SEISMOLOGICAL BULLETIN

OF

MATSUSHIRO

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1969

Matsushiro Seismological Observatory

Matsushiro-machi, Nagano-shi

Nagano-ken, Japan.

Matsushiro Seismological Observatory , Japan

Seismological Bulletin

Latitude 36° 32′ 30″N.
Longitude 138° 12′ 32″E.
Elevation 440 M.

Instrumental Constants

Instruments	Comp.	Period(sec.)	Damping ratio	Magnification
Benioff Seismograph (Short Period)	N	$T_1 = 1.0$ $T_2 = 0.23$	$h_1 = 0.63$ $h_2 = 1.7$	46 000 (max)
	E	$T_1 = 1.0$ $T_2 = 0.22$	$h_1 = 0.64$ $h_2 = 1.6$	46 000 (max)
	Z	$T_1 = 1.0$ $T_2 = 0.21$	$h_1 = 0.67$ $h_2 = 1.2$	57 000 (max)
Benioff Seismograph (Long Period)	N	$T_1 = 1.0$ $T_2 = 89$	$h_1 = 0.63$ $h_2 = 2.5$	3,200 (max)
	E	$T_1 = 1.0$ $T_2 = 55$	$h_1 = 0.64$ $h_2 = 2.5$	4,700 (max)
	Z	$T_1 = 1.0$ $T_2 = 64$	$h_1 = 0.67$ $h_2 = 2.7$	3,500 (max)
WWSS Seismograph (Short Period)	N	$T_1 = 1.0$ $T_2 = 0.75$		100,000
	E	$T_1 = 1.0$ $T_2 = 0.75$		100,000
	Z	$T_1 = 1.0$ $T_2 = 0.75$		100,000
WWSS Seismograph (Long Period)	N	$T_1 = 15$ $T_2 = 100$		3,000
	E	$T_1 = 15$ $T_2 = 100$		3,000
	Z	$T_1 = 15$ $T_2 = 100$		3,000
Short Period Vertical Seismograph	Z	$T_1 = 1.0$ $T_2 = 2.82$	$h_1 = 1.4$ $h_2 = 1.2$	32,000 (max)
Wood-Anderson Seismograph	N	$T = 0.8$	$h = 0.8$	1,300
	E	$T = 0.8$	$h = 0.8$	1,200

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Date	Phase	Comp.	Time(GMT) h m s
1.	eP	Z	02 43 20
	eL	N	48 20
	eL	E	32
	23.5 N., 121.2 E.		
	Taiwan.		
	h: 58 km.		
	H= 02 38 43.0		USCGS
1.	iP Z, P	NE	11 21 39.5
	PP	Z	25 33
	SKS	NE	32 30
	SS	NE	39 14
	eSSS	E	42 30
	eSSS	N	50
	L	N	46 00
	L	E	26
	P: D		
	Mag. 7 - 7½ (Mat.)		
	23.1 N., 107.9 W.		
	Gulf of California.		
	h: N.		
	H= 11 08 20.9		USCGS
1.	P	NEZ	11 21 50
	S	NE	22 33
	35.8 N., 135.4 E.		
	Near Honshu, Japan.		
	h: 340 km.		
	H= 11 20 53.2		JMA
1.	eP	Z	21 14 59
	eL	E	24 15
	3.7 S., 143.2 E.		
	Near north coast of New Guinea.		
	h: 36 km.		
	H= 21 07 22.9		USCGS
2.	eP	Z	01 52 24
	eS	NE	53 13
	34.1 N., 135.1 E.		
	Honshu, Japan.		
	h: 10 km.		
	H= 01 51 20.0		JMA
2.	P	EZ	02 43 48
	22.1 S., 179.8 W.		
	South of Fiji Is.		
	h: 640 km.		
	H= 02 33 34.6		USCGS
2.	iP	NEZ	03 30 56.0
	iX	EZ	31 10
	P: S,E,D		
	36.4 N., 140.6 E.		
	Honshu, Japan.		
	h: 50 km.		
	H= 03 30 24.2		JMA

Date	Phase	Comp.	Time(GMT) h m s
2.	eP	N	06 20 49
	iX	Z	50.5
	iX	NE	50.9
	iX	Z	22 32
	S	E	37
	46.0 N., 142.9 E.		
	Sakhalin I.		
	h: 344 km.		
	H= 06 18 30.8		USCGS
2.	iP	EZ	07 50 00.6
	eS	N	26
	P: E,D		
	35.8 N., 140.7 E.		
	Honshu, Japan.		
	h: 40 km.		
	H= 07 49 23.9		JMA
2.	eP	Z	13 30 02
	eS	NE	25
2.	eP	Z	14 52 43
2.	eP	Z	19 02 12
	eL	E	19 00
	eL	N	20 20
	6.5 S., 107.1 E.		
	Java.		
	h: 57 km.		
	H= 18 53 06.6		USCGS
2.	P	Z	19 30 15
	iX	NE	16
	iX	NE	24
2.	eP	Z	20 09 16
2.	P	NEZ	22 58 52
	iX	Z	59 16
	0.9 N., 125.2 E.		
	Molucca Passage.		
	h: 67 km.		
	H= 22 51 43.3		USCGS
3.	P	NEZ	03 42 43
	45.8 S., 123.2 E.		
	South of Australia.		
	h: N.		
	H= 03 30 19.3		USCGS
3.	eP	EZ	10 20 24
3.	eP	Z	10 59 02
	29.8 S., 178.2 W.		
	Kermadec Is. region.		
	h: 123 km.		
	H= 10 47 18.9		USCGS

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Date	Phase	Comp.	Time(GMT) h m s	
3.	eP	Z	13 24 23	
	eX	E	33	
	20.5 N., 120.4 E.			
	Philippine Is. region.			
	h: N.			
	H= 13 19 26.7			USCGS
3.	P	Z	20 10 08	
	45.3 N., 150.2 E.			
	Kurile Is.			
	h: 58 km.			
	H= 20 07 12.2			USCGS
3.	eP	NEZ	21 56 50	
	eS	EZ	57 12	
4.	iP Z, P	NE	02 04 11.8	
	eS	N	34	
	P: C			
4.	P	NEZ	02 30 34	
	iX	Z	46	
4.	P	Z	04 05 21	
	iX	Z	36	
	6.2 S., 130.1 E.			
	Banda Sea.			
	h: N.			
	H= 03 57 23.2			USCGS
4.	P	Z	05 21 05	
	S	NE	28	
4.	P	NEZ	06 21 23	
4.	iP	NEZ	08 51 45.5	
	S	NEZ	52 31	
	P: S,W,D			
	33.8 N., 137.3 E.			
	Near south coast of Honshu, Japan.			
	h: 340 km.			
	H= 08 50 47.4			JMA
4.	P	Z	08 52 20	
	eX	N	57 30	
	eX	E	40	
4.	P	Z	09 23 15	
	iX	Z	22	
	43.6 N., 147.7 E.			
	Kurile Is.			
	h: N.			
	H= 09 20 50.4			USCGS
4.	P	Z	12 15 26	
	17.0 N., 147.2 E.			
	Mariana Is. region.			

(cont.)

Date	Phase	Comp.	Time(GMT) h m s	
	h: 43 km.			
	H= 12 10 42.5			USCGS
4.	eP	Z	14 37 34	
	52.3 N., 169.6 W.			
	Fox Is. Aleutian Is.			
	h: 42 km.			
	H= 14 30 05.8			USCGS
4.	P	Z	15 37 04	
	1.5 N., 126.9 E.			
	Molucca Passage.			
	h: N.			
	H= 15 30 02.8			USCGS
4.	eP	Z	17 21 38	
	eX	Z	43	
	43.6 N., 147.7 E.			
	Kurile Is.			
	h: N.			
	H= 17 19 14.9			USCGS
4.	eP	Z	19 07 26	
	iX	Z	49	
	eS	NE	54	
4.	iP NZ, P	E	22 11 32.4	
	eL	NE	20 20	
	eL	N	25 00	
	P: N,C			
	0.1 S., 125.0 E.			
	Molucca Sea.			
	h: N.			
	H= 22 04 11.9			USCGS
4.	iP Z, P	NE	23 50 39.2	
	pP	Z	52 41	
	P: D			
	22.2 S., 179.7 W.			
	South of Fiji Is.			
	h: 610 km.			
	H= 23 40 22.7			USCGS
5.	iP Z, P	NE	06 30 01.8	
	S	NE	06	
5.	iP	Z	18 06 07.2	
	eX	Z	27	
	PPP	Z	10 38	
	S	E	15 58	
	iX	N	16 00	
	eL	N	26 12	
	eL	EZ	30	
	P: C			
	Mag. 6¼ - 6½ (Mat.)			
	34.8 N., 121.2 W.			
	Off coast of California.			
	h: 11.			
	H= 7 54 13.6			USCGS

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Date	Phase	Comp.	Time(GMT) h m s	Date	Phase	Comp.	Time(GMT) h m s
5.	eS	E	21 09 40	6.	iP	NZ	17 27 32.2
	eL	N	12 30		iX	Z	41
	eL	E	13 00		P: S,C		
	eL	Z	14 00				
	32.6 N., 101.9 E.			6.	iP	EZ	18 47 30.7
	Szechwan Province, China.				iX	N	34
	h: N.				iX	N	48 09
	H= 20 58 47.0		USCGS		eS	N	14
					P: E,D		
5.	iP	EZ	21 32 59.7		37.1 N., 141.7 E.		
	P: W,D				Near east coast of Honshu, Japan.		
5.	P	Z	22 13 29.6		h: 40 km.		
	S	EZ	52.3		H= 18 46 44.6		JMA
5.	P	Z	23 10 05	6.	iP	Z	20 26 57.3
	eX	NE	16		PP	Z	28 23
	PP	Z	24		PcP	Z	29 38
	19.2 N., 120.5 E.				S	NE	32 06
	Philippine Is. region.				eL	N	34 10
	h: 17 km.				eL	E	15
	H= 23 04 59.7		USCGS		eL	Z	26
					eLr	Z	36 00
6.	iP	Z	01 58 06.0		P: C		
	iX	E	59 35		Mag. 6 - 6¼ (Mat.)		
	eX	N	02 00 25		51.5 N., 178.9 W.		
	eX	E	40		Andreanof Is. Aleutian Is.		
	eL	Z	50		h: 36 km.		
	P: D				H= 20 20 18.5		USCGS
	43.8 N., 147.8 E.			6.	iP	Z	22 01 36.0
	Kurile Is.				iX	N	37
	h: 40 km.				S	N	02 17
	H= 01 55 33.5		JMA		P: C		
6.	P	Z	03 21 49		36.4 N., 142.1 E.		
	S	E	22 40		Near east coast of Honshu, Japan.		
6.	P	Z	06 40 41		h: 10 km.		
	4.4 S., 155.1 E.				H= 22 00 42.7		JMA
	Solomon Is.			7.	P	Z	00 42 40
	h: 502 km.						
	H= 06 33 20.3		USCGS	7.	iP	Z	02 40 57.4
					iX	NE	57.8
6.	P	NEZ	11 42 02		S	NE	45 37
	S	E	34		P: C		
					6.9 N., 124.6 E.		
6.	iP	Z	16 23 11.7		Mindanao, P.I.		
	iX	Z	27		h: 413 km.		
	S	E	24 31		H= 02 35 06.1		USCGS
	iX	N	41				
	P: N,E,D			7.	iP	NZ	04 07 42.6
	39.9 N., 142.7 E.				iX	E	58
	Near east coast of Honshu, Japan.				S	N	09 07
	h: 30 km.				P: N,D		
	H= 16 21 56.9		JMA		41.5 N., 141.9 E.		
					Near east coast of Honshu, Japan.		
					h: 90 km.		(cont.)

