UNITED STATES
DEPARTMENT OF THE INTERIOR
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HAWAIIAN VOLCANO OBSERVATORY

SUMMARY 25

January, February, and March, 1962

By

R. Y. Koyanagi, H. L. Krivoy, and A. T. Okamura

with an introduction by C. K. Wentworth

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Introduction

Of interest to students of Hawaiian volcanism are the various approaches to the natural history of this region. Dr. Chester K. Wentworth of the HVO staff very kindly prepared the following short summary of his more detailed work on the subject of the history of the Hawaiian Volcano Observatory. We are very pleased to present this abstract, therefore, as a guide to historical researches in Hawaiian volcanism. Scientists, as well as the agencies which support them, are quite incidental to the ageless volcanic process. Dr. Wentworth describes the painful--often penurious--circumstances under which workers in Hawaii have labored to examine a minuscule sample of the countless events that have built the volcanoes.

History of the Hawaiian Volcano Observatory

By Chester K. Wentworth

The earliest recording of events and history at Kilauea Volcano was the work of certain individuals among the Protestant missionaries, who first arrived in Hawaii in 1820. There were legends among the Polynesians for the preceding centuries, which were recorded by the missionaries, and also a few notes from the voyages of Cook and Vancouver.

The condition and history of Kilauea first became known to the world through the journals and diaries of certain members of the missionary company who speculated about volcanic behavior at the time when valid accounts were just beginning to be formulated in the rest of the world. There were also the visits of naval expeditions coming to Hawaii with various missions in the first half of the 19th century; these usually visited Kilauea as a favored "world wonder." Several of these expeditions left printed accounts or maps. Later there were specific scientific missions that issued reports.

From the arrival of the missionaries, there were individuals among them who made repeated visits to the volcanoes and developed a comparative narrative. There was a growing facility and permanence of communication. Among the recurrent visitors were those who emphasized the need for a permanent agency and station for observation and analysis of Kilauea. Such suggestions were made for 50

years before the first effective steps were taken by Thomas A. Jaggar to organize local interest by means of the Hawaiian Volcano Research Association and to gain the support of the Massachusetts Institute of Technology. The first continued observations were made by F. A. Perret, in 1911, from temporary buildings on the floor of Kilauea caldera, near the edge of the Halemaumau pit. In early 1912, a permanent observatory building was built, largely with labor and materials donated by the citizens of Hilo, and T. A. Jaggar arrived to take resident charge, with the continued cooperation of H.V.R.A. and M.I.T.

Publication of the Bulletins of the Hawaiian Volcano Observatory was commenced. During the first decade of the Observatory, Perret, and H. O. Wood were observers. Later, in 1919, the sponsorship of the Observatory, with the same staff and facilities, was transferred to the U.S. Weather Bureau. At that time R. H. Finch, who had been with the latter bureau, came out as assistant to Jaggar.

In 1924 came the spectacular steam-blast eruption by which Halemaumau was enlarged to 3,000 feet in diameter and more than 1,300 feet deep. In July 1924 the Observatory control was assumed by the U.S. Geological Survey. After the 1924 explosion, Halemaumau was filled slowly, mostly by small flows coming into the bottom of the shallowing pit. Different techniques continued to be devised for studying the underground activity. In 1935 the Volcano Observatory became a part of the Hawaii National Park with the same objectives as before but with a closer participation in the work of the Park Service.

Dr. Jaggar retired in 1940. During the ensuing several years of the war, Finch, who had succeeded Jaggar as volcanologist, managed to keep active a minimum program of observations. He also preserved intact essential property of the Observatory which otherwise might have been lost in the course of moves made necessary by the burning of the Volcano House hotel and by growth of Park Service activities. Late in 1947, the station was transferred back to the U.S. Geological Survey. Since that time there has been a continued growth of the staff in numbers and skills. The facilities and support have been greatly increased.

The 1950's and early 1960's were marked by several types of activity, adding greatly to the experience of observers of this generation. However, Kilauea being a prodigious uncontrolled phenomenon of irregular habits, it is increasingly evident that only observing and recording events over many human generations, or thousands of years, can build a picture of total activity that will support any presumption to generalize or predict.

Chronological summary

The summit of Kilauea Volcano continued to swell throughout the last quarter of 1961 and the first quarter of 1962. Outward tilting of the ground at the inner ring of tilt-bases (U, TM, Kea, and Kam) averaged about 12 microradians per month from October 8, 1961 to January 5, 1962 (fig. 1) and about 6 microradians per month from January 5, 1962 to March 29, 1962 (fig. 2). The most distant tilt-base, HP, tilted gently toward the caldera during both quarters, while gentle tilting at Kal and KN showed no consistent tilting pattern.

The frequency of feeble shallow earthquakes from the vicinity of Kilauea caldera increased steadily throughout the quarter. From about 20 per day during the last 3 months of 1961, the average daily count of these earthquakes increased to 46, 53, and 83 during January, February, and March, respectively. Earthquakes from the source about 30 km beneath Halemaumau were prominent again during this quarter, averaging nearly 10 per day; the largest number--113--occurred on March 23. In late February another persistent source of earthquakes developed along the southeastern flank of Kilauea. The seismograms of these earthquakes are very difficult to interpret: normal phases, such as S, are very poorly developed, and recorded amplitudes diminish rapidly between the nearest stations (A, N, and U) and the next closest ones (Pa, D, ML, Hi).

Five earthquakes were reported felt during January; all of them were associated with Kilauea Volcano. The largest, of magnitude 4.0, originated 14 km southwest of Pahoa on January 7 and was felt throughout the island. The three earthquakes felt during February all originated about 30 km beneath Kilauea caldera on February 7. The largest earthquake of the month was not felt. It occurred beneath the sea about 35 km southeast of Cape Kumukahi on February 10.

Eight earthquakes were reported felt during March, and all but one of them originated beneath Kilauea. The one exception occurred at a depth of about 15 km beneath Puu Waawaa on March 9. It has a magnitude of about 4.0 and was felt over half of the island. The two largest earthquakes of the month both originated about 30 km beneath Halemaumau and were felt over the entire island. The first, with a magnitude of 4.4, occurred on March 23; the second, with a magnitude of 4.5, occurred on March 30.

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 (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

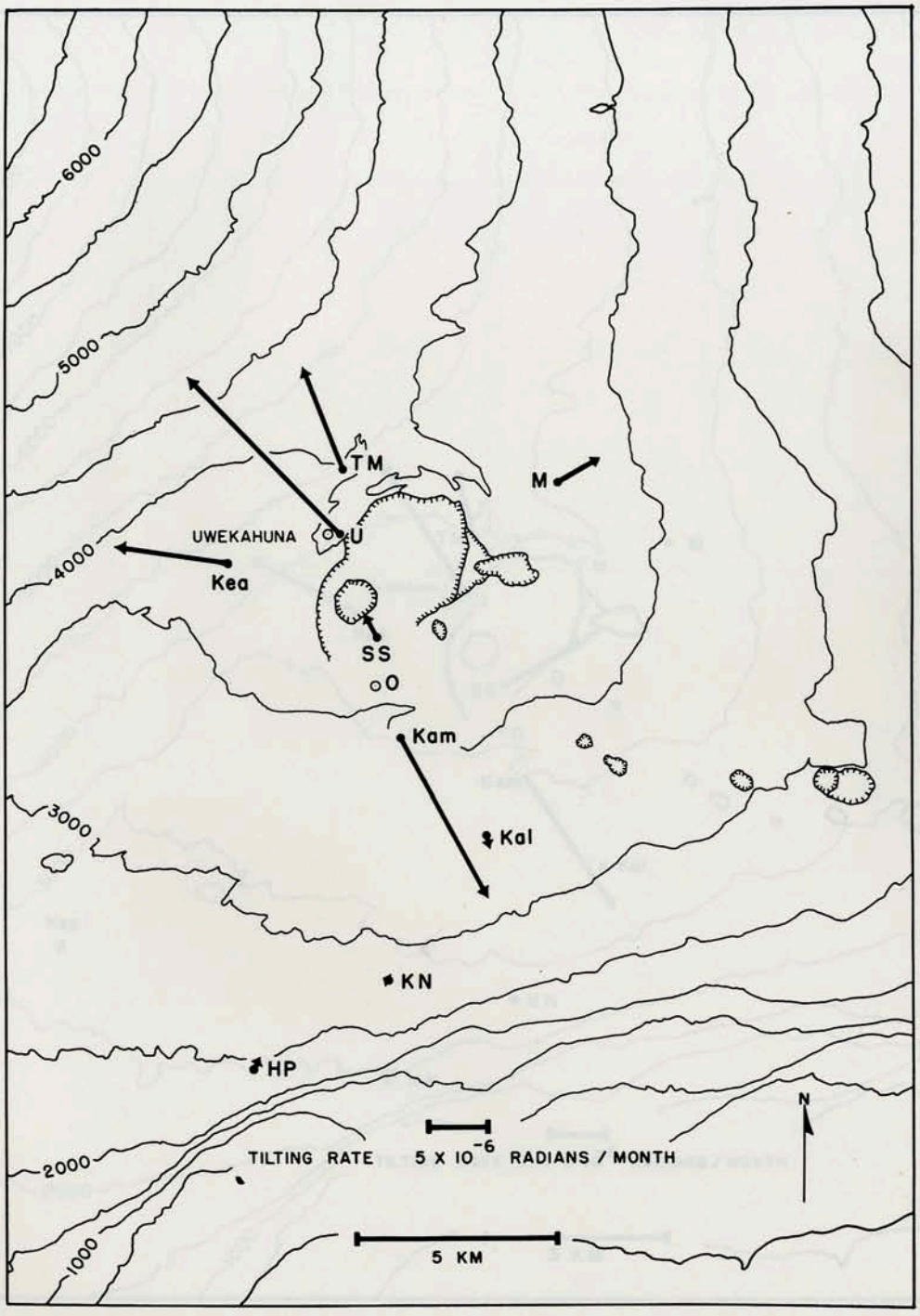

Figure 1.--Tilting of the ground around Kilauea caldera, October 8, 1961, to January 5, 1962. The vector depicting tilting at a given tilt base points in the direction of maximum relative subsidence and has a length proportional to the rate of tilting during the measurement interval. Closed circles represent field tilt bases; open circles, short-base water-tube tiltmeters.

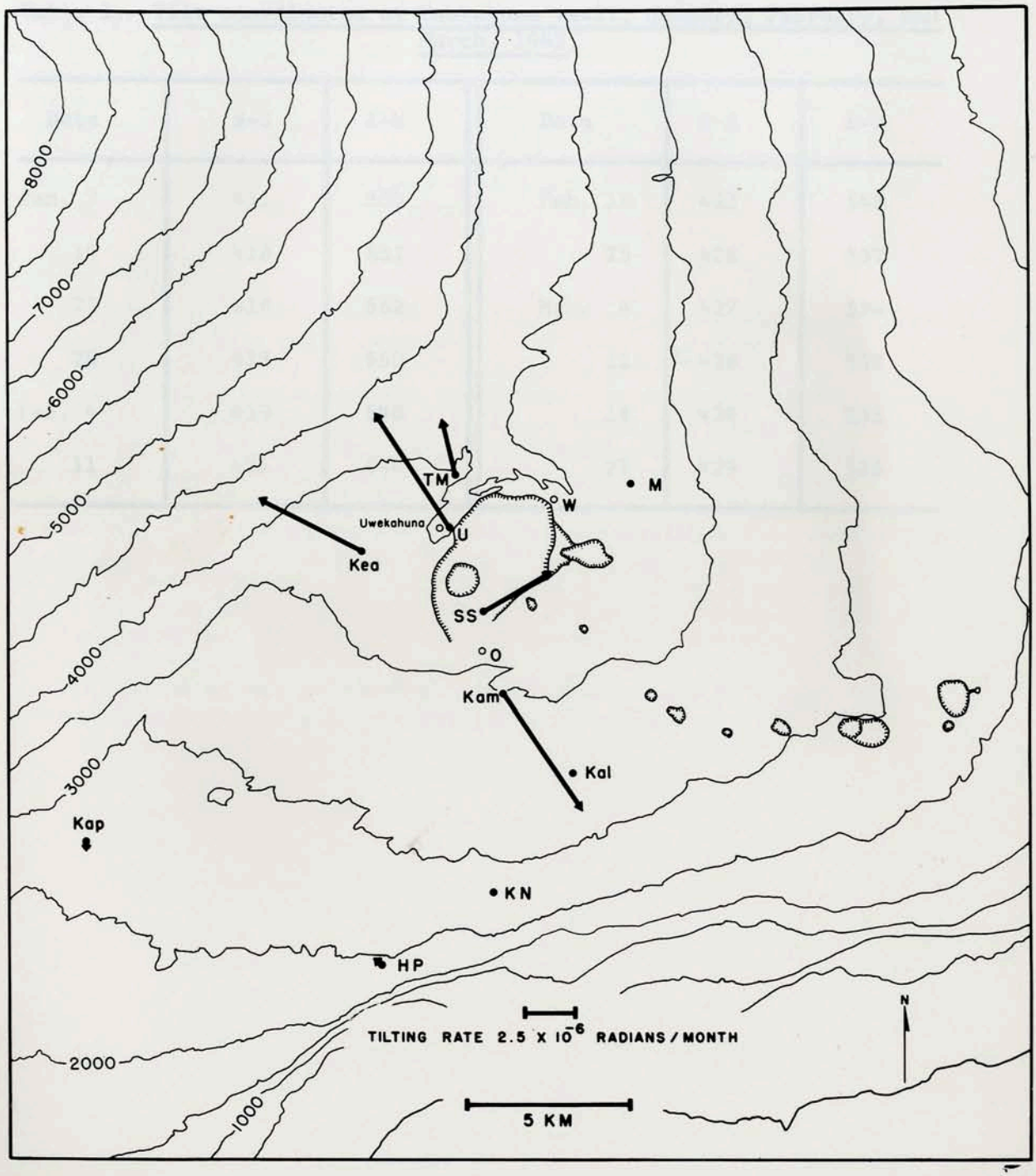

Figure 2.--Tilting of the ground around Kilauea caldera, January 5, 1962, to March 29, 1962. The vector depicting tilting at a given tilt base points in the direction of maximum relative subsidence and has a length proportional to the rate of tilting during the measurement interval. The area covered by this diagram has been increased to include the new tilt base at Kapapala (Kap).

Table 1.--Tilt coordinates at Uwekahuna vault, January, February, and March, 1962

Date	N-S	E-W	Date	N-S	E-W
Jan. 7	411	553	Feb. 18	423	543
14	418	551	25	426	537
21	418	552	Mar. 4	427	536
28	419	550	11	438	537
Feb. 4	419	546	18	429	535
11	421	546	25	429	536

(table 2). 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 1-unit change in coordinate corresponds to a tilting of 1 microradian (1 mm per km) in the direction indicated.

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 farther 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 into groups on the basis of region of origin as determined by analysis of records obtained daily at the Observatory (U, M, A, D, N). Earthquakes of magnitude 2.5 or greater are generally sufficiently well recorded to be located with greater precision; they are listed individually in table 4. Data on identifiable phases from distant earthquakes are listed in table 5.

Locations of the seismograph stations are shown on figure 3, and essential data on the stations are given in table 6.

Table 2.--Tilt coordinates and changes at bases around Kilauea caldera (see figs. 1 and 2)

Tilt base (location)	Date (1962)	Tilt coordinates		Rate (10^{-6} rad/mo) and direction of tilting since last reading		Date of last reading (1961)
		N-S	E-W			
Uwekahuna (19°25.5' N., 155°17.4' W.)	Jan. 2	394.1	531.1	17.3	N. 44° W.	Oct. 6
Tree Molds (19°26.3' N., 155°17.3' W.)	4	412.9	519.4	8.7	N. 22° W.	7
Sand Spit (19°24.1' N., 155°16.8' W.)	9	844.1	693.4	2.0	N. 29° W.	11
Kalihipaa (19°21.4' N., 155°15.3' W.)	5	583.4	422.3	1.1	S. 18° E.	8
Keamoku (19°25.1' N., 155°19.0' W.)	5	447.0	651.0	9.0	N. 82° W.	8
Kamokukolau (19°22.7' N., 155°16.6' W.)	3	733.6	489.0	14.4	S. 29° E.	7
Kipuka Nene (19°19.4' N., 155°16.7' W.)	4	516.7	494.4	0.4	N. 66° W.	9
Hilina Pali (19°18.2' N., 155°18.6' W.)	8	513.7	499.2	1.0	N. 28° E.	9
Mehana (19°26.2' N., 155°14.3' W.)	2	525.7	536.6	3.3	N. 83° E.	10
Kapapala Ranch (19°20.5' N., 155°23.8' W.)	9	501.0	501.4	0.8	N. 55° E.	10

Table 2.--Tilt coordinates and changes at bases around Kilauea caldera (see figs. 1 and 2)

Tilt base (location)	Date (1962)	Tilt coordinates		Rate (10^{-6} rad/mo) and direction of tilting since last reading		Date of last reading (1962)
		N-S	E-W			
Uwekahuna (19°25.5' N., 155°17.4' W.)	Mar. 27	409.2	521.3	6.4	N. 33° W.	Jan. 2
Tree Molds (19°26.3' N., 155°17.3' W.)	27	420.5	517.5	2.8	N. 14° W.	4
Sand Spit (19°24.1' N., 155°16.8' W.)	29	849.2	701.9	3.7	N. 59° E.	9
Kalihipaa (19°21.4' N., 155°15.3' W.)	28	583.2	422.1	0.1	S. 56° W.	5
Keamoku (19°25.1' N., 155°19.0' W.)	29	453.8	637.6	5.4	N. 63° W.	5
Kamokukolau (19°22.7' N., 155°16.6' W.)	28	717.6	499.6	6.8	S. 34° E.	3
Kipuka Nene (19°19.4' N., 155°16.7' W.)	Apr. 5	516.4	494.6	0.1	S. 34° E.	4
Hilina Pali (19°18.2' N., 155°18.6' W.)	4	515.0	498.2	0.6	N. 50° W.	8
Mehana (19°26.2' N., 155°14.3' W.)	-------	------	------	-----	---------	---------
Kapapala Ranch (19°20.5' N., 155°23.8' W.)	Mar. 30	500.0	501.4	0.4	Due south	9

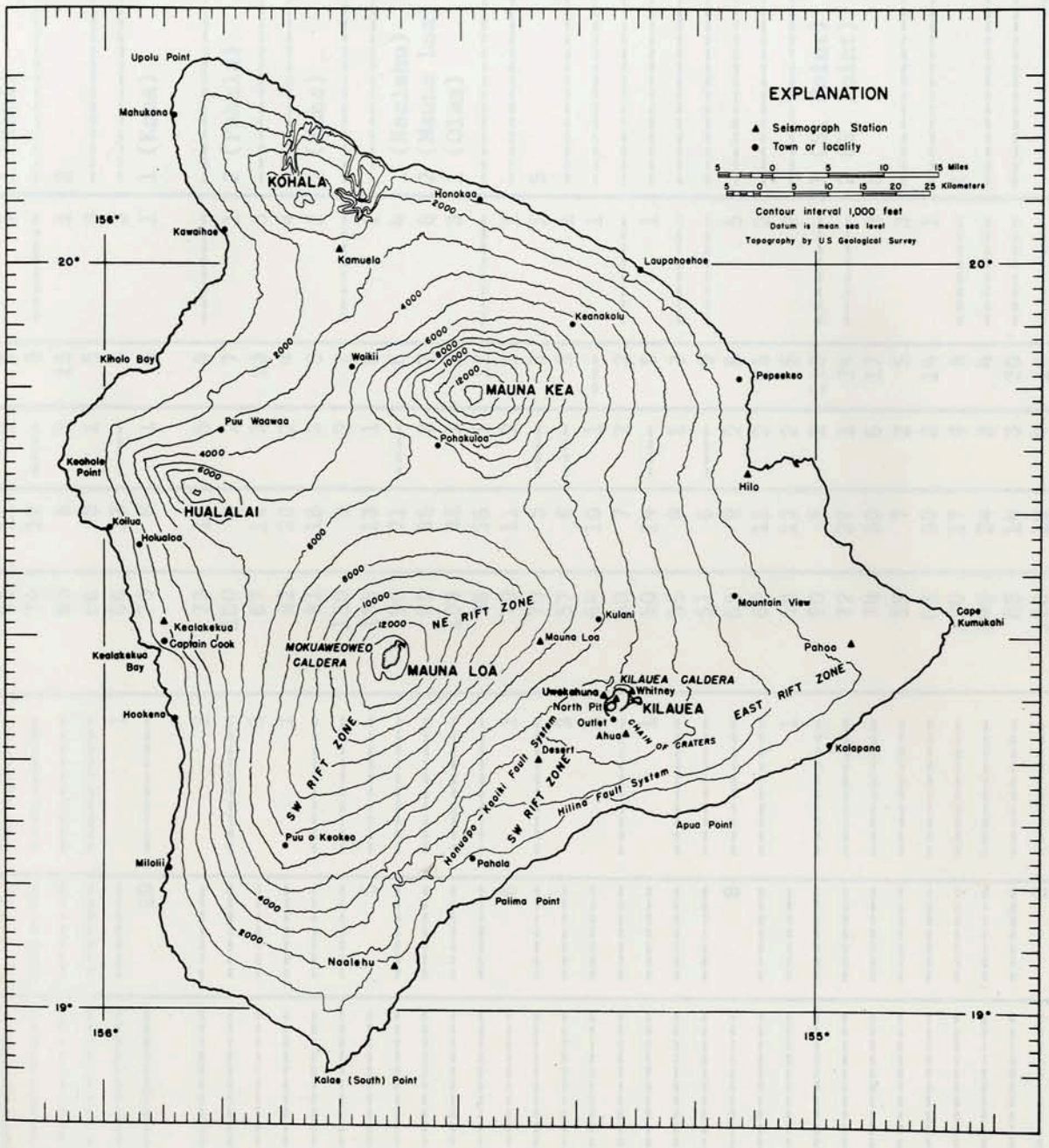

Figure 3.--Map of the island of Hawaii showing seismograph stations operated by the Geological Survey and localities mentioned in the text. Epicenters of local earthquakes are given in terms of geographic coordinates, which are indicated at the edges of the map.

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs around Kilauea caldera (U, M, A, D, and N)

[Tremor is separated into three categories--(1) deep, (2) intermediate, and (3) 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.

Halemaumau rock slides (4) are detected by the characteristic record they produce on the North Pit seismograph.

Earthquake categories are: 5, shallow earthquakes in the Kilauea caldera region;
6, shallow earthquakes along the SW. rift zone of Kilauea and the adjacent portion of the Kaoiki fault system;
7, earthquakes along the eastern half of Kilauea's east rift zone;
8, earthquakes from a source about 30 km beneath Halemaumau;
9, shallow earthquakes along the Kalapana Trail (SE. flank of Kilauea 10 to 15 km W. of Kalapana);
10, earthquakes from other regions: Kona, Mauna Kea, etc.]

Date (1962)	Tremor (in minutes)			Halemaumau slides	Kilauea caldera	SW. rift	E. rift	30 km	Kalapana Trail	Others
	Deep	Intermediate	Shallow							
	1	2	3	4	5	6	7	8	9	10
Jan. 1	----	----------	-------	1	82	10	----	9	--------	----------
2	----	5	-------	----------	88	5	----	18	--------	1
3	----	----------	-------	8	76	20	3	9	--------	----------
4	----	3	-------	8	118	5	4	2	--------	----------
5	----	----------	-------	----------	27	10	13	7	--------	----------
6	----	----------	-------	----------	30	6	8	10	--------	2
7	----	----------	-------	----------	53	6	3	2	--------	----------
8	----	----------	-------	1	41	3	----	5	--------	----------
9	----	----------	-------	----------	33	6	1	7	--------	----------
10	----	----------	-------	----------	40	4	1	6	--------	1
11	----	----------	5	3	41	5	3	7	--------	----------

	13	4	----------	-------	----------	51	5	1	3	--------	1 (Kona)
	14	----	3	9	1	95	7	----	6	--------	3
	15	----	----------	6	----------	81	7	----	3	--------	3
	16	----	----------	-------	----------	35	10	----	3	--------	----------
	17	----	----------	-------	----------	70	8	----	6	--------	1
	18	----	3	-------	----------	4	3	----	2	--------	3 (15 km)
	19	----	----------	8	----------	44	4	2	2	--------	1 (Kona)
	20	----	----------	2	----------	31	8	2	---	--------	----------
	21	----	----------	-------	1	22	8	----	8	--------	----------
	22	----	7	-------	----------	36	4	----	2	--------	1 (Kona)
	23	----	----------	-------	----------	23	10	1	4	--------	1 (Mauna Loa)
	24	----	5	-------	2	30	8	1	17	--------	----------
	25	----	5	-------	----------	45	5	2	3	--------	----------
	26	----	12	-------	----------	22	14	----	16	--------	----------
	27	----	2	-------	----------	27	11	----	4	--------	----------
	28	----	----------	-------	----------	33	8	2	6	--------	1 (Kona)
	29	----	----------	7	----------	31	5	1	5	--------	----------
	30	----	----------	-------	----------	29	6	1	3	--------	----------
	31	----	----------	-------	----------	33	22	----	3	--------	1
Feb.	1	15	----------	-------	2	25	5	4	2	--------	1 (Kona)
	2	----	----------	-------	----------	60	8	4	4	--------	1 (S. Point)
	3	----	----------	-------	1	47	9	----	7	--------	1 (Kona)
	4	----	----------	-------	----------	51	10	----	12	--------	----------
	5	----	4	-------	----------	60	13	1	5	--------	----------
	6	----	2	-------	----------	74	18	1	13	--------	6
	7	----	----------	-------	----------	40	8	1	70	--------	----------
	8	----	----------	-------	----------	35	14	3	3	--------	1 (Kona)
	9	----	----------	3	----------	30	7	----	3	--------	----------
	10	----	2	-------	1	58	3	2	4	--------	3
	11	----	----------	-------	2	59	7	----	7	--------	1 (Kona)
	12	----	3	-------	3	40	10	1	3	--------	----------
	13	----	6	-------	7	45	6	1	3	--------	----------
	14	----	----------	-------	5	44	16	1	3	--------	----------
	15	----	----------	-------	----------	40	14	3	2	--------	3 (Kohala, Kona)
	16	----	----------	-------	1	25	8	----	5	--------	2
	17	----	----------	-------	----------	52	10	1	---	--------	2
	18	----	----------	-------	----------	27	13	----	3	--------	----------
	19	----	----------	-------	----------	33	17	1	3	--------	1 (Kona)
	20	----	----------	-------	----------	52	7	1	3	--------	1 (Mauna Loa)
	21	----	----------	-------	3	70	8	1	4	--------	----------
	22	----	----------	-------	----------	38	----	----	11	2	----------

	23	----	----------	-------	---------	55	11	2	9	1	1 (Maui)
	24	----	----------	-------	---------	70	12	----	3	--------	----------
	25	----	----------	-------	---------	65	8	2	15	1	2
	26	----	----------	-------	---------	66	5	1	5	3	----------
	27	----	----------	-------	1	66	13	----	4	3	----------
	28	----	----------	20	---------	70	8	1	6	1	1 (Kona)
Mar.	1	----	----------	-------	2	73	15	5	4	--------	----------
	2	----	----------	-------	---------	100	9	2	7	1	2 (Pahala)
	3	----	----------	-------	3	67	13	3	23	5	----------
	4	----	----------	-------	1	82	20	2	4	4	----------
	5	----	----------	-------	---------	81	16	3	3	2	1 (Kona)
	6	----	----------	-------	---------	150	9	2	7	--------	----------
	7	----	----------	5	---------	155	13	1	6	2	----------
	8	35	----------	-------	---------	96	21	----	6	4	1 (Naalehu)
	9	----	----------	-------	---------	95	35	3	7	6	2 (Mauna Loa)
	10	----	----------	-------	---------	103	33	1	1	3	1 (Olaa)
	11	----	----------	-------	---------	96	26	1	12	--------	----------
	12	----	----------	6	1	70	11	2	1	1	----------
	13	----	----------	-------	---------	70	5	----	3	1	5
	14	----	----------	-------	3	57	8	----	5	1	----------
	15	----	----------	-------	1	64	10	1	---	1	----------
	16	----	----------	-------	---------	60	7	2	2	--------	----------
	17	----	----------	-------	1	50	14	----	5	1	----------
	18	39	----------	-------	---------	55	9	5	3	--------	----------
	19	----	----------	-------	---------	51	6	----	9	--------	----------
	20	----	----------	8	---------	65	9	2	8	5	----------
	21	----	----------	-------	---------	62	11	2	25	2	----------
	22	----	----------	-------	1	58	12	2	5	2	----------
	23	----	----------	-------	---------	50	5	2	113	--------	1 (S. Point)
	24	----	----------	-------	---------	72	27	1	24	--------	2 (S. Point)
	25	----	----------	-------	---------	74	30	6	17	3	3
	26	----	----------	-------	---------	59	7	2	5	3	----------
	27	----	----------	-------	---------	61	30	2	14	1	----------
	28	----	----------	-------	---------	120	17	8	8	--------	1
	29	----	----------	-------	---------	146	24	3	4	--------	----------
	30	----	----------	-------	---------	85	14	3	20	--------	----------
	31	----	----------	3	---------	160	19	4	10	--------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March, 1962

[Except for smaller earthquakes of special interest, only earthquakes with magnitudes of 2.5 or greater are listed. Origin time is Hawaiian standard.

In the following list some origin times are followed only by "KM 30" and a statement of magnitude. These are all members of a continuing family of quakes noted in other summaries. They were prominent in this quarter and so are listed in this abbreviated fashion. The best mean focus for this group is beneath Halemaumau at a depth of 30 km (19°24.1' N., 155°17.1' W.).

In the Chronological summary another recurrent earthquake type was described. The table of daily events in this quarter has been expanded to include earthquakes of this type, which are listed in column 9 (table 3). In the following list, origin times of these quakes are followed by "KT" (Kalapana Trail). The tentative epicenter for these quakes is 19°20' N., 155°05' W. This location is remote from habitation and traffic, and these quakes are generally not felt. Because they originate at very shallow depths and far from our seismometer concentrations, these quakes are poorly recorded, and the epicenter given above is only approximate]

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Jan. 3	11	51	41.8	3.1	19°27.0'	155°11.7'	12 km ENE. of Uwekahuna seismograph. Felt at Volcano.	25 km deep.
3	18	16	41.6	3.1	19°26.6'	155°12.5'	10 km ENE. of Uwekahuna seismograph. Felt at Volcano.	Do.
4	06	39	55.1	2.8	19°56.5'	155°05.5'	12 km NNE. of Pepeekeo--	12.5 km deep.
5	01	23	35.4	2.8	19°18.8'	155°07.0'	11 km NE. of Apua Point-	3 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Jan. 5	11	57	04.6	3.0	19°23.5'	155°23.2'	7 km N. of Desert seismograph.	3 km deep.
6	05	36	46.3	2.7			KM 30.	
7	01	40	55.1	2.3	19°12.1'	155°13.8'	7 km SW. of Apua Point---	15 km deep.
7	02	57	53.4	4.0	19°24.5'	155°03.1'	14 km SW. of Pahoa. Felt throughout the island.	5 km deep.
7	09	17	27.6	2.7	19°31.1'	155°36.0'	5 km NNW. of Mokuaweoweo caldera.	3 km deep.
7	12	29	29.4	2.9			KM 30.	
8	15	18	17.7	2.5			KM 30.	
9	17	44	22.4	3.0	19°13.2'	155°32.8'	8 km WNW. of Pahala------	12.5 km deep.
10	02	57	50.8	3.0			KM 30.	
10	16	59	52.1	2.9	21°16.0'	155°25.0'	125 km NE of Upolu Point-	----do--------
14	08	10	49.9	2.9	19°30.0'	155°42.2'	22 km ESE. of Kealakekua-	3 km deep.
17	18	58	45.5	2.3	19°20.2'	155°13.3'	7 km SE. of Ahua seismograph.	8 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Jan. 18	17	07	06.5	2.4			KM 30.	
20	03	01	20.3	2.6	19°31.8'	155°42.9'	23 km E. of Kealakekua---	3 km deep.
21	04	05	36.5	3.1	19°23.0'	155°02.0'	7 km NW. of Kalapana-----	50 km deep.
21	16	31	08.9	2.8			KM 30. Felt at Volcano.	
25	07	55	45.9	2.3	19°06.2'	155°45.5'	20 km WNW. of Naalehu----	8 km deep.
26	14	04	23.2	3.3	19°15.8'	155°12.8'	2 km W. of Apua Point. Felt from Hilo to Volcano.	15 km deep.
28	08	21	51.5	3.0	19°35.8'	155°49.8'	13 km NE. of Kealakekua--	3 km deep.
Feb. 1	19	30	08.3	2.5	19°31.0'	154°35.0'	25 km E. of Cape Kumukahi.	12.5 km deep.
3	23	41	25.7	2.0	19°22.8'	155°26.2'	8 km NW. of Desert seismograph.	8 km deep.
4	07	33	26.2	3.0	19°42.2'	155°56.0'	21 km NNW. of Kealakekua-	8 km deep.
6	19	27	26.1	2.2	19°20.7'	155°04.3'	22 km SW. of Pahoa-------	5 km deep.
6	20	49	42.1	2.8	19°22.1'	154°51.7'	17 km SE. of Pahoa-------	8 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Feb. 6	22	49	00.0	2.8	19°50.4'	155°34.4'	30 km SSW. of Honokaa----	3 km deep.
7	01	30	25.2	2.9			KM 30.	
7	06	09	20.3	2.9			KM 30.	
7	10	06	35.2	3.5			KM 30. Felt at Volcano.	
7	10	10	43.0	3.5			KM 30. Felt at Volcano.	
7	10	49	18.3	2.7			KM 30.	
7	11	13	40.9	2.4			KM 30.	
7	11	57	07.4	3.1			KM 30.	
7	15	26	39.3	2.9			KM 30. Felt at Volcano.	
7	15	29	45.0	2.5			KM 30.	
7	20	39	46.5	2.7			KM 30.	
8	16	15	51.8	2.5	19°40.0'	156°32.0'	50 km WSW. of Keahole Point.	8 km deep.
8	16	34	44.6	2.5	19°10.1'	155°22.2'	13 km ESE. of Pahala-----	3 km deep.
10	16	00	46.6	4.0	19°18.2'	154°33.0'	35 km SE. of Cape Kumukahi	Do.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Feb. 11	06	04	32.0	3.0	19°42.7'	156°05.0'	12 km NW. of Kailua------	8 km deep.
11	14	21	52.8	2.8	19°31.3'	155°51.4'	7 km ENE. of Kealakekua--	3 km deep.
14	00	58	25.2	2.5	19°35.2'	155°49.0'	13 km NE. of Kealakekua---	Do.
14	06	31	55.0	2.3	19°24.5'	155°27.6'	12 km SW. of Mauna Loa seismograph.	5 km deep.
15	09	01	21.7	2.9	19°31.6'	155°50.5'	8 km ENE. of Kealakekua--	3 km deep.
15	20	33	44.2	2.6	20°05.1'	155°50.1'	5 km N. of Kawaihae------	12.5 km deep.
15	22	40	44.3	2.7	20°01.5'	155°50.0'	2 km S. of Kawaihae------	8 km deep.
16	07	52	27.5	2.7	19°52.2'	156°00.0'	17 km NE. of Keahole Point.	12.5 km deep.
17	02	47	34.9	2.8			KM 30.	
23	05	01	54.8	2.7			KM 30.	
23	05	51	18.6	2.9	19°12.7'	155°40.7'	19 km NW. of Naalehu-----	8 km deep.
23	16	44	48.1	2.0	19°25.7'	155°29.1'	13 km SW. of Mauna Loa seismograph.	Do.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March, 1962--Continued

Date	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Feb. 23	19	03	59.3	2.8	21°09.0'	155°38.0'	102 km NNE. of Upolu Point	12.5 km deep.
25	12	54	33.0	3.2	19°06.9'	155°37.8'	7 km NW. of Naalehu-------	Do.
25	18	55	10.4	2.7			KT.	
26	22	24	38.7	3.0			KT.	
Mar. 3	02	29	28.0	2.0	19°06.5'	155°21.4'	17 km SE. of Pahala-------	15 km deep.
4	01	32	13.7	2.5			KT.	
4	03	37	58.3	2.7	19°39.2'	154°56.1'	18 km NNE. of Pahoa-------	Do.
6	02	50	33.0	2.7	19°32.0'	155°51.0'	7 km ENE. of Kealakekua---	3 km deep.
8	21	14	43.1	2.6	19°09.6'	155°37.7'	11 km NW. of Naalehu------	12.5 km deep.
9	21	39	02.2	3.3			KT. Felt at Volcano.	
9	23	46	19.0	4.0	19°47.8'	155°50.3'	2 km NNE. of Puu Waawaa. Felt in half the island.	15 km deep.
10	00	24	38.0	2.7			KT.	
10	00	34	56.9	2.3			KT.	
10	21	37	04.4	2.3	19°32.7'	155°07.9'	3 km SW. of Mountain View-	3 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Mar. 12	05	17	06.0	2.7			KM 30.	
15	05	23	45.1	2.7			KT.	
16	23	28	09.9	2.7	19°14.1'	155°37.2'	19 km NNW. of Naalehu----	3 km deep.
18	00	33	45.0	2.4	19°46.0'	156°09.0'	11 km WNW. of Keahole Point.	At shallow depth.
18	04	13	13.7	2.7			KT.	
20	05	55	10.0	2.5			KM 30.	
21	10	04	28.2	2.9			KT.	
21	12	26	52.0	2.7	18°55.2'	155°27.2'	22 km SE. of Naalehu-----	8 km deep.
22	09	30	12.3	2.8			KT.	
22	16	35	42.1	3.4	19°14.3'	154°57.8'	13 km SSE. of Kalapana. Felt at Volcano.	45 km deep.
23	14	56	46.6	4.4			KM 30. Felt throughout the island.	
23	18	47	03.8	3.0			KM 30. Felt at Volcano.	
24	04	16	34.8	2.0	18°57.2'	155°15.6'	38 km ESE. of Naalehu----	12.5 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, January, February, and March, 1962--Continued

Date (1962	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Mar. 24	11	13	27.4	2.5			KM 30.	
24	19	47	53.3	2.9			KM 30. Felt at Volcano.	
27	15	36	10.2	2.5			KT.	
28	15	52	40.0	3.4	19°16.9'	155°13.4'	5 km NW. of Apua Point. Felt at Volcano.	5 km deep.
30	06	42	16.6	2.3	19°21.7'	155°25.7'	5 km NW. of Desert seismograph.	Do.
30	18	15	55.1	4.5			KM 30. Felt throughout the island.	

