[S.I.R.—20.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

DOMINION OBSERVATORY, WELLINGTON, NEW ZEALAND.

SEISMOLOGICAL REPORT FROM NEW ZEALAND STATIONS.

The report is divided into two parts :—

Part I gives readings of distant earthquakes (Wellington $\Delta > 10°$ ca.) : and Part II gives readings of local earthquakes ($\Delta < 10°$ ca.). But where a local earthquake is likely to have been recorded outside New Zealand, a reference to it is also included in Part I. In both parts, where the clock correction is not known, the time of P (or first phase recorded) is enclosed in a bracket. Whenever they are definitely indicated, the trace amplitude and the direction of the vertical component of P are given. An upward ground movement is designated (+), and a downward movement (—).

In Part II determinations of absolute time are not attempted from Jaggar records, only the intervals between pulses being measured. In many cases the P movements are very small, and the first movement recorded is not necessarily Pn, or any other particular pulse.

Unless otherwise indicated, times recorded refer to the incidence of impulsive movements.

A list of provisional epicentres in New Zealand and the South-west Pacific is appended. The New Zealand epicentres are determined from the records of local stations, and the more distant ones with the assistance of data from Manila, Hong-Kong, Apia, Papeete, Brisbane, Riverview, Sydney, Melbourne, and Adelaide.

List of New Zealand Seismograph Stations.

Station Name and Abbreviation.	Position.		Height above M.S.L.	Lithologic Foundation.	Seismographs.	Observers.
	Latitude.	Longitude.				
			Feet.			
Wellington (W) ..	41° 17′ S	174° 46′ E	401	Greywacke	Milne-Shaw (N-S)* ..	Dominion Observatory, Central Station.
					Galitzin-Wilip (Z)* ..	Acting-Director—
					Wood-Andersons (N-S)* and (E-W)*	R. C. Hayes.
					Jones (Z)*	Observers—
					Imamura (three components)*	C. N. M. Watson-Munro.
						W. M. Jones.
Arapuni (A).. ..	38° 5′ S	175° 39′ E	212	Rhyolite tuffs ..	Milne (E-W)*	Powerhouse Superintendent.
Rotorua (R) ..	38° 8′ S	176° 15′ E	930	Rhyolitic silts and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Tuai (TU)	38° 48′ S	177° 9′ E	960	Gravels	Wood-Anderson (N-S)* ..	Resident Electrical Engineer.
New Plymouth (N) ..	39° 4′ S	174° 4′ E	112	Ash, agglomerate, and lava	Wood-Anderson (E-W)* ..	Superintendent, the Prison.
Stratford (S) ..	39° 21′ S	174° 17′ E	1,000	Water-sorted volcanic debris	Jaggar (E-W)	Mr. A. W. Burrell.
Hastings (H) ..	39° 38′ S	176° 53′ E	35	Alluvial sands, silts, and gravels	Jaggar (NE-SW)	Mr. H. de Denne.
Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
Takaka (TA) ..	40° 51′ S	172° 48′ E	25	Alluvial gravels ..	Imamura (three components)*	The Postmaster.
Greymouth (G) ..	42° 25′ S	171° 13′ E	14	Deltaic sands and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Christchurch (C) ..	43° 32′ S	172° 37′ E	25	Alluvial sands, silts, and gravels	Galitzin (three components)	Magnetic Observatory.
					Wood-Anderson (N-S)* ..	Director—H. F. Skey.
						Observer—H. F. Baird.
Monowai (M) ..	45° 47′ S	167° 37′ E	538	Tertiary sandstone ..	Jaggar (E-W)	Mr. A. Walker.
Chatham Islands (CH)	43° 57′ S	176° 31′ W	210	Volcanic breccia ..	Milne (E-W)*	Superintendent, Radio Station.

* For constants, see station register.

1,000/2/39—19353]

PART I.

Distant Earthquakes.

WELLINGTON.

Instrument Constants.

Milne-Shaw (N-S) Pendulum period 11.7 secs.
Damping 20:1
Magnification 250

Galitzin-Wilip (Z) Pendulum period 7.0 secs.
Galvanometer period 10.6 secs.

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
May 1	eP?	04 34 35		35?	small movements on Z.
	S	40 13			
	Lq	42 40			
	Lr	44			Poorly defined.
1	eZ	06 10 29			Small
	iZ	42			Small Probably a complex
	iZ	11 22			prominent shock about 80° dis-
	iZH	12 58			Largest phase on Z tant.
	eH	18 32			
	iH	19 12			Typical S phase
	iH	22 47			May be S or SS
	iH	24 37			
	eL	28			
	iLq?	29 33	20		Followed by series of irregular surface waves with maximum at 06h.45m.
	W2	08 00 ca.			Renewed surface tremors.
1		10 18			Surface tremors.
1	eP?	16 18 30		85ca.	Small movements on Z
	eH	29+			Very small and indefinite movemen ments on H
	eLq	42	40		Prolonged surface tremors.
2	eH	10 24+			Very small and indefinite
	eL	27	23		
2	PP	13 32 20		88ca.	
	eZ	33 30			
	SKS	39 48			
	S	40 30			
	eH	42 28			
	iH	43 40	25		prominent
	SS	46 20	25		Well marked
	Lq	54 55	35		
	Lr	59 35	22		
3	eH	07 18			
	eL	22			Tremors.
3	eL	16 40			Prolonged surface tremors.
4		07 15			Surface tremors
6	eH	06 33			Prolonged tremors.
6		17 26			Slight seismic activity
6	eP	20 11 04		33	
	PF	12 37			
	PcP	13 50			Prominent
	S	16 23			
	ScP	17 07			
	Lq	18 58			
	Lr	20 53			
	ScS	21 26			

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
May 7		02 50			Surface tremors.
8	PKP	02 06 58		164ca.	Emergent Az=-1mm.followed 2 secs.
	iZ	07 21			Very sharp: may be pPKP later by Az=+4mm.
	PKP_2	55			
	PP	11 40			large
	iZ	12 18			sharp
	iZ	13 47			
	SKS	59			Emergent
	PPP	15 26			Well marked
	iZ	16 25			
	eZ	18 35			May be PPPa
	SKKS	57			Well marked phase on H
	PSKS	22 22			Well marked on H
	iZ	27 27			May be ScSPKPa
	SS	32 35			
	SSS	39 05			Strong
	iH	40 55			Prominent
	iH	43 05			Sharp
	iH	44 10	16		
	eH	50 15	25		Marked lengthening of period
	Lq?	55 15			indefinite
	Lr?	03 05			"
	M	26	21		
	M2	59			Renewed surface tremors.
10	eP?	08 04 07			Small movement on Z
	iH	08 05			
	M	31	25		
14		18 13			See local register
16		08 01			Surface movements.
16	eL	23 34			Surface tremors.
17	eP?	00 03+			Small movements on Z superimposed
	eL	23			on surface waves of previous shock.
	M	34			
17	S	15 25 40		45 ca.	
	Lq	29 10	25		
	Lr	33 15			
17	P	18 41 51		69	Az=+1mm.Max.Az=4mm.at 42m.00s.
	PcP	42 10			Prominent phase
	eZ	43 50			
	PP	44 14			
	S	50 57			
	ScS	51 29			sharp
	eH	52 01			
	eSS	55 28			Rises to a max.at 55m.40s.
	Lq	59 03			
18		20 08			Surface tremors.
20		15 25			A few surface waves.
21	eP	20 25 46		14	
	S	28 26			
	ScS?	36 04			Deep focus; surface waves very small.
22	eS	01 50 32		45ca.	
	Lq	54 30	45		
	Lr	58 30	17		
24	S	18 21 23		20ca.	Tremors in strong microseisms.
	eL	22			
26	P	17 59 09		49	Small, in microseisms.
	iS	18 06 10			
	Lq	10 12			
	M	18	16		
28		17 57			Surface tremors.
29	eL	11 47			Tremors.
31	eL	16 10			

CHRISTCHURCH.

(Provisional Readings of Distant Earthquakes)

Instrument Constants:

	$kA_1T/4\pi l$	T (pend.)	T_1 (Galv.)	$\frac{1}{2}\mu 2$
N	300	23.4	23.6	-0.07
E	300	24.35	24.4	-0.02
Z	300	12.79	12.86	-0.02

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
May 1	eP	4 34 57		34	
	eSNE	40 30			
	LqE	43 11	34		Later on N
	eLrNZ	45 47			
1	PNZ	6 11 21		89.4	Compression fron N, apparently multiple shocks.
	iNEZ	12 52			P_2? Compression largest on Z and N from NW, larger than P_1.
	iZNE	16 37			PR2?, P_3? Dilatation smallest on E from NNW.
	iEZ	21 32			Small.
	eNE	47			Increase in period
	iSE	22 13			
	S_2?	23 51			Complex
	S_3?	27 29			
	iSSN	28 17			Emergent on E.
	iSSSE	31 45			" " N.
	LqE	35 21	42		" " ", large waves.
	eLrZ	41 23			Two 19 sec.period waves.
	L_2rZ	42 13			Larger 24 second waves.
	iE	7 37 05			May be another S on lengthy coda of earlier shocks.
	V2L	8 06 ca.			Lasted over 30 minutes.
1	eLqNE	10 19 02	20		Larger on N, small surface waves.
	eLrEZ	20 59	14		
1	iPZ	16 18 47			Small compression
	eS	29 36			Largest on E.
	LqE	42 38	44		Very definite on E, later on N.
	eLrZ	49 00	18ca.		
2	PNZ	10 17 36		41.6	Compression from N, emergent on E.
	eS	24 00			
	LqE	27 02	26		Complex
	eLrNZ	29 38	16		
2	ePZ	13 29 21	8		Shallow compression.
	eE	39 40			Erratic movements SKS
	SNE	40 14			Small on N
	iN	20			
	SSE	46 36			Smaller on N
	SSSE	50 08			
	eE	53 48			26 second waves complicating Lq.
	LqE	55 02			
	LrZ	59 30	27		
3	eP	07 16 09		31.6	In microseisms.
	eS	21 25			
	Lq	23 25			
	Lr	25 38			
3	eNE	16 42 19	30		Shallow, small on E.
	eZ	45 39	30		" " " "
	iE	46 10	15		Larger
	iN	48 27			Followed by erratic waves.
	eZ	51 34			A train of 16 sec.period waves.

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
May 4		7 12 ca.			A few surface waves.
5		12 47 ca.			Slight seismic activity, surface waves
5		20 28 ca.			Slight surface activity, surface waves
6	ePZ	6 17 40		89.6	Small compression, later movements sharper.
	SKSE	27 45			
	SZ	28 33			Complex on E.
	iSSE	33 35			
	SSSNE	37 07			
	eLqN	42 17	45		More definite from 44.20
	LrEZ	47 30	26		
6	eLqE?	17 26 ca.	50ca.		
	eNEZ	30 12	21		Followed by irregular waves.
6	P	20 11 17		34.4	Compression
	iS	16 53			Small on Z
	Lq	19 34	34		Slightly larger on E.
	Lr	22 04	19		
8	iPKPZ	2 06 59		165±	Conspicuous dilatation, the succeeding compression is the actual maximum amplitude on Z.
	iZ	07 00			
	iZ	23			Dilatation.
	iPKP$_2$Z	55			Compression, small emergent dilatation at 07.53
	iE	08 02			
	iZ	09 53			Small compression
	iZ	11 37			Compression.
	iPPZEN	43			Dilatation almost as large as PZ movement, much larger on E than on N.
	iE	59			Very sharp.
	iE	12 50			
	iE) PPP	15 39			eZ small dilatation.
	iZ)	42			Compression followed by irregular waves.
	SKKS	18 50			Complex on E.
	iNZ	19 59			Dilatation from N.
	eNEZ	21 54			" largest on E.
	eZ	25 27			Compression, PSKS?
	iZ	32			Dilatation, becomes large group.
	iNE	35			Larger on E.
	eNEZ	28 22			Erratic but larger on N
	eZ	30 32			Compression. followed by 12sec. waves.
	eNESS	32 22	26		Larger on E.
	iZ	56			Dilatation.
	iZ	34 16			Compression
	iNE	45	25ca.		Larger on E,
	iNESSS	39 31	25		Erratic on Z, larger on E than on N but maximum amplitude on both.
	eNEZ	43 33ca.			Larger on E, shallow on N & Z
	iE	45 37			
	iE	50	45		Less definite on N.
	eNE	50 10	25		Larger on N.
	Lq	57 09	50		Earlier complex movement larger on E, but later more definite and sustained on N
	LrZ	3 06 37	30		Larger on E than on N.
	eZ	3 17 ca.	20		

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
May 10	eP?NZ	8 04 20		79?	Masked by microseisms.
	S	14 22			
	LqE	23 42	34		
	LrNZ	28 40			
14		18 14			See local register.
16	eP	7 54 14		25.1	Small compression.
	eS	58 42			Larger on E.
	eLq	59 44			" " "
	eLrNZ	8 01 37			
16	ePZ?	23 26 17		34.1	Small movements.
	eS?	31 51			
	LqE	33 17			
	LrNZ	35 45			
17	iZ	00 03 49			Impulse, short sharp movements on
	eZ	09 34			coda of above.
	eEZ	14 38			
	eZ	16 13			A few shallow waves.
	LqE	28 00			
	eLrZ	33 53			
17	PZ	15 19 01		45.9	Sharp impulse.
	iS	25 51			Sharp on E.
	Lq	30 23	26		Complex movements earlier.
	eLr	33 11	18		
17	iPZ	18 41 56			Small sharp compression.
	iNZ	42 04			Large compression from S?
	iNEZ	14			Small from SE
	iZ	30			Compression.
	eZ	48 47			A few 12 sec.period waves, traces on N
	S	51 10			Largest on N
	iE	35			SP? small on N.
	iNE	52 07			Followed by a few 36sec.period waves
	iSS	55 51			Becomes largest on N
	SSSN	58 31	20		
	eZ	59 59			
	LqE	19 00 15	42		Complex on N.
	eLrZ	04 15			
	eL	06 33	20		Large on all components.
18	ePNZ	20 02 17			Small and doubtful.
	eS	06 40			" " "
	Lq	07 21			
	LrNZ	08 53	15		
21	iPNZ	20 28 50			Sharp compression from N, maximum phase on Z.
	iNZ	29 31			Compression maximum phase on N.
	eE	29 31			Pulsatory
	iZ	31 29			Emergent from 31.21
	iNZ	33 13			Compression followed by longer irregular waves.
	iE	38			First sharp movement on E followed by longer irregular waves.
	iSNE	36 14			A very conspicuous maximum on E.
	iENZ	40 30			Small on Z, apparently exceptionally deep as no surface waves recognisable though shallow movement on E at 41.07 may be Lq.
22	iPZ	1 43 38		48.5	Sharp compression.
	iPNE	42			Compression az. NNW.
	iS	50 44			Largest on E.
	LqE	55 30	50		
	eLrZ	59 30			
	LNZ	2 01 16	21		Much larger.

