



SEISMOLOGICAL REPORT

OF THE

APIA OBSERVATORY, SAMOA,

1923, JULY, TO 1924, DECEMBER.

Latitude, $13^{\circ} 48' 26''$ S.; longitude, 11h. 27m. 6s. W. (= $171^{\circ} 46' 30''$ W.)
Height above sea-level, 2 metres.

DIRECTOR—A. THOMSON. SEISMOLOGIST—C. J. WESTLAND.

Instruments: Wiechert horizontal seismograph, M = 1000 k.g.
Wiechert vertical seismograph, M = 180 k.g.

THIS report deals with 364 earth-movements of all descriptions. Twenty-two of these are distant earthquakes, and 58 are from epicentres within a few hundred miles of Apia.

The remainder, 284 in number, are local shocks, and are all small. Sixty-one of these have been included in the tabulated data, but only 14 of them have been reported as having been felt. Judging by the period and the ground-movement in the other 47, it is possible that some may have been felt by a few individuals who have not reported them, but they must have been very slight.

The large number remaining—viz., 223—have been put in a separate catalogue. They are all very small movements, recorded clearly enough, but certainly much too small to be felt. No attempt has been made to measure the ground-movement, because it is always small and could not be determined with precision. The frequency with which they occur is really the most important point to be considered. The average is 12 per month, and the record is as follows:—

1923—July 12, August 11, September and October (record incomplete),
November 14, December 7.

1924—January 19, February 14, March 9, April 12, May 20, June 19,
July 11, August 12, September 15, October 12, November 15, December
21.

The figures at present available show no sign of a seasonal distribution, and the times of their occurrence are found to be spread over the twenty-four hours of the day without any indication of a diurnal variation. Nor does there seem to be any connection between these small shocks and the size of the microseisms which appear on the records. The largest microseisms generally occur when heavy seas are breaking on the reef, and may be ascribed directly to the effect thereof. Microseisms of undoubted seismic origin are not usually prominent.

The constants of the instruments on December 16, 1924, are given herewith, and they may be regarded as typical of the values found on other dates:—

				E.	N.	V.
T	..	..	..	8.5	8.8	2.3
e	..	..	..	2.0	2.0	2.0
V	..	..	..	126	155	87

The catalogue of epicentres in 1922 given at the end of this report is a continuation of the catalogue from 1913 to 1921, already published. These have been determined by the same methods that were used in studying the epicentres of earthquakes in 1921.

C. J. WESTLAND, Seismologist.

The Observatory, Apia, Samoa, March 1, 1925.

Date.	Character.	Phase.	G.M.T.	T.	AE.	AN.	AV.	Remarks.
1923.			h. m. s.	s.				
July 4	..	e	23 3	20	..	45	..	Distant earthquake.
7	Iv	e	12 49					
		M	12 52					
		F	13 0					
10	..	..	8 33	1	45	20	10	
12	Iv	e	3 18		..	..	..	F after 4h.
		M	3 21	..	..	..	..
12	..	M	10 18	6	30	40	..	
13	..	M	11 54	20	..	65	..	Distant earthquake.
			16 5	4	..	20	..	
15	Iv	M	17 55	3	..	30	..	Distant earthquake.
22	..	..	14 55	24	..	80	..	Felt in Apia. 2 RF.
23	..	..	23 39	1	..	..	40	
Aug. 6	..	e	23 4 19	..	..	..	16	
		M	23 4 54	1	50	50	20	
12	..	e	9 31 54		..	..	..
		M	9 32 30	1	..	..	50	
14	..	..	21 28	..	45	35	20	
21	..	e	2 37 48		..	..	..
		M	2 38 30	1	15	15	5	
24	..	e	1 43 12		..	..	..
		M	1 43 34	1	45	45	10	
24	..	e	5 25 34		..	..	..
		M	5 29	3	25	50	5	
Sept. 1	IIIu	P	3 9 44	2	..	..	1	Horizontal seismograph not working.
			3 12 23		..	..	..
			3 13 23		..	..	..
			3 15 17		..	..	..
		S	3 19 7	6	..	..	14	D = 72½°. O = 2h. 58m.
			3 29 37	30(?)	..	..	..	17s. Reported from
			3 29 50	23	..	..	930	Japan.
		M	3 31 35	23	..	..	1100	
			3 38 0	18	..	..	350	
			3 50 0	20	..	..	220	
			4 0 0	20	..	..	175	
2	..	Fv	4 25		..	..	..
12	Iv	M	3 23	25	..	..	200	Distant earthquake.
		i	5 55 28		..	..	..
		M	5 56 38	1	..	..	40	
		Fv	6 5		..	..	..
12	Iv	i	12 43 16		..	..	..
		M	12 43 54	1	..	..	20	
13	Iv	e	20 16 29		..	..	..
		M	20 17 24	1	..	..	15	
19	..	e ₁	8 23 48	1	..	..	6	
		e ₂	8 24 15	1	..	..	7	
21	Iv	e	11 57 58		..	..	..
		M ₁	11 58 25	..	..	..	6	
28	..	..	3 13	1	..	..	3	
29	Iv	e	12 16 7	..	..	..	40	
		M	12 16 25	1	..	..	120	Felt in Apia. 3 RF.
		Fv	12 25		..	..	..
Oct. 1	..	..	22 32	1	..	..	20	
6	..	..	7 2	1	..	..	3	
28	..	..	4 33	..	15	17	..	Noise heard; no motion felt.
29	..	M	17 20	1	25	15	30	
31	Iv	P	16 19 17	1	3	7	32	D = 2°. Azim. 23° S.W.
		M	16 19 40	1	40	25	60	O = 16h. 18m. 48s.
		F	16 26	..	..	..	..	Felt in Apia. 2 RF.

