UNIVERSITY OF WASHINGTON

SEATTLE 5, WASHINGTON

U. S. A.

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SEISMOLOGICAL BULLETIN NO. 9

REGISTRATION OF EARTHQUAKES AT SEATTLE, 1955
AND
NOTE ON LOCATION OF LOCAL SHOCKS

By

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JUNE, 1956

STATION CONSTANTS

Latitude: 47° 39.3' North
Longitude: 122° 18.5' West
Elevation: 30 meters
Foundation: Compact glacial till

INSTRUMENTAL CONSTANTS - 1955

VERTICAL component, Sprengnether SHORT-PERIOD pendulum

$T_o = T_g = 1.4$ sec.
$h_o = h_g = 1.0$ ca
$V_s = 3000$ or 1750. See 1954 report for further explanation.

NORTH-SOUTH component, Sprengnether SHORT-PERIOD pendulum

$T_o = T_g = 1.40$ sec.
$h_o = h_g = 1.0$ ca.
$V_s = 3600, 2500, 1800,$ or 900.
See 1954 bulletin for explanation of sensitivity control

EAST-WEST component, Sprengnether SHORT-PERIOD pendulum

$T_o = T_g = 1.4$ sec.
$h_o = h_g = 1.0$ ca.
$V_s = 3100, 2200, 1550,$ or 800 to July 1, 1954
$V_s = 3800, 2700, 1900,$ or 950 from July 1, 1954.
(Shifted coil magnet for greater sensitivity. See 1954 bulletin for explanation of sensitivity controls)

NORTH-SOUTH component, Sprengnether LONG-PERIOD pendulum

$T_o = 15.0$ sec. $T_g = 1.4$ sec.
$h_o = h_g = 1.0$ ca.
The following figures define the magnification curve for maximum V_s based on assumptions applicable to Galitzin seismographs:

$T_e = 0$ 1.4 sec. 3.0, 5.0, 7.5, 10, 15, 20, 30.
$V_s = 0$ 1250 (max.) 930, 590, 370, 230, 115, 70, 45.
Operating values were either 0.82, 0.50, 0.25, or 1.10 of these figures.

EAST-WEST component, Sprengnether LONG-PERIOD pendulum

Same as NORTH-SOUTH component.

Note on the Location of Earthquakes in Western Washington from Instrumental Data

The following is applicable to all epicenters in Western Washington reported in Bulletins 6, 7, and 8 of this series:

Since the local wave speeds for earthquakes in this area have never been adequately determined either from the analysis of earthquake data or from controlled explosion tests, it was necessary to undertake a certain amount of exploratory work in order to determine epicenter locations. For this purpose there was available, in addition to the Seattle seismographic data, the readings from three British Columbia stations located at Victoria and Alberni on Vancouver Island, and at Horseshoe Bay near the city of Vancouver. For some of the stronger shocks, data were obtained from the private station of F. W. Geitz in Portland, Oregon and from the station at Oregon State College in Corvallis. The British Columbia network went into operation in August, 1951.

A wide variety of representative speeds and crustal structures were postulated in an effort to obtain consistent epicenters and focal depths from the data registered at these stations, but the results were negative. The most consistent results were obtained when certain specific velocities (5.8, 6.4, and 7.0 km/sec.) were used, and these velocities were treated as though they were represented constant focus-to-station speeds over straight-line paths. Such an assumption has theoretical merit only to the extent that in most cases the actual travel-time in a layered crust is governed largely by the speed in the layer in which the wave travels a large portion of its real focus-to-station path. The assumption ignores the complexity resulting from overlying slower speed layers at the station end of the true seismic ray and also, to probably a lesser degree, at the focal end. The assumption would make the travel time less than that computed by accepted methods for a multi-layered crust.

When using travel-time curves based on the linear ray assumption and the quoted velocities, it was possible, regardless of theoretical objections, to obtain values of epicentral position and depth that were consistent with a common time of origin, and epicentral positions that were founded on good arc intersections. A base map drawn to a scale of one millimeter per kilometer was used in the epicenter work. The results were consistent to the extent that the greater focal depths were always associated with the higher velocity layers in the same locale, and the epicenters were reasonably consistent with positions that might be deduced from the limited number of intensity distribution maps obtained through local earthquake questionaire coverage.

It would seem that the process of forcibly fitting the data to a "point" epicenter combined with a permissible latitude in the choice of origin time within the range of computed values and a small percentage increase in assumed velocity for the deeper foci may all work to compensate to some degree for the inconsistencies apparent from a solely theoretical consideration of the problem. Until more is known of crustal structure and speeds of seismic waves in western Washington there is no other alternative than to accept this technique as yielding a "first approximation" of epicenter locations. Epicenters based on a 5.8 km/sec velocity are believed more accurate than others because of the presumable absence of overlying layers of significant thickness.

A list of western Washington instrumental epicenters located by the technique just explained is appended to this report.

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
January 8	ePZ	7 46 53	Santa Cruz Is. h - 60 km 11½ S., 166½ E. USCGS Mag. 7 - 9700 km ca
January 10	eLZ	13 20.0	Nevada aftershock 40 N., 118½ W. USCGS
January 11	H	10 20 08	Western Olympic Mts. Wash.
	iPZ	10 20 28.2	47° 29' N., 124° 01' W.
	iSNE	10 20 42.5	Felt lightly over wide area. 130 km
January 13	ePZ	2 29 51	Fox Is., Aleutians. Felt.
	iSE	14 46	53 N., 167½ W. USCGS
	SN	15 00	Mag. 6.9 (P). 3200 km ca
	eLN	17.2	
	eLE	2 18.0	
January 20	ePZ	3 55 55	Off west coast of Mexico
	eLE	4 08.5	15 N., 104½ W. USCGS Mag 6¼ (P). 4000 km ca
January 25	eLNE	15 15 15	Arctic Ocean. 80 N., 3 W. USCGS. 5250 km
January 27	iPZ	18 50 02	Fiji Island region. h-400 k 17½ S., 177 W. USCGS 9100 km ca
January 31	iPZ	5 15 32	Mato Grosso, Brazil
	iE	5 15 38	12½ S., 57 W. USCGS Mag 6 3/4 (P). 9300 km ca

