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Seismic Records

at De Bilt

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P R E F A C E

This seismic Yearbook was composed under the supervision of Dr. J. Veldkamp, director of the Geophysical Section. The records have been reduced by Mr. J. Oldeman, scientific headassistant.

The Director in Chief of
the Royal Netherlands Meteorological Institute,

Ir. C.J. Warners.

De Bilt, May 1964.

I N T R O D U C T I O N

SEISMOLOGICAL STATION DE BILT

The geographic coordinates of the seismological station are 52°06'.1 N and 5°10'.6 E. The instruments are placed at a height of 3 m above mean sea-level on a subsoil consisting of sand (pleistocene).

The instruments are: a set of seismographs (two horizontal and one vertical) with galvanometric recording according to GALITZIN.

THE GALITZIN SEISMOGRAPHS AT DE BILT. Below are given: the period of the galvanometer T1, the reduced pendulum length l, the distance Al between the mirror of the galvanometer and the recording paper, and the rough values for the natural period of the undamped pendulum T, of the damping constant and of the multiplying factor k for the year 1959.

	NS comp.	EW comp.	Z comp.
Period of galvanometer T1	24.43 sec	24.96 sec	12.0 sec
Reduced length of pendulum l	123 mm	123 mm	406 mm
Distance Al	1380 mm	1380 mm	1380 mm
Period of pendulum T	25 sec	25 sec	12 sec
Damping constant	0.0	0.0	0.0
Multiplying factor k	11.0	11.0	175

SEISMOLOGICAL STATION HEERLEN

The geographic coordinates of the seismological station are: 50°53'.0 N and 5°59'.0 E.

The instrument, a horizontal seismograph, M = 450 kg, is placed at a height of 100 m above mean sea-level on a subsoil consisting of loess.

The mean values of the constants for the year 1959 are:

T		V	V max.	T max.
2	3	400	600	2

SEISMOLOGICAL STATION WITTEVEEN

The geographic coordinates of the seismological station are: 52°48'.8 N and 6°40'.1 E.

The instrument, a GRENET vertical seismograph with galvanometric record, is placed at a height of 2 m above mean sea-level on a subsoil consisting of pleistocene sand.

The period of the seismograph is 2.3 sec, the period of the galvanometer is 0.8 sec. The maximum amplification is 6500 for a period of about 1 sec.

EXPLANATION OF THE TABLES

The data given in this Yearbook have mostly been obtained from the GALITZIN records. The velocity of the recording paper is 30 mm per minute, allowing a good time-accuracy.

In a few cases the data from the seismograph at Heerlen are mentioned.

The time is Greenwich mean time.

In the column "direction" + means an upward movement of the soil (compression), - means a downward movement (dilatation). Uncertain data have been given in parentheses. The following symbols were used for the phases.

P = normal first phase, or first longitudinal tremor.
pP = P-wave once reflected at the earth's surface near the epicentre.
PP = P-wave reflected halfway between epicentre and station.
PPP = P-wave two times reflected at the earth's surface.
PPPP = P-wave three times reflected.
S = second phase, arrival of the transversal tremor.
sS = S-wave reflected at the earth's surface near the epicentre.
PS = wave changed from longitudinal to transversal oscillation through reflection at the earth's surface.
PPS = wave twice reflected, having been transversal on one branch of the path.
SS = S-wave reflected halfway between epicentre and station.
SSS = S-wave two times reflected at the earth's surface.
SSSS = S-wave three times reflected at the earth's surface.
PcP = P-wave reflected at the core boundary.
ScS = S-wave reflected at the core boundary.
P' = PKP = wave having penetrated the core.
S' = SKS = transversal wave, having been longitudinal within the core.
PKS = alternating wave having penetrated the core.
pP' = P'-wave reflected near the epicentre.
sS' = S'-wave reflected near the epicentre.
SKKS = alternating wave which has been reflected within the core.
L = long wave or surface waves.
M = maximum of the surface waves.
L' = surface waves travelling around the major arc.
M' = maximum of these waves.
i = sudden beginning of the phase.
e = gradual beginning of the phase.
F = end of discernable movement.
H = time of the shock at point of origin.
h = depth of the origin.
Δ = distance of epicentre.

The indices H, N, E and Z refer to horizontal, north-south, east-west and vertical components of the movement.

The distance of the epicentre and the depth of origin have been calculated by means of curves constructed with the aid of the time tables of Jeffreys and Bullen (1940).

The data given in the column "amplitude" are the maximal amplitudes measured from the medium line. The amplitudes have been calculated by means of the formula:

$$V = \frac{A_1 \; k \; T_b}{2\pi l} \cdot \frac{1}{\left\{1 + \left(\frac{T_b}{T}\right)^2\right\}^2}$$

In this formula Al is the distance between galvanometer mirror and recording paper, k is the multiplying factor, T_b the period of the wave, l the reduced length of the pendulum, T the free period of the undamped seismograph, and V the magnification. The period of the galvanometer is assumed to be equal to the free period of the undamped seismograph.

For the horizontal components of the GALITZIN records the following mean values were used: k = 11,0 and T = 24,5 sec, and for the vertical component k = 175 and T = 12,0 sec.

Whenever it was possible the amplitudes and periods of the first P- and S-waves have been given. As the movement of these waves is irregular in general, the accuracy of these data is small. The amplitudes of the maxima of L-waves have been calculated in case of very strong earthquakes.

The amplitudes have been omitted when the oscillations were very irregular.

The seismological bulletins of the following stations were available: Algeria, Alicante, Almeria, Athens, Azores, BCIS (Bureau Central International de Séismologie), Beograd, Bogota, Brisbane, Budapest, Coimbra, Columbia-University (Palisades N.Y. and Bermuda), Djakarta, Dublin, Firenze, Geophysics Division (New Zealand), Granada, Harvard University, Helsinki, Hermanus, Huancayo, Istanbul, Jena, John Carroll University (Cleveland), JSA (Jesuit Seismological Association), Kew, Kiruna, København, Ksara, La Paz Lisboa, Manila, Melbourne, Paris, Pasadena, Perth, Poona, Praha, Prato, Quetta, Reykjavik, Riverview N.S.W., Roma, Santiago (Chile), Seismographic Stations of the University of California, Seismological Service of Canada, Stuttgart, Tacubaya, Tananarive, Toledo, Tortosa, Trieste, Uppsala, USCGS, (United States Coast and Geodetic Survey), Western Samoa, Weston (Mass.), Wien, Zürich.

THE MICROSEISMIC ACTIVITY

The table on page 1 shows the character of the microseismic activity (see also 1915 p. 101 and 1916 p. 101). The numbers 0, 1, 2 and 3 mean:

0 = very weak and weak
1 = moderate
2 = strong
3 = very strong

For measuring the microseismic activity the records of the GALITZIN seismograph were used. The table below gives the amplitudes of the oscillations (measured from the medium line) and the corresponding amplitudes of the movement of the surface.

Character	Ampl. record	Ampl. surface
0	0 - ½ mm	0 - 1¼ μ
1	½ - 2 "	1¼ - 5 "
2	2 - 4 "	5 - 10 "
3	4 "	10 "

CHARACTER OF THE MICROSEISMIC MOVEMENT

Date 1959	Jan.	Febr.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1	2 3	2	2	2	1	0 1	1 2	1 0	1 0	1	1 2	3 2
2	3	2 3 2	2	2 1	1	1 2	2 1	0 1	0 1	1	2 3	2 3
3	3	2 3	2 3	1 2	1	2	1	1 0	1	1	3 2	3
4	3	3 2	3	2	1	2 1	1 0	0	1	1	2 1	3
5	3	2 1	3	2	1	1	0 1 0	0	1	1	1	3
6	3	1	3 2	2 3	1	1 2	0 1 0	0	1	1	1	3
7	3	1	2	3	1	2	0 1 0	0	1 0	1	1 2	3
8	3 2	1 2	2	3	1	2	0	0	0 1	1 2	2 3	3
9	2 3	2 3	2	3 2	1	2 1	0	0	1	2	3	3
10	3 2	3	2	2 1	1	1	0	0	0	2 1	3	3 2
11	2	3	2 3	1 2	1	1 0	0 1	0 1	1	1	3 2	2
12	2 3	3	3 2	2 3	1 0	0 1	1 2	1 0	1	1 2 1	2	2
13	3 2	3	2	3	0	1	2 1	0 1	1	1 2	2 3	2 3
14	2 1	3	2 3 2	3	0	1	1 0	1 2	1	2 1	3 2	3
15	1	3	2	3	0 1	1	0	2	1	1 0	2 1	3 2
16	1	3	2 1	3 2	1 0	1	0	2 1	1	0 1	1	2 3
17	1 2	3	1	2 3 2	0	1	0	1 0	1	1 2	1 2	3
18	2 3	3	1 2	2	0 1 0	1 2	0	0	1	2 3 2	2 3	3
19	3	3	2 1	2 1	0 1	2 1	0 1	0	1	2 1	3	3
20	3	3	1	1	1 0	1	1 0 1	0 1 0	1	1 2	3	3
21	3	3 2	1	1 0	0 1	1 0	1 0	0	1	2 3	3 2	3 2
22	3	2	1 2	0	1 0	0	0	0	1 2	3	2	2 3
23	3 2	2	2	0	0 1 0	0	0 1 0	0 1	2 1	3	2 3	3
24	2	2 1	2	0 1	0	0	0 1 0	1	1	3 2	3 2	3
25	2	1 2	2 1	1 2	0 1	0	0	1	1	2	2 3	3
26	2	2 3	1	2	1	0	0 1	1	1 2 1	2 3	3 2	3
27	2 1	3	1 2	2 1	1	0	1	1	1 2	3	2 1	3
28	1 2 1	3 2	2	1	1 0	0 1	1	1	2	3 2	1	3 2
29	1 2		2 3	1 2 1	0 1 0	1	1 0	1	2 1	2 1	1 2	2 3
30	2		3 1	1 2 1	0	1	0 1	1	1 2 1	1	2 3	3
31	2		1 2		0		1	1		1		3 2