Date.	Character.	Phase.	G.M.T.	T.	AE.	AN.	AV.	Remarks.
1923.			h. m. s.	s.				
Nov. 2	IIIr	e	21 14 59	1	2	..	..	D = 34°. Azim. 70° N.W.
		P	21 15 42	2	16	6	2	Lat. 6° S.; long. 156° E.
			21 16 57	2	8	9	1	O = 21h. 8m. 30s.
			21 17 36	2	15	10	..	
		PS	21 20 8	5	12	..	..
		S	21 21 18	9	13	10	..	
		L	21 23 18		..	..	..
		M ₁	21 26	20	590	800	350	
		M ₂	21 30	14	280	480	280	
		F	22 20		..	..	..
3	..	M	16 56	20	5	65	..	Distant earthquake.
4	IIr	eP	0 11 36	3	2	7	1	D = 34°. Azim. N.W.
		S	0 17 13	11	4	6	..	O = 0h. 4m. 34s. Pos-
		L	0 19 53	20	65	105	..	sibly from same epicentre
		M ₁	0 21 30	22	70	150	..	as shock on Nov. 2.
		M ₂	0 24 30	22	..	..	105	
		F	0 55		..	..	..
5	..	e	21 44	4	1	3	..	
		e ₂	21 51	16	..	15	..	
		e ₃	22 2	22	3	70	..	
		F	22 30		..	..	..
7	..	..	7 28	1	65	60	3	
10	..	e ₁	21 27	1	3	..	2	
		e ₂	21 36	12	..	7	..	
16	Iv	P	18 32 48	1	5	9	6	
		Mv	18 33 48	..	..	..	20	
16	..	L	0 34 16	8	80	50	..	D = 5½°. Azim. 30° S.W.
		M	0 34 50	7	100	70	..	Lat. 18° S.; long. 173° W.
		F	19		..	..	..
17	Iv	P	2 0 55	1	5	3	5	
		L	2 1 44	4	18	10	16	
21	Iv	i	10 11 17	1	27	24	23	Felt in Apia. 2 RF.
		e	10 11 38	2	..	130	80	
			10 12 22	2	..	170	62	
Dec. 4	..	..	15 55	1	18	24	..	
6	..	..	18 35	1	24	20	3	
7	..	..	10 46	1	60	27	8	
10	..	..	17 20	1	50	25	10	
15	..	..	13 33	1	60	35	9	Felt in Apia. 2 RF.
15	..	..	23 39	1	22	14	6	
25	..	..	23 51	1	28	10	..	
27	Iv	e	10 33	1	..	..	..
		M	10 35	5	12	8	12	
1924.								
Jan. 1	..	M	0 1	1	70	40	9	Felt in Apia. 2 RF.
16	Iv	P	21 40 14	1	8	..	4	D = 5½°. Lat. 18° S.; long.
		S	21 41 19		..	..	..	173° W. Reported from
		M	21 42 29	2	55	90	30	Nukualofa.
		F	22 0		..	..	..
22	..	..	9 43	1	25	33	10	Felt in Apia. 2 RF.
29	IIu	..	2 48	16	..	..	..	Distant; reported from
Feb. 6	Iv	e	21 18 14	1	3	..	3	Chile.
		M	21 19 4	4	15	28	..	
		F	21 26		..	..	..
22	..	..	6 35	1	32	30	4	
Mar. 4	..	L	10 50	18	16	26	..	Distant; reported from
9	..	e	12 34 13	1	18	8	12	Costa Rica.
		M	12 34 36	1	75	130	40	Felt in Apia. 2 RF.
		F	12 42		..	..	..
19	..	e	10 42		..	..	..
		M	10 48	4	12	9	..	

