

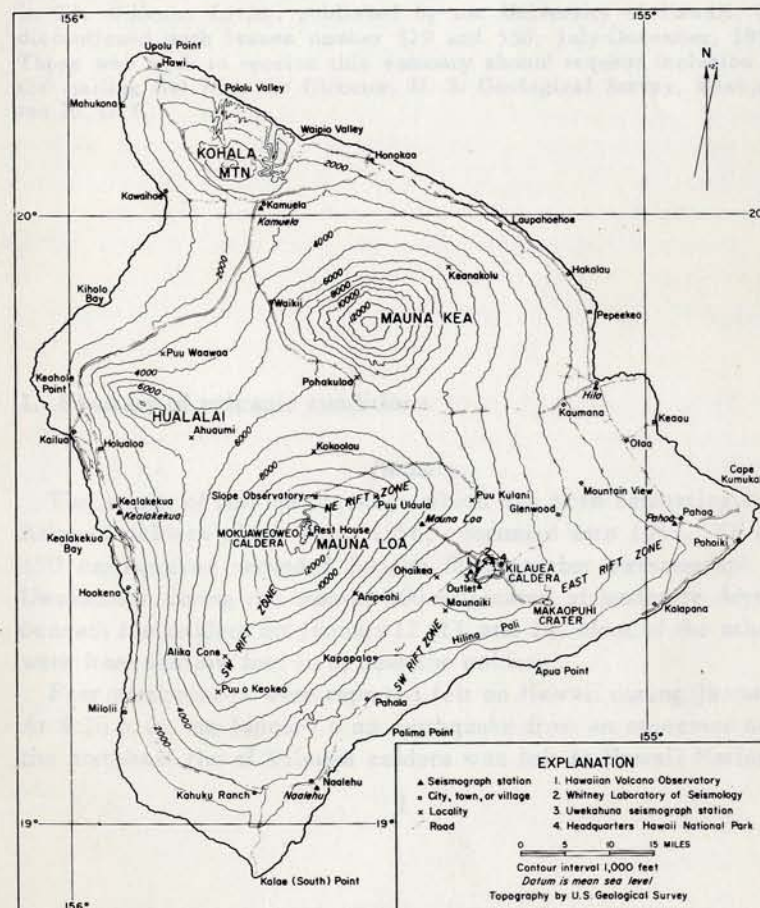
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY
SUMMARY 5

January-March 1957

By

J. P. Eaton and George D. Fraser



Map of the Island of Hawaii, showing location of the Hawaiian Volcano Observatory, seismograph stations operated by the observatory, and localities mentioned in text.

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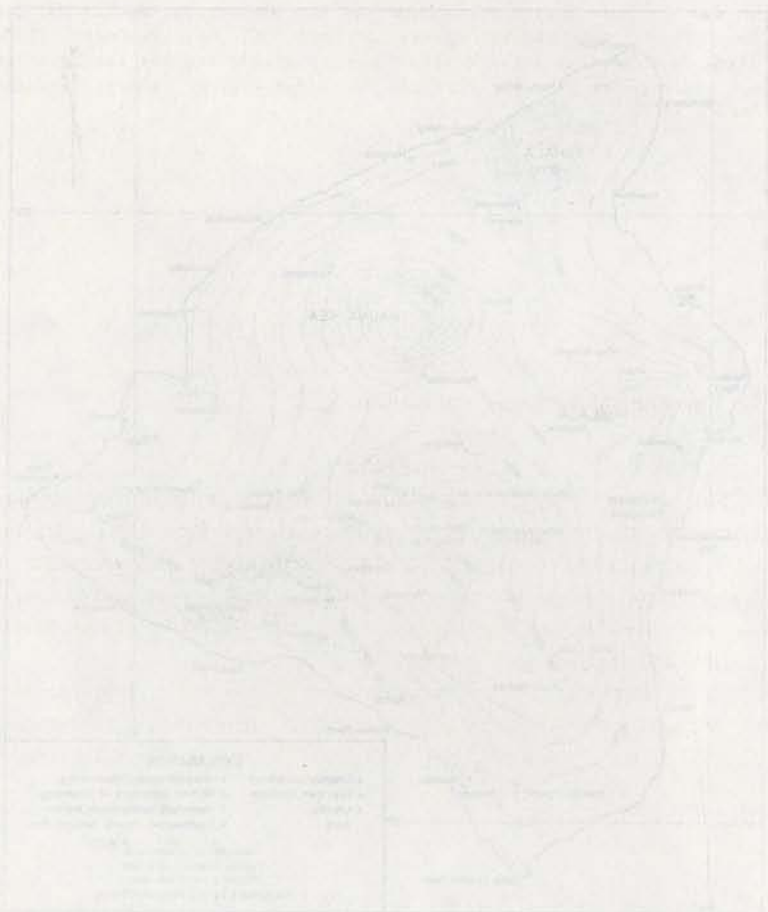
HAWAIIAN VOLCANO OBSERVATORY

SUMMARY

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By

J. M. Patton and George D. Fraser



PREFATORY NOTE

This summary of observations made at the Hawaiian Volcano Observatory is published for the use of volcanological and seismological observatories and others interested in the data at intervals more frequently than once a year. Heretofore this material was available in *The Volcano Letter*, published by the University of Hawaii, but discontinued with issues number 529 and 530, July-December, 1955. Those who wish to receive this summary should request inclusion on the mailing list from the Director, U. S. Geological Survey, Washington 25, D. C.

1. Summary of volcanic conditions

January

The swarm of tiny earthquakes which has been emanating from Kilauea caldera since July, 1956, continued into 1957. Of the 490 earthquakes recorded by the Sprengnether seismograph at Uwekahuna during the month, 360 originated at moderate depths beneath the caldera on January 12, 13, and 14. Most of the others were from shallow foci in or near the caldera.

Four earthquakes were reported felt on Hawaii during January. At 9:26 p. m. on January 6 an earthquake from an epicenter near the northeast rim of Kilauea caldera was felt at Hawaii National

Park headquarters. An earthquake in Kona on January 6 was felt by many people in central Kona at 8:45 a. m. The largest earthquake on Hawaii during the month originated seven km east of Anipeahi on the southeast flank of Mauna Loa at 12:54 p. m. on January 7. It was felt from Kilauea caldera to central Kona. An earthquake from an epicenter in Kona was felt by several people in central Kona at 6:35 p. m. on January 22.

Tilting of the ground surface at the Whitney station was marked by the absence of strong southerly tilting normal for January. Westward tilting recorded during the month was only slightly less than normal.

February

The number of earthquakes recorded on the Sprengnether seismograph at Uwekahuna increased to 525 for February. Almost all of these earthquakes were very small and stemmed from shallow foci in or near Kilauea caldera.

The largest earthquake of the month, which was felt near Kilauea caldera and in central Kona, originated 7 km west of Apua Point at a depth of 15 km on February 11 at 2:03 p. m. An earthquake in Kona at 5:35 p. m. on February 23 was felt by many people in central Kona.

Tilting of the earth's surface recorded at the Whitney station was in the southwesterly direction normal for this season, but its amount was only one fifth of that expected for February.

March

Increased seismic unrest at Kilauea caldera raised the number of earthquakes recorded by the Sprengnether seismograph at Uwekahuna to 1,260 for March. These earthquakes, half of which occurred on March 2, 3, and 4, were predominantly from extremely shallow foci in or near the caldera.

An earthquake which originated 10 km beneath the sea 25 km southeast of Apua Point at 7:57 a. m. on March 13 was felt just east of Kilauea caldera. A slightly larger earthquake with a focus 30 km deep and 5 km west of Uwekahuna which occurred at 10:07 a. m. on March 14 was not reported felt.

At the Whitney station on the northeast rim of the caldera strong southerly tilting normal for March was entirely absent. Only a weak westerly tilting which was normal in direction but only one third of the normal amount was recorded.

2. Earthquakes recorded on the Bosch-Omori seismograph in the Whitney Laboratory of Seismology, on the northeast rim of Kilauea caldera.

Week beginning	Minutes of tremor	Very feeble	Feeble	Slight	Moderate	Strong	Total	Local seismicity*
Dec. 30	0	0	0	0	1	0	1	3.00
Jan. 6	1	0	1	1	0	0	3	3.25
13	0	4	0	0	0	0	4	2.00
20	0	2	0	0	0	0	2	1.00
27	1	6	0	0	0	0	7	3.25
Feb. 3	3	3	0	0	0	0	6	2.25
10	4	6	0	0	1	0	11	6.00
17	0	3	0	0	0	0	3	1.50
24	0	3	0	0	0	0	3	1.50
Mar. 3	0	2	0	0	0	0	2	1.00
10	0	4	2	0	0	0	6	4.00
17	8	2	0	0	0	0	10	3.00
24	1	3	0	0	0	0	4	1.75

* Local seismicity is an arbitrary value. Each local earthquake is assigned a seismicity value according to its strength, as follows: tremor, 0.25; very feeble, 0.5; feeble, 1.0; slight, 2.0; moderate, 3.0; strong, 4.0. These values are totaled to give the weekly local seismicity. Continuous volcanic tremor is ignored in the calculation. The strength assigned to the earthquake depends on the double amplitude of the maximum oscillation it causes on the Bosch-Omori seismograph, as follows: Tremor, less than 0.5 mm; very feeble, 0.5 to 4 mm; feeble, 4 to 11 mm; slight, 11 to 25 mm; moderate, 25 to 60 mm; strong, greater than 60 mm.

3. Table of tilt at seismograph stations on the rim of Kilauea caldera.

Week beginning	Whitney station (northeast rim)		Uwekahuna station (west rim)	
	Direction*	Amount (seconds of arc)	Direction	Amount (seconds of arc)
Dec. 30	N 56° W	0.4		0
Jan. 6	N 45° E	1.0	N 76° W	1.3
13	S 58° W	1.1	W	0.5
20	S 53° E	0.6	N 72° E	0.3
27	N 76° W	0.5	W	0.3
Feb. 3	N 72° E	0.4	W	0.6
10	S 27° E	0.3	N 18° W	0.5
17	S 45° W	0.5	N 57° E	0.5
24	S 50° W	0.9	S 45° E	0.9
Mar. 3	N 9° W	0.7	E	0.2
10	S 45° W	0.2	N 51° W	0.8
17	S 56° E	0.4	S 18° W	0.5
24	N 53° W	0.6	E	0.5

* Note: In some previous issues, some unconventional expressions of direction were used, i.e., E 18° N, or W 18° N. The directions are correct as stated, and not typographic errors.

LOCAL EARTHQUAKES

The data for the following local earthquakes were determined from seismographs on the islands of Hawaii and Maui operated by the Hawaiian Volcano Observatory. Except for smaller earthquakes of special interest, only earthquakes classed as slight or larger were included in the list. The intensity ratings are based on the Bosch-Omori seismograph at the Whitney Laboratory. This intensity scale has been extended empirically to permit its use with the Loucks-Omori and Sprengnether seismographs. The entries for a given earthquake are: date, origin time (Hawaiian standard time), intensity at the nearest station, epicenter, and general remarks.

