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# **The Registration of Earthquakes**

**AND**

# **Press Dispatches on Earthquakes**

**FROM**

**JANUARY 1st, 1922 To JANUARY 1st, 1923**

**BY**

**F. A. TONDORF, S. J., Chief Seismologist**

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## BULLETIN OF THE SEISMOGRAPHIC STATION

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### THE REGISTRATION OF EARTHQUAKES

AT THE

GEORGETOWN UNIVERSITY STATION

AND

PRESS DISPATCHES ON EARTHQUAKES

RECEIVED AT THE

GEORGETOWN STATION

FROM

JANUARY 1, 1922, TO JANUARY 1, 1923

BY

F. A. TONDORF, S.J., *Chief Seismologist*

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## INSTALLATION AND EQUIPMENT OF THE SEISMOLOGICAL OBSERVATORY OF GEORGETOWN UNIVERSITY.

The Georgetown University Seismological Observatory was founded in 1911. The original installation consisted of an horizontal and vertical seismograph after Weichert, carrying a stationary mass of 80 kilos. These instruments were tentatively placed, January, 1911, at the base of the South Tower of the Healy Building. It was soon ascertained that this choice of position was unfortunate because of the rocking of the tower, 212 feet in height, under heavy wind conditions. A cave was promptly excavated beneath the quadrangle, measuring 12 ft. 4 in. in width, 30 ft. 10 in. in length and 11 ft. high. This station is designated as Station A. Care was taken to make this new home of the seismographs heat and damp proof. A new Weichert horizontal seismograph, with a stationary mass of 200 kilos, was purchased to replace the one of 80 kg. mass. This smaller instrument is now installed in Guatemala City, Guatemala, and is in charge of Senor Claudio Urrutia, consulting engineer to the Guatemalan Government. The cave also houses two Bosch-Omori pendulums of 25 kilos each, and two conical pendulums after Mainka, of 135 kgs. mass. At present a Galitzin Vertical Seismograph is being mounted in this same cave. A concrete building, situated on observatory hill, at an altitude of 159 feet above sea level, designated as Station B, shelters a Bosch photographic instrument with pendulums of 200 grams each. The time is automatically registered on these instruments by five contact clocks noting minutes and hours. The clocks are corrected daily by signals received through the courtesy of the Western Union Telegraph Company and the Arlington Wireless Station.

## CONSTANTS

### CONSTANTS OF THE STATION.

Latitude and longitude of the seismograph room:

$\phi = 38^{\circ} 54' 25''$  N. Lat.

$\lambda = 77^{\circ} 04' 24''$  W. from Greenwich.

TIME. All determinations are reduced to Greenwich mean civil time.

ALTITUDE, Station A—42.4 meters above mean sea level.

Station B—48.2 meters above mean sea level.

GEOLOGY, subsoil of piers: decayed diorite.

### CONSTANTS OF THE SEISMOGRAPHS.

#### BOSCH-OMORI TROMOMETERS (25 Kilos).

|                    | <i>Period.</i> | <i>Magnification.</i> |
|--------------------|----------------|-----------------------|
| N-S Component..... | 11             | 13.5                  |
| E-W Component..... | 11             | 13.7                  |

#### WIECHERT HORIZONTAL SEISMOGRAPH (200 Kilos).

|                    | <i>Period.</i> | <i>Magnification.</i> |
|--------------------|----------------|-----------------------|
| N-S Component..... | 5              | 143                   |
| E-W Component..... | 5              | 165                   |

#### MAINKA CONICAL PENDULUM (135 Kilos).

|                    | <i>Period.</i> | <i>Magnification.</i> |
|--------------------|----------------|-----------------------|
| N-S Component..... | 9              | 70                    |
| E-W Component..... | 9              | 93                    |

#### WIECHERT VERTICAL SEISMOGRAPH (80 Kilos).

|  | <i>Period.</i> | <i>Magnification.</i> |
|--|----------------|-----------------------|
|  | 4              | 80                    |

#### BOSCH PHOTOGRAPHIC SEISMOGRAPH (200 gms).

|                    | <i>Period.</i> | <i>Magnification.</i> |
|--------------------|----------------|-----------------------|
| N-S Component..... | 5              | 133                   |
| E-W Component..... | 5              | 133                   |

## SYMBOLS AND NOTATIONS.

### 1. *Character of the Earthquake.*

#### ROSSI-FOREL SCALE OF EARTHQUAKE INTENSITIES:

- I. *Microseismic shock*: recorded by a single seismograph or by seismographs of the same model, but not by several seismographs of different kinds; the shock felt by an experienced observer.
- II. *Extremely feeble shock*: recorded by several seismographs of different kinds; felt by a small number of persons at rest.
- III. *Very feeble shock*: felt by several persons at rest; strong enough for the direction or duration to be appreciable.
- IV. *Feeble shock*: felt by persons in motion; disturbances of movable objects, doors, windows; creaking of ceilings.
- V. *Shock of moderate intensity*: felt generally by everyone; disturbance of furniture, beds, etc., ringing of swinging bells.
- VI. *Fairly strong shock*: general awakening of those asleep; general ringing of house bells; oscillation of chandeliers; stopping of pendulum clocks; visible agitation of trees and shrubs; some startled persons leave their dwellings.
- VII. *Strong shock*: overthrow of movable objects; fall of plaster; ringing of church bells; general panic, without damage to buildings.
- VIII. *Very strong shock*: fall of chimneys, cracks in walls of buildings.
- IX. *Extremely strong shock*: partial or total destruction of some buildings.

X. *Shock of extreme intensity*: great disaster, buildings ruined, disturbance of the strata, fissures in the ground, rock-falls from mountains.

|                               |                                                                |
|-------------------------------|----------------------------------------------------------------|
| $d$ (terrae motus domesticus) | Local shock (origin nearby, perceptible at the station).       |
| $v$ (terrae motus vicinus)    | Near shock (origin less than 1,000 kilometers distant).        |
| $r$ (terrae motus remotus)    | Distant shock (origin from 1,000 to 5,000 kilometers distant). |
| $u$ (terrae motus ultimus)    | Very distant shock (origin more than 5,000 kilometers).        |

## 2. *Phases of the Seismogram.*

|                      |                                                                                                                      |
|----------------------|----------------------------------------------------------------------------------------------------------------------|
| $P$ (undae primae)   | First phase, or first preliminary tremors.                                                                           |
| $PR_n$               | Waves $n$ -times reflected at the earth's surface.                                                                   |
| $S$ (undae secundae) | Second phase, or second preliminary tremors.                                                                         |
| $SR_n$               | Waves $n$ -times reflected at the earth's surface.                                                                   |
| $PS$                 | Waves changed from longitudinal to transverse oscillation, or vice versa, through reflection at the earth's surface. |
| $L$ (undae longae)   | Long waves, chief phase, or principal part.                                                                          |
| $M$ (undae maximae)  | Greatest motion in the chief phase.                                                                                  |
| $C$ (cauda)          | Tail or end portion.                                                                                                 |
| $F$ (finis)          | End of discernible movement.                                                                                         |

### 3. Nature of the Motion.

*i* (impetus) Sudden beginning of the motion.

*e* (emersio) Gradual beginning of the motion.

*T* (period) Time of one complete oscillation.

*A* amplitude of the motion, measured from the median line in millimeters. Instrumental trace.

*A<sub>E</sub>* E-W component of *A*.

*A<sub>N</sub>* N-S component of *A*.

*A<sub>Z</sub>* Vert. component of *A*.

