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AFTAC ltr 28 Feb 1972

LONG RANGE SEISMIC MEASUREMENTS

DUMONT

19 MAY 1966

Prepared for

AIR FORCE TECHNICAL APPLICATIONS CENTER

Washington, D. C.

15 SEPTEMBER 1966

By

EARTH SCIENCES DIVISION

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

DUMONT

19 May 1966

SEISMIC DATA LABORATORY REPORT NO. 160

AFTAC Project No.:	VELA T/6702
Project Title:	Seismic Data Laboratory
ARPA Order No.:	624
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Name of Contractor:	EARTH SCIENCES DIVISION TELEDYNE INDUSTRIES, INC.
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P. O. Box 334, Alexandria, Virginia

AVAILABILITY

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DUMONT

EVENT DESCRIPTION

DATE: 19 May 1966

TIME OF ORIGIN: 13:56:28.1Z

YIELD:

MAGNITUDE: 5.48 ± 0.56

LOCATION:

SITE: Nevada Test Site, Area U2t

GEOGRAPHIC COORDINATES:

Lat: 37°06'40.0" N

Long: 116°03'29.0" W

ENVIRONMENT:

GEOLOGIC MEDIUM: Tuff

SURFACE ELEVATION: 4195 ft.

SHOT ELEVATION: 1995 ft.

SHOT DEPTH: 2200 ft.

COMPUTED EPICENTER: ALL STATIONS

GEOGRAPHIC COORDINATES:

Lat: 37°02'06.0" N

Long: 116°07'19.2" W

TIME OF ORIGIN: 13:56:32.8Z

DEPTH: 48.5 km

EPICENTER SHIFT: 10.2 km, S 34° W

Code	Station	Final							
		SPZ	SPR	SPT	LPZ	LPR	LPT	Tape	
MN-NV	Mina, Nevada	+	+	+	+	+	+	*	
KN-UT	Kanab, Utah	+	+	+	+	+	+	*	
TFSO-Z1	Tonto Forest Observatory, Arizona	+	+	+	+	+	+	*	I
UBSO-Z10	Uinta Basin Observatory, Utah	+	+	+	+	+	+	*	P
BMSO-Z3	Blue Mountain Observatory, Oregon	+	+	+	+	+	+	*	P
LAO	Sunarray, AO-10, Montana	+	N	N	N	N	N	*	P
SW-MA	Sweetgrass, Montana	+	+	+	+	+	+	*	P
RG-SD	Redig, South Dakota	+	+	+	+	+	+	*	P
WN-SD	Winner, South Dakota	+	+	+	+	+	+	*	P
WMSO-Z6	Wichita Mountain Observatory, Oklahoma	+	+	+	+	+	+	*	P
CR-NE	Crete, Nebraska	+	+	+	+	+	+	*	P
JP-AT	Jasper, Alberta, Canada	+	+	+	+	+	+	*	P
KC-MO	Kansas City, Missouri	+	+	+	+	+	+	*	P
PG-BC	Prince George, British Columbia, Canada	+	+	+	I	I	I	*	P
ST-BC	Smithers, British Columbia, Canada	+	+	+	I	I	I	*	P
RK-ON	Red Lake, Ontario Canada	+	+	+	+	+	+	*	P
CPSO-Z9	Cumberland Plateau Observatory, Tennessee	+	+	+	+	+	+	*	P
AX-AL	Alexander City, Alabama	+	+	+	+	+	+	*	P
BE-FL	Belleview, Florida	+	+	-	+	I	+	*	P
HN-ME	Houlton, Maine	+	+	-	+	+	+	*	P
SM-QU	Schefferville, Quebec, Canada	+	+	+	+	+	+	*	P
MB-NT	Mould Bay, Northwest Territories, Canada	+	+	+	+	+	I	*	P

I Inoperative + Signal

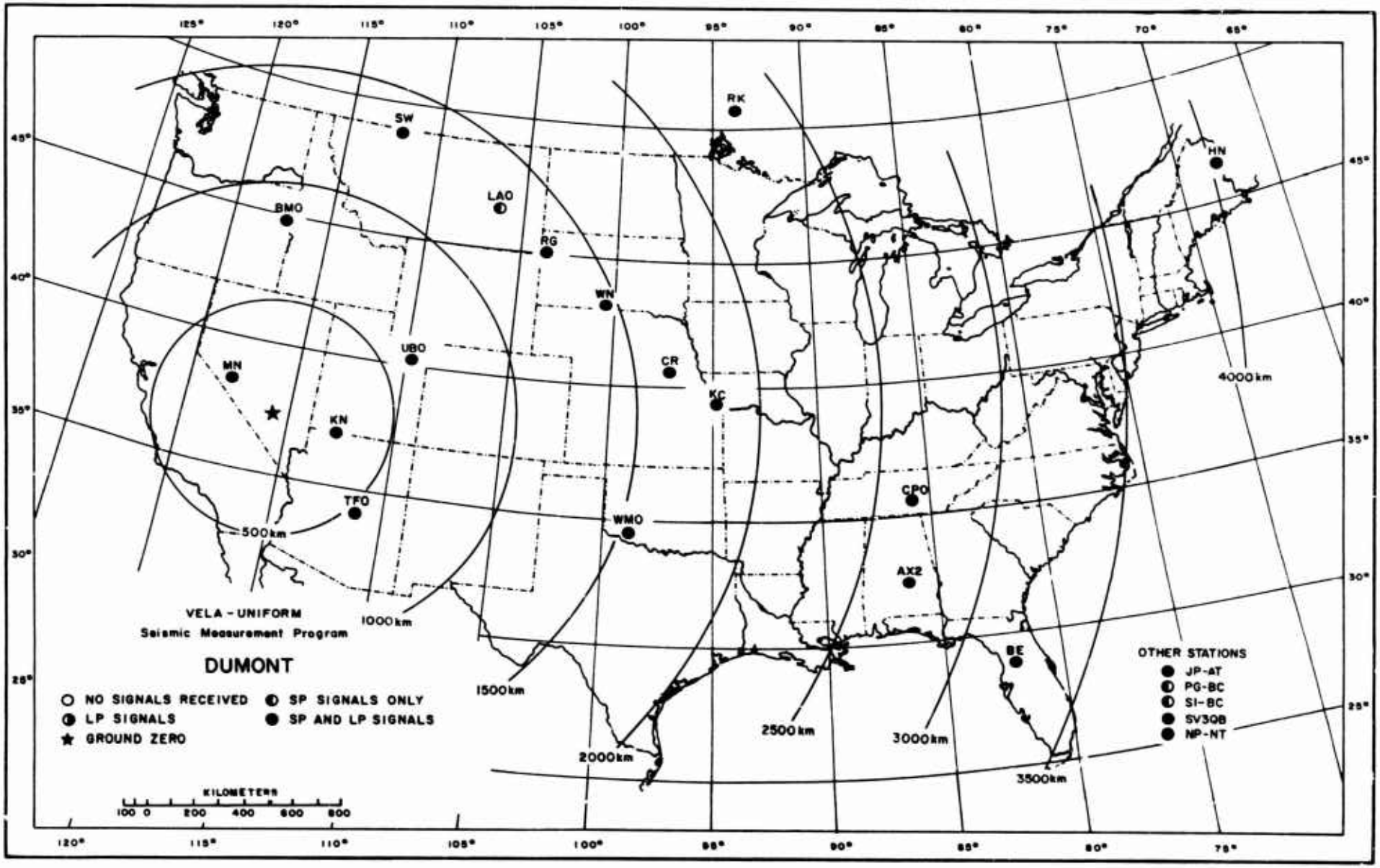
N No Instrument - No Signal

P Primary Timing * Magnetic Tape Available

S Secondary Timing

Station Status Report - DUMONT

Table 1



Recording Stations and Signals Received

Figure 1

INTRODUCTION

A long range seismic measurements (LRSM) program and several larger seismographic observatories were established under VELA-UNIFORM to record seismological data resulting from natural seismic activity and a planned series of U. S. underground nuclear tests. The LRSM teams are mobile and occupy locations selected to provide optimum data from events of special interest; the observatories are permanent installations as follows:

Wichita Mountains Seismological Observatory (WMSO)
Lawton, Oklahoma

Uinta Basin Seismological Observatory (UBSO)
Vernal, Utah

Blue Mountain Seismological Observatory (BMSO)
Baker, Oregon

Cumberland Plateau Seismological Observatory (CPSO)
McMinnville, Tennessee

Tonto Forest Seismological Observatory (TFSO)
Payson, Arizona

Large Aperture Seismic Array (LASA)
Billings, Montana

The purpose of this report is to provide an analysis of data resulting from the DUMONT event recorded by the

LRSM teams and the VELA observatories and a preliminary summary of data reported by other permanent and temporary seismographic stations.

INSTRUMENTATION AND PROCEDURE

The instrumentation at each of the LRSM locations consists of three-component short-period and three-component long-period seismographs. In general, data are recorded on 35 millimeter film and on one-inch 14 channel magnetic tape although recently more portable instrumentation has been incorporated which records only on magnetic tape. The stations are all equipped to record WWV continuously to provide accurate time control and calibration is accomplished once each day and just prior to each shot at the operational settings. Pertinent information useful for analysis of LRSM data is available to qualified users of this data and is contained in Technical Report 65-43, "Interpretation and Usage of Seismic Data, LRSM program." General information on LRSM van and portable system equipment and operation is given in Technical Reports 66-27, "The LRSM Mobile Seismological Laboratory," and 65-74, "A Portable Seismograph." Copies of these reports may be obtained from DDC. The AD control number of Technical Report 66-27 is 480343. All the ob-

servatories have both long-period and short-period, three-component instrumentation, in addition to their other specialized facilities.

Station information is presented in Appendix I. This includes the station name and code; the geographic coordinates, distances and azimuths involved; the station elevations; and the type of instruments in use at each location. Representative instrumental response curves are shown in Appendix II(B).

The procedures used in measuring amplitudes reported herein is illustrated in Appendix II(A) and the unified magnitude is calculated as shown in Appendix I(B). The distance factors (B) beyond 16° are from Gutenberg and Richter*. For distances less than 16° values were read from a curve in the Gutenberg and Richter paper back to 10° and then extrapolated to 2°, using an inverse cube relationship.

A standard hypocenter location program for a digital computer is used to determine the location using data from all stations analyzed. Best-fit values of latitude, longi-

*Gutenberg, B. and Richter, C. F., Magnitude and Energy of Earthquakes, Ann. Geofis., 9 (1956), pp. 1-15

tude, depth of focus, and time of origin are determined statistically by a least squares technique. This utilizes a Jeffreys-Bullen travel-time curve as modified by Herrin in 1961 on the basis of Pacific surface-focus recordings. Precision of the computation is limited primarily by the accuracy of arrival times, the validity of the standard travel-time curve, and by local velocity deviations. Since the method is based on P-wave arrivals, this particular program does not make use of later phases such as pP and S in the determination of depth or location.

DATA AND RESULTS (LRSM and VELA OBSERVATORIES)

The parameters of the DUMONT event and a summary of the seismic evaluation is shown on the Event Description page. The operational status of the 22 LRSM stations and observatories is given in Table 1 and illustrated in Figure 1.

Table 2 summarizes the measurements made of the principal phases from the DUMONT event at the LRSM and VELA stations. Included are the Pn and P arrival times, the maximum amplitudes (A/T) of Pn or P motion and other phases as seen on the short-period vertical instruments. Long-period Love and Rayleigh wave motion are also tabulated in (A/T) form.

In addition, individual station Rayleigh wave areas (mm^2) is indicated as measured on the LPZ only. Although reduced to 1K magnification, they have not been normalized to any magnitude. Twenty-two stations recorded short-period signals. Long-period signals from this event were recorded by 19 stations.

The unified magnitudes determined from the LRSM and VELA observatories is shown in Figure 2. The average magnitude is 5.48 ± 0.56 .

The travel-time residuals from the Pn and P phases are shown in Figure 3. Figures 4 through 8 illustrate plots of the amplitude of P, Pg, Lg, LQ, and LR.

Attached to the report are illustrative seismograms showing the signals recorded at 4 stations. The most distant station analyzed that recorded DUMCNT was NP-NT at a distance of 4366 kilometers.

