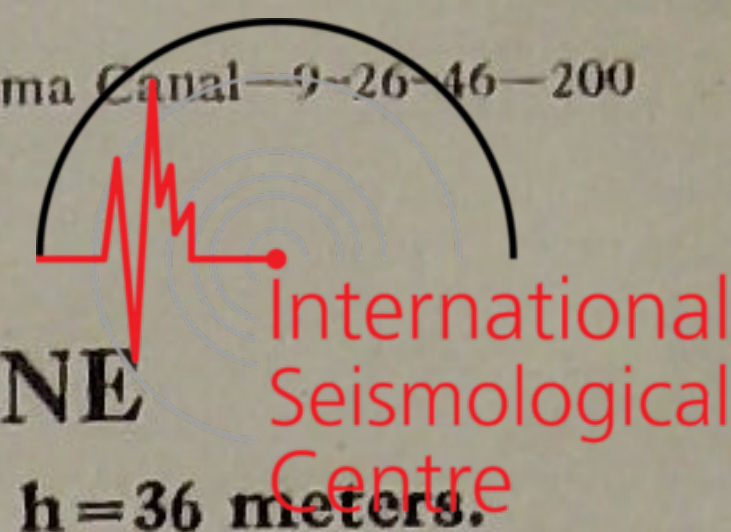


**THE PANAMA CANAL**  
DEPARTMENT OF OPERATION AND MAINTENANCE  
SECTION OF METEOROLOGY AND HYDROGRAPHY



**SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE**

Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h=36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 1.0 sec.

**INSTRUMENTS—FIXED CONSTANTS**

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100 kg.

**INSTRUMENTS—DETERMINED CONSTANTS**

INSTRUMENTS	COMPONENT	T.	V	G	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	" " "
Bosch-Omori )	Not in operation.				
Bosch-Omori )					

Month JANUARY, 1949.

Page No. 1

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
<p>Maximum trace amplitudes are tabulated for each phase whenever the maximum amplitude for either component exceeds 3.0 millimeters. No entry in the amplitude column indicates an amplitude of less than 3.0 millimeters.</p> <p>Approximate distances are given whenever the P and S phases seem clear and distinct. For earthquakes distant less than 300 statute miles local tables are used. For earthquakes distant more than 300 statute miles the 1932 Edition of Jeffrey's Tables is used. Whenever the beginning of the P and S phases is indistinct, earthquakes are roughly classified as NEARBY or DISTANT depending upon whether the character of the record indicates an epicenter distant less or more respectively than 300 statute miles.</p> <p>All earthquakes felt in any degree by any residents of the Canal Zone are rated on the MODIFIED MERCALLI SCALE.</p>							
# 1 Jan. 2	e P e F	4:59:21 5:00:06 5:02					Nearby
# 2 Jan. 9	1 P 1 S F	7:49:22 7:50:21 7:57			3.2 N 2.5 E		Approximate distance 285 miles.
# 3 Jan. 22	e P e S F	9:38:55 9:39:36 9:43					Approximate distance 200 miles.
# 4 Jan. 24	1 P 1 S F	21:53:28 21:54:16 21:59			4.4 N 3.3 E		Approximate distance 230 miles.
# 5 Jan. 25	e F	7:54:44 8:00					Distant
<p>G. E. Matthew, Chief Hydrographer.</p>							



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## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

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### INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100 kg.

### INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	G	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	"
Bosch-Omori	Not in Operation				
Bosch-Omori					