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Date	Phase	Comp.	Time(GMT) h m s	
	H= 04 06 14.6		JMA	
7.	ePKP 1	Z	04 17 50	
	PKP 2	Z	18 10	
	iX	Z	26	
	epPKP	Z	19 18	
	24.1 S., 66.9 W.			
	Salta Province, Argentina.			
	h: 211 km.			
	H= 03 58 30.9		USCGS	
7.	iP Z, P N		08 08 33.4	
	iX	E	35.5	
	iX	NEZ	09 10	
	iX	EZ	50	
	P: C			
	42.4 N., 143.0 E.			
	Hokkaido, Japan.			
	h: 80 km.			
	H= 08 06 52.4		JMA	
7.	iP	NEZ	08 35 19.2	
	S	N	58	
	P: S,E,C			
	39.3 N., 140.5 E.			
	North of Honshu,Japan.			
	h: 20 km.			
	H= 08 34 26.6		JMA	
7.	eP	Z	08 41 25	
	iX	Z	33	
	eS	E	42 36	
7.	iP EZ, P N		11 50 08.8	
	iX	N	34	
	P: W,C			
7.	P	Z	13 44 31	
	iX	NEZ	36	
	S	NEZ	47 10	
	26.3 N., 126.4 E.			
	Ryukyu Is.			
	h: 130 km.			
	H= 13 41 12.4		JMA	
7.	iP	NZ	18 44 38.8	
	iX	Z	58	
	PP	Z	47 00	
	PPP	E	48 54	
	S	NEZ	53 14	
	ScS	E	54 06	
	ScS	N	54 12	
	SS	NE	57 00	
	SSS or Lq	NE	19 01 00	
	eL	E	05 34	
	eL	N	06 00	
	eLr	NE	10 44	
	PKPPKP	Z	13 13	
	PKP2 PKP2	Z	24	

(cont.)

Date	Phase	Comp.	Time(GMT) h m s	
	P: S,C			
	Mag. 7 (Mat.)			
	27.9 N., 60.1 E.			
	Southern Iran.			
	h: 35 km.			
	H= 18 33 59.9		USCGS	
7.	P	Z	19 29 03	
7.	P	Z	20 05 40	
	iX	NZ	47	
	46.8 N., 151.8 E.			
	Kurile Is.			
	h: 128 km.			
	H= 20 02 20.9		USCGS	
7.	P	NZ	20 57 48	
	S	N	58 05	
7.	iP Z, P N		23 04 02.6	
	S	NZ	30	
	P: D			
	35.9 N., 140.6 E.			
	East of Honshu, Japan.			
	h: 40 km.			
	H= 23 03 28.6		JMA	
8.	eP	Z	01 18 33	
	iX	NE	36	
	eS	E	21 48	
	eL	E	24 20	
	20.0 N., 147.1 E.			
	Mariana Is. region.			
	h: 65 km.			
	H= 01 14 22.2		USCGS	
8.	iP	EZ	01 51 42.8	
	iX	NE	51	
	S	N	59 44	
	eSS	N	02 04 00	
	eL	E	06 24	
	eL	N	30	
	eL	Z	09 14	
	P: W,C			
	Mag. 6 - 6½ (Mat.)			
	16.2 S., 167.5 E.			
	New Hebrides Is.			
	h: 23 km.			
	H= 01 41 41.3		USCGS	
8.	iP	NEZ	05 36 58.0	
	S	E	38 27	
	P: S,W,C			
	39.9 N., 143.8 E.			
	Off east coast of Honshu, Japan.			
	h: 40 km.			
	H= 05 35 34.1		JMA	

Date	Phase	Comp.	Time(GMT) h m s	Date	Phase	Comp.	Time(GMT) h m s
8.	iP	NEZ	07 02 51.4		h: 33 km.		
	iS	NEZ	58.4		H= 22 23 18.1		USCGS
	P: N,E,C			8.	P	NZ	22 41 47
8.	iP Z, P	NE	07 24 25.7		S	NEZ	42 05
	eX	E	27 00	8.	P	NEZ	23 07 51
	eX	N	15		S	NE	08 11
	P: C			8.	P	NEZ	23 33 20
	44.3 N., 149.8 E.				S	N	39 10
	Kurile Is.				L	N	42 08
	h: 10 km.				L	E	10
	H= 07 21 35.0		JMA		L	Z	20
8.	P	NEZ	11 21 21		Mag. 5¾ - 6 (Mat.)		
	iX	NEZ	23		1.0 S., 127.0 E.		
	S	EZ	46		Halmahera.		
8.	eP	NZ	12 21 39		h: 55 km.		
	48.8 N., 156.0 E.				H= 23 26 00.0		USCGS
	Kurile Is. region.			9.	P Z, eP	NE	01 16 47
	h: N.				PP	Z	18 32
	H= 12 17 30.2		USCGS		S	NE	22 36
8.	P	NEZ	17 37 09		L	NEZ	25 30
	iX	Z	13		Mag. 5¾ - 6 (Mat.)		
8.	iP	EZ	20 15 22.0		1.0 S., 127.1 E.		
	iX	N	22.5		Halmahera.		
	S	NE	39		h: 19 km.		
	P: E,D				H= 01 09 24.3		USCGS
	36.5 N., 139.8 E.			9.	P	Z	01 29 31
	East of Honshu, Japan.				1.2 S., 126.9 E.		
	h: 90 km.				Molucca Sea.		
	H= 20 14 57.5		JMA		h: 69 km.		
8.	P	Z	21 10 33		H= 01 22 10.6		USCGS
	iX	NE	34	9.	P	NZ	05 19 50
	22.1 S., 179.7 W.				eS	E	20 57
	South of Fiji Is.			9.	P	NEZ	06 21 07
	h: 600 km.				S	E	31
	H= 21 00 16.1		USCGS		iX	N	32
8.	P	NZ	22 02 15	9.	iP	NZ	07 11 49.5
	iX	Z	31		S	E	12 42
	iX	NE	36		P: S,D		
	S	NE	08 16		32.2 N., 138.6 E.		
	iX	NE	25		South of Honshu, Japan.		
	eL	NEZ	11 14		h: 291 km.		
	eScS	N	12 25		H= 07 10 39.7		USCGS
	Mag. 6½ (Mat.)			9.	P	Z	07 17 04
	1.1 S., 127.0 E.				iX	N	26
	Halmahera.				iX	Z	31
	h: 18 km.						
	H= 21 54 50.8		USCGS				
8.	P	Z	22 30 40	9.	iP	NEZ	09 17 36.4
	1.1 S., 126.9 E.				PcP	Z	18 23
	Molucca Sea.				S	NE	25 20

(cont.)

(cont.)

Date	Phase	Comp.	Time(GMT) h m s
	eSSS	NE	09 32 20
	P: S, E, D		
	16.3 S., 167.9 E.		
	New Hebrides Is.		
	h: 185 km.		
	H= 09 07 50.9		USCGS
9.	P	NEZ	09 22 07
9.	eP	Z	19 51 41
	eX	NE	49
9.	P	NEZ	21 21 36
9.	P	NEZ	21 35 11
	S	NEZ	26
9.	iP Z, P NE		22 24 11.6
	S	NEZ	26
	P: C		
10.	P	Z	10 45 12
	43.4 N., 147.8 E.		
	Kurile Is.		
	h: N.		
	H= 10 42 37.1		USCGS
10.	iP	EZ	11 36 49.6
	P: W, C		
	8.7 S., 112.1 E.		
	Java.		
	h: 133 km.		
	H= 11 27 56.6		USCGS
10.	P	NZ	16 25 23
	S	NEZ	26 07
10.	iP	Z	18 42 22.6
	iX	N	31
	P: C		
10.	P	Z	19 15 26
	iX	EZ	40
	43.7 N., 147.7 E.		
	Kurile Is.		
	h: N.		
	H= 19 13 06.5		USCGS
10.	iP Z, P NE		22 38 27.4
	S	E	40
	iX	N	41
11.	eP	Z	01 43 07
	51.3 N., 178.9 W.		
	Andreanof Is.,		
	Aleutian Is.		
	h: 46 km.		
	H= 01 36 28.6		USCGS
11.	iP Z, P NE		05 01 44.8
	S	NE	02 00
	P: D		
11.	eP	N	06 17 10
	eS	N	34
11.	eP	Z	07 15 23
11.	eP	Z	08 14 33
11.	P	Z	11 14 19
11.	P	NZ	12 16 38
	43.4 N., 146.7 E.		
	Kurile Is.		
	h: 64 km.		
	H= 12 14 24.7		USCGS
11.	eP	Z	15 31 58
	PP	Z	33 45
	eS	E	38 52
	L	E	42 20
	5.7 S., 151.4 E.		
	New Britain region.		
	h: 73 km.		
	H= 15 23 59.2		USCGS
11.	P	Z	16 11 50
	S	Z	16 14
	L	Z	21 40
	15.7 N., 119.3 E.		
	Luzon, P. I.		
	h: 30 km.		
	H= 16 06 03.6		USCGS
11.	eP	Z	18 48 08
12.	iP Z, P NE		00 02 25.2
	iX	NE	45
	P: C		
12.	eP	EZ	00 07 10
	eS	N	46
12.	P	Z	01 29 20
	eS	N	31 17
	43.5 N., 146.6 E.		
	Kurile Is.		
	h: 0 km.		
	H= 01 27 04.1		JMA
12.	eP	Z	06 32 34
	eX	Z	47
	eX	NE	51
12.	eP	Z	07 01 06