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
January 31	ePZ	16 11 35	Kurile Is. 46½ N., 153 E
	eE	16 12.0	USCGS. 6½ - (P), 6100 km ca
February 2	eLZNE	22 14 04	200 miles off Oregon coast.
	eLZNE	22 15 06	44 N., 128½ W. USCGS
			600 km ca
February 3	ePZ	3 12 09	200 Miles off Oregon coast
	ePNE	12.7	44½ N., 128 W. USCGS
	iLE	14 00	600 km ca
	eLN	14 13	
	eZ	14 45	
	eLZE	3 15 50	
February 3	ePZ	12 24 17	Aftershock
	eN	24 24	44 N., 128½ W. USCGS
	SE?	25 23	600 km ca
	LNZ	26 30	
	eLN	27.1	
	eLEZ	27 24	
	eLNZ	12 28.3	
February 3	ePZ	12 42 54	Aftershock
	ePNE	43 07	44 N., 128½ W. USCGS
	eN	43 47	
	SE	44 05	
	eLZNE	45 00	
	eLZ	12 45.8	
February 4	ePZNE	7 41 41	Mascarene Is. region, Indian O.
	eE	7 42 04	17 S., 67 E. USCGS
			16,600 km ca
February 11	LZNE	16 17 34	Nevada aftershock
			39½ N., 118 W. USCGS
			Mag. 4 3/4 (B). 900 km ca
February 11	PZNE	18 56 31	Possibly one of a swarm of
	eZNE	57 31	tremors felt around Othello
	LN	19 00 31	and Warden, Wash. between
			January 10 and February 17.
February 19	iPZE	3 56 44	Off north coast of Panama
			USCGS. 5500 km ca
February 19	ePZ?	23 52 47	Nevada aftershock?
	iLNZ	23 55 16	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
February 24	iPZ	10 01 03.0	Northern Olympic Peninsula
	iSNE	10 01 13.1	S.W. of Sequim. Felt
			slightly. 47°59'N. 123°11
			H - 10 00 50. 76 km
February 27	iPZ	20 56 24	Kermadec Is. region
	iSZ	56 37	27½ S., 176 W. USCGS
	eNE	58.5	Mag. 8 (P)(B).
	eSKSN	21 07 07	10,000 km ca
	ScSNE	07.4	
	SZE	08.0	
	PSN	08.7	
	eZ	14.5	
	eLZNE	22.4	
	iLNE	21 25.0	
March 1	iPZNE	4 47 41	Yukon
	eSZNE	51.0	65 N., 133 W. USCGS
	iLZNE	52 32	Mag. 6 3/4 - (P).
	iLE	4 53 18	2100 km ca
March 1	ePZ	14 06 49	Yukon aftershock
	eNE	07.0	
	eNE	11.0	
	iLN	12 06	
	iLE	14 12 37	
March 5	eLRZ	8 00 56	Hudson Strait
	eLRNE	8 00.6	60½ N., 67 W. USCGS
			3700 km ca
March 7	iPZ	4 57 52	New Hebrides Is.
	eNE	4 58.1	18 S., 169 E. USCGS
			10,200 km ca
March 7	ePZ	15 00 10	Kermadec Is. region
	eNE	15 00.6	27½ S., 176 W. USCGS
			10,700 km ca
March 9	PZ	3 55 30	Aftershock
March 14	iPZ	13 18 34	Adreanoff Is., Aleutians
	eNE	20 30	h-100 km. USCGS
	SNE	13 23 40	Mag. 7 (P). 3700 km ca

