

MINISTRY OF PUBLIC WORKS, EGYPT

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PHYSICAL DEPARTMENT

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Royal Observatory Helwan

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**SEISMOLOGICAL AND MAGNETIC REPORT**  
**FOR THE YEAR 1940**

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*Director of the Observatory*

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## INTRODUCTION

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The seismological Service in Egypt is carried out at Helwan Observatory, a section of the Physical Department, under the direction of the Ministry of Public Works.

A Milne-Shaw East West component seismograph had been in use since November, 1921, replacing the two Milne instruments which had been previously in use. The room at the Observatory in which the Milne-Shaw was housed, is subject to considerable solar radiation and to wind currents. The seismograph records showed crowding in the lines, and sometimes considerable overlapping that made the records very difficult to read.

To remedy this defect, and to provide sufficient space for the two recently bought seismographs a new building was constructed.

It consists essentially of a double-walled and double-ceiling room  $7 \times 7 \times 4$  metres; the floor of the inner room is about 3 metres below ground level. The outer surface of the rooms is covered with Selton blocks to minimise the variations in the temperature.

The diurnal variation in temperature is about  $0.2^{\circ}\text{C}$ . and the extreme seasonal change not more than  $10^{\circ}\text{C}$ .

A large massive concrete pillar at the centre supports the three seismographs namely:—

- (1) N-S Component Milne-Shaw installed on May 19, 1938.
- (2) E-W " " re-installed on April 13, 1939.
- (3) Galitzin Wilip vertical seismograph installed on June, 1938.

An improvement in the N-S and vertical Galitzia components is the time scale of the records, being 15 mm. = 1 minute.

Monthly reports of the phases of the various earthquakes recorded are sent regularly to about 70 observatories.

We wish to acknowledge with thanks the regular receipt of bulletins from the following stations, continuance of which will be appreciated:—

Station	Station	Station
Batavia	Bucarest	Cape Town
Collmberg (Leipzig)	Florissant	Gottingen
Hamburg	Helgeland	Jesuit (Central Station)
Kew	Ksara	La plata
Malaga	Melbourne	Ottawa
Paris	Pittsburgh	Praha
Passedena	Riverview	Rocco di Papa
Saint Louis	San Fernando	State College
Strasbourg	Uccle	Zurich



# ROYAL OBSERVATORY HELWAN

## Seismological Bulletin

Constants of the Station.

$$\phi = 29^{\circ} 51' N. \quad \lambda = 31^{\circ} 20' E. \quad h = 115 \text{ m.}$$

NATURE OF STRATA: Limestone rock.

INSTRUMENTS: Galitzin Wilip Aperiodic Seismograph, Photo Galvanometric Registration, Vertical Component.  
Milne-Shaw Seismographs, Photographic Registration, two Horizontal Components.

Component	Date From which Constants Apply	Pendulum Free Period T	Galvanometer Free Period T <sub>g</sub>	Damping Constant	Transmission Coefficient K	Static Magnification V
		sec.	sec.			
N	Monthly	12.0				250
E	"	12.0				250
Z	9-6-1938	11.16	11.13	+0.05	175	1000

Phases of the Seismogram:—

- $\bar{P}$  (undae primae superiores) Direct P-type waves whose path lies wholly above the first major discontinuity.
- P (undae primae) Normal first preliminary tremor; condensation rarefaction or Longitudinal waves that have passed below the subcrustal or Mohorovičić discontinuity.
- PKP P waves that have traversed the earth's core.
- PP P wave reflected once at the earth's surface.
- PPP P wave reflected twice at the earth's surface.
- pP P wave from a deep focus reflected near the epicentre.
- $\bar{S}$  (undae secundae superiores) Direct S-type waves whose path lies wholly above the uppermost major discontinuity.
- S (undae secundae) Normal second preliminary tremors, traverse or shear waves which have passed below the Mohorovičić discontinuity.
- PS (undae transformatae) waves transformed from P to S on reflection at the earth's surface.
- sS S Type waves from a deep focus reflected near the epicentre.
- SS S Type waves reflected once at the earth's surface.
- SSS S Type waves reflected twice at the earth's surface.
- SKS S Waves transformed to P-waves on reflection into the core and back to S-waves when leaving the core.
- SKKS S Waves in the mantle reflected and internally reflected as P-waves in the core.
- L (undae longae) Long surface waves of irregular form at the beginning of the "principal phase".
- M (undae maximae) Shorter and more regular waves of large amplitude which follow the L-waves.
- F (finis) End of discernible movement.

Nature of the Motion:—

- i (impetus) Sudden beginning of the motion.
- e (emersio) Gradual beginning of the motion.
- T (period) Time of one complete oscillation.
- A Amplitude of the earth motion, measured from the median line in microns.  
( $\mu = \frac{1}{1000} \text{ mm.}$ )

\*\* Confused with the succeeding earthquake.

\*\*\* Lost in changing the paper.



## ROYAL OBSERVATORY, HELWAN

No.	Date 1940	Comp.	Phase	G. M. T.			Period Sec.	Amplitude			$\Delta$ Km	Remarks
				n.	m.	s.		$\Delta_x$ $\mu$	$\Delta_y$ $\mu$	$\Delta_z$ $\mu$		
1	January 1	Z Z Z EZ E	iP i i i e F	12	33 34 36 39 43	57 06 42 48 42					Compression	
2	2	Z Z E E	e e i e F	00	11 12 13	09 48 21 22						
3	2	Z N	iP e F	10	09 10	29 33					Dilatation.	
4	2	Z Z Z Z	(PKP) e e e e F	11	27 28 29 32	07 30 15 12 08						
5	5	Z N N	(P) S PS F	21	40 48 49	10 28 02				5590		
6	6	EZ Z E E NE	eP i SKS i SKKS F	8	28 38 39	24 45 48 06 22				10400	Very weak.	
7	6	NE	e F	11 11.8	06	54						
8	6	Z Z Z Z EZ E E E E E	iPKP i i PP SKP SKS i SKKS PSKS (SS) M F	14	22 23 24 26 29 30 32 36 44 15 17.0	48 08 08 08 25 48 10 48 17 48 00				16180	Compression.	
9	6	Z Z Z E	iP i i i F	19	06 07 08	24 03 42 24					Dilatation (probably two superposed earthquakes).	
0	7	E	e F	3 4.1	46	12						



