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**DEPARTMENT OF COMMERCE**  
**U. S. COAST AND GEODETIC SURVEY**  
**E. LESTER JONES, DIRECTOR**

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**RESULTS OF OBSERVATIONS MADE AT THE UNITED STATES COAST AND GEODETIC SURVEY MAGNETIC OBSERVATORY NEAR HONOLULU, HAWAII IN 1921 AND 1922**

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BY

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# RESULTS OF OBSERVATIONS MADE AT THE UNITED STATES COAST AND GEODETIC SURVEY MAGNETIC OBSERVATORY NEAR HONOLULU, HAWAII, IN 1921 AND 1922

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## INTRODUCTION

[Latitude, 21° 19'.2 N.; longitude, 158° 03'.8 W.; elevation 50 feet (15 meters)]

The Honolulu magnetic observatory is situated on a large coral plain, 12½ miles (21 km.) west of the city of Honolulu, Oahu Island, Hawaii. Its operation began in January, 1902. For a description of the buildings and instruments see the first volume of observatory results. The methods of observing are explained in Directions for Magnetic Measurements, by D. L. Hazard, published in 1911, second edition in 1921.

The division of terrestrial magnetism of the Coast and Geodetic Survey, of which N. H. Heck, hydrographic and geodetic engineer, is chief, includes both office and field work. The work of the Honolulu observatory was carried on during the two years by H. E. McComb, magnetic observer. The office computations and preparation of results for publication were in charge of the writer, assisted by Frank Neumann, O. S. Hill, J. B. Goldsmith, and I. I. Kaplan, computers.

Up to the end of 1914 each hourly value of declination, horizontal intensity or vertical intensity in the monthly tabulations represented the momentary value of the quantity for the specified hour, local mean time. Beginning with 1915 the published hourly values are average values for successive periods of an hour, beginning at midnight of the specified standard meridian time (one hundred and sixty-fifth meridian in the case of Honolulu). Thus a value in a column headed 1 represents the average value for the hour beginning at midnight and ending at 1 a. m., one hundred and sixty-fifth meridian mean time.

EARTHQUAKES

In April, 1903, a Milne seismograph belonging to the seismological committee of the British Association was transferred from Oahu College to the magnetic observatory. In February, 1921, this instrument was replaced by a Milne-Shaw seismograph. It consists of two horizontal pendulums, one recording east-west motion (E) and the other recording north-south motion (N). Because of the large magnification (150), microseisms are continuously present on the seismograms, with amplitudes ranging from 0.5 mm. to 2.0 mm. and predominant periods of 4 and 8 seconds, the larger amplitudes usually accompanying the longer period. Preliminary phases of small amplitude are difficult to separate from the microseisms. The amplitudes have been computed on the basis of the constants given below. Where the periods of the waves could not be determined, the trace amplitude has been divided by 100. These values are indicated by asterisks.

Period of pendulums, 12 sec.  
Multiplication, 150.

Damping ratio, about 20:1.  
Sensitivity, 25 to 30 mm.

Register of earthquakes

| No. | Date    | Component | P               |                 | S               |                 | L               |              | M            | C            | F            | A        |
|-----|---------|-----------|-----------------|-----------------|-----------------|-----------------|-----------------|--------------|--------------|--------------|--------------|----------|
|     |         |           | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m.</i> | <i>h. m.</i> | <i>h. m.</i> | <i>h. m.</i> | <i>μ</i> |
| 1   | Jan. 9  | E         | 13 20 42        |                 |                 |                 | 13 36 36        | 13 43 42     |              | 13 47        | 15 50        |          |
| 2   | Jan. 14 | E         |                 |                 |                 |                 | 19 22 00        | 19 27 00     |              |              | 19 30        |          |
| 3   | Jan. 20 | E         | 1 37 48         | 1 41 18         |                 |                 | 1 46 30         | 1 53 30      |              | 1 56         | 2 11         |          |
| 4   | Jan. 20 | E         | 21 24 36        |                 |                 |                 | 21 37 42        | 21 43 42     |              | 21 48        | 22 18        |          |
| 5   | Feb. 27 | E         | 18 31 37        |                 |                 |                 | 18 41 58        | 18 42 10     |              | 19 10        | 20 14        | 162      |
| 6   | Mar. 6  | E         | 18 31 31        |                 |                 |                 | 18 42 40        | 18 47 13     |              | 19 23        | 20 08        | 232      |
|     |         | N         |                 | 18 37 25        |                 |                 | 7 44 53         | 7 48 50      |              | 7 50         | 8 07         | 68       |
| 7   | Mar. 10 | E         |                 |                 |                 |                 | 7 43 32         | 7 47 52      |              | 7 53         | 8 14         | 54       |
|     |         | N         |                 |                 |                 |                 | 20 31 55        | 20 34 00     |              |              |              | *20      |
| 8   | Mar. 24 | E         |                 |                 |                 |                 | 20 27 50        | 20 33 40     |              | 20 41        |              | *18      |
|     |         | N         | 14 56 52        | 15 00 36        |                 |                 | 15 03 00        | 15 06 37     |              | 15 08        | 15 13        | 105      |
| 9   | Mar. 28 | E         | 14 56 52        |                 |                 |                 | 15 02 51        | 15 06 28     |              | 16 10        | 15 20        | 88       |
|     |         | N         | 8 00 21         | 8 09 16         |                 |                 | 8 20 53         | 8 21 17      |              | 8 28         | 8 38         | 142      |
| 10  | Mar. 29 | E         | 8 00 33         | 8 09 22         |                 |                 |                 | 8 09 38      |              | 8 27         | 8 51         | *170     |
|     |         | N         |                 | 22 27 12        |                 |                 | 22 35 47        | 22 38 12     |              |              |              | 22 43    |
| 11  | Mar. 30 | E         |                 | 22 27 12        |                 |                 | 22 33 22        |              |              |              |              | 22 43    |
|     |         | N         | 15 13 59        | 15 23 37        |                 |                 | 15 37 56        | 15 40 29     |              |              |              | 16 02    |
| 12  | Apr. 1  | E         |                 | 15 24 19        |                 |                 |                 |              |              |              |              | 15 39    |
|     |         | N         | 12 16 23        |                 |                 |                 | 12 20 15        | 12 25 24     |              |              |              | 12 36    |
| 13  | Apr. 2  | E         | 12 16 15        |                 |                 |                 | 12 20 18        | 12 24 40     |              | 12 28        | 12 36        | 42       |
| 14  | Apr. 3  | E         | 10 06 28        |                 |                 |                 | 10 09 32        | 10 23 26     |              |              | 10 31        | 32       |
|     |         | N         |                 |                 |                 |                 | 2 54 47         | 2 59 04      |              | 3 01         | 3 07         | 24       |
| 15  | Apr. 10 | E         |                 |                 |                 |                 | 2 54 55         | 2 58 28      |              | 2 59         | 3 08         | 29       |
|     |         | N         |                 | 13 53 29        |                 |                 | 13 56 44        | 13 59 05     |              | 14 07        | 14 50        | 90       |
| 16  | Apr. 12 | E         |                 | 13 53 32        |                 |                 | 13 57 14        | 14 00 47     |              | 14 05        | 14 55        | 74       |
|     |         | N         |                 |                 |                 |                 | 7 45 36         | 7 52 07      |              | 7 55         | 8 01         | 28       |
| 17  | Apr. 22 | E         |                 |                 |                 |                 | 7 46 00         | 7 51 36      |              |              | 7 59         | 14       |
|     |         | N         |                 |                 |                 |                 | 6 46 42         | 6 49 34      |              |              | 6 57         | 25       |
| 18  | Apr. 25 | E         |                 |                 |                 |                 | 6 51 35         |              |              |              | 7 12         | 10       |
|     |         | N         |                 |                 |                 |                 | 17 52 00        | 17 55 18     |              |              | 18 23        | 27       |
| 19  | May 1   | E         |                 |                 |                 |                 | 17 52 20        | 17 58 09     |              |              | 18 17        | 27       |
|     |         | N         |                 | 5 55 25         |                 |                 | 6 02 29         | 6 04 06      |              | 6 10         | 7 20         | 45       |
| 20  | May 3   | E         |                 |                 |                 |                 | 11 00 35        | 11 01 08     |              |              | 11 04        | 5        |
|     |         | N         |                 |                 |                 |                 | 11 00 20        | 11 01 53     |              |              | 11 06        | 5        |
| 21  | May 4   | E         | 21 29 10        |                 |                 |                 | 21 29 20        | 21 30 18     |              |              | 21 34        | 14       |
|     |         | N         |                 |                 |                 |                 | 21 29 40        |              |              |              | 21 34        | 4        |
| 22  | May 12  | E         | 3 49 45         | 3 57 18         |                 |                 | 4 05 49         | 4 14 24      |              | 4 16         | 4 48         | 26       |
|     |         | N         |                 |                 |                 |                 | 4 08 04         | 4 14 51      |              | 4 16         | 4 40         | 14       |
| 23  | May 14  | E         | 11 40 56        |                 |                 |                 | 12 01 53        | 12 02 05     |              |              | 13 11        | 15       |
|     |         | N         | 11 40 56        |                 |                 |                 |                 |              |              |              | 11 55        |          |
| 24  | May 14  | E         | 20 27 19        | 20 35 05        |                 |                 |                 | 20 42 48     |              |              | 21 35        | 18       |
|     |         | N         | 20 27 31        | 20 35 01        |                 |                 | 20 44 13        | 20 47 41     |              | 20 49        | 21 31        | 24       |
| 25  | May 14  | E         |                 | 22 30 32        |                 |                 | 22 30 32        | 22 35 00     |              |              | 22 52        | 12       |
|     |         | N         |                 | 22 30 40        |                 |                 | 22 35 35        | 22 35 53     |              |              | 22 46        | 11       |
| 26  | May 16  | E         |                 |                 |                 |                 | 15 32 42        | 15 39 27     |              |              | 16 09        | 7        |
|     |         | N         |                 |                 |                 |                 | 15 38 04        | 16 00 43     |              |              | 16 09        | 5        |
| 27  | May 21  | E         | 8 53 51         | 9 03 31         |                 |                 | 9 17 36         | 9 27 49      |              |              | 9 56         | 18       |
|     |         | N         |                 | 9 03 16         |                 |                 |                 | 9 13 01      |              |              | 9 35         | 8        |
| 28  | May 21  | E         | 22 41 02        | 22 44 46        |                 |                 | 22 46 29        | 22 51 13     |              | 22 56        | 24 24        | 23       |
|     |         | N         | 22 41 02        | 22 44 38        |                 |                 | 22 46 12        | 22 46 55     |              | 22 59        | 24 23        | 20       |
| 29  | May 28  | E         |                 |                 |                 |                 | 21 10 30        | 21 12 25     |              |              | 21 18        | 12       |
|     |         | N         |                 |                 |                 |                 | 21 10 23        | 21 11 40     |              |              | 21 22        | 10       |