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
March 18	iPZ	0 15 14	Kamchatka region
	eNE	18 15	54½ N., 161 E. USCGS
	SE	22 12	5200 km ca
	SN	22 32	
	LN	0 25.5	
March 22	eZ	14 00 10	Yukon. 65½ N., 133 W. USCGS
	eLNE	14 06.0	2000 km ca
March 22	ePPZ	14 26.8	Indian Ocean
			8½ S., 92E. USCGS
			Mag. 7 (P). 14700 km
March 26	H	6 55 50	N.E. of Everett Wash. MM-6
	iPZ	6 56 00.3	48°08' N., 122°02' W.
	iSNE	56 07.3	55 km
	iSNE	6 56 07.7	
March 28	iPZ	9 24 24	Ryuku Is. 39 N., 130 E.
	eNE	9 24.7	USCGS. 9000 km ca
March 31	iPZ	18 31 10	N.W. coast of Mindanao, P.I.
	ePPZNE	35.2	8 N., 124 E. USCGS
	SKSZ	39 37	Mag. 7½ (P). 11,200 km
	PSNE	43.2	
	PSZ	43.6	
	LGN	18 57.0	
	LRNE	19 01	
April 4	iPZ	11 24 28	Near S. coast of Formosa
	eNE	24.6	22 N., 121 E. USCGS
	eN	25 04	Mag. 6 (P). 10200 km ca
	eSNE	11 35.3	
April 4	PZ	19 32 28	Nicaragua
	ePNE	32.6	13 N., 87 W. USCGS
	eZ	33.7	Mag. 6¼ (P). 5200 km ca
	eE	35 27	
	eLNE	19 51.2	
April 5	PZ	15 14 42	Gulf of California
	ePNE	14 50	24½ N., 110 W. USCGS
	eSNEZ	19 25	Mag. 7 (P). 2800 km ca
	LNE	15 23.0	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
April 5	ePZ	16 21 53	Aftershock. USCGS
	iPZ	22 02	
	eNE	22.2	
	eN	26 40	
	LNE	16 30.0	
April 6	eP'Z	13 10 45	Mascarene Is. Indian Ocean
	iZ	10 51	17½ S., 66½ E. USCGS
	iN	13 11 22	17000 km ca
April 6	eP'Z	20 08 42	Indian Ocean
	iZ	09 04	33½ S., 87 E. USCGS
	P'_2Z	20 09 52	17300 km ca
April 14	PZ	1 42 24	Sikiang Province, China
	eZ	42 42	30 N., 101½ E. USCGS
	ePPZ	46.2	Mag. 7¼ (P). 10500 km ca
	SKSNE	52.8	
	SNZ	53.8	
	PSEZ	1 54.4	
	LNE	2 11.0	
	LNE	2 18.0	
April 15	ePZ	3 54 02	Kirghiz, USSR
	iPZ	54 04	40 N., 74½ E. USCGS
	eN	3 55 09	Mag. 7 (P). 10200 km ca
	SKSN	4 04.7	
	SZNE	05 12	
	eZ	06.0	
	PSNE	06 19	
	LE	27.5	
	LN	4 33.7	
April 15	iPZ	4 26 37	Aftershock. USCGS
	SN	37 11	
	PSN	4 38 28	
April 17	ePZ	18 44 05	Kamchatka region
	eNE	44.5	52 N., 159½ E. USCGS
	eN	45 24	Mag. 6 3/4 (P). 5500 km ca
	ePPNE	47 11	
	eN	50.7	
	eE	52.1	
	eLN	54.1	
	eLE	18 54.7	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
April 18	PZ	9 00 45	About 150 mi. off N. coast of Formosa. USCGS. 9500 km ca
April 19	ePZ	17 00 14	Near E. coast of Greece. Destructive at Velos. 39½ N., 23 E. USCGS. 9700 km ca
	SKSN	10 19	
	SNE	11 04	
	PSNE	11 14	
April 19	ePZ	20 37 13	Near coast of Central Chile 30 S., 72 W. USCGS Mag. 7 (P). 10100 km ca
	iPZ	37 22	
	eZ	37 41	
	SKSN	47.5	
	SE	48 03	
	SPZE	48.3	
	EZNE	50.3	
	eLN	20 14.0	
April 21	PZ	7 31 14	Greece; destructive aftershock 9700 km ca. USCGS
	SE	7 42 19	
April 22	iPNZ	6 29 18.7	Local. Felt at Longmire, Wash. on lower slope of Mt. Rainier
	eSEZ?	31.0	
	eNE	6 29 41.0	
April 24	ePZ	13 12.0	Sikiang Province, China 45 N., 86 E. USCGS. 9400 km
April 25	PZ	10 47 10	Calif.-Mexico border. 32 N., 115 W. USCGS Mag. 5 (P). 1800 km ca
	eNE	47.4	
	iLNE	52 21	
	LZ	10 54.2	
April 26	eLNE	3 31	El Salvador; USCGS. Heavy microseisms obscure all phases.
April 28	iPZ	19 12 05	Aleutian Is., Adak. Felt 51 N., 178½ W. USCGS Mag. 6½ (P). 4000 km ca
	ePNE	12.2	
	eNE	15.2	
	eZ	17 06	
	iSNE	17 43	
	iZ	17 54	
	eNE	18.4	
	eNE	19 20	
	eLNE	19 20.5	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
April 30	PZ?	1 41 00	Nicaragua
	iPZNE	1 41 30	12½ N., 87 W. USCGS
	LNE	2 01.0	5200 km ca
April 30	PZ	1 52 28	Aftershock
	eNE	52.6	
	eE	1 53 31	
May 1	ePZ	10 06.0	Off coast of N. Honshu, Japan
	iZ	06 07	39½ N., 143½ E. USCGS
	SNE	14 43	Mag. 6 3/4 (P). 7200 km ca
	LNE	10 28	
May 2	iPZ	12 51 01	Marianas Is. 19 N., 145 E. USCGS. 8700 km ca
May 3	eZNE	2 39.9	Regional?
May 8	eNEZ	3 45 07	Yukon. 65½ N., 133½ W.
	LE	3 46 20	USCGS. 1900 km ca
May 8	eE	9 42.6	Idaho-Wyoming border
	eZ	9 43.6	43 N., 111 W. USCGS 1000 km ca
May 8	eE	10 43.8	Near Fallon, Nev. 39 N., 118 W. USCGS 900 km ca. Heavy microseisms
May 11	iPZ	11 14 24	Ecuador. 0, 78 W. USCGS 6900 km ca
May 13	eZ	3 40.3	Virgin Is. region. Felt
	eLNE	3 56.6	19½ N., 64 W. USCGS 6100 km ca
May 13	iPZNE	6 15 11	Bonin Is. region. h-500 km
	iPPZ	17 00	28 N., 139½ E. USCGS
	iSNE	6 24 12	8200 km ca
May 14	iPZ	20 04 30	Pacific O. off Lower Calif.
	PNE	04 37	29 N., 126½ W. USCGS
	eN	04 55	2200 km ca
	eNE	07.1	
	eLNE	20 24.6	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
May 16	iSNE	3 01 43.9	Light local shock. Not felt.
	eN	01 48.0	
	iEZ	01 50.5	
May 17	iPZ	15 08 48	Nicobar Is.
	SKSZNE	15.3	7 N., 94½ E. USCGS
	ScSN	16.8	Mag. 7 (P). 12900 km ca
	eN	19.3	
	eN	19.8	
	eLNE	15 50	
May 19	eZNE	7 19.0	Regional?
	eNE	7 29.5	
May 27	iSNE	23 00 01.5	Light local shock. Not felt.
	iLN	23 00 08.0	
May 21	ePNEZ	3 41.9	Bonin Is. 29 N., 140½ E.
			USCGS. 8200 km ca
May 21	iPZ	15 51 18 C	Samoa Is. 15½ S., 173 W.
			USCGS. 8700 km ca
May 23	ePZ	17 54 45	New Hebrides Is. 18 S., 169 E.
	eZ	17 54 50	USCGS. 10200 km ca
May 25	PZN	3 17 08	Off Guatemala coast
	eLN	32.5	14 N., 92½ W. USCGS
	eLZ	3 33.7	4800 km ca
May 26	PZ	16 36 11	Solomon Is. 10 S., 161 E. USCGS
	LNE	17 07	Mag. 7 (P). 10000 km ca. S. lost in changing records.
May 28	iPZ	6 33 37	Argentina, Cordoba Province
	eZN	34 28	30½ S.,65 W. h-200 km
	SN	6 44 24	USCGS. 10600 km ca
May 29	P'Z	4 19 02	Bouvet Is. region. S. Atlantic O.
	eZ	4 19 19	USCGS. 16000 km ca
May 29	PZ	13 36 16	Kodiak Is.
	eZ	40 07	56 N., 155 W. USCGS
	SNE	40 30	Mag. 5 3/4 (P). 2350 km ca
	LNE	41 09	
	LNE	42.5	
	LNE	13 45.6	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
May 29	ePZ	21 08 07	Aftershock
	SNE	12 10	Mag. 5 (P)
	LN	14.1	
	LN	21 16.4	
May 30	ePZ	12 42 35	Near Volcano Is. h-600 km
	iPZNE	42 37	24½ N., 142½ E. USCGS
	pPZ	44 04	Mag. 7¼ (P). 8600 km ca
	iSZNE	51 35	
	eNE	12 52.1	
May 31	iPZ	9 43 49	Kermadec Is. region. h-100 km
			27 S., 177½ W. USCGS
			Mag. 6 3/4 (P). 10200 km
May 31	iPZ	14 54 42 R	Near S. coast of Hokkaido,
			Japan. 42 N., 141 E. h-100 km
			USCGS. 7200 km ca
May 31	iPZ	18 06 47	Galapagos Is. 0., 92 W.
	LNE	18 25.0	USCGS. 6200 km
June 2	iPZ	0 26 10 R	Aleutians, Adreanoff Is.
	SNE	31 58	51½ N., 180 W. USCGS
	LE	0 34.7	Mag. 6 3/4 (P). 4100 km ca
June 2	iPZ	2 09 24	Aftershock. USCGS
	eN	15 10	
	SNE	2 15 22	
June 5	iPZ	2 00 30 R.	Aftershock. USCGS
	iSN	06 12	
	eSE	06 26	
	eLNE	2 11.2	
June 5	ePZ	6 24 13	Formosa. 24½ N., 122 E.
	iPZ	6 24 26	USCGS. 9800 km ca
June 5	iPZ	15 08 41 R	Near N. coast of Algeria
			36½ N., 1½ E. USCGS
			9100 km ca
June 7	eLNE	1 42.0	China, Sikiang, Province
June 8	eLNEZ	12 27 24	Regional

