JESUIT SEISMOLOGICAL ASSOCIA

CENTRAL STATION
3621 OLIVE STREET, ST. LOUIS 8, MO., U. S. A.

PRELIMINARY BULLETIN

IN COOPERATION WITH SCIENCE SERVICE AND THE UNITED STATES COAST AND GEODETIC SURVEY

OBSERVATIONS CONCERNING EPICENTERS LOCATED BY THE JESUIT SEISMOLOGICAL ASSOCIATION

It is the policy of the Jesuit Seismological Association to determine the epicenter of all earthquakes of magnitude 6 1/4 or greater, as determined at the Seismological Laboratory, Pasadena, and published in the Provisional Readings at Pasadena. The determination of each epicenter is based upon the arrival times of P at a group of stations selected for each earthquake. The stations chosen depend upon the stations from which readings are available and upon the geographic location of the stations with respect to a trial epicenter.

The coordinates are given in geographical coordinates. The direction cosines of the epicenter, however, are listed in terms of geocentric coordinates.

The location of each epicenter is further identified by the region in which the earthquake occurred. The classification according to region corresponds to that defined by Gutenberg and Richter in Seismicity of the Earth. The descriptive location given by the United States Coast and Geodetic Survey is also included.

P-O distances used in the determination of the epicenters are based on the Jeffreys-Bullen travel time tables (1948). Origin times determined by the JSA by use of these tables are systematically about 4 seconds later than those given by the U.S.C.G.S.

A measure of the quality or accuracy of each epicenter determination is given. The quality is based on the standard deviation (σ) at a single station of the residuals in epicentral distance:

$$\sigma = \sqrt{\frac{\Sigma(\Delta p\text{-}o - \Delta M)^2}{N-1}}$$

where N is the number of stations used, $\Delta p\text{-}o$ is the epicentral distance corresponding to the P-O time interval read from the tables, Δ_M is the great circle distance from the station to the epicenter determined. The quality A, B, C, D corresponds to the following classification:

$$\begin{aligned} A:&\quad 0 < \sigma < 0.2^\circ \\ B:&\quad 0.2^\circ \leq \sigma < 0.4^\circ \\ C:&\quad 0.4^\circ \leq \sigma < 0.6^\circ \\ D:&\quad 0.6^\circ \leq \sigma < 1.0^\circ \end{aligned}$$

For St. Louis, Florissant, and Little Rock the readings of the arrival times of various phases at the stations of the Jesuit Seismological Association are based upon readings from the original records. Readings at the other stations of the JSA network are taken from station bulletins.

William Stauder, S.J.
Director, Central Station JSA

Gene Braught
Graduate Assistant

JESUIT SEISMOLOGICAL ASSOCIAT

CENTRAL STATION
3621 OLIVE STREET, ST. LOUIS 8, MO., U. S. A.