- Jan. 3, 21:25:42*, moderate at the Whitney Laboratory. Northeast rim of Kilauea caldera. Felt by a few people at Hawaii National Park headquarters.
- Jan. 6, 03:52:46*, slight at Mauna Loa. Ten km southwest of the Mauna Loa seismograph station at a shallow depth.
- Jan. 6, 08:45*, feeble at Kealakekua Central Kona. Felt by many people in central Kona.
- Jan. 7, 12:54:15*, moderate at Mauna Loa. Seven km east of Anipeahi at a shallow depth. Felt from Kilauea caldera to Kona. Magnitude 4.3.
- Jan. 22, 18:35:24*, slight at Kealakekua. Central Kona. Felt by several people in central Kona.
- Jan. 29, 07:36:42*, feeble at Naalehu. At sea south of Hawaii 35 km west southwest of Naalehu at a depth of about 5 km.
- Feb. 11, 14:03:24*, moderate at Uwekahuna. Seven km west of Apua point at a depth of 15 km. Felt in the vicinity of Kilauea caldera and in central Kona. Magnitude 4.0.
- Feb. 23, 17:34:32*, moderate at Kealakekua. Central Kona. Felt by many people in central Kona.
- Mar. 2, 05:04:33*, moderate at Mauna Loa. Five km southwest of the Mauna Loa seismograph station at a depth of 5 km.
- Mar. 6, 00:01:25*, slight at Naalehu. Five km north of Naalehu.
- Mar. 13, 07:57:26*, very feeble at Uwekahuna. Twenty-five km southeast of Apua point at a depth of about 10 km. Felt near Kilauea caldera. Magnitude 3.5.
- Mar. 14, 10:06:48*, slight at Uwekahuna. Five km west of Uwekahuna at a depth of 30 km. Magnitude 3.8.
- Mar. 17, 10:51:11*, slight at Mauna Loa. Seven km south of the Mauna Loa seismograph station at a depth of 5 km.

DISTANT EARTHQUAKES

The following earthquakes of distant origin were recorded on seismographs of the Hawaiian Volcano Observatory on Hawaii

(Uwekahuna, U, 19° 25.4' N, 155° 17.6' W, 1240m) and on Maui (Haleakala, H, 20° 46.0' N, 156° 15.0' W, 2090m). Beginnings of phases are given in Greenwich civil time, which is 10 hours faster than Hawaiian standard time. A "c" following the time of P indicates that the first motion was a compression; a "d", that it was a dilatation. Locations of epicenters, origin times, focal depths, and magnitudes are from the notices of Preliminary Determinations of Epicenters published by the U. S. Coast and Geodetic Survey.

Jan. 2

- U eP 00:46:13.0 c
- iS 00:51:48
- eL 00:54:48
- 53° N., 168½° W., 00:39:22
- Magnitude 6½-6¾

Jan. 2

- U eP 02:24:26.8 c
- iS 02:29:58
- eL 02:33:00
- H Tmax 03:00:06
- 52½° N., 168 W., 02:17:35
- Magnitude 6¾

Jan. 2

- U eP 03:19:42.8 c
- iS 03:25:16
- eL 03:28:32
- H eL 03:27:13
- Tmax 03:55:32
- 53 N., 168 W., 03:12:52
- Magnitude 7

Jan. 2

- U eP 03:55:37.7 c
- eS 04:01:13
- H eL 04:04:58
- Tmax 04:31:01
- 53 N., 168 W., 03:48:44
- Magnitude 7-7¼

Jan. 2

- U eP 04:10:18
- 52½° N., 169 W., 04:03:26

Jan 2

- U eP 10:56:25.0
- eS 11:01:56
- eL 11:04:56
- H eL 11:04:40
- 52½° N., 168 W., 10:49:32

Jan. 3

- U eP 00:47:58
- 53 N., 168 W., 00:41:02

Jan. 3

- U iP 12:58:17.6 c
- eS 13:06:19
- H eP 12:58:08.6
- 44 N., 130 E., 12:48:27
- Magnitude 7. Depth about 600 km.

Jan. 9

- U iP 07:59:56.2 c
- eS 08:05:22
- eL 08:08:37
- H eL 08:07:15

- 53 N., 167½ W., 07:52:56
- Magnitude 6¼-6½

Jan. 17

- U eP 22:36:28.7 c
- 33 N., 137½ E., 22:26:10

Jan. 25

- U iP 03:43:56.4 d
- eL 03:53:35
- Tmax 04:22:58
- H Tmax 04:20:27
- 51½° N., 177 W., 03:36:47

