No. 49. 1939.

# Geodætisk Institut

Proviantgaarden, Copenhagen, Denmark.

## Bulletin

of the seismological station

# KØBENHAVN

$\varphi = 55°41'$ N. $\lambda = 12°27'$ E. $h = 13$ m.

Lithologic foundation: chalk.

*No. 49. Jan.—Dec. 1939.*

Instruments:

Galitzin-Wilip seismographs.

Constants:

| Component | $l$ | $A_1$ | $T_1$ | $T$ | $k$ |
|---|---|---|---|---|---|
| | cm | cm | sec | sec | |
| $N$ | 12.5 | 100 | 12.59 | 12.4 | 103 |
| $E$ | 12.5 | 100 | 12.60 | 12 | 102 |
| $Z$ | 14.5 | 100 | 11.52 | 11 | 91 |

Damping was approximately aperiodic.

Wiechert 1000 kg. horizontal seismograph.

Wiechert 1300 kg. vertical seismograph.

Constants:

| Component | | $T$ | $v$ | $\varrho$ | $V$ |
|---|---|---|---|---|---|
| | | sec | | mm | |
| $N$ | $^1/_1$—$^{16}/_3$ | 8.9 | 3.2 | 0.5 | 210 |
| | $^{16}/_3$—$^{14}/_5$ | 9.4 | 4.7 | 0.2 | 135 |
| | $^{14}/_5$—$^{31}/_{12}$ | 9.3 | 4.7 | 0.5 | 180 |
| $E$ | $^1/_1$—$^{16}/_3$ | 8.9 | 3.4 | 0.4 | 215 |
| | $^{16}/_3$—$^{31}/_{12}$ | 9.2 | 5.2 | 0.5 | 215 |
| $Z$ | | 5.2 | 4 | 0.2 | 160 |

Milne-Shaw seismograph, $E$ component, with the approximate constants $T = 12^s$ $v = 20$ $V = 300$.

Benioff vertical seismograph, $T_1 = {}^1/_4{}^s$ $T = 1^s$.

The Galitzin-Wilip and Benioff seismographs were not recording from $^{25}/_8$ to $^{17}/_{10}$, and the Milne-Shaw seismograph was not recording from $^{25}/_9$ to $^{17}/_{10}$.