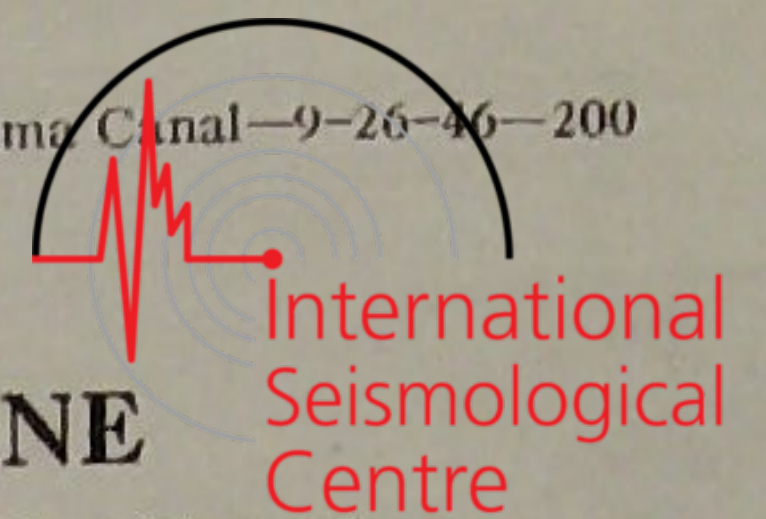
Month February, 1949Page No. 2

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#6 Feb. 7	1P	18	41	22		7.5N 5.0E	Approximate distance 150 miles
	1S	18	41	52			
	F	18	45				
#7 Feb. 11	1P	14	45	35		5.0N 2.5E	Nearby
	1	14	46	12			
	F	14	51				
#8 Feb. 19	eP	20	24	14			Approximate distance 390 miles
	1S	20	25	18			
	F	20	28				
#9 Feb. 20	eP	06	52	48		4.5N 3.0E	Approximate distance 115 miles
	1S	06	53	12			
	F	06	56				

G. E. MATTHEW  
Chief Hydrographer



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DEPARTMENT OF OPERATION AND MAINTENANCE  
SECTION OF METEOROLOGY AND HYDROGRAPHY



**SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE**

Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h=36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 1.0 sec.

**INSTRUMENTS—FIXED CONSTANTS**

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100 kg.

**INSTRUMENTS—DETERMINED CONSTANTS**

INSTRUMENTS	COMPONENT	T.	V	C	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori	Not in Operation				
Bosch-Omori					

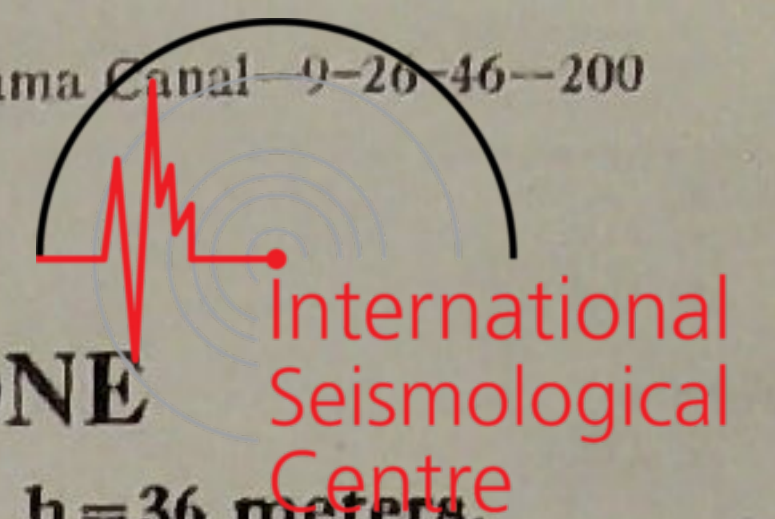
Month March 1949Page No. 3

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE	REMARKS
		h	m	s			
#10 Mar. 4	oP	10	38	08			Provisional epicenter is located by the U.S. Coast and Geodetic Survey in lat. 37° N. Long. 70° E., near Afghanistan. This indicates a distance of approximately 8,800 miles from Balboa Heights.
	F	11	09				
#11 March 17	o	16	45	57			Nearby
	oS	16	46	18			
	F	16	49				
#12 March 19	oP	03	41	07			11.0N Approximate distance 110 miles
	oS	03	41	30			
	F	03	45				
#13 March 25	oP	12	25	50			Approximate distance 150 miles
	oS	12	26	21		6.4 N 3.5 E	
	F	12	30				
#14 March 30	oP	2	00	48		11.0N	Intensity I Felt by attendants at meeting at Balboa School Building Approximate distance 120 miles
	oS	2	01	13		- E 34.5N	
	F	2	05			- E	
#15 March 30	oP	5	33	39		5.0 N	Nearby
	F	5	38			- E	

G. E. MATTHEW  
Chief Hydrographer



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INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100 kg.

### INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	Q	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori	Not in Operation.				
Bosch-Omori					

Month APRIL 1949Page No. 4

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#16 APR. 4	1P	13	15	03			
	1S	13	15	38		9.0 N 8.5 E	
	F	Merged with #17					Approximate distance 170 miles
#17 APR. 4	oP	13	18	54			
	1S	13	19	29			
	F	13	21				Approximate distance 170 miles
#18 APR. 7	oP	6	13	43			
	1S	6	14	23			
	F	6	17				Approximate distance 190 miles
#19 APR. 9	1P	4	21	10			
	o	4	22	06			
	F	4	30				Nearby
#20 APR. 13	o	20	04	49			
	oL	20	24				
	F	20	30				Distant
#21 APR. 20	o	3	37	36			
	o	3	44	48			
	F	4	02				Distant
#22 APR. 24	oP	1	06	21			
	oS	1	06	50			
	F	1	09				Approximate distance 140 miles
#23 APR. 24	1P	15	10	37			
	1S	15	11	03		7.5 N	
	F	15	13			7.0 E	Approximate distance 125 miles



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

APRIL 1949

5

Month

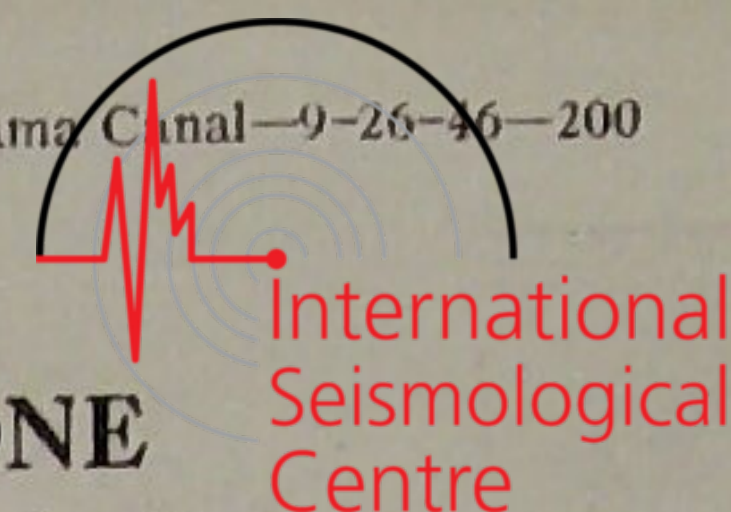
Page No.

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#24 APR. 25	1P e S F	14	01	12			Approximate distance 2100 miles
#25 APR. 26	1P 1S F	19	45	08 33 49		17.5 M 15.0 E	Approximate distance 120 miles
#26 APR. 27	1P e F	4	01	47 28 05			Nearby
#27 APR. 30	eP F	1	43	07 55			Distant

G. B. MATTHEW  
Chief Hydrographer



**THE PANAMA CANAL**  
DEPARTMENT OF OPERATION AND MAINTENANCE  
SECTION OF METEOROLOGY AND HYDROGRAPHY



**SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE**

Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h=36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 1.0 sec.

**INSTRUMENTS—FIXED CONSTANTS**

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100 kg.

**INSTRUMENTS—DETERMINED CONSTANTS**

INSTRUMENTS	COMPONENT	T.	V	Q	DETERMINED
Wood-Anderson	NS	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	NW	1.0	1370	18 to 1	"
Bosch-Omori	} <b>Not in Operation</b>				
Bosch-Omori					

Month May 1949

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No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#28 May 1	ep es F	0	22	42 26 26			Nearby
No record 11:15 to 12:15 G.C.T., May 2							
#29 May 13	1P 1S F	12	34	12 37 36			Approximate distance 120 miles

G. E. MATTHEW  
Chief Hydrographer



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INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
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**INSTRUMENTS—DETERMINED CONSTANTS**

INSTRUMENTS	COMPONENT	T.	V	G	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori	} <b>Not in Operation.</b>				
Bosch-Omori					