Jan. 28

U eP 08:23:47.9 d
eL 08:34:02

H eP 08:23:57

15½ S., 173 W., 08:16:19

Feb. 3

U eP 17:33:41.1
eS 17:40:46
eL 17:45:05

53½ N., 159 E., 17:24:50
Magnitude 6¼-6¾

Feb. 9

U eL 16:51:43

41½ N., 126 W., 16:38:10
Magnitude 6¼-6½

Feb. 10

U eP 22:44:09.1 c

10 N., 126 E., 22:32:15
Magnitude 6½-6¾

Feb. 10

U eP 23:02:53.5 d

10½ N., 126½ E., 22:50:52
Magnitude 6¾

Feb. 11

U eP 01:26:44 c

10 N., 126 E., 01:14:44

Feb. 13

U eP 00:41:40.2 d

10 N., 126½ E., 00:29:48

Feb. 13

U eP 12:45:48

18 S., 170 E., 12:36:51

Feb. 17

U eP 16:11:21.5 c

Banda Sea?, 16:03:55

Feb. 21

U eP 14:36:58.0 c

53 N., 171 W., 14:30:06
Magnitude 6¾. Depth about 100 km.

Feb. 23

U eP 20:38:03.5 d

H eP 20:38:01.9
eL 21:03

24 N., 122 E., 20:26:12
Magnitude 7-7¼

Mar. 9

U iP 14:29:29.3 c
i 14:29:47.1 c
Tmax 15:09:19

H eP 14:29:06.0
Tmax 15:06:45

51 N., 175 W., 14:22:27
Magnitude 8-8½, Tsunami

Mar. 9

U P 14:39:29
Tmax 15:17:43

H Tmax 15:15:40

Mar. 9

U eP 15:48:48.7
Tmax 16:26:29

H Tmax 16:25:55

50½ N., 177 W., 15:41:50

Mar. 9

H Tmax 16:59:55

Mar. 9

H Tmax 17:29:40

51½ N., 174 W., 16:45:26

Mar. 9

H Tmax 18:40:10

Mar. 9

H Tmax 20:20:30

51½ N., 173 W., 19:37:31

Mar. 9

U iP 20:46:08.4 d
iS 20:51:42
eL 20:54:35
Tmax 21:23:35

H eP 20:45:58
eL 20:53:21
Tmax 21:21:44

52½ N., 169½ W., 20:39:15
Magnitude 6¾-7¼

Mar. 9

H Tmax 22:16:55

Mar. 9

H Tmax 22:38:55

53 N., 168 W., 21:56:24

Mar. 10

H Tmax 01:15:55

Mar. 10

H Tmax 02:26:05

Mar. 10

U iP 03:13:11.4 d
eS 03:18:46
eL 03:22:14

H eP 03:13:05
Tmax 03:49:10

52 N., 176 W., 03:06:02
Magnitude 6½-6¾

Mar. 10

U iP 03:15:59.5 c
Tmax 03:53:09

H Tmax 03:51:55

51½ N., 174 W., 03:08:55

Mar. 10

H Tmax 05:13:10

Mar. 10

H Tmax 08:12:40

52 N., 176 W., 07:23:18

Mar. 10

H Tmax 10:57:25

Mar. 10

U eP 11:27:36
iS 11:33:12
eL 11:38:52
Tmax 12:05:19

H Tmax 12:03:05

52 N., 171 W., 11:19:57

Mar. 10

U eP 12:42:55.0
eL 12:51:18
Tmax 13:21:31

51 N., 171 W., 12:36:04

Mar. 10

U eP 13:17:43.6
Tmax 13:56:38

H Tmax 13:55:25

51½ N., 180 W., 13:10:13

Mar. 10

U eP 13:35:51.1
eL 13:45:11
Tmax 14:15:16

H Tmax 14:12:15

51½ N., 179 W., 13:28:30

Mar. 10

H Tmax 14:32:55

Mar. 10

U eP 15:33:18.3
iS 15:38:55
eL 15:42:21
Tmax 16:11:15

H Tmax 16:08:45

52 N., 173 W., 15:26:23
Magnitude 6¾

Mar. 10

U eP 16:46:43.0
Tmax 17:23:45

H Tmax 17:22:30

51½ N., 173½ W., 16:37:45

Mar. 10

HTmax 21:55:11

Mar. 11

U eL 00:26:02

52 N., 174 W., 00:08:07

Mar. 11

U iP 03:19:45.8 d

eS 03:25:39

eL 03:28:48

Tmax 03:58:47

H eP 03:19:32

eL 03:27:12

Tmax 03:56:15

 51 N., 177 W., 03:12:41
 Magnitude $6\frac{3}{4}$ -7

Mar. 11

U iP 10:05:36.2 d

iS 10:11:13

eL 10:14:29

Tmax 10:43:02

H eP 10:05:27.5

eS 10:10:49

eL 10:12:46

Tmax 10:40:53

 53 N., 164½ W., 09:58:42
 Magnitude $6\frac{3}{4}$ -7¼

Mar. 11

U iP 15:02:31.7 c

iS 15:08:15

eL 15:12:01

Tmax 15:42:12

H eP 15:02:15

eS 15:07:49

eL 15:10:04

Tmax 15:39:36

 51½ N., 178½ W., 14:55:19
 Magnitude $6\frac{3}{4}$ -7¼

Mar. 11

U iP 15:43:08.1 c

Tmax 16:22:18

H eP 15:42:57

Tmax 16:20:15

51½ N., 178 W., 15:35:58

Mar. 12

HTmax 03:04:57

53 N., 170½ W., 02:22:57

Mar. 12

U iP 07:35:43.6 c

iS 07:41:21

eL 07:44:35

Tmax 08:13:56

H eL 07:43:27

Tmax 08:11:42

 51½ N., 173½ W., 07:28:40
 Magnitude $6\frac{1}{4}$ -7

Mar. 12

U eP 07:46:25.7 c

Tmax 08:25:48

HTmax 08:23:33

52 N., 178 W., 07:39:17

 Magnitude $6\frac{1}{4}$ -6½

Mar. 12

U eP 11:51:54.4 c

e 11:52:04 c

iS 11:57:40

eL 12:01:20

Tmax 12:31:06

H eP 11:51:47

eS 11:57:28

eL 11:59:43

Tmax 12:29:03

 51 N., 177 W., 11:44:50
 Magnitude 7-7¼

Mar. 12

U eP 12:53:07.0 c

Tmax 13:30:32

HTmax 13:28:22

53 N., 168½ W., 12:46:12

Mar. 12

HTmax 20:43:07

Mar. 13

U iP 02:55:13.1 d

eL 03:03:45

Tmax 03:32:45

52 N., 171½ W., 02:48:20

Mar. 13

HTmax 08:05:57

52 N., 178 W., 07:21:54

Mar. 13

HTmax 09:50:42

52½ N., 170 W., 09:09:34

Mar. 13

U iP 15:49:17.4 d

iS 15:55:04

eL 15:58:52

Tmax 16:28:50

H eP 15:49:05.8

eL 15:56:50

Tmax 16:20:17

 51½ N., 179 W., 15:42:05
 Magnitude $6\frac{3}{4}$
Mar. 13

U eP 20:06:45

eS 20:11:40

eL 20:15:10

Tmax 20:43:48

HTmax 20:42:03

54 N., 166 W., 19:59:23

Mar. 14

U eL 02:10:16

52½ N., 169 W., 01:52:16

Mar. 14

UTmax 04:20:13

Mar. 14

HTmax 11:16:38

Mar. 14

U iP 14:54:48.1 d

iS 15:00:41

eL 15:04:25

Tmax 15:33:44

H eP 14:54:36

eS 15:00:13

eL 15:02:06

Tmax 15:31:38

 51½ N., 177 W., 14:47:45
 Magnitude $7\frac{1}{4}$ -7½

Mar. 14

U iP 15:58:06.3 c

51½ N., 177½ W., 15:51:00

Mar. 15

U iP 02:58:59.4 d

iS 03:04:33

eL 03:07:37

Tmax 03:36:28

H eP 02:58:36

eL 03:06:12

Tmax 03:34:28

 53 N., 167 W., 02:52:08
 Magnitude $6\frac{1}{2}$ -6¾

Mar. 16

U eP 02:41:30.2 d

i 02:41:47.7 d

iS 02:47:15

eL 02:51:01

Tmax 03:21:20

H eP 02:41:17

eS 02:46:43

eL 02:49:08

Tmax 03:18:46

 52 N., 179 W., 02:34:12
 Magnitude $6\frac{3}{4}$ -7

Mar. 17

U eL 08:21

51 N., 179 W., 07:53:51

Mar. 17

UTmax 12:14:42

HTmax 12:12:39

53½ N., 167 W., 11:30:07

Mar. 17

U eP 16:23:58 d

eL 16:32:54

H eL 16:32:13

52½ N., 166 W., 16:17:13

Mar. 17

U eP 22:51:39.6 c

eS 22:57:15

eL 23:00:54

Tmax 23:29:12

Mar. 17—Continued

H eL 23:00:14
Tmax 23:27:23
54 N., 166 W., 22:44:44
Magnitude 6½

Mar. 18

U eP 02:32:22
eL 02:41:34
Tmax 03:09:54
HTmax 03:07:45
52½ N., 171 W., 02:24:39

Mar. 18

U eL 21:40
6 S., 152 E., 21:14:12

Mar. 19

HTmax 04:22:48
52 N., 175½ W., 03:39:35

Mar. 19

HTmax 12:12:31
51½ N., 176½ W., 11:28:50

Mar. 19

U iP 12:57:50.9 c
eS 13:03:59
eL 13:07:17
Tmax 13:36:30
H eP 12:57:43
eL 12:05:03
Tmax 13:34:11

51½ N., 175 W., 12:50:51
Magnitude 6¾

Mar. 19

HTmax 21:08:01

Mar. 20

U eP 00:29:09
53 N., 169 W., 00:22:25

Mar. 20

HTmax 01:25:21

Mar. 21

U iP 12:38:25.2 d
H eP 12:38:14
Tmax 13:13:52
52 N., 171 W., 12:31:30

Mar. 22

HTmax 00:18:32

Mar. 22

U iP 14:28:03.7 c
i 14:28:14.6 d
iS 14:33:37
eL 14:37:06
Tmax 15:05:55

H eP 14:27:49
eS 14:33:05
eL 14:34:47
Tmax 15:03:39

54 N., 166 W., 14:21:06
Magnitude 7

Mar. 22

U eP 14:40:01.5 c
Tmax 15:17:25

HTmax 15:15:16

54 N., 165½ W., 14:33:13

Mar. 22

U eP 17:16:39.0
Tmax 17:54:32

HTmax 17:52:15

52½ N., 171 W., 17:09:51

Mar. 22

U eL 20:00:02
eT 20:25:21
iT 20:26:04
Tmax 20:26:20

H eT 20:25:49
Tmax 20:26:18

37.9 N., 122.6 W., 19:44:22
Magnitude 5¼-5½

Mar. 23

HTmax 00:56:43

Mar. 23

U iP 05:24:20.2 d
H iP 05:24:18.1 d
5½ S., 131 E., 05:12:31
Magnitude 7

Mar. 23

HTmax 09:35:33

Mar. 23

U eP 13:31:33
51½ N., 179 W., 13:24:33

Mar. 23

HTmax 22:51:18

Mar. 23

U eP 07:36:33 c
Tmax 08:15:50
HTmax 08:13:33
51 N., 179½ W., 07:29:15

Mar. 24

U eP 08:29:38.3 c
eL 08:38:44
Tmax 09:09:13
H eL 08:39:33
Tmax 09:07:41

51 N., 130 W., 08:22:23
Magnitude 6-7

Mar. 24

U iP 11:13:00.5 d
Tmax 11:50:45
HTmax 11:48:43
52½ N., 169½ W., 11:06:10

Mar. 24

U iP 11:43:47.0 d
eL 11:53:03
Tmax 12:21:03

H eP 11:43:36
Tmax 12:19:15
52½ N., 171½ W., 11:36:50

Mar. 24

HTmax 14:37:59

Mar. 25

U eP 00:46:17.1 c
Tmax 01:23:57
HTmax 01:21:48
53 N., 168 W., 00:39:22

Mar. 25

HTmax 01:47:28
52 N., 176 W., 01:03:59

Mar. 25

U eP 14:20:26.6
54 N., 165½ W., 14:13:33

Mar. 26

HTmax 02:53:04
54 N., 165½ W., 02:10:15

Mar. 26

HTmax 03:37:14
51 N., 177½ W., 02:47:50

Mar. 26

U iP 16:09:01.1 d
50½ N., 180 W., 16:01:53

Mar. 28

HTmax 18:04:44

Mar. 28

U eL 20:29:24
51 N., 171½ W., 20:08:20

Mar. 29

U iP 05:17:24.8 d
iS 05:22:59
eL 05:25:29
Tmax 05:54:46

H eP 05:17:15
eS 05:22:29
eL 05:24:26
Tmax 05:52:47

53½ N., 167 W., 05:10:28

53½ N., 167 W., 07:25:58

Mar. 29

U iP 22:56:39.5 c
eL 23:07:45

H eL 23:05:17
Tmax 23:32:15

53 N., 169 W., 22:49:51
Magnitude 6-6¼

Mar. 30

HTmax 01:27:10

51½ N., 179½ W., 00:42:40

Mar. 30

U iP 09:24:04.3 d
Tmax 10:02:43

HTmax 10:00:10

52 N., 175 W., 09:17:00

Mar. 31

U eP 10:15:46
eL 10:25:31
Tmax 10:55:00

HTmax 10:52:45

51½ N., 178 W., 10:08:28

○

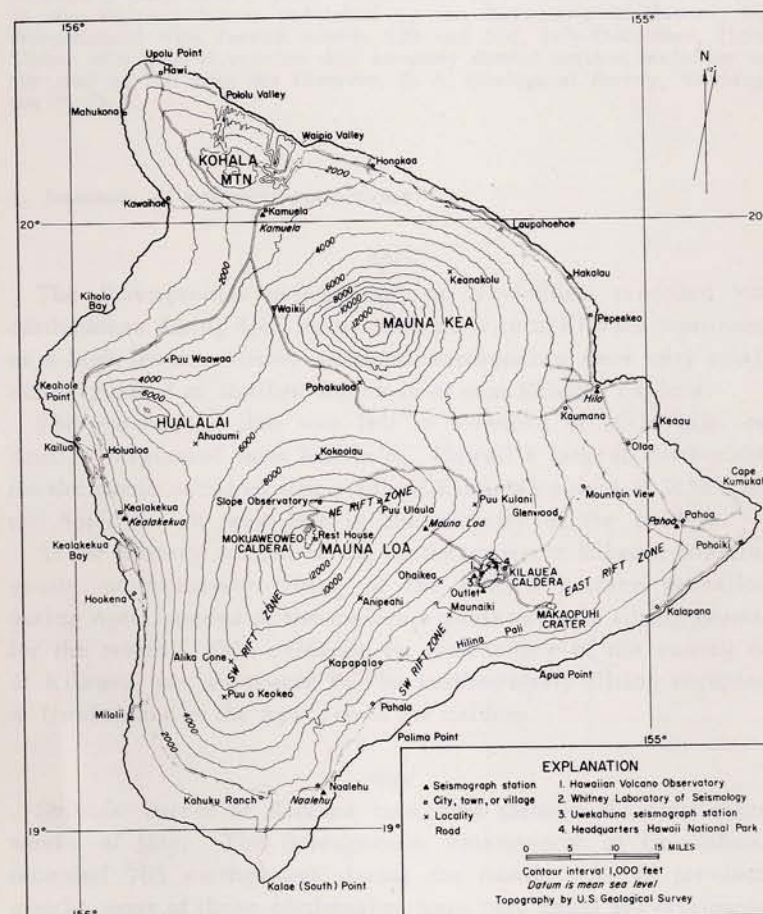
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY
SUMMARY 6

April-June 1957

By

J. P. Eaton and George D. Fraser



Map of the Island of Hawaii, showing location of the Hawaiian Volcano Observatory, seismograph stations operated by the observatory, and localities mentioned in text.

DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY

MEMORANDUM

April-June 1957

BY

J. C. Barton and Charles D. Peters

PREFATORY NOTE

This summary of observations made at the Hawaiian Volcano Observatory is published for the use of volcanological and seismological observatories and others interested in the data at intervals more frequently than once a year. Heretofore this material was available in *the Volcano letter*, published by the University of Hawaii, but discontinued with issues number 529 and 530, July-December, 1955. Those who wish to receive this summary should request inclusion on the mailing list from the Director, U. S. Geological Survey, Washington 25, D. C.

1. Summary of volcanic conditions

April

The Sprengnether seismograph at Uwekahuna recorded 590 earthquakes during April as seismic activity at Kilauea continued at a high level. Almost all these earthquakes were very small and originated at shallow depths in or near Kilauea caldera.

The earthquake that was felt in Kamuela at 10:29 p.m. on April 5 originated near Kamuela. Hawaii's largest earthquake for the month occurred just south of Kilauea caldera at 9:58 a.m. on April 6. It was felt in the vicinity of the caldera.

At the Whitney station on the northeast rim of Kilauea caldera, gentle northeasterly tilting of the earth's surface prevailed during April instead of the moderate southwesterly tilting normal for the month. This evidence for tumescence of the summit of Kilauea was supported by the northwesterly tilting recorded at Uwekahuna on the west rim of the caldera.

May

Seismic unrest at Kilauea continued through the first three weeks of May. The Sprengnether seismograph at Uwekahuna recorded 705 earthquakes during the month. As in previous months, most of these earthquakes were very small and originated at shallow depths in or near Kilauea caldera.

An earthquake that occurred about 5 km southwest of Pahala at 4:52 p.m. on May 14 was felt at Kapapala. The largest earthquake of the month on Hawaii was felt from Hilo to Kapapala at 3:38 a.m. on May 16. It originated about 5 km south of the Mauna Loa seismograph station. At 10:53 on May 18 a few persons in Capt. Cook felt an earthquake that stemmed from the Kealakekua fault. An earthquake from a focus 35 km deep and 10 km southeast of Uwekahuna was felt from Kilauea caldera to Hilo at 6:47 a.m. on May 21. This earthquake marked the end of the months-long sequence of shallow earthquakes at Kilauea caldera.

Tilting of the earth's surface outward from Kilauea caldera recorded at the Uwekahuna and Whitney stations during April ceased abruptly at the end of the first week in May. For the remainder of the month both stations recorded a moderate tilting toward the caldera.

June

Only 90 earthquakes were recorded by the Sprengnether seismograph at Uwekahuna during June. This is the smallest number recorded during any month since February 1956.

A small earthquake beneath the northeast rim of Kilauea caldera was felt sharply in the vicinity of the caldera at 6:41 a.m. on June 5. Two small earthquakes were felt at Capt. Cook during June. The first of these occurred at 12:36 a.m. on June 9; the second, at 10:37 p.m. of June 20. The largest earthquake of the month originated 13 km north of Naalehu at 11:00 p.m. on June 23. It was not reported as felt.

At the Whitney station moderate southwesterly tilting of the earth's surface replaced the moderate northwesterly tilting normal for June.

2. Earthquakes recorded on the Bosch-Omori seismograph in the Whitney Laboratory of Seismology, on the northeast rim of Kilauea caldera.