Code	Station	Distance (km)	Inst	Magn fication (k) Fix x 10	Phase	Observed Travel Time (min)	Observed Travel Time (sec)	Period T (sec)	Maximum Amplitude A/T	Magnitude (m)	Area (km^2) LPZ
MN-NV	Mina, Nevada	236	SPZ	1.26	Pn	0	36.6	0.4	4172	5.88	
			SPZ	0.59*	Pg	0	38.7	0.45	14.375		
			SPT	0.746	Lg			(1.0)	(48.053)		
			LPT		LQ			---	---		
			LPZ	1.52	LR			14.0	2517		1042.76
KN-UT	Kanab, Utah	267	SPZ	1.005	Pn	0	43.2	0.6	2718	5.93	
			SPZ	1.005	e	0	44.6	0.6	2549		
			SPZ		Pg	0	48.1	---	---		
			SPT		Lg			---	---		
			LPT	3.24*	LQ			14.0	1059		
			LPZ	2.25*	LR			12.0	2576		333.33
TFSO	Tonto Forest Observatory, Utah	535	SPZ-1	6.0	Pn	1	14.9	0.6	305	5.83	
			SPZ-1	6.0	e	1	21.1	0.6	244		
			SPZ-1	1.0	Pg	1	29.3	1.3	2207		
			SPN	1.0	Lg			1.3	2049		
			SPE	1.0	Lg			1.3	2364		
			LPN	2.0	LQ			(15.0)	(140)		
			LPE	2.0	LQ			(15.0)	(126)		
			LPR		LR			---	---		
UBSO	Uinta Basin Observatory, Utah	667	SPZ-10	4.85	Pn	1	33.7	0.9	760	6.48	
			SPZ-10	4.85	e	1	35.3	0.8	842		
			SPZ-10	4.85	e	1	41.1	0.95	461		
			SPZ-10	4.85	(P*)	1	46.2	0.9	532		
			SPZ-10	4.85	Pg	1	52.7	0.7	1681		
			SPN	5.00	Lg			1.45	4673		
			SPE	4.70	Lg			1.2	3114		
			LPN	32.0*	LQ			15.0	182		
			LPE	(38.0*)	LQ			15.0	(71.5)		
			LPZ	34.0*	LR			14.0	219		65.88
BMSO	Blue Mountain Observatory, Oregon	866	SPZ-3	35.0	Pn	1	57.6	0.6	29.3	5.43	
			SPZ-3	35.0	e	1	59.0	0.45	49.6		
			SPZ-3	35.0	e	2	01.5	0.9	105.7		
			SPZ-3	35.0	(P*)	2	05.8	(0.8)	(131.0)		
			SPZ-3	35.0	Pg	2	(24.3)	---	---		
			SPE		Lg			---	---		
			SPN		Lg			---	---		
			LPN	1.0	LQ			(17.0)	(83.3)		
			LPE	1.0	LQ			16.0	356		
			LPZ	1.0	LR			14.0	554		375.00
LAO	Subarray AO-10, Montana	1339	SPZ	350	Pn	2	52.6	1.0	22.1	5.44	
			SPZ	32.5	e	2	55.4	0.9	107		
			SPZ	32.5	PP	3	04.1	0.8	179		
			SPZ	32.5	e	3	29.0	0.8	115		
			SPZ	32.5	Pg	4	05.1	1.4	240		
SW-MA	Sweetgrass, Montana	1359	SPZ	84.3	P	2	57.8	0.9	99.8	5.18	
			SPZ	84.3	e	3	01.3	1.0	182		
			SPZ	84.3	e	3	03.4	0.9	99.3		
			SPZ	116.5*	PP	3	10.0	0.95	228		
			SPZ	84.3	e	3	22.1	0.8	133		
			SPZ	84.3	e	3	28.9	1.0	136		
			SPZ	84.3	Pg	3	49.0	0.8	144		
			SPZ	84.3	e	4	17.0	0.9	102		
			SPR	129*	Lg			1.3	503		
			SPT	90.5	Lg			(1.4)	(485)		
			LPR	23.3	LQ			17.0	133		
			LPT	22.4	LQ			17.0	42.9		
			LPZ	3.6	LR			12.0	350		207.72
RG-SD	Rediq, South Dakota	1381	SPZ	42.0*	P	2	58.5	0.8	112	6.11	
			SPZ	42.0*	e	3	01.6	0.8	210		
			SPZ	42.0*	e	3	04.7	0.7	89.8		
			SPZ	42.0*	PP	3	07.3	0.7	131		
			SPZ	42.0*	e	3	14.3	0.8	(625)		
			SPZ	42.0*	e	3	24.5	0.8	252		
			SPZ	42.0*	e	3	31.0	0.8	289		
			SPZ	42.0*	Pg	3	51.0	(0.8)	(219)		
			SPZ	42.0*	e	4	06.7	1.0	286		
			SPT	35.7*	Lg			2.0	2987		
			SPR	16.2*	Lg			2.0	2590		
			LPR	4.93	LQ			22.0	(41.1)		
			LPT	7.0	LQ			16.0	(146)		
			LPZ	0.976	LR			13.0	328		136.27
WN-SD	Winner, South Dakota	1510	SPZ	27.5*	P	3	(15.1)	(1.0)	(245)	(6.16)	
			SPZ	27.5*	(PP)	3	27.1	1.1	746		
			SPZ	27.5*	(Pg)	4	14.5	1.0	291		
			SPR	52.5*	Lg			1.6	844		
			SPT	60.7*	Lg			2.0	1352		
			LPR	21.6	LQ			14.0	353		
			LPT	18.5	LQ			15.0	104		
			LPZ	33.0	LR			12.0	361		113.33
WMSO	Wichita Mountain Observatory, Oklahoma	497	SPZ-6	266*	P	3	26.5	1.3	124	5.50	
			SPZ-6	266*	e	3	34.6	1.4	115		
			SPZ-6	266*	PP	3	39.7	1.4	97.9		
			SPZ-6	266*	e	3	54.9	1.4	67.1		
			SPZ-6	266*	Pg	4	29.3	---	---		
			LPN	10.0	(S)	6	21.9	15.0	16.8		
			SPN	30.0	Lg			1.65	619		
			SPE	30.0	Lg			1.65	391		
			LPN	10.0	LQ			18.0	138		
			LPZ	2.1	LR			15.0	213		50.95
CR-NB	Crete, Nebraska	1709	SPZ	32.3	P	3	38.5	1.0	240	5.54	
			SPZ	32.3	e	3	44.8	1.0	457		
			SPZ	32.3	PP	3	49.4	0.7	191		
			SPZ	32.3	e	3	57.9	0.7	138		
			SPZ	32.3	e	4	10.0	0.7	92.9		
			SPZ	32.3	(Pg)	4	(41.9)	(0.7)	(85.0)		
			SPR	14.55	Lg			1.0	601		
			SPT	17.2	Lg			1.0	727		
			LPR	11.9	LQ			14.0	312		
			LPT	10.55	LQ			14.0	305		
			LPZ	4.46	LR			(12.0)	(706)		236.55
JP-AT	Jasper, Alberta, Canada	1762	SPZ	150.3	P	3	46.1	0.6	8.0	3.86	
			SPZ	150.3	e	3	48.1	(1.0)	(180)		
			SPZ	88.1*	e	3	54.5	0.8	100		
			SPZ	150.3	PP	4	07.6	1.0	83.2		
			SPZ	150.3	(Pg)	4	31.4	1.0	68.2		
			SPZ	150.3	e	4	51.0	1.1	91.6		
			SPR	144	Lg			(1.6)	275		
			SPT	96.7*	Lg			1.2	135		
			LPR	6.0*	LQ			15.0	177		
			LPT	17.0*	LQ			15.0	125		
			LPZ	4.38	LR			16.0	211		401.83

Principal Phases
DUMONT
19 May 1966
11:56:28.12

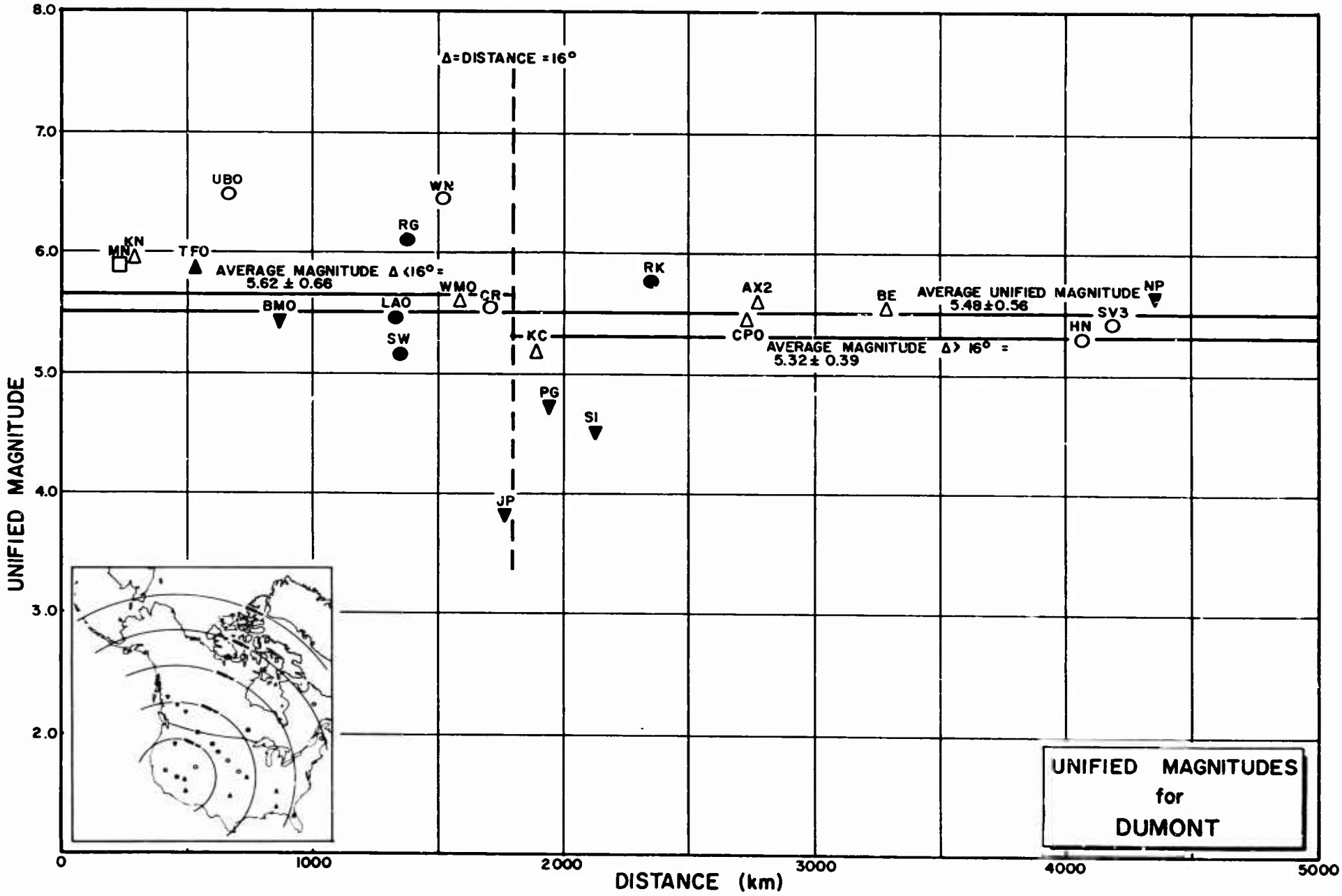
Code	Station	Distance (km)	Inst	Magnification (k) Film x 10	Phase	Observed Travel Time (min)	Observed Travel Time (sec)	Period T (sec)	Maximum Amplitude A/T	Magnitude (ML)	Area (mm)² LPZ
KC-MO	Kansas City, Missouri	1685	SPZ	50.2	P	3	58.8	1.0	(189)	(5.18)	
			SPZ	50.2	e	4	02.5	1.3	402		
			SPZ	50.2	PP	4	12.7	0.65	94.8		
			SPZ	50.2	e	4	35.4	0.7	64.9		
			SPZ	50.2	e	4	56.1	(0.8)	(56.7)		
			SPZ	50.2	(Pg)	5	18.8	(0.9)	(101)		
			SPT	40.7	Lg			1.1	159		
			SPR	40.6	Lg			1.0	134		
			LPT	21.3	LQ			16.0	138		
			LPR	18.3	LQ			(14.0)	(253)		
			LPZ	3.96	LR			14.0	316		260.33
PG-BC	Prince George, British Columbia, Canada	1941	SPZ	184	P	4	06.6	1.3	74.3	4.77	
			SPZ	184	e	4	09.3	1.3	306		
			SPZ	184	e	4	(11.8)	1.3	254		
			SPZ	184	e	4	54.6	1.6	98.2		
			SPZ	184	(Pg)	5	37.6	1.2	49.5		
			SPZ	184	e	6	06.7	1.4	50.9		
			SPR	139	Lg			1.7	141		
			SPT	147	Lg			2.15	271		
SI-BC	Smithers, British Columbia, Canada	2138	SPZ	177	e	4	27.7	(0.7)	(345.9)	(4.55)	
			SPZ	129.3*	e	4	29.2	0.7	103		
			SPZ	129.3*	e	4	30.6	1.3	374		
			SPZ	129.3*	e	4	36.2	1.3	236		
			SPZ	129.3*	PP	4	44.2	1.3	153		
			SPZ	129.3*	e	4	48.6	1.2	160		
			SPZ	129.3*	e	5	00.9	1.3	159		
			SPZ	129.3*	(Pg)	6	09.1	1.4	99.0		
			SPR	167	Lg			(1.9)	(85.8)		
			SPT	180	Lg			2.1	156		
RK-ON	Red Lake, Ontario, Canada	2341	SPZ	48.0*	P	4	45.5	0.8	467	5.77	
			SPZ	48.0*	e	4	47.0	1.05	905		
			SPZ	51.5	e	4	54.5	0.9	118		
			SPZ	51.5	e	5	00.5	0.8	103		
			SPZ	51.5	PP	5	06.6	0.9	122		
			SPZ	48.0*	e	5	22.7	0.8	80.4		
			SPT	51.5	Lg			1.5	131		
			LPT	35.6	LQ			17.0	29.6		
			LPZ	45.1	LR			12.0	83.8		64.08
CPRO	Cumberland Plateau Observatory, Tennessee	2730	SPZ-8	45.0	P	5	(21.8)	0.85	101	5.42	
			SPZ-8	45.0	e	5	23.3	0.9	139		
			SPZ-8	45.0	e	5	33.4	0.9	87.4		
			SPZ-8	45.0	e	5	43.4	1.3	77.1		
			SPZ-8	45.0	PP	5	52.4	0.85	70.2		
			SPN		Lg			---	---		
			SPE		Lg			---	---		
			LPN	22.0	LQ			17.0	97.5		
			LPE	19.0	LQ			19.0	39.9		
			LPZ	1.0	LR			13.0	360		200.00
AX2AL	Alexander City, Alabama	2764	SPZ	176.7*	P	5	(25.1)	0.75	128	5.58	
			SPZ	176.7*	e	5	26.8	(1.0)	(291)		
			SPZ	176.7*	e	5	38.4	0.95	41.4		
			SPZ	134.1	e	5	40.9	0.9	42.9		
			SPZ	134.1	e	7	(07.1)	1.0	24.4		
			LPR	43.4	(S)	9	56.9	16.0	11.8		
			LPT	31.8	(S)	9	48.9	17.0	9.6		
			SPR	171	Lg			(2.4)	(194)		
			SPT	170	Lg			(2.4)	(314)		
			LPR	43.3	LQ			21.0	38.5		
			LPT	31.8	LQ			20.0	70.8		
			LPZ	3.98	LR			17.0	116		314.07
BE-FL	Belleview, Florida	3285	SPZ	11.2	P	7	09.7	0.8	83.0	5.52	
			SPR	27.6	Lg			(2.3)	(127)		
			LPT	29.4	LQ			(34.0)	(9.9)		
			LPZ	4.26	LR			16.0	115		242.25
HN-ME	Houlton, Maine	4066	SPZ	103	P	7	07.9	0.8	58.9	5.31	
			SPZ	103	e	7	09.1	0.8	102		
			SPZ	103	e	7	10.4	0.9	67.4		
			SPZ	103	e	9	31.0	0.7	11.7		
			SPZ	103	PcP	9	32.2	0.8	17.8		
			SPT	99.0	Lg			2.0	106		
			LPT	8.6*	LQ			16.0	129		
			LPZ	28.8	LR			13.0	82.6		97.40
SV-QB	Schefferville, Quebec, Canada	4188	SPZ	108	P	7	16.2	0.9	83.7	5.42	
			SPZ	108	e	7	18.2	0.8	109		
			SPZ	108	e	7	24.0	0.8	36.6		
			SPZ	108	e	7	31.8	0.9	19.5		
			SPZ	108	e	7	44.1	0.9	42.8		
			SPZ	108	(PP)	8	(44.4)	1.0	22.0		
			SPZ	108	e	9	11.2	0.75	14.5		
			SPZ	108	e	10	(28.3)	0.9	9.7		
			SPR	111	Lg			2.4	99.7		
			SPT	120	Lg			(2.2)	(55.2)		
			LPR	28.3	LQ			14.0	37.0		
			LPT	29.6	LQ			(14.0)	(19.3)		
			LPZ	36.7	LR			16.0	46.7		57.90
NP-NT	Mould Bay, Northwest Territories, Canada	4368	SPZ	124	P	7	31.1	0.8	179	5.65	
			SPZ	124	e	7	35.6	0.8	114		
			SPZ	124	e	7	44.8	0.75	82.4		
			SPZ	124	PP	8	59.0	1.6	150		
			SPZ	124	PcP	9	38.4	0.95	56.2		
			SPT	202	PcS	13	26.9	1.4	12.8		
			SPR	206	Lg			2.75	167		
			SPT	202	Lg			2.8	239		
			LPR	7.0	LQ			18.0	42.8		
			LPZ	12.7	LR			18.0	105		395.24