PRELIMINARY BULLETIN

IN COOPERATION WITH SCIENCE SERVICE AND THE UNITED STATES COAST AND GEODETIC SURVEY

1959 NUMBER 1

EARTHQUAKES LOCATED: JANUARY - MARCH, 1959

JSA NO.	DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	REGION	MAGNITUDE
59-1	January 5	09 46 50	22.2°S	171.4°E	0.00R	14	6 1/2-6 3/4
59-2	January 8	01 33 52	15.0°N	61.0°W	0.01R	7	6 1/2-6 3/4
59-3	January 13	01 15 31	13.9°N	146.3°E	0.00R	18	6 3/4
59-4	January 15	21 20 28	25.7°S	179.9°W	0.07R	12	6 1/2
59-5	January 18	22 23 21	18.9°S	178.2°W	0.07R	13	6 1/4 ±
59-6	January 22	05 10 27	37.1°N	142.5°E	0.00R	19	6 3/4-7
59-7	January 24	19 42 25	14.9°N	192.2°W	0.00R	5	6 1/4
59-8	January 24	19 55 15	37.1°N	24.4°W	0.00R	32	6 1/4-6 1/2
59-9	January 28	10 04 15	30.4°S	78.6°W	0.00R	8	6 1/4
59-10	January 29	23 24 33	70.9°N	7.4°E	0.00R	40	6 1/2
59-11	January 30	00 19 31	10.0°S	161.6°E	0.00R	15	6 3/4
59-12	January 30	22 16 51	43.7°N	144.1°E	0.00R	19	6 1/4
59-13	February 7	09 36 58	3.6°S	81.6°E	0.00R	8	7 1/4-7 1/2
59-14	February 8	01 02 30	49.6°N	28.0°W	0.00R	32	6 1/4-6 1/2
59-15	February 15	03 59 29	60.2°S	26.0°W	0.00R	10	6 1/2-6 3/4
59-16	February 15	04 42 38	60.3°S	25.4°W	0.00R	10	6 3/4
59-17	February 20	04 12 56	30.5°S	71.0°W	0.005	8	6 1/4-6 1/2
59-18	February 20	18 16 25	15.9°N	90.7°W	0.01R	5	6 1/2
59-19	March 1	16 49 16	1.0°S	134.1°E	0.01R	16	7
59-20	March 19	08 25 32	34.9°N	36.0°W	0.00R	32	6 1/4
59-21	March 23	07 10 28	39.9°N	117.7°W	0.00R	3	6 1/4-6 1/2

JESUIT SEISMOLOGICAL ASSOCIAT

CENTRAL STATION
3621 OLIVE STREET, ST. LOUIS 8, MO., U. S. A.

PRELIMINARY BULLETIN

IN COOPERATION WITH SCIENCE SERVICE AND THE UNITED STATES COAST AND GEODETIC SURVEY

JSA No. 59-1

EARTHQUAKE OF JANUARY 5, 1959

JSA[1]: 22.2°S, 171.4°E
Region 14 (Loyalty Islands)
Quality: B (σ = 0.33)
Geocentric Direction Cosines:
A = -0.9161, B = +0.1385, C = -0.3762

O = 09 46 50
h = 0.00R
M = 6 1/2 - 6 3/4
(Pasadena)

USCGS: 22°S, 171½°E O = 09 46 42

JSA Station Readings

Station	Phase	Time (GCT)	O-C	Remarks	Δ
Saint Louis	ePPZ	10 05 54	+1s	Large amplitude microseisms make identification of other phases impossible.	109.8°

1. Stations used in epicenter determination: Adelaide, Apia, Brisbane, Byrd, Djakarta, Guam, Honolulu, Macquarie, Manila, Melbourne, Port Moresby, Rabaul, Riverview, South Pole, Wellington.

JESUIT SEISMOLOGICAL ASSOCIATION
CENTRAL STATION
3621 OLIVE STREET, ST. LOUIS 8, MO., U. S. A.
PRELIMINARY BULLETIN
IN COOPERATION WITH SCIENCE SERVICE AND THE UNITED STATES COAST AND GEODETIC SURVEY

JSA No. 59-2

EARTHQUAKE OF JANUARY 8, 1959

JSA[1]: 15°.0 N, 61°.0 W
Region 7 (Windward Islands)
Quality: B (σ = 0.35)
Geocentric Direction Cosines:
A = +0.4685, B = -0.8452, C = +0.2571

O = 01 33 52
h = 0.01R
M = 6 1/2 - 6 3/4 (Pasadena)

USCGS: 15½°N 61°W, O = 01 33 48, h about 100 km.