Week beginning	Minutes of tremor	Very feeble	Feeble	Slight	Moderate	Strong	Total	Local seismicity *
Mar. 31	0	3	0	1	0	0	4	3.25
Apr. 7	0	0	0	0	0	0	0	0.00
14	16	2	0	0	0	0	18	5.00
21	5	8	0	0	0	0	13	5.25
28	25	13	0	1	0	0	39	14.75

Table—Continued

Week beginning	Minutes of tremor	Very feeble	Feeble	Slight	Moderate	Strong	Total	Local seismicity *
May 5	11	6	0	0	0	0	17	5.75
12	33	10	0	1	0	0	43	15.25
19	4	0	1	0	0	0	5	2.00
26	1	0	0	0	0	0	1	0.25
June 2	0	2	0	0	1	0	3	4.00
9	0	0	0	0	0	0	0	0.00
16	0	1	0	0	0	0	1	0.50
23	1	0	1	0	0	0	2	1.25

* Local seismicity is an arbitrary value. Each local earthquake is assigned a seismicity value according to its strength, as follows: tremor, 0.25; very feeble, 0.5; feeble, 1.0; slight, 2.0; moderate, 3.0; strong, 4.0. These values are totaled to give the weekly local seismicity. Continuous volcanic tremor is ignored in the calculation. The strength assigned to the earthquake depends on the double amplitude of the maximum oscillation it causes on the Bosch-Omori seismograph, as follows:

Tremor, less than 0.5 mm; very feeble, 0.5 to 4 mm; feeble, 4 to 11 mm; slight, 11 to 25 mm; moderate, 25 to 60 mm; strong, greater than 60 mm.

3. Table of tilt at seismograph stations on the rim of Kilauea caldera.

Week beginning	Whitney station (northeast rim)		Uwekahuna station (west rim)	
	Direction	Amount (seconds of arc)	Direction	Amount (seconds of arc)
March 31	-----	0.0	N 72° W	0.5
April 7	S	0.4	N 56° W	0.5
14	S 27° E	0.3	N 45° W	0.6
21	N 23° E	0.9	N 76° W	1.2
28	E	0.1	N 56° W	0.5
May 5	S 11° E	0.6	N	0.3
12	S 63° W	0.3	S 63° W	0.7
19	W	0.5	S 67° E	1.2
26	S 72° W	0.4	N 82° E	1.1
June 2	S 53° W	0.6	S 56° E	1.1
9	S	0.7	N 14° E	0.6
16	N 45° W	0.2	N 41° W	1.4
23	N 63° W	0.3	S	0.2

LOCAL EARTHQUAKES

The data for the following local earthquakes were determined from seismographs operated by the Hawaiian Volcano Observatory on the islands of Hawaii and Maui. Except for smaller earthquakes of special interest, only earthquakes classed as slight or larger were included in the list. The intensity ratings are based on the Bosch-Omori seismograph at the Whitney Laboratory. This intensity scale has been extended empirically to permit its use with the Loucks-Omori and Sprengnether seismographs. The entries for a given earthquake are: date, origin time (Hawaiian standard time), intensity at the nearest station, epicenter, and general remarks.

- Apr. 5, 22:28:40, moderate at Kamuela. Near Kamuela at a depth of about 30 km. Felt 5 km northwest of Honokaa.
- Apr. 6, 09:57:38, slight at Uwekahuna. Five km south of Uwekahuna at a depth of about 35 km. Felt in the vicinity of Kilauea caldera. Magnitude 3.8.
- Apr. 28, 12:00:40, slight at Uwekahuna. Five km west of Makaopuhi Crater at a depth of 15 km. Magnitude 3.3.
- May 14, 16:51:47, feeble at Naalehu. Five km southwest of Pahala at a depth of 20 km. Felt at Kapapala.
- May 16, 03:38:27, moderate at Mauna Loa. Five km south of the Mauna Loa seismograph station at a depth of 15 km. Felt from Hilo to Kapapala. Magnitude 3.5.
- May 18, 10:52:56, very feeble at Kealakekua. Kealakekua fault. Felt at Capt. Cook.
- May 21, 06:46:44, feeble at the Whitney station. Ten km southeast of Uwekahuna at a depth of 35 km. Felt from Kilauea caldera to Hilo. Magnitude 3.1.
- June 5, 06:41:19, moderate at the Whitney station. One km north of the Whitney station at a depth of 2 km. Felt along the northeast rim of Kilauea caldera.
- June 5, 20:43:02, very feeble at Pahoa. Sixty km south of Pahoa ($18^{\circ} 57' N$, $154^{\circ} 56' W$) at a depth of 55 km. Magnitude 3.0.
- June 9, 00:35:52, feeble at Kealakekua. Kealakekua fault. Felt at Capt. Cook.
- June 20, 22:37:15, very feeble at Kealakekua. Kealakekua fault. Felt at Capt. Cook.
- June 23, 23:00:25, moderate at Naalehu. 13 km north of Naalehu at a depth of 5 km. Magnitude 3.3.

DISTANT EARTHQUAKES

The following earthquakes of distant origin were recorded on seismographs of the Hawaiian Volcano Observatory on Hawaii (U=Uwekahuna, $19^{\circ} 25.4' N$, $155^{\circ} 17.6' W$, 1240m), and Maui (H=Haleakala, $20^{\circ} 46.0' N$, $156^{\circ} 15.0' W$, 2090m). Beginnings

of phases are given in Greenwich civil time, which is 10 hours faster than Hawaiian standard time. A "c" following the time of P indicates that the first motion was a compression; a "d", that it was a dilatation. Locations of epicenters, origin times, focal depths, and magnitudes are from the notices of Preliminary Determinations of Epicenters published by the U. S. Coast and Geodetic Survey.

Apr. 1,
U iP 08:06:04.2
 $4\frac{1}{2}^{\circ} N$, $129^{\circ} E$, 07:54:20
Depth about 100 km.

Apr. 1,
U eP 11:42:19.3
 $51^{\circ} N$, $173^{\circ} W$, 11:35:30

Apr. 2,
U iP 00:46:33.6 c
 $51^{\circ} N$, $173^{\circ} W$, 00:39:42

Apr. 2,
U eP 20:23:47.5
 $51\frac{1}{2}^{\circ} N$, $173^{\circ} W$, 20:16:57

Apr. 2,
U eP 21:34:47.4
 $51^{\circ} N$, $173^{\circ} W$, 21:27:54

Apr. 4,
U iP 00:20:19.8 d
 $58^{\circ} N$, $155\frac{1}{2}^{\circ} W$, 00:13:08
Depth about 150 km.

Apr. 5,
U iP 02:56:36.7 c
Tmax 03:33:51
H Tmax 03:31:50
 $52^{\circ} N$, $172\frac{1}{2}^{\circ} W$, 02:49:39
Magnitude $6\frac{1}{2}$

Apr. 5,
U iP 07:39:39.4 d
 $26\frac{1}{2}^{\circ} S$, $177^{\circ} W$, 07:30:22
Depth about 100 km.
Magnitude $6\frac{3}{4}$

Apr. 5,
U eP 16:22:57.2 d
 $12\frac{1}{2}^{\circ} N$, $88^{\circ} W$, 16:12:20
Depth about 100 km.

Apr. 7,
U eP 10:25:20.8
 $1^{\circ} S$, $137\frac{1}{2}^{\circ} E$, 10:14:08
Magnitude $6-6\frac{1}{4}$

Apr. 8,
U iP 20:29:29.9 d
 $8\frac{1}{2}^{\circ} N$, $83^{\circ} W$, 20:18:09
Magnitude $6\frac{1}{2}$

Apr. 9,
U iP 00:34:11.5 c
 $30\frac{1}{2}^{\circ} N$, $138\frac{1}{2}^{\circ} E$, 00:24:39
Depth about 450 km.
Magnitude $6\frac{1}{4}-6\frac{3}{4}$

Apr. 9,
H Tmax 10:43:38
 $51^{\circ} N$, $178\frac{1}{2}^{\circ} W$, 09:59:27

Apr. 9,
U eP 11:09:25.9 d
Tmax 11:48:22
H Tmax 11:46:19
 $51\frac{1}{2}^{\circ} N$, $178\frac{1}{2}^{\circ} W$, 11:02:12

Apr. 9,
H Tmax 18:24:26
 $51\frac{1}{2}^{\circ} N$, $179\frac{1}{2}^{\circ} W$, 17:40:13

Apr. 9,
U iP 20:30:45.6 c
 $52\frac{1}{2}^{\circ} N$, $169^{\circ} W$, 20:23:56

Apr. 9,
 H Tmax 23:33:48
 51½° N, 177° W, 22:49:47

Apr. 10,
 U eP 03:32:27.8 c
 Tmax 04:09:33
 H Tmax 04:07:27
 53° N, 168° W, 03:25:20

Apr. 10,
 U iP 05:21:37.1 d
 15½° N, 98° W, 05:12:08
 Magnitude 6½-7

Apr. 10,
 U iP 09:16:18.2 c
 51° N, 177° W, 09:09:18

Apr. 10,
 U eP 11:37:06.0 c
 eS 11:42:42
 eL 11:46:04
 Tmax 12:15:48
 H eL 11:44:52
 Tmax 12:14:42
 56° N, 154° W, 11:29:58
 Magnitude 7-7¼

Apr. 10,
 U eP 13:28:20
 Tmax 14:06:16
 51½° N, 176½° W, 13:20:14

Apr. 12,
 H Tmax 05:01:50
 51½° N, 178½° W, 04:17:45
 H Tmax 07:37:58
 51½° N, 176° W, 06:49:11

Apr. 12,
 H Tmax 13:46:48
 Andreanof Islands, 13:03:45

Apr. 13,
 U e 03:53:43
 eL 03:59:48
 Tmax 04:29:01
 48½° N, 128° W, 03:44:00

6

Apr. 13,
 U eP 06:42:04 d
 6½° N, 126½° E, 06:30:08

Apr. 14,
 U eP 19:25:26.2 c
 i 19:25:28.3 d
 eS 19:31:32
 eL 19:34:41
 Tmax 20:03:31
 H iP 19:25:35.3
 eL 19:34:45
 Tmax 20:06:03
 15½° S, 173° W, 19:17:57
 Magnitude 7½-8

Apr. 14,
 U iP 21:06:03.6
 50½° N, 179° W, 20:59:00

Apr. 15,
 U eP 10:45:47.6 d
 eS 10:51:35
 eL 10:55:19
 H Tmax 11:22:50
 51½° N, 179° W, 10:38:37

Apr. 15,
 H Tmax 20:37:16
 51½° N, 176° W, 19:53:39

Apr. 15,
 U eP 21:39:59
 eS 21:45:21
 eL 21:50:19
 H Tmax 22:18:26
 51½° N, 167° W, 21:33:05

Apr. 16,
 U eP 04:16:46.3 c
 iP 04:18:53.5 c
 eG 04:44:22
 4½° S, 107½° E, 04:04:04
 Depth about 600 km.
 Magnitude 7½

Apr. 17,
 U eP 08:15:15.5 c
 20° S, 176° W, 08:07:58
 Depth about 200 km.

