No. 51. 1941.

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. 51. Jan.—Dec. 1941.

Instruments:

Galitzin-Wilip seismographs.

Constants:

Component	l	A_1	T_1	T	k
	cm	cm	sec	sec	
N	12.5	100	12.59	12.7	104
E	12.5	100	12.60	12–13	104
Z	14.5	100	11.52	9	90

Damping was approximately aperiodic.

Wiechert 1000 kg. horizontal seismograph.

Wiechert 1300 kg. vertical seismograph.

Constants:

Component	T	ν	ϱ	V
	sec		mm	
N	9.2	4.5	0.4	180
E	8.7	4.5	0.5	210
Z	5.3	5	0.2	160

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

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

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No.	Date	Hour	Forerunners P or P′	Forerunners S			L	△	Remarks
	1941 Jan.		m s	m s	m s	m s	h m	°	
1	5	19			11 20	13 39			
2	9	18	i e 18 4		20 52		23		Asia Minor.
3	11	8	e i 40 20 —	46 42	40 44	47 8		42	
4	13	16	e 43.4		e 46 56	47 48			48^m0^s. $53^m.5$. 54^m33^s. 57^m51^s. $64^m.0$. $68^m.5$. △ = ca. 120°.
5	17	12	e 46 35				68		
6	20	3	e 42 26	i 46 49	47 7		50	25	i i P 42^m28^s. P (+ 3.3, — 4.0, + 3.5; — 7.0, + 7.9, — 8.0). Deeper than normal. Cyprus.
7	21	12	i e 52 5	60 31	62 5	64 40		62	
8	24	15	e e 46 10	54 30	54 37			61	Atlantic Ocean.
9	25	23			e 53 53				
10	27	2	i i 40 30 +	48 59	50 29	53 5		63	
11	29	7			i 6 44				
	Febr.								
12	4	12	e 7 46				36		
13	4	14	i i 15 31 —		17 43	21 21			25^m11^s, 48^s. 27^m5^s. 28^m26^s. $29^m.6$. 30^m52^s. Mindanao. Deep focus.
14	4	19	i 17 4						
15	7	12	i 16 22						
16	7	12	i 31 35						
17	7	12	i 36 38						
18	7	14	e 28 58						
19	7	15	i e 24 17	33.2	33 34			67	
20	8	14	i 29 57						
21	8	19			i 10 27	i 12 44			
22	9	4	i i 27 50 +				.9		
23	9	9	i e 56 3	65 57	56 28	59 4		78	$70^m.9$. California.
24	9	19			e 38 17	45 48			47^m15^s. $50^m.0$.
25	11	14	e 48 21		51 40	58 47	77		59^m9^s.
26	16	16	- i 46 29	52 29	53 40			39	
27	22	19	i 33 29						
28	23	10	e 7 7						
29	25	5			56 45				
30	28	23	i 57 43		i 57 56				
	March								
31	1	3	i e 56 54	60 12	i 60 19		61	18	Larissa, Greece.
32	11	21	i e 56 39		59 24	66 28			
33	12	14	i e 28 23	38 8	31.2		54	76	
34	12	21	i e 48 40	58 28			77	77	Japan.
35	14	14	i e 42 33	52 21			70	77	Japan.
36	15	5	e e 58 56		69 24		83		
37	16	7	i e 53 38 +	62 53	63 5		76	71	Kamchatka. P (— 1.1, x, + 2.2; + 2.0, x, — 2.9).
38	16	16	e e 39 13 —	42 25	i 39 17	42 34	43	18	North of Palermo.
39	16	18	e e 52 24	55 42			57	18	
40	16	21	i 5 57	14 58			.5	68	