JSA Station Readings

Station	Phase	Time (GCT)	O-C	Remarks	Δ
Georgetown	iP_Z	01 39 28	-5s		27.7°
	$i(\overline{PP})_Z$	01 40 01			
	eS	01 44 00	-6		
Weston	iP	01 39 41	-1	Compression	28.7
	e	01 45 13			
Cleveland	iP_Z	01 40 09	-1	Compression	31.9
	iS_E	01 45 06	-7		
Saint Louis	eP_Z	01 40 32	-4	Compression	34.9
	iP_{ZEN}	01 40 33	-5	Dilatation	
	PP_N	01 41 54	-3	Strong 8 sec. microseisms	
	S_N	01 45 42	-7		
	Lg_N	01 47 54			
	ScS_N	01 50 58	-7		
Florissant	iP_{NE}	01 40 36	-2		35.1
	S_{NE}	01 45 55	-7		
	Lg_N	01 48 01			
	$eScS_E$	01 50 49			

1. Stations used in epicenter determination: Bogota, Cartugena, Chinchina, Columbia, Eureka, Fayetteville, Kiruna, Ottawa, Paris, Pasadena, Resolute, San Juan, Stuttgart, Uppsala.

JESUIT SEISMOLOGICAL ASSOCIATION
CENTRAL STATION
3621 OLIVE STREET, ST. LOUIS 8, MO., U. S. A.
PRELIMINARY BULLETIN
IN COOPERATION WITH SCIENCE SERVICE AND THE UNITED STATES COAST AND GEODETIC SURVEY

JSA No. 59-3

EARTHQUAKE OF JANUARY 13, 1959

JSA[1]: 13.9°N, 146.3°E
Region 18 (Mariana Islands)
Quality: A (σ = 0.14)
Geocentric Direction Cosines:
A = -0.8080, B = +0.5388, C = +0.2385

O = 01 15 31
h = 0.00R
M = 6 3/4 (Pasadena)

USCGS: 13½°N, 146°E, O = 01 15 25*

JSA Station Readings

Station	Phase	Time (GCT)	O-C	Remarks	Δ
Saint Louis	eSS_N	01 49 06	$+7^s$		105.8°

1. Stations used in epicenter determination: College, Guam, Matsushiro, Djakarta, Baguio, Brisbane, Melbourne, Riverview.

CLEVELAND

SEISMOLOGICAL OBSERVATORY
JOHN CARROLL UNIVERSITY, CLEVELAND 18, OHIO, U. S. A.

41° 29′ 27.90″ North, 81° 31′ 52.22″ West, h = 326 m.

Seismographs: Two Sprengnether long-period horizontal, one Sprengnether vertical.
Two Sprengnether short-period horizontal.

JANUARY, 1959; BULLETIN

Date	Phase	G.M. C. T.	Remarks	
8	iPZ	$01^h40^m08.9^s$ C	USCGS: 15½°N, 61°W	H = $01^h33^m48^s$*
	iSE	01 45 06	Windward Islands	h about 100 km
			Felt: Trinidad	Δ = 31.6°
11	iPZ	07 28 15.4 C	USCGS: 15°N, 90°W	H = 07 22 40 *
	eSne	07 32 43.5	Guatemala	h about 200 km
			Δ = 27.5°	
13	iPZ	08 40 36.6 C	USCGS: 9°N, 83½°W,	H = 08 34 08 *
	iSn	08 45 51	Guatemala	H about 100 km
			Δ = 32.3°	
16	iPz	01 41 19.3 d	USCGS: 52½°N, 171°W	H = 01 33 22 *
			Fox Islands, Aleutian Islands	
			Δ = 58.3°	
22	iPz	05 23 39.3 C	USCGS: 34°N, 142°E	H = 05 10 25
	iSNE	05 34 30	Near East Coast of Honshu, Japan, Felt	
			Mag: 6 3/4 - 7 Pasadena; 6 3/4 Berkeley	
			Δ = 95.2°	
24	iPnz	19 48 16.6 dil	USCGS: 15°N, 92½°W	H = 19 42 20 *
	iZ	19 48 32.3 dil	Mexico-Guatemala border; Mag 6¼ (Pas)	
	eSR_1E	19 54 23	Δ = 28.0°	
24	iPz	20 03 21.7 com	USCGS: 37½°N, 24½°W	H = 19 55 14 *
	iSE	20 09 57	Azores Islands Mag: 6¼ - 6½ (Pas)	
			Δ = 43.7°	
27	iPZe	00 26 13.0 C	USCGS: 18°N, 68½°W	H = 00 20 22 *
	ipPZ	00 26 24.5	Eastern Dominican Republic Felt: San	
	iSn	00 30 42.5	Juan, Puerto Rico	h about 100 km
			Δ = 26.3°	
29	ePe	20 31 38.4	USCGS: 52°N, 174°W	H = 20 21 27 *
			Andreanof Islands, Aleutian Islands	
			Mag: 5 3/4-6 (Pas)	Δ = 60.7°
29	iPne	21 08 27.0	USCGS: 52°N, 174°W	H = 20 58 18 *
	iPz	21 08 27.4 dil	Fox Islands, Aleutian Islands	
			Δ = 60.7°	
29	iPneZ	23 33 37 dil	ESCGS: 71°N, 8°E	H = 23 24 30 *
	eSN	23 40 46	Off coast of Norway	Δ = 51.3°