A T m. sec

( ) Doubtful Values or Phases

--- Maximum Amplitude Clipped on Film and Magnetic Tape

• Measurements made from Playouts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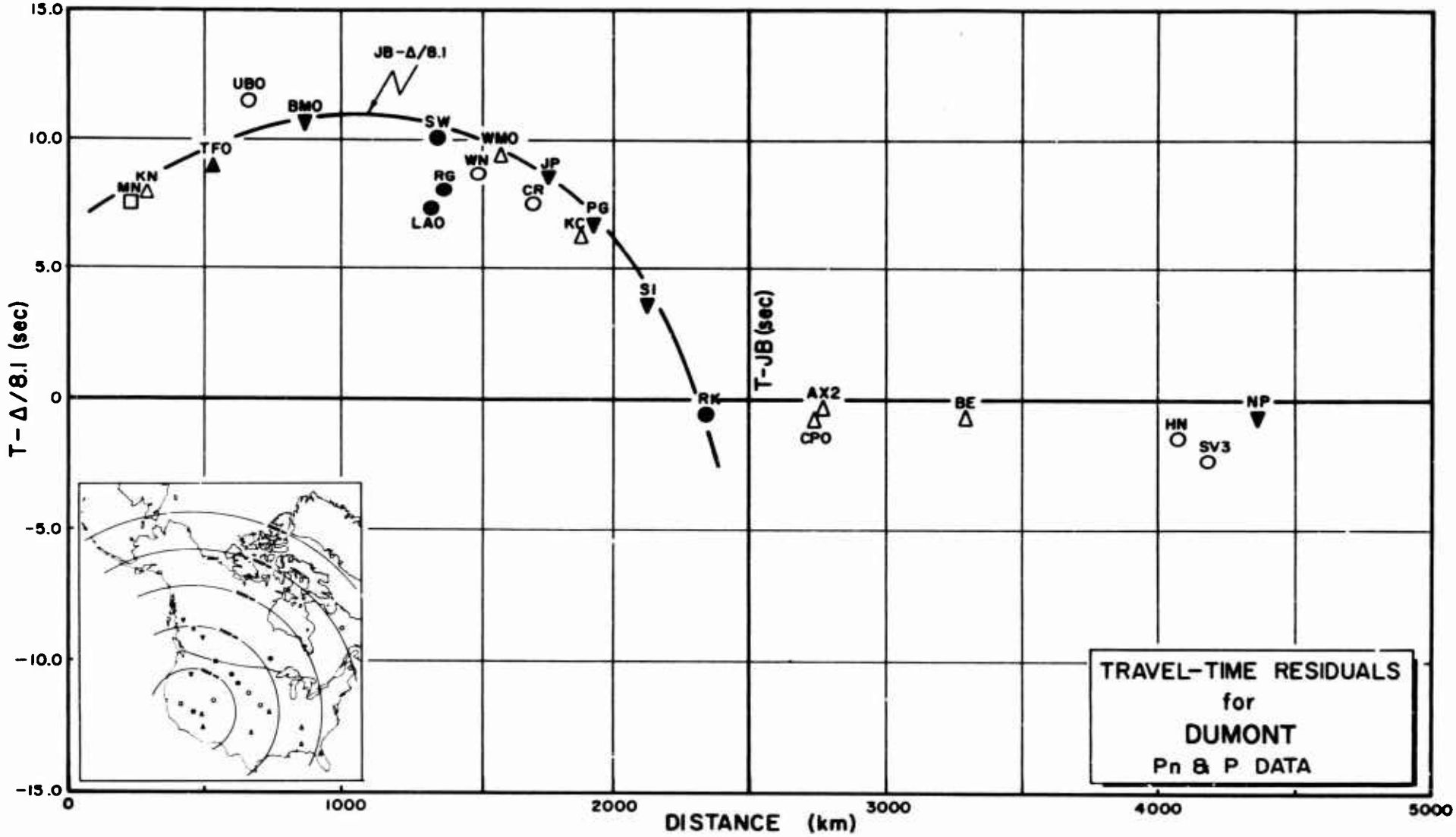
7.0
6.0
5.0
4.0
3.0
2.0
UNIFIED MAGNITUDE
Δ=DISTANCE =16°
UBO
WN
RG
KN
MN
TFO
AVERAGE MAGNITUDE Δ <16° =
5.62 ± 0.66
RK
AX2
BE
AVERAGE UNIFIED MAGNITUDE
5.48±0.56
NP
SV3
HN
WMQ
CR
BMO
LAO
SW
KC
CPO
AVERAGE MAGNITUDE Δ> 16° =
5.32± 0.39
PG
SI
JP
UNIFIED MAGNITUDES
for
DUMONT
0
1000
2000
3000
4000
5000
DISTANCE (km)

Figure 2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10.0
5.0
0
-5.0
-10.0
-15.0
T-Δ/8.1 (sec)
T-JB (sec)
0
1000
2000
3000
4000
5000
DISTANCE (km)
JB-Δ/8.1
UBO
BMO
SW
WMO
TFO
WN
JP
KN
MN
RG
CR
PG
LAO
KC
SI
RK
AX2
CPO
BE
NP
HN
SV3
TRAVEL-TIME RESIDUALS
for
DUMONT
Pn & P DATA

Figure 3

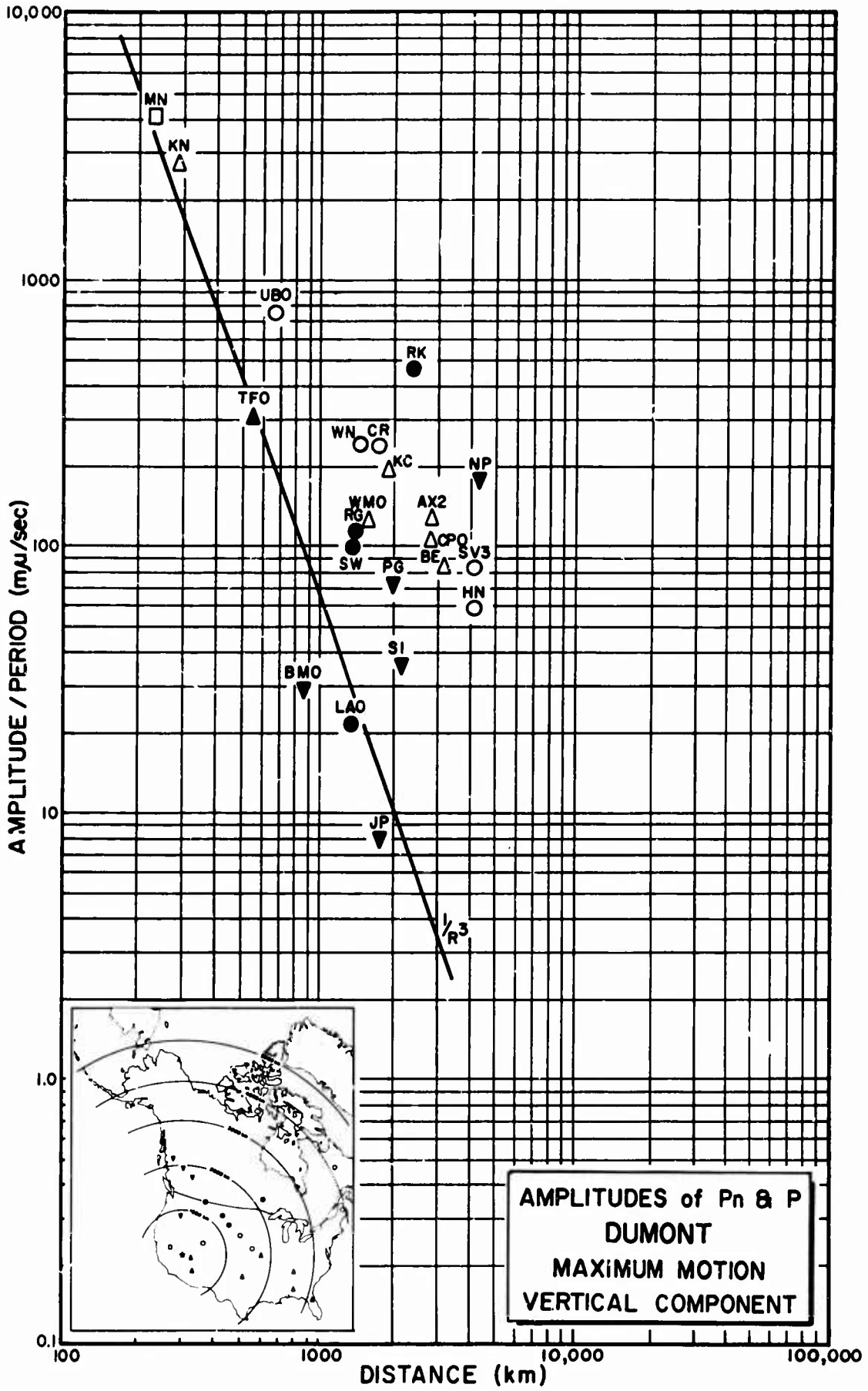
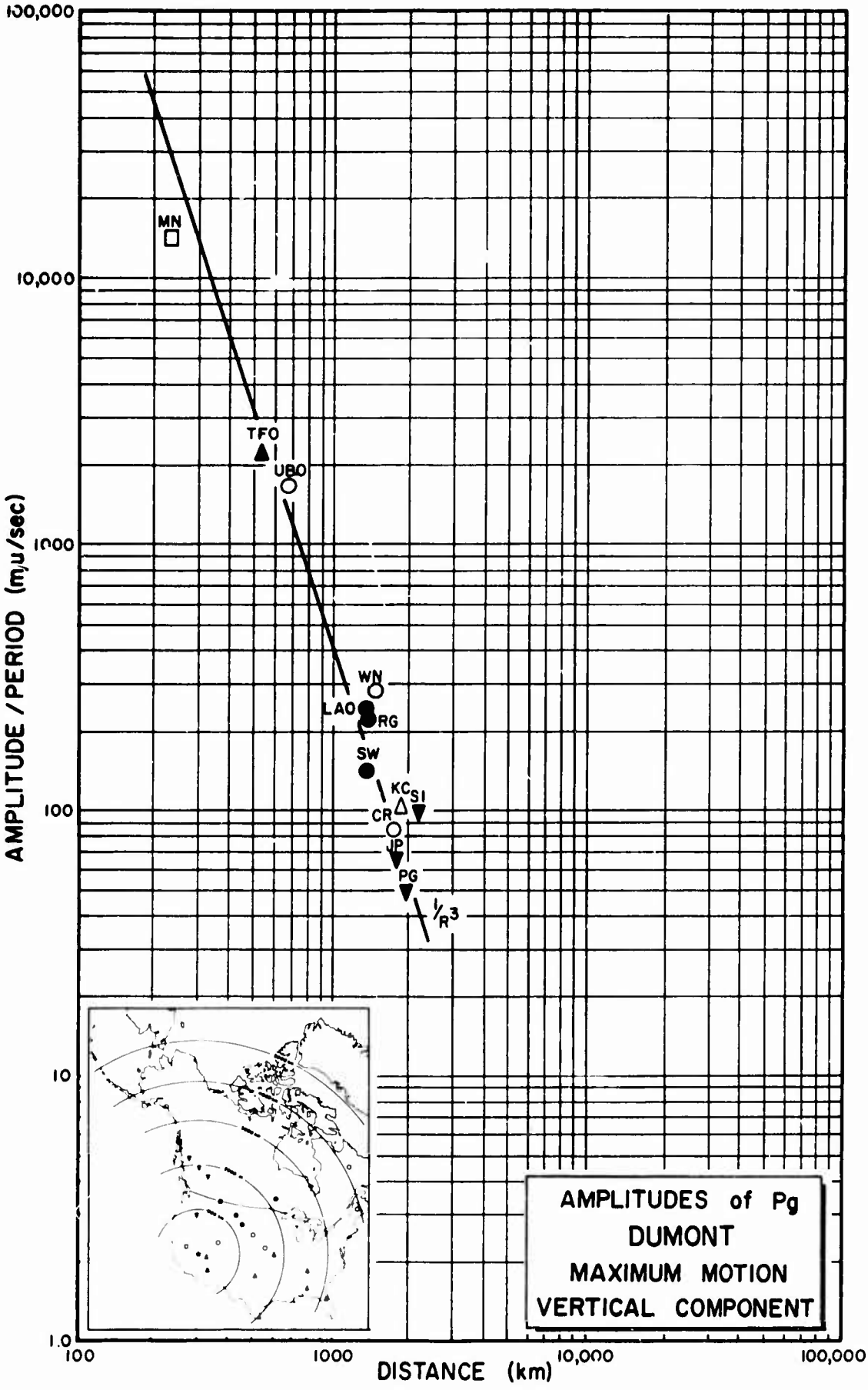