# REGISTRATION OF EARTHQUAKES AT THIS STATION

From January 1, 1922, to January 1, 1923



| Date    | Character. | Phase.             | Time.    | Period. | Amplitude.*    |                |                | Remarks.                       |
|---------|------------|--------------------|----------|---------|----------------|----------------|----------------|--------------------------------|
|         |            |                    |          |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                                |
| †Jan. 1 |            | L <sub>E</sub>     | 20 40 36 | 22      |                |                |                | Very heavy<br>microseisms.     |
|         |            | L <sub>N</sub>     | 20 45 26 | 15      |                |                |                |                                |
|         |            | L <sub>E</sub>     | 20 50 00 | 20      |                |                |                |                                |
|         |            | F                  | 21 20    |         |                |                |                |                                |
| Jan. 6  |            | P <sub>E</sub> (?) | 14 20 43 |         |                |                |                | Microseisms.<br>No distinct M. |
|         |            | P <sub>N</sub>     | 14 20 43 |         |                |                |                |                                |
|         |            | S <sub>E</sub>     | 14 28 32 |         |                |                |                |                                |
|         |            | S <sub>N</sub>     | 14 28 31 |         |                |                |                |                                |
|         |            | eL <sub>E</sub>    | 14 37.0  | 30      |                |                |                |                                |
|         |            | L <sub>E</sub>     | 14 45    | 22      |                |                |                |                                |
|         |            | L <sub>N</sub>     | 14 46 06 | 16      |                |                |                |                                |
|         |            | F                  | 15 30    |         |                |                |                |                                |
| Jan. 9  |            | eP <sub>E</sub>    | 5 15 47  |         |                |                |                | No distinct M.                 |
|         |            | eP <sub>N</sub>    | 5 15 47  |         |                |                |                |                                |
|         |            | iS <sub>E</sub>    | 5 21 05  |         |                |                |                |                                |
|         |            | eS <sub>N</sub>    | 5 21 05  |         |                |                |                |                                |
|         |            | eL <sub>E</sub>    | 5 24.2   | 21      |                |                |                |                                |
|         |            | F                  | 6 (ca)   |         |                |                |                |                                |
| Jan. 17 |            | eP <sub>E</sub>    | 3 57 37  |         |                |                |                |                                |
|         |            | iP <sub>N</sub>    | 3 57 40  |         |                |                |                |                                |
|         |            | i <sub>E</sub>     | 3 59 33  |         |                |                |                |                                |
|         |            | i <sub>E</sub>     | 4 00 51  |         |                |                |                |                                |
|         |            | iS <sub>E</sub>    | 4 03 26  |         |                |                |                |                                |
|         |            | iS <sub>N</sub>    | 4 03 28  |         |                |                |                |                                |
|         |            | eL <sub>E</sub>    | 4 7.4    | 7       |                |                |                |                                |
|         |            | eL <sub>N</sub>    | 4 7.6    | 6       |                |                |                |                                |
|         |            | M <sub>E1</sub>    | 4 08 31  |         |                | 6.7mm          |                |                                |
|         |            | M <sub>N1</sub>    | 4 08 45  |         | 4.3mm          |                |                |                                |
|         |            | M <sub>E2</sub>    | 4 09 34  |         |                | 5.0mm          |                |                                |
|         |            | M <sub>N2</sub>    | 4 09 40  |         | 4.6mm          |                |                |                                |
|         |            | M <sub>E3</sub>    | 4 10 40  |         |                | 4.1mm          |                |                                |

\* Instrumental trace.

† All records, unless otherwise noted, are from grams on Wiechert Horizontal (200) and Vertical (80) Seismographs.

## REGISTRATION OF EARTHQUAKES—Continued



| Date.   | Character. | Phase.          | Time.      | Period. | Amplitude.     |                |                | Remarks.                                                         |
|---------|------------|-----------------|------------|---------|----------------|----------------|----------------|------------------------------------------------------------------|
|         |            |                 |            |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                                                                  |
| Jan. 17 |            | M <sub>N3</sub> | 4 10 54    |         | 3.9mm          |                |                |                                                                  |
|         |            | M <sub>E4</sub> | 4 11 07    |         |                | 5.5mm          |                |                                                                  |
|         |            | M <sub>N4</sub> | 4 13 02    |         | 1.9mm          |                |                |                                                                  |
|         |            | M <sub>E5</sub> | 4 12 12    |         |                | 3.8mm          |                |                                                                  |
|         |            | F               | 4 50       |         |                |                |                |                                                                  |
|         |            | iP <sub>Z</sub> | 3 57 40    |         |                |                |                |                                                                  |
|         |            | i <sub>Z</sub>  | 3 59 27    |         |                |                |                |                                                                  |
|         |            | S <sub>Z</sub>  | 4 03 25    |         |                |                |                |                                                                  |
|         |            | eL <sub>Z</sub> | 4 7.4      |         |                |                |                |                                                                  |
|         |            | L <sub>Z</sub>  | 4 19       | 17      |                |                |                |                                                                  |
|         |            | F               | 4 44       |         |                |                |                |                                                                  |
| Jan. 19 |            | L <sub>E</sub>  | 23 16 23   | 18      |                |                |                | Very heavy microseisms.                                          |
|         |            | F <sub>E</sub>  | 23 23      |         |                |                |                | N-S component does not show.                                     |
| Jan. 22 |            | eL <sub>E</sub> | 4 16       |         |                |                |                | N-S component barely shows.                                      |
|         |            | L <sub>E</sub>  | 4 18       | 23      |                |                |                |                                                                  |
|         |            | L <sub>E</sub>  | 4 27       | 20      |                |                |                |                                                                  |
|         |            | F               | 4 30       |         |                |                |                |                                                                  |
| Jan. 22 |            | L <sub>E</sub>  | 21 38 20   |         |                |                |                | Heavy microseisms.                                               |
|         |            | F               | 22 10 (ca) |         |                |                |                |                                                                  |
| Jan. 26 |            | e <sub>E</sub>  | 9 37 27    |         |                |                |                | Heavy microseisms.                                               |
|         |            | e <sub>N</sub>  | 9 37 27    |         |                |                |                |                                                                  |
|         |            | eL <sub>E</sub> | 9 42.0     | 13      |                |                |                |                                                                  |
|         |            | eL <sub>N</sub> | 9 41.6     | 13      |                |                |                |                                                                  |
|         |            | L <sub>E</sub>  | 9 51 25    | 15      |                |                |                |                                                                  |
|         |            | L <sub>N</sub>  | 9 51       | 15      |                |                |                |                                                                  |
|         |            | F               | 10 15      |         |                |                |                |                                                                  |
| Jan. 31 |            | iP <sub>E</sub> | 13 24 36   |         |                |                |                | Time evaluation very difficult because of the severity of quake. |
|         |            | iP <sub>N</sub> | 13 24 36   |         |                |                |                |                                                                  |
|         |            | iS <sub>E</sub> | 13 30 28   |         |                |                |                |                                                                  |
|         |            | iS <sub>N</sub> | 13 30 28   |         |                |                |                |                                                                  |
|         |            | eL <sub>E</sub> | 13 36.0    | 11      |                |                |                |                                                                  |
|         |            | eL <sub>N</sub> | 13 36.0    | 11      |                |                |                |                                                                  |

## REGISTRATION OF EARTHQUAKES—Continued



| Date    | Character. | Phase.            | Time.    | Period. | Amplitude.     |                |                | Remarks.                                           |
|---------|------------|-------------------|----------|---------|----------------|----------------|----------------|----------------------------------------------------|
|         |            |                   |          |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                                                    |
| Jan. 31 |            | M <sub>E1</sub>   | 13 38 18 |         |                | 24.5mm         |                |                                                    |
|         |            | M <sub>N1</sub>   | 13 38 35 |         | 24.3mm         |                |                |                                                    |
|         |            | M <sub>E2</sub>   | 13 43 02 |         |                | 19.0mm         |                |                                                    |
|         |            | M <sub>N2</sub>   | 13 39 42 |         | 18.7mm         |                |                |                                                    |
|         |            | M <sub>E3</sub>   | 13 44 10 |         |                | 20.5mm         |                |                                                    |
|         |            | M <sub>N3</sub>   | 13 41 42 |         | 15.6mm         |                |                |                                                    |
|         |            | M <sub>N4</sub>   | 13 43 16 |         | 15.5mm         |                |                |                                                    |
|         |            | F                 | 17 (ca)  |         |                |                |                |                                                    |
|         |            | iP <sub>Z</sub>   | 13 24 35 |         |                |                |                |                                                    |
|         |            | eS <sub>Z</sub>   | 13 30 36 |         |                |                |                |                                                    |
|         |            | eL <sub>Z</sub>   | 13 34.4  | 14      |                |                |                |                                                    |
|         |            | M <sub>Z</sub>    | 13 40 39 |         |                |                | 8.0mm          |                                                    |
|         |            |                   |          |         |                |                |                |                                                    |
| Feb. 14 |            | L <sub>E</sub>    | 14 01    | 26      |                |                |                | Heavy micros.                                      |
|         |            | F                 | 14 10    |         |                |                |                | N-S does not show.                                 |
| Feb. 16 |            | eP <sub>E</sub>   | 3 20 43  |         |                |                |                | Heavy micros.                                      |
|         |            | eP <sub>N</sub>   | 3 20 43  |         |                |                |                |                                                    |
|         |            | eS <sub>E</sub>   | 3 25 32  |         |                |                |                |                                                    |
|         |            | eS <sub>N</sub>   | 3 25 38  |         |                |                |                |                                                    |
|         |            | eL <sub>E</sub>   | 3 27.8   | 8       |                |                |                |                                                    |
|         |            | M <sub>E</sub>    | 3 32 28  |         |                | 2.2mm          |                |                                                    |
|         |            | M <sub>N</sub>    | 3 32 13  |         | 1.3mm          |                |                |                                                    |
|         |            | F                 | 4 15     |         |                |                |                |                                                    |
| Feb. 19 |            | eL <sub>N</sub> ? | 22 6.4   |         |                |                |                | Heavy micros.                                      |
|         |            | L <sub>E</sub>    | 22 09 16 |         |                |                |                | No distinct M.                                     |
|         |            | L <sub>N</sub>    | 22 07 33 | 19      |                |                |                |                                                    |
|         |            | F                 | 22 26    |         |                |                |                |                                                    |
| Feb. 20 |            | eL <sub>E</sub>   | 8 40.6   |         |                |                |                | Heavy micros.                                      |
|         |            | F                 | 8 50     |         |                |                |                |                                                    |
| Feb. 28 |            | eL <sub>N</sub>   | 21 31.8  | 18      |                |                |                |                                                    |
|         |            | F                 | 21 40    |         |                |                |                | Difficultt.<br>Heavy micros.<br>E-W does not show. |