Table 5.--Distant earthquakes

[Times are reported in Greenwich Civil Time which is 10 hours faster than Hawaiian Standard Time. A "c" following the time of P indicates compressional first motion; a "d" indicates dilatational first motion. Station symbols, locations, and instrumentation are presented in Summary 25. Magnitudes calculated from the Hawaii seismograms are followed by (HVO). Location of epicenter, origin times, and focal depths, and magnitudes reported by other institutions are taken from "Preliminary Determination of Epicenters" published by the U.S. Coast and Geodetic Survey]

Jan. 1

M	Z	eP	02:48:44.3 c
A	Z	eP	02:48:44.0 d
D	Z	eP	02:48:45.2 d
U	Z	eP	02:48:45.7 d

Magnitude 5.7 (HVO).

C&GS card 1-62:
52.3° N., 177.9° E.
02:41:06.0
Rat Islands, Aleutian Islands.
h about 26 km.

Jan. 1

M	Z	eP	23:47:48.0 c
N	Z	eP	23:47:48.3 c
U	Z	eP	23:47:50.3 c
U	PEZ	eR	23:58:02

C&GS card 1-62:
52.4° N., 177.7° E.
23:40:20.3.
Rat Islands, Aleutain Islands.
h about 27 km.

Jan. 4

A	Z	eP	04:46:05.2 c
N	Z	eP	04:46:03.8 c
D	Z	eP	04:46:05.2 c

Jan. 4--Continued

U	Z	eP	04:46:05.2 d
Pa	Z	eP	04:46:06.3 c
Hi	Z	iP	04:46:05.2 d
Na	Z	eP	04:46:03.8 d
Ka	Z	eP	04:46:01.5 d
Ha	Z	eP	04:45:56.2 c
U	PEE	eS	04:55:00
U	PEN	eG	05:01:24
U	PEZ	iR	05:04:00

Magnitude 6.5 (HVO).

C&GS card 1-62:
33.9° N., 135.2° E.
04:35:42.6.
Near Shikoku, Japan.
h about 56 km.
Magnitude 6.0 (Berk).

Jan. 5

U	PEZ	eP	00:31:18
U	PEZ	eS	00:37:38
U	PEN	eL	00:40:33

Magnitude 6.7 (HVO).

Table 5.--Distant earthquakes--Continued

Jan. 5--Continued

C&GS card 4-62:
15.5° S., 177.7° W.
00:23:32.1.
Fiji Islands.
h about 24 km.
Magnitude 6.25 (Pas), 6.25 to 6.5 (Berk).

Jan. 5

U	PEZ	eL	08:24:10.

C&GS card 3-62:
15.5° S., 172.5° W.
08:08:07.5.
Tonga Islands region.
h about 60 km.

Jan. 8

M	Z	eP	01:12:27.5 c
A	Z	eP	01:12:26.2 c
D	Z	eP	01:12:29.0 c
Pa	Z	eP	01:12:26.6 d
Hi	Z	eP	01:12:27.9 c
Ka	Z	eP	01:12:27.8 c
U	PEN	e	01:34:06
U	PEZ	eR	01:36:54

Magnitude 6.5 (HVO).

C&GS card 1-62:
18.5° N., 70.5° W.
01:00:24.2.
Near south coast of Dominican Republic.
h about 63 km.
Magnitude 7.0 to 7.5 (Pas), 6.25 to 6.5 (Berk), 6.5 (Pal).

Jan. 9

M	Z	eP	12:52:17.1 d
A	Z	eP	12:52:17.7 d
D	Z	eP	12:52:17.4 d
U	PEZ	eScS	13:01:47
U	PEZ	eR	13:04:53

Magnitude 6.2 (HVO).

C&GS card 2-62:
42.9° N., 144.8° E.
12:40:49.3.
Near coast of Hokkaido, Japan.
h about 78 km.

Jan. 10

N	Z	Tmax	06:46:21
Pa	Z	Tmax	06:46:31

Off coast of Oregon.

No preliminary C&GS listing.

Jan. 10

N	Z	Tmax	07:08:28
Pa	Z	Tmax	07:08:24
Hi	Z	Tmax	07:08:00

C&GS card 3-62:
44.3° N., 128.8° W.
06:27:45.2.
Off coast of Oregon.
h about 25 km.

Table 5.--Distant earthquakes--Continued

Jan. 10

N	Z	Tmax	07:09:40
Pa	Z	Tmax	07:09:13
Ha	Z	Tmax	07:09:19

C&GS card 5-62:
44.3° N., 128.7° W.
06:28:40.5.
Off coast of Oregon.
h about 61 km.
Magnitude 4.75 (Pal).

Jan. 10

N	Z	Tmax	07:14:28
Pa	Z	Tmax	07:14:31
Hi	Z	Tmax	07:14:20
Ha	Z	Tmax	07:14:07

C&GS card 3-62:
44.3° N., 128.8° W.
06:33:56.5.
Off coast of Oregon.
h about 25 km.

Jan. 10

N	Z	Tmax	07:16:47
Pa	Z	Tmax	07:16:25
Hi	Z	Tmax	07:16:01
Ha	Z	Tmax	07:16:07

Off coast of Oregon.

No preliminary C&GS listing.

Jan. 10

N	Z	Tmax	07:48:45
Pa	Z	Tmax	07:48:40
Ha	Z	Tmax	07:48:14

Off coast of Oregon.

No preliminary C&GS listing.

Jan. 11

U	PEN	ePP	06:57:49	
U	PEZ	eR	07:05:53	
Ha	Z	Tmax	07:33:11	

C&GS card 9-62:
51.9° N., 179.3° W.
06:49:07.6.
Andreanof Islands, Aleutian Islands.
h about 60 km.

Jan. 16

M	Z	eP	11:45:07.5	c
A	Z	eP	11:45:07.0	c
D	Z	eP	11:45:05.5	c
Pa	Z	eP	11:45:10.7	d
Hi	Z	eP	11:45:11.9	d
Ka	Z	eP	11:45:10.7	d
Ha	Z	eP	11:45:29.9	c
U	PEZ	iP	11:45:08	c
U	PEZ	iS	11:52:52	
U	PEN	eG	11:59:10	

Table 5.--Distant earthquakes--Continued

Jan. 16--Continued

Magnitude 6.0 (HVO).

C&GS card 6-62:
30.5° S., 177.9° W.
11:35:41.3.
Kermadec Islands.
h about 39 km.
Magnitude 6.5 (Pas).

Jan. 28

M	Z	eP	05:47:43.1 d
A	Z	eP	05:47:43.0 d
D	Z	eP	05:41:41.6 d
N	Z	eP	05:47:43.1 d
Hi	Z	eP	05:47:44.4 d
Ka	Z	eP	05:47:46.5 c
U	PEZ	eR	05:58:17

C&GS card 11-62:
17.2° S., 172.0° W.
05:40:08.2.
Tonga Islands.
h about 25 km.
Magnitude 6.25 (Pas).

Jan. 30

M	Z	eP	08:45:01.8 d
A	Z	iP	08:45:00.6 d
D	Z	eP	08:45:00.8 d
Pa	Z	eP	08:44:59.4 d
Hi	Z	eP	08:44:59.1 d

Jan. 30--Continued

C&GS card 9-62:
12.7° N. 87.7° W.
08:34:26.8.
Near coast of Nicaragua.
h about 101 km.

Jan. 30

M	Z	eP	15:32:12.5 d
A	Z	eP	15:32:13.6 d
D	Z	eP	15:32:12.5 d
Hi	Z	eP	15:32:15.5 d

C&GS card 8-62:
20.7° N., 144.5° E.
15:22:49.4.
Mariana Islands region.
h about 187 km.

Feb. 2

U	PEN	e	21:26:00

Single acoustic pulse - 70 sec period.

C&GS card 9-62:
49.9° N., 78.2° E.
07:59:58.5.
Kazakh, U.S.S.R.
h about 0 km.

Feb. 3

M	Z	eP	00:49:02.3 c
A	Z	eP	00:49:02.8 c
D	Z	eP	00:49:02.9 c
N	Z	eP	00:49:03.2 c
U	Z	eP	00:49:06.4 c

Table 5.--Distant earthquakes--Continued

Feb. 3--Continued

Hi	Z	eP	00:49:07.3 c
Na	Z	eP	00:49:02.6 c
U	PEZ	iS	00:58:04
U	PEZ	iR	01:09:43
U	PEN	iSSS	01:05:47

Magnitude 6.5 (HVO).

C&GS card 10-62:
1.2° S., 137.8° E.
00:37:53.6.
North of New Guinea.
h about 17 km.

Feb. 4

M	Z	eP	03:07:28.8 d
A	Z	eP	03:07:28.4 d
D	Z	eP	03:07:28.4 d
N	Z	eP	03:07:29.1 d

C&GS card 11-62:
4.6° S., 119.0° E.
02:54:42.1.
Celebes.
h about 89 km.

Feb. 5

M	Z	eP	23:05:42.3 d
A	Z	eP	23:05:43.1 d
D	Z	eP	23:05:42.6 d
Pa	Z	eP	23:05:43.9 c

Feb. 5--Continued

C&GS card 9-62:
35.9° N., 138.8° E.
22:55:49.6.
Central Honshu.
h about 151 km.

Feb. 8

M	Z	iP	12:00:01.0 d
A	Z	eP	12:00:00.1 d
U	Z	eP	12:00:00.3 d
Pa	Z	eP	12:00:03.5 d
Hi	Z	eP	12:00:03.6 d
Na	Z	eP	11:59:58.8 d
Ka	Z	iP	12:00:07.0 d
Ha	Z	eP	12:00:07.1 d
U	PEZ	eR	12:19:10
U	PEN	iG	12:16:18

Magnitude 6.1 (HVO).

C&GS card 14-62:
3.2° S., 141.3° E.
11:49:13.9.
New Guinea.
h about 87 km.

Feb. 9

M	Z	iP	22:03:29.8 c
A	Z	iP	22:03:29.8 c
D	Z	eP	22:03:28.4 c
N	Z	iP	22:03:29.6 c

Table 5.--Distant earthquakes--Continued

Feb. 9--Continued				
U	Z	iP	22:03:29.3	c
C&GS card 11-62: 0.6° N., 123.9° E. 21:51:13.2. Celebes. h about 50 km.				
Feb. 11				
M	Z	iP	02:52:03.5	c
A	Z	iP	02:52:05.0	c
D	Z	eP	02:52:03.5	c
Pa	Z	iP	02:52:05.3	c
Ha	Z	iP	02:51:55.7	c
Na	Z	iP	02:52:03.5	c
C&GS card 11-62: 29.6° N., 139.0° E. 02:42:36.1. South of Honshu, Japan. h about 400 km. Magnitude 6.25 (Pas).				
Feb. 11				
M	Z	iP	19:05:00.7	d
M	Z	ePcP	19:05:29.7	
A	Z	iP	19:05:00.7	d
A	Z	ePcP	19:05:33.4	
D	Z	eP	19:05:00.0	d
D	Z	ePcP	19:05:30.9	
Pa	Z	eP	19:05:03.1	c
Hi	Z	iP	19:05:03.8	c
Feb. 11--Continued				
Hi	Z	ePcP	19:05:34.2	
Na	Z	iP	19:04:58.5	c
Ha	Z	iP	19:05:08.4	c
Ha	Z	iPcP	19:05:35.1	
U	PEZ	eP	19:05:00.9	c
U	PEZ	iG	19:18:46	
U	PEN	iS	19:12:52	
Magnitude 6.4 (HVO).				
C&GS card 11-62: 4.5° S., 153.5° E. 18:55:32.0. New Ireland region. h about 100 km. Magnitude 6 (Berk).				
Feb. 14				
U	PEZ	iP	06:49:35	d
U	PEZ	iPP	06:53:33	
U	PEZ	iPPP	06:55:38	
U	PEZ	iPS	07:02:09	
U	PEZ	iSS	07:07:22	
U	PEZ	iR	07:20:03	
U	PEE	iS	07:00:05	
U	PEE	iSSS	07:11:23	
U	PEN	iL	07:15:09	
U	PEN	iG	07:16:03	
M	Z	Tmax	08:36:13	

Table 5.--Distant earthquakes--Continued

Feb. 14--Continued

A	Z	Tmax	08:35:58
D	Z	Tmax	08:36:02
N	Z	Tmax	08:36:04
U	Z	Tmax	08:36:06
Pa	Z	Tmax	08:35:42
Na	Z	Tmax	08:35:56

Magnitude 7.5 (HVO).

C&GS card 11-62:
38.1° S., 73.1° W.
06:36:01.3.
Near coast of Chile.
h about 44 km.
Magnitude 7.25 (Pas), 7.5 (Berk).

Feb. 18

M	Z	iP	17:37:14.1 c
A	Z	iP	17:37:14.7 c
N	Z	iP	17:37:14.5 c
Pa	Z	eP	17:37:10.1 c
Ka	Z	eP	17:37:15.6 c
U	PEZ	eR	18:01:44

Magnitude 6.1 (HVO).

C&GS card 14-62:
8.1° N., 74.6° W.
17:25:17.3.
Northern Colombia
h about 70 km.

Feb. 19

M	Z	iP	11:12:46.8 c
A	Z	iP	11:12:45.9 c
D	Z	eP	11:12:45.5 c
Pa	Z	eP	11:12:48.0 d
Hi	Z	iP	11:12:49.3 c

C&GS card 14-62:
20.2° S., 175.1° W.
11:04:46.6.

Feb. 19--Continued

C&GS card 14-62--Continued
Tonga Islands.
h about 95 km.

Feb. 20

M	Z	iP	10:15:40.0 c
A	Z	iP	10:15:39.0 c
D	Z	eP	10:15:38.4 c
N	Z	iP	10:15:38.6 d
U	Z	iP	10:15:38.9 d
Pa	Z	iP	10:15:40.2 c
Hi	Z	iP	10:15:41.3 c
Ka	Z	iP	10:15:41.4 c

C&GS card 14-62:
25.9° S., 178.4° E.
10:07:26.6.
South of Fiji Islands region.
h about 655 km.

Feb. 20

M	Z	iP	16:15:26.5 c
A	Z	iP	16:15:27.4 c
D	Z	eP	16:15:27.0 c
U	Z	iP	16:15:26.1 c
Pa	Z	iP	16:15:28.6 c
Hi	Z	iP	16:15:26.9 c
Na	Z	iP	16:15:31.4 c
Ha	Z	iP	16:15:16.5 c
U	PEZ	iR	16:30:36

Magnitude 6.2 (HVO).

C&GS card 14-62:
43.0° N., 144.9° E.
16:05:44.6
Near coast of Hokkaido, Japan.
h about 55 km.

Table 5.--Distant earthquakes--Continued

Feb. 23

Hi	Z	eP	11:51:07.6	c

C&GS card 15-62:
6.3° S., 147.0° E.
11:40:52.8.
North coast of New Guinea.
h about 80 km.

Feb. 23

M	Z	eP	20:31:15.4	c
A	Z	eP	20:31:16.7	c
U	PEZ	eR	20:47:24	

C&GS card 17-62:
3.8° S., 152.0° E.
20:21:28.6.
New Britain.
h about 25 km.

Feb. 26

M	Z	iP	08:57:14.8	c
N	Z	eP	08:57:18.2	c

C&GS card 15-62:
0.1° S., 122.3° E.
08:44:48.8.
Northern Celebes.
h about 25 km.

Feb. 27

U	PEZ	eP	13:06:51	c
U	PEZ	iPKS	13:12:15	
U	PEZ	iSKS	13:16:47	
U	PEZ	iPSPS	13:24:43	

Magnitude 6.3 (HVO).

C&GS card 15-62:
37.4° S., 73.2° W.
12:40:48.9.
Near coast of central Chile.
h about 40 km.
Magnitude 6.25 to 6.5 (Pas),
6 (Berk).

Mar. 1

Pa	Z	eP	23:49:35.6	d
Hi	Z	iP	23:49:37.2	c
U	PEZ	iP	23:49:34	d
U	PEZ	iSS	23:56:30	
U	PEZ	eP	00:01:42	
U	PEN	eScS	23:59:42	

Magnitude 5.7 (HVO).

C&GS card 16-62:
14.0° S., 172.5° E.
23:41:14.5.
Samoa.
h about 73 km.
Magnitude 6 (Pas).

Mar. 2

M	Z	iP	13:14:54.0	d
A	Z	eP	13:14:55.4	d
D	Z	eP	13:14:53.6	d
N	Z	eP	13:14:54.5	d
U	Z	iP	13:14:55.0	d
Ha	Z	eP	13:15:05.4	d

C&GS card 16-62:
5.4 N., 126.5° E.
13:02:59.0.
Off south coast of Mindanao,
P.I.
h about 30 km.

Table 5.--Distant earthquakes--Continued

Mar. 3

M	Z	iP	12:26:39.0 c
A	Z	iP	12:26:39.4 c
D	Z	iP	12:26:38.5 c
N	Z	iP	12:26:39.0 c
U	Z	iP	12:26:39.7 c
Pa	Z	eP	12:26:41.2 c
U	PEZ	eR	12:49:42.2

C&GS card 16-62:
7.4° N., 126.5° E.
12:14:52.1.
Near east coast of Mindanao, P.I.
h about 90 km.

Mar. 4

Ha	Z	Tmax	12:21:35
Pa	Z	Tmax	12:21:40

No preliminary C&GS listing.

Mar. 5

Ha	Z	Tmax	08:26:03

C&GS card 19-62:
34.6° N., 121.6° W.
07:44:00.0.
Off coast of California.
h about 25 km.
Magnitude 4.25 (Pas), 4.25 (Berk).

Mar. 5

M	Z	Tmax	21:39:11
A	Z	Tmax	21:39:12
D	Z	Tmax	21:39:11

Mar. 5--Continued

N	Z	Tmax	21:39:12
U	Z	Tmax	21:39:12
Pa	Z	Tmax	21:39:07
Ha	Z	Tmax	21:38:52

C&GS card 20-62:
40.3° N., 125.1° W.
20:57:52.1.
Off coast of California.
h about 25 km.

Mar. 7

M	Z	iP	11:09:44.0 c
M	Z	iPcP	11:10:29.3
M	Z	isPP	11:14:53.6
A	Z	iP	11:09:44.8 c
A	Z	iPcP	11:10:30.4
A	Z	iPP	11:12:06.8
A	Z	isPP	11:14:49.1
D	Z	iP	11:09:43.9 c
D	Z	iPcP	11:10:29.1
D	Z	iPP	11:12:05.3
N	Z	iP	11:09:44.4 c
N	Z	iPcP	11:10:31.9
N	Z	ePP	11:12:06.0
Pa	Z	iP	11:09:47.8 d
Pa	Z	iPcP	11:10:34.1
Hi	Z	iP	11:09:46.7 d

Table 5.--Distant earthquakes--Continued

Mar. 7--Continued

Na	Z	iP	11:09:43.6 d
Ka	Z	eP	11:09:41.1 d
Ha	Z	iP	11:09:38.1 c
U	PEZ	isP	11:12:41
U	PEZ	isPP	11:14:49
U	PEZ	iS	11:16:41
U	PEZ	iG	11:23:46
U	PEE	eScS	11:18:01
U	PEN	eSS	11:20:25

Magnitude 6.6 (HVO).

C&GS card 20-62:
19.3° N., 145.3° E.
11:01:00.4.
Mariana Islands.
h about 680 km.
Magnitude 6 (Berk), 7 (Pas).

Mar. 8

M	Z	eP	10:43:41.7 d
A	Z	eP	10:43:42.9 d
N	Z	eP	10:43:42.8 d
Ka	Z	eP	10:43:46.4 d

C&GS card 21-62:
35.1° S., 179.7° W.
10:33:41.9.
Off northeast coast of North Island, N.Z.
h about 25 km.

Mar. 11

M	Z	eP	15:30:56.3 d
A	Z	eP	15:30:58.9 d
D	Z	eP	15:30:58.5 d
N	Z	eP	15:30:58.3 d
Pa	Z	eP	15:30:58.4 d
Hi	Z	iP	15:30:56.8 c
Ka	Z	eP	15:30:52.2 c

C&GS card 18-62:
52.3° N., 178.0° E.
15:23:40.7.
Rat Islands, Aleutian Islands.
h about 135 km.

Mar. 11

M	Z	iP	19:30:54.4
A	Z	iP	19:30:56.1
A	Z	iPcP	19:31:13.5
D	Z	eP	19:30:53.8
N	Z	iP	19:30:54.5
Pa	Z	eP	19:31:01.7
U	PEZ	iS	19:40:50
U	PEZ	eSS	19:45:40
U	PEZ	eSSS	19:48:46
U	PEZ	iR	19:53:40

Magnitude 6.3 (HVO).

Table 5.--Distant earthquakes--Continued

Mar. 11--Continued

C&GS card 19-62:
9.0° N., 126.7° E.
19:19:05.6.
Near east coast of Mindanao, P.I.
h about 25 km.

Mar. 12

M	Z	iP	09:52:55.1 c
A	Z	iP	09:52:52.3 c
D	Z	eP	09:52:52.8 c
Pa	Z	eP	09:52:49.5 c
Hi	Z	eP	09:52:55.0 d

C&GS card 18-62:
9.0° N., 83.0° W.
09:41:45.7.
Costa Rica.
h about 113 km.

Mar. 12

M	Z	iP	11:51:36.1 d
A	Z	eP	11:51:33.1 d
A	Z	ePcP	11:52:26.6
D	Z	iP	11:51:36.1 d
D	Z	ePcP	11:52:30.4
N	Z	eP	11:51:33.6 d
N	Z	ePcP	11:52:31.7
Pa	Z	iP	11:51:35.5 d
Hi	Z	eP	11:51:34.1 d
Na	Z	eP	11:51:37.2 d

Mar. 12--Continued

Ka	Z	eP	11:51:37.4 c
Ha	Z	iP	11:51:45.1 c
U	PEZ	iS	12:01:24
U	PEZ	eG	12:11:20
U	PEZ	eR	12:14:24

Magnitude 6.7 (HVO).

C&GS card 19-62:
8.1° N., 83.0° W.
11:40:12.8
Near south coasts of Panama and Costa Rica.
h about 58 km.
Magnitude 6.75 (Pas), 6.25 to 6.5 (Pal).

Mar. 16

M	Z	iP	19:51:25.8 d
A	Z	iP	19:51:25.9 d
D	Z	iP	19:51:24.9 d
N	Z	iP	19:51:25.9 d
U	Z	iP	19:51:25.9 d
Pa	Z	iP	19:51:26.4 d
Na	Z	iP	19:51:22.0 c
Ha	Z	iP	19:51:26.8 d
U	PEZ	eS	19:58:36
U	PEZ	iR	20:05:00

Magnitude 5.8 (HVO).

Table 5.--Distant earthquakes--Continued

Mar. 16--Continued

C&GS card 22-62:
10.8° S., 165.7° E.
19:42:39.2.
Santa Cruz Islands region.
h about 25 km.

Mar. 17

U	PEZ	iPP	21:06:19
U	PEZ	iPS	21:15:40
U	PEZ	iSS	21:21:27
U	PEE	iG	21:32:12

Magnitude 6.8 (HVO).

C&GS card 24-62:
10.6° N., 43.7° W.
20:47:31.7.
North Atlantic Ocean.
h about 25 km.

Mar. 18

U	PEZ	eR	03:28:39

C&GS card 23-62:
16.1° S., 167.2° E.
03:06:39.4.
New Hebrides Islands region.
h about 200 km.

Mar. 19

M	Z	iP	06:06:42.0	c
A	Z	iP	06:06:42.4	c
D	Z	eP	06:06:41.7	c
U	Z	iP	06:06:42.2	c
Pa	Z	iP	06:06:44.2	c
Hi	Z	iP	06:06:43.3	c

Mar. 19--Continued

C&GS card 23-62:
0.3° N., 123.5° E.
05:54:24.4.
Near south coast of Minahossa Peninsula, Celebes Islands.
h about 53 km.

Mar. 20

M	Z	Tmax	17:17:34
A	Z	Tmax	17:17:44
N	Z	Tmax	17:17:50
U	Z	Tmax	17:17:37
Pa	Z	Tmax	17:17:42
Ha	Z	Tmax	17:17:00

C&GS card 23-62:
50.8° N., 129.7° W.
16:31:48.3.
Queen Charlotte Sound area.
h about 25 km.

Mar. 22

U	PEZ	iP	15:23:56	c
U	PEZ	iG	15:40:07	
U	PEZ	iR	15:43:02	
U	PEE	iS	15:32:33	

Magnitude 6.7 (HVO).

C&GS card 23-62:
3.2° S., 142.3° E.
15:13:03.9.
Near north coast of New Guinea.
h about 25 km.
Magnitude 5.75 (Berk).

Table 5.--Distant earthquakes--Continued

Mar. 23

Ha	Z	eP	14:16:55.0 d

No preliminary C&GS listing.

Mar. 24

A	Z	eP	01:59:31.3 d
D	Z	eP	01:59:31.5 d

Deep.

No preliminary C&GS listing.

Mar. 24

M	Z	iP	13:09:56.7 c
A	Z	eP	13:09:56.7 c
D	Z	iP	13:09:56.1 c
U	Z	eP	13:09:56.1 c
Pa	Z	eP	13:09:58.6 d
Hi	Z	eP	13:09:58.8 c
Ka	Z	eP	13:09:59.0 c
U	PEE	iS	13:18:26
U	PEZ	eSS	13:22:47
U	PEZ	iR	13:28:55
U	PEN	iQ	13:25:45

Magnitude 6.1 (HVO).

C&GS card 24-62:
5.7° S., 145.0° E.
12:59:30.9.
Near north coast of New Guinea.
h about 111 km.

Mar. 26

U	PEZ	eR	17:17:04

C&GS card 24-62:
40.6° S., 73.3° W.
16:32:43.6.
Near coast of Southern Chile.
h about 32 km.

Mar. 29

M	Z	iP	02:00:57.9 c
D	Z	eP	02:00:58.6 c
N	Z	eP	02:00:58.7 c
U	Z	eP	02:00:58.1 c

C&GS card 25-62:
51.8° N., 157.2° E.
01:52:25.4.
Near south coast of Kamchatka.
h about 155 km.

Mar. 29

M	Z	iP	20:21:02.3 c
A	Z	eP	20:21:02.8 c
N	Z	eP	20:21:02.6 c
U	Z	iP	20:21:02.7 c
Hi	Z	iP	20:21:03.5 c

C&GS card 28-62:
0.5° S., 127.4° E.
20:09:01.9.
Halmahera region.
h about 25 km.

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

Station	Symbol	Location		Altitude (m) above sea level	Equipment (Z, vertical; N, north-south; E, east-west)
		Latitude N.	Longitude 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	Remote recording HVO-2: Z.
Desert----------	D	19°20.2'	155°23.3'	815	Do.
North Pit----------	N	19°24.9'	155°17.0'	1,115	Do.
Whitney----------	W	19°25.9'	155°15.7'	1,210	Bosch-Omori: N, E. (Seismometer period 9 seconds.) Short-base liquid-level tiltmeter.
Hilo----------	Hi	19°43.2'	155°05.3'	20	HVO-1: Z. Wood-Anderson: N, E. Operated by Sister Thecla at St. Joseph's School.
Naalehu----------	Na	19°03.8'	155°35.2'	205	HVO-1: Z. Operated by Rev. H. Hanson at Naalehu School.

Table 6.--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)
		Latitude N.	Longitude W.		
Pahoa----------	Pa	19°29.7'	154°56.8'	205	HVO-1: Z. Operated by Mr. Kongo Kimura at Pahoa School.
Kamuela----------	Ka	20°01.9'	155°42.0'	740	HVO-1: Z. Operated by Mr. Edward Van Gorder, Preparatory Academy, Kamuela.
Konawaena----------	Ko	19°30.8'	155°55.1'	495	Not operated in 1962.
Haleakala, Maui----	Ha	20°46.0'	156°15.0'	2,090	HVO-1: Z. Wood-Anderson: N, E. Operated by the staff of Hawaii National Park at Haleakala, Maui.

1/ HVO-1 is a moving-coil, hinged, vertical-component seismograph with seismometer and galvanometer periods of 0.5 second. Over-damping 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. The response of this seismograph is similar to that of HVO-1. Records from these seismographs at the M, O, and D stations are recorded on a 3-component drum to permit an accurate comparison of arrival times at these stations.

Visitors to the Hawaiian Volcano Observatory during the first quarter, 1962, included the following:

E. J. Walter, John Carroll University.
Robert E. Houtz, Lamont Observatory.
T. A. Eastland, Bendix Radio Corp.
A. F. Ellman, Bendix Radio Corp.
Tokuji Utsu, Japan Meteorological Agency.
Warren Hastings, Howard Leak, Stan Lord, Swede Miller, Dan Davis--U.S. Geological Survey, Ground Water Division.
Masatusugi Suzuki, Nihon University.
Ryutaro Takahasi, University of Tokyo.
Senator and Mrs. Hubert Humphrey and son Robert.
A. Furumoto, Institute of Geophysics, University of Hawaii.
M. Vitousek, Institute of Geophysics, University of Hawaii.
Richard Sykes, Magabor Co., Kansas.
Tom Bastien, University of Minnesota.
John Aaron, U.S. Geological Survey, Washington D.C.
Masashi Honma, University of Tokyo.

During the quarter "felt reports" were either phoned or mailed in by the following people to whom we wish to express our gratitude for these and other instances of cooperation.

From North Hawaii: Mrs. Christensen, Mr. Paiva, Honokaa Police station.
From Kau: Mrs. Walters.
From Central Hawaii: Mr. Walker, Mr. Hansen, Mrs. Lindsey.
From the Hilo area: Mr. Chang, Mr. Pierce, Mrs. Shaeffer, Mr. Blackwood, Mr. Baldwin, Mr. Kumukahi, Mrs. Elalauli, Mr. Ho, U.S. Weather Bureau.
From the Kilauea Volcano summit district: Mr. Mist, Mrs. Francis, Mrs. Hansen, Mrs. Duncan, Miss Cruz, Miss English, Mrs. Moore, Mrs. Correa, Mrs. Sumner, Mrs. Wentworth, Mr. Hamilton, and Dr. D'Avanzo.

UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY

SUMMARY 26

April, May, and June, 1962

By

A. T. Okamura, R. Y. Koyanagi, and H. L. Krivoy

and

Report on the International Symposium on Volcanology, Tokyo, 1962, by H. A. Powers

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October 1963

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HAWAIIAN VOLCANO OBSERVATORY SUMMARY 26

By A. T. Okamura, R. Y. Koyanagi, and H. L. Krivoy

Introduction

Dr. Powers, who has written the following report, has worked on or with volcanoes for a large part of his professional career. He was first employed at the Volcano Observatory from 1929 through 1930. From 1932 through 1941 he worked on ground-water problems in Maui and also served the Hawaii National Park at Haleakala. Dr. Powers worked at the Hawaiian Volcano Observatory again from 1946 through 1948. Since 1949 he has been stationed at Denver and concerned with geological problems in northern California, the Aleutian Islands, and in Hawaii.

Report on the International Symposium on Volcanology, Tokyo, 1962

By Howard A. Powers

Scientists from 22 countries attended the International Symposium on Volcanology that was convened on May 9, 1962, in the Nihon Toshi Center, Tokyo. Included were 140 representatives from 40 centers of learning in Japan, and about 80 representatives from 23 other countries located on every continent of the globe. Fourteen wives and daughters were among the foreign delegation. The entire group met socially at two delightful evening receptions, hosted by the Science Council of Japan and by the Ministry of Education. The ladies of the group were entertained at many varied functions during the course of the conference.

The 2-week scientific program was ingeniously arranged to intersperse auditorium sessions with field observation trips. Altogether, 4 days were allotted to auditorium meetings and a total of 50 papers were presented. Six papers were directed toward problems of prediction of volcanic eruptions and of minimizing their hazards to the local populace. Twenty papers dealt with the characteristics, either general or specific, of a number of volcanic regions; ignimbrites or pyroclastic flows and calderas are the prominent features of 11 of the areas discussed. The ubiquitous subject of terminology of the process and products of pyroclastic eruption was discussed informally in a special half-day session. Seven reports were concerned with some aspect of igneous volatile constituents or volcanic sublimate deposits. Results of current expanded research at the Hawaiian Volcano Observatory were discussed in three papers, and certain aspects of continuing laboratory experimental

investigations of silicate liquids with the composition of, or approaching, natural basalts were summarized in three reports. Three papers appraised geophysical knowledge of the crust and upper mantle in terms of hypotheses of origin and behavior of magmas. Several papers discussed specialized subjects, for example: geomagnetic changes at Volcano Mihara, potassium-argon dating of rocks, mechanics of volcanic earthquakes, and special conditions of possible lunar volcanism.

Field sessions of the conference were held at the active volcano Asama and in the inactive Hakone caldera complex. At the Asama Volcano Observatory we were briefed on the instrumentation and the types of geophysical observations now being made as a result of 30 years of operational experience. We examined in detail the products and results of different phases of activity during the eruption of 1783. At Hakone the emphasis was centered on the major changes in eruptive activity and in rock composition during the long evolution of the Hakone center.

Three post-conference field trips were run concurrently, one northward to Hokkaido, one southward to Kyushu, and to Ito and Ō shima in central Japan. Both the Hokkaido and Kyushu trips featured explosive activity and caldera formation involving magma of intermediate to silicic composition; the Ito and Ō shima trip featured basaltic to andesitic lavas and their pertinent type of eruption. The trips had been planned with meticulous care; each stop was at a magnificent "textbook" example of volcanism, and together they presented a clear picture of the array of volcanism for which Japan is famous.

Chronological summary

Inflation of the summit region of Kilauea Volcano continued at nearly the same rate during the second quarter of 1962 as during the first quarter. The average rate of tilting, outward from the caldera, at the inner ring of tilt bases (U, TM, Kam and Kea) was about 5 microradians per month (fig. 2).

Very small shallow earthquakes at Kilauea caldera continued unabated throughout the second quarter. Average daily counts during April, May, and June were 56, 38, and 56, respectively. Twenty-one earthquakes, 6 of which were larger than magnitude 2.5, originated along the Kalapana Trail beneath the southeast flank of Kilauea between April 5 and April 8. This source was responsible for occasional earthquakes throughout the rest of the second quarter. An earthquake from this region at 4:04 a.m. on June 7 was reported felt in Hilo.

During most of April the number of earthquakes emanating from the eastern half of the east rift zone of Kilauea averaged less than 2 per day. Earthquakes from this region increased moderately in frequency on April 29, and during May the average daily count was 5. The east rift zone was relatively quiet during June, when the average daily count was again less than 2 per day. One earthquake from this region was felt at Pahoa on May 26 at 1:14 p.m.; two others were felt at Kapoho on June 11 at 9:05 p.m. and 9:41 p.m.

The zone about 30 km beneath Halemaumau was again a source of frequent earthquakes during the second quarter. Average daily earthquake counts from this source were 6, 7, and 4 during April, May, and June, respectively. Intervals of relative inactivity (less than 5 earthquakes per day) were interrupted every few weeks by flurries of heightened activity lasting several days. A magnitude 4.3 earthquake from this 30 km deep source was felt throughout the island of Hawaii at 5:56 a.m. on May 10. Another, with a magnitude of 3.7, was felt over the eastern half of the island at 6:37 a.m. on May 11. A second magnitude 4.3 earthquake from this zone, at 4:35 p.m. on June 14, was felt over the entire island. A magnitude 2.7 earthquake from the same source was felt near Kilauea caldera at 8:31 p.m. on June 14.

The southwest rift zone of Kilauea and the adjacent portion of the Kaoiki fault system near the Desert seismometer yielded an average of about 15 earthquakes per day during April, May, and most of June. At 3:05 a.m. on April 24 a magnitude 4.0 earthquake from this region was felt over the entire island of Hawaii. A magnitude 3.5 earthquake from the same region was felt in Pahala and Hilo at 9:43 p.m. on June 8.

On June 27 a magnitude 6.1 earthquake from an epicenter along the Kaoiki fault system (19°24' N., 155°25' W., focal depth 3 to 8 km, origin time 6:27:14.3 HST) was felt over the entire island of Hawaii and on the islands of Maui and Oahu. It was the largest earthquake in the Hawaiian Islands since March 30, 1954, when two earthquakes of comparable size originated near the south shore of Hawaii west of Kalapana. As the epicenter lay in the very thinly populated Kau District of Hawaii, no serious damage was done, although there was widespread minor damage to loose objects which were overturned or dislodged.

Aftershocks of this earthquake were very numerous. Hourly aftershock counts for the first 60 hours following the main earthquake are shown on figure 1. More than 500 were recorded during the first 6 hours. The largest aftershock (magnitude 3.7) occurred at 3:37 a.m. on June 28; it was felt in Hilo.

In addition to earthquakes belonging to the groups discussed above, seven others were felt in Hawaii during the second quarter. The first of these originated about 7 km northwest of Hilo at a depth

of about 20 km at 11:19 p.m. on April 11. Its magnitude was 3.0 and it was reported felt in Hilo. An earthquake felt in Pahoa at 9:26 p.m. on May 16 had a magnitude of only 2.4 and emanated from a shallow focus about 9 km southeast of the Ahua seismometer.

A magnitude 3.5 earthquake from a focus about 12 km deep and 3 km north of Kealakekua was felt near its epicenter at 11:17 a.m. on May 23.

The earthquake felt over the entire island of Hawaii at 10:58 p.m. on May 23 had a magnitude of 3.7 and originated about 10 km south of the Desert seismometer at a depth of about 45 km. A magnitude 3.6 earthquake from a focus about 8 km deep and 14 km northwest of the Desert seismometer was felt in Mountain View at 9:11 p.m. on May 29. An earthquake felt in Honokaa at 11:02 p.m. on May 31 originated about 22 km east of Honokaa at a depth of about 12 km. Its magnitude was 2.9.

On June 4 at 11:58 p.m. a magnitude 3.9 earthquake from a focus about 5 km deep and 20 km south-southeast of the Ahua seismometer was felt over the southern half of the island of Hawaii. The earthquake felt at Pahala at 10:03 a.m. on June 7 originated about 5 km south of the Desert seismometer at a depth of about 45 km. Its magnitude was 3.4.

The field tilt-base network was reoccupied immediately after the large Kaoiki fault earthquake of June 27 to ascertain whether the summit region of Kilauea had been deformed at the time of the earthquake. The pattern of tilt changes spanning the occurrence of the earthquake (fig. 2) is very similar to that during the previous several months (Summary 25). However, it does appear that tilt changes at Keamoku (Kea) and Kapapola Ranch (Kap) were abnormally large during the second quarter. Both stations are on the downthrown side of the Kaoiki fault system. Keamoku tilted toward the fault, and Kapapala tilted away from it.

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 (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 (table 3). 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 1-unit change in coordinate corresponds to a tilting of 1 microradian (1 mm per km) in the direction indicated.

