No. 13. 1930.

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. 13. Jan.—March 1930.

Instruments:

Galitzin pendulums with galvanometric registration.

Constants:

Component	l	T_1	A_1	μ^2	T	k
	cm	sec	cm		sec	
N	12.5	12.63	100	0.15	12.6	105
Z	14.4	11.55	100	0.2	8	95

Wiechert 1000 kg. horizontal seismograph.

Wiechert 1300 kg. vertical seismograph.

Constants:

Component	T	ν	ϱ	V
	sec		mm	
N	9.6	4.3	0.8	225
E	9.6	4.4	0.4	195
Z	5.6	4.2	0.2	165

Milne-Shaw seismographs, N and E components, with the approximate constants $T = 12^s$ $\nu = 20$ $V = 300$.

Wood-Anderson torsion seismometers, N component, $T =$ c. 11^s; E component, $T =$ c. 4^s; working intermittingly.

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No.	Date	Hour	Forerunners P	Forerunners S	Forerunners	Forerunners	L	Undefined	△	Remarks
	1930 Jan.		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
1*	5*	1	30 49	39 49			.9		67	Sea of Okhotsk.
2	5	19	3 50	13.3			.5		72	Kurile Islands.
3	7	1					.3			
4	7	17					.9			
5	10	18					.9			
6	14	22			24.1		1.1			
7	16	0			7.3		.2			
8	17	17					.7			
9	18	7			23.5		.9			
10	23	3						.6		
11	23	11						7		
12	25	2					.4			
13	28	7					.3			
	Febr.									
14	1	19					.7			
15*	2*	15	7 26	16 46*	11.9	21.7	.5		71	Aleutian Islands.
16	5	1					.1			
17	7	7					.5			Faint forerunners.
18	7	9					.4			
19	7	13					.5			Faint.
20	7	16			58 20		1.3			
21	8	0						53		Faint.
22	8	4						.0		„
23	8	5		30 8			36			Kurdistan.
24	8	6		43 35			51			Afghanistan.
25	12	6					1.7			Faint forerunners disturbed by microseisms.
26*	14*	18	42 50							Aegean Sea.
27	14	21			0 47		1.1			
28	15	19					.4			
29	18	2			14.5	24.5	.8			
30	18	7					.3			
31*	23*	18	23 18	26 50			28		19	Aegean Sea.
32	24	21			9	14 36	.7			
33	26	3					.2			
34	27	3					.6			
35	28	1		16 20			.4			Atlantic Ocean.
	March									
36	1	6					.0			
37	6	0			0.0					Not very distant.
38	6	3		53 3						*L* faint.
39	6	8					32			
40*	6*	9		27 21	23 45	27 51	31			Archipelago.
41	6	15			55.1	70.5	1.8			
42	7	6					.9			
43	7	11					.6			
44	8	3			58.2	68 10	1.4			
45	9	10					.4			

København.

No.	Date	Hour	Forerunners P	Forerunners S			L	Undefined	△	Remarks
	1930 March		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
46	10	14					.5			
47*	10*	16	37 31	45 41	39 39	46 28			60	Sea of Okhotsk.
48	15	4					.8			
49	15	7					.9			
50	15	9			22.7		27			
51	16	5					.8			
52	20	14					.0			
53	22	9					.5			
54	23	20					.0			
55*	26*	7	26 37				1.0			Timor.
56	26	11						45		Superposed on following shock.
57	26	12					.5			
58	30	1					.2			
59	30	8			.9		1.2			Disturbed.
60	30	15			38.5	47.8	1.3			
61*	31*	12	37 56	41.3			44			Aegean Sea.

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NOTES

No. 1. Jan. 5. 1^h. Sea of Okhotsk. Phases not clearly marked; disturbed by microseisms. *L* irregular.

No. 15. Febr. 2. 15^h. Aleutian Islands. *PP* 10^m12^s; *PPP* $11^m.9$, stronger. *S* followed by much movement, but other phases not clearly marked. *M* regular.

No. 26. Febr. 14. 18^h. Aegean Sea; $\triangle$ = c. 20°. Destructive in Crete. Strong microseismic movement. Light too faint on *GN*; *WN* indistinct owing to bad smoking. The beginning of *P* small; on *Z* increase of movement 43^m10^s; large oscillations i_Z 43^m23^s; 43^m53^s. On *E* some increase of movement 46^m22^s (*S* or microseisms?); 46^m42^s (*S*); 46^m50^s* very large oscillations on all; on *E*, *i* 47^m22^s, large. *L* irregular, smaller than *S*, the beginning uncertain. Deep focus?

No. 31. Febr. 23. 18^h. Aegean Sea. This earthquake seems to belong to the same epicentral region as no. 26, but the difference in the seismograms is striking. In this case *P*, *S* and *L* are distinct and clearly separated phases. There are no further phases; *L* is much larger than the forerunners.