## REGISTRATION OF EARTHQUAKES—Continued

| Date.   | Character. | Phase.            | Time.          | Period. | Amplitude.     |                |                | Remarks.                                                           |
|---------|------------|-------------------|----------------|---------|----------------|----------------|----------------|--------------------------------------------------------------------|
|         |            |                   |                |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                                                                    |
| Mar. 4  |            | eP <sub>E</sub>   | 13 19          |         |                |                |                | Very heavy<br>micros.                                              |
|         |            | P <sub>N</sub>    | 13 19 12       |         |                |                |                |                                                                    |
|         |            | i <sub>E</sub>    | 13 20 05       |         |                |                |                |                                                                    |
|         |            | i <sub>N</sub>    | 13 20 08       |         |                |                |                |                                                                    |
|         |            | iS <sub>E</sub>   | 13 28 40       |         |                |                |                |                                                                    |
|         |            | S <sub>N</sub>    | 13 28 43       |         |                |                |                |                                                                    |
|         |            | eL <sub>E</sub>   | 13 40.4        |         |                |                |                |                                                                    |
|         |            | L <sub>E</sub>    | 13 45          | 12      |                |                |                |                                                                    |
|         |            | L <sub>N</sub>    | 13 54 33       | 16      |                |                |                |                                                                    |
|         |            | F                 | 14 10          |         |                |                |                |                                                                    |
| Mar. 10 |            | eP <sub>E</sub> ? | 11 34 42       |         |                |                |                | Very heavy<br>micros.<br>S <sub>E</sub> ?<br>P possibly<br>sooner. |
|         |            | eP <sub>N</sub> ? | 11 34 42       |         |                |                |                |                                                                    |
|         |            | S <sub>N</sub>    | 11 39 59       |         |                |                |                |                                                                    |
|         |            | eL <sub>E</sub>   | 11 42.4        | 10      |                |                |                |                                                                    |
|         |            | eL <sub>N</sub>   | 11 42.1        | 10      |                |                |                |                                                                    |
|         |            | M <sub>E</sub>    | 11 43 39       |         |                | 2.3mm          |                |                                                                    |
|         |            | M <sub>N</sub>    | 11 42 12       |         | 2.0mm          |                |                |                                                                    |
|         |            | F                 | 12 10          |         |                |                |                |                                                                    |
| Mar. 10 |            | i <sub>E</sub>    | 17 15 13       |         |                |                |                | Very heavy<br>micros.<br>Difficult.                                |
|         |            | F                 | Lost in micros |         |                |                |                |                                                                    |
| Mar. 22 |            | e <sub>E</sub>    | 22 33 46       |         |                |                |                | Very heavy<br>micros.                                              |
|         |            | e <sub>N</sub>    | 22 34          |         |                |                |                |                                                                    |
|         |            | F                 | 22 37          |         |                |                |                |                                                                    |
| Mar. 28 |            | eP <sub>E</sub>   | 4 08           |         |                |                |                | Heavy micros.<br>No distinct M.                                    |
|         |            | iP <sub>N</sub>   | 4 07 56        |         |                |                |                |                                                                    |
|         |            | iS <sub>E</sub>   | 4 16 05        |         |                |                |                |                                                                    |
|         |            | iS <sub>N</sub>   | 4 16 04        |         |                |                |                |                                                                    |
|         |            | eL <sub>E</sub> ? | 4 26.3         | 11      |                |                |                |                                                                    |
|         |            | eL <sub>N</sub>   | 4 26.3         | 11      |                |                |                |                                                                    |
|         |            | L <sub>N</sub>    | 4 36 04        | 18      |                |                |                |                                                                    |
|         |            | F                 | 4 47           |         |                |                |                |                                                                    |

# REGISTRATION OF EARTHQUAKES—Continued



| Date    | Character. | Phase.            | Time.     | Period. | Amplitude.     |                |                | Remarks.           |
|---------|------------|-------------------|-----------|---------|----------------|----------------|----------------|--------------------|
|         |            |                   |           |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                    |
| April 2 |            | e <sub>E</sub>    | 17 08     |         |                |                |                | Very difficult.    |
|         |            | e <sub>N</sub>    | 17 08     |         |                |                |                |                    |
|         |            | eL <sub>E</sub>   | 17 17     |         |                |                |                | Very heavy micros. |
|         |            | eL <sub>N</sub>   | 17 17     |         |                |                |                |                    |
|         |            | F                 | 17 40     |         |                |                |                |                    |
| April 2 |            | eP <sub>E</sub> ? | 19 26 04  |         |                |                |                | Very heavy micros. |
|         |            | eP <sub>N</sub>   | 19 26 47  |         |                |                |                |                    |
|         |            | S <sub>E</sub>    | 19 36 06  |         |                |                |                | S <sub>N</sub> ?   |
|         |            | eL <sub>E</sub>   | 19 47.7   | 16      |                |                |                |                    |
|         |            | eL <sub>N</sub>   | 19 47.7   | 16      |                |                |                |                    |
|         |            | L <sub>E</sub>    | 19 52     | 21      |                |                |                |                    |
|         |            | F                 | 20 40     |         |                |                |                |                    |
| April 5 |            | e <sub>E</sub>    | 10 22 10  |         |                |                |                | Very heavy micros. |
|         |            | e <sub>N</sub>    | 10 22 12  |         |                |                |                |                    |
|         |            | L <sub>E</sub>    | 11 05     | 25      |                |                |                |                    |
|         |            | L <sub>N</sub>    | 11 04 22  | 24      |                |                |                |                    |
|         |            | F                 | 12 (ca)   |         |                |                |                |                    |
| April 6 |            | e <sub>E</sub>    | 3 29 52   |         |                |                |                | Very heavy micros. |
|         |            | e <sub>N</sub>    | 3 30      |         |                |                |                |                    |
|         |            | F                 | in micros |         |                |                |                |                    |
| April 8 |            | eP <sub>E</sub>   | 20 51     |         |                |                |                |                    |
|         |            | eP <sub>N</sub>   | 20 51     |         |                |                |                |                    |
|         |            | eS <sub>E</sub>   | 20 58 00  |         |                |                |                |                    |
|         |            | eS <sub>N</sub>   | 20 58 04  |         |                |                |                |                    |
|         |            | eL <sub>E</sub>   | 21 4.4    |         |                |                |                |                    |
|         |            | eL <sub>N</sub> ? | 21 4.2    |         |                |                |                |                    |
|         |            | L <sub>E</sub>    | 21 08     | 16      |                |                |                |                    |
|         |            | L <sub>N</sub>    | 21 08 09  | 16      |                |                |                |                    |
|         |            | F                 | 22 (ca)   |         |                |                |                |                    |

# REGISTRATION OF EARTHQUAKES—Continued

| Date.    | Character. | Phase.            | Time.    | Period. | Amplitude.     |                |                | Remarks.              |
|----------|------------|-------------------|----------|---------|----------------|----------------|----------------|-----------------------|
|          |            |                   |          |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                       |
| April 11 |            | eL <sub>E</sub>   | 1 20 25  |         |                |                |                |                       |
|          |            | eL <sub>N</sub>   | 1 20 25  |         |                |                |                |                       |
|          |            | L <sub>E</sub>    | 1 22 10  | 21      |                |                |                |                       |
|          |            | L <sub>N</sub>    | 1 23 20  | 20      |                |                |                |                       |
|          |            | F                 | 1 40     |         |                |                |                |                       |
| April 13 |            | eP <sub>E</sub>   | 15 20 22 |         |                |                |                | Difficult.            |
|          |            | eP <sub>N</sub>   | 15 20 19 |         |                |                |                |                       |
|          |            | eS <sub>E</sub> ? | 15 24 37 |         |                |                |                |                       |
|          |            | eS <sub>N</sub> ? | 15 24 33 |         |                |                |                |                       |
|          |            | F                 | 15 50    |         |                |                |                |                       |
| April 25 |            | L <sub>E</sub>    | 22 22    | 22      |                |                |                |                       |
|          |            | L <sub>N</sub>    | 22 24    | 22      |                |                |                |                       |
|          |            | L <sub>E</sub>    | 22 45    | 21      |                |                |                |                       |
|          |            | F                 | 24 (ca)  |         |                |                |                |                       |
| April 26 |            | e <sub>E</sub>    | 4 14 24  |         |                |                |                |                       |
|          |            | e <sub>N</sub>    | 4 14 24  |         |                |                |                |                       |
|          |            | S <sub>E</sub> ?  | 4 22 06  |         |                |                |                |                       |
|          |            | eL <sub>E</sub> ? | 4 28.1   | 15      |                |                |                |                       |
|          |            | F                 | 5 20     |         |                |                |                |                       |
| May 4    |            | e <sub>E</sub>    | 9 25 30  |         |                |                |                | Micros.               |
|          |            | e <sub>N</sub>    | 9 25 25  |         |                |                |                |                       |
|          |            | S <sub>E</sub>    | 9 35 45  |         |                |                |                |                       |
|          |            | L <sub>E</sub>    | 10 02    |         |                |                |                |                       |
|          |            | L <sub>N</sub>    | 10 07    |         |                |                |                |                       |
|          |            | F                 | 11 13    |         |                |                |                |                       |
| May 10   |            | e <sub>E</sub>    | 23 13    |         |                |                |                | Very heavy<br>micros. |
|          |            | e <sub>N</sub>    | 23 13    |         |                |                |                |                       |
|          |            | eL <sub>N</sub>   | 23 20    |         |                |                |                |                       |
|          |            | F                 | 23 30    |         |                |                |                |                       |

