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AUTHORITY

usaf ltr, 28 feb 1972

LONG RANGE SEISMIC MEASUREMENTS

BOXCAR

26 APRIL 1968

Prepared for

AIR FORCE TECHNICAL APPLICATIONS CENTER

Washington, D. C.

29 AUGUST 1968

By

TELEDYNE INDUSTRIES, INC.

Under

Project VELA UNIFORM

Sponsored By

ADVANCED RESEARCH PROJECTS AGENCY
Nuclear Test Detection Office
ARPA Order No. 624

LONG RANGE SEISMIC MEASUREMENTS

BOXCAR

SEISMIC DATA LABORATORY REPORT NO. 223

AFTAC Project No.:	VELA T/6702
Project Title:	Seismic Data Laboratory
ARPA Order No.:	624
ARPA Program Code No.:	8F10
Name of Contractor:	TELEDYNE INDUSTRIES, INC.
Contract No.:	F 33657-68-C-0945
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Amount of Contract:	$ 1,251,000
Contract Expiration Date:	1 March 1969
Project Manager:	Royal A. Hartenberger (703) 836-7647

P. O. Box 334, Alexandria, Virginia

AVAILABILITY

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WASH DC 20333

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2 Unified Magnitudes for BOXCAR
3 Adjusted Unified Magnitudes for BOXCAR

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Unified Magnitudes From Pn or P Waves

BOXCAR
EVENT SUMMARY

DATE:	26 April 1968
TIME OF ORIGIN:	15:00:00.0Z
YIELD:	
MAGNITUDE: UNIFIED:	6.42 ± 0.45
EVERNDEN:	6.14 ± 0.40
LOCATION:	Nevada Test Site (NTS), Area U20i
	GEOGRAPHIC COORDINATES:
	Latitude: 37° 17' 44.0" N
	Longitude: 116° 27' 21.0" W
SHOT ENVIRONMENT:	GEOLOGIC MEDIUM: Rhyolite
	SURFACE ELEVATION: 6770 ft.
	SHOT DEPTH: 3800 ft.
NUMBER OF STATIONS REPORTING:	23
COMPUTED EPICENTER:	
METHOD 1 (LOCATE)	
	GEOGRAPHIC COORDINATES:
	Latitude: 37° 16' 33.6" N
	Longitude: 116° 32' 24.0" W
	TIME OF ORIGIN: 15:00:00.6Z
	DEPTH CONSTRAINED TO: 0 Km
	EPICENTER SHIFT: 5.1 Km S63°W
METHOD 2 (HYPO I)	
	GEOGRAPHIC COORDINATES:
	Latitude: 37° 16' 51.6" N
	Longitude: 116° 31' 26.4" W
	TIME OF ORIGIN: 15:00:01.1Z
	DEPTH CONSTRAINED TO: 0 Km
	EPICENTER SHIFT: 7.7 Km S78°W

INTRODUCTION

Under Project Vela-Uniform, and the Long Range Seismic Measurement (LRSM) Program, several seismographic observatories were established to record seismological data generated by natural seismic activity and U.S. underground nuclear tests. The LRSM teams are mobile and occupy locations selected to provide optimum coverage for events of special interest; the observatories, permanent installations, are listed below:

Wichita Mountains Seismological Observatory (WMSO)
Lawton, Oklahoma

Uinta Basin Seismological Observatory (UBSO)
Vernal, Utah

Tonto Forest Seismological Observatory (TFSO)
Payson, Arizona

Large Aperture Seismic Array (LASA)
Billings, Montana

The purpose of this report is to provide a summary of data resulting from the BOXCAR event as recorded by the LRSM teams and the VELA observatories.

STATIONS REPORTING

A total of 23 network stations from 190 to 4400 kilometers recorded at the time of the BOXCAR event. A list of these stations, together with pertinent recording site information, is listed in Table 1. These recording sites and the NTS shot site are shown in Figure 1.

CODE	STATION	DISTANCE (KM)	GEOGRAPHIC LATITUDE	GEOGRAPHIC LONGITUDE	ELEV. (KM)	COMPUTED AZIMUTH		INSTALLED AZIMUTH		SP INST.	LP
						EPI. STA.	STA. EPI.				
MN-NV	Mina, Nevada	195	38°26'10" N	118°08'53" W	1.52	311°	130°	308°	38°	L	**
BP-CL	Bishop, California	198	37°21'36" N	118°41'25" W	2.32	273°	91°	274°	4°	PS	**
AT-NV	Austin, Nevada	249	39°28'53" N	117°04'26" W	1.98	348°	167°	343°	73°	PS	**
EY-NV	Ely, Nevada	255	39°24'36" N	115°18'46" W	2.01	23°	203°	18°	108°	PS	**
KM-CL	Kramer, California	277	34°52'52" N	117°15'24" W	0.85	195°	15°	200°	290°	PS	**
BF-CL	Bakersfield, California	282	35°38'53" N	118°51'27" W	0.57	230°	49°	234°	324°	PS	**
WW-UT	Wah Wah Mountains, Utah	286	38°30'50" N	113°35'20" W	1.83	61°	243°	58°	148°	PS	**
KG-AZ	Kingman, Arizona	293	35°38'30" N	113°54'28" W	1.07	128°	310°	130°	220°	PS	**
ND-CL	Needles, California	310	34°35'57" N	115°33'05" W	0.37	164°	345°	169°	259°	PS	**
KN-UT	Kanab, Utah	324	37°01'22" N	112°49'39" W	1.74	94°	276°	95°	185°	L	**
CP-CL	Campo, California	507	32°43'44" N	116°22'16" W	1.19	179°	359°	182°	272°	PS	**
*TF50-Z60	Tonto Forest Observatory, Arizona	576	34°17'12" N	111°16'03" W	1.49	124°	307°	90°	0°	JM	**
*UBSO-Z10	Uinta Basin Observatory, Utah	686	40°19'18" N	109°34'07" W	1.60	59°	243°	90°	0°	JM	**
LC-NM	Las Crucas, New Mexico	1051	32°24'08" N	106°35'58" W	1.59	118°	304°	133°	223°	S	**
CC-WA	Cascade Tunnel, Washington	1224	47°46'09" N	121°05'01" W	1.04	343°	160°	311°	41°	PS	
*LAO	Subarray A0-10, Montana	1343	46°41'19" N	106°13'20" W	0.90	36°	223°	0°	90°	HS	**
*WMSO-Z6	Wichita Mountains Observatory, Oklahoma	1634	34°43'05" N	98°35'21" W	0.51	95°	285°	90°	0°	JM	**
*PG-BC	Prince George, British Columbia, Canada	1915	53°59'50" N	122°31'23" W	0.91	348°	163°	110°	200°	L	**
RK-ON	Red Lake, Ontario, Canada	2350	50°50'20" N	93°40'20" W	0.37	43°	239°	58°	148°	S	**
WH2YK	Whitehorse, Yukon Territory, Canada	2913	60°41'41" N	134°58'02" W	0.85	339°	145°	325°	55°	L	**
HN-NE	Houlton, Maine	4086	46°09'43" N	67°59'09" W	0.21	60°	274°	93°	183°	S	**
*SV3Q8	Schaffarvilla, Northwest Territories, Canada	4199	54°48'39" N	66°45'00" W	0.58	46°	263°	139°	229°	S	**
NP-NT	Mould Bay, Northwest Territories, Canada	4345	76°15'08" N	119°22'18" W	0.06	359°	176°	356°	86°	JMZ S	**

* Seismometers Not Orientad Toward N.T.S.

L Large Benioff

S Small Benioff

JM Johnson-Mathesor

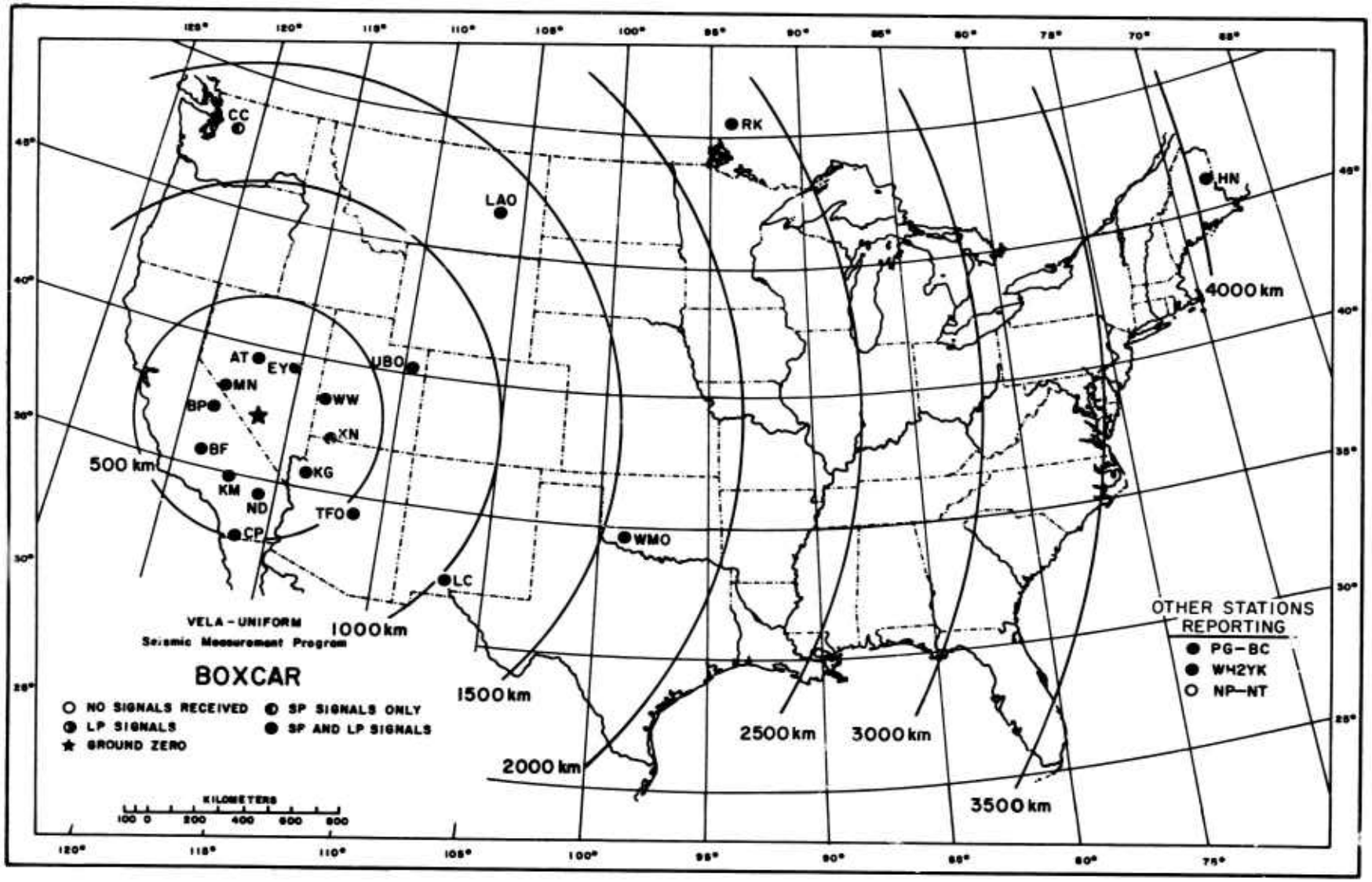
HS Hall Sears

PS Geotech Portable System

** Long Period Instrument at Site

RECORDING SITE INFORMATION - BOXCAR

TABLE 1



SHOT AND RECORDING STATION LOCATIONS-BOXCAR

Figure 1

INSTURMENTATION AND PROCEDURE

The instrumentation at LRSM locations consists of three-component short-period and long-period seismographs. In general, data are recorded on 35 millimeter film and one-inch 14-channel magnetic tape, although recently, more portable instrumentation has been incorporated which records only on magnetic tape. All stations are equipped to record WWV continuously. Calibration at operational settings is accomplished once each day and prior to each shot. Information for analysis of LRSM data is available to qualified users and is contained in Technical Report 65-43, "Interpretations and Usage of Seismic Data, LRSM Program" (AD 488-352). General information on LRSM van and portable system equipment and operation is given in Technical Reports 66-27, "The LRSM Mobile Seismological Laboratory" (AD 480-343), and 65-74, "A Portable Seismograph" (AD 488-144). These reports may be obtained from the Defense Documentation Center.

Standard distance factors, (B), are given in the Appendix; Magnitudes determined using these factors are shown in Figure 2. Adjusted magnitudes for less than 16° are computed using a method described by Evernden*, and averaged with the standard results for distances greater than 16°. (Figure 3).

Hypocenter location programs are used to determine the shot location. Values of latitude, longitude, and time or origin are determined statistically by several methods utitizing least-squares techniques. The computational methods use P-wave arrivals with shot depth constrained to zero.

*Evernden, J.F., Magnitude Determination at Regional and Near Regional Distances in the United States, AFTAC/VELA Seismological Center Technical Report VU-65-4A, (1965), pp. 6, 13.

DATA

Table 2 summarizes time and amplitude data for principle phases from the BOXCAR event as observed at the LRSM and VELA stations. Included are Pn and P arrival times, maximum amplitudes (A/T) of the Pn and P motions, and times and amplitudes for other phases observed on the records for the short-period instruments. Long-period Love and Rayleigh wave motion are also tabulated. In addition, the individual station Rayleigh wave areas (mm^2) as measured on the LPZ are included. Although reduced to 1K magnification, these areas have not been normalized for magnitude.

PRELIMINARY RESULTS

The unified magnitudes determined from the LRSM and VELA observatories are shown in Figure 2. The average magnitude is 6.42 ± 0.45 (one standard deviation). The adjusted unified magnitude (Figure 3) is 6.14 ± 0.40 (one standard deviation).

REPRESENTATIVE SEISMOGRAMS

Illustrative seismograms showing signals recording at KG-AZ (293 km), CP-CL (507 km), PG-BC (1915 km), and SV3QB (4199 km) are included in the report jacket.