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Date	Phase	Comp.	Time(GMT) h m s	Date	Phase	Comp.	Time(GMT) h m s
12.	iP Z, P NE		12 21 04.5	12.	P	Z	19 34 14
	P: C				eS	N	39
12.	iP	NEZ	12 31 37.6	12.	P	NEZ	21 33 34
	S	N	33 08		S	N	34 10
	P: S, W, C						
	42.4 N., 145.4 E.			13.	iP	Z	00 50 48.5
	Off Hokkaido, Japan.				P: D		
	h: 40 km.						
	H= 12 29 40.9		JMA	13.	P	Z	04 29 46
					S	Z	30 48
12.	iP Z, P NE		15 48 12.0				
	iX	EZ	28	13.	iP	Z	05 08 59.0
	PP	Z	49 59		S	N	17 38
	S	NE	54 36		P: D		
	iX	Z	57 44		23.7 S., 179.9 E.		
	L	N	16 00 32		South of Fiji Is.		
	L	Z	01 35		h: 540 km.		
	P: C				H= 04 58 30.9		USCGS
	6.0 S., 148.8 E.						
	New Britain region.			13.	eP	Z	06 17 24
	h: 32 km.				S	NEZ	18 36
	H= 15 40 15.5		USCGS		iX	Z	45
12.	P	Z	16 15 59	13.	P	Z	07 21 28
	S	NEZ	16 13		eS	N	56
12.	iP Z, P N		17 27 56.0	13.	iP	NEZ	07 55 56.5
	S	Z	28 11		S	N	56 03
	P: C				P: N, E, C		
	36.4 N., 140.4 E.			13.	PKP1	Z	08 11 16
	East Honshu, Japan.				iX	Z	25.0
	h: 60 km.				iX	Z	27.4
	H= 17 27 24.8		JMA		iPKP2	Z	37.5
					iPP	Z	15 10
12.	iP	NEZ	18 24 03.2		iPPP	Z	18 50
	eS	N	38		SKSP	E	25 20
	eX	E	43		PPS	E	30 20
	P: N, W, C				SS	E	35 06
	35.4 N., 141.2 E.				L	N	54 58
	Near east coast of Honshu, Japan.				L	E	09 01 30
	h: 50 km.				L	Z	50
	H= 18 23 20.8		JMA		Mag. 6¼ (Mat.)		
					27.8 S., 71.6 W.		
12.	eP	Z	18 39 18		Near coast of northern Chile.		
					h: N.		
12.	iP	NEZ	19 16 36.0		H= 07 51 29.5		USCGS
	ePcP	Z	18 36				
	S	NE	22 30	13.	P	Z	13 24 57
	L	E	24 54		eS	NE	26 15
	L	N	25 35				
	L	Z	46	13.	iP	NZ	13 54 20.5
	P: S, W, C				iX	N	24.4
	Mag. 6¼ (Mat.)				iS	N	32.5
	53.0 N., 168.3 W.				P: S, C		
	Fox Is., Aleutian Is.						
	h: 53 km.			13.	iP	Z	15 10 50.5
	H= 19 09 09.0		USCGS		S	NEZ	11 38
					P: C		

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Date	Phase	Comp.	Time(GMT) h m s	Date	Phase	Comp.	Time(GMT) h m s
13.	iP Z, P NE		15 54 10.0	15.	iP	NEZ	03 37 20.4
	S	Z	55 33		S	E	38 30
	P: C				P: S, W, C		
					40.2 N., 144.1 E.		
13.	P	Z	23 22 50		Off east coast of Honshu, Japan.		
	S	NE	23 11		h: 0 km.		
14.	P	Z	00 49 06		H= 03 36 48.8		JMA
14.	P	NEZ	01 49 14.5	15.	P	Z	07 40 45
	S	NE	39				
	P: N, E, D			15.	P	Z	10 42 51
					iS	NE	43 12.5
14.	iP	NZ	03 12 07.5				
	iS	NEZ	14.5	15.	P	Z	12 56 17
	P: N, E, C				S	E	51
14.	iP EZ, P N		03 15 20.2	15.	iP	EZ	13 13 12.0
	S	NEZ	35.7		iX	N	56
	P: E, C				P: E, C		
14.	P	Z	07 19 17	15.	P	NEZ	14 16 54
	eS	E	52		eX	N	17 21
14.	iP	NEZ	07 48 40.5	15.	iP	NEZ	17 50 57.6
	pP	Z	49 26		S	E	51 32
	S	E	57 36		P: S, E, D		
	ScS	E	58 33		36.6 N., 141.2 E.		
	sS	E	59 12		Near east coast of Honshu, Japan.		
	L	NE	08 07 05		h: 40 km.		
	P: S, E, D				H= 17 50 18.1		JMA
	Mag. $5\frac{3}{4}$-6 (Mat.)						
	19.7 S., 175.9 W.			15.	iP	Z	18 18 21.7
	Tonga Is.				P: D		
	h: 209 km.						
	H= 07 37 45.7		USCGS	15.	iP	Z	22 11 23.6
					S	NE	13 14
14.	eP	Z	12 06 39		P: D		
	21.6 S., 68.4 W.				25.4 N., 140.6 E.		
	Chile-Bolivia border region.				Volcano Is. region.		
	h: 114 km.				h: 160 km.		
	H= 11 46 54.6		USCGS		H= 22 08 43.9		USCGS
14.	P	Z	12 14 52	16.	eP	Z	03 46 27
	L	E	25 30		18.7 N., 143.8 E.		
	53.0 N., 168.3 W.				Mariana Is. region.		
	Fox Is., Aleutian Is.				h: 129 km.		
	h: 62 km.				H= 03 42 01.7		USCGS
	H= 12 07 19.4		USCGS				
14.	eP	Z	15 48 12	16.	P	Z	08 00 11
	14.6 S., 173.5 W.				64.1 N., 147.5 W.		
	Samoa Is. region.				Central Alaska.		
	h: N.				h: 34 km.		
	H= 15 37 15.6		USCGS		H= 07 51 11.0		USCGS
14.	eP	Z	17 27 19	16.	P	NEZ	08 07 46
15.	iP	NEZ	01 49 45.6	16.	iP	NEZ	10 56 44.6
	S	E	50 48		S	E	58 21
	P: S, W, C				P: N, W, C		

Date	Phase	Comp.	Time(GMT) h m s	
16.	eP	N	15 04 40	
	eX	E	07 40	
16.	P	Z	19 07 39	
	iX	Z	56	
16.	P	Z	19 09 47	
	iX	N	48.5	
	S	NEZ	10 09	
	iX	N	10.7	
16.	P	Z	20 06 41	
	64.1 N., 147.5 W.			
	Central Alaska.			
	h: 30 km.			
	H= 19 57 40.3			USCGS
16.	P	Z	20 17 09	
	iX	Z	19.7	
	iX	Z	22.5	
	S	N	23 32	
	L	E	26 52	
	Lr	N	30 26	
	6.2 S., 147.9 E.			
	East New Guinea region.			
	h: 62 km.			
	H= 20 09 10.4			USCGS
17.	P	Z	00 54 33	
	28.9 S., 179.1 W.			
	Kermadec Is.			
	h: 344 km.			
	H= 00 43 19.6			USCGS
17.	P	Z	02 54 22	
17.	eP	Z	03 27 02	
	S	N	32	
17.	eP	Z	12 34 20	
17.	P	Z	12 49 35	
17.	P	Z	12 53 58	
	S	NZ	55 56	
	L	N	56 13	
	43.2 N., 147.6 E.			
	Kurile Is.			
	h: 40 km.			
	H= 12 51 36.8			USCGS
17.	P	Z	14 09 57	
17.	eP	Z	16 22 42	
17.	P	Z	17 19 27	
	iS	NEZ	46.0	
17.	P	NZ	17 59 04	
	eS	Z	18 00 46	

(cont.)

Date	Phase	Comp.	Time(GMT) h m s	
	43.4 N., 147.0 E.			
	Kurile Is.			
	h: 50 km.			
	H= 17 57 47.2			JMA
17.	eP	Z	22 31 07	
	eS	Z	33 13	
	43.6 N., 148.4 E.			
	Kurile Is. region.			
	h: 40 km.			
	H= 22 28 36.8			JMA
18.	eP	Z	00 20 07	
18.	iP	NZ, P E	00 47 23.8	
	S	N	47	
	P: S, D			
	35.0 N., 137.0 E.			
	Honshu, Japan.			
	h: 10 km.			
	H= 00 46 50.1			JMA
18.	eP	Z	02 45 13	
	11.2 N., 140.0 E.			
	West Caroline Is.			
	h: 70 km.			
	H= 02 39 49.1			USCGS
18.	P	Z	04 12 16	
	S	NE	12 46	
18.	iP	NEZ	09 37 43.0	
	S	EZ	57	
	P: N, E, C			
	36.4 N., 140.8 E.			
	Near east coast of Honshu, Japan.			
	h: 60 km.			
	H= 09 37 08.5			JMA
18.	iP	NEZ	17 21 32.5	
	eS	E	22 43	
	P: S, W, C			
	40.2 N., 142.4 E.			
	Near east coast of Honshu, Japan.			
	h: 60 km.			
	H= 17 20 11.7			JMA
18.	P	Z	20 57 11	
	S	N	21 06 46	
	L	E	16 10	
18.	P	Z	23 21 54	
19.	iP EZ, P N		02 08 52.0	
	iS	NE	09 05.6	
	P: E, C			
19.	P	Z	07 07 45	
	S	NE	08 11	

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Date	Phase	Comp.	Time(GMT) h m s	
19.	P	NEZ	08 46 43	
	eX	E	47 10	
	S	EZ	58	
	P: S, E, C			
	41.7 N., 134.5 E.			
	Sea of Japan.			
	h: 460 km.			
	H= 08 45 08.8		JMA	
19.	eP	Z	13 20 50	
	eL	N	35 30	
	L	E	37 28	
	0.9 N., 97.8 E.			
	Northern Sumatra.			
	h: 33 km.			
	H= 13 11 45.8		USCGS	
19.	P	Z	13 46 48	
19.	iP	Z	15 01 08.8	
	P: C			
20.	P	NE	03 49 02	
	7.0 S., 123.4 E.			
	Banda Sea.			
	h: 630 km.			
	H= 03 41 35.3		USCGS	
20.	P	Z	09 11 04	
	S	NE	12 06	
20.	P	NEZ	10 05 34	
	S	E	05 56	
20.	iP Z, P N		21 02 49.2	
	iX	NE	03 00	
	iX	Z	49	
	eS	N	04 35	
	L	NE	05 06	
	Lr	N	25	
	P: C			
	42.9 N., 148.2 E.			
	Kurile Is.			
	h: 60 km.			
	H= 21 00 23.6		JMA	
20.	iP	Z	23 42 55.0	
	eS	N	43 18	
	P: C			
20.	P	Z	23 54 53	
	PP	Z	56 24	
	S	E	00 01 52	
	S	N	57	
	Lq	N	05 44	
	Lq	E	06 50	
	Lr	E	08 10	
	Lr	N	40	
	Mag. 6½-6½ (Mat.)			