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	μ	
Feb. 8	iP	1 07 15	+			(30) BCIS: 48¾°N 28½°W, H. 1h 02m 24s. USCGS: 49°N 28½°W, H. 1h 02m 26s. North Atlantic Ocean.
(30)	iz	1 07 19				
	eS	1 11 18				
	L	1 13				
	F	2 50				
Feb. 9	eP	4 54 39				(31) USCGS: 50½°N 177½°W, H. 4h 42m 33s. Andreanof Islands, Aleutian Islands.
(31)	eS	5 04 41				
	eL	5 20				
	F	5 50				
Feb. 14	eL	23 05				(32) Disturbed by microseisms. USCGS: 28°N 97°S, H. 22h 25m 50s. India - Burma border.
(32)	F	23 20				
Feb. 15	ez	4 29				(33) Disturbed by microseisms. USCGS: 59½°S 25°W, H. 3h 59m 35s. Sandwich Islands.
(33)	ez	4 34				
	eL	4 58				
	F	6 30				
Feb. 16	eL	1 03				(34) Disturbed by microseisms. USCGS: 1°S 81½°W, H. 0h 39m 32s. Near coast of Ecuador.
(34)	F	1 40				
Feb. 17	eP	12 15.0				(35) Disturbed by microseisms. USCGS: 51½°N 171°W, H. 12h 03m 05s. Fox Islands, Aleutian Islands.
(35)	eS	12 24.9				
	ePS	12 25.5				
	eL	12 40				
	F	13 50				
Feb. 23	e	3 00				(36) Disturbed by microseisms. USCGS: 5½°S 150°E, H. 1h 58m 38s. New Britain.
(36)	F	3 30				
Feb. 23	eL	16 55				(37) Disturbed by microseisms. USCGS: 50°N 157°E, H. 16h 04m 48s. Kurile Islands.
(37)	F	17 15				
Feb. 27	eL	21 40				(38) Disturbed by microseisms. USCGS: 27½°N 129°E, H. 20h 56m 30s. Ryukyu Islands.
(38)	F	22 00				
Mar. 1	eP	0 36 26				(39) Disturbed by microseisms. Wi: eP 0h 36m 18s. USCGS: 74½°N 9°E, H. 0h 31m 20s. BCIS: 75½°N 8°E, H. 0h 31m 14s. Arctic Ocean, south of Spitzbergen.
(39)	eS	0 40 36				
	eL	0 43.0				
	F	0 50				
Mar. 1	ePP	17 08 45				(40) USCGS: ½°S 134½°E, H. 16h 49m 13s, h about 100 km. Near north coast of New Guinea.
(40)	ePS	17 18 20				
	ePPS	17 20.0				
	eSS	17 24 40				
	eSSS	17 29				
	eL	17 40				
	F	19 30				
Mar. 12	eL	2 20				(41) USCGS: 7°N 145°E, H. 1h 29m 07s. Caroline Islands.
(41)	F	2 50				
Mar. 13 (42)						(42) Wi: ePKP 16h 59m 43s. USCGS: 21°S 176½°W, H. 16h 40m 15s, h about 200 km. Tonga Islands.
Mar. 14	eL	3 40				(43) USCGS: 45°N 151½°E, H. 2h 55m 24s. Kurile Islands.
(43)	F	4 00				

Seismic Records at De Bilt

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	μ	
Mar. 17	eP	8 38 10				(44) Wi: iP 8h 38m 08s. BCIS and USCGS: 27½°N 130°E, H. 8h 25m 22s. Ryukyu Islands.
(44)	eS	8 48 52				
	eL	9 07				
	F	10 00				
Mar. 18	eS	1 04 59				(45) Disturbed by microseisms. Wi: eP 0h 54m 06s. BCIS and USCGS: 27°N 129°E, H. 0h 41m 17s. Ryukyu Islands.
(45)	ePS	1 05.9				
	eL	1 25				
	F	2 00				
Mar. 19	eP	8 32.4				(46) Disturbed by microseisms. Wi: eP 8h 32m 21s. BCIS: 35½°N 36°W, H. 8h 25m 35s. USCGS: 35°N 36°W, H. 8h 25m 32s. North Atlantic Ocean.
(46)	eS	8 37 50				
	eL	8 40.5				
	F	9 30				
Mar. 20	eL	16 35				(47) USCGS: 36½°N 142½°E, H. 15h 44m 31s, h about 100 km. Off east coast of Honshu, Japan.
(47)	F	16 50				
Mar. 21 (48)						(48) Wi: iPKP 4h 46m 01s. USCGS: 19°S 178°W, H. 4h 27m 21s, h about 550 km. Fiji Islands.
Mar. 22	ez	22 40 45				(49) Wi: e 22h 40.5m. BCIS: 46¾°N 3¼°W, H. 22h 36m 41s, USCGS: 46½°N 3½°W, H. 22h 36m 28s, 100 miles off west coast of France.
(49)	eF	22 45				
Mar. 23	eL	7 50				(50) Disturbed by microseisms. Change of papers from 7.26 till 7.31. USCGS: 40°N 118°W, H. 7h 10m 22s. Western Nevada, USA.
(50)	F	8 10				
Mar. 24	eL	18 06				(51) USCGS: 34°N 142°E, H. 17h 18m 24s. Off coast of Honshu, Japan.
(51)	F	18 24				
Mar. 26	eL	3 27				(52) Wi: iPKP 2h 43m 16s. USCGS: 7°S 155½°E, H. 2h 24m 12s, h about 60 km. Solomon Islands.
(52)	F	3 55				
Mar. 26	eL	11 25				(53) USCGS: 39°N 71½°E, H. 11h 04m 35s. Tadzhik, SSR.
(53)	F	11 40				
Mar. 28	ePKP	20 05.9				(54) Wi: iPKP 20h 05m 54s +. USCGS: 20°S 178½°W, H. 19h 47m 07s, h about 600 km. Fiji Islands.
(54)	F	20 10				
Mar. 30	eL	21 15				(55) BCIS: 41°N 30°W, H. 21h 04.0m. Atlantic Ocean, near Azores Islands.
(55)	F	21 20				
Mar. 31	eL	8 44				(56) USCGS: 15°S 173°W, H. 7h 20m 45s. Solomon Islands region.
(56)	F	9 05				
Apr. 1	iP	0 40 46				(57) Wi: eP 0h 40m 50s; i 0h 40m 53s. BCIS: 27¾°N 21°W, H. 0h 34m 18s. USCGS: 27½°N 21°W, H. 0h 34m 18s, deeper than normal. Canary Islands.
(57)	eS	0 45 50				
	eL	0 49				
	F	1 46				
Apr. 2	eL	4 46				(58) USCGS: 26°N 125°E, H. 4h 02m 31s. Ryukyu Islands region.
(58)	F	4 50				
Apr. 2	eL	20 10				(59) Wi: eP 19h 34.5m. USCGS: 20½°N 121°E, H. 19h 21m 34s. Batan Islands region.
(59)	F	20 30				