## Register of earthquakes—Continued

| No. | Date     | Component | P               | S               | L               | M               | C            | F            | A     |
|-----|----------|-----------|-----------------|-----------------|-----------------|-----------------|--------------|--------------|-------|
|     |          |           | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m.</i> | <i>h. m.</i> | $\mu$ |
| 30  | June 17  | E         |                 |                 | 8 27 48         | 8 30 54         | 8 31         | 8 33         | 7     |
|     |          | N         |                 |                 | 8 27 37         | 8 28 50         | 8 31         | 8 33         | 8     |
| 31  | June 25  | E         |                 |                 | 2 20 20         | 2 22 44         | 2 27         | 2 48         | 24    |
|     |          | N         | 2 15 52         | 2 19 29         | 2 20 20         | 2 23 22         | 2 24         | 2 48         | 28    |
| 32  | June 28  | E         |                 |                 | 14 09 23        |                 |              | 14 48        |       |
| 33  | July 3   | E         |                 |                 | 5 21 13         | 5 22 37         | 5 23         | 5 32         | 14    |
|     |          | N         | 5 17 10         |                 | 5 21 30         | 5 23 46         | 5 29         | 5 41         | 10    |
| 34  | July 4   | E         | 14 35 16        |                 | 14 47 47        | 14 50 07        |              | 14 56        | 25    |
|     |          | N         | 14 35 16        | 14 40 11        |                 | 14 21 26        |              | 14 49        | 25    |
| 35  | July 7   | E         | 11 06 00        | 11 08 20        | 11 09 20        | 11 21 05        |              | 11 55        | 31    |
|     |          | N         |                 |                 | 11 08 50        | 11 19 09        |              | 11 45        | 17    |
| 36  | July 10  | E         | 2 07 55         | 2 11 23         | 2 15 25         | 2 20 10         |              | 2 43         | 14    |
|     |          | N         | 2 07 22         | 2 10 43         | 2 16 20         | 2 20 14         |              | 2 26         | 9     |
| 37  | July 10  | E         |                 |                 | 7 04 --         |                 |              | 7 18         |       |
| 38  | July 13  | E         |                 |                 | 11 24 --        |                 |              | 11 37        |       |
|     |          | N         |                 |                 | 11 30 --        |                 |              | 11 37        |       |
| 39  | July 13  | E         | 13 23 40        |                 | 13 31 35        | 13 35 03        |              | 13 45        | 10    |
|     |          | N         |                 |                 | 13 32 30        |                 |              | 13 41        |       |
| 40  | July 15  | E         |                 | 18 42 33        | 18 45 50        | 18 48 40        |              | 18 53        | 4     |
|     |          | N         | 18 27 24        |                 |                 |                 |              | 18 50        |       |
| 41  | July 23  | E         |                 |                 | 8 57 30         | 9 00 35         | 9 04         | 9 30         | 13    |
| 42  | July 26  | E         | 10 52 38        |                 | 11 01 32        | 11 02 45        | 11 03        | 11 12        | 4     |
|     |          | N         | 10 52 38        |                 |                 | 11 01 58        |              | 11 05        | 1     |
| 43  | July 29  | E         | 0 42 27         | 0 45 02         | 0 46 30         | 0 47 10         | 0 50         | 1 01         | 24    |
|     |          | N         | 0 42 27         | 0 45 02         | 0 45 57         | 0 47 31         | 0 54         | 1 09         | 42    |
| 44  | July 31  | E         | 10 06 48        | 10 11 00        | 10 13 10        | 10 16 23        | 10 28        | 10 52        | 35    |
|     |          | N         | 10 06 48        | 10 11 18        | 10 13 10        | 10 15 46        | 10 23        | 10 54        | 37    |
| 45  | July 31  | E         |                 |                 | 23 46 42        | 23 48 55        | 23 50        | 24 07        | 5     |
|     |          | N         |                 |                 | 23 46 42        | 23 48 50        | 23 50        | 24 04        | 9     |
| 46  | Aug. 9   | E         |                 |                 | 11 01 20        | 11 03 25        |              | 11 06        | 9     |
|     |          | N         |                 |                 | 11 01 25        | 11 03 30        |              | 11 07        | 5     |
| 47  | Aug. 17  | E         | 23 55 40        |                 | 24 01 20        | 24 02 30        | 24 06        | 24 29        | 11    |
|     |          | N         | 23 55 33        |                 |                 | 24 02 37        | 24 08        | 24 49        | 14    |
| 48  | Aug. 22  | E         |                 |                 | 4 29 49         | 4 30 00         | 4 32         | 4 57         | 6     |
|     |          | N         |                 |                 | 4 29 43         | 4 30 00         | 4 33         | 4 50         | 6     |
| 49  | Aug. 23  | E         | 20 41 05        | 20 48 58        |                 | 21 04 19        | 21 10        | 21 19        | 8     |
|     |          | N         | 20 41 05        |                 | 21 00 55        | 21 06 57        | 21 10        | 21 23        | 5     |
| 50  | Aug. 24  | E         |                 |                 | 11 13 28        |                 |              | 11 22        | 5     |
|     |          | N         |                 |                 | 11 13 28        |                 |              | 11 17        | 4     |
| 51  | Aug. 24  | E         |                 |                 | 11 35 --        |                 |              | 11 46        | 4     |
|     |          | N         |                 |                 | 11 37 --        |                 |              | 11 44        | 1     |
| 52  | Aug. 29  | E         |                 |                 | 19 14 19        |                 |              | 19 17        | 2     |
|     |          | N         |                 |                 | 19 13 40        |                 |              | 19 16        | 6     |
| 53  | Sept. 3  | E         | 9 15 11         |                 | 9 23 00         | 9 23 30         | 9 36         | 10 29        | 8     |
|     |          | N         | 9 15 31         | 9 20 26         | 9 23 00         | 9 23 16         | 9 37         | 10 14        | 5     |
| 54  | Sept. 4  | E         |                 |                 | 23 52 40        | 23 53 31        |              | 23 58        | 4     |
|     |          | N         |                 |                 | 23 52 31        | 23 53 31        | 23 54        | 23 58        | 9     |
| 55  | Sept. 5  | E         | 20 01 58        | 20 12 36        | 20 29 25        | 20 33 15        | 20 52        | 22 47        | 26    |
|     |          | N         | 20 01 58        | 20 12 38        | 20 29 47        | 20 30 30        | 20 52        | 23 02        | 11    |
| 56  | Sept. 8  | E         |                 |                 | 19 40 28        | 19 44 33        | 19 45        | 19 52        | 10    |
|     |          | N         |                 |                 | 19 41 03        | 19 41 54        | 19 45        | 19 50        | 19    |
| 57  | Sept. 11 | E         | 4 15 03         | 4 26 00         | 4 45 56         | 4 50 50         | 5 12         | 7 35         | 62    |
|     |          | N         | 4 15 03         | 4 26 24         | 4 39 50         | 4 43 20         | 5 28         | 7 15         | 41    |
| 58  | Sept. 13 | E         | 2 58 11         |                 | 3 38 00         | 3 42 20         |              | 4 55         | 24    |
|     |          | N         |                 |                 | 3 37 --         | 3 43 --         |              |              | 58    |
| 59  | Sept. 19 | E         | 4 18 51         |                 | 4 20 20         | 4 21 42         | 4 30         | 6 12         | 69    |
|     |          | N         | 4 18 51         |                 | 4 20 44         | 4 21 29         | 4 29         | 6 34         | 46    |
| 60  | Sept. 19 | E         | 23 25 05        | 23 31 50        | 23 35 22        | 23 38 48        | 23 42        | 26 12        | 89    |
|     |          | N         | 23 25 05        | 23 31 50        | 23 35 05        | 23 38 38        | 23 44        | 26 16        | 60    |
| 61  | Sept. 20 | E         |                 |                 | 19 09 42        | 19 12 34        | 19 13        | 19 39        | 13    |
|     |          | N         |                 |                 | 19 09 42        | 19 12 44        | 19 15        | 19 49        | 10    |
| 62  | Sept. 23 | E         |                 |                 | 2 32 21         | 2 35 18         |              | 3 08         | 10    |
|     |          | N         |                 |                 | 2 32 21         | 2 33 10         |              | 3 05         | 8     |
| 63  | Sept. 29 | E         | 13 28 43        |                 | 13 30 42        | 13 32 57        |              | 13 43        | 15    |
|     |          | N         | 13 28 48        |                 | 13 30 35        | 13 33 05        |              | 13 37        | 13    |
| 64  | Oct. 5   | E         |                 |                 | 1 57 45         |                 |              | 2 01         |       |
| 65  | Oct. 10  | E         | 2 25 45         |                 | 2 41 30         |                 | 2 48         | 2 55         | 21    |
|     |          | N         | 2 25 45         | 2 33 02         | 2 41 30         |                 | 2 48         | 2 53         | 25    |
| 66  | Oct. 15  | E         | 5 14 11         | 5 18 25         | 5 21 05         | 5 26 35         | 5 37         | 6 05         | 100   |
|     |          | N         | 5 14 11         | 5 18 50         | 5 20 50         | 5 25 10         | 5 36         | 6 08         | 96    |
| 67  | Oct. 18  | E         |                 |                 | 0 53 --         |                 |              | 0 58         |       |
|     |          | N         |                 |                 | 0 53 --         |                 |              | 0 56         |       |
| 68  | Nov. 2   | E         |                 |                 | 8 37 --         |                 |              | 9 08         |       |
|     |          | N         |                 |                 | 8 33 --         |                 |              | 9 23         |       |
| 69  | Nov. 6   | E         |                 |                 | 17 14 --        |                 |              | 17 42        |       |
|     |          | N         |                 |                 | 17 14 --        |                 |              | 17 42        |       |
| 70  | Nov. 7   | E         | 16 11 32        | 16 20 43        | 16 34 16        | 16 34 30        | 16 49        |              | 81    |
|     |          | N         |                 | 16 20 48        |                 |                 |              |              |       |
| 71  | Nov. 11  | E         | 14 45 43        |                 | 14 48 50        | 14 49 00        | 14 51        | 14 58        | 50    |
|     |          | N         | 14 45 46        | 14 48 02        | 14 48 52        | 14 49 45        | 14 53        | 15 07        | 52    |