REGISTRATION OF EARTHQUAKES—Continued

| Date.   | Character. | Phase.            | Time.     | Period. | Amplitude.     |                |                | Remarks.         |
|---------|------------|-------------------|-----------|---------|----------------|----------------|----------------|------------------|
|         |            |                   |           |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                  |
| May 11  |            | e <sub>E</sub>    | 1 08 22   |         |                |                |                | Micros.          |
|         |            | e <sub>N</sub>    | 1 09      |         |                |                |                |                  |
|         |            | F                 | 1 20      |         |                |                |                |                  |
| May 11  |            | eP <sub>E</sub>   | 6 52 00   |         |                |                |                | Heavy micros.    |
|         |            | iP <sub>N</sub>   | 6 52 00   |         |                |                |                |                  |
|         |            | S <sub>E</sub> ?  | 6 57 15   |         |                |                |                |                  |
|         |            | S <sub>N</sub> ?  | 6 57 10   |         |                |                |                |                  |
|         |            | eL <sub>E</sub>   | 7 4.3     | 20      |                |                |                |                  |
|         |            | eL <sub>N</sub>   | 7 4.3     |         |                |                |                |                  |
|         |            | F                 | 7 20 (ca) |         |                |                |                |                  |
| May 12  |            | S <sub>E</sub> ?  | 19 12 10  |         |                |                |                |                  |
|         |            | eL <sub>E</sub> ? | 19 40 33  | 24      |                |                |                |                  |
|         |            | L <sub>N</sub>    | 19 43 23  | 19      |                |                |                |                  |
|         |            | L <sub>E</sub>    | 19 45     | 19      |                |                |                |                  |
|         |            | F                 | 19 55     |         |                |                |                |                  |
| June 2  |            | S <sub>E</sub>    | 20 33     |         |                |                |                | Heavy micros.    |
|         |            | S <sub>N</sub>    | 20 33     |         |                |                |                | S quite certain. |
|         |            | L <sub>E</sub>    | 21 39     |         |                |                |                |                  |
|         |            | L <sub>N</sub>    | 21 20     |         |                |                |                |                  |
|         |            | F                 | 22 20     |         |                |                |                |                  |
| June 8  |            | e <sub>E</sub>    | 11 08 49  |         |                |                |                | Heavy micros.    |
|         |            | e <sub>N</sub>    | 11 08 49  |         |                |                |                |                  |
|         |            | F                 | 11 15     |         |                |                |                |                  |
| June 12 |            | eP <sub>E</sub>   | 4 53 54   |         |                |                |                | Heavy micros.    |
|         |            | eP <sub>N</sub>   | 4 54 00   |         |                |                |                |                  |
|         |            | S <sub>E</sub>    | 4 59 04   |         |                |                |                |                  |
|         |            | iS <sub>N</sub>   | 4 59 04   |         |                |                |                |                  |
|         |            | i <sub>E</sub>    | 5 01 43   |         |                |                |                |                  |
|         |            | eL <sub>E</sub>   | 5 4.4     | 6       |                |                |                |                  |
|         |            | eL <sub>N</sub>   | 5 4.1     | 6       |                |                |                |                  |
|         |            | M <sub>E</sub>    | 5 07      | 15      |                | 7.7mm          |                |                  |
|         |            | M <sub>N</sub>    | 5 04 48   | 8       | 17.2mm         |                |                |                  |
|         |            | F                 | 6 (ca)    |         |                |                |                |                  |

## REGISTRATION OF EARTHQUAKES—Continued



| Date.   | Character. | Phase.            | Time.             | Period. | Amplitude.     |                |                | Remarks.       |
|---------|------------|-------------------|-------------------|---------|----------------|----------------|----------------|----------------|
|         |            |                   |                   |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                |
| June 12 |            | e <sub>E</sub>    | 10 49 16          |         |                |                |                | Heavy micros.  |
|         |            | e <sub>N</sub>    | 10 49 17          |         |                |                |                | No distinct M. |
|         |            | eS <sub>E</sub> ? | 10 54 39          |         |                |                |                |                |
|         |            | eS <sub>N</sub> ? | 10 54 39          |         |                |                |                |                |
|         |            | eL <sub>E</sub>   | 11 1.0            | 13      |                |                |                |                |
|         |            | eL <sub>N</sub>   | 11 0.3            | 13      |                |                |                |                |
|         |            | F                 | 11 56             |         |                |                |                |                |
| June 16 |            | L <sub>E</sub>    | 12 59 to<br>13 02 |         |                |                |                | Heavy micros.  |
|         |            |                   |                   |         |                |                |                |                |
| June 16 |            | e <sub>N</sub>    | 21 12 37          |         |                |                |                | Heavy micros.  |
|         |            | S <sub>E</sub>    | 21 15 44          |         |                |                |                |                |
|         |            | S <sub>N</sub>    | 21 15 44          |         |                |                |                |                |
|         |            | F                 | 21 50             |         |                |                |                |                |
| June 27 |            | e <sub>N</sub>    | 15 00 32          |         |                |                |                | Heavy micros.  |
|         |            | L <sub>N</sub>    | 15 22             |         |                |                |                |                |
|         |            | F                 | 15 30             |         |                |                |                |                |
| July 2  |            | eP <sub>E</sub>   | 13 45 45          |         |                |                |                |                |
|         |            | eP <sub>N</sub>   | 13 45 34          |         |                |                |                |                |
|         |            | S <sub>E</sub> ?  | 13 52 23          |         |                |                |                |                |
|         |            | S <sub>N</sub> ?  | 13 52 21          |         |                |                |                |                |
|         |            | eL <sub>E</sub>   | 14 00             | 18      |                |                |                |                |
|         |            | eL <sub>N</sub>   | 14 6.4            | 16      |                |                |                |                |
|         |            | L <sub>E</sub>    | 14 08             |         |                |                |                |                |
|         |            | L <sub>N</sub>    | 14 10 58          |         |                |                |                |                |
|         |            | F                 | 15 15 (et postea) |         |                |                |                |                |
| July 2  |            | eP <sub>E</sub> ? | 21 27 24          |         |                |                |                | Heavy micros.  |
|         |            | eP <sub>N</sub> ? | 21 27 24          |         |                |                |                |                |
|         |            | S <sub>E</sub>    | 21 29 45          |         |                |                |                |                |
|         |            | S <sub>N</sub>    | 21 29 45          |         |                |                |                |                |
|         |            | F                 | 21 40             |         |                |                |                |                |