No. 40. March 6. 9^h. Archipelago. Possibly some disturbance due to work at the station. *P* faint; 22^m53^s* on *WZ* not quite certain. 23^m12^s certain on *WZ*, but on *GZ* first discernible movement 23^m17^s. *S* more clearly marked; *L* faint.

No. 47. March 10. 16^h. *P* very faint, visible on *WZ* only. *PP* clearly marked on *GN* and *Z*. *S* a large oscillation, followed on *N* by clearly marked phase. *L* irregular, the beginning uncertain.

No. 55. March 26. 7^h. Timor. $\triangle$ = c. 110°. Phases clearly marked. *P'* $30^m.3$; *PP* 31^m17^s; *e* 32^m8^s; *PPP* 33^m24^s; *e* $35^m.5$; $\overline{S_cP_eS_E}$ $37^m.4$; $\overline{S_cP_eP_eS_E}$ $38^m.2$; *S* 38^m56^s; *PS* $40^m.5$; *SS* c. $46^m.5$; *SSS* c. $50^m.4$. *L* earliest on *N*; of long duration.

No. 61. March 31. 12^h. Aegean Sea; $\triangle$ = c. 20°. Recorded on Wiechert and Wood-Anderson instruments only. *S* a distinct phase, but the beginning uncertain. *M* irregular.

BIANCO LUNO A/S, KØBENH.

No. 14. 1930.

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. 14. April—June 1930.

Instruments:

Galitzin pendulums with galvanometric registration.

Constants:

Component	l	T_1	A_1		μ^2	T	k
	cm	sec	cm			sec	
N	12.5	12.63	100		0.15	12.6	104
E	12.5	12.69	100	$^9/_4$—$^{17}/_5$	0.1	12	100
				$^{24}/_5$—$^{30}/_6$	0.05	12.5	100
Z	14.4	11.55	100	$^1/_4$—$^9/_4$	0.2	8	95

E was remounted on April 9th.
Z was dismounted on April 9th and remounted on June 19th; in June the constants were undetermined.

Wiechert 1000 kg. horizontal seismograph.

Wiechert 1300 kg. vertical seismograph.

Constants:

Component	T	ν	ϱ	V
	sec		mm	
N	9.7	4.4	0.8	223
E	9.5	4.5	0.5	195
Z	5.6	4.3	0.2	160

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

København.

No.	Date	Hour	Forerunners P	Forerunners S			L	Undefined	△	Remarks
	1930 April		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
1	2	5					.2			
2	2	20					.8			
3	4	9			46		1.4			Disturbed.
4	5	11	35.8	45			1.0			Kamtchatka.
5	9	5	33 5	37 16			43		24	Armenia.
6	10	14			39.1		45			
7	15	10			9 22		.3			
8	15	10			56.0		1.5			
9	16	4					.7			
10	16	13	50 18	54 46			57		26	Overlapped by following shock.
11	16	14					8			
12	16	14			51.3		1.1			
13	17	2					.4			
14*	17*	20	11 4	14 41					20	Greece.
15	18	13					.3			
16	20	10			30.3		.6			
17	20	16			44.9		1.5			
18	21	10			41.1		.9			
19*	21*	12			11.1	16 23	.7			Atlantic Ocean.
20	21	19					31			
21	21	22					.6			
22	22	14					.9			Faint.
23	23	18		47 42			1.0			
24*	23*	22	0 26	9 57	14.8	18	.4		72	
25	24	0			35 8		1.0			Forerunner on *Z*.
26	25	11					.8			
27	25	15					.7			Faint preceding movement.
28	26	7					.1			
29	26	11					.6			Faint.
30	26	16					.1			„
31*	26*	16	29 42	39 5	43.9				71	Aleutian Islands.
32	27	10					.8			
33	27	14			43.2	50.6	1.2			
34	27	16					.7			
35	27	21			56	65.9	1.5			
36	28	13			27		.5			Overlapped by following shock.
37	28	14					.1			
38*	28*	18	45 30	54 23	49 37	58 43*			66	China.
39	29	9					.1			
40	30	16			25 19		1.1			
	May									
41	1	1	9 56	19 48	12 56		.6		76	Japan.
42	1	5					.0			
43	1	10			.5		.8			
44	2	2			4		.7			
45	2	6			21 4	24 36	1.0			
46	3	16					.6			
47*	5*	13	57 22	66 39					70	Burma.
48	6	7			10		18			Armenia.