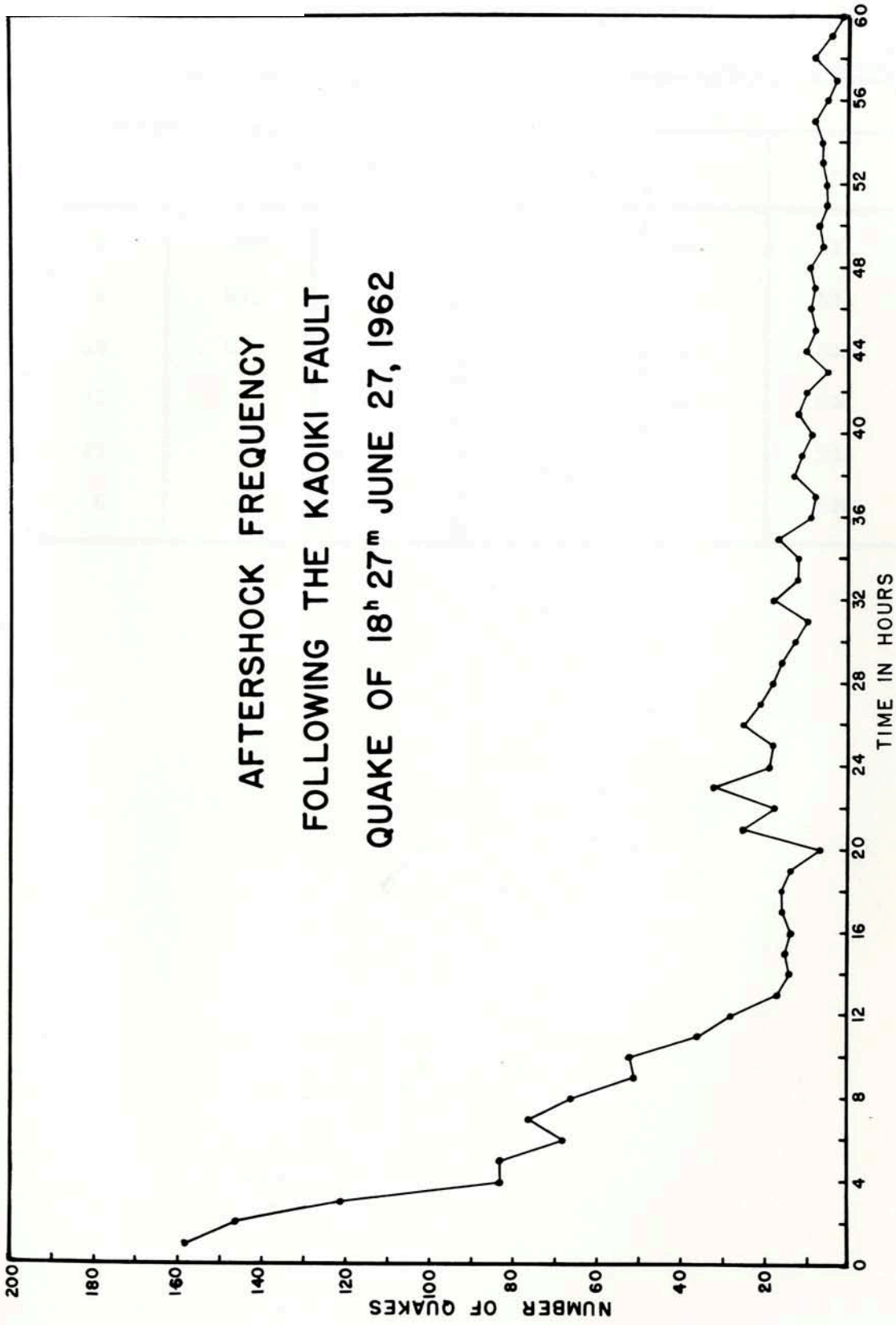

Figure 1.--Hourly count of aftershocks following the Kaoiki fault earthquake of 6:27 p.m., June 27, 1962.

Table 1.--Tilt coordinates at Uwekahuna vault, April, May, and June, 1961

Date	N-S	E-W	Date	N-S	E-W
Apr. 1	430	535	May 13	433	531
8	431	536	20	433	531
15	432	535	June 3	434	533
22	433	535	10	435	534
29	435	535	17	436	532
May 6	436	532	24	435	529

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

Tilt base (location)	Date (1962)	Tilt coordinates		Rate (10^{-6} rad/mo) and direction of tilting since last reading		Date of last reading (1962)
		N-S	E-W			
Uwekahuna (19°25.5' N., 155°17.4' W.)	June 29	422.2	510.1	5.5	N. 40° W.	Mar. 27
Tree Molds (19°26.3' N., 155°17.3' W.)	29	427.1	514.7	2.3	N. 24° W.	27
Sand Spit (19°24.1' N., 155°16.8' W.)	Not occupied this epoch.					29
Kalihipaa (19°21.4' N., 155°15.3' W.)	July 5	583.2	422.3	Change negligible, direction random.		28
Keamoku (19°25.1' N., 155°19.0' W.)	June 30	466.1	623.2	6.3	N. 50° W.	29
Ahua Kamokukolau (19°22.7" N., 155°16.6' W.)	July 1	704.7	509.5	5.2	S. 38° E.	28
Kipuka Nene (19°19.4' N., 155°16.7' W.)	Not occupied this epoch.					Apr. 5
Hilina Pali (19°18.2' N., 155°18.6' W.)	Not occupied this epoch.					4
Mehana (19°26.2' N., 155°14.3' W.)	Not occupied this epoch.					Mar. 26
Kapapala Ranch (19°20.5' N., 155°23.8' W.)	June 30	496.8	503.6	1.3	S. 34° E.	30

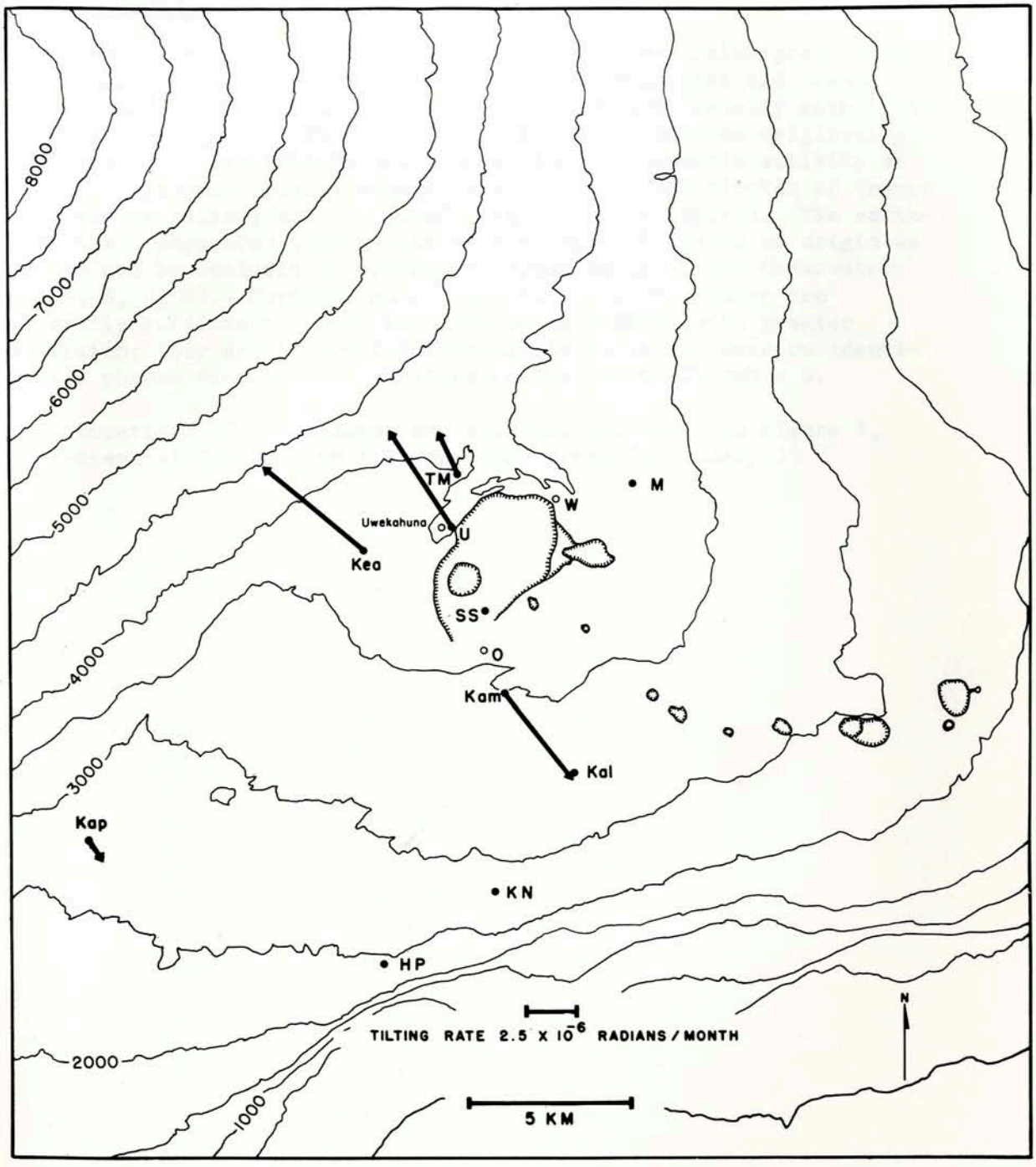

Figure 2.--Tilting of the ground around Kilauea caldera, March 29, 1962, to June 30, 1962. The vector depicting tilting at a given tilt base points in the direction of maximum relative subsidence and has a length proportional to the rate of tilting during the measurement interval. Closed circles represent field tilt bases; open circles, short-base water-tube tiltmeters.

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 into groups on the basis of region of origin as determined by analysis of records obtained daily at the Observatory (U, M, A, D, N). Earthquakes of magnitude 2.5 or greater are generally sufficiently well recorded to be located with greater precision; they are listed individually in table 4. Data on identifiable phases from distant earthquakes are listed in table 5.

Locations of the seismograph stations are shown on figure 3, and essential data on the stations were given in Summary 25.

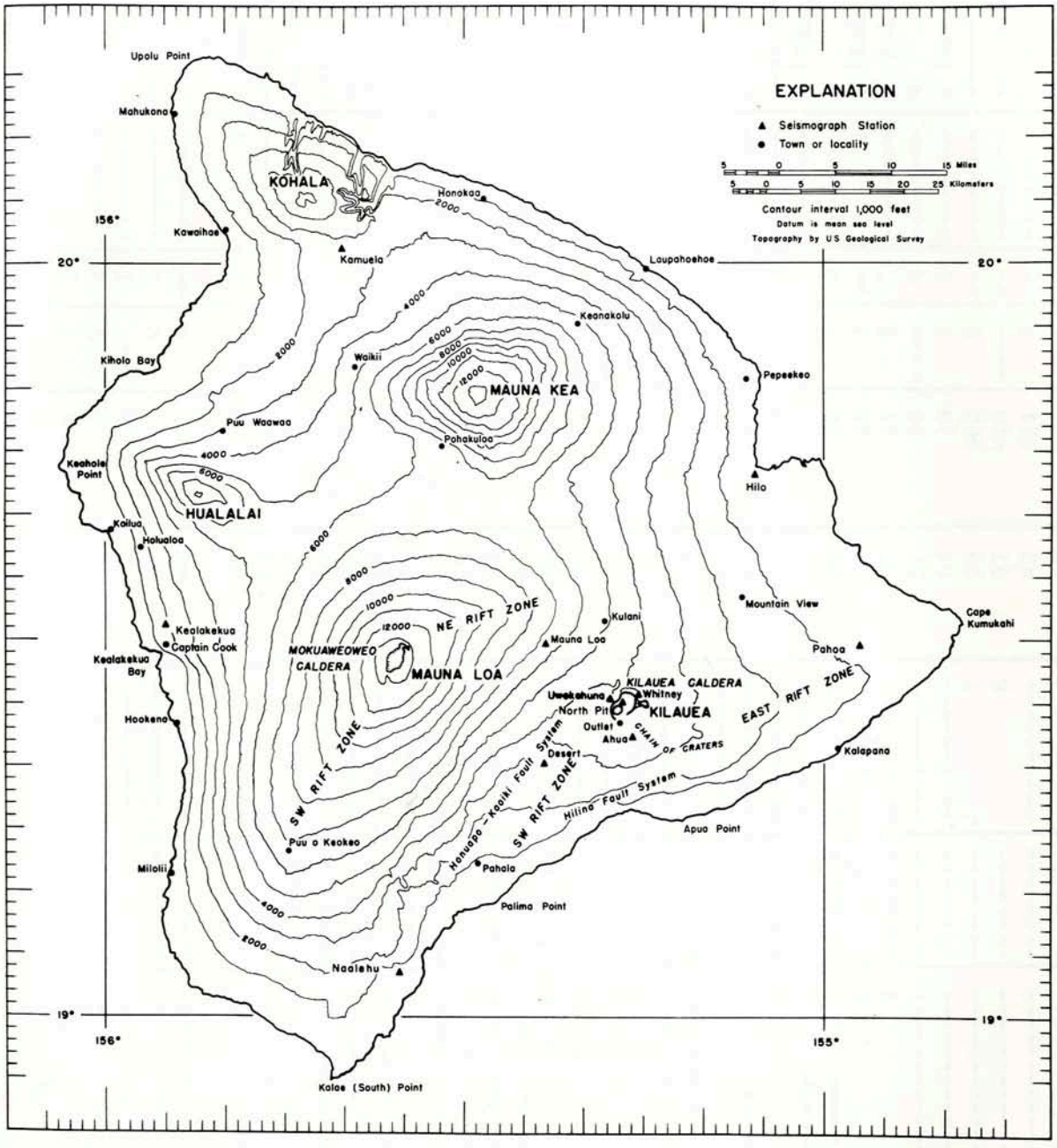

Figure 3.--Map of the island of Hawaii showing seismograph stations operated by the Geological Survey and localities mentioned in the text. Epicenters of local earthquakes are given in terms of geographic coordinates, which are indicated at the edges of the map.

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs around Kilauea caldera (U, M, A, D, and N)

[Tremor is separated into three categories--(1) deep, (2) intermediate, and (3) 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.

Halemaumau rock slides (4) are detected by the characteristic record they produce on the North Pit seismograph.

Earthquake categories are: 5, shallow earthquakes in the Kilauea caldera region;
6, shallow earthquakes along the SW. rift zone of Kilauea and the adjacent portion of the Kaoiki fault system;
7, earthquakes along the eastern half of Kilauea's east rift zone;
8, earthquakes from a source about 30 km beneath Halemaumau;
9, shallow earthquakes along the Kalapana Trail (SE. flank of Kilauea 10 to 15 km W. of Kalapana);
10, earthquakes from other regions: Kona, Mauna Kea, etc.]

Date (1962)	Tremor (in minutes)			Halemaumau slides	Kilauea caldera	SW. rift and Kaoiki	E. rift	30 km	Kalapana Trail	Others
	Deep	Intermediate	Shallow							
	1	2	3	4	5	6	7	8	9	10
Apr. 1	----	----------	--------	----------	245	14	----	6	--------	----------
2	----	----------	--------	----------	71	9	----	11	--------	1 (Kawaihae)
3	----	18	--------	----------	42	12	1	10	--------	1 (Puu ou)
4	----	2	--------	----------	71	15	2	6	--------	1 (Kona)
5	----	----------	--------	----------	30	3	----	7	5	1 (Kona)
6	----	----------	--------	----------	40	11	----	---	13	----------
7	----	----------	--------	----------	40	8	1	5	2	1 (Kona)
8	33	----------	--------	----------	45	11	1	5	1	2 (offshore)
9	----	----------	--------	----------	63	9	1	14	--------	1 (Kona)
10	6	----------	--------	----------	37	12	1	11	--------	1 (Kona)
11	----	----------	--------	----------	55	12	1	12	--------	1 (Hilo)
12	----	----------	--------	----------	47	7	2	11	--------	----------

	13	----	----------	--------	---------	40	13	5	9	--------	8 (Scripps tests)
	14	----	----------	--------	---------	44	25	----	4	--------	3 (Mt. View)
	15	----	----------	--------	---------	52	10	----	3	--------	1 (Mt. View)
	16	----	----------	--------	---------	60	16	1	2	--------	2 (Mt. View)
	17	----	3	--------	---------	37	19	1	5	--------	1 (Kona)
	18	----	----------	--------	---------	44	10	----	5	--------	1 (Mauna Kea)
	19	----	----------	--------	---------	57	11	2	8	--------	----------
	20	----	5	--------	---------	60	10	3	2	--------	----------
	21	24	----------	--------	---------	45	7	----	3	--------	----------
	22	----	----------	--------	---------	70	14	2	3	--------	----------
	23	----	----------	--------	---------	63	33	2	11	--------	----------
	24	----	----------	--------	---------	39	57	----	3	--------	----------
	25	----	----------	--------	---------	56	14	----	3	--------	2
	26	----	3	--------	---------	44	36	1	3	--------	2 (offshore)
	27	----	22	62	---------	37	22	3	2	--------	----------
	28	----	----------	7	---------	60	5	1	8	--------	----------
	29	----	----------	2	---------	45	11	13	4	--------	----------
	30	----	5	--------	---------	37	9	4	8	1	----------
May	1	----	9	--------	---------	37	7	1	14	--------	1 (offshore)
	2	----	2	--------	---------	38	24	----	2	1	----------
	3	----	12	2	---------	41	7	----	7	--------	2
	4	----	----------	--------	---------	26	4	1	3	--------	----------
	5	3	3	--------	---------	30	9	8	3	--------	----------
	6	----	----------	--------	---------	25	7	9	3	1	1 (S. Point)
	7	----	----------	--------	---------	38	10	8	3	--------	2
	8	----	----------	--------	---------	50	11	9	20	--------	----------
	9	----	----------	--------	---------	40	8	1	26	--------	----------
	10	----	----------	--------	---------	34	28	1	46	--------	----------
	11	15	----------	7	---------	50	15	2	20	--------	1 (S. Pali)
	12	----	14	--------	---------	45	20	5	6	--------	1 (S. Pali)
	13	----	----------	80	---------	33	10	3	4	1	----------
	14	----	----------	--------	---------	26	33	23	4	5	----------
	15	----	----------	6	---------	25	27	9	5	--------	----------
	16	----	4	3	---------	35	9	3	4	--------	----------
	17	----	----------	--------	---------	30	5	4	3	5	----------
	18	----	----------	--------	---------	30	9	4	3	--------	1 (Ainapo)
	19	----	----------	--------	---------	30	12	4	7	1	1 (Mauna Loa)
	20	----	25	--------	---------	38	14	11	5	--------	1 (Mauna Kea)
	21	----	----------	3	---------	60	21	----	4	--------	1 (Honokaa)
	22	----	2	--------	---------	36	4	5	1	--------	----------
	23	----	----------	--------	---------	39	26	3	--	--------	2

	24	----	----------	25	----------	52	19	2	2	--------	----------
	25	----	4	--------	----------	35	14	----	--	--------	----------
	26	----	----------	--------	----------	33	5	8	1	--------	----------
	27	----	----------	--------	----------	39	5	2	1	--------	1 (Kaena Point)
	28	----	----------	--------	----------	21	8	2	3	--------	----------
	29	2	----------	--------	----------	32	18	----	1	--------	1 (offshore)
	30	----	----------	--------	----------	32	10	4	1	--------	----------
	31	----	----------	--------	----------	49	29	6	--	--------	2 (Pahala, Honokaa
June	1	----	----------	6	----------	39	6	----	3	1	2 (Kau)
	2	----	----------	--------	----------	35	22	2	2	--------	----------
	3	----	----------	--------	----------	31	16	----	2	--------	----------
	4	----	----------	--------	----------	43	10	1	3	--------	----------
	5	----	----------	--------	----------	34	11	1	2	--------	----------
	6	3	----------	7	----------	57	20	----	1	2	1 (Kona)
	7	----	2	--------	----------	35	14	----	2	--------	----------
	8	4	----------	--------	----------	31	30	----	1	8	1 (Hilo)
	9	----	----------	3	----------	50	14	----	--	--------	----------
	10	----	----------	--------	----------	51	12	3	--	--------	----------
	11	----	----------	--------	1	64	25	----	6	--------	5 (Pahala, Kohala)
	12	----	----------	--------	----------	78	22	----	10	--------	----------
	13	6	----------	--------	----------	44	25	----	30	--------	----------
	14	----	----------	--------	----------	40	15	----	7	--------	----------
	15	----	4	--------	----------	39	10	----	3	1	----------
	16	----	----------	--------	----------	42	25	5	5	--------	2 (Mauna Kea, Kona)
	17	----	----------	--------	----------	93	27	2	4	--------	1 (Kona)
	18	----	2	5	----------	95	15	2	7	--------	2
	19	----	----------	4	----------	102	16	----	10	--------	2
	20	----	6	--------	----------	95	9	----	1	--------	----------
	21	----	----------	5	----------	95	24	1	1	--------	1 (Mauna Kea)
	22	----	----------	--------	----------	71	10	7	2	--------	1
	23	----	2	10	----------	69	18	2	--	1	2 (Kona)
	24	----	2	--------	----------	54	13	5	7	--------	1 (Kohala)
	25	----	----------	--------	----------	57	16	----	9	--------	4
	26	----	----------	--------	----------	69	19	1	5	--------	1 (Kona)
	27	----	----------	--------	7	29	500	2	--	--------	----------
	28	----	----------	--------	8	37	410	----	--	--------	----------
	29	----	----------	--------	----------	42	111	3	4	--------	2 (Maui)
	30	----	----------	--------	----------	65	126	3	6	--------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962

[Except for smaller earthquakes of special interest, only earthquakes with magnitudes of 2.5 or greater are listed. Origin time is Hawaiian standard.

In the following list some origin times are followed only by "KM 30" and a statement of magnitude. These are all members of a continuing family of quakes noted also in other Summaries. The best mean focus for this group is beneath Halemaumau at a depth of 30 km (19°24.1' N., 155°17.1' W.).

Origin times of members of a second persistent sequence of earthquakes are followed by "KT" (Kalapana Trail). These earthquakes originate at very shallow depths in a remote region along the Kalapana Trail west of Kalapana, and they generally are not felt. Seismograms of these earthquakes are poorly recorded and difficult to interpret; so only an approximate epicenter, 19°20' N., 155°05' W., can be assigned to them.

The mean focus of the magnitude 6.1 Kaoiki fault system earthquake of June 27 and its aftershocks is 19°24' N., 155°25' W., at a depth of 3 to 8 km. This focus has been abbreviated "Kaoiki"]

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Apr. 2	12	21	51.0	2.1	19°24.9'	155°04.1'	13 km NW. of Kalapana---	8 km deep.
2	23	22	24.5	2.9	19°59.0'	155°49.8'	12 km S. of Kawaihae----	5 km deep.
4	07	32	04.0	2.0	19°30.5'	155°43.5'	21 km E. of Kealakekua--	3 km deep.
5	01	35	01.9	2.4	19°15.9'	155°12.2'	2 km NW. of Apua Point--	12.5 km deep.
5	08	33	57.0	2.2	19°24.0'	155°42.8'	15 km NNE. of Puu o Keokeo.	5 km deep.
5	10	33	25.9	2.3	19°24.9'	155°16.2'	Kilauea caldera---------	50 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Apr. 5	22	19	12.6	3.4			KT.	
5	22	46	20.9	2.7			KT.	
6	17	38	02.7	3.8			KT.	
6	19	58	46.5	3.2			KT.	
6	23	46	10.8	3.5			KT.	
7	05	29	03.0	3.0			KT.	
8	07	08	15.4	2.8	19°16.0'	156°33.0'	70 km WSW. of Kealakekua-	8 km deep.
8	23	57	53.1	2.4	19°06.8'	154°55.2'	34 km SE. of Apua Point--	12.5 km deep.
9	10	55	26.2	2.4	19°22.1'	155°51.9'	5 km SE. of Hookena------	5 km deep.
10	02	54	25.3	2.5			KT.	
10	20	53	14.5	2.2	19°13.7'	155°49.2'	11 km NE. of Milolii-----	Do.
11	03	26	06.0	2.4	19°19.1'	155°11.4'	10 km SE. of Ahua seismometer.	3 km deep.
11	14	33	17.6	2.7			KT.	
11	23	19	16.5	3.0	19°44.5'	155°08.5'	7 km NW. of Hilo. Felt in Hilo.	20 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Apr. 13	15	30	34.7	2.5	19°29.2'	155°46.4'	15 km ESE. of Kealakekua	3 km deep.
14	05	42	05.3	2.9	19°38'	156°19'	53 km WSW. of Keahole Point.	8 km deep.
14	07	46	58.8	2.7			KT.	
16	16	38	40.1	2.1	19°38.8'	155°10.8'	13 km SW. of Hilo-------	45 km deep.
16	17	50	48.3	2.1	19°26.7'	155°09.7'	32 km SSW. of Hilo------	25 km deep.
17	19	40	55.6	2.3	19°28.6'	155°16.8'	6 km NNE. of Uwekahuna seismometer.	12.5 km deep.
18	23	24	18.2	2.0	19°44.9'	155°29.6'	3 km ESE. of Pohakuloa--	5 km deep.
20	17	32	24.1	2.3			Kaoiki.	
23	18	23	16.9	2.4			KM 30.	
24	03	04	50.1	4.0			Kaoiki. Felt island-wide.	
26	04	54	20.5	2.5	19°07.3'	155°04.0'	66 km S. of Hilo--------	8 km deep.
26	09	21	58.8	3.4	20°05'	156°08'	50 km WNW. of Kamuela---	12.5 km deep.
27	12	47	07.3	2.7			KT.	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
Apr. 27	22	08	27.2	2.6			Kaoiki.	
28	20	03	02.8	2.4	19°26.5'	155°21.4'	6 km SE. of Mauna Loa seismometer.	8 km deep.
29	17	51	39.0	2.5	19°20.0'	155°07.7'	16 km SE. of Ahua seismometer.	12.5 km deep.
30	16	38	36.5	3.0			KT.	
May 1	18	58	13.4	3.7	18°40'	156°40'	117 km SW. of Kealakekua	12.5 km deep.
2	01	25	29.7	2.5	19°13.0'	155°17.5'	16 km SE. of Desert seismometer.	40 km deep.
2	13	31	47.7	2.1	19°25.1'	155°04.0'	34 km SSE. of Hilo------	3 km deep.
3	13	11	45.5	2.3	19°09.8'	155°38.6'	13 km NW. of Naalehu----	Do.
3	16	22	57.0	2.1	19°37.8'	155°06.8'	9 km N. of Mt. View-----	Do.
6	03	38	57.7	2.3			KT.	
6	05	20	23.1	2.1			Kaoiki.	
6	15	18	31.5	2.3	19°03.1'	155°17.8'	34 km SSE. of Desert seismometer.	12.5 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
May 11	00	47	34.3	2.4	19°16.7'	155°08.5'	18 km SE. of Ahua seismometer.	8 km deep.
11	01	55	47.3	2.3			KM 30.	
11	02	51	39.8	2.3			KM 30.	
11	05	00	23.0	2.3	19°08.5'	155°00.4'	13 km SW. of Pahoa------	3 km deep.
11	06	37	23.4	3.7			KM 30. Felt in eastern half of island.	
11	06	40	50.2	2.7			KM 30.	
11	10	38	02.5	2.6	19°18.8'	155°13.9'	9 km SSE. of Ahua seismometer.	3 km deep.
11	15	04	20.2	2.3			KM 30.	
12	16	16	56.3	2.4	19°18.4'	155°05.2'	45 km S. of Hilo--------	3 km deep.
12	22	27	23.5	2.5	19°15.1'	155°12.9'	14 km SSE. of Ahua seismometer.	45 km deep.
13	06	36	55.9	2.3			KM 30.	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
May 13	07	57	14.7	3.3			Kaoiki.	
14	04	00	54.0	2.5			KT.	
14	16	59	52.0	3.1	19°14.0'	154°59.8'	34 km SE. of Ahua seismometer.	At shallow depth.
16	21	25	44.1	2.4	19°27.9'	154°52.7'	9 km SE. of Ahua seismometer. Felt at Pahoa.	Do.
17	14	24	45.7	2.7			KT.	
17	17	13	12.2	2.9			KT.	
18	09	24	37.2	2.6	19°22.0'	155°30.0'	19 km SW. of Mauna Loa seismometer.	3 km deep.
18	23	21	38.1	2.4			KT.	
20	13	43	18.6	2.1	19°52.9'	155°26.1'	11 km SW. of Keanakolu--	8 km deep.
20	19	05	15.3	2.5	19°23.2'	155°30.0'	18 km SW. of Mauna Loa seismometer.	3 km deep.
21	02	11	41.4	2.4	19°16.0'	155°12.1'	14 km SE. of Ahua seismometer.	8 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
May 21	15	19	29.6	2.4	19°24.8'	155°18.4'	2 km SW. of Uwekahuna seismometer.	8 km deep.
21	15	43	23.0	2.4	19°27.5'	155°11.4'	11 km ENE. of Uwekahuna seismometer.	12.5 km deep.
21	23	16	30.2	2.9	20°11.7'	155°23.6'	15 km NE. of Honokaa----	3 km deep.
22	02	41	45.0	2.6	19°11.2'	155°28.0'	2 km SE. of Pahala------	5 km deep.
23	11	17	05.5	3.5	19°32.5'	155°55.5'	3 km N. of Kealakekua. Felt at Kona.	12.5 km deep.
23	22	58	09.9	3.7	19°15.1'	155°23.1'	10 km S. of Desert seismometer. Felt island-wide.	45 km deep.
26	13	13	45.8	2.9	19°26.0'	154°55.3'	8 km SSE. of Pahoa. Felt at Pahoa.	5 km deep.
29	21	11	08.3	3.6	19°23.3'	155°30.0'	14 km NW. of Desert seismometer. Felt at Mt. View.	8 km deep.
29	21	27	27.5	2.2	19°04.8'	155°19.6'	30 km SSE. of Desert seismometer.	Do.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
May 31	13	44	29.1	2.7	19°13.1'	155°30.9'	5 km NW. of Pahala------	8 km deep.
31	23	02	03.8	2.9	20°03.3'	155°17.5'	22 km E. of Honokaa. Felt at Honokaa.	12.5 km deep.
June 1	18	59	01.8	2.2	18°50.1'	155°30.5'	20 km SE. of Kalae Pt.--	8 km deep.
1	23	37	40.4	2.0	19°12.3'	155°23.9'	8 km E. of Pahala-------	45 km deep.
2	07	33	05.8	2.3			KM 30.	
2	12	20	46.3	2.4	19°22.4'	155°03.2'	18 km SW. of Pahoa------	5 km deep.
3	11	30	11.5	2.5	19°19.0'	155°02.5'	22 km SW. of Pahoa------	45 km deep.
4	23	35	21.3	3.9	19°13'	155°13'	20 km SSE. of Ahua seismometer. Felt in Hilo, Pohakuloa, Puna, Pahala, and Volcano.	5 km deep.
7	01	33	19.2	2.4	19°25.0'	155°42.9'	25 km SE. of Kealakekua-	3 km deep.
7	04	03	37.0	2.7			KT. Felt at Hilo.	
7	10	02	58.8	3.4	19°17.7'	155°23.1'	5 km S. of Desert seismometer. Felt at Pahala.	45 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
June 8	10	10	54.1	2.4			Kaoiki.	
8	11	21	55.9	2.5	19°39.2'	155°12.6'	15 km SW. of Desert seismometer.	45 km deep.
8	11	24	58.9	2.5			KT.	
8	17	38	31.0	2.6			KT.	
8	21	43	16.5	3.5			Kaoiki. Felt at Pahala and Hilo.	
9	00	47	52.0	2.9			KT.	
9	04	32	38.8	3.2			KT.	
10	00	15	04.4	2.7	19°09.4'	154°59.7'	11 km SW. of Pahoa------	8 km deep.
10	01	09	45.4	3.0			KM 30.	
10	02	24	15.4	2.5	19°14.0'	155°03.7'	53 km S. of Hilo--------	8 km deep.
10	05	28	46.0	2.7			Kaoiki.	
10	17	09	17.0	2.5	19°21.5'	155°03.4'	40 km SSE. of Hilo------	8 km deep.
11	02	55	57.0	2.7	20°06.1'	155°42.3'	10 km NW. of Kamuela----	3 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
June 11	08	11	29.2	2.5	20°06.1'	155°42.3'	10 km NW. of Kamuela----	3 km deep.
11	09	41	58.0	2.6	19°20.5'	155°30.6'	17 km NNW. of Pahala----	8 km deep.
11	10	53	28.7	2.8	20°06.1'	155°42.3'	10 km NW. of Kamuela----	3 km deep.
11	19	46	35.5	2.6	19°17.3'	155°30.1'	10 km NNW. of Pahala----	Do.
11	21	04	54.1	2.8	19°25.5'	155°00.4'	10 km SW. of Pahoa. Felt at Kapoho.	8 km deep.
11	21	41	18.3	1.9	---do---	---do----	-------do----------	Do.
12	06	15	35.4	2.5	19°12.5'	155°10.2'	21 km SE. of Ahua seismometer.	Do.
13	16	34	55.3	4.3			KM 30. Felt island-wide.	
13	19	16	18.9	3.2			KM 30.	
13	19	27	52.7	2.4			KM 30.	
14	20	31	18.9	2.7			KM 30. Felt at Volcano region.	
15	01	10	00.5	2.6	19°18.7'	155°16.8'	13 km S. of Uwekahuna seismograph.	8 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
June 16	13	41	00.5	2.5			KM 30.	
16	13	50	05.6	2.1	19°45.2'	155°28.7'	5 km E. of Pohakuloa----	12.5 km deep.
16	20	11	23.8	2.5	19°13.7'	155°36.6'	18 km NNW. of Naalehu---	3 km deep.
17	07	02	49.9	2.5	19°20.5'	155°49.4'	20 km SE. of Kealakekua-	Do.
18	04	38	11.1	2.5			Kaoiki.	
18	05	40	47.2	2.5	19°21.9'	155°05.2'	40 km S. of Hilo--------	8 km deep.
18	15	21	38.3	2.5	19°56.2'	155°31.5'	20 km SE. of Kamuela----	3 km deep.
19	04	09	22.7	2.7			Kaoiki.	
19	21	37	02.3	2.8	20°06'	156°19'	67 km WNW. of Kamuela---	12.5 km deep.
21	11	13	25.5	2.3	19°55.0'	155°31.5'	20 km SW. of Kamuela----	3 km deep.
21	12	57	45.4	2.9	19°16.5'	155°07.1'	20 km SE. of Ahua seismometer.	8 km deep.
22	00	11	45.3	3.2			KT.	
22	00	21	59.1	2.9	20°58'	155°01'	128 km NE. of Kamuela---	12.5 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
June 22	00	57	40.1	2.5			KT.	
22	01	05	43.7	2.5	19°21.8'	155°03.4'	19 km SW. of Pahoa------	12.5 km deep.
22	02	15	28.2	2.8	---do---	---do----	----------do----------	Do.
23	00	08	49.3	2.3	19°21.5'	155°05.6'	40 km S. of Hilo--------	8 km deep.
23	17	00	34.2	2.8			KT.	
24	02	33	17.1	2.5			KM 30.	
24	04	22	27.0	2.5	19°32.2'	155°53.1'	3 km NE. of Kealakekua--	3 km deep.
24	09	53	37.0	2.5	---do---	---do----	----------do----------	Do.
25	10	00	46.4	3.0	18°33'	154°40'	115 km SE. of Ahua seismometer.	12.5 km deep.
25	22	06	36.0	2.7	19°52.2'	155°33.7'	20 km SE. of Kamuela----	8 km deep.
26	18	48	18.3	2.3	19°24.1'	155°47.9'	18 km SE. of Kealakekua-	At shallow depth.
27	04	31	33.5	2.5			KM 30.	
27	18	27	14.3	6.1	19°24'	155°25'	Kaoiki. Felt on Hawaii, Maui, and Oahu.	3 to 8 km deep.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June, 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
June 27	19	15	30.4	3.2			Kaoiki.	
27	19	40	27.0	2.3			Kaoiki.	
27	19	48	03.7	2.5			Kaoiki.	
27	20	14	10.7	2.9			Koaiki.	
27	21	30	38.5	2.8			Kaoiki.	
27	21	50	52.4	2.5			Kaoiki.	
27	22	42	05.8	2.5			Kaoiki.	
27	22	47	49.0	2.5			Kaoiki.	
27	23	09	27.0	2.5			Kaoiki.	
27	23	51	27.9	2.5			Kaoiki.	
28	00	05	42.0	2.4			Kaoiki.	
28	00	46	29.4	2.4			Kaoiki.	
28	01	57	09.4	2.8			Kaoiki.	
28	02	22	02.4	2.7			Kaoiki.	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
June 28	02	25	21.2	2.4			Kaoiki.	
28	02	46	47.0	3.0			Kaoiki.	
28	02	58	06.2	2.9			Kaoiki.	
28	03	35	18.9	2.8			Kaoiki.	
28	03	36	56.7	3.7			Kaoiki. Felt at Hilo.	
28	04	17	11.1	2.3			Kaoiki.	
28	04	55	16.0	2.4			Kaoiki.	
28	07	28	03.3	2.7			Kaoiki.	
28	08	00	11.4	2.6			Kaoiki.	
28	08	44	08.8	2.6			Kaoiki.	
28	10	30	19.4	2.3			Kaoiki.	
28	10	37	06.0	2.3			Kaoiki.	
28	12	55	12.5	2.6			Kaoiki.	
28	14	59	12.8	2.3			Kaoiki.	

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, April, May, and June 1962--Continued

Date (1962)	Time			Magnitude	Epicenter			Remarks
	h	m	s		Lat. N.	Long. W.	Description	
June 28	15	17	38.9	2.3			Kaoiki.	
28	15	20	14.3	2.3			Kaoiki.	
28	15	23	02.5	2.3			Kaoiki.	
28	15	29	25.7	2.6			Kaoiki.	
28	17	13	00.3	2.5			Kaoiki.	
29	01	19	30.3	2.3			Kaoiki.	
29	03	23	09.8	2.4			Kaoiki.	
29	08	30	37.6	3.2			Kaoiki.	
29	08	39	52.8	2.6			Kaoiki.	
29	14	41	53.0	3.0	20°52'	155°22'	95 km NE. of Haleakala--	12.5 km deep.
29	16	59	00.0	3.5			Kaoiki.	
29	17	41	56.2	3.1			Kaoiki.	
29	17	47	53.3	2.4			KM 30.	
29	21	13	33.0	2.7	20°06'	156°39'	87 km SW. of Haleakala--	12.5 km deep.
29	23	43	16.2	2.5			Kaoiki.	
30	07	10	56.5	2.3	19°23.1'	155°03.6'	17 km SW. of Pahoa------	3 km deep.
30	20	39	15.1	2.5			Kaoiki.	