No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
				h.	m.	s.		μ	μ	μ		
11	Jan. 7	Z Z E E E	eP PP e S i M F	9 9.8	07 09 13 14 22	55 03 15 51 27 24	16		+ 8	4135	Very weak.	
12	10	E E E E	i i i i F	00 0.9	39 40 41	24 24 03 48					Near earthquake.	
13	10	Z Z N	e e e F	11 12.2	27 35	18 48 03					Preceded by microseisms.	
14	15	Z Z Z	e i e F	13 14.0	23 26	24 31 55						
15	17	Z Z ZEN E EN E E E	iP i PP i SKS i S FS PPS F	1 4.7	28 32 33 34 39 40 42 43	54 65 68 54 39 65 54 12 (18)				11710	Compression.	
16	20	Z Z Z Z Z E E E	ePKP ePKKP e PP e SS SS M F	10 11 12.2	18 19 22 25 41 47 25	17 42 21 06 35 48 40 42	19		+21	11710		
17	25	Z E	e i F	10 10.5	17 22	54 24						
18	25	E E ZE E	Pg Sn S W	13 13.4	11 12	33 57 04 10				320	Local (not felt).	
19	26	E E E	e i e W	7 9.0	04 10	06 34 36					Preceded by microseisms.	



No.	Date 1940	Comp.	Phase	G. M. T.			Period SEC	Amplitude			Δ Km.	Remarks				
				h.	m.	s.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ						
20	Jan. 26	Z	P	17	17	00				11000	Deep focus h=180 Kms.					
		Z	i			26										
		Z	pP			40										
		Z	i		20	21										
		E	SKS		27	27										
		E	S		28	10										
		E	sS		29	30										
		E	PS		30	06										
		E	PPS		31	10										
		E	SS		34	45										
			F	19.0												
21	26	Z	e	23	19	05										
			F	23.8												
22	February 2	E	e	00	29	36										
		E	e		32	04										
			F	0.7												
23	2	Z	P	15	49	09										
		E	i		53	13										
		Z	(S)			42										
		NE	e		54	12										
			F	16.1												
24	3	Z	i	19	41	58										
		ZE	i		42	18										
		Z	i			30										
		Z	i			59										
			F	19.9												
25	4	Z	e	18	20	37										
		E	i		23	09										
			F	19.0												
26	7	Z	iP	17	29	10				10600	Compression					
		Z	i		32	24										
		ENZ	PP			55										
		Z	i		33	60										
		Z	i			33										
		Z	i		33	51										
		Z	PPP		54	12										
		ZE	i		36	35										
		E	SKS		39	40										
		E	eS		40	28										
		EN	PS		41	32										
					F	20.2										
		27	8	E	i	15						22	24			
EN	i				26	48										
N	e				29	30										
			F	15.9												
28	9	Z	e	13	34	18										
		Z	e			48										
		E	e		44	34										
		E	e		45	30										
			F	13.9												
29	9	ZN	iP	14	06	18				10380	Dilatation.					
		ZN	PcP			24										
		Z	i			31										
		E	SKS		16	40										
		E	i		17	06										
		E	S			(15)										
			F	15.0												





No.	Date 1940	Comp.	Phase	G. M. T.			Period SEC	Amplitude			Δ KM.	Remarks
				H.	M.	S.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
30	Feb. 11	Z E N	(eP) i i F	10 10.9	29 31	27 09 12						
31	11	Z Z N	e e e F	20 20.8	29 37	33 54 42						
32	12	E Z E E E E E E E E	(ePKP) e PP e SKS SKKS S PS PPS M F	00 1 2.2	20 11	12 47 08 32 02 10 (20) 40 52 30	17		+17	12780		
33	12	Z Z ZE Z Z	iP i i i i F**	8	40	27 36 50 21 21					Compression	
34	12	Z Z N E E	P e e e e F	9 10.7	31	06 23 54 30 52						
35	13	Z E E	P e e F	5 6.1	32	30 20 24						
36	13	Z E	e e F	11 12 12.4	55	15 38						
37	13	Z E E E E E E N	eP e PPP S SS M M F	13 14.3	32	(35) 06 00 06 20 30 24	9 3		+5 +4	3735		
38	14	Z Z E	(iPKP) (PKKP) M F	10 11 12.5	44	30 12 50				17450	Compression	
39	15	E	L F	1 2.5	53							
40	15	Z	(P) F	5 5.6	17	18						



No.	Date 1940	Comp.	Phase	G. M. T.			Period Sec.	Amplitude			Δ Km.	Remarks
				H.	M.	S.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
41	Feb. 15	Z Z Z E	e i i i F	8	49	06 51 00 00	9.2					
42	16	E	L F	1 1.9	36							
43	20	EN E E E EN EN N N N E E E	ePKP e pPKP sPKP PP pPP pPKS e i i SS F	2             5.1	37 38 40 41 42 46 48 57	24 54 12 37 06 54 02 33 39 03 28				15000	Preceded by microseisms h = 200 Kms.	
4	20	Z NE E	iP S SS F**	13	05 17 22	48 00 24				9040	Compression	
5	20	Z Z Z E NE E	iP i i e S e F**	13	25 26 30 36	53 00 18 16 03 57						Compression
	20	Z E	e i F	14 15 16.0	59 09	10 00						
	20	Z Z	e e F	20 21 21.7	59 00	12 24						
	21	Z EN E E E	iPn Sn S* Sg i F	00    1.6	51 53 54 55 56	55 54 42 12 27				1180	Dilatation	
	22	Z Z E	iP e i F	13  14.4	45 53	00 19 00						Dilatation
	23	Z E E E	iP i i i F	00   1.2	43 45 46 47	15 48 18 21						Compression
	24	Z E E E	eP e e e F	12   14.8	18 19 25 26	39 24 12 06						