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No.	Date	Hour	Forerunners P	Forerunners S			L	Undefined	△	Remarks
	1930 May		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
49*	6*	22	*i* 40 14	45 0					29	Persia.
50	7	6					.0			
51*	7*	9					.7			
52	7	13					63			Some preceding movement.
53	7	14			37 1					
54	8	5			40 5		45			Persia.
55	8	13			6	11.9	.7			Overlapped by next shock.
56	8	13			59		1.6			„ „ „ „
57	8	15						17		„ „ „ „
58*	8*	15	41 16	*i* 46 0	41 59	47.5			29	Armenia.
59	8	23					.5			
60	8	23			43		52			
61	9	2					.0			
62	9	7	12 43*	17 6	18.1		23		26	Mediterranean Sea.
63	9	8						.2		
64	9	14					.8			
65	9	21					23			
66	10	0					.8			
67	10	21			54.1		59			
68	10	22			34		.9			
69	11	0					15			
70	11	11					.9			Faint preceding movement.
71*	11*	22	43 34	49 52	45.3	50 11			42	Persia.
72	12	0	28 59	35.1			.7		41	„
73	12	13					.2			
74	12	22					.9			
75	13	1					.2			Faint.
76	13	8			39.4		1.0			Disturbed.
77	13	18					.7			
78	13	20					.7			
79	14	0						6		Italy.
80	14	12						.6		Faint.
81	14	19			52 59		1.1			
82	16	2					.9			Overlapped by next shock.
83	16	3					.3			
84	16	20					.9			
85	18	0			.6		1.0			
86	19	3			.6		1.1			
87	19	15	16 7	26 12	26 57		.8		79	
88	20	8			10		.6			
89	20	11	26 25	35 38	40.6		.8		69	Aleutian Islands. Disturbed.
90	21	12					.5			
91	21	14						.1		
92	21	21					.2			
93	21	22	15 20	20.4			24		31	Atlantic Ocean.
94	23	0					.7			
95	23	9			55		64			
96*	23*	16	50 4	59 55	60 7	65	.3		76	Japan.
97	24	22						8		
98	26	16					.5			

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No.	Date	Hour	Forerunners P	Forerunners S			L	Undefined	△	Remarks
	1930 May		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
99	26	22			59		1.2			
100	27	13					.2			
101	27	17						.1		Faint.
102	29	3						.2		"
103	29	17						25		Armenia.
104	31	10			.7		1.0			
105	31	18	10 18	20 6	25.0		.6		76	Japan.
	June									
106	1	3					.5			
107	1	13			28.9	37.8	1.3			Faint preceding movement.
108	1	21					.9			
109	3	18			19.4		.6			
110	4	7	33 58	38 40					28	Persia.
111	4	10			8.8	14 17	.8			Disturbed.
112	5	12			6.0		.7			
113	5	17					.1			
114	5	22	3 24	7.6			11		24	Mediterranean Sea.
115	9	4					47			
116*	11*	1			10 3	19 39				Salomon Islands.
117	11	11					.3			
118	11	14					.5			
119	13	1	5 27	15.0			.5		73	
120	15	8					.9			Disturbed.
121	15	21			27.7	50.5	1.2			
122	17	20						34		
123	18	16					.5			
124	19	13			31.5		1.0			2 shocks acc. to *URSS*.
125	21	22					.0			
126	22	18			57.3	62.6	1.3			
127	23	19			54.5	64.6	1.5			
128	25	1					.3			
129*	25*	10	31 35	43 16	42 14	44.8	1.0			Peru.
130	25	12	17 1	25 50	26 53		.6		66	
131	25	13					.7			
132*	25*	21			*i* 27 32					
133*	25*	21	35 31	47 15	46 15	48.7	1.1			Peru.
134	26	4					.7			Faint.
135	28	19					.9			
136	30	0					.5			

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NOTES

No. 14. April 17. 20^h. Greece. First movement faint; increase 11^m6^s and 11^m8^s. *S* large and clearly marked; *L* shortly after *S* 21^m large *M*.

No. 19. April 21. 12^h. Atlantic Ocean. $\triangle$ = c. 110. *PP* $11^m.1$, faint, on *GN* only. $\overline{S_cP_cS}$ 16^m23^s; *e* $17^m.7$; *PS* $20^m.4$; *SS* $26^m.8$; *SSS* $31^m.1$. *L* earliest on *E*; regular.

No. 24. April 23. 22^h. First movement faint, on *Z* only; P_N 0^m28^s. On *E*, the first part of *L* is a group of long-period, regular waves of relatively large amplitude.

No. 31. April 26. 16^h. *P* and *S* clearly marked. *P* reflections faint. *S* followed by much movement, 40^m5^s clearest marked impulse. The first part of *L* irregular; after 17^h regular *M* waves.

No. 38. April 28. 18^h. China. Not strong record, but all phases, including *L*, have very clearly marked beginnings. *L* irregular begins $67^m.7$ on *N*, on *E* $71^m.6$; *M* group on *N* about $71^m.5$.