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
May 24		6 17 ca.			Slight seismic activity.
24	eP	18 17 29		24.8	Compression.
	S	21 54			
	LqE	22 24	30ca.		
	LrNZ	24 30	19		
26	iPEZ	17 59 13		48.5	Compression
	iS	18 06 19			
	SS	9 36			
	iNEZ	10 36	40		Brief on Z, sustained Lq followed immediately on N and later on E.
	LrEZ	15 55	20		
	LEZ	16 20			Much larger amplitudes.
29	iPNZ	11 38 23		37.7	Compression.
	S	44 22			
	LqE	47 12			Larger on E.
	LrNZ	49 23			
31	eP	15 59 43		47.5	Compression
	eS	16 06 43			Interpretation doubtful.
	LqE	10 41	22		
	LrNZ	13 56	15		

ARAPUNI.

Constants of Milne Seismograph:

Pendulum period (Undamped) 25 secs.
Magnification 5.6

May 6	eL	20 18.2			Surfacetremors.
8	PSKS	02 22.4			
	SS	32.0			
	SSS	39.3			
	iH	44.1			
	eL	55			
14		18 13			See local register.
17	S	15 25.3		40ca.	
	eL	29			
17	S	18 50.5			
	SS	55.0			
	Lq	59			
26	S	18 06.1		48ca.	
	Lr	13.0			

PART II.

Local Earthquakes.

(For instrument Constants see Bulletin E85, p.6)

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
May 1	N	P	11 39 05		Felt Motu, R-F 2.
			12		
			22		Onset of S doubtful.
	W	P	11 39 15	4.3	Epicentre near 38°S, 178¼°E.
		S	40 06		
		M1	08		
		M2	11		
4	W	P	04 21 52	1.0	
			22 01		
		S	04½		
	N	P	04 22 15	2.3?	
		S?	44		
9	W	P	22 32 26	0.7	
		S	34		
12	N	P	10 53 01	1.1	Epicentre near 40.1°S, 174.5°E.
		S	16		
	W	P	10 53 05	1.2	
		S	21		
		M	23		
12	W	P	14 55 54½	1.2	Felt Wanganui, R-F 5-6, Paraparaumu and Wellington R-F 2.
			56 01		
		S	09½		
	N	P	14 55 57	1.2	Epicentre 40.2°S, 175° E
		S	56 12½		
12	W	P	22 17 31	0.6	
		S	38½		
13	W	P	00 21 56½	0.6	
		S	22 03½		
13	W	S	02 43 02		
14	W	P?	08 13 52	1.0?	
		S	14 04		
		N	08 14 39		Small.
14	TU	P	18 13(00)	2.7	Felt in East Cape District, from Tamanga to Wairoa and Gisborne. Max. R-F 5 at Opotiki and Tolaga Bay.
			12		
		S	34		
		M	38		
	A	e	18 13.1		Epicentre near 37½°S, 180°.
		i	13.8		
		L	14.1		
	H	e	18 13(30)		
		S	14 12		
			25		
		M	45		
			15 02		
	N	P	18 13 42	5.0	
			46		
			57		
			14 32		
		S?	42		
	W	eP	18 13 51	5.6	
			14 03		
			19		
		S	55		Very sharp
			15 21		
		ScS?	21 31		

Date 1939	Station	Phase	G.N.T. h. m. s.	Δ deg.	Remarks.
May 14 (Cont.)	C	?	18 14 33		
			46		
			15 42		
			53		
		S	57		
16	W	P	14 36 02½	1.1	
			08		
		S	16		
	N		14 37 25		Traces
	C		14 36 22		Small
			47		
17	W	P	13 02 25	1.25	Felt Wanganui, R-F 3. Epicentre near 40.2°S, 175°E.
		S	39½		
	N	?	13 02 29		
		S	44		
19	W	P	08 08 54½	1.0	Felt Nelson, R-F 3, Farewell Spit, R-F3-4 and New Plymouth. Epicentre near 40½°S, 174°E.
		S	09 06½		
	N	P?	08 08 59	1.2?	
			09 01½		
		S	15		
	C	?	08 09 38		
		S	59		
25	W	P	11 01 15	0.6	
		S	22		
26	W	P	10 40 02	1.0	
		S	14½		
27	N	S	21 58 42		Sharp
			47		
	W	P	21 58 22	1.8	Epicentre near 40.4 S, 172.8 E.
		S	43½		
		M	52		
	C	S	21 59 22		Sharp

In addition, small tremors were recorded as follows:-

Hastings 16d.16h.07m.: 29d.22h.13m.
Wellington 21 01 05

NOTES:

No earthquakes were recorded during the month at ROTORUA, BUNNYTHORPE, TAKAKA, GREYMOUTH or MONOWAI.

Earthquakes not recorded on any instrument were reported felt as follows:

Wanganui	7d.	10h.	48m.	R-F 3.	Waipawa	19d.	15h.	50m.	R-F	2
Westport	9	19	31	" 2	Whakatane	20	01	26	"	2?
Wanganui	12	15	15	" 3?	"		01	51½	"	4
Waipawa	16	16	08	" 4	"		02	49	"	4
Wanganui	16	18	30	" 2?	Wanganui	21	0	6 15	"	2?
"	17	08	30	" 2?						
Morrinsville	18	19	00							
"		19	32							
"		20	45							

In all, 18 shocks were felt in the North Island, with maximum R-F 5-6 at Wanganui; and 2 in the South Island, max.R-F 3-4 at Farewell Spit; one shock being felt in both Islands.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

DOMINION OBSERVATORY, WELLINGTON, NEW ZEALAND.

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Tuai (TU)	38° 48′ S	177° 9′ E	960	Gravels	Wood-Anderson (N-S)* ..	Resident Electrical Engineer.
New Plymouth (N) ..	39° 4′ S	174° 4′ E	112	Ash, agglomerate, and lava	Wood-Anderson (E-W)* ..	Superintendent, the Prison.
Stratford (S) ..	39° 21′ S	174° 17′ E	1,000	Water-sorted volcanic debris	Jaggar (E-W)	Mr. A. W. Burrell.
Hastings (H) ..	39° 38′ S	176° 53′ E	35	Alluvial sands, silts, and gravels	Jaggar (NE-SW)	Mr. H. de Denne.
Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
Takaka (TA) ..	40° 51′ S	172° 48′ E	25	Alluvial gravels ..	Imamura (three components)*	The Postmaster.
Greymouth (G) ..	42° 25′ S	171° 13′ E	14	Deltaic sands and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Christchurch (C) ..	43° 32′ S	172° 37′ E	25	Alluvial sands, silts, and gravels	Galitzin (three components)	Magnetic Observatory.
					Wood-Anderson (N-S)* ..	Director—H. F. Skey.
						Observer—H. F. Baird.
Monowai (M) ..	45° 47′ S	167° 37′ E	538	Tertiary sandstone ..	Jaggar (E-W)	Mr. A. Walker.
Chatham Islands (CH)	43° 57′ S	176° 31′ W	210	Volcanic breccia ..	Milne (E-W)*	Superintendent, Radio Station.

* For constants, see station register.

1,000/2/39—19353]

PART I.

Distant Earthquakes.

WELLINGTON.

Instrument Constants:

Milne-Shaw (N-S) Pendulum period 11.7 secs.
damping 20:1
Magnification 250

Galitzin-Wilip (Z) Pendulum period 7.0 secs.
Galvanometer period 10.6 secs.

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
June 2	eP	03 43 35		62	
	iZ	42			
	PcP	44 08			
	iZ	46 03			
	PcS?	47 42			small movement on H
	S	52 02			
	PS	17			
	iH	57			
	ScS	53 28			
	SS	56 07			
	Lq	57 39	35		
	Lr	04 00 42			
4	iH	00 49 23			May be Lq of distant shock.
	iL	56 10			
	eL	59+			
4	eP?	12 01 42		35ca.	Small movement on Z
	eH	08 07			
	Lq	09+			Poorly defined.
4	eP?	15 30 58		43?	
	S	37 20			
	Lq	40 25	26		
	Lr	43 40	20		
7		01 30			Slight seismic activity
8	eHS?	15 38 05			
	eL	41			
8	iP	20 52 34		28	Deep focus; U.S.C.G.S.(Honolulu) give preliminary epicentre 15° S, 173° W. Origin time 20h. 47m. 04s.
	PP	53 08			
	iZ	54 16			
	PcP?	55 55			
	iZ	56 17			(may be pPcP)
	S	57 02			
	Lq	59 05	30		
	PcS	33			
	iZH	21 00 03			May be pPcS
	iScS	03 13			very sharp and well defined
	sScS?	05 04			
9	eS	19 25 10			
	Lq	30+			Poorly defined
	Lr	35			
	M	38			
10		10 09			Slight seismic activity
14		17 32			Surface tremors.
16	eLq?	05 58			
	M	06 05			Surface tremors.

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	REMARKS.
June 16		11 30			Slight seismic activity.
17	eP	12 08 25		27	
	S	13 07			
	eL	16			
22	PKP?	19 39 05		>130	Prominent
	iZ	43 48			Prominent
	eH	20 02			Indefinite movements complicated by wind vibrations.
	eLr	29	25		Surface waves continue for over 1½h.
23	eP	23 21 23		26	
	eS	25 58			
	eL	27			
25		03 15			Surface tremors
27	eP	23 15 11		62	
	iZ	26			
	eZ	16 20			May be PcP
	PP	17 15			
	eS	23 40			
	eH	26 00			
	Lq	28 30	20		
28	eH	11 56			
4	M	58	20		

CHRISTCHURCH

(Provisional Readings of Distant Earthquakes)

Instrument Constants:

	kA1T/4π1	T (Pend.)	T1 (Galv.)	½μ2
N	300	23.4	23.6	-0.07
E	300	24.35	24.4	-0.02
Z	300	12.79	12.86	-0.02

June 2	iP	3 43 43		61.1	sharp dilatation, small on N, az. WNW
	iNEZ	50			Dilatation, az. SSE, max. amplitude on Z
	iZ	44 09			Compression, early PcP?
	iZE	45 11			Dilatation
	iZ	46 11			
	iSNE	52 09			Much smaller on E
	eSZ	52 09			
	iScSNEZ	53 33			Largest on E
	iSSN	56 16			
	eLqN	59 23	40		
	iN	4 00 09			A sharp movement.
	iZ	15			A sharp compression
	eE	01 04			Simpler conspicuous Lq waves emerge from complex movements.
	eLrZ	03 25			
	iLZ	04 53	30		
4	ePZ	0 05 38		152±	10 sec. period in 8 sec. microseisms.
	eP'Z	0 7 40			Period longer than average microseism
	ePPNZ	11 21			
	eN	12 10			
	eNZ	14 33			SKS?
	eSKKSE	18 11			
	eE	22 32			followed by train of shallow waves.
	SSNE	30 23	38		Conspicuous movements, larger on E.

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
June 4 (Cont.)	SSSSE	0 41 26			
	Lq	49 32	46		More conspicuous on E.
	eZ	51 30			Shallow erratic waves.
	LrZ	59 33			Definite 18 sec. waves, become largest on N.
4	eP	12 01 38		34.3	Small compression in microseisms.
	eS	07 13			
	iE	21			
	eLq	09 11			
	LrZ	11 27			
4	ePEZ	15 30 52			Small compression from W, in microseisms
	SNZ	37 09			
	Lq	40 10	25		Larger on N.
	LrZ	43 14	20		
7	eNE	1 24 27	20		A few waves
	eZ	26 31			Pulsatory
	eZ	30 17	18		Shallow
8	ePZE?	15 31 28		44.7?	Masked by large microseisms.
	eS?	38 10			" " " "
	Lq	42 20	30		
	eLrZ	45 46	20		Definite from 46.06
8	iPZ	20 52 58			A large compression, probably h=250KM.
	iPPZ	53 38			Compression.
	iZ	54 16			sP? compression.
	iSE	57 30			A sharp conspicuous movement
	iNEZ	58 26			Compression
	LqE	40	28		Small on N
	PcS	59 15			Largest on E, probably SS
	iE	20			sS?
	iE	21 00 55			Three very large 30 sec.waves, but Lr not recognised on Z.
	eZ	02 18			Complex 24 sec.period wave
	iScSEZ	03 07			Short period waves become quite large on E.
9	ePZ?	19 17 59		53.1?	Compression, obscured by microseisms.
	eS?	25 34			" " "
	Lq	30 34			
	LrZ	34 50			
14		17 34 ca.			Slight seismic activity
16	eP?	5 51 48		29.0?	Obscured by microseisms.
	S	56 47			
	Lq	58 10			
	LrZ	59 48			
	iScSNZ?	6 02 10			
16		11 33 ca.			Slight seismic activity.
17	iE	12 12 09			
	iE	16 47			large 30 sec.period
	eZ	18 09			Erratic surface waves.
22	ePKPZ	19 36 18			Small compression in microseisms.
	ePKP2?	36 31			
	eZ	39 10			
	eNZE	56			Erratic.
	ePP	40 18			
	eNEZ	43 35			
	ePPP	45			
	eSKKSE	47 12			
	eSSEZ	59 30			
	eEZ	20 00 30			Becomes more definite.
	SSNE	05 32			Larger on N
	LqE	18 33	60ca.		

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
June 22 (cont.)	eLrZ	20 28 40	30 ca.		
	eLNZ	30 06	24		
	eLNEZ	30 06	22 ca.		
23	eF	23 21 11		28.3	Very small compression, may be only sharp microseisms.
	S	26 03			
	eLq	27 19	25		Large and more definite on E from 28.00
	eLrZ	29 03			
	eZ	31 33	14		First conspicuous movement on Z.
27	iPEZ	23 15 15		61.8	Compression from West.
	iSNEZ	23 46			
	iPSE	24 30			
	iScSNE	25 04			Large on E.
	iSSN	28 07			
	iSSE	32			
	SSSN	30 32			
	Lq	31 46			Emerges from SS.
	LrZ	36 14			
28	eNEZ	11 55 32			Compression on Z, mere drift on N & E
	iNE	39			Small compression, very abrupt on N and E.
	iNE	56 37			Large 20sec. period, emergent on Z with 10 sec. period only.
	eZ	57 00	15		Followed by surface waves for 30 mins

ARAPUNI.

Constants of Milne-Seismograph:

Pendulum period (undamped) 25 secs.
Magnification 5.6

June 8	S	03 52.0		60ca.	
	i	52.4			
	Lq	57.5			
8	S	20 56.5		26ca.	
	i	58.1			
	Lq	58.8			

PART II.

Local Earthquakes.

(For instrument Constants see Bulletin E 86, p.7)

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
June 1	W	P	04 00 26	3.7	
		S	01 10		
5	W	eP	05 40 23	4.8	
		S	41 19		
		M	21		
	C	S?	05 42 14		
5	W	S	15 59 50		
	N	S?	15 59 53		Sharp impulse
12	W	P	05 22 51	1.5	Epicentre 40° S, 173.6° E.
		S	23 10		
		M	14		
			17		
	N	P	05 22 41	1.0	
		S	54		
	C	S?	05 24 05		Very sharp.
20	W	P	17 25 33	0.5	
		S	39		
20	W	P	20 06 17	1.8	Epicentre 41° S, 172.5°E. A shock of R-F 3, was reported from Paraparaumu at about 20h.00m.
		S	39		
			41½		
	N	P	20 06 24	2.3	
		S	54		
		M	55½		
	C	S	20 07 01		
			11		
			19		
			28		
22	W	P	11 05 52	1.1	From Wanganui Bight area.
		S	06 05½		
		M	09		
	N	?	11 05 57	1.4	
		S	06 13		
25	W	P?	23 10 28	1.9ca.	Felt Karamea, R-F 3.
		S	51		
			54		
	N	S	23 11 10		
27	N		18 16 47		Felt New Plymouth, R-F 2.