10,000
1000
100
10
1.0
0.1
AMPLITUDE / PERIOD (mμ/sec)
100
1000
10,000
100,000
DISTANCE (km)
MN
KN
UBO
RK
TFO
WN
CR
KC
NP
WMO
RG
AX2
CPO
SV3
SW
BE
PG
HN
SI
BMO
LAO
JP
1/R3
AMPLITUDES of Pn & P
DUMONT
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 4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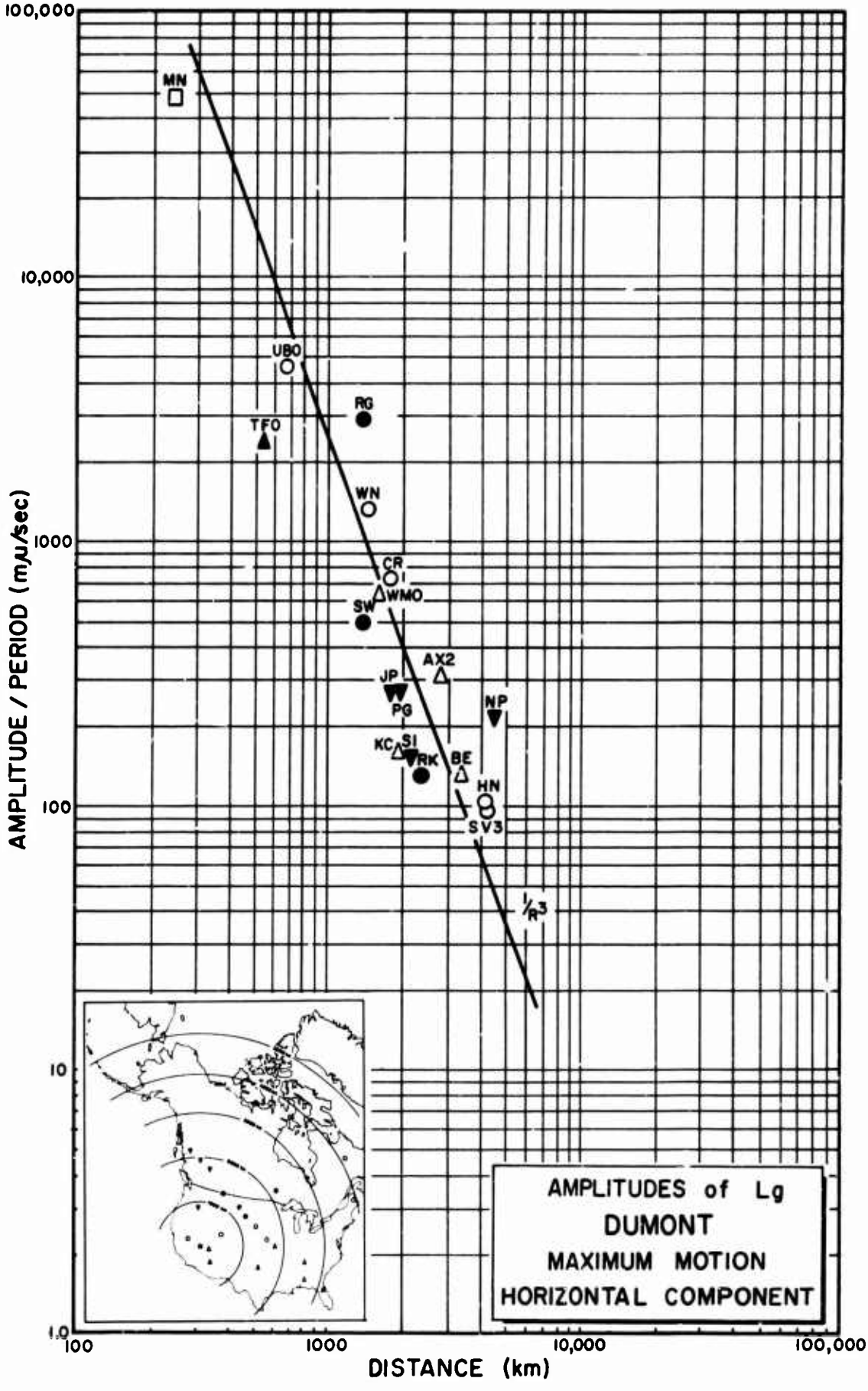
10,000
1000
100
10
1.0
AMPLITUDE / PERIOD (mμ/sec)
MN
TFO
UBO
WN
LAO
RG
SW
KC
SI
CR
JP
PG
1/R3
100
1000
10,000
100,000
DISTANCE (km)
AMPLITUDES of Pg
DUMONT
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 5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100
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1.0
AMPLITUDE / PERIOD (mμ/sec)
MN
UBO
TFO
RG
WN
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WMO
SW
AX2
JP
PG
NP
KC
SI
RK
BE
HN
SV3
1/R3
100
1000
10,000
100,000
DISTANCE (km)
AMPLITUDES of Lg
DUMONT
MAXIMUM MOTION
HORIZONTAL COMPONENT

Figure 6

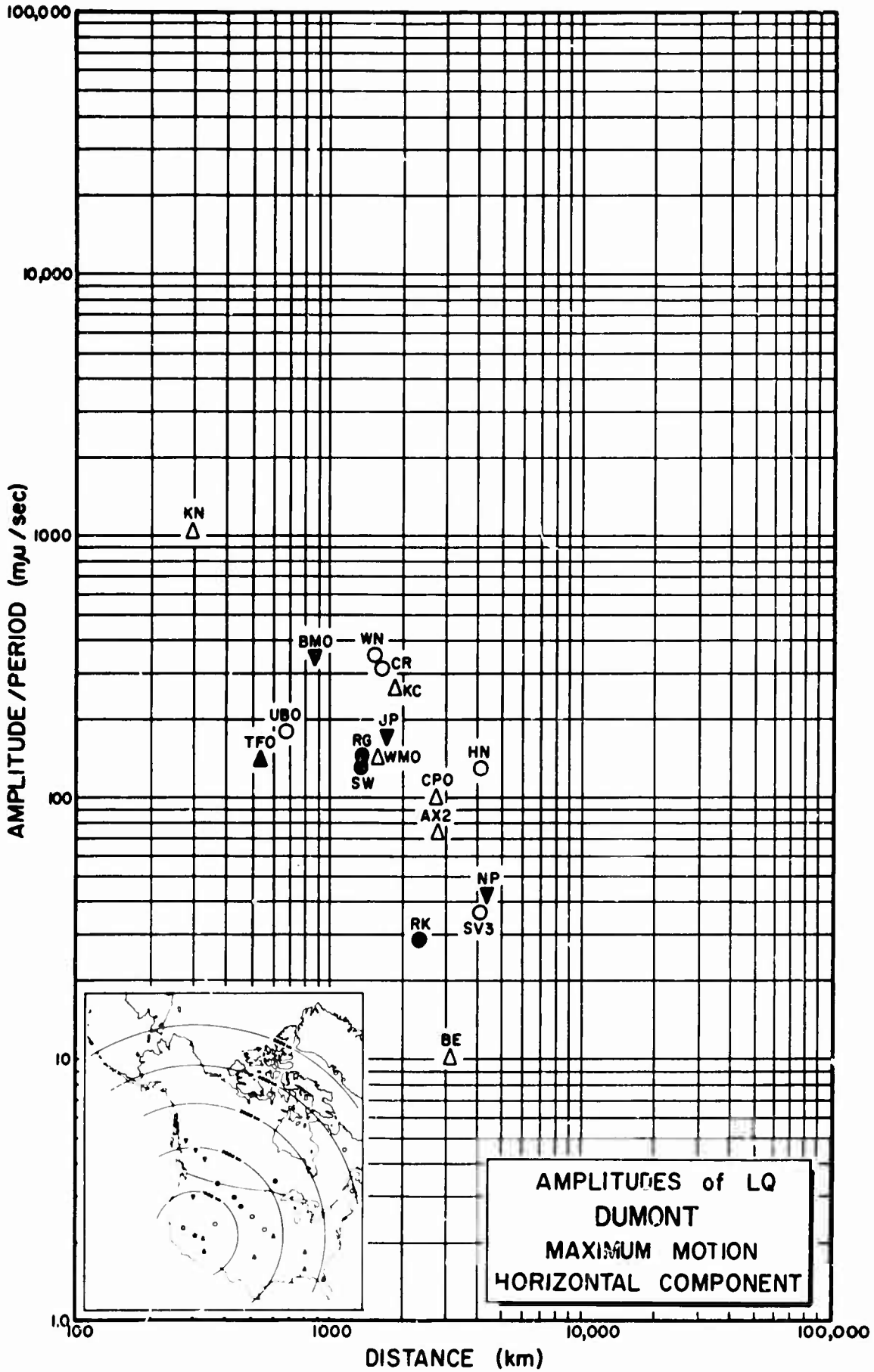
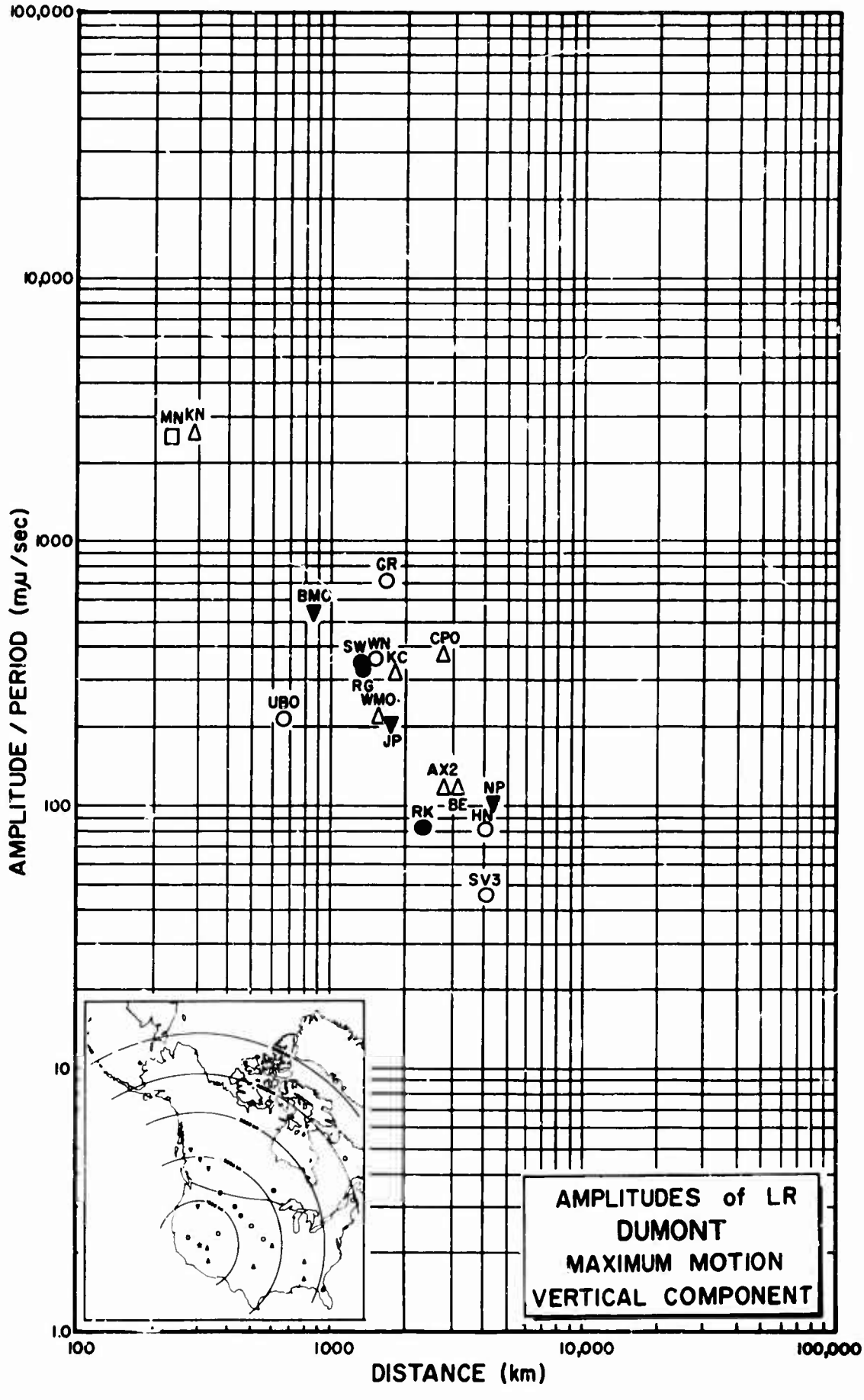