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s		
Apr. 5	eH	10 51.4				(60) Disturbed by microseisms. BCIS: 44º6 W 6º8 E, H. 10h 47m 53s. USCGS: 44ºN 7ºE, H. 10h 47m 52s. East Alps, France.
(60)	F	11 15				
Apr. 6	eL	0 33				(61) BCIS and USCGS: 5½ºS 146ºE, H. 23h 29m 25s. Near north coast of New Guinea.
(61)	F	0 55				
Apr. 6	eL	15 00				(62) Disturbed by microseisms. USCGS: 10ºS 120½ºE, H. 14h 12m 36s. Sumba Island.
(62)	F	16.0				
Apr. 9	e	18 00				(63) Disturbed by microseisms. USCGS: 7ºN 82ºW, H. 17h 36m 10s. South of Panama.
(63)	F	19.0				
Apr. 10 (64)						(64) Wi: iPKP 6h 06m 42s; epPKP 6h 08m 50s. USCGS: 25ºS 178½ºE, H. 5h 47m 34s, h about 600 km. South of Fiji Islands.
Apr. 12	eL	16 22				(65) Disturbed by microseisms. USCGS: 4½ºS 134ºE, H. 15h 22m 33s, h about 100 km. Near north coast of New Guinea.
(65)	F	17 00				
Apr. 12	eL	22 00				(66) Disturbed by microseisms. USCGS: 15½ºS 173ºW, H. 20h 54m 00s. Samoa Islands region.
(66)	F	22 30				
Apr. 15	eL	0 55				(67) Disturbed by microseisms. USCGS: 41½ºN 143ºE, H. 0h 15m 21s. Near south coast of Hokkaido, Japan.
(67)	F	1 20				
Apr. 20	eL	4 30				(68) Disturbed by microseisms. USCGS: 6ºS 149½ºE, H. 3h 27m 52s. New Britain.
(68)	F	5 30				
Apr. 22	eL	19 45				(69) USCGS: 11½ºN 86½ºW, H. 19h 01m 41s. Near coast of Nicaragua.
(69)	F	20 10				
Apr. 22	eSS	21 05 00				(70) USCGS: 36½ºS 97½ºW, H. 20h 26m 46s. Pacific Ocean.
(70)	eL	21 25				
	F	22 05				
Apr. 24	iPKP	18 18 00	+	2	3	(71) Wi: iPKP 18h 18m 01s; ePP 18h 22m 13s. USCGS: 31ºS 178ºW, H. 17h 57m 58s. Kermadec Islands.
(71)	iPP	18 22 17				
	ePPP	18 26 00				
	eSS	18 42.6				
	eL	19 15				
	F	20 30				
Apr. 25	iP	0 31 40	-	5	5	(72) Wi: iP 0h 31m 38s; iS 0h 35m 50s. BCIS: H. 0h 26m 41s. USCGS: 37ºN 28½ºE, H. 0h 20m 40s. Southwestern Turkey.
(72)	eS	0 35 50				
	eSS	0 37.0				
	eL	0 37.5				
	F	1 35				
Apr. 25	e	9 41				(73) BCIS: 39º2 N 22º0 E, H. 9h 31m 00s. Greece.
(73)	F	9 46				
Apr. 26	e	14 49				(74) Wi: e 14h 17m 09s. BCIS and USCGS: 46º5 N 130ºE, H. 14h 45m 16s. Venetian Alps, Italy.
(74)	F	14 55				
Apr. 26	iP	20 53 06	+	8	25	(75) Wi: iP 20h 53m 02s. USCGS: 25ºN 122½ºE, H. 20h 40m 38s, h about 150 km. Near northeast coast of Formosa.
(75)	iPP	20 56 31				
	ipPP	20 57 01				
	iS	21 03 19				
	isS	21 04 23				
	iSS	21 10 00				
	eL	21 19				
	F	24.0				
Apr. 27	eL	13 41				(76) USCGS: 33½ºN 93ºE, H. 13h 09m 20s. Tsinghai Province, China.
(76)	F	14 00				
Apr. 28	iP	11 21 58	+	7	3	(77) Wi: eP 11h 22m 00s. USCGS: 15ºN 93ºW, H. 11h 09m 30s. Mexico - Guatemala border.
(77)	eS	11 32 12				
	eSS	11 37 58				
	eSSS	11 41.5				
	eL	11 50				
	F	14 15				
May 3	eL	5 22				(78) USCGS: 12½ºN 87½ºW, H. 4h 41m 24s, h about 100 km. Near coast of Nicaragua - El Salvador.
(78)	F	5 40				
May 4	iP	7 27 14	+	6	35	(79) Wi: iP 7h 27m 07s. USCGS: 52½ºN 159½ºE, H. 7h 15m 42s. Near east coast of Kamchatka.
(79)	iS	7 36 34				
	eL	7 51				
	F	11.5				
May 5	eP	19 15 43				(80) USCGS: aftershock of (79) 53ºN 159ºE, H. 19h 04m 16s.
(80)	eS	19 25.0				
	e	19 38.0				
	eL	19 41				
	F	20 30				
May 7	ePP	0 23 55				(81) USCGS: 3½ºS 148½ºE, H. 0h 03m 24s. Bismarck Sea.
(81)	ePPP	0 26 25				
	ePS	0 33.9				
	eL	1 02				
	F	2.0				
May 8	iP	11 46 15	(+)			(82) Wi: iP 11h 46m 11s. USCGS: 53½ºN 160½ºE, H. 11h 34m 50s, h about 60 km. Near east coast of Kamchatka.
(82)	eS	11 55.5				
	eL	12 15				
	F	12 50				
May 10	eL	0 42				(83) USCGS: May 9, 45ºN 149ºE, H. 23h 57m 03s. Kurile Islands.
(83)	F	1 00				
May 12	iP	5 09 04				(84) Wi: iP 5h 09m 00s. USCGS: 54½ºN 168ºE, H. 4h 57m 35s. Komandorski Islands.
(84)	iPPP	5 13.5				
	iS	5 18 31				
	ePS	5 19.3				
	eSS	5 23.3				
	eL	5 31				
	F	7 00				
May 12	iP	10 00 25	-			(85) BCIS and USCGS: 23½ºS 64½ºW, H. 9h 46m 51s. Salta Province, Argentina.
(85)	ePP	10 04 19				
	eSKS	10 11 05				
	e	10 11 41				
	eSS	10 18.0				
	eL	10 30				
	F	12 30				
May 12	eP	21 52 20				(86) F in next shock. USCGS: 51½ºN 177ºW, H. 21h 40m 22s. Andreanof Islands, Aleutian Islands.
(86)	eL	22 21				