BOXCAR
28 April 1968
18:00:00.0 Z

CODE	STATION	DIST ARCS (KM)	TEST.	MAGNIFICATION (G) PILM × 10	PHASE	TRAVEL TIME OBSERVED (MIN)	TRAVEL TIME OBSERVED (SEC)	TRAVEL TIME COMPUTED (J-B) (MIN)	TRAVEL TIME COMPUTED (J-B) (SEC)	PERIOD T (SEC)	MAXIMUM AMPLITUDE A/T (0-P)	MAGNITUDE (m) MS	MAGNITUDE (m) Mn	AREA (mm^2) LPZ
MB-NV	Mina, Nevada	186	SPZ	0.13	Pn		31.6		32.08	0.6	23,652	6.53	$6.16_{7.8}$	
			SPZ	0.05*	Pg		33.1			0.6	201,360			
			SPT	0.11	Lg					1.1	303,856			
			LPT		LQ					---	---			
			LPZ	0.035	LR					(8.6)	(316,287)			62,000.00
BP-CL	Bishop, California	168	SPZ	**	Pn		32.0		32.85	0.8				
			SPZ	**	Pg		33.8			0.85				
			SPT	**	Lg					(0.78)				
			LPT		LQ					---	---			
			LPZ		LR					---	---			
AT-NV	Austin, Nevada	248	SPZ	0.18	Pn		38.0		38.03	0.5	34,222	6.85	$6.78_{7.8}$	
			SPZ	0.068*	Pg		51.0			0.4	123,200			
			SPT	0.18*	Lg					0.8	63,211			
			LPT	0.33	LQ					13.0	15,043			
			LPZ	0.35	LR					15.0	22,768			7,068.25
EY-NV	Ely, Nevada	255	SPZ	0.16*	Pn		(38.5)		38.88	(0.48)	(12,880)	(6.56)	$(6.28)_{7.8}$	
			SPZ	0.18*	Pg		45.0			0.7	100,287			
			SPT	0.16*	Lg					0.8	34,167			
			LPT	0.87	LQ					11.0	11,393			
			LPZ	0.08	LR					(18.0)	(83,459)			35,115.00
KM-CL	Kramer, California	277	SPZ	ONTA QUESTIONABLE										
			SPT	0.31	Lg					0.8	3,472			
			LPT	1.78	LQ					7.0	20,448			
			LPZ		LR					---	---			
BF-CL	Bakersfield, California	282	SPZ	2.18*	Pn		42.9		43.23	0.8	2,705	5.90	$5.81_{7.9}$	
			SPZ	2.18*	Pg		(46.2)			(0.7)	(8,823)			
			SPT	3.88*	Lg					(1.0)	(2,984)			
			LPT	0.50	LQ					10.0	3,851			
			LPZ	0.20	LR					10.0	8,589			5,675.00
HB-UT	Hah Keh Mountains, Utah	286	SP	**										
			LPT	0.21	LQ					13.0	8,880			
			LPZ	0.078	LR					(16.0)	(13,258)			3,205.13
KB-AZ	Kingman, Arizona	283	SPZ	0.88	Pn		(44.2)		55.65	0.35	16,438	6.74	$6.64_{7.9}$	
			SPZ	0.65	e		(45.1)			0.4	11,850			
			SPZ	6.12*	Pg		(48.4)			0.7	103,708			
			SPT	0.14	Lg					1.0	38,288			
			LPT	0.89	LQ					12.0	5,239			
			LPZ	0.08	LR					16.0	18,888			7,250.00
ND-CL	Needles, California	310	SPZ	5.75	Pn		(58.0)		48.76	0.75	2,872	8.00	$5.75_{7.9}$	
			SPZ	0.43*	Pg		61.3			0.76	38,843			
			SPT	0.30*	Lg					1.0	71,887			
			LPT	0.13	LQ					12.0	28,846			
			LPZ	0.12	LR					13.0	67,517			10,333.33
KN-UT	Kanab, Utah	325	SPZ	0.43	Pn		57.8		48.85	0.8	11,119	8.71	$6.58_{7.9}$	
			SPZ	0.53	e		49.3			(0.5)	(7,577)			
			SPZ	0.18*	Pg		54.8			0.6	113,833			
			SPT	0.432	Lg					(1.0)	(58,028)			
			LPT		LQ					---	---			
			LPZ	0.0959	LR					10.0	31,882			3,023.88
CP-CL	Campo, California	807	SPZ	1.6	Pn	1	11.3	1	11.53	0.5	883	8.35	$8.03_{7.6}$	
			SPZ	1.6	e	1	11.9			0.48	8,105			
			SPZ	1.6	Pg	1	25.5			1.1	14,763			
			SPT	2.0	Lg					1.0	7,500			
			LPT	0.48	LQ					12.0	13,732			
			LPZ	0.20*	LR					10.0	31,914			940.00
TFSO	Tonto Forest Observatory Arizona	576	SPZ-60	5.5	Pn	1	20.3	1	20.73	0.35	564	8.16	$5.93_{7.8}$	
			SPZ-60	5.5	e	1	20.8			0.8	806			
			SPZ-60	5.5	e	1	27.1			(0.6)	(1,840)			
			SPZ-60	0.6	Pg	1	36.1			0.9	7,099			
			SPN	0.92	Lg					1.3	9,565			
			SPE	1.0	Lg					1.3	6,620			
			LPN	0.84	LQ					(14.0)	(3,522)			
			LPE	0.82	LQ					14.0	2,849			
			LPZ	0.07	LR					15.0	18,466			7,500.00

ARRIVAL TIMES AND AMPLITUDES - BOXCAR
TABLE 2

CODE	STATION	DISTANCE (KM)	INST.	MAGNIFICATION (S) FILM x 10	PHASE	TRAVEL TIME OBSERVED (MIN)	TRAVEL TIME OBSERVED (SEC)	TRAVEL TIME COMPUTED (J-B) (MIN)	TRAVEL TIME COMPUTED (J-B) (SEC)	PERIOD T (SEC)	MAXIMUM AMPLITUDE A/T (C-P)	AMPLITUDES (m) BS	AMPLITUDES (m) Rm	AREA (mm^2) LPZ
UBSO	Ulata Basin Observatory, Utah	500	SPE-19	8.0	Pn	1	36.1	1	34.70	1.0	4,660	7.28	$8.07_{8.5}$	
			ZPZ-10	0.50	Pg	1	65.0			0.7	10,964			
			SPB	0.50	Lg					1.E	11,163			
			SPS	0.80	Lg					1.2	8,730			
			LPB	0.2E	LQ					17.0	3,302			
			LPS	0.2	LQ					17.0	2,049			
			LPZ	0.2	LQ					18.0	3,780			4,800.00
LC-NM	Las Cruces,Geo Mexico	1051	SPZ	7.48	Pn	2	(20.8)	2	20.68	0.5	26.2	5.83	$5.23_{7.9}$	
			SPZ	7.49	e	2	21.9			0.8	180			
			SPZ	7.49	e	2	32.2			1.0	434			
			SPZ	7.48	Pg	2	57.7			1.2	5,874			
			3PT	7.96	Lg					1.7	4,743			
			LPT		LQ					---	---			
			LPE	1.76	LQ					17.0	531			991.37
CC-WA	Cascade Tunnel, Washington	1224	SPZ	17.6	Pn	2	42.6	2	41.84	0.7	(1,057)	(7.23)	$(8.64)_{8.5}$	
			SPZ	17.6	(Pg)	3	24.4			1.0	557			
LA0	?aSarray A0-10, Nevada	1343	ZPZ		Pn	2	53.0	2	50.31	***	***			
			LPB		LQ					***	***			
			LPZ		LQ					***	***			
			LPZ		LQ					***	***			
WMSO	Wichita Mountains Seismological Observatory, Oklahoma	1034	SPZ-6	8.9	P	3	31.2	3	31.00	1.4	1,254	8.45	$5.25_{8.5}$	
			SPZ-8	8.6	e	3	57.4			1.4	582			
			SPZ-8	8.9	Pg	4	37.1			1.3	2,054			
			LPB	12.8	S	8	30			14.0	185			
			SPB	7.8	Lg					1.6	6,381			
			LPB		LQ					---	***			
			LPZ		LQ					***	***			
PB-BC	Prince George, British Columbia, Canada	1615	SPZ	14.5	P	4	03.8	4	03.76	1.4	3,571	4.50		
			SPZ	14.5	PP	4	20.8			1.2	1,221			
			SPB	14.8	Lg					2.2	858			
			SPT	12.6	Lg					2.2	749			
			LPB	1.03*	LQ					12.5	2,388			
			LPT	5.03*	LQ					12.5	1,811			
			LPZ	1.44	LQ					10.5	8,458			2953.05
BS-OB	Red Lake, Ontario, Canada	2358	SPZ	14.3	P	4	58.0	4	48.86	1.3	2,354	8.48		
			SPZ	14.3	e	4	69.1			1.25	3,381			
			LPZ	21.4	S	8	48			18.0	181			
			SPT	15 8	Lg					2.8	1,839			
			LPT		LQ					---	---			
			LPZ	2.8	LQ					18.0	234			1,875.00
WHZY8	Whitehorse Yukon Territories, Canada	2513	SPZ	16.5	P	6	37.0	5	37.82	1.1	231	5.78		
			SPZ	16.5	e	6	43.0			0.9	140			
			ZPZ	16.5	e	6	55.7			1.8	182			
			LPZ	12.7	(S)	10	30			16.0	87.1			
			SPT	17.1	Lg					(2.3)	(270)			
			LPT		LQ					---	---			
			LPZ	1.17	LQ					14.0	4,324			5,266.23
HG-BE	Houlton, Maine	4088	SPZ	13.8	P	7	06.3	7	10.76	1.2	822	4.44		
			SPZ	13.8	e	7	18.5			0.8	146			
			SPT	14.5	Lg					3.0	835			
			LPZ		LQ					---	---			
			LPZ	1.8	LQ					14.0	511			3,794.45
SY3O8	Schefferville, Quebec Canada	4169	ZPZ	24.4	P	7	15.4	7	16.22	1.1	801	8.10		
			SPZ	24.4	e	7	18.7			0.6	267			
			SPZ	24.4	PP	8	48.2			1.3	219			
			LPB	38.7	S	13	10			(22.0)	(10.3)			
			LPZ	28.4	S	13	10			(22.0)	(36.4)			
			SPB	24.4	Lg					2.2	451			
			SPZ	23.2	Lg					2.0	151			
			LPB	1.15*	LQ					14.0	668			
			LPT	1.20*	LQ					14.0	713			
			LPZ	3.28	LG					15.0	1,545			7,577 83

S/T Hm/sec
() Doubtful Values or Phases
--- Maximum Amplitudes Clipped On Film and Tape
* Measurements Made from Playback
** No Calibration
*** Unreadable on Film; Tape Not Available

TABLE 2 (Cont.)

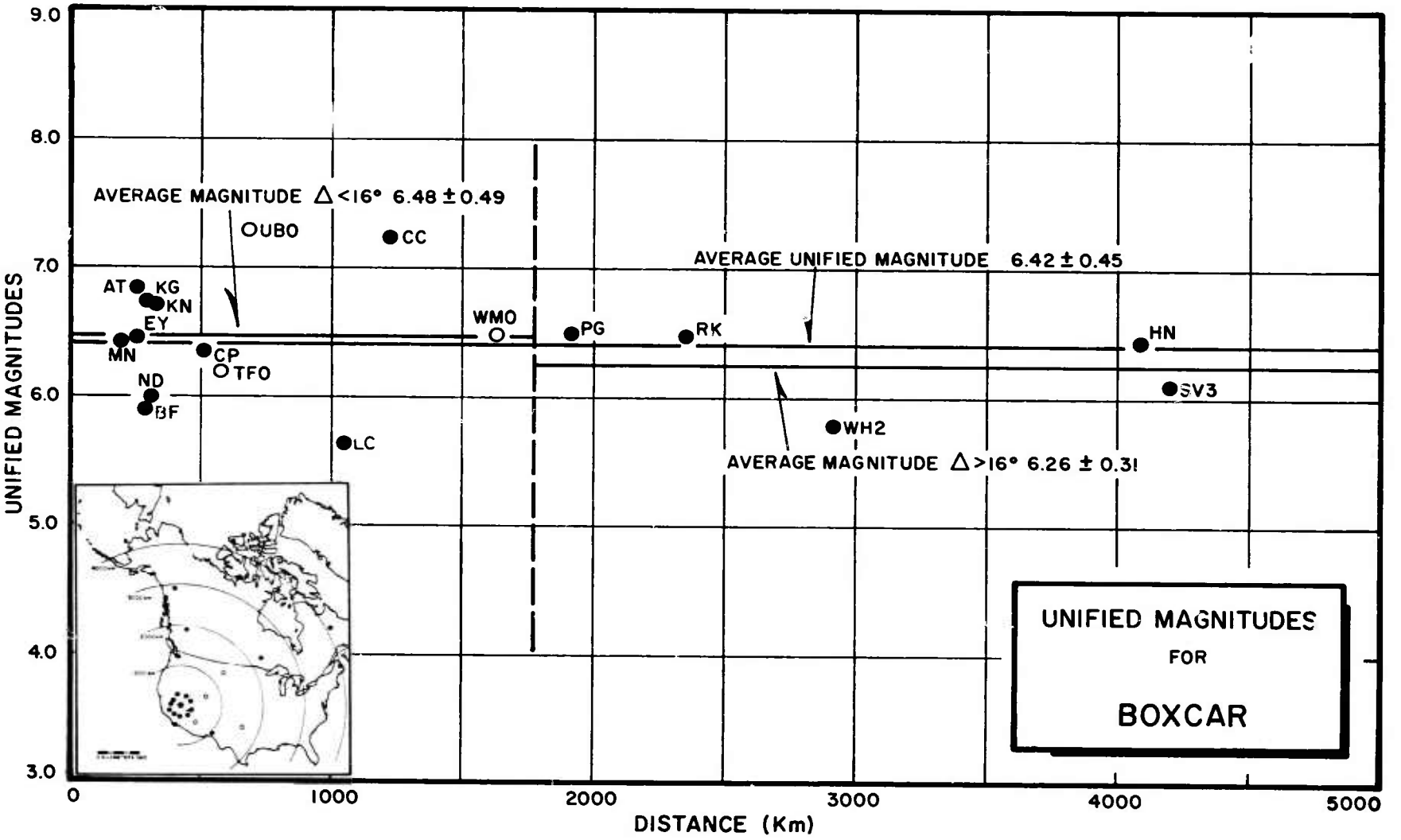
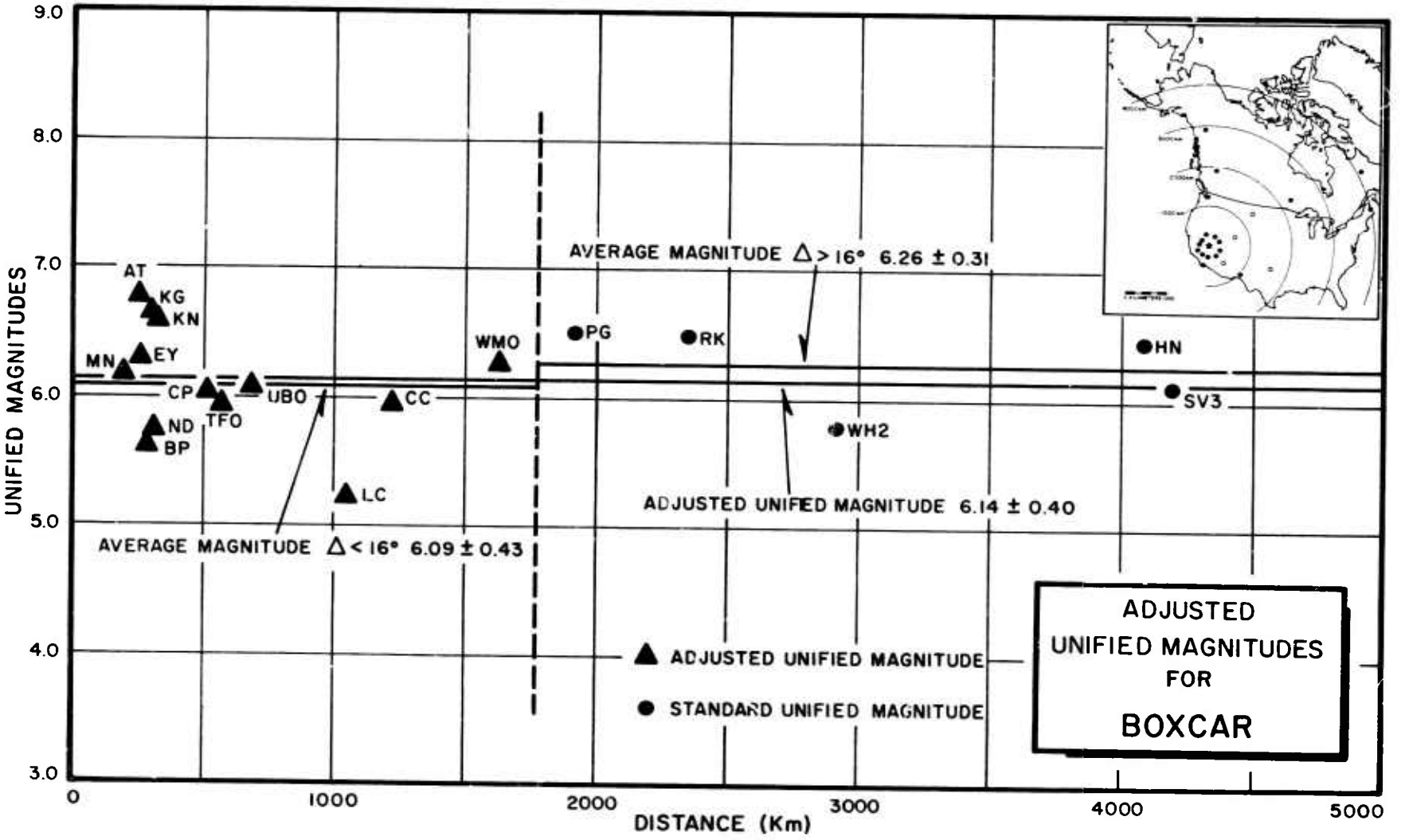