Month June 1949

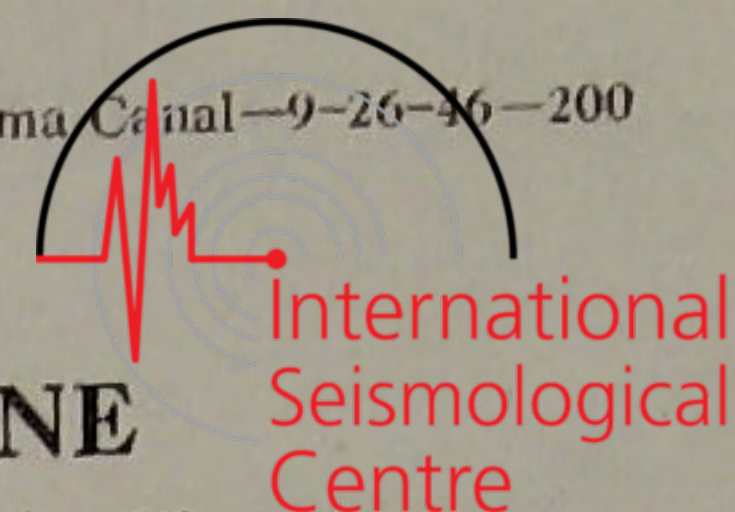
Page No. 7

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#30 June 1	eP	23	27	00			Approximate distance 40 miles
	IS	23	27	08			
	F	23	29				
#31 June 10	1P	20	19	53			Approximate distance 185 miles
	IS	20	20	32			
	F	20	23				
#32 June 11	e	7	36	58			Distant - Very faint trace
	F	7	44				
#33 June 12	eP	7	18	09			Approximate distance 145 miles
	IS	7	18	34			
	F	7	20				
#34 June 13	e	17	59	12			Distant - faint trace
	I	18	02	39			
	F	18	09				
#35 June 14	e	14	08	34			Distant
	e	14	09	59			
	F	14	12				
#36 June 27	eP	4	40	04			Approximate distance 200 miles
	eS	4	40	46			
	F	4	42				

G. E. MATTHEW  
Chief Hydrographer



THE PANAMA CANAL,  
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INSTRUMENTS	COMPONENT	T.	V	ε	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1949
Wood-Anderson	E-W	1.0	1370	18 to 1	
Bosch-Omori	Not in operation				
Bosch-Omori					

Month July 1949Page No. 8

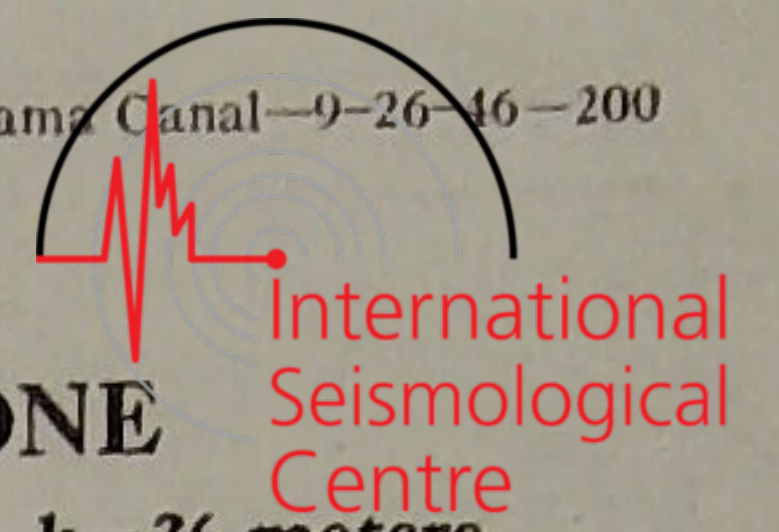
No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#37 July 2	eP F	13:45:14 13:48					Nearby
#38 July 11	1P 1S F	0:15:54 0:16:34 0:20			5.0N 3.0E		Approximate distance 190 miles
#39 July 15	1P 1S F	23:45:53 23:46:15 23:50			20.0 N 17.5 E 56.0 N 43.0 E		Approximate distance 105 miles Intensity I. Felt by a few people.
#40 July 16	1P 1S F	5:59:55 6:00:17 6:03			5.3 N 6.5 E		Approximate distance 105 miles
#41 July 28	eP 1S F	1:14:27 1:14:58 1:17					Approximate distance 150 miles
#42 July 30	eP eS F	6:58:30 6:59:21 7:06					Approximate distance 240 miles
#43 July 30	1P e F	15:26:19 15:27:18 15:30					Nearby







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**INSTRUMENTS—DETERMINED CONSTANTS**

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Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	"
Bosch-Omori	Not in operation				
Bosch-Omori					

Month August, 1949

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No. and Date	Phase	Time	Period	AMPLI-	REMARKS
		G. M. T.		TUDE	
		h m s		mm	
#45 Aug. 5	IP eS eL F	19:11:19 19:13:21 19:14:11 19:36			Destructive earthquake reported from Central Ecuador, severest near Ambato. Approximate distance, 700 miles.
#46 Aug. 18	eP eS F	13:34:16 13:35:07 13:46		21.0 H - E 54.0 H - E	Felt by a few Canal Zone residents. Intensity II. U.S.C. & G.S. locates epicenter in Province of Chiriqui, R. P. Approximate distance, 220 miles.
#47 Aug. 20	SP IS F	09:00:22 09:01:05 09:04			Approximate distance, 205 miles.
#48 Aug. 22	e eL F	04:11:40 04:20 05:39			Distant. U.S.C. & G.S. locates epicenter off coast of British Columbia, approximate distance, 4300 miles.
#49 Aug. 25	eP IS F	16:47:07 16:47:33 16:51			Approximate distance, 125 miles.