## REGISTRATION OF EARTHQUAKES—Continued



| Date.   | Character. | Phase.            | Time.    | Period. | Amplitude.     |                |                | Remarks.                                                       |
|---------|------------|-------------------|----------|---------|----------------|----------------|----------------|----------------------------------------------------------------|
|         |            |                   |          |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                                                                |
| Aug. 11 |            | eP <sub>E</sub>   | 8 31 27  |         |                |                |                | Rest lost in heavy micros.                                     |
|         |            | iS <sub>E</sub>   | 8 41 52  |         |                |                |                |                                                                |
|         |            | iS <sub>N</sub>   | 8 41 52  |         |                |                |                |                                                                |
| Aug. 11 |            | e <sub>E</sub>    | 13 56    |         |                |                |                | Very heavy micros.<br>No distinct M.                           |
|         |            | e <sub>N</sub>    | 13 56 29 |         |                |                |                |                                                                |
|         |            | L <sub>E</sub>    | 13 17 40 | 19      |                |                |                |                                                                |
|         |            | L <sub>N</sub>    | 13 21 34 | 21      |                |                |                |                                                                |
|         |            | F                 | 15 (ca)  |         |                |                |                |                                                                |
| Aug. 13 |            | P <sub>E</sub>    | 0 21 16  |         |                |                |                | Very heavy micros.<br>Sheets off 1 hr. 23m.<br>Quake still on. |
|         |            | P <sub>N</sub>    | 0 21 16  |         |                |                |                |                                                                |
|         |            | iS <sub>E</sub>   | 0 31 55  |         |                |                |                |                                                                |
|         |            | iS <sub>N</sub>   | 0 31 55  |         |                |                |                |                                                                |
|         |            | eL <sub>N</sub> ? | 0 45.3   |         |                |                |                |                                                                |
|         |            | L <sub>E</sub>    | 0 48     | 26      |                |                |                |                                                                |
| Aug. 16 |            | L <sub>N</sub>    | 0 48     | 26      |                |                |                | Very heavy micros.<br>No distinct M.                           |
|         |            | eP <sub>E</sub>   | 16 08 13 |         |                |                |                |                                                                |
|         |            | iP <sub>N</sub>   | 16 08 13 |         |                |                |                |                                                                |
|         |            | eS <sub>E</sub>   | 16 18 13 |         |                |                |                |                                                                |
|         |            | eS <sub>N</sub>   | 16 18 13 |         |                |                |                |                                                                |
|         |            | L <sub>E</sub>    | 16 35 28 | 21      |                |                |                |                                                                |
|         |            | L <sub>N</sub>    | 16 41 38 | 21      |                |                |                |                                                                |
| Aug. 18 |            | F                 | 17 10    |         |                |                |                | Very heavy micros.<br>N-S does not show.                       |
|         |            | e <sub>N</sub>    | 5 29 27  |         |                |                |                |                                                                |
| Aug. 29 |            | F                 | 5 41     |         |                |                |                | Rather heavy micros.                                           |
|         |            | e <sub>E</sub>    | 17 22 22 |         |                |                |                |                                                                |
|         |            | e <sub>N</sub>    | 17 22 22 |         |                |                |                |                                                                |
|         |            | S <sub>N</sub> ?  | 17 28 51 |         |                |                |                |                                                                |
| Aug. 30 |            | F                 | 18 (ca)  |         |                |                |                | Difficult.<br>Heavy micros.                                    |
|         |            | e <sub>N</sub>    | 22 58 49 |         |                |                |                |                                                                |
|         |            | F                 | 23 20    |         |                |                |                |                                                                |

# REGISTRATION OF EARTHQUAKES—Continued



| Date.    | Character. | Phase.            | Time.        | Period. | Amplitude.     |                |                | Remarks.                                                     |
|----------|------------|-------------------|--------------|---------|----------------|----------------|----------------|--------------------------------------------------------------|
|          |            |                   |              |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                                                              |
| Sept. 1  |            | eP <sub>N</sub>   | 19 34 41     |         |                |                |                | P <sub>E</sub> does not show.<br>No distinct M. on E-W comp. |
|          |            | eS <sub>E</sub>   | 19 45 35     |         |                |                |                |                                                              |
|          |            | S <sub>N</sub>    | 19 45 35     |         |                |                |                |                                                              |
|          |            | eL <sub>E</sub> ? | 19 57.3      | 27      |                |                |                |                                                              |
|          |            | eL <sub>N</sub> ? | 19 57.3      | 27      |                |                |                |                                                              |
|          |            | L <sub>E</sub>    | 20 12        | 33      |                |                |                |                                                              |
|          |            | L <sub>N</sub>    | 20 13        | 38      |                |                |                |                                                              |
|          |            | M <sub>N</sub>    | 20 28 18     |         | 1.7mm          |                |                |                                                              |
|          |            | F                 | 21 15        |         |                |                |                |                                                              |
| Sept. 1  |            | eP <sub>Z</sub>   | 19 34 52     |         |                |                |                | Heavy micros.                                                |
|          |            | S <sub>Z</sub>    | 19 44 38     |         |                |                |                |                                                              |
|          |            | L <sub>Z</sub>    | 20 22        | 22      |                |                |                |                                                              |
|          |            | M <sub>Z</sub>    | 20 28 45     | 20      |                |                |                |                                                              |
|          |            | F                 | 21 15        |         |                |                |                |                                                              |
| Sept. 3  |            | eP <sub>E</sub> ? | 3 51 19      |         |                |                |                |                                                              |
|          |            | S <sub>E</sub> ?  | 3 54 06      |         |                |                |                |                                                              |
|          |            | S <sub>N</sub> ?  | 3 54 06      |         |                |                |                |                                                              |
|          |            | eL <sub>N</sub> ? | 3 57.1       |         |                |                |                |                                                              |
|          |            | F                 | Not apparent |         |                |                |                |                                                              |
| Sept. 4  |            | e <sub>E</sub>    | 17 12        |         |                |                |                | Difficult.                                                   |
|          |            | e <sub>N</sub>    | 17 12 16     |         |                |                |                |                                                              |
|          |            | i <sub>N</sub>    | 17 14 14     |         |                |                |                |                                                              |
|          |            | i <sub>E</sub>    | 17 18 40     |         |                |                |                |                                                              |
|          |            | i <sub>N</sub>    | 17 18 40     |         |                |                |                |                                                              |
|          |            | F                 | 18 35        |         |                |                |                |                                                              |
| Sept. 14 |            | e <sub>N</sub>    | 19 48        |         |                |                |                | Heavy micros.                                                |
|          |            | S <sub>N</sub> ?  | 19 57 21     |         |                |                |                |                                                              |
|          |            | eL <sub>N</sub> ? | 20 15.4      |         |                |                |                |                                                              |
|          |            | L <sub>E</sub>    | 20 29 27     | 32      |                |                |                |                                                              |
|          |            | L <sub>N</sub>    | 20 30 27     | 32      |                |                |                |                                                              |
|          |            | F                 | 21 45        |         |                |                |                |                                                              |

# REGISTRATION OF EARTHQUAKES—Continued



| Date.    | Character. | Phase.            | Time.    | Period. | Amplitude.     |                |                | Remarks.                              |
|----------|------------|-------------------|----------|---------|----------------|----------------|----------------|---------------------------------------|
|          |            |                   |          |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                                       |
| Sept. 29 |            | e <sub>E</sub>    | 21 40 48 |         |                |                |                | Very heavy micros.                    |
|          |            | e <sub>N</sub>    | 21 40 48 |         |                |                |                |                                       |
|          |            | eL <sub>E</sub> ? | 21 57.0  |         |                |                |                |                                       |
|          |            | F                 | 22 10    |         |                |                |                |                                       |
| Sept. 30 |            | e <sub>E</sub>    | 23 46 11 |         |                |                |                | Heavy micros.                         |
|          |            | e <sub>N</sub>    | 23 46 08 |         |                |                |                |                                       |
|          |            | F                 | 23 58    |         |                |                |                |                                       |
| Oct. 6   |            | eP <sub>E</sub>   | 5 51     |         |                |                |                | P is very uncertain.<br>Heavy micros. |
|          |            | eP <sub>N</sub>   | 5 51     |         |                |                |                |                                       |
|          |            | iS <sub>E</sub>   | 5 54 55  |         |                |                |                |                                       |
|          |            | S <sub>N</sub>    | 5 54 55  |         |                |                |                |                                       |
|          |            | F                 | 6 15     |         |                |                |                |                                       |
| Oct. 11  |            | eP <sub>E</sub>   | 14 59 27 |         |                |                |                |                                       |
|          |            | iP <sub>N</sub>   | 14 59 27 |         |                |                |                |                                       |
|          |            | iS <sub>E</sub>   | 15 07 11 |         |                |                |                |                                       |
|          |            | eS <sub>N</sub>   | 15 07 11 |         |                |                |                |                                       |
|          |            | eL <sub>E</sub>   | 15 13.6  |         |                |                |                |                                       |
|          |            | eL <sub>N</sub>   | 15 13.0  |         |                |                |                |                                       |
|          |            | L <sub>E</sub>    | 15 18 08 | 27      |                |                |                |                                       |
| Oct. 15  |            | L <sub>N</sub>    | 15 18 33 | 16      |                |                |                | Heavy micros.                         |
|          |            | e <sub>N</sub>    | 0 33     |         |                |                |                |                                       |
|          |            | eL <sub>E</sub> ? | 0 48.3   |         |                |                |                |                                       |
|          |            | L <sub>E</sub>    | 0 49     | 27      |                |                |                |                                       |
|          |            | L <sub>N</sub>    | 0 53 22  | 16      |                |                |                |                                       |
| Oct. 16  |            | F                 | 1 15     |         |                |                |                | Very heavy micros.                    |
|          |            | e <sub>N</sub> ?  | 16 43    |         |                |                |                |                                       |
|          |            | e <sub>E</sub>    | 16 48    |         |                |                |                |                                       |
|          |            | eL <sub>N</sub> ? | 16 51.7  |         |                |                |                |                                       |
|          |            | F?                |          |         |                |                |                |                                       |