## København.

| No. | Date | Hour | Forerunners P or P′ | Forerunners S | | | L | △ | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | 1939 Jan. | | m s | m s | m s | m s | h m | ° | |
| 1 | 20 | 1 | e 29 49 | 34 0* | | | | | Somewhat uncertain owing to microseismic movement. Tripoli. |
| 2 | 20 | 14 | e 27 56 | | | | | | Possibly earlier; microseisms. Tripoli. |
| 3 | 20 | 20 | i 53 6 | 63 50 | *i* 53 7 | | | | |
| 4 | 23 | 2 | *e* 28 10 | 32 28 | i 28 14 | *i* 32 36 | | 24 | *eP* small, uncertain. Tripoli. |
| 5 | 24 | 4 | i 13 39 | | | | | | |
| 6* | 25* | 3 | 47.4 | | e 50 56 | 52 25 | | | Chile. |
| 7 | 27 | 20 | 14 22 | | | | 20 | | |
| 8* | 30* | 2 | i 37 23 | | 38 42 | 46 4 | 69 | | Felt in New Guinea. |
| 9 | 31 | 0 | i 8 55 | | 10 55 | 17.0 | | | $e_N$ $19^m.9$, $21^m16^s$, $26^m.2$. |
| | Febr. | | | | | | | | |
| 10 | 2 | 13 | i *i* 3 40 | | i 6 25 | i 9 13 | | | |
| 11* | 3* | 5 | | | 47.4 | | | | |
| 12 | 3 | 20 | i *i* 33 1 | | *i* 33 46 | | 1.5 | | |
| 13 | 6 | 7 | i 25 52 | | | | | | |
| 14 | 7 | 15 | | | e 1 15 | | | | |
| 15 | 9 | 2 | i 50 4 | | | | | | |
| 16 | 14 | 17 | | | i 32 6 | | | | |
| 17 | 16 | 19 | e *e* 3 3 | | i 3 4 | | | | |
| 18 | 24 | 5 | | | i 45 7 | | | | |
| | March | | | | | | | | |
| 19 | 8 | 22 | i 17 13 | | *i* 18 54 | | | | |
| 20 | 13 | 5 | i *i* 29 51 | | *e* 30 17 | | | | |
| 21 | 20 | 3 | - *i* 34 23+ | | 44.2 | 44 37 | 60 | | $e$ $45^m.4$. Japan. Masked by microseisms. |
| 22* | 21* | 1 | i 23 41 | 33 49 | 27 1 | 38.4 | | 81 | Indian Ocean. |
| 23 | 23 | 16 | *e* 40 21 | | 44.1 | 44 41 | | | i *e* $40^m27^s$, i *i* $40^m45^s$ large on B*Z*. |
| | April | | | | | | | | |
| 24 | 4 | 20 | e 31 31 | | | | | | First onset possibly $27^s$; microseisms. |
| 25* | 5* | 17 | *e* 2 3+ | | *i* 2 9 | *i* 5 6 | .7 | | Fiji Islands. |
| 26 | 6 | 4 | e 14 59 | 20 35 | 20 38 | | | | The time of *P* not quite certain; microseisms. Iran. |
| 27 | 10 | 11 | i 36 24 | | | | | | |
| 28 | 12 | 12 | i 34 13 | | | | | | |
| 29* | 18* | 6 | e *e* 37 3+ | | 41 16 | 47 34 | | | Chile. |
| 30* | 21* | 4 | i *i* 39 13— | *i* 47 29 | *e* 40 58 | *i* 41 53 | | | Sea of Okhotsk. |
| 31* | 23* | 16 | e *i* 33 16+ | *i* 41 34 | 35 31 | 45 27 | 49 | 61 | Atlantic Ocean. |
| 32 | 28 | 0 | i 38 58 | | | | | | |
| 33 | 28 | 14 | i 21 39 | | | | | | |
| 34* | 30* | 3 | 11.9 | | 14 37 | 16 34 | 48 | | Solomon Islands region. |
| | May | | | | | | | | |
| 35* | 1* | 6 | i *e* 10 8 | *i* 19 48 | | | | 76- | Japan. |
| 36* | 1* | 6 | i *i* 11 51+ | 21 34 | | | | 76 | « |
| 37* | 1* | 6 | i 14 31 | | | | | | « |
| 38 | 1 | 16 | i *e* 17 29 | 27 6 | 17 32 | | 43 | 75 | « |