No.	Date 1940	Comp.	Phase	G. M. T.		Period	Amplitude			Δ	Remarks
				H.	M.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
	March					SEC.	μ	μ	μ	Km.	
62	13	Z	i F	22 23.2	25	54					
63	14	Z Z Z Z Z Z E E E E E E E	eP e e e e e PP e PPP SKKS PS PPS M F	18             19 21.5	41 42 43 44 45 46 48 49 53 56 57 36	51 06 12 02 40 05 40 05 00 30 08 00 26	15		+9	12720	Preceded by microseisms.
64	17	EZ E E E	eP PPP S (L) F	9   9.7	11 12 14 15	54 06 33 48				1500	
65	18	Z Z	iPKP i F	5 8.3	58 59	51 15					Compression.
66	19	Z Z Z E E E E N	eP pP PP i i S sS SS F	4       5.5	42  44 47 48 49 50 52	24 54 05 30 30 06 00 40				5110	h = 150 Kms.
67	21	Z EZ NE E E	iP e S ScS PS F	14    15.9	05  15 16	21 54 37 03 30				9165	Compression.
68	22	Z EZ EZ Z E	ePKP e PKKP PP e F	20    23.0	40  44 51	11 24 36 12 00				10490	
69	27	ENZ EZ EN EN E EN N	P PP SKS i S i SS F	12      13 15.5	44 48 55  57 02	36 24 12 26 50 15 21					
70	27	Z Z E	eP e e F	19   20.0	24 25 30	03 40 06					





No.	Date 1940	Comp.	Phase	G. M. T.			Period Sec	Amplitude			Δ KM.	
				H.	M.	S.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
71	March 28	EZ EZ Z Z E EN N E N E	iP pP i pPP PPP SKS S SP i sS F	16	00	54					9555 Dilatation h = 220 Kms.	
					01	44						
					02	39						
					05	06						
					06	24						
					10	54						
					11	06						
					12	57						
					12	15						
				18.0	46							
72	29	Z N E	P (S) M F	21	48	21				7335		
					57	15						
				22	16							
				22.6								
73	30	Z N EZ EZ	e i e e F	6	23	18					Near earthquake.	
						42						
					24	06						
						27						
				6.5								
74	30	E	i F	6	46	04						
					7.7							
75	31	E	M F	17	57	50	18		+10			
					18.7							
76	April 1	Z Z Z Z Z Z Z E E E E E	eP pP i i PP pPP sPP (SKS) SKKS S sS PS SS F	11	33	20					11780 h = 130 Kms.	
						48						
						57						
						36						55
						37						50
						38						20
												39
						43						55
						44						20
						45						10
						46						07
						47						00
						52						40
77	6	Z E E E N	P PP e PS M F	13	53	27					7855	
					56	16						
				14	02	00						
					03	15						
					21							
				15.0								
78	8	Z NE E	e i i F	3	02	21						
					12	39						
					13	00						
				3.4								
79	8	Z E E E E	e e e M F**	9	10	30						
					19	00						
					20	12						
				10	01	39						
80	8	Z E Z	i i i	9	47	45						
					50	06						
						21						



No.	Date 1940	Comp.	Phase	G. M. T.			Period SEC.	Amplitude			Δ KM.	Remarks
				H.	M.	S.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
81	April 10	NE E NE E E	P PcP i e PS M F	20 21 22.0	31 09	24 30 35 30 10				9680		
82	11	E E	e i F	9 10.3	27	30 42						
83	11	NEZ Z Z E E N	P PP PPP S SS M F	13 14.1	27 28 32 33 36	45 12 27 10 20 36	18	+11		2720		
84	12	N Z Z Z	e i i i F	16 16.9	41 42 43	33 50 28 20					Near earthquake.	
85	13	Z Z Z NE Z	iP PPP i S PcP F	6 8.0	31 32 33 37	36 44 06 50 33				1220	Compression (Destructive in Antoli).	
86	13	Z E N E	iP S M M F	17 18.1	27 32 36	22 00 10 25	12 9	+14 +8		2890	Compression	
87	14	EZ Z E NZ	e i i i F	4 4.9	34 35 36	28 54 42 42					Confused with microseisms.	
88	14	Z Z E	i i e F	15 16.1	09 19	00 27 30					Confused with microseisms.	
89	16	NEZ EZ E N E	iP*** i (SSS) L M F	6 7 10.4	20 21 45 58 10	50 00 42 30 00	15	+42		12610	Dilatation	
90	17	Z Z -Z NE	(eP) e i e F	10 11.0	33 34 36 39	57 68 51 36						



No.	Date 1940	Comp.	Phase	G. M. T. \			Period SEC.	Amplitude			Δ Km.	
				h.	m.	s.		A <sub>N</sub> μ	A <sub>B</sub> μ	A <sub>Z</sub> μ		
91	April 17	Z	iPn	21	17	47				660	Compression (Felt at Limasol)	
		Z	Pg		13	15						
		ENZ	Sn			58						
		ENZ	Sg	19	24							
			F	21.5								
92	17	Z	i	21	55	33						
		E	e		56	54						
		E	e		59	48						
			F	22.3								
93	19	Z	i	11	04	32					Very weak	
		E	e		15	30						
94	19	Z	iP	14	52	35					Dilatation.	
		EZ	i		48							
		EN	e	15	03	15						
		E	e	04	12							
			F	16.5								
95	20	Z	iP	15	58	57					Dilatation.	
		E	e	16	09	12						
		E	e		10	24						
		E	e		11	36						
			F	16.5								
96	20	Z	iP	20	02	33					Compression	
		E	e		13	30						
97	21	NE	L F	6 6.6	14							
98	21	E	(eP)	22	05	30				2980		
		Z	PP		06	12						
		Z	e		08	11						
		E	S		10	15						
		E	e		11	00						
		E	L F		13							
			F	22.8								
99	22	EZ	iP	12	23	30				2220	Dilatation h = 220 Km	
		Z	pP		24	03						
		E	sP			24						
		E	i	25	18							
		E	i	26	08							
		Z	S		59							
		Z	PcP	27	30							
		Z	i		52							
		Z	i	28	52							
			F	13.1								
100	27	Z	eP	9	54	48						
		Z	i		57	27						
		E	e			42						
		E	e		58	22						
		E	i	10	08	05						
			F**									
101	27	Z	P	10	43	00				6400		
		Z	PcP		44	02						
		Z	PP		45	11						
		Z	PPP		46	18						
		E	e		50	00						
		E	S		51	02						
		E	PS			36						
		E	M	11	13	00						
		N	M		14	30						
		E	F									
			F	13.8								
						9	-13					
						12		-16				