Date	Character.	Phase.	G.M.T.	T.	AE.	AN.	AV.	Remarks.
1924.			h. m. s.	s.				
Mar. 26	..	e	14 50					
		M	14 52	8	..	25		
		F	15 6					
- 26	..	e	20 4 30					
		M	20 7	8	115	155	40	
		F	20 30					
27	..	e	21 41					
		M	21 42	1	300	210	5	
April 6	..	..	13 55	1	30	23		
- 14	Iv	e ₁	8 58 14	..	..	..	..	Small, doubtful. From epicentre near Keppel Island Lat. 15° S.; long. 172° W.
		e ₂	8 59 30	1	6	13	8	
		L	8 59 47	4				
		M ₁	9 0 49	4	30			
		M ₂	9 2 51	4	..	240	25	
		F	9 30					
- 14	IIIu	eP	16 31 28	..	..	..	..	D = 67°. O = 16h. 20m. 36s. Mindanao Island.
			16 31 34	2	10	12	1	
			16 34 17	3	10			
		PR	16 34 51	3	..	8		
			16 38 36	6	4			
		PS	16 40 2					
			16 44 27	11	..	26		
		L	16 48 7	16	63	200		
		M	16 55	16	210	250		
		F	18					
			19 6	..	..	8	..	Repetition; major arc.
16	..	..	19 59	1	60	25	30	Felt in Apia, also in Pago Pago.
18	..	e ₁	11 10					
		M ₁	11 12	8	5	4		
		M ₂	11 17	8	9	20		
		F	11 24					
21	..	e ₁	0 36					
21	..	M	0 37	1	70	100	25	Felt in Apia. 2 RF.
		F	0 45					
		e	16 52					
		F	17					
22	Iv	e	21 41					
		M ₁	21 45	8	6	20	20	
		F	21 50					
- 29	Iv	e ₁	20 59 7	2	2	8		
		e ₂	21 0 24	4	15	6	4	
			21 0 53	9	16	25	20	
		L	21 2 0	12	50	125		
		M	21 3 45	12	210	135		
		F	22					
- 30	..	P	4 3 55	2	2	5	..	A series of shocks, possibly from epicentre near Ker madee Islands.
		S	4 7 42	8	4			
			4 10 2	9	8	3		
		L	4 10 26	10	..	9		
			4 10 42	10	46			
			4 12	9	..	20		
			4 24	9	17	35		
			4 30	9	10	24		
- 30	..	P	5 12 17	2	2	4	..	D = 18°. Azim. 27° S.W.
		SE	5 15 40	7	2			
		SN	5 15 45	8	..	2		
		L	5 16 12	14	25			
			5 20 57	14	60			
			5 21 30	16	..	60		
			5 32	11	15			
			5 36	10	35			
		F	6					