## København.

| No. | Date | Hour | Forerunners P or P′ | Forerunners S | | | L | △ | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | 1939 May | | m s | m s | m s | m s | h m | ° | |
| 39* | 2* | 13 | e *e* 27 24 | | | | 49 | | California. |
| 40 | 4 | 4 | | | e 16 24 | | | | |
| | 6 | 6 | | | | | | | No Galitzin records. |
| 41* | 8* | 1 | *e* 53 9 | i 58 14 | 54 4 | | | 30 | Azores. |
| 42 | 9 | 7 | 39 27+ | 48 29 | | | | 69 | Pacific Ocean south of Alaska. |
| 43 | 10 | 7 | e 55 47 | 65 12 | *i* 55 48 | | | 73 | South of Aleutian Islands. |
| 44 | 13 | 13 | | | i 11 28 | i 12 0 | | | |
| 45 | 13 | 20 | | | i 5 57 | | | | |
| 46 | 14 | 18 | *e* 32 19 | | *e* 32 31 | | | | |
| 47 | 16 | 7 | i *i* 32 29+ | 42 34 | | | 1.0 | 80 | Riukiu Islands. |
| 48* | 17* | 18 | i *e* 43 36+ | | 47 17 | 54 7 | 76 | | Pacific Ocean. |
| 49 | 19 | 18 | | | 43.3 | 49 43 | | | *e* $50^m34^s$. |
| 50 | 19 | 19 | | | 0 8 | 2 4 | | | *e* $7^m.2$, $10^m.7$. |
| 51 | 20 | 9 | e *e* 39 3 | 42 7 | | | 44 | 17 | Albania. |
| 52 | 21 | 20 | i *i* 40 32 | | *e* 42 48 | i 43 16 | | | e $40^m28^s$. *e* $40^m31^s$. |
| 53 | 23 | 4 | e *e* 28 48 | | i 28 50 | | | | |
| 54 | 26 | 9 | e *e* 49 42 | 57 0* | i 49 48 | 60 42 | | 51 | |
| 55* | 27* | 3 | i *e* 56 23 | 65 3 | *i* 56 40 | 65 31 | 1.4 | 65 | Birma. Depth ca. 60 km. |
| 56 | 30 | 10 | e *e* 14 51 | 21 6 | *i* 16 32 | i 16 38 | | 41 | *SS* $23^m.9$. |
| 57 | 31 | 0 | e *e* 28 33 | 31 47 | 32.0 | 32.1 | 34 | 18 | Greece. *P* small. |
| | June | | | | | | | | |
| 58 | 2 | 3 | e *e* 46 55 | 58 15 | 50 57 | 57.5 | | | $e_Z$ $59^m41^s$. East of Mindanao. |
| 59 | 4 | 12 | | | 17 7 | | | | |
| 60 | 4 | 20 | i 37 10 | | | | | | |
| 61 | 5 | 23 | e 10 52 | | | | | | |
| 62* | 8* | 21 | *e* 6 5 | | *i* 6 46 | *i* 9 52 | | | Pacific Ocean. |
| 63 | 12 | 4 | i *e* 16 4 | 24 55 | 17 18 | 18 37 | 37 | 67 | i *i* $16^m12^s$. *e* $20^m10^s$. $26^m.1$. |
| 64 | 13 | 20 | *e* 53 40 | | 57 55 | 66 52 | 91 | | *SKS* $64^m16^s$. |
| 65 | 18 | 4 | i 4 8 | | | | 34 | | |
| 66 | 18 | 12 | e 32 21 | | | | | | |
| 67 | 18 | 16 | i *e* 58 39 | 68 58 | *i* 58 53 | | 1.4 | 83 | |
| 68 | 19 | 0 | e 50 37 | | i 50 42 | i 51 2 | | | |
| 69 | 22 | 19 | i *i* 28 33— | 36 2 | 30 32 | 39 28 | 44 | 53 | *P* (—0.8, x, —1.0; +2.1, x, +2.0). Atlantic Ocean. |
| 70 | 27 | 23 | - *e* 17 55 | | 21 54 | 22 29 | .8 | | East of Mindanao. |
| | July | | | | | | | | |
| 71 | 2 | 19 | *e* 54 23 | 63 48 | | | 1.3 | 73 | Pacific Ocean. |
| 72 | 4 | 18 | | | 40.7 | 44 45 | | | $49^m46^s$; $50^m24^s$; $50^m43^s$; $52^m.7$; $54^m25^s$. |
| 73* | 5* | 22 | i *i* 59 33— | | *i* 59 40 | *i* 61 57 | | | Deep focus. Fiji Basin. |
| 74 | 6 | 1 | | | i 24 25 | i 27 8 | | | |
| 75 | 7 | 3 | | | 17 51 | | .4 | | |
| 76 | 12 | 20 | i *i* 19 58+ | 29 25 | | | .8 | 73 | Pacific Ocean. |
| 77 | 12 | 23 | | | *i* 17 55 | 27 18 | 50 | | Some preceding movement. No G. *Z* record. |
| 78 | 13 | 17 | *e* 18 17— | | 28.5 | | 50 | | Pacific Ocean. |
| 79 | 14 | 8 | i *e* 42 46+ | 51 52 | | | 1.1 | 69 | Pacific Ocean. |
| 80 | 17 | 3 | | | i 48 47 | | | | |