100,000
10,000
1000
100
10
1.0
AMPLITUDE/PERIOD (mμ/sec)
KN
BMO
WN
CR
KC
UBO
JP
TFO
RG
WMO
SW
HN
CPO
AX2
NP
RK
SV3
BE
100
1000
10,000
100,000
DISTANCE (km)
AMPLITUDES of LQ
DUMONT
MAXIMUM MOTION
HORIZONTAL COMPONENT

Figure 7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10,000
1000
100
10
1.0
AMPLITUDE / PERIOD (mμ/sec)
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KN
GR
BMC
SW
WN
KC
CPO
RG
WMO
UBO
JP
AX2
NP
BE
RK
HN
SV3
100
1000
10,000
100,000
DISTANCE (km)
AMPLITUDES of LR
DUMONT
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 8

Code	Station	Distance (km)	Geographic Latitude	Geographic Longitude	Elev. (km)	Computed Azimuth		Installed Azimuth		Large or Small SP	LP Inst.
						Epi. Sta.	Sta. Epi.	Radial	Tang.		
MN-NV	Mina Nevada	236	38°26'10" N	118°08'53" W	1.52	309°	128°	308°	38°	L	X
KN-UT	Kanab, Utah	287	37°01 22" N	112°40 39" W	1.74	91°	273°	95°	185°	L	X
TFSO-Z1*	Tonto Forest Observatory, Arizona	535	34°17'12" N	111°16'03" W	1.49	124°	307°	90°	0°	JM	X
UBSO-Z2*	Uinta Basin Observatory, Utah	667	40°19'18" N	109°34'07" W	1.60	56°	240°	90°	0°	JM	X
BMSO-Z3*	Blue Mountain Observatory, Oregon	866	44°50'56" N	117°18'20" W	1.19	353°	173°	0°	90°	JM	X
LAO	Suberray AO-10, Montana	1339	46°41'19" N	106°13'20" W	.90	34°	221°			HSZ	
SW-MA*	Sweetgrass, Montana	1359	48°58'08" N	111°57'46" W	1.11	13°	196°	121°	211°	S	X
RG-SD*	Redig, South Dakota	1381	45°12'59" N	103°32'05" W	.95	45°	2.4°	127°	217°	L	X
WN-SD*	Winner South Dakota	1510	43°15 08" N	100°11'46" W	.79	58°	249°	129°	219°	L	X
WMSO-Z6*	Wichita Mountain Observatory, Oklahoma	1597	34°43'05" N	98°35'21" W	.51	94°	285°	90°	0°	JM	X
CR-NB*	Crete, Nebraska	1709	40°39'52" N	96°51'15" W	.44	71°	263°	131°	221°	L	X
JP-AT*	Jasper Alberta Canada	1762	52°53'50" N	118°05'25" W	1.13	355°	174°	114°	204°	L	X
KC-MO*	Kansas City, Missouri	1885	39°21'21" N	94°40'17" W	.27	76°	269°	133°	223°	S	X
PG-BC*	Prince George, British Columbia, Canada	1943	53°59'50" N	122°31'23" W	.91	347°	163°	110°	200°	L	X
SI-BC*	Smithers, British Columbia, Canada	2138	54°47'18" N	127°04'17" W	.58	340°	152°	107°	197°	L	X
RK-ON	Red Lake Ontario Canada	2341	50°50'20" N	93°40'20" W	.37	42°	238°	58°	148°	S	X
CPSO-Z8*	Cumberland Plateau Observatory, Tennessee	2730	35°35'41" N	85°34'13" W	.57	84°	283°	90°	0°	JM	X
AX2AL*	Alexander City, Alabama	2764	32°46'38" N	86°07'48" W	.23	91°	288°	138°	228°	L	X
BE-FL*	Belleview, Florida	3285	28°54'19" N	82°03'52" W	.02	96°	296°	140°	230°	S	X
HN-ME	Houlton, Maine	4066	46°09'43" N	67°59'09" W	.21	60°	273°	93°	183°	S	X
SV3QB*	Schefferville, Quebec, Canada	4188	54°48'39" N	66°45'00" W	.58	46°	263°	139°	229°	S	X
NP-NT	Mould Bay, Northwest Territories Canada	4366	76°15'08" N	119°22'18" W	.06	359°	176°	356°	86°	JMZ S	X

*Seismometers not orientated toward Nevada Test Site

Recording Site Information - DUMONT

Appendix I(A)

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

where

A = zero to peak ground motion in millimicrons

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

T = signal period in seconds

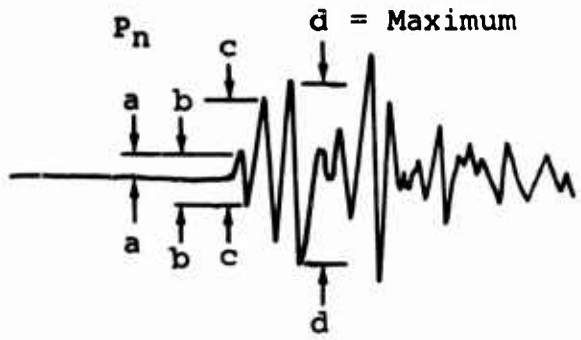
B = distance factor (see Table below)

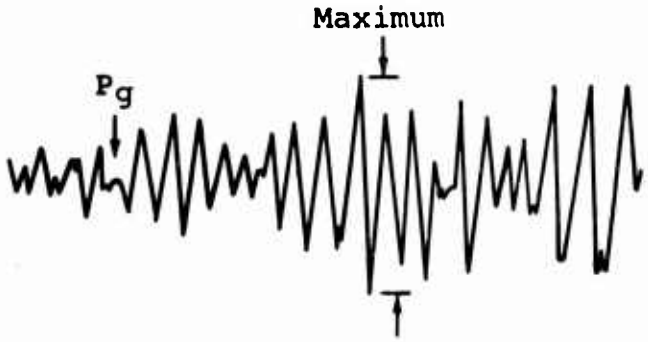
mm = record amplitude in millimeters zero to peak

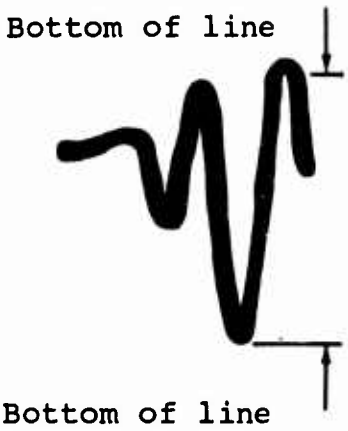
K = magnification in thousands at signal frequency

Table of Distance Factors (B) for Zero Depth

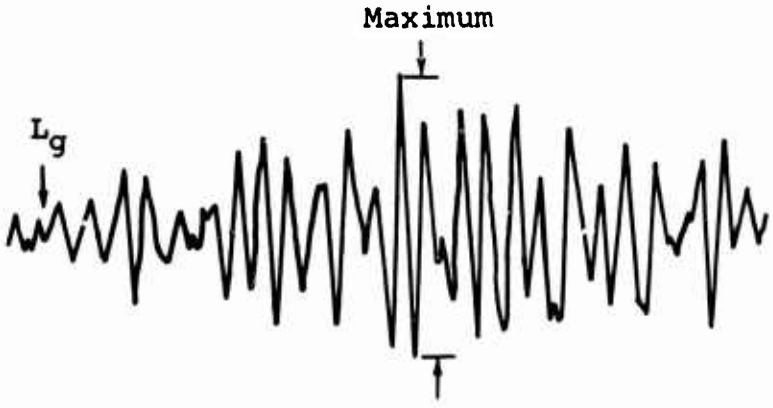
Dist (deg)	B	Dist (deg)	B	Dist (deg)	B	Dist (deg)	B
0°	-	27°	3.5	54°	3.8	80°	3.7
1	-	28	3.6	55	3.8	81	3.8
2	2.2	29	3.6	56	3.8	82	3.9
3	2.7	30	3.6	57	3.8	83	4.0
4	3.1	31	3.7	58	3.8	84	4.0
5	3.4	32	3.7	59	3.8	85	4.0
6	3.6	33	3.7	60	3.8	86	3.9
7	3.8	34	3.7	61	3.9	87	4.0
8	4.0	35	3.7	62	4.0	88	4.1
9	4.2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







Detail Showing Allowance For Line Width



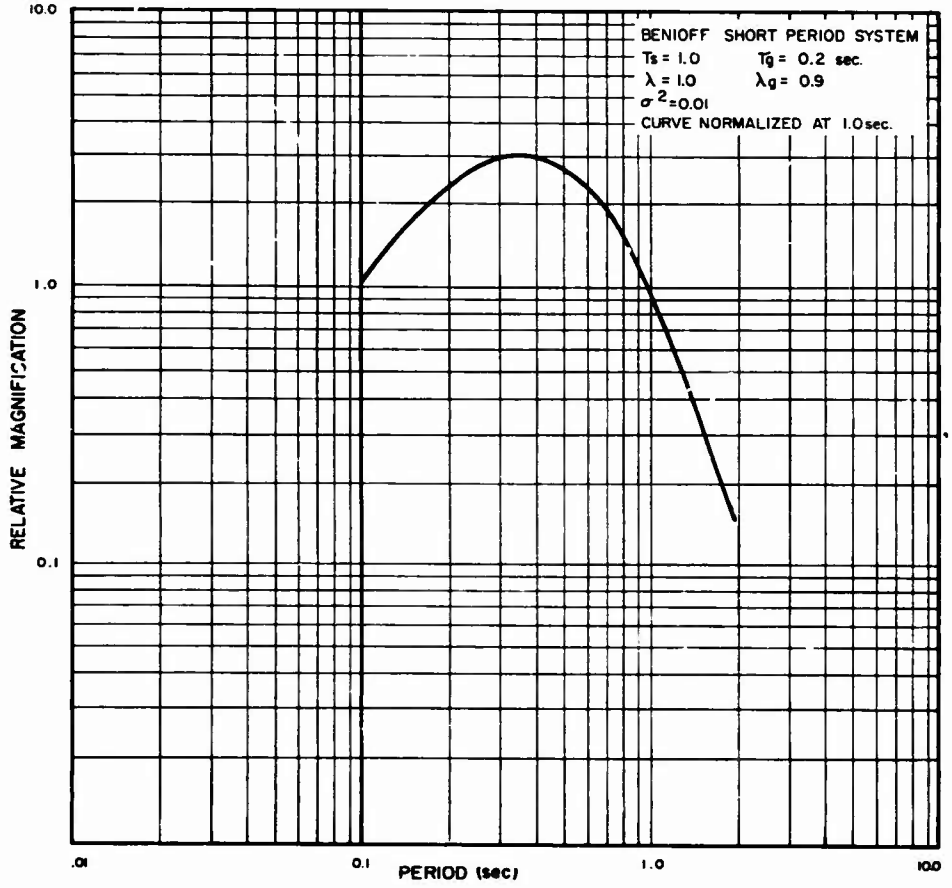
Pick <u>time</u> of <u>Pn</u> at beginning of "a" half cycle.

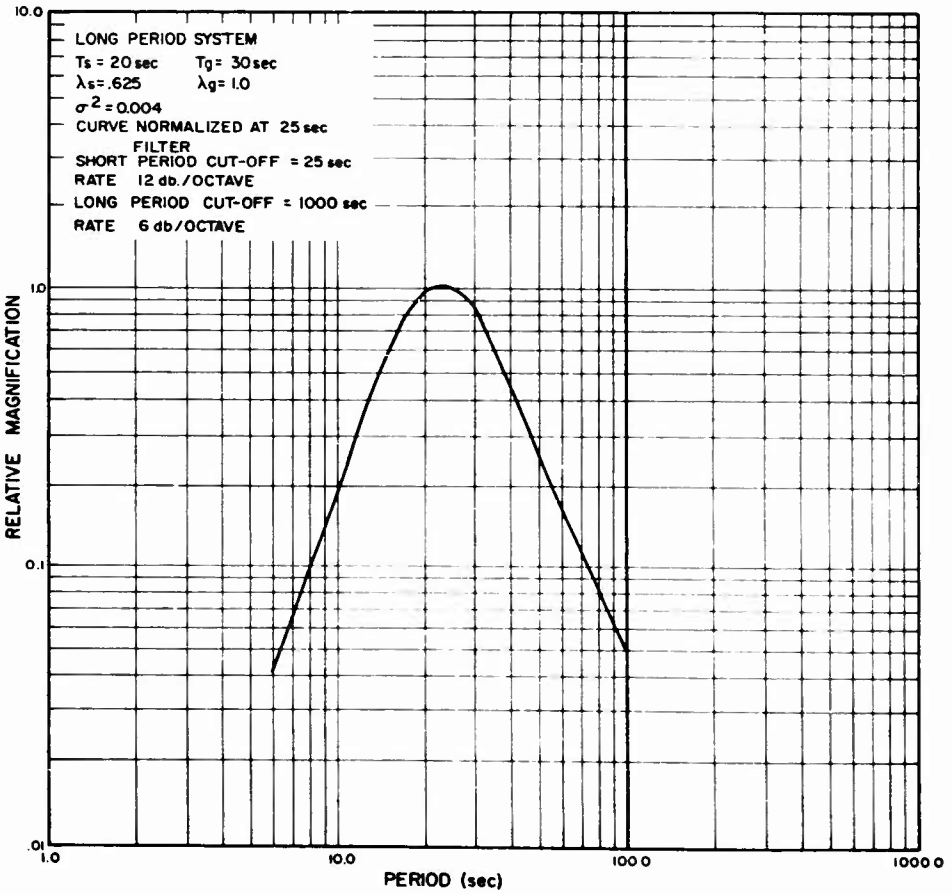
Pick <u>amplitude</u> of <u>Pn</u> as maximum "$d/2$" within 2 or 3 cycles of "c".

Pick <u>amplitudes</u> of <u>Pg</u> and <u>Lg</u> at maximum of corresponding motion.

Seismic Analysis Diagram

APPENDIX II(A)





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3. REPORT TITLE

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4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Scientific Report

5. AUTHOR(S) (Last name, first name, initial)

Clark, Don M.