No. 47. May 5. 13^h. Burma. Very strong record. Condensation. *P* reflections not clearly marked: PP_E $60^m.0$; PPP_E $61^m.9$. *S* begins earliest on *N*; S_E 66^m49^s. After *S* large oscillations; best defined impulses: 67^m29^s, sharpest on *E*; e_E $68^m.2$; e_N $68^m.6$; e_N $69^m.2$; e_N $70^m.7$; e_E $72^m.7$; e_N $73^m.2$. Large irregular oscillations continue into *L*. On *N* a group of very large *M* waves begin 87^m; on *E* and *Z*, *M* waves begin 91^m; several groups of large waves.

No. 49. May 6. 22^h. Persia. Very strong record. *P* begins faintly, dilatation, increases *i* 40^m20^s; 40^m41^s; *i* 41^m1^s, followed by large oscillations. e_E $42^m.2$. *S* largest on *E*; $i_{N,Z}$ 45^m23^s, followed by very large movement. i_E $46^m.6$; i_N (*L*) $47^m.6$. On *N*, very large *M* group begins $50^m.0$; M_E some minutes later.

No. 51. May 7. 9^h. Some long-period disturbance which continues until about 21^h makes the reading of this and the following records uncertain.

No. 58. May 8. 15^h. Armenia. *S* largest on *E*; followed by movement of long period. The beginning of *L* not certain; *M* earliest on *N*.

No. 71. May 11. 22^h. Persia. Small, but phases clearly marked. e_E $53^m.6$; e_N (*L*) $54^m.7$; e_E (*L*) $55^m.5$.

No. 96. May 23. 16^h. Japan. *P* just visible, on *Z* only. *S* and the next phase clearly marked, each by a large oscillation. The following movement small.

No. 116. June 11. 1^h. Salomon Islands; $\triangle$ = c. 120°. *PP* 10^m3^s, clearly marked; *PPP* $12^m.5$; *PS* 19^m39^s; *e* 19^m45^s; *e* 21^m18^s; *SS* 27^m9^s. About 2 min. after *SS* series of regular waves begin, of the appearance of *L* waves. *L* begins about $1^h.7$ with less regular waves of longer period; *M* about $2^h.0$.

No. 129. June 25. 10^h. Peru; $\triangle$ = c. 100°. Record not strong, but phases clearly marked. The beginning of *P* not quite certain owing to disturbance of the *Z* record. *PP* $35^m.6$. S_cP_cS on *E* only, 42^m14^s; S_n, best marked on *N*, 43^m16^s. PS_E $44^m.8$ i_Z 45^m33^s; *SS* $50^m.4$. *L* earliest on *N*; regular, of long duration.

No. 132. June 25. $21^h27^m32^s$, large oscillation on *Z* followed by very small movement, lasting a few minutes only.

No. 133. June 25. 21^h. Peru; $\triangle$ = c. 100°. Stronger than no. 129; same phases recorded. *PP* $39^m.6$; $\overline{S_cP_cS_E}$ 46^m15^s; S_n 47^m15^s; PS_E $48^m.7$, e_Z 49^m35^s; *SS* $54^m.3$. *L* earliest on *N*; regular, of long duration.

BIANCO LUNO A/S, KBHVN

No. 15. 1930.

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. 15. July—Sept. 1930.

Instruments:

Galitzin pendulums with galvanometric registration.

Constants:

Component	l	T_1	A_1		μ^2	T	k
	cm	sec	cm			sec	
N	12.5	12.63	100		0.15	12.6	105
E	12.5	12.69	100		0.1	12.6	100
Z	14.4	11.55	100	from $^5/_9$	—0.1	10	95

Z was recording regularly, but the temperature compensation was adjusted and therefore the constants were undetermined until Sept. 5th.

Wiechert 1000 kg. horizontal seismograph.

Wiechert 1300 kg. vertical seismograph.

Constants:

Component	T	v	ϱ	V
	sec		mm	
N	9.7	4.6	0.7	223
E	9.6	4.6	0.6	194
Z	5.7	4.2	0.2	160

Milne-Shaw seismographs, N and E components, with the approximate constants $T = 12^s$ $v = 20$ $V = 300$

Wood-Anderson torsion seismometers, ($^7/_1$—$^9/_9$), N component, $T =$ c. 11^s; E component, $T =$ c. 4^s.

København.