(cont.)

Date	Phase	Comp.	Time(GMT) h m s	
	56.6 N., 153.2 W.			
	Kodiak I. region.			
	h: N.			
	H= 23 46 11.6		USCGS	
21.	iP	Z	00 22 55.6	
	P: D			
21.	eP	Z	00 38 34	
	56.4 N., 153.6 W.			
	Kodiak I. region.			
	h: 12 km.			
	H= 00 29 50.1		USCGS	
21.	iP Z, P E		02 14 51.6	
	X	NZ	59	
	X	Z	16 08	
	PP	Z	17 03	
	S	E	22 06	
	X	N	19	
	X	N	26 10	
	L	Z	20	
	L	E	30	
	Lr	N	28 25	
	Lr	E	29.6	
	Lr	Z	31 23	
	P: E, C			
	Mag. 7.1 (Mat.)			
	2.1 N., 94.6 E.			
	Off west coast of northern Sumatra.			
	h: 20 km.			
	H= 02 05 35.3		USCGS	
21.	iP	Z	03 16 08.9	
	S	NEZ	24	
	P: C			
21.	P	NZ	03 45 04	
	41.1 N., 142.7 E.			
	Near east coast of Honshu, Japan.			
	h: 60 km.			
	H= 12 43 35.4		JMA	
21.	eP	Z	07 32 40	
	X	E	33 03	
	X	N	04	
	8.1 N., 146.8 E.			
	Caroline Is. region.			
	h: N.			
	H= 07 26 35.4		USCGS	
21.	eP	E	08 14 51	
	X	E	59	
	X	NE	15 05	
	eS	E	16 40	
	X	N	58	
	L	N	17 10	

(cont.)

ate	Phase	Comp.	Time(GMT) h m s
	L	E	08 17 26
	43.7 N., 147.9 E.		
	Kurile Is.		
	h: 63 km.		
	H= 08 12 31.6		USCGS
21.	eP	Z	08 59 36
	X	N	57
	S	N	09 01 29
	L	N	02 12
	43.4 N., 147.9 E.		
	Kurile Is.		
	h: 40 km.		
	H= 08 57 15.2		USCGS
21.	eP	N	11 23 04
	S	N	24 54
	43.6 N., 147.5 E.		
	Kurile Is.		
	h: N.		
	H= 11 20 39.3		USCGS
21.	eP	Z	15 04 09
21.	P	NZ	17 24 02.0
	eS	E	25 57
	X	N	26 11
	44.0 N., 147.7 E.		
	Kurile Is.		
	h: 40 km.		
	H= 17 21 31.7		USCGS
21.	iP	NEZ	17 30 24.5
	iS	EZ	34.3
	P: N, E, C		
22.	P	Z	05 12 25
	28.2 S., 177.2 W.		
	Kermadec Is.		
	h: 65 km.		
	H= 05 00 39.6		USCGS
22.	eP	Z	06 21 14
	eS	E	23 14
	X	N	18
	eL	E	51
	eL	N	53
22.	eP	NZ	06 41 21
	eX	E	43 12
	eL	E	44 00
22.	P	Z	11 26 51
	X	Z	55.6
	X	N	30 40
	47.1 N., 154.2 E.		
	Kurile Is.		
	h: 60 km.		
	H= 11 23 18.4		USCGS
22.	P	Z	14 41 12
22.	iP	Z	14 44 29.7
	P: C		
22.	iP	NEZ	15 10 02.9
	PcP	NZ	11 41
	eS	NE	16 18
	eX	E	19 36
	X	Z	21 26
	P: S, W, D		
	6.9 S., 127.4 E.		
	Banda Sea.		
	h: 330 km.		
	H= 15 02 22.9		USCGS
22.	P	Z	16 58 46
	eX	N	59 15
	eX	E	27
22.	P	Z	19 39 16
	S	NE	48 50
	X	E	49 38
	eSS	E	53 40
	L	N	57.1
	22.3 N., 174.9 W.		
	Tonga Is. region.		
	h: N.		
	H= 19 27 45.9		USCGS
22.	P	Z	20 14 41
	S	N	15 21
	38.2 N., 141.5 E.		
	Near east coast of Honshu, Japan.		
	h: 50 km.		
	H= 20 13 52.0		JMA
22.	iP	NZ	23 15 16.6
	S	E	19 53
	L	NE	22 00
	Lr	Z	25 22
	P: S, W, C		
	Mag. 6.6 (Mat.)		
	57.8 N., 163.5 E.		
	Near east coast of Kamchatka.		
	h: N.		
	H= 23 09 37.2		USCGS
22.	P	NZ	23 59 20
	57.4 N., 163.1 E.		
	Off east coast of Kamchatka.		
	h: N.		
	H= 23 53 44.4		USCGS
23.	P	NZ	00 54 18
	57.3 N., 163.1 E.		

(cont.)

Date	Phase	Comp.	Time(GMT) h m s
	Near east coast of Kamchatka. h: 33 km. H= 00 48 40.3 USCGS		
23.	P	Z	04 21 02
	X	Z	19
	27.0 S., 176.4 W. Kermadec Is. h: 50 km. H= 04 09 17.4 USCGS		
23.	P	EZ	07 11 08
	eX	E	13 06
	eX	N	16
	X	N	28
	L	E	44
	eL	Z	52
	43.4 N., 148.9 E. Kurile Is. h: 50 km. H= 07 08 34.2 JMA		
23.	iP	Z	09 03 54.0
	X	Z	04 06
	P: D 10.4 S., 161.5 E. Solomon Is. h: 59 km. H= 08 54 53.5 USCGS		
24.	iP	EZ	13 53 31.1
	iX	N	31.3
	S	N	54 31
	X	E	36
	P: E, D		
24.	P	NEZ	15 54 52
	S	NE	55 09
24.	iP NE, P	Z	17 32 20.0
	X	N	33 12
	X	Z	17
	eS	E	39 36
	eX	E	45 10
	eL	Z	48 48
	eL	N	49 46
	P: N, W, D 37.2 N., 71.7 E. Afganistan-USSR border region. h: 123 km. H= 17 23 20.2 USCGS		
24.	iP	NEZ	21 41 20.0
	iPcP	Z	42.0
	S	E	49 34
	X	E	53 50
	eX	E	57 14

(cont.)

Date	Phase	Comp.	Time(GMT) h m s
	P: S, E, D 18.0 S., 178.4 W. Fiji Is. region. h: 593 km. H= 21 31 17.6 USCGS		
24.	P	Z	23 00 33
	X	E	41
	PP	Z	02 20
	S E, eS N		07 35
	X	E	10 35
	L	N	11 24
	Lr	Z	19 16
	Mag. 6½-6½ (Mat.) 56.2 N., 153.6 W. Kodiak Is. region. h: N. H= 22 51 50.1 USCGS		
25.	eP	Z	04 59 39
	eL	E	05 06 00
25.	iP	NEZ	09 35 48.6
	S	EZ	36 04
	P: N, E, C		
25.	P	Z	13 54 30
	eL	E	14 02 06
25.	P	Z	13 54 34
	X	Z	43
	iX	E	46.3
	X	N	55 25
	34.2 N., 135.2 E. Central Honshu, Japan. h: 10 km. H= 13 53 38.0 JMA		
25.	iP	NEZ	19 35 21.5
	eS	E	37 10
	eX	N	44
	eL	E	58
	eL	Z	38 12
	P: N, E, D 43.4 N., 147.7 E. Kurile Is. h: N. H= 19 32 59.2 USCGS		
25.	iP	Z	23 59 41.3
	P: C		
26.	iP	EZ	09 28 09.4
	eS	E	26
	X	Z	29
	P: E, C 35.7 N., 137.1 E. Central Honshu, Japan. h: 10 km. H= 09 27 45.5 JMA		

Date	Phase	Comp.	Time(GMT) h m s
26.	P	Z	12 54 09
	S	E	13 02 15
	S	N	16
	eL	Z	08 54
	L	NE	09 10
	Mag. 6¼ (Mat.)		
	16.8 S., 167.7 E.		
	New Hebrides Is.		
	h: 33 km.		
	H= 12 44 04.7		USCGS
26.	P	NEZ	14 37 25
	X	N	38 06
	eS	N	45 30
	eX	E	38
	X	N	50 10
	eL	E	52 00
	16.8 S., 167.8 E.		
	New Hebrides Is.		
	h: 34 km.		
	H= 14 27 20.4		USCGS
26.	ePKP	EZ	18 46 16
	ePP	Z	50 00
	eX	Z	59 32
	X	NE	19 09 11
	eSSS	E	15 25
	eL	E	31 20
	eLr	Z	38 30
	eLr	E	43 38
	Mag. 6¼-6½ (Mat.)		
	58.8 S., 24.7 W.		
	South Sandwich Is. region.		
	h: N.		
	H= 18 26 08.9		USCGS
26.	P	NZ	21 28 04
	16.9 S., 167.8 E.		
	New Hebrides Is.		
	h: 16 km.		
	H= 21 17 55.8		USCGS
26.	eP	Z	22 50 46
	eS	E	23 01 18
	X	N	22
	eL	NE	14 00
	17.9 S., 65.4 E.		
	Mascarene Is. region.		
	h: 27 km.		
	H= 22 37 56.0		USCGS
27.	iP	Z	00 33 06.2
	eX	N	35 34
	X	E	36 16
	X	N	20
	P: C		
	34.1 N., 127.7 E.		
	Near west coast of Kyushu, Japan.		
	h: 50 km.		
	H= 00 30 57.4		JMA

