000 km from Hawaii. As an index of seismic activity at Hawaiian volcanoes, daily counts of earthquakes and minutes of tremor recorded by seismographs in Hawaii are listed in table 3. The earthquakes are separated in groups on the basis of region of origin as determined by analysis of records obtained daily at the observatory (U, M, Mx, A, D, N, WP, MP, Kx, O,). Earthquakes of magnitude 2.0 or greater are generally sufficiently well recorded to be located with greater precision; they are listed individually in table 4.

Location of and essential data on each seismograph station are listed in table 5 in the first-quarter issue each year.

Acknowledgments

Several people or agencies reported "felt" earthquakes during the 4th quarter, 1968. Their assistance is gratefully acknowledged.

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera

Tremor is separated into three categories: deep, intermediate, and shallow, on the basis of relative amplitudes on seismographs in the summit region. Unless otherwise stated, tremor is presumed to be associated with movement of magma within the central complex of Kilauea.

Earthquake categories are: Kilauea summit, 30 km, earthquakes from a source about 30 km beneath the Kilauea summit region; long-period, earthquakes characterized by low-frequency waves that originate about 5 km beneath Kilauea summit; and shallow earthquakes in the Kilauea Caldera region; shallow earthquakes along the SW. rift zone of Kilauea and the adjacent portion of the Kaoiki fault system; earthquakes along the eastern half of Kilauea's east rift zone--detected largely on the Pahoa seismograph; earthquakes from the upper east rift zone and the adjacent fault systems of Kilauea's south flank; and earthquakes from other regions: west Hawaii, Mauna Kea, etc.

Date (1968)	Tremor (m = minutes h = hours)			Earthquakes							
				Kilauea Summit			SW rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Other
	Deep	Inter-mediate	Shallow	30KM	Long Period	Shallow					
October 1	.	4m	.	4	.	107	9	1	31	10	
2	.	.	.	3	.	175	27	.	40	7	2
3	.	7m	.	1	.	98	7	.	36	7	
4	5m	.	.	1	.	84	12	.	43	3	
5	.	34m	.	2	.	77	17	.	57	.	
6	2m	.	.	2	.	87	14	.	63	3	
7	.	.	.	.	.	.	.	--	.	.	
8	.	.	24h	.	.	.	.	--	.	.	
9	.	.	24h	.	.	19	11	--	224	1	2
10	.	.	24h	2	.	10	2	--	.	.	
11	.	.	24h	.	.	.	.	--	.	.	
12	.	.	24h	.	.	.	.	--	.	.	
13	.	.	24h	.	.	19	.	.	33	3	

October 14	.	.	24h	.	.	22	.	.	7	4	
15	3	.	24h	.	.	27	.	.	66	8	1
16	.	.	24h	.	.	13	.	.	22	3	
17	.	12m	24h	.	.	20	.	1	34	4	1
18	.	.	24h	1	.	15	.	.	29	1	
19	.	.	24h	.	.	30	.	.	23	3	
20	.	.	24h	.	.	15	.	.	14	2	
21	.	.	24h	.	.	24	.	.	16	1	
22	25m	.	.	.	.	.	.	.	10	6	1
23	.	.	24h	.	.	30	.	.	22	2	
24	.	.	24h	4	.	64	5	.	17	7	
25	20m	.	24h	.	.	53	16	.	19	4	1
26	.	.	24h	1	.	35	25	.	20	3	1
27	.	6m	24h	4	.	45	23	.	.	.	1
28	.	13m	24h	2	.	29	12	.	32	2	1
29	3m	.	24h	3	.	26	5	.	11	5	
30	.	6m	24h	2	.	35	34	.	16	9	
31	.	.	24h	15	.	10	22	.	13	2	

Oct. 7-21, volcanic activity between Kane Nui O Hamo and Napau Crater. Weak harmonic tremor continued to record for several weeks after the end of surface activity.