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
June 11	iPZ	22 31 48	Argentina. h-600 km 27 S. 63 W. USCGS. 10100 km ca
June 12	PZ	20 40 00	Kurile Is. 49 N., 155 E. USCGS. 5900 km ca
June 14	iPZ	6 17 45	Near Colima, Mexico, off coast 20 N., 107 W. USCGS Mag. 7 (P). 3500 km ca
	iZ	17 47	
	eN	17 56	
	eZ	18 21	
	eSN	23.0	
	iSNZ	23 17	
	LN	28.8	
	LE	6 29.5	
June 14	iPZ	11 33 07	Regional?
June 14	ePZ	19 36 12	Near W. coast of Lower California 25 N., 113 W. USCGS. 2600 km ca
June 16	iPZ	12 42 36	Aftershock
	eSN	47 05	
	eLE	50.5	
	eLN	12 51 13	
June 17	eLNE	22 51.5	9-sec. waves.
June 19	H	19 21 05	Near Fallon, Nev. 39 N., 118½ W. USCGS Mag. 5½ (B). 900 km ca
	eZ	23 22	
	LN	26 06	
	LE	26 10	
	LE	19 26 40	
June 19	H	19 25 19	Aftershock. Mag. 5 (B).
	eN	30 15	
	LNE	30 27	
	LE	19 30.8	
June 20	iPZ	12 14 38	Aleutians; Adreanoff Islands. 51½ N., 180 W. USCGS Mag. 7 (P). 4100 km ca
	iZ	14 40	
	eE	20.0	
	iSNE	20 24	
	LNE	23.1	
	LZ	12 23 42	
June 21	PZ	10 59 37	Kamchatka region. 52 N., 161½ E. USCGS. 5400 km ca

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
June 25	ePZ	12 16 50.4	Local. Not felt
	iPZ	16 51.0	
	iSNE	12 16 53.7	
June 26	ePZ	21 04 45	Feeble regional disturbance
June 27	eLNE	2 17.5	Colima, Mexico, off coast
June 28	PZ	4 36 31	North polar region
	eSN	43 18	86½ N., 70 E. USCGS
	LNE	4 54.3	5200 km ca
June 29	iPZ	13 07 07.7	Weak regional disturbance
	iZ	07 10.3	Not felt
	iLN	13 07 11.2	
June 30	iNEZ	13 54 50.8	Slight local tremor
	F	54 54	
July 3	eZ	14 34 09	Aleutians, Rat Is. 52 N., 178 E. USCGS 4200 km ca
	iPZ	34 14	
	iN	36 25	
	eSNE	40.2	
	SE	40 29	
	eE	42 47	
	eLqE	43.9	
	LN	14 48.0	
July 4	PZ	14 27 11	Aleutians, Rat is. 51½ N., 177 E. USCGS Mag. 6 3/4 (P). 4200 km ca
	PPNE	27.4	
	eSE	33 46	
	eSN	34.2	
	SSN	37.4	
	LN	39.5	
	LNE	14 41.5	
July 5	iSZNE	7 52 39.3	Light local shock
	eNE	52 45	
	eLNE	7 52 52	
July 5	PZ	15 16 25	200 miles off Oregon Caost USCGS. 700 km ca
	eNE	16 42	
	eE	17 28	
	iSNE	15 17 42	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
July 6	PZ	2 03 12	Kamchatka region
	iNE	03 21	51 N., 158 E. USCGS
	eSE	10 20	Mag. 6 3/4 (P). 5600km ca
	SN	10 30	
	eN	11 20	
	LN	2 13.0	
July 6	PZ	10 35 19	Near S. coast of Alaska Peninsula
	eN	10 40.0	54½ N., 161½ W. USCGS. 2700 km ca
July 6	iPZ	15 12 04	Tonga Is. h - 100 km
	eN	13.0	24½ S., 177 W. USCGS
	eSE	20 17	10000 km ca
	SN	15 20 36	
July 7	ePZ	9 24 12	Regional?
July 8	ePZ	18 51 50	Fiji Island. h - 600 km
	iPZ	52 56	20½ S., 179½ W. USCGS
	iSN	19 00 40	9700 km ca
July 8	eP'Z	19 22 24	Java Sea. h - 600 km
	eSKSN	27.0	5 S., 110 E. USCGS
	iE	19 28 25	13400 km ca
July 9	ePZ	0 57 27	Near Kenai Peninsula, Alaska
			USCGS. 2200 km ca
July 10	ePZ	14 33 18	Tonga Is.
	iPZ	33 21	20 S., 175½ W. USCGS
	SN	43 40	Mag. 6¼ (P). 9300 km ca
	eLN	15 06	
July 13	P'Z	20 36 14	Sandwich Is. region, S. Atlantic
	PPE	39 00	USCGS. 1500 km ca
	PPN	39 17	
	iPKSZ	20 39 39	
July 15	eZNE	4 47 35	About 200 mi. off coast of
	eLZN?	48.0	Vancouver Is., B.C. USCGS
	LN	48.8	Record is not typical and
	iZ	49 10	solution seems open to
	eENZ	4 48 57	doubt.