Register of earthquakes—Continued

| No. | Date    | Component | P               | S               | L               | M               | C            | F            | A        |
|-----|---------|-----------|-----------------|-----------------|-----------------|-----------------|--------------|--------------|----------|
|     |         |           | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m.</i> | <i>h. m.</i> | <i>μ</i> |
| 72  | Nov. 11 | E         | 18 47 55        | 18 57 22        | 19 10 08        | 19 22 ..        | 19 45        | 20 27        | 188      |
| 73  | Nov. 13 | N         | 18 47 37        | 18 57 22        |                 | 19 19 20        | 19 55        | 20 46        | 62       |
| 74  | Nov. 14 | E         |                 | 14 07 55        |                 |                 |              | 14 18        |          |
| 75  | Nov. 15 | N         | 7 08 12         | 7 11 50         | 14 12 05        | 7 16 30         | 7 21         | 14 21        | 12       |
| 76  | Nov. 29 | E         | 7 08 00         | 7 11 50         | 7 13 58         | 7 16 55         | 7 19         | 7 32         | 29       |
| 77  | Dec. 2  | N         | 20 54 47        | 21 04 51        | 7 14 11         | 21 22 ..        |              | 7 35         | 24       |
| 78  | Dec. 8  | E         |                 |                 | 21 21 05        | 21 05 45        |              | 22 11        | 50       |
| 79  | Dec. 18 | N         |                 |                 | 21 03 52        | 21 13 35        |              | 21 14        | 16       |
| 80  | Dec. 31 | E         | 15 41 45        | 15 51 19        | 21 05 25        | 21 13 35        |              | 21 20        | 18       |
| 81  | Jan. 1  | N         |                 |                 | 21 08 ..        |                 |              | 21 18        |          |
| 82  | Jan. 5  | E         |                 |                 | 12 55 40        | 12 58 00        |              | 13 04        | 11       |
| 83  | Jan. 6  | N         |                 |                 | 12 54 38        | 12 58 00        |              | 13 02        | 19       |
| 84  | Jan. 9  | E         |                 |                 |                 | 15 51 42        |              | 16 26        | 75       |
| 85  | Jan. 14 | N         |                 |                 | 0 12 04         | 0 14 42         |              | 0 18         | 14       |
| 86  | Jan. 17 | E         |                 |                 | 0 12 04         | 0 14 26         |              | 0 18         | 18       |
| 87  | Jan. 19 | N         |                 |                 | 20 00 59        | 20 06 25        |              | 21 46        | 170      |
| 88  | Jan. 22 | E         | 19 54 27        | 20 00 59        | 20 04 01        | 20 08 14        |              | 21 51        | 210      |
| 89  | Jan. 22 | N         |                 |                 | 9 25 44         | 9 25 32         |              | 9 31         |          |
| 90  | Jan. 26 | E         |                 |                 | 14 34 45        | 14 52 30        | 14 54 44     | 9 32         | 48       |
| 91  | Jan. 26 | N         |                 |                 | 14 35 15        | 14 53 00        | 15 36 10     | 16 27        | 31       |
| 92  | Jan. 31 | E         |                 |                 | 5 52 01         | 9 14 05         | 9 19 20      | 6 18         |          |
| 93  | Feb. 2  | N         |                 |                 | 9 17 05         | 9 19 40         | 9 25         | 9 25         | 21       |
| 94  | Feb. 21 | E         | 4 02 25         | 4 11 65         | 4 31 55         | 4 32 50         |              | 6 15         | 22       |
| 95  | Feb. 21 | N         | 4 02 35         | 4 12 00         |                 |                 |              | 6 25         | 77       |
| 96  | Feb. 24 | E         | 22 18 18        | 22 25 28        | 22 31 30        | 22 33 00        |              | 5 53         |          |
| 97  | Feb. 24 | N         | 22 18 08        | 22 26 32        | 22 31 18        | 22 37 30        |              | 23 15        | 80       |
| 98  | Feb. 24 | E         | 3 38 08         | 3 41 10         | 3 42 08         | 3 44 15         |              | 23 09        | 35       |
| 99  | Feb. 24 | N         | 3 38 08         | 3 41 17         | 3 42 14         | 3 44 20         |              | 5 08         | 147      |
| 100 | Feb. 24 | E         | 20 58 50        | 21 01 46        | 21 02 40        | 21 04 02        |              | 22 17        | 219      |
| 101 | Feb. 24 | N         | 20 58 47        |                 | 21 02 52        | 21 04 48        |              | 22 30        | 69       |
| 102 | Feb. 24 | E         | 9 26 27         |                 | 9 34 25         | 9 35 45         |              | 22 30        | 26       |
| 103 | Feb. 24 | N         |                 |                 | 9 45 20         | 9 46 44         |              | 11 08        | 121      |
| 104 | Feb. 24 | E         | 13 24 10        | 13 29 38        |                 |                 | 13 34        | 16 45        | *850     |
| 105 | Feb. 24 | N         | 13 24 10        |                 |                 |                 | 13 35        | 16 22        | *850     |
| 106 | Feb. 24 | E         |                 |                 | 3 28 40         |                 |              | 3 39         | *20      |
| 107 | Feb. 24 | N         |                 |                 | 18 25 18        | 18 26 45        |              | 18 35        | *45      |
| 108 | Feb. 24 | E         |                 |                 | 18 25 18        | 18 26 30        |              | 18 35        | 61       |
| 109 | Feb. 24 | N         |                 |                 | 5 30 40         | 5 35 10         |              | 5 40         | 12       |
| 110 | Feb. 24 | E         |                 |                 | 5 32 04         | 5 33 35         |              | 5 58         | 35       |
| 111 | Feb. 24 | N         | 13 15 54        | 13 22 21        | 13 28 56        | 13 22 35        |              | 13 56        | 45       |
| 112 | Feb. 24 | E         | 13 15 54        | 13 22 33        | 13 29 03        | 13 27 18        |              | 14 07        | 40       |
| 113 | Feb. 24 | N         |                 |                 | 11 38 22        |                 |              | 11 55        |          |
| 114 | Feb. 24 | E         |                 |                 | 11 36 27        | 11 38 18        |              | 11 53        | 20       |
| 115 | Feb. 24 | N         |                 |                 | 17 06 27        |                 |              | 17 24        | 24       |
| 116 | Feb. 24 | E         |                 |                 | 17 06 27        |                 |              | 17 24        | 28       |
| 117 | Feb. 24 | N         | 17 39           |                 |                 |                 |              | 17 55        |          |
| 118 | Feb. 24 | E         | 17 35 09        |                 | 17 43 14        | 17 45 ..        |              | 17 52        | 21       |
| 119 | Feb. 24 | N         |                 |                 | 13 58 16        |                 |              | 14 16        |          |
| 120 | Feb. 24 | E         |                 |                 | 13 58 16        |                 |              | 14 27        |          |
| 121 | Feb. 24 | N         |                 |                 | 4 22 58         | 4 25 30         |              | 4 54         | *20      |
| 122 | Feb. 24 | E         |                 |                 | 4 23 34         | 4 30 25         |              | 5 09         | *20      |
| 123 | Feb. 24 | N         |                 |                 | 19 29 42        | 19 33 49        |              | 20 50        | *240     |
| 124 | Feb. 24 | E         | 18 52 38        |                 | 19 29 42        | 19 35 44        |              | 20 50        | 144      |
| 125 | Feb. 24 | N         |                 |                 | 10 19 16        | 10 36 10        |              | 11 23        | *50      |
| 126 | Feb. 24 | E         |                 |                 | 10 19 16        | 10 27 30        |              | 11 30        | *32      |
| 127 | Feb. 24 | N         |                 |                 | 21 26 45        | 21 33 00        |              | 21 41        | *20      |
| 128 | Feb. 24 | E         |                 |                 | 21 23 07        | 21 32 00        |              | 21 44        | 58       |
| 129 | Feb. 24 | N         |                 |                 | 4 12 40         |                 |              | 4 28         |          |
| 130 | Feb. 24 | E         |                 |                 | 4 10 40         |                 |              | 4 28         |          |
| 131 | Feb. 24 | N         |                 |                 | 0 45 10         | 0 46 28         |              | 1 33         | 42       |
| 132 | Feb. 24 | E         | 0 35 02         |                 | 0 41 58         | 0 48 20         |              | 1 30         | 24       |
| 133 | Feb. 24 | N         | 0 35 02         |                 | 21 44 55        | 21 49 40        |              | 22 58        | 58       |
| 134 | Feb. 24 | E         | 1 28 54         | 1 33 16         | 1 36 06         | 1 39 ..         |              | 1 42         | 14       |
| 135 | Feb. 24 | N         | 4 14 39         | 4 20 31         |                 | 4 29 13         |              | 5 54         | 19       |
| 136 | Feb. 24 | E         | 4 14 39         | 4 20 31         | 4 25 32         | 4 20 45         |              | 5 21         | 29       |
| 137 | Feb. 24 | N         |                 |                 | 4 14 00         |                 |              | 4 54         | 11       |
| 138 | Feb. 24 | E         |                 |                 | 4 14 00         |                 |              | 5 14         | 7        |
| 139 | Feb. 24 | N         | 9 21 20         | 9 28 08         |                 | 9 38 16         |              | 11 30        | *40      |
| 140 | Feb. 24 | E         | 9 21 20         | 9 28 08         |                 | 9 34 58         |              | 11 35        | *34      |
| 141 | Feb. 24 | N         | 9 32 17         |                 | 9 37 ..         | 9 52 12         |              | 10 29        | 11       |
| 142 | Feb. 24 | E         | 9 30 36         |                 | 9 37 38         | 9 50 43         |              | 10 21        | 15       |
| 143 | Feb. 24 | N         | 18 48 54        | 18 56 37        |                 | 19 07 22        |              | 20 05        | 55       |
| 144 | Feb. 24 | E         |                 |                 | 16 10 30        |                 |              | 16 16        |          |
| 145 | Feb. 24 | N         |                 |                 | 16 09 55        |                 |              | 16 22        |          |
| 146 | Feb. 24 | E         | 3 24 09         |                 | 3 25 35         | 3 25 55         | 3 29         | 4 05         | 121      |
| 147 | Feb. 24 | N         | 3 23 23         |                 | 3 26 00         | 3 28 55         | 3 29         | 3 49         | 97       |