November 1	.	.	24h	4	.	19	42	.	20	4	
2	.	.	24h	5	.	22	12	.	18	2	1
3	2m	.	24h	4	.	16	10	.	19	3	
4	.	.	24h	2	.	11	9	.	16	3	
5	.	.	24h	2	4	32	6	.	19	2	1
6	.	.	24h	1	14	13	18	.	15	1	
7	.	.	24h	8	75	21	22	.	24	7	
8	.	.	24h	3	31	143	14	.	47	.	
9	.	.	24h	.	25	172	20	.	10	2	
10	.	.	24h	1	26	165	23	.	17	.	
11	33m	.	24h	.	4	139	12	1	16	8	2
12	14m	.	24h	3	.	90	10	.	13	4	
13	13m	.	24h	6	.	189	16	.	58	1	
14	26m	.	.	9	.	265	2	.	38	5	
15	17m	.	.	.	.	182	9	.	13	3	
16	15m	.	.	.	.	205	10	.	9	4	1

Table 3.--Number of earthquakes and minutes of tremor recorded on seismographs around Kilauea Caldera--Continued

Date (1968)	Tremor (m = minutes h = hours)			Earthquakes							
				Kilauea Summit			SW rift and Kaoiki	Eastern east rift	Upper east rift	Koae	Other
	Deep	Inter-mediate	Shallow	30KM	Long Period	Shallow					
November 17	10m	.	.	3	.	195	14	.	15	11	
18	34m	.	.	1	.	132	18	1	13	6	2
19	31m	.	.	14	.	148	27	1	10	5	1
20	37m	.	.	2	.	113	34	.	12	5	2
21	13m	.	.	8	.	120	16	.	7	3	
22	65m	.	.	3	.	94	33	.	15	1	
23	18m	.	.	1	.	108	29	.	11	4	
24	2m	.	.	6	.	169	22	.	14	5	
25	12m	.	.	2	.	74	18	.	24	3	2
26	40m	.	.	1	.	75	41	.	31	3	1
27	24m	.	.	5	.	90	51	.	25	6	
28	18m	.	.	.	.	65	18	.	27	2	1
29	26m	.	.	2	5	81	18	.	20	1	1
30	.	.	.	2	3	81	13	.	16	6	1
December 1	3m	.	.	5	4	95	14	.	18	5	
2	.	.	.	14	.	85	13	2	14	2	1
3	.	.	.	6	.	.	10	.	14	.	1
4	.	.	.	2	.	102	12	.	14	6	
5	.	.	.	2	.	154	18	.	11	7	
6	.	.	.	6	.	124	24	.	28	2	1
7	.	.	.	.	.	68	6	.	17	2	
8	.	.	.	4	3	64	12	1	22	2	
9	.	.	.	3	.	105	36	.	24	1	
10	.	.	.	5	.	149	25	1	22	5	2
11	21m	.	.	5	.	149	28	.	22	4	

December 12	.	.	.	3	.	111	13	.	7	4	
13	.	.	.	3	.	127	27	.	24	.	3
14	.	.	.	1	.	106	36	.	18	4	1
15	.	.	.	.	.	59	13	.	12	3	
16	.	.	.	.	.	99	7	.	117	1	
17	.	.	60m	.	.	87	8	.	31	6	
18	.	.	.	1	.	91	7	.	15	4	
19	.	.	.	.	3	82	9	1	42	3	1
20	.	.	.	.	.	79	13	.	25	.	
21	.	.	.	.	.	87	43	.	16	1	
22	.	.	.	1	.	129	39	.	28	2	1
23	.	.	.	1	.	70	36	.	33	1	1
24	3m	.	.	8	.	96	54	.	23	5	1
25	.	.	.	6	.	123	33	.	19	3	
26	.	.	.	1	.	81	40	.	23	3	
27	.	6m	.	.	.	121	17	.	17	3	3
28	.	6m	.	5	2	104	18	.	10	5	
29	.	.	.	2	13	117	33	1	43	3	2
30	2m	13m	.	2	2	145	31	.	32	2	
31	.	8m	.	1	.	123	30	.	29	2	1

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Entries for a given quake are: Date, origin time (Hawaiian Standard Time), magnitude, depth, epicenter, and felt report. All earthquakes of magnitude 2.5 and larger, as well as many favorably located smaller ones, occurring on or near the island of Hawaii are included in the list.