Table 5.--Distant earthquakes

[Times are reported in Greenwich Civil Time which is 10 hours faster than Hawaiian Standard Time. A "c" following the time of P indicates compressional first motion; a "d" indicates dilatational first motion. Station symbols, locations, and instrumentation are presented in Summary 25. Magnitudes calculated from the Hawaii seismograms are followed by (HVO). Location of epicenter, origin times, and focal depths, and magnitudes reported by other institutions are taken from "Preliminary Determination of Epicenters" published by the U.S. Coast and Geodetic Survey.

It is unusual to record clear, identifiable phases from the Atlantic or the Caribbean on seismographs in Hawaii. Such a quake is listed on April 20.

Although many seismic phenomena from distant sources are recorded, few such events are felt in Hawaii. Such an uncommon event was recorded on May 11th in the form of T-phase arrivals from an underwater nuclear test (these data are being prepared for special publication). In this case the T-phase was reported felt by residents of the coastal towns and cities of the Big Island]

Apr. 1

M	Z	eP	12:22:05.4 c
Hi	Z	eP	12:22:07.9 d
U	PEN	eG	12:37:36
U	PEE	eR	12:40:44

C&GS card 25-62:
4.2° S., 143.6° E.
12:11:09.2.
Near north coast of New Guinea.
h about 80 km.

Apr. 2

M	Z	iP	00:24:08.3 c
A	Z	iP	00:24:09.0 c
D	Z	eP	00:24:07.9 c
U	Z	iP	00:24:08.8 c
Pa	Z	iP	00:24:10.9 c
Hi	Z	eP	00:24:09.8 c

Apr. 2--Continued

C&GS card 25-62:
18.6° N., 145.5° E.
00:14:50.4.
Mariana Islands.
h about 205 km.

Apr. 3

M	Z	eP	16:33:59.1 d
Pa	Z	eP	16:34:00.5 d
Hi	Z	eP	16:33:59.7 d
Ha	Z	iP	16:33:58.0 c
U	PEN	iG	16:45:12
U	PEZ	eR	16:46:56

Magnitude 5.9 (HVO).

C&GS card 26-62:
10.6° S., 164.9° E.
16:24:55.6.
Santa Cruz Islands region.
h about 36 km.
Magnitude 5.5 (Pal).

Table 5.--Distant earthquakes--Continued

Apr. 6

M	Z	eP	17:00:29.4 d
D	Z	eP	17:00:27.5 d
N	Z	eP	17:00:32.1 d
U	Z	eP	17:00:32.4 d

C&GS card 26-62:
26.7° S., 113.2° W.
16:50:14.2.
Easter Island region.
h about 33 km.

Apr. 7

D	Z	eP	06:31:34.1 c
N	Z	eP	06:31:33.1 d
U	PEZ	eR	06:40:35

C&GS card 28-62:
10.0° N., 144.4° E.
06:21:38.4.
Caroline Islands region.
h about 50 km.
Magnitude 6 (Pas).

Apr. 12

M	Z	iP	01:02:24.2 c
A	Z	eP	01:02:25.5 c
D	Z	eP	01:02:25.1 c
N	Z	eP	01:02:25.2 c
Ha	Z	iP	01:02:15.3 c
Na	Z	eP	01:02:24.4 d
Hi	Z	eP	01:02:25.6 c
Pa	Z	eP	01:02:26.1 d

Apr. 12--Continued

U	PEZ	iS	01:10:19
U	PEZ	iSS	01:14:18
U	PEZ	iR	01:18:15
U	PEE	iL	01:15:32
U	PEN	iG	01:16:04

Magnitude 7.4 (HVO).

C&GS card 28-62:
38.2° N., 142.3° E.
00:52:47.0
Near east coast of Honshu, Japan.
h about 68 km.
Magnitude 7 to 7.25 (Pas), 6.75 to 7.0 (Pal).

Apr. 16

M	Z	iP	13:29:55.0 d
A	Z	iP	13:29:56.0 d
D	Z	eP	13:29:55.2 d
N	Z	iP	13:29:55.4 d
Ha	Z	iP	13:29:47.0 d
Na	Z	iP	13:29:54.6 d
Hi	Z	eP	13:29:56.2 d
Pa	Z	eP	13:29:57.8 d
U	PEE	eS	13:37:38
U	PEZ	iR	13:46:22

Magnitude 6.0 (HVO).

Table 5.--Distant earthquakes--Continued

Apr. 16--Continued

C&GS card 28-62:
30.6° N., 140.6° E.
13:20:15.1.
South of Honshu, Japan.
h about 176 km.

Apr. 18

M	Z	eP	19:26:51.3	d
A	Z	iP	19:26:49.5	d
D	Z	eP	19:26:49.8	d
N	Z	iP	19:26:49.6	d
U	Z	iP	19:26:50.1	d
Pa	Z	iP	19:26:50.5	d
Hi	Z	eP	19:26:49.4	d
Ha	Z	iP	19:26:58.5	d
U	PEZ	iP	19:26:51	c
U	PEZ	iR	19:50:34	
U	PEN	iS	19:37:00	
U	PEN	eSS	19:43:19	

Magnitude 6.6 (HVO).

C&GS card 29-62:
10.0° S., 79.0° W.
19:14:37.2.
Off coast of Peru. Felt at Casma, Peru.
h about 39 km.
Magnitude 6.75 (Pas).

Apr. 19

M	Z	eP	23:26:39.9	d
A	Z	eP	23:26:40.9	d
D	Z	eP	23:26:40.4	d
N	Z	eP	23:26:40.3	d
Ha	Z	eP	23:26:33.1	d
Hi	Z	eP	23:26:39.2	d
Pa	Z	eP	23:26:40.6	d
Na	Z	iP	23:26:41.5	d

Deep, northwest source.

Apr. 20

M	Z	iP	05:59:50.7	c
A	Z	iP	05:59:49.7	c
D	Z	eP	05:59:50.1	c
N	Z	iP	05:50:49.8	c
Ha	Z	iP	05:59	c
Hi	Z	iP	05:59	c
Pa	Z	iP	05:59	c
Na	Z	iP	05:59	d
U	PEZ	iP	05:59:50	c
U	PEN	eS	06:10:34	
U	PEN	eSS	06:15:58	
U	PEN	iG	06:21:10	

Table 5.--Distant earthquakes--Continued

Apr. 20--Continued

Magnitude 6.6 (HVO).

C&GS card 31-62:
20.6° N., 72.2° W.
05:47:55.3.
Near north coast of Haiti,
minor damage at Port-au-Prince.
Felt at San Juan, Puerto Rico.
h about 25 km.
Magnitude 6.5 to 6.75 (Pas),
6.75 to 7.0 (Berk), 6.0 (Pal).

Apr. 22

M	Z	eP	02:18:52.4 c
A	Z	eP	02:18:51.8 c
D	Z	eP	02:18:51.5 c
N	Z	eP	02:18:51.8 c
U	Z	eP	02:18:52.3 d
Pa	Z	eP	02:18:54.2 c
Hi	Z	iP	02:18:55.9 d
Ha	Z	eP	02:18:56.1 c

C&GS card 31-62:
18.9° S., 169.5° E.
02:10:12.1.
New Hebrides Islands region.
h about 288 km.

Apr. 22

M	Z	iP	04:55:17.1 d
A	Z	iP	04:55:16.6 d
D	Z	iP	04:55:17.2 d
N	Z	iP	04:55:16.6 d
U	Z	iP	04:55:16.8 d

Apr. 22--Continued

Pa	Z	iP	04:55:14.4 c
Hi	Z	iP	04:55:14.9 c
U	PEN	eSKS	05:03:58
U	PEZ	eG	05:10:50

C&GS card 30-62:
15.5° N., 93.1° W.
04:45:20.3.
Near coast of Chiapas, Mexico.
h about 69 km.
Magnitude 5.25 to 5.5 (Pal).

Apr. 23

M	Z	eP	06:07:45.3 d
A	Z	eP	06:07:45.8 d
D	Z	iP	06:07:45.6 d
N	Z	eP	06:07:45.3 d
U	Z	iP	06:07:51.3 c
Ha	Z	iP	06:07:40.7 d
Hi	Z	eP	06:07:49.2 c
Pa	Z	eP	06:07:47.1 c
Na	Z	eP	06:07:48.9 d
U	PEZ	iP	06:07:52 c
U	PEZ	ipP	06:08:14
U	PEZ	iPP	06:09:52
U	PEZ	eSS	06:19:20
U	PEZ	iR	06:23:55
U	PEN	iS	06:15:36
U	PEN	iL	06:20:55

Table 5.--Distant earthquakes--Continued

Apr. 23--Continued

U	PEN	iG	06:21:19

Magnitude 6.8 (HVO).

C&GS card 30-62:
42.9° N., 143.4° E.
05:58:04.9.
Hokkaido, Japan.
h about 25 km.
Magnitude 7 to 7.25 (Pas),
7 (Pal).

Apr. 25

U	PEE	iS	16:05:00
U	PEZ	eSS	16:08:27
U	PEZ	iR	16:13:06
U	PEN	eL	16:10:16

C&GS card 32-62:
38.4° N., 142.5° E.
15:47:29.2.
Honshu, Japan.
h about 56 km.

Apr. 26

M	Z	iP	07:33:41.1	d
A	Z	iP	07:33:40.6	d
D	Z	eP	07:33:40.1	d
N	Z	iP	07:33:40.6	d
U	Z	eP	07:33:40.9	d
Na	Z	iP	07:33:38.4	c
Pa	Z	iP	07:33:43.7	d
Hi	Z	iP	07:33:44.8	c

Apr. 26--Continued

Ha	Z	iP	07:33:46.3	c

C&GS card 32-62:
17.8° S., 179.1° W.
07:26:31.3.
Fiji Islands.
h about 689 km.

Apr. 30

M	Z	iP	02:36:16.6	c
A	Z	eP	02:36:17.5	c
D	Z	eP	02:36:16.9	c
N	Z	eP	02:36:16.5	c
U	Z	eP	02:36:16.2	c
Hi	Z	eP	02:36:16.5	c
U	PEE	iP	02:36:18	c
U	PEE	iPP	02:38:29	
U	PEE	eSS	02:48:16	
U	PEE	iR	02:52:33	
U	PEE	iS	02:44:13	
U	PEE	iG	02:50:42	

C&GS card 33-62:
38.8° N., 140.9° E.
02:26:30.0.
Honshu, Japan.
h about 104 km.

Apr. 30

M	Z	eP	16:24:41.8	c
N	Z	eP	16:24:40.3	c

Table 5.--Distant earthquakes--Continued

Apr. 30--Continued

U	PEE	iS	16:31:12
U	PEE	iG	16:33:58

C&GS card 34-62:
17.9° S., 176.1° W.
16:16:47.8.
Tonga Islands region.
h about 26 km.

Apr. 30

U	PEE	eS	18:45:19
U	PEE	eG	18:48:25
U	PEZ	eR	18:49:48

C&GS card 34-62:
18.0° S., 176.4° W.
18:31:06.6
Fiji Islands region.
h about 135 km.

Apr. 30

M	Z	iP	20:51:52.9 d
A	Z	eP	20:51:53.4 d
N	Z	iP	20:51:52.8 d

C&GS card 34-62:
6.4° N., 124.0° E.
20:39:45.1.
Banda Sea.
h about 28 km.

May 2

M	Z	Tmax	03:28:53
A	Z	Tmax	03:28:50
D	Z	Tmax	03:29:00

May 2--Continued

N	Z	Tmax	03:28:52
U	Z	Tmax	03:28:58
Pa	Z	Tmax	03:28:44
Na	Z	Tmax	03:28:29
Hi	Z	Tmax	03:28:27
Ha	Z	Tmax	03:28:51

C&GS card 33-62:
55.9° N., 156.1° W.
02:43:25.9.
Kodiak Island, Alaska region.
h about 25 km.

May 2

U	PEN		19:49:00

Start of pressure wave from Christmas Island nuclear blast; 5 mm max. seismogram amplitude, 75 second period--lasts till 20:04:00.

May 6

U	PEZ	ePP	19:20:42
U	PEZ	ePS	19:30:38
U	PEZ	eR	19:56:10
U	PEN	eSS	19:37:34
U	PEN	eSSS	19:41:54
U	PEN	eG	19:50:49

Magnitude 6.8 (HVO).

Table 5.--Distant earthquakes--Continued

May 6--Continued

C&GS card 35-62:
60.0° S., 32.8° W.
19:00:10.2.
Sandwich Islands region.
h about 25 km.
Magnitude 7.0 (Pas), 6.75 to 7 (Berk), 7.0 (Pal).

May 7

M	Z	iP	17:49:15.1	c
A	Z	iP	17:49:15.9	c
D	Z	iP	17:49:15.0	c
N	Z	iP	17:49:15.5	c
Ha	Z	iP	17:49:04.0	c
Ka	Z	eP	17:49:09.5	c
Hi	Z	eP	17:49:12.6	d
Pa	Z	eP	17:49:16.7	c
Na	Z	eP	17:49:17.4	c
U	PEZ	iP	17:49:14	c
U	PEZ	eS	17:57:02	
U	PEZ	eSS	18:00:46	
U	PEZ	iR	18:03:34	

C&GS card 38-62:
45.3° N., 146.7° E.
17:39:50.3.
Kurile Islands
h about 25 km.
Magnitude 6.75 (Pas), 7.0 (Berk), 6.0 to 6.25 (Pal).

May 10

M	Z	iP	00:11:30.9	d
M	Z	epP	00:11:50.0	
A	Z	iP	00:11:31.9	d
A	Z	epP	00:11:50.3	
D	Z	iP	00:11:31.9	d
D	Z	epP	00:11:50.1	
Ha	Z	eP	00:11:21.5	d
Ka	Z	eP	00:11:27.5	d
Hi	Z	iP	00:11:29.5	c
Pa	Z	eP	00:11:29.5	d

C&GS card 35-62:
62.0° N., 150.1° W.
00:03:40.2.
Alaska.
h about 72 km.
Magnitude 6.0 (Berk), 4.75 to 5.0 (Pal).

May 10

U	PEZ	eR	01:00:46

C&GS card 38-62:
41.8° S., 171.6° E.
00:27:17.5.
South Island, N.Z.
h about 54 km.

May 10

M	Z	iP	05:19:07.5	c
M	Z	ePP	05:20:20.6	
A	Z	iP	05:19:13.7	c

Table 5.--Distant earthquakes--Continued

May 10--Continued

A	Z	ePP	05:20:24.2
N	Z	iP	05:19:07.7 c
N	Z	ePP	05:20:22.7
Ha	Z	eP	05:19:02.6 c
Hi	Z	ePP	05:20:23.7
U	PEZ	iS	05:24:42
U	PEZ	iR	05:28:10
U	PEE	iL	05:26:50
M	Z	Tmax	05:56:20
A	Z	Tmax	05:56:49
D	Z	Tmax	05:56:52
N	Z	Tmax	05:56:45
U	Z	Tmax	05:56:43
Ha	Z	Tmax	05:54:20
Hi	Z	Tmax	05:56:08
Pa	Z	Tmax	05:56:28

C&GS card 36-62:
52.4° N., 170.9° W.
05:12:15.9.
Fox Islands, Aleutians.
h about 43 km.
Magnitude 6.0 (Berk), 5.5 (Pal).

May 11

M	Z	iP	12:14:25.9 c
A	Z	eP	12:14:25.4 d
D	Z	eP	12:14:24.6 c
N	Z	iP	12:14:25.6 c
U	Z	eP	12:14:25.6 c
Na	Z	eP	12:14:22.1 d
Pa	Z	iP	12:14:27.9 c
Hi	Z	iP	12:14:28.5 c
Ka	Z	iP	12:14:27.1 c
Ha	Z	eP	12:14:28.0 c

C&GS card 39-62:
14.3° S., 170.4° E.
12:06:42.1.
New Hebrides Islands region.
h about 623 km.

May 11

M	Z	eP	14:21:05.7 c
A	Z	eP	14:21:05.1 c
D	Z	iP	14:21:05.9 d
N	Z	eP	14:21:03.6 c
U	Z	eP	14:21:05.0 c
Pa	Z	eP	14:21:07.5 c
Hi	Z	iP	14:21:08.7 c
Ka	Z	eP	14:21:08.6 c
Na	Z	eP	14:21:12.4 d
U	PEZ	eS	14:28:38
U	PEZ	eSS	14:32:22
U	PEZ	eG	14:34:04
U	PEZ	iR	14:36:04

Table 5.--Distant earthquakes--Continued

May 11--Continued

Magnitude 6.6 (HVO).

C&GS card 35-62:
17.0° N., 99.7° W.
14:11:51.9.
Near coast of Mexico.
h about 25 km.
Magnitude 7.0 (Pas), 7.0 to 7.25 (Berk).

May 11

M	Z	Tmax	20:39:56
A	Z	Tmax	20:39:53
D	Z	Tmax	20:39:54
N	Z	Tmax	20:39:54
U	Z	Tmax	20:39:54
Pa	Z	Tmax	20:39:45
Hi	Z	Tmax	20:39:43
Ha	Z	Tmax	20:49:17

Artificial T-phase--probably caused by nuclear explosion; felt on northeast coast of Hawaii Island, Hawaii.

No preliminary C&GS listing.

May 15

M	Z	iP	05:35:54.4 c
A	Z	eP	05:35:55.0 c
D	Z	eP	05:35:54.0 c
N	Z	eP	05:35:55.7 c
Hi	Z	iP	05:36:01.2 c

May 15--Continued

Ha	Z	eP	05:36:02.2 d
U	PEZ	iP	05:35:54 c
U	PEZ	ipP	05:36:45
U	PEZ	ipP	05:39:19
U	PEZ	eR	06:01:10
U	PEN	iS	05:46:08
U	PEN	iSS	05:50:43
U	PEN	iSSS	05:54:26
U	PEN	iG	05:56:49

C&GS card 38-62:
7.3° S., 128.3° E.
05:23:45.9.
Banda Sea.
h about 34 km.
Magnitude 7.0 to 7.25 (Pas), 7.5 (Berk).

May 16

U	PEZ	eR	17:55:48

C&GS card 40-62:
13.4° S., 167.3° E.
17:33:05.5.
New Hebrides Islands.
h about 35 km.

May 19

M	Z	iP	15:07:31.2 d
A	Z	iP	15:07:29.9 d
D	Z	iP	15:07:31.1 d
N	Z	iP	15:07:30.1 d
U	Z	iP	15:07:32.5 d

Table 5.--Distant earthquakes--Continued

May 19--Continued

Pa	Z	iP	15:07:31.3	c
Hi	Z	eP	15:07:31.4	c
Ka	Z	eP	15:07:29.9	c
Ha	Z	iP	15:07:40.2	d
U	PEZ	iP	15:07:34	d
U	PEZ	iS	15:15:01	
U	PEZ	iR	15:22:42	
U	PEN	iScS	15:17:20	
U	PEN	iSS	15:18:34	
U	PEN	eG	15:19:45	

Magnitude 6.8 (HVO).

C&GS card 38-62:
17.2° N., 99.5° W.
14:58:13.3.
Near coast of Mexico.
h about 20 km.
Magnitude 7.0 to 7.25 (Pas).

May 21

M	Z	iP	12:16:06.4	d
A	Z	iP	12:16:09.7	d
D	Z	eP	12:16:04.7	d
N	Z	eP	12:16:01.9	d
U	Z	eP	12:16:09.2	d
Ha	Z	eP	12:15:59.4	c
Ka	Z	eP	12:15:58.7	d

May 21--Continued

Hi	Z	eP	12:16:02.5	c
Pa	Z	iP	12:16:09.0	d
U	PEZ	iP	12:16:10	d
U	PEZ	iPP	12:19:46	
U	PEZ	eS	12:26:52	
U	PEZ	ePS	12:28:34	
U	PEZ	eSS	12:33:34	
U	PEZ	eG	12:40:50	
U	PEZ	eR	12:45:22	

Magnitude 6.6 (HVO).

C&GS card 39-62:
37.3° N., 96.0° E.
12:02:50.6.
Chinghai Province, China.
h about 25 km.
Magnitude 7.0 to 7.25 (Pas),
6.5 to 6.75 (Pal).

May 21

M	Z	eP	21:23:12.5	c
A	Z	eP	21:23:12.5	c
D	Z	iP	21:23:12.1	c
N	Z	eP	21:23:12.5	c
U	Z	iP	21:23:12.4	
Pa	Z	iP	21:23:14.3	d
Hi	Z	iP	21:23:15.3	c
Ka	Z	eP	21:23:15.5	c

Table 5.--Distant earthquakes--Continued

May 21--Continued				
Ha	Z	iP	21:23:18.5	d
U	PEZ	iP	21:23:14	c
U	PEZ	ipP	21:24:43	
U	PEZ	isP	21:25:24	
U	PEE	iS	21:29:24	
U	PEE	isS	21:31:38	
U	PEE	iSS	21:32:42	
U	PEN	iG	21:34:22	
Magnitude 7.1 (HVO).				
C&GS card 39-62: 20.0° S., 177.5° W. 21:15:31.0. Fiji Island region. h about 379 km. Magnitude 6.75 to 7.0 (Pas).				
May 22				
M	Z	iP	08:15:13.2	d
M	Z	ipP	08:15:44.1	
A	Z	eP	08:15:13.2	c
A	Z	ipP	08:15:44.0	
D	Z	eP	08:15:13.3	c
D	Z	ipP	08:15:42.8	
N	Z	eP	08:15:13.4	c
N	Z	ipP	08:15:43.8	
U	Z	eP	08:15:13.7	c
May 22--Continued				
U	Z	ipP	08:15:44.3	
Pa	Z	iP	08:15:15.7	d
Pa	Z	ipP	08:15:46.3	
Hi	Z	eP	08:15:17.3	c
Hi	Z	ipP	08:15:45.5	
Ka	Z	eP	08:15:16.4	d
Ha	Z	iP	08:15:15.8	d
Ha	Z	ipP	08:15:34.3	
U	PEZ	iP	08:15:14	c
U	PEZ	ipP	08:15:45	
U	PEZ	isS	08:23:06	
U	PEZ	iSSS	08:27:43	
U	PEZ	eR	08:28:48	
U	PEE	iS	08:22:13	
U	PEN	isSS	08:26:42	
C&GS card 39-62: 12.3° S., 166.6° E. 08:06:38.7. Santa Cruz Islands. h about 151 km. Magnitude 6.5 to 6.75 (Pas), 5.75 to 6.0 (Pal).				
May 22				
U	PEZ	eS	22:22:56	
U	PEZ	eSSS	22:29:29	

Table 5.--Distant earthquakes--Continued

May 22--Continued

U	PEN	eG	22:29:00	

C&GS card 43-62:
5.5° S., 152.0° E.
22:03:36.0.
New Britain.
h about 100 km.

May 24

U	PEZ	eP	04:31:08	d
U	PEZ	ePP	04:32:43	
U	PEN	eS	04:36:52	
U	PEN	eL	04:39:29	
U	PEN	iR	04:41:08	
M	Z	Tmax	05:09:49	
A	Z	Tmax	05:09:45	
D	Z	Tmax	05:09:53	
N	Z	Tmax	05:09:41	
U	Z	Tmax	05:09:59	
Ha	Z	Tmax	05:09:06	
Hi	Z	Tmax	05:09:28	
Pa	Z	Tmax	05:09:38	

C&GS card 41-62:
49.1° N., 129.4° W.
04:24:49.8.
Vancouver Island region.
h about 25 km.

May 25

U	PEZ	eP	04:27:56	c
U	PEZ	eS	04:34:11	
U	PEE	eScS	04:37:26	
U	PEE	ePKS	04:42:21	

C&GS card 42-62:
20.7° S., 174.3° W.
04:19:57.0.
Tonga Islands.
h about 281 km.

May 29

Ha	Z	Tmax	21:43:54

C&GS card 42-62:
51.8° N., 177.1° W.
21:00:16.4.
Andreanof Islands, Aleutian Islands.
h about 25 km.

May 29

U	PEZ	iR	22:22:52

C&GS card 44-62:
26.3° S., 113.7° W.
21:52:50.0.
Easter Island region.
h about 25 km.

May 30

Ha	Z	Tmax	05:40:03

C&GS card 42-62:
44.6° N., 129.5° W.
04:57:46.2.
Off northern coast of California.
h about 25 km.

Table 5.--Distant earthquakes--Continued

May 31				
M	Z	iP	06:37:52.4	d
M	Z	isP	06:38:56.4	
A	Z	iP	06:37:52.9	d
D	Z	iP	06:37:52.4	d
D	Z	isP	06:38:56.7	
N	Z	iP	06:37:52.6	d
U	Z	iP	06:37:52.8	d
Ha	Z	iP	06:37:44.7	c
Ka	Z	iP	06:37:49.5	d
Hi	Z	iP	06:37:53.9	d
Pa	Z	iP	06:37:54.3	d
Na	Z	eP	06:37:52.8	d
U	PEZ	iP	06:37:52	c
U	PEZ	iPP	06:40:07	
U	PEE	iS	06:45:33	
U	PEN	iG	06:52:07	

C&GS card 41-62:
22.1° N., 142.6° E.
06:28:26.2.
Volcano Islands region.
h about 257 km.
Magnitude 6.5 (Pas).

May 31				
M	Z	iP	06:42:18.4	d
A	Z	iP	06:42:18.6	d
D	Z	iP	06:42:18.0	c

May 31--Continued				
N	Z	iP	06:42:18.6	d
U	Z	iP	06:42:18.7	d
Pa	Z	iP	06:42:19.8	d
Hi	Z	iP	06:42:19.4	d
Ka	Z	iP	06:42:17.2	c

Deep, northwest source.

June 2			
U	PEE	eL	12:41:05
M	Z	Tmax	13:11:17
A	Z	Tmax	13:11:29
D	Z	Tmax	13:11:28
N	Z	Tmax	13:11:40
U	Z	Tmax	13:11:34
Ha	Z	Tmax	13:10:52
Hi	Z	Tmax	13:11:06
Pa	Z	Tmax	13:11:30

C&GS card 45-62:
49.9° N., 129.8° W.
12:26:09.6.
Vancouver Island region.
h about 25 km.
Magnitude 5.75 (Pal).

June 2				
U	PEZ	eR	17:45:49	

C&GS card 44-62:
29.8° N., 130.6° E.
17:15:08.7.
Kyushu, Japan.
h about 15 km.

Table 5.--Distant earthquakes--Continued

June 6

U	PEN	eL	18:04:13	
Ha	Z	Tmax	18:32:02	
Pa	Z	Tmax	18:32:03	

C&GS card 44-62:
39.1° N., 123.1° W.
17:50:08.6.
California.
h about 23 km.
Magnitude 5.25 (Pas).

June 8

M	Z	iP	01:39:13.7	d
N	Z	eP	01:39:13.3	d
U	Z	iP	01:39:13.3	d
Hi	Z	iP	01:39:16.3	d
Ha	Z	iP	01:39:18.6	d

C&GS card 45-62:
18.1° S., 178.4° W.
01:31:59.9.
Fiji Islands.
h about 603 km.

June 11

U	PEN	eL	01:08:17	
Pa	Z	Tmax	01:37:53	

C&GS card 47-62:
49.7° N., 129.3° W.
00:52:47.3.
Vancouver Island region.
h about 25 km.

June 11

M	Z	eP	04:42:43.0	c
A	Z	eP	04:42:43.5	c
N	Z	iP	04:42:43.6	c
Pa	Z	eP	04:42:41.5	c
Hi	Z	iP	04:42:41.3	c
Ha	Z	iP	04:42:44.9	c

C&GS card 46-62:
19.6° S., 177.7° W.
04:35:00.6.
Fiji Islands.
h about 370 km.

June 14

M	Z	iP	08:00:01.2	d
A	Z	eP	08:00:02.0	d
D	Z	eP	08:00:01.8	d
N	Z	iP	08:00:01.6	d
U	Z	eP	08:00:01.4	c
Ha	Z	iP	07:59:49.5	c
Hi	Z	iP	07:59:55.0	c
Pa	Z	eP	08:00:01.7	d
U	PEZ	iP	08:00:01	d
U	PEZ	iS	08:06:43	
U	PEZ	iR	08:12:05	
U	PEE	iG	08:09:57	

Table 5.--Distant earthquakes--Continued

June 14--Continued

C&GS card 45-62:
54.3° N., 169.1° E.
07:51:51.0.
Aleutian Is., Near Islands.
h about 34 km.
Magnitude 6.0 to 6.25 (Pas), 5.75 (Berk).

June 14

M	Z	iP	08:03:55.9	c
A	Z	iP	08:03:56.4	c
D	Z	eP	08:03:56.6	d
N	Z	eP	08:03:56.3	c
U	Z	iP	08:03:56.0	d
Ha	Z	iP	08:03:43.5	c
Hi	Z	iP	08:03:54.9	c
Pa	Z	eP	08:03:56.0	c
U	PEZ	iP	08:03:56	c
U	PEZ	iS	08:10:36	
U	PEE	iG	08:14:11	

C&GS card 45-62:
54.2° N., 169.3° E.
07:55:48.9.
Aleutain Is., Near Islands.
h about 56 km.
Magnitude 6.0 (Pas).

June 16

M	Z	iP	06:39:39.8	d

C&GS card 46-62:
0.2° S., 122.8° E.
06:27:29.8.
Celebes region.
h about 177 km.

June 17

M	Z	eP	22:35:44.3	d
A	Z	eP	22:35:45.0	d
D	Z	eP	22:35:44.7	d
U	Z	eP	22:35:45.7	d
Hi	Z	iP	22:35:35.6	c
Ka	Z	eP	22:35:31.0	c

C&GS card 46-62:
51.7° N., 177.0° E.
22:28:04.1.
Andreanof Islands, Aleutian Islands.
h about 22 km.

June 18

M	Z	iP	23:52:17.6	d
Hi	Z	eP	23:52:20.5	d
Ha	Z	iP	23:52:15.7	d
U	PEE	iS	00:00:09	
U	PEN	eG	00:07:01	
U	PEZ	eR	00:08:33	

C&GS card 48-62:
4.8° S., 151.8° E.
23:42:31.3.
New Britain region.
h about 47 km.
Magnitude 6.75 (Pas).

June 23

M	Z	iP	09:55:50.6	d
A	Z	iP	09:55:51.0	d
D	Z	eP	09:55:50.9	d

Table 5.--Distant earthquakes--Continued

June 23--Continued

N	Z	eP	09:55:50.5	d
U	Z	iP	09:55:50.8	d
Ha	Z	iP	09:55:43.2	d
Ka	Z	iP	09:55:47.0	d
Hi	Z	iP	09:55:52.1	d
Pa	Z	iP	09:55:52.9	d
U	PEZ	iP	09:55:51	d
U	PEZ	iR	10:16:33	
U	PEE	ePP	09:57:36	
U	PEE	eS	10:05:05	

C&GS card 48-62:
25.7° N., 128.5° E.
09:44:37.7.
Ryukyu Islands.
h about 36 km.
Magnitude 5.75 (Berk).

June 23

M	Z	eP	10:10:25.8	d
A	Z	eP	10:10:25.4	d
D	Z	eP	10:10:24.9	d
N	Z	eP	10:10:24.8	d
U	Z	eP	10:10:24.8	c
U	PEZ	eP	10:10:25.3	d
Hi	Z	eP	10:10:23.8	c

June 23--Continued

C&GS card 49-62:
19.1° N., 121.4° E.
09:58:26.0.
Near coast of Luzon, Philippine Islands.
h about 40 km.

June 25

M	Z	eP	11:22:12.9	c
A	Z	eP	11:22:11.9	c
N	Z	eP	11:22:10.9	c
Pa	Z	eP	11:22:13.3	d
U	PEZ	iP	11:22:09	c
U	PEZ	eR	11:44:33	
U	PEN	iS	11:31:55	

C&GS card 49-62:
24.3° N., 122.6° E.
11:10:23.3.
Off coast of Formosa.
h about 33 km.
Magnitude 5.75 (Pas), 5.5 (Berk).

June 30

M	Z	eP	19:41:51.3	c
D	Z	eP	19:41:51.1	c
N	Z	eP	19:41:51.4	c
U	PEZ	eR	20:06:15	

Magnitude 5.9 (HVO).

C&GS card 50-62:
16.5° N., 122.0° E.
19:29:51.0.
Coast of Luzon, Philippine Islands.
h about 40 km.

An unusually large number of persons visited the Observatory during the second quarter, 1962. Many of them were going to or returning from the International Symposium on Volcanology in Tokyo. These visitors were:

Dan A. Davis, Milton Hackett, G. F. Worts, Jack Rosenau, U.S. Geological Survey, Ground Water Division.
Thomas E. Chase, U.S. Bureau of Commercial Fisheries.
Stuart M. Smith, Dept. of Earth Science, Scripps Institution.
Donald Wise, Dept. of Geology, Franklin and Marshall College.
Victor Vacquier, Scripps Institution.
George Shor, Jr., Scripps Institution.
L. Radley Squier, Shannon and Wilson, Inc., Seattle.
Robert Eppley, U.S. Coast and Geodetic Survey, Honolulu Observatory.
Keichi Kasahara, Earth Research Institute, University of Tokyo.
Robert A. Stonely, U.S. Coast and Geodetic Survey, Washington, D.C.
A. S. Furumoto, Institute of Geophysics, University of Hawaii.
M. Bordner, Hawaii State Economic Research and Development Commission.
Hatten Yoder, Jr., Geophysical Laboratory.
C. E. Tilley, Cambridge, England.
J. F. Schairer, Geophysical Laboratory.
A. R. McBirney, Scripps Institution.
C. R. Robson, Seismic Research Unit, U.C.W.I., Trinidad.
Jerry McLaughlin, Donald J. Murray, Eugene E. Moe, Harry Carles, Mell Baker, U.S. Geological Survey, Topographic Division.
E. F. Osborn, Penn. State University.
Ann Palm, University of California, Berkeley.
W. T. Cronenwett, Electro-Mechanics Co., Austin, Texas.
Bernard Geze, Institut National Agronomique, Paris.
J. Noetzlin, CNRS de France, Geneva, Switzerland.
J. L. Kulp, Lamont Observatory.
Robert Decker, Dartmouth College, N.H.
Pierre Evrard, Universite de Liege.
Jerry P. Eaton, U.S. Geological Survey, Crustal Studies Branch.
Howard A. Powers, U.S. Geological Survey, Denver, Colorado.
Allan Wilson, University of Queensland, Brisbane.
K. J. Murata, U.S. Geological Survey, Menlo Park.
Irving Friedman, U.S. Geological Survey, Washington and Denver.
Roland VonHuene, Naval Ordnance, China Lake.
Kumizi Iida, Institute of Earth Sciences, Nagoya University.
Allen Loomis, Jet Propulsion Lab., Pasadena.
Harry Smedes, Robert Fournier, U.S. Geological Survey, Washington.
Willard H. Parsons, Wayne State University.
Robert L. Smith, Branch of Field Geochemisty and Petrology, U.S. Geological Survey, Washington.
Roy A. Bailey, U.S. Geological Survey, Washington.
George M. Brownell, University of Manitoba, Winnipeg.
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UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY

SUMMARY 27

July, August, and September, 1962

By
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and Akira Yamamoto

and

Direction of First Motion from Four Earthquakes
from a Single Focus
By Harold L. Krivoy

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HAWAIIAN VOLCANO OBSERVATORY SUMMARY 27

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Direction of First Motion from Four Earthquakes from a Single Focus

By Harold L. Krivoy

Table A presents data on four earthquakes: epicenter, focal depth, origin times, compressional wave travel times, first-motion directions, and magnitudes. The first two quakes were felt weakly only in the community of "Volcano." The second two were felt island-wide. This size difference is also reflected in the questionable timing of the first arrival at such distant stations as Maui. In quakes I and II, the Maui instruments evidently failed to record the earliest compressional arrival.

Thanks are due to the following Hawaii residents who reported feeling the four quakes:

1st quake--Miss English (Volcano)
2nd quake--Miss English, Mrs. Duncan (Volcano)
3rd and 4th quakes--Miss English, Mrs. Duncan, Mrs. Fraser, Mrs. Hansen, Mr. Mist, Mr. Francis, Mr. Ayers, Mrs. Wehrsig, Dr. Wentworth, Mr. Koyanagi, Mr. Yamamoto, Dr. Moore, Mr. Krivoy (Volcano or National Park); Mr. and Mrs. Baldwin, Mr. Zuprick, Mr. Wilson, Mr. Elliot, Mrs. Ingledue, Miss Nitta, Mr. Ho (Hilo area); Mr. Hansen (Central Hawaii); Kulani Honor Camp personnel; Mrs. Linsey (North Kona); Mrs. Walters, Mrs. Kiva (Kau region); Honokaa Police, Mrs. Christensen (North Hawaii).

With only one exception, residents who reported the third quake also reported the smaller fourth quake. These quakes originated about 25 km beneath the community of Volcano, which probably accounts for the numerous reports from Volcano, Hilo, National Park and Kulani Honor Camp. Of special interest is the report from Mrs. Lindsey of Puu Anahula--a small community near Puu Waawaa where deep Kilauea quakes are surprisingly well-felt. In this case (as in others) Mrs. Lindsey reported quakes not felt by equally perceptive observers in parts of Kona and Kau much closer to the epicenter.

The pattern of first-motion direction is identical for the first three quakes, and is reversed for the last quake of the group. The third and fourth quakes come within 3 minutes of each other from essentially the same focus; they suggest complex strains in the focal region because every discernible first-motion of IV is opposite to its counterpart in I, II, and III.

Table A.

	First motion of P				P-O, compressional wave travel time				Magnitudes (? magnitude = motion too great for recording system)			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Mauna Loa	-	-	-	+	4.8	4.8	4.8	4.8	2.9	2.9	?	?
Ahua	-	-	-	+	4.4	4.1	4.2	4.3	?	2.9	?	?
Desert	-	-	-	+	5.2	5.1	5.1	4.9	?	?	?	?
North Pit	-	-	-	+	4.0	4.0	4.1	3.9	?	?	?	?
Uwekahuna	-	-	-	+	4.1	3.9	4.1	3.9	3.1	3.1	3.7	3.5
Hilo	+	+	?	-?	6.2	6.2	6.1	6.3	3.0	3.0	3.9	3.8
Pahoa	+?	+	+?	?	6.1	5.9	6.0	5.9	3.0	3.0	?	?
Naalehu	-	?	-?	+?	9.4	9.1	9.6	9.4	2.8	2.7	?	?
Kamuela	?	?	?	?	11.6?	13.1?	11.9	11.6	2.8	3.1	?	?
Maui	?	?	-?	-	28.0?	28.7?	24.0	24.0	3.1	2.9	3.6	3.4

I = 11:51:41.9 HST, Jan. 3, 1962
II = 18:16:41.8 HST, Jan. 3, 1962
III = 07:22:49.7 HST, Sept. 11, 1962
IV = 07:25:27.7 HST, Sept. 11, 1962

Epicenter: 19°28.6' N., 155°14.0' W.
Depth: 25 km

First-motions plotted on the station location map do not fall into the quadrant pattern typical of strike-slip faults; the region of compression can be separated from that of rarefaction by a single line through the epicenter with an azimuth between about N. 35° W. and N. 80° W. The uncertainty could be materially reduced by additional stations at such sites as Puu Waawaa, Makaopuhi or Kalapana. Apparently the fault movement was predominantly dip-slip in all four quakes, the southwest side being downthrown during the first three and upthrown during the fourth.