## København.

| No. | Date | Hour | Forerunners P or P′ | Forerunners S | | | L | △ | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | 1939 July | | m s | m s | m s | m s | h m | ° | |
| 81 | 18 | 3 | e 38 1* | 47 15 | 47 19 | 48 34 | 57 | 71 | No G. Z record. $e$ 55m34s. Pacific Ocean. |
| 82* | 20* | 2 | i i 41 33— | | 44.0 | 48 11 | | | Fiji Basin. |
| 83 | 24 | 22 | i 9 53 | 13.9 | | | 17 | | Iran. |
| 84 | 25 | 3 | i i 44 51 | 48 28 | 48 32 | | 51 | 20 | Asia Minor. |
| 85 | 27 | 23 | i 38 45 | | | | 1.1 | | Pacific Ocean. |
| 86 | 31 | 13 | e 37 16 | | | | 44 | | Asia Minor. |
| | Aug. | | | | | | | | |
| 87 | 1 | 16 | e 6 54 | | i 6 57 | | 27 | | Pacific Ocean. |
| 88 | 2 | 1 | | | 10 31 | 10 57 | 26 | | 11mg8s; 17m.2. Some preceding movement. |
| 89 | 2 | 13 | e 10 42 | 14 17 | i 10 44 | 14 20 | 17 | 20 | $e_Z$ 14m25s. Asia Minor. |
| 90 | 3 | 2 | | | 48 3 | | 1.8 | | |
| 91 | 3 | 12 | e 37 17 | 41 0* | i 37 19 | i 37 22 | | 21 | i 37m35s. $P$ (—1.0, +1.0, —1.1; +4.6, —4.7, +4.6). Asia Minor. |
| 92 | 9 | 23 | e e 48 14 | 51 56 | | | 54 | 21 | Asia Minor. |
| 93 | 12 | 2 | i i 26 31 | | 27 15 | i 29 10 | | | i i 29m46s. $e$ 29m.9; 31m10s. New Hebrides. Deep focus. |
| 94 | 12 | 10 | e 1 27 | 10.9 | i 1 28 | i 1 46 | 27 | | |
| 95 | 16 | 17 | - e 19 51 | | 30.4 | 36.0 | | | Mexico. |
| 96 | 17 | 15 | | | i 57 27 | | 1.4 | | |
| 97 | 18 | 22 | e 35 17 | | i 35 30 | i 38 22 | 1.3 | | $i_{N,E}$ 39m5s. |
| 98 | 18 | 23 | | | e 0 21 | i 0 31 | | | i e 0m25s. |
| 99 | 19 | 1 | e 7.0 | | 9 52 | 10 35 | 50 | | |
| 100 | 21 | 15 | i e 30 32 | 39 55 | | | .9 | 72 | South of Aleutian Islands. |
| 101 | 22 | 0 | i e 18 16 | 28 3 | 21 10 | | 44 | 77 | Japan. |
| 102 | 23 | 4 | | | 55.7 | 59.7 | 1.7 | | |
| 103 | 25 | 4 | | | 8 24 | 14.0 | .7 | | 15m23s; 18m.1. |
| | Sept. | | | | | | | | |
| 104* | 8* | 12 | 16 10 | 25 38 | 18 54 | 29 32 | 35 | | Aleutian Islands. |
| 105 | 15 | 23 | 20 57 | 24 38 | 21 34 | | 27 | 20 | Asia Minor. |
| 106 | 18 | 0 | | | 17 31 | | | | Near Wien. |
| 107 | 19 | 3 | i 30 52 | 36 22 | | | | 34 | |
| 108 | 20 | 0 | | | | | | | No time-marks. |
| 109 | 21 | 12 | 49 28 | | 49 37 | | 57 | | |
| 110 | 22 | 0 | 40 59— | | 41 37 | 44.4 | 45 | | $e_E$ 44m39s, $e_N$ 44m43s. Asia Minor. |
| | Oct. | | | | | | | | |
| 111 | 10 | 18 | 43 51+ | 53 37 | | | 1.1 | 77 | Japan. |
| 112 | 15 | 14 | | | | | | | |
| 113 | 17 | 6 | 41 19+ | | 42 29 | 43.9 | 1.4 | | e 11m; small preceding movement. Italy. |
| 114 | 19 | 21 | 37 14+ | 40 53 | | | 44 | 20 | $e_Z$ 44m.0; 44m38s; $e_{N,E}$ 44m49s. New Hebrides. Deep focus. |
| 115 | 22 | 14 | | | 51 11 | | 1.3 | | |
| 116 | 24 | 14 | i 54 1 | | | | | | Preceded by small movement, 51m5s? |
| 117 | 26 | 1 | | | 16 6 | | .4 | | |
| 118 | 30 | 13 | | | 34 48 | i 35 18 | | | $e_N$ 35m.5; $e_Z$ 36m29s. $L$ small. |