In addition small tremors were recorded as follows:

Wellington 7d.23h.28m.; 8d.12h.37m.; 12d.22h.50m.; 18d.04h.55m.
29 06 46 29 06 53 29 08 19
New Plymouth: 27d. 18h. 19m.; 29d. 19h. 39m.

NOTES:

A quiet month. No earthquakes were recorded at TUAL, ROTORUA, BUNNYTHORPE, HASTINGS, TAKAKA, GREYMOUTH, or MONOWAI.

Earthquakes not recorded on any instrument were reported felt as follows:

Palmerston North 10d. 21h. 40m. "slight" (Press)
Whakatane 16 23 50 R-F 5.
" 17 01 28 R-F 5.

In all, 5 shocks were felt in the North Island, with maximum R-F 5 at Whakatane, and one in the South Island, R-F 3 at Karamea.

PROVISIONAL EPICENTRES IN NEW ZEALAND AND SOUTH-WEST PACIFIC - 1939 APRIL.

Origin Time 1939 d. h..m.	Provisional Epicentre Lat.(deg)	Long. (deg)	Remarks.
Apr. 2 06 28.8	41.2 S	175.3 E	Felt in southern part of North Island max. R-F 4.
5 16 42.6	20 S	169 E	
7 11 00.1	40½ S	173½ E	Felt about Cook Strait, max. R-F 4-5
13 08 13.3	41.2 S	172.5 E	Felt in north-west Nelson, R-F 5.
15 20 03.8	60 S	148 E	
17 08 44.8	39¾ S	175½ E	Felt at Wanganui & Patea, R-F 3.
21 01 34.1	40¾ S	173½ E	
28 02 49.0	41¼ S	172½ E	
30 02 55.5	10 S	158 E	
30 03 06.8	39¼ S	179¼ E	
30 14 00.9	40.9 S	172.3 E	Felt in north-west Nelson, max. R-F 3.

The Acting-Director of the Dominion Observatory gratefully acknowledges the following seismological bulletins:

Pasadena	March April
Stuttgart	April
Uccle	July - December
Rathfarnham	March April
Roseneath	No.2.
Melbourne	May
Brisbane	May
Perth	May
Adelaide	April
Uccle	1938 November-December.
Parc.St. Maur	March
Strasbourg	March
Bureau Central	March
U.G.et G.I.	Jan.-March
Formosa	April
Hong Kong	April
Sydney	Jan. Feb.
St. Louis	June - September.
J.S.A.	February - May
Cape Girardeau	OctoberMay
Kew	May
Firenze	Jan. - March
Sydney	March
Stuttgart	May (Provisional)
U.S.C.G.S.	June, provisional.

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[S.I.R.—20.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

DOMINION OBSERVATORY, WELLINGTON, NEW ZEALAND.

SEISMOLOGICAL REPORT FROM NEW ZEALAND STATIONS.

The report is divided into two parts :—

Part I gives readings of distant earthquakes (Wellington $\Delta > 10°$ ca.) ; and Part II gives readings of local earthquakes ($\Delta < 10°$ ca.). But where a local earthquake is likely to have been recorded outside New Zealand, a reference to it is also included in Part I. In both parts, where the clock correction is not known, the time of P (or first phase recorded) is enclosed in a bracket. Whenever they are definitely indicated, the trace amplitude and the direction of the vertical component of P are given. An upward ground movement is designated (+), and a downward movement (−).

In Part II determinations of absolute time are not attempted from Jaggar records, only the intervals between pulses being measured. In many cases the P movements are very small, and the first movement recorded is not necessarily Pn, or any other particular pulse.

Unless otherwise indicated, times recorded refer to the incidence of impulsive movements.

A list of provisional epicentres in New Zealand and the South-west Pacific is appended. The New Zealand epicentres are determined from the records of local stations, and the more distant ones with the assistance of data from Manila, Hong-Kong, Apia, Papeete, Brisbane, Riverview, Sydney, Melbourne, and Adelaide.

List of New Zealand Seismograph Stations.

Station Name and Abbreviation.	Position.		Height above M.S.L.	Lithologic Foundation.	Seismographs.	Observers.
	Latitude.	Longitude.				
			Feet.			
Wellington (W) ..	41° 17′ S	174° 46′ E	401	Greywacke	Milne-Shaw (N-S)* .. Galitzin-Wilip (Z)* .. Wood-Andersons (N-S)* and (E-W)* Jones (Z)* Imamura (three components)*	Dominion Observatory, Central Station. Acting-Director— R. C. Hayes. Observers— C. N. M. Watson-Munro. W. M. Jones.
Arapuni (A).. ..	38° 5′ S	175° 39′ E	212	Rhyolite tuffs ..	Milne (E-W)*	Powerhouse Superintendent.
Rotorua (R) ..	38° 8′ S	176° 15′ E	930	Rhyolitic silts and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Tuai (TU)	38° 48′ S	177° 9′ E	960	Gravels	Wood-Anderson (N-S)* ..	Resident Electrical Engineer.
New Plymouth (N) ..	39° 4′ S	174° 4′ E	112	Ash, agglomerate, and lava	Wood-Anderson (E-W)* ..	Superintendent, the Prison.
Stratford (S) ..	39° 21′ S	174° 17′ E	1,000	Water-sorted volcanic debris	Jaggar (E-W)	Mr. A. W. Burrell.
Hastings (H) ..	39° 38′ S	176° 53′ E	35	Alluvial sands, silts, and gravels	Jaggar (NE-SW)	Mr. H. de Denne.
Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
Takaka (TA) ..	40° 51′ S	172° 48′ E	25	Alluvial gravels ..	Imamura (three components)*	The Postmaster.
Greymouth (G) ..	42° 25′ S	171° 13′ E	14	Deltaic sands and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Christchurch (C) ..	43° 32′ S	172° 37′ E	25	Alluvial sands, silts, and gravels	Galitzin (three components) Wood-Anderson (N-S)* ..	Magnetic Observatory. Director—H. F. Skey. Observer—H. F. Baird.
Monowai (M) ..	45° 47′ S	167° 37′ E	538	Tertiary sandstone ..	Jaggar (E-W)	Mr. A. Walker.
Chatham Islands (CH)	43° 57′ S	176° 31′ W	210	Volcanic breccia ..	Milne (E-W)*	Superintendent, Radio Station.

* For constants, see station register.

1,000/2/39—19353]

Part I - Distant Earthquakes.

WELLINGTON.

Instrument Constants.

Milne-Shaw (N-S) Pendulum period 11.8 sec.
Damping 20:1
Galitzin-Wilip (Z) Pendulum period 7.0 sec.
Galvanometer period 10.6 sec.

Date 1939	Phase	G.M.T. h. m. s	Period sec.	Δ deg.	Remarks.
July 2		17 05			Surface tremors.
3		13 22 42			See local register
5	P	22 44 48		17	Focal depth 700 km.
	S	47 42			
	i	59			
	i	48 08			
	ScP	51 27			
	i	35			
	ScS	55 05			
8		08 40			Surface tremors
8		17 19			see local register
10		16 05			slight seismic activity.
12		13 20			surface tremors
12	P	23 07 07		48	
	iZ	34			
	iZ	08 02			
	PP	09 18			
	iZ	10 13			
	S	14 07			
	i	15 14			
	i	16 12			
	SS	17 01			
	Lq	19+			
	Lr	22 00	20		
16	eZ	08 43 32			
	iH	44 32			
	eL	45			
16		20 50			A few surface tremors
18		04 16			Surface tremors.
18		12 43			Irregular tremors
18		14 08			Slight seismic activity.
19		13 58			Slight seismic activity
19	P	23 20 00		23	Deep focus
	iZ	21			
	iZ	29			
	iZ	21 16			
	S	24 06			
	iH	36			
	Lr	25 11			
	ScS?	30 50			
20	P	02 29 25		53?	Deep focus
	iZ	45			Rises to strong maximum at 30m.10s.
	iZ	30 50			M undergoing period test.
	iZ	32 31			
	iZ	33 15			
	S?	36 55			
	i	38 10			
	i	39 45			

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
July 22		13 24			A few long period tremors.
22		16 28			Surface tremors
23	eL	16 41			
23		18 23			Slight seismic activity
29		02 15			See local register
31		06 40			Slight seismic activity.

CHRISTCHURCH

(Provisional readings of Distant Earthquakes)

Instrument Constants:

	$kA_1T/4\pi1$	T (Pend.)	T_1 (Galv.)	$\frac{1}{2}\mu_2$
N	300	23.4	23.6	-0.07
E	300	24.35	24.4	-0.02
Z	300	12.79	12.86	-0.02

July 8		8 42 ca.			A few surface waves in microseisms.
8		17 19 ca.			See local register R-F 4-5
10	eNE	16 04 ca.			Slight seismic activity
	eZ	06 48			
12	iP	23 07 10		48.5+	Dilatation from W.N.W.
	ipPZ	52			Compression
	iSN	14 16			
	iE	28			
	iZ	40			Sharp compression.
	isSNE	15 27			Larger on E
	eScSN	16 22			Later movements more prominent.
	SS	17 32			
	iZN	18 31			Dilatation.
	Lq	19 21			Complex becomes 36 sec. period.
	eLrZ	22 18	21		Emerges from complex movements.
14	eN	9 17 ca.			Slight seismic activity.
16	P	8 31 35			Dilatation
	eS	38 19			
	LqE	41 34	40		
	LrZN	44 55	21		
18		4 20 ca.			Some surface waves in microseisms.
18		12 43 ca.			" " " " "
19	iPZ	23 19 57		18.5	Compression.
	iNEZ	20 06			Compression mainly from E.
	iSNE	23 27			
	iSZ	33			
	iPcPZ	24 43			Compression
	LrZ	57			
20	iPZ	2 30 15			Compression, develops into maximum movement on Z.
	iPNE	30 15			From N.N.E. predominantly 20 sec. period on N.
	iPcPZ	31 28			Compression
	iZ	32 44			Dilatation.
	PcSNZ	35 29			
	iSNE	37 19			Larger on E, maximum movement on N and E
	iN	39 52			
	iE	41 44			A large sharp wave, may be exceptionally deep

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
July 22		16 26 ca.			Minor seismic activity.
23	eE	15 30 12	26		Shallow
	eN	40 10	23		Very shallow
	eNEZ	42 30	28		Train of decreasing period for 30 minutes largest on E.
	eNZ	45 35	21		First definite movement on Z.
23	eE	16 50 30	25		Shallow, traces on N.
	eN	52 57	18		Followed by decreasing waves for 12 minutes.
	eZ	53 20	18		Followed by decreasing waves for 11 minutes.
	iE	58 07			A small impulse.
23	eN	18 28 ca.			Very minor seismic activity.
29	iNEZ	2 11 18			Compression. See local register.
	iEZ	42			"
29	iZ	2 14 03			Compression. See local register.
	eE	14 03			Pulsatory.
	iN	50			Followed by large short period waves
	iEZ	54			" " " " " "
	eEZ	15 16			Longer period.
	iNEZ	16 12			Compression, largest on E.

NEW PLYMOUTH.

(For constants see Local Register)

July 5	P	22 44 48		16	Focal depth 700 km.
	S	47 27			
	i	46			
	i	57			
	i	49 48			
	ScP	51 08			
	PcS	52 14			
	ScS?	54 58			

ARAPUNI.

Milne-Seismograph. Pendulum period (Undamped) 25 secs.

July 5	P	22 44.4		15	Deep focus
	S	47.2			
	i	47.5			
	i	48.9			
	i	53.2			
12	S	23 14.2		50ca.	
	SS	16.8			
	Lr	21.4			
	M	25			
19	e	23 24+			Small movements
	i	27.1			

Part II- Local Earthquakes.

Instrument Constants:

Wellington: Wood-Anderson Short-period seismograph, two components.
Pendulum periods N-S = 0.47 sec.
E-W = 0.55 "
Geophone (oil-damped moving armature type) for Z.
Geophone Period 0.11 sec.
Galvanometer " 0.6 "

Imamura Strong-motion seismograph, three components:
Pendulum periods N & S components = 6 secs.
Z component = 4 sec.

Christchurch. Wood-Anderson Short-period seismograph, E-W component.
Pendulum period = 0.74 sec.

New Plymouth: Wood-Anderson Short-period seismograph, E-W component.
Pendulum period = 0.55 sec.

Takaka: Imamura Strong-Motion seismograph, three components.
Pendulum periods N & S components = 6 secs.
Z " = 2.5 "

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
July 2	N	S	6 13 52		Sharp, but no visible P-motion.
	W	S	6 14 01		
2	N	?	15 16 50		
		S	17 13		
	W	P	15 16 29	1.2	Felt Dannevirke R-F 4, and Masterton
		S	45		
3	Tu	P	13 22(00)		Approximate epicentre 40.2/3S., 176 1/2E
		S	20		Felt in East Cape district, with max.
			24		R-F 6 at Motu and Opotiki; also in
		M	26		Hawkes Bay as far south as Dannevirke.
	H	P	13 22 (00)		
		S?	28		Provisional Epicentre 38° S, 177¾°E.
		M1	53		Focal depth probably greater than
		M2	71		normal.
	N	P	13 22 28½	3.2	
		S?	23 08		
		M1	14		
		M2	18		
		M3	30		
	B	eP	13 22(00)		
			23		
		S?	28		
		M1	39		
		M2	48		
	W	P	13 22 42½	4.2	
		S	32		Large amplitudes.

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
July 6	H	eF	15 27 (00)	<1	Epicentre near 38¾° S, 176½° E.
		S	12		
			16		
	N	P?	15 27 05	1.9ca.	
		S	27		
	W	eP	15 27 16	2.8	
		S	50		
	C		15 28 52		Small.
7	N		8 32 02		Sharp pulse
	W	P	8 31 48	3.1	
		S	32 26		
	C		8 33 29		Small.
8	N	P?	16 31 37		
		S	52		
	W	P?	16 31 44	1.8	
		S	32 06½		
8	N	P?	17 19 42		Felt Wellington and Blenheim, R-F 4, also at Nelson and Dannevirke. Epicentre near 42¼° S, 174½° E.
		S?	20 14½		
		M	20½		
	W	P	17 19 10	0.9	
		S	21		
	C	P?	17 19 23		
		S	40½		
8	N	P?	22 22 02		Probably from N.W.Nelson.
		?	17		
		S?	42		
		M	53		
	W	P	22 21 57	1.9	
		S	22 20½		
	C		22 22 13		
		S?	29		
			37		
9	N	?	4 57 23		
		S	41		
	W	P	4 56 45	1.4	
		S	57 03		
15	W	P	6 42 14	0.6	
		S	21		
15	W	P	8 39 15½	2.1	
		S	42		
18	W	P?	13 29 55		
		S	30 32		
	C	S?	13 30 36		Sharp, but no earlier motion visible
19	C	P	5 07 21	1.1	
		S	35		
21	N	S?	7 03 16		Approximate epicentre 40½ S, 172½ E.
	W	P	7 02 54	1.9	
		S	03 17		
	C	S	7 03 51		
22	W	P	7 23 47	0.6	
		S	54		
25	N	P	8 58 49	1.7?	Felt Paraparaumu R-F 2. Epicentre probably near 40½ S, 174½ E.
		S?	59 12		
			16		
	W	P	8 58 41	0.8	
		S	51		
25	N	?	17 47 56		Felt Hanmer Springs, R-F 6 & Christchurch. Approximate epicentre 42½ S 172½ E.
		?	48 35		
		M	54		
	W	P	17 47 24	2.1	
		S	47		
	C	P	17 47 16	1.0	
		S?	25½		
		M			

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
July 29	M	P	2 11 (00)	1 ca.	Felt Monowai.
		S	11½		
		M	13		
	C		2 11 08		Traces
29	M	P	2 13 (30)	1 ca.	Felt Monowai.
			32		This and the preceding shock
		S	41½		probably from vicinity 45 S, 167 E.
			49		
	C	P?	2 13 46		
			50		
		S?	14 41		
			44		
		M1	57		
		M2	15 02		
	W	eP	2 14 22		
		S?	15 31		
			41		
31	W	P	17 10 15	<1	
		S	23		

In addition small tremors were recorded as follows:

Wellington	1d.	5h.	26m;	20d.	9h.	7m.;	20d.	20h.	40m;
	28	5	38						
Hastings	27	15	58						
Monowai	11	6	10						

NOTES:

No earthquakes were recorded at ROTORUA, TAKAKA or GREYMOUTH. (The seismograph at Rotorua not working owing to clock trouble) Earthquakes not recorded on any instrument were reported felt as follows:

Pahiatua	1d.	15h.	10m.	"slight" (Press)
Karamea	2	7	26	R-F 2
Kahurangi Pt.	4	11	10	" 3
Rotorua (3)	10	22	30+	three light shocks (Press)
Greymouth	14	12	25	
"		16	30	
Waipawa	15	21	33	R-F 3-4

In all, 9 shocks were felt in the North Island, with maximum R-F 6 at Opotiki and Motu; and 8 in the South Island, with maximum R-F 6 at Hanmer Springs; one shock being felt in both Islands.