Seismic Records at De Bilt

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	(1)	
May 12	eP	22 11 50				(87) USCGS: 51½°N 177°W, H. 21h 59m 56s. Andreanof Islands, Aleutian Islands.
(87)	eS	22 22				
	eL	22 35				
	F	23 50				
May 14	eL	1 05.5				(88) BCIS: 40°N 23°E, H. 0h 55m 55s. Aegean Sea.
(88)	F	1 14				
May 14	iP	6 41 53	-	3	7	(89) Wi: iP 6h 41m 50s. BCIS: 35°1 N 24°9 E, H. 6h 36m 55s. USCGS: 35½°N 24½°E, H. 6h 36m 57s. Crete.
(89)	iS	6 45 55				
	eL	6 47.5				
	F	8 00				
May 14	ePKP	9 53 04				(90) USCGS: 19°S 170°E, H. 9h 33m 22s. New Hebrides Islands.
(90)	eL	10 50				
	F	11 10				
May 14	eL	19 31.5				(91) BCIS: 40°0 N 23°0 E, H. 19h 22m 18s. USCGS: 40°N 24½°E, H. 19h 22m 18s. Aegean Sea.
(91)	F	19 45				
May 16	ePKP	6 35 21				(92) USCGS: 4½°S 153½°E, H. 6h 16m 23s, h about 60 km. New Britain.
(92)	ePP	6 37 20				
	eL	7 14				
	F	8 30				
May 20	eL	16 48				(93) BCIS: 36°9 N 26°3 E, H. 16h 36m 52s. Dodecanese Islands.
(93)	F	17 00				
May 20	eP	19 50 08				(94) USCGS: 41½°N 42°E, H. 19h 49m 12s. Georgia, SSR.
(94)	eS	19 59.5				
	F	21 00				
May 21	ePP	11 52 43				(95) USCGS: 28°S 69°W, H. 11h 34m 23s, h about 60 km. Chile - Argentina border.
(95)	ePS	12 02 00				
	eL	12 28				
	F	13 00				
May 24		13 27				(96) BCIS: 36°3 N 4°8 E, H. 13h 19m 32s. USCGS: 37½°N 4°3 E, H. 13h 19m 41s. Algeria.
(96)		13 50				
May 24	iP	19 30 03				(97) BCIS and USCGS: 17½°N 97°W, H. 19h 17m 40s, h about 100 km. Oaxaca, Mexico.
(97)	ipP	19 30 25				
	iz	19 30 56				
	iPP	19 33 29				
	iS	19 40 21				
	isS	19 40 58				
	iPS	19 41 46				
	eL	19 57				
	F	22 00				
May 27	eL	20 44.7				(98) BCIS: 45¾°N 21¼°E, H. 20h 38m 24s, USCGS: 46°N 21°E, H. 20h 38m 26s. Hungary - Rumania border.
(98)	F	21 00				
May 29	iPKP	11 02 16	+			(99) USCGS: 19°S 169½°E, H. 10h 42m 48s, h about 100 km. New Hebrides Islands.
(99)	ePP	11 06 03				
	eL	11 51				
	F	12 35				
May 31	ePKP	9 47 20				(100) BCIS and USCGS: 6½°S 155°E, H. 9h 28m 09s. Solomon Islands.
(100)	ePP	9 49 25				
	ePKS	9 59 45				
	eL	10 30				
	F	11 15				
May 31	eS	12 22 42				(101) BCIS: 45°7 N 27°7 E, H. 12h 15m 41s. USCGS: 46½°N 27°E, H. 12h 15m 51s. Rumania.
(101)	eL	12 24.5				
	F	12 40				
June 1	iPP	17 28 32				(102) USCGS: 6½°S 155½°E, H. 17h 07m 23s, h about 100 km. Solomon Islands.
(102)	iPKS	17 29 50				
	eL	18 10				
	F	18 40				
June 2	eP	1 00.2				(103) BCIS and USCGS: 32½°N 131½°E, H. 0h 47m 17s. Kyushu, Japan.
(103)	eL	1 29				
	F	2 00				
June 2	eS	3 01.5				(104) BCIS and USCGS: 21°N 121°E, H. 2h 37m 46s. Batan Islands region.
(104)	eL	3 22				
	F	4 00				
June 2	eL	5 40				(105) Disturbed by microseisms. USCGS: 21°N 121½°E, H. 4h 57m 18s. Batan Islands region.
(105)	F	7.0				
June 5	eL	21 16				(106) USCGS: 12°N 86½°W, H. 20h 37m 15s, h about 100 km. Near coast of Nicaragua.
(106)	F	21 50				
June 7	eS	13 57.0				(107) Disturbed by microseisms. USCGS: ½°N 18°W, H. 13h 39m 38s. Atlantic Ocean.
(107)	eL	14 07				
	F	14 30				
June 10	eS	4 25 15				(108) BCIS: 35¾°N 24½°E, H. 4h 16m 03s. Near north coast of Crete.
(108)	eL	4 28				
	F	4 40				
June 13	e	22 00 40				(109) Wi: e 22h 00.5m. BCIS: 46°15'N 12°34'E, H. 21h 56m 45s. USCGS: 46½°N 13°E, H. 21h 56m 40s. Venetian Alps.
(109)	F	22 08				
June 14	eP	0 25 22				(110) Wi: epP 0h 26.0m; ePP 0h 29m 26s. USCGS: 20½°S 68°W, H. 0h 11m 57s, h about 100 km. Southwestern Bolivia.
(110)	ipP	0 25 56	+			
	iPP	0 29 18				
	iSKS	0 35 52				
	iS	0 36 52				
	iH	0 41 09				
	iH	0 41 40				
	iSS	0 43 06				
	eL	0 58				
	F	3 30				
June 16	e	0 41.4				(111) BCIS: 42°3 N 24°1 E, H. 0h 32m 17s. USCGS: 42½°N 24°E, H. 0h 32m 17s. Bulgaria.
(111)	F	0 50				
June 18	eP	15 42.7				(112) Wi: eP 15h 42.8s. USCGS: 54°N 161°E, H. 15h 31m 25s. Near east coast of Kamchatka.
(112)	eS	15 52 18				
	eL	16 08				
	F	18 30				
June 23	e	11 12				(113) USCGS: 41½°N 82°E, H. 11h 44m 55s. Sinkiang Province, China.
(113)	F	11 20				
June 23	eL	15 15				(114) USCGS: 39°N 119°W, H. 14h 35m 02s. Western Nevada.
(114)	F	15 40				

Seismic Records at De Bilt

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	mm	
June 25 (115)	iP	6 51 26	+	6	5	(115) Wi: eP 6h 51m 31s. USCGS: 62°N 27½°W, H. 6h 46m 55s. South of Iceland.
	eS	6 55 26				
	eL	6 56.5				
	F	7 40				
June 27 (116)	iP	19 20 22				(116) Wi: eP 19h 20m 14s. F in next shock. USCGS: 42°N 80°E, H. 19h 11m 23s. China - USSR border.
	eS	19 27 36				
	eL	19 37				
June 27 (117)	iPKP$_1$	19 24 21				(117) Wi: ePKP$_1$ 19h 24m 19s; ePKP$_2$ 19h 25m 03s; ePP 19h 28m 40s. USCGS: 33°S 179°W, H. 19h 04m 27s, h about 100 km. South of Kermadec Islands.
	ePKP$_2$	19 25 03				
	iPP	19 28 46				
	F	21.3				
June 28 (118)	eL	4 32				(118) USCGS: 63½°N 20°W, H. 4h 23m 28s. South of Iceland.
	F	4 50				
June 28 (119)	ePKP	20 03.0				(119) BCIS and USCGS: 9½°S 122½°E, H. 19h 43m 22s. Savu Sea.
	ePS	20 12 24				
	eL	20 35				
	F	21 15				
July 1 (120)	eSKS	2 49 37				(120) 28°N 139½°E, H. 2h 27m 46s, h about 550 km. Bonin Islands region. No z-record.
	ePS	2 51 18				
	eL	3 16				
	F	3 45				
July 3 (121)	iPKP	18 14 46				(121) BCIS: 16°1 S 172°8 E, H. 17h 55m 12s. USCGS: 16°S 173°E, H. 17h 55m 10s. New Hebrides Islands region.
	eSS	18 37				
	eL	19 05				
	F	20 30				
July 3 (122)	ePKP	18 15 30				(122) USCGS: aftershock of (121), H. 17h 55m 53s, BCIS: H. 17h 55m 55s.
July 6 (123)	epP	9 25 10				(123) F in next shock. Wi: epP 9h 25m 16s; ePP 9h 27m 11s. USCGS: 26½°S 61°W, H. 9h 10m 17s, h about 600 km. Chaco Province, Argentina.
	ePP	9 26 55				
	ePPP	9 29 15				
	eSKS	9 32 38				
	eS	9 33 29				
	eSP	9 35.0				
July 6 (124)	epP	9 38 22				(124) Wi: epP 9h 38m 26s; ePP 9h 40m 23s. Aftershock of (123). USCGS: 26½°S 61½°W, H. 9h 23m 27s, h about 600 km.
	ePP	9 40 15				
	ePPP	9 42.1				
	eSKS	9 45 46				
	eS	9 46 40				
	eSS	9 53.5				
	F	10.5				
July 8 (125)	eL	2 18				(125) BCIS: 71½°N 20°W, H. 2h 03m 58s. USCGS: 71½°N 19°W, H. 2h 04m 00s. Near east coast of Greenland.
	F	2 25				
July 9 (126)	eP	16 18.7				(126) Wi: eP 16h 18m 49s; ipP 16h 19m 20s. USCGS: 20½°S 68°W, H. 16h 05m 18s, h about 100 km. Chile - Bolivia border.
	epP	16 19 14				
	ez	16 22 10				
	ePP	16 22 35				
	eSKS	16 29 10				
	F	18.0				
July 10 (127)	e	4 55				(127) USCGS: 19°S 69°W, H. 4h 11m 40s. Chile - Bolivia border.
	F	5 25				
July 11 (128)	eL	6 08				(128) USCGS: 18½°S 169°E, H. 4h 51m 30s. New Hebrides Islands.
	F	6 25				
July 11 (129)	ePP	12 21.0				(129) Disturbed by microseisms. BCIS: 37½°S 78°E, H. 12h 01m 42s. USCGS: 37°S 79°E, H. 12h 01m 39s. Indian Ocean.
	eS	12 28.0				
	eL	13.0				
	F	14				
July 13 (130)	eP	12 40				(130) Disturbed by microseisms. 52°N 172½°W, H. 12h 28m 45s. Andreanof Islands, Aleutian Islands.
	eL	13 05				
	F	14				
July 16 (131)	ePKP	19 33 40				(131) Wi: ePKP 19h 33m 35s. USCGS: 21½°S 169°E, H. 19h 13m 52s. Loyalty Islands.
	ez	19 34 15				
July 18 (132)	iP	20 07 58	-	5	5	(132) USCGS: 15½°N 120½°E, H. 19h 54m 57s, h about 150 km. Luzon, Philippine Islands.
	ePP	20 11 42				
	iSKS	20 18 18				
	iS	20 18 47				
	eSS	20 25.1				
	eSSS	20 28.2				
	eL	20 37				
	F	22.5				
July 19 (133)	eL	4 37				(133) USCGS: 6½°S 105°E, H. 3h 42m 02s. Sunda Strait.
	F	5 10				
July 19 (134)	iP	15 19 07	+	6	2	(134) Wi: eP 15h 19m 12s. USCGS: 15°S 70½°W, H. 15h 06m 10s, h about 200 km. Peru.
	ipP	15 19 55				
	ePP	15 22 54				
	epPP	15 23 36				
	iSKS	15 29 20				
	iPS	15 30 25				
	eL	15 45				
	F	17 30				
July 20 (135)	ePP	3 00 20				(135) Wi: ePP 3h 00m 18s. USCGS: 6°S 111°E, H. 2h 41m 04s. Java Sea.
	ez	3 00 32				
	ePS	3 07.0				
	eL	3 37				
	F	4 15				
July 21 (136)	ePKP	8 02 45				(136) BCIS and USCGS: 14½°N 167½°E, H. 7h 43m 13s. New Hebrides Islands.
	ePP	8 05 41				
July 21 (137)	eP	12 41 (54)				(137) Wi: eP 12h 41m 51s. USCGS: 16°N 98°W, H. 12h 29m 09s. Near coast of Oaxaca, Mexico.
	ePP	12 45 (04)				
	eS	12 52 30				
	eSS	12 58.0				
	F	14.0				
July 22 (138)	iP	19 34 29	-	5	3	(138) Wi: iP 19h 34m 32s. BCIS and USCGS: 53°N 153°E, H. 19h 24m 17s, h about 650 km. Sea of Okhotsk.
	epP	19 36 50				
	iPP	19 37 32				
	ez	19 37 53				
	iS	19 43 12				
	esS	19 47 00				
	F	21 00				
July 22 (139)	iPKP	23 21 30				(139) Wi: ePKP 23h 21m 23s. USCGS: 5°S 152½°E, H. 23h 02m 27s, h about 60 km. New Britain.
	ePP	23 23 20				
	ePKS	23 24 50				
	ePKKS	23 30 30				
	ePS	23 33.0				
	eSS	23 40.5				
	eL	23 57				
	F	2.0				