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
July 16	ePZ	7 20 15	Dodecanese Is. Damage on Samos
	eZ	25 12	37½ N., 27 E. USCGS
	eN	26.0	Mag. 7-(P). 10,000 km ca
	eSN	30 51	
	eE	31 23	
	ePSE	31 53	
	ePSN	32 03	
	eLE	7 54 34	
July 16	ePZ	12 29 22	Tonga Is. USCGS. 9100 km ca
July 17	ePZ	22 04 43	Aleutians, Fox Is.
	iPcPZ	06 45	54 N., 168 W. USCGS
	eN	10 17	Mag. 6 (P). 3500 km ca
	LN	12.7	
	LE	22 13.8	
July 18	iPZ	1 07 40	New Hebrides Is. 18 S., 170 E.
			USCGS. 10000 km ca
July 18	iPZ	11 42 35 R	New Hebrides Is. h-150 km
	eZ	11 43 18	13½ S., 167 E. USCGS.
			10,000 km ca
July 19	iPZ	16 25 26	Near S. coast of Alaska
	eN	16 29.1	60½ N., 145½ W. USCGS
			2100 km ca
July 19	iPZ	23 57 10	Near S. coast of Kodiak Is.,
	eNE	59.5	Alaska. 56½ N., 153 W. USCGS
	eSN	24 01 02	Mag. 6 (P). 2300 km ca
	eSE	01 20	
	eN	24 03.4	
July 20	iPZ	21 10 59 R	Northern Ecuador. Damage at
	eE	21 19 16	Catacachi. ½ N., 78½ W.
			USCGS. 6700 km ca
July 21	iPZNE	11 57 24 R.	Southern Peru. h - 100 km
	iZ	11 57 49	25 S., 74 W. USCGS
	eN	12 05 52	Mag. 6 3/4 (P). 9800 km ca
	eN	06 36	
	iSNE	07 03	
	LN?	12 23	
July 22	iPZ	23 35 34.5	Regional disturbance.
	iSE	35 56.8	iP weak.
	LZ	23 36 02	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
July 23	ePZ	19 02 41.4	S. tip of Camano Island, Puget Sound
	iSNE	19 02 46.8	48°03' N., 122°22'W.
			H - 19 02 34. 43 km
July 24	ePZ	1 17 08	Near Samoa. 14 S., 175 W.
	eZ	1 18 03	USCGS. 8800 km ca
July 24	PZ	11 13 16	Southern Honshu Is., Japan
	eNE	13 40	36 N., 140 E. h - 100 km
	eE	15 35	USCGS. 7700 km ca
	eSE	11 22 18	
July 24	iPZ	16 33 04 C	Near E. coast of Formosa
	eNE	33 07	24 N., 122 E. USCGS
	eSNE	44 09	9900 km ca
	eE	16 44 27	
July 25	ePZ	11 35 05	Northern Chile. h - 200 km
	eE	35 12	22½ S., 69½ W. USCGS
	eSNE	11 45 31	9600 km ca
July 26	ePZ	4 09 08	Kodiak Is., Alaska. Foreshock
	eZNE	09 18	56½ N., 153 W. USCGS
	eNE	09.6	2300 km ca
	eSZNE	13.3	
	eSNE	13.5	
	eLN	14.2	
	eLE	4 14.5	
July 26	iPZNE	14 20 32.5	Weak local jolt. Not felt
July 26	iPZ	15 22 40.0	Index Mt. near Everett Wash
	iSNE	15 22 47.0	47° 48' N., 121°36' W. 55 km
			iP weak. Not reported felt
July 27	iPZ	1 32 31	Shikoku, Japan
	eZ	33.0	34 N., 134 E. USCGS
	iE	1 33 06	8300 km ca
July 27	ePZ	18 23 55	Near S. coast of Kodiak Is., Alaska
	eNE	23 58	56½ N., 153 W. USCGS
	iZNE	24 05	Mag. 6¼ (P). 2300 km ca
	eSZE	27 40	
	eSN	28 00	
	LNE	28.0	
	LN	18 31.5	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
July 28	PNE	21 45 25.2	Probably near Everett Wash.
	iSNE	21 45 28.7	Not felt.
July 29	iPNE	13 35 33.0	Near Clallam Bay, Strait of
	iSE	13 35 50.7	San Juan de Fuca.
			48°14' N., 124°06' W.
			H - 13 34 09. Not felt
August 5	eLNE	3 30 --	Off Colima, Mexico. USCGS
			3700 km ca
August 6	eLN	5 36.5	9-second waves
August 6	iPZ	8 43 28	Tonga Is. region. h-350 km
	iPPNE	44 51	21½ S., 177½ W. USCGS
	eN	45 07	Mag. 6 3/4 (P). 9600 km ca
	iZ	45 52	
	iSNE	53 17	
	SZ	53 40	
	eE	8 55.9	
August 8	PZ	10 38 09	Mineral Co., Nevada
	ePNE	38.2	38½ N., 118.8 W. USCGS
	SN	39 48	1050 km ca
	SE	40 01	
	eE	40 22	
	LNE	40.8	
	LNE	41.2	
	LE	41 52	
	LN	10 42 05	
August 11	iPZ	6 40 38.8	Near Monroe, Wash.
	iSNE	6 40 43.7	47°49' N., 121°58' W.
			H - 6 30 32. 30 km. Not felt.
August 14	eSE	17 07.7	Kermadec Is. region
	eSN	08.0	33 S., 179 W. USCGS
	eLE	17 29.5	10800 km ca
August 16	iPZ	11 59 43	Solomon Is. h - 200 km
	ePNE	59.8	6 S., 155 E. USCGS
	eSE	12 10.0	Mag. 7¼ (P). 10200 km ca
	SN	10 24	
	iSZE	12 10 28	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
August 16	PZ	19 18 41	Nicaragua. 12½ N., 86½ W. USCGS. 5300 km ca
August 21	ePZ	17 47 47	New Guinea
	eZ	48 05	3 S., 137½ E. USCGS
	PPE	52 03	Mag. 7- (P)(B). 11200 km ca
	eE	52 44	
	SKSE	58 23	
	SE	17 59 16	
	PSZ	18 00 32	
	SSE	06.5	
	LRE	18 19.6	
August 23	iPZ	16 34 05	About 170 miles off coast of
	iN	34 10	Oregon. 43½ N., 128 W. USCGS
	iNE	34 13	Mag. 6½-(P). 650 km ca
	iSNE	35 18	
	LE	35 50	
	LNE	36.2	
	iLE	36 47	
	LZ	16 37 23	
August 24	ePZ	6 57 51	Off coast of Oregon
	eSE	59 08	44½ N., 129½ W. USCGS
	eSN	59 15	650 km ca
	LNE	7 00 01	
	iLNE	00 26	
	LEZ	7 01.6	
August 26	eLZNE	6 33.5	Yukon, Canada
	LE	33.8	65½ N., 133 W. USCGS
	LN	6 34.0	2000 km ca
August 27	ePZ	7 01 28	USCGS reports shock in
	eZNE	02.5	New Hebrides Is. This
	iN	03 02	record has the character-
	eNE	03 10	istics of a shock about
	LN	04.0	1000 km away.
	LZ	04 22	
	LNZ	7 05 13	
August 28	iPZE	20 21 30	Near coast of Guatamala. h-60 km
	eE	36 02	14 N., 91 W. USCGS
	eSN	27 20	Mag. 6 3/4 (P). 4800 km ca
	eLE	28.0	
	LN	31.2	
	LN	35.1	
	LNE	20 39.2	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
August 29	PZ	15 41 06	Adreanoff Is., Aleutians
	eE	46 25	51 N., 178½ W. USCGS
	SNE	46 40	3900 ca.
	SE	15 46 51	
August 30	eLZNE	2 01.2	Cape Mendocino, Calif.
	F	2 05	Felt in Eureka. 900 km ca
August 30	iPZ	17 46 20	Bonin Is. region. h-500 km
	eNE	46 27	28 N., 139 E. USCGS
	eE	17 46 54	8100 km ca
August 31	eLNE	12 35	Alaska. USCGS
September 3	ePZ	12 44 15	Guatemala. h - 100 km
	eEN	44.4	14 N., 91 W. USCGS
	eZ	45 12	Mag. 6½ (P). 4700 km
	SNE	51 16	
	LN	54.6	
	LNE	13 03.5	
September 3	ePPZ	16 41 38	Celebes Is. 1 N., 123 E.
			USCGS. 12,000 km ca
September 4	ePZ	11 42 07	Northern Chile h-100 km
			22 S., 69 W. USCGS. 9600 km ca
September 5	iPZ	2 03 52	Near San Jose, Calif
	SZN	06 03	37½ N., 122 W. USCGS
	LN	06 40	Mag. 5.8 (P). 1200 km ca
	LNE	07 05	S very weak
	LQE	2 07.8	
September 8	P'Z	2 22 44	Sandwich Island region
	eN	23 05	Mag. 7-(P). 14700 km ca
	iSNE	26 23	
	eZ	2 27 09	
September 8	ePZ	3 40 18	Solomon Island region
	eN	40 30	7 S., 155½ E. USCGS
	eSNE	51 52	10,100 km ca
	ePSE	52 42	
	LQN	4 15 43	
	LRN	4 20.3	
September 8	ePZ	22 07 06	Local tremor. Not felt
	iSN	07 07.8	
	iN	22 07 09.2	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
September 8	eNE	23 48.5	
	eNE	49.2	
	LNE	23 51 15	
September 9	iP'ZN	10 00 56	Near S. coast of Sumatra
	iN	01 03	2 S., 100 E. USCGS
	ePPNE	02 06	13700 km ca
	eZ	10 02 32	
September 10	PZ	6 01 03	Komandorski Is.
	iN	02 28	54½ N., 169 E. USCGS
	iN	6 03 11	4600 km ca
September 10	iPZ	9 35 56	Adreanoff Is. Aleutians 50½ N,
	eNE	9 36.0	173½ W. USCGS. 3600 km ca
September 10	eZNE	19 41.2	
	eZ	19 41.8	
September 11	iPZ	0 53 36.5	Neah Bay, Washington. Felt
	iSE		48° 24' N., 124° 36' W.
			H - 0 52 45. 190 km
September 11	eLNE	9 08.3	Swan Is. region. Caribbean Sea.
			USCGS. 5300 km ca
September 11	ePZ	18 17 22	Solomon Islands
	eE	18.2	7 S., 155 E. USCGS
	eSNE	28.0	10300 km ca
	ePPSE	29 33	
	SSSN	38.0	
	LGE	18 41	
September 12	ePZ	6 23 00	Off coast of Egypt. Destructive
	eN	23 21	32½ N., 30 E. USCGS
	iSKSNE	6 33 27	Mag. 6½ (P). 10700 km ca
September 13	iPZ	2 07 32	Adreanoff Is., Aleutians.
	iZNE	07 43	h-60 km. 52 N., 176 W. USCGS
	SE	13 00	Mag. 6 - (P). 3700 km ca
	SN	13 06	
	eE	13 35	
	eLN?	2 22.0	
September 14	iPZ	13 03 09.7 C	Local tremor. 50 km ca
	iSNE	03 17.3	
	iNE	03 23.5	
	LZ	13 03 32	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
September 19	iPN	20 30 44	Adreanoff Islands
	eZ	20 30 50	USCGS. 3700 km ca
September 20	ePZ	13 33 43	Kermadec Islands
	eN	44.5	32 S., 178 W. USCGS
	SNE	45.0	Mag. 6½ (P)(B). 10700 km ca
	eN	49.5	
	eN	13 59	
September 21	PZ	6 52 43	New Hebrides Is. 17½ S.,
	eNE	6 53.0	169 E. USCGS. 10100 km ca
September 21	SKPP'Z	7 55 08	Atlantic Ocean.
	LNE	8 03.0	14 S., 14½ W. 12500 km ca
September 21	eZ?	9 19 35	Near Oregon coast
	PZ	19 39	USCGS. 750 km ca
	eN	20 46	
	eZ	20 51	
	SN	21 19	
	SE	9 21 51	
September 22	iPZ	3 38 00	Off E. Coast of Taipeh.
	eSKSN	48 45	24 N., 123 E. USCGS
	eSN	3 49.5	10,000 km ca
	LE	4 13.7	
September 23	ePZ	15 19 51	China, Yunnan Province
	eNE	20 13	27 N., 101½ E. USCGS
	iN	20.6	Mag. 6 3/4 (P). 10700 km ca
	eE	29.7	
	eSKSN	30.5	
	ePSE	15 32.4	
September 23	iPZNE	19 30 29	New Hebrides Is.
	iN	30 42	USCGS. 10,000 km ca
	iN	19 31 24	
September 24	ePZN	10 34 32	Off E. coast of Formosa
	eN	36 39	22 N., 122 E. USCGS
	PSN	10 46 27	10,000 km ca
September 24	iPZNE	17 03 18	Northern Chile. h-100 km
			23 S., 68 W. USCGS.
			9500 km ca