Date	Character.	Phase.	G.M.T.	T.	AE.	AN.	AV.	Remarks.
1924.			h. m. s.	s.				
May 2	..	M ₁	2 35	9	30	30		
		M ₂	2 41	9	40	45		
4	..	..	8 1	1	23	13	2	
- 4	Iv	P	16 54 18	..	..	..	..	In minute mark, uncertain, probably in Tongan Deep.
			16 54 22	1	110	75	15	
		L	16 55 57	4	315	220	210	
		Mv	16 56 30	3	..	..	230	Motion small after 17h. 14m.
		F	18 10					
- 6	Iv	e	2 55	2	2	3		
		M	3 5	12	10	16		
- 10	Iv	e	2 58 45					
		M	3 1	8	..	12		
		F	3 30					
12	..	M	22 25	8	4	6		
14	..	..	23 42	1	215	170	95	Felt in Apia. 3 RF.
16	..	e	22 53 40					
		M	22 57 20	5	40	25	50	
- 17	Iv	e	3 49 5	2				
		L	3 50 17	10	30	40	50	
		M	3 51	9	180	205	80	
		F	4 10					
22	..	..	19 12					
- 25	Iv	P	13 48 52	2	13	11	2	
		S	13 50 0	2	..	..	2	
		L	13 50 23	5	30	28		
		F	14 10					
June 10	Iv	..	14 14	1	18	15	3	
			14 15	4	10	11	2	
10	..	e ₁	5 6					
		F	5 24					
12	..	..	17 27	1	18	15	5	
			17 28	1	210	205	25	Felt in Apia. 3 RF.
- 25	Iv	Pe	16 18 42					
		S	16 20 16					
		MN	16 21 4	6	..	23		
		ME	16 22 26	7	26			
		F	16 35					
- 26	IIIu	P	1 45 27	2	..	..	1	D = 48°. O = 1h. 36m. 37s. Lat. 58° S.; long. 163° E.
			1 45 33	7	21	30		
			1 50 18	16				
		S	1 52 29					
		L	1 59	18	370	380		
		Mv	2 2	32	..	..	..	Period uncertain.
			2 2	16	440	450	150	
		ME	2 7	14	746	..	160	
		MN	2 8	13	..	580	140	
			2 16	12	150	190	60	
			2 20	10	75	80	40	
			2 28	9	40			
		C	2 31					
		F	5 5	12	3	..	..	This may be M rep. 2.
26	..	M	11 30	10	12			
27	..	e	22 23					
		F	22 34					
28	..	..	22 11	10	20			
- 30	Iu	e ₁	15 55.8	..	..	..	..	Small and difficult to measure.
			16 0.9					
			16 5.3					
			16 12.7	20	35			
		M	16 15	15	50	20		
		F	16 45					

Date.	Character.	Phase.	G.M.T.	T.	AE.	AN.	AV.	Remarks.
1924.			h. m. s.	s.				
July 4	..	..	4 9	1	20	16		
7	IIv	P	2 40 32	2	35	12	1	Too near and too violent for this seismograph.
		L	2 40 41	2	104	50	6	
			2 42 32	7	300	300	100	
			2 42 52	6	300	300	170	
			2 43 31	6	300	300	200	
			2 46	6	130	150	35	Amplitude now diminishes rapidly.
			3 0	6	25	14	5	
		F	4 0					
7	..	e	10 47	..	..	..	..	Obscured by previous quake; overlapping.
		M	10 48	7	20	30		
		F	10 55					
8	..	e	20 48					
		M	20 53	8	4	6		
		F	21 3					
12	..	..	21 20	1	18	8		
23	..	..	20 23	1	18	12		
24	IIr	eP	5 3 24	..	..	..	..	0 = 4h. 55m. 3s. Distance 44°. Lat. 50° S.; long. 157° E.
			5 3 35	2	20	17		
		PR ₁	5 5 16	5	8			
		S	5 10 1	8	23			
			5 13 29	20	70			
			5 18 9	14	50	40		
		M ₁	5 20 19	12	100			
		M ₂	5 20 53	11	65			
		M ₃	5 23 19	10	..	60	15	
		C	5 26					
		F	6 20					
26	..	..	11 8	1	22	30	10	
Aug. 1	..	..	14 8	1	20	25		
3	..	..	21 20	1	110	55	15	
6	Iv	e ₁	0 24	..	..	..	..	Small.
		e ₂	0 26	2	5	3		
		M ₁	0 27 30	9	50	15		
		M ₂	0 28 50	8	..	..	12	
		M ₃	0 34 50	8	35	60		
		F	1 15					
10	..	e	6 15					
		M	6 25	12	15	..	..	F. after 7h.
14	..	P	18 14 0	4	4	..	..	D = 66° (Japan?)
		S	18 22 48					
			18 32	12	5			
		L	18 33 30	24	50	..	..	N. arm not working well.
		F	19 30					
17	..	e	10 53					
		M	10 57	8	7			
18	..	..	17 7	1	35	20	12	
20	..	..	10 22	12	..	14	..	L waves of small v shocks, probably.
20	..	..	10 28	12	..	26	..	
24	..	..	20 6	1	20	15		
30	..	P	3 15 56	4	7	7	..	Near Philippine Is.
		S	3 24 50	9	..	6		
			3 33 20	12	14			
		L	3 35 43	20	24			
		M	3 39	20	40	..	..	F after 4h.
Sept. 6	..	e	20 29					
		F	20 33					
7	..	..	11 54	1	27	25	2	
8	..	..	23 10	1	20	12		
13	..	..	15 2	1	120	95	45	
14	..	M	14 46	21	10	..	..	Distant earthquake.