Because of its small size, this group of four similar quakes has proven convenient as an illustration of the needs and possibilities in analysis of first-motion data provided by the Volcano Observatory seismic net. In 6 years of modern recording we have observed about six distinctive earthquake families. Some of these appear to be endemic and are still being recorded; others, once prolific, seem now to have ceased. Some of these families consist of swarms of thousands of quakes; some come by the hundreds. We hope to be able to review and to analyze each such group in an effort to learn more about the dynamics of Hawaiian volcanism.

Chronological summary

Inflation of the summit region of Kilauea appears to have been somewhat more rapid during the third quarter of 1962 than during the previous 6 months. Tilting at Uwekahuna Vault (table 2) averaged 12 urad/month toward N. 50° W. during the third quarter as compared with 7 urad/month and 3 urad/month in the same direction during the first and second quarters, respectively.

Small shallow earthquakes at Kilauea caldera (table 3) continued through the third quarter; the average daily counts were 52, 64, and 62 for July, August, and September, respectively.

Average daily counts of earthquakes from the source about 30 km beneath Halemaumau were 6 for July, 3 for August, and 2 for September. Earthquakes of this group were felt in the region of Kilauea caldera and elsewhere on Hawaii on July 6, July 14, July 27, and September 27.

The frequency of aftershocks of the magnitude 6.1 Kaoiki earthquake of June 27 and of small earthquakes from the adjacent part of Kilauea's southwest rift zone decreased steadily during July from 112 on the 1st to 15 on the 31st. The average daily count of these earthquakes decreased from 37 for July to 12 for August and to 8 for September. Earthquakes from this source were felt in Hilo on July 15 and in Hilo, Pahoa, and Naalehu on July 27.

An unusual variety of large local quakes from scattered sources was recorded during July, and many of them were felt (table 4). The largest, from a shallow focus 14 km west-northwest of Kealakekua, had a magnitude of 4.9 and was felt over the entire island at 23^h53^m on July 23. Loose objects were overturned and there was alarm in Kona; but no serious damage was reported. A magnitude 4.5 shock from

a shallow focus 8 km west-southwest of Kealakekua was felt in Kona at 23^h53^m on July 23. The earthquake felt over the entire island at 7^h38^m on July 14 had a magnitude of 4.0 and originated 18 km south-southwest of Waikii at a depth of about 10 km.

The largest earthquake during August occurred about 8 km deep and 11 km southeast of the Ahua seismometer at 16^h59^m on the 18th. It had a magnitude of 4.6 and was felt over the entire island. A magnitude 4.0 earthquake from a focus 14 km northeast of Naalehu and about 8 km deep was felt from Hilo to Kona at 23^h30^m on August 17.

The largest earthquake during September (magnitude 4.1) originated 25 km south-southeast of Apua Point and was felt in Hilo and the Kilauea caldera region at 3^h59^m on September 8. Two earthquakes from a focus 9 km northeast of Uwekahuna and 25 km deep were felt over the entire island on September 11. The first, at 7^h23^m, had a magnitude of 3.7; the second, at 07^h25^m, had a magnitude of 3.6.

Minutes of deep tremor recorded during September greatly exceeded that recorded during any other month since October 1961.

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 (table 2), 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 1-unit change in coordinate corresponds to a tilting of 1 microradian (1 mm per km) in the direction indicated.

The field tilt-bases were not occupied during this third quarter, 1962.

Table 1.--Tilt coordinates at Uwekahuna Vault, July, August, and September, 1962

Date	N-S	E-W	Date	N-S	E-W
July 1	440	529	Sept. 2	449	516
8	440	527	9	452	513
15	442	530	16	454	511
22	444	526	23	456	505
29	444	525	30	457	505
Aug. 5	446	523			
12	446	520			
19	446	522			
26	447	520			

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 into groups on the basis of region of origin as determined by analysis of records obtained daily at the Observatory (U, M, A, D, N). Earthquakes of magnitude 2.5 or greater are generally sufficiently well recorded to be located with greater precision; they are listed individually in table 4. Data on identifiable phases from distant earthquakes are listed in table 5.

Locations of the seismograph stations are shown on figure 1, and essential data on the stations were given in Summary 25.

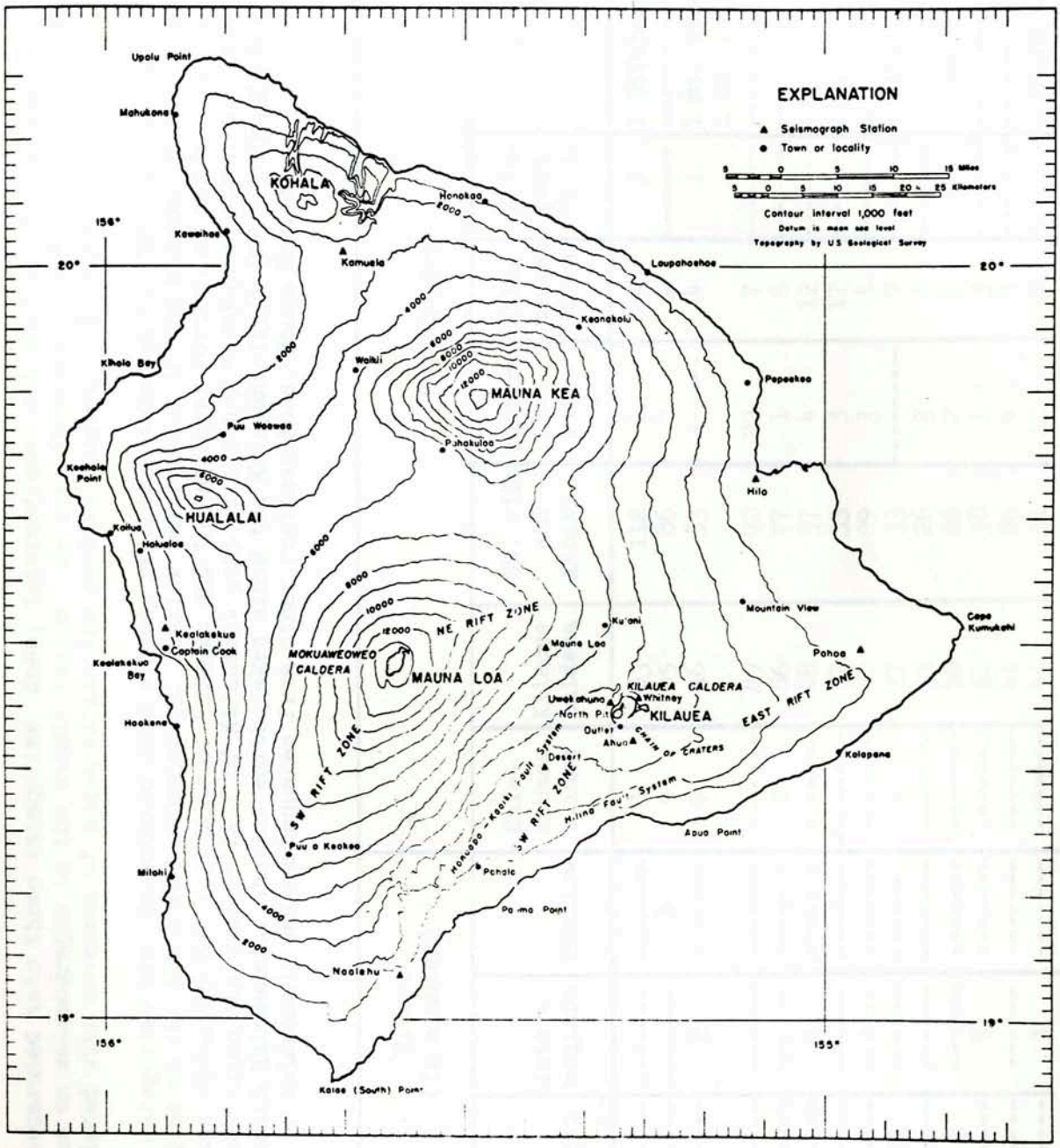

Figure 1.--Map of the island of Hawaii showing seismograph stations operated by the Geological Survey and localities mentioned in the text. Epicenters of local earthquakes are given in terms of geographic coordinates, which are indicated at the edges of the map.

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N 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 magna within the central complex of Kilauea.

Earthquake categories are: Halemaumau rock slides, which are detected by the characteristic record they produce on the North Pit seismograph; shallow earthquakes in the Kilauea caldera region; shallo 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; earthquakes from a source about 30 km beneath Halemaumau; shallow earthquakes along the Kalapana Trail (SE. flank of Kilauea 10 to 15 km W. of Kalapana); and earthquakes from other regions: Kona, Mauna Kea, etc.

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Intermediate	Shallow	Halemaumau slides	Kilauea caldera	SW. rift and Kaoiki	Eastern East rift	Halemaumau 30 km	Kalapana Trail	Others
July 1	------	------	------	1	83	112	2	9	1	1 Offshore Kalapana
2	------	------	4	9	105	86	2	4	------	------
3	------	2	------	2	36	53	------	4	1	1 Mt. View 1 SW. rift Mauna Loa
4	------	------	------	------	89	90	22	7	------	------
5	------	------	------	2	86	77	1	6	------	------
6	------	2	------	------	48	37	4	12	------	------
7	------	------	------	------	37	33	3	17	------	2 Apua Pt.
8	------	------	------	------	42	29	3	5	------	1 Offshore Apua Pt.
9	37	------	------	1	37	33	------	9	------	1 Offshore Naalehu
10	------	------	------	------	33	26	3	5	------	------
11	3	------	------	------	58	26	2	7	2	------
12	------	8	------	------	51	38	1	3	------	------
13	------	------	------	------	41	26	4	4	------	------
14	------	3	------	------	41	31	12	2	------	1 Mauna Kea

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N around Kilauea caldera--Continued

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Intermediate	Shallow	Halemaumau slides	Kilauea caldera	SW. rift and Kaoiki	Eastern East rift	Halemaumau 30 km	Kalapana Trail	Others
July 15	-----	-------	--------	1	69	37	2	13	-------	1 Offshore Naalehu
16	-----	-------	--------	------	68	34	3	3	-------	1 Offshore Apua Pt.
17	3	-------	--------	------	30	15	3	5	-------	1 Kona
18	-----	-------	--------	------	36	26	1	8	-------	1 Offshore Naalehu
19	-----	-------	--------	------	38	20	1	1	-------	----------
20	-----	3	--------	------	22	22	3	1	-------	1 Hilina Pali
21	-----	-------	--------	------	38	23	2	3	-------	1 Offshore Kawaihae
22	-----	-------	--------	------	66	17	----	6	2	1 Offshore Apua Pt.
23	-----	-------	--------	1	83	39	----	1	-------	1 Kona
24	-----	-------	--------	------	56	23	----	4	-------	1 Kona
25	-----	-------	--------	------	37	32	1	1	1	1 Mauna Kea
26	-----	-------	--------	------	60	46	----	1	-------	----------
27	-----	-------	--------	------	43	33	16	22	1	----------
28	-----	-------	--------	1	38	22	5	4	-------	----------
29	-----	-------	--------	------	49	28	2	3	-------	1 N. Kona
30	-----	6	--------	------	24	20	10	3	1	1 Mauna Kea
31	2	3	--------	1	68	15	2	1	1	----------
Aug. 1	-----	------	--------	------	53	22	1	------	-------	1 Offshore Hamakua
2	3	------	2	------	34	18	5	5	-------	----------
3	-----	5	2	------	50	15	1	------	-------	1 Offshore Naalehu
4	-----	2	--------	1	45	19	4	6	2	----------
5	-----	------	--------	------	38	15	3	4	-------	----------
6	-----	------	--------	1	50	8	-----	9	-------	----------
7	-----	------	2	1	63	9	-----	4	-------	----------
8	-----	------	--------	------	75	16	-----	5	-------	----------

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N around Kilauea caldera--Continued

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Intermediate	Shallow	Halemaumau slides	Kilauea caldera	SW. rift and Kaoiki	Eastern East rift	Halemaumau 30 km	Kalapana Trail	Others
Aug. 9	------	------	------	------	94	22	------	1	------	----------
10	------	------	------	------	56	18	1	2	------	1 Kona 2 Hilina Pali
11	------	------	------	1	95	18	------	1	------	1 Kona
12	37	4	------	------	62	14	------	2	------	1 N. Kona
13	------	------	------	------	60	9	------	3	1	1 N. of Naalehu 1 Cape Kumukahi
14	------	4	------	------	83	14	5	1	------	1 Offshore Kona
15	------	------	------	------	65	11	------	2	------	1 Hilina Pali 2 Kona
16	14	------	------	------	50	8	3	----	2	----------
17	------	------	------	------	43	9	------	----	------	1 NE of Naalehu
18	------	9	------	4	61	7	------	1	------	1 Hilina Pali
19	------	------	------	------	52	10	3	8	------	1 Laupahoehoe 1 Kamuela
20	------	------	------	------	55	6	6	----	9	1 Offshore Kona 1 Offshore Hilo
21	------	------	------	1	70	11	1	1	------	2 Offshore Kona 2 SW. rift Mauna Loa
22	------	------	------	1	66	7	1	1	3	1 Offshore Kona
23	3	------	------	------	69	10	------	8	------	----------
24	------	------	------	------	79	3	3	2	------	1 N. Kona
25	------	------	------	3	80	4	6	3	------	1 Offshore Kona
26	------	------	------	------	74	11	4	2	------	----------

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N around Kilauea Caldera--Continued

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Inter-mediate	Shallow	Hale-maumau slides	Kilauea caldera	SW. rift and Kaoiki	Eastern East rift	Hale-maumau 30 km	Kala-pana Trail	Others
Aug. 27	------	-------	-------	------	80	5	2	3	-------	1 Central Kona 1 Offshore Kona
28	------	3	-------	1	76	6	1	1	-------	1 N. Kona
29	------	-------	-------	1	47	30	1	-----	-------	1 Offshore Kona
30	------	-------	-------	-------	86	17	2	3	1	----------
31	------	-------	-------	-------	65	6	-----	-----	-------	----------
Sept. 1	7	-------	-------	-------	73	7	4	-----	1	----------
2	------	-------	-------	-------	57	11	-----	-----	-------	1 Kulani 1 Offshore Kona
3	------	-------	-------	-------	40	4	-----	-----	-------	----------
4	------	-------	-------	-------	37	5	-----	1	-------	----------
5	------	-------	-------	-------	90	2	1	6	-------	----------
6	------	-------	-------	-------	73	6	-----	2	-------	1 Offshore Kawaihae.
7	------	-------	-------	-------	110	6	1	6	-------	----------
8	------	-------	-------	-------	60	9	1	3	-------	1 Offshore Apua Pt.
9	------	-------	-------	2	80	8	5	------	-------	1 S. Kona
10	------	-------	-------	1	52	13	------	2	-------	1 Offshore Kona
11	25	-------	-------	-------	53	8	------	2	-------	2 Kulani 1 Offshore Kona
12	21	-------	-------	-------	60	8	------	2	-------	1 Central Kona
13	------	-------	-------	-------	64	12	------	2	3	----------
14	------	-------	-------	-------	62	7	------	2	2	2 Kona
15	------	-------	-------	-------	82	6	------	2	-------	----------

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N around Kilauea Caldera--Continued

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Intermediate	Shallow	Halemaumau slides	Kilauea caldera	SW. rift and Kaoiki	Eastern East rift	Halemaumau 30 km	Kalapana Trail	Others
Sept. 16	3	-------	-------	------	72	15	1	------	-----	1 Offshore Kona
17	3	-------	-------	------	51	21	1	------	2	----------
18	----	-------	-------	------	50	7	-------	3	-----	1 Mauna Kea
										2 Kona
19	----	-------	-------	------	36	5	1	1	-----	1 Offshore Maui
										2 Mauna Kea
20	----	-------	-------	------	45	14	1	1	2	1 Offshore Maui
21	----	-------	-------	1	54	7	-----	3	-----	1 Offshore Naalehu
22	----	-------	-------	------	38	7	3	1	-----	1 Offshore Naalehu
										2 Offshore Kona
23	----	-------	-------	1	73	9	1	------	-----	1 Kohala
24	----	-------	-------	2	64	4	1	1	-----	----------
25	----	-------	-------	------	50	12	3	------	-----	1 S. Flank Mauna Loa
										1 Mt. View
26	----	-------	-------	------	75	10	------	1	-----	----------
27	21	-------	-------	------	78	7	2	8	-----	1 Offshore Laupahoehoe.
28	55	-------	-------	------	55	12	1	3	-----	1 Offshore Naalehu
										1 Offshore Molokai
29	----	-------	-------	------	55	4	5	2	-----	2 Kona
30	----	-------	-------	1	75	8	29	------	-----	1 Kona
										1 Offshore Naalehu

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962

[Except for smaller earthquakes of special interest, only earthquakes with magnitudes of 2.5 or greater are listed. Origin time is Hawaiian standard.

In the following list some origin times are followed only by "KM 30" and a statement of magnitude. These are all members of a continuing family of quakes noted also in other Summaries. The best mean focus for this group is beneath Halemaumau at a depth of 30 km (19°24.1' N., 155°17.1' W.).

Origin times of members of a second persistent sequence of earthquakes are followed by "KT" (Kalapana Trail). These earthquakes originate at very shallow depths in a remote region along the Kalapana Trail west of Kalapana, and they generally are not felt. Seismograms of these earthquakes are poorly recorded and difficult to interpret; so only an approximate epicenter, 19°20' N., 155°05' W., can be assigned to them.

The mean focus of the magnitude 6.1 Kaoiki fault system earthquake of June 27 and its aftershocks is 19°24'N., 155°25' W., at a depth of 3 to 8 km. This focus has been abbreviated "Kaoiki"]

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
July 1	09	18	53.5	3.1	13	19°10.2'	154°58.2'	20 km south of Kalapana	----------
1	10	17	38.1	2.1	5	19°17.9'	155°38.8'	27 km north-northwest of Naalehu.	----------
3	02	07	13.2	2.7	13	19°34.8'	155°11.6'	8 km west-northwest of Mountain View.	Felt in Mountain View.
3	18	40	41.3	3.5	5	19°15.0'	155°37.7'	21 km north-northwest of Naalehu.	Felt in Pahala

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
July 4	00	08	37.6	2.7	---	------	--------	KT----------	----------
4	01	17	21.5	2.0	8	19° 20.2'	155°23.2'	Near Desert seismometer	----------
4	06	21	45.0	2.7	35	19°22.1'	155°16.8'	Near Ahua seismometer--	----------
5	01	05	12.6	2.3	---	------	--------	Kaoiki----------	----------
6	00	58	42.3	3.0	---	------	--------	Kaoiki----------	----------
6	06	41	52.9	2.5	---	------	--------	KM 30----------	Felt in Kilauea caldera region.
6	16	41	25.0	2.3	---	------	--------	Kaoiki----------	----------
7	05	53	50.5	2.1	3	19°14.9'	155°07.1'	8 km east-southeast of Apua Point.	----------
7	05	55	12.5	2.7	5	19°13.0'	155°06.8'	10 km southeast of Apua Point.	----------
7	17	28	10.6	2.7	---	------	--------	KM 30	----------
8	22	24	12.7	2.9	8	18°48'	155°08'	50 km south-southeast of Apua Point.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
July 9	21	52	08.0	2.5	---	------	--------	KM 30----------	----------
9	01	45	28.4	2.6	8	18°58.1'	155°21.5'	27 km east-southeast of Naalehu.	----------
12	04	18	47.2	2.7	---	------	--------	KT----------	----------
12	15	35	42.4	2.6	---	------	--------	KM 30----------	----------
13	03	06	28.5	2.3	---	------	--------	KM 30----------	----------
14	05	48	33.6	2.9	---	------	--------	KM 30----------	Felt in Kilauea caldera region.
14	07	37	53.1	4.0	10	19°44.4'	155°38.2'	18 km south-southeast of Waikii.	Felt island-wide
15	02	35	22.6	3.2	---	------	--------	Kaoiki----------	Felt in Hilo
15	17	11	12.5	3.1	3	19°01.3'	155°27.5'	15 km east-southeast of Naalehu.	----------
16	04	28	47.2	2.7	---	-----	--------	KM 30----------	----------
16	04	30	45.7	2.0	---	-----	--------	KM 30----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
July 16	13	03	53.6	2.8	13	18°14'	155°01'	62 km south-southeast of Apua Point.	----------
16	19	12	59.0	2.5	45	19°39.8'	155°21.0'	19 km north-northeast of Mauna Loa seismometer.	----------
17	23	26	18.4	2.3	--	-------	--------	Kaoiki----------	----------
18	04	44	23.0	2.0	3	19°03.4'	155°25.3'	17 km east of Naalehu	----------
19	11	39	40.0	2.5	--	-------	--------	Kaoiki----------	----------
19	12	45	04.7	2.5	--	-------	--------	Kaoiki----------	----------
19	19	14	52.2	2.4	--	-------	--------	KM 30----------	----------
21	16	50	36.5	3.5	3	19°58'	156°16'	45 km west-southwest of Kawaihae.	----------
22	11	55	20.6	2.7	3	18°54.2'	155°08.2	40 km south-southeast of Apua Point.	----------
22	14	08	55.5	3.1	--	-------	--------	KT----------	----------
22	22	16	37.3	2.5	--	-------	--------	KM 30----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
July 23	04	19	26.3	2.3	---	------	--------	KT----------	----------
23	23	52	41.1	4.5	shallow	19°28.9'	155°59.2'	8 km west-southwest of Kealakekua.	Felt along west coast of Hawaii
24	09	18	44.8	2.5	---	------	--------	Kaoiki----------	----------
24	13	15	53.0	2.2	3	19°25.2'	154°52.8'	12 km southeast of Pahoa.	----------
24	17	48	13.9	4.9	3	19°34.0'	156°01.9'	14 km west-northwest of Kealakekua.	Felt island-wide.
25	00	32	06.5	2.5	13	19°56.1'	155°25.8'	10 km west-northwest of Keanakolu.	----------
25	08	28	00.1	2.5	---	-------	--------	KT----------	----------
25	15	21	52.1	2.4	---	-------	--------	KT----------	----------
27	00	04	44.2	3.0	---	-------	--------	Kaoiki----------	Felt in Hilo, Pahala, and Naalehu.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
July 27	20	57	48.5	2.5	---	-------	-------	Kaoiki----------	----------
27	22	06	41.7	3.4	---	-------	-------	KM 30----------	Felt in Pahala and Kilauea caldera region.
27	22	16	49.1	2.8	---	-------	-------	KM 30----------	----------
28	05	44	36.8	2.1	---	-------	-------	KT----------	Felt in Kapoho (Cape Kumukahi)
29	06	51	16.0	2.9	13	19°46.2'	155°54.9'	10 km west of Puu Waawaa	----------
30	22	58	56.3	2.7	8	19°52.5'	155°19.3'	5 km south-southeast of Keanakolu.	Felt in Paauilo (northern coast of Hawaii).

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
July 31	02	46	48.0	3.5	shallow	19°25.5'	155°.00.0'	8 km southwest of Pahoa	Felt in Kap
31	03	24	15.8	3.7	----	-------	--------	KT----------	Felt in Hil
Aug. 1	09	57	39.2	3.0	13	20°57'	155°08'	105 km north-northeast of Laupahoehoe.	----------
1	16	06	28.4	3.0	----	-------	--------	Kaoiki----------	----------
1	16	28	37.6	2.3	----	-------	--------	KT----------	----------
1	21	58	51.2	2.4	----	-------	--------	KT----------	----------
2	04	38	13.1	1.9	8	19°28.8'	155°01.7'	8 km west-southwest of Pahoa.	Felt in Pahoa
3	05	50	41.7	2.5	8	19°24.0'	154°57.7'	13 km south-southwest of Pahoa.	----------
3	05	57	44.0	2.5	3	19°24.1'	155°01.1'	13 km southwest of Pahoa.	----------
3	08	31	59.0	2.3	8	19°04.9'	155°31.8'	7 km east-northeast of Naalehu.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Aug. 5	02	18	06.3	2.1	----	-------	--------	KM 30----------	----------
5	02	58	29.0	2.4	3	19°27'	154°54'	8 km SE of Pahoa---------	----------
8	11	46	29.0	2.3	----	-------	--------	KM 30----------	----------
9	00	27	11.2	2.3	----	-------	--------	KM 30----------	----------
9	06	44	53.9	2.7	----	-------	--------	KT----------	----------
9	15	50	07.0	2.7	----	-------	--------	Kaoiki----------	----------
9	21	16	54.2	2.5	----	-------	--------	Kaoiki----------	----------
9	23	12	19.0	2.0	----	-------	--------	KT----------	----------
10	02	17	55.0	2.0	----	-------	--------	KT----------	----------
10	15	37	20.1	2.2	----	-------	--------	KM 30----------	----------
11	01	39	26.2	2.6	50	19°10.6'	155°20.2'	20 km SSE of Desert seismometer.	----------
11	22	46	57.2	2.5	----	-------	--------	KM 30----------	----------
12	02	07	18.2	2.5	13	19°45.0'	155°46.5'	7 km ESE of Puu Waawaa	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Aug. 13	16	28	01.5	2.2	8	19°13.4'	155°35.0'	18 km north of Naalehu	----------
13	22	32	06.0	2.4	5	19°14'	154°34'	40 km southeast of Cape Kumukahi.	----------
14	19	28	25.4	2.6	3	19°22'	156°16'	40 km southwest of Kealakekua.	----------
14	21	11	39.0	2.5	shallow	19°28.2'	154°58.7'	5 km southwest of Pahoa.	----------
14	23	37	50.0	2.7	----	-------	--------	KT----------	----------
16	17	15	07.5	2.6	1 1/2	19°23.2'	154°53.6'	14 km south-southeast of Pahoa.	Felt in Kapoho (Cape Kumakahi)
16	18	31	39.5	2.7	1 1/2	19°23.2'	154°53.6'	14 km south-southeast of Pahoa.	Felt in Kapoho (Cape Kumakahi)

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Aug. 17	23	30	06.5	4.0	8	19°10.8'	155°32.0'	14 km northeast of Naalehu.	Felt in the southern half of Hawaii.
18	16	58	41.8	4.6	8	19°18.2'	155°11.7'	11 km southeast of Ahua seismometer.	Felt island-wide.
18	18	21	49.8	2.7	8	19°17.7'	155°24.4'	13 km northeast of Pahala.	----------
18	18	47	21.0	2.0	3	19°22.8'	155°09.7	11 km east of Ahua seismometer.	----------
19	00	19	02.4	2.2	8	19°52.7'	155°16.8'	15 km south-southeast of Laupahoehoe.	----------
19	00	53	11.0	3.0	8	19°22.0'	155°29.0'	18 km north of Pahala	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Aug. 19	20	23	50.0	2.5	8	19°50.5'	155°31.4'	28 km southeast of Kamuela.	----------
20	01	39	07.3	3.0	8	19°10'	156°13'	50 km southwest of Kealakekua.	----------
20	03	44	25.9	2.2	8	19°48.9'	155°15.9'	23 km northwest of Hilo.	----------
20	05	31	39.1	3.0	---	-------	--------	KT----------	----------
20	06	24	37.1	2.7	---	-------	--------	KT----------	----------
20	13	40	23.9	2.9	---	-------	--------	KT----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Aug. 20	14	41	51.9	2.6	---	-------	--------	KT----------	---------
20	14	58	29.2	2.8	---	-------	--------	KT----------	---------
21	04	26	34.5	2.8	8	19°10'	156°13'	50 km southwest of Kealakekua.	----------
21	13	29	31.8	2.9	8	19°10'	156°13'	50 km southwest of Kealakekua.	----------
21	13	39	58.8	2.6	3	19°29.2'	155°42.6'	13 km west-northwest of Mokuaweoweo caldera.	----------
21	13	52	22.5	2.4	3	19°27.9'	155°42.1'	12 km west of Mokuaweoweo caldera.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Aug. 22	14	24	41.7	2.8	8	19°10'	156°13'	50 km southwest of Kealakekua.	----------
22	22	52	44.9	2.7	---	--------	--------	KM 30----------	----------
22	23	22	34.9	3.3	---	--------	--------	KT----------	Felt in Kilauea caldera region.
23	18	39	20.8	2.5	---	--------	--------	KM 30----------	----------
23	18	39	38.9	2.9	---	--------	--------	KM 30----------	----------
25	13	20	44.5	2.2	---	--------	--------	KM 30----------	----------
25	17	54	00.5	2.4	---	--------	--------	Kaoiki----------	----------
25	21	41	14.3	2.1	8	19°20.5'	155°01.5'	19 km southwest of Pahoa.	----------
25	22	22	19.0	3.4	13	19°09'	156°10'	50 km southwest of Kealakekua.	----------
27	03	23	19.9	2.8	13	19°07'	156°10'	53 km southwest of Kealakekua.	----------
27	12	31	53.7	2.5	8	19°32.2'	155°55.5'	3 km north-northwest of Kealakekua.	----------
29	20	30	40.2	2.6	13	18°57'	156°15 '	70 km southwest of Kealakekua.	----------
30	03	27	13.4	2.5	8	19°21.1'	155°23.2'	1 1/2 km north of Desert seismometer.	----------
30	15	53	43.1	2.3	---	--------	--------	KM 30----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Aug. 30	16	16	33.2	3.1	---	-------	--------	KT----------	----------
30	16	44	28.9	2.5	3	19°22.1'	155°29.3'	17 km southwest of Mauna Loa seismometer.	----------
31	09	42	31.0	3.0	8	19°28.0'	155°25.5'	5 km southwest of Mauna Loa seismometer.	----------
Sept. 2	13	16	00.4	2.6	30	19°25.7'	155°18.1'	1 km northwest of Uwekahuna seismometer.	----------
2	14	11	07.3	2.2	30	19°25.7'	155°18.1'	1 km northwest of Uwekahuna seismometer.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Sept. 2	15	34	40.0	2.5	---	-------	-------	Kaoiki----------	----------
2	17	17	05.2	3.1	30	19°28.5'	155°15.0'	7 km northeast of Uwekahuna seismometer.	Felt in Kilauea caldera region
2	21	49	20.0	3.5	13	19°08'	156°11'	50 km southwest of Kealakekua.	----------
3	07	28	02.8	2.4	---	-------	-------	Kaoiki----------	----------
3	13	34	50.3	2.5	---	-------	-------	Kaoiki----------	----------
4	04	27	54.0	2.4	10	19°18.6'	155°15.8'	7 km south of Ahua seismometer.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Sept. 4	04	36	48.0	2.4	10	19°18.6'	155°15.8'	7 km south of Ahua seismometer.	----------
6	02	47	23.9	3.3	13	19°59.8'	156°00.0'	19 km west-southwest of Kawaihae.	----------
8	01	42	12.8	2.8	3	19°27.3'	154°50.1'	13 km southeast of Pahoa.	Felt in Pahoa
8	03	58	58.0	4.1	8	19°02.3'	155°08.5'	25 km south-southeast of Apua Point.	Felt in Hilo and Kilauea caldera region.
9	07	17	32.7	2.6	3	19°20.7'	155°06.6'	17 km east-southeast of Ahua seismometer.	----------
9	10	05	26.1	2.5	3	19°23.8'	155°00.6'	13 km southwest of Pahoa.	----------
9	17	57	57.0	2.7	8	19°18.0'	155°50.3'	12 km southeast of Hookena.	----------
10	19	11	15.0	3.6	3	19°20.0'	155°06.3'	18 km east-southeast of Ahua seismometer.	Felt in eastern Hawaii.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Sept. 10	22	36	44.6	2.9	13	19°05.5	156°10.0'	55 km southwest of Kealakekua.	----------
11	07	22	49.8	3.7	25	19°28.6'	155°14.0'	9 km northeast of Uwekahuna seismometer.	Felt island-wide.
11	07	25	27.5	3.6	25	19°28.6'	155°14.0'	9 km northeast of Uwekahuna seismometer.	Felt island-wide.
11	17	39	51.7	2.9	13	19°05.5'	156°10.0'	55 km southwest of Kealakekua.	----------
12	17	46	05.7	2.8	8	19°34.5'	155°55.4'	7 km north of Kealakekua.	----------
12	00	30	54.9	2.2	8	19°16.0'	155°12.1'	14 km southeast of Ahua seismometer.	----------
12	16	08	26.6	2.0	3	19°18.1'	155°27.6'	9 km southwest of Desert seismometer.	----------
13	12	41	59.9	2.2	---	-------	--------	KT----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Sept. 13	13	09	38.3	2.5	----	-------	--------	KT----------	----------
14	16	32	11.7	3.6	----	-------	--------	KT----------	----------
15	02	22	14.3	3.1	----	-------	--------	KT----------	----------
16	11	27	26.0	2.7	3	19°16.2'	155°02.9'	27 km southwest of Pahoa.	----------
17	11	17	55.3	3.1	----	-------	--------	Kaoiki----------	----------
18	03	30	03.1	2.8	----	-------	--------	Kaoiki----------	----------
18	03	46	32.2	3.0	8	19°50.4'	155°43.8'	21 km south-southwest of Kamuela.	----------
18	06	55	08.1	2.6	5	19°22.6'	155°05.1'	37 km south of Hilo	----------
19	03	29	45.1	2.8	13	20°46'	155°49'	40 km east of Haleakala, Maui seismograph.	----------
19	04	27	08.7	2.5	8	20°00.8'	155°20.8'	11 km west-northwest of Laupahoehoe.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Sept. 19	16	02	37.3	3.7	13	19°18.5'	155°04.7'	45 km south of Hilo.	Felt in Hi
19	17	54	18.0	2.8	8	19°53.5'	155°37.7'	16 km southeast of Kamuela.	----------
20	22	46	05.9	3.7	13	20°46'	155°01'	109 km northeast of Kamuela.	----------
21	15	28	08.0	2.7	13	19°02.8'	155°25.3'	18 km east-southeast of Naalehu.	----------
21	18	52	10.6	2.1	--	--------	--------	KM 30----------	----------
22	13	27	29.2	3.0	13	19°46.'	156°32'	70 km northwest of Kealakekua.	----------
22	13	33	42.0	2.6	8	19°22.1'	155°56.9'	16 km south-southwest of Kealakekua.	----------
22	19	34	11.2	2.2	8	19°06.6'	155°22.8'	23 km east-northeast of Naalehu.	----------
23	10	38	47.4	2.9	13	20°13.2'	155°49.0'	25 km northwest of Kamuela.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Sept. 23	14	50	26.0	2.4	30	19°26.3'	155°07.9'	16 km northeast of Ahua seismometer.	----------
24	13	34	47.4	2.3	10	19°18.6'	155°12.5'	6 km southeast of Ahua seismometer.	----------
24	19	05	21.3	2.8	--	--------	---------	Kaoiki----------	----------
25	09	03	48.5	2.6	3	19°25.8'	155°02.5'	25 km east-northeast of Ahua seismometer.	----------
25	13	22	50.4	3.5	8	19°15.1'	155°30.2'	8 km northwest of Pahala.	Felt in Hilo and Pahala.
26	13	09	51.9	2.4	--	-------	--------	Kaoiki----------	----------
27	00	52	02.6	.2	15	20°03.3'	155°05.2'	38 km north of Hilo	----------
27	18	04	17.7	3.2	--	-------	--------	KM 30----------	Felt in north Hawaii, and Kilauea caldera region.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, July, August, and September, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Sept. 27	20	11	42.7	2.6	--	-------	--------	KM 30----------	----------
28	09	44	49.0	2.5	8	18°56.8'	155°18.1'	35 km southeast of Naalehu.	----------
28	12	44	43.7	3.3	13	21°27'	156°47'	96 km northwest of Haleakala seismometer.	----------
28	22	50	05.0	2.5	30	19°21.2'	155°19.6'	7 km east-northeast of Desert seismometer.	----------
29	09	50	53.9	2.3	8	19°33.7'	155°41.5'	25 km east-northeast of Kealakekua.	----------
29	10	13	50.0	3.2	8	19°21.0'	155°54.9'	5 km south-southwest of Hookena.	----------
30	12	45	10.5	2.5	--	-------	--------	Kaoiki----------	----------
30	13	05	42.0	2.5	3	19°25.7'	154°56.8'	8 km south of Pahoa	----------
30	20	22	12.0	2.9	3	19°02.8'	155°25.2'	18 km east of Naalehu	----------

Table 5.--Distant earthquakes

[Times are reported in Greenwich Civil Time which is 10 hours faster than Hawaiian Standard Time. A "c" following the time of P indicates compressional first motion; a "d" indicates dilatational first motion. Station symbols, locations, and instrumentation are presented in Summary 25. Magnitudes calculated from the Hawaii seismograms are followed by (HVO). Location of epicenter, origin times, and focal depths, and magnitudes reported by other institutions are taken from "Preliminary Determination of Epicenters" published by the U.S. Coast and Geodetic Survey.

A major disaster recorded this quarter was the Iranian quake of September 1, 1962. By comparison, the Agadir earthquake of February 29, 1960, caused roughly equivalent casualties and damage, but it failed to record any recognizable phases on the HVO network]

July 2, 1962

M	Z	iP	08:41:16.7 c
A	Z	iP	08:41:16.7
D	Z	eP	08:41:16.2 d
U	Z	iP	08:41:16.5 c
Pa	Z	iP	08:41:18.6 c
Na	Z	iP	08:41:13.7 d
Hi	Z	iP	08:41:19.4 c
Ha	Z	iP	08:41:18.2 d
U	PEZ	iP	08:41:17 c
		iR	08:54:57
U	PEN	eS	08:48:18
U	PEE	eL	08:52:29

C&GS card 54-62:
08:32:37.9
10.3° S., 165.9° E.
Santa Cruz Island
h about 50 km
Magnitude 6.3 (Berk).

July 3

U	PEN	eS	18:44:17
U	PEZ	iR	18:56:53

C&GS card 59-62:
18:22:06.3
54.6° S., 132.3° W.
South Pacific Ocean
h about 25 km.

July 5

U	PEZ	eR	18:06:30

C&GS card 52-62:
17:40:55.3
30.9° N., 141.4° E.
South of Honshu
h about 23 km.

Table 5.--Distant earthquakes--Continued

July 6, 1962

M	Z	eP	23:23:50.1	c
A	Z	eP	23:23:50.1	c
N	Z	eP	23:23:49.1	c
U	PEZ	iP	23:24:10	c
U	PEN	eSKS	23:33:52	
U	PEZ	eG	23:58:30	

C&GS card 54-62:
23:05:32.2
36.6° N., 70.4° E.
Hindu Kush
h about 203 km.