## København.

| No. | Date | Hour | Forerunners P or P′ | Forerunners S | | | L | △ | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | 1939 Nov. | | m s | m s | m s | m s | h m | ° | |
| 119 | 4 | 10 | i e 22 10+ | 27 38 | i 22 16 | | | 34 | |
| 120 | 17 | 18 | i i 58 8— | | | | | | Large $Z$ record; no succeeding movement. |
| 121 | 18 | 1 | e 43 56 | 53 2 | 53 53 | 58.0 | 1.1 | 69 | |
| 122 | 21 | 8 | i e 54 10 | i 58 32 | | | | 25 | |
| 123* | 21* | 11 | i i 9 31+ | i 15 44 | i 10 18 | 10 40 | | 44 | Hindu Kush. |
| | Dec. | | | | | | | | |
| 124 | 5 | 8 | e i 42 51+ | 53 28 | 46 10 | 53 10 | 67 | | $SS$ 59m.0. $SSS$ 63m.1. |
| 125 | 7 | 11 | i e 27 53 | i 37 16 | | | 51 | 73 | |
| 126 | 16 | 10 | i i 58 3 | i 67 28 | i 58 4 | i 68 40 | 80 | | $P$ (— 3.5, — 2.1, + 9.5; + 5.0, + 4.0, — 11,8). Deeper than normal. Kurile Islands. |
| 127 | 21 | 21 | e 7 24 | | | | | | |
| 128 | 21 | 21 | e e 14 19 | | 17.7 | 18 35 | | | Large earthquake. Later phases not clearly marked. Celebes. |
| 129 | 25 | 12 | e 58 24 | | | | 65 | | |
| 130* | 27* | 0 | i i 2 33 | 7.0 | i 2 35 | 3 0* | | | Destructive in Anatolia. |
| 131 | 27 | 0 | e 55 52 | | | | | | |
| 132 | 27 | 2 | i 53 34 | | | | | | |
| 133 | 27 | 22 | e e 39 5 | 43 15 | | | | 24 | |
| 134 | 28 | 2 | e 28 16 | | | | | | |
| 135 | 28 | 3 | i 30 20 | 34.4 | i 34 33 | | | | |
| 136 | 28 | 10 | i 39 6 | | | | | | |
| 137 | 29 | 11 | e 38 48 | 43.2 | | | | | |

## NOTES

No. 6. Jan. 25. $3^h$. Destructive in Chile; △ = ca. 120°. Deeper than normal. No Galitzin *Z* record. *P* $47^m.4$ read on Wiechert *Z*, quite small, uncertain. *eP'* $50^m56^s$. *e* $52^m.0$. *PP* $52^m25^s$. *e* $54^m39^s$. *SKS* $57^m34^s$ and *e* $59^m3^s$ large on *N* and *E*. e $61^m34^s$; *e* $61^m40^s$ large. *ee* $65^m15^s$. *L* about $80^m$; periods of more than 1 min.