No.	Date	Hour	Forerunners P	Forerunners S			L	Undefined	△	Remarks
	1930 July		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
1	1	1	20 17	29.5	22.9	33.7	.7		73	
2	1	20						.2		Seismic?
3*	2*	21	14 4	22.4	16 38	26.3			61	Tibet.
4	3	0	29 32	37 45			52			„ . *P* uncertain.
5	4	5					.3			
6	4	21						.2		
7	4	22					.2			Faint.
8	5	18			16 55		.9			
9	5	23			20.6		24			Faint preceding movement.
10	7	13			56.3		1.2			
11	7	20					.6			
12	8	10					.3			
13	8	17					.6			
14	9	4						.8		
15	10	13						.1		Faint.
16	10	20						15		„
17	11	7			25 46	30.1				
18	13	1			34 50		1.2			
19	13	14					.1			
20	13	14			19.2		.6			
21*	13*	19	*i* 37 8	45 8	40.3	48.9	.9		58	China.
22	14	20			55.6		1.1			
23*	14*	22	53 14*		63 44	68.0				Central America.
24	16	3					.7			
25	17	14	46 41	56 39			.3		77	Disturbed.
26	17	18					.9			Faint.
27	19	15						.7		„
28	19	23			49.9		1.0			
29	20	11					.2			
30	20	15					.4			
31	21	14			28 33					
32	22	12					.0			
33*	22*	19	37 10	46 25	42.1		1.0		70	Kurile Islands.
34*	23*	0	12 6	15 3					15	Italy.
35	23	5						38		„
36	23	14					1			„
37	23	18						10		Faint.
38	23	19					.4			
39	24	8						.5		Faint.
40	24	12					12			
41	24	15					.2			Faint.
42	24	21					.0			
43	25	19	52.0	56.5			61			
44	25	22					.2			
45	27	15			24.4		.8			
46	27	19	11 24		14.7	21 57	.7			
47	28	17						.2		Faint.
48	28	18			.4	28.5				
49	29	6	36.9		39.9	46.8	1.0			*P* faint, time not certain.
50	31	0						29		

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No.	Date	Hour	Forerunners P	Forerunners S	Forerunners	Forerunners	L	Undefined	△	Remarks
	1930 July		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
51	31	5						32		
	Aug.									
52	1	0					.9			
53	2	3			17 8					
54*	2*	16			26.2		1.3			
55	2	23					.4			Faint.
56	3	2					.5			"
57	3	22			11 41		.5			
58*	4*	5	16 47							
59	4	12					.5			
60	4	16					.7			
61	5	0			31.1	32.9	.9			
62	5	23			32 15		36			Aegean Sea.
63	6	8					.1			
64	8	0					.5			
65	9	18			14 47*	19.2	23			
66	9	20					.6			
67	9	22					.1			
68	9	22			58.3		64			
69	10	1					.1			
70	13	5					.9			
71	13	6					.8			
72	13	21			46.9		1.1			
73	17	9			50 28		1.2			
74	17	12	37 12	43 28	39 1	46.8			42	Persia.
75*	18*	10	8 40*		13 22	19 8	41			Atlantic Ocean.
76	19	5					.9			
77	19	18					.4			
78*	20*	21	6.3	16 21			31		78	Formosa.
79	21	7			7.0		11			
80	21	11					.4			
81	21	15					.8			Faint.
82	22	0			53 58		59			
83	22	10						8		
84*	23*	11	1 2	7 16	2 47	10.6			42	Persia.
85	23	15						.5		Faint.
86	24	10					.2			Forerunners disturbed.
87	24	11					.4			Superposed on preceding shock.
88	27	15			.2		.9			
89	29	7					.8			
90	29	9					.1			Preceding movement disturbed.
91	29	20			23		.6			
92	31	4					.3			Faint.
	Sept.									
93	1	5			37.8		.9			
94	1	17	52 10	59 22	54.1	63		69	51	Himalaya.
95	2	16					.6			
96	2	19	6 7	11 54			20		38	Persia.

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No.	Date	Hour	Forerunners P	Forerunners S			L	Undefined	△	Remarks
	1930 Sept.		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
97	5	16			34.9		42			Persia.
98	7	11					8			
99	9	11					.5			
100	10	15						.1		Faint.
101	10	23					.2			„
102	11	3					.6			„
103	11	4					.5			
104*	11*	12	*i*41 41	45 49	41 48		49		24	Asia Minor.
105	11	17		34 13	30.0	37.7				Hindu Kush.
106	12	8	22.9				30			Archipelago.
107	12	9		30.6			33			„
108	12	13						42		
109	13	18					.6			
110	13	20	10 13	13 49			16		20	Mediterranean Sea.
111	13	23			37		1.4			
112	14	3			21.1		1.3			
113	14	17			32 11	35 30	1.3			
114	16	0						.2		
115	17	3					.9			
116	17	17			17.2		.4			
117	20	13					.5			
118*	21*	23	15 7	23 58	19 13*	28.3	.6		66	China.
119*	22*	1			51 15*		1.9			
120	22	5		14 38			.5			China.
121*	22*	14	29 50	38 27	38 55	42.7	.9		64	Assam.
122	22	16		40 37	36.0	43.7				Turkestan. Disturbed.
123	22	21					.8			
124	23	6					.9			
125	23	10			25		.6			
126	23	12					.7			
127	24	0			1.7		.5			
128	24	3					.9			
129	24	8					.5			
130	24	12			31.0		.9			
131	24	16					.7			
132	25	12					.7			
133	25	17					.5			
134*	25*	18			26.5	30 29				
135	25	19					.2			Burma.
136	29	13			44 32		.9			
137	30	21			41.9		1.3			