9.0
8.0
7.0
6.0
5.0
4.0
3.0
UNIFIED MAGNITUDES
0
1000
2000
3000
4000
5000
DISTANCE (Km)
AVERAGE MAGNITUDE Δ<16° 6.48 ± 0.49
AVERAGE UNIFIED MAGNITUDE 6.42 ± 0.45
AVERAGE MAGNITUDE Δ>16° 6.26 ± 0.31
OUBO
CC
AT
KG
KN
EY
MN
CP
TFO
WMO
PG
RK
HN
ND
BF
SV3
WH2
LC
UNIFIED MAGNITUDES
FOR
BOXCAR

Figure 2


9.0
8.0
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6.0
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UNIFIED MAGNITUDES
0
1000
2000
3000
4000
5000
DISTANCE (Km)
AT
KG
KN
MN
EY
CP
TFO
UBO
ND
BP
LC
CC
WMO
PG
RK
WH2
HN
SV3
AVERAGE MAGNITUDE Δ > 16° 6.26 ± 0.31
ADJUSTED UNIFIED MAGNITUDE 6.14 ± 0.40
AVERAGE MAGNITUDE Δ < 16° 6.09 ± 0.43
ADJUSTED UNIFIED MAGNITUDE
STANDARD UNIFIED MAGNITUDE
ADJUSTED
UNIFIED MAGNITUDES
FOR
BOXCAR

Figure 3

UNIFIED MAGNITUDES FROM P_n or P WAVES

Unified Magnitude: $m = \log_{10} (A/T), + B$

A = zero to peak ground motion in millimicrons

$= \frac{(mm) \quad (1000)}{K}$

T = signal period in seconds

B = distance factor (see Table below)

mm = record amplitude in millimeters, zero to peak

K = magnification in thousands, at signal frequency

Table of Distance Factors (B) for Zero Depth

Dist (deg)	B	Dist (deg)	B	Dist (deg)	B	Dist (deg)	B
0°	-	27°	3.5	54°	3.8	80°	3.7
1	-	28	3.6			81	3.8
2	2.2	29	3.6	55	3.8	82	3.9
3	2.7			56	3.8	83	4.0
4	3.1	30	3.6	57	3.8	84	4.0
		31	3.7	58	3.8		
5	3.4	32	3.7	59	3.8	85	4.0
6	3.6	33	3.7			86	3.9
7	3.8	34	3.7	60	3.8	87	4.0
8	4.0			61	3.9	88	4.1
9	4.2	35	3.7	62	4.0	89	4.0
		36	3.6	63	3.9		
10	4.3	37	3.5	64	4.0	90	4.0
11	4.2	38	3.5			91	4.1
12	4.1	39	3.4	65	4.0	92	4.1
13	4.0			66	4.0	93	4.2
14	3.6	40	3.4	67	4.0	94	4.1
		41	3.5	68	4.0		
15	3.3	42	3.5	69	4.0	95	4.2
16	2.9	43	3.5			96	4.3
17	2.9	44	3.5	70	3.9	97	4.4
18	2.9			71	3.9	98	4.5
19	3.0	45	3.7	72	3.9	99	4.5
		46	3.8	73	3.9		
20	3.0	47	3.9	74	3.8	100	4.4
21	3.1	48	3.9			101	4.3
22	3.2	49	3.8	75	3.8	102	4.4
23	3.3			76	3.9	103	4.5
24	3.3	50	3.7	77	3.9	104	4.6
		51	3.7	78	3.9		
25	3.5	52	3.7	79	3.8	105	4.7
26	3.4	53	3.7				

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13 ABSTRACT
An analysis of seismological data from an underground nuclear explosions as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

14 KEY WORDS
Seismic Magnitude
Seismic Travel-Time
Seismic Amplitude
Vela-Uniform
Nuclear Tests

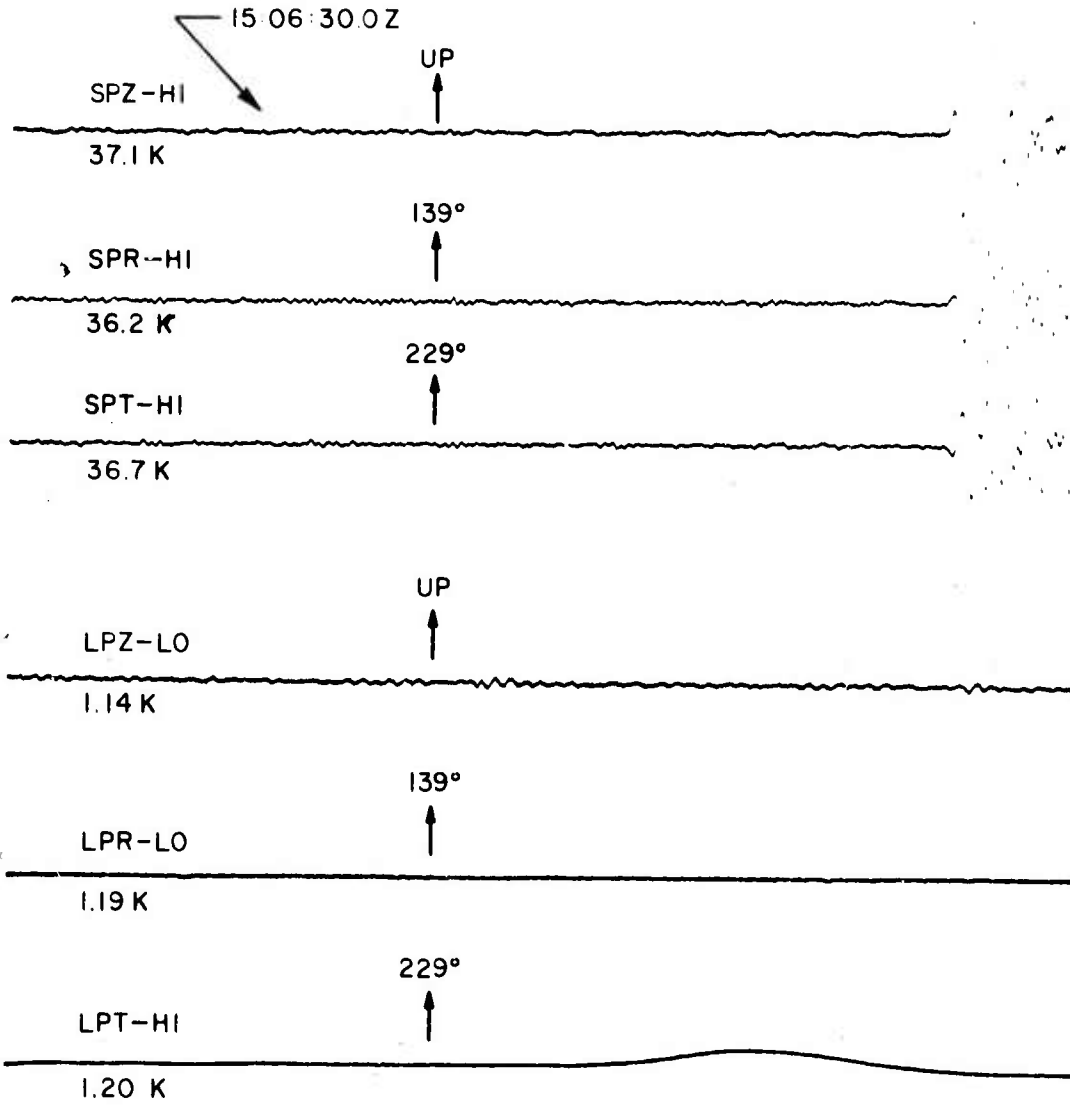
Unclassified
Security Classification

BOXCAR

SV3QB

Schefferville, Quebec
Canada
26 April 1968

Δ = 4199 Km



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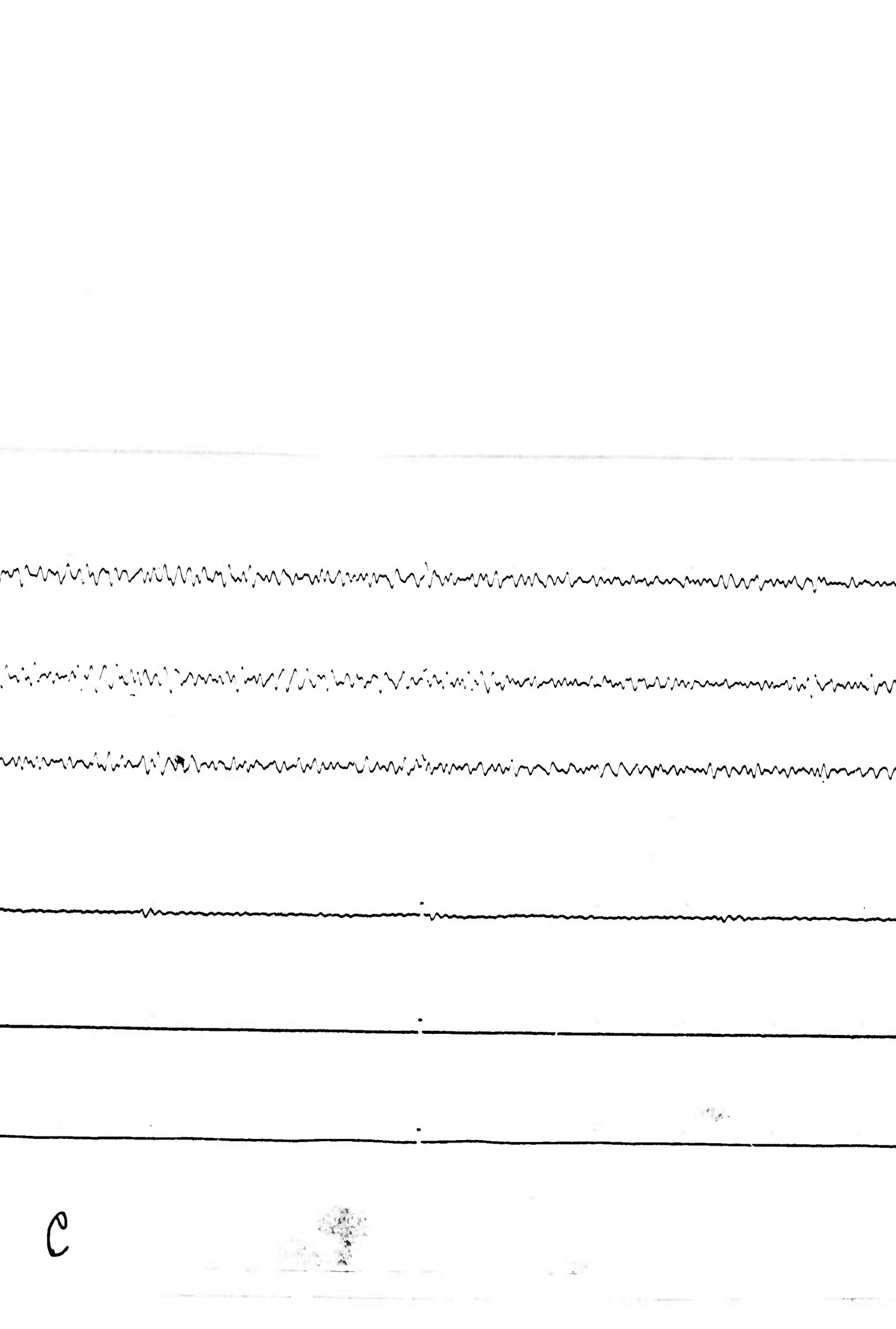