## Register of earthquakes—Continued

| No. | Date     | Component | P               | S               | L               | M               | C            | F            | A     |
|-----|----------|-----------|-----------------|-----------------|-----------------|-----------------|--------------|--------------|-------|
|     | 1922     |           | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m.</i> | <i>h. m.</i> | $\mu$ |
| 116 | May 24   | E         |                 |                 | 8 22 23         |                 |              | 8 25         |       |
|     |          | N         |                 |                 | 8 22 23         |                 |              | 8 26         |       |
| 117 | May 26   | E         | 9 07 50         |                 | 9 08 38         |                 |              | 9 11         | 18    |
|     |          | N         | 9 07 52         |                 | 9 08 38         |                 |              | 9 11         | 14    |
| 118 | June 2   | E         | 20 23 20        | 20 34 00        | 20 51 05        | 20 54 28        |              | 21 27        | 26    |
|     |          | N         | 20 23 32        | 20 33 56        |                 |                 |              | 21 29        |       |
| 119 | June 12  | E         | 4 57 20         | 5 02 55         | 5 12 07         | 5 14 30         |              | 6 46         | 40    |
|     |          | N         |                 | 5 02 50         | 5 10 08         | 5 14 11         |              | 6 55         | 52    |
| 120 | June 12  | E         | 10 57 57        | 11 02 40        | 11 03 50        | 11 05 45        |              | 12 11        | 45    |
|     |          | N         | 10 58 10        | 11 02 18        | 11 04 07        | 11 05 10        |              | 12 18        | 55    |
| 121 | June 12  | N         |                 |                 | 14 14           |                 |              | 14 28        |       |
| 122 | June 16  | E         |                 |                 | 21 17 38        | 21 21 34        |              | 21 34        | 14    |
|     |          | N         |                 |                 | 21 16 28        | 21 21 02        |              | 21 28        | 14    |
| 123 | June 21  | E         |                 |                 | 13 23 05        |                 |              | 13 24        | 3     |
|     |          | N         |                 |                 | 13 23 05        |                 |              | 13 29        |       |
| 124 | June 22  | E         |                 |                 | 20 26 17        | 20 26 00        |              | 20 59        | 7     |
|     |          | N         |                 |                 | 20 25 30        | 20 26 32        |              | 20 52        | 3     |
| 125 | June 27  | E         | 14 41 20        | 14 50 45        | 15 03 30        | 15 15 18        |              | 15 54        | 16    |
|     |          | N         | 14 41 20        | 14 51 45        |                 |                 |              | 15 25        |       |
| 126 | July 2   | E         | 13 42 46        | 13 47 55        | 13 51 01        | 13 53 47        |              | 15 51        | 175   |
|     |          | N         | 13 42 34        | 13 47 55        | 13 51 01        | 13 53 47        |              | 15 42        | 140   |
| 127 | July 5   | E         |                 |                 | 18 50 45        | 18 53 23        |              | 19 06        | 19    |
|     |          | N         |                 |                 | 18 51 00        | 18 53 23        |              | 19 03        | 15    |
| 128 | July 13  | E         |                 |                 | 5 19            |                 |              | 6 01         |       |
|     |          | N         |                 |                 | 5 19            |                 |              | 6 01         |       |
| 129 | July 29  | E         |                 |                 | 20 24 15        |                 |              | 20 33        | 10    |
|     |          | N         |                 |                 | 20 24           |                 |              | 20 30        |       |
| 130 | Aug. 3   | E         |                 |                 | 10 05           |                 |              | 10 16        |       |
| 131 | Aug. 5   | E         |                 |                 | 18 02 00        |                 |              | 16 13        |       |
|     |          | N         |                 |                 | 18 02 00        |                 |              | 16 08        |       |
| 132 | Aug. 6   | E         | 1 20 09         |                 | 1 21 15         | 1 22 28         |              | 1 30         | 4     |
|     |          | N         | 1 20 01         |                 | 1 21 01         | 1 22 28         |              | 1 32         | 7     |
| 133 | Aug. 7   | E         | 12 40 25        |                 | 12 51 35        | 12 53 22        |              | 13 28        | 14    |
|     |          | N         | 12 40 50        | 12 46 40        | 12 50 31        | 12 53 59        |              | 13 18        | 12    |
| 134 | Aug. 11  | E         |                 | 13 52 45        | 13 55 54        | 13 57 32        |              | 14 38        | 14    |
|     |          | N         |                 | 13 52 45        | 13 55 59        | 13 57 36        |              | 14 38        | 14    |
| 135 | Aug. 13  | E         |                 |                 | 1 02            |                 |              | 2 28         |       |
|     |          | N         |                 |                 | 1 05            | 1 23 16         |              | 2 37         | 21    |
| 136 | Aug. 14  | E         |                 |                 | 11 55 40        |                 |              | 12 07        |       |
|     |          | N         |                 |                 | 11 55 40        |                 |              | 12 15        |       |
| 137 | Aug. 16  | E         |                 | 16 11 20        | 16 17 29        | 16 17 21        |              | 16 24        | 66    |
|     |          | N         |                 | 16 11 17        | 16 17 20        | 16 17 25        |              | 16 25        | 39    |
| 138 | Aug. 18  | E         |                 |                 | 5 27 40         |                 |              | 5 30         |       |
| 139 | Aug. 18  | E         |                 |                 | 20 58 12        |                 |              | 21 25        |       |
|     |          | N         |                 |                 | 20 58 03        |                 |              | 21 13        |       |
| 140 | Aug. 25  | E         | 11 52 40        | 12 00 00        | 12 06 30        | 12 10 20        |              | 12 37        | 8     |
|     |          | N         | 11 52 40        |                 | 12 07 38        | 12 10 24        |              | 12 32        | 10    |
| 141 | Aug. 25  | E         | 19 58 35        | 20 09 40        | 20 25 30        | 20 16 55        |              | 20 27        | 4     |
| 142 | Aug. 26  | E         |                 |                 | 2 44 50         |                 |              | 2 51         |       |
| 143 | Aug. 26  | E         | 6 41 15         | 6 45 35         | 6 47 15         | 6 49 58         |              | 7 06         | 12    |
|     |          | N         | 6 41 24         |                 |                 | 6 54 29         |              | 7 23         | 9     |
| 144 | Aug. 29  | E         |                 |                 |                 | 17 56           |              |              | 8     |
| 145 | Aug. 30  | E         |                 |                 | 11 07 40        | 11 09 00        |              | 18 10        |       |
| 146 | Aug. 30  | E         | 10 49 40        |                 | 23 03 40        |                 |              | 11 22        | 3     |
|     |          | N         |                 |                 | 23 03 58        | 23 07 27        |              | 23 08        |       |
|     |          | E         |                 |                 | 19 50 00        | 19 59 36        |              | 23 10        | 6     |
| 147 | Sept. 1  | E         |                 |                 | 19 49 56        | 19 52 02        |              | 22 08        | 134   |
|     |          | N         | 19 27 34        | 19 37 12        |                 |                 |              | 21 19        | 61    |
| 148 | Sept. 2  | E         |                 |                 | 20 37 13        |                 |              | 20 40        |       |
| 149 | Sept. 6  | E         |                 |                 | 1 51 05         |                 |              | 1 52         |       |
| 150 | Sept. 6  | E         |                 |                 | 22 54           |                 |              | 23 01        |       |
| 151 | Sept. 9  | E         |                 |                 | 0 37 56         | 0 39 30         | 0 40         | 0 48         | 11    |
|     |          | N         |                 |                 | 0 37 56         | 0 39 41         | 0 41         | 0 48         | 9     |
| 152 | Sept. 11 | E         |                 |                 | 12 56           |                 |              | 13 02        |       |
| 153 | Sept. 11 | E         |                 |                 | 15 24           |                 |              | 15 28        |       |
| 154 | Sept. 12 | E         |                 |                 | 11 52 05        | 11 56 12        |              | 12 12        | 9     |
|     |          | N         |                 |                 | 11 54 22        | 11 56 09        |              | 12 12        |       |
| 155 | Sept. 14 | E         | 19 52 40        |                 | 20 07 15        | 20 02 45        |              | 20 50        | *13   |
| 156 | Sept. 16 | E         | 23 05 35        |                 |                 | 23 32 30        |              | 23 50        | 5     |
|     |          | N         | 23 05 35        |                 |                 | 23 16 50        |              | 23 43        | 13    |
| 157 | Sept. 17 | E         | 7 43 58         |                 | 7 57 25         | 8 00 40         |              | 8 52         | 15    |
|     |          | N         | 7 43 58         |                 | 7 58 00         | 8 00 30         |              | 8 28         | 6     |
| 158 | Sept. 17 | E         | 10 20 19        |                 | 10 36 00        | 10 42 42        | 10 50        | 11 14        | 23    |
|     |          | N         | 10 20 19        |                 | 10 34 15        | 10 45 35        |              | 11 03        | 8     |
| 159 | Sept. 18 | E         |                 |                 | 12 08 27        | 12 10 18        |              | 12 17        |       |
|     |          | N         |                 |                 | 12 08 40        | 12 10 30        |              | 12 17        | 8     |
| 160 | Sept. 30 | E         |                 | 8 33 00         | 8 35 32         | 8 38 30         |              | 9 21         | 23    |
|     |          | N         |                 | 8 33 03         |                 | 8 38 19         |              | 9 17         | 18    |
| 161 | Oct. 5   | E         | 8 30 25         |                 | 8 48            |                 |              | 6 09         |       |