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8a. CONTRACT OR GRANT NO. AF 33(657)-15919 b. PROJECT NO. VELA T/6702 c. ARPA Order No. 624 d. ARPA Program Code No. 5810	9a. ORIGINATOR'S REPORT NUMBER(S) SDL Report No. 160 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) --

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13. ABSTRACT

An analysis of seismological data from an underground nuclear explosion 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.

DD FORM 1 JAN 64 1473

Unclassified

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Seismic Magnitude						
Seismic Travel-Time						
Seismic Amplitude						
VELA-UNIFORM						
Nuclear Tests						

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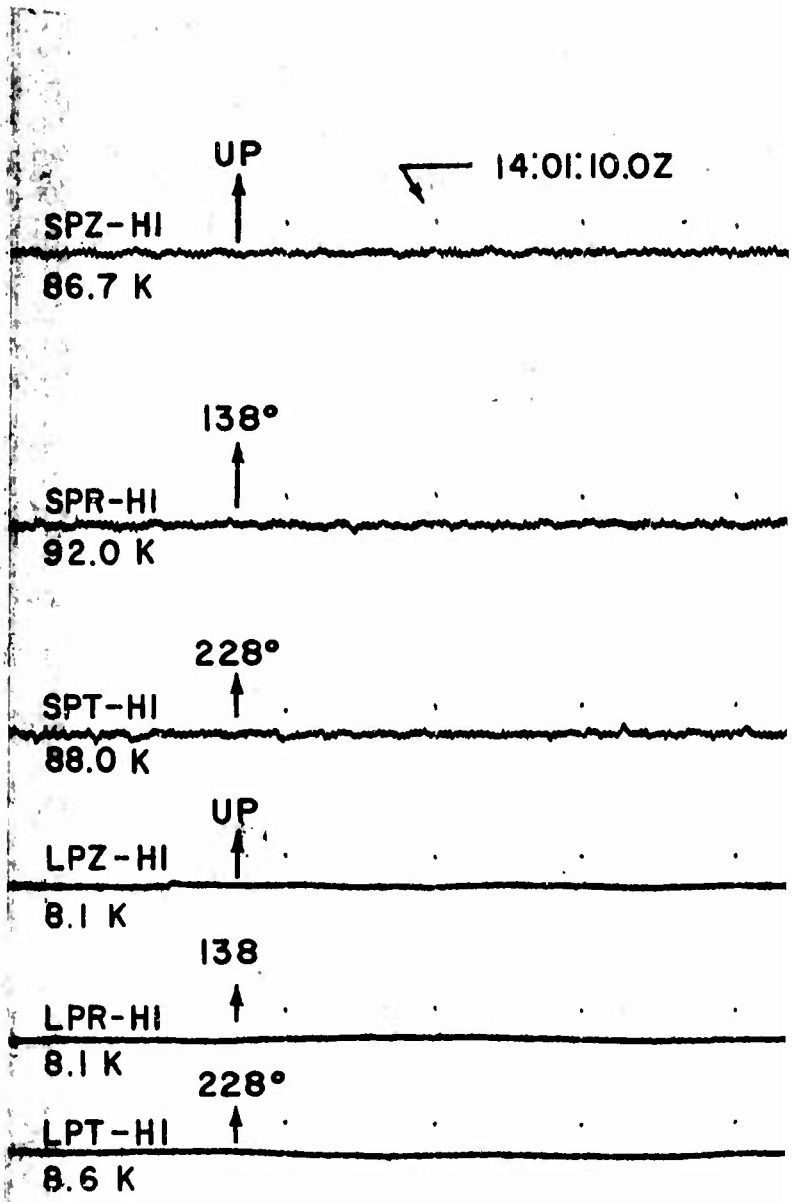
DUMONT

AX2AL

ALEXANDER CITY, ALABAMA

19 MAY 1966

Δ=2764 km



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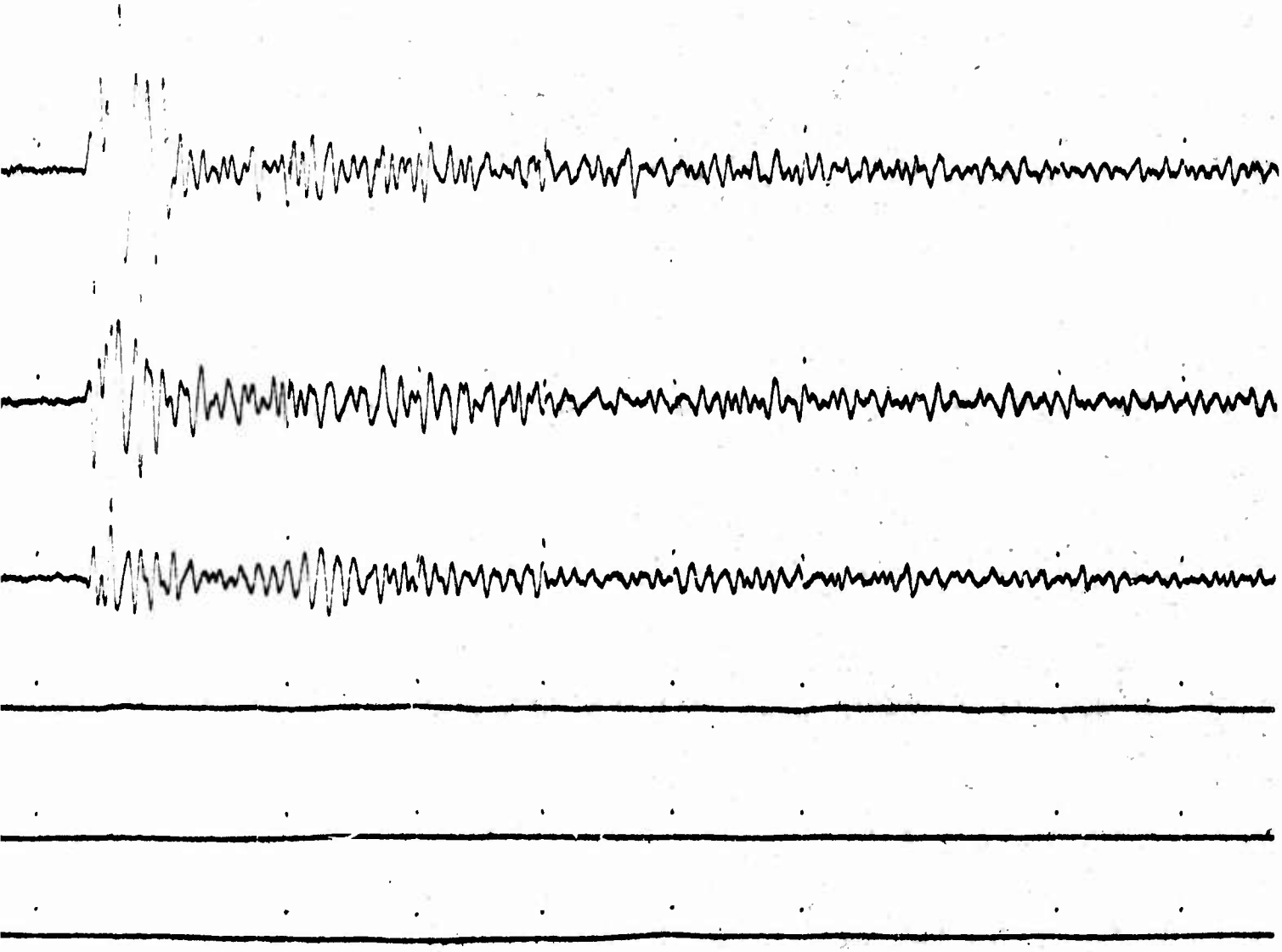

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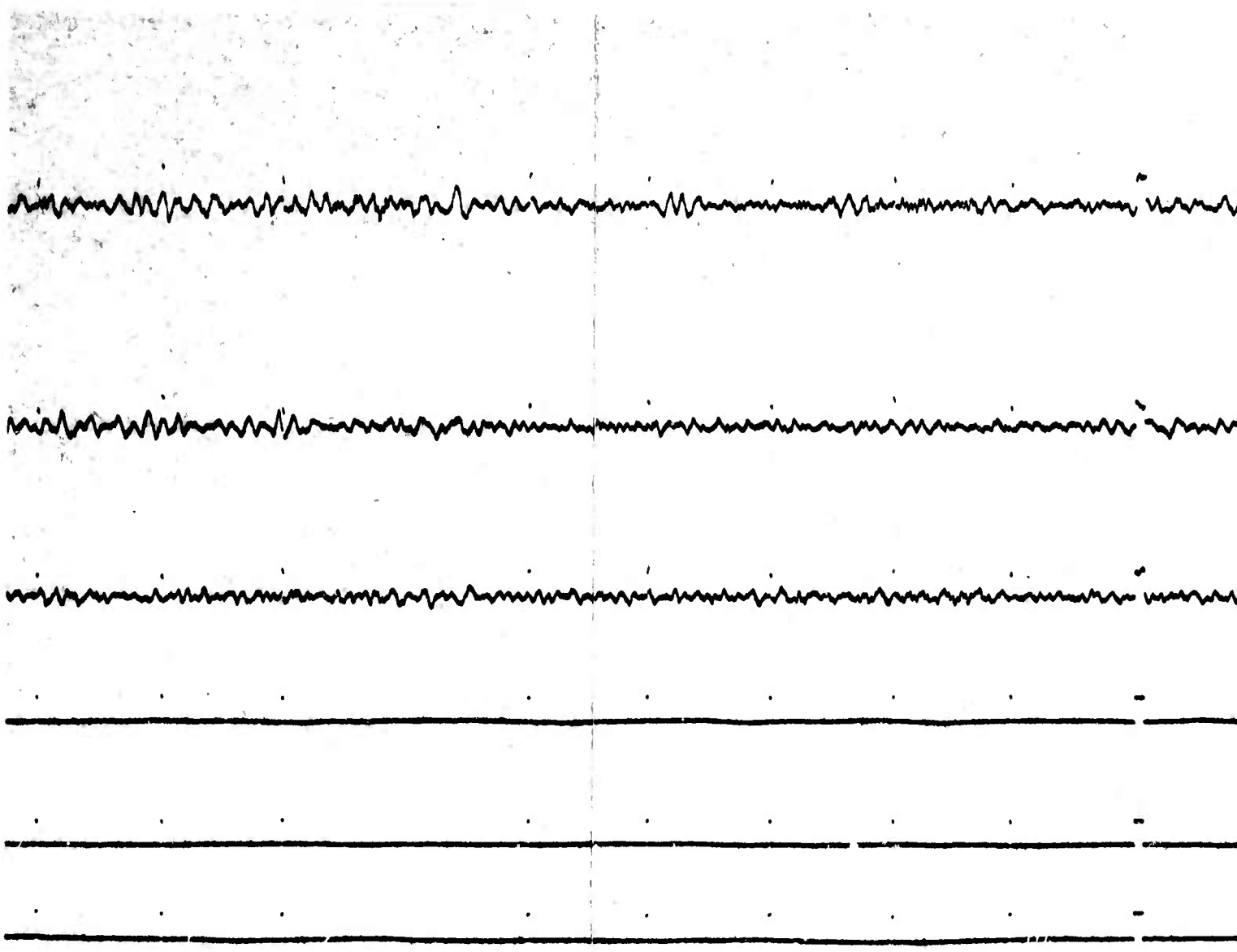

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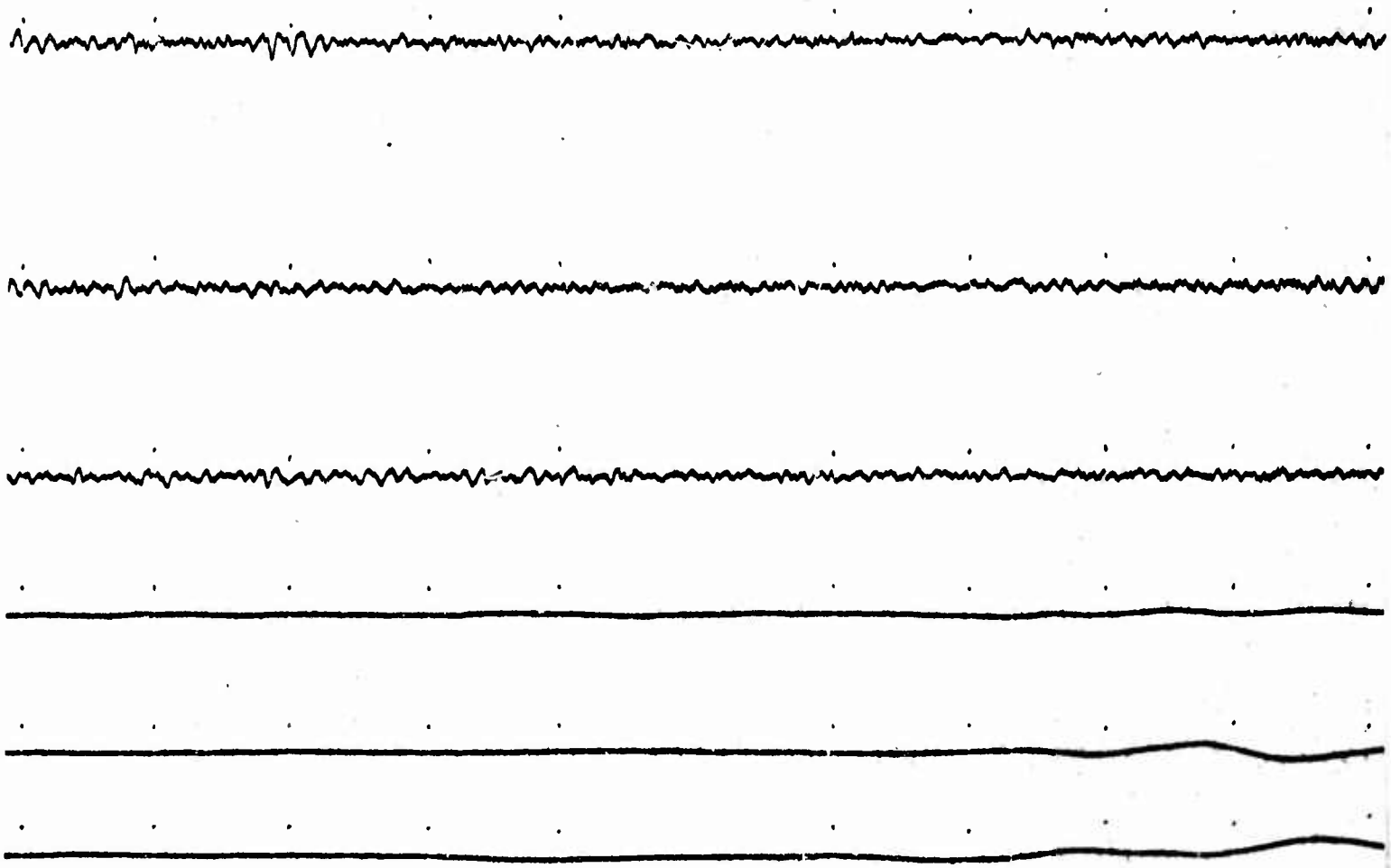