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
October 1	13-56-24.5	2.4	8	19°21.2'	155°01.7'	5 km W W of Kalapana	
1	19-11-10.7	2.1	30	19°22.7'	155°18.4'	4 km W of Ahua seismometer	
1	19-46-17.0	2.0	8	19°17.4'	155°11.1'	4 km NE of Apua Point	
2	02-10-04.8	3.3	8	19°18'	156°46'	93 km WSW of Kealakekua	
2	12-59-38.5	2.0	5	19°25.0'	155°25.8'	10 km NW of Desert seismometer	
2	21-54-30.4	2.0	0	19°21.1'	155°44.7'	17 km ESE of Hookena	
3	18-26-54.4	2.5	8	19°25.5'	155°25.2'	10 km NW of Desert seismometer	
4	20-40-28.5	2.5	9	19°20.8'	155°06.3'	7 km SE of Makaopuhi seismometer	
4	22-32-56.6	2.5	15	19°24.8'	155°17.7'	Kilauea Caldera	
6	08-29-01.8	2.4	30	19°22.2'	155°17.1'	2 km W of Ahua seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
October	6	11-59-51.8	2.0	10	19°21.2'	155°08.8'	3 km SE of Makaopuhi seismometer	
	7	11-00-59.7	2.2	3	19°22.5'	155°11.3'	3 km NW of Makaopuhi seismometer	
	7	11-04-59.3	2.2	4	19°22.5'	155°11.0'	2 km NW of Makaopuhi seismometer	
	7	11-36-21.2	2.3	5	19°21.9'	155°12.3'	4 km W of Makaopuhi seismometer	
	7	11-57-14.8	2.1	5	19°22.1'	155°12.6'	5 km W of Makaopuhi seismometer	
	7	13-52-26.7	2.1	5	19°22.7'	155°08.3'	4 km NE of Makaopuhi seismometer	
	7	14-24-43.2	2.2	4	19°22.7'	155°09.0'	2 km NE of Makaopuhi seismometer	
	7	14-36-31.3	2.7	6	19°21.4'	155°10.9'	2 km SW of Makaopuhi seismometer	
	7	16-27-54.0	2.7	7	19°22.7'	155°10.4'	2 km NW of Makaopuhi seismometer	
	7	18-25-09.0	2.2	2	19°23.3'	155°08.1'	4 km NE of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
October	7	18-40-26.6	2.0	2	19°23.8'	155°08.3'	5 km NE of Makaopuhi seismometer	
	7	19-00-29.2	2.5	2	19°23.7'	155°07.3'	6 km NE of Makaopuhi seismometer	
	7	19-04-06.1	2.5	1	19°24.7'	155°08.8'	6 km NE of Makaopuhi seismometer	
	7	19-12-41.4	2.7	5	19°23.3'	155°08.5'	4 km NE of Makaopuhi seismometer	
	7	19-21-29.7	2.4	0	19°21.2'	155°09.0'	2 km SE of Makaopuhi seismometer	
	7	19-54-26.0	2.1	3	19°23.7'	155°07.8'	5 km NE of Makaopuhi seismometer	
	7	20-00-55.6	2.2	4	19°23.1'	155°08.0'	5 km NE of Makaopuhi seismometer	
	7	20-29-12.1	2.0	3	19°23.2'	155°07.7'	5 km NE of Makaopuhi seismometer	
	7	20-46-19.0	2.1	5	19°22.8'	155°09.0'	3 km NE of Makaopuhi seismometer	
	7	22-18-22.0	2.2	4	19°24.8'	155°16.9'	Kilauea Caldera	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
October	8	00-10-10.8	2.0	4	19°22.8'	155°07.3'	5 km NE of Makaopuhi seismometer	
	8	00-28-25.5	2.1	3	19°24.8'	155°17.4'	Kilauea Caldera	
	8	01-14-22.5	2.4	4	19°23.4'	155°07.3'	5 km NE of Makaopuhi seismometer	
	8	01-36-51.1	2.7	5	19°23.2'	155°08.6'	3 km NE of Makaopuhi seismometer	
	8	01-39-55.2	2.7	4	19°23.0'	155°07.9'	4 km NE of Makaopuhi seismometer	