Date	Phase	Comp.	Time(GMT) h m s
27.	P	Z	02 25 22
	S	E	43
27.	P	NEZ	03 17 57
	epP	NEZ	18 30
	eX	E	21 38
	19.6 S., 169.3 E.		
	New Hebrides Is.		
	h: 135 km.		
	H= 03 07 42.4		USCGS
27.	eP	Z	15 25 44
	eS	E	30 18
	eL	E	33 00
	eL	N	05
	eL	Z	34 00
	L	E	35 04
27.	eP	Z	18 25 43
	eS	E	26 47
27.	eP	Z	19 57 58
	16.9 S., 167.7 E.		
	New Hebrides Is.		
	h: 30 km.		
	H= 19 47 53.6		USCGS
27.	eP	Z	20 05 17
	eX	E	12 48
	eS	N	13 45
	eL	E	22 04
	16.9 S., 167.8 E.		
	New Hebrides Is.		
	h: 30 km.		
	H= 19 55 11.3		USCGS
27.	P	Z	21 00 41
	iX	E	43.6
	S	E	02 27
	S	N	28
28.	P	EZ	01 36 40
	eS	E	38 08
28.	iP	Z	13 55 09.4
	iPcP	Z	56 54.2
	ScP	Z	14 00 32
	eS	NE	01 28
	eL	E	04 20
	L	N	50
	eL	Z	05 00
	P: C		
	6.9 S., 129.7 E.		
	Banda Sea.		
	h: 75 km.		
	H= 13 47 08.9		USCGS
28.	iP	Z	14 31 44.9
	S	EZ	32 09
	P: C		

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Date	Phase	Comp.	Time(GMT) h m s
28.	iP	Z	14 59 18.8
	P: D		
	26.4 S., 178.6 W.		
	South of Fiji Is.		
	h: 375 km.		
	H= 14 48 18.7		USCGS
28.	P	EZ	16 14 22
	eX	E	41
	eS	E	49
28.	iP	Z	20 21 28.2
	eS	E	22 45
	P: C		
	41.3 N., 142.6 E.		
	Near east coast of Honshu, Japan.		
	h: 10 km.		
	H= 20 19 58.0		JMA
28.	P	Z	22 24 50
	eS	E	25 55
28.	eP	Z	22 30 13
	eS	E	31 01
	34.0 N., 135.1 E.		
	Central Honshu, Japan.		
	h: 0 km.		
	H= 22 29 04.6		JMA
29.	PKP	Z	03 33 45
	epPKP	Z	34 13
	19.2 S., 69.4 W.		
	Northern Chile.		
	h: 108 km.		
	H= 03 14 04.1		USCGS
29.	P	Z	04 25 45
	iX	Z	46.2
	7.4 S., 128.2 E.		
	Banda Sea.		
	h: 82 km.		
	H= 04 17 38.9		USCGS
29.	P	NEZ	16 15 00
	iX	NEZ	02.4
	iX	NEZ	08.5
	eX	N	18 28
	46.6 N., 154.1 E.		
	Kurile Is. region.		
	h: 53 km.		
	H= 16 11 25.9		USCGS
29.	iP	NEZ	16 44 41.1
	X	E	49
	X	N	51
	X	EZ	46 22
	X	N	24
	P: N, E, C		

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Date	Phase	Comp.	Time(GMT) h m s
	33.3 N., 132.4 E.		
	Shikoku, Japan.		
	h: 40 km.		
	H= 16 43 16.1		JMA
29.	iP	Z, P N	16 52 39.5
	P: C		
	18.3 S., 175.0 W.		
	Tonga Is.		
	h: 250 km.		
	H= 16 41 52.5		USCGS
29.	eP	EZ	17 58 24
	eX	E	44
29.	eP	NEZ	18 35 59
	2.2 N., 126.5 E.		
	Molucca Passage.		
	h: 101 km.		
	H= 18 29 07.8		USCGS
30.	P	Z	00 18 51
	5.7 S., 149.5 E.		
	New Britain region.		
	h: 161 km.		
	H= 00 11 04.1		USCGS
30.	iP	EZ	03 41 06.7
	iX	N	07.0
	eX	EZ	42 52
	P: E, C		
	49.9 N., 79.0 E.		
	Eastern Kazakh.		
	h: 0 km.		
	H= 03 32 57.2		USCGS
30.	iP	NEZ	04 13 46.9
	eX	EZ	14 11
	eX	E	15 24
	eX	N	32
	P: N, E, C		
	33.3 N., 132.4 E.		
	Shikoku, Japan.		
	h: 40 km.		
	H= 04 12 21.5		JMA
30.	P	NZ	06 55 50
30.	P	NEZ	08 49 50
	eX	Z	50 12
	52.7 N., 158.2 E.		
	Near east coast of Kamchatka.		
	h: 88 km.		
	H= 08 45 06.9		USCGS
30.	iP	NEZ	12 49 31.2
	S	NE	58
	P: S, E, D		

(cont.)

November , 1969

Date	Phase	Comp.	Time(GMT) h m s	Date	Phase	Comp.	Time(GMT) h m s
	34.7 N., 140.0 E.						
	Near south coast of Honshu,						
	Japan.						
	h: 100 km.						
	H= 12 48 52.0		JMA				
30.	iP	EZ	12 59 16.2				
	iX	N	16.4				
	S	NE	43				
	P: E, D						
30.	eP	EZ	14 45 28				
	S	NE	41				

Mineo Takehana

Director

December , 1969

Date	Phase	Comp.	Time(GMT) h m s	
1.	iP	Z	02 26 47.5	
	P: D			
	18.4 S., 178.0 W.			
	Fiji Is. region.			
	h: 600 km.			
	H= 02 16 42.7		USCGS	
1.	P	Z	09 43 35	
	iS	N	44 03.4	
	P: D			
1.	P	Z	13 08 28	
	0.2 S., 123.0 E.			
	Northern Celebes.			
	h: 196 km.			
	H= 13 01 20.1		USCGS	
1.	eP	N	15 36 56	
	S	N	37 24	
1.	eP	Z	17 34 39	
1.	P	Z	20 30 42	
	35.0 N., 24.3 E.			
	Crete.			
	h: 53 km.			
	H= 20 18 06.3		USCGS	
1.	P	Z	20 39 47	
	20.1 S., 175.0 W.			
	Tonga Is.			
	h: 38 km.			
	H= 20 28 27.2		USCGS	
1.	ePKP	Z	20 54 38	
	60.0 S., 28.5 W.			
	South Sandwich Is. region.			
	h: 163 km.			
	H= 20 35 05.2		USCGS	
1.	eP	Z	22 32 49	
	SS	E	51 28	
	eLq	E	23 04 53	
	eLr	N	14 15	
	Mag. 6½ (Mat.)			
	16.7 N., 60.8 W.			
	Leeward Is.			
	h: 41 km.			
	H= 22 13 53.4		USCGS	
2.	P	Z	00 17 09	
	S	E	34	
2.	P	Z	04 18 13	
	S	N	23 10	
	Lq	E	25 29	
	Lr	Z	27 00	
	57.4 N., 163.4 E.			

(cont.)

Date	Phase	Comp.	Time(GMT) h m s	
	Near east coast of Kamchatka.			
	h: N.			
	H= 04 12 34.6		USCGS	
2.	P	Z	08 32 02	
	13.4 N., 143.9 E.			
	South of Mariana Is.			
	h: 142 km.			
	H= 08 27 03.8		USCGS	
2.	iP	NEZ	14 11 29.6	
	S	Z	54	
	P: S,E,D			
2.	P	Z	17 31 37	
	X	E	36 25	
	13.1 N., 143.9 E.			
	South of Mariana Is.			
	h: 110 km.			
	H= 17 26 33.1		USCGS	
2.	P	Z	18 03 06	
	X	Z	30	
	S	NE	07 54	
	Lq	N	09 40	
	Lr	Z	11 07	
	Mag. 6¼ (Mat.)			
	8.2 N., 126.3 E.			
	Mindanao, P.I.			
	h: 102 km.			
	H= 17 57 04.3		USCGS	
2.	iP	NEZ	19 03 06.2	
	X	N	04 40	
	P: S,W,C			
	40.2 N., 143.9 E.			
	Off east coast of Honshu, Japan.			
	h: 37 km.			
	H= 19 01 39.4		USCGS	
3.	P	Z	04 31 49.5	
3.	P	Z	08 38 14	
3.	P	NZ	12 40 06	
	54.7 N., 161.4 E.			
	Near east coast of Kamchatka.			
	h: 35 km.			
	H= 12 34 52.3		USCGS	
3.	P	Z	16 22 32	
	54.6 N., 160.6 E.			
	Near east coast of Kamchatka.			
	h: 57 km.			
	H= 16 17 24.8		USCGS	

December , 1969

Date	Phase	Comp.	Time(GMT) h m s	
4	P	Z	03 08 16	
	eL	E	14 10	
	eL	Z	15 30	
	12.1 N., 143.6 E.			
	South of Mariana Is.			
	h: N.			
	H= 03 02 56.7			
4.	iP	EZ	08 51 59.8	
	S	E	53 11	
	P: E, C			
	Mag. 5.6 (Mat.)			
	40.7 N., 144.7 E.			
	Off east coast of Honshu, Japan.			
	h: 20 km.			
	H= 08 50 21.6		USCGS	
4.	P	Z	11 39 20	
	13.1 N., 143.3 E.			
	South of Mariana; Is.			
	h: 190 km.			
	H= 11 34 24.0		USCGS	
4.	P	Z	12 48 07	
	X	Z	13	
	X	NE	14	
	S	N	41	
4.	iP	NZ	21 20 10.0	
	S	Z	27	
	P: S, D			
4.	eP	Z	23 49 42	
	X	N	50 11	
	iX	N	20	
5.	P	Z	07 28 41	
	X	NEZ	48	
	P: D			
5.	iP	NZ	15 04 45.4	
	S	NEZ	05 30	
	P: N, C			
	34.0 N., 137.2 E.			
	Near south coast of Honshu, Japan.			
	h: 343 km.			
	H= 15 03 48.4		USCGS	
5.	P	NEZ	15 16 04	
	S	NEZ	18	
5.	P	Z	17 12 08	
	37.2 N., 116.2 W.			
	Southern Nevada.			
	h: 0 km.			
	H= 17 00 00.0		USCGS	