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
September 25	ePZ	19 13 05	Off coast of Mindanao, P.I.
	PPE	17 17	6 N., 127½ E. h - 100 km
	eSKSNE	23.8	USCGS. Mag. 6½ (P). 11000 km ca
	eSZ	25 08	
	SPE	19 26.4	
September 26	ePZ	8 35 48	Chiapas, Mexico. h - 200 km
	iPZ	35 50	15½ N., 92½ W. USCGS
	eSN	41 44	Mag. 6 3/4 (P). 4600 km ca
	iSN	41 56	
	iLN	45 36	
	eLN	8 46.0	
September 28	iPZ	18 17 05	Near coast of Oaxaca, Mexico
	eZN	18 43	15 N., 97½ W. USCGS
	eSN	23.2	Mag. 6 (P). 4400 km ca
	LNZ	26 08	
	LE	28.9	
	LGNE	18 31.0	
September 29	eP	20 09 02	Northern Honshu, Japan
	eE	20 14 13	40 N., 141 E. h - 150 km
			USCGS. 7400 km ca
September 30	ePZ	19 21 19	Adreanoff Is., Aleutians.
	eNZE	21 32	51½ N., 176½ W. USCGS
	eSN?	24 55	3800 km ca
	eSE?	19 25.4	
October 3	ePZ?	11 25 11	Near S. coast of Vancouver Is.
	iSE?	25 47	USCGS. 400 km ca?
	iLNE	11 25 53	
October 10	ePZ	9 11 05	New Britain
	eSPZ	23 13	5 S., 153 E. USCGS
	LRE	9 40.3	Mag. 7¼ (P). 10300 km ca
October 13	iPZ	9 39 41 C	Solomon Islands.
	SE	50 12	9½ S., 161 E. USCGS
	ePSN	50 27	Mag. 7 (P). 9800 km ca
	LE	10 10	
October 14	PZ	8 52 24 R.	West of Galopagos Is.
	eSN	9 00.5	3 S., 103½ W. USCGS
	eLQE	9 11.1	Mag. 6¼-(P). 5800 km ca