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
				h.	m.	s.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
	April						SEC.	μ	μ	μ	KM.	
102	27	Z E E E	eP i i i F	18	24 26 27 28	11 55 50 50						Very weak
103	30	Z E E	iP e S F	5	14 22	36 49 15					5890	Dilatation
104	May 2	Z Z E E	i i e i F	8	46 47 52	00 15 30 12						
105	4	NZ Z NZ Z Z NE N N	eP e PP i PPP i S PS F	7	37 40 41 42 47 48 49	14 24 52 35 54 48 20 15					10245	
106	4	Z E E E	e e e M F**	17	09 10 14 22	43 16 00 54	12		-4			
107	4	Z Z Z E	i i e M F	17	18 19 52	26 36 17						
108	4	Z E E E E NE E E	iP PPP i i i iS SS M F	21	06 07 08 09 10 11 12 18	57 42 00 40 18 17 (48) 00	18		+462		2665	Dilatation
109	5	E Z E E E Z E E E E	e i e e e e e e e e M F	2 3 4.5	05 10 12 19 22 23 25 29 30 32 11	15 03 10 20 25 12 25 35 20 20 42	18		+14			





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		Sec.	A <sub>N</sub>	A <sub>E</sub>		
110	May 5	Z Z Z Z E E E	iP e PPP i S e SS F	6 6.6	06 07 11 12 13	41 15 40 52 35 10 05				3135	Dilatation	
111	5	Z Z Z Z Z	eP i i i e F	17 17.9	25 26 17	09 18 21 16 42						
112	7	NEZ Z Z Z Z EZ EZ E EZ E	iP PP PPP e e i iS e e M F	22 24.0	27 28 29 30 31 32 35	21 35 45 30 09 30 58 12 30 06	12		-27	2180	Dilatation	
113	10	EZ N E E	iP e e M F	19 20.5	11 22 50	57 18 48					Compression (very weak)	
114	11	E Z Z	e e e F	3 3.8	38	00 06 48					Very weak	
115	11	Z EZ	e i	12	12 14	51 12					Very weak	
116	11	Z Z Z Z Z E E E E E	iP e e PP e SKS e S e M F	14 17.0	07 08 11 13 18 19 20 56	48 15 28 42 21 20 45 12 02 42	15		+5	10720	Dilatation	
117	11	EZ Z E E	iP i e e F	21 22.0	09 17 18 19	57 46 36 12					Dilatation	



No.	Date 1940	Comp.	Phase	G. M. T.			Period SEC	Amplitude			Δ KM.	Remarks
				h.	m.	s.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
18	May 14	Z Z EZ Z E NZ N	iP i PP e S SS e F	5      5.9	38   39 41 42 43	00 09 21 12 45 28 14				2245	Dilatation	
19	14	Z Z Z E	eP e e e F	17   17.9	33 35 38 40	51 06 09 00					Very weak	
20	15	Z Z	e i F	4 5.0	35 37	06 15					Very weak	
21	15	EZ Z E E N N	iP PPP S SS L M F**	20	06 07 09 10 11 13	42 (03) 52 20 18 20	18		-24	1820	Dilatation	
22	15	Z E	eP L F	20 21.1	37 42	20						
23	16	E E E	e i i F	21 22.0	39 42 51	00 24 42					Preceded by microseisms.	
24	17	E E	e e F**	2	24 26	48 42						
25	17	E E	i e F	3 4.0	40 44	12 09						
26	18	Z E	i e F	5 5.9	17 19	30 06					Very weak	
27	19	Z ENZ E E Z E EN N E N E	eP i PPP e e SKS e SKKS PS M M F	4 5     6 8.4	55 56 02 04 05 06  07 09 01 03	54 20 32 20 51 32 45 10 25 42 36	18 20		-29 +34	11710		









No.	Date 1940	Comp.	Phase	G. M. T.			Period SEC.	Amplitude			Δ KM.	Remarks
				H.	M.	S.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
135	25	Z Z Z	e i i F	8  9.1	47 49	12 45 13						
136	27	EZ EZ EZ Z Z E E E E	iP pP sP PP PPP e S sS i F	4    4.8	17 18 19 22 23 24 26	00 48 12 48 30 40 20 42 00				4890	Compression h = 220 Kms.	
137	27	Z Z EN	e e M F	8 9 10.0	12 10	15 36						
138	27	EZ Z	iP e F	11 12 12.4	59 01	45 05					Compression	
139	28	Z Z ZE ZE ZE E E E E E FN E E	P i PP i i PPP e SKS i SKKS S PS SS F	9  10   13.1	55 58 50 00 01 02 05 06 07 08 15	00 33 24 35 30 45 30 35 50 38 15 45 00				12220		
140	29	NZ E E E	eP (S) e PS F	2  5.0	10 20 21	(18) 45 57 24					9090	
141	29	Z Z Z Z N N	P PP (S) e L M F	15  16.2	27 30 31 34	33 45 39 58 42 40	9	+11			1780	Preceded by microseisms.
142	31	Z Z E E	P e e e F	1  1.6	01 11 15	06 39 48 06						
143	31	NZ NZ	P S F	1  1.1	05	12 15						Local (Not felt)