No. 8. Jan. 30. $2^h$. Felt in New Guinea; △ = ca. 125°. *iP'* $37^m23^s$, *ii P'* $37^m26^s$. *PP* $38^m42^s$; $39^m0^s$. $e_Z$ $40^m0^s$. $e_E$ $40^m36^s$. *SKKS* $46^m4^s$, *e* $48^m37^s$. $e_Z$ $48^m.9$. $e_{N,E}$ $49^m0^s$. $e_{N,E,Z}$ $50^m23^s$. $e_E$ $51^m17^s$; $52^m.5$. $e_Z$ $54^m43^s$. $e_N$ $55^m.6$; $e_E$ $55^m.9$. *e* $57^m.3$, $59^m.7$.

No. 11. Febr. 3. $5^h$. No Galitzin *Z* record. *PP* $47^m.4$. *e* $48^m.8$; $52^m.8$; $e_N$ $57^m.7$. *e* $59^m.0$; $63^m.9$. $e_N$ $64^m40^s$.

No. 22. March 21. $1^h$. Indian Ocean. *iP* $23^m41^s$, *iP* $23^m45^s$; *i* $23^m54^s$. *PP* $27^m1^s$; *PPP* $29^m2^s$. $iS_N$ $33^m49^s$; $i_E$ $34^m6^s$; $i_{N,E}$ $34^m27^s$. *SS* $38^m.4$. The oscillations following *S* have periods of about 1 min.

No. 25. April 5. $17^h$. Fiji Islands; △ = ca. 140°. $e_ZP'$ $2^m3^s$; i $2^m8^s$; $i_Z$ $2^m9^s$. *iPP* $5^m6^s$; i $5^m44^s$. $iPKS_{N,E}$ $5^m50^s$. $e_N$ $7^m.0$. *PPP* $8^m.6$. *SKKS* $12^m.1$. $e_{N,E}$ $13^m.7$. $SKSP_N$ $15^m.2$. *PPS* $17^m22^s$. *SS* $23^m.5$. $e_N$ $27^m.9$.

No. 29. April 18. $6^h$. Chile; △ = ca. 110°. *eeP* $37^m3^s$ small. $e_E$ $37^m31^s$. $PP_Z$ $41^m16^s$; *e* $41^m30^s$. *PPP* $43^m.9$. $SKS_E$ $47^m34^s$; *e* $48^m.0$; $SKKS_E$ $48^m34^s$. $e_N$ $49^m.2$, $49^m.6$. *PS* $50^m52^s$; $i_{N,E}$ $51^m15^s$.

No. 30. April 21. $4^h$. Sea of Okhotsk. Depth about 500 km. *ii*$_Z$*P* $39^m13^s$. i $39^m52^s$. *epP* $40^m58^s$. *ee*$_Z$ $41^m44^s$; *iisP* $41^m53^s$. *eePP* $43^m34^s$. $e_Z$ $47^m.4$. *iS* $47^m29^s$ and *i* $48^m18^s$ large on *N* and *E*. *e* $50^m.6$; $e_E$ $51^m18^s$; *e* $52^m.0$. *L* small.

No. 31. April 23. $16^h$. Atlantic Ocean. *ei*$_Z$*P* $33^m16^s$; i $33^m21^s$. $e_N$ $33^m45^s$. $PP_Z$ $35^m31^s$. $PPP_N$ $37^m.0$. $iS_{N,E}$ $41^m34^s$ large. $e_N$ $42^m33^s$. $e_{N,E}$ $43^m20^s$, clearly marked on *E*. *SS* $45^m27^s$.

No. 34. April 30. $3^h$. Solomon Islands region; △ = ca. 130°. Very large earthquake. Phases marked by groups of waves, most onsets not well defined. *eP* $11^m.9$ quite small. *eP'* $14^m30^s$, *ee*$_Z$ $37^s$, $e_Z$ $58^s$. *PP* $16^m34^s$, *ee* $55^s$. $e_{N,E}$ $17^m.7$. $e_Z$ $18^m5^s$. $e_E$ $19^m.2$; $e_Z$ $19^m.4$. *e* $20^m.1$, $20^m.4$, $21^m.7$. $e_Z$ $23^m.9$. *ee* $24^m2^s$. *PS* $26^m.9$, *PPS* $28^m.2$. $e_E$ $30^m.5$, $e_Z$ $31^m.4$, $e_E$ $32^m.0$. *SS* $33^m.9$.