G. E. MITCHELL  
Chief Hydrographer



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Bosch-Omori					

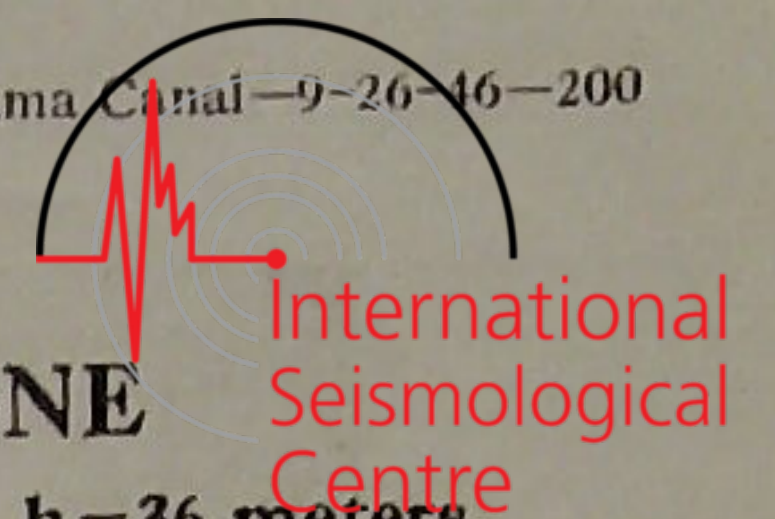
Month September, 1949

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No. and Date	Phase	Time G. M. T.			Period	AMPLITUDE mm	REMARKS
		h	m	s			
#50 Sept. 4	eP	9	53	50			Approximate distance 150 miles.
	IS	9	54	21			
	F	9	56				
#51 Sept. 13	1P	16	11	14	---	3.0 N	Approximate distance 170 miles
	IS	16	11	49	---	3.2 E	
					---	10.5 N	
	F	16	16			5.5 E	
#52 Sept. 21	eP	12	58	07			Distant
	F	13	11				
#53 Sept. 22	1P	18	33	53		5.0 N	Approximate distance 45 miles.
	eS	18	34	02		3.5 E	
	F	18	36			7.0 N 8.5 E	
#54 Sept. 24	1P	10	10	14			Approximate distance 135 miles
	eS	10	10	42			
	F	10	13				
#55 Sept. 27	1P	11	35	21		3.0 N	Approximate distance 75 miles.
	IS	11	35	37		3.5 E	
	F	11	39			29.0 N 20.0 E	
							G. E. MATTHEW Chief Hydrographer



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**INSTRUMENTS—DETERMINED CONSTANTS**

INSTRUMENTS	COMPONENT	T <sub>0</sub>	V	C	DETERMINED
Wood-Anderson	N - S	1.0	1370	14-1	June 30, 1947
Wood-Anderson	E - W	1.0	1370	18-1	" " "
Bosch-Omori	Not in operation				
Bosch-Omori					

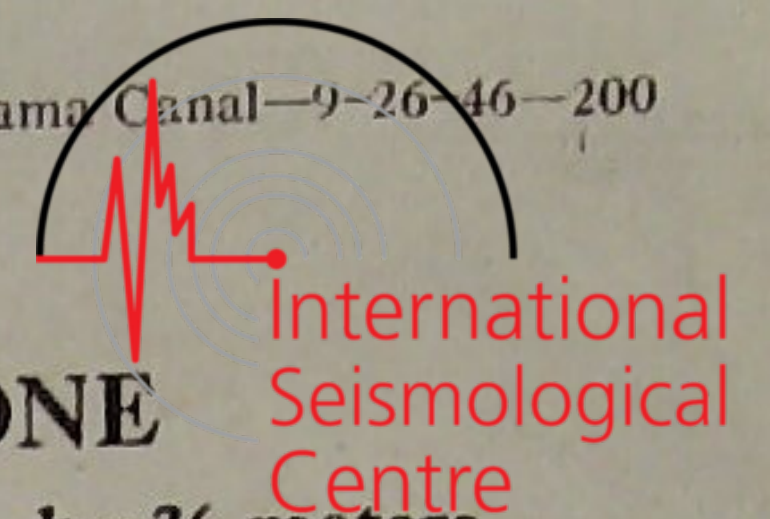
Month October 1949Page No. 12

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE  mm	REMARKS
		h	m	s			
# 56 Oct. 2	eP IS F	18:08:57 18:09:28 18:11					Approximate distance 150 miles
# 57 Oct. 22	IP IS F	8:41:46 8:41:58 8:43			5.0 N 3.0 E		Approximate distance 60 miles
# 58 Oct. 29	eP eS F	0:00:25 0:01:07 0:03					Approximate distance 200 miles
# 59 Oct. 31	IP IS F	7:59:47 8:00:18 8:04			5.0 N 4.0 E		Approximate distance 150 miles