30	iPn	01 46 45.3		
30	iPZ eSe	05 22 30.2 C 05 25 31.0	USCGS: 61°N, 78½°W Hudson Bay	H = 05 17 32 * Δ = 19.7°
30	iPZ ipPZ	16 26 55.7 dil 16 27 09.8 dil	USCGS: 26½°S, 71°W Near Coast of Chile Δ = 69.0°	H = 16 15 58 * H about 100 km
30	iPZ eskksE	20 51 43.1 dil 21 02 17	USCGS: 44°N, 144°E Hokkaido, Japan; Mag 5 3/4 - 6 (Pas) = 85.7°	H = 20 38 58 *
30	iPZ eSKKSe	22 29 31.9 comp 22 40 08	USCGS: 44°N, 144°E Hokkaido, Japan; Minor damage at Deshikutsu Δ = 85.7°	H = 22 16 47 *

E. J. Walter, Associate Director
John Carroll University
Seismological Observatory
Cleveland 18, Ohio

FEBRUARY, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.	Remarks
7	iP	Z	$09^h\ 45^m\ 09.7^s$ c	USCGS: 4°S 81.5°W
	eS	E	09 54 55	H = $09^h\ 36^m\ 51^s$ *
				Mag. = $7\frac{1}{4}$ - $7\frac{1}{2}$
8	iP	Z	01 09 42.8 c	USCGS: 49°N, 28.5°W
	eS	E	01 15 36	H = $01^h\ 02^m\ 26^s$ *
				Mag. = $6\frac{1}{2}$
20	iP	e	18 21 56.8	USCGS: 15.5°N 91°W
	iS	e	18 26 15.8	H = $18^h\ 16^m\ 22^s$ *
				Mag. = $6\frac{1}{2}$

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA

MARCH, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.	Remarks
1	iPKP	n	$17^h\ 08^m\ 14.1^s$	USCGS: 0.5°S 134.5°E
	iS	E	17 17 57	H = $16^h\ 49^m\ 13^s$ *
				h = 100 km
9	i	Z	22 08 35.6 c	
10	eP	E	22 55 50.2	USCGS: 14°N 92.5°W
	eS	N	23 00 36.2	H = $22^h\ 49^m\ 39$ *
11	i	n	19 29 07.5	
	l	n	23 09 54.7	
19	iP	Z	08 32 39.12	USCGS: 35°N 36°W
	iS	N	08 38 11.1	H = $08^h\ 25^m\ 32^s$ *
23	iP	Z	07 16 12	USCGS: 90°N 118°W
				H = $07^h\ 10^m\ 22^s$ *