# REGISTRATION OF EARTHQUAKES—Continued

| Date.   | Character. | Phase.          | Time.      | Period. | Amplitude.     |                |                | Remarks.                                     |
|---------|------------|-----------------|------------|---------|----------------|----------------|----------------|----------------------------------------------|
|         |            |                 |            |         | A <sub>N</sub> | A <sub>E</sub> | A <sub>Z</sub> |                                              |
| Oct. 24 |            | eP <sub>E</sub> | 21 33 38   |         |                |                |                | Heavy micros.                                |
|         |            | eP <sub>N</sub> | 21 33 36   |         |                |                |                |                                              |
|         |            | iS <sub>E</sub> | 21 43 44   |         |                |                |                |                                              |
|         |            | S <sub>N</sub>  | 21 43 44   |         |                |                |                |                                              |
|         |            | eL <sub>E</sub> | 21 58.8    | 15      |                |                |                |                                              |
|         |            | L <sub>E</sub>  | 22 01      | 14      |                |                |                |                                              |
|         |            | L <sub>N</sub>  | 22 09 25   | 16      |                |                |                |                                              |
|         |            | F               | 22 40      |         |                |                |                |                                              |
| Oct. 30 |            | c <sub>N</sub>  | 2 10       |         |                |                |                | E W comp. does<br>not show.<br>Heavy micros. |
|         |            | F               | 2 20       |         |                |                |                |                                              |
| Nov. 4  |            | e <sub>N</sub>  | 3 29 26    |         |                |                |                | E-W does not<br>show.<br>Heavy micros.       |
|         |            | eL <sub>N</sub> | 3 39 48    |         |                |                |                |                                              |
|         |            | L <sub>N</sub>  | 3 42 29    |         |                |                |                |                                              |
|         |            | F               | 4 (ca)     |         |                |                |                |                                              |
| Nov. 7  |            | eP <sub>E</sub> | 23 11 07   |         |                |                |                | Heavy micros.<br>No distinct M.              |
|         |            | iP <sub>N</sub> | 23 11 07   |         |                |                |                |                                              |
|         |            | eS <sub>E</sub> | 23 19 57   |         |                |                |                |                                              |
|         |            | iS <sub>N</sub> | 23 19 58   |         |                |                |                |                                              |
|         |            | eL <sub>E</sub> | 23 31      |         |                |                |                |                                              |
|         |            | L <sub>E</sub>  | 23 41      | 21      |                |                |                |                                              |
|         |            | L <sub>N</sub>  | 23 40      | 27      |                |                |                |                                              |
|         |            | F               | 00 10 (ca) |         |                |                |                |                                              |

REGISTRATION OF EARTHQUAKES—Continued



Seismology Centre

| Date.                                                                     | Character.        | Phase.          | Time. |    |    | Period. | Amplitude.     |                 |                                                                         | Remarks. |
|---------------------------------------------------------------------------|-------------------|-----------------|-------|----|----|---------|----------------|-----------------|-------------------------------------------------------------------------|----------|
|                                                                           |                   |                 |       |    |    |         | A <sub>N</sub> | A <sub>E</sub>  | A <sub>Z</sub>                                                          |          |
| Nov. 11                                                                   |                   | eP <sub>E</sub> | 4     | 43 | 41 | 31      | 2.7mm<br>4.0mm | 4.8mm<br>10.1mm | E-W comp. ob-<br>scure. Rest<br>lost in cauda<br>of preceding<br>quake. |          |
|                                                                           | iP <sub>N</sub>   | 4               | 43    | 37 | 30 |         |                |                 |                                                                         |          |
|                                                                           | iS <sub>E</sub>   | 4               | 52    | 32 |    |         |                |                 |                                                                         |          |
|                                                                           | eS <sub>N</sub>   | 4               | 52    | 32 |    |         |                |                 |                                                                         |          |
|                                                                           | eL <sub>E</sub>   | 5               | 0.7   |    |    |         |                |                 |                                                                         |          |
|                                                                           | eL <sub>N</sub>   | 5               | 1.5   |    |    |         |                |                 |                                                                         |          |
|                                                                           | M <sub>E1</sub>   | 5               | 04    | 27 |    |         |                |                 |                                                                         |          |
|                                                                           | M <sub>N1</sub>   | 5               | 10    |    |    |         |                |                 |                                                                         |          |
|                                                                           | M <sub>E2</sub>   | 5               | 10    | 24 |    |         |                |                 |                                                                         |          |
|                                                                           | M <sub>N2</sub>   | 5               | 12    | 11 |    |         |                |                 |                                                                         |          |
|                                                                           | F                 | 8               | 50    |    |    |         |                |                 |                                                                         |          |
|                                                                           | e <sub>E</sub> ?  | 7               | 37    | 44 |    |         |                |                 |                                                                         |          |
|                                                                           | e <sub>N</sub>    | 7               | 37    | 44 |    |         |                |                 |                                                                         |          |
|                                                                           | S <sub>N</sub> ?  | 7               | 46    | 40 |    |         |                |                 |                                                                         |          |
| Nov. 11                                                                   |                   | eP <sub>E</sub> | 18    | 20 | 21 |         |                |                 | Heavy micros.<br>No distinct M.                                         |          |
|                                                                           | iP <sub>N</sub>   | 18              | 20    | 23 |    |         |                |                 |                                                                         |          |
|                                                                           | iS <sub>E</sub>   | 18              | 29    | 16 |    |         |                |                 |                                                                         |          |
|                                                                           | eS <sub>N</sub>   | 18              | 29    | 15 |    |         |                |                 |                                                                         |          |
|                                                                           | eL <sub>E</sub>   | 18              | 50.3  |    |    |         |                |                 |                                                                         |          |
|                                                                           | eL <sub>N</sub>   | 18              | 50.4  |    |    |         |                |                 |                                                                         |          |
|                                                                           | F                 | 19              | 10    |    |    |         |                |                 |                                                                         |          |
| Nov. 17                                                                   |                   | eP <sub>E</sub> | 11    | 13 | 02 | 21      |                |                 | Heavy micros.<br>No distinct M.                                         |          |
|                                                                           | eP <sub>N</sub>   | 11              | 13    | 02 |    |         |                |                 |                                                                         |          |
|                                                                           | S <sub>E</sub>    | 11              | 22    | 00 |    |         |                |                 |                                                                         |          |
|                                                                           | S <sub>N</sub>    | 11              | 22    | 02 |    |         |                |                 |                                                                         |          |
|                                                                           | eL <sub>N</sub> ? | 11              | 40.6  |    |    |         |                |                 |                                                                         |          |
|                                                                           | L <sub>N</sub>    | 11              | 42    | 30 |    |         |                |                 |                                                                         |          |
|                                                                           | F                 | 12              | 15    |    |    |         |                |                 |                                                                         |          |
| Because of repairs in the cave, no records are<br>available for December. |                   |                 |       |    |    |         |                |                 |                                                                         |          |

# DISPATCHES OF EARTHQUAKES AT THIS STATION

From January 1, 1922, to January 1, 1923.