No. 3. July 2. 2
again 14m
by increas
earliest or
about 36m
No. 21. July 13.
No. 23. July 14. 2
on *E*, abo
regular, of
No. 33. July 22. 1
possibly o
No. 34. July 23.
and increa
No. 54. Aug. 2. 16
No. 58. Aug. 4. 5h
means of
23m44s. (*S*
Z also. e_E
No. 75. Aug. 18.
e_E 18m20s.
SS 28m.9;
No. 78. Aug. 20. 2
No. 84. Aug. 23. 1
uncertain;
No. 104. Sept. 11. 1
No. 118. Sept. 21. 2
SS 28m.3,
No. 119. Sept. 22.
duration.
No. 121. Sept. 22. 1
following p
No. 134. Sept. 25. 1
the less re

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NOTES

No. 3. July 2. 21^h. Tibet. Strong record. The beginning of *P* not large, condensation; on *E* and *Z* sharp impulse 14^m15^s, and again 14^m19^s, followed by large oscillations. On *N* increase of movement 14^m35^s. *S* not sharp on *E*, about $22^m.4$, followed by increasing oscillations; on *N* a definite beginning 22^m31^s and an impulse 22^m55^s, followed by larger movement. *L* begins earliest on *N*, 33^m, with waves of very long period (movement of shorter period superposed); *M* c. 40^m. On *E*, *L* begins about 36^m; c. 46^m a small group of large oscillations on *E* and *Z*.

No. 21. July 13. 19^h. China. *P*, condensation, and *S* well-defined phases. *M* earliest on *N*, irregular.

No. 23. July 14. 22^h. Central America. *P* small, in minute-break. *PP* about $56^m.3$. S_cP_cS (?) begins 63^m44^s on *N*, less clearly on *E*, about $63^m.7$; on *E* well marked impulse 63^m55^s, S_n (?); simultaneous increase of movement on *N*. *L* c. 75^m, regular, of long duration.

No. 33. July 22. 19^h. *eP*, 37^m10^s, not quite certain; *iP*, 37^m11^s, large oscillation; condensation; followed by irregular movement, possibly other phases. *S* and following phases: 47^m6^s, $48^m.0$, best marked on *E*.

No. 34. July 23. 0^h. Italy. *P* read from *W-A E*, on other records in minute-break. *S* earliest on *E*; 15^m15^s *S* begins on *N* and increases on *E*. Very large *M*, on *E* shortly after *S*, on *N* about $1^1/_2$ min. later.

No. 54. Aug. 2. 16^h. Small, but following phases clearly marked: e_Z $26^m.2$; $e_{E,Z}$ $30^m.5$; $e_{E,Z}$ $30^m.9$; e_E 37^m24^s; e_E $40^m.9$.

No. 58. Aug. 4. 5^h. Very clearly marked forerunners and no main phase. It does not seem possible to identify the phases by means of the ordinary time-curves and it is presumably a deep focus shock. P_Z 16^m47^s; $(pP)_{E,Z}$ 19^m3^s, stronger; $e_{E,Z}$ 23^m44^s. (*S*) 26^m18^s and (*SP*) 27^m0^s, both very clearly marked on *N* and *E*, the latter phase the stronger and recorded on *Z* also. $e_{E,Z}$ $28^m.3$; $(sS)_E$ $30^m.7$; $e_{N,E}$ $31^m.1$; e_N 33^m43^s; e_N $35^m.6$; e_E $37^m.2$; e_N $39^m.4$.

No. 75. Aug. 18. 10^h. Atlantic Ocean; $\triangle$ = c. 115°. No *GE* record. *P* and *P'*, $12^m.6$, small; *PP* 13^m22^s sharp and large. e_E 18^m20^s. $\overline{S_cP_cS}$ 19^m8^s, $S_cP_cP_cS$ 20^m25^s, both clearly marked on *N* and *E*; S_E $21^m.6$; *PS* 23^m10^s clearly marked. *SS* $28^m.9$; *SSS* $33^m.2$. *M* regular, largest on *N*.