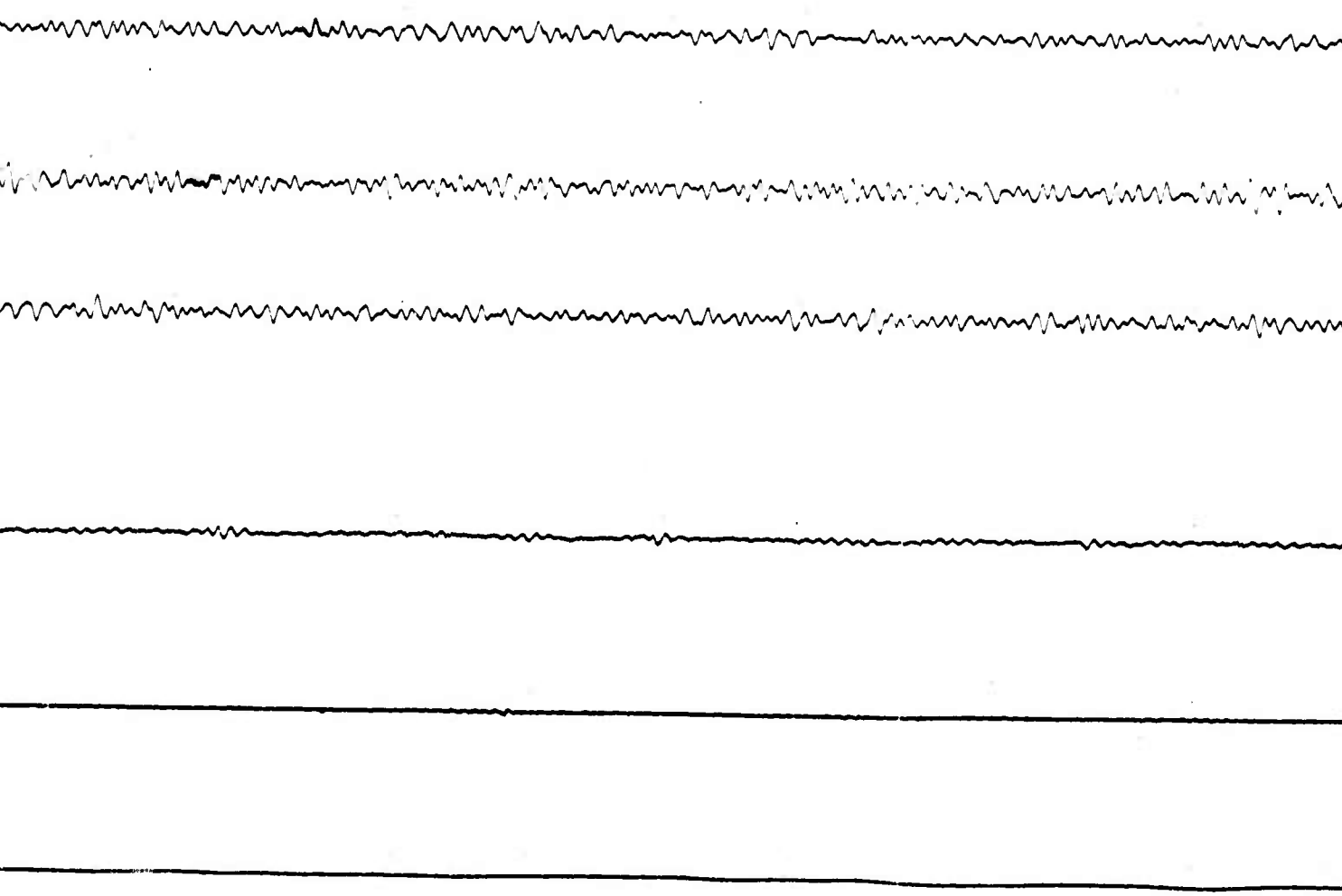

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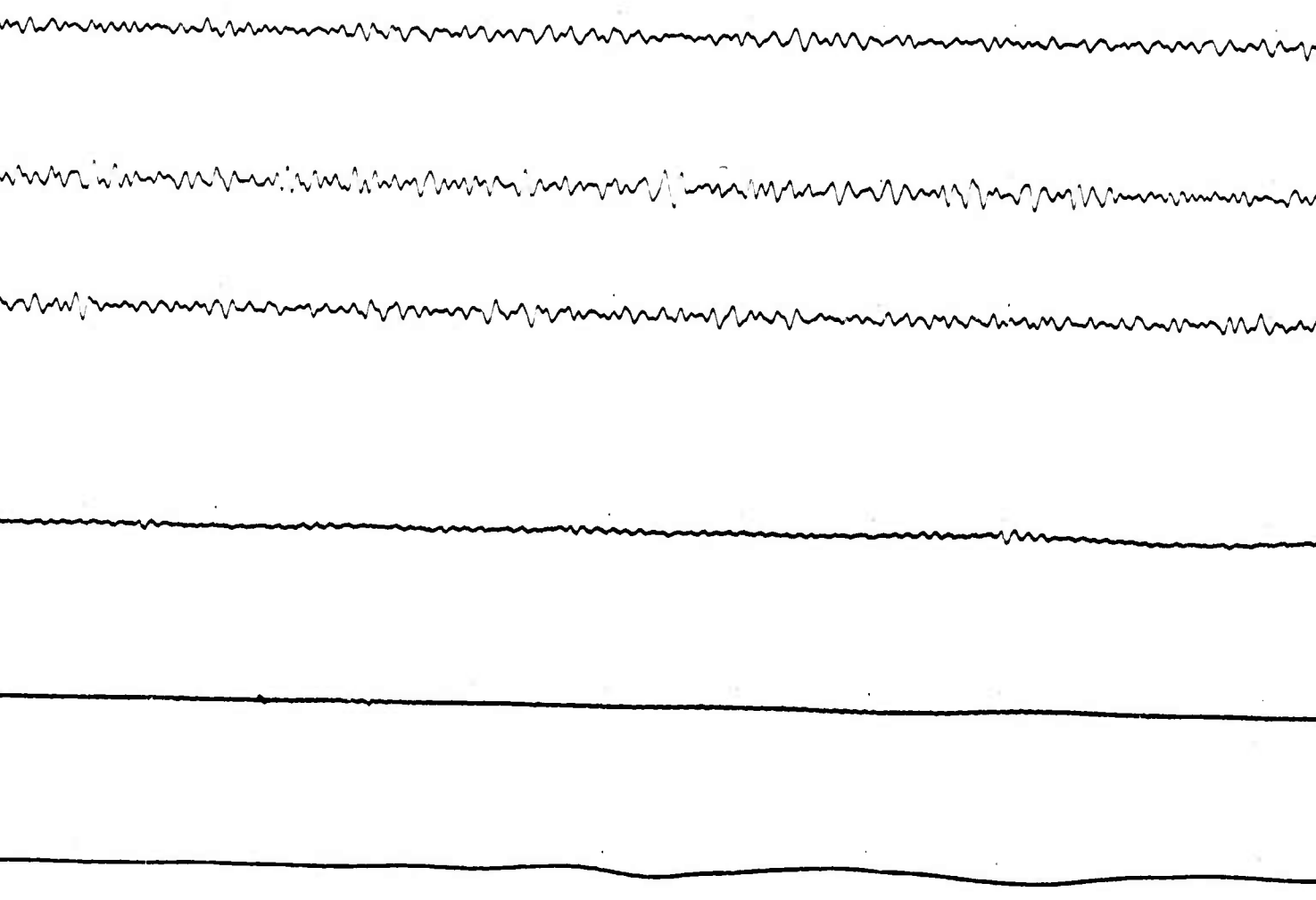

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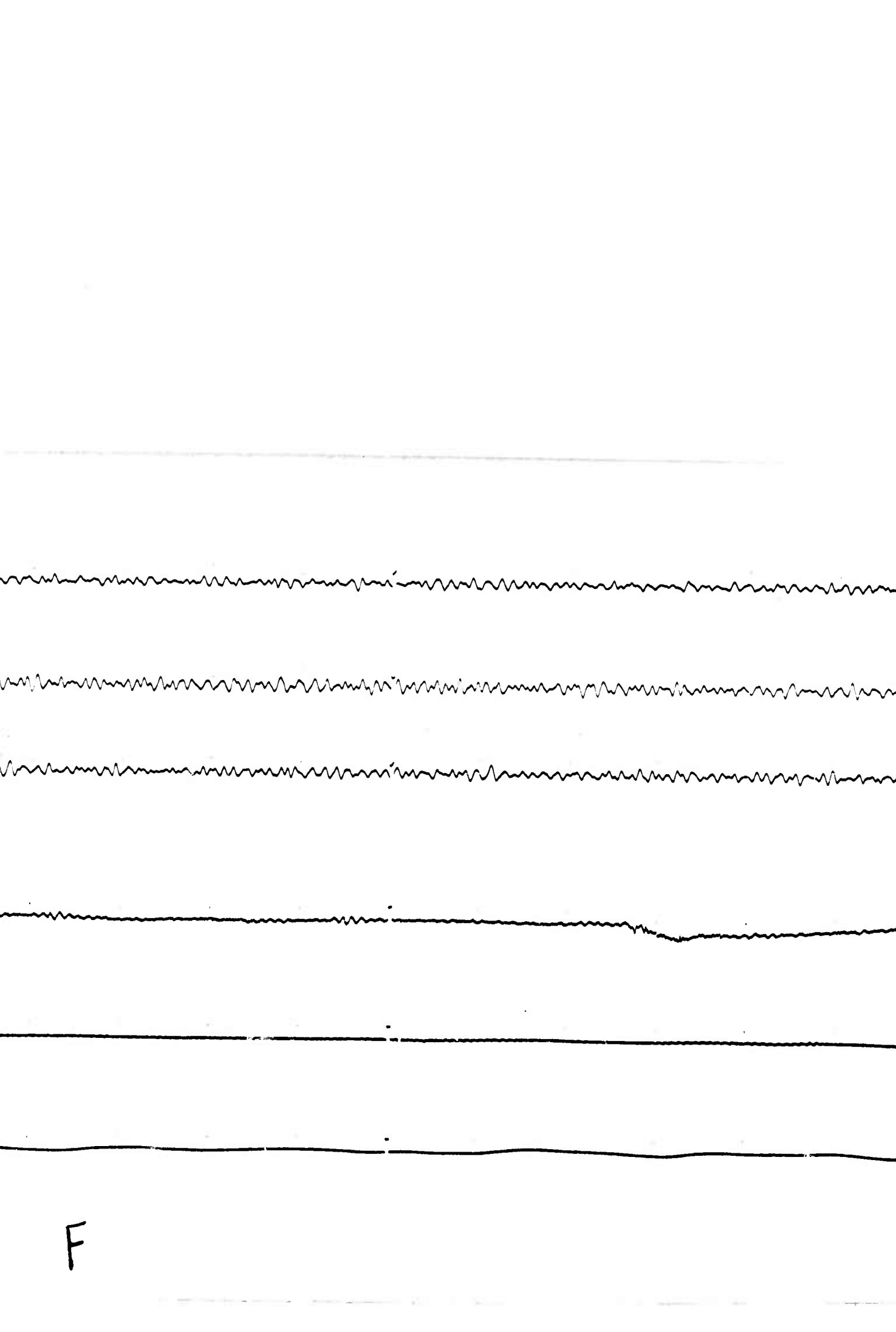

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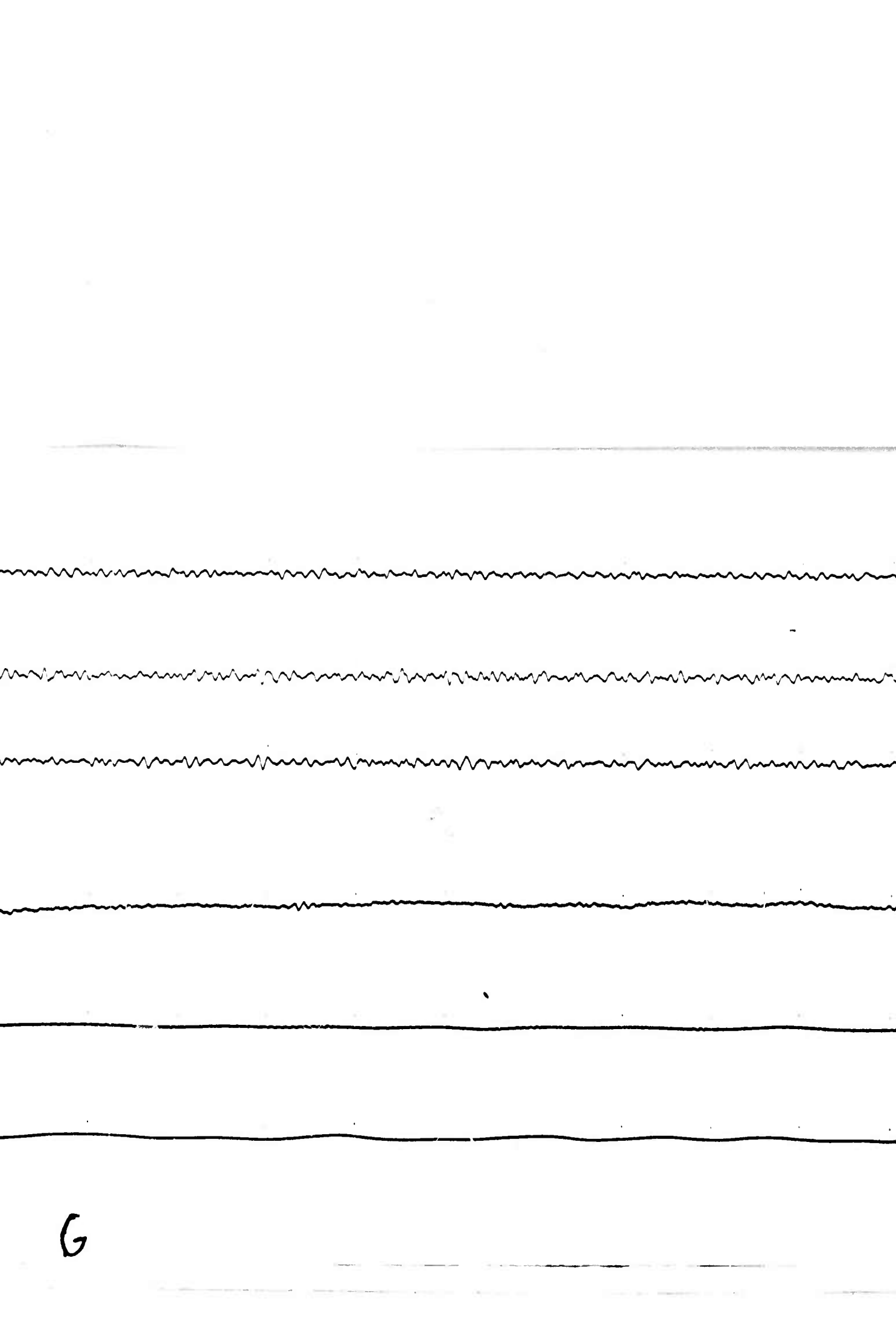