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No.	Date	Hour	Forerunners P or P′	Forerunners S			L	△	Remarks
	1941 March		m s	m s	m s	m s	h m	°	
41	17	23	i 40 36						
42	19	2	i e 56 44				85		
43	21	8	e e 8 16	16 39				62	P not quite certain. Atlantic Ocean.
44	28	21			27 8				
	April								
45	1	10	i e 52 2	61 3*	54 35	61 19		68	$65^m.6$. Alaska.
46	3	15	e 35 11		39 25	i 45 33			46^m22^s; 46^m40^s. 48^m18^s. $53^m.7$. Chile.
47	4	22	e 8 33		15 1*		23		P small, uncertain.
48	7	23	e e 41 10		41 17	43 58			50^m57^s; 51^m10^s. Mexico.
49	14	19	i 40 25						
50	15	19	i i 22 44 —		33 11	34 28			Mexico.
51	15	19	e 58 51						Mexico.
52	19	8	i e 3 23 +	11 17				57	Tibet.
53	20	17	i e 46 13 —	i 52 28	47 44	55.3		41	Pamir Mountains.
54	26	23	e e 18 45	25 0	20 19	27 55	33	41	» »
55	27	13	e e 6 23	10 25	i 10 35			23	Anatolia.
56	30	9	i e 57 54	68 4*				81	
57	30	22	i 57 29						
	May								
58	5	15	i e 29 1						Manchukuo.
59	6	17	i e 3 15	9 30	4 50		18	41	
60	8	10	e e 40 11						
61	9	5	e 45 42		56.1				
62	9	9	i e 44 3						
63	13	16		23 44			.6		California.
64	14	8	e e 40 31 —	43 57			45	19	Asia Minor.
65	15	4	i 7 17						
66	16	1	e e 32 4	35 31			37	19	Asia Minor.
67	16	7	e e 25 41	34 46	35 47	39 16	46	69	42^m24^s.
68	17	2	e e 44 7		46 22	48 15			$63^m.8$.
69	23	19	e e 56 42 —	60 39	i 56 45		63	22	Asia Minor.
70	23	22	e e 39 0	43 1*			45	23	» »
71	26	14	i 47 48						
72	30	17	e e 49 22		i 49 24				
73	30	21	e e 47 16		50 17				
74	31	5	e e 15 31						
	June								
75	5	2	i 52 4						
76	6	21	e 6 28				11		
77	10	20	e e 45 20		i 45 22				
78	16	10	i 43 51						
79	17	2	i 42 53						
80	18	11	i i 14 55 +	19 26	i 15 17	i 20 4		26	21^m25^s. P (x, + 5.0, + 5.8; x, — 4.6, — 6.1). Atlantic Ocean.
81	26	12	i i 3 40 —	13 1*	4 2*	6 46		72	8^m35^s. 13^m14^s; 13^m50^s. $18^m.5$. Bay of Bengal. Great earthquake.
82	27	17	i e 23 54	33 57	35 32				Mexico. Deep focus.

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No.	Date	Hour	Forerunners P or P′	Forerunners S			L	△	Remarks
	1941		m s	m s	m s	m s	h m	°	
	June								
83	30	16	e e 46 48	57.1				83	
84	30	18	i e 35 13	44 47	i 35 25			74	Bay of Bengal.
	July								
85	3	7			30 54	37 5			$38^{m}0^{s}$. $40^{m}.5$; $40^{m}53^{s}$.
86	6	0	i *i* 46 43 —	*i* 56 49	57 37	62.1		80	Argentina.
87	7	22			49 3*				
88	13	15	e 44 3	47 55	*e* 44 7	e 44 14	50	22	Asia Minor.
89	14	2			23 42		.7		
90	15	14	- *e* 57 20	67 8			86	77	Japan.
91	17	22	e e 13 59		i 14 4	18.3			
92	18	15	i 43 26						
93	19	15	e e 25 16	35 10	25 26			78	Japan.
94	21	16	*e* 46 27	54 50			66	62	
95	23	9	i 42 1						
96	23	21	*i* 17 33		28 3		46		
97	24	14	e *i* 4 54	14 58				80	
98	30	2	i *i* 1 51 +	*i* 10 22	i 2 0	11 43		63	$14^{m}42^{s}$. Alaska.
	Aug.								
99	1	3	e e 57 29	65 8				55	
100	2	12	e *i* 1 15 +		*i* 1 23	2 3			$5^{m}8^{s}$. $9^{m}48^{s}$. $14^{m}48^{s}$. $18^{m}52^{s}$. $20^{m}21^{s}$. $25^{m}.0$. Kermadec Islands.
101	4	11	*e* 4 34	13 40	*i* 13 54			69	Aleutian Islands.
102	6	6	i *i* 25 57 —	*i* 34 53	26 37	35 43			Alaska. Deep focus.
103	8	22	e 12 25		*e* 12 30				
104	9	15	*e* 32 21	36 19			38	22	
105	9	15	e *e* 39 7	43.1			45	22	
106	9	22	i *e* 29 28	38 51	39 12		1.0	72	Bay of Bengal.
107	13	1	i *e* 3 30		i 3 34				
108	14	2			7 54	8 36			
109	15	6	e *i* 17 55 +	24 40	19 56	*i* 24 45		46	Atlantic Ocean.
110	19	16			31 32	41 17			
111	19	17	*e* 59 39		62 11	63 9			
112	20	8			*i* 40 3				
113	24	17	i 30 7		i 30 20				
114	28	0	i 25 13	30 33				33	
115	30	9	*e* 49 11		53 42	60 27	1.4		$67^{m}47^{s}$.
116	30	13			24 24				
117	31	4	e *e* 33 3						
	Sept.								
118	1	6	i *i* 34 19						
119	4	10			41 57	46 39	1.2		$47^{m}24^{s}$. $48^{m}10^{s}$, 50^{s}. $52^{m}0^{s}$. $54^{m}.5$.
120	5	17	i 18 36						Region of New Britain.
121	5	23	i 32 51	41 56				69	East of Kamchatka.
122	7	0	e *e* 54 53 +				59		
123	9	7	i *i* 38 39 +		40 5	42 0*			$45^{m}25^{s}$; $46^{m}18^{s}$. $49^{m}49^{s}$; $51^{m}.9$. $56^{m}.9$.
124	10	21	i *i* 59 32	64 4	59 51	64 12		26	