| PLACE.                        | DATE.    | TIME.                              | CHARACTER.              | SOURCE OF INFORMATION. | REMARKS.              |
|-------------------------------|----------|------------------------------------|-------------------------|------------------------|-----------------------|
| Aluna, California.            | Jan. 1.  | 1h. 10m.*                          | Moderate.               | L.O.                   |                       |
| Amberlin, S. Dakota.          | Jan. 2.  | 14h. 50m.*                         | Moderate.               | L.O.                   |                       |
| ama, Canal Zone.              | Jan. 2.  | 1 A. M. (about)†                   | Strong.                 | A.P.                   | One minute duration.  |
| t DuFrance, Martinique.       | Jan. 7.  | 1h. 40m. P. M.†                    | Considerable intensity. | A.P.                   | No damage.            |
| ant Vernon, Indiana.          | Jan. 11. | 3h. 42m.*                          | Moderate.               | L.O.                   |                       |
| Angeles, California.          | Jan. 17. | 7h. 30m.-8h. P. M.†                | Strong.                 | A.P.                   |                       |
| boa Heights, Canal Zone.      | Jan. 22. | Evening.                           | Pronounced.             | L.O.                   | No damage.            |
| nett, Idaho.                  | Jan. 24. | 17h.*                              | Very feeble.            | L.O.                   | ?                     |
| exico, California.            | Jan. 26. | 1h. 10m.*                          | Moderate.               | L.O.                   |                       |
| exico, California.            | Jan. 27. | 5h. 25m.*                          | Very feeble.            | L.O.                   |                       |
| exico, California.            | Jan. 27. | 7h. 50m.*                          | Feeble.                 | L.O.                   |                       |
| exico, California.            | Jan. 27. | 8h. 3m.*                           | Extremely feeble.       | L.O.                   |                       |
| exico, California.            | Jan. 27. | 18h. 11m.*                         | Very feeble.            | L.O.                   | Abrupt.               |
| tiago de Cuba, Cuba.          | Jan. 27. | 3 P. M.†                           | Slight.                 | A.P.                   | No damage.            |
| se Terre, Guadalupe, F. W. I. | Jan. 28. | Various times in past three weeks. | Considerable intensity. | A.P.                   |                       |
| wley, California.             | Jan. 30. | 7h. 55m.*                          | ?                       | L.O.                   |                       |
| gene, Oregon.                 | Jan. 31. | 5h. 30m. A. M.†                    | Pronounced.             | A.P.                   |                       |
| ater Lake, Oregon.            | Jan. 31. | 13h. 20m.*                         | Feeble.                 | L.O.                   |                       |
| land, Oregon.                 | Jan. 31. | 13h. 20m.*                         | Very feeble.            | L.O.                   |                       |
| asket, Washington.            | Jan. 31. | 14h. 30m.*                         | Very feeble (?)         | L.O.                   |                       |
| ublic, Washington.            | Jan. 31. | 19h. (ca)*                         | Extremely feeble.       | L.O.                   |                       |
| yada City, California.        | Feb. 1.  | 13h. 18m.*                         | Extremely feeble.       | L.O.                   |                       |
| eckels, California.           | Feb. 4.  | 20h. 20m.*                         | Extremely feeble.       | L.O.                   |                       |
| eka, California.              | Feb. 5.  | 1h. 28m.*                          | Very feeble.            | L.O.                   |                       |
| ondido, California.           | Feb. 6.  | 2h. 35m.*                          | Feeble.                 | L.O.                   |                       |
| ian, California.              | Feb. 9.  | 7h. 7m.*                           | Feeble.                 | L.O.                   |                       |
| a Juan Del Sur, Nicaragua.    | Feb. 15. | 10h. 14m. A. M.†                   | Pronounced.             | A.P.                   | Damage.               |
| yan, Idaho.                   | Feb. 19. | 21h. (ca)*                         | Feeble (?)              | L.O.                   |                       |
| erside, California.           | Feb. 20. | 3h. 15m. P. M.†                    | Slight.                 | A.P.                   |                       |
| exico, California.            | Feb. 21. | { 19h. 10m.*<br>19h. 13m.*         | Extremely feeble.       | L.O.                   |                       |
| anagua, California.           | Feb. 22. | Not indicated.                     | Very strong.            | A.P.                   | Continued shocks.     |
| wley, California.             | Feb. 26. | 2h.*                               | Feeble.                 | L.O.                   |                       |
| ou, P. I.                     | Feb. 28. | Not indicated.                     | Very strong.            | A.P.                   | Persons killed.       |
| Gatos, California.            | Feb. 28. | 19h. 51m.*                         | Feeble.                 | L.O.                   |                       |
| enos Aires, Argentina.        | Mar. 1.  | 4h. 25m. A. M.†                    | Strong.                 | A.P.                   | No serious damage.    |
| a Juan Del Sur, Nicaragua.    | Mar. 4.  | 1h. 50m. A. M.<br>(New York).      | Strong.                 | A.P.                   | Lasting four minutes. |
| Angeles, California.          | Mar. 10. | 3h. 27m. A. M.                     | Light.                  | A.P.                   | No damage.            |
| Angeles, California.          | Mar. 10. | 11h. 23m.*                         | Moderate.               | A.P.                   |                       |
| a Salvador, Nicaragua.        | Mar. 11. | Not indicated (continued shocks).  |                         | A.P.                   | Damage.               |
| telope Valley, California.    | Mar. 16. | 23h. 10m.*                         | Feeble.                 | L.O.                   |                       |
| o Robles, California.         | Mar. 19. | 23h.*                              | Very feeble.            | L.O.                   |                       |
| ckman, Kentucky.              | Mar. 22. | 4h. 31m. P. M.†                    | Moderate.               | A.P.                   |                       |
| lucah, Kentucky.              | Mar. 22. | 6h. 24m. P. M.†                    | Moderate.               | A.P.                   |                       |
| ansville, Indiana.            | Mar. 22. | 8h. 30m. P. M.†                    | Moderate.               | A.P.                   |                       |
| rtheville, Arkansas.          | Mar. 23. | 2h. 20m.*                          | Feeble.                 | L.O.                   | Three shocks.         |

\* G. M. T.

† Local Time.

L.O.—Local Observer.

A.P.—Associated Press.

# DISPATCHES OF EARTHQUAKES RECEIVED AT THIS STATION—Continued.



| PLACE.                      | DATE.     | TIME.                                   | CHARACTER.                             | SOURCE OF INFORMATION. | REMARKS.           |
|-----------------------------|-----------|-----------------------------------------|----------------------------------------|------------------------|--------------------|
| Paso Robles, California.    | Mar. 23.  | 10h.*                                   | Very feeble.                           | L.O.                   |                    |
| Blandville, Arkansas.       | Mar. 23.  | 22h. 35m.*                              | Very feeble.                           | L.O.                   |                    |
| Paso Robles, California.    | Mar. 25.  | 12h.*                                   | Very feeble.                           | L.O.                   |                    |
| Memphis, Tennessee.         | Mar. 30.  | 10h. A. M.†                             | Distinctly felt.                       | A.P.                   |                    |
| Cairo, Illinois.            | Mar. 30.  | 16h. 52m.*                              | Extremely feeble.                      | L.O.                   |                    |
| Belgrade, Serbia.           | April 2.  | Continuous shocks.                      | Severe.                                | A.P.                   | Damage. Heavy loss |
| Belgrade, Serbia.           | April 5.  | Intermittant.                           | Less Severe.                           | A.P.                   | Northern section.  |
| Summerville, S. Carolina.   | April 9.  | 16h. 58m.*                              | Microseismic.                          | L.O.                   |                    |
| Melbourne, Australia.       | April 10. | 8h. 47m. P. M.†                         | Violent.                               | A.P.                   |                    |
| Monmouth, Illinois.         | April 11. | 5h.*                                    | Extremely feeble.                      | L.O.                   |                    |
| Yorba Linda, California.    | April 13. | 4h. 12m.*                               | Very feeble.                           | L.O.                   |                    |
| Riverside, California.      | April 16. | 5h. 30m.*                               | ?                                      | L.O.                   |                    |
| Guatemala.                  | April 20. | Not indicated                           | Strong.                                | A.P.                   | Damage. Loss of    |
| Tokio, Japan.               | April 26. | 10h. 15m. A. M.†                        | Heavy.                                 | A.P.                   | life.              |
| Calexico, California.       | April 26. | 0h. 12m.*                               | Very feeble.                           | L.O.                   |                    |
| Corato, Italy.              | May 5.    | Not indicated.                          | Severe.                                | A.P.                   | Great damage.      |
| Pittsfield, New Hampshire.  | May 7.    | 22h. 40m.*                              | Feeble. ?                              | L.O.                   |                    |
| Fort Du France, Martinique. | May 11.   | 2h. 45m.†                               | Strong.                                | A.P.                   | No damage.         |
| Oakland, California.        | May 14.   | 10h. 12m.*                              | Very feeble. ?                         | L.O.                   |                    |
| Portland, Oregon.           | May 15.   | 9h. 30m.†                               | Slight.                                | A.P.                   |                    |
| Quincy, California.         | May 15.   | 20h. 30m.*                              | Feeble.                                | L.O.                   |                    |
| San Salvador, San Salvador. | May 20.   | Continuous shocks.                      | Slight.                                | A.P.                   |                    |
| Santiago, Cuba.             | May 21.   | 10h. 50m. A. M.†                        | Severe.                                | A.P.                   |                    |
| Terni, Italy.               | May 27.   | Not indicated.                          | Violent.                               | A.P.                   |                    |
| Paso Robles, California.    | May 30.   | 22h. 25m.*                              | ?                                      | L.O.                   |                    |
| Spokane, Washington.        | June 1.   | 23h. 27m.*                              | Feeble.                                | L.O.                   |                    |
| Spokane, Washington.        | June 2.   | Late today.                             | Feeble.                                | A.P.                   | Heavy rumblings.   |
| Hollister, California.      | June 10.  | 14h. 55m.*                              | Feeble.                                | L.O.                   |                    |
| Salinas, California.        | June 10.  | 20h. 3m.*                               | Very feeble.                           | L.O.                   |                    |
| Yuma, Arizona.              | June 15.  | { 13h. 40m.*<br>15h. 20m.*<br>21h. 1m.* | { Feeble.<br>Very feeble.<br>Moderate. | L.O.                   |                    |
| Calexico, California.       | June 16.  | 19h. 43m.*                              |                                        | L.O.                   |                    |
| Amos, California.           | June 16.  | 20h.*                                   | Moderate.                              | L.O.                   |                    |
| Natural Bridge, Arizona.    | June 17.  | 23h. 30m.*                              | Feeble. ?                              | L.O.                   |                    |
| Moncton, New Brunswick.     | July 2.   | 5h. 25m. P. M.†                         | Not indicated.                         | A.P.                   | Three seconds.     |
| Wytotitlock, Maine.         | July 2.   | 21h. 26m.*                              | Very feeble. (?)                       | L.O.                   |                    |
| Portland, Oregon.           | July 5.   | 18h. 6m.*                               | Very feeble.                           | L.O.                   |                    |
| Los Alamos, California.     | July 5.   | 19h.*                                   | Very feeble.                           | L.O.                   |                    |
| Fond Du Lac, Wisconsin.     | July 7.   | ?                                       | ?                                      | L.O.                   |                    |
| Los Alamos, California.     | July 9.   | 12h.*                                   | Very feeble.                           | L.O.                   |                    |
| Los Alamos, California.     | July 11.  | 5h.*                                    | Very feeble.                           | L.O.                   |                    |
| Christiana, Norway.         | July 13.  | Not indicated.                          | Heavy.                                 | A.P.                   | Tremor 52 seconds. |
| Granada, Spain.             | July 27.  | Late at night.                          | Brief.                                 | A.P.                   |                    |
| Guatemala City, Guatemala.  | July 27.  | Night.                                  | Considerable.                          | A.P.                   |                    |
| Eureka, California.         | Aug. 6.   | { 3h. 30m.*<br>5h. 40m.*                | { Very feeble.<br>Feeble.              | L.O.                   |                    |
| Edmunston, New Brunswick.   | Aug. 8.   | Morning.                                | Severe.                                | A.P.                   | Damage.            |
| Summerville, S. Carolina.   | Aug. 8.   | 9h. 25m.*                               | Extremely feeble.                      | L.O.                   |                    |
| Fresno, California.         | Aug. 17.  | 9h. 10m. P. M.†                         | Slight.                                | A.P.                   |                    |