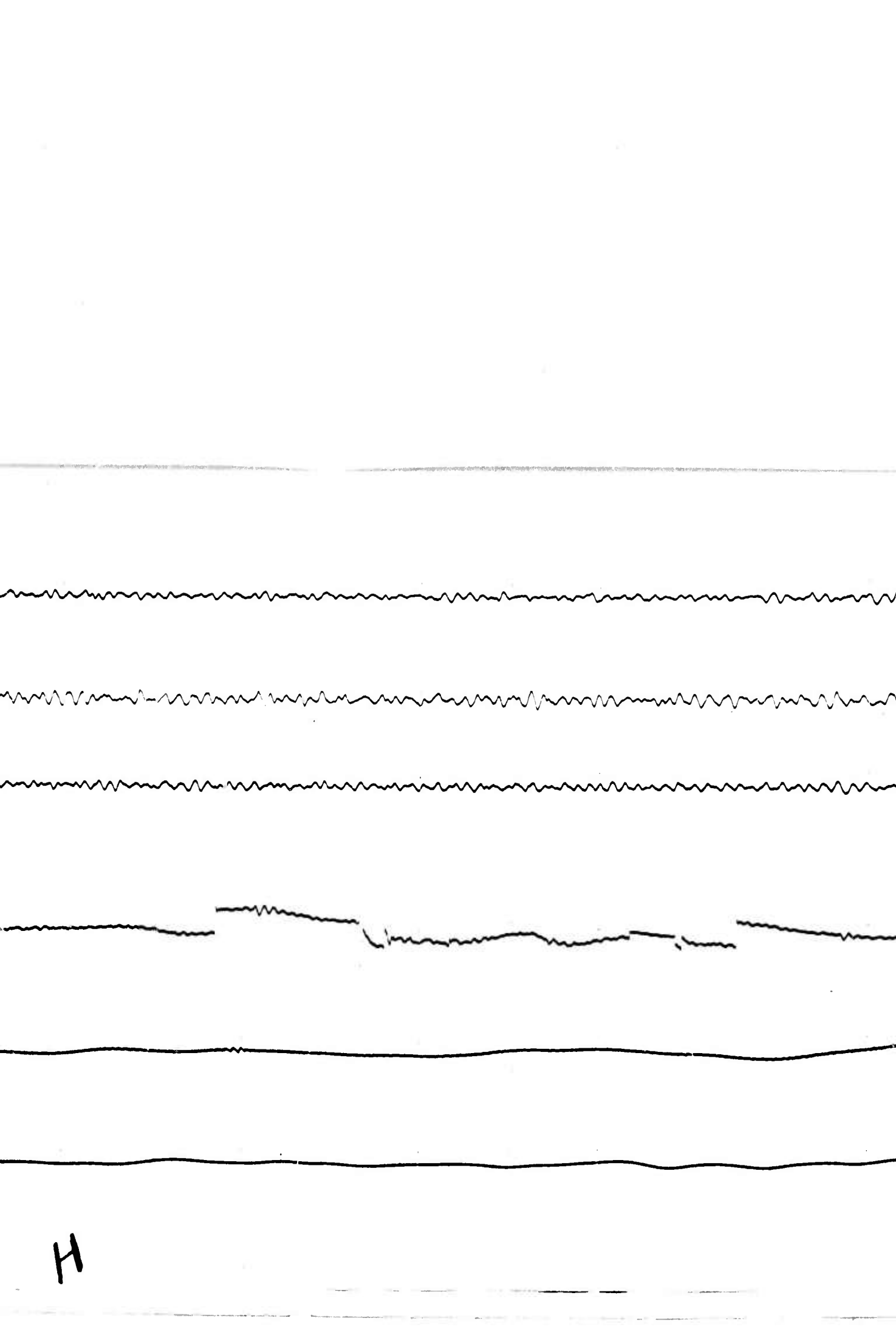
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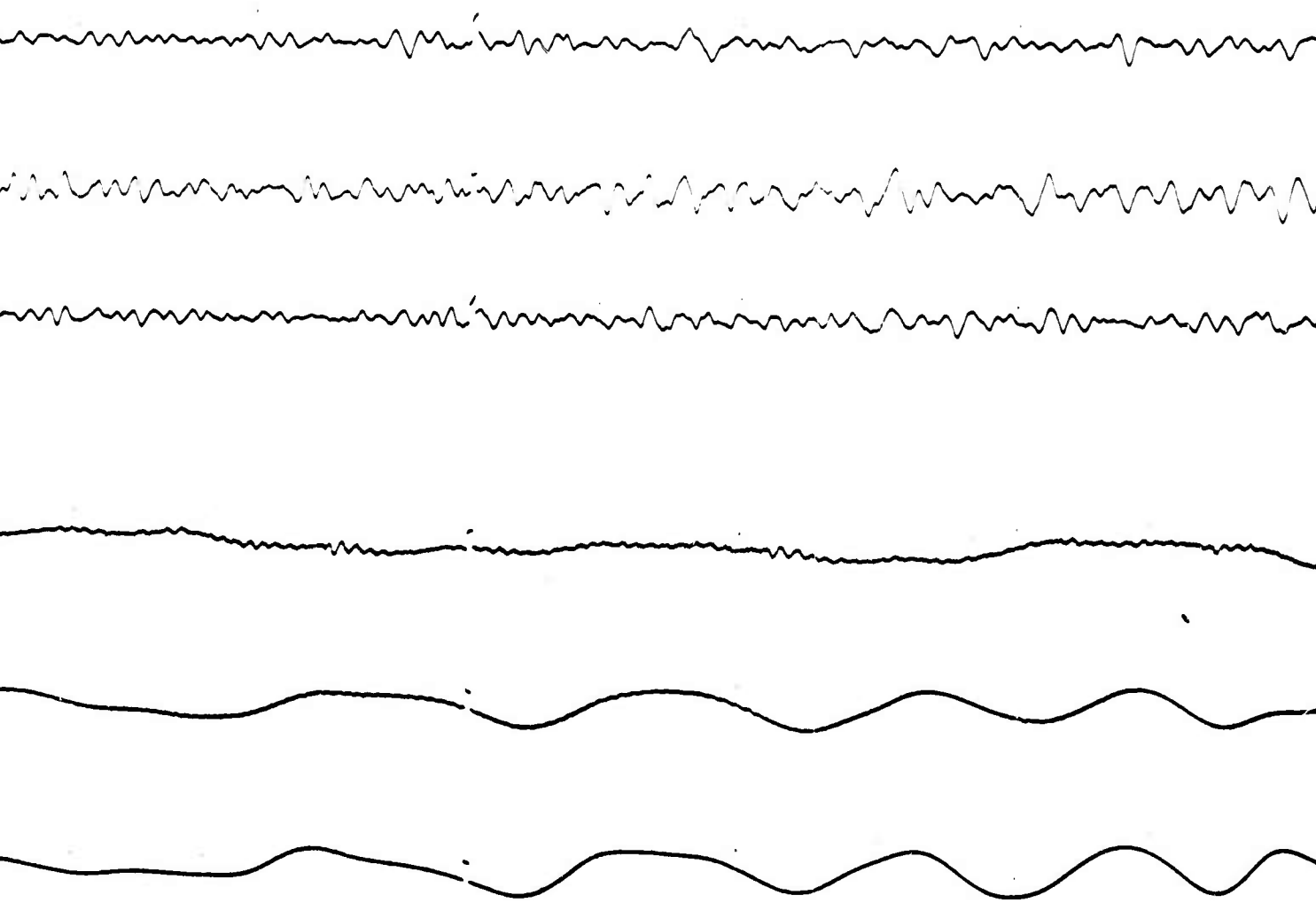

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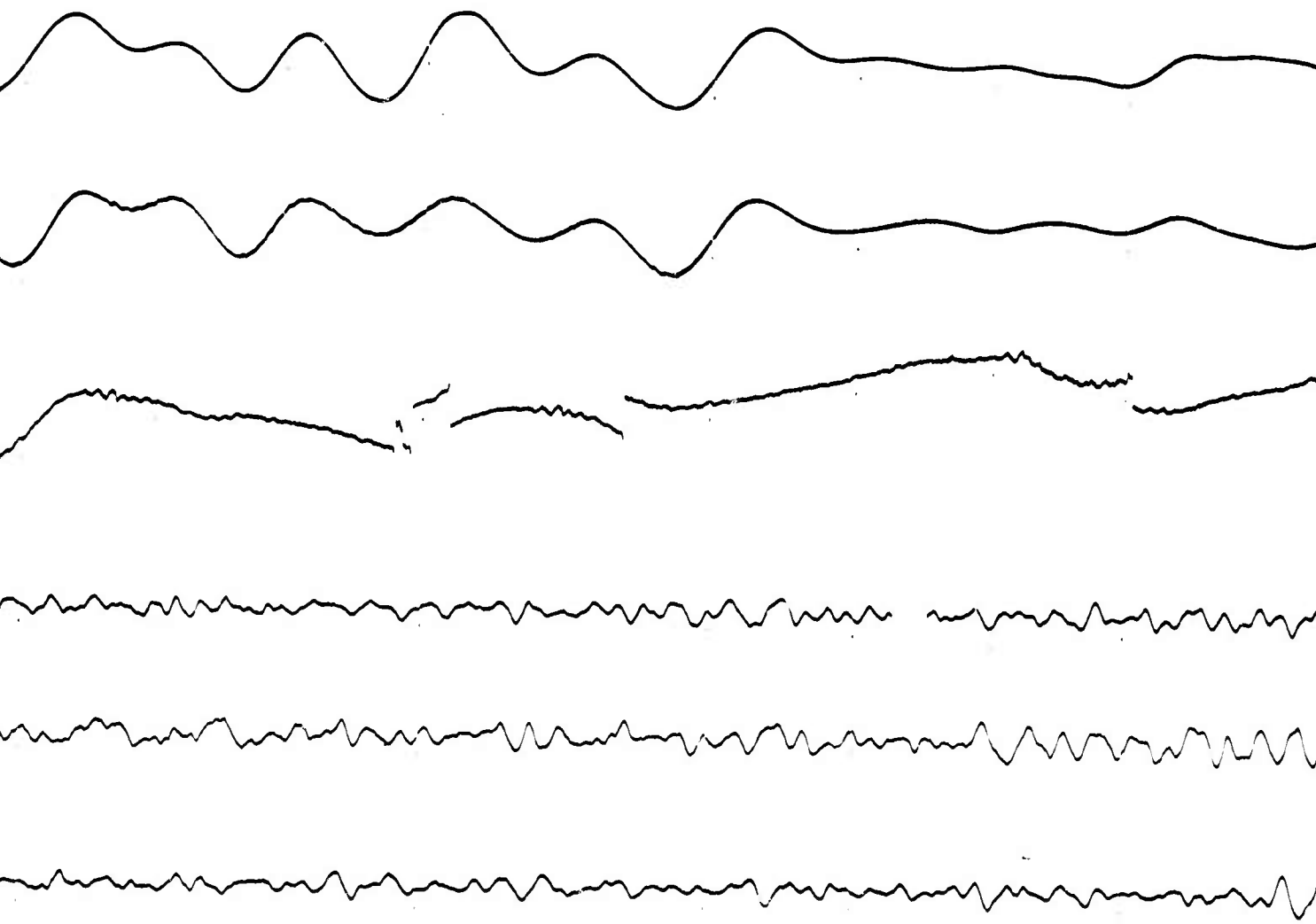