Date	Phase	Comp.	Time(GMT) h m s	
5.	eP	Z	17 21 33	
	X	N	57	
	30.0 N., 131.9 E.			
	Kyushu, Japan.			
	h: 57 km .			
	H= 17 26 14.8		USCGS	
5.	P	NZ	17 28 16	
5.	P	NE	22 28 25	
	S	NE	29 43	
5.	eP	Z	22 44 23	
	S	E	38	
6.	iP	EZ	01 19 32.1	
	S	NE	45	
	P: W, C			
6.	P	NE	07 13 18	
	43.8 N., 54.8 E.			
	Wastern Kazakh SSR.			
	h: 0 km.			
	H= 07 02 57.4		USCGS	
6.	iP	Z	13 17 24.2	
	iS	NE	47.6	
	P: D			
6.	ePKP	Z	15 14 07	
	X	Z	16	
	58.7 N., 25.1 W.			
	South Sandwich Is. region.			
	h: N.			
	H= 14 54 00.8		USCGS	
6.	P	Z	15 36 58	
	X	Z	37 03	
	S	E	38 16	
	30.7 N., 140.4 E.			
	South of Honshu, Japan.			
	h: 116 km.			
	H= 15 35 27.7		USCGS	
7.	P	Z	04 05 43	
	eS	NEZ	14 00	
	Lq	E	20 00	
	Lr	Z	24 33	
	18.1 S., 168.2 E.			
	New Hebrides Is.			
	h: 49 km.			
	H= 03 55 31.1		USCGS	
7.	iP Z, P NE		13 40 40.5	
	eX	N	47 00	
	P: C			
	6.7 S., 129.6 E.			
	Banda Sea.			
	h: 119 km.			
	H= 13 32 45.2		USCGS	

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Date	Phase	Comp.	Time(GMT) h m s	
7.	P	Z	21 52 11	
	S	NE	57 10	
	Lq	E	58 09	
	Lr	Z	59 39	
	9.6 N., 125.6 E.			
	Mindanao, P. I.			
	h: 51 km.			
	H= 21 46 15.1		USCGS	
7.	P	Z	22 40 00	
	4.8 S., 143.5 E.			
	New Guinea.			
	h: 105 km.			
	H= 22 32 31.5		USCGS	
8.	iP	Z	05 11 12.5	
	iPcP	Z	13 38.0	
	eS	NZ	16 50	
	L	E	19 00	
	P: C			
	1.7 N., 127.3 E.			
	Halmahera.			
	h: 101 km.			
	H= 05 04 19.7		USCGS	
8.	P	Z	05 24 06	
	eS	N	28 24	
	eLq	E	30 00	
	eLr	E	32 00	
	57.2 N., 162.3 E.			
	Near east coast of Kamchatka.			
	h: 54 km.			
	H= 05 18 34.8		USCGS	
8.	P	Z	09 44 48	
	0.1 S., 122.8 E.			
	Northern Celebes.			
	h: 194 km.			
	H= 09 37 30.0		USCGS	
8.	iP Z, P NE		19 33 04.0	
	iS	NE	18.5	
	P: C			
8.	eP	Z	19 45 20	
9.	P	Z	03 32 53	
	X	Z	33 41	
	L	NEZ	41 28	
	0.9 N., 126.2 E.			
	Molucca Passage.			
	h: 99 km.			
	H= 03 25 51.7		USCGS	
9.	P	EZ	16 35 22	
9.	P	Z	18 58 04	
	X	Z	59 11	
	eS	NE	19 01 33	

(cont.)

Date	Phase	Comp.	Time(GMT) h m s	
	eLq	E	19 03 17	
	Lr	Z	04 43	
	47.6 N., 156.1 E.			
	Kurile Is. region.			
	h: N.			
	H= 18 54 06.0		USCGS	
9.	P	Z	22 01 41	
	X	E	02 03	
	eS	NE	04 23	
	44.0 N., 148.4 E.			
	Kurile Is.			
	h: N.			
	H= 21 59 11.0		USCGS	
10.	P	Z	00 02 51	
10.	eP	Z	00 18 04	
	X	Z	05	
	eS	N	24 17	
	eLq	N	27 23	
	2.7 S., 129.2 E.			
	Ceram.			
	h: N.			
	H= 00 10 31.8		USCGS	
10.	iP Z, P N		01 48 02.3	
	P: C			
10.	X	N	05 54 10	
	L	N	57 40	
	L	Z	06 00 39	
10.	P	EZ	08 36 06	
	eX	N	33	
	X	N	48	
10.	iP	Z	20 03 49.7	
	X	NEZ	55	
	PP	Z	06 00	
	PPP	Z	07 30	
	S	N	11 37	
	Lq	N	16 00	
	Lr	Z	18 25	
	P: D			
	Mag. 6½-6¾ (Mat.)			
	14.8 S., 167.0 E.			
	New Hebrides Is.			
	h: 21 km.			
	H= 19 53 58.2		USCGS	
10.	P	Z	22 01 47	
11.	iP	Z	00 55 29.3	
	X	NZ	33	
	S	E	56 44	
	S	N	47	
	P: D			
	30.2 N., 137.0 E.			

(cont.)

Date	Phase	Comp.	Time(GMT) h m s
	South of Honshu, Japan.		
	h: 320 km.		
	H= 00 53 52.3		JMA
11.	iP	NEZ	02 40 39.7
	iS	NEZ	56.0
	P: E, D		
11.	eX	E	11 11 10
	eX	N	16 00
	eL	N	24 49
	eX	Z	25 50
	eL	Z	31 30
11.	P	Z	13 51 41
11.	PKP1	Z	17 16 09
	PKP2	Z	39
	eL	N	18 05 15
	eL	NZ	08 00
	21.2 S., 68.5 W.		
	Chile-Bolivia border region.		
	h: 119 km.		
	H= 16 56 25.2		USCGS
11.	PKP	Z	22 53 04
	19.9 S., 70.2 W.		
	Near coast of Northern Chile.		
	h: 60 km.		
	H= 22 33 09.1		USCGS
12.	iP	NEZ	01 14 39.6
	X	E	59
	eS	E	15 44
	eS	N	47
	L	NE	58
	P: S, W, C		
	40.1 N., 143.8 E.		
	Off east coast of Honshu, Japan.		
	h: 11 km.		
	H= 01 13 11.4		USCGS
12.	eP	Z	06 08 26
	45.8 N., 150.0 E.		
	Kurile Is.		
	h: 90 km.		
	H= 06 05 31.1		USCGS
12.	iP	NEZ	07 12 58.9
	S	NE	13 21
	P: N, E, D		
	37.2 N., 140.4 E.		
	Northern Honshu, Japan.		
	h: 80 km.		
	H= 07 12 26.8		JMA
12.	iP	EZ	21 50 03.1

(cont.)

Date	Phase	Comp.	Time(GMT) h m s
	S	NE	21 50 24
	P: W, C		
13.	iP	NEZ	03 41 33.4
	iS	NEZ	42 19
	P: S, W, D		
	34.0 N., 137.0 E.		
	Near south coast of Honshu, Japan.		
	h: 353 km.		
	H= 03 40 34. 8		USCGS
13.	iP	NZ	04 10 58.3
	eX	N	11 15
	eX	E	17 50
	eL	N	19 26
	eX	Z	30
	eX	NZ	21 40
	P: N, C		
	1.3 N., 126.4 E.		
	Molucca Passage.		
	h: 56 km.		
	H= 04 03 56.4		USCGS
13.	iP	NEZ	08 08 37.7
	S	NEZ	55
	P: N, E, C		
13.	P	NEZ	13 32 07
	X	EZ	16
	X	Z	27
	46.5 N., 152.6 E.		
	Kurile Is.		
	h: N.		
	H= 13 28 39.5		USCGS
13.	P	NEZ	20 16 36
	eX	Z	51
	eS	E	17 20
13.	eP	NEZ	21 40 53
	eX	NE	58
	S	N	43 56
	S	E	44 04
	L	N	45 30
	23.9 N., 126.5 E.		
	Ryukyu Is. region.		
	h: 20 km.		
	H= 21 37 06.0		USCGS
13.	PKP	Z	21 53 04
	X	Z	17
	X	EZ	35
	32.7 S., 70.0 W.		
	Chile-Argentina border region.		
	h: 105 km.		
	H= 21 33 21.9		USCGS

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Date	Phase	Comp.	Time(GMT) h m s	
13.	eP	Z	22 13 15	
	eL	Z	23 00	
	4.2 N., 126.3 E.			
	Talaud Is.			
	h: 42 km.			
	H= 22 06 55.3			USCGS
14.	iP	NEZ	00 03 36.5	
	X	NEZ	04 15	
	P: S, W, C			
14.	iP NZ, P E		02 49 06.7	
	PP	NEZ	50 32	
	eX	N	51 11	
	X	N	53 14	
	S	NE	54 37	
	ScP	Z	55 14	
	L	N	56 45	
	L	EZ	57 00	
	P: S, W, D			
	Mag. $6\frac{1}{2}$-$6\frac{3}{4}$ (Mat.)			
	2.0 N., 126.9 E.			
	Molucca Passage.			
	h: 42 km.			
	H= 02 42 09.4			USCGS
14.	P	NEZ	09 16 18	
	X	Z	24	
	S	E	53	
	eX	N	17 00	
14.	P	NEZ	16 05 56	
	S	E	07 32	
	X	N	47	
	eL	NEZ	08 00	
	43.6 N., 145.9 E.			
	Hokkaido, Japan region.			
	h: 68 km.			
	H= 16 03 53.9			USCGS
14.	P	E	18 48 52	
	PPP	EZ	53 52	
	S	Z	58 42	
	S	E	48	
	S	N	52	
	SS	NE	19 03 30	
	eX	Z	06 37	
	eX	E	07 30	
	Lq	N	08 56	
	eLr	Z	13 00	
	eLr	NE	14 40	
	eL	E	18 00	
	Mag. $6\frac{1}{2}$-$6\frac{1}{2}$ (Mat.)			
	8.2 N., 58.5 E.			
	Carlsberg Ridge.			
	h: N.			
	H= 18 37 09.5			USCGS
15.	eP	EZ	06 13 20	
15.	eP	Z	08 45 08	
	7.1 S., 129.3 E.			
	Banda Sea.			
	h: 40 km.			
	H= 08 37 02.1			USCGS
15.	iP	NEZ	09 49 26.4	
	S	NE	50 11	
	P: N, E, C			
15.	iP	NEZ	10 53 37.8	
	S	EZ	45	
	P: N, W, C			
15.	iP	NEZ	18 04 02.8	
	P: N, E, D			
15.	iP	NEZ	20 52 00.7	
	S	N	31	
	P: N, E, C			
	Mag. 3.4 (JMA)			
	36.2 N., 141.0 E.			
	Near east coast of Honshu, Japan.			
	h: 50 km.			
	H= 20 51 23.0			JMA
15.	eP	Z	22 22 17	
16.	P	Z	08 51 15	
	S	E	52 00	
16.	iP	EZ	09 06 37.9	
	P: D			
16.	P	Z	11 26 09	
	S	E	29	
	eX	NEZ	43	
16.	eX	N	15 44 40	
	eX	Z	45 40	
	eX	NE	16 00 30	
	eL	Z	07 30	
16.	iP	Z	17 43 16.0	
	X	N	32	
	X	NE	36	
	S	N	40	
	P: C			
	35.6 N., 140.1 E.			
	Central Honshu, Japan.			
	h: 110 km.			
	H= 17 42 44.0			JMA
17.	eX	Z	02 48 50	
	eL	E	50 00	
17.	iP	NEZ	04 42 08.9	
	S	NE	57	