PROVISIONAL EPICENTRES IN NEW ZEALAND AND SOUTH-WEST PACIFIC - 1939 MAY.

Origin Time 1939	d.	h.	m.	Provisional Epicentre Lat.(Deg)		Long.(Deg)		
May	1	11	38.2	38	S	178¼	E	Felt Motu,R-F 2.
	6	20	04.3	10¼	S	160¼	E	
	12	10	52.7	40.1	S	174.5	E	
	12	14	55.5	40.2	S	175	E	Felt in southern part of North Island, R-F 5-6 at Wanganui.
	14	18	12.5	37½	S	180		Felt in East Cape district,max.R-F 5.
	17	13	02.1	40.2	S	175	E	Felt Wanganui, R-F 3.
	19	08	08.6	40½	S	174	E	Felt Nelson,Farewell Spit & New Plymouth, R-F 3.
	21	20	21.9	22½	S	180		The readings agree with a focal depth of 600 km.ca; Ksara gives 590 km.ca.
	27	2[illegible]	57.9	40.4	S	172.8	E	

The Acting-Director of the Dominion Observatory gratefully wishes to acknowledge the following seismological bulletins:

Adelaide	
Ottawa	June
Papeete	April
Berkeley, Mt. Hamilton & stations,	May
Hong Kong	Oct. -Dec.1937.
Hamburg	May
Helgoland	January - March
Melbourne	January - March
Bucarest	June
Rathfarnham	January - May
Manila	May-June
Taihoku	June
Brisbane	May
Ksara	June
Apia	May
Nagoya	May-June
Phu Lien	1938
Perth	Sept. - Feb.
Strasbourg	June
Zurich Central	April
Paris St. Maur	March
Schweizerisches Erdbebenbulletin	April
Uccle	107, 108.
Manila	January - March
Hong Kong	May, July
Batavia	June
Zow	July - September,1938
Martinique	June
Tahiti	January-March,1939
	no.7 - 9.

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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

DOMINION OBSERVATORY, WELLINGTON, NEW ZEALAND.

SEISMOLOGICAL REPORT FROM NEW ZEALAND STATIONS.

The report is divided into two parts :—

Part I gives readings of distant earthquakes (Wellington $\Delta > 10°$ ca.) : and Part II gives readings of local earthquakes ($\Delta < 10°$ ca.). But where a local earthquake is likely to have been recorded outside New Zealand, a reference to it is also included in Part I. In both parts, where the clock correction is not known, the time of P (or first phase recorded) is enclosed in a bracket. Whenever they are definitely indicated, the trace amplitude and the direction of the vertical component of P are given. An upward ground movement is designated (+), and a downward movement (—).

In Part II determinations of absolute time are not attempted from Jaggar records, only the intervals between pulses being measured. In many cases the P movements are very small, and the first movement recorded is not necessarily Pn, or any other particular pulse.

Unless otherwise indicated, times recorded refer to the incidence of impulsive movements.

A list of provisional epicentres in New Zealand and the South-west Pacific is appended. The New Zealand epicentres are determined from the records of local stations, and the more distant ones with the assistance of data from Manila, Hong-Kong, Apia, Papeete, Brisbane, Riverview, Sydney, Melbourne, and Adelaide.

List of New Zealand Seismograph Stations.

Station Name and Abbreviation.	Position.		Height above M.S.L.	Lithologic Foundation.	Seismographs.	Observers.
	Latitude.	Longitude.				
			Feet.			
Wellington (W) ..	41° 17′ S	174° 46′ E	401	Greywacke	Milne-Shaw (N-S)* ..	Dominion Observatory, Central Station.
					Galitzin-Wilip (Z)* ..	Acting-Director—
					Wood-Andersons (N-S)* and (E-W)*	R. C. Hayes.
					Jones (Z)*	Observers—
					Imamura (three components)*	C. N. M. Watson-Munro.
						W. M. Jones.
Arapuni (A).. ..	38° 5′ S	175° 39′ E	212	Rhyolite tuffs ..	Milne (E-W)*	
Rotorua (R) ..	38° 8′ S	176° 15′ E	930	Rhyolitic silts and gravels	Jaggar (E-W)	Powerhouse Superintendent.
						District Engineer, P.W. Dept.
Tuai (TU)	38° 48′ S	177° 9′ E	960	Gravels	Wood-Anderson (N-S)* ..	Resident Electrical Engineer.
New Plymouth (N) ..	39° 4′ S	174° 4′ E	112	Ash, agglomerate, and lava	Wood-Anderson (E-W)* ..	Superintendent, the Prison.
Stratford (S) ..	39° 21′ S	174° 17′ E	1,000	Water-sorted volcanic debris	Jaggar (E-W)	Mr. A. W. Burrell.
Hastings (H) ..	39° 38′ S	176° 53′ E	35	Alluvial sands, silts, and gravels	Jaggar (NE-SW)	Mr. H. de Denne.
Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
Takaka (TA) ..	40° 51′ S	172° 48′ E	25	Alluvial gravels ..	Imamura (three components)*	The Postmaster.
Greymouth (G) ..	42° 25′ S	171° 13′ E	14	Deltaic sands and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Christchurch (C) ..	43° 32′ S	172° 37′ E	25	Alluvial sands, silts, and gravels	Galitzin (three components)	Magnetic Observatory.
					Wood-Anderson (N-S)* ..	Director—H. F. Skey.
						Observer—H. F. Baird.
Monowai (M) ..	45° 47′ S	167° 37′ E	538	Tertiary sandstone ..	Jaggar (E-W)	Mr. A. Walker.
Chatham Islands (CH)	43° 57′ S	176° 31′ W	210	Volcanic breccia ..	Milne (E-W)*	Superintendent, Radio Station.

* For constants, see station register.

1,000/2/39—19353]

Part I - Distant Earthquakes.

WELLINGTON.

Instrument Constants:

Milne-Shaw (N-S) Pendulum period 11.8 secs.
Damping 20:1
Magnifications 250

Galitzin-Wilip(Z) Pendulum period 7.0 sec.
Galvanometer " 10.6 "

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Aug.2	eP?	01 00 17		80	Small movement on Z.
	eZH	14 35			
	iZ	45			
	eZH	19 30	25		
	eL	33	40		
	M	39	20		
2		03 00 ca.			Prolonged surface waves.
		21 40 ca.			Milne-Shaw light off edge of paper owing to exceptional tilt of over 10 seconds of arc towards south.
2	P	04 59 59		13	Deep focus; all phases from W-A seismographs. small.
	S	05 02 26			
	iH	32			
	M	45			
3	eZ	05 32 02			
	eLr	36			
3	eZ	02 32 58			
	iH	35 38			
	iH	36 43			
	iH	37 08			
	eL	39 03			
8		20 18			
9		00 35			A few surface tremors.
9		01 40			Slight Seismic activity.
9		04 10			Tremors.
12	iP	02 12 43		28	Slight seismic activity
	iZ	13 15			Az=+3mm. AH=-2mmδ Hh=500 km.
	iZ	36			The data available indicate a provisional epicentre near 14S, 168E.
	iZ	14 13			May be PP or pP
	iS	16 59			
	iH	17 43			
	iHPcS?	19 33			
	iH	20 38			
	ScS	23 19			
12		10 13			Prolonged surface tremors.
13	eP	04 21 43		23	Characteristically shallow shock.
	S	25 50			
	iZPcP	26 00			
	iH	31			
	eL	27+			
	M	29	15		Poorly defined.
15		04 51			
16		14 00			See local register.
16		17 57			Slight seismic activity
18	iP	22 21 11		23	Surface tremors.
	iZ	19			The data available indicate a provisional epicentre near 18 S 167 E.
	iZ	22 02			
	iZ	55			
	iS	25 20			
	iH	34			
	iHZ	47			
	Lr	27 52	18		

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Aug. 19	P	01 52 40		24 ca.	
	iZ	49			
	iZ	53 54			
	iH	56 38			
	iHZ	57 11			S not well defined.
	Lr	59 18			
21		09 35			
21		16 05			Slight seismic activity.
21		18 19			Surface tremors.
22	eL	00 47			A few surface tremors.
	M	51	30		
23	eP	04 41 11		24	
	PP	42 00			
	iHZ	43 58			
	PcP	45 00			
	S	26			
	Lq	46 52			
24		15 15			
25	e	03 05			Slight seismic activity.
	eL	08			Small movements.
26		08 10			
26		18 11			Surface tremors.
27	P	11 22 37			Slight seismic activity.
	iZ	23 17		21	Focal depth greater than norma
	S	26 22			
29.		04 01			
29	eP?	08 05 10			See local register.
	eZ	07 50			Focal depth greater than norma
	S	10 56			
31		14 22			See local register.

CHRISTCHURCH.

(Provisional Readings of Distant Earthquakes)

Instrument Constants:

	$kA_1T/4\pi l$	T (Pend.)	T_1 (Galv.)	$\frac{1}{2}\mu 2$
N	300	23.4	23.6	-0.07
E	300	24.35	24.4	-0.02
Z	300	12.79	12.86	-0.02

July 31	eP	6 37 06		29.6	Masked by microseisms.
	SE	42.08			" " "
	Lq	43.56	25		
	eLrZ	45 59			
Aug. 2	ePZ	1 00 08		104±	Compression.
	ePPZ	04 12			
	ePPP	06 38			
	SKS	10 42			
	SKKS	11 22			
	eS	12 04			
	Ss	19 20	24		
	SSSN	23 36			Largest on N.
	Lq	28 40			
	LrZ	35 03	27		Larger on E, period complex

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Aug.2	iZ	5 31 28			Sharp compression apparently f
	eNEZ	34 56			NNW.
	eNEZ	35 12			
	LrZ	36 10			Increase in period particularl on N & E.
3	ePZ	2 27 08		46.8	Compression masked by microsei
	S	34 04			
	LqN	37 18			
	LrZ	41 10			
8	eP?	20 00 22		51	Small compression.
	eS	07 44			
	Lq	13 04			
	eLrZ	16 16			
	eMZ	18 06	16		
9		0 35 ca.			Slight seismic activityp
9	eP	1 38 32		32.3	
	~~eS~~	43 53			
	Lq	45 20			
	eLrZ	47 20			
12	iNE	2 13 01			Z equivalent bleached.
	iNE	~~17~~ 30			Larger on N
	iNE	19 06			
	iZ	10			Compression
	iNZ	34	9		
	iE	56			Followed by maximum waves
	iNZ	21 44			Compression.
	iN	22 30			Followed by maximum on N.
12		10 32 ca.			Surface waves.
13	iNEZ	4 26 25			Compression from NNW
	eNE	28 07	20		
	eZ	29 12	17		
	iNE	34			Amplitudes increase becoming max on E.
	iZ	30 05			Amplitudes increase
	iN	36			Max. amplitudes on N.
16		17 56 ca.			Followed by surfacewaves for 30 minutes.
18	iP	22 21 28		24.6	Compression NNW.
	PcPZ	24 59			
	iS	25 52			Sharpest on E.
	LqE	27 16	38		Very large on E.
	LrZN	28 47			
	iNEZ	31 48	15		Large waves.
19	iPZ	00 52 58		24.3	
	iSE	57 19			
	eNE	57 19			
	iNE	44			
	eLqE	58 38			
	eLr	01 00 14			
19		4 10 30ca.			Probably a near shock.
21		16 08 ca.			Slight seismic activity.
21		19 16 ca.			" " "
22		0 49 ca.			" " "

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Aug.23	iPZ	4 41 42			Az. =NNW
	S	46 12			
	eL	47 18			Larger on E.
	iZ	52			Dilatation followed by large movements on N & E.
	LrZ	49 15			
25	ePNZ	3 56 09		40.1	
	iNZ	18			Compression
	iSNE	4 02 22			Larger on E.
	iSZ	24			Comprrssion
	Lq	05 04			
	ScSZ	06 10			
	LrNZ	08 30			
26		8 10 ca.			Slight seismic activity;
26	eNE	18 10 05	26		
	eZ	13 55	16		More definite from 16.11.
27	ePZ?	11 22 35			
	ePNZ	53			Compression from N
	iSE	26 55			
	LqE	27 33			
	eLrZ	30 07			
29	eP?	8 08 10		20.1	
	eS	11 54			
	eLq	12 19			
	LrZ	13 32			
31		14 22 ca.			See local register.

ARAPUNI.

Milne Seismograph Pendulum period (Undamped) 25sec.

Aug.12	e	02 15.0		2 ca.	Deep focus.
	S	16.5			
	i	17.3			
18	P	22 21.0		21	
	S	24.6			
	i	25.3			
	M	27			
19	P	01 55.1			
	S	56.2			
	i	57.5			

NEW PLYMOUTH.

(for Constants see Local register)

Aug.2	P	04 59 47+		13	In 2-second time mark
	S	05 02 10			

TUAI.

(For constants see local register)

Aug.12	eP	02 12 30		26.5	
	S	16 33			
	ScS?	23 12			

CHATHAM ISLANDS.

Milne Seismograph Pendulum period (undamped) 20 seconds.

June 2	e	03 53 ca.			
	e	58			
8	e	20 58 ca.			
	e	59.2			

Part II - Local Earthquakes.

Instrument Constants:

WELLINGTON: Wood-Anderson Short-period seismograph, two components.
Pendulum periods N-S = 0.47 sec.
E-W = 0.55 "

Geophone (oil damped moving armature type) for Z.
Geophone period 0.11 sec.
Galvanometer " 0.6 "

Imamura Stron-motion seismograph, three components
Pendulum periods N & S = 6 secs.
Z = 4 secs.