No.	Date 1940	Comp.	Phase	G. M. T.			Period Sec.	Amplitude			Δ Km.	Remarks
				H.	M.	S.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
144	June 1	EZ E E	eP i i F	15 15.8	14 18 22	42 51 48						
145	2	Z Z E E	P e e e F	19 20.4	36 38 39 46	29 29 09 30					Very weak	
146	2	Z Z	e e	23	32 34	16 09					Very weak	
147	3	Z E E E	P i e e F	18 19.8	24 33 34 37	57 03 38 00						
148	5	Z Z Z NE E E NE E	P i pP i SKKS S (sS) PS SS F	11 14.3	13 14 15 23 24 25 28 30	36 42 03 12 58 16 10 06 23				10000	b = 100 Kms.	
149	5	Z E	iP e F	14 15 16.0	59 10	59 00					Dilatation	
150	7	Z Z E E	e i i e F	23 23.6	11 16 17 18	57 12 42 35						
151	8	Z Z Z E	i e e e F	4 5.0	20 23 30	09 30 42 36						
152	11	E E E E	e e i M F	8 9 10.1	59 08 09 39	48 36 16 15	19	+11				
153	12	EZ EN E EN	e i i e F	14 15.5	23 34	00 12 42 48					Preceded by microseisms.	
154	12	Z Z E	i e e	18 19	49 53 00	54 32 48						





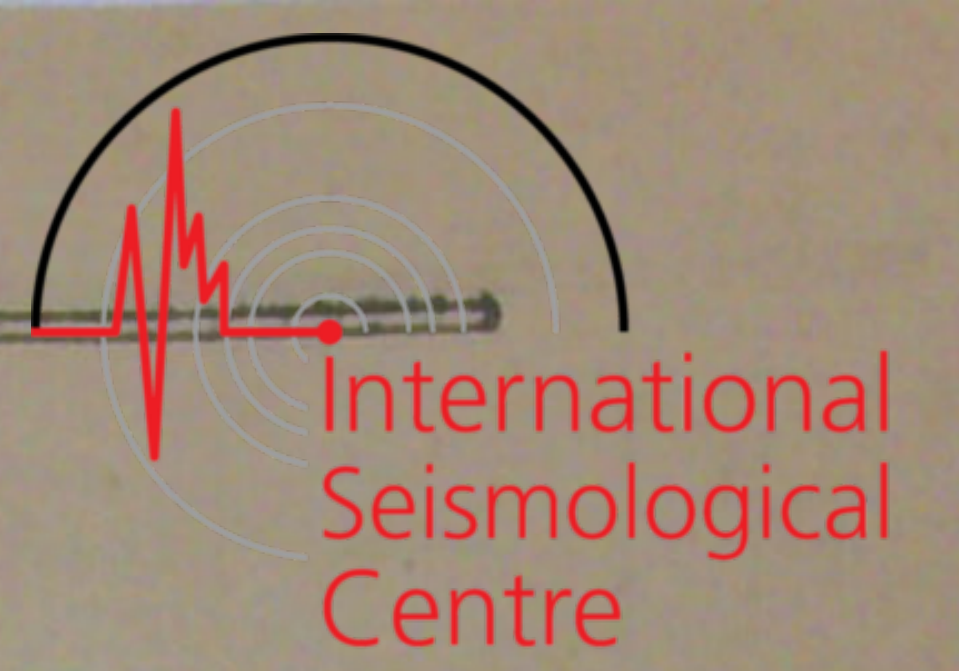
No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
								A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
	June			h.	m.	s.	Sec.	μ	μ	μ	Km.	
155	13	Z E	e e F	11 11.4	04 06	40 30						
156	13	NZ Z ENZ EZ	iPn P* Sn S* F	11 12.2	56 57 58	39 53 38 26					780	Dilatation
157	13	Z Z NZ E	iPn P* Sn i F	14 15.0	47 48 49	18 33 45 02					780	Dilatation
158	17	Z E E	e i e F	10 11 13.1	48 05 07	21 36 12						
159	18	EZ Z Z E E NE E	iP pP PP PPP SKS S sS F	14 15.5	04 06 08 10 14 18	30 34 10 21 03 24 10					9780	Compression (h = 600 Kms.)
160	18	Z Z EN E E	eP PP (SKS) S PS F	18 19 21.1	52 55	09 45 40 28 24					10335	
161	20	ENZ ENZ	e i	4	53 55	36 00						
162	21	Z Z	e e F	8 8.5	20 25	48 39						Very weak
163	22	EZ Z EZ E E E E E E	iP pP PP i SKS S SP i i F	11 12 14.2	49 53 56 59 00 01 06	27 (55) 10 00 44 12 10 42 33					10000	Dilatation (h = 100 Kms.)
164	23	Z	i F	7 7.5	04	38						
165	23	Z EN N	eP i (L) F	8 8.0	01 06 09	51 04 00						





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
								A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
	June			h.	m.	s.	SEC.	μ	μ	μ	KM.	
166	24	NZ Z ENZ E	iP PP S SS F	10 10.4	01 04	08 21 09 38					1120	Dilatation.
167	15	Z	i F	3 3.5	05	04						
168	25	Z	i F	4 5.8	57	30						
169	26	Z E E E E E	e S i PS SS M F	8 9.3	12 21 22 26 46	06 24 44 06 38 33	18		+ 5			
170	28	E E	i i F	3 4.1	56	36 42						
171	28	EN	i F	20 21.1	55	06						
July												
172	1	E E	e i F	21 22.4	40 45	36 42						
173	2	Z Z ENZ	i i i F	11 12.8	41 42 45	39 21 42						
174	2	Z Z Z	i i i	19	28 30 32	48 40 48						
175	4	E	i F	10 11.0	51	18						
176	6	Z NZ NZ E E	eP e S SS M F	2 2.4	08 10 13 14 16	48 15 18 24 39	8		+ 3		2810	Preceded by microseisms.
177	6	EZ EZ EZ E E EZ E E E	iP pP sP PP SKS S sS PS sPS F	3 4 5.6	52 53 56 02 03 04	45 21 31 24 55 06 06 16 56					9555	Compression (h=160 Kms.)