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Date	Phase	Comp.	Time(GMT) h m s	
	P: N, W, D			
	37.0 N., 134.9 E.			
	Sea of Japan.			
	h: 382 km.			
	H= 04 41 09.3			USCGS
17.	eS	N	07 48 05	
	eX	NE	54 40	
	eL	E	08 15 00	
	15.4 S., 167.6 E.			
	New Hebrides Is.			
	h: 134 km.			
	H= 07 30 22.4			USCGS
17.	P	Z	09 15 06	
	27.0 S., 176.6 W.			
	Kermadec Is region.			
	h: 47 km.			
	H= 09 03 19.4			USCGS
17.	P	EZ	10 33 30	
	X	NZ	34	
	S	NE	55	
17.	iP Z, P NE		15 12 08.8	
	P: C			
	37.1 N., 116.0 W.			
	Southern Nevada.			
	h: 0 km.			
	H= 15 00 00.0			USCGS
17.	P	NZ	20 53 27	
	30.9 S., 179.0 W.			
	Kermadec Is region.			
	h: 407 km.			
	H= 20 42 13.9			USCGS
18.	P	Z	02 19 33	
	42.1 N., 135.6 E.			
	Sea of Japan.			
	h: 369 km.			
	H= 02 18 02.6			USCGS
18.	ePKP	Z	05 11 25	
	17.2 S., 72.2 W.			
	Near coast of Peru.			
	h: 46 km.			
	H= 04 51 35.1			USCGS
18.	P	Z	06 16 24	
	eX	E	18 45	
18.	P	NZ	06 21 41	
	X	Z	22 52	
	S	N	32 50	
	SS	N	37 43	
	eLq	NE	42 00	
	eLr	Z	46 30	
	27.0 S., 176.3 W.			
	Kermadec Is.			
	h: 49 km.			
	H= 06 09 56.2			USCGS
18.	P	NEZ	10 21 54	
	eS	NE	22 08	
18.	iP	NEZ	13 34 23.8	
	S	N	36 16	
	P: S, W, C			
	Mag. 7.2 (Mat.)			
	46.3 N., 142.5 E.			
	Sakhalin Is.			
	h: 344 km.			
	H= 13 32 05.2			USCGS
18.	P	Z	19 12 09	
	37.1 N., 116.0 W.			
	Sothern Nevada.			
	h: 0 km.			
	H= 19 00 00.0			USCGS
18.	P	Z	19 25 09	
18.	iP	NEZ	23 05 13.8	
	iS	NE	20.0	
	P: N, E, D			
19.	P	Z	00 23 01	
	6.9 S., 124.8 E.			
	Banda Sea.			
	h: 535 km.			
	H= 00 15 33.0			USCGS
19.	iP Z, P NE		02 27 19.7	
	iX	E	20.1	
	S	EZ	34	
	P: D			
19.	P	Z	04 32 20	
	eS	NE	34 09	
	eL	N	20	
	43.2 N., 147.7 E.			
	Kurile Is.			
	h: 29 km.			
	H= 04 29 59.7			USCGS
19.	eP	NEZ	09 02 17	
	eX	N	40	
19.	P	NEZ	09 04 03	
	eS	NE	05 00	
19.	P	Z	13 40 02	
	eS	NE	47 28	
	eScS	NE	50 00	
	eLq	N	52 00	
	eLr	NE	54 00	
	L	Z	14 00 00	

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Date	Phase	Comp.	Time(GMT) h m s
	60.2 N., 147.0 W.		
	Southern Alaska.		
	h: 14 km.		
	H= 13 30 54.6		USCGS
19.	P	NEZ	15 57 00
	55.9 N., 162.2 E.		
	Near east coast of Kamchatka.		
	h: N.		
	H= 15 51 34.9		USCGS
[illegible]	iP	NZ	18 44 47.8
	eS	N	46 45
	P: N, E, D		
20.	eX	N	02 19 02
	eX	E	20 30
	eX	Z	21 35
	eL	N	23 00
20.	P	EZ	05 40 11
	X	N	17
20.	iP Z, P NE		05 40 34.4
	eS	NZ	41 02
	P: W, C		
	35.5 N.,140.4 E.		
	Near east coast of Honshu, Japan.		
	h: 64 km.		
	H= 05 40 00.9		USCGS
20.	iP Z, P E		09 18 24.8
	eX	EZ	33
	S	N	52
	P: W, C		
20.	P	Z	10 33 23
	eS	N	55
20.	P	NEZ	12 17 47
	S	N	18 39
	34.5 N., 133.6 E.		
	Wastern Honshu, Japan.		
	h: 0 km.		
	H= 12 16 24.8		JMA
20.	iP Z, P N		13 13 20.5
	X	NEZ	52
	P: N, C		
	7.2 S., 129.2 E.		
	Banda Sea.		
	h: 130 km.		
	H= 13 05 28.5		USCGS
20.	iP Z, P NE		14 28 06.0
	X	NEZ	16
	X	NEZ	24
	eS	NE	29 55

(cont.)

Date	Phase	Comp.	Time(GMT) h m s
	P: C		
	43.6 N., 147.5 E.		
	Kurile Is.		
	h: N.		
	H= 14 25 44.8		USCGS
20.	iP	NZ	20 41 37.2
	S	NE	42 00
	P: N, C		
	35.0 N., 139.7 E.		
	Honsnu, Japan.		
	h: 40 km.		
	H= 20 41 04.1		JMA
21.	iP	EZ	00 41 15.1
	P: E, D		
	29.7 S., 179.1 W.		
	Kermadec Is.		
	h: 268 km.		
	H= 00 29 50.0		USCGS
21.	iP	Z	01 55 04.0
	S	NE	33
	P: C		
	Mag. 3.6 (JMA)		
	35.8 N., 140.8 E.		
	Honshu, Japan.		
	h: 30 km.		
	H= 01 54 25.6		JMA
21.	iP	Z	02 37 36.9
	S	N	54
	P: D		
21.	iP	NEZ	10 20 34.0
	S	E	22 30
	L	Z	23 24
	P: N, E, C		
	28.2 N., 130.6 E.		
	Ryukyu Is.		
	h: 28 km.		
	H= 10 18 02.4		USCGS
21.	iP	NZ	12 22 10.2
	S	NE	23 40
	P: S, C		
	42.5 N., 144.9 E.		
	Hokkaido, Japan.		
	h: 28 km.		
	H= 12 20 14.8		USCGS
21.	PKP	Z	13 23 27
	X	Z	48
	16.4 S., 72.8 W.		
	Near coast of Peru.		
	h: 68 km.		
	H= 13 03 53.3		USCGS
21.	iP	EZ	16 34 50.6

(cont.)

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Date	Phase	Comp.	Time(GMT) h m s	
	S	N	16 35 27	
	P: W, C			
	36.6 N., 142.7 E.			
	Honshu, Japan.			
	h: 12 km.			
	H= 16 22 54.9			JMA
21.	iP	NEZ	21 58 13.4	
	S	E	31	
	P: N, E, D			
	36.9 N., 140.9 E.			
	Near east coast of Honshu, Japan.			
	h: 70 km.			
	H= 21 57 36.4			JMA
22.	PKP	Z	00 25 41	
	16.9 S., 72.9 W.			
	Near coast of Peru.			
	h: 50 km.			
	H= 00 06 04.2			USCGS
22.	iP	Z	01 17 24.8	
	X	N	19 45	
	P: D			
	43.6 N., 147.7 E.			
	Kurile Is.			
	h: N.			
	H= 01 15 03.3			USCGS
22.	L	Z	01 40 40	
	9.8 N., 126.1E.			
	Mindanao, P.I.			
	h: 61 km.			
	H= 01 27 07.2			USCGS
22.	L	Z	04 05 30	
22.	L	E	09 39 40	
	62.0 S., 164.6 E.			
	Balleny Is.			
	h: N.			
	H= 08 52 10.2			USCGS
22.	iP	NEZ	11 26 56.1	
	X	Z	27 10	
	S	NE	33 08	
	Lq	N	35 46	
	Lr	Z	37 40	
	P: W, C			
	52.5 N., 168.1 W.			
	Fox Is.			
	h: N.			
	H= 11 19 19.3			USCGS
22.	iP	Z	20 03 57.0	
	S	NE	04 33	
	P: D			
22.	P	Z	21 03 42	

(cont.)

Date	Phase	Comp.	Time(GMT) h m s	
	29.0 S., 176.6 W.			
	Kermadec Is.			
	h: 31 km.			
	H= 20 51 41.4			USCGS
23.	P	Z	02 22 01	
	52.5 N., 152.4 E.			
	Northwest of Kurile Is.			
	h: 488 km.			
	H= 02 18 11.5			USCGS
23.	P	Z	11 49 27	
	iS	NZ	42.4	
23.	iP	Z	13 28 30.2	
	PcP	Z	31 54	
	S	E	32 40	
	L	N	33 18	
	L	NE	34 50	
	L	Z	35 40	
	P: D			
	57.4 N., 163.1 E.			
	Near east coast of Kamchatka.			
	h: N.			
	H= 13 22 54.2			USCGS
23.	P	NZ	14 13 36	
	eS	E	17 35	
	X	EZ	21 12	
	13.8 N., 120.6 E.			
	Mindanao, P.I.			
	h: 118 km.			
	H= 14 08 00.5			USCGS
23.	P	Z	15 52 45	
	44.5 N., 147.3 E.			
	Kurile Is.			
	h: 90 km.			
	H= 15 50 16.7			USCGS
23.	L	NE	16 28 16	
	24.7 N., 122.6 E.			
	Taiwan.			
	h: 19 km.			
	H= 16 20 35.8			USCGS
23.	iP	EZ	19 45 30.8	
	iX	N	31.0	
	eS	E	46	
	P: E, D			
	36.4 N., 140.0 E.			
	Honshu, Japan.			
	h: 70 km.			
	H= 19 45 05.3			JMA
23.	iP	Z	23 05 44.0	
	P: C			
24.	P	Z	02 06 56	
	eS	N	07 42	