Apr. 17,
 U eP 09:34:47.4 c
 Tmax 10:12:08
 52½° N, 171° W, 09:27:54

Apr. 17,
 U eP 13:31:47.4
 Tmax 14:09:15
 H Tmax 14:07:26
 52½° N, 169° W, 13:24:58

Apr. 18,
 U eP 07:07:12.0 d
 Tmax 07:45:49
 51½° N, 176° W, 07:00:06

Apr. 19,
 U eP 15:51:34.2 c
 eS 15:57:01
 eL 15:59:54
 51½° N, 168½° W, 15:44:53

Apr. 19,
 U iP 22:26:14.1 d
 i 22:26:25 c
 iS 22:31:43
 eL 22:34:36
 H Tmax 23:02:05
 52° N, 166½° W, 22:19:26
 Magnitude 7-7¼

Apr. 20,
 U eL 07:24
 54½° S, 148½° E, 06:48:04

Apr. 21,
 U eP 21:24:46.9 c
 H eP 21:24:55.2
 7° N, 72° W, 21:12:26
 Magnitude 6½-6¾

Apr. 25,
 U eP 02:44:37.5 d
 eL 03:24
 36½° N, 29° E, 02:25:36
 Magnitude 7-7¼

7

Apr. 25,
 U eP 11:18:09.9 c
 1½° N, 126° E, 11:06:02

Apr. 25,
 U eL 22:14
 33° N, 115½° W, 21:57:36
 Magnitude 5½-6

Apr. 25,
 U eL 22:40
 33½° N, 115½° W, 22:24:11
 Magnitude 5½-6

Apr. 28,
 U iP 01:35:36.8 d
 7° N, 127° E, 01:23:40
 Magnitude 5¼-6

Apr. 28,
 U eL 15:06
 52½° N, 168½° W, 14:48:52

Apr. 29,
 U eL 04:48
 52½° N, 168½° W, 04:30:04

May 1,
 U eP 23:35:18.5 d
 52½° N, 171° W, 23:28:09

May 2,
 H Tmax 03:04:44
 54° N, 166° W, 02:22:18

May 2,
 U iP 04:06:53.5 c
 72° N, 67½° W, 03:55:34
 Magnitude 6-6½

May 2,
 U eP 10:46:30 d
 eL 11:10:53
 56½° S, 123° W, 10:34:14

May 2,

U eP 11:35:58.9
HTmax 12:11:35
52½° N, 169° W, 11:29:13

May 2,

U eP 11:45:43.8
Tmax 12:23:00
HTmax 12:21:25
52½° N, 169° W, 11:38:52

May 2,

U iP 21:48:17.3 d
7½° S, 120° E, 21:36:25
Depth about 600 km.

May 8,

U eP 20:17:15.6 d
eL 20:26:47
15½° S, 179° E, 20:09:55
Depth about 400 km.

May 18,

U eP 05:30:19
51° N, 171° W, 05:24:01

May 20,

U eL 02:08
51° N, 180°, 01:50:54

May 21,

U iP 01:21:36.7 d
iS 01:29:23
H iP 01:21:28.5 d
21½° N, 144° E, 01:11:58
Depth about 100 km.

May 22,

U eP 13:36:39.6
eS 13:42:21
eL 13:45:19
H eP 13:36:27.2 d
eS 13:40:47
eL 13:43:47
Tmax 14:11:44
50° N, 177° W, 13:29:44
Magnitude 6½

May 24,

U iP 02:49:43.9 d
H iP 02:49:48.6 d
3° N, 76½° W, 02:37:37
Magnitude 6½-6¾

May 24,

U eP 03:43:42
Tmax 04:20:43
HTmax 04:18:44
53° N, 167½° W, 03:36:33
Magnitude 6-6¼

May 26,

U e 06:55:02
eL 07:29:39
41° N, 31° E, 06:33:31
Magnitude 7

May 31,

U eP 22:24:27
H eP 22:24:17.4
Tmax 23:01:29
51° N, 179½° W, 22:17:10

June 4,

U iP 11:23:38.0 c
H iP 11:23:38.1 c
10½° S, 166½° E, 11:14:50

June 4,

U iP 17:12:25.5 c
H iP 17:12:31.1 c
17½° S, 178° W, 17:05:02
Depth about 550 km.
Magnitude 6¼-6½

June 6,

HTmax 04:14:45
52° N, 178° W, 03:30:22

June 6,

U eP 05:45:29.8 c
Tmax 06:22:30
H e 05:45:24
Tmax 06:20:45
52° N, 171½° W, 05:38:27

June 6,

U iP 20:01:49.4
3° N, 126½° E, 19:49:47

June 7,

HTmax 03:30:42
51½° N, 179° W, 02:46:40

June 10,

U iP 01:13:00.5
H iP 01:12:59.3
9° S, 117° E, 00:59:54

June 10,

U iP 03:22:58.8 c
H iP 03:22:52.8 c
13½° N, 143½° E, 03:13:11
Magnitude 6¾-7

June 11,

U eP 14:59:07.6
iS 15:06:46
eL 15:13:45
H iP 14:59:14.4
30° S, 178° W, 14:49:47
Depth about 100 km.
Magnitude 6¾-7

June 11,

U eP 19:01:34.3
H eP 19:01:28.4 d
18° N, 120½° E, 18:49:24

June 12,

U eP 00:00:58
H eP 00:00:45
Tmax 00:37:31
52° N, 176° W, 23:53:57

June 12,

U eP 08:38:17.5 c
H eP 08:38:06.9 c
41½° N, 142½° E, 08:28:34

June 13,

U eP 10:47:38.2 c
iS 10:53:17
eL 10:56:25
Tmax 11:26:26
H eP 10:47:29 c
Tmax 11:24:09
51½° N, 175° W, 10:40:38
Magnitude 7

June 13,

U iP 21:39:42.2 c
½° N, 123½° E, 21:27:18

June 14,

U iP 06:31:26.6 d
eS 06:37:04
eL 06:40:56
Tmax 07:09:40
HTmax 07:07:57
52° N, 175½° W, 06:24:20
Magnitude 6¼

June 15,

U eP 18:25:15
eS 18:30:53
eL 18:35:23
Tmax 19:02:41
HTmax 19:00:38
52° N, 171° W, 18:18:20
Magnitude 6

June 17,

U iP 06:24:13 d
15° S, 173½° W, 06:16:44
Magnitude 5¾

June 18,

U iP 11:30:57.7 c
18° N, 120½° E, 11:18:53
Depth about 60 km.

June 18,

U iP 18:05:49.3 d
iS 18:13:42
eL 18:21:08
25° S, 170° E, 17:56:03
Magnitude 6

June 19,

U eP 08:10:21
 iS 08:16:36
 eL 08:19:51
 16½° S, 176½° E, 08:01:30
 Magnitude 6½-6¾

June 20,

U iP 01:16:04.8 d
 H iP 01:15:57.1
 20° N, 145½° E, 01:06:25

June 22,

U iP 06:29:03.1 d
 eS 06:37:04
 eL 06:44:12
 H iP 06:29:03.5 d
 16° N, 94° W, 06:19:06
 Magnitude 6½

June 23,

U iP 00:01:38.5 d
 eS 00:10:43
 eL 00:18:51
 H eS 00:11:15
 1° S, 137° E, 23:50:23
 Magnitude 7-7¼

June 23,

U eL 03:45:39
 Tmax 04:18:05
 H Tmax 04:16:42
 58½° N, 137° W, 03:27:02
 Magnitude 5½-5¾

June 24,

U iP 09:59:42.7
 16° N, 94° W, 09:49:47

June 27,

U eP 00:21:01.7 d
 eS 00:30:34
 eL 00:40:28
 H iP 00:20:53.1 d
 eS 00:30:23
 eL 00:40:09
 56½° N, 116° E, 00:09:28
 Magnitude 7½-7¾

June 29,

U iP 07:54:57.3 c
 eS 08:00:29
 eL 08:03:34
 H Tmax 08:30:48
 51½° N, 166° W, 07:48:18

June 29,

H Tmax 11:34:00
 51½° N, 178° W, 10:49:42

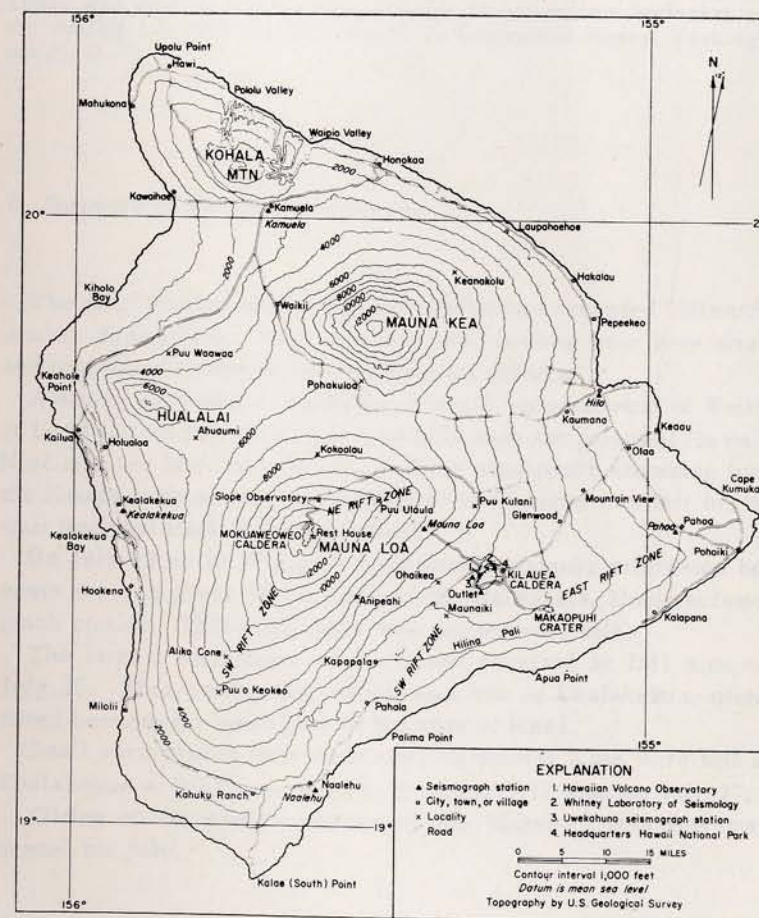
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 GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY
 SUMMARY 7

July-September 1957

By

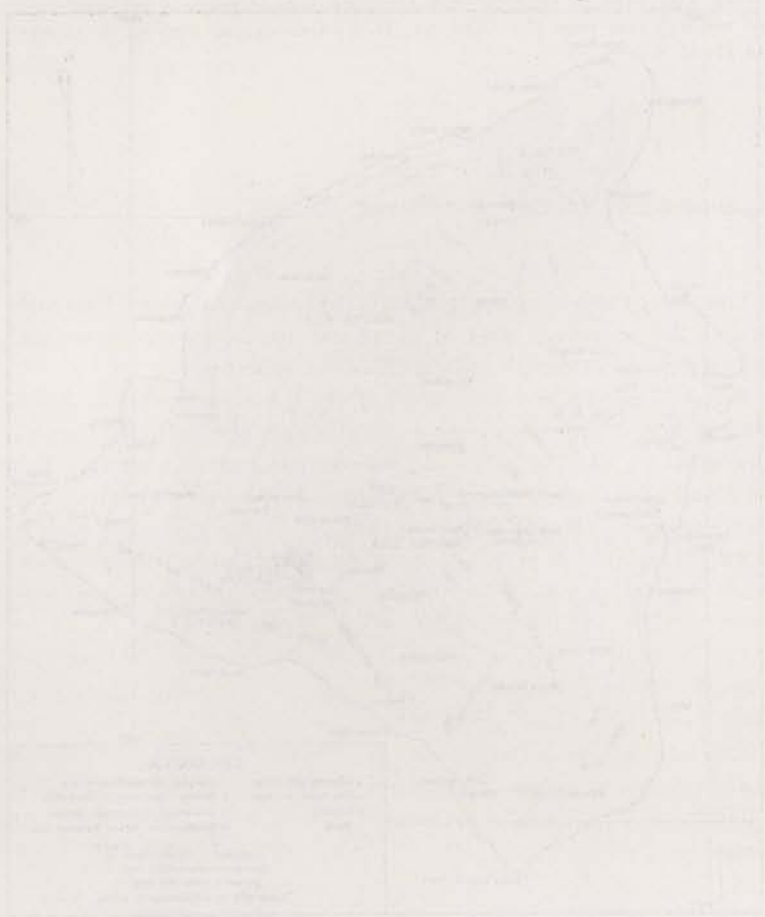
J. P. Eaton and George D. Fraser



Map of the Island of Hawaii, showing location of the Hawaiian Volcano Observatory, seismograph stations operated by the observatory, and localities mentioned in text.

DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 HAWAIIAN VOLCANO OBSERVATORY
 SUMMARY
 July-September 1955

J. T. Fisher and George D. Fisher



PREFATORY NOTE

This summary of observations made at the Hawaiian Volcano Observatory is published for the use of volcanological and seismological observatories and others interested in the data at intervals more frequently than once a year. Heretofore this material was available in *The Volcano Letter*, published by the University of Hawaii, but discontinued with issues number 529 and 530, July-December, 1955. Those who wish to receive this summary should request inclusion on the mailing list from the Director, U. S. Geological Survey, Washington 25, D. C.

1. Summary of Volcanic Conditions

July

The Sprengnether seismograph at Uwekahuna recorded 190 earthquakes during July. Most of these earthquakes were very small and originated in the vicinity of Kilauea caldera.

A strong earthquake originating about 8 km southwest of Waikii at 12:54 a.m. on July 4 was felt generally over the island of Hawaii. Nine minutes later, at 1:03 a.m., a sharp earthquake stemming from the Kaoiki fault about 5 km southwest of Ohaieka was felt in Hawaii National Park and Kealahou.

On July 22 at 10:17 a.m. a moderate earthquake originated beneath the sea about 35 km north of the Haleakala, Maui, seismograph station. This earthquake was not reported felt.

The largest earthquake of the month occurred at 1:41 a.m. on July 26. This earthquake, which was felt in Kealahou, originated beneath the sea about 30 km west of Hawaii.

Small earthquakes from epicenters in central Kona were felt in Kealahou at 9:32 a.m. on July 19 and at 2:17 a.m. on July 27.

Tilting of the earth's surface at the Whitney Laboratory was normal for July.

August

The relatively low level of seismic activity at Kilauea that characterized June and July extended into August. 200 earthquakes were registered on the Sprengnether seismograph at Uwekahuna. About half of these quakes originated at Kilauea caldera and were very small.

The largest earthquake in the Hawaiian area in many months originated at a shallow depth beneath the sea 45 km east of Hana, Maui, at 12:42 a.m. on August 18. This earthquake was felt generally over the islands of Maui and Hawaii. 59 earthquakes, including 9 with magnitudes of 3.0 or greater, stemmed from this region during August.

A moderate earthquake from an epicenter beneath the sea 30 km east of Naalehu at 5:21 p.m. on August 21 was not reported felt.

Three small, sharp earthquakes that originated near the northeast rim of Kilauea caldera at 8:38 a.m., 8:41 a.m., and 8:47 a.m. on August 23 were felt at Hawaii National Park Headquarters.

A moderate earthquake from a focus about 35 km beneath the summit of Kohala mountain was felt at Pohakuloa and Kukuihaele on August 26.

Tilting of the earth's surface at the Whitney Laboratory was approximately normal for August.

September

A mild resurgence of seismic activity in the vicinity of Kilauea caldera during mid-September raised the number of earthquakes recorded by the Sprengnether seismograph at Uwekahuna to 310. Most of these earthquakes occurred on September 8, 14, and 15 and originated at depths of more than 30 km.

A moderate earthquake from a focus about 30 km deep and 5 km northwest of Kamuela at 6:28 a.m. on September 4 was not reported felt.

An earthquake from an unusual source was felt in Hilo at 9:31 a.m. on September 5. It originated 10 km north of Keaau at a depth of 50 km.

The largest of 9 earthquakes originating 45 km east of Hana, Maui, during September occurred at 1:36 a.m. on September 7. It was not reported felt.

An earthquake from an epicenter 5 km east of Apua Point was felt in Hilo at 5:23 a.m. on September 14.

The largest earthquake of the month originated at 3:37 a.m. on September 29 on the Kaouiki fault 5 km south of Ohaikea. This

earthquake, which had a focal depth of about 25 km, was felt at the Mauna Loa Slope Observatory and at Capt. Cook.

At the Whitney Laboratory mild southeasterly tilting replaced the strong northeasterly tilting of the ground normally recorded during September.

2. Earthquakes recorded on the Bosch-Omori seismograph in the Whitney Laboratory of Seismology, on the northeast rim of Kilauea caldera.

Week beginning	Minutes of tremor	Very feeble	Feeble	Slight	Moderate	Strong	Total	Local seismicity *
June 30	0	0	1	0	0	1	2	5.00
July 7	1	1	0	1	0	0	3	2.75
14	0	1	0	0	0	0	1	0.50
21	1	2	0	0	0	0	3	1.25
28	1	1	0	0	0	0	2	0.75
Aug. 4	0	1	1	0	0	0	2	1.50
11	0	4	1	0	0	0	5	3.00
18	1	2	2	0	1	1	7	10.25
25	1	4	0	0	0	0	5	2.25
Sept. 1	1	1	1	0	0	0	3	1.75
8	0	1	2	0	0	0	3	2.50
15	54	1	0	0	0	0	55	14.00
22	0	1	0	0	0	0	1	0.50

* Local seismicity is an arbitrary value. Each local earthquake is assigned a seismicity value according to its strength, as follows: tremor, 0.25; very feeble, 0.5; feeble, 1.0; slight, 2.0; moderate, 3.0; strong, 4.0. These values are totaled to give the weekly local seismicity. Continuous volcanic tremor is ignored in the calculation. The strength assigned to the earthquake depends on the double amplitude of the maximum oscillation it causes on the Bosch-Omori seismograph, as follows:

Tremor, less than 0.5 mm; very feeble, 0.5 to 4 mm; feeble, 4 to 11 mm; slight, 11 to 25 mm; moderate, 25 to 60 mm; strong, greater than 60 mm.

3. Table of tilt at seismograph stations on the rim of Kilauea caldera.

Week beginning	Whitney station (northeast rim)		Uwekahuna station (west rim)	
	Direction	Amount (seconds of arc)	Direction	Amount (seconds of arc)
June 30	N 27° W	0.5	Instrument out of order	
July 7	N 27° W	0.3		
14	W	0.1		
21	N 27° E	0.3		

Table—Continued

Week beginning	Whitney station (northeast rim)		Uwekahuna station (west rim)	
	Direction	Amount (seconds of arc)	Direction	Amount (seconds of arc)
July 28	N 57° E	0.4	N 27° W	0.3
Aug. 4	N	0.4	N 79° W	0.8
11	N 76° E	0.5	W	0.2
18	N 11° W	0.6	N 79° W	0.8
25	E	0.4	W	0.2
Sept. 1	S 18° E	0.4	S 18° E	0.5
8	S 72° E	0.4	N 45° W	0.2
15	S 45° E	0.3	N 57° W	0.5
22	N 18° W	0.4	S 63° W	0.7

LOCAL EARTHQUAKES

The data for the following local earthquakes were determined from seismographs operated by the Hawaiian Volcano Observatory on the islands of Hawaii and Maui. Except for smaller earthquakes of special interest, only earthquakes classed as slight or larger were included in the list. The intensity ratings are based on the Bosch-Omori seismograph at the Whitney Laboratory. This intensity scale has been extended empirically to permit its use with the Loucks-Omori and Sprengnether seismographs. The entries for a given earthquake are: date, origin time (Hawaiian standard time), intensity at the nearest station, epicenter, and general remarks.

- July 4, 00:53:59, strong at Kamuela. 8 km southwest of Waikii at a depth of about 15 km. Felt generally over the island of Hawaii. Magnitude 4.5.
- July 4, 01:03:28, feeble at Uwekahuna. 5 km southwest of Ohaieka at a depth of about 15 km. Felt in Kealakekua and Hawaii National Park. Magnitude 2.8.
- July 13, 00:01:06, slight at Uwekahuna. Kilauea caldera.
- July 19, 09:31:51, near Kealakekua. Felt in Kealakekua.
- July 22, 10:17:22, 35 km north of the Haleakala seismograph station at a depth of about 35 km. Magnitude 3.2.
- July 26, 01:40:30, strong at Kamuela. About 30 km west of Hawi. Felt in Kealakekua. Magnitude 4.6.
- July 27, 02:16:57, feeble at Kealakekua. Near Kealakekua. Felt in Kealakekua.
- Aug. 10, 14:43:43, 23° 48' N, 155° 28' W. 45 km east of Hana, Maui, at a depth of about 10 km. Magnitude 4.2.
- Aug. 11, 04:39:26, 23° 48' N, 155° 28' W. Depth about 10 km. Magnitude 4.3.

- Aug. 11, 09:39:18, 23° 48' N, 155° 28' W. Depth about 10 km. Magnitude 4.0.
- Aug. 18, 00:41:56, 23° 48' N, 155° 28' W. 45 km east of Hana, Maui, at a depth of about 10 km. Felt widely on the islands of Hawaii and Maui. Magnitude 5.6.
- Aug. 19, 15:52:07, 45 km east of Hana, Maui. Magnitude 3.0.
- Aug. 19, 18:38:10, 45 km east of Hana, Maui. Magnitude 3.0.
- Aug. 21, 17:21:05, slight at Naalehu. About 30 km east of Naalehu at a depth of about 15 km. Magnitude 3.5.
- Aug. 23, 08:38, feeble at the Whitney Laboratory. Felt at Hawaii National Park Headquarters.
- Aug. 23, 08:41:14, moderate at the Whitney Laboratory. Felt at Hawaii National Park Headquarters.
- Aug. 23, 08:46:44, very feeble at the Whitney Laboratory. Felt at Hawaii National Park Headquarters.
- Aug. 26, 08:04:18, 45 km east of Hana, Maui. Magnitude 3.2.
- Aug. 26, 16:58:52, strong at Kamuela. Beneath the summit of Kohala mountain at a depth of about 35 km. Felt at Kukuihaele and Pohakuloa. Magnitude 3.3.
- Aug. 28, 09:59:52, 45 km east of Hana, Maui. Magnitude 3.0.
- Sept. 4, 06:28:18, 5 km northwest of Kamuela at a depth of about 30 km. Magnitude 3.3.
- Sept. 5, 09:31:24, slight at Hilo. 10 km north of Keeau at a depth of 50 km. Felt in Hilo. Magnitude 3.3.
- Sept. 7, 01:35:13, 20° 46' N, 155° 27' W. 45 km east of Hana, Maui, at a depth of about 5 km. Magnitude 3.6.
- Sept. 8, 08:37:22, 60 km beneath the Mauna Loa seismograph station. Magnitude 2.3.
- Sept. 8, 19:36:08, 20° 16' N, 157° 38' W. 115 km south of Koko Head, Oahu. Magnitude 2.7.
- Sept. 14, 05:22:48, very feeble at the Whitney Laboratory. 5 km east of Apua Point at a depth of about 5 km. Felt in Hilo. Magnitude 2.5.
- Sept. 14, 15:38:46, 45 km east of Hana, Mau. Magnitude 3.0.
- Sept. 17, 11:47:37, 45 km east of Hana, Maui. Magnitude 3.0.
- Sept. 29, 03:37:02, slight at Uwekahuna. 5 km south of Ohaieka at a depth of about 25 km. Felt at the Slope Observatory and Capt. Cook. Magnitude 3.9.

DISTANT EARTHQUAKES

The following earthquakes of distant origin were recorded on seismographs of the Hawaiian Volcano Observatory on Hawaii (U=Uwekahuna, 19° 25.4' N, 155° 17.6' W, 1240m), and Maui (H=Haleakala, 20° 46.0' N, 156° 15.0' W, 2090m). Beginnings of

phases are given in Greenwich civil time, which is 10 hours faster than Hawaiian standard time. A "c" following the time of P indicates that the first motion was a compression; a "d", that it was a dilatation. Locations of epicenters, origin times, focal depths, and magnitudes are from the notices of Preliminary Determinations of Epicenters published by the U. S. Coast and Geodetic Survey.