	8	01-46-42.7	2.1	5	19°22.8'	155°08.8'	3 km NE of Makaopuhi seismometer	
	8	03-20-25.9	2.1	6	19°23.3'	155°08.7'	3 km NE of Makaopuhi seismometer	
	8	03-41-38.4	2.0	5	19°23.2'	155°08.3'	4 km NE of Makaopuhi seismometer	
	8	04-10-41.8	2.2	5	19°22.8'	155°08.2'	3 km NE of Makaopuhi seismometer	
	8	04-10-43.0	2.0	3	19°23.0'	155°08.3'	3 km NE of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
October	8	04-18-43.0	2.0	3	19°23.0'	155°08.3'	3 km NE of Makaopuhi seismometer	
	8	04-57-49.1	2.5	5	19°22.9'	155°07.5'	5 km NE of Makaopuhi seismometer	
	8	05-19-55.5	2.2	2	19°23.3'	155°06.9'	6 km NE of Makaopuhi seismometer	
	8	05-39-05.6	2.1	5	19°22.3'	155°08.0'	4 km NE of Makaopuhi seismometer	
	8	06-14-38.0	2.4	3	19°23.1'	155°06.9'	6 km NE of Makaopuhi seismometer	
	8	07-06-25.6	2.6	9	19°18.8'	155°07.8'	9 km NE of Apua Point	
	8	07-20-31.5	2.1	2	19°23.1'	155°07.8'	5 km NE of Makaopuhi seismometer	
	8	07-40-24.8	2.1	2	19°23.2'	155°06.2'	7 km NE of Makaopuhi seismometer	
	8	07-46-35.1	2.4	4	19°22.8'	155°07.7'	5 km NE of Makaopuhi seismometer	
	8	08-23-03.5	2.5	6	19°22.9'	155°07.5'	5 km NE of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
October	8	08-49-22.7	2.1	5	19°23.1'	155°08.3'	4 km NE of Makaopuhi seismometer	
	8	08-54-44.4	2.1	5	19°23.0'	155°07.8'	5 km NE of Makaopuhi seismometer	
	8	09-24-23.3	2.1	5	19°22.8'	155°08.8'	3 km NE of Makaopuhi seismometer	
	8	11-02-39.3	2.1	4	19°23.0'	155°07.7'	5 km NE of Makaopuhi seismometer	
	8	11-31-39.2	2.0	4	19°22.9'	155°08.0'	4 km NE of Makaopuhi seismometer	
	8	12-31-52.5	2.4	3	19°23.2'	155°07.2'	5 km NE of Makaopuhi seismometer	
	8	12-39-05.8	2.5	6	19°22.7'	155°08.4'	3 km NE of Makaopuhi seismometer	
	8	12-45-57.3	2.0	3	19°22.9'	155°08.6'	3 km NE of Makaopuhi seismometer	
	8	17-24-09.6	2.1	4	19°22.9'	155°08.0'	4 km NE of Makaopuhi seismometer	
	8	17-40-55.4	2.0	3	19°23.1'	155°07.8'	5 km NE of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date		Time	Magnitude	Depth (km)	Epicenter			Felt Report
		h m s			Lat. N.	Long. W.	Description	
October	8	22-07-17.1	2.1	4	19°23.2'	155°07.8'	5 km NE of Makaopuhi seismometer	
	9	06-31-50.4	2.0	2	19°22.7'	155°08.0'	4 km NE of Makaopuhi seismometer	
	9	13-39-57.5	2.4	30	19°23.3'	155°16.2'	2 km S of Kilauea Caldera	
	9	22-32-40.2	2.7	10	19°13.0'	155°06.9'	10 km SE of Apua Point	
	9	23-27-55.8	2.2	3	19°20.4'	155°17.8'	5 km SW of Ahua seismometer	
	9	23-30-58.8	2.0	3	19°20.8'	155°17.8'	5 km SW of Ahua seismometer	
	10	17-34-17.1	3.3	9	19°13.9'	155°05.9'	10 km SE of Apua Point	
	14	06-09-54.0	2.0	8	19°24.0'	155°24.3'	7 km NW of Desert seismometer	Pahala
	15	12-05-03.7	2.5	0	19°30.3'	155°48.0'	13 km ESE of Kealakekua	