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Date	Phase	Comp.	Time(GMT) h m s
24.	P	Z	11 03 02
	S	N	26
24.	iP	NE	15 00 01.8
	S	NE	27
	P: N, W		
24.	iP	EZ	18 11 04.3
	S	NE	27
	P: W, C		
	36.6 N., 140.5 E.		
	Honshu, Japan.		
	h: 60 km.		
	H= 18 10 31.8		USCGS
24.	P	Z	18 40 21
	X	Z	33
	52.6 N., 168.4 W.		
	Fox Is.		
	h: 24 km.		
	H= 15 32 45.0		USCGS
25.	iP	NEZ	03 47 38.3
	iS	Z	46.4
	iS	NE	46.6
	P: N, E, C		
25.	iP	NE	04 00 00.6
	S	EZ	09
	P: N, E		
25.	eP	Z	07 39 50
	L	N	42 10
25.	iP	Z	19 16 55.3
	iX	NE	55.5
	S	E	18 12
	P: C		
	30.5 N., 138.4 E.		
	South of Honshu, Japan.		
	h: 438 km.		
	H= 19 15 19.0		USCGS
25.	iP	Z	21 32 05.4
	S	NEZ	20
	P: C		
25.	PKP1	Z	21 51 30
	PKP2	Z	42
	PP	NEZ	53 30
	PPP	Z	55 40
	eSKS	Z	58 10
	PPS	Z	22 04 50
	PSPS	NE	10 15
	ScSScS	NE	12 35
	SSS	Z	13 35
	G	N	20 47
	Lq	NE	23 40
	Lr	NZ	32 00
	PKP: C		
	Mag. 7¾ (Mat.)		

Date	Phase	Comp.	Time(GMT) h m s
	15.8 N., 59.7 W.		
	Leeward Is.		
	h: 7 km.		
	H= 21 32 27.3		USCGS
25.	PKP	Z	22 45 13
	15.8 N., 59.7 W.		
	Leeward Is.		
	h: 15 km.		
	H= 22 26 11.8		USCGS
25.	iPKP	Z	22 50 03.6
	X	Z	20
	PP	Z	51 50
	iPKP: C		
	16.1 N., 59.8 W.		
	Leeward Is.		
	h: 8 km.		
	H= 22 31 02.3		USCGS
26.	iP	NEZ	00 26 35.5
	P: S, W, C		
	55.2 N., 160.4 W.		
	Alaska Peninsula.		
	h: 25 km.		
	H= 00 18 21.0		USCGS
26.	P	Z	03 22 17
26.	P	NZ	16 30 35
	X	NEZ	32 21
26.	P	Z	17 46 55
	S?	NE	48 00
26.	eP	Z	20 22 27
	15.8 N., 59.6 W.		
	Leevard Is.		
	h: N.		
	H= 20 03 28.8		USCGS
26.	eP	Z	20 23 17
	X	NE	19
	S	E	59
26.	P	NEZ	22 55 24
26.	P	NEZ	23 01 04
27.	L	NE	03 08 00
	13.9 N., 125.2 E.		
	Philippine Is.		
27.	P	Z	06 31 02
	iS	N	17.6
27.	iP	NZ	08 00 36.8
	S	NZ	52
	P: S, D		

(cont.)

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Date	Phase	Comp.	Time(GMT) h m s
27.	iP	NZ	09 20 10.5
	S	E	27 10
	L	E	30 40
	Lr	NZ	34 40
	10.0 S., 118.0 E.		
	South of Sumatra I.		
	h: N.		
	H= 09 11 20.3		USCGS
27.	P	Z	14 55 19
	S	NZ	55
27.	L	Z	15 09 40
27.	iP	Z	15 22 43.8
	S	NEZ	23 20
	P: D		
27.	iP	NEZ	15 33 58.6
	S	NE	34 59
	P: S, E, D		
27.	iP	NEZ	15 59 17.8
	P: N, W, D		
28.	P	Z	00 44 59
	S	E	45 21
	S	N	22
28.	iP	Z	01 21 33.8
	iX	NE	34.3
	S	NE	23 22
	L	E	40
	P: C		
	43.6 N., 147.8 E.		
	Kurile Is.		
	h: 47 km.		
	H= 01 19 13.4		USCGS
28.	iP	NEZ	01 32 51.6
	P: N, E, D		
28.	iP	Z	03 55 13.7
	P: D		
	50.0 N., 77.8 E.		
	Eastern Kazakh SSR.		
	h: 0 km.		
	H= 03 46 58.0		USCGS
28.	P	NEZ	04 27 02
	S	E	29 05
	L	N	20
	43.8 N., 147.7 E.		
	Kurile Is.		
	h: 30 km.		
	H= 04 24 41.1		USCGS
28.	iP	NEZ	04 55 32.5
	S	NE	57 30
			(cont.)

Date	Phase	Comp.	Time(GMT) h m s
	L	NE	04 57 40
	P: N, E, D		
	43.5 N., 147.9 E.		
	Kurile Is.		
	h: 26 km.		
	H= 04 58 09.2		USCGS
28.	iP	Z	05 09 13.2
	iX	E	13.4
	S	E	11 00
	P: C		
	43.6 N., 147.7 E.		
	Kurile Is.		
	h: 45 km.		
	H= 05 06 52.7		USCGS
28.	iP	NEZ	07 44 44.8
	S	NE	45 00
	P: N, E, C		
	35.7 N., 137.1 E.		
	Honshu, Japan.		
	h: 1 km.		
	H= 07 44 21.3		USCGS
28.	iP	NZ	14 40 20.5
	L	N	42 40
	P: N, D		
	43.6 N., 147.8 E.		
	Kurile Is.		
	h: N.		
	H= 14 37 58.7		USCGS
28.	iP	NEZ	17 43 35.3
	S	NE	57
	P: S, E, D		
	35.5 N., 139.7 E.		
	Near south coast of Honshu, Japan.		
	h: 126 km.		
	H= 17 43 05.9		USCGS
28.	iP	NEZ	20 51 19.2
	S	N	40
	P: S, E, D		
	35.8 N., 139.8 E.		
	Honshu, Japan.		
	h: 120 km.		
	H= 20 50 51.0		JMA
28.	X	N	22 58 00
	18.4 N., 120.3 E.		
	Luzon, P.I.		
	h: 51 km.		
	H= 22 47 38.2		USCGS
29.	eP	Z	01 10 48
	SS	N	29 30
	SS	E	40
	L	E	52 00
			(cont.)

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Date	Phase	Comp.	Time(GMT) h m s	
	16.2 N., 59.7 W.			
	Leeward Is.			
	h: 17 km.			
	H= 00 51 47.2			USCGS
29.	eP	Z	09 30 12	
	54.3 N., 163.1 W.			
	Unimak Is.			
	h: N.			
	H= 09 22 11.0			USCGS
29.	eX	N	14 57 34	
29.	P	Z	16 25 53	
	iX	Z	26 03	
	X	N	34	
	X	E	49	
	34.1 N., 135.2 E.			
	Honshu, Japan.			
	h: 10 km.			
	H= 16 24 57.2			JMA
30.	iP	Z	09 09 27.4	
	S	E	42	
	P: D			
30.	iP	NZ	11 24 48.0	
	PcP	Z	26 59	
	L	N	33 30	
	P: N, C			
	0.1 S., 124.1 E.			
	Molucca Sea.			
	h: 88 km.			
	H= 11 17 31.8			USCGS
30.	eP	NZ	12 45 19	
	X	NE	33	
30.	P	Z	15 25 45	
	eS	N	27 00	
30.	iP	NZ	17 45 55.8	
	S	N	46 50	
	P: D			
30.	P	Z	22 23 38	
	S	N	24 13	
31.	iP	EZ	03 39 47.0	
	S	E	40 38	
	37.8 N., 142.1 E.			
	Off east coast of Honshu, Japan.			
	h: N.			
	H= 03 38 53.4			USCGS
31.	iP	NEZ	05 41 22.2	
	S	N	43 25	
	L	Z	44 05	

(cont.)

Date	Phase	Comp.	Time(GMT) h m s	
	Mag. 4.7 (JMA)			
	42.1 N., 147.1 E.			
	Near east coast of Hokkaido, Japan.			
	h: 10 km.			
	H= 05 39 04.9			JMA
31.	P	Z	05 49 38	
	34.4 N., 26.1 E.			
	Crete.			
	h: 27 km.			
	H= 05 37 02.5			USCGS
31.	iP	Z	07 30 03.2	
	S	E	30	
	S	N	31	
	P: D			
31.	iP	NEZ	07 39 30.8	
	S	NE	52	
	P: S, E, C			
31.	iP	Z	09 57 25.3	
	P: D			
31.	Lq	E	13 52 04	
	44.9 N., 17.2 E.			
	Yugoslavia.			
	h: N.			
	H= 13 18 32.8			USCGS
31.	iP	EZ	15 48 10.1	
	S	EZ	24	
	P: E, D			
31.	P	Z	18 10 36	
	S	E	11 20	
31.	P	Z	19 04 33	
	iX	NEZ	39.0	
	S	N	06 35	
	28.5 N., 129.1 E.			
	Ryukyu Is.			
	h: 44 km.			
	H= 19 01 56.1			USCGS
31.	eP	Z	19 10 02	
31.	eP?	Z	19 13 39	
31.	eP	Z	19 41 24	
31.	iP	Z	20 51 15.0	
	X	Z	29	
	P: C			
	55.2 N., 160.5 W.			
	Alaska Peninsula.			
	h: N.			
	H= 20 43 01.8			USCGS

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Date	Phase	Comp.	Time(GMT) h m s	Date	Phase	Comp.	Time(GMT) h m s
31.	iP	NEZ	23 46 42.3				
	iPcP	Z	48 05.0				
	X	Z	19				
	X	Z	49 55				
	S	NE	52 50				
	ScS	N	55 42				
	G	NZ	58 55				
	P: N, E, C						

7.0 S., 117.8 E.
Bali Sea.
h: 483 km.
H= 23 38 52.3 USCGS

(Additional data)

22. iP NEZ 11 26 56.1
Mag. $5\frac{3}{4}$ (Mat.)

23. iP Z 13 28 30.2
Mag. $6\frac{1}{4}$ (Mat.)

29. eP Z 01 10 48
Mag. $6\frac{1}{4}$ (Mat.)

31. P Z 19 04 33
Mag. 6.5 (Mat.)

Mineo Takehana

Director