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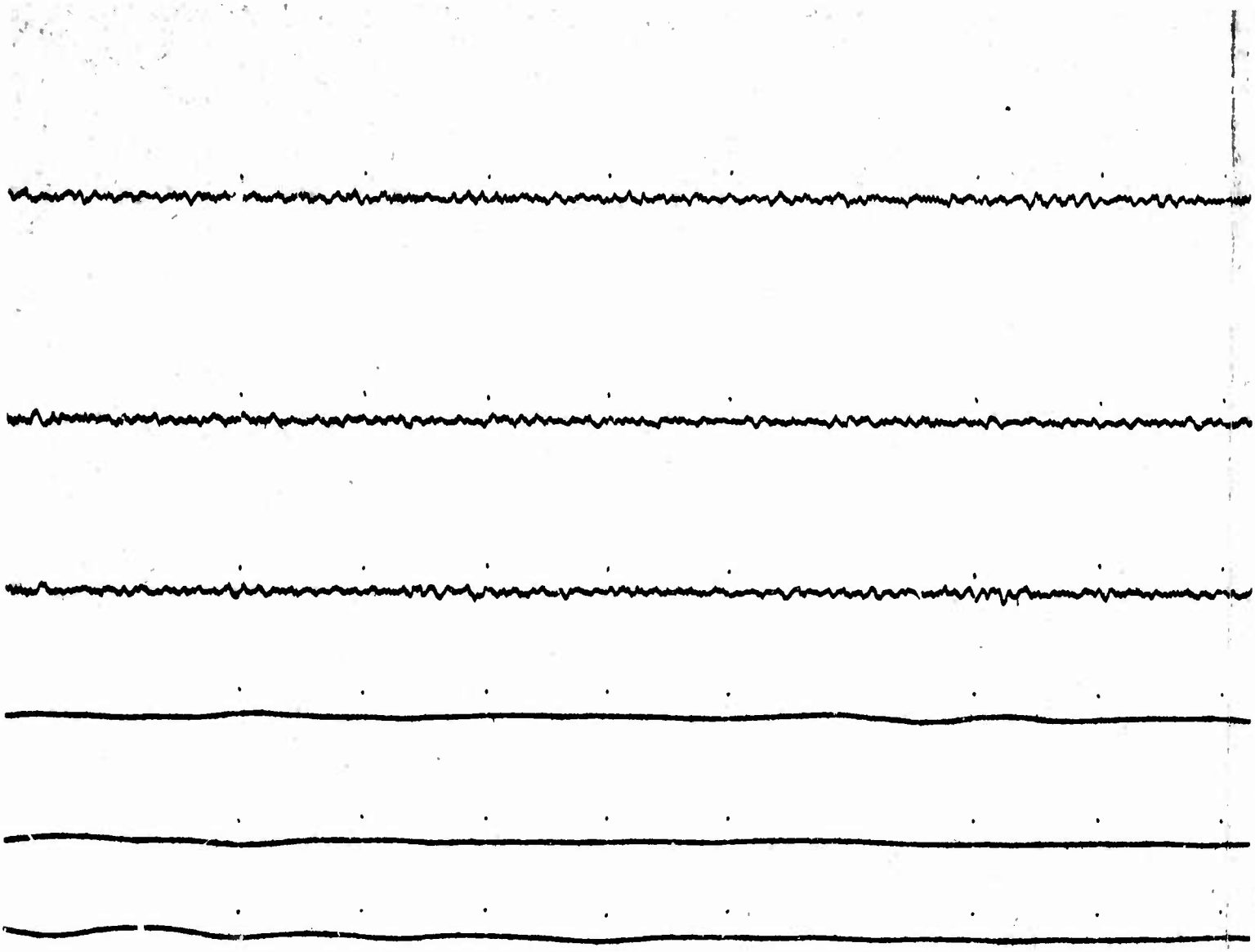

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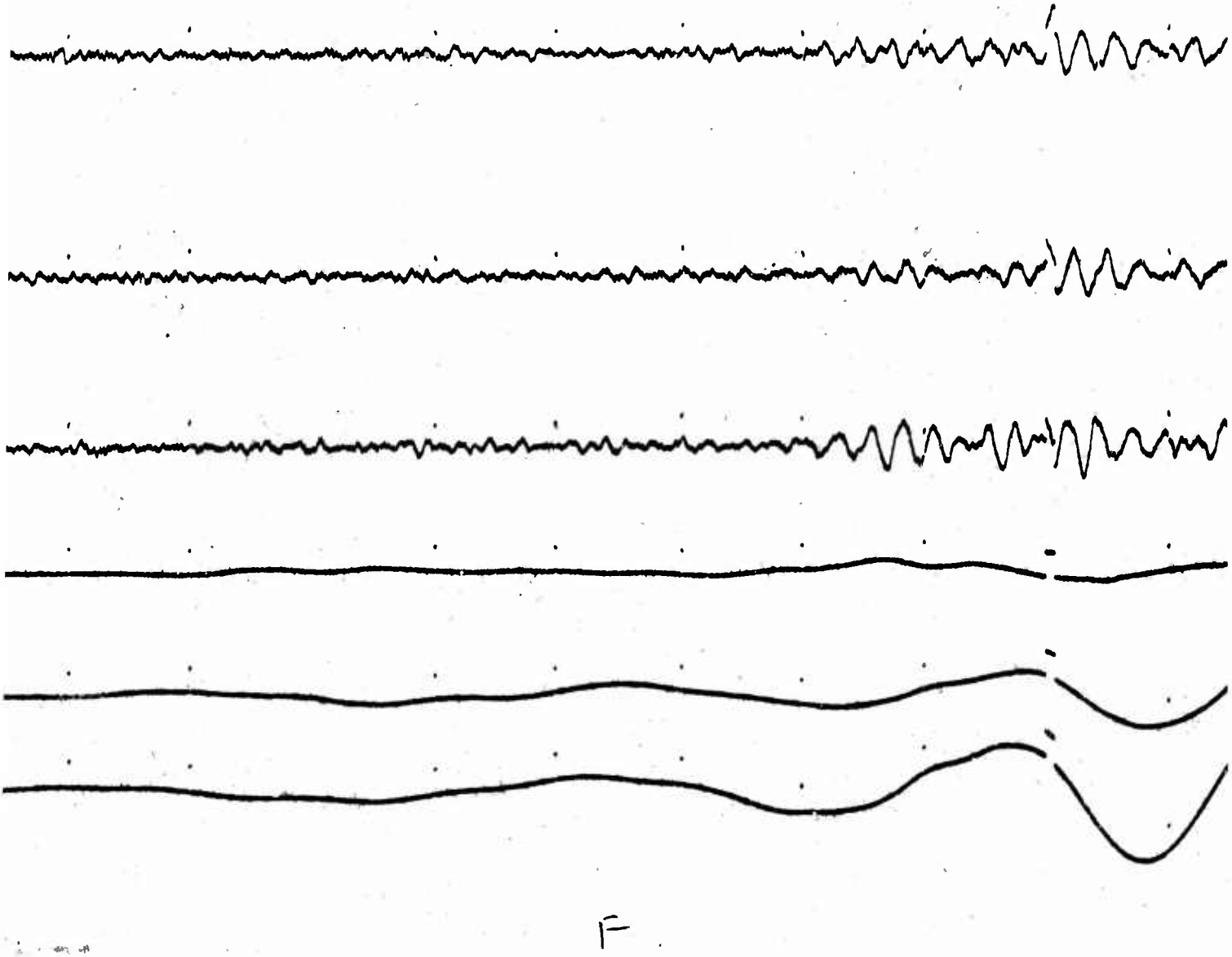

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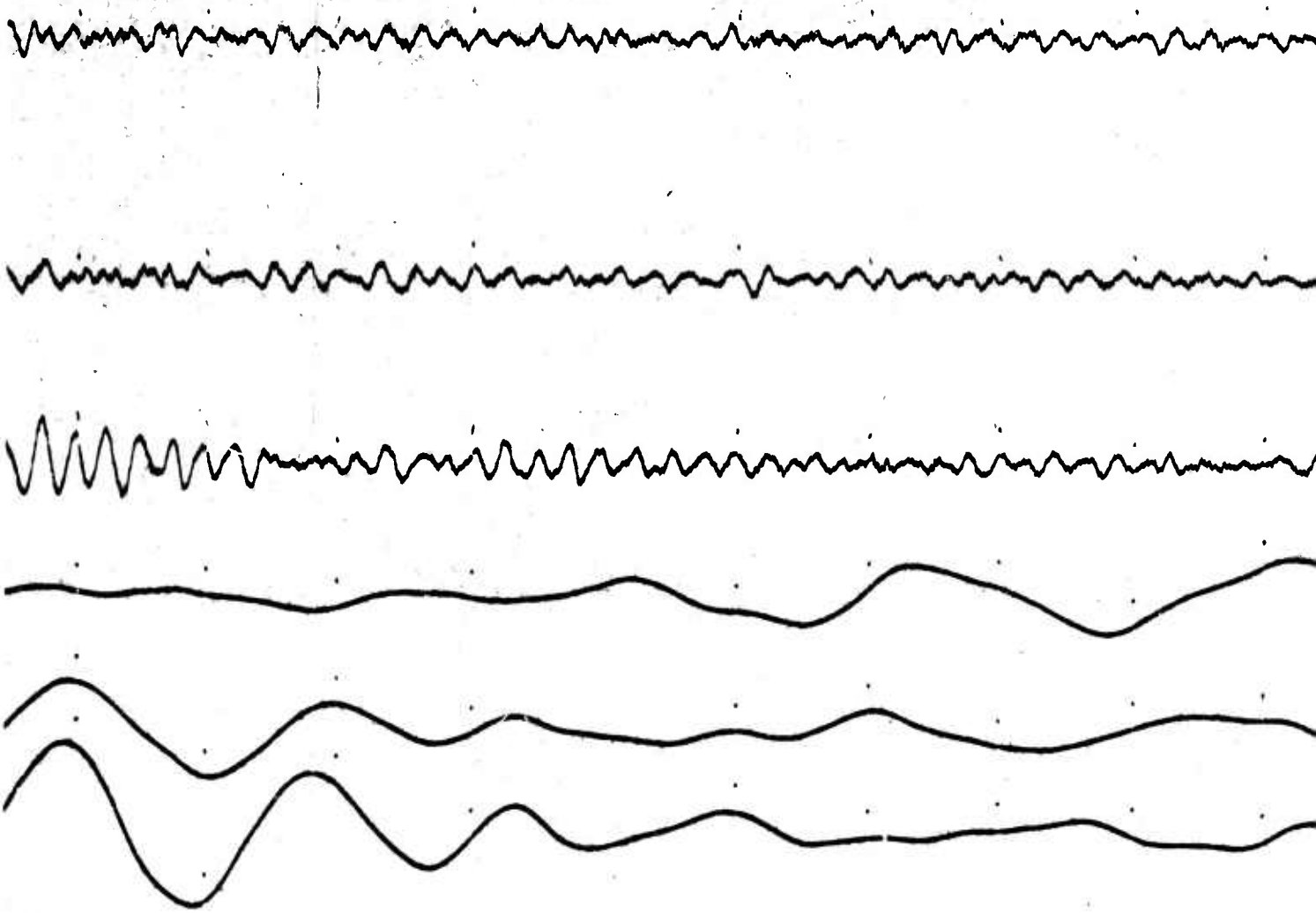