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA

APRIL, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.				Remarks
1	iP	Z	00^h	43^m	25.7^s	c	USCGS: $27.5°$N, $21°$W
	eS	N	00	50	52.7		H = $00^h\ 34^m\ 18^s$ *
12	iP	Z	10	00	15.1	c	USCGS: $17.5°$N, $95°$W
	iS	N	10	04	46.1		H = $09^h\ 54^m\ 51^s$ *
							h = 100 km
14	eS	E	03	01	52.9		USCGS: Calif. foreshock
							H = $02^h\ 51^m\ 13^s$ **
20	ePP	N	04	28	55		USCGS: $8.5°$N, $83°$W
							H = $04^h\ 21^m\ 10^s$ *
22	iP	N	19	07	55.4		USCGS: $11.5°$N, $86.5°$W
							H = $19^h\ 01^m\ 41^s$ *
22	eP	N	20	38	54.2		USCGS: $36.5°$S, $97.5°$W
							H = $20^h\ 26^m\ 46^s$ *
23	iP	N	20	59	57.6		USCGS: $37.5°$N, $80.5°$W
							H = $20^h\ 58^m\ 41^s$
26	eP	N	20	54	58		USCGS: $25°$N, $122.5°$E
	epP	N	20	55	35		H = $20^h\ 40^m\ 33^s$
	ePKP	N	20	58	50		h = 150 km
	epPKP	N	20	59	30		
	eSKS	N	21	05	22		
	eS	N	21	07	02		
28	eP	N	11	15	26.9		USCGS: $15°$N, $93°$W
	iPPP	N	11	16	23.5		H = $11^h\ 09^m\ 30^s$
	iS	N	11	20	21.5		

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA

MAY, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.		Remarks
4	iP	N	$07^h\ 27^m\ 04.3^s$		USCGS: ^{h}52.5°N, ^{s}159.5°E
	ipP	N	07 27 15.4		H = $07^h\ 15^m\ 42^s$
		N	07 36 16.2		h = 60 km
12	eP	N	05 08 32.7		USCGS: ^{h}54.5°N, ^{s}168°E
	eS	N	05 17 24.5		H = $04^h\ 57^m\ 35^s$
12	eP	Z	09 57 41.9	c	USCGS: ^{h}23.5°S, ^{s}64.5°N
	eS	E	10 06 27		H = $09^h\ 46^m\ 51^s$
12	iP	E	21 50 46.7		USCGS: ^{h}51.5°N, ^{s}177°W
					H = $21^h\ 40^m\ 22^s$
12	iP	E	22 10 21		USCGS: ^{h}51.5°N, ^{s}177°W
					H = $21^h\ 59^m\ 56^s$
14	iP	E	06 48 59.7		USCGS: ^{h}35.5°N, ^{s}24.5°E
	eS	N	06 58 52.5		H = $06^h\ 36^m\ 57^s$
16	ePP	E	6 37 14		USCGS: 4.5°S, 153.5°E
	eSKKS	E	6 43 38		H = $06^h\ 16^m\ 23^s$
					h = about 60 km
21	eP	N	11 45 34.4		USCGS: ^{h}28°S, 69°W
					H = $11^h\ 34^m\ 23^s$
24	iP	Z	19 23 20.0	c	USCGS: ^{h}17.5°N, ^{s}97°W
	iS	N, E	19 27 56.0		H = $19^h\ 17^m\ 40^s$
					h = about 100 km

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA

JUNE, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.	Remarks
3	iP	N	$03^h\ 51^m\ 04.4^s$	USCGS: ^{h}4°N, 77°W
	iS	N	03 56 46	H = $03^h\ 43^m\ 42^s$
5	eP	N	20 43 20.1	USCGS: ^{h}12°N, 86.5°W
	eS	E	20 48 19.1	H = $20^h\ 37^m\ 15^s$
				h = 100 km
14	iP	N	00 22 18	USCGS: ^{h}20.5°S, ^{s}68°W
	iS	E	00 30 37	H = $00^h\ 11^m\ 57^s$
	eSS	E	00 34 49	
17	eP	N	10 33 12	USCGS: ^{h}34.5°N, ^{s}98.5°W
	eS	N	10 34 50	H = $10^h\ 27^m\ 07^s$
	eSS	E	10 35 13	
18	eP	E	15 42 47	USCGS: ^{h}54°N, 160°E
	ePPP	N	15 47 15	H = $15^h\ 31^m\ 25^s$
	eS	E	15 52 02	
23	iP	E	14 41 00	USCGS: ^{h}39°N, 119°W
				H = $14^h\ 35^m\ 02^s$
25	iP	E	6 54 15	USCGS: ^{h}62°N, 27.5°W
	iS	E	7 00 01	H = $06^h\ 46^m\ 55^s$
27	iSKS	E	19 29 42	USCGS: ^{h}33°S, 179°W
				H = $19^h\ 04^m\ 27^s$