	17	11-41-52.3	2.5	10	19°22.1'	155°01.0'	5 km NW of Kalapana	
	17	20-06-39.6	2.5	10	19°21.2'	155°06.6'	6 km E of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
October 17	22-51-20.1	2.7	3	19°45.1'	155°44.2'	10 km ESE of Puu Waawaa	
18	17-23-38.8	2.4	30	19°23.0'	155°16.9'	2 km S of Kilauea Caldera	
21	09-53-42.7	2.3	9	19°19.8'	155°08.3'	5 km SE of Makaopuhi seismometer	
22	11-58-27.1	2.0	5	19°09.4'	155°03.3'	18 km SE of Apua Point	
25	14-47-09.9	3.7	8	19°19.9'	155°30.6'	5 km SW of Pahala	Milolii, Pahala, South Point, Hilo
25	21-13-38.6	2.4	10	19°16.3'	155°10.8'	2 km NE of Apua Point	
26	15-20-36.7	2.4	7	19°23.9'	155°26.1	8 km NW of Desert seismometer	
26	16-22-03.2	2.5	9	19°20.0'	155°08.4'	5 km SE of Makaopuhi seismometer	
26	16-31-57.0	2.0	3	19°36.4'	156°06.0'	21 km NW of Kealakekua	
27	13-50-27.3	2.3	3	19°22.3'	155°00.4'	4 km NW of Kalapana	
27	22-00-07.6	2.3	10	19°49.2'	155°26.9'	Near Mauna Kea Summit	
28	14-58-53.0	2.0	0	19°27.2'	155°47.9'	15 km SE of Kealakekua	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
October 28	21-39-08.7	2.1	10	19°19.0'	155°13.0'	7 km NW of Apua Point	
29	05-10-01.2	2.5	6	19°24.4'	155°27.0'	10 km NW of Desert seismometer	
November 2	07-31-24.4	2.0	8	19°22.9'	155°27.8'	9 km NW of Desert seismometer	
2	09-03-20.6	2.0	9	19°19.0'	155°13.7'	8 km NW of Apua Point	
2	15-39-54.8	2.6	13	19°55'	156°20'	35 km NW of Keahole Point	
3	06-53-27.2	2.0	8	19°26.3'	155°24.7'	6 km SW of Mauna Loa seismometer	
3	10-02-42.3	2.3	9	19°19.8'	155°09.0'	4 km SE of Makaopuhi seismometer	
3	20-29-28.8	2.1	30	19°23.0'	155°16.7'	2 km S of Kilauea Caldera	
5	09-41-19.5	2.6	0	19°28.2'	155°50.5'	10 km SE of Kealakekua	
10	10-28-45.4	3.3	7	19°24.5'	155°29.4'	13 km NW of Desert seismometer	Pahala
10	20-53-42.1	2.0	20	19°25.7'	155°17.0'	Kilauea Caldera	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
November 11	05-33-54.9	2.2	8	19°12.3'	155°27.8'	2 km NE of Pahala	
11	10-39-23.2	2.5	8	19°11.9'	155°27.1'	3 km E of Pahala	
11	11-11-22.8	2.2	9	19°22.4'	155°06.1'	7 km E of Makaopuhi seismometer	
11	14-34-20.9	2.9	10	19°20.5'	155°02.5'	7 km SW of Kalapana	
12	14-45-23.5	2.7	8	19°25.8'	155°24.0'	7 km S of Mauna Loa seismometer	
14	00-27-44.1	2.0	9	19°21.8'	155°04.1'	9 km WNW of Kalapana	
15	00-41-14.7	2.6	10	19°11.2'	155°26.8'	4 km SE of Pahala	
15	14-16-44.5	2.5	8	19°23.2'	155°25.7'	7 km NW of Desert seismometer	Pahala
16	04-05-40.1	2.6	0	19°30.3'	155°46.9'	13 km E of Kealakekua	
18	02-03-37.8	2.9	0	19°13.3'	155°36.6'	14 km NW of Pahala	
18	19-34-21.8	2.4	9	19°22.7'	155°03.7'	9 km NW of Kalapana	
18	21-06-41.2	2.0	8	20°48'	155°09'	85 km NE of Honokaa	
18	23-52-59.0	4.3	7	19°13.3'	154°58.0'	15 km S of Kalapana	Hilo