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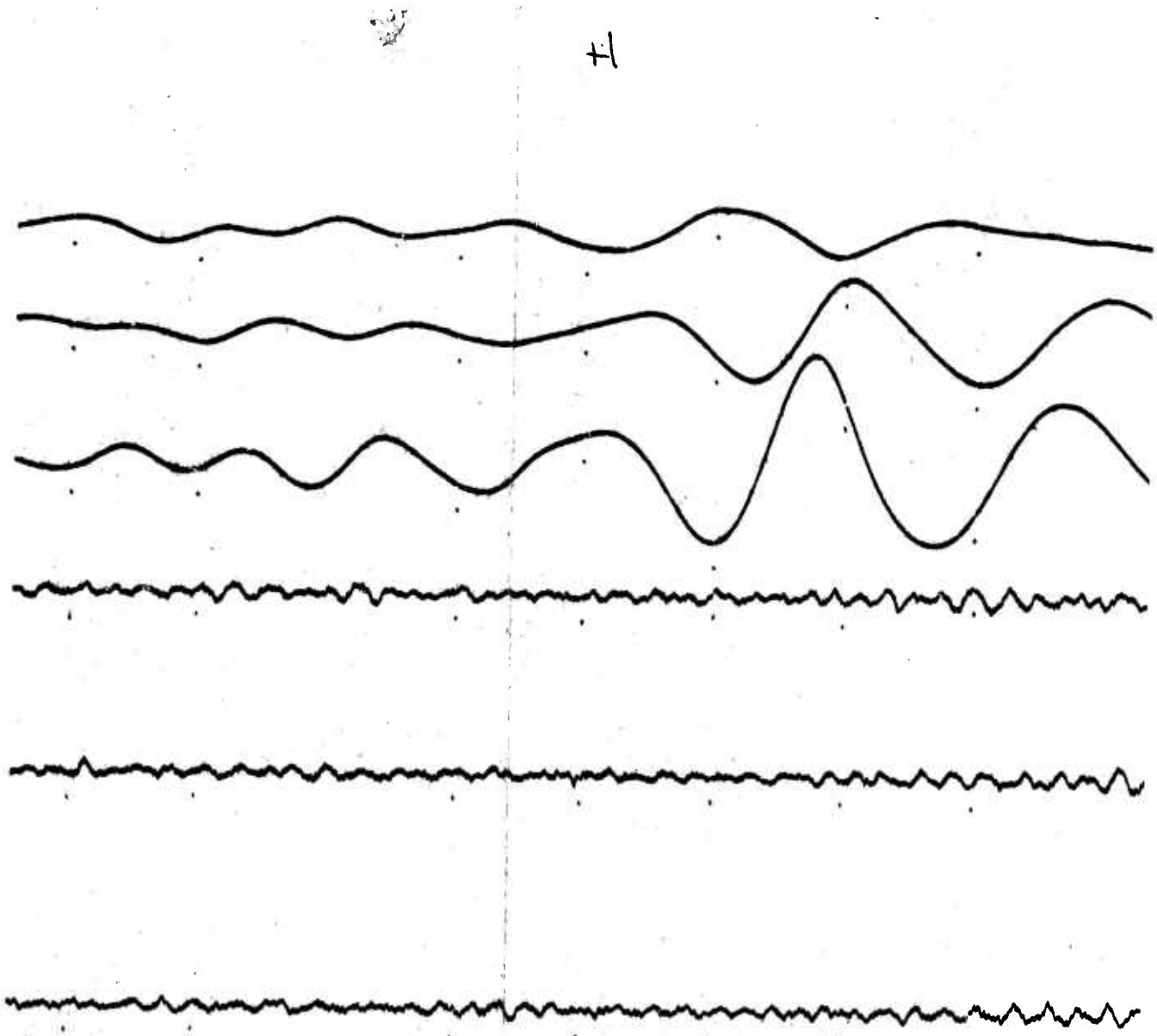
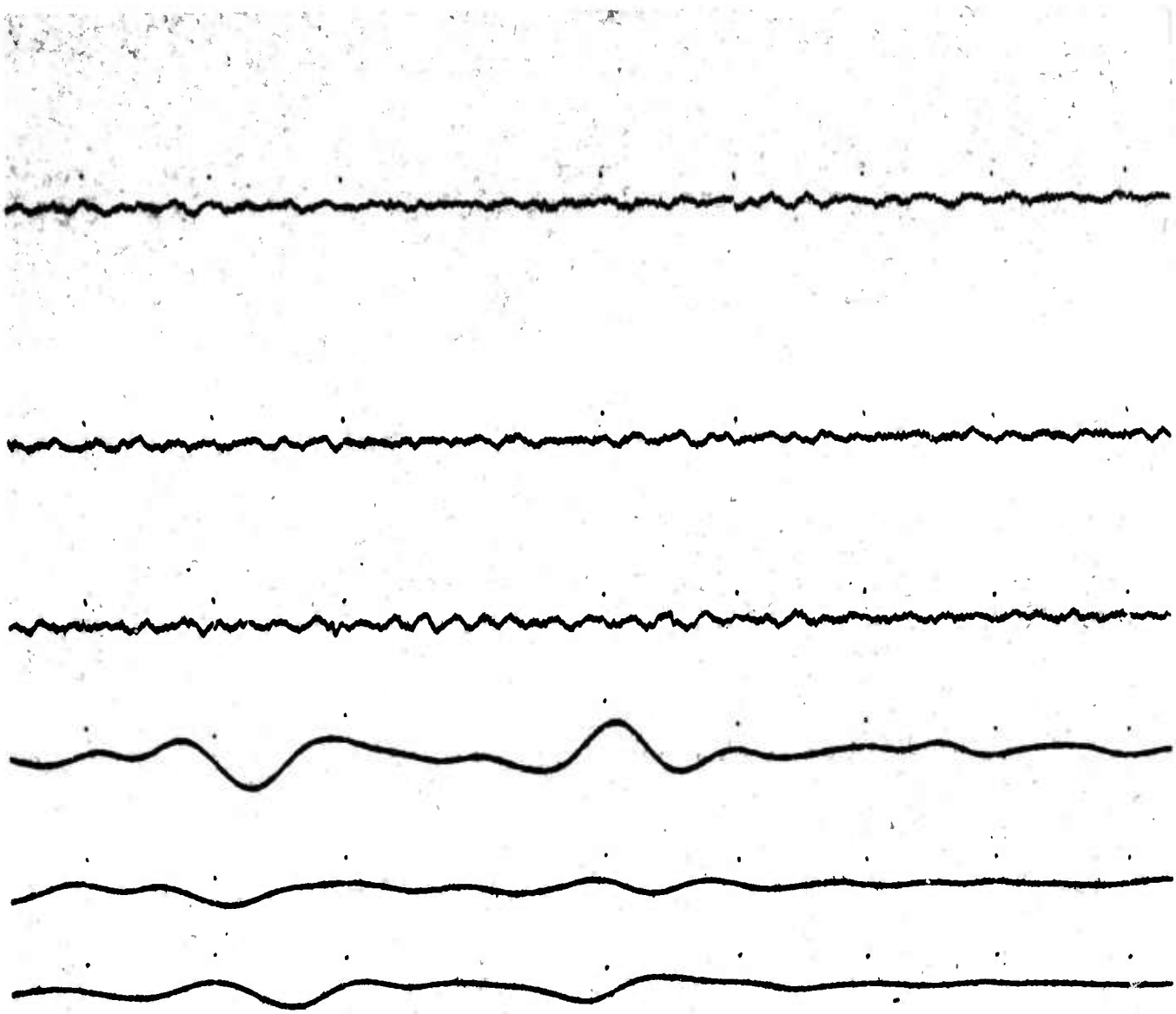




I

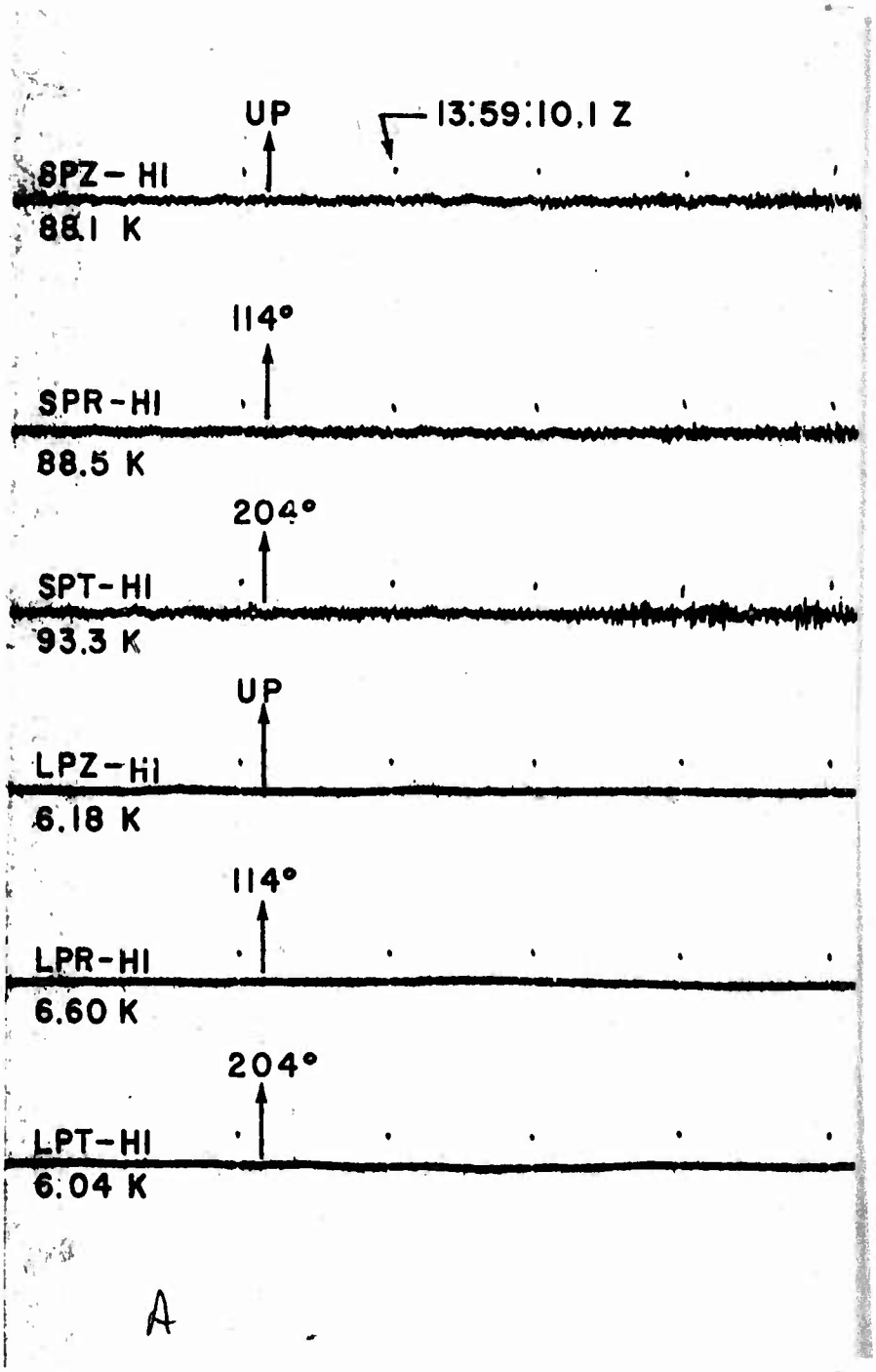
DUMONT

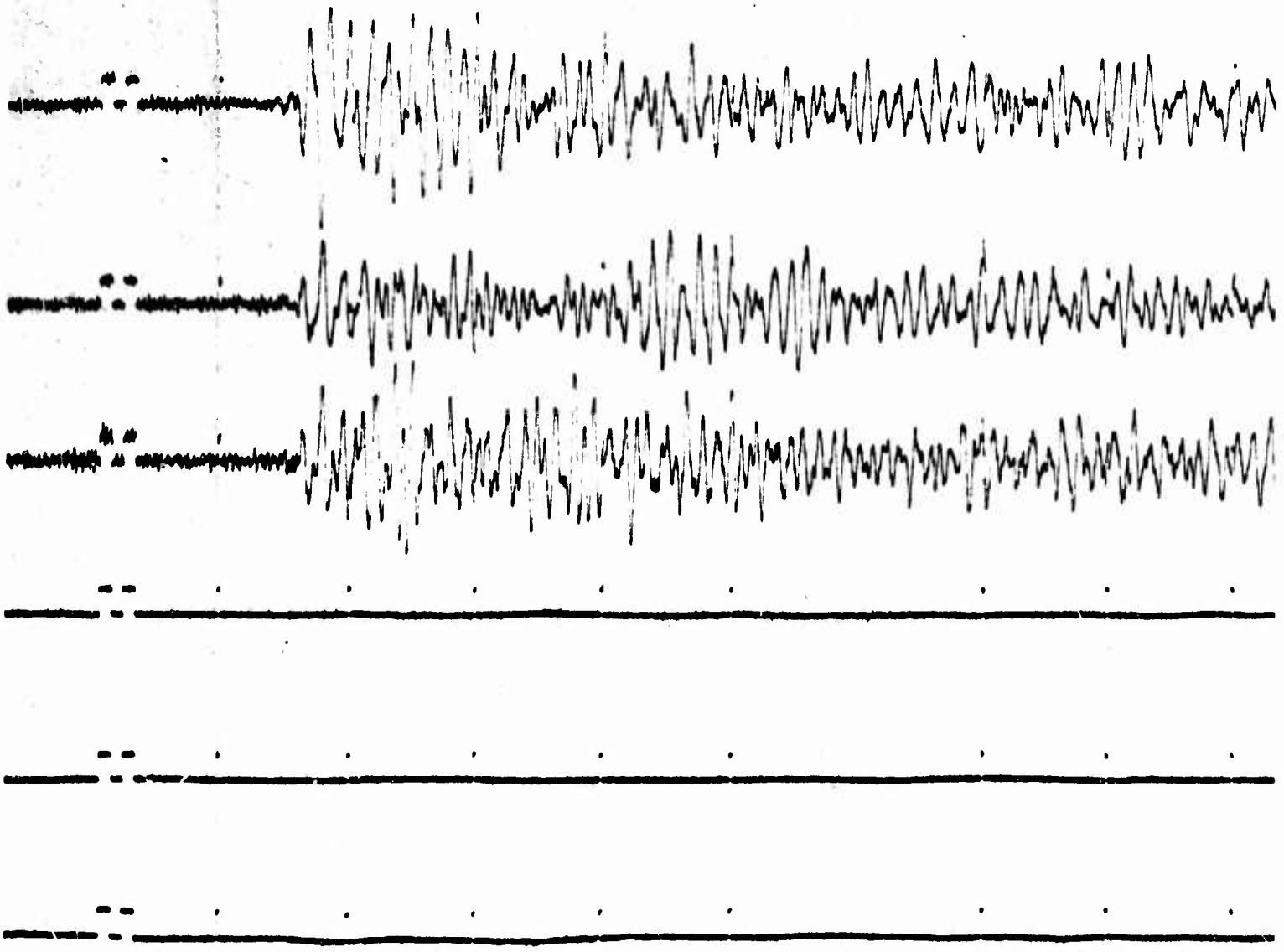
JP-AT