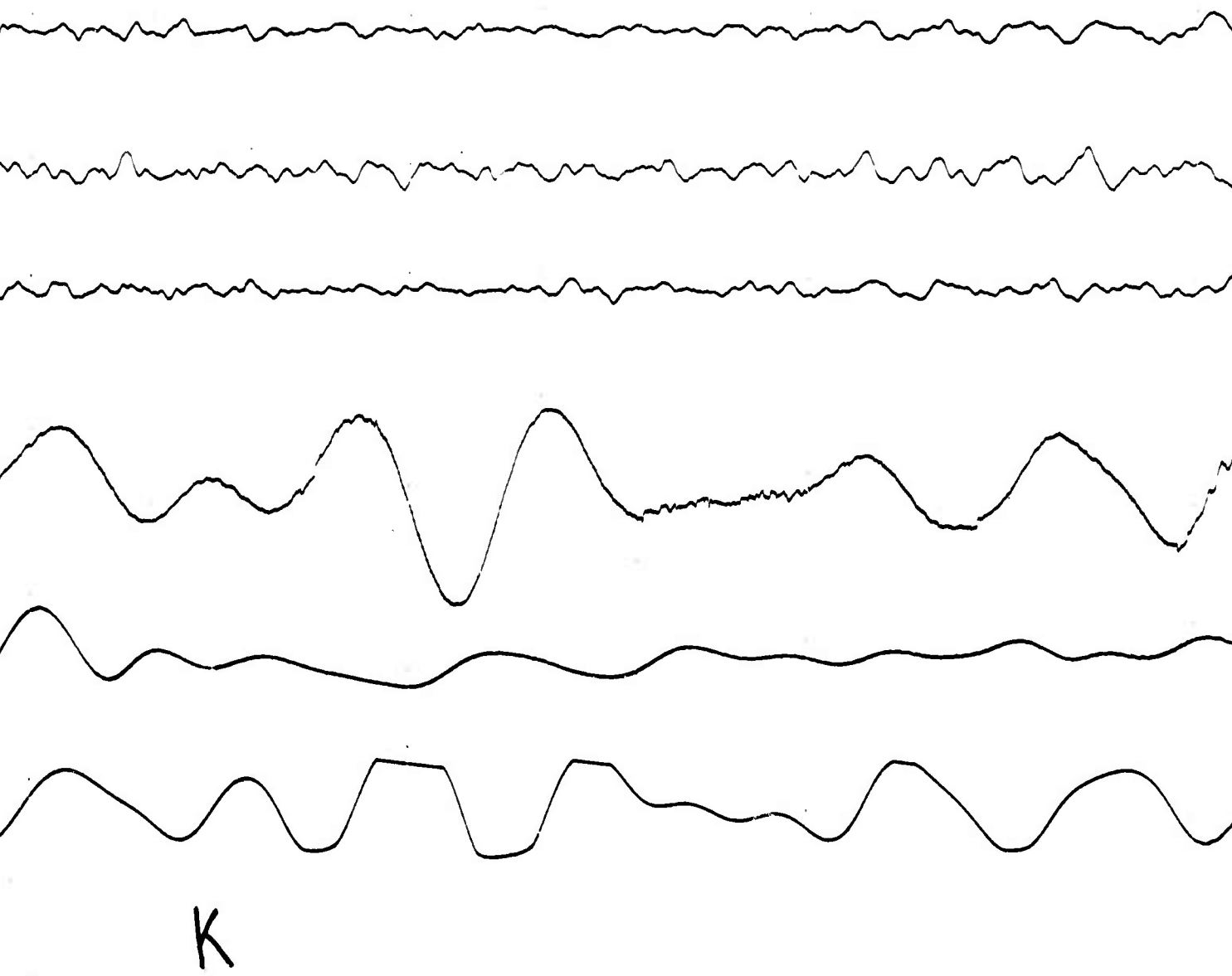
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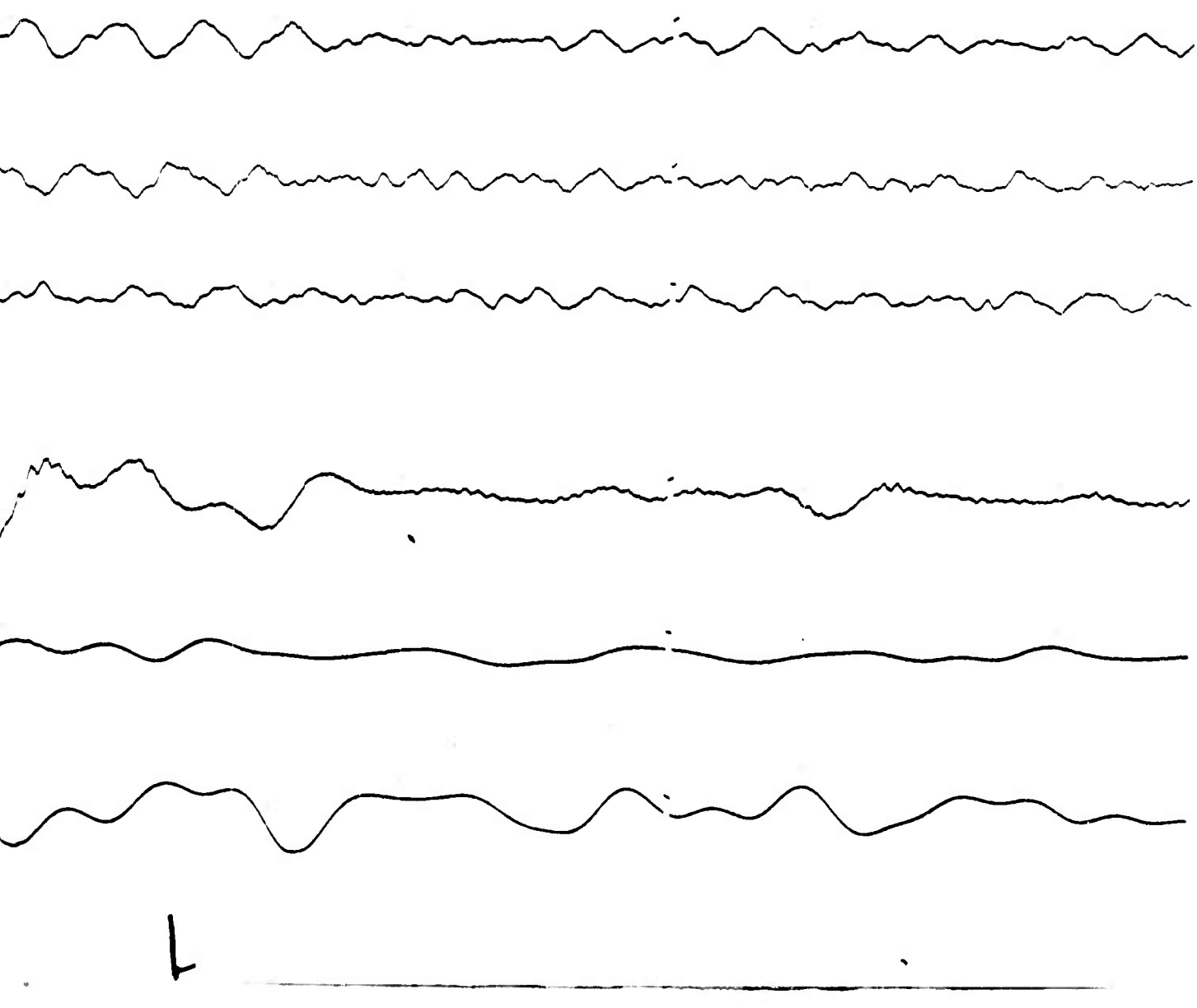
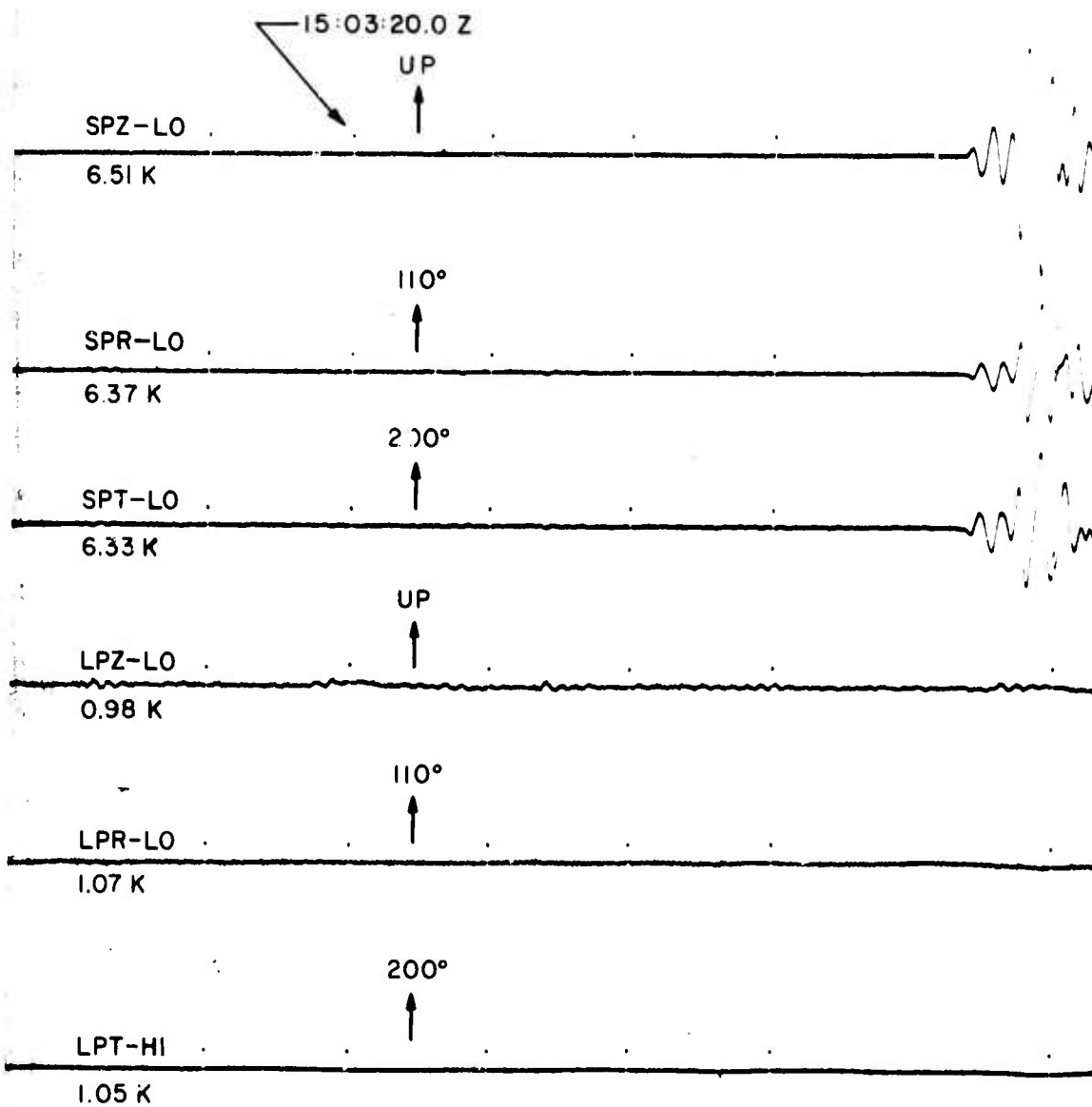