CHRISTCHURCH. Wood-Anderson Short-period seismograph, E-W components.
Pendulum period = 0.74 sec.

NEW PLYMOUTH: Wood-Anderson Short-period seismograph
E-W component.
Pendulum period = 0.55 sec.

TUAI: Wood-Anderson Short-period seismograph
N-S component.
Pendulum period = 0.49 sec.

TAKAKA: Imamura Strong-motion Seismograph, three components.
Pendulum periods N & S = 6 sec.
Z = 2.5 "

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
Aug.2	TU	P	14 24(00)	0.6	Approximate epicentre 39¼°S, 176 2/
		S	08		
	H	P	14 24(00)	0.5	
	N	P	14 24 57	2.1	
			25 22½		
	W	e	14 25 13		
		S	25½		
3	W	P	01 58 30½	0.8	
		S	40		
4	W	P?	09 53 16		
		S	55 52		
	TU	S?	09 54 47		
	C	S?	09 56 52		
8	W	P	01 42 17	0.4	
		S	22		
9	W	P	08 00 59	0.4	
		S	01 04		
12	TU	P	22 39 18	0.5	
		S	24½		
14	W	P	10 50 45	0.4	Felt to Hutt Valley.
		S	49½		
14	TU	P?	18 23 45	1.0	Felt Gisborne, R-F 3.
		S	56½		

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
Aug.16	TU	P	04 51 42	2.2	Approximate epicentre 39°S,180.
		S	52 09		
	N	P	04 52 13		remainder lost in changing paper.
	W	P	04 52 15	4.7	
		S	53 11		
	C	P	04 52 53		
		S	54 15		
17	TU	P	13 26 52	1.3	
		S	27 09		
17	TU	P	14 48 51	1.7	Approximate epicentre 40¼S,178½E.
		S	49 12		
	N		14 - -		record too faint to read phases.
	H		14 49(00)		small.
	W	P	14 49 09	3.2	
		S	47		
	C	S	14 50 45		
18	W	P	20 17 58	1.2	Felt Dannevirke R-F 3, and Porangahau.
		S	18 13		
	N	?	20 18 38		faint record.
	TU		20 18 13		traces
	H		20 18(00)		traces.
19	TU	P	19 34 04	2.4	Felt Tolaga Bay,R-F 2,and Opotiki
		S	33½		
	N	P	19 34 32		Approximate epicentre 38½S, 180.
		S?	35 20		
	W	e	19 34 42		
		S?	35 41		
	C	?	19 35 08		
		S?	36 47		
		M	55		
20	TU	P	08 32 52½	0.6ca.	Felt Gisborne,R-F 2.
		S	33 01		
20	TU	P	10 49 37	1.4	Approximate epicentre 39 2/3S,178½
		S	55½		
	N		10 - -		Record too faint to read phases.
	W	P	10 50 10	3.3	
		S	49		
	C		10 51 54		Beginning of small motion.
22	W	P	23 52 09	0.6	
		S	16		
24	TU	P	14 45 30	0.6ca.	
		S	38		
25	W	P	09 42 05	0.5	25 TU P? 22 35 04 0.6ca.
		S	10½		S 12
29	N	P	04 01 18	0.8	Felt at Whangamomona R-F 5,and over most of Taranaki,also Wanganui.
		S	26½		
	TU	S?	04 01 54		Amplitudes much small than at Wgtn
	W	P	04 01 37	2.1	Epicentre 39 1/3S, 175 E.
		S	02 02		
29	N	S	04 21 35		Felt Whangamomona;probably aftersh of above.
29	W	P	12 50 27	0.4	
			32		
30	W	eP	22 25 49	1.0	
		S	26 01.		
31	C	P	14 22 06	4.4?	Felt generally over Otago,R-F 6 at Cromwell.
			37		
			45½		Epicentre in vicinity of 45°S,167°
			49		
		S?	58½		
	M	P	14 22(00)	1.1	
		S	11		Sharp maximum.
	W	e	14 22 45		P's very small.
			51		
		S?	23 44		
	N	?	14 23 04		irregular small motion.
		M	24 26		

In addition, small tremors were recorded as follows:

Wellington: 15d. 18h. 39m; 24d. 00h. 13m.

NOTES:

No earthquakes were recorded at Bunnythorpe, Takaka, and Greymouth. The Jaggar at Rotorua was not in action owing to clock trouble.

At Tuai recording on a Wood-Anderson seismograph with accurate timing was commenced at the beginning of the month.

Seven earthquakes were felt in the North Island, with maximum R-F 5 at Whangamomona, and one in the South Island with maximum R-F 6 at Cromwell.

PROVISIONAL EPICENTRES IN NEW ZEALAND AND SOUTH-WEST PACIFIC - 1939 JUNE.

Origin Time 1939 d. h. m.	Provisional Epicentre Lat.(deg.)	Long.(deg.)	Remarks.
June 8 20 46.9	16 S	174 W	Reported felt at Apia, R-F 5. The observations agree with a focal depth of 100-130 kms.
12 05 22.5	40 S	173.6 E	
20 20 05.8	41 S	172.5 E	Felt at Paraparaumu, R-F 3?.

The Acting-Director of the Dominion Observatory gratefully acknowledges receipt of the following seismological bulletins:

Brisbane	June
Zagreb	Sept-Dec.
Papeete	No.2
Ksara	June
Melbourne	June, April-June.
Adelaide	July
J.S.A.	March - May-June
Bucarest	June
U.S.C.& G.S.	March - May, 1937.
Manila	July, June
Hong Kong	June, July.
Williams Town	Jan.-March
Ottawa	May
Florrissant	Oct.-Nov.
Pasadena	Sept.1938, Local shocks Feb.-Apr. Preliminary April-July.
Gottingen	Oct.-March.
Stuttgart	June, July
Riverview	May-July
Malaga	Jan-June, 1938.
U.G.et G.H.	May, March, April.
Kew	July
San Fernando	January-June.
Martinique	April-June.

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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

DOMINION OBSERVATORY, WELLINGTON, NEW ZEALAND.

SEISMOLOGICAL REPORT FROM NEW ZEALAND STATIONS.

The report is divided into two parts:—

Part I gives readings of distant earthquakes (Wellington $\Delta > 10°$ ca.); and Part II gives readings of local earthquakes ($\Delta < 10°$ ca.). But where a local earthquake is likely to have been recorded outside New Zealand, a reference to it is also included in Part I. In both parts, where the clock correction is not known, the time of P (or first phase recorded) is enclosed in a bracket. Whenever they are definitely indicated, the trace amplitude and the direction of the vertical component of P are given. An upward ground movement is designated (+), and a downward movement (—).

In Part II determinations of absolute time are not attempted from Jaggar records, only the intervals between pulses being measured. In many cases the P movements are very small, and the first movement recorded is not necessarily Pn, or any other particular pulse.

Unless otherwise indicated, times recorded refer to the incidence of impulsive movements.

A list of provisional epicentres in New Zealand and the South-west Pacific is appended. The New Zealand epicentres are determined from the records of local stations, and the more distant ones from the readings of as many overseas stations as are available.

List of New Zealand Seismograph Stations.

Station Name and Abbreviation.	Position.		Height above M.S.L.	Lithologic Foundation.	Seismographs.	Observers.
	Latitude.	Longitude.				
			Feet.			
Wellington (W) ..	41° 17′ S	174° 46′ E	401	Greywacke	Milne-Shaw (N-S)* ..	Dominion Observatory, Central Station.
					Galitzin-Wilip (Z)* ..	Acting-Director—
					Wood-Andersons (N-S)* and (E-W)*	R. C. Hayes.
					Jones or Geophone (Z)* ..	Observer—
					Imamura (three components)*	W. M. Jones.
Arapuni (A) ..	38° 5′ S	175° 39′ E	212	Rhyolite tuffs ..	Milne (E-W)*	Powerhouse Superintendent.
Rotorua (R) ..	38° 8′ S	176° 15′ E	930	Rhyolitic silts and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Tuai (TU)	38° 48′ S	177° 9′ E	960	Gravels	Wood-Anderson (N-S)* ..	Mr. H. C. Scott, P.W. Dept.
New Plymouth (N.) ..	39° 4′ S	174° 4′ E	112	Ash, agglomerate, and lava	Wood-Anderson (E-W)* ..	Superintendent, the Prison.
Hastings (H) ..	39° 38′ S	176° 53′ E	35	Alluvial sands, silts, and gravels	Jaggar (NE-SW)	Mr. H. de Denne.
Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
Takaka (TA) ..	40° 51′ S	172° 48′ E	25	Alluvial gravels ..	Imamura (three components)*	The Postmaster.
Greymouth (G) ..	42° 25′ S	171° 13′ E	14	Deltaic sands and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Christchurch (C) ..	43° 32′ S	172° 37′ E	25	Alluvial sands, silts, and gravels	Galitzin (three components)	Magnetic Observatory.
					Wood-Anderson (N-S)* ..	Director—H. F. Skey.
						Observer—H. F. Baird.
Monowai (M) ..	45° 47′ S	167° 37′ E	538	Tertiary sandstone ..	Jaggar (E-W)	Mr. A. Walker.
Chatham Islands (CH)	43° 57′ S	176° 31′ W	210	Volcanic breccia ..	Milne (E-W)*	Superintendent, Radio Station.

* For constants, see station register.

1,000/9/39—9599]

Part I - Distant Earthquakes.

WELLINGTON.

Instrument Constants:

Milne-Shaw (N-S) Pendulum period 11.8sec.
Damping 20:1
Magnification 250

Galitzin-Wilip (Z) Pendulum period 7.0sec.
Galvanometer " 10.6 "

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Sept.2	eP	9 04 48		30	
	iPP	05 52			
	iS	09 48			
	L?	13 30	25		
	M	15+	20		
8	iP	12 17 52		96	Reports so far available indicate an epicentre north of Japan.
	iZ	18 02			
	PP	21 40			
	eH	27 01			
	iSKS	28 11			
	iS	29 09			
	iPS	30 00			
	iSS	34 47			
	eSSS	39 02			
	Lq	42 47			
	W2	14 09 ca.			Prolonged series of L-waves of period 20 secs. ca.
L12	P	12 09 30		11.0	Felt Kermedecs, max. R-F 6.
	S	11 30			
	M	43			
15	iH	11 55 13			doubtful
	eS?	57 00			
	L	58.6	18ca.		
17	iP	19 23 05		14½	Reports so far available indicate an epicentre in the vicinity of 53 S, 167 E.
	eS	25 50			
	Lq	26.5			
	Lr	27.5			
19	eLH	18 05			Indefinite L-wave in heavy micro-seisms.
	M	14	15ca.		
20	iP	07 31 11		14	Reports so far available indicate an epicentre in the vicinity of: 53 S, 167 E (as on 17d.19h.)
	iS	33 51			
	Lq	34.5			
	Lr	35+			
	M	36			
22	eL	01 59			Considerable movements on H for 4m. ca. Prolonged waves of small amplitude

CHRISTCHURCH.

(Provisional Readings of Distant Earthquakes)

	$kA_1T/4\pi l$	T (Pend.)	T_1 (Galv.)	$\frac{1}{2}\mu 2$
N	300	23.4	23.6	-0.07
E	300	24.35	24.4	-0.02
Z	300	12.79	12.86	-0.02

Sept.2	iP	09 05 07		29.4	Compression az N.N.W.
	eZ	09 36			Shallow 12 sec.period.
	S	10 08			
	eLqE	11 35			Large from 12.08
	eLrZ	13 51			" " 14.08

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Sept.7		14 53 ca.			Very shallow surface waves largest on N.
8	iPNZ	12 18 11		93.1	Compression from N.
	eSKSN	28 36			
	iZ	29 04			
	iSEN	20			Small on N
	SSNE	35 41			
	SSSN	39 34			
	SSSSE	42 34			
	LqE	43 12	50		Large
	LrZ	48 51			Large from 50 21
12		12 14 ca.			Seismic activity in large micro-seisms.
15	PNZ	11 53 14		24	Compression from N.
	SNE	57 33			
	LqE	59 00			
	Lr	12 00 40			
16		7 52 ca.			Slight seismic activity.
17	P	19 22 31			Az. S.W., followed by large 33 sec. period movement on N & E.
	iE	24 21	22		Large
	iNZ	40			Sharp serrating 22 sec.period wave.
	iSE	53	20		Becomes maximum.
	iLrZ	25 42	12		
18		10 06 ca.			Seismic activity reaching max.10.14 ca.
20	ePZ	7 30 32			Modification of microseism.
	eN	30 32			Train of 22 sec.period waves follow
	eNEZ	32 16			Large 22 sec.period waves follow on E.
	iSNEZ	32 53			Short period N & Z,large 20 sec. period on E.
	iZ	33 12			Followed by 14 sec.period waves.
	iLrZ	40	12		
22	pP1?	1 26 32			Small compression
	SKP	30 06			
	PPZ	23			
	eZ	33 30			SKS?
	SKKS	37 12			
	SS	50 07			
	SSS	56 06			
	LqN?	2 10 25	35		
	eLr?	17 50	18		

The Director of the Christchurch Magnetic Observatory acknowledges with thanks receipt of the following seismogrcal publications:

Tokyo	Imperial University	1938 Part 1-2
"	" "	1938 Vol. XVI,part 4.
"	Jap.Jour.Ast.& Geop.	1937-8" XV
"	" " " "	1938 " XVI,part 1
"	E.R.I.	1939 " XVII, part 1
Denver		1938 pp. 2-8
J.S.A.Central Station		1938 pp. 36-43,1939,pp.1-5
		8,9,11-14,16-18, 20-28
Batavia		1938 Jan.-Sept.
Pasadena		1938 Prelim.9-13,Nos.42-66

Ksara	1936
Manila	1938
Malaga	1938 Jan - June
	1937 July December.
Sydney	1938 Nov - 1939 June.
Apia	1939 nos. 1& 2.
Florissant	1938 pp. 7 -27, 1939 1 - 4.
Cape Girardeau	1938 pp. 8-14,16-18,1939-1-2
Littel Rock	1938 pp.11-16
Riverview	1939 Feb.-May
Weston	1938 Nos. 23-24
Stl Louis	1938 pp.10-22
Melbourne	No.46
De Bilt	1936 24
Budapest	1938 "A - - - terkep"
	1939 C Sorozat: 3 Serie
	1938 B Sorozat Serie
	1938 Die mikroseismische unrue in Budapest.
	1938 A Sorozat Serie
Northern California	1937 Oct. - Dec.
Hamburg	1937 pp. 3-8, 1938 pp.30 - 38.

ARAPUNI.

Milne Seismograph,Pendulum Period 25 secs.(undamped)

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Aug.23	iS	4 45.0			
29	eS	8 09.6			
Sept.2	eS?	9 09.6			very small.
	L	12			
	M	14			
8	e	12 23.1			
	eS	29.6			Subsequent record masked by artificial disturbance.
15	e	11 55.0			
	eL	56.7			
17		19 30ca.			Tremors,confused with artificial disturbance.
20		07 31 ca.			Tremors, confused with artificial disturbance.

NEW PLYMOUTH.

(For constants see Local Register.)

Sept.20	i	7 31+			
	eL	36			

TUAI.

(For constants see Local Register.)

Sept.12	S	12 10 29			
	M	35			
20	eL	7 36 ca.			

Part II - Local Earthquakes.