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
October 19	PZ	10 03 56	Northern Kuriles
	iZ	04 12	49½ N., 155 E. USCGS
	iN	04 21	Mag. 6½ (P). 5800 km ca
	eNE	05.6	
	iSE	11 22	
	iSNZ	11 46	
	eZ	12.3	
	iEN	10 14 13	
October 20	ePZ?	0 14 05	Regional desturbance?
	eSN?	14 20	Interpretation questionable
	iSE?	14 35	
	eN	14 42	
	LE	0 15 32	
October 21	iPZ	19 14 16	Fiji Is. h - 650 km
	iN	14 29	21 S., 179 W. USCGS
	iPPZ	16 32	9600 km ca
	iNE	16 40	
	SZNE	19 23 41	
October 21	eP'Z?	23 27 20	Northern Celebes
	PPZ	23 28 32	½ S., 123½ E. USCGS
			12000 km ca
October 24	ePZ	4 13 09	Damage in and near
	eZ	13 40	Oakland, Calif.
	eZ	14 08	37.9 N., 121.9 W. USCGS
	iSZN	15 09	Mag. 5½ (P). 1100 km ca
	eZE	15 40	
	LN	16.4	
	LZE	4 16.8	
October 25	eLQNE	16 56.0	Oaxaca, Mexico. 16½ N.,
	eZ	16 57.0	95½ W. USCGS. 4300 km ca
November 3	iPZ	1 40 38.9	Northeast of Everett, Wash.
	iSNE	40 46.7	48°06' N., 121° 45'W.
	iLNE	1 40 51.7	H - 01 40 28. 65 km
			Max. MM intensity - 4
November 10	iPZ	1 55 58	Samoa Is. h - 100 km
	eZNE	56 12	15 S., 174 W. USCGS
	eZN	1 56 29	Mag. 7½-(P). 8700 km ca
	iSN	2 05 46	