## Register of earthquakes—Continued

| No. | Date         | Component | P               | S               | L               | M               | C            | F            | A     |
|-----|--------------|-----------|-----------------|-----------------|-----------------|-----------------|--------------|--------------|-------|
|     |              |           | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m. s.</i> | <i>h. m.</i> | <i>h. m.</i> | $\mu$ |
| 162 | Oct. 11 1922 | E         |                 | 15 13 52        | 15 32 30        | 15 34 54        |              | 15 47        | 21    |
|     |              | N         |                 | 15 13 52        |                 | 15 26 40        |              | 15 52        | *32   |
| 163 | Oct. 24      | N         | 21 29 37        | 21 36 30        | 21 43 00        | 21 43 04        |              | 23 12        | 350   |
| 164 | Oct. 27      | E         |                 |                 | 14 57 --        |                 |              |              |       |
|     |              | N         |                 |                 | 14 44 --        |                 |              | 15 04        |       |
| 165 | Nov. 4       | E         | 3 33 55         |                 | 3 34 57         | 3 36 07         |              | 3 39         | 15    |
|     |              | N         | 3 33 55         |                 | 3 35 07         | 3 36 07         |              | 3 39         | 18    |
| 166 | Nov. 7       | E         | 23 24 27        | 23 32 10        | 23 44 55        | 23 47 00        |              | 24 50        | 64    |
|     |              | N         |                 |                 | 23 44 48        | 23 46 36        |              | 24 52        | 38    |
| 167 | Nov. 11      | E         | 4 46 25         | 4 57 25         | 5 13 45         | 5 18 --         |              | 8 46         | 2,060 |
|     |              | N         | 4 46 30         | 4 57 25         | 5 13 30         | 5 19 57         |              | 8 49         | 730   |
| 168 | Nov. 17      | E         | 11 27 18        | 11 34 50        | 11 47 18        | 11 49 --        | 11 57        | 13 03        | 77    |
|     |              | N         | 11 27 08        | 11 34 50        | 11 46 55        | 11 49 --        | 11 53        | 13 03        | 46    |
| 169 | Nov. 21      | E         | 13 59 00        |                 |                 | 14 00 20        |              | 14 05        | 47    |
|     |              | N         | 13 59 00        |                 |                 | 14 00 08        |              | 14 03        | 21    |
| 170 | Nov. 22      | E         |                 |                 | 15 03 48        |                 |              | 15 08        |       |
|     |              | N         |                 |                 | 15 05 30        |                 |              | 15 11        |       |
| 171 | Dec. 14      | E         | 23 15 30        | 23 22 05        |                 |                 |              | 24 19        | 35    |
|     |              | N         |                 | 23 22 05        | 23 32 00        | 23 33 36        | 23 44        | 18 16        | 15    |
| 172 | Dec. 19      | E         | 18 03 40        |                 | 18 07 38        | 18 09 45        |              | 18 17        | 56    |
|     |              | N         | 18 04 30        |                 | 18 05 43        | 18 08 25        |              | 22 23        |       |
| 173 | Dec. 23      | E         | 22 15 --        |                 | 22 15 08        |                 |              |              |       |
|     |              | N         |                 |                 | 22 18 15        |                 |              |              |       |
| 174 | Dec. 31      | E         | 7 28 42         | 7 35 41         | 7 41 45         | 7 48 23         |              | 8 54         | 53    |
|     |              | N         |                 | 7 35 45         | 7 41 50         | 7 48 38         |              | 8 24         | 48    |

## REMARKS

1. Beginning indefinite; LR at 14:08.
3. Phases tabulated as P and S do not fit in with L.
4. Beginning indefinite. The old Milne seismograph was dismounted on January 27 and the new Milne-Shaw seismograph was started on February 25.
5. An impetus on both components at 18:37:56.
8. The phases tabulated as P and S are well defined but do not harmonize with L.
9. SR<sub>1</sub> on N at 8:17:11.
10. The phase tabulated as S may be some other phase.
12. The phase tabulated as P resembles S but no evidence of P could be found among the preceding microseisms.
19. E not in operation. The tabulated S, SR<sub>1</sub> at 5:59:24 and SR<sub>2</sub> at 6:00:32 correspond approximately with the location of the epicenter and time at origin derived from other stations.
21. P<sub>E</sub> doubtful; N ill defined.
22.  $\Delta = 5,900$  km.
23. SR<sub>1</sub> on N at 11:54:23.
24. SR<sub>2</sub> on E at 20:40:42.  $\Delta = 6,000$  km.
25. Difficult to interpret; initial phase may be SR<sub>1</sub>.
26. 29. No distinct phases.
27. SR<sub>1</sub> on E at 9:08:31.  $\Delta = 8,000$  km.
30. Phases not well defined. A slight renewal of activity from 10:36 to 10:40 may be from the local shock recorded at Tucson.
31. L may come as late as 2:21:44.
32. Phases indistinct. E obscured by overlapping of record.
34. Difficult to interpret. The phase tabulated as P is probably PR<sub>1</sub>. There is also an impetus on N at 14:37:12.
- 36, 39, 40, 41. Phases ill defined.
42. P doubtful. Phase on N at 10:59:21 may be L.
43. P and S not well defined.
44. Distance 2,700 km.
49. SR<sub>1</sub>E at 20:53:27; O at 20:31:25; distance 6,200 km.
53. O at 9:09:35; distance 3,100 km.
55. PR<sub>1</sub> on both at 20:05:36; PR<sub>2N</sub> at 20:07:30; SR<sub>1</sub> at 20:19:03 on E, at 20:18:45 on N. P difficult to distinguish from microseisms.
57. PR<sub>1</sub> at 4:19:10 on E and at 4:19:18 on N; SR<sub>1</sub> at 4:32:20 on N.
- 59, 61, 62, 63. No definite phases.
65. SR<sub>1</sub>N at 2:37:07; maximum amplitude at P.
66. Some motion at 5:07:11, but it may not be seismic. The phase tabulated as S may be L.
69. Beginning lost in changing paper from 17:07 to 17:14.
- 71, 73. Phases ill defined.
72. Actual maximum on N at 18:57:30, 133  $\mu$ .
76. E obscured by overlapping.
79. PR<sub>1</sub> on N at 15:45:03. SR<sub>2</sub> at 16:00:20.
81. L doubtful.
83. An emergence on E at 14:41:17.
86. Actual maximum on E at 4:12:35, 307  $\mu$  and on N at 4:18:13, 113  $\mu$ . SR<sub>1</sub> on N at 4:17:01.
88. End portion lost on N.
90. N not operating. F lost in next earthquake.
91. N not operating. Beginning confused with end of 90. Recorded on Z variometer from 9:46 to 9:49.