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	mm	
July 23 (140)						(140) Wi: ePKP 15h 16m 38s. USCGS: 24½°S 176°W, H. 14h 56m 45s, h about 60 km. Tonga Islands region.
July 24 (141)	eP	1 35.0				(141) USCGS: 41°N 125½°W, H. 1h 23m 09s. Off coast of northern California.
	eS	1 45 12				
	eSS	1 50.2				
	eL	1 57				
	F	3 30				
July 26 (142)	eP	17 11 28				(142) Wi: eP 17h 11m 25s. BCIS: 40°8 N 27°5 E, H. 17h 07m 03s. USCGS: 41°N 27½°E, H. 17h 07m 03s. Northwestern Turkey.
	eH	17 15.1				
	eL	17 17				
	F	17 50				
July 31 (143)	eS	20 08 18				(143) Disturbed by microseisms. USCGS: 38½°N 70°E, H. 19h 53m 02s. Tadzhik, SSR.
	eSS	20 11 45				
	eL	20 16				
	F	20 41				
Aug. 5 (144)	eL	6 10				(144) USCGS and BCIS: 12½°N 125°E, H. 5h 16m 39s. Samar Island, Philippine Islands.
	F	6 30				
Aug. 7 (145)	eP	10 54 50				(145) Wi: eP 10h 54m 46s. USCGS: 56°N 154°W, H. 10h 43m 32s. Kodiak Island region.
	eS	11 04 06				
	eL	11 24				
	F	12 20				
Aug. 7 (146)	iP	21 56 42				(146) Wi: eP 21h 56m 43s. BCIS and USCGS: 56½°N 154°W, H. 21h 45m 26s. Kodiak Island region.
	eS	22 06 00				
	eL	22 20				
	F	23 25				
Aug. 8 (147)	eP	0 59.2				(147) Wi: eP 0h 59m 00s. USCGS: 55°N 162½°E, H. 0h 47m 38s. Near east coast of Kamchatka.
	iS	1 08 21				
	eL	1 22				
	F	2 30				
Aug. 9 (148)	e	5 18				(148) BCIS: 0°lat. 66°E, H. 4h 48m 30s. Indian Ocean.
	F	5 50				
Aug. 9 (149)	e	21 37				(149) USCGS: 8½°S 159°E, H. 23h 40m 03s, h about 100 km. Solomon Islands.
	F	22 15				
Aug. 11 (150)	e	23 00				(150) USCGS: 11°S 163°E, H. 21h 49m 42s. Solomon Islands region.
	F	23 15				
Aug. 11 (151)	eH	23 37				(151) BCIS: 41½°N 23°0 E, H. 23h 28m 04s. Macedonia - Yugoslavia border.
	F	23 45				
Aug. 12 (152)	eH	4 40				
	F	5 00				
Aug. 12 (153)	ePKP	10 18.5				(153) Wi: ePKP 10h 18m 07s. De Bilt no z-record. USCGS: 16½°S 177½°W, H. 9h 58m 22s. Fiji Islands region.
	eSS	10 40				
	eL	11 06				
	F	12 30				
Aug. 15 (154)	eP	9 09 57				(154) Wi: eP 9h 09m 46s. De Bilt no z-record. USCGS: 23°N 121°E, H. 8h 57m 04s. South of Formosa.
	ePP	9 13 28				
	eSKS	9 19 48				
	iS	9 20 17				
	iH	9 26 32				
	eH	9 31.2				
	eL	9 41				
	F	12				
Aug. 16 (155)	eSS	1 34				(155) Wi: ePKP 1h 11m 20s. Disturbed by microseisms. USCGS: 21°S 169°E, H. 0h 51m 40s. Loyalty Islands region.
	eL	2 05				
	F	3 00				
Aug. 17 (156)	e	1 37				(156) Wi: e 1h 36.9s. BCIS: 41°N 19½°E, H. 1h 33m 14s. USCGS: 41°N 20°E, H. 1h 33m 11s. Coast of Albania.
	eL	1 39.8				
	F	2 40				
Aug. 17 (157)	e	4 37				(157) Wi: e 4h 37.0m. Disturbed by microseisms. De Bilt no z-record. Aftershock of (156). BCIS: H. 4h 29m 01s. USCGS: 4h 29m 00s.
	F	4 50				
Aug.17 (158)	ePKP	21 23 56				(158) Wi: ePKP 21h 23m 56s; ePP 21h 26m 10s. USCGS: 7½°S 156°E, H. 21h 04m 40s. Solomon Islands.
	ePP	21 26 07				
	eSS	21 43.5				
	eL	22 03				
	F	0 30				
Aug. 18 (159)	iP	0 46 34				(159) Wi: eP 0h 46m 27s. USCGS: 22½°N 122°E, H. 0h 34m 03s. Near south coast of Formosa.
	ez	0 48 27				
	ePP	0 50 01				
	eS	0 57 02				
	eL	1 22				
	F	1 55				
Aug. 18 (160)	iP	6 48 23	-			(160) Wi: eP 6h 48m 23s; i 6h 48m 28s. USCGS: 44°55'N 111°05'W, H. 6h 37m 15.0s. Yellowstone Park, Wyoming.
	iPP	6 51 04				
	iS	6 57 33				
	eL	7 08				
	F	11.0				
Aug. 18 (161)	iP	15 37 14	-			(161) USCGS: aftershock of (160), H. 15h 26m 06.5s.
	eS	15 46 15				
	eH	15 46 22				
	iSS	15 50.5				
	eL	15 59				
	F	17.5				
Aug. 18 (162)	e	22 15.8				(162) Aftershock of (156). BCIS: H. 22h 04m 00s. USCGS: H. 22h 04m 01s.
	F	22 25				
Aug. 19 (163)	eS	4 24 20				(163) Aftershock of (160). USCGS: H. 4h 04m 03s.
	eL	4 38				
	F	5 45				
Aug. 21 (164)	ePKP	8 23.0				(164) USCGS: 50½°S 139½°E, H. 8h 03m 15s. Indian Ocean, south of Australia.
	eL	9 18				
	F	10 30				
Aug. 21 (165)	eL	11.0				(165) USCGS: aftershock of (164), H. 9h 37m 49s.
	F	12.0				