July 7

M	Z	iP	06:20:11.3	c
A	Z	eP	06:20:13.0	c
D	Z	eP	06:20:12.4	c
N	Z	eP	06:20:12.3	c
U	PEZ	iP	06:20:13	c
U	PEN	eS	06:25:55	
U	PEN	iR	06:29:35	
Ha	Z	Tmax	06:58:05.6	

C&GS card 54-62:
06:12:48.9
51.3° N., 178.6° E.
Rat Islands, Aleutian Islands
h about 60 km.

July 8

M	Z	eP	03:29:15.2	d
A	Z	eP	03:29:16.2	d
N	Z	eP	03:29:16.7	d
U	PEZ	eR	03:39:11.2	

C&GS card 54-62:
03:22:03.8
51.5° N., 178.5° E.
Aleutian Islands, Rat Islands
h about 60 km.

July 11

M	Z	eP	12:52:47.5	c
A	Z	eP	12:52:48.0	c
D	Z	eP	12:52:47.4	c
N	Z	eP	12:52:47.8	c
U	PEN	eG	13:13:41	
U	PEZ	eR	13:17:05	

C&GS card 53-62:
12:40:30.7
11.9° N., 122.1° E.
Panay, Philippine Islands
h about 25 km.

July 13

M	Z	eP	03:44:02	c
U	PEZ	eR	04:08:22	

C&GS card 53-62:
03:32:00.5
10.4° N., 122.6° E.
Panay, Philippine Islands
h about 66 km.

Table 5.--Distant earthquakes--Continued

July 15, 1962

M	Z	iP	06:57:04.6 d
A	Z	iP	06:57:05.2 d
D	Z	iP	06:57:04.4 d
N	Z	iP	06:57:05.0 d
U	Z	iP	06:57:04.4 c
Pa	Z	eP	06:57:05.8 c
Hi	Z	eP	06:57:05.4 d
Ha	Z	eP	06:57:18.2 d
U	PEZ	eG	07:13:43

C&GS card 53-62:
06:47:22.5
39.8° N., 140.9° E.
Honshu, Japan
h about 103 km.

July 16

M	Z	iP	13:02:36.7 d
A	Z	iP	13:02:37.9 d
D	Z	eP	13:02:37.7 d
N	Z	iP	13:02:36.7 d
U	Z	eP	13:02:37.4 c
Hi	Z	iP	13:02:34.4 d
Ha	Z	eP	13:02:27.5 d
U	PEZ	eP	13:02:37.2 c
U	PEZ	eR	13:14:55
U	PEE	eS	13:10:27

July 16--Continued

C&GS card 53-62:
12:54:40.6
62.3° N., 153.1° W.
Alaska
h about 39 km.

July 17

M	Z	iP	17:30:05 d
Hi	Z	eP	17:30:06 c
U	PEN	eS	17:37:43
U	PEE	eL	17:42:55
U	PEZ	iR	17:45:17

C&GS card 56-62:
17:20:22.9
43.1° N., 144.5° E.
Hokkaido, Japan
h about 30 km.

July 22

M	Z	iP	13:46:01 d
D	Z	eP	13:46:08
N	Z	eP	13:46:01 d

C&GS card 57-62:
13:36:49.7
8.4° S., 158.8° E.
Solomon Islands
h about 107 km.

July 24, 1962

M	Z	iP	21:18:15.3	d
A	Z	ip	21:18:15.0	d
D	Z	eP	21:18:15	
N	Z	eP	21:18:14.3	d
Pa	Z	iP	21:18:12.1	c
Hi	Z	iP	21:18:13.8	c
Ka	Z	iP	21:18:15.8	d
U	PEZ	eP	21:18:18	d
M	Z	ipP	21:18:42.5	
A	Z	ipP	21:18:41	
N	Z	epP	21:18:41.4	
U	PEZ	epP	21:18:41	
U	Z	eS	21:26:43	

C&GS card 57-62:
21:08:22.6
15.5°N., 92.5° W.
Mexico
h about 129 km
Magnitude 5.6 (Berk)
5.5 (Pal)

July 25

U	PEZ	eP	04:48:19	c
Hi	Z	eP	04:48:58	d
Ka	Z	eP	04:48:57	c
U	PEZ	eS	04:58:21	
U	PEZ	eSS	05:02:27	
U	PEZ	eR	05:09:59	

July 25--Continued

C&GS card 60-62:
04:37:50.7
18.9° N., 81.1° W.
West of Jamaica
h about 64 km
Magnitude 6 (Pas), 6.2 (HVO),
5.5 (Berk),
6 (Pal).

July 26

M	Z	iP	08:26:05.4	c
A	Z	iP	08:26:04.8	c
D	Z	iP	08:26:05.0	c
N	Z	iP	08:26:04.6	c
U	PEZ	iP	08:26:05	c
Pa	Z	iP	08:26:03.1	c
Na	Z	eP	08:26:07.5	c
Hi	Z	iP	08:26:03.8	c
Ka	Z	iP	08:26:06.4	c
Ha	Z	iP	08:26:09.8	c
A	Z	ePP	08:28:53	
U	PEZ	iS	08:35:23	
U	PEZ	iSS	08:40:07	
U	PEN	iL	08:43:55	
U	PEZ	iR	08:47:25	

C&GS card 58-62:
08:14:41.8
7.5° N., 82.7° W.
South of Panama
h about 21 km
Magnitude 6.8 (Pas)
7 (Berk)
7.5 (HVO)

July 28, 1962

M	Z	iP	00:12:44.0 c
A	Z	iP	00:12:43.8 c
D	Z	eP	00:12:42.7
N	Z	eP	00:12:44.0 c
Hi	Z	iP	00:12:44.7 c
Ha	Z	iP	00:12:49.3 c
U	PEZ	iP	00:12:55
U	PEZ	eS	00:18:47
U	PEZ	eG	00:22:11

C&GS card 61-62:
00:05:10.8
16.2° S., 173.2° W.
Samoa Islands
h about 40 km.
Felt: Apia

July 30

M	Z	iP	17:27:21.3 c
A	Z	eP	17:27:21.7 c
D	Z	eP	17:27:21.4 c
U	Z	eP	17:27:21.9 c
U	PEZ	iP	17:27:21.1 c
Hi	Z	iP	17:27:22.8 d
U	PEZ	ePP	17:29:51
U	PEE	iS	17:36:11
U	PEE	iSS	17:40:25
U	PEN	iG	17:43:21
U	PEZ	iR	17:45:56

July 30--Continued

C&GS card 60-62:
17:16:44.4
3.3° S., 143.9° E.
North Coast of New Guinea
h about 25 km
Magnitude 6.8 - 7 (Pas)
7 (Berk)
7 (Pal)

July 30

M	Z	iP	20:30:44.6 d
A	Z	iP	20:30:41.8 d
D	Z	eP	20:30:44.9
N	Z	eP	20:30:44.3 d
Hi	Z	eP	20:30:47.0 c
Ha	Z	eP	20:30:53.2 c
U	PEZ	iP	20:31:19 c
U	PEZ	ePP	20:34:11
U	PEE	iS	20:41:05
U	PEE	iSS	20:45:21
U	PEE	iL	20:51:10
U	PEE	iG	20:51:41

C&GS card 58-62:
20:18:49.3
5.0° N., 76.3° W.
Western Colombia
h about 45 km
Magnitude 7.0 (HVO)
6.8 (Pas)
6.8 (Berk)
6 (Pal).
47 killed in Caldas Province; property damage over 400,000 sq. miles.

Table 5.--Distant earthquakes--Continued

July 31, 1962

M	Z	iP	05:25:05.8 d
A	Z	iP	05:25:06.5 d
D	Z	iP	05:25:05.6 d
N	Z	iP	05:25:06.1 d
U	PEZ	eR	05:50:13

C&GS card 60-62:
05:13:04.1
18.8° N., 120.8° E.
Near north coast of Luzon, Philippines
h about 39 km.

Aug. 1

M	Z	iP	04:47:34.9 c
Pa	Z	iP	04:47:39.6 d
Hi	Z	iP	04:47:34.5 c
Ha	Z	iP	04:47:32.0 c
U	Z	eP	04:47:37.7
U	PEZ	iP	04:47:37
U	PEZ	iPcP	04:48:15
U	PEZ	iPP	04:49:57
U	PEZ	iPPP	04:51:32
U	PEE	iS	04:56:16
U	PEN	iSS	05:00:23
U	PEN	iG	05:03:29
U	PEZ	iR	05:06:09

August 1--Continued

C&GS card 62-62:
04:36:57.6
3.2° S., 143.7° E.
North coast of New Guinea
h about 33 km
Magnitude 6.5-6.8 (Pas)
7 (Berk)
6.5 (Pal)

Aug. 3

M	Z	iP	09:09:31.4 c
A	Z	iP	09:09:29.9 d
U	Z	iP	09:09:30.6 d
U	PEZ	iP	09:09:31 d
Pa	Z	iP	09:09:28.9 d
Hi	Z	iP	09:09:30.4 d
Ha	Z	iP	09:09:36.7 d
U	PEZ	iPP	09:13:23
U	PEZ	iPPP	09:15:23
U	PEE	eSKS	09:19:58
U	PEE	eS	09:21:01
U	PEE	iPPS	09:22:39
U	PEN	eG	09:35:09
U	PEZ	iR	09:39:27
Pa	Z	Tmax	10:53:13.9
Ha	Z	Tmax	10:55:17.7
M	Z	Tmax	10:53:51

Aug. 13, 1962

A	Z	eP	06:47:25.1 c
N	Z	eP	06:47:24.8 c
U	PEZ	eS	06:56:46
U	PEZ	eL	07:06:16

C&GS card 65-62:
06:35:56.0
2.1°N., 83.5° W.
About 300 miles NW of Ecuador
h about 33 km
Magnitude 6.5-6.8 (Pas)
5.4 (Berk)
5.5-5.8 (Pal)

Aug. 15

M	Z	eP	08:28:12.4 c
U	PEZ	eR	08:42:04

C&GS card 63-62:
08:19:37.8
54.6° N., 161.5° E.
East coast of Kamchatka
h about 52 km.

Aug. 17

M	Z	iP	05:16:41.6 c
A	Z	iP	05:16:42.8 c
D	Z	eP	05:16:42.3 c
N	Z	eP	05:16:42.6 c
U	PEZ	iP	05:16:44 c
Hi	Z	eP	05:16:44.7 c
U	PEZ	eSKS	05:27:40
U	PEZ	ePPS	05:29:42
U	PEZ	eG	05:41:22

August 17,--Continued

C&GS card 67-62:
05:04:31.5
10.6° N., 121.6° E.
Panay region, Philippine Islands
h about 33 km.

Aug. 18

M	Z	iP	16:51:50.1 d
A	Z	iP	16:51:51.1 d
D	Z	iP	16:51:51.0 d
N	Z	eP	16:51:50.2 d
Pa	Z	iP	16:51:50.0 d
Hi	Z	iP	16:51:48.8 d
U	PEZ	eR	17:04:49

C&GS card 67-62:
16:43:54.3
62.3° N., 152.5° W.
Central Alaska. Felt.
h about 32 km
Magnitude 6-6.3 (Pas)
5.3-5.5 (Pal)
5.3 (HVO)

Aug. 18

M	Z	iP	17:54:10.4 d
A	Z	eP	17:54:11.0 d
D	Z	eP	17:54:11.2 d
N	Z	eP	17:54:10.4 d
Pa	Z	iP	17:54:08.2 c
Hi	Z	iP	17:54:09.0 d
U	PEZ	eS	18:00:53
U	PEZ	eR	18:06:25

Table 5.--Distant earthquakes--Continued

Aug. 18--Continued

C&GS card 65-62:
17:46:14.9
62.3° N., 152.5° W.
Central Alaska. Felt.
Magnitude 6-6.3 (Pas)
5.3-5.5 (Pal)
5.3 (HVO)

Aug. 22

M	Z	iP	21:20:28.6 c
D	Z	eP	21:20:28.8 c
N	Z	eP	21:20:28.6 c
Hi	Z	iP	21:20:25.3 c
U	PEN	ePP	21:22:41
U	PEE	iS	21:29:05
U	PEZ	eSS	21:33:17
U	PEE	iG	21:36:21

C&GS card 67-62:
21:08:22.9
8.3° N., 123.8° E.
Mindanao, Philippine Islands
h about 125 km.

Aug. 23

U	PEZ	eR	19:43:06
M	Z	Tmax	20:12:33
A	Z	Tmax	20:12:36
D	Z	Tmax	20:12:29
U	Z	Tmax	20:12:30
Pa	Z	Tmax	20:12:07
Hi	Z	Tmax	20:12:02

Aug. 23--Continued

Ka	Z	Tmax	20:12:17
Ha	Z	Tmax	20:11:59

C&GS card 69-62:
19:17:26.6
15.6° S., 172.2° W.
Samoa Islands Region
h about 33 km.

Aug. 24

M	Z	eP	09:11:49.7 c
A	Z	eP	09:11:47.9 c
D	Z	eP	09:11:49.7 c
Hi	Z	eP	09:11:50.4 d
U	PEE	eS	09:17:47
U	PEE	eG	09:19:49

C&GS card 69-62:
09:04:22.9
15.0° S., 173.3° W.
Samoa Islands region
h about 33 km
Magnitude 5.3-5.5 (Pal)

Aug. 25

M	Z	iP	08:39:22.4 d
A	Z	iP	08:39:21.8 d
D	Z	eP	08:39:21.2 d
U	Z	iP	08:39:21.3 c
Pa	Z	iP	08:39:23.3 c
Hi	Z	iP	08:39:24.6 c
Ka	Z	iP	08:39:24.3
Ha	Z	iP	08:39:27.0
U	PEZ	esP	08:42:07

Table 5.--Distant earthquakes--Continued

Aug. 25--Continued

U	PEZ	iS	08:45:29
U	PEE	eScS	08:48:23

C&GS card 67-62:
08:31:48.7
20.5° S., 178.5° W.
Fiji Islands
h about 561 km.

Aug. 26

M	Z	eP	06:58:51.2 d
A	Z	eP	06:58:49.3 d
D	Z	eP	06:58:50.8 d
U	PEN	eG	07:13:04
U	PEZ	eR	07:16:44

C&GS card 67-62:
06:48:57.1
34.0° N., 139.2° E.
East coast of Honshu, Japan
Felt: Tokyo
h about 38 km.

Aug. 26

M	Z	eP	23:41:31.7 d
A	Z	eP	23:41:31.4 d
D	Z	eP	23:41:26.8
N	Z	eP	23:41:31.4 d
Hi	Z	eP	23:41:33.4 d
U	PEZ	eR	00:01:24

C&GS card 68-62:
23:30:38.0
3.7° S., 140.1° E.
New Guinea
h about 50 km.

Aug. 27

M	Z	iP	02:28:39.7 c
A	Z	iP	02:28:45.9 c
D	Z	eP	02:28:36.0 c
Hi	Z	iP	02:28:40.4 d

C&GS card 67-62:
02:18:58.8
40.2° N., 137.8° E.
Sea of Japan
h about 274 km.

Aug. 27

M	Z	eP	16:29:44.3 c

C&GS card 68-62:
16:20:04.7
38.3° N., 142.4° E.
Off east coast of Honshu, Japan
h about 40 km.

Aug. 28

M	Z	iP	11:18:44.0 d
A	Z	iP	11:18:44.3 d
D	Z	iP	11:18:45.1 d
U	Z	iP	11:18:43.8 d
Hi	Z	iP	11:18:43.1 d
Ka	Z	iP	11:18:58.1 d

C&GS card 68-62:
10:59:58.5
38.0° N., 23.1° E.
Greece
h about 120 km
Magnitude 6.8 (Pas) one death
Felt: Italy, Sicily, Crete, Malta, and Yugoslvia.

Aug. 29, 1962

M	Z	eP	22:46:49.5 c
A	Z	eP	22:46:48.7 c
N	Z	eP	22:46:49.2
U	PEN	eG	23:01:08
U	PEZ	eR	23:03:40

C&GS card 70-62:
22:36:53.9
34.1° N., 139.1° E.
Near east coast of Honshu, Japan
h about 33 km
Magnitude 5.7 (HVO)

Aug. 30

M	Z	eP	13:43:28.6 d
A	Z	eP	13:43:29.8 d
D	Z	iP	13:43:31.4 d
U	Z	eP	13:43:29.3 c
U	PEN	eG	13:53:40
U	PEZ	eR	13:55:48

C&GS card 66-62:
13:35:28.9
41.9° N., 111.4° W.
Utah-Idaho border
h about 33 km
Magnitude 5.8 (Pas)
5.8 (Pal)

Minor damage in Logan, Utah
Felt in four states.

Aug. 30

M	Z	eP	17:25:59.0 c
A	Z	eP	17:26:02.3 c
D	Z	eP	17:26:01.5 c

Aug. 30--Continued

Hi	Z	eP	17:26:06.1 c

C&GS card 71-62:
17:17:51.9
21.2° S., 174.4° W.
Tonga Islands
h about 33 km
Magnitude 5.5 (Berk)

Aug. 31

M	Z	iP	17:09:53.9 c
A	Z	eP	17:09:55.4 c
D	Z	iP	17:09:54.7 c
N	Z	eP	17:09:53.9 c
U	PEZ	iP	17:09:55 d
Pa	Z	eP	17:09:54.1 c
Na	Z	eP	17:09:55.9 c
Hi	Z	eP	17:09:53.2 c
Ka	Z	eP	17:09:48.9 c
U	PEZ	iS	17:15:40
U	PEZ	iR	17:19:40

C&GS card 72-62:
17:02:43.4
51.3° N., 179.7° W.
Rat Islands, Aleutian Islands
h about 26 km
Magnitude 6.8 (Pas)
6-6.3 (Pal)

Sept. 1

M	Z	iP	03:53:31.9 c
A	Z	eP	03:53:31.0 c
N	Z	eP	03:53:31.1 c
U	PEZ	iS	03:59:04

Table 5.--Distant earthquakes--Continued

Sept. 1, 1962--Continued

U	PEE	eG	04:01:26
U	PEZ	iR	04:03:16
Ha	Z	Tmax	04:30:38

C&GS card 70-62:
03:46:05.0
51.3° N., 179.7° W.
Rat Islands, Aleutian Islands
h about 25 km
Magnitude 6.5 (Pas)
6 (Pal)

Sept. 1

M	Z	iP	05:00:47.9 c
A	Z	iP	05:00:47.6 c
D	Z	iP	05:00:46.6 c
N	Z	iP	05:00:47.6 c
Pa	Z	iP	05:00:49.9 c
Na	Z	iP	05:00:44.5 c
Hi	Z	iP	05:00:50.4 c
Ka	Z	iP	05:00:48.4 c
Ha	Z	iP	05:00:49.5 c
U	PEE	eScS	05:10:10
U	PEZ	eSSS	05:13:40

C&GS card 70-62:
04:52:14.5
15.9° S., 168.2° E.
h about 244 km.
New Hebrides Islands.

Sept. 1

M	Z	eP	07:58:16.2 c
A	Z	eP	07:58:17.3 c
D	Z	eP	07:58:18.7 c
N	Z	eP	07:58:18.0 c
Hi	Z	eP	07:58:14.6 d
U	PEN	iS	08:04:08
U	PEE	eG	08:06:20
U	PEZ	iR	08:07:56
Ha	Z	Tmax	08:35:34

C&GS card 70-62:
07:51:08.2
51.3° N., 179.9° W.
Rat Islands, Aleutian Islands
h about 42 km
Magnitude 6.5 (Pas)
6 (Pal)

Sept. 1

M	Z	eP	19:39:47.4 c
A	Z	eP	19:39:47.4 c
Hi	Z	eP	19:39:28.6 c
U	PEZ	iPP	19:41:00
U	PEN	iPS	19:50:56
U	PEN	iSS	19:57:51
U	PEN	eSSS	20:02:36
U	PEN	iR	20:17:48

C&GS card 70-62:
19:20:38.5
35.6° N.
50.0° E.

Sept. 1, 1962--Continued

C&GS card 70-62--Continued
Northwest Iran
h about 21 km
Magnitude 7.3 (Pas), 7.8 (Berk)
7 (Pal)
Over 10,000 killed, many injured, extensive property damage.

Sept. 7

M	Z	iP	23:46:42.8 d
A	Z	iP	23:46:42.1 d
U	Z	iP	23:46:42.1 d

C&GS card 75-62:
23:37:27.5
26.3° S., 178.0° W.
Kermadec Islands region
h about 50 km.

Sept. 10

M	Z	iP	15:51:34.3 c
A	Z	iP	15:51:33.8 c
D	Z	eP	15:51:32.6 c
N	Z	eP	15:51:33.8 c
U	PEZ	iP	15:51:35 d
Pa	Z	iP	15:51:34.5 d
Na	Z	iP	15:51:30.7 d
Hi	Z	iP	15:51:30.7 d
Ka	Z	iP	15:51:36.5 c
Ha	Z	iP	15:51:38.9 d
U	PEZ	ePPP	15:54:25
U	PEN	iS	15:57:39
U	PEZ	iSS	16:01:11

C&GS card 73-62:
15:43:59.4
21.1° S., 179.2° W.
Fiji Islands
h about 640 km
Magnitude 6.5 (Pas), 6.0 (HVO).

Sept. 14

M	Z	iP	18:25:34.0 c

Sept. 14--Continued

A	Z	iP	18:25:33.5 c
D	Z	eP	18:25:33.5 c
U	Z	iP	18:25:34.0 c
Na	Z	eP	18:25:31.0 d
Hi	Z	iP	18:25:36.6 d
Ha	Z	iP	18:25:39.2 c

C&GS card 75-62:
18:17:52.1
19.9° S., 177.6° W.
Fiji Islands
h about 350 km.

Sept. 15

M	Z	eP	22:59:25.2 c
A	Z	eP	22:59:25.7 c
D	Z	eP	22:59:25.7 c
UU	Z	eP	22:59:26.6 c
Pa	Z	eP	22:59:27.8 c
Hi	Z	eP	22:59:26.0 c
Ka	Z	eP	22:59:25.2 d
Ha	Z	eP	22:59:18.1 c
U	PEN	iS	23:06:30
U	PEE	eG	23:10:38
U	PEZ	eR	23:12:59

Table 5.--Distant earthquakes--Continued

Sept. 15, 1962--Continued

C&GS card 73-62:
22:50:46.3
48.5° N., 156.8° E.
Kurile Islands
h about 33 km
Magnitude 6.5 (Pas), 6 (Pal)

Sept. 16

M	Z	iP	03:14:12.7 c
A	Z	iP	03:14:11.9 d
D	Z	iP	03:14:12.6 c
N	Z	iP	03:14:11.2 c
M	Z	ipP	03:14:31.6
A	Z	ipP	03:14:28.7
U	Z	epP	03:14:30.2

C&GS card 75-62:
03:05:33.0
19.3° N., 103.1° W.
Jalisco, Mexico
h about 100 km
Magnitude 4.8-5 (Pal).

Sept. 17

M	Z	iP	18:03:21.7 d
A	Z	iP	18:03:21.3 d
D	Z	eP	18:03:21.5 d
U	Z	eP	18:03:21.4 d
Ka	Z	iP	18:03:24.0 d
Ha	Z	iP	18:03:27.1 d

C&GS card 75-62:
17:55:45.4
21.0° S., 179.1° W.
Fiji Islands
h about 601 km.

Sept. 18

M	Z	iP	00:40:29 d
A	Z	iP	00:40:28.4 d
D	Z	eP	00:40:28.7 d
U	Z	eP	00:40:25.2 d
U	PEZ	iP	00:40:28 c
Na	Z	eP	00:40:30.7 c
Hi	Z	iP	00:40:24.2 d
U	PEN	iS	00:49:50
U	PEZ	iSS	00:54:11
U	PEN	iG	00:57:54
U	PEZ	iR	01:01:04

C&GS card 75-62:
00:29:05.2
7.5° N., 82.3° W.
South of Panama
h about 33 km
Magnitude 7 (Pas)
7 (Berk)
6.5-6.8 (Pal)
Felt: Chiriqui Province.

Sept. 18

M	Z	eP	06:22:26.1 c
U	Z	eP	06:22:29.9 c

C&GS card 77-62:
06:10:26.3
2.3° N., 126.9° E.
Molucca Passage
h about 33 km.

Table 5.--Distant earthquakes--Continued

Sept. 30, 1962

M	Z	eP	22:09:22.1 d
A	Z	iP	22:09:23.9 d
D	Z	iP	22:09:23.3 d
U	Z	iP	22:09:23.3 d
Pa	Z	iP	22:09:25.1 d
Na	Z	eP	22:09:22.6 d
Hi	Z	eP	22:09:24.7 d

C&GS card 78-62:
21:57:24.8
18.6° N., 120.9° E.
Near north coast of Luzon, Philippine Islands
h about 51 km.

The following persons or agencies reported "felt" earthquakes during the third quarter, 1962. Their assistance is gratefully acknowledged.

North Hawaii

Mr. McKay
Mrs. Eklund
Honokaa Police
Mrs. Christianson

Kilauea Summit region

Mr. and Mrs. Francis
Mrs. Hansen
Dr. Wentworth
Mr. Richter
Mr. Yamamoto
Mr. Yong
Mr. Forbes
Mrs. Fraser
Miss English
Mr. Koyanagi
Mrs. Duncan
Dr. Moore
Mr. Wehrsig
Mr. and Mrs. Mist
Mrs. Ferry
Mr. Ayres

Kona coast

Miss Wallace
Mr. Sutherland
Miss Greenwell
Mr. Mitchell
Mr. Paris
Mr. Ackerman
Mr. Greenwell
Mrs. Higashihara
Mr. Tanaka
Mr. Glass
Mr. Hayashi
Mr. Chong
Mr. Baldwin
Mr. Vredenberg
Kealakekua Police
Mr. Vanderbrook
Mr. Johnston

Kona coast--Continued

Mr. Apple
Mr. Lind
Mr. Mitchell
Mrs. Higashi
Mr. Toy
Mr. Yoshina
Mr. Harai
Mrs. Hahn
Mr. S. Greenwell
Mr. Schattauer

Central Hawaii

Kulani Honor Camp
Mrs. Lindsey

Hilo region

Mrs. Elliott
Mrs. Zsupnik
Miss Nitta
Mrs. Duncan
Mrs. Hansen
Mr. Williamson
Mrs. Ingledue
Mrs. Schaeffer
Dr. Hinds
Mrs. Weight
Mr. Ho
Mr. and Mrs. Baldwin
Mr. Wilson
Mr. Chong
Mr. Northwood
Mr. Donahoe

Kau region

Mrs. Elarionoff
Mr. Billings
Mrs. Walters
Mr. Coram
Mrs. Akana

Kau region--Cont.

Mrs. Kiva
Mr. Meinecke
Mr. Godfrey

Puna

Mr. Warner
Mr. Edwards
Mr. Ho

NOTE: The Kona coast is Hawaii's western coast, Kau is the district south of Mauna Loa summit, southwest of Kilauea and on the flanks of both volcanoes. Puna is the cultural/political district which lies on the East Rift of Kilauea.

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HAWAIIAN VOLCANO OBSERVATORY SUMMARY 28

By Harold L. Krivoy, Robert Y. Koyanagi, Arnold Okamura, and George Kojima

The 1962 Flank Eruption of Kilauea, by James G. Moore

On December 7-9, 1962, a small flank eruption occurred on the upper part of the east rift zone of Kilauea Volcano in and east of Aloi Crater. This outbreak occurred 15 months after the last previous eruption of the volcano which occurred on the lower (eastern) part of the same rift.

The first indication of the possibility of an imminent eruption was the onset of sporadic tremor and local shallow earthquakes at 19^h30^m December 6. The harmonic tremor rapidly became continuous and was accompanied by small shallow earthquakes averaging about one per minute. A few of these earthquakes were large enough to be felt, particularly in the community of Volcano, 3 miles northeast of the center of the caldera.

At 01^h10^m December 7, a glow, described as white at first, changing to red, was observed from both the south side of the caldera and from the Volcano Observatory, toward the direction of the upper part of the east rift zone. From each observation point, the glow was seen to grow from virtually nothing to a prominent light visible for many miles. Hence it is believed that the first actual outbreak occurred only slightly before it was first sighted. At 01^h20^m an Observatory party arrived at Aloi Crater on the upper east rift zone of Kilauea Volcano and found a nearly continuous line of fountains extending in a line completely across the wooded floor of the pit crater (fig. 2). The fissure was about 500 feet long and was slightly modified by right-offset en echelon arrangement. The lava fountains were playing to heights of about 30 feet with spurts up to 60 or 80 feet. Almost the entire floor of the crater was covered by approximately 10 feet of new lava, but trees were still standing in many places on the crater floor even within a few feet of the lava fountains themselves.

The fountains continued at about the same height until 02^h20^m and gradually filled up the bottom of the pit crater. By 03^h00^m the fountains had become thicker and increased in volume, and occasional bursts threw spatter above the opposite rim, or more than 250 feet high. These large bursts were accompanied by loud booming sounds.

By 03^h05^m the lava lake was approximately 40 feet deep and the line of fountains had consolidated to three areas of fountaining, one near each end of the original fissure and a large fountain in the middle of the pit crater. The rim of the pit crater was perceptibly shaking in rhythm with the activity of the fountains. Shortly after 03^h05^m the lava lake began to drown the fountain on the west.

By 03^h08^m the fountains died down and rapid drainback into the vents commenced. By 03^h10^m the fountains were almost quiet, drainback (especially into the west vent) having lowered the entire lava lake approximately 10 feet. The crust of the lake was, in general, no longer incandescent, being perhaps 6 inches or a foot thick. However, cracks through the crust showed the bright red of the molten lava below. Several groups of cracks concentric to the small bubbling west fountain indicated the process of drainback operating there.

By 03^h33^m all the fountains had stopped and drainback into the eruptive vents continued to lower the lake surface. At 03^h49^m a large part of the south rim of the crater broke off and crashed down into the lava lake which by then was entirely black on its surface except for a few incandescent cracks. The landslide broke through the lake crust and splashed incandescent lava 20 or 30 feet into the air. The appearance of the boulders as they plunged into the lava lake suggested that its depth was 10 to 20 feet.

At 04^h20^m two new lava fountains broke out northwest of Makaopuhi Crater on the west slope of Kane Nui o Hamo (no. 2, fig. A). While lava was still playing from these fissures a third outbreak occurred at 04^h45^m one-quarter mile to the southwest (no. 3, fig. A). These fountains played only for about one hour, and by 07^h00^m they were not active except for strong degassing, though booming and roaring noises were heard from their direction for several hours more.

At 11^h02^m a new vent (no. 4, fig. A) on the north side of Alae Crater (called Alea Lea Crater on some maps) began liberating fume. At 11^h25^m this vent developed a small lava fountain. Incandescent spatter was erupted from this vent until 11^h33^m, at which time the faint roaring sound died and erupting spatter was no longer visible from the road near Alae Crater.

At 07^h03^m, December 8, a ball of brown-yellow smoke was seen, from the Observatory, rising about 100 feet above the eruptive area east of Aloi Crater. The smoking which lasted about 20 minutes is believed to

have been caused by outbreak number 5 less than one-quarter mile northeast of Aloi Crater (fig. A). This vent was visited at 11^h00^m and the small lava flow was still hot and incandescent in cracks at that time.

A sixth and final outbreak occurred between 08^h30^m and 09^h15^m December 9, about midway between Aloi and Alae Craters (no. 6, fig. A). The active vent was observed from the air at 08^h40^m. At that time a thin line of fountains 300 to 400 feet long played to heights of 60 feet, but averaged less than 30 feet. A rumbling noise was heard during this period for about 20 minutes in the community of Volcano, 5 miles north of the eruptive area. The lava flow from this fissure started a small forest fire which swept to the summit of the cinder cone, Puu Huluhulu.

Minor falls of Pele's hair were reported on the road near Aloi Crater at 11^h45^m and about 14^h00^m on December 9. Presumably this originated from vent number 6 and was blown south at that time by winds.

Total volume of lava conducted to the surface during the entire eruption was 436,000 cubic yards (table A). However, 280,000 cubic yards drained back down the eruptive fissure in Aloi Crater leaving a total of 156,000 cubic yards on the surface.

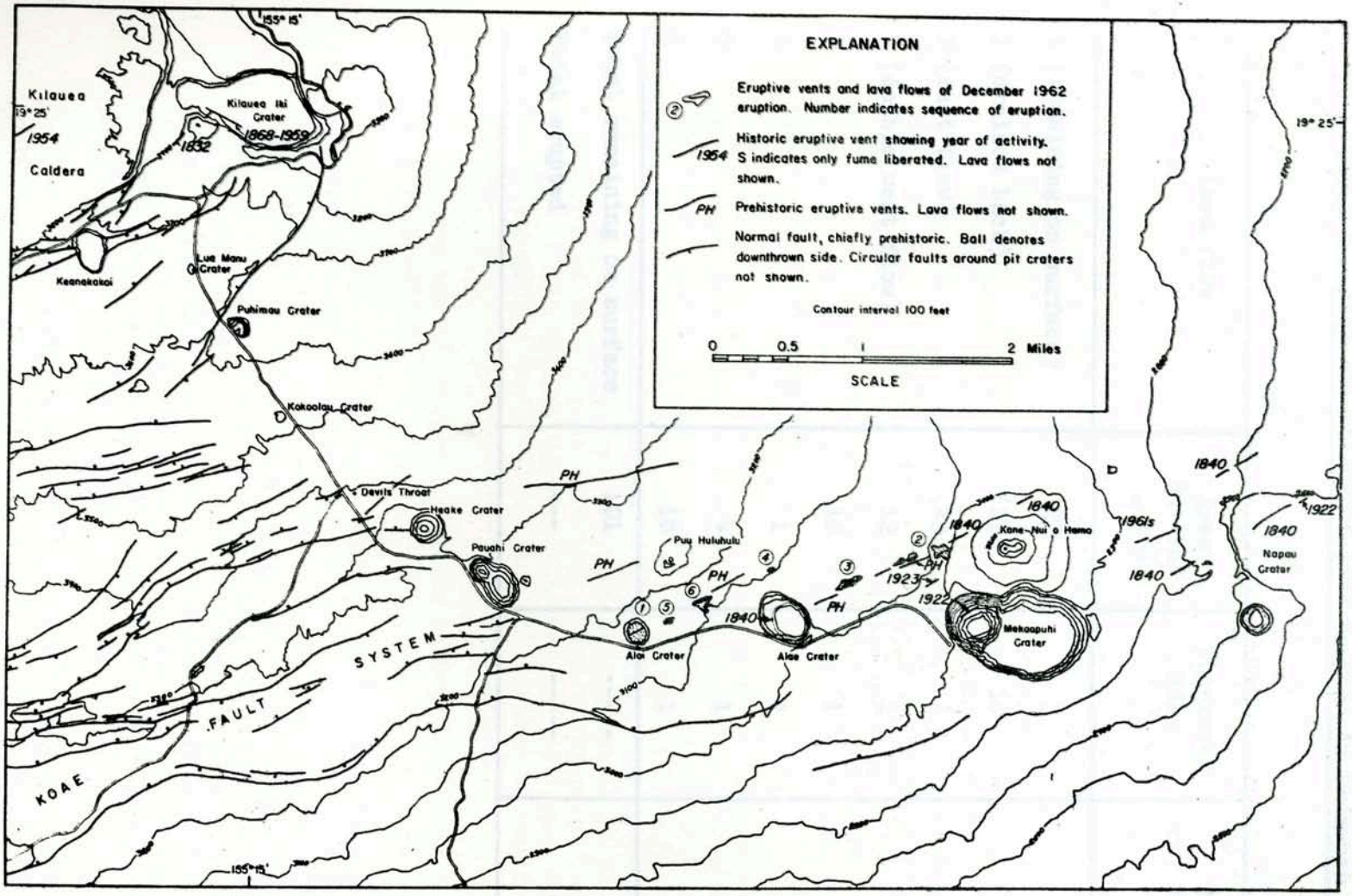

Figure A.--Map of the upper east rift zone of Kilauea showing vents and flows of the 1962 eruption.

Table A.--Area and volume of lava erupted in December 1962

Lava flow	Area Sq. yds. x 10^3	Thickness yds.	Volume cu. yds. x 10^3
1 (remaining on surface)	27	3	82
1 (drained back)	(27)	10	(280)
2 (east flow)	23	1	23
2 (double west flow)	12	1	12
3	16	1	16
4	1	1	1
5	4	1	4
6	18	1	18
Total remaining on surface	101	-----	156
Total erupted	---	-----	436

Chronological summary

The most interesting event of the fourth quarter was the brief eruption of Kilauea in and near Aloi Crater in December. This summary reviews the geophysical manifestations that preceded and accompanied the eruption for comparison with Moore's just-presented description of the eruption.

After the sharp collapse during the September 1961, east rift zone eruption (Summary 24), swelling of Kilauea volcano resumed and continued at a moderate, but diminishing, rate until the end of June 1962. At the inner ring of tilt bases (Uwe, T M, Kea, Kam) the average rate of outward tilting declined from 12 μrad/month (Oct. 8, 1961, to Jan 5, 1962, Summary 25) to 5 μrad/month (March 29, 1962, to June 30, 1962, Summary 26). Between June 30, 1962, and October 30, 1962, (fig. 2-a and table 2-a) the average rate of outward tilting at these stations increased again to 8 μrad/month. From the record of the short-base tiltmeter in Uwekahuna Vault (table 1), it appears that this increased rate of swelling continued until the December eruption.

Subsidence of the caldera region in response to withdrawal of magma from the central reservoir during the eruption is revealed in the pattern of tilting between October 30 and December 12 (fig. 2-b and table 2-b). The amount of subsidence is best indicated by the change at Uwekahuna Vault (table 1), where a tilting of about 16 μradians toward the caldera occurred during the eruption. Comparison of this figure with that which accompanied the collapse of the Kilauea summit following the 1960 east rift zone eruption suggests that 5-10 million cubic yards of magma escaped from the reservoir during the December eruption.

By the end of December swelling of the Kilauea summit was again in progress.

The daily count of small shallow earthquakes at Kilauea caldera averaged 63 during the first two weeks of October. On October 16 this number jumped to 90, and by October 31 it had reached 155. The count climbed to 460 on November 7, then decreased slowly to 208 on November 18. These earthquakes averaged only 54 per day during the rest of November. From an eleven month low of 20 on December 1, the daily count rose to 110 on December 5, just before the eruption. Following the eruption, the average daily number of earthquakes from the caldera was 38 for December 10-18, but rose to 133 for the rest of the month.

Possibly indicative of a rapid flow of magma at depth, episodes of continuous tremor originating beneath the Kilauea summit totaled 177 minutes during October and 101 minutes during November.

Harmonic tremor beginning at 19^h30^m on December 6 (Introduction) testified to the escape of magma from the summit reservoir, and the concurrent swarm of small shallow earthquakes from the vicinity of Aloi Crater heralded the opening of fissures along the rift zone for about 5 hours before lava appeared at the surface early on December 7. These earthquakes were all smaller than magnitude 2.7, and only the largest were felt in the nearby community of Volcano.