Nos. 35/7. May 1. $6^h$. Japan. 3 shocks. *P* onsets very well defined on B.*Z*. *ieP*$_I$ $10^m8^s$, small and uncertain on G.-W. and Wi. instruments. *e* $10^m.3$. *iiP*$_{II}$ $11^m51^s$; *ii* $11^m56^s$. *e* $13^m.0$. *iP*$_{III}$ $14^m31^s$; $i_Z$ $14^m37^s$. *e* $16^m.3$. $iS_I$ $19^m48^s$. $e_Z$ $20^m.1$. $eS_{II}$ $21^m34^s$. $S_I$ and $S_{II}$ large and well defined. $e_Z$ $22^m.4$. $e_N$ $22^m50^s$. *e* $24^m.0$; $24^m.4$; $25^m.4$; $26^m.4$. $e_E$ $28^m.2$, $28^m.8$. *L* $31^m$.

No. 39. May 2. $13^h$. California; △ = ca. 85°. *eeP* $27^m24^s$ quite small; i $27^m34^s$. $e_Z$ $28^m26^s$, $29^m17^s$; ie $30^m32^s$. $e_{N,E}$ $37^m.8$. $e_N$ $37^m51^s$; $i_E$ $37^m57^s$. *e* $39^m.0$. $e_N$ $40^m56^s$, $e_E$ $41^m6^s$. *e* $43^m.1$, $46^m.0$.

No. 41. May 8. $1^h$. Azores. Deeper than normal? $e_Z$ $53^m9^s$ quite small; e $53^m10^s$, i $11^s$. $e_{N,E}$ $i_Z$ $53^m12^s$. *e* $54^m4^s$. $e_E$ $55^m27^s$. *ee* $55^m42^s$. $e_E$ $57^m.7$. *iS* $58^m14^s$ large. $e_Z$ $58^m26^s$.

No. 48. May 17. $18^h$. Pacific Ocean; △ = ca. 90°. *ieP* $43^m36^s$ quite small on Galitzin records. *iePP* $47^m17^s$ rather large. *SKS* $54^m7^s$; $e_N$ $54^m55^s$. *PS* $55^m38^s$, *PPS* $56^m.2$. *SS* $60^m.8$.

No. 55. May 27. $3^h$. Birma. Depth about 60 km. *ieP* $56^m23^s$ small. *iipP* $56^m40^s$ large on B.*Z*. *PP* $59^m.0$. *PPP* $60^m56^s$. *S* $65^m3^s$. $e_N$ $65^m31^s$, $i_E$ $65^m37^s$. *e* $66^m.6$. *e* $69^m.3$; $e_N$ $69^m46^s$, $e_E$ $69^m55^s$. *SSS* $72^m.9$.

No. 62. June 8. $21^h$. Pacific Ocean; △ = ca. 140°. Deep focus. *eP'*$_Z$ $6^m5^s$ and e $6^m10^s$ small; $i_Z$ $6^m15^s$, $i_Z$ $6^m46^s$. $e_N i_Z$ $9^m7^s$. $i_{N,E}$ $9^m52^s$. *e* $10^m.4$, $10^m36^s$. *e* $15^m31^s$, $16^m.8$, $17^m.6$. *e* $19^m18^s$. *e* $21^m.3$. $e_E$ $22^m41^s$; $e_E$ $27^m17^s$.

No. 73. July 5. $22^h$. Fiji Basin; △ = ca. 145°. Deep focus. *iiP'* $59^m33^s$ small; *ii* $59^m40^s$ large. $i_Z$ $61^m57^s$; i $62^m14^s$, $62^m18^s$. *e* $63^m0^s$; $65^m13^s$; $66^m.3$. $e_N$ $68^m.8$. *e* $72^m.3$; $74^m.6$; $75^m.3$. $e_E$ $81^m2^s$; $e_E$ $84^m57^s$. *L* small.