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s		
Aug. 23 (166)	eP	22 25 36				(166) Wi: eP 22h 25m 47s. BCIS and USCGS: 35½°N 3°W, H. 22h 21m 30s. Mediterranean Sea, north of Spanish Marocco.
	eS	22 29 10				
	eL	22 30.0				
	F	22 50				
Aug. 24 (167)	e	0 43				(167) BCIS: aftershock of (166), H. 0h 33m 56s.
	F	0 47				
Aug. 24 (168)	iPKP	21 50 13				(168) Wi: ePKP 21h 50m 04s. USCGS: 10½°S 161°E, H. 21h 30m 46s. Solomon Islands.
	ePP	21 52 48				
	ePKS	21 53 43				
	ePS	22 03				
	eSS	22 10.5				
	eL	22 27				
	F	1 30				
Aug. 26 (169)	iP	8 37 52	-	5	4	(169) Wi: iP 8h 37m 56s +. USCGS: 18°N 94½°W, H. 8h 25m 30s. Vera Cruz, Mexico.
	iS	8 48 04				
	eSS	8 53 25				
	eSSS	8 57.5				
	eL	9 00				
	F	10.0				
Aug. 26 (170)	eP	10 39 08				(170) Wi: eP 10h 39m 04s. USCGS: 51°N 132°W, H. 10h 27m 41s. Queen Charlotte Island.
	eS	10 48 22				
	eL	11 01				
	F	12 30				
Aug. 28 (171)	eL	0 30				(171) Wi: eP 0h 04m 30s. USCGS: 25°N 96°E, H. 23h 53m 10s. Northern Burma.
	F	1 00				
Aug. 29 (172)	eL	5 57				(172) No z-record. Quetta: 39°N 74½°E, H. 5h 31m 40s. Western Sinkiang Province, China.
	F	6 05				
Aug. 29 (173)	eL	13 53				
	F	14 08				
Aug. 29 (174)	iP	17 12 58	-			(174) Wi: eP 17h 12m 51s. BCIS: 5390 N 10698 E, H. 17h 03m 11s. USCGS: 52°N 106½°E, H. 17h 03m 10s. Lake Baikal, SSR.
	iPP	17 15 14				
	iS	17 20 57				
	eSS	17 24 48				
	eL	17 30				
	F	19.0				
Aug. 30 (175)	eP	3 29.0				(175) BCIS: 35°4 N 3°4 W, H. 3h 24m 54s. USCGS: 35½°N 30W, H. 3h 24m 54s. Mediterranean Sea, north of Spanish Marocco.
	eS	3 32 35				
	eL	3 34				
	F	3 50				
Aug. 30 (176)	e	22 30				(176) USCGS: 36½°S 78½°E, H. 21h 45m 07s. Indian Ocean.
	F	24 00				
Sep. 1 (177)	eL	5 50				
	F	6 00				
Sep. 1 (178)	e(P)	11 41 26				(178) Wi: eP 11h 41m 16s; i 11h 41m 24s. No z-record. BCIS: 41°0 N 19°6 E, H. 11h 37m 40s. USCGS: 41½°N 20°E, H. 11h 37m 42s. Albania.
	eS	11 44 15				
	eL	11 45				
	F	13 50				
Sep. 3 (179)	eL	4 10				(179) USCGS: aftershock of (178), H. 4h 02m 00s.
	F	4 20				
Sep. 3 (180)	ePP	6 46 44				(180) BCIS: 4½°S 122½°E, H. 6h 27m 33s. USCGS: 4½°S 123°E, H. 6h 27m 30s. Celebes Island.
	eS	6 54.5				
	ePS	6 56.1				
	eL	7 20				
	F	8.0				
Sep. 4 (181)	e	0 44				
	F	0 51				
Sep. 4 (182)	ez	11 07.5				(182) BCIS: aftershock of (178), H. 10h 58m 45s.
	F	11 12				
Sep. 4 (183)	eP	18 36 35				(183) USCGS: 1°S 24°W, H. 18h 26m 41s. Atlantic Ocean.
	eS	18 44 50				
	F	19 30				
Sep. 5 (184)	ePP	6 27.0				(184) Disturbed by microseisms. USCGS: 1°N 129°E, H. 6h 07m 38s. Halmahera Island region.
	eL	7 03				
	F	7 40				
Sep. 5 (185)	eL	16 30				(185) USCGS: aftershock of (184), H. 15h 34m 44s.
	F	17 00				
Sep. 5 (186)						(186) Wi: iPKP 23h 23m 41s. USCGS: 18°S 178½°W, H. 23h 05m 00s, h about 550 km. Fiji Islands.
Sep. 8 (187)	e	14 10				(187) Wi: e 14h 11.6m. BCIS: 54½°S 22°E, H. 13h 12m 08s. USCGS: H. 13h 12m 04s. South Atlantic Ocean.
	F	14 30				
Sep. 8 (188)	e	19 57				(188) Wi: eP 19h 31m 44s. USCGS: 42½°N 142½°E, H. 19h 19m 39s, h about 100 km. Hokkaido, Japan.
	F	20 40				
Sep. 9 (189)						(189) Wi: eP 5h 52m 25s. BCIS: 3695 N 7005 E, H. 5h 44m 40s, h about 220 km. USCGS: H. 5h 44m 38s, h about 200 km. Hindu Kush.
Sep. 10 (190)						(190) Wi: ePKP 5h 54m 40s. USCGS: 6½°S 154½°E, H. 5h 35m 04s. Solomon Islands.
Sept. 11 (191)	eP	12 36 28				(191) BCIS: 43°N 29°W, H. 12h 31m 01s. Mid Atlantic Crust.
	eS	12 40 53				
	eL	12 43				
	F	13 05				
Sep. 11 (192)	eP	14 23.5				(192) BCIS and USCGS: aftershock of (191), H. 14h 18m 07s.
	eS	14 28.1				
	eL	14 30				
	F	14 50				
Sep. 12 (193)	ePP	2 15				(193) USCGS: 3°S 146½°E, H. 1h 53m 47s. Bismarck Sea.
	eS	2 22.5				
	eSS	2 31.0				
	eL	2 50				
	F	4 50				
Sep. 14 (194)	ePKP	13 35 42				(194) Wi: ePKP 13h 35m 45s; e 13h 36m 16s. USCGS: 24°S 176½°W, H. 13h 15m 49s. Tonga Islands region.

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	mm	
Sep. 14	ePKP	14 29 40	+	7	3	(195) Wi: ePKP 14h 29m 40s. F in next shock. USCGS: 28½°S 177°W, H. 14h 09m 39s. Kermadec Islands.
(195)	ePP	14 33 10				
	eSS	14 53.5				
Sep. 14	ePKP	17 26 12				(196) Wi: ePKP 17h 26.4m. USCGS: 29°S 176½°W, H. 17h 06m 15s. Kermadec Islands.
(196)	eSS	17 50				
	eL	18 32				
	F	19 30				
Sep. 14	ePKP	22 43 52				(197) USCGS: 29°S 177°W, H. 22h 23m 53s. Kermadec Islands.
(197)	ePP	22 48.0				
	eL	23 48				
	F	24 40				
Sep. 15	ePKP	16 19 38				(198) Wi: ePKP 6h 19.7m. F after 09h. USCGS: 28½°S 177°W, H. 5h 59m 42s. Kermadec Islands.
(198)	ePP	16 23 44				
	eSS	16 43 40				
Sep. 16	$ePKP_1$	16 17 07				(199) USCGS: 28½°S 176°W, H. 15h 57m 03s. Kermadec Islands.
(199)	$ePKP_2$	16 17 43				
	eSS	16 41				
	eL	17 22				
	F	18 10				
Sep. 17	($ePKP_1$	14 56 12)				(200) USCGS: 28½°S 176°W, H. 14h 36m 11s. Kermadec Islands.
(200)	$ePKP_2$	14 56 42				
	ePP	14 59 50				
	F	17 00				
Sep. 17	e	22 59				(201) USCGS: 30½°N 114°W, H. 22h 14m 40s. Gulf of California.
(201)	F	23 03				
Sep. 18	eL	2 13.5				(202) BCIS: aftershock of (166), H. 2h 05m 00s.
(202)	F	2 30				
Sep. 18	ePS	12 30.2				(203) USCGS: 57½°S 24°W, H. 12h 01m 11s. Sandwich Islands.
(203)	eL	12 55				
	F	13 45				
Sep. 23	eL	23 07				(204) USCGS: 35½°N 138½°E, H. 22h 23m 11s. Honshu, Japan.
(204)	F	23 30				
Sep. 25	iP	2 44 39	+	7	3	(205) Wi: iP 2h 49m 34s (+). BCIS and USCGS: 22°N 122°E, H. 2h 36m 48s. Near east coast of Formosa.
(205)	iPP	2 53 06				
	ez	2 53 32				
	eS	3 00 20				
	eSS	3 06 07				
	eL	3 20				
	F	5 30				
Sep. 26	ez	8 23.9				(206) Wi: eP 8h 32m 49s. USCGS: 43½°N 128½°W, H. 8h 20m 51s. Off coast of Oregon.
(206)	eH	8 42.5				
	eL	8 53				
	F	10.0				
Sep. 28	e	4 38 10				(207) Wi: eP 4h 33m 11s. USCGS: 26½°N 128°E, H. 4h 20m 27s. Okinawa Island.
(207)	F	4 40				
Sep. 28	e	5 10				(208)
(208)	eL	5 17				
	F	5 25				