No. 78. Aug. 20. 21^h. Formosa. Forerunners small. *L* begins very clearly with waves of long period. A large *M* group on *N*.

No. 84. Aug. 23. 11^h. Persia. Stronger than no. 74 from the same epicentral region. *S* clearly marked. *L* irregular, the beginning uncertain; no pronounced *M* groups.

No. 104. Sept. 11. 12^h. Dilatation. Phase division very clear. *L* late, *M* almost at beginning.

No. 118. Sept. 21. 23^h. First forerunners small; PP_Z 17^m40^s; *PPP* 19^m13^s**. *S* well marked, but the beginning not sharp. e_N $25^m.2$; *SS* $28^m.3$, large on *E*; *SSS* $31^m.4$. *L* irregular; a large *M* group on *N*.

No. 119. Sept. 22. 1^h. P'_Z 51^m15^s, in minute-break; later forerunners distinct, but phases not clearly marked. *L* regular, of long duration.

No. 121. Sept. 22. 14^h. Assam. Wiechert records only. *P* clearly marked on *Z*, condensation; followed by impulse 30^m7^s. *S* and following phases clearly marked on *N*, hardly visible on *E*.

No. 134. Sept. 25. 18^h. Forerunners read on *Z*; seem to belong to a distant shock, the regular *L* waves of which are seen after the less regular, but larger *L* waves of the next shock.

No. 16. 1930.

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. 16. Oct.—Dec. 1930.

Instruments:

Galitzin pendulums with galvanometric registration.

Constants:

Component	l	T_1	A_1	μ^2	T	k
	cm	sec	cm		sec	
N	12.5	12.63	100	0.15	12.6	105
E	12.5	12.69	100	0.1	12.6	100
Z	14.4	11.55	100	—0.1	10	95

Wiechert 1000 kg. horizontal seismograph.
Wiechert 1300 kg. vertical seismograph.

Constants:

Component	T	ν	ϱ	V
	sec		mm	
N	9.7	4.6	0.7	223
E	9.6	4.6	0.5	194
Z	5.7	4.2	0.2	160

Milne-Shaw seismographs, N and E components, with the approximate constants $T = 12^s$ $\nu = 20$ $V = 300$
Wood-Anderson torsion seismometer, E component, $T =$ c. 4^s, recording intermittingly.

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No.	Date	Hour	Forerunners P	Forerunners S	Forerunners	Forerunners	L	Undefined	△	Remarks
	1930 Oct.		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
1	1	3					.6			
2	1	14					.7			
3	2	1			.0	6.0	.5			
4	2	10			22.7		.7			
5	2	15		45 13			.9			Persia.
6	3	19					.1			
7	4	0					.0			
8	5	19					.7			
9	7	21		5.0			12			Persia.
10	7	23						31		The Alps.
11*	8*	10			38.6	41.4	1.3			
12	9	22					.0			
13	10	0		56 57*			1.2			Burma.
14*	11*	3	*i* 10 49	14 28	14 46		15		20	Greenland Sea.
15	12	15					29			
16	13	20					.2			
17	15	10					.1			
18	15	22					.0			Faint.
19	16	22					.3			
20	17	9			6.0	13.0	.6			Disturbed.
21	19	11					.9			Faint.
22	21	19			17 10		.4			
23	22	19					.2			
24	23	9			35		1.1			Disturbed.
25	24	0						59		Faint.
26	24	11		3.6	7.3		.2			Gulf of Aden.
27*	24*	20	28 37	39 51	32 34	39 12	1.0		97	Marianne Islands.
28	25	12	13 37				.6			Alaska.
29	25	16			45.1		.9			
30	25	17			58.1		.2			
31	25	23					.8			
32	26	7					21			Not very distant.
33	26	7					38			" " "
34	26	22					.9			
35	27	23			44.8		.9			
36*	28*	21	24.0		27 48	34 23	.9			Marianne Islands.
37*	30*	7		18 35	18 45					Italy.
38	31	11			.0		.4			Strong microseisms.
39*	31*	23	*i* 16 48	*i* 16 55						
	Nov.									
40	3	19					.7			Faint preceding movement.
41	4	5					.3			
42	4	15	48.9	57 52			1.2		67	Burma.
43	7	6	1 53	6.0			9		24	Caucasus.
44	8	3		*i* 44 46	39 20					
45*	9*	19			27.3		.9			
46	10	14			.2		.7			Disturbed.
47	12	19					.9			
48	17	12			45		1.0			