92. PR<sub>1</sub> at 13:25:11 on E and 13:25:20 on N. SR<sub>1</sub> at 13:32:10 on E and 13:31:40 on N. Spots moving too rapidly to record between 13:32 and 13:34. The greatest amplitude recorded is tabulated. The values given are the trace amplitudes divided by 100.
94. Local shock. Recorded on D variometer from 18:25 to 18:27.
95. No distinct phases.
96. PR<sub>1</sub> on N at 13:17:29. SR<sub>1</sub> on E at 13:25:30, on N at 13:25:20. SR<sub>2</sub> on E at 13:26:50, on N at 13:26:41.
98. This may not be seismic; most of the record lost while changing paper.
- 99, 100. No distinct phases.
107. SR<sub>1</sub> on N at 21:40:00. Record of E lost by overlapping of lines.
111. PR<sub>1</sub> at 9:23:23. SR<sub>1</sub> on N at 9:31:30. SR<sub>2</sub> at 9:32:35 on E and at 9:33:05 on N.
112. The first phase on N may not be seismic.
113. E lost by overlapping of lines.
115. P doubtful. Activity on E at 3:20:17. Recorded on D and H variometers from 3:24 to 3:27.
118. No definite L nor M on N. O at 20:10:38; distance 9,600 km.
119. P<sub>2</sub> barely perceptible. SR<sub>1</sub> on N at 5:06:08; possibly SR<sub>2</sub> on E at 5:07:55. O at 4:47:30; distance 5,080 km.
122. Emergence of E at 21:16:18.
125. O at 14:29:54, distance 8,100 km.
126. SR<sub>1</sub> at 13:49:49. O at 13:35:47, distance 3,580 km.
132. Phases III defined.
133. P<sub>2</sub> doubtful. PR<sub>1</sub> on N at 12:42:10. SR<sub>1</sub> at 12:48:55 on E and at 12:48:38 on N. O at 12:33:28, distance 4,050 km.
135. Another M on N at 2:23. Nothing definite on E.
137. PR<sub>1</sub> at 16:08:21. SR<sub>1</sub> at 16:14:53 on E and at 16:14:43 on N. L<sub>2</sub> at 16:08:04 on E and at 16:08:08 on N. O at 15:55:58, distance 5,080 km.
140. SR<sub>1</sub> on N at 12:04:22. L<sub>2</sub> on N at 12:10:00. O at 11:43:27, distance 5,700 km.
141. E record lost through overlapping of lines. SR<sub>1</sub> at 20:16:22. SR<sub>2</sub> at 20:21:30.
143. Nothing definite on N. Emergence on E at 6:43:45.
147. SR<sub>1</sub> on N at 19:41:50. SR<sub>2</sub> on N at 19:45:20. E record obscured by overlapping of lines. Actual maximum on N at 19:37:10, 92 $\mu$ ; O at 19:15:54, distance 8,860 km.
155. E record obscured by overlapping of lines. Another phase on N at 20:01:10.
156. Other phases at 23:17:25, 23:21:25 and 23:30:02 on E and 23:15:02 on N. Distance may be 5,200 km. or 8,200 km.
157. L doubtful.
158. SR<sub>1</sub> on N at 10:30:18.
160. P and S very weak. A phase on N at 8:32:30 may be PS.
162. SR<sub>1</sub> at 15:20:40 on E and at 15:20:10 on N. SR<sub>2</sub> at 15:23:20 on N.
163. E not operating. PR<sub>1</sub> on N at 21:31:29. O at 21:20:56, distance 5,200 km.
166. PR<sub>1</sub> at 23:28:33 on E and at 23:27:05 on N. Another phase on N at 23:37:25. Interpretation doubtful.
167. PR<sub>1</sub> at 4:50:21. Another impetus at 4:50:40; PR<sub>2</sub> at 4:52:44; PS at 4:59:32; SR<sub>1</sub> at 5:03:45 on E and 5:03:50 on N. SR<sub>2</sub> at 5:10:15 on E and 5:09:25 on N. L<sub>2</sub> at 5:17:22. L rep. at 8:12:20 on E at 8:12:10 on N.
168. The first two phases may be S and SR<sub>1</sub> indicating Chile as the origin. L<sub>N</sub> may be at 11:43:55 or 11:48:09 instead of 11:46:55.
170. Not well defined.
171. PR<sub>1</sub> on E at 23:17:45.
172. Phases III defined.
174. SR<sub>1</sub> at 7:39:42 on E and at 7:39:30 on N. O at 7:19:54, distance, 5,310 km.

## MAGNETIC STORMS

Magnetic disturbances of considerable magnitude were recorded at the times tabulated below. When the storm began abruptly, the time is given to the nearest minute.

On the succeeding pages will be found reproductions of the magnetograms showing the principal magnetic storms. A storm selected for reproduction is indicated in the table by an asterisk after the date. An upward motion of the curves corresponds to decreasing east declination, increasing  $H$ , and decreasing  $Z$ .



Serial No. 452

**UNITED STATES DEPARTMENT OF COMMERCE**

R. P. LAMONT, Secretary

**COAST AND GEODETIC SURVEY**

R. S. PATTON, Director

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**RESULTS OF OBSERVATIONS MADE AT THE UNITED  
STATES COAST AND GEODETIC SURVEY MAGNETIC  
OBSERVATORY NEAR HONOLULU, HAWAII  
IN 1923 AND 1924**

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BY

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# RESULTS OF OBSERVATIONS MADE AT THE UNITED STATES COAST AND GEODETIC SURVEY MAGNETIC OBSERVATORY NEAR HONOLULU, HAWAII, IN 1923 AND 1924

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## INTRODUCTION

[Latitude, 21° 19'.2 N.; longitude, 158° 03'.8 W.; elevation 50 feet (15 meters)]

The Honolulu magnetic observatory is situated on a large coral plain, 12½ miles (20 km.) west of the city of Honolulu, Oahu Island, Hawaii. Its operation began in January, 1902. For a description of the buildings and instruments see the first volume of observatory results. The methods of observing are explained in *Directions for Magnetic Measurements*, by D. L. Hazard, published in 1911, second edition in 1921.

The division of terrestrial magnetism of the Coast and Geodetic Survey, of which N. H. Heck, hydrographic and geodetic engineer, is chief, includes both office and field work. The work of the Honolulu observatory was carried on during the two years by H. E. McComb and W. M. Hill, magnetic observers. H. E. McComb was in charge of the observatory from January 1 to May 31, 1923, when he was relieved by W. M. Hill. Mr. Hill continued in charge until August 14, 1924, when Mr. McComb again took charge, continuing to the end of the year. The office computations and preparation of results for publication were in charge of D. L. Hazard, the assistant chief of the division, and the writer, assisted by O. S. Hill, Augustine McCarthy, and I. I. Kaplan, mathematicians, and R. R. Bodle and Louis P. Sissman, magnetic observers.

Up to the end of 1914 each hourly value of declination, horizontal intensity or vertical intensity in the monthly tabulations represented the momentary value of the quantity for the specified hour, local mean time. Beginning with 1915 the published hourly values are average values for successive periods of an hour, beginning at midnight of the specified standard meridian time (one hundred and sixty-fifth meridian in the case of Honolulu). Thus a value in a column headed 1 represents the average value for the hour beginning at midnight and ending at 1 a. m., one hundred and sixty-fifth meridian mean time.

## INSTRUMENTS

### VARIATION INSTRUMENTS

The magnetograph is of the Eschenhagen pattern and consists of declination (*D*), horizontal intensity (*H*) and vertical intensity (*Z*) variometers, and a recording apparatus. The variometers are mounted west of the recording apparatus. Upward motion of the curves on the magnetogram corresponds to decreasing east declination, increasing *H* and decreasing *Z*. Variations in temperature were determined by means of the photographic

EARTHQUAKES

In April, 1903, a Milne seismograph belonging to the seismological committee of the British Association was transferred from Oahu College to the magnetic observatory. In February, 1921, this instrument was replaced by a Milne-Shaw seismograph. It consists of two horizontal pendulums, one recording east-west motion (E) and the other recording north-south motion (N). Because of the large magnification (150), microseisms are continuously present on the seismograms, with amplitudes ranging from 0.5 mm. to 2.0 mm. and predominant periods of 4 and 8 seconds, the larger amplitudes usually accompanying the longer period. Preliminary phases of small amplitude are difficult to separate from the microseisms. The amplitudes have been computed on the basis of the constants given below.

Period of pendulums, 12.0 sec.  
 Multiplication, 150.

Damping ratio, about 20:1.  
 Sensitivity, 25 to 30 mm.

In order to find a place in the table for impulses and emergences which have not been identified with any phase of the seismogram, the times of their appearances have often been included in the column headed P and sometimes in the columns headed S and L.

On January 31, 1925, the President approved an act of Congress which authorized the Coast and Geodetic Survey to make investigations and reports in seismology, and in accordance with the provisions of this act the scope of the work of this bureau in seismology has been enlarged, and its importance has been felt to warrant the issuance of separate publications for the seismological reports. Accordingly, the records of the operation of the Milne-Shaw seismograph at the Honolulu Magnetic Observatory will be published hereafter in the seismological reports, which are issued quarterly, beginning with the first quarter of 1925.