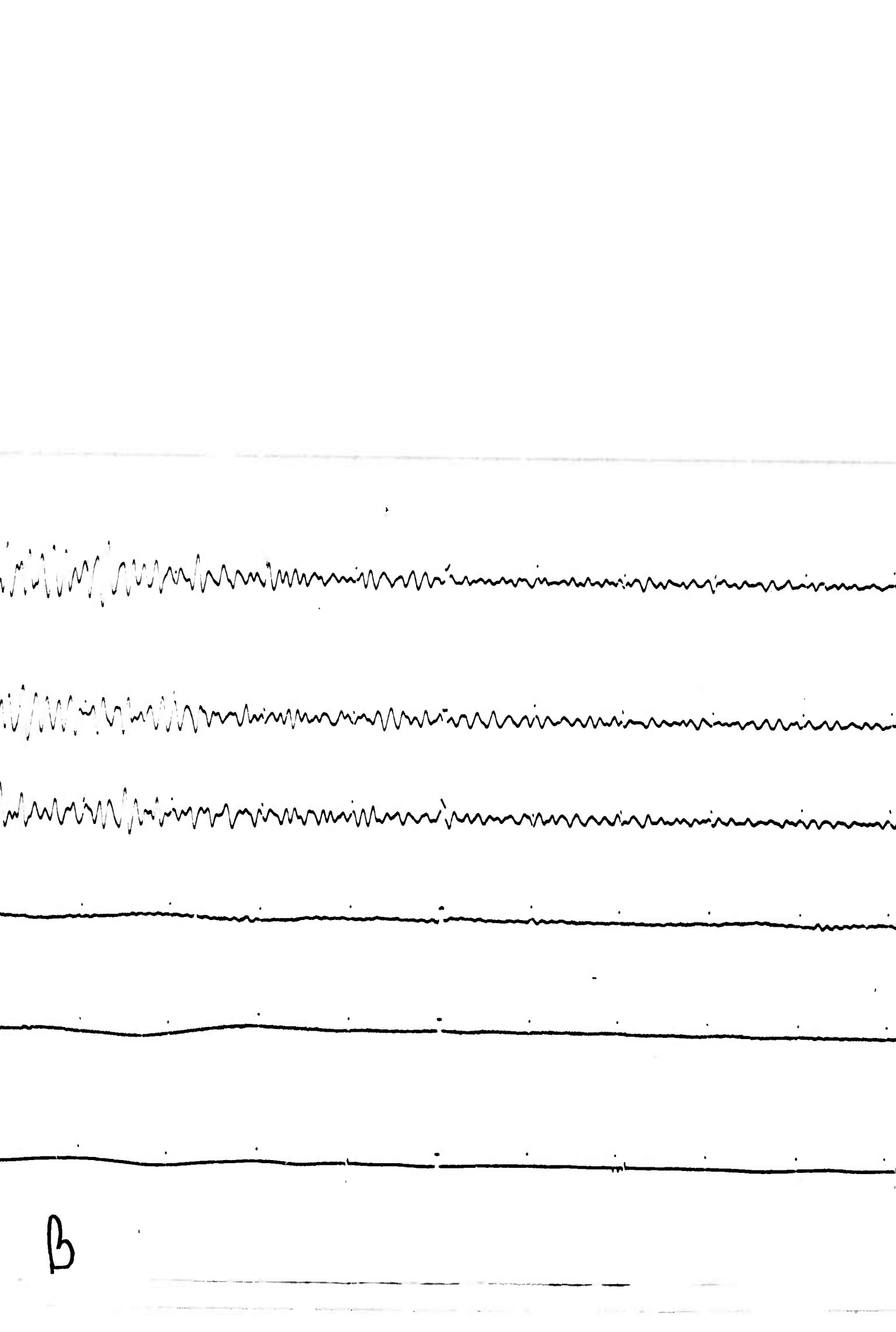
XCAR

-BC

ce George British
mbia, Canada
April 1968

1915 Km

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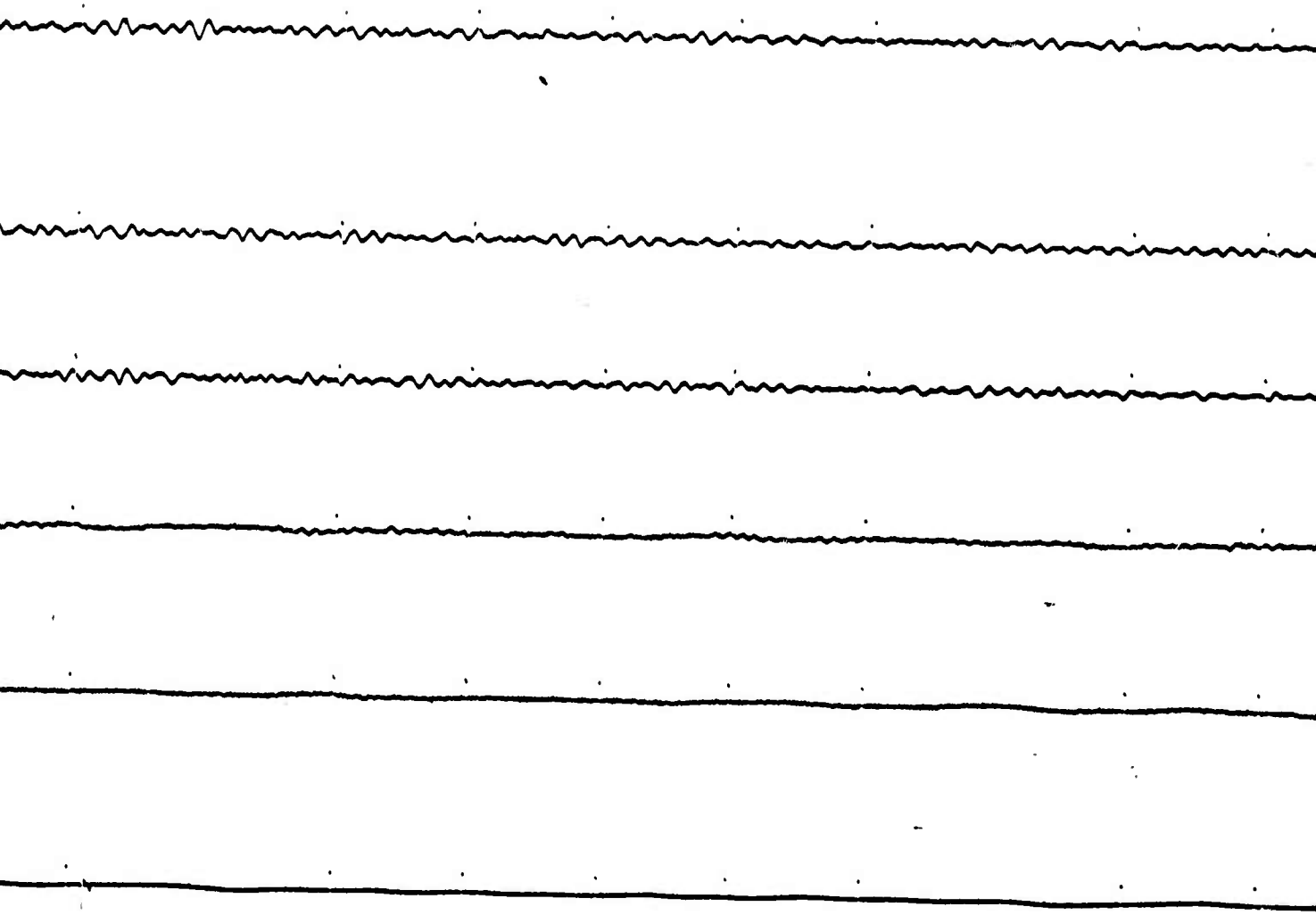

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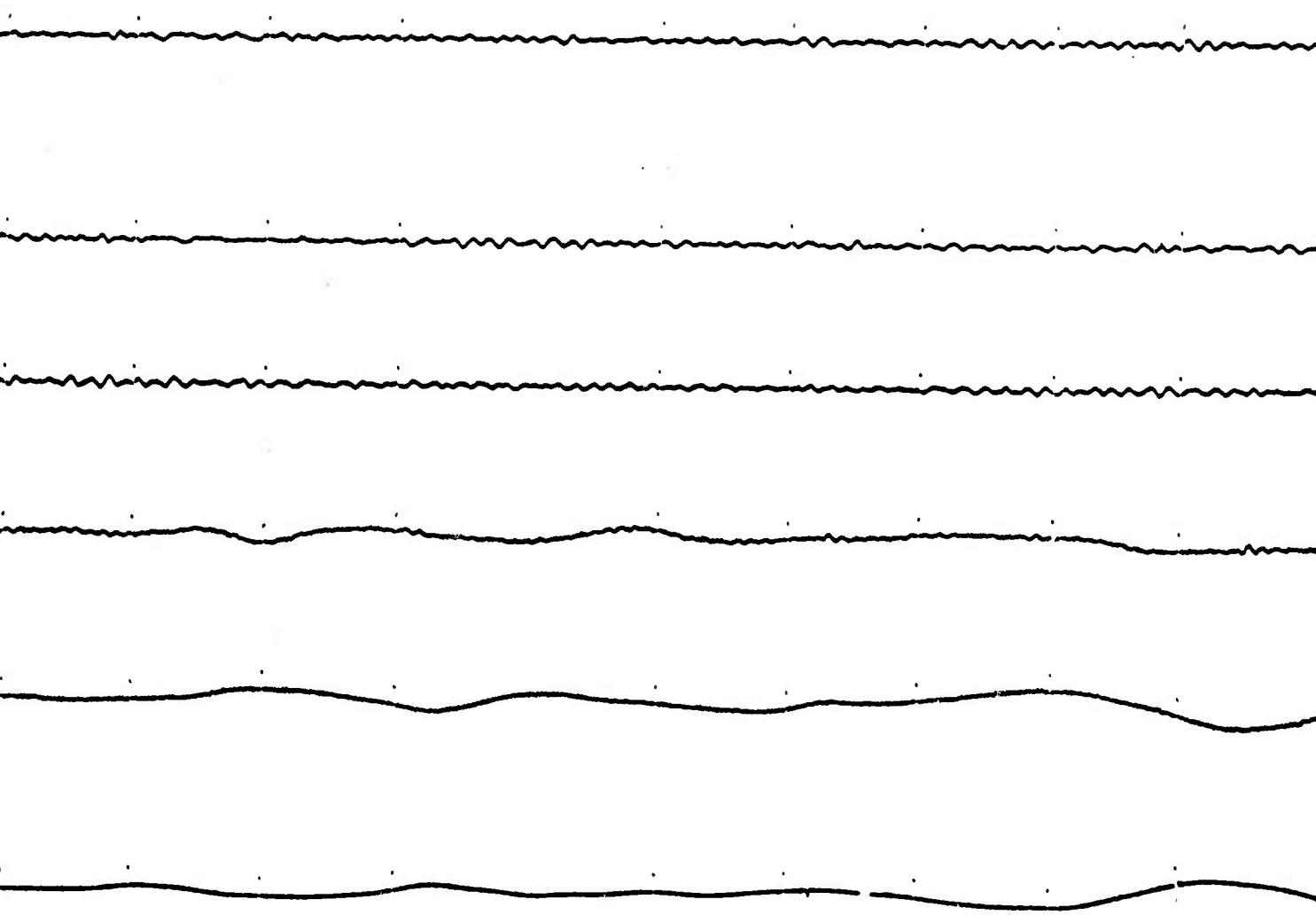

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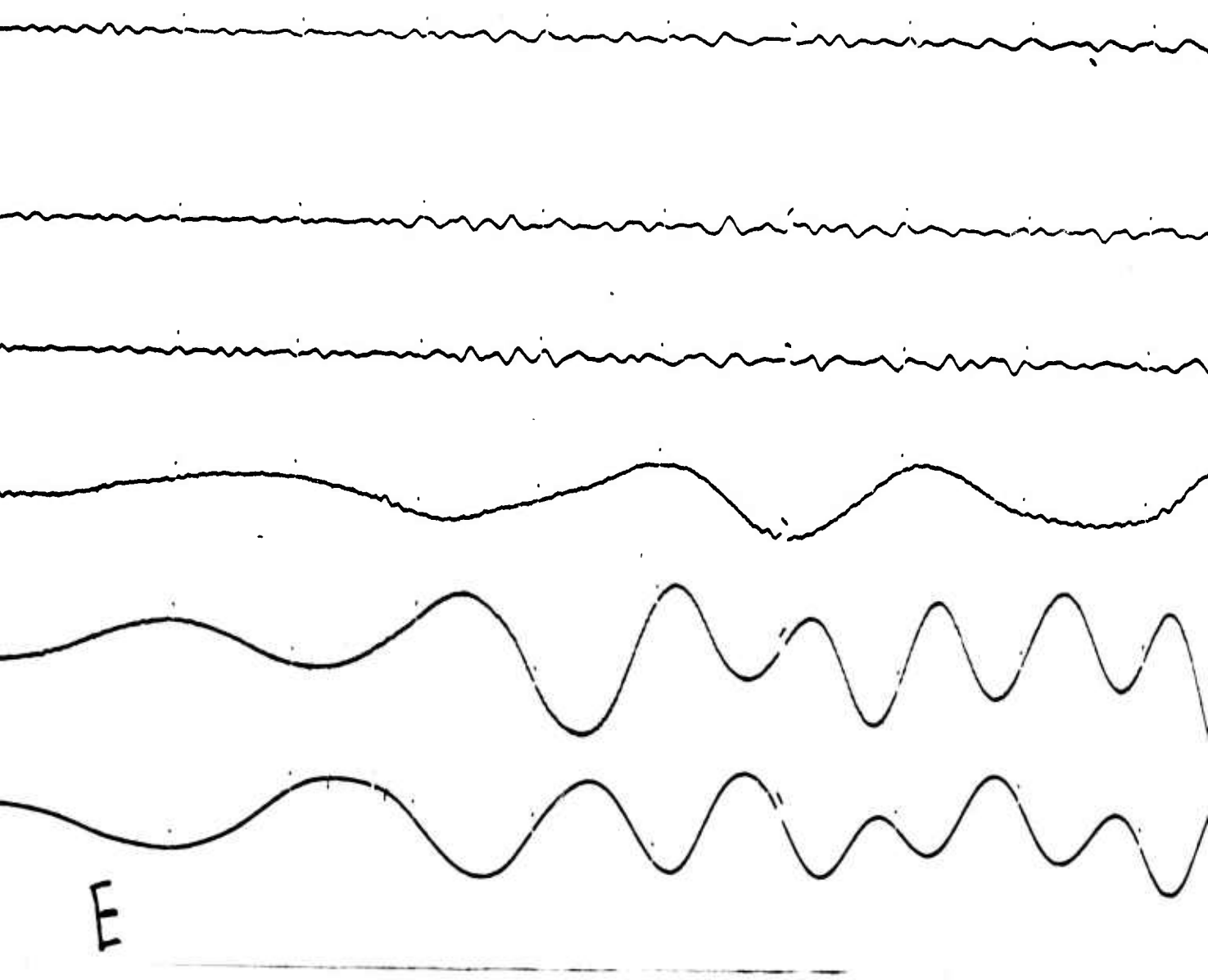
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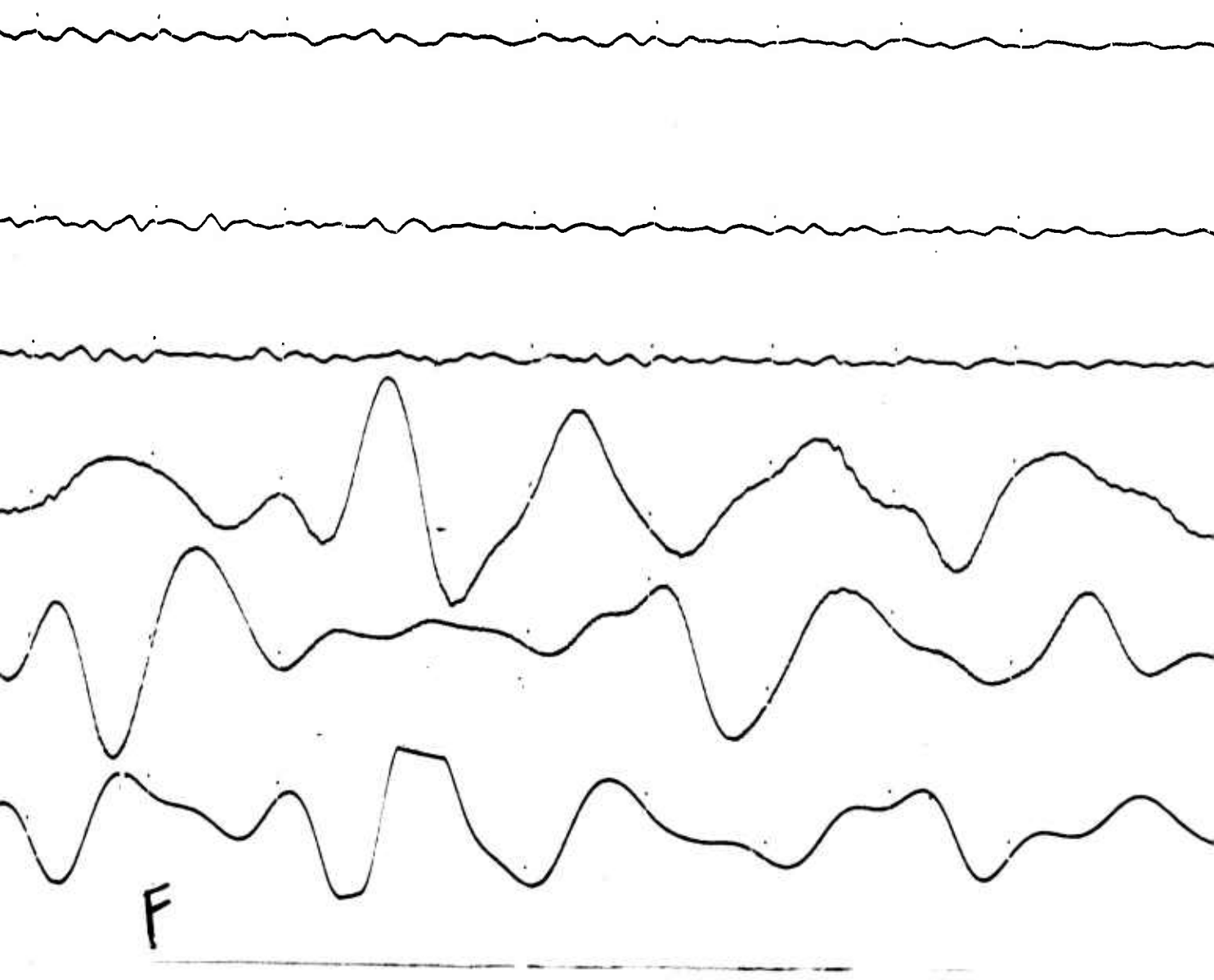
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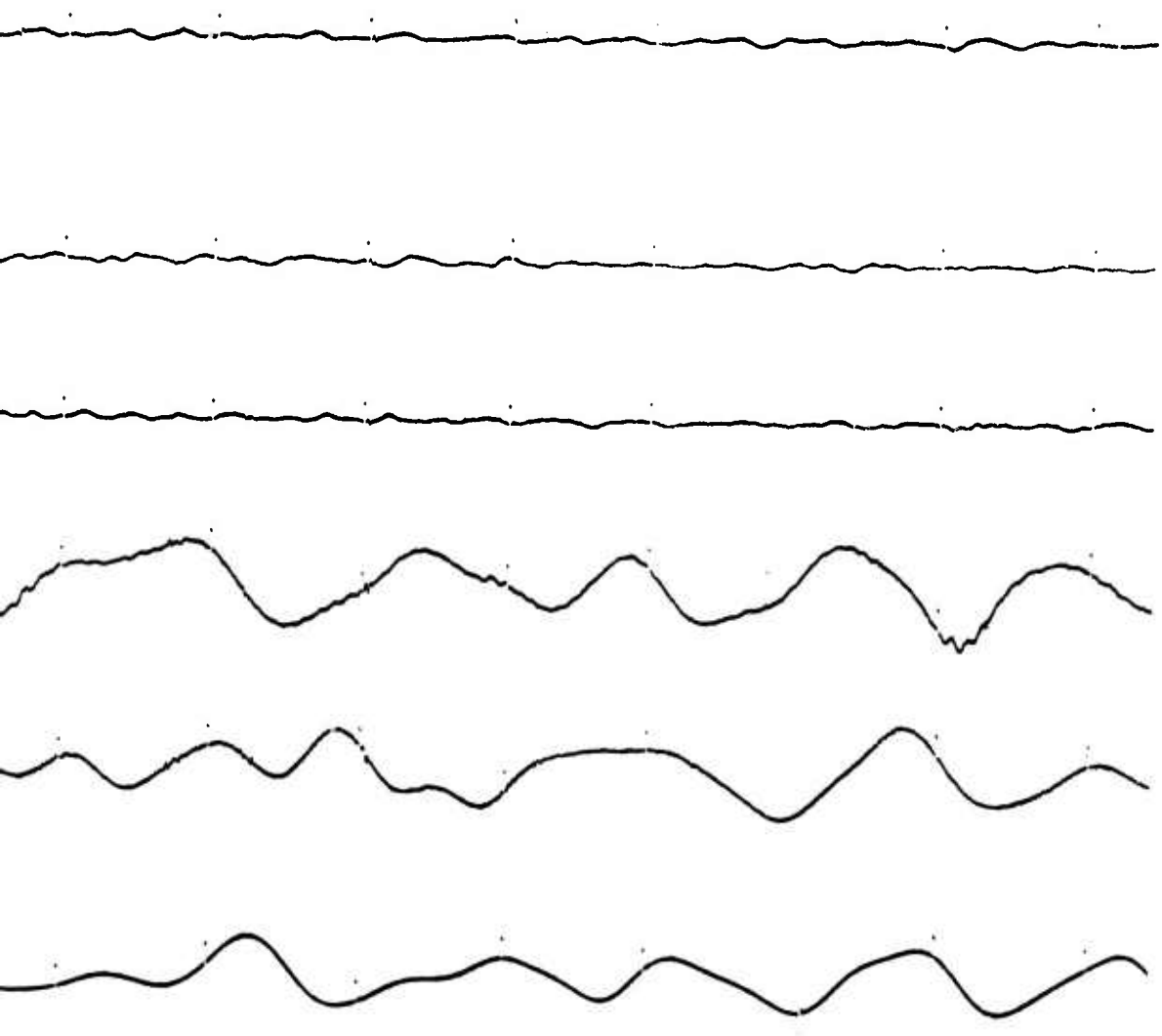