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	mm	
Sep. 29	iPKP	15 51 56				(209) USCGS: 29°S 176½°W, H. 15h 31m 57s. Kermadec Islands.
(209)	eSS	16 16 00				
	eL	16 58				
	F	18 00				
Sep. 30	e	17 07				(210) No z-record. BCIS: 36°N 3°3 W, H. 16h 57m 37s. USCGS: 35°N 3°W, H. 16h 57m 30s. Near coast of Spanish Marocco.
(210)	F	17 12				
Sep. 30						(211) Wi: ePKP 20h 45m 34s. USCGS: 18°S 168°E, H. 20h 25m 58s. New Hebrides Islands.
(211)						
Oct. 3						(212) Wi: iP 20h 19m 50s. USCGS: 42°N 146°E, H. 20h 02m 40s. Off coast of Hokkaido, Japan.
(212)						
Oct. 5	iP	18 35 28				(213) USCGS: 83½°N 112½°E, H. 18h 24m 47s. Arctic Ocean.
(213)	eS	18 41.5				
	eL	18 47				
	F	19 30				
Oct. 5	eS	20 40.7				(214) BCIS: 41°N 19½°E, H. 20h 34m 06s. USCGS: 41°N 20°E, H. 20h 34m 04s. Albania.
(214)	eL	20 42				
	F	21 00				
Oct. 7	eP	8 34.3				(215) Wi: eP 8h 34m 20s; eL 8h 38.5m. BCIS: 41°N 19½°E, H. 8h 30m 41s. USCGS: 41°N 20°E, H. 8h 30m 41s. Albania.
(215)	eS	8 37 20				
	eL	8 38.4				
	F	9 20				
Oct. 8						(216) Wi: ePKP 0h 23.0m. USCGS: 19°S 169°E, H. 0h 03m 28s. New Hebrides Islands.
(216)						
Oct. 8						(217) Wi: iP 2h 47m 07s. USCGS: 52½°N 171°W, H. 2h 35m 20s. Fox Islands, Aleutian Islands.
(217)						
Oct. 8	e	14 50				(218) USCGS: 52½°N 107°E, H. 14h 14m 10s. Lake Baikal, SSR.
(218)	F	14 56				
Oct. 11						(219) Wi: iP 9h 45m 50s. USCGS: 41½°N 142°E, H. 9h 33m 44s. Near north coast of Honshu, Japan.
(219)						
Oct. 12	e	4 10				(220) Disturbed by microseisms. Wi: eP 3h 34m 54s. USCGS: 2°N 98½°E, H. 3h 21m 52s. Near coast of Sumatra.
(220)	F	4 40				
Oct. 12	eL	20 05				(221) USCGS: 7°S 155½°E, H. 19h 21m 50s. Solomon Islands.
(221)	F	20 12				
Oct. 15	iP	6 29 47				(222) Wi: eP 6h 29m 40s; ePP 6h 34.0m. BCIS and USCGS: ½°N 120½°E, H. 6h 15m 32s. Celebes.
(222)	iPP	6 34 10				
	iSKS	6 40 28				
	iz	6 41 10				
	eSS	6 49				
	eL	7 05				
	F	9.0				

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	μ	
Oct. 19 (223)						(223) Wi: iP 2h 58m 50s. USCGS: 44½°N 148°E, H. 2h 46m 49s. Kurile Islands.
Oct. 19	eL	9 55				(224) Disturbed by microseisms.
(224)	F	10 50				USCGS: 27½°S 177°W, H. 8h 27m 21s. Kermadec Islands.
Oct. 19	(ez	16 13.2)				(225) Disturbed by microseisms.
(225)	ePP	16 14.6				BCIS and USCGS: 54½°S 29°W, H.
	ePS	16 24 10				15h 55m 30s. Sandwich Islands
	eSS	16 30.0				region.
	eSSS	16 34				
	eL	16 48				
	F	18 20				
Oct. 24	eSS	23 58.5				(226) Disturbed by microseims.
(226)	eL	0 03				Wi: eP 23h 50.3m. BCIS: 41°8 N
	F	0 40				69°8 E, H. 23h 40m 37s. USCGS:
						4½°N 70°E, H. 23h 40m 34s.
						Kazakh, SSR.
Oct. 25	eL	7 03				(227) BCIS: 45°0 N 28°5 W, H.
(227)	F	7 10				6h 51m 18s. Atlantic Ocean.
Oct. 26	iP	7 47 38				(228) Disturbed by microseisms.
(228)	iz	7 48 07				Wi: eP 7h 47m 32s. BCIS and
	iPP	7 50 54				USCGS: 37½°N 142½°E, H. 7h 35m
	eS	7 58 00				12s, h about 60 km. Near east
	eL	8 15				coast of Honshu, Japan.
	F	9 40				
Oct. 27	eS	7 14.7				(229) Disturbed by microseisms.
(229)	eSS	7 20.5				Wi: eP 7h 03m 03s. BCIS and
	eL	7 34				USCGS: 45½°N 151°E, H. 6h 52m
	F	8 30				50s, h about 100 km. Kurile
						Islands.
Oct. 30	eL	1 39				(230) USCGS: 8½°N 138°E, H. 0h
(230)	F	1 47				32m 29s. Caroline Islands.
Oct. 31 (231)						(231) Wi: iPKP 4h 45m 59s. BCIS and USCGS: 16½°S 178°W, H. 4h 27m 12s, h about 450 km. Fiji Islands.
Nov. 2	eL	20 55				(232) Disturbed by microseisms.
(232)	F	21 30				Wi: ePKP 20h 22m 27s. USCGS:
						51½°S 151½°E, H. 20h 03m 32s,
						h about 60 km. New Britain.
Nov. 2 (233)						(233) Wi: ePKP 22h 13m 00s. USCGS: 23½°S 175½°W, H. 21h 53m 05s. Tonga Islands region.
Nov. 3	eL	10 30				(234) Disturbed by microseisms.
(234)	F	11 10				USCGS: 10½°S 111°E, H. 9h 40m
						05s. South of Java.
Nov. 5	eL	13 00				(235) Disturbed by microseisms.
(235)	F	13 30				Wi: ePKP 12h 10m 17s. USCGS:
						13°S 166½°E, H. 11h 50m 17s, h
						about 100 km. New Hebrides
						Islands region.