Date	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
							A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
1940			H.	M.	S.	SEC.	μ	μ	μ	KM.	
July 6	EZ Z ENZ Z N N E	eP i i (PcP) (S) L M F	7	23 24 26 27 29 31	30 36 02 26 36 38	8		+ 6		2465	
6	Z EZ EZ Z E N N	P PP PPP PcP S SS M F	17	48 49 52 53 56	31 57 08 33 36 30 35	6		+ 8		2480	
8	E E	e M F	8	18 45	09						
8	E E	e e F	20	04 05	42 33						
10	NEZ Z Z Z NEZ E Z	iPKP PP SKP PP SKKS PS PPS F	6	00 02 03 05 09 12 14	45 45 48 30 35 38 18					14210	Compression.
10	EZ E E	eP i i F	13	14 18 21	36 12 12						
13	Z E E	(eP) i i	17	06 12 15	14 21 23						
13	N E	e i	17	21 25	09 24						
13	Z Z Z Z Z	P <sub>n</sub> $\bar{P}$ $\overline{R_sP_2S}$ $\overline{R_sPS_2}$ $\bar{S}$ F	20	17 18 19	33 53 27 02 08					600	Preceded by microseisms (h = 25 Kms.)
14	NEZ Z NEZ ZE N N E N N	iP (iP) PP PPP SKS SKKS S L M F	6	06 09 12 16 17 38 52	05 30 51 02 32 05 24 30 54	22		+69		10600	Compression.





No.	Date 1948	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	
				h.	m.	s.		Sec.	μ	μ		
188	July 17	E E	e e F	6 7.4	51 57	53 12						
189	17	E E	e e F	11 12.5	58 59	22 20						
190	19	Z NE N	(eP e M F	4 5 6.2	58 02 10	21 33 18	10	+4				
191	20	E E E E NE NE	ePKP PKKP SKP PP SKKS PSKS F	2 4.6	13 14 17 24 27	54 06 27 42 32 54					16890	Very weak
192	21	EZ Z NE NE E	iP PP SKKS PS M F	15 16 18.3	51 54 02 03 37	21 51 07 12 36	15		-9		10000	Dilatation
193	21	Z E Z E	ePn Sn S* Sg F	20 20.6	12 13	09 24 48 54					720	
194	23	E	M F	1 2.0	16	38	14		+3			
195	23	E	L F	3 4.1	34							
196	24	NE E E E E	iPn P* Pg Sn Sg F	22 22.6	16 17	42 51 00 34 58					490	Compression (Felt at Limasol)
197	26	NE E	i M F	12 12.5	03 08	24 50	9		+4			Near earthquake
198	27	Z Z NE E E E	iP PP PPP SKS PS M F	13 14 16.6	51 55 57 01 04 36	25 (15) 30 54 06 12	24		+24		10810	Dilatation
199	30	Z Z E E	iP PPP S M F	00 2.4	14 16 26	39 46 55 12	12		-27		1235	Dilatation Destructive in Anatoli





No.	Date 1940	Comp.	Phase	G. M. T.			Period Sec	Amplitude			Δ Km.	Remarks
				h.	m.	s.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
200	July 31	Z E E	(P) e i F	10  11.3	39 41 48	00 15 53						
201	August 1	ZE ZE ZE E E E	iP i PP i SKS PPS SS F	12  13  14.5	58  02 08 09 11 16	28 47 22 20 00 54 54				10955	Compression	
202	1	Z ZE E E EN E N E E E	iP PcP i PP SKS S PS G LQ M F	15  16 19.7	20  22 23 30 31 32 43 45 18	40 48 00 53 46 (12) 02 18 48 00	15		-36	9490	Dilatation	
203	1	Z ZE	eP e F	19  20.6	51 53	51 12						
204	5	Z EN	iP e F	21  22.7	41 51	21 18					Dilatation	
205	7	ZE E E	e e e F	3  4.4	14 20 24	48 48 40					Very weak	
206	7	ZE ZE	i i F	8  8.5	07 08	54 44					" "	
207	8	Z E	e e F	14  16.1	55 56	06 08					" "	
208	11	Z Z Z E E	i i e e M F	17  18 19.2	06  10 17 18	35 43 40 09					" "	
209	12	Z Z E	(eP) (PP) (eS) F	15  16.8	44 45 50	00 34 30					" "	
210	13	Z Z Z E	P PP PPP S F	5  6.3	25 26 30	35 08 21 10				2835		



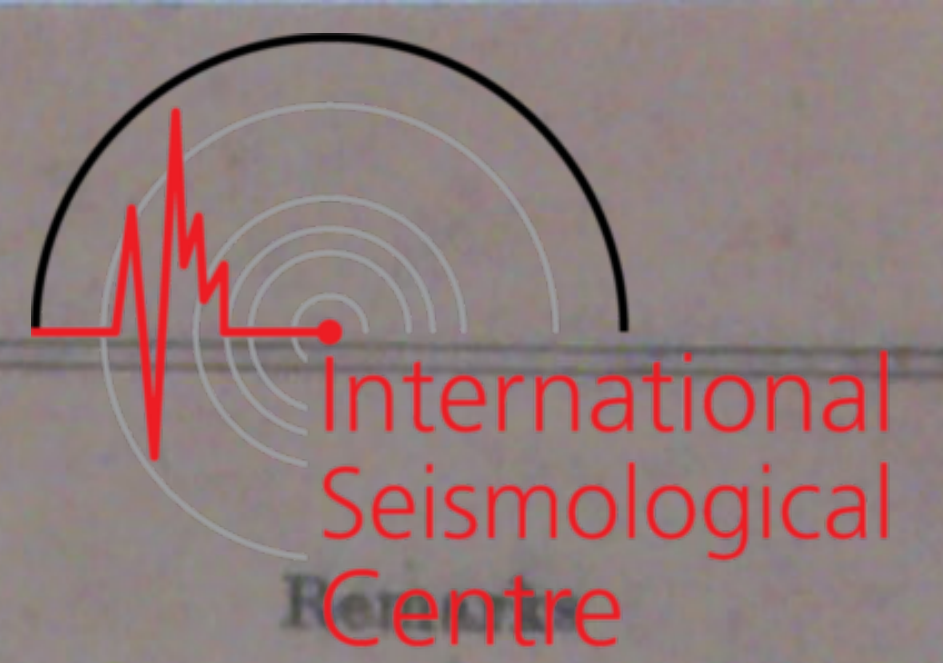
No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
				h.	m.	s.		A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
	August						Sec.	μ	μ	μ	Km.	
211	13	Z	eP	15	48	57					9445	h=100 kms.
		ZE	PcP		49	00						
		ZE	pP			25						
		ZE	PP		52	22						
		Z	pPP			46						
		ZE	PPP		54	15						
		E	SKS		59	05						
		E	S			15						
		E	sS	16	00	00						
		E	sPS			50						
		E	SS		04	57						
E	M		31	45	12	-9						
E	M		32	45	15		-10					
			F	18.4								
212	14	NEZ	iP	8	54	35					2590	Compression
		Z	PP		55	02						
		Z	(PPP)			12						
		NE	S		58	50						
		E	SS		59	50						
		E	M	9	04	36	10		+5			
			F	9.8								
213	15	E	i	21	47	24						
		E	e		48	36						
			F	22.2								
214	16	Z	iPn	16	04	00					622	Compression
		Z	P*			12						
		E	Pg			27						
		Z	Sn		05	06						
		Z	Sg			42						
			F	17.1								
215	16	Z	iPn	18	24	48					622	Compression (Replica)
		Z	P*		25	00						
		N	Sn			54						
		Z	S*		26	15						
		N	Sg			28						
			F	19.2								
216	18	Z	iP	6	15	12						Compression
		E	e		19	18						
			F	6.7								
217	18	NEZ	e	7	27	06						
		Z	i			18						
218	18	Z	ePn	7	57	03						(Felt at Limasol)
		N	i			57						
		N	i		58	06						
			F	8.2								
219	18	E	M	16	29	12	12					
			F	16.8					+3			
220	19	NE	e	20	46	06						Very weak
		E	e		47	00						
		E	e		48	18						
			F	21.2								