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No.	Date	Hour	Forerunners P	Forerunners S	Forerunners	Forerunners	L	Undefined	△	Remarks
	1930 Nov.		*m s*	*m s*	*h m s*	*m s*	*h m*	*h m*	°	
49*	21*	2	4 11	7 26			9		17	Adriatic Sea.
50	22	15			.0		.4			
51	24	4					.2			Faint preceding movement.
52	24	6						31		
53*	25*	19	14.9	24 52	18 1	30.0	.7		78	Japan.
54	26	16					.2			
55	28	7			48.9	56 30	1.3			
56	30	1					.0			
57	30	22			.0		.2			
	Dec.									
58*	2*	7					.6			Burma.
59*	3*	19	3 12	12 30	5 52				70	„
60	6	7			24.3		.6			
61	8	7					.0			
62	8	8	13.2	23 19			.7			*P* small.
63	8	17			41.5	65.0	1.7			
64	9	20					.1			
65*	10*	10	36.7	40 58						Armenia.
66	11	9					.7			
67	12	3					.5			
68	13	15					.0			
69	15	16						43		
70	16	19						36		
71	20	14					.7			
72	21	12					.9			
73*	21*	15	3 36	13 44	6.9	15.0			79	Formosa.
74	22	0					.6			Superposed on next shock.
75	22	0					.8			
76	22	5					3			
77	23	6					.1			
78	23	22					.5			Small preceding movement.
79	24	0					.6			
80	24	6			.6		.8			
81	25	12					45			
82	25	13			20		.9			
83	30	19					.2			

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NOTES

No. 11. Oct. 8. 10^h. New Hebrides region; $\triangle$ = c. 135°. Distinct forerunners, but phases not clearly marked. Much microseismic movement. The first *L* waves have periods of more than 1 min.

No. 14. Oct. 11. 3^h. Greenland Sea NW. of Jan Mayen. The record is of an unusual appearance. *P* (condensation) and the following oscillations (period c. 6^s) are relatively very large, on the records, in all components, larger than *S*. On *E*, *S* is clearly marked by a somewhat irregular movement beginning 14^m28^s. On *N* the second forerunner begins 14^m46^s with a few regular oscillations. *L* waves of long period shortly after *S*; in *M* the period about 18^s.

No. 27. Oct. 24. 20^h. Marianne Islands; $\triangle$ = 96°.5. *P* small, readable on *Z* only. e_Z $31^m.8$; *PP*, 32^m34^s, large and sharp; e_Z $33^m.5$; e_Z 34^m54^s. S_cP_cS 39^m12^s, *PS* 41^m15^s, *SS* 46^m20^s, all large and sharp.

No. 36. Oct. 28. 21^h. Marianne Islands. *P* small, the reading uncertain; *PP* 27^m48^s well marked. ($\overline{S_cP_cS}$) 34^m23^s, small; *PS*, $37^m.0$, larger; *SS*, $41^m.7$, well marked.

No. 37. Oct. 30. 7^h. Italy. $\triangle$ = c. 12°. *P* very faint, perhaps $16^m.2$; *L* large, earliest on *E*.

No. 39. Oct. 31. 23^h. 55°17′ N. 12°46′ E. Felt in Denmark and Sweden.

No. 45. Nov. 9. 19^h. N. of New Guinea; $\triangle$ = c. 110°. Phases not clearly marked; disturbed by strong microseisms. First discernible movement about $27^m.3$. Clearest marked impulses: e_E 34^m46^s; e_N 34^m53^s; e_E 36^m54^s; *e* $42^m.4$. *L* begins earliest on *N* with waves of long period.

No. 49. Nov. 21. 2^h. *P* and *S* small; masked by microseisms; the readings not quite certain.

No. 53. Nov. 25. 19^h. Japan. *P* begins very faintly about $14^m.9$, larger movement 14^m59^s. *PP* c. $17^m.9$, large impulse 18^m1^s. *S* followed by much movement. *M* large.

No. 58. Dec. 2. 7^h. Burma. Forerunners masked by strong microseismic movement: *P* c. $12^m.4$; *S* c. $21^m.3$.

No. 59. Dec. 3. 19^h. Burma. Very strong record. Seconds in readings hardly reliable owing to strong microseismic movement. *PP* 5^m52^s; *PPP* 7^m50^s, stronger. *S* large and followed by large oscillations. *SS* c. $16^m.4$. On *E* movement of longer period begins about 18^m and increases into very large oscillations about 21^m; then follows smaller movement; large *L* waves of period of more than 1 min. begin about 26^m. On *N*, *L* waves of long period begin about 20^m; very large *M* between c. 30^m and 38^m; on *E* largest *M* later and considerably smaller.

No. 65. Dec. 10. 10^h. Armenia. The beginning of *P* not sharp. *S* large. The beginning of *L* uncertain, c. 45^m.

No. 73. Dec. 21. 15^h. Formosa. The beginning of *P* faint, the reading not quite certain; *iP* 3^m39^s, a large oscillation. *L* irregular, small, the beginning uncertain.

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