Date	Phase	Time (G.C.T.)	Remarks
1955		h. m. s.	
November 14	iPZ	13 35 01	Marianas Is. h - 150 km ca
	eN	35 08	17½ N., 145½ E. USCGS
	eE	13 35 44	8700 km ca
November 15	iPZ	10 11 46 R	Alaska, S. of Kodiak Is.
	SE	15 36	55½ N., 155 W. USCGS
	LNE	15.9	Mag. 6¼ (P). 2400 km ca
	LE	10 17.5	
November 17	ePZ?	17 06 17	Weak regional disturbance?
	eSE?	17 06 39	
November 21	iPZ	20 27 50 R	Fallon, Nevada.
	SN	29 52	39.4 N., 118 W. USCGS
	LNE	20 30 28	Mag. 5½ (B)(P). 1000 km ca
November 22	iPZ	3 35 31 C	Eastern Tuamotu Archipelago
	eSE	3 45.2	24½ S., 123 W. USCGS
			Mag. 6 3/4-(P). 8000 km ca
November 23	iPZ	6 38 26 C	Kamchatka region. 50½ N., 157 E.
	iSE	6 45 43	USCGS. Mag. 7 (P). 5550 km ca
November 26	eSZ	17 42 48	Northern Lower California
	eLNE	46.0	32 N., 116 W. USCGS
	LE	17 47.5	Mag. 5½-(P). 1850 km ca
December 2	ePZ?	11 59 02.0	Local tremor
	iSE	11 59 07.9	Not felt
December 12	iPZ	19 42 50 R	Off Oregon coast
	eSE	43.5	43½ N., 127½ W. USCGS
	LN	19 44 17	615 km ca. Heavy microseisms
December 17	eZ	5 26 15	Brawley, California. Foreshock
	LE	5 26.7	USCGS
December 17	iPZ	6 11 18	Brawley, California
	iZ	11 25	Slight Damage.
	eSN	14 55	32.9 N., 115.5 W. USCGS
	iLE	16 07	Mag. 5½ (P). 1730 km ca
	LNE	16 15	
	eLQE	6 16.7	
December 17	eNE	7 00 50	Aftershock
	eLZE	7 01.2	
December 29	PZ?	16 09 58	Southern Alaska. h - 100 km
	eNE	16 10.3	59½ N., 154 W. USCGS
			2300 km ca

PROVISIONAL EPICENTERS IN PUGET SOUND AR

Based on assumptions (1) that crustal layers of variable thickness have velocities (Vp) of 5.8, 6.4, and 7.0 km. sec., (2) that P waves for small shocks are propagated to the more distant regional stations primarily through the layer in which the shock originates, and (3) other simplifying assumptions. The stations contributing data were Victoria, Horseshoe Bay, and Alberni, all in British Columbia; Corvallis and Portland, Oregon and Seattle, Washington. Practically all origin times are based on Seattle (S-P) values. All epicenters and focal depths (h in km.) are subject to further revision as the study progresses. See introductory portion of this report for further explanation.

Date	h. m. s.	Lat.	Long.	Vp	h	Location and MM Intensity
1951						
ct. 9	22 59 24.0	48 04	122 44	5.8	40	Whidbey Island. IV
1952						
eb. 20	19 07 07.7	48 37	123 14	5.8	28	In San Juan Islands. IV
eb. 22	9 39 31.6	48 36	123 17	5.8	20	San Juan Islands. Haro Strait. IV
eb. 23	9 28 03.9	47 51	122 08	5.8	35	Monroe, Sultan area. F
arch 14	14 59 36.4	48 38	123 12	5.8	30	San Juan Islands. Haro Strait. IV
arch 22	2 01 36.7	47 39	122 27	7.0	85	Near Fort Lawton. III
pril 11	9 48 35.7	48 26	124 25	7.0	45	Neah Bay. IV
uly 27	19 52 17.2	47 53	121 52	7.0	25	Near Sultan. IV
uly 27	20 13 52.9	47 54	121 46	7.0	10	Near Sultan. IV
ug. 6	17 31 53.7	47 29	122 25	5.8	30	S.W. of Seattle. F.
ept. 13	22 58 41.0	48 44	122 13	5.8	30	E. of Bellingham
ept. 22	7 21 44.0	48 32	122 56	5.8	33	San Juan Islands
ct. 12	17 06 02.9	48 35	122 39	5.8	25	W. Edge Bainbridge Island
ov. 10	22 54 02.5	47 34	121 33	6.4	40	Garfield Mt. F.
953						
c. 16	4 31 52.8	45 41	123 08	7.0	30	Portland, Oregon. VI.
954						
rch 16	15 56 09	47.1	121.8	6.4	85	S. E. of Enumclaw. V.
y 15 *	13 02 13.0	47 25	122 22	7.0	40	3 mi. N.W. of Des Moines. V.
ne 18	15 09 43.8	47 37	122 40	7.0	35	Near Bremerton
pt. 1	12 42 14.0	48 08	122 56	5.8	5	Discovery Bay
955						
n. 11	10 20 08.0	47 49	124 01	7.0	25	Upper Hoh River. V.
b. 24	10 00 50.3	47 59	123 11	6.4	30	Near Sequim
rch 26	6 55 50.4	48 08	122 02	5.8	5	N.E. of Everett. VI.
y 23	19 02 34.0	48 03	122 22	5.8	5	S. Tip Camano Island
y 26	15 22 30.4	47 48	121 36	6.4	10	Index Int.
y 29	13 34 09.2	48 14	124 06	6.4	10	Clallam Bay area
. 11	6 30 32.3	47 49	121 58	6.4	30	Near Monroe
t. 11	0 52 45.5	48 24	124 36	7.0	70	Neah Bay. III.
. 2	1 40 28.6	48 06	121 45	7.0	25	Big Bear Mt. IV.
56						
. 7	4 29 35.0	47 19	122 25	7.0	65	Dash Point near Tacoma. IV.
. 9	0 57 11.8	48 21	122 39	6.4	55	N. end of Whidbey Island. IV.
11 8	22 28 11.3	48 26	123 08	5.8	10	S. end Haro Strait. IV

* Secondary and major epicenter 47.5° N., 121.3° W. in Cascade Mts.