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ Km.	Remarks
				h.	m.	s.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
221	20	E E E E E	eP	17	49	24				12890	Very weak	
			SKP		55	18						
			SKS		59	54						
			ePS	18	03	48						
			M F		42							
				20.5								
222	22	Z Z Z Z E NE N E Z N E	iP	3	40	48				10990	Dilatation	
			PcP			56						
			PP		44	50						
			PPP		46	57						
			SKS		51	25						
			S		52	18						
			PS		53	32						
			SS		59	03						
			L	4	14	24	24					
			M M F		25 26	24 30	24 24	-69 +59				
				7.4								
223	24	Z ZE ZE E	i	13	51	06						
			i			16						
			i		54	50						
			i	14	05	02						
			F				16.0					
224	24	NE	e	19	57					Local (not felt)		
225	27/28	E E E E E	eP	23	13	20				1780		
			PPP			36						
			S		16	25						
			SS		17	00						
			PcP F		18	19						
				0.1								
226	29	E E E	P	8	12	09				5745		
			PP			06						
			S		19	36						
			F				9.0					
Sep.												
227	1	E E	e	18	56	06						
			e	19	02	18						
			F				19.5					
228	2	Z Z E E E	iPn	10	33	37				666	Dilatation	
			P*			51						
			Pg		34	06						
			Sn			46						
			S*		35	08						
				10.8								
229	3	Z E	i	1	47	24					Very weak	
			e		50	30						
			F				2.3					





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
				h.	m.	s.		Sec.	μ	μ		
230	3	EZ Z NE E	iP PP S PS F	14 16.1	49 51 57	41 42 00 38				5610	Dilatation	
231	3	E	i F	20 20.8	13	38						
232	5	Z E	e i F	10 10.9	35 38	02 24					Near earthquake	
233	6	E E	iP e F	3 4.1	03 14	49 30					Dilatation	
234	7	Z E E E E	P i SKS S PS F	19 20.7	36 37 47 48 49	33 12 10 12 24				10655	Weak	
235	8	NE	i F	10 11.4	39	12					Very weak	
236	10	Z E E E E	P i (S) i M F	18 19 19.5	57 58 02 03 06	48 42 00 18 27					" "	
237	12	Z EZ Z E E E E	P e PP SKKS PS PPS M F	13 14 16.6	36 37 40 47 49 50 23	00 29 27 36 48 48				12210		
238	13	Z E	e e F	15 16.0	41 43	36 15						
239	16	Z Z	e i	22	39 40	27 33						
240	18	Z E	eP (S) F	7 8.0	18 22	21 48						
241	18	E E	e i F	15 16.5	28 38	27 12						









No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		SEC.	μ	μ		
252	25	ZNE	iP	19	35	39					3000	Dilatation
		Z	i			57						
		Z	PP			20						
		NZ	PPP			37						
		NE	PcP			08						
		Z	S			22						
253	26	Z	eP	4	15	27					8000	
		Z	(PP)			09						
		Z	(PPP)			47						
		E	(SP)			54						
		E	(SSS)			12						
			F***									
254	30	Z	ePKP	11	33	00					17400	
		Z	PKKP			27						
		E	PP			00						
		E	M									
			F									
255	30	Z	ePKP	14	30	24					17400	Replica
		E	PKKP			48						
		E	PP			24						
			F									
256	1	Z	eP	11	02	21					12180	
		E	PP			41						
		NE	PPP			12						
		E	SKS			54						
		E	PS			10						
		E	M			00						
257	1/2	Z	(e)	21	57	48					15180	
		Z	eP			12						
		NE	PP			33						
		E	PPP			42						
		E	SKS			06						
		E	M			06						
258	3	EZ	i	17	51	24						
		Z	i			04						
			F									
259	4	EZ	e	4	45	00						
		E	i			20						
		E	i			08						
		E	e			30						
		E	M									
			F									