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No.	Date	Hour	Forerunners P or P′	Forerunners S			L	△	Remarks
	1941		m s	m s	m s	m s	h m	°	
	Sept.								
125	12	7	*e* 16 18		20 45	28 15			$30^{m}0^{s}$. $34^{m}.7$. $36^{m}.0$.
126	13	18	*e* 28.0		31 33	38.9			$40^{m}.0$.
127	14	4			33 45	36.6			
128	16	21	e *e* 58 54		i 59 2	59 22			$59^{m}.6$. $62^{m}53^{s}$. $73^{m}.0$. $78^{m}.0$. $82^{m}.5$.
129	17	7	*e* 1.5		2.6	5 46			$6^{m}45^{s}$. *i* $11^{m}40^{s}$. $12^{m}44^{s}$. $14^{m}10^{s}$. $15^{m}49^{s}$. $17^{m}.1$. $19^{m}.4$. $19^{m}.9$. $20^{m}.3$. $23^{m}.6$. $27.^{m}9$. Deeper than normal. Celebes Island region.
130	18	13	e *e* 27 42		28 7	31.8	57		$32^{m}13^{s}$. *i* $38^{m}16^{s}$. $39^{m}0^{s}$. $40^{m}27^{s}$. $41^{m}3^{s}$. $46^{m}.0$. Deeper than normal. Peru.
131	21	22	e *e* 45 3	48 50			51	21	
132	24	1	i *i* 12 34 +	*i* 21 49	15 13	16 59	34	71	$23^{m}17^{s}$. $26^{m}.0$. Kamchatka.
133	29	2	*e* 42 18	47 10				29	
	Oct.								
134	3	16	i *e* 25 6	35 1*	39 57	43 57		78	California.
135	5	10	30 45		33 45	34 15			$34^{m}29^{s}$. $34^{m}40^{s}$.
136	8	5	e *e* 36 57		47 20	47 31	69		Costa Rica.
137	8	7	e *e* 4 58	9.0			14	23	
138	8	15	e 34 54				57		
139	8	16	i 2 23						
140	18	23	i 27 29						
141	31	6			50 52	52.1	1.1		
	Nov.								
142	4	2	e 45 12						
143	5	13	*e* 24 51						
144	5	17	*e* 51 52		e 51 55	55 29	1.4		$57^{m}.4$. $62^{m}24^{s}$. $63^{m}49^{s}$. Philippine Islands.
145	6	7	e 24 53						
146	8	23	e *e* 51 12		55.1	55 26	1.3		$56^{m}0^{s}$. $61^{m}43^{s}$; $62^{m}13^{s}$; $62^{m}53^{s}$. $63^{m}21^{s}$. $69^{m}.5$. Celebes Sea.
147	12	10		14 20					*P* disturbed. Deeper than normal. Anatolia.
148	18	16	i *e* 58 26	68 23	61.4	63.3		79	$64^{m}35^{s}$. $69^{m}.2$. $73^{m}29^{s}$. Japan.
149	20	15			49 0*				
150	20	20	e 6 9						
151	20	21	i 37 39						
152	24	22	e *i* 6 6 +		*i* 6 13	9 52			
153	25	15			e 31 59		1.0		
154	25	18	i *i* 9 47 +	14 34	15 9			28	*S* difficult to read, not quite certain. Very strong shock. Amplitudes in *P* (+ 2.1, + 7.9, + 5.0; — 4.9, — 8.5, — 10.5) measured on Wiechert records. Atlantic Ocean; felt in Portugal.
155	27	8	e 55 8		64.0				
156	28	3	i *i* 30 51						Felt in Jutland, Denmark.
157	28	12	e 31 6		37 18	38 30			$40^{m}26^{s}$. $40^{m}.7$. Deep focus.

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No.	Date	Hour	Forerunners P or P′	Forerunners S			L	△	Remarks
	1941 Dec.		m s	m s	m s	m s	h m	°	
158	2	5	e 9 16				16		
159	5	20	e *i* 59 41 +		i 59 44	*i* 60 5			$62^m.7$. 63^m40^s. 70^m22^s. 70^m43^s. $75^m.4$. Costa Rica.
160	5	21	e 46 53						
161	6	19	e 8 7						
162	6	21	*e* 37 33		e 38 11	41 0			48^m7^s; 48^m54^s.
163	8	3			7 46		.6		
164	13	6	i *i* 20 49 —	24 48			27	22	
165	16	19	i *i* 31 54 +	42 0	34.9	47.0		80	Formosa.
166	26	15		*i* 8 34	12.8	16.3			
167	27	18	e *i* 22 51 +	27 20			30	26	Atlantic Ocean.
168	31	17	- *i* 41 51		60 36				

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Seismometric readings; Notation

P — normal first preliminary tremors, longitudinal waves.
P+ — first wave, as recorded on Galitzin or Wiechert instruments, condensational (away from the epicentre).
P— — first wave, as recorded on Galitzin or Wiechert instruments, 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.
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.