Register of earthquakes

| No.  | Date    | Component | P   |    |    | S  |      |    | L  |    |    | M  |    |    | C  |    | F     | A  |    |       |     |
|------|---------|-----------|-----|----|----|----|------|----|----|----|----|----|----|----|----|----|-------|----|----|-------|-----|
|      |         |           | h.  | m. | s. | h. | m.   | s. | h. | m. | s. | h. | m. | s. | h. | m. | $\mu$ |    |    |       |     |
| 1923 |         |           |     |    |    |    |      |    |    |    |    |    |    |    |    |    |       |    |    |       |     |
| 1    | Jan. 2  | N         |     |    |    |    |      |    | 22 | 57 | 02 | 24 | 00 | 15 | h. | m. | 24    | 19 | 25 |       |     |
| 2    | Jan. 8  | N         | e   | 22 | 09 | 10 |      |    |    |    |    |    |    |    |    |    |       |    |    |       |     |
| 3    | Jan. 14 | E         | e   | 12 | 59 | 40 |      |    |    | 12 | 59 | 50 | 13 | 01 | 40 | 13 | 03    | 13 | 10 | 1,200 |     |
|      |         | N         | ?   | 12 | 59 | 18 |      |    |    | 12 | 59 | 55 | 13 | 01 | 45 | 13 | 02    | 13 | 15 | 82    |     |
| 4    | Jan. 22 | E         | e   | 1  | 10 | 34 |      |    |    |    |    |    | 1  | 14 | 32 |    |       | 1  | 22 | 1,300 |     |
| 5    | do      | E         | i   | 9  | 11 | 15 | 9    | 16 | 50 | 9  | 19 | 02 | 9  | 21 | 49 |    |       | 11 | 16 | 176   |     |
|      |         | N         | i   | 9  | 11 | 15 |      |    |    | i  | 9  | 18 | 52 | 9  | 21 | 06 |       |    | 11 | 29    | 230 |
| 6    | Jan. 27 | E         | e   | 8  | 19 | 12 |      |    |    |    |    |    | 8  | 19 | 32 |    |       | 8  | 23 |       |     |
|      |         | N         | e   | 8  | 18 | 24 |      |    |    |    |    |    |    |    |    |    |       | 8  | 23 | 19    |     |
| 7    | Feb. 1  | N         | i   | 19 | 42 | 12 | ? 19 | 47 | 47 | 19 | 49 | 30 | 19 | 49 | 54 |    |       | 20 | 01 | 130   |     |
| 8    | Feb. 2  | N         | i   | 1  | 21 | 53 | ? 1  | 27 | 16 | 1  | 28 | 30 | 1  | 31 | 23 |    |       | 1  | 51 | 80    |     |
| 9    | do      | E         | e   | 5  | 16 | 41 | e    | 5  | 22 | 46 | e  | 5  | 29 | 21 | e  | 5  | 30    | 08 | 6  | 55    | 310 |
|      |         | N         | e   | 5  | 16 | 08 | e    | 5  | 22 | 30 | e  | 5  | 28 | 10 | e  | 5  | 32    | 45 | 6  | 55    | 420 |
| 10   | Feb. 3  | E         | i   | 16 | 10 | 15 | i    | 16 | 16 | 58 | 16 | 22 | 18 |    |    |    |       | 20 | 53 |       |     |
|      |         | N         | i   | 16 | 10 | 15 | i    | 16 | 16 | 58 | 16 | 22 | 12 |    |    |    |       | 20 | 53 |       |     |
| 11   | Feb. 8  | E         | e   | 0  | 16 |    |      |    |    |    |    |    |    |    |    |    |       | 0  | 23 |       |     |
|      |         | N         | e   | 0  | 16 |    |      |    |    |    |    |    |    |    |    |    |       | 0  | 23 |       |     |
| 12   | do      | E         | e   | 8  | 11 | 10 | e    | 8  | 14 | 04 | e  | 8  | 17 | 20 |    |    | 8     | 26 |    |       |     |
|      |         | N         | e   | 8  | 11 | 00 |      |    |    |    |    |    |    |    |    |    |       | 8  | 27 |       |     |
| 13   | Feb. 10 | E         | e   | 7  | 11 | 33 |      |    |    |    |    |    |    |    |    |    |       | 7  | 13 |       |     |
|      |         | N         | e   | 7  | 12 | 28 |      |    |    |    |    |    |    |    |    |    |       | 7  | 13 |       |     |
| 14   | Feb. 11 | E         | e   | 22 | 59 | 40 |      |    |    | e  | 23 | 04 | 20 | e  | 23 | 04 | 51    | 23 | 18 | 30    |     |
|      |         | N         | e   | 22 | 59 | 40 |      |    |    | e  | 23 | 04 | 30 | e  | 23 | 05 | 18    | 23 | 26 | 50    |     |
| 15   | Feb. 12 | E         | ?   | 2  | 07 | 02 |      |    |    |    |    |    | 2  | 20 | 11 |    |       | 2  | 49 | 60    |     |
|      |         | N         | ? 2 | 07 | 02 |    | 2    | 13 | 51 | 2  | 19 | 55 | 2  | 21 | 37 |    |       | 2  | 45 | 80    |     |
| 16   | Feb. 16 | E         | e   | 9  | 35 | 10 |      |    |    |    |    |    | 9  | 36 | 34 |    |       | 9  | 40 | 10    |     |
|      |         | N         | e   | 9  | 35 |    |      |    |    |    |    |    |    |    |    |    |       | 9  | 40 |       |     |
| 17   | Feb. 19 | E         | e   | 0  | 02 |    |      |    |    |    |    |    |    |    |    |    |       | 0  | 08 |       |     |
|      |         | N         | e   | 0  | 02 |    |      |    |    |    |    |    |    |    |    |    |       | 0  | 17 |       |     |
| 18   | Feb. 21 | E         | e   | 4  | 11 |    |      |    |    |    |    |    |    |    |    |    |       | 4  | 23 |       |     |
| 19   | Feb. 23 | E         | i   | 6  | 13 | 46 |      |    |    | 6  | 35 | 25 |    |    |    |    |       | 6  | 43 |       |     |
|      |         | N         | e   | 6  | 14 | 30 | e    | 6  | 24 | 27 |    |    |    |    |    |    |       |    | 6  | 34    |     |
| 20   | Feb. 24 | E         | i   | 7  | 42 | 57 | i    | 7  | 49 | 34 | 7  | 55 | 21 | 7  | 53 | 40 |       |    | 10 | 37    | 180 |
|      |         | N         | i   | 7  | 42 | 57 | i    | 7  | 49 | 34 | 7  | 54 | 46 | 7  | 56 | 00 |       |    | 10 | 40    | 200 |
| 21   | Feb. 25 | E         | e   | 14 | 58 |    |      |    |    |    |    |    |    |    |    |    |       | 15 | 03 |       |     |
|      |         | N         | e   | 14 | 58 |    |      |    |    |    |    |    |    |    |    |    |       | 15 | 03 |       |     |
| 22   | Feb. 27 | E         | e   | 20 | 55 |    |      |    |    |    |    |    |    |    |    |    |       | 21 | 03 |       |     |
|      |         | N         | e   | 20 | 55 |    |      |    |    |    |    |    |    |    |    |    |       | 21 | 03 |       |     |
| 23   | Mar. 1  | E         | e   | 8  | 40 | 05 |      |    |    |    |    |    | 8  | 44 | 26 |    |       | 9  | 41 | 60    |     |
|      |         | N         | e   | 8  | 40 | 05 |      |    |    |    |    |    | 8  | 43 | 36 |    |       | 9  | 44 | 40    |     |
| 24   | Mar. 2  | E         | e   | 17 | 20 | 42 | e    | 17 | 25 | 32 | 17 | 30 | 10 | 17 | 33 | 20 |       |    | 18 | 10    | 32  |
|      |         | N         | e   | 17 | 20 | 42 | e    | 17 | 25 | 32 | 17 | 30 | 10 | 17 | 33 | 20 |       |    | 18 | 10    | 38  |
| 25   | Mar. 4  | E         | e   | 7  | 07 | 42 | e    | 7  | 10 | 33 | 7  | 11 | 46 | 7  | 12 | 10 |       |    | 7  | 58    | 38  |
|      |         | N         | e   | 7  | 07 | 42 | e    | 7  | 10 | 33 | 7  | 11 | 46 | 7  | 12 | 10 |       |    | 7  | 58    | 21  |
| 26   | Mar. 16 | E         | e   | 22 | 22 | 57 | e    | 22 | 35 | 48 | 22 | 49 | 10 | 22 | 50 |    |       | 23 | 24 | 50    |     |
|      |         | N         | e   | 22 | 22 | 57 | e    | 22 | 35 | 48 | 22 | 49 | 10 | 22 | 49 | 09 |       |    | 23 | 00    | 40  |
| 27   | Mar. 24 | E         | 13  | 03 | 48 |    | 13   | 09 | 22 | 13 | 13 | 40 | 13 | 26 | 50 |    |       | 14 | 24 | 42    |     |
|      |         | N         | 13  | 03 | 48 |    | 13   | 09 | 50 | 13 | 15 | 55 | 13 | 27 | 17 |    |       | 14 | 24 | 32    |     |
| 28   | Apr. 13 | E         | 10  | 19 | 17 |    |      |    |    |    |    |    |    |    |    |    |       | 19 | 29 |       |     |
|      |         | N         | 10  | 19 | 17 |    |      |    |    |    |    |    |    |    |    |    |       | 19 | 29 |       |     |
| 29   | do      | E         | i   | 15 | 39 | 30 | i    | 15 | 46 | 13 | 15 | 52 | 10 | 15 | 53 | 52 |       |    | 16 | 22    | 150 |
|      |         | N         | i   | 15 | 39 | 30 | i    | 15 | 46 | 13 | 15 | 52 | 10 | 15 | 53 | 52 |       |    | 16 | 22    |     |
| 30   | Apr. 19 | E         | e   | 3  | 32 | 51 |      |    |    |    |    |    |    |    |    |    |       | 4  | 28 |       |     |
|      |         | N         | e   | 3  | 32 | 10 |      |    |    |    |    |    |    |    |    |    |       | 4  | 17 |       |     |
| 31   | Apr. 29 | E         | e   | 2  | 46 | 20 |      |    |    |    |    |    | 2  | 48 | 18 |    |       | 2  | 56 | 14    |     |
|      |         | N         | e   | 2  | 45 | 42 |      |    |    |    |    |    | 2  | 47 | 25 |    |       | 2  | 55 | 18    |     |
| 32   | May 2   | E         | e   | 16 | 39 | 30 |      |    |    |    |    |    | 16 | 41 | 54 |    |       | 16 | 49 | 10    |     |

1 Trace amplitude.





HONOLULU MAGNETIC OBSERVATORY

Register of earthquakes—Continued

Table with columns: No., Date, Component, P (h, m, s), S (h, m, s), L (h, m, s), M (h, m, s), C (h, m), F (h, m), and A (μ). It lists various earthquakes from 1924, including their dates, magnitudes, and components (e.g., E, N, E, N, E, N, E, N, E, N).