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks	
				H.	M.	S.		SEC.	$A_N$	$A_E$			$A_Z$
0	Oct. 4	EZ Z EZ E NE E E E N E	P PKP PPP SKS PS PPS SS L M M F	8 9 11.2	09 13 16 20 24 25 30 49 01 01 11.2	36 15 48 06 00 06 06 42 24 48					12890		
1	5	E E	e e F	6 7.0	41 42	24 18							
2	5	Z E	e i F	7 7.7	10 13	00 36							
3	5	Z E E	e e i F	10 10.6	10 16 19	24 00 21							
4	5	Z E	(eP) i F	14 14.4	01 08	03 18							
5	5	EZ Z	e i F	14 16.7	57 06	36 48							
6	5	Z E E E	e i i i F	23 24.0	34 37 41 43	54 50 00 42							
7	6	E EZ E	i e i F	6 7.0	42 46	06 06 24							
8	6	Z Z E E	iP PP S (M) F	10 11.6	47 50 53	38 51 49 15					1820	Dilatation	
9	6	EZ E E E E NE E E	eP PPP i i S i M M F	15 17.5	57 03 04 07 09 12 44	21 35 30 18 06 51 00 13					11235		
0	7	Z Z	i i F	1	45 49	08 27							

-153  
-552

+12  
+21





No.	Date 1940	Comp.	Phase	G. M. T.			Period Sec.	Amplitude			Δ Km.	Remarks
				H.	M.	S.		A <sub>N</sub> μ	A <sub>E</sub> μ	A <sub>Z</sub> μ		
271	11	E E	e i F	1 1.9	42 43	36 46					Very weak	
272	11	Z E	i i F	8 8.4	06 17	15 06						
273	11	ZN ZE E E	eP PPP PS M F	19 20 22.0	01 07 13 03	27 08 42 30	15		+29	10390		
274	18	ZN Z Z ZN E E N	iP PP PPP S SS M M F	12 13.8	29 33 34 37	05 32 40 12 05 15 30	8 8	-17	-12	2500	Dilatation	
275	21	Z NE	e i F	22 22.4	15 17	48 30					Near earthquake (weak)	
276	22	Z ZN ZNE	iP PPP S F	6 7.7	40 43	40 54 36				1655	Compression (Felt in Bucarest)	
277	24	Z E ZE E	e i i M F	20 21 22.0	26 32 36 14	48 06 06						
278	24	Z Z E	iP PP S F	21 22 22.5	59 03	13 40 30				2645	Dilatation	
279	26	Z	i	6	01	21						
280	27	Z N N	eP e e F	5 6 8.6	49 02 09	52 00 45						
281	28	N Z	e i F	2 2.9	41 42	48 50						
282	30	Z Z Z N N N	eP i i (S) SS M F	3 5.1	20 28 34 42	09 18 24 24 39 21	15	+46		6600		
283	30	Z Z Z Z	i i i i	12	07 09	12 21 36 42						





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
								A <sub>N</sub>	A <sub>E</sub>	A <sub>Z</sub>		
	Oct.			H.	M.	S.	SEC.	μ	μ	μ	KM.	
4	31	Z Z N N	iP PP S M F	5 6.5	28 29 33 39	12 02 21 48	12	+16			3390	Dilatation
5	31	EZ Z N N E E	iP pP S sS SS M F	10 11 12.0	50 52 56 58 59 11	47 05 30 48 42 00	12		+11		4445	Dilatation (h = 400 Kms.) ?
6	6	EZ Z Z E E	iP i i i i F	16 17.1	21 29 30 31	31 36 57 20 26						Dilatation
7	7	Z Z NE NE N	iP (pP) (S) i e F	14 15.1	09 11 19 26	57 48 39 57 06					9335	Dilatation h = 500 Kms.
8	8	Z Z Z Z	i i i i F**	10	53 56 57	39 50 36 15						
9	8	Z	i F	12 12.8	04	21						
10	10	ENZ E	iP S F	1 5.0	42 45	48 42					1665	Dilatation (Destructive in Roumania)
11	10	Z Z Z	i i i F	21 22.3	55	09 21 40						
12	11	Z Z N	P i i F	6 6.9	38 41	00 33 04						Very weak
13	13	E	M F	12 12.5	14							
14	14	EZ Z Z EN	P i i i F	10 11.8	46 50 58	42 54 08 06						Very weak
15	15	Z Z	e i F	13 14.2	53 54	09 06						Very weak





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
				H.	M.	S.		SEC.	μ <sub>N</sub>	μ <sub>E</sub>		
	Nov.											
296	18	Z Z E N	i i e e F	13	00	06 12 09 36	13.3					Very weak
297	19	EZ Z E E E EN	iP PP PPP S PS M F	15	14	17 39 35 40 34 55	16.8				9620	Dilatation
298	20	Z Z Z NE	e e e i F	18	06	21 00 24 25	18.5					Very weak
399	23	Z Z Z	iP i i F	15	46	49 15 42	16.1					Compression
300	23	Z E	e e F	18	11	39 42	18.4					Very weak
301	27	E E	e e F	4	29	30 42	4.6					Very weak
302	27	EZ Z E E E E E	(iPKP) (PKKP) e e e e e F	15	01	24 47 00 15 06 54 42	17.5					Compression
	Dec.											
303	4	Z Z E NE E	e e e e M F	13	15	12 39 30 36 9	14.8					
304	8	Z Z	e i	3	18	04 09						
305	8	Z Z	i i	6	23	21 33						
306	16	Z Z NE N	P PP S M F	9	56	20 48 25 06	10.5				2465	





No.	Date 1940	Comp.	Phase	G. M. T.			Period	Amplitude			Δ	Remarks
				h.	m.	s.		SEC.	$A_N$	$A_E$		
307	18	Z Z E E N	iP PPP S SS M F	3	47	24	13	+66			4665	Compression
					49	27						
					53	50						
				4	56	35						
				5.0	04	36						
308	19	Z E	i i	16	00	56						
					11	15						
309	22	Z EZ Z	P i i F	12	51	33						
					52	19						
				15.0	53	10						
310	22	Z Z NE E E	eP PKP SKS i PS F	19	14	42				13645		
					18	10						
					24	06						
					25	00						
				20.8	28	45						
311	28	Z E NE E N	P PP SKS S M F	16	51	36				11065		
					55	30						
				17	02	13						
					03	10						
				20.0	42							
312	30	Z Z	e i	21	44	26						
					45	36						