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
November 18	23-56-52.3	2.3	7	19°12.7'	154°58.1'	16 km S of Kalapana	
19	20-43-21.1	3.7	30	19°22.8'	155°18.0'	3 km SW of Kilauea Caldera	Island-wide
19	21-17-21.1	2.4	0	19°22.1'	155°47.6'	12 km ESE of Hookena	Naalehu
19	21-21-31.7	2.5	30	19°22.8'	155°17.8'	3 km SE of Kilauea Caldera	
19	22-21-32.6	2.8	9	19°12.0'	154°58.9'	17 km S of Kalapana	
20	09-08-36.9	2.8	35	19°04.7'	155°28.8'	12 km E of Naalehu	
20	11-04-03.2	2.5	3	19°33.6'	155°44.8'	19 km ENE of Kealakekua	
21	01-36-19.4	2.2	8	19°13.9'	155°00.3'	14 km SW of Kalapana	
22	07-03-12.1	2.4	9	19°19.1'	155°02.3'	9 km SW of Kalapana	
22	13-46-26.6	2.5	8	19°26.4'	155°25.5'	7 km SW of Mauna Loa seismometer	
25	05-20-41.8	2.8	8	19°55.0'	155°37.0'	8 km NE of Waikii	
25	16-46-00.4	2.9	8	19°12.0'	154°58.0'	18 km S of Kalapana	
26	02-41-15.5	2.3	8	19°13.1'	155°33.9'	10 km NW of Pahala	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
November 26	19-40-59.3	2.7	5	19°22.7'	155°26.7'	7 km NW of Desert seismometer	
27	02-29-06.1	2.5	10	19°20.0'	155°08.7'	4 km SE of Makaopuhi seismometer	
28	01-36-16.0	2.5	7	19°14.5'	155°34.4'	11 km NW of Pahala	
28	02-37-34.2	2.3	9	19°21.7'	155°04.3'	10 km E of Makaopuhi seismometer	
28	06-42-03.3	2.3	8	19°22.0'	155°24.5'	4 km NW of Desert seismometer	
28	15-40-18.8	2.0	8	19°25.6'	155°24.7'	8 km SW of Mauna Loa seismometer	
28	21-25-41.3	2.1	9	19°19.4'	155°11.7'	7 km N of Apua Point	
29	03-11-33.9	2.2	8	19°24.5'	155°26.0'	9 km NW of Desert seismometer	
29	10-11-40.5	2.3	8	19°36.7'	156°05.0'	10 km SW of Kailua	
29	13-30-06.6	2.4	30	19°21.8'	155°16.9'	2 km SW of Ahua seismometer	
29	20-11-46.6	2.1	7	19°23.3'	155°22.8'	6 km NE of Desert seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
November 30	08-44-37.8	2.0	10	19°19.2'	155°13.0'	7 km NW of Apua Point	
30	18-19-42.4	2.4	30	19°24.1'	155°14.9'	SE rim of Kilauea Caldera	
30	19-16-31.4	2.2	0	19°26.6'	155°47.2'	16 km SE of Kealakekua	
December 2	10-31-01.8	2.3	3	19°31.8'	155°05.3'	4 km SE of Mountain View	
2	10-38-33.5	2.9	30	19°23.2'	155°16.8'	2 km S of Kilauea Caldera	
2	10-41-47.8	2.1	30	19°23.2'	155°16.8'	2 km S of Kilauea Caldera	Pahala
2	21-47-38.6	2.6	30	19°22.7'	155°17.8'	3 km SW of Kilauea Caldera	
3	06-01-49.9	2.0	8	19°20.8'	155°11.2'	3 km SW of Makaopuhi seismometer	
3	13-10-31.7	2.4	3	19°11.8'	155°35.1'	11 km W of Pahala	
4	11-17-30.7	2.4	8	19°26.1'	155°28.0'	11 km SW of Mauna Loa seismometer	
6	19-38-24.5	2.9	8	19°55.3'	155°28.8'	19 km SW of Paauilo	
7	04-09-37.9	2.2	10	19°19.3'	155°13.0'	8 km NW of Apua Point	
7	10-11-29.1	2.0	10	19°19.9'	155°11.8'	8 km N of Apua Point	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