July 2,

U e 01:12:21
eL 01:38:21
36° N, 53° E, 00:42:23
Magnitude 7¼ - 7½

July 3,

U eP 12:31:42.9 d
eS 12:37:26
eL 12:40:58
50½° N, 179° W, 12:24:37
Magnitude 5¾ - 6¼

July 7,

U iP 16:20:51.1 c
H iP 16:20:49.5 c
6½° S, 156° E, 16:11:15
Magnitude 6¼

July 10,

U eP 09:15:30.4 c
eS 09:25:03
eL 09:33:18
8° N, 82½° W, 09:04:08
Magnitude 6½ - 7

July 14,

U iP 06:32:44.8 d
iS 06:39:52
H iP 06:32:50.8 d
27½° S, 177° W, 06:23:50
Depth about 200 km.
Magnitude 6¼ - 7¼

July 14,

U iP 08:20:10.1 c
iS 08:27:43
eL 08:34:47
H iP 08:20:16.4 c
30° S, 177° W, 08:10:45
Magnitude 6¼ - 7

July 17,

U eP 11:18:57.2 c
eS 11:26:00
eL 11:30:09
H iP 11:18:58.2 c
11° S, 167° E, 11:10:10
Magnitude 6¼ - 6½

July 18,

U iP 12:16:10.0 c
H iP 12:16:04.0 c
30° N, 139° E, 12:06:39
Depth about 400 km.

July 22,

U eP 06:26:48.8 c
33½° S, 178° W, 06:16:52

July 23,

U eP 00:52:16.6 d
eS 00:58:00
eL 01:01:42
Tmax 01:31:04
H eP 00:52:01.7
Tmax 01:29:05
52° N, 177° W, 00:45:12
Magnitude 6¼ - 6½

July 24,

U eS 11:19:00
eL 11:23:40
H iP 11:11:42.9 c
20° S, 169° E, 11:02:30
Magnitude 6½

July 25,

U iP 07:49:39.6
eS 07:55:15
eL 07:58:44
H Tmax 08:26:20
51° N, 177° W, 07:42:25
Magnitude 6¼

July 27,

U eP 15:49:20.9
5½° N, 127½° E, 15:37:30

July 28,

U iP 08:49:25.3 d
e 08:49:38
eS 08:56:58
eG 09:00:24
Tmax 09:46:23
H eP 08:49:31.0 d
i 08:49:41
Tmax 09:47:19
17° N, 99° W, 08:40:04
Magnitude 7¼ - 7½

July 29,

U eS 17:54:05
eL 17:57:25
Tmax 19:13:13
23½° S, 71½° W, 17:15:14
Magnitude 6¼ - 7¼

Aug. 4,

U iP, 14:25:40
17° N, 99½° W, 14:16:18
Magnitude 6¼

Aug. 12,

U eP 07:20:53
6° N, 124½° E, 07:08:38

Aug. 16,

U eP 23:40:56.7
iS 23:48:13
Tmas 00:34:42
HTmax 00:37:12
10½° N, 104° W, 23:31:55
Magnitude 6½ - 6¼

Aug. 17,

U iP 12:49:18.5 c
29° N, 141° E, 12:39:23

Aug. 18,

U eP 08:48:59.5
eS 08:58:59
eL 09:08:51
12° N, 124° E, 08:36:57

Aug. 18,

U eP 21:21:40.1 c
16½° N, 99° W, 21:10:42

Aug. 18,

U ep 21:51:31
eS 21:58:21
eL 22:04:31
HTmax 22:43:14
50° N, 157° E, 21:42:30
Magnitude 6¼ - 6½

Aug. 20,

U eP 12:11:09.1
eS 12:18:42
eL 12:23:23
10° S, 161° E, 12:01:54
Magnitude 6¼ - 6½

Aug. 22,

U eP 08:07:36.0 d
1° N, 126° E, 07:55:06

Aug. 22,

U eP 16:53:01
15° S, 168° E, 16:43:35

Aug. 23,

U eP 02:09:50
eS 02:17:37
Tmax 03:09:12
6° S, 154½° E, 02:00:05
Magnitude 6½

Aug. 27,

U iP 21:04:43 d
25½° S, 178° E, 20:56:29
Depth about 650 km.

U eP 23:59:54
 21° N, 145° E, 23:50:15

Sept. 7,

U eP 10:13:50
 eL 10:23:32
 Tmax 10:53:13
 H eP 10:13:43
 Tmax 10:50:56
 51½° N, 178½° W, 10:06:47

Sept. 10,

U iP 15:39:43
 5° N, 125½° E, 15:29:40

Sept. 12,

U eP 00:38:49
 17½° N, 85° W, 00:28:02

Sept. 20,

U eP 23:14:13
 52° N, 170½° W, 23:07:22

Sept. 24,

U iP 08:33:01.4 d
 eS 08:42:39
 eG 08:51:29
 H eP 08:32:56.8 d
 5½° N, 127° E, 08:21:05
 Magnitude 7¼

Sept. 26,

U eP 12:13:36
 39½° S, 174½° E, 12:03:01
 Depth 150 km

Sept. 27,

U iP 04:20:35 d
 1° S, 127° E, 04:08:23

Sept. 27,

U eP 04:30:52
 1° S, 127½° E, 04:18:49

Sept. 27,

U Tmax 06:32:20
 H Tmax 06:30:25
 53° N, 168° W, 05:48:15

Sept. 28,

U iP 00:37:01.4 c
 H iP 00:36:52.5 c
 30½° N, 137½° E, 00:27:31
 Depth about 500 km.
 Magnitude 6¾

Sept. 28,

U iP 14:27:32.9 d
 iS 14:33:35
 H iP 14:27:38.3 d
 iS 14:33:46
 20½° S, 178° W, 14:20:00
 Depth about 650 km.
 Magnitude 7-7½

Sept. 29,

U iP 06:49:36.7 c
 0°, 124° E, 06:37:33
 Depth about 200 km.

Sept. 29,

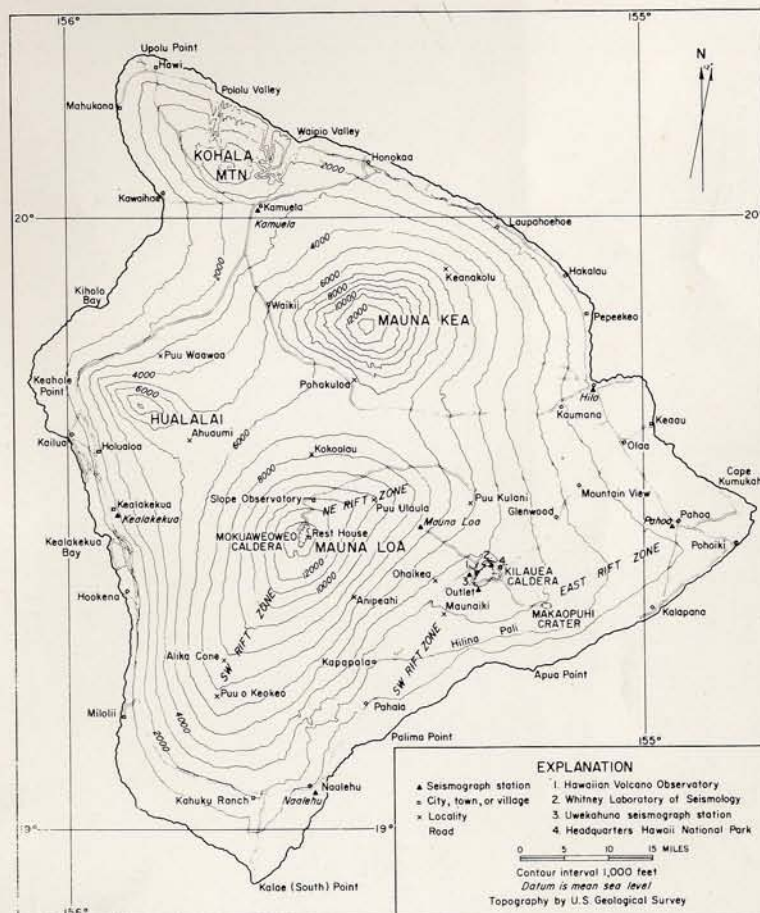
U iP 08:21:36.5
 H iP 08:21:41.5
 25° S, 178½° E, 08:12:22
 Depth about 600 km.
 Magnitude 6¾

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HAWAIIAN VOLCANO OBSERVATORY
SUMMARY 8

October-December 1957

By
J. P. Eaton and George D. Fraser



Map of the Island of Hawaii, showing location of the Hawaiian Volcano Observatory, seismograph stations operated by the observatory, and localities mentioned in text.

DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 HAWAIIAN VOLCANO OBSERVATORY
 SUMMARY
 October-December 1955
 by
 J. P. Fisher and George D. Fryer

PREFATORY NOTE

This summary of observations made at the Hawaiian Volcano Observatory is published for the use of volcanological and seismological observatories and others interested in the data at intervals more frequently than once a year. Heretofore this material was available in *The Volcano Letter*, published by the University of Hawaii, but discontinued with issues number 529 and 530, July-December, 1955. Those who wish to receive this summary should request inclusion on the mailing list from the Director, U. S. Geological Survey, Washington 25, D. C.

1. Summary of Volcanic Conditions

October

The Sprengnether seismograph at Uwekahuna recorded only 120 earthquakes during October. Most of these earthquakes were very small and originated at shallow depths near Kilauea caldera or along the Kaoiki fault zone southwest of the caldera.

An earthquake from an epicenter near Keahole Point was felt in Capt. Cook at 1:03 a. m. on October 25. At 7:24 p. m. on October 28 a small, sharp earthquake originating at the eastern rim of Kilauea caldera was felt at Hawaii National Park Headquarters. An earthquake felt in Capt. Cook at 5:48 a. m. on October 31 stemmed from the Kealakekua fault about 5 km south-east of Kealakekua.

Moderate northeasterly tilting of the ground at the Whitney station was normal for October.

November

Seismic activity in Hawaii remained at a low level during November. Most of the 165 earthquakes recorded by the Sprengnether seismograph at Uwekahuna were very small and stemmed from Kilauea caldera or the adjacent portion of the Kaoiki fault zone.

An earthquake felt in Kealakekua and Capt. Cook at 2:31 a.m. on November 16 originated beneath the ocean 30 km west of Kailua. At 8:21 p. m. on November 23 an earthquake from an epicenter near Anipeahi was felt at Hawaii National Park, Kealakekua, and Kamuela. A small earthquake from the Kealakekua fault was felt in Capt. Cook at 5:16 p. m. on November 30.

At the Whitney station the northward component of ground tilting was normal for November, but the eastward component was about three times greater than normal.

December

The Sprengnether seismograph at Uwekahuna recorded only 160 earthquakes during December. As in preceding months most of these earthquakes were very small and originated near Kilauea caldera at shallow depths.

No earthquakes were reported felt on Hawaii during December.

The largest earthquake of the month originated beneath the ocean about 45 km east of Hana, Maui, at 01:21 p. m. on December 6.

At the Whitney station on the northeastern rim of Kilauea caldera gentle northwesterly tilting of the ground replaced the moderate northeasterly tilting normal for December.

2. Earthquakes recorded on the Bosch-Omori seismograph in the Whitney Laboratory of Seismology, on the northeast rim of Kilauea caldera.