No. 82. July 20. $2^h$. Fiji Basin; △ = ca. 145°. Deep focus. *iiP'* $41^m33^s$ very large on B.*Z*. e$_Z$ $44^m.0$. i $44^m13^s$. *e* $44^m50^s$; $48^m11^s$, $48^m.9$. $e_N$ $50^m45^s$. *e* $55^m11^s$; $58^m21^s$.

No. 104. Sept. 8. $12^h$. Aleutian Islands. Deeper than normal. $eP_Z$ $16^m10^s$, $e_N$ $16^m12^s$, $i_Z$ $16^m17^s$. $i_Z$ $16^m50^s$. $PP_Z$ $18^m54^s$. $e_{Z,N}$ $20^m.8$. $e_N$ $24^m15^s$, $25^m.5$. $S_E$ $25^m38^s$ very large; $S_N$ $25^m42^s$. *e* $26^m.4$, $27^m.0$. $e_E$ $29^m32^s$. $L_E$ $35^m$, $L_N$ $37^m$. *L* not large.

No. 123. Nov. 21. $11^h$. Hindu Kush. Large earthquake. Depth about 220 km. *iiP* $9^m31^s$ ($x$, −8.0, +10.8; $x$, +15.0, −18.3). $e_N$ $9^m51^s$. *iipP* $10^m18^s$; *sP* $10^m40^s$ larger. $e_N$ $11^m2^s$. *PP* $11^m20^s$. *pPP* $11^m.9$. *sPP* and $sP_cP$ $12^m17^s$ very large on *Z*. $e_N$ $12^m40^s$. *iS* $15^m44^s$. $e_{N,E}$ $17^m3^s$; *sS* $17^m.2$ large. $S_cS$ and *SS* $19^m.1$; $19^m.3$ very large.

No. 130. Dec. 27. $0^h$. Destructive in Anatolia. Dilatation. *iiP* $2^m33^s$, i $2^m35^s$. After the $3^m$ time-break very large oscillations; a second, larger shock? *eS* $7^m.0$, *i* $7^m9^s$ very large. L very large.





## Seismometric readings; Notation

*P* — normal first preliminary tremors, longitudinal waves.
*P*+ — first wave condensational (away from the epicentre).
*P*− — first wave dilatational (towards the epicentre).
*P*(±a, ±b, ±c) — a, b and c are trace amplitudes in mm. of first swing on NS, EW and vertical component Galitzin records respectively. + indicates ground motion directed to N, to E or up, — indicates ground motion to S, to W or down. When a second set of amplitudes is given it refers to the second swing. If an amplitude is not measurable the number is replaced by x.
*PP*... — longitudinal waves reflected at the earth's surface.
*S* — normal second preliminary tremors, transverse waves.
*SS*... — transverse waves reflected at the earth's surface.
*PS*; *PPS*; ... — waves reflected at the earth's surface which travel partly as longitudinal, partly as transverse waves.
*SKS* — waves which traverse the mantle as transverse waves but are refracted through the core with longitudinal oscillation.
*PKS* — waves which pass the mantle on one side of the core as longitudinal waves, on the other side as transverse waves and are refracted through the core with longitudinal oscillation.
*SKKS* — waves which traverse the mantle as transverse waves, are refracted through the core with longitudinal vibration and are reflected on its inner boundary.
*L* — long, or surface, waves; main phase.
*M* — waves of greatest amplitude in the surface waves.
i, *i* — sharply defined beginning of a phase as recorded on Benioff seismograph and other seismographs respectively.
e, *e* — gradual beginning of a phase as recorded on Benioff seismograph and other seismographs respectively.
△ — arcual distance from the station to the epicentre.
*) affixed to time of phase indicates that the beginning is in a time-mark.
*) affixed to number and date refers to Notes.