December 8	05-09-40.2	2.8	10	19°21.6'	155°04.8'	9 km E of Makaopuhi seismometer	
8	06-51-00.8	2.3	10	19°21.7'	155°04.6'	10 km E of Makaopuhi seismometer	
10	01-55-18.9	2.0	13	19°47'	156°09'	10 km NW of Keahole Point	
10	13-07-02.9	2.0	40	19°30.5'	155°16.4'	9 km N of Kilauea Caldera	
10	19-40-53.4	2.7	9	19°21.1'	155°05.7'	8 km SE of Makaopuhi seismometer	
10	20-11-01.2	2.2	45	19°10.1'	155°23.2'	7 km NE of Palima Point	
11	14-08-13.5	2.0	8	19°25.5'	155°30.8'	15 km SW of Mauna Loa seismometer	
12	05-30-02.6	2.0	9	19°18.9'	155°14.8'	8 km NW of Apua Point	
13	06-38-54.5	3.3	8	20°47'	156°57'	55 km W of Haleakala, Maui	
13	15-25-29.6	2.7	0	19°21.3'	155°48.5'	10 km SE of Hookena	
13	19-30-48.8	2.0	13	19°38'	156°29'	60 km WNW of Kealakekua	
14	03-00-18.3	2.1	8	19°50.6'	155°37.7'	3 km SE of Waikii	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
December 15	00-07-12.1	2.7	9	19°14.6'	155°11.8'	2 km S of Apua Point	
16	16-33-03.5	4.7	10	19°19.9'	155°12.3'	5 km SW of Makaopuhi seismometer	Island-wide
19	00-41-13.6	2.7	8	19°26.1'	155°24.6'	8 km SSW of Mauna Loa seismometer	
19	22-16-11.1	3.5	9	19°20.2'	155°06.8'	7 km SE of Makaopuhi seismometer	Hilo, Kilauea Summit Area, Pahala
20	01-42-02.6	2.3	9	19°19.8'	155°11.9'	5 km SW of Makaopuhi seismometer	
20	15-26-59.2	2.6	8	19°22.8'	155°26.7'	8 km NW of Desert seismometer	
22	00-39-54.7	2.3	0	19°48.0'	156°06.0'	8 km NW of Keahole Point	
22	23-28-29.2	2.1	7	19°25.2'	155°25.9'	11 km NW of Desert seismometer	
23	01-09-16.6	2.3	8	19°26.2'	155°24.4'	7 km SSW of Mauna Loa seismometer	
23	03-37-45.8	2.4	9	19°20.0'	155°07.7'	5 km SE of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
December 23	12-09-58.2	2.4	0	19°40.0'	156°01.8'	5 km NW of Kailua	
23	16-03-01.1	2.1	35	19°24.3'	155°07.6'	6 km NE of Makaopuhi seismometer	
23	16-49-24.1	2.0	8	19°23.9'	155°28.1'	11 km NW of Desert seismometer	
24	17-44-35.2	2.2	8	19°24.3'	155°25.2'	8 km NW of Desert seismometer	
24	20-32-12.0	2.3	0	19°26.8'	155°48.0'	15 km SE of Kealakekua	
25	04-28-04.7	2.0	8	19°26.0'	155°24.7'	7 km SW of Mauna Loa seismometer	
27	13-08-09.0	2.3	8	20°04.5'	155°44.0'	6 km NW of Kamuela	
27	17-12-32.2	3.1	3	19°53.0'	155°38.9'	3 km N of Waikii	
27	23-13-45.5	2.3	3	19°47.9'	155°42.0'	8 km SW of Waikii	
29	07-50-55.5	2.7	8	19°49.2'	155°43.9'	10 km SW of Waikii	
29	17-58-11.7	2.0	8	19°50'	156°10'	15 km NW of Keahole Point	
30	10-17-11.2	2.6	9	19°21.4'	155°05.7'	8 km E of Makaopuhi seismometer	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey

October, November, December 1968

Date	Time	Magnitude	Depth (km)	Epicenter			Felt Report
	h m s			Lat. N.	Long. W.	Description	
December 31	09-35-38.0	3.2	13	20°17.5'	156°00.5'	15 km WNW of Upolu Point	

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