G. E. MATTHEW  
Chief Hydrographer



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**INSTRUMENTS—DETERMINED CONSTANTS**

INSTRUMENTS	COMPONENT	T.	V	Q	DETERMINED
Wood-Anderson	N - S	1.0	1370	14:1	June 30, 1947
Wood-Anderson	E - W	1.0	1370	18:1	"
Bosch-Omori	Not in operation				
Bosch-Omori					

Month November, 1949

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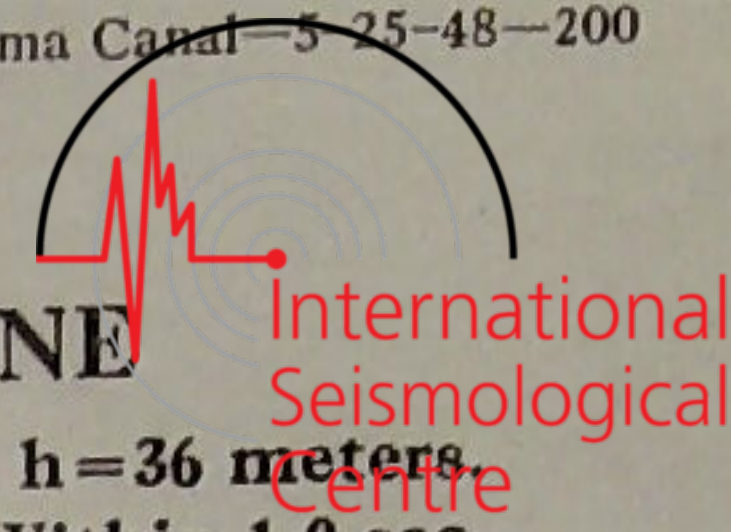
No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#60 Nov. 3	1P	23	29	15		4.0 N 4.0 E	Approximate distance 115 miles.
	1S	23	29	39			
	F	23	32				
#61 Nov. 13	eP	4	44	19			Approximate distance 500 miles
	eS	4	45	42			
	F	4	56				
#62 Nov. 18	eP	1	44	31			Approximate distance 200 miles
	1S	1	45	13			
	F	1	47				
#63 Nov. 20	eP	19	52	24			Times given for this Quake approximate but probably correct to nearest minute. Approx. dis- tance 105 miles
	1S	19	52	46			
	F	19	53				
#64 Nov. 22	1P	13	11	54			Approximate distance 250 miles
	eS	13	12	45			
	F	13	15				
#65 Nov. 26	eP	06	25	13			Approximate distance - 200 miles
	eS	06	25	55			
	F	06	31				
#66 Nov. 26	eP	07	45	03			Approximate distance - 200 miles
	eS	07	45	45			
	F	07	49				
#67 Nov. 28	eP	16	54	22			Approximate distance - 160 miles
	eS	16	54	56			
	F	16	59				

G. E. MATTHEW  
Chief Hydrographer



DEPARTMENT OF OPERATION AND MAINTENANCE  
SECTION OF METEOROLOGY AND HYDROGRAPHY

## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE



Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h = 36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 1.0 sec.

## INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100 kg.

## INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V.	Q.	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori	} Not in operation				
Bosch-Omori					

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No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#68 Dec. 5	ep e F	12:44:44 12:46:33 12:52					U. S. Coast & Geodetic Survey reports epicenter 6° N., 84-1/2 W., approximate distance 400 miles. Faint trace.
#69 Dec. 17	e eL F	7:04:10 7:13:00 8:06					Distant. Faint trace with phases 72.7 Indistinct.
#70 Dec. 17	e eL F	15:18:28 15:27:00 16:18					Distant. Trace similar to No. 69.
#71 Dec. 22	e F	9:34:18 9:48					Distant. Faint trace.
#72 Dec. 31	ep IS F	10:18:27 10:19:02 10:21					Nearby.

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