Instrument Constants:

WELLINGTON: Wood-Anderson Short-period seismograph, two components.
Pendulum periods N-S = 0.47 sec.
E-W = 0.55 "
Geophone (oil-damped moving armature type) for Z.
Geophone Period 0.11 sec.
Galvanometer " 0.6 "

Imamura Strong-motion seismograph, three components:
Pendulum periods N & S components = 6 secs.
Z component = 4 "

CHRISTCHURCH: Wood-Anderson Short-period seismograph, E-W component.
Pendulum period 0.74 sec.

NEW PLYMOUTH: Wood-Anderson Short-period seismograph, E-W component.
Pendulum period 0.55 sec.

TAKAKA: Imamura Strong-motion seismograph, three components.
Pendulum periods N & S components = 6 secs.
Z " = 2.5 "

TUAI: Wood-Anderson Short-period seismograph, N-S Component.
Pendulum period 0.49 sec.

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
Sept.5	W	P	21 25 22	0.7	
		S	31		
	N	?	21 26 14		
		M	28		
6	Tu	P	6 03 54½	2.7	Epicentre near 39½°S, 179½°W.
		S	04 27½		
	H		6 04(00)		
			06		
			08		
	W	P	6 04 24	4.6	
		S	05 19		
	N		6 05 17		Traces only
	C	S?	6 06 23		
8	Tu	P	7 02 33	0.5ca.	Felt Wairoa R-F 2.
		S	38½		
	W	?	7 03 34		Traces only.
			41		
8	TU	P	7 07 55½	0.5ca.	Similar to above
		S	08 01		
	W		7 09 04		Traces only.
12	W	P?	1 22 37	1.0?	?Felt Whangamomona R-F 4.
		S	50½		
	N	P	1 22 44½	1.4	
		S	23 02½		

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
Sept.21	Tu	P	15 47 43	1.8?	
		S?	48 06		
	N		15 48 17		Beginning of confused motion.
	W	e	15 48 30		
		S	49 12		
22	TU	P	6 42 32	0.6	Felt Wairoa, R-F 3-4.
		S?	46		
		M	49½		sharp maximum
	H		6 43(00)		maximum on first pulse.
			09		
			14		Epicentre near 38½°S, 176½°E with
	N	P	6 42 43½	1.9	focal depth 100 km.ca.
		S	43 10		
	W	P	6 42 55½	3.0	
		S	43 34		
	C	P?	6 43 32		
		S	44 36		
22	W		9 57 04		
			13		
	N	S?	9 57 17		
26	W	P	17 40 18½	1.2	Felt Wanganui, R-F 5. Epicentre near
		S	33		40.2 S, 175.2 E.
	N	P?	17 40 27	1.5?	
		S	40		

In addition, small tremors were recorded as follows:

ROTORUA: (times approximate): 26d. 1h. 20m., 1h. 21m.
28d. 20s.24m., 28m, 29m, 58m; 21h; 01m; 32m.
29d. 00h. 27m, 29m.

TUAI: 7d. 5h. 17m (Δ=0.8°); 9d. 5h. 41m.(Δ=0.7°); 12d. 12h. 10m; 18d.12h.33m; 15d. 21h. 45m; 19d.20h.52m; (Δ=0.5°); 21d.22h.08m.(Δ=0.4°); 29d.13h.50m; 29d.13h.49m; 30d.14h.38m; 30d.14h.43m.(Δ=1.3°) 30d.14h.49m. (Δ=1.3°); 30d.15h.53m.

NEW PLYMOUTH: 30d. 15h. 19m.

HASTINGS: 12d. 3h. 19m; 24d. 23h. 22m; 25d. 15h. 41m.

WELLINGTON: 7d. 5h.16m.; 9d.10h.30m.; 9d.14h.12m.; 9d.17h.05m.;
9 22 15 (Δ = 0.6°); 9 23 39 (Δ=0.5°)
11 00 43 ; 15 22 33 ; 21 10 21 ; 24 06 30 ;
25 00 57 (Δ = 0.4°); 25 15 45 ; 27 16 23(Δ=1.2°)
27 16 38 ; 29 00 11

CHRISTCHURCH: 09d. 00h. 58m.(possibly not seismic)

MONOWAI: 07d. 15h. 05m.ca. another 12 secs.later; 19d. 18h. 28m.

NOTES: No earthquakes were recorded at BUNNYTHORPE, TAKAKA, or GREYMOUTH. Only four earthquakes were reported felt all in the North Island; maximum R-F 4 at Wanganui.

PROVISIONAL EPICENTRES IN NEW ZEALAND AND SOUTH-WEST PACIFIC: 1939
JULY.

Origin Time (G.M.T.) 1939 d. h. m.	Provisional Epicentre Lat.(deg.)	Long (deg.)	Remarks.
July 2 15 16.1	40 2/3S	176 1/3E	Felt Dannevirke,R-F 4,also Masterton.
3 13 21.7	38 S	177¾ E	Felt East Cape district,max.R-F 6; also Hawkes Bay as far south as Dannevirke. Focal depth probably greater than normal.
5 22 41.0	23 S	178 E	Focal depth 600 km+
6 15 26.6	38¾ S	176½ E	
8 17 18.9	42¼ S	174½ E	Felt in southern Hawkes Bay and about Cook Strait, max.R-F 4.
12 22 58.4	4 S	140 E	
21 07 02.8	40½ S	172½ E	
25 08 58.4	40½ S	174½ E	Felt Paraparaumu, R-F 2.
25 17 46.8	42½ S	172½ E	Felt Hanmer Springs and Christchurch, max. R-F 6.
29 02 12.6	45 S	167 E	Felt Monowai.

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Bucarest	July
La Plata	February -June
Parc St. Maur	June
Strasbourg	June
Bureau Central	June
U.G.et G.	April - June
Denver	August to December
St. Luois	October - December
J.S.A.	April
Pasadena	Local shocks,May - July
Perth	August
Cape Girardeau	November - January
Florissant	December - February
Manila	July
Hong Kong	July
U.S.C.& G.S.	August
Melbourne	August Provisional
Batavia	October-December
Manila	August
Ksara	July
Brisbane	August
Adelaide	August
Sydney	May
Toledo	January - March
Schweizerisches Erdbebenbulletin 109 & 110	
Ottawa	June
Papeete	11 - 13

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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

DOMINION OBSERVATORY, WELLINGTON, NEW ZEALAND.

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			Feet.			
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					Galitzin-Wilip (Z)* ..	Acting-Director—
					Wood-Andersons (N-S)* and (E-W)*	R. C. Hayes.
					Jones or Geophone (Z)* ..	Observer—
					Imamura (three components)*	W. M. Jones.
Arapuni (A) ..	38° 5′ S	175° 39′ E	212	Rhyolite tuffs ..	Milne (E-W)*	Powerhouse Superintendent.
Rotorua (R) ..	38° 8′ S	176° 15′ E	930	Rhyolitic silts and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
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Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
Takaka (TA) ..	40° 51′ S	172° 48′ E	25	Alluvial gravels ..	Imamura (three components)*	The Postmaster.
Greymouth (G) ..	42° 25′ S	171° 13′ E	14	Deltaic sands and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Christchurch (C) ..	43° 32′ S	172° 37′ E	25	Alluvial sands, silts, and gravels	Galitzin (three components)	Magnetic Observatory.
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						Observer—H. F. Baird.
Monowai (M) ..	45° 47′ S	167° 37′ E	538	Tertiary sandstone ..	Jaggar (E-W)	Mr. A. Walker.
Chatham Islands (CH)	43° 57′ S	176° 31′ W	210	Volcanic breccia ..	Milne (E-W)*	Superintendent, Radio Station.

* For constants, see station register.

1,000/9/39—9599]

Part I - Distant Earthquakes.

WELLINGTON.

Instrument Constants:

Milne-Shaw (N-S) Pendulum period 11.3 secs.
Damping 20:1
Magnification 250

Galitzin-Wilip (Z) Pendulum period 7.0 sec.
Galvanometer " 10.6 "

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks
Oct.7	eHS?	21 02 26			
	L	09 30			
9	P ZH	2 23 00		21.4	Reports to hand indicate an epicentre in the vicinity of New Hebrides.
	PP Z	35			
	iS H	26 54			Prominent.
	L?	29			Long period irregular movements.
	iH	30 10	20		Series of regular surface waves.
	M_1	32	12		
	M_2	33	13		
10	P Z	18 44 18		96	Small.
	i Z	47			
	SKS	54 54			Prominent;
	S?	55 36			small.
	iH?	56 03			
	SS	19 00 38	18		Prominent.
	Lq	11+	30ca.		
	Lr	15	25		Prolonged surface waves of small amplitude.
10		19 40			See local Register.
10	eL	21 04	20		Small surface waves for 30 mins.ca.
17	iP	06 27 45		27.0	Very sharp movement; AZ=+4mm.ca. reaching max. on Z within a few secs.
	pP	28 08			
	PP	37			Large especially on H. Focal
	i Z	49			depth 100-120km. Reports available
	i Z	59			indicate an epicentre near 15°S,
	PcP?	31 25			167° E.
	iS	32 13			
	sS	58			large on H; and large amplitudes and
	SS	33 52			fairly confused movements follow, until 02h.42m.ca.
	ScP?	34 25			
	PcS?	42			
	ScS	38 24			From W-A.
	sScS	39 19ca.			" "
17	iZ	09 05 08			Possibly aftershock of above.
	eH	12 23			
	M	18	13		
19	eL	5 08			small.
20	eL	7 40			Small surface waves for 13 mins.ca.
26		21 27			See local register.
27	eZ	6 01			small movements of rather long period
27	iZ	11 00 15			Small and indefinite.
	eZ	03 00			Longer period movements: small amplitude
28		08 16			Small movements.
30	P?	13 18 06		30ca.	Small and indefinite.
	S?	23 10			
	ScS	28 45			
30		22 03			See local register.

CHRISTCHURCH.

(Provisional Readings of Distant Earthquakes)

Instrument Constants:

	$kA_1T/4\pi l$	T (Pend.)	T_1(Galv.)	$\frac{1}{2}\mu 2$
N	300	23.4	23.6	-0.07
E	300	24.35	24.4	-0.02
Z	300	12.79	12.86	-0.02

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Oct. 2		6 39 ca.			Slight seismic activity.
3	eNEZ	13 47 39			In microseisms.
	eNZ	49 43			
	eE	52 39	20		Shallow
	iE	56 00			
	eZ	14 01 00	20		Shallow.
7	iP	20 52 18		23?	
	iNEZ	56 28			
	eNEZ	58 55			
	paper off	21 04 01			
9	P	2 23 17		24	Compression
	S	27 36			Largest on N.
	LqE	28 12			
	LrZ	30 08			
9		23 39 ca.			Slight seismic activity.
10		0 35 ca.			" " "
10		2 56 ca.			" " "
10		10 06 ca.			" " "
10	PZ	18 44 46		87.2	
	S	55 07			Largest on N.
	SSNZ	19 00 40			
	LqE	06 34			Shallow.
	LrZ	12 14	32		
	LZ	13 54	25		
10	iPZ	19 40			See local register.
16		16 00 ca.			Slight seismic activity.
16		17 38 ca.			" " "
17	iP	6 28 00			Huge compression, in μ N:W:Z = 129: 23:111
	iNEZ	29 02			Dilatation, N:W:Z = 166:46:110.
	iSNEZ	32 44			Largest on E being 170.
	iEZ	34 05			N movements too large to follow.
	iZ	34 25			
	iE	35 22	ca.30		Went off stit. Large movements over on Z by 6.51 but coda lasted 3 hours, increased activity at 9.11ca.may be later shock.
20		7 40 ca.			Slight seismic activity, small on N.
20		21 58 ca.			" " " " "
26		21 30			See local register.
26		23 28 ca.			A few surface waves.
27		1 31 ca.			" " "
27		4 32 ca.			" " " "
27	eLe	6 01 52			
	eLNZ	03 11			
27	Lq	11 03 12	24		Larger on E.
	eLrNZ	04 32			
27		14 33 ca.			A few surfacewaves.

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Oct.30	eP?	13 18 26		35.3?	Compression in microseisms
	S	24 08			
	Lq	26 08	34		Larger on E.
	eLrZ	28 40			
30		18 14 ca.			Slight seismic activity.
30		22 05			See Local Register.

ARAPUNI.

Milne-Seismograph. Pendulum Period 25 secs. (Undamped)

Oct.7		21 07			Slight tremors.
9	S	2 26.0			
	L?	P9.0			
10	SKS	18 54.7			
10		19 46			Prolonged tremors.
17		06 27 20			See Local register.
	P			25.0	
	S	31 37			
	sS	32 22			Prominent;
	SS	33 23			
	i	35 26			
26		21 29.0			Tremors for 30 mins. ca. See Local Register.
27		11 00 ca.			Tremors; beginning in Time gap.
30	e	13 22.0			Small.
	iS	23.0			
30		22 03			See Local Register.

TUAI.

(For constants see Local Register)

Oct. 17	P	6 27 29		25.3	
	S	31 47			
	ScS	38 15			

New Plymouth.

(For Constants see Local Register)

Oct.17	P	6 27 28		25.0	
	S?	31 44			

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
Oct.30	TU	P	22 02 24	6.3	Epicentre in Pacific; probably about 500 km. eastward from East Cape; compare with above on 26d.21h.
		S	03 35		
		L	04 13		
		L	26		
	A	e	22 02.6		
		L	04.4		
	N		22 03 22		
			04 55		
	W	e	22 03 27	8.9	
		S	04 42		
		L	05 45		
	C	S?	22 05 44	11.5?	
			53		
30	W	P?	23 05 22		Felt Dannevirke R-F 3.
		S	37½		
	N	S?	23 05 57		

In addition, small shocks were recorded as follows:

WELLINGTON: 6d.12h.26m.35s. (Δ=1.0°) 9d.03h.18m.32s.
15 03 43 13 (Δ=0.5°) 19 22 30 40
23 21 39 06 (Δ=1.0°)

NEW PLYMOUTH: 18d.17h.39m.46s. (?seismic) 25d. 21h.17m.32s.(Δ=0.5°)
28 00 24 24 (? ")

TUAI: 2d.15h.43m.48s. 2d.15h.52m.54s. (Δ=0.5°)
3 07 12 12)Δ=0.5°) 4 07 53 01)Δ=0.7°)
8 00 58 52 (Δ=0.7°) 12 08 08 36
12 19 58 46 18 06 19 41
26d.8h. 7m. 31s; 21 03 14 34 (Δ=0.6°) 27 06 14 43 ;26 8 07
)(Δ=0.6°) 30 23 23 08 31 02 15 38 (?seismic)

CHRISTCHURCH: 11 00 46 57 (?seismic) 11 03 22 06 (?seismic)

MONOWAI: 2 18 (00))Δ=0.8°) 3 1 0 46 (Δ=0.8°)
21 22 28 28 07 25

NOTES:

No earthquakes were recorded at ROTORUA, TAKAKA , and GREYMOUTH.

Shocks not recorded on any instrument were reported felt as follows:

Naseby: 2d. 04h. 48m. R-F 6.
" 2 05 10 R-F 2.
Feilding 19d.06h. Press - "Slight tremor".

In all, 12 shocks were reported felt in the North Island. Maximum R-F 4 at Waituna, Waipawa, and Hastings; 4 in the South Island; Maximum R-F 6 at Naseby; one being felt in both Islands. A total of 15 shocks for the whole of New Zealand.