G

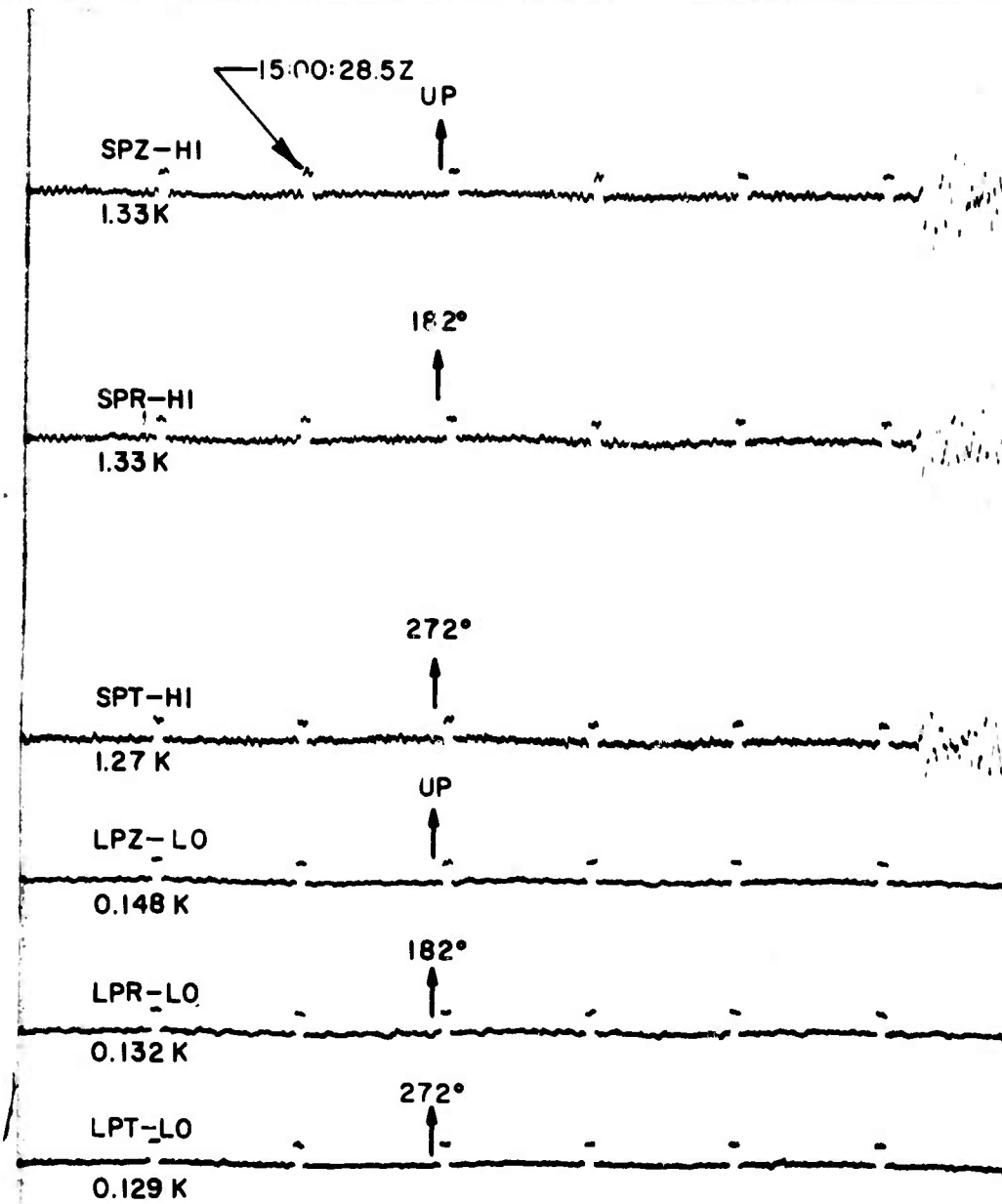
BOXCAR

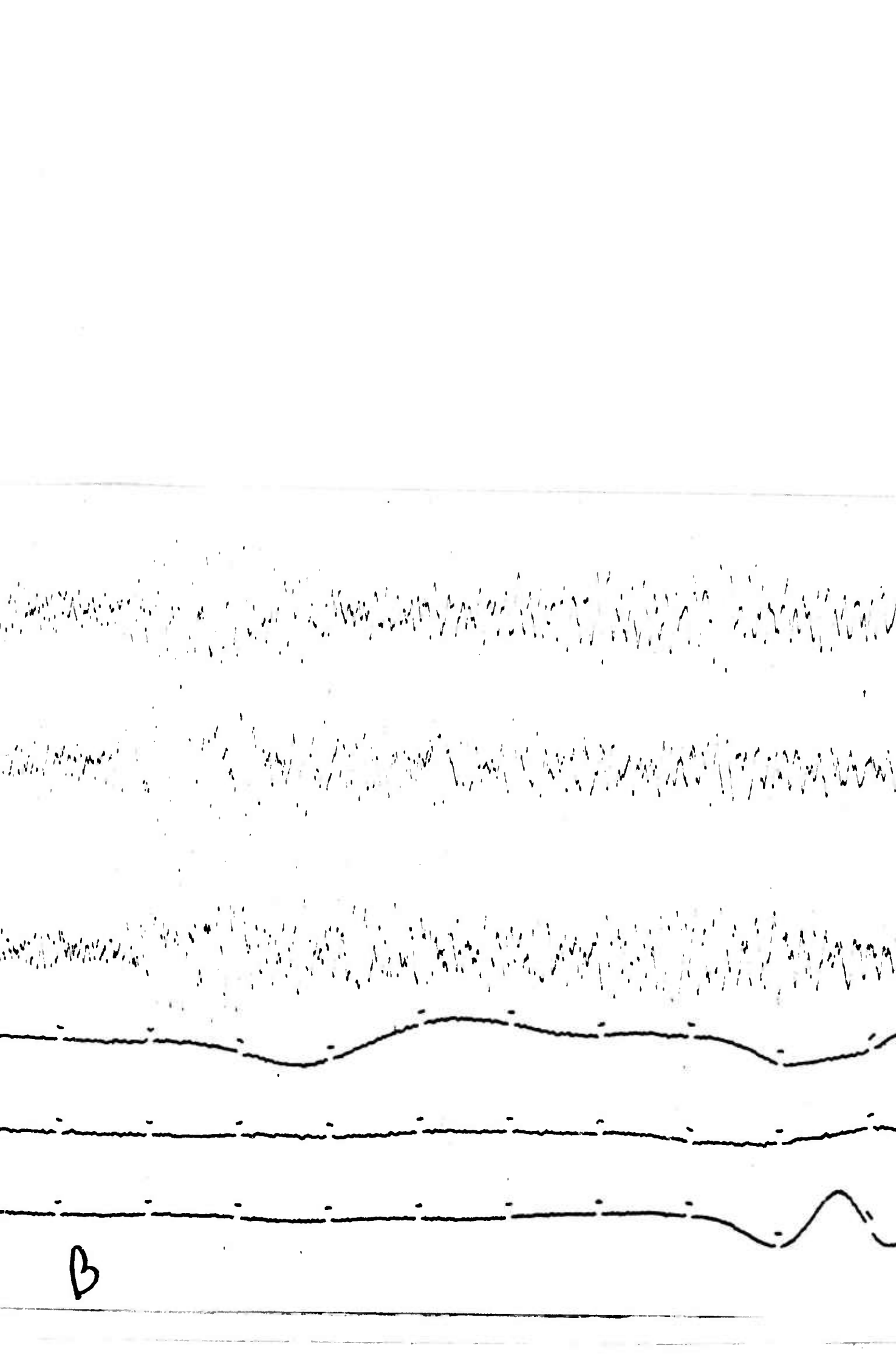
CP-CL

Campo, California

26 April 1968

Δ = 507 Km

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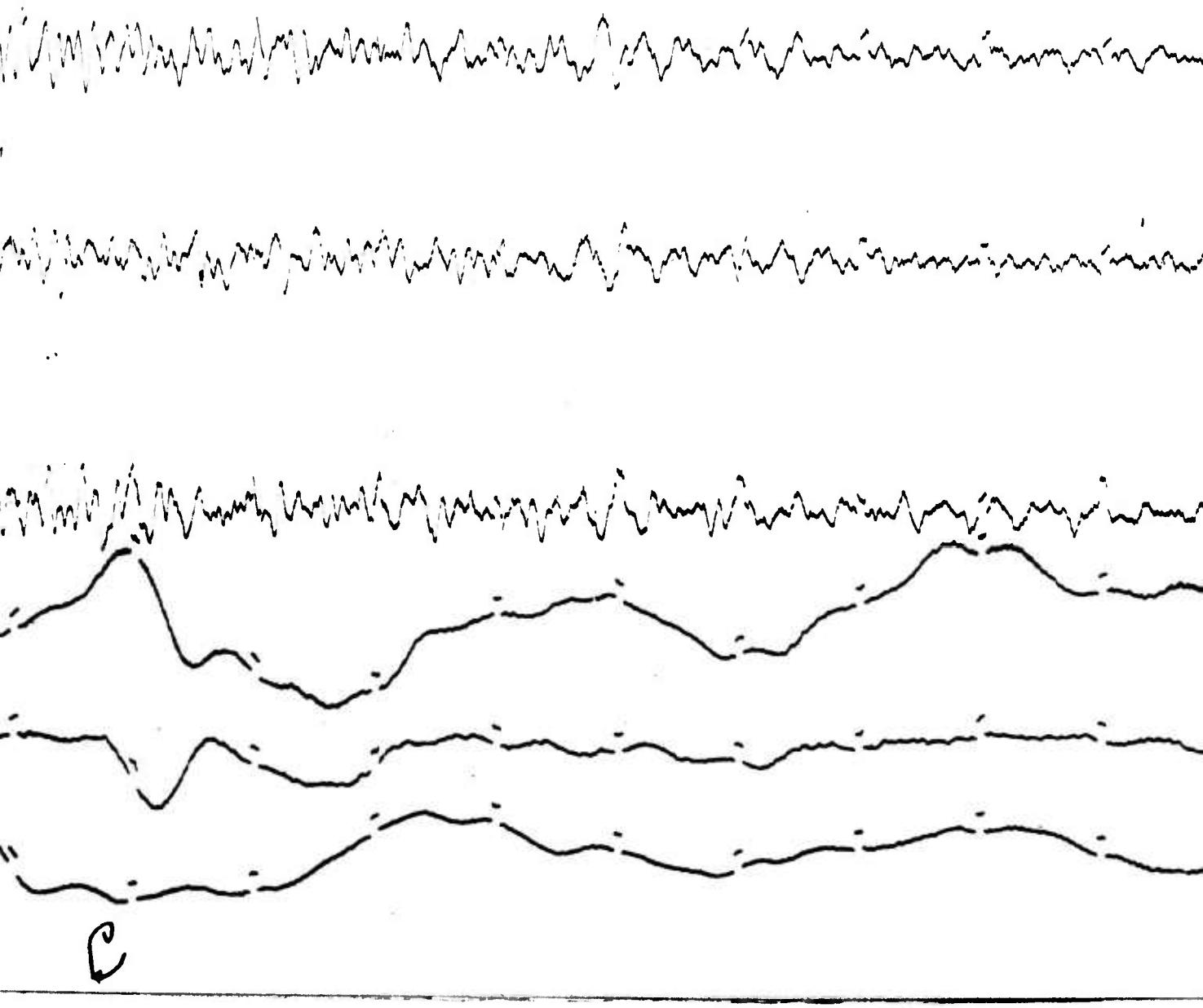
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