Earthquakes from the source about 30 km beneath Halemaumau averaged about 2 per day during October and November and 5 per day during December. Only one was felt: it had a magnitude of 3.7 and was felt over the entire island at 21^h36^m on December 13.

The largest earthquake during October originated at 13^h31^m on the 31st about 15 km north-northeast of Naalehu and 3 km deep. It had a magnitude of 3.7 and was felt in Naalehu. The largest earthquake during November had a magnitude of 4.1 and originated at 05^h18^m on November 22 at about 19°20' N., 155°05' W. (Kalapana Trail). It was felt from Volcano to Hilo.

An earthquake from a focus 13 km east-northeast of Apua Point and 8 km deep was felt over half of the island at 01^h06^m on December 28. It had a magnitude of 4.1 and was the largest earthquake of the month. A magnitude 4.0 earthquake from a focus 18 km north of Naalehu and about 3 km deep was felt over half the island at 17^h47^m on December 30.

Other earthquakes felt in Hawaii during the fourth quarter (23 in addition to those associated with the outbreak of the December eruption) are included in Table 4.

Starting with the eruption, small shallow quakes have become frequent all along the Koae fault system just south of Kilauea caldera. Such earthquakes have not been frequent in recent years, except at times of major collapse such as the spring of 1960.

During this quarter, George Keller, U.S. Geological Survey, visited Hawaii Island and carried out assorted electromagnetic and electrical experiments. He found, among other things, that the electrical resistivity of Hawaiian rocks was very uniform and that three classifications were possible:

1). very recent flows had resistivities between 5,000 and 10,000 ohm-meters,

2). the bulk of Hawaii Island above sea-level had resistivities between 500 and 1,000 ohm-meters,

3). at or below the water table, resistivity was less than 5 ohm-meters.

Electromagnetic studies by Frank Frischknecht and Leonard Anderson in April 1962 revealed a resistivity of 1.2 ohm-meters for the still-molten portions of the 1959 Kilauea-Iki lava lake.

During the quarter a Scripps Institution experiment in noise analysis was completed and equipment removed from HVO. This gear included a short-period installation and a three-component long-period set established in the old West Pit tilt cellar. At the time of their departure there were extra tele-recording channels available at HVO, and so the abandoned data-lines were put to use and recordings made from West Pit. These have proven to be very useful in clarification of small seismic events near Halemaumau. The new instrument (West Pit = WP) is located between the western edge of Halemaumau and the western rim of Kilauea caldera. It is not convenient to plot this new installation at the scale of Figure 1.

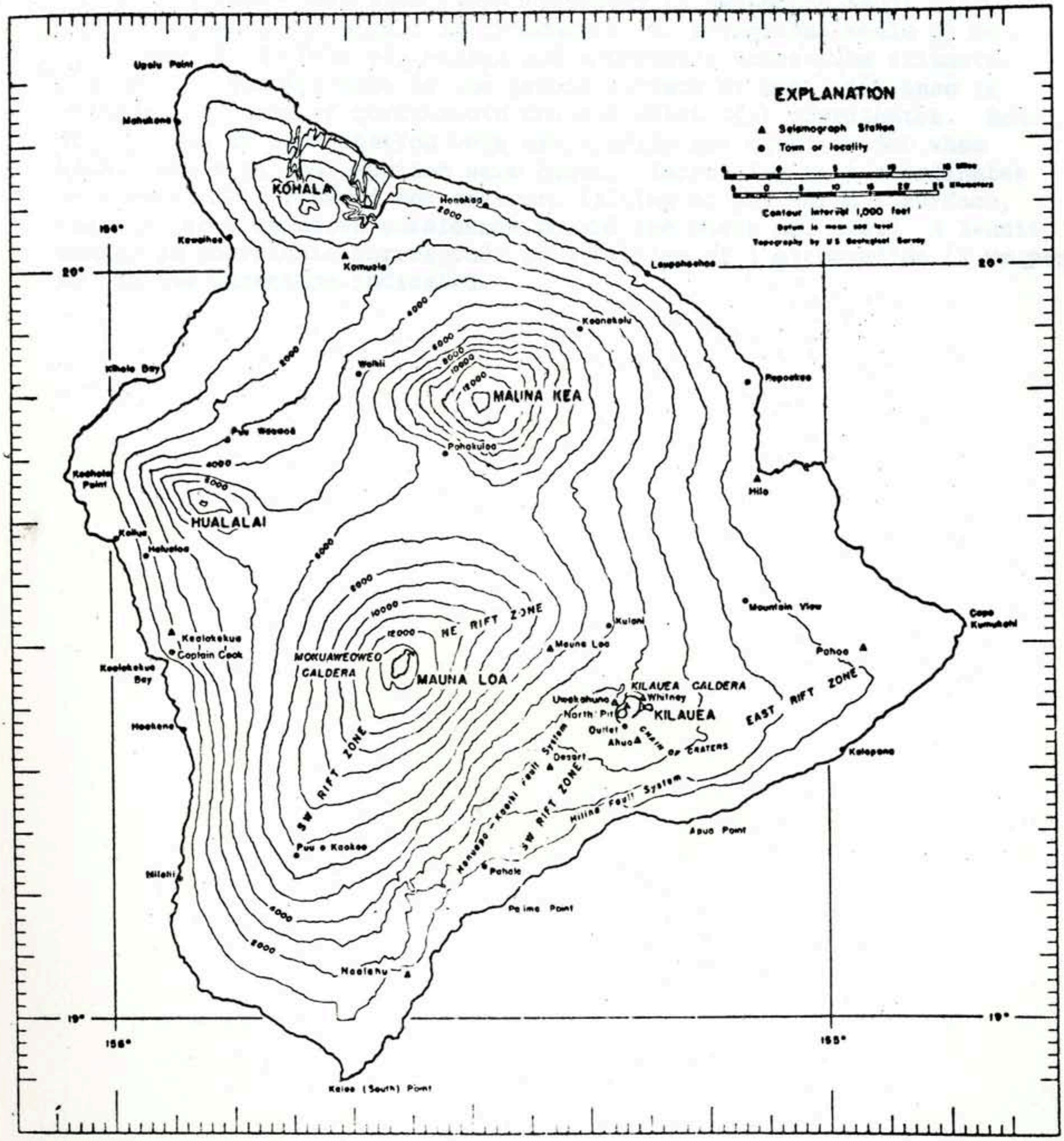

Figure 1.--Map of the island of Hawaii showing seismograph stations operated by the Geological Survey and localities mentioned in the text. Epicenters of local earthquakes are given in terms of geographic coordinates, which are indicated at the edges of the map.

Tilting of the ground around Kilauea caldera

Tilting of the ground around the summit of Kilauea is monitored daily by a short-base water-tube tiltmeter in Uwekahuna Vault (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 (table 2). 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 1-unit change in coordinate corresponds to a tilting of 1 microradian (1 mm per km) in the direction indicated.

Table 1.--Tilt coordinates at Uwekahuna Vault, October, November, and December, 1962

Date	N-S	E-W	Date	N-S	E-W
Sept. 30	457	505	Dec. 2	472	487
Oct. 7	459	504	9	462	499
14	461	503	16	467	502
21	463	500	23	467	497
28	465	497	30	462	496
Nov. 4	467	497			
11	468	496			
18	469	495			
25	470	490			

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

Tilt base (location)	Date (1962)	Tilt coordinates		Rate (10^{-6} rad/mo) and direction of tilting since last reading		Date of last reading (1962)
		N-S	E-W			
Uwekahuna (19°25.5' N., 155°17.4' W.)	Oct. 30	447.0	496.3	7.1	N. 29° W.	June 29
Tree Molds (19°26.3' N., 155°17.3' W.)	31	438.5	512.8	2.9	N. 9.3° W.	29
Sand Spit (19°24.1' N., 155°16.8' W.)	Nov. 1	895.1	707.7	6.7	N. 7.3° E.	Mar. 29
Kalihipaa (19°21.4' N., 155°15.3' W.)	Oct. 30	574.4	427.1	2.6	S. 28.5° E.	July 5
Keamoku (19°25.1' N., 155°19.0' W.)	31	481.3	598.3	7.4	N. 58.5° W.	June 30
Ahua Kamokukolau (19°22.7' N., 155°16.6' W.)	26	652.6	522.0	14.0	S. 13.5° E.	July 1
Kipuka Nene (19°19.4' N., 155°16.7' W.)	25	514.7	495.2	.26	S. 18° E.	Apr. 5
Hilina Pali (19°18.2' N., 155°18.6' W.)	24	512.0	496.1	.5	S. 35° W.	4
Kapapala Ranch (19°20.5' N., 155°23.8' W.)	23	497.6	504.4	.6	S. 51.3° E.	Mar. 30

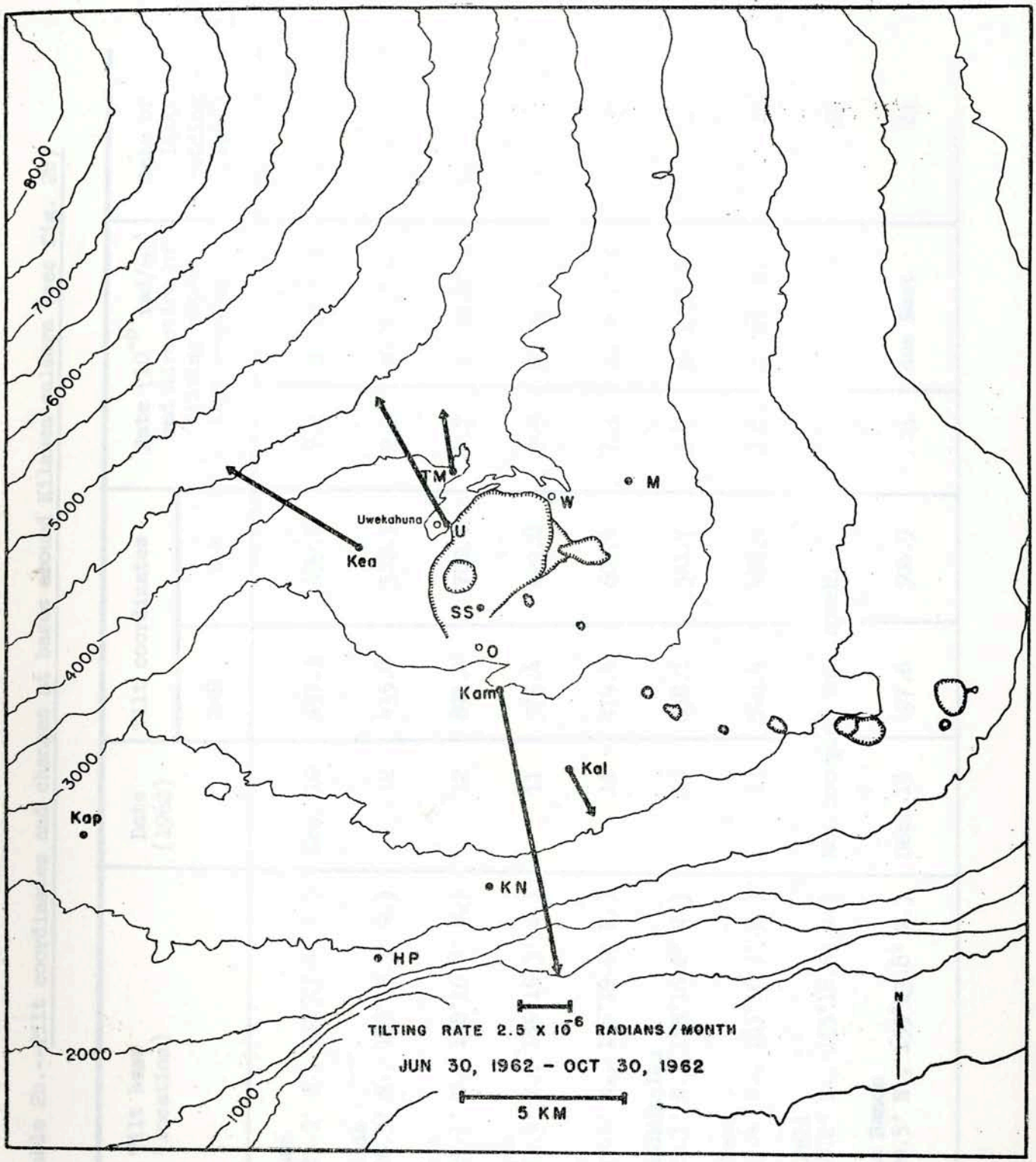

Figure 2a.--Tilting of the ground around Kilauea caldera between June 30 and October 30.

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

Tilt base (location)	Date (1962)	Tilt coordinates		Rate (10^{-6} rad/mo) and direction of tilting since last reading		Date of last reading (1962)
		N-S	E-W			
Uwekahuna (19°25.5' N., 155°17.4' W.)	Dec. 10	437.3	499.6	7.7	S. 18.7° E.	Oct. 30
Tree Molds (19°26.3' N., 155°17.3' W.)	12	435.8	512.5	2.0	S. 9.5° W.	31
Sand Spit (19°24.1' N., 155°16.8' W.)	12	891.4	702.5	4.7	S. 54.8° W.	Nov. 1
Kalihipaa (19°21.4' N., 155°15.3' W.)	11	575.4	423.8	2.5	N. 72.4° W.	Oct. 30
Keamoku (19°25.1' N., 155°19.0' W.)	11	474.4	605.4	7.3	S. 46.2° E.	31
Ahua Kamokukolau (19°22.7' N., 155°16.6' W.)	10	658.1	521.7	3.7	N. 2.5° W.	26
Kipuka Nene (19°19.4' W., 155°16.7' W.)	13	510.4	496.4	2.8	S. 15° E.	25
Hilina Pali (19°18.2' N., 155°18.6' W.)	Not occupied this epoch.					24
Kapapala Ranch (19°20.5' N., 155°23.8' W.)	Dec. 19	497.6	504.9	.3	due East	23

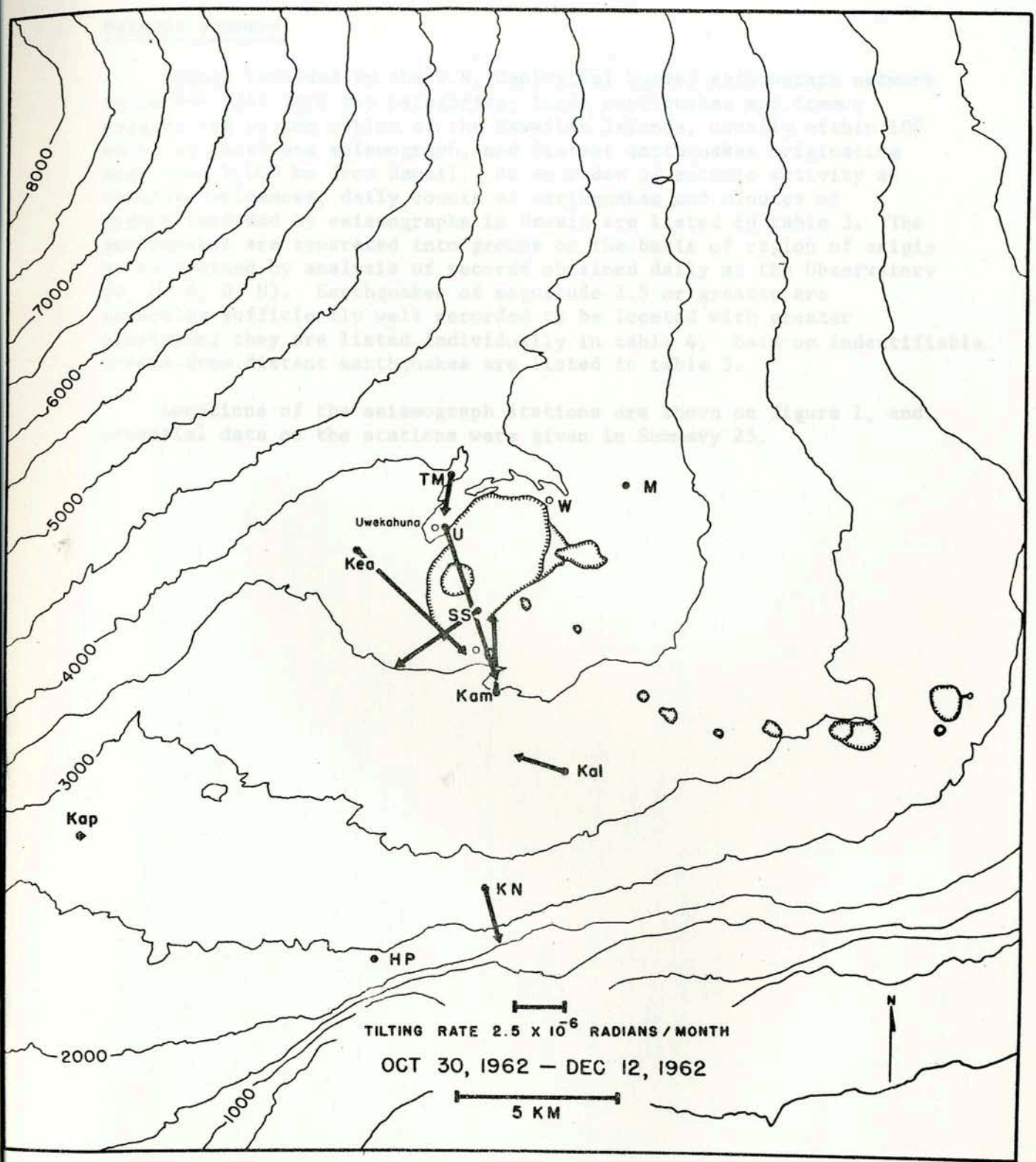

Figure 2b.--Tilting of the ground around Kilauea caldera between October 30 and December 12.

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 into groups on the basis of region of origin as determined by analysis of records obtained daily at the Observatory (U, M, A, D, N). Earthquakes of magnitude 2.5 or greater are generally sufficiently well recorded to be located with greater precision; they are listed individually in table 4. Data on indentifiable phases from distant earthquakes are listed in table 5.

Locations of the seismograph stations are shown on figure 1, and essential data on the stations were given in Summary 25.

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N 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: Halemaumau rock slides, which are detected by the characteristic record they produce on the North Pit seismograph; 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; earthquakes from a source about 30 km beneath Halemaumau; shallow earthquakes along the Kalapana Trail (SE. flank of Kilauea 10 to 15 km W. of Kalapana); and earthquakes from other regions: Kona, Mauna Kea, etc.

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Intermediate	Shallow	Halemaumau slides	Kilauea Caldera	SW. rift and Kaoiki	Eastern East rift	Halemaumau 30 km	Kalapana Trail	Others
Oct. 1	------	3	------	------	81	7	7	------	------	1 Kona
2	------	------	------	------	68	13	------	1	11	------
3	------	------	------	------	42	11	------	5	9	1 Kona
4	21	------	------	------	?	7	------	1	------	1 Kona
5	------	------	------	------	81	7	1	------	------	1 Kona
6	------	------	------	1	?	3	6	2	4	1 Kona
7	------	------	------	------	90	3	4	1	3	------
8	------	5	------	------	7	1	2	6	------	------
9	45	------	------	------	75	10	------	5	------	1 Honokaa
10	------	------	------	------	59	8	------	1	------	------
11	------	------	------	------	65	7	------	3	------	1 Mauna Kea

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N around Kilauea caldera--Continued

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Intermediate	Shallow	Halemaumau slides	Kilauea Caldera	SW. rift and Kaoiki	Eastern East rift	Halemaumau 30 km	Kalapana Trail	Others
Oct. 12	-----	-------	-------	------	60	8	------	4	-----	----------
13	-----	-------	-------	------	63	13	3	------	-----	----------
14	-----	-------	-------	------	63	18	1	3	-----	2 Kona
15	-----	-------	-------	------	65	7	5	1	-----	2 Kawaihae
16	10	-------	-------	------	90	3	------	6	-----	1 Kona
17	-----	28	-------	------	111	12	1	9	-----	1 Mauna Kea
18	-----	-------	-------	------	96	6	1	2	-----	1 Kona
19	-----	-------	7	------	98	9	1	------	-----	1 Mauna Loa 1 Kona
20	-----	-------	-------	1	120	7	1	2	1	----------
21	-----	-------	-------	------	135	7	1	5	-----	1 Kona
22	-----	-------	-------	------	116	9	1	3	-----	----------
23	-----	-------	-------	------	96	15	1	2	-----	----------
24	-----	-------	-------	------	106	7	3	2	5	1 Kona
25	-----	-------	10	------	95	7	1	2	-----	1 Kulani
26	35	5	-------	------	126	6	------	2	-----	----------
27	-----	-------	-------	------	137	9	1	2	-----	1 Kona
28	-----	1	-------	------	130	11	19	2	-----	----------
29	-----	4	-------	------	135	8	10	2	-----	1 Pahala
30	2	1	-------	1	140	15	1	5	-----	----------
31	-----	-------	-------	------	155	8	1	------	-----	1 Mauna Loa
Nov. 1	-----	-------	-------	------	178	4	1	6	1	----------
2	-----	-------	-------	------	160	4	2	3	-----	1 Mauna Loa 2 Kona

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N around Kilauea caldera--Continued

Date (1962)	Tremor (In minutes)			Earthquakes						
	Deep	Intermediate	Shallow	Halemaumau slides	Kilauea Caldera	SW. rift and Kaoiki	Eastern East rift	Halemaumau 30 km	Kalapana Trail	Others
Nov. 3	20	-------	------	------	157	5	------	------	------	1 Mauna Kea
4	-----	3	14	------	187	8	1	------	------	----------
5	-----	-------	------	------	250	7	3	1	2	----------
6	-----	-------	8	2	180	3	2	2	1	1 Pahala
7	2	-------	------	------	460	10	2	------	1	----------
8	-----	-------	------	------	300	8	12	4	6	1 Offshore Naalehu
9	-----	-------	------	------	226	11	1	1	------	1 Mauna Loa
10	-----	-------	------	1	288	4	------	1	------	2 Kona
11	-----	-------	------	------	87	26	1	3	------	1 Kona
12	-----	-------	------	------	145	6	------	4	------	----------
13	-----	-------	------	------	235	9	------	3	2	----------
14	-----	-------	------	------	256	6	1	------	------	----------
15	-----	-------	------	------	228	10	9	------	------	1 Kona
16	-----	-------	------	------	220	8	2	1	------	2 Kona
										1 Mt. View
17	-----	-------	------	------	220	11	4	------	------	2 Mauna Kea
18	-----	-------	------	------	208	3	3	2	------	1 Mauna Kea
										1 Kona
19	-----	6	------	------	143	8	3	1	------	1 Kona
20	-----	-------	------	------	86	5	2	3	7	1 Kawaihae
21	-----	-------	------	------	52	6	-------	------	------	----------
22	-----	6	------	------	53	2	4	3	------	----------
23	-----	-------	------	1	48	4	-------	------	4	----------
24	-----	-------	------	------	65	11	3	1	------	----------
25	42	-------	------	------	45	3	1	------	------	1 Offshore Naalehu

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A, D, and N around Kilauea caldera --Continued

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Inter-mediate	Shallow	Hale-maumau slides	Kilauea Caldera	SW. rift and Kaoiki	Eastern East rift	Hale-maumau 30 km	Kala-pana Trail	Others
Nov. 26	------	-------	-------	------	37	7	6	------	------	----------
27	------	-------	-------	------	25	2	2	------	------	----------
28	------	-------	-------	------	24	2	2	------	------	----------
29	------	-------	-------	------	32	5	-------	1	------	----------
30	------	-------	-------	------	41	4	3	8	------	----------
Dec. 1	------	-------	-------	------	20	2	4	30	------	----------
2	------	-------	-------	------	45	5	2	5	1	1 Kohala
3	------	-------	-------	6	48	12	1	1	------	1 Mauna Loa
										1 Kona
4	------	-------	-------	2	97	10	-------	2	------	----------
5	------	-------	-------	-------	110	16	3	5	------	1 Kona
6	Aloi eruption			-------	?	13	1	4	------	1 Hilina Pali
7	Aloi eruption			-------	?	11	2	15	------	1 Laupahoehoe
										2 Apua Pt.
8	Aloi eruption			1	?	10	-------	15	------	----------
9	Aloi eruption			2	?	23	-------	2	------	1 Mauna Kea
10	------	-------	-------	-------	24	15	-------	4	------	1 Mauna Kea
11	------	-------	-------	1	19	10	-------	4	------	1 Apua Pt.
12	------	-------	-------	-------	40	13	-------	1	3	1 Mauna Kea
										1 Mauna Loa
13	------	-------	-------	-------	45	22	-------	12	1	2 Mauna Loa

Table 3.--Numbers of earthquakes and minutes of tremor recorded on seismographs U, M, A D, and N around Kilauea caldera--Continued

Date (1962)	Tremor (in minutes)			Earthquakes						
	Deep	Intermediate	Shallow	Halemaumau slides	Kilauea Caldera	SW. rift and Kaoiki	Eastern East rift	Halemaumau 30 km	Kalapana Trail	Others
Dec. 14	----	2	-------	------	30	15	1	-----	------	1 Hilina Pali
15	----	-------	-------	------	70	16	1	9	------	----------
16	----	-------	-------	------	47	22	2	2	------	1 Hilina Pali 2 Offshore Naalehu
17	----	-------	-------	------	39	5	-----	4	------	----------
18	----	2	-------	------	30	14	-----	4	------	1 Hakalau 1 Pohakuloa
19	10	------	-------	------	76	21	-----	3	------	1 Keahole Pt.
20	----	------	-------	------	69	8	-----	1	------	1 Mauna Loa
21	----	------	-------	------	85	15	-----	3	------	1 Maui 2 Kona
22	----	------	-------	------	82	14	-----	2	------	----------
23	26	------	-------	------	90	19	-----	4	------	----------
24	----	30	-------	1	74	17	-----	-----	------	1 Kona
25	23	------	-------	------	116	9	2	2	------	1 Kona
26	----	------	-------	------	94	20	3	10	------	1 Kona
27	----	------	-------	------	124	14	-----	2	------	1 Kona
28	----	------	-------	------	97	8	2	3	------	1 Kona 1 Apua Pt.
29	----	------	-------	2	89	9	-----	5	------	1 Mauna Loa
30	19	------	-------	------	96	11	-----	1	------	1 Kona 1 Mauna Loa
31	6	------	-------	------	103	10	-----	2	------	1 Mauna Loa 1 Kona

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962

[Except for smaller earthquakes of special interest, only earthquakes with magnitudes of 2.5 or greater are listed. Origin time is Hawaiian standard.

In the following list some origin times are followed only by "KM 30" and a statement of magnitude These are all members of a continuing family of quakes noted also in other Summaries. The best mean focus for this group is beneath Halemaumau at a depth of 30 km (19°24.1' N., 155°17.1' W.)

Origin times of members of a second persistent sequence of earthquakes are followed by "KT" (Kalapana Trail). These earthquakes originate at very shallow depths in a remote region along the Kalapana Trail west of Kalapana, and they generally are not felt. Seismograms of these earthquakes are poorly recorded and difficult to interpret; so only an approximate epicenter, 19°20' N., 155°05' W., can be assigned to them.

The mean focus of the magnitude 6.1 Kaoiki fault system earthquake of June 27 and its aftershocks is 19°24' N., 155°25' W., at a depth of 3 to 8 km. This focus has been abbreviated "Kaoiki".

In the following list a number of quakes are described as "Upper east rift". These were generally so small and shallow as to make exact location impossible at this time. Statistical treatment of the "family", which began just before the December eruption, gives a near-surface focus within one km, to the south, of Aloi Crater]

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Oct. 1	06	52	03.6	3.0	13	19°32.7'	155°56.0'	3 km NW of Kealakekua	----------
3	06	13	04.5	2.5	8	19°24.0'	155°04.9'	36 km south of Hilo	----------
3	09	47	39.5	2.2	---	--------	---------	Kaoiki----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Oct. 3	12	55	34.5	2.1	3	19°23.5'	155°05.4'	36 km south of Hilo	----------
3	13	19	32.3	2.2	3	19°21.4'	155°04.6'	40 km south of Hilo	----------
3	15	46	02.5	2.2	3	19°19.8'	155°04.0'	43 km south of Hilo	----------
3	22	31	26.8	2.8	---	-------	--------	KT----------	----------
4	03	07	29.5	2.7	3	19°26.8'	155°44.2'	21 km ESE of Kealakekua.	----------
4	03	11	20.5	2.4	5	19°19.1'	155°04.0'	44 km south of Hilo	----------
5	14	56	23.3	2.8	13	19°34.2'	155°53.4'	7 km NNE of Kealakekua.	----------
6	14	02	41.2	2.5	---	-------	--------	KT----------	----------
6	15	15	01.2	3.5	8	19°22.8'	155°03.0'	17 km SW of Pahoa	----------
6	15	21	38.0	3.0	8	19°21.2'	155°03.4'	20 km SW of Pahoa	----------
6	21	57	19.6	2.2	3	19°22.7'	155°08.5'	14 km east of Ahua seismometer.	----------
6	22	16	08.9	2.2	8	19°21.0'	155°08.5'	14 km ESE of Ahua seismometer.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Oct. 7	02	11	37.7	2.9	8	19°28.6'	155°50.5'	10 km SE of Kealakekua	----------
7	13	32	29.6	2.2	10	19°18.9'	155°11.5'	10 km SE of Ahua seismometer.	----------
7	13	33	25.0	2.3	10	19°18.9'	155°11.5'	10 km SE of Ahua seismometer.	----------
7	18	47	46.3	3.1	8	19°18.8'	155°03.0'	24 km SW of Pahoa	----------
7	21	54	35.7	2.2	---	--------	---------	KT----------	----------
8	03	32	27.5	2.3	---	--------	---------	KM 30----------	----------
8	07	40	44.9	2.5	13	19°19.5'	155°05.9'	20 km SE of Ahua seismometer.	----------
8	21	12	28.6	2.3	---	-------	---------	KM 30----------	----------
9	09	21	38.6	3.3	13	20°13.6'	155°31.0'	16 km NNW of Honokaa	----------
10	21	35	34.7	2.4	---	--------	---------	KM 30----------	----------
11	11	03	16.0	2.4	8	19°52.2'	155°29.1'	28 km SE of Kamuela	----------
13	04	12	47.7	2.3	50	19°29.0'	155°21.0'	5 km ESE of Mauna Loa seismometer.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Oct. 14	16	48	43.0	2.2	8	19°13.8'	155°09.8'	20 km SE of Ahua seismometer	----------
14	18	56	28.2	2.1	13	19°22.6'	155°08.1'	15 km east of Ahua seismometer.	----------
15	00	35	26.0	3.3	8	19°37'	156°09'	28 km WNW of Kealakekua-----	----------
15	02	08	48.3	3.2	---	-------	--------	Km 30----------	----------
15	04	23	15.7	3.3	13	19°40'	156°20'	46 km NW of Kealakekua------	----------
15	15	37	28.7	2.7	8	20°01.2'	155°53.1'	20 km west of Kamuela-------	----------
15	16	47	00.7	2.6	8	20°01.2'	155°53.1'	20 km west of Kamuela-------	----------
15	22	23	43.5	2.3	8	19°07.7'	154°57.0'	41 km SSW of Pahoa----------	----------
16	03	15	26.7	2.3	5	19°30.1'	155°40.6'	25 km east of Kealakekua----	----------
17	03	12	56.8	2.8	13	19°48.0'	155°42.7'	26 km south of Kamuela------	----------
17	21	59	01.0	3.0	12 1/2	20°05'	156°59'	112 km SW of Haleakala seismometer.	----------
18	03	07	37.5	2.6	3	19°23.5'	154°54.4'	12 km SSE of Pahoa----------	----------
18	03	19	32.4	2.6	---	-------	--------	KM 30----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Oct. 18	05	10	16.6	2.6	---	-------	--------	KM 30----------	----------
18	08	48	49.1	2.5	35	19°19.1'	154°59.5'	20 km SW of Pahoa--------	----------
18	16	29	08.7	2.0	---	--------	---------	KM 30----------	----------
19	06	43	29.0	3.6	13	19°40.1'	156°06.0'	25 km NW of Kealakekua---	Felt at Kealakekua.
20	02	30	25.7	2.5	---	--------	---------	Kaoiki----------	----------
21	06	52	05.4	2.5	8	19°21.9'	155°03.1'	18 km SW of Pahoa--------	----------
21	10	04	53.4	2.9	3	19°24.2'	155°57.5'	15 km SW of Kealakekua---	----------
21	16	09	17.1	2.1	3	19°16.1'	155°34'	23 km north of Naalehu---	----------
24	02	00	26.6	3.0	10	19°17.6'	155°27.3'	10 km SW of Desert seismometer.	Felt in Pahala and Hilo.
24	05	43	37.6	2.1	---	--------	---------	Kaoiki----------	----------
24	07	02	47.5	2.3	---	--------	---------	KM 30----------	----------
25	02	49	12.3	2.3	---	--------	---------	KT----------	----------
25	03	32	01.9	3.5	---	--------	---------	KT----------	----------
26	03	36	04.4	2.3	---	--------	---------	Kaoiki----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Oct. 27	10	27	53.0	2.7	3	19°22.8'	155°30.5'	15 km WNW of Desert seismometer	---
28	06	37	28.0	2.2	10	19°12.0'	155°15.7'	14 km SE of Ahua seismometer	---
28	15	13	59.0	2.7	---	---	---	KM 30	---
28	23	02	33.1	2.3	---	---	---	Kaoiki	---
29	00	34	40.8	2.1	5	19°25.8'	154°57.6'	7 km SSW of Pahoa	---
29	04	27	11.0	2.2	35	19°13.3'	155°29.1'	4 km NNW of Pahala	---
30	11	55	40.9	2.1	---	---	---	KM 30	---
31	13	30	50.0	3.7	3	19°11.8'	155°33.2'	15 km NNE of Naalehu	Felt in Naalehu.
Nov. 2	04	51	40.6	2.7	---	---	---	KT	---
2	09	02	37.7	2.4	10	19°18.7'	155°13.3'	9 km SE of Ahua seismometer	---
2	22	30	39.3	2.8	8	19°32.2'	155°53.0'	5 km NW of Kealakekua	---
2	22	50	28.9	2.6	8	19°09.8'	155°34.6'	11 km north of Naalehu	Felt in Naalehu.
3	03	55	31.2	2.5	13	19°46.3'	155°34.8'	13 km SE of Waikii	---
3	06	32	20.9	2.4	8	19°19.1'	155°01.1'	20 km SW of Pahoa	---

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Nov. 6	00	16	26.4	2.7	13	19°18.6'	155°05.5'	45 km south of Hilo----	Felt in Hilo
6	05	56	13.5	2.8	3	19°11.8'	155°28.7'	1 km south of Pahala---	Felt in Pahala
6	07	15	54.3	3.1	---	--------	---------	KT----------	----------
6	21	55	31.9	3.0	3	19°24.1'	155°00.6'	12 km SW of Pahoa------	Felt in Pahoa
7	08	07	38.6	3.0	3	19°09.9'	154°59.1'	37 km SSW of Pahoa-----	----------
8	00	06	52.3	2.7	3	19°27.9'	154°56.7'	4 km south of Pahoa----	Felt in Pahoa
8	00	08	27.0	2.7	3	19°27.9'	154°56.7'	4 km south of Pahoa----	Felt in Pahoa
8	00	09	21.5	2.5	3	19°27.9'	154°56.7'	4 km south of Pahoa----	Felt in Pahoa
8	06	43	36.2	2.8	---	--------	---------	KT----------	----------
8	10	27	39.0	2.6	3	19°21.8'	155°04.5'	40 km south of Hilo----	----------
8	14	24	55.0	3.0	13	19°01.3'	155°15.8'	35 km ESE of Naalehu---	----------
10	05	07	12.9	2.1	---	--------	---------	KM 30----------	----------
11	06	26	30.0	2.6	8	19°24.4'	155°30.5'	15 km NW of Desert seismometer.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Nov. 14	03	10	36.3	2.4	3	19°24.1'	155°01.5'	14 km SW of Pahoa----------	----------
14	20	28	27.9	2.3	20	19°26.5'	155°18.6'	2 km NW of Uwekahuna seismometer.	----------
15	13	15	42.8	2.4	3	19°23.4'	155°05.6'	36 km south of Hilo--------	----------
16	22	19	16.0	2.7	8	19°49.7'	156°01.8'	37 km NNW of Kealakekua----	----------
17	00	31	16.0	2.5	15	19°52.8'	155°14.8'	25 km NW of Hilo----------	----------
17	10	06	28.0	2.4	13	19°47.8'	155°40.2'	7 km SSW of Waikii---------	----------
17	10	07	34.0	2.3	---	--------	---------	Kaoiki---------------------	----------
18	13	49	18.5	2.5	8	19°28.0'	155°51.9'	8 km SE of Kealakekua------	----------
18	17	53	45.0	2.3	12 1/2	19°47.3'	155°43.5'	10 km SW of Waikii---------	----------
19	03	23	04.6	2.3	13	19°21.5'	155°56.4'	18 km SSW of Kealakekua----	----------
19	21	01	28.0	2.2	---	--------	---------	Kaoiki---------------------	----------
20	01	56	55.2	3.7	13	20°00.1'	155°53.4'	8 km SW of Kawaihae--------	Felt in Kamuela, Kohala.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Nov. 20	04	33	34.5	2.0	---	--------	--------	Kaoiki----------	----------
20	16	54	30.5	2.7	---	--------	--------	KT----------	----------
20	20	38	11.4	2.9	---	--------	--------	KT----------	----------
21	06	45	31.1	2.9	---	--------	--------	KT----------	----------
22	03	05	55.6	2.6	---	--------	--------	KT----------	----------
22	04	26	10.0	3.9	---	--------	--------	KT----------	----------
22	05	18	21.7	4.1	---	--------	--------	KT----------	Felt from Kilauea summit to Hilo
22	19	32	26.5	2.0	---	--------	--------	KM 30----------	----------
23	09	57	50.0	2.5	---	--------	--------	KT----------	----------
23	11	52	54.5	2.7	---	--------	--------	KT----------	----------
23	12	04	57.3	2.2	---	--------	--------	KT----------	----------
23	16	47	37.5	2.0	3	19°19.7'	155°03.5'	10 km WSW of Kalapana-------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Nov. 24	17	54	57.0	2.4	3	19°23.0'	154°57.7'	14 km SSW of Pahoa----------	----------
25	09	45	31.5	2.2	3	19°04.1'	155°26.1'	17 km east of Naalehu---------	----------
26	06	56	04.3	3.2	3	19°27.0'	154°58.0'	6 km SSW of Pahoa----------	Felt in Pahoa and along the SE coast of Hawaii.
30	02	02	56.0	2.5	----	--------	---------	Kaoiki----------	----------
Dec. 1	03	22	14.5	2.4	----	--------	---------	KM 30----------	----------
1	09	41	54.4	2.2	----	--------	---------	KM 30----------	----------
2	02	13	15.6	2.1	----	--------	---------	KM 30----------	----------
2	02	21	45.5	2.8	13	20°17.2'	155°38.9'	28 km NNE of Kamuela seismograph station.	----------
2	11	50	03.2	2.5	----	--------	---------	KT----------	----------
3	03	28	17.0	2.9	8	19°17.0'	155°47.0'	17 km NE of Milolii----------	----------
3	03	34	50.0	2.5	8	19°11.0'	155°36.9'	14 km NNE of Naalehu---------	----------
3	07	30	55.0	2.3	13	19°23.5'	155°18.5'	6 km WNW of Ahua seismometer	Felt in the summit region of Kilauea.