57. Beginning lost in coda of preceding earthquake.  
 59. O at 12:55:18, distance 1,940 km.  
 60. O at 0:43:53, distance 6,000 km.; L<sub>2</sub> on E at 1:14:00. Interpretation doubtful.  
 61. O at 3:15:14, distance 4,800 km.; iL<sub>2</sub> on E at 3:34:05; L<sub>2</sub> on N at 3:35:00.  
 63. O at 11:13:47, distance 7,000 km.; L<sub>2</sub> on E at 11:49:20; M<sub>2</sub> on E at 11:43:40 and M<sub>3</sub> on E at 12:00:00; M<sub>2</sub> on N at 11:47:00.  
 65. O at 23:56:42, distance 6,820 km. Interpretation doubtful.  
 66. O at 13:38:18, distance 5,540 km.; SR<sub>1</sub> at 13:58:25 on E and 13:58:52 on N.  
 68. O at 14:17:40, distance 4,270 km.; PR<sub>1</sub> on N at 14:26:50; e on N at 14:32:40; L<sub>2</sub> and L<sub>3</sub> on N at 14:35:28 and 14:36:02, respectively; M<sub>2</sub> on E at 14:41:35.  
 69. SR<sub>1</sub> on both at 7:46:19; L<sub>2</sub> on N at 7:49:13. Interpretation based on Sitka record.  
 72. E record obscured by overlapping of traces.  
 73. E record obscured by overlapping of traces.  
 74. O at 15:07:49, distance 4,120 km.; e on N at 15:20:42; L<sub>2</sub> on E at 15:27:00; L<sub>2</sub> on N at 15:25:20.  
 80. N partly obscured by overlap. Distance, 5,325 km.  
 81. N record partly obscured by overlap. Distance, 8,430 km.  
 84. E record obscured by overlapping of traces.  
 85. SR<sub>1</sub> on E at 12:36:02.  
 86. N not recording on account of misplaced drum.  
 90. O at 23:15:11, distance 4,830 km. E record partly obscured by overlap.  
 92. O at 2:58:28, distance 6,360 km.; SR<sub>2</sub> at 3:21:23 on E and 3:21:30 on N; M<sub>2</sub> on E at 3:47; M<sub>2</sub> on E is an estimated value as the spot of light went off the paper in one direction. The motion was so rapid as a result of the large amplitude of the swing after S that L could not be picked out.  
 93. O at 2:46:45, distance 6,100 km.; e on both at 3:09:28; e on E at 3:12:28.  
 94. O at 9:26:53, distance 6,110 km.; e on N at 9:46:18; SR<sub>1</sub> on N at 9:49:37; e on E at 9:52:08; e on N at 9:52:00.  
 95. E record obscured by overlap.  
 96. O at 22:18:40, distance 6,025 km.  
 103. e on N at 8:47:11.  
 106. O at 1:21:01, distance 10,360 km.; e at 1:58:31 on E and 1:58:27 on N.  
 107. O at 3:29:28, distance 8,360 km.; PR<sub>1</sub> at 3:43:32 on E and 3:43:57 on N; PR<sub>2</sub> on N at 3:45:55; iPS on E at 3:51:28; e on E at 3:54:30; SR<sub>2</sub> on N at 3:59:59; e on E at 4:03:20.  
 108. Nothing definite on E.  
 109. O at 21:08:53, distance 5,510 km.; iL<sub>2</sub> on N at 21:31:25. Most of E record lost through overlapping of traces.  
 111. O at 0:04:18, distance 6,050 km.; PS on E at 0:22:04; SR<sub>2</sub> at 0:27:20 on E and 0:27:00 on N.  
 113. O at 21:38:10, distance 5,660 km.; SR<sub>1</sub> on N at 21:58:09. Most of E record lost through overlapping of traces.  
 116. Merely an irregular activity of the microseisms.  
 117. Activity on E barely perceptible.  
 118. Nothing on N.  
 120. No definite maximum.  
 122. Very slight.  
 128. SR<sub>2</sub> on both at 21:13:36; iL<sub>2</sub> on E at 21:29:22. Exact time of P on N doubtful on account of hour break.  
 130. L<sub>2</sub> on E at 2:12:34.  
 135. Heavy microseisms prevailing.  
 136. E-W component out of order.  
 137. e on N at 10:31:52; eSR at 10:37:21 on N and 10:38:08 on E; M<sub>2</sub> on N at 10:49:40.  
 139. E record obscured by overlapping of traces.  
 140. O at 10:31:04, distance 6,300 km.; e at 10:53:28 on E and 10:54:00 on N.  
 145. O at 16:20:05, distance 8,900 km.; SR<sub>2</sub> on E at 16:51:52; i on E at 16:55:21. N component not operating.  
 146. O at 20:01:19, distance 5,700 km.  
 147. E record obscured by overlapping of traces.  
 150. O at 19:54:12, distance 6,780 km.; L<sub>2</sub> at 20:25:27 on E and 20:24:27 on N. Preliminary phases difficult to distinguish because of microseisms. L<sub>2</sub> is the beginning of regular waves.  
 151. Light spot on N was off the paper because of tilt. P<sub>E</sub> may have been a few seconds earlier as the 15 seconds time break ended at the recorded time.  
 154. O at 16:11:18, distance 7,720 km.  
 159. O at 3:26:12, distance 3,320 km.  
 161. O at 9:52:10, distance 4,940 km.; PR<sub>2</sub> on both at 10:02:49. Interpretation doubtful. The phases tabulated as S and L are quite similar in character.  
 163. No definite phases. Slight indication of activity on E at 19:11:09. Evidently not far away.  
 167. O at 1:37:30, distance 9,620 km.; PS on E at 2:01:50; SR on E at 2:06:00. N not operating.  
 170. O at 15:45:09, distance 4,460 km.; e on both at 15:55:28; SR at 16:00:46 on E and 16:00:51 on N.  
 171. L<sub>2</sub> on E at 5:25:40. Damping ratios near 30:1 during July.  
 174. O at 2:41:01, distance 3,270 km.; L<sub>2</sub> on N at 2:58:22. Preliminary phases very weak.  
 176. E traces overlapping.  
 183. e on N a well-defined phase.  
 186. e on E at 14:57:50.  
 187. O at 4:55:13, distance 9,120 km.; PR<sub>2</sub> on E at 5:13:09; e on N at 5:17:04; PS on both at 5:18:40; SR<sub>2</sub> on E at 5:28:40; e on N at 5:30:26 and 5:33:08.  
 188. e on N at 5:53:30.  
 189. Damping ratios near 30:1 during August.  
 192. O at 6:12:12, distance 5,920 km.; SR<sub>2</sub> on E at 6:35:08; L<sub>2</sub> on N at 6:41:13. No definite maximum.  
 195. O at 18:02:24, distance 6,300 km.; SR on N at 18:25:04. Most of E trace obscured by overlap.  
 201. O at 14:32:38, distance 5,100 km.; L<sub>2</sub> on E at 14:54:42  
 202. e on N at 23:21:51; PS on N at 23:27:55; SR on E at 23:35:30; eSR on N at 23:35:50. Record weak; interpretation doubtful.  
 203. O at 3:05:05, distance 8,220 km.; PR on E at 3:21:30; PS on N at 3:26:51; SR on E at 3:31:26; eL<sub>2</sub> on N at 3:42.  
 204. E trace obscured by overlap. Damping ratios near 30:1 during September.  
 206. E record can not be distinguished from microseisms.  
 208. N record can not be distinguished from microseisms.  
 210. e on E at 14:29:44; L<sub>2</sub> on E at 14:41:20; L<sub>2</sub> on E may be major arc wave.  
 211. E not recording.  
 212. Damping ratios during October; E, aperiodic; N, 20:1.  
 215. e on N at 20:06:10; SR<sub>1</sub> at 20:11:00 on E and 20:10:50 on N; SR<sub>2</sub> at 20:11:54 on E and 20:11:54 on N; L<sub>2</sub> on E at 20:14:24.  
 216. Long swells continue intermittently for several hours. N-S traces overlap.  
 218. Damping ratios during November; N, aperiodic; E, 15:1.  
 219. SR<sub>1</sub> on E at 8:54:31; e on E at 8:56:33; SR<sub>2</sub> on E at 8:59:43. Interpretation uncertain; microseisms mask all phases on N.  
 222. E traces overlapping. Damping ratios during December, 20:1.  
 224. O at 22:54:18, distance 5,930 km.; e on E at 23:12:00; SR<sub>1</sub> at 23:15:40 on E and 23:15:26 on N; reported near Kushiro, Japan, at 22:55.

### MAGNETIC STORMS

Magnetic disturbances of considerable magnitude were recorded at the times tabulated below. When the storm began abruptly, the time is given to the nearest minute.

On the succeeding pages will be found reproductions of the magnetograms showing the principal magnetic storms. A storm selected for reproduction is indicated in the table by an asterisk after the date. An upward motion of the curves corresponds to decreasing east declination, increasing  $H$ , and decreasing  $Z$ .