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	μ	
Nov. 6	eL	2 15				(236) Disturbed by microseisms.
(236)	F	2 30				USCGS: 9°S 157½°E, H. 1h 07m 31s.
						Solomon Islands.
Nov. 6	e	7 45				(237) Disturbed by microseisms.
(237)	F	7 50				BCIS: 41⅝°N 21⅛°E, H. 7h 37m 08s.
						Yugoslavia.
Nov. 6 (238)						(238) Wi: iPKP 12h 03m 05s. USCGS: 24°S 174½°W, H. 11h 43m 06s. Tonga Islands region.
Nov. 7	e	2 39				(239) Disturbed by microseisms.
(239)	F	3 00				Wi: e 2h 36m 08s. BCIS: 36°1 N
						2°5 E, H. 2h 32m 08s. USCGS:
						36½°N 2½°E, H. 2h 32m 07s.
						Algeria.
Nov. 7	eL	23 38				(240) Disturbed by microseisms.
(240)	F	24 10				Wi: ePKP 22h 36m 14s. USCGS:
						23½°S 175½°W, H. 22h 16m 15s.
						Tonga Islands region.
Nov. 8	iP	14 06 55				(241) Disturbed by microseisms.
(241)	eS	14 16 44				Wi: iP 14h 06m 47s -. USCGS:
	e	14 25				44°N 140½°E, H. 13h 54m 55s.
	eL	14 35				Near west coast of Hokkaido,
	F	15 30				Japan.
Nov. 10	e	21 26				(242) Disturbed by microseisms.
(242)	F	21 46				USCGS: 36°N 89°E, H. 20h 56m 12s.
						Northern Tibet.
Nov. 15	eL	10 44				(243) Disturbed by microseisms.
(243)	F	11 20				USCGS: 38°N 74½°E, H. 10h 25m
						03s. East Turkestan.
Nov. 15	iz	17 12 59			+	(244) Disturbed by microseisms.
(244)	iH	17 16 24				Wi: e 17h 12m 57s. BCIS: 37°8 N
	eL	17 17.5				20°5 E, H. 17h 08m 41s. USCGS:
	F	21.0				37½°N 20½°E, H. 17h 08m 41s.
						Ionean Sea near west coast of
						Greece.
Nov. 16	eP	10 31 14				(245) Disturbed by microseisms.
(245)	eS	10 39 12				Wi: eP 10h 31m 18s. BCIS and
	eL	10 50				USCGS: 1°N 26½°W, H. 10h 21m 17s.
	F	11 40				Mid Atlantic Ocean.
Nov. 19	eSS	11 46.1				(246) Disturbed by microseisms.
(246)	eL	11 59				USCGS: 5½°S 146°E, H. 11h 08m
	F	13 10				31s. Near north coast of New
						Guinea.
Nov. 19	eL	14 11				(247) Disturbed by microseisms.
(247)	F	14 20				Wi: e 14h 05m 01s. BCIS: 38°8 N
						26°5 E, H. 14h 00m 26s. USCGS:
						38½°N 26°E, H. 14h 00m 24s. Off
						west coast of Turkey.
Nov. 22	eL	17 45				(248) Disturbed by microseisms.
(248)	F	18 30				USCGS: 54°S 136°W, H. 16h 26m
						34s. South Pacific Ocean.
Nov. 22 (249)						(249) Wi: iPKP 19h 53m 22s - ipPKP 19h 55m 32s. USCGS: 21½°S 178½°W, H. 19h 34m 35s, h about 550 km. Fiji Islands region.

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s	μ	
Nov. 22 (250)						(250) Wi: ePKP 23h 02m 34s. USCGS: 19½°S 175°E, H. 22h 42m 49s. Fiji Islands region.
Nov. 24 (251)	eL F	20 30 20 50				(251) Disturbed by microseisms. USCGS: 7½° 37°W, H. 20h 06m 35s. Atlantic Ocean.
Nov. 26 (252)	eS eL F	7 31.5 7 55 9.0				(252) Disturbed by microseisms. Change of papers from 7h 20m till 7h 28m. USCGS: 5½°S 102½°E, H. 7h 06m 19s. Near coast of Sumatra.
Nov. 26 (253)	eS eL F	23 34 30 23 55 1.0				(253) Disturbed by microseisms. USCGS: 5½°S 103°E, H. 23h 09m 23s. Near coast of Sumatra.
Nov. 28 (254)						(254) Wi: ePKP 3h 05m 30s. USCGS: 19½°S 174½°E, H. 2h 45m 45s. Fiji Islands region.
Nov. 28 (255)	eL F	3 55 4 45				(255) Disturbed by microseisms. USCGS: 26°N 128½°E, H. 3h 20m 24s. Ryukyu Islands.
Nov. 28 (256)	eL F	23 25 14 00				(256) Disturbed by microseisms. USCGS: 28½°S 71°W, H. 12h 34m 53s. Chile.
Nov. 28 (257)						(257) Wi: ePKP 22h 58m 38s. USCGS: 13°S 167½°E, H. 22h 39m 13s. New Hebrides Islands.
Nov. 30 (258)	e F	11 38 11 55				(258) Disturbed by microseisms. Wi: e 11h 38m 20s. USCGS: 44½°N 80½°E, H. 11h 12m 43s. Sinkiang Province, China.
Nov. 30 (259)						(259) Wi: eP 15h 29m 02s. USCGS: 59½°N 152°W, H. 15h 18m 37s. Kenai Peninsula, Alaska.
Dec. 1 (269)	eP eS eL F	12 42 58 12 46 28 12 48 13 15				(260) Disturbed by microseisms. Wi: eP 12h 43.0m. BCIS: 38°0 N 21°1 E, H. 12h 38m 49s. USCGS: 38°N 21½°E, H. 12h 38m 46s. Near west coast of Greece.
Dec. 1 (261)	eL F	15 35 17.0				(261) Disturbed by microseisms. USCGS: 63°S 154°E, H. 14h 59m 40s. Balleny Island region.
Dec. 2 (262)	ePP ePS eL F	9 57 58 10 02.5 11 23 11.5				(262) Disturbed by microseisms. BCIS and USCGS: 1°S 123°E, H. 9h 34m 00s. Celebes.
Dec. 4 (263)						(263) Wi: iPKP 9h 42m 47s. USCGS: 21°S 178½°W, H. 9h 24m 04s, h about 650 km. Fiji Islands region.
Dec. 7 (264)						(264) Wi: iPKP 3h 20m 22s. USCGS: 18°S 178°W, H. 3h 01m 44s. Fiji Islands.
Dec. 8 (265)	e F	13 49 14.0				(265) Disturbed by microseisms. USCGS: 42°N 44½°E, H. 13h 33m 59s. Georgia, SSR.
Dec. 11 (266)	eL F	3 05 3 15				(266) Disturbed by microseisms. USCGS: 23°S 175°W, Tonga Islands region.
Dec. 13 (267)						(267) Wi: ePKP$_1$ 17h 55m 50s; ePKP$_2$ 17h 56m 00s. USCGS: 18°S 173½°W, H. 17h 36m 07s. Tonga Islands.
Dec. 14 (268)	eL F	22 35 23 25				(268) Disturbed by microseisms. Wi: eP 22h 12m 36s. BCIS and USCGS: 52½°N 168°W, H. 22h 00m 50s. Fox Islands, Aleutian Islands.
Dec. 14 (269)	ez ePS eSS eL F	23 41 39 23 51.5 23 57.5 24 11 2.0				(269) Disturbed by microseisms. BCIS: 60½°S 27½°W, H. 23h 21m 55s. USCGS: 59½°S 31°W, H. 23h 21m 56s. Sandwich Islands.
Dec. 15 (270)						(270) Wi: iPP 9h 14m 16s. USCGS: 17½°N 145°E, H. 8h 56m 20s. Marianas Islands.
Dec. 18 (271)	eL F	17 10 17 30				(271) Disturbed by microseisms. Wi: eP 16h 36m 35s. USCGS: 53°N 168½°W, H. 16h 24m 50s. Fox Islands, Aleutian Islands.
Dec. 21 (272)	eP eS eSS eL F	11 28 40 11 36 09 11 40 11 45 13 30				(272) Disturbed by microseisms. BCIS: 13½°N 52°E, H. 11h 19m 13s. USCGS: 14°N 52°E, H. 11h 19m 14s. Gulf of Aden.
Dec. 22 (273)						(273) Wi: eP 17h 32m 39s. USCGS: 37½°N 141½°E, H. 17h 20m 19s. Off east coast of Honshu, Japan.
Dec. 26 (274)						(274) Wi: iP 22h 14m 04s -. BCIS and USCGS: 53°N 160°E, H. 22h 02m 35s. Kamchatka.
Dec. 27 (275)						(275) Wi: iP 4h 59m 41s. USCGS: 52½°N 160½°E, H. 4h 47m 45s. Near southeast coast of Kamchatka.
Dec. 27 (276)	iP eS eSS eL F	16 04 15 16 13 46 16 18.0 16 26 17 25	+	7	6	(276) Disturbed by microseisms. Wi: eP 16h 04m 18s. USCGS: 56°N 162½°E, H. 15h 52m 55s. Kamchatka.
Dec. 28 (277)	eP eS eL F	7 32 12 7 41 50 7 58 9 15				(277) Disturbed by microseisms. Wi: iP 7h 32m 06s; i 7h 32m 08s. USCGS: 52½°N 160°E, H. 7h 20m 32s. Near east coast of Kamchatka.
Dec. 28 (278)	eL F	13 50 14 15				(278) Disturbed by microseisms. Wi: iP 13h 16m 05s -. USCGS: 52½°N 160°E, H. 13h 04m 30s. Near east coast of Kamchatka.

Date 1959	Phase	Time	Direction	Period	Amplitude	Remarks
		h m s		s		
Dec. 29 (279)						(279) Wi: ePKP 17h 34.5m. USCGS: 21½°S 174°W, H. 17h 14m 40s. Tonga Islands.
Dec. 31 (280)	eS	21 03				(280) Disturbed by microseisms. Wi: eP 20h 58m 40s. BCIS: 37°9 N 25°2 W, H. 20h 52m 57s. USCGS: 37½°N 25°W, H. 20h 52m 55s. Azores Islands.
	eL	21 06				
	F	21 20				