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA

JULY, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.	Remarks
13	iP	Z	$12^h\ 38^m\ 46.6^s$ c	USCGS: 52°N, 172.5°W
	eS	E	12 46 44	H = $12^h\ 28^m\ 45^s$ *
18	iP[1]	Z	20 13 37.1 d	USCGS: 15.5°N, 120.5°W
	eSKS	E	20 20 13	H = $19^h\ 54^m\ 57^s$ *
	eSKKS	N	20 21 40	h about 150 km
	iS	E	20 22 34	
19	iP[1]	Z	04 01 42.1	USCGS: 6.5°s, 105°E
				H = $03^h\ 42^m\ 02^s$ *
19	iP	Z	15 15 39.4 c	USCGS: 15°S, 70.5°W
	iS	NE	15 23 16	H= $15^h\ 06^m\ 10^s$ *
	isS	NE	15 25 07	h about 200 km
19	iP	Z	15 45 47.2 c	USCGS: 15.5°S, 71°W
	iP	ne	15 45 47.3	H = $15^h\ 36^m\ 17^s$ *
				h about 200 km
20	iP[1]	Zne	02 59 41.8 e	USCGS: 6°S, 111°E
				H = $02^h\ 41^m\ 04^s$ *
				h about 500 km
21	eP	Zne	09 23 19.6 d	USCGS: 19°N, 68.5°W
	iS	E	09 27 42	H = $09^h\ 17^m\ 51^s$ *
21	eP	Zne	12 35 11.5 d	USCGS: 16°N, 98°W
	iS	E	12 40 08	H = $12^h\ 29^m\ 09^s$ *
21	eP	Z	13 09 33.3 d	USCGS: 16°N, 98°W
	eS	N	13 14 31	H = $13^h\ 03^m\ 31^s$ *
21	iP	e	17 44 48.3	USCGS: 37°N, 112.5°W
	eS	E	17 49 19	H = $17^h\ 39^m\ 29^s$ *

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA

AUGUST, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.	Remarks
3	iP	N	$06^h\ 10^m\ 42.5^s$	USCGS: 33°N, 79.5°W
	iPP	N	06 10 44.5	H = $06^h\ 08^m\ 30^s$
	iPPP	N	06 10 49	
	iS	E	06 12 00.5	
7	iS	E	10 59 00	USCGS: 56°N, 154°W
	iSS	N	11 01 58	H = $10^h\ 43^m\ 32^s$
7	iS	E	22 00 54	USCGS: 56.5°N, 154°W
				H = $21^h\ 45^m\ 38^s$
8	iP	Z	24 58 47.4	USCGS: 55°N, 162.5°E
	iS	E	01 08 07.3	H = $00^h\ 47^m\ 38^s$
12	iP	Z	00 39 43	USCGS: 12°N, 86°W
				H = $00^h\ 33^m\ 38^s$
12	iP	Z	00 41 41	USCGS: 12°N, 86°W
				H = $00^h\ 35^m\ 36^s$
12	iS	N	10 24 42	USCGS: 16.5°S, 177.5°W
				H = $09^h\ 58^m\ 22^s$
16	iP	N	01 36 14	USCGS: 22°N, 121°E
				H = $01^h\ 21^m\ 05^s$
17	eP	E	01 44 37	USCGS: 41°N, 20°E
	iS	N	01 53 57	H = $01^h\ 33^m\ 11^s$
17	eP	N	21 30 32	USCGS: 7.5°S, 156°E
	eS	E	21 34 23	H = $21^h\ 24^m\ 40^s$ *
18	iP	N	06 42 08	USCGS: 44.55°N, 111.05°W
	iS	N	06 46 06	H = $06^h\ 37^m\ 15.0^s$
18	iP	N	08 01 08	USCGS: 45°N, 110.5°W
				H = $07^h\ 56^m\ 18^s$
20	iP	E	19 16 26.5	USCGS: 45°N, 111°W
				H = $19^h\ 11^m\ 27^s$
23	iP	E	22 31 32	USCGS: 35.5°N, 3°W
				H = $22^h\ 21^m\ 30^s$
24	ePR_1	Z	21 50 41.1 d	USCGS: 10.5°S, 161°E
				H = $21^h\ 30^m\ 46^s$
29	iP	Z	17 15 52.4	USCGS: 52°N, 106.5°E
	eS	N	17 26 17	H = $17^h\ 03^m\ 10^s$
	iSS	E	17 32 08	