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Dec. 4	10	52	20.0	2.0	25	19°18.0'	155°17.2'	9 km SSW of Ahua seismometer.	----------
5	06	28	05.2	2.8	8	19°36.5'	156°10.1'	28 km WNW of Kealakekua	----------
5	12	32	42.5	2.1	---	--------	---------	Kaoiki----------	----------
6	19	01	36.0	2.2	13	19°03.4'	155°16.5'	37 km SSE of Desert seismometer.	----------
6	19	59	53.0	2.6	---	--------	---------	Upper east rift----------	Felt just NE of Kilauea Iki.
6	20	31	39.1	2.4	---	--------	---------	Upper east rift----------	Do.
6	20	40	25.0	2.4	---	--------	---------	Upper east rift----------	Do.
6	21	26	26.9	2.7	---	--------	---------	Upper east rift----------	Do.
7	08	05	43.0	2.4	---	--------	---------	Upper east rift----------	----------
7	13	42	57.8	2.0	---	--------	---------	Upper east rift----------	----------
7	23	37	38.5	2.6	13	19°59.3'	155°19.8'	10 km west of Laupahoehoe.	Felt between Honakaa and Laupahoehoe.
7	23	57	28.0	2.0	13	19°16.9'	155°13.1'	4 km NW of Apua Point.	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Dec. 8	22	42	15.6	2.3	10	19°25.9'	155°17.8'	NW rim of Kilauea caldera	----------
8	23	59	00.5	2.4	10	19°23.2'	155°19.6'	6 km SW of Uwekahuna seismograph station.	----------
9	00	08	00.5	3.0	45	19°51.2'	155°23.0'	20 km SW of Laupahoehoe-------	Felt near Puu Waawaa.
9	03	05	42.3	2.1	8	19°25.1'	155°16.5'	Kilauea caldera----------	----------
10	20	15	39.0	2.3	3	19°58.5'	155°20.5'	12 km WSW of Laupahoehoe------	Felt in Honokaa
11	00	16	34.8	2.8	3	18°50'	155°07'	47 km SSE of Apua Point	----------
11	08	49	55.2	2.6	8	19°17.5'	154°47.8'	30 km SE of Pahoa----------	----------
12	00	08	23.4	1.5	8	19°12.2'	155°21.1'	17 km SSE of Desert seismometer	----------
12	02	36	10.0	2.8	3	19°12.9'	155°21.5'	12 km ENE of Pahala----------	Felt at Volcano
12	16	30	00.5	2.4	3	19°54.2'	155°28.5'	26 km SE of Kamuela seismograph station.	----------
12	23	18	34.5	2.2	---	--------	---------	KT----------	----------
13	00	20	11.1	2.7	---	--------	---------	Kaoiki----------	----------
13	02	02	32.0	2.2	5	19°11.8'	155°39.1'	16 km NW of Naalehu----------	----------
13	20	21	31.7	3.5	3	19°13.3'	155°21.2'	13 km ENE of Pahala----------	Felt near Pahala

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Dec. 13	20	24	58.3	2.0	3	19°12.2'	155°21.3'	16 km SSE of Desert seismometer	----------
13	21	36	18.7	3.7	---	--------	---------	KM 30----------	Felt island-wide.
14	13	04	51.5	2.8	---	--------	---------	Kaoiki----------	----------
14	13	47	27.6	2.5	---	--------	---------	KT----------	----------
14	23	49	47.5	2.0	8	19°07.5'	155°18.0'	27 km SSE of Desert seismometer	----------
15	11	05	54.0	3.0	---	--------	---------	Kaoiki----------	----------
16	04	39	33.0	2.3	25	19°08.1'	155°25.1'	21 km ENE of Naalehu----------	----------
16	06	23	44.8	2.2	8	19°03.3'	155°19.6'	28 km east of Naalehu----------	----------
16	06	47	35.9	1.8	8	19°15.5'	155°22.0'	10 km SSE of Desert seismometer	----------
16	08	38	37.7	2.5	<3	19°11.8'	155°19.8'	17 km SSE of Desert seismometer	----------
17	19	39	23.7	2.1	---	--------	---------	KM 30----------	----------
18	23	28	28.5	2.4	8	19°54.1'	155°10.1'	5 km west of Hakalau----------	----------
18	23	30	09.4	2.3	13	19°47.3'	155°33.8'	7 km NW of Pohakuloa----------	----------
19	04	52	57.5	2.3	3	19°09.5'	155°25.7'	7 km SE of Pahala----------	----------
19	20	08	11.5	2.2	---	--------	---------	Kaoiki----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Dec. 20	05	15	50.5	2.8	8	19°47'	156°12'	45 km NE of Kealakekua-----	----------
21	05	08	03.3	2.3	3	19°12.0'	155°41.0'	18 km NW of Naalehu--------	----------
21	07	00	56.5	3.3	8	19°06.4'	155°21.8'	16 km SW of Pahala---------	----------
21	16	20	08.0	2.8	8	20°40'	154°38'	140 km ENE of Upolu Point--	----------
21	17	21	44.5	2.6	3	19°24.1'	155°43.1'	25 km SE of Kealakekua-----	----------
21	21	47	10.3	2.8	13	20°48'	155°25'	75 km NE of Upolu Point----	----------
23	15	27	19.9	2.0	8	19°19.8'	155°25.8'	5 km WSW of Desert seismometer.	----------
24	08	12	30.5	2.0	---	-------	--------	Kaoiki----------	----------
25	12	19	35.3	2.7	8	19°40.8'	156°07.8'	29 km NW of Kealakekua------	----------
26	20	24	38.5	2.6	3	19°25.2'	155°58.2'	13 km SW of Kealakekua------	----------
27	04	59	06.4	2.8	---	--------	--------	KM 30----------	----------
27	05	20	23.0	2.3	---	--------	--------	KM 30----------	----------
27	12	14	18.0	2.7	---	--------	--------	Kaoiki----------	----------

Table 4.--Local earthquakes recorded by seismographs of the U.S. Geological Survey, October, November, and December, 1962--Continued

Date (1962)	Time			Magnitude	Depth (km)	Epicenter			Felt Report
	h	m	s			Lat. N.	Long. W.	Description	
Dec. 28	01	06	10.1	4.1	8	19°18.5'	155°05.0'	13 km ENE of Apua Point------	Felt over the eastern half of the island.
28	03	49	36.0	3.4	8	19°14.2'	155°48.8'	33 km SSE of Kealakekua-----	----------
29	14	09	38.1	3.0	8	19°08.8'	155°41.5'	14 km NW of Naalehu---------	----------
29	18	41	27.5	3.0	---	--------	---------	KM 30----------	----------
29	18	48	25.5	2.4	---	--------	---------	KM 30----------	----------
30	17	47	19.0	4.0	3	19°14.0'	155°35.8'	18 km north of Naalehu------	Felt over half the island.
31	06	02	03.5	3.0	<3	19°24.1	155°45.5'	21 km SE of Kealakekua------	Felt on the western half of the island.
31	07	11	10.1	2.9	<3	19°12.0'	155°38.0'	16 km NNW of Naalehu---------	----------

Table 5.--Distant earthquakes

[Times are reported in Greenwich Civil Time which is 10 hours faster than Hawaiian Standard Time. A "c" following the time of P indicates compressional first motion; a "d" indicates dilatational first motion. Station symbols, locations, and instrumentation are presented in Summary 25. Magnitudes calculated from the Hawaii seismograms are followed by (HVO). Location of epicenter, origin times, and focal depths, and magnitudes reported by other institutions are taken from "Preliminary Determination of Epicenters" published by the U.S. Coast and Geodetic Survey.

During the quarter, no exceptionally large or disastrous quakes were recorded from distant sources. The period was notable, however, for the number of deeper quakes which took place. Also, both long-period and short-period energy was recorded from U.S. atmospheric tests about 800 miles from Hawaii. Some of these were even felt or sensed in the State; the largest (which took place during the day and so was not visible) alarmed many people in Honolulu. During this quarter large Russian nuclear tests recorded at HVO as long period barometric pulsations on the Press-Ewing set at Uwekahuna]

Oct. 1, 1962

M	Z	iP	04:04:08.1 d
A	Z	iP	04:04:07.7 d
D	Z	eP	04:04:08.0 d
U	Z	iP	04:04:07.8 d
Pa	Z	iP	04:04:09.3 c
Na	Z	iP	04:04:04.4 c
Ka	Z	eP	04:04:11.0 d
Ha	Z	iP	04:04:12.9 c
Hi	Z	iP	04:04:10.7 c

C&GS card 78-62:
03:56:52.0
17.5° S., 178.9° W.
Fiji Islands
h about 550 km.

Oct. 1

M	Z	iP	10:02:24.7 c
A	Z	eP	10:02:25.8 d
D	Z	eP	10:02:25.4 d
U	Z	eP	10:02:25.2 d
Pa	Z	iP	10:02:26.3 c
Hi	Z	eP	10:02:24.5 c

C&GS card 78-62:
09:53:32.9
47.3° N., 151.5° E.
Kurile Islands
h about 127 km.

Oct. 6

M	Z	eP	04:32:37.6 c
A	Z	eP	04:32:37.4 c
Pa	Z	eP	04:32:39.0 c
Hi	Z	eP	04:32:42.2 d
Ha	Z	eP	04:32:43.4 d
U	PEZ	iS	04:40:00
		iSS	04:43:37
		iR	04:46:57
U	PEN	eG	04:44:29

C&GS card 81-62:
04:23:24.1
17.4° S., 167.7° E.
New Hebrides Islands
h about 33 km
Felt: Port Vila
Magnitude 6.6 (HVO).

Table 5.--Distant earthquakes--Continued

Oct. 6, 1962

U	PEZ	eS	08:12:47
		iR	08:20:16

C&GS card 81-62:
07:56:20.4
17.4° S., 167.9° E.
New Hebrides Islands
h about 33 km
Felt.

Oct. 6

U	PEZ	eS	23:48:11
		iR	23:54:51

C&GS card 87-62:
23:31:27.7
17.5° S., 167.6° E.
New Hebrides Islands
h about 42 km.

Oct. 8

M	Z	eP	22:08:08.9	c
U	PEZ	iP	22:08:09	c
		eR	22:31:21	
U	PEN	iS	22:18:03	

C&GS card 82-62:
21:56:22.2
24.3° N., 121.7° E.
Near east coast of Formosa
h about 29 km
Magnitude 6.0 (Pas)
6.3 (Pal).

Oct. 9

U	PEE	iS	20:32:57
U	PEZ	iR	20:41:33

C&GS card 84-62:
20:14:38.3
3.2° S., 148.2° E.
Bismarck Sea
h about 33 km
Magnitude 6.3 (Pas)
6.6 (HVO).

Oct. 13

U	PEZ	eR	19:10:23

C&GS card 84-62:
18:47:44.5
12.6° S., 166.6° E.
Santa Cruz Islands region
h about 33 km.

Oct. 14

M	Z	eP	00:39:41.5	c
A	Z	eP	00:39:40.6	c
N	Z	eP	00:39:41.2	c

C&GS card 84-62:
00:29:56.0
33.4° S., 179.3° W.
Kermadec Islands region
h about 33 km.

Oct. 14

M	Z	Tmax	10:22:41.3
A	Z	Tmax	10:22:49.3
D	Z	Tmax	10:23:04.0
U	Z	Tmax	10:22:48.8
Pa	Z	Tmax	10:22:30.1
Ha	Z	Tmax	10:22:30.1
Ka	Z	Tmax	10:22:40.1
Hi	Z	Tmax	10:22:36.1

Table 5.--Distant earthquakes--Continued

Oct. 14, 1962--Continued

C&GS card 84-62:
09:41:09.6
38.8° N., 123.5° W.
Off coast of northern Calif.
h about 33 km.

Oct. 14

M	Z	Tmax	10:56:01.3
A	Z	Tmax	10:56:05.1
D	Z	Tmax	10:56:01.4
U	Z	Tmax	10:55:58.8
Pa	Z	Tmax	10:56:57.6
Ha	Z	Tmax	10:55:54.6
Ka	Z	Tmax	10:56:07.4
Hi	Z	Tmax	10:55:54.2

C&GS card 83-62:
10:14:32.4
38.7° N., 124.0° W.
Off coast of northern Calif.
h about 33 km.

Oct. 14

M	Z	Tmax	11:52:00.5
A	Z	Tmax	11:52:03.0
U	Z	Tmax	11:51:59.6
Pa	Z	Tmax	11:52:46.2
Ha	Z	Tmax	11:51:45.4
Ka	Z	Tmax	11:51:42.7
Hi	Z	Tmax	11:51:53.8

No C&GS preliminary listing.

Oct. 16

M	Z	iP	18:09:33.5 d
A	Z	iP	18:09:35.1 c
D	Z	eP	18:09:34.3 d
U	Z	eP	18:09:34.4 d
Ka	Z	eP	18:09:27.3 c

C&GS card 84-62:
18:02:32.9
51.6° N., 175.8° W.
Near Islands, Aleutian Islands
h about 27 km
Magnitude 5.3 (Pal).

Oct. 17

M	Z	iP	12:48:51.2 d
D	Z	iP	12:48:51.5 d
Na	Z	iP	12:48:50.9 d

C&GS card 86-62:
12:39:12.0
33.3° N., 137.7° E.
South of Honsu, Japan
h about 335 km.

Oct. 18

M	Z	iP	08:49:53.1 c
A	Z	eP	08:49:53.7 c
	Z	ePcP	08:50:56.1
D	Z	iP	08:49:53.5 c
	Z	ePcP	08:50:53.9
U	Z	eP	08:49:53.8 d
Pa	Z	iP	08:49:55.1 d
Hi	Z	iP	08:49:53.6 d
Ka	Z	eP	08:49:48.3 d

Table 5.--Distant earthquakes--Continued

Oct. 18, 1962--Continued

C&GS card 85-62:
08:40:55.5
46.5° N., 149.6° E.
Kurile Islands
h about 140 km.

Oct. 18

U	PEZ	eR	16:07:53
U	PEN		17:22:37

Probably due to U.S. nuclear testing in Pacific--pressure waves start about 17:22:37 with 64 sec. period and amplitude of 17 mm. Pressure waves "sensed" on island of Hawaii.

Oct. 18

M	Z	eP	19:59:42.2	c
A	Z	iP	19:59:41.3	c
D	Z	eP	19:59:42.2	c
U	Z	eP	19:59:41.5	c

C&GS card 84-62:
19:49:59.2
16.2° N., 93.5° W.
Chiapas, Mexico
h about 179 km.

Oct. 19

M	Z	iP	23:54:12.6	d
A	Z	iP	23:54:12.4	d
U	Z	eP	23:54:12.4	d

C&GS card 86-62:
23:42:34.9
5.7° S., 130.3° E.
Banda Sea
h about 177 km.

Oct. 21

M	Z	eP	02:13:18.2	c
	Z	ipP	02:13:34.9	
A	Z	iP	02:13:18.7	c
	Z	ipP	02:13:35.2	
U	Z	eP	02:13:18.2	c
Pa	Z	eP	02:13:24.0	c
Na	Z	eP	02:13:27.5	d
Hi	Z	eP	02:13:17.2	d
Ka	Z	iP	02:13:15.3	c

C&GS card 85-62:
02:05:22.7
61.1° N., 149.7° W.
Vicinity Anchorage, Alaska. Felt.
h about 80 km.

Oct.22

U	PEZ	eR	05:03:29

C&GS card 84-62:
04:34:38.9
3.4° S., 145.3° E.
Bismarck Sea
h about 36 km.

Oct. 22

U	PEZ	eR	15:45:37

C&GS card 85-62:
15:23:32.9
49.8° N., 155.8° E.
Northern Kurile Islands
h about 19 km.

Oct. 22, 1962

U PEN 17:36:57

C&GS card 84-62:
09:06:10.1
73.4° N., 54.9° E.
Novaya Zemlya
h=0
Magnitude 5.3 (Pal)

Pressure waves from nuclear blast start about 17:36:57 with period of 80 sec. and amplitude of 2 mm.

Oct. 25

M	Z	iP	09:46:08.9 c
A	Z	iP	09:46:09.0 c
D	Z	iP	09:46:08.2 c
U	Z	iP	09:46:09.0 c
Pa	Z	iP	09:46:10.3 c
Na	Z	iP	09:46:07.2 c
Ka	Z	iP	09:46:11.7 c
Hi	Z	iP	09:46:10.5 c

C&GS card 85-62:
09:34:14.6
3.0° N., 126.7° E.
Molucca Passage
h about 33 km.

Oct. 27

M	Z	eP	08:20:35.4 d
	Z	ipP	08:20:50.1
A	Z	iP	08:20:34.8 d
	Z	epP	08:20:48.4
D	Z	iP	08:20:35.5 d
	Z	ipP	08:20:49.8
Hi	Z	eP	08:20:34.0 d

C&GS card 86-62:
08:10:24.5
14.0° N., 90.4° W.
Guatemala--El Salvador border
Felt: western El Salvador
h about 107 km.

Oct. 27

U PEZ 17:09:57

Pressure waves from nuclear blast start about 17:09:57 with a period of 40 sec. and an amplitude of 8 mm.

Oct. 28

M	Z	iP	15:12:31.9 c
A	Z	iP	15:12:31.9 c
D	Z	eP	15:12:31.4 c
U	Z	iP	15:12:31.8 c
Hi	Z	eP	15:12:33.3 d

C&GS card 86-62:
15:00:17.0
0.1° N., 123.6° E.
Northern Celebes
h about 61 km.

Oct. 28

M	Z	eP	23:02:46.8 d
A	Z	iP	23:02:46.1 d
D	Z	eP	23:02:46.7 d
U	Z	eP	23:02:45.7 d
Pa	Z	iP	23:02:44.0 c

C&GS card 86-62:
22:53:01.3
16.0° N., 93.6° W.
Chiapas, Mexico
h about 110 km.

Oct. 30

A	Z	eP	08:42:24.0 d
D	Z	eP	08:42:25.0 d
U	Z	eP	08:42:25.0 d
Hi	Z	eP	08:42:26.1 d
Ka	Z	eP	08:42:27.6 c

C&GS card 89-62:
08:31:51.8
12.5° N., 88.0° W.

Table 5.--Distant earthquakes--Continued

Oct. 30--Continued

C&GS card--Continued
Off west coast of Nicaragua
h about 80 km.

Oct. 30

U	PEN		17:45:58

Pressure waves from nuclear blast start at 17:45:58 with a period of 120 sec. and amplitude of 11 mm.

Oct. 31

M	Z	eP	11:43:51.3 d
A	Z	eP	11:43:50.8 d
D	Z	eP	11:43:51.1 d
U	Z	eP	11:43:50.8 d
Pa	Z	eP	11:43:51.0 d
M	Z	Tmax	13:02:10
A	Z	Tmax	13:01:59
D	Z	Tmax	13:02:00
U	Z	Tmax	13:02:09
Pa	Z	Tmax	13:01:56
Na	Z	Tmax	13:01:48
Hi	Z	Tmax	13:02:06

C&GS card 86-62:
11:32:29.0
5.6° N., 82.6° W.
South of Panama
h about 33 km
Magnitude 6.5 (Pas)
5.5 (Pal).

Nov. 1

M	Z	eP	15:44:50.2 d
U	Z	eP	15:44:50.0 d

Nov. 1--Continued

C&GS card 88-62:
15:33:22.6
1.9° N., 133.0° E.
Off coast of Western New Guinea
h about 56 km.

Nov. 2

M	Z	eP	14:59:42.9 d
A	Z	eP	14:59:42.7 d
D	Z	eP	14:59:42.1 d
Ka	Z	eP	14:59:43.2 d

C&GS card 90-62:
14:46:39.2
10.0° S., 117.8° E.
South of Sumbawa
h about 33 km.

Nov. 4

U	PEZ	eR	23:38:20

C&GS card 90-62:
22:53:34.2
43.2° S., 75.6° W.
Off coast of southern Chile
h about 33 km
Magnitude 5.8-6 (Pas)
5.5 (Pal).

Nov. 8

U	PEZ	eR	00:43:02

C&GS card 90-62:
00:02:08.6
15.1° S., 75.6° W.
near coast of southern Peru
h about 33 km.

Nov. 10, 1962

M	Z	iP	01:42:34.1 d
A	Z	iP	01:42:35.3 d
D	Z	iP	01:42:34.7 d
U	Z	iP	01:42:34.9 d
Pa	Z	iP	01:42:37.0 d
Hi	Z	eP	01:42:34.7 d
U	PEZ	eR	01:57:25

C&GS card 92-62:
01:33:15.0
43.7° N., 147.7° E.
Kurile Islands region
h about 24 km
Magnitude 6.0 (HVO).

Nov. 11

M	Z	eP	16:19:03.7 c
D	Z	eP	16:19:01.2 c
Pa	Z	iP	16:19:04.0 c
Ha	Z	eP	16:19:06.0 c
Hi	Z	eP	06:19:03.9 d
U	PEZ	iS	06:26:32
		eR	06:33:37

C&GS card 92-62:
16:09:57.6
12.9° S., 166.5° E.
Santa Cruz Islands
h about 77 km
Felt: Port Vila
Magnitude 6-6.3 (Pas)
6.1 (HVO).

Nov. 11

Ha	Z	Tmax	22:30:02
Pa	Z	Tmax	22:30:18

C&GS card 92-62:
21:45:20.5
48.9° N., 128.8° W.
Vancouver Island region
h about 33 km.

Nov. 11

U	PEZ	eR	22:58:29

C&GS card 91-62:
22:14:18.7
43.2° S., 76.0° W.
Off coast of southern Chile
h about 33 km
Magnitude 6.5-6.8 (Pas).

Nov. 14

M	Z	iP	22:11:31.1 d
	Z	ipP	22:11:52.8
A	Z	ipP	22:11:53.1
N	Z	eP	22:11:29.0 d
	Z	epP	22:11:53.3

C&GS card 96-62:
21:59:16.1
0.3° S., 123.0° E.
northern Celebes
h about 92 km.

Nov. 15

M	Z	eP	23:37:17.9 c
A	Z	eP	23:37:18.8 c
D	Z	iP	23:37:19.3 d
Pa	Z	iP	23:37:17.6 c
Hi	Z	iP	23:37:18.6 c
Ka	Z	eP	23:37:21.3 c
Ha	Z	iP	23:37:25.9 c
U	PEZ	eR	00:01:53

C&GS card 93-62:
23:25:15.7
8.7° S., 79.8° W.
near coast of northern Peru
h about 45 km
Magnitude 6 (Pas).

Nov. 16, 1962

D	Z	eP	07:29:28.1 c
Pa	Z	eP	07:29:28.2 c
U	PEE	iS	07:38:25
U	PEN	iG	07:45:57
	PEN	iR	07:48:13

C&GS card 93-62:
07:18:37.3
32.3° S., 111.1° W.
Easter Island region
h about 43 km
Magnitude 6.5-6.8 (Pas)
6 (Pal)
6.6 (HVO).

Nov. 17

M	Z	iP	14:32:53.9 d
A	Z	eP	14:32:54.1 d
D	Z	eP	14:32:53.4 d

C&GS card 94-62:
14:21:30.6
2.8° N., 121.7° E.
Celebes Sea
h about 609 km.

Nov. 23

M	Z	eP	23:13:27.7 c
A	Z	eP	23:13:26.9 c
N	Z	eP	23:13:26.9 c
Pa	Z	eP	23:13:28.2 d
Hi	Z	iP	23:13.29.8 c
Ha	Z	iP	23:13:32.1 d

C&GS card 96-62:
23:05:47.4
21.5° S., 179.3° W.
Fiji Islands
h about 609 km.

Nov. 27

M	Z	iP	07:04:24.8 d
A	Z	iP	07:04:25.5 d
D	Z	iP	07:04:24.9 d

Nov. 27--Continued

Pa	Z	iP	07:04:26.5 d
Hi	Z	iP	07:04:25.6 c

C&GS card 95-62:
06:52:57.8
25.1° N., 122.9° E.
Ryukyu Islands
h about 148 km.

Nov. 29

Hi	Z	eP	19:15:45.4 c
U	PEZ	iS	19:23:03
	PEZ	iR	19:29:31

C&GS card 96-62:
19:06:37.6
17.3° S., 168.5° E.
New Hebrides Islands
Felt: Port Vila and Tongoa
h about 33 km
Magnitude 6.1 (HVO).

Dec. 1

M	Z	iP	01:57:10.0 d
	Z	iPP	01:58:23.6
A	Z	iP	01:57:11.1 d
	Z	iPP	01:58:27.8
D	Z	eP	01:57:11.1 d
	Z	iPP	01:58:28.7
U	Z	eP	01:57:10.6 d
	Z	iPP	01:58:24.9
U	PEZ	eR	02:06:25

C&GS card 96-62:
01:50:20.4
52.4° N., 170.1° W.
Fox Islands, Aleutian Islands
h about 38 km
Magnitude 5.5 (HVO).

Table 5.--Distant earthquakes--Continued

Dec. 1, 1962

M	Z	iP	04:26:15.9	d
A	Z	iP	04:26:15.2	d
U	Z	iP	04:26:15.4	d
Pa	Z	iP	04:26:16.5	d
Hi	Z	eP	04:26:18.4	c

C&GS card 100-62:
04:16:59.6
29.7° S., 177.7° W.
Kermadec Islands
h about 52 km.

Dec. 1

M	Z	iP	21:10:03.9	d
A	Z	iP	21:10:03.5	d
D	Z	eP	21:10:02.8	d
U	Z	iP	21:10:03.4	d
Pa	Z	iP	21:10:05.2	d
Hi	Z	iP	21:10:06.2	c
Ka	Z	iP	21:10:06.0	c
Ha	Z	iP	21:10:08.7	c

C&GS card 98-62:
21:02:51.8
17.7° S., 178.7° W.
Fiji Islands region
h about 620 km.

Dec. 4

U	PEZ	eR	03:52:16

C&GS card 101-62:
03:29:40.8
10.1° N., 103.6° W.
Off coast of Guerrero, Mexico
h about 33 km.

Dec. 4

U	PEE	eL	16:56:17

C&GS card 99-62:
16:40:06.0
16.5° S., 172.8° W.
Samoa Island region
h about 33 km

Dec. 4--Continued

C&GS card--Continued
Magnitude 5-5.3 (Pal).

Dec. 7

M	Z	eP	14:13:03.8	d
D	Z	eP	14:13:03.6	d
U	Z	eP	14:13:04.4	c
Pa	Z	iP	14:13:06.1	c
Na	Z	iP	14:13:04.1	c
Hi	Z	iP	14:13:05.1	c
	Z	ipP	14:14:37	
Ka	Z	iP	14:13:02.3	c
U	PEZ	iP	14:13:03	c
	PEZ	ipP	14:14:38	
	PEZ	iPP	14:15:18	
U	PEN	iS	14:20:46	
	PEN	iG	14:28:02	

C&GS card 96-62:
14:03:37.0
29.2° N., 139.2° E.
Bonin Islands region
h about 411 km
Magnitude 6.8-7 (Brk).

Dec. 8

Na	Z	eP	18:25:49.5	d
Hi	Z	iP	18:25:54.5	d
Ka	Z	eP	18:25:55.4	d
Ha	Z	iP	18:26:00.8	c
U	PEZ	iP	18:25:52	d
	PEZ	iPP	18:27:28	
	PEZ	eS	18:32:14	
	PEZ	iL	18:35:50	

C&GS card 99-62:
18:18:29.1
15.2° S., 173.7° W.
Tonga Island region
h about 33 km
Magnitude 6.1 (HVO).

Table 5.--Distant earthquakes--Continued

Dec. 8, 1962

Hi	Z	eP	21:40:05.2	c
	Z	epP	21:42:14.3	
Pa	Z	eP	21:40:06.0	c
U	PEZ	iP	21:40:10	c
	PEZ	epP	21:42:23	
	PEZ	iPP	21:44:22	
	PEZ	iSKS	21:49:50	
	PEZ	iSP	21:52:30	
	PEZ	eSS	21:58:16	
	PEZ	eSSS	22:01:50	
	PEZ	iG	22:08:30	
U	PEN	eS	21:50:51	
U	PEE	iPS	21:53:52	
	PEE	isSP		
	PEE	isPS	21:56:18	

C&GS card 99-62:
21:27:22.2
25.8° S., 63.4° W.
Salta-Santiago
Del Estero Provinces
border, Argentina
h about 620 km.

Dec. 8

M	Z	iP	23:01:56.1	d
D	Z	eP	23:01:56.7	d
U	Z	iP	23:01:56.6	d
Pa	Z	iP	23:01:57.1	d
Hi	Z	iP	23:01:33.2	c
Ka	Z	eP	23:01:49.6	d
Ha	Z	iP	23:01:43.2	c
U	PEZ	eR	13:11:06	

C&GS card 99-62:
22:55:01.2
50.5° N., 176.8° W.
Andreanof Islands,
Aleutian Islands
h about 33 km.

Dec. 10

M	Z	iP	05:15:53.4	c
D	Z	iP	05:15:52.9	c
U	Z	iP	05:15:53.4	c
Hi	Z	eP	05:15:53.9	c

No C&GS preliminary listing.

Dec. 12

M	Z	eP	10:18:20.5	c
M		epP	10:18:41	
M		ePcP	10:19:03	
A	Z	eP	10:18:20.5	c
D	Z	eP	10:18:19.8	c
	Z	epP	10:18:40	
	Z	ePcP	10:19:02	
Pa	Z	eP	10:18:22.3	d
Na	Z	eP	10:18:16.9	d
Hi	Z	eP	10:18:22.2	c
Ha	Z	eP	10:18:37.3	c
U	PEE	iS	10:26:09	
U	PEZ	eG	10:32:55	

C&GS card 103-62:
10:08:48.5
4.8° S., 153.8° E.
New Britain
h about 94 km.

Dec. 13

M	Z	eP	04:29:25.0	d
D	Z	eP	04:29:26.0	d
Hi	Z	eP	04:29:25.6	c

C&GS card 99-62:
04:21:21.2
63.3° N., 149.7° W.
South central Alaska.
h about 47 km.

Dec. 17, 1962

M	Z	eP	11:11:54.1 c
A	Z	eP	11:11:54.3 c
D	Z	eP	11:11:53.6 c
U	Z	eP	11:11:54.0 c
Hi	Z	eP	11:11:55.4 c

C&GS card 102-62:
11:00:16.0
2.1° N., 122.9° E.
Celebes Sea
h about 393 km.

Dec. 18

M	Z	eP	10:42:50.3 d
A	Z	eP	10:42:49.8 d
Pa	Z	iP	10:42:51.5 d

C&GS card 104-62:
10:33:58.4
28.3° S., 178.2° W.
Kermadec Islands
h about 214 km.

Dec. 20

M	Z	iP	08:55:27.2 d
A	Z	eP	08:55:26.7 d
D	Z	eP	08:55:26.2 d
U	Z	eP	08:55:27.0 d
Pa	Z	eP	08:55:28.4 c
Hi	Z	eP	08:55:30.1 d
Ha	Z	iP	08:55:31.8 d

C&GS card 105-62:
08:47:23.3
23.4° S., 179.3° E.
Fiji Islands region
h about 512 km.

Dec. 21

M	Z	eP	08:49:33 d
A	Z	eP	08:49:35 d
D	Z	eP	08:49:34 d
N	Z	eP	08:49:34 d
		ePP	08:50:45
		ePP	08:50:45
Pa	Z	eP	08:49:35 d
Hi	Z	eP	08:49:34 c
U	PEZ	iP	08:49:30 d
	PEZ	iPP	08:50.54
	PEZ	iS	08:55:06
	PEZ	eG	08:57:54
	PEZ	eR	09:00:54

C&GS card 102-62:
08:42:48.1
52.4° N., 168.5° W.
Fox Islands, Aleutian Islands
h about 33 km
Magnitude 6.3 (Brk)
6.5 (Pas)
6.8 (Pal)
6.8 (HVO).

Dec. 21

M	Z	iP	09:07:26.3 c
A	Z	iP	09:07:27.3 c
	Z	ePP	09:08:41
D	Z	eP	09:07:28 c
N	Z	iP	09:07:26.4 c

C&GS card 102-62:
09:00:41.4
52.4° N., 168.5° W.
Fox Islands, Aleutian Islands
h about 33 km.

Dec. 21

M	Z	eP	09:16:46 c
A	Z	eP	09:16:49 c
	Z	ePP	09:17:58
D	Z	eP	09:16:49 c
	Z	ePP	09:17:58
N	Z	eP	09:16:48 c

Dec. 21, 1962--Continued

C&GS card 102-62:
09:10:01.6
52.5° N., 168.5° W.
Fox Islands, Aleutian Islands
h about 33 km.

Dec. 21

M	Z	iP	09:42:58.7 d
A	Z	iP	09:42:59.9 c
D	Z	iP	09:42:59.1 d
N	Z	iP	09:42:59.5 c
Pa	Z	iP	09:43:00.2 d
Na	Z	eP	09:43:00.5 d
Hi	Z	iP	09:43:00.0 d

C&GS card 104-62:
09:33:15.5
42.4° N., 142.3° E.
Near south coast of
Hokkaido, Japan
h about 27 km.

Dec. 22

M	Z	iP	01:01:40.4 c
D	Z	iP	01:01:40.5 c
U	Z	iP	01:01:40.6 c
Hi	Z	iP	01:01:44.5 c
U	PEZ	iS	01:09:19
		iSS	01:13:07
		iR	01:17:09

C&GS card 106-62:
00:52:23.4
22.0° S., 170.1° E.
Loyalty Island region
h about 33 km
Magnitude 6.5-6.8 (Pas)
6.2 (HVO)

Dec. 22

M	Z	iP	15:27:16.8 c
A	Z	iP	15:27:17.6 c
D	Z	iP	15:27:18.1 c
U	Z	eP	15:27:16.9 c
Pa	Z	iP	15:27:17.3 c
		iPP	15:28:28.5
Na	Z	eP	15:27:19.0 d
Hi	Z	eP	15:27:13.6 c
U	PEZ	iS	15:32:52
		eR	15:35:40

Dec. 22--Continued

C&GS card 102-62:
15:20:31.0
52.5° N., 168.8° W.
Fox Islands, Aleutian Islands
h about 47 km
Magnitude 6.3 (Pas)
6.4 (HVO).

Dec. 26

M	Z	eP	22:33:22.3 c
A	Z	eP	22:33:23.6 c
D	Z	eP	22:33:23.5 c
U	Z	iP	22:33:23.0 c
Pa	Z	eP	22:33:23.1 c
Na	Z	eP	22:33:24.3 c
Hi	Z	eP	22:33:22.1 c
Ka	Z	eP	22:33:17.9 c
Ha	Z	iP	22:33:11.5 c
U	PEZ	iP	22:33:22
	PEZ	iR	22:45:18
U	PEN	iS	22:40:06
U	PEE	iG	22:43:22

C&GS card 104-62:
22:25:15.5
53.9° N., 168.7° E.
Komandorskie Islands
h about 33 km
Magnitude 6.5 (Pas)
6.4 (HVO)

Dec. 26

M	Z	iP	23:54:21.0 c
A	Z	eP	23:54:22.2 c
D	Z	iP	23:54:21.7 c
U	Z	eP	23:54:21.5 d
Ha	Z	iP	23:54:13.9 c
Ka	Z	iP	23:54:15.2 c
Hi	Z	iP	23:54:21.5 c
Na	Z	eP	23:54:22.7 c

C&GS card 104-62:
23:46:14.7
54.0° N., 168.8° E.
Kormandorskie Islands
h about 33 km.

Table 5.--Distant earthquakes--Continued

Dec. 29, 1962

M	Z	iP	04:24:04.7 d
A	Z	eP	04:24:04.6 c
D	Z	eP	04:24:04.1 c
U	Z	iP	04:24:04.6 c
Hi	Z	iP	04:24:06.0 d

C&GS card 104-62:
04:12:09.0
2.4° N., 127.1° E.
Halmahera region
h about 33 km.

Dec. 29

U	PEZ	eS	11:06:25
	PEZ	eR	11:23:13
M	Z	Tmax	12:36:38
A	Z	Tmax	12:36:25
D	Z	Tmax	12:36:28
U	Z	Tmax	12:36:39
Pa	Z	Tmax	12:36:03
Na	Z	Tmax	12:36:41
Hi	Z	Tmax	12:36:22
Ha	Z	Tmax	12:38:02

C&GS card 104-62:
10:41:04.1
20.0° S., 69.9° W.
northern Chile
Felt: Arequipa, Peru
h about 46 km
Magnitude 6.8 (Pas)
6.5 (Brk)
6 (Pal).

Dec. 29

M	Z	eP	14:57:11.5 c
A	Z	eP	14:57:11.7 c
N	Z	eP	14:57:11.7 c
U	PEN	eS	15:04:57
U	PEZ	eR	15:14:57

Dec. 29--Continued

C&GS card 106-62:
14:47:41.4
31.2° S., 177.9° W.
Kermadec Island region
h about 43 km
Magnitude 6-6.3 (Pas).

During this last quarter of 1962 "felt" reports were received from the following people to whom we express our continued mahalo:

North Hawaii

Dr. Tabrah
Mr. Godfrey

Kilauea Summit Region

Miss English
Mr. Cruz
Mrs. Hansen
Mrs. Mist
Mrs. Fraser
Mr. Ferry
Mr. Soriano
Mr. English
Mr. Moriwaki
Mr. Walter
Mr. Yamamoto
Mr. Ayres
Mr. Lake
Mrs. Yong
Mr. Moore
Mr. Loucks

Central Hawaii

Mr. Greenwell
Mrs. Lindsey
Mr. Eklund
Hawaii Prep. Academy students
Kulani Honor Camp

Kau District

Mrs. Billings
Mrs. Schattauer
Naalehu Police
Mr. Thompson

Hilo Region

Mrs. Bryan
Mr. Paiva
Mr. Ho
Mrs. Baldwin
Mrs. Brayton
Mrs. Schaffer
Mrs. Pacheco
Mr. Okamura
Mrs. Ingledue

Puna

Mr. Isbell
Mr. Warner
Mr. Williamson
Mrs. Kimura
Mr. R. Ho
Mr. Thompson
Mr. Green
Mrs. Hoopai
Mr. Schattauer
Mr. Edwards
Mr. Albright

Kona Coast

Miss Greenwell
Mrs. Conley
Miss Wallace
Mr. McKinkle
Mr. Johnson
Mrs. Hahn
Mr. Glass

Northwest Coast

Mr. McKay

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