Date.	Character.	Phase.	G.M.T.	T.	AE.	AN.	AV.	Remarks.
1924.			h. m. s.	s.				
Sept. 18	..	e	3 8					
		M	3 19	8	20	5	..	Not clear.
19	Iv	eP	6 52 18	..	..	..	..	Small. D = 6°. Probably in Tongan Deep.
		L	6 53 31	12	15	120	20	
		M	6 54 45	9	130	250	16	
		F	7 20					
29	..	..	8 3	1	23	20		
29	..	..	9 19	1	27	20		
Oct. 9	..	..	12 48	1	36	22		
10	..	..	0 6	1	22	12		
14	..	e	4 43					
		M	4 48	5	6	30		
14	..	..	18 36	1	88	45	20	Felt in Apia. 2 RF.
20	..	e ₁	20 15	..	..	..	..	Distant earthquake (Japan?)
		e ₂	20 28	25	..	8		
		e ₃	20 32	20	..	11		
Nov. 2	..	e	18 26					
		M	18 30	9	10	8		
5	Iv	eP	8 33 13					
		L	8 34 9	9	44	17		
		M ₁	8 35 5	9	88	40		
		M ₂	8 40 3	9	..	40	12	
12	..	..	4 57	1	28	12	7	
13	Ir	e	8 35 21	..	..	..	..	Confused. D = 19°. Azim. S.W. Probably from epicentre near Kermadec Is.
		iP	8 35 37	2	4	6		
			8 36 9	3	3	4		
		S	8 39 9					
		L	8 39 30	12	105	10		
		M ₁	8 41 50	12	215	84	25	
		M ₂	8 51 50	10	135	100	35	
		F	10					
28	..	e	5 10 40	1	10	4	1	
		M	5 11 13	1	100	80	28	Felt in Apia. 2 RF.
		F	6 20					
29	..	..	6 38	1	26	15		
Dec. 1	..	e	22 57 51	1	8	13	18	
		M	22 58 50	1	..	320	160	Felt in Apia. 3 RF. Pen of E.W. arm thrown off.
		F	23 40					
2	..	..	10 31	1	35	15	4	
5	..	eP	0 16 10	1	1	..	1	
		L	0 16 30	1	35	15	2	
6	..	P	20 38 28	..	..	..	..	D = 5°. In Tongan Deep, probably.
		L	20 39 25					
		M	20 44 20	9	7	13		
12	..	e ₁	9 13 13					
		e ₂	9 14 30					
		M	9 20	12	..	17		
15	..	e	20 53 45	..	..	..	..	Two or more small v shocks.
		F	21 5					
24	..	..	2 57	8	2	2	..	Difficult to read.
24	..	e	22 5	1	10	8	3	
		M	22 6	1	130	90	25	
		F	22 30					
25	..	e	23 34 46	1				
		M	23 36 52	1				
28	..	M ₁	23 32	20	..	50		
		M ₂	23 45	16	..	15		
30	..	eP	15 27 21					
		L	15 28 33					
		M	15 30	10	..	60	2	
		F	16 20					

A CATALOGUE OF 223 SMALL LOCAL EARTHQUAKES NOT INCLUDED ELSEWHERE
IN THIS REPORT.