PROVISIONAL EPICENTRES IN NEW ZEALAND AND SOUTH-WEST PACIFIC, 1939 AUGUST.

Origin Time. 1939 d. h. m.	Provisional Epicentre Lat.(deg.)	Long.(deg.)	Remarks.
Aug. 2 14 24.4	39¼ S	176 2/3E	
12 02 07.4	17 S	167 E	Focal depth appears to be about 150 kms.
16 04 51.1	39 S	180	
17 14 48.4	40¼ S	178½ E	
18 22 15.9	19 S	168 E	
19 00 47.4	19 S	168 E	
19 19 33.4	38½ S	180	Felt Tologa Bay, R-F 2; and Opotiki.
20 10 49.2	39 2/3S	178½ E	
29 04 01.1	39 1/3S	175 E	
31 14 21.0	45 S	167 E	Felt generally over Otago, max.R-F 6.

The Acting-Director of the Dominion Observatory gratefully acknowledges receipt of the following seismological bulletins:

Riverview	August-September
Brisbane	September
Apia	July-Sept.April-June.
Toledo	Jan. - June, 1937.
Manila	September 8
Hong Kong	August
Pennsylvania	Acknowledgement List
Perth	June-September
San Fernando	July, August.
J.S.A.	September preliminary
Ottawa	July
Sydney	July August
Riverview	October, Preliminary.
Ksara	August.
Melbourne	September, preliminary.

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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

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A list of provisional epicentres in New Zealand and the South-west Pacific is appended. The New Zealand epicentres are determined from the records of local stations, and the more distant ones from the readings of as many overseas stations as are available.

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Station Name and Abbreviation.	Position.		Height above M.S.L.	Lithologic Foundation.	Seismographs.	Observers.
	Latitude.	Longitude.				
			Feet.			
Wellington (W) ..	41° 17′ S	174° 46′ E	401	Greywacke	Milne-Shaw (N-S)* ..	Dominion Observatory, Central Station.
					Galitzin-Wilip (Z)* ..	Acting-Director— R. C. Hayes.
					Wood-Andersons (N-S)* and (E-W)*	Observer— W. M. Jones.
					Jones or Geophone (Z)* ..	
Arapuni (A) ..	38° 5′ S	175° 39′ E	212	Rhyolite tuffs ..	Imamura (three components)*	
Rotorua (R) ..	38° 8′ S	176° 15′ E	930	Rhyolitic silts and gravels	Milne (E-W)*	Powerhouse Superintendent.
					Jaggar (E-W)	District Engineer, P.W. Dept.
Tuai (TU)	38° 48′ S	177° 9′ E	960	Gravels	Wood-Anderson (N-S)* ..	Mr. H. C. Scott, P.W. Dept.
New Plymouth (N.) ..	39° 4′ S	174° 4′ E	112	Ash, agglomerate, and lava	Wood-Anderson (E-W)* ..	Superintendent, the Prison.
Hastings (H) ..	39° 38′ S	176° 53′ E	35	Alluvial sands, silts, and gravels	Jaggar (NE-SW)	Mr. H. de Denne.
Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
Takaka (TA) ..	40° 51′ S	172° 48′ E	25	Alluvial gravels ..	Imamura (three components)*	The Postmaster.
Greymouth (G) ..	42° 25′ S	171° 13′ E	14	Deltaic sands and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Christchurch (C) ..	43° 32′ S	172° 37′ E	25	Alluvial sands, silts, and gravels	Galitzin (three components)	Magnetic Observatory. Director—H. F. Skey. Observer—H. F. Baird.
					Wood-Anderson (N-S)* ..	
Monowai (M) ..	45° 47′ S	167° 37′ E	538	Tertiary sandstone ..	Jaggar (E-W)	Mr. A. Walker.
Chatham Islands (CH)	43° 57′ S	176° 31′ W	210	Volcanic breccia ..	Milne (E-W)*	Superintendent, Radio Station.

* For constants, see station register.

1,000/9/39—9599]

NOTE: Owing to circumstances arising out of the present International situation, it is found necessary to suspend publication of further monthly bulletins of our E-Series. These are being replaced by a series of abridged bulletins, designated by the letter "P". Thus, the present bulletin is "P-93"; in continuation of a series of provisional earthquake bulletins which were issued during the period 1929 - 1936.

PART I-DISTANT EARTHQUAKES

Date 1939	Station	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Nov.10	C	iP?	16 52 57			Compression SW.
		eS?	55 19			
	W	iS?	16 53 29			
	A	e	16 57.9			
10	C	ePZ?	20 28 31		37.6?	
		S	34 29			
17	TU	P	18 43 15		18.7	Focal depth 600 km.ca.
		S	46 13			
	N	P	18 43 26		20.0	
		S	46 36			
	W	P	18 43 39		21.0	
		S	46 58			
	C	eNEZ	18 46 45			/for 30 minutes ca. followed by small irregular waves
18	W	P?	00 19 23ca.		24ca.	small.
		S	23 50			
	C	ePZ	00 19 30		27.9	small compression in microseisms.
		eS	24 19			
	A	e	00 52.0			tremors.
18	C	ePZ	01 46 13		91±	compression.
		eSKSN	56 33			
		PSN	58 21			
	W	iH	01 56 22			small
		iH	57 03			prominent.
18	C	eP	12 16 25	20	13.7?	
		SNE?	19 07	20		
	W	eH	12 16			small irregular waves for 10m.ca.
	A	e	12 15 ca.			slight tremors.
21	W	P	11 21 45		96ca.	
		S	33 01			
	C	P	11 22 49		87.8	Compression, az. NNE?
		S	33 43			
24	W	P	23 27 11		37.0?	
		S?	32 57			
	C	P	23 28 23			
		iS	32 33			
	A	S?	23 30 ca.			In time gap.

In addition other distant shocks of less importance were recorded as follows?

	d. h. m.		d. h. m.	d. h. m.	d. h. m.
Wellington:	1 06 01ca.	(L)	3 19 56	9 10 58	9 13 38
	(L)17 19 34	(L)	21 21 41	27 14 12	
Christchurch:	1 05 57	(L)	1 09 18ca.	(L) 9 11 02 ca	(L)9 13 42ca.
	13 08 35ca.	(L)	15 03 58ca.	(L)17 09 20ca.	
	17 16 48ca.		17 19 34	21 10 02	27 14 15ca.
Arapuni:	(L)1 06 17	(L)	3 19 54ca.	9 10 58	9 13 38
	10 20 03		27 14 10		

PART II -LOCAL EARTHQUAKES.

Date 1939	Origin Time G.M.T. h. m.	Provisional Epicentre Lat.	Long.	Stations recording shock.	Remarks.
Nov.2	05 01.6	42.3 S	173.5 E	W,N,C.	
2	13 27.7	40.1 S	175.0 E	W,N,TU,C.	Felt Cook Strait area, Max.RF5
2	14 20	40.1 S	175.0 E	W,N.	Felt Wanganui, R-F 1-2.
2	14 26	40.1 S	175.0 E	W,N.	" " " "
2	18 57.3	40.1 S	175.0 E	W,N.	" " R-F 5?
4	14 05.3	40.1 S	175.0 E	W,N.	" " " 4
6	13 37.5	39½ S	177 E	H,TU,W,	Felt southern Hawkes Bay,R-F4.
6	13 38.7	39½ S	177 E	H,TU,W,C.	" " " " "
7	20 21.7	39½ S	177 E	H,TU,N,W,C.	" " " " "
8	19 04.8	37 S	177 W	TU,A,N,W,C.	
8	19 31.4	Cook strait area		W,N.	Felt Paraparaumu, R-F 1
14	12 38	37 S	177 W	TU,A,N,W,C.	
15	17 09.5	37 S	177 W	TU,A,N,W,C.	
15	22 20	37 S	177 W	TU,W.	
24	15 50.2	39.7 S	180	TU,W.	
24	22 45ca.	near Rotorua		R	Felt Rotorua
25	21 45ca.	" "		R	" "
26	0 45ca.	" "		R	" "
29	08 25ca.	Milford Sd.region		M,C,W.	Felt Cromwell,R-F 4,& Milford Sound.

The
A number of additional small shocks recorded was as follows:

Wellington 12; Tuai 9; Hastings 1; New Plymouth 8; Christchurch 3.

Shocks not recorded on any instrument were reported felt as follows:

Wanganui 4d. 19h. (Minor Tremor); Hastings 7d.09h.ca.(Press Report)
Kahurangi Point 19d.08h.20m.(R-F 4),Cromwell 30d.14h.ca.(R-F 2).

PROVISIONAL EPICENTRES IN SOUTHWEST PACIFIC, 1939 SEPTEMBER.

(In addition to those in the N.Z.region quoted previously in Part II of Bulletin E-90)

Origin Time 1939 d.h.m.	Provisional Epicentre Lat.(deg)	Long.(deg)	Remarks.
Sept. 2 08 58.7	13 S	167 E	
1212 06.5	30 S	176 W	Felt Kermedec Island,R-F 6,focal depth 300 km.ca.
17 19 20.1	51½ S	164 E	
20 07 28.2	51½ S	164 E	

[S.I.R.—20.

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					Jones or Geophone (Z)* ..	Observer—
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Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
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						Observer—H. F. Baird.
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* For constants, see station register.

1,000/9/39—9599]

Part I - Distant Earthquakes.

WELLINGTON.

Instrument Constants.

Milne-Shaw IN-S) pendulum period 11.3 secs.
damping 20:1
Magnification 250

Galitzin-Wilip (Z) Pendulum period 7.0 sec.
Galvanometer " 10.6 "

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Nov.1	eS?	5 01 ca.			Small and indefinite.
	eL	20.7			
	M	25 ca.	15		
3	eL	19 56			Slight tremors.
8		10 06			See local register.
9	iS?	10 56 44			
	iL?	11 00 19			
9	iS?	13 38 43			
	e H	13 38 50			
	L	41 10			
10	iS?	16 53 29			H-component clock stopped.
	L	59			
14		12 40 ca.			See local register.
15		17 11 ca.			See local register.
17	P	18 43 39		21.0	Focal depth 600 km. ca.
	S	46 58			18 39.6 19 4.5 180
	ScS	53 50			
17	eL	19 34	20		Small surface waves.
18	P?	00 19 23ca.		24ca.	Small
	S	23 50			
	Lr	26			Irregular waves.
18	i H	01 56 22			Small.
	i H	57 03			Prominent.
	eL	02 16	20-30		Series of regular waves until 02h. 26m.ca.
18	eH	12 16			Small irregular waves for 10 mins. ca.
21	P	11 21 45		96ca.	
	PP	25 39			
	S	33 01			
	PPS	34 20			
	SS	38 45			
	SSS	43 08			
	Lq?	52			Surface waves small and irregular.
21	iH?	21 41 30			Very small and doubtful.
	iL	50 53	15ca.		
24	P	23 27 11		37.0?	H-component clock stopped.
	i	35			
	PP	28 50			
	SK	32 57			
	Lr	36 50			
27	eL	14 12			Small surface waves for 20 mins.ca.

CHRISTCHURCH.

(Provisional Readings of Distant Earthquakes)

Instrument Constants.

	$KA_1T/4$ 1	T(End.)	T_1 (Galv.)	$\frac{1}{2}\mu 2$.
N	300	23.4	23.6	-0.07
E	300	24.35	24.4	-0.02
Z	300	12.79	12.86	-0.02

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Nov.1	iZ	5 57 51			Compression, large movement in microseisms.
	eNE	6 00 24			Followed by train of irregular waves.
	eZ	08 13			
	eNE	19 42			Lq? complex
	LrZ	25 08			
1		9 18 ca.			Followed by a few surface waves.
8		19 08			See local register.
9		11 02 ca.			Surface waves for over 30 mins.
9		13 42 ca.			" " " " " "
10	iP?	16 52 57			Compression from SW.
	eS?	55 19			16 19.7 53 S 160 E
	LqNE	25	25		Larger on E.
	eLrZ	56 09			
10	ePZ?	20 28 31		37.6?	20 20.9 10 S 147½ E
	S	34 29			
	eLqN	39 25			
	Lr	30			
13		8 35 ca.			Slight seismic activity.
14		12 42			See local register.
15		3 58 ca.			Some surface waves.
15		17 13			See local register.
17		9 20 ca.			Some small surface waves.
17		16 48 ca.			Slight seismic activity.
17	eNEZ	18 46 45			Followed by small irregular waves for 30 minutes.
	eNEZ	19 34 30	25		
18	eP	0 19 30		27.9	Small compression in microseisms.
	eS	24 19			
	LqE	25 25	28		
	eLrZ	27 17	15		
18	ePZ	1 46 13		91±	Compression.
	eSKSN	56 33			
	PSN	58 21			
	SSN	2 04 00			
	SSSN	07 33			
	LqE	12 10	40		
	eLrZ	16 50	28ca.		
18	eP	12 16 25		13.7?	
	SNE?	19 07	20		
	eLrZ	20 27	16		
21	eEN	10 02 14	35		Shallow, small on N.
	eEN	10 13 ca.			A further train of shallow waves.
	eZ	10 31 ca.			Shallow waves for some 10 minutes.
21	P	11 22 49		87.8	Compression, az. NNE?
	iEZ	23 33			Sharp compression.
	PP	26 25			
	eSKS	33 05			
	S	33 43			
	SS	39 37			
	eSSS	43 09			Some 40 sec. period waves.
	eLqE	46 09	32		Larger on E.
	eLr	52 15			Small.

Date 1939	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Nov.24	P	23 28 23			Compression from NW?
	iS	32 22			
	LqE	33 18	40		
	LrZ	34 20			
27		14 15 ca.			Slight seismic activity.

ARAPUNI.

Milne seismograph, pendulum period 25 secs. (Undamped).

Nov. 1	eL	6 17.0			
	e	18.3			
3	eL?	19 54 ca.			Small tremors.
8		19 06.1			See local register.
9	eS?	10 58.6			Small tremors.
9	eS?	13 38.5			" "
10	e	16 57.9			
	L?	17 00ca.			in hour gap.
10	e	20 03.8			
	e	10.4			
14		12 39.6			See local register.
15		17 10.5			See local register.
18	e	00 52.0			Tremors.
18	e	12 15 ca.			Small tremors.
24	S?	23 30 ca.			In time gap.
	i	31.6			
27		14 10			Tremors.

TUAI.

(For constants see Local Register.)

Nov.17	P	18 43 15		18.7	
	S	46 13			

NEW PLYMOUTH.

(For constants see Local Register.)

Nov.17	P	18 43 26		20.0	
	S	46 36			

Part II-Local Earthquakes.

Instrument Constants:

WELLINGTON: Wood-Anderson Short-period seismograph, two components:
Pendulum periods N-S =0.47 sec.
E-W = 0.56 sec.

Jones Short-peeiod Vertical Seismograph.
Pendulum period = 0.2 secs.

Imamura Strong-motion seismograph, three components.
Pendulum periods N & S = 6 secs.
Z = 4 secs.

CHRISTCHURCH: Wood-Anderson Short-period seismograph, E-W components.
Pendulum period =0.74 secs.

NEW PLYMOUTH: Wood-Anderson Short-period seismograph, E-W component.
Pendulum period = 0.55 secs.

TUAI: Wood-Anderson Short-period seismograph, N-S component.

Pendulum period = 0.49 secs.