Week beginning	Minutes of tremor	Very feeble	Feeble	Slight	Moderate	Strong	Total	Local seismicity*
Sept. 29	0	1	0	1	0	0	2	2.50
Oct. 6	1	0	0	0	0	0	1	0.25
13	1	0	0	0	0	0	1	0.25
20	0	0	1	0	0	0	1	1.00
27	0	1	1	0	0	0	2	1.50
Nov. 3	0	1	0	0	0	0	1	0.50
10	0	1	0	0	0	0	1	0.50
17	0	3	1	1	0	0	5	4.50
24	0	3	0	0	0	0	3	1.50
Dec. 1	1	3	0	0	0	0	4	1.75
8	1	1	0	0	0	0	2	0.75
Dec. 15	0	2	0	0	0	0	2	1.00
22	0	0	0	0	0	0	0	0.00

* Local seismicity is an arbitrary value. Each local earthquake is assigned a seismicity value according to its strength, as follows: tremor, 0.25; very feeble, 0.5; feeble, 1.0; slight, 2.0; moderate, 3.0; strong, 4.0. These values are totaled to give the weekly local seismicity. Continuous volcanic tremor is ignored in the calculation. The

Table—Continued

strength assigned to the earthquake depends on the double amplitude of the maximum oscillation it causes on the Bosch-Omori seismograph, as follows: tremor, less than 0.5 mm; very feeble, 0.5 to 4 mm; feeble, 4 to 11 mm; slight, 11 to 25 mm; moderate, 25 to 60 mm; strong, greater than 60 mm.

3. Table of tilt at seismograph stations on the rim of Kilauea caldera.

Week beginning	Whitney station (northeast rim)		Uwekahuna station (west rim)	
	Direction	Amount (seconds of arc)	Direction	Amount (seconds of arc)
Sept. 29	N 79° E	0.6	N 34° W	0.5
Oct. 6	E	0.4	E	0.2
13	N 45° E	0.7	N 63° W	0.3
20	N 81° E	0.7	S 45° W	0.2
27	N 51° E	1.5	N 37° W	0.3
Nov. 3	N 40° E	0.9	W	0.4
10	N 63° E	0.5	S 81° E	0.9
17	S 74° E	0.9	S 72° W	1.0
24	N 60° E	1.0	N 79° W	0.8
Dec. 1	S 27° W	0.8	S 72° E	0.5
8	N 30° E	1.7	S 68° W	0.8
15	S 84° W	1.20	N 56° E	0.5
22	E	0.6	W	0.2

LOCAL EARTHQUAKES

The data for the following local earthquakes were determined from seismographs operated by the Hawaiian Volcano Observatory on the islands of Hawaii and Maui. Except for smaller earthquakes of special interest, only earthquakes classed as slight or larger were included in the list. The intensity ratings are based on the Bosch-Omori seismograph at the Whitney Laboratory. This intensity scale has been extended empirically to permit its use with the Loucks-Omori and Sprengnether seismographs. The entries for a given earthquake are: date, origin time (Hawaiian standard time), intensity at the nearest station, epicenter, and general remarks.

Oct. 20, 05:09:43, slight at Uwekahuna. 5 km west of Ohaikea at a depth of about 5 km. Magnitude 2.8.

Oct. 25, 01:02:38, very feeble at Kealakekua. Near Keahole Point. Felt at Captain Cook. Magnitude 2.2.

Oct. 28, 19:23:57, feeble at the Whitney station. East rim of Kilauea caldera. Felt at Hawaii National Park Headquarters.

- Oct. 31, 05:48:24, feeble at Kealakekua. On the Kealakekua fault about 5 km southeast of Kealakekua. Felt at Capt. Cook.
- Nov. 9, 11:26:25, very feeble at Kamuela. 25 km northwest of Kamuela at a depth of 35 km. Magnitude 3.1
- Nov. 16, 02:30:32, very feeble at Kealakekua. 30 km west of Kailua at a shallow depth. Felt at Kealakekua and Capt. Cook. Magnitude 3.5.
- Nov. 23, 20:21:28, moderate at Uwekahuna. 10 km southwest of the Mauna Loa seismograph station at a depth of 5 km. Felt at Hawaii National Park, Kealakekua, and Kamuela. Magnitude 3.5.
- Nov. 30, 17:15:45, Kealakekua fault. Felt at Capt. Cook.
- Dec. 6, 13:20:34, 45 km east of Hana, Maui, at a depth of about 5 km. Magnitude 3.2.

DISTANT EARTHQUAKES

The following earthquakes of distant origin were recorded on seismographs of the Hawaiian Volcano Observatory on Hawaii (U=Uwekahuna, $19^{\circ} 25.4' N$, $155^{\circ} 17.6' W$, 1240m), and Maui (H=Haleakala, $20^{\circ} 46.0' N$, $156^{\circ} 15.0' W$, 2090m). Beginnings of phases are given in Greenwich civil time, which is 10 hours faster than Hawaiian standard time. A "c" following the time of P indicates that the first motion was a compression; a "d", that it was a dilatation. Locations of epicenters, origin times, focal depths, and magnitudes are from the notices of Preliminary Determinations of Epicenters published by the U. S. Coast and Geodetic Survey.

- Oct. 3,
U iP 06:09:53
 $4^{\circ} S$, $134^{\circ} E$, 05:58:08
- Oct. 5,
U eP 16:18:22
 $10\frac{1}{2}^{\circ} S$, $122\frac{1}{2}^{\circ} E$, 16:05:38
- Oct. 10,
U eP 19:00:54
Tmax 19:38:41
 $54^{\circ} N$, $166^{\circ} W$, 18:53:59
Magnitude $5\frac{3}{4}$
- Oct. 15,
U iP 06:04:34
 $30^{\circ} S$, $179^{\circ} W$, 05:55:21
Depth about 100 km.

- Oct. 19,
U eP 18:40:45 c
 $23\frac{1}{2}^{\circ} N$, $122^{\circ} E$, 18:28:50
Magnitude $6\frac{1}{2}-6\frac{3}{4}$
- Oct. 23,
U eP 06:03:43
eS 06:09:13
eL 06:12:37
Tmax 06:40:22
HTmax 06:38:58
 $52\frac{1}{2}^{\circ} N$, $169\frac{1}{2}^{\circ} W$, 05:56:52
Magnitude $6\frac{1}{4}$
- Oct. 24,
U eP 00:26:33
eS 00:33:47
eL 00:40:09
 $14\frac{1}{2}^{\circ} S$, $167\frac{1}{2}^{\circ} E$, 00:17:37
Magnitude $6\frac{1}{2}$

- Oct. 24,
U iP 09:15:05 c
H iP 09:15:12 c
 $20\frac{1}{2}^{\circ} S$, $179^{\circ} W$, 09:07:30
Depth about 550 km

- Oct. 25,
U eP 10:12:31
iS 10:19:22
iL 10:24:53
 $50\frac{1}{2}^{\circ} N$, $156\frac{1}{2}^{\circ} E$, 10:03:32
Magnitude $6\frac{1}{2}-6\frac{3}{4}$

- Oct. 26,
U iP 08:33:50
 $20\frac{1}{2}^{\circ} S$, $178^{\circ} W$, 08:26:12
Magnitude $6-6\frac{1}{4}$

- Oct. 27,
U eP 22:41:07
eL 23:02:20
H eP 22:41:01
 $56^{\circ} N$, $161^{\circ} E$, 22:32:25
Magnitude $6\frac{1}{2}-6\frac{3}{4}$

- Oct. 31,
U eP 10:19:27
eS 10:28:55
iL 10:40:48
 $6\frac{1}{2}^{\circ} N$, $83^{\circ} W$, 10:07:54
Magnitude $6\frac{1}{2}-6\frac{3}{4}$

- Nov. 2,
U iP 07:30:53 c
 $15^{\circ} N$, $93\frac{1}{2}^{\circ} W$, 07:20:58
Depth about 100 km

- Nov. 2,
U eP 18:39:15
eS 18:46:30
eL 18:51:04
 $13^{\circ} S$, $166\frac{1}{2}^{\circ} E$, 18:30:24

- Nov. 5,
U eP 10:02:16 d
 $13^{\circ} S$, $169^{\circ} E$, 09:54:29
Depth about 650 km

- Nov. 13,
U iP 17:32:28 c
iL 17:48:21
H eP 17:32:33
 $33^{\circ} S$, $179^{\circ} W$, 17:22:41
Magnitude $6\frac{1}{2}-6\frac{3}{4}$

- Nov. 16,
U eP 01:56:08 c
eS 02:01:41
eL 02:05:24
 $51\frac{1}{2}^{\circ} N$, $177^{\circ} W$, 01:48:48

- Nov. 17,
U iP 18:04:36 c
 $30\frac{1}{2}^{\circ} N$, $138^{\circ} E$, 17:55:04
Depth about 450 km

- Nov. 20,
U eP 12:47:19 c
eS 12:52:54
eL 12:54:42
Tmax 13:25:02
H eP 12:47:11
Tmax 13:22:55

- $54^{\circ} N$, $165^{\circ} W$, 12:40:23
Magnitude $6\frac{1}{4}-6\frac{1}{2}$

- Nov. 23,
U eP 01:05:30
eS 01:11:04
eL 01:14:53
Tmax 01:42:48
 $52\frac{1}{2}^{\circ} N$, $168^{\circ} W$, 00:58:33

- Nov. 25,
U eL 19:08:43
Tmax 19:40:45
HTmax 19:40:25
 $44^{\circ} N$, $130^{\circ} W$, 18:55:12

- Nov. 25,
U eL 20:48:00
Tmax 21:13:30
HTmax 21:12:38
 $44\frac{1}{2}^{\circ} N$, $129\frac{1}{2}^{\circ} W$, 20:32:25

Nov. 25,

HTmax 22:57:28
45° N, 130° W, 22:16:44

Nov. 26,

U eP 11:42:46
eS 11:48:24
eL 11:51:58
51½° N, 176° W 11:35:44

Nov. 28,

U eP 20:59:06
eS 21:06:13
eL 21:12:39
Tmax 21:52:09
H eP 20:59:04
Tmax 21:52:32
15° S, 168½° E, 20:50:10

Nov. 29,

U iP 22:32:50 d
iS 22:43:09
H iP 22:32:56 c
21° S, 66° W, 22:19:38
Depth about 200 km
Magnitude 7½-8

Dec. 4,

U iP 03:50:36 c
iS 04:01:08
iL 04:13:50
H iP 03:50:30 d
eS 04:01:03
eL 04:16
45½° N, 99½° E, 03:37:45
Magnitude 7¼-8

Dec. 7,

U iP 03:28:21 c
6½° S, 123½° E, 03:16:43
Depth about 550 km

Dec. 10,

U iP 14:45:37 c
iS 14:53:19
eL 14:58:08
6° S, 154½° E, 14:35:57
Magnitude 6½-6¾

Dec. 13,

U iS 20:38:40
eL 20:41:09
52½° N, 170° W, 20:26:22

Dec. 16,

U Tmax 18:15:13
H Tmax 18:14:15
50° N, 127° W, 20:26:22

Dec. 17,

U eP 05:18:40
eS 05:25:35
eL 05:31:42
43½° N, 162° E, 05:10:11
Magnitude 6¾

Dec. 17,

U eP 13:58:57 c
iS 14:05:51
iL 14:10:09
Tmax 14:52:19
H iP 13:58:57 c
eS 14:05:54
eL 14:10:40
12° S, 167° E, 13:50:05
Magnitude 7¼

Dec. 26,

U iP 12:18:59 c
eL 12:35
32½° S, 178° W, 12:09:11

Dec. 26,

U Tmax 13.01:08
41½° N, 127° W, 12:20:35

Dec. 31,

U eP 14:39:49
eL 15:02:26
45° S, 165½° E, 14:28:15