1923.	h. m.	1924.	h. m.	1924.	h. m.	1924.	h. m.
July 3	18 28	Jan. 22	20 16	May 19	15 18	Sept. 14	19 30
5	8 12	24	5 2	26	12 42	21	5 11
5	14 25	24	16 25	27	2 13	23	20 36
11	3 2	24	23 46	27	17 37	26	12 43
12	1 30	25	6 49	28	4 30	28	4 56
16	3 37	25	17 49	28	19 33	30	11 46
18	16 7	26	6 13	29	5 19	30	18 11
20	23 28	30	14 2	June 3	11 55	30	22 24
23	4 16	Feb. 1	13 26	7	13 59	Oct. 1	4 2
25	11 35	5	13 21	7	14 37	5	12 38
29	1 38	6	13 55	10	5 34	7	16 29
31	19 22	7	10 22	11	21 23	8	7 27
Aug. 1	12 25	7	19 26	11	22 46	9	16 54
2	4 50	8	6 0	11	23 18	10	9 44
9	21 9	9	16 52	12	12 55	15	10 13
9	23 33	10	22 20	12	13 35	15	13 15
15	17 35	13	10 19	14	5 3	18	20 52
15	18 1	18	9 6	14	8 39	20	16 18
18	5 36	18	16 42	19	17 1	29	8 53
18	7 56	20	20 19	21	3 44	29	11 33
20	0 4	21	12 11	22	2 58	Nov. 1	6 21
20	1 30	25	18 58	24	11 4	2	5 48
20	20 44	Mar. 5	23 11	29	4 13	3	23 52
Nov. 6	12 24	9	11 58	29	13 3	4	14 26
10	23 49	9	17 18	29	19 58	5	8 19
11	1 20	19	12 9	30	17 10	6	13 11
11	12 8	22	0 31	July 4	21 34	9	22 41
12	8 3	22	19 50	4	22 32	10	12 20
14	7 40	24	23 44	5	15 44	16	10 5
16	21 7	28	22 1	5	18 30	16	10 50
16	23 4	31	4 11	14	23 57	20	9 15
17	4 28	April 3	3 22	24	2 47	26	0 2
20	19 20	8	22 21	24	10 38	26	0 14
25	6 56	10	8 28	26	12 43	26	10 33
25	11 1	15	0 17	28	1 26	26	21 2
25	17 43	15	11 24	31	15 9	Dec. 1	3 19
27	23 54	17	10 3	31	18 30	1	10 1
Dec. 14	10 12	17	12 13	Aug. 2	13 7	3	12 42
20	1 0	18	21 46	2	18 58	4	6 21
Three small shocks.		21	20 40	4	14 47	4	17 16
21	5 24	21	21 38	11	0 43	6	6 2
22	10 20	22	12 38	19	20 26	6	10 59
24	10 5	30	23 39	20	10 1	6	11 2
1924.		May 1	22 12	21	6 1	6	14 37
Jan. 1	16 0	2	17 37	22	6 18	9	21 25
5	11 11	2	19 17	23	19 9	11	4 13
9	13 48	4	21 53	25	1 6	11	20 33
10	1 59	6	22 1	26	5 15	12	3 47
10	5 8	7	5 48	30	23 32	12	21 49
12	16 48	8	12 55	Sept. 4	0 5	17	16 41
15	13 27	9	23 23	4	7 0	17	17 50
18	14 51	10	5 30	5	9 5	18	2 55
18	16 28	11	6 36	11	23 10	21	2 21
18	16 52	13	3 16	13	8 46	21	21 14
21	16 25	14	1 45	13	19 30	26	12 47
		15	22 30	14	17 53	31	13 13

EPICENTRES OF EARTHQUAKES REGISTERED AT APIA DURING 1922.

No.	O.	D.	P.	S.	Lat.	Long.	AE.	AN.	AV.
	d.	h. m. s.	°	h. m. s.	h. m. s.	°	°		
119	Jan. 31	19 47 45	1-5	19 48 6	..	15 S. 172 W.	300	300	200
120	31	13 17 17	71	13 28 34	13 37 51	43 N. 126 W.	200	150	..
121	April 25	21 18 4	26	21 23 50	21 28 10	26 S. 168 E.	20	..	60
122	25	21 38 37	26	21 44 23	21 49 0	26 S. 168 E.	30	20	60
123	May 12	18 39 28	19	18 43 55	18 47 24	24 S. 170 E.	28	40	..
124	Nov. 11	4 33 0	91	4 45 59	4 57 3	29 S. 73 W.	490	250	800
125	Dec. 25	3 33 20	32	3 40 ?	..	43 S. 174 E.	20	25	..

No. 120 at sea off California; reported from several places on coast. No. 124 reported from Chile. No. 125 reported from New Zealand.

By Authority: W. A. G. SKINNER, Government Printer, Wellington.—1925.

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