TAKAKA: Imamura Strong-motion seismograph, three components:
Pendulum periods N & S = 6 secs.
Z = 2.5 "

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
Nov.2	W	P	05 02 10	2.0	Epicentre 42.3 S, 173.5 E.
		S	35		
	N	P	05 02 27		
			58		
			03 02		
			13		
	C	P	05 02(09)	1.3	?ΔT
		S	25½		
2	W	P	13 28 01½	1.2	Felt Cook Strait area, max. R-F 5. at Wanganui and CapeJackson.
		S	17		
	N	P?	13 28 04½		Epicentre 40.1 S, 175.0/E.
		S	19½		
	TU	eL?	13 29 21		
	C	?	13 28 56½		
			29 00		
2	W	S	14 21 09		Felt Wanganui, R-F 1-2. Epicentre:-
	N	S	1421 13		Aftershock of above. 40.1S, 175.0 E.
2	W	S	14 26 17		Felt Wanganui, R-F 1-2 Epicentre:-
	N	S	14 26 21		Another aftersho ck. 40.1S, 175.0 E.
2	W	P	18 57 37	1.2	Felt Wanganui R-F 5?
		S	53		Epicentre 40.1 S, 175.0 E.
	N	P	18 57 41½	1.3	
		S	58		
3	W	P	00 25 53	1.2	Aftershock.
		S	26 08½		
	N	S	00 26 13		
4	W	P	14 05 38	1.2	Felt Wanganui R-F 4.
		S	54		Epicentre 40.1 S, 175.0 E as on 2nd.
	N	P	14 05 38	1.2	
		S	54		

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
Nov. 4	W	S	17 41 42		Aftershock.
	N	S	17 41 45		
6	H	P	13 38 (00)	0.4	Felt Waipawa, R-F 4, also Napier and Dannevirke. Epicentre near 39½ S, 177 E.
		S	05		
	TU	P	13 37 48	0.9	
		S	59		
	W	e	13 38 27		
		S	38 42½		
	N		no record.		
6	H	P	13 39 (00)	0.4	Felt as above. Epicentre near 39½ S, 177 E.
		S	05		
	TU	P	13 39 00½	0.9	
		S	11		
	W	S	13 39 54½		
	N		no record.		
	C	S	13 40 59		
7	H	P	20 22 (00)	0.4	Felt as above. Epicentre near 39½ S, 177 E.
		S	05		
	TU	P	20 21 57	0.9	
		S	22 07½		
	N	P	20 22 19	2.25	
		S	47		
	W	P	20 22 19½	2.3	
		S	48		
	C	S?	20 23 53½		
8	TU	P	19 05 57	4.7	Epicentre near 37 S, 177 W.
		S	06 50		
	A	e	19 06.1		
		S?	6.9		
	N	?	19 06 26		
		S?	07 04		
		L	51		
	W	P?	19 06 38	7.2?	
		S	08 00		
	C	e	19 08 35		
		S?	09 06		
8	W	P	19 31 34½	<1	Felt Paraparaumu, R-F 1. Epicentre Cook Strait Region.
		S	42½		
	N	S?	19 32 08		
11	W	?	21 19 14		
		S	41		
	TU	S?	21 19 45		
	C	S?	21 20 26		
14	TU	S	12 39 45		P obscured by artificial vibrations. Epicentre probably near that of 8d. 19h. (37°S, 177 W.)
		L	40 20		
	A	e	12 39.6		
		e	40.7		
	N	?	12 39 53		
			40 13		
		S?	36		
	W	P?	12 39 59		
		S	40 55		
	C	S	12 42 00		
		L	43 41		
15	TU	P	17 10 32	4.5	Epicentre probably near that of 8d.19h. (37°S, 177W.)
		S	11 21		
	A	e	17 10.5		
		L	14.1		
	N	e	17 11 13		
		S?	12 21		
	W	e	17 11 27		
		S	12 32		
		L	13 22		
	C	e	17 13 38		Readings from Galitzin seismographs.
		e	14 13		
		e	27		
		e	15 10		
		i	15 44		

Date 1939	Station	Phase	G.M.T. h. m. s.	Δ deg.	Remarks.
Nov.15	TU	S?	22 22 08		Apparently a smaller shock.from same region. (37S, 177W.)
		L	35		
	W	eP?	22 21 31		
		S	23 17		
		L	24 03		
24	TU	P	15 50 45	2.3	Epicentre near 39.7 S, 180.
		?	53		
		S	51 14		
	W	P	15 51 14	4.2	
		?	19		
		S	52 05		
		M	07		
	C		no record.		
24	R	M	22 45 ca.		Slight shock, felt Rotorua.
25	R	M	21 45 ca.		" " " "
26	R	M	00 45 ca.		" " " "
29	C	S?	8 26 14		Felt Cromwell, R-F 4, and Milford Sound. Epicentre Milford Sound region.
	W	S?	8 27 09		
	M.	S?	8 26 (00)		

In addition, small shocks were recorded as follows:

	d. h. m.	d. h. m.	d. h. m.
Wellington:	4 16 12	4 20 31	9 20 53
	13 17 13 (Δ=0.8°);	15 03 55	15 9 49
	23 04 09 (Δ=1.9°?)	29 20 17 (Δ=1.1°)	29 21 34 (?seismic)
Tuai:	3 12 43 (Δ=0.7°)	5 18 49	7 7 58 (Δ=0.6°)
	7 8 5 (Δ=0.6°)	17 22 07 (Δ=0.7°)	23 04 10
	28 15 14	29 20 03 (Δ=0.6°)	
Hastings:	27 11 42		
New Plymouth:	17 08 42	23 04 10	26 02 06
	26 02 33 (Δ= <1°)	26 19 56	29 20 17
Christchurch:	16 13 35	20 11 11	

NOTES.

No earthquakes were recorded at BUNNYTHORPE, TAKAKA, GREYMOUTH, and MONOWAI.

Shocks not recorded on any instrument were reported felt as follows:

Wanganui Nov. 4d. 19h. Minor tremor.
Hastings 7d. 09h.ca. (Press Report)
Cromwell 30d. 14h.ca. R-F 2.
Kahurangi Point 19d 08h 20m. R-F 4.

In all, 14 shocks were reported felt in the North Island, with maximum R-F 5 at Wanganui; and 4 in the South Island, with maximum R-F 5 at Cape Jackson. One shock was felt in both Islands; making a total of 18 for the whole of New Zealand.

NOTE: "For provisional epicentres in the South-west Pacific for 1939 September, see Bulletin P-93, p. 2."

[S.I.R.—20.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

DOMINION OBSERVATORY, WELLINGTON, NEW ZEALAND.

SEISMOLOGICAL REPORT FROM NEW ZEALAND STATIONS.

The report is divided into two parts:—

Part I gives readings of distant earthquakes (Wellington $\Delta > 10°$ ca.); and Part II gives readings of local earthquakes ($\Delta < 10°$ ca.). But where a local earthquake is likely to have been recorded outside New Zealand, a reference to it is also included in Part I. In both parts, where the clock correction is not known, the time of P (or first phase recorded) is enclosed in a bracket. Whenever they are definitely indicated, the trace amplitude and the direction of the vertical component of P are given. An upward ground movement is designated (+), and a downward movement (—).

In Part II determinations of absolute time are not attempted from Jaggar records, only the intervals between pulses being measured. In many cases the P movements are very small, and the first movement recorded is not necessarily Pn, or any other particular pulse.

Unless otherwise indicated, times recorded refer to the incidence of impulsive movements.

A list of provisional epicentres in New Zealand and the South-west Pacific is appended. The New Zealand epicentres are determined from the records of local stations, and the more distant ones from the readings of as many overseas stations as are available.

List of New Zealand Seismograph Stations.

Station Name and Abbreviation.	Position.		Height above M.S.L.	Lithologic Foundation.	Seismographs.	Observers.
	Latitude.	Longitude.				
			Feet.			
Wellington (W) ..	41° 17′ S	174° 46′ E	401	Greywacke	Milne-Shaw (N-S)* ..	Dominion Observatory, Central Station.
					Galitzin-Wilip (Z)* ..	
					Wood-Andersons (N-S)* and (E-W)*	Acting-Director—R. C. Hayes.
					Jones or Geophone (Z)* ..	Observer—W. M. Jones.
					Imamura (three components)*	
Arapuni (A) ..	38° 5′ S	175° 39′ E	212	Rhyolite tuffs ..	Milne (E-W)*	Powerhouse Superintendent.
Rotorua (R) ..	38° 8′ S	176° 15′ E	930	Rhyolitic silts and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Tuai (TU)	38° 48′ S	177° 9′ E	960	Gravels	Wood-Anderson (N-S)* ..	Mr. H. C. Scott, P.W. Dept.
New Plymouth (N.) ..	39° 4′ S	174° 4′ E	112	Ash, agglomerate, and lava	Wood-Anderson (E-W)* ..	Superintendent, the Prison.
Hastings (H) ..	39° 38′ S	176° 53′ E	35	Alluvial sands, silts, and gravels	Jaggar (NE-SW)	Mr. H. de Denne.
Bunnythorpe (B) ..	40° 17′ S	175° 36′ E	197	Gravels, sands, and silts	Jaggar (NW-SE)	Mr. W. A. Waters.
Takaka (TA) ..	40° 51′ S	172° 48′ E	25	Alluvial gravels ..	Imamura (three components)*	The Postmaster.
Greymouth (G) ..	42° 25′ S	171° 13′ E	14	Deltaic sands and gravels	Jaggar (E-W)	District Engineer, P.W. Dept.
Christchurch (C) ..	43° 32′ S	172° 37′ E	25	Alluvial sands, silts, and gravels	Galitzin (three components)	Magnetic Observatory.
					Wood-Anderson (N-S)* ..	Director—H. F. Skey.
						Observer—H. F. Baird.
Monowai (M) ..	45° 47′ S	167° 37′ E	538	Tertiary sandstone ..	Jaggar (E-W)	Mr. A. Walker.
Chatham Islands (CH)	43° 57′ S	176° 31′ W	210	Volcanic breccia ..	Milne (E-W)*	Superintendent, Radio Station.

* For constants, see station register.

1,000/9/39—9599]

Part I - Distant Earthquakes.

Date 1939	Station *	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Dec.1	W	P	06 38 14		41.5?	
		S?	44 27			
	C	eP	6 39 21		27.7	
		iS E	44 09			
	A	eS?	6 42.5			
5	W	eP	8 44 00		100ca.	
		iSKS	54 47			L-waves follow, with max. at 9h.21m. ca.
	C	eP Z	8 44 22		102±	
		iSKS E	54 54			
	A	SKS?	8 54.5		104ca.	very small movement.
		ScSP?	58.5			
7	W	iP	11 35 35		23.5	Az.=-1mm.
		iS	39 49			Irregular L-waves follow.
	C	iP NZ	11 35 07			May be S.
		eN	39 11	20		
		eLr	45			
	A	L	11 45.0			
16	W	P	10 59 28		83ca.	Az.=-1mm.
		SKS	11 09 37			
		iS	43			Some L-waves follow.
	C	iP Z	10 59 43			
		i NEZ	11 10 23			
	A	SKS?	11 08 ca.			
18	W	P	6 32 03		27.5?	
		S?	36 45			
	C	P	6 32 15		30.7	
		S	37 25			
	A	e	6 33.3			
		eS?	37.0			
18	C	eP	10 29 21		38.4	
		iS	35 25			
	W	P?	10 31 28		23ca?	Focal depth possibly 400 km.ca.
		iS	35 15			
	A	eS	10 35.1			
21	C	eP	21 10 43		62.6±	
		iP	49			
		iNEZ	57			
		iS	19 18			
	N	P	21 10 45		60 ca.	
		S?	18 52			
	W	P	21 10 49		60.5±	Az.= +1mm.
		S?	19 02			
		ScS?	45			Large & confused movements till 21h. 45mca.
	A	iP	21(11.0)		61ca.	
		S?	19.3			
		ScS?	19.8			
22	C	eP Z	4 58 23		100±	
		iSKS	5 08 54			
		Lr Z	33 45			
	W	PP	5 02 28		105ca.	
		SKS	08 46			
		SS	17 20			
		Lr	32.5	25		L-waves reach max. about 5h.39m.
	A	eSKS	5(08.6)			
		SS	17.5			
		Lr	33ca.			
27	W	iPKP?	00 16 47			
		i H	20 10			PKS or PP?
		i Z	33 15			PPS?
		eSS	40+			
		Lq?	58+	25-50		
		Lr?	01 09 ca.	25-40		Large amplitudes follow till 2h.03m. ca.

* See list of Stations on Title page.

Date 1939	Station	Phase	G.M.T. h. m. s.	Period sec.	Δ deg.	Remarks.
Dec.27 (cont.)	C	e Z	00 16 49			small comp.
		i Z	17 05			
		i Z	20 20			
		SKKS E	28 28			
		SKSP E	31 57			
		PPS	33 19			
		Lq	59 15			
			01 30 ca.			Larger waves from later shock.
	A	e	00 22 ca.			small and indefinite.
		i	0 45.8			
		Lq	58			
		Lr	01 11			
	N		00 17+		v	Tremor

In addition, minor activity was recorded as follows.

WELLINGTON:	d. h. m.	d. h.m.	d. h. m.	d. h. m.	d. h. m.
	12 17 31	13 14 04 (L?)	14 18 24	17 08 12 (L)	25 16 42
	25 22 23 (L)	26 12 44	27 03 11ca. (L)	28 00 12 (L)	31 13 30ca.
CHRISTCHURCH:	1 16 52ca.	13 14 02ca.	25 16 32ca.	25 22 22ca.	25 23 08ca.
	26 12 44ca.	27 23 55ca. (S)	28 03 42	30 11 46ca.	
ARAPUNI:	12 17 30ca.	13 14 02	17 08+	25 16 39	28 00 11

Part II- Local Earthquakes.

The principal local shocks were as follows:

Date 1939	Origin Time G.M.T. h. m.	Provisional Epicentre Lat.	Long.	Stations Recording shock.	Remarks.
Dec.3	00 11.1	Takaka region		W, N.	Felt Upper Takaka, R-F 3.
6	17 51.6	Cook Strait region		W, N.	Felt Paraparaumu, R-F 3.
9	18 56.3	41 S	176 E.	B,W,TU,C.	Felt southern part of North Island about Cook Strait, max. R-F 4.
25	23 08.2	Within Christchurch	0.5° of	C.	Felt in parts of Canterbury, R-F4
27	13 53.8	39 S	176½E	W,N,C.	Probably deeper than normal.
30	19 12.4	42 S	178 E	W,B,C.	Felt eastern and southern parts of North Isl and, and about Cook Strait, max.R-F 5. Probably deeper than normal.

The number of additional small shocks recorded was as follows:

Wellington 14 — Tuai 13 (no records after Dec.23 owing to suspension breaking)
New Plymouth 4 (records interrupted by clock trouble after Dec.28)
Hastings 1 (no records available after Dec.24)
Christchurch 3

Shocks not recorded on any instrument were reported felt as follows:

d. h. m.	
Dec. 10 03 ca.	Foxton, minor tremor.
10 13 30	Rotorua, Series of shocks.
10 16 30	Rotorua, R-F 4.
13 02 08½	Hastings, Very slight.
22 15 48	Cape Maria Van Diemen, R-F 4.
29 19 47	Gisborne, Motu, R-F 3.