SEPTEMBER, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.	Remarks
1	eP	N	$10^h\ 55^m\ 19.3^s$	USCGS: 20°N, 64.5°W
	eS	E	10 59 46	H = $10^h\ 49^m\ 43^s$
13	i	E	19 58 42.0	USCGS: 45°N, 111°W
				H = $19^h\ 49^m\ 36^s$
14	iPP	E	14 29 27	USCGS: 28.5°S, 177°W
	eSKS	E	14 35 29	H = $14^h\ 09^m\ 39^s$
	i	N	14 37 08	
25	ePKP	N	02 56 23.8	USCGS: 22°N, 122°E
				H = $02^h\ 36^m\ 48^s$
26	eP	E	09 27 36	USCGS: 43.5°N, 128.5°W
	eS	N	09 32 55	H = $08^h\ 20^m\ 51^s$

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA

NOVEMBER, 1959, BULLETIN

Date	Phase	Component	G. M. C. T.	Remarks
8	iP	Z	$14^h\ 07^m\ 46^s$	USCGS: 44°N, 140.5°E
	eSKS	N	14 18 12	H = $13^h\ 54^m\ 55^s$
15	eP	N	17 20 22.4	USCGS: 37.5°N, 20.5°E
	iS	N	17 29 53	H = $17^h\ 08^m\ 41^s$
16	eP	Z	10 31 54.1 c	USCGS: 1°N, 26.5°W
				H = $10^h\ 21^m\ 17^s$
26	eP^1	Z	07 26 10	USCGS: 5.5°S, 102.5°E
				H = $07^h\ 06^m\ 19^s$
26	ep^1	Z	23 29 00	USCGS: 5.5°S, 103°E
				H = $23^h\ 09^m\ 23^s$
28	iP	Z	12 46 11.6	USCGS: 28.5°S, 71°W
				H = $12^h\ 34^m\ 53^s$

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA

December, 1959, Bulletin

Date	Phase	Component	G. M. C. T.		Remarks
2	iSKP	n	$09^h\ 56^m\ 51.8^s$		USCGS: $^h1°S,\ 123°E$ $H = 09^h\ 34^m\ 00^s$
14	iS	N	22 18 32		USCGS: $^h52.5°N,\ ^s168°W$ $H = 22^h\ 00^m\ 50^s$
14	ePR_1	Z	23 40 45	d	USCGS: $^h59.5°S,\ ^s31°W$ $H = 23^h\ 21^m\ 56^s$
25	iP	Z	10 29 37.8	c	USCGS: $^h25.5°S,\ ^s67°W$ $H = 10^h\ 18^m\ 35^s$
	iPcP	Z	10 30 05.1	d	
27	iP	Z	10 04 02	c	USCGS: $^h56°N,\ ^s162.5°E$ $H = 15^h\ 52^m\ 55^s$
	iS	N	16 13 00		
28	eP	Z	07 32 03	d	USCGS: $^h52.5°N,\ ^s160°E$ $H = 07^h\ 20^m\ 32^s$
	iS	E	07 41 19		

Seismological Observatory
John Carroll University
Cleveland 18, Ohio USA