\* G. M. T.

† Local Time.

L.O.—Local Observer.

A.P.—Associated Press.

## DISPATCHES OF EARTHQUAKES RECEIVED AT THIS STATION—Continued



| PLACE.                        | DATE.     | TIME.                                               | CHARACTER.                                    | SOURCE OF INFORMATION. | REMARKS.                                   |
|-------------------------------|-----------|-----------------------------------------------------|-----------------------------------------------|------------------------|--------------------------------------------|
| aso Robles, California.       | Aug. 18.  | 5h. 12m.*                                           | Feeble.                                       | L.O.                   |                                            |
| ureka, California.            | Aug. 18.  | 6h. 13m.*                                           | Very feeble.                                  | L.O.                   |                                            |
| tascadero, California.        | Aug. 20.  | 21h. 14m.*                                          | Very feeble.                                  | L.O.                   |                                            |
| aiboko, Japan.                | Sept. 2.  | Early morning.                                      | Severe.                                       | A.P.                   | Heavy damage.                              |
| aso Robles, California.       | Sept. 4.  | 10h. 15m.*                                          | Feeble.                                       | L.O.                   |                                            |
| an Luis Obispo, California.   | Sept. 5.  | 9h. 5m.*                                            | Moderate.                                     | L.O.                   |                                            |
| orth Perry, Maine.            | Sept. 9.  | 6h.*                                                | Extremely feeble.                             | L.O.                   |                                            |
| omelos, Spain.                | Sept. 15. | Evening.                                            | Sharp.                                        | A.P.                   | Persons injured.                           |
| ureka, California.            | Sept. 18. | 11h. 55m.*                                          | Extremely feeble.                             | L.O.                   |                                            |
| ncorage, Alaska.              | Sept. 21. | Between 1h. and 5h.<br>A. M.†                       | Severe.                                       | A.P.                   | Seven shocks.                              |
| ncona, Italy.                 | Oct. 11.  | Not indicated.                                      | Strong.                                       | A.P.                   |                                            |
| ima, Peru.                    | Oct. 11.  | Not indicated.                                      | Violent.                                      | A.P.                   | Considerable damage.                       |
| ermiston, Oregon.             | Oct. 16.  | 4h. 20m.*                                           | Very feeble.                                  | L.O.                   |                                            |
| ollister, California.         | Oct. 18.  | 5h. 30m.*                                           | Slight.                                       | L.O.                   |                                            |
| uffalo, Wyoming.              | Oct. 25.  | 2h. 30m.*                                           | Feeble.                                       |                        |                                            |
| asper, Wyoming.               | Oct. 26.  | 1h. 20m.*                                           | Very feeble.                                  | L.O.                   |                                            |
| ureka, California.            | Nov. 4.   | 3h. 18m.*                                           | Extremely feeble.                             | L.O.                   |                                            |
| ureka, California.            | Nov. 7.   | 15h.*                                               | Extremely feeble.                             | L.O.                   |                                            |
| ellowstone Park, Wyoming.     | Nov. 10.  | 16h. 45m.*                                          | Extremely feeble.                             | L.O.                   |                                            |
| antiago, Chile.               | Nov. 11.  | { Before midnight.<br>3h. A. M.†<br>4h. 45m. P. M.† | { Severe.<br>Not indicated.<br>Not indicated. | A.P.                   | 1,200 to 1,300 killed.                     |
| uenos Aires.                  | Nov. 11.  | 12h. 35m. A. M.                                     | Slight.                                       | A.P.                   |                                            |
| onstitution, Chile.           | Nov. 13.  | 10h. 30m.†                                          | Severe.                                       | A.P.                   |                                            |
| a Serena, Chile.              | Nov. 13.  | 11h. P. M.†                                         | Severe.                                       |                        |                                            |
| iverside, California.         | Nov. 15.  | 8h. 25m. P. M.†                                     | Slight.                                       | A.P.                   | Four tremors.                              |
| ndes Region, S. America.      | Nov. 15.  | Not indicated.                                      | Distinct.                                     | A.P.                   |                                            |
| opiapo, Chile.                | Nov. 17.  | 8h. P. M.†                                          | Violent.                                      | A.P.                   | Two other shocks felt. Time not indicated. |
| romentin, Algiers.            | Nov. 20.  | Not indicated.                                      | *Severe.                                      | A.P.                   | Damage.                                    |
| ilo, H. J.                    | Nov. 21.  | Not indicated.                                      | Slight.                                       | A.P.                   |                                            |
| alparaiso, Chile.             | Nov. 23.  | 11h. 23m. P. M.†                                    | Slight.                                       | A.P.                   |                                            |
| ouisville, Kentucky.          | Nov. 26.  | 9h. 35m. P. M.†                                     | Slight.                                       | A.P.                   | Felt in four States.                       |
| Whittier, California.         | Nov. 28.  | 3h.*                                                | ?                                             | L.O.                   |                                            |
| entral Chile.                 | Nov. 29.  | 3h. 10m. A. M.†                                     | Strong.                                       | A.P.                   | Felt at Valparaiso and Concepcion.         |
| axaca, Maine.                 | Dec. 4.   | Morning.                                            | ?                                             | A.P.                   | Twelve seconds                             |
| an Francisco, California.     | Dec. 6.   | Night.                                              | Slight.                                       | A.P.                   | duration.                                  |
| ushiu, Japan.                 | Dec. 8.   | ?                                                   | Severe.                                       | A.P.                   | Loss of life.                              |
| anton, New York.              | Dec. 8.   | 4h. 24m. P. M.†                                     | Moderate.                                     | L.O.                   |                                            |
| lapel, Chile.                 | Dec. 11.  | Early today.                                        | Strong.                                       | A.P.                   | Also at Ovalle.                            |
| endelton, Oregon.             | Dec. 12.  | ?                                                   | Distinct.                                     | A.P.                   |                                            |
| orba Linda, California.       | Dec. 13.  | 9h. 15m. P. M.†                                     | Extremely feeble.                             | L.O.                   |                                            |
| utte, Montana.                | Dec. 18.  | 9h. 45m. P. M.†                                     | Very feeble.                                  | L.O.                   |                                            |
| an Jose, Costa Rica.          | Dec. 21.  | Continuous.                                         | ?                                             | A.P.                   |                                            |
| orth Canterbury, New Zealand. | Dec. 25.  | Afternoon.                                          | Severe.                                       | A.P.                   |                                            |
| vezzone, Italy.               | Dec. 29.  | 1h. 35m. P. M.†                                     | Moderate.                                     | A.P.                   |                                            |
| aso Robles, California.       | Dec. 29.  | 3h. A. M. (about)                                   | Extremely feeble.                             | L.O.                   |                                            |
| aso Robles, California.       | Dec. 29.  | 4h. A. M. (about)                                   | Extremely feeble.                             | L.O.                   |                                            |

\* G. M. T.

† Local Time.

L.O.—Local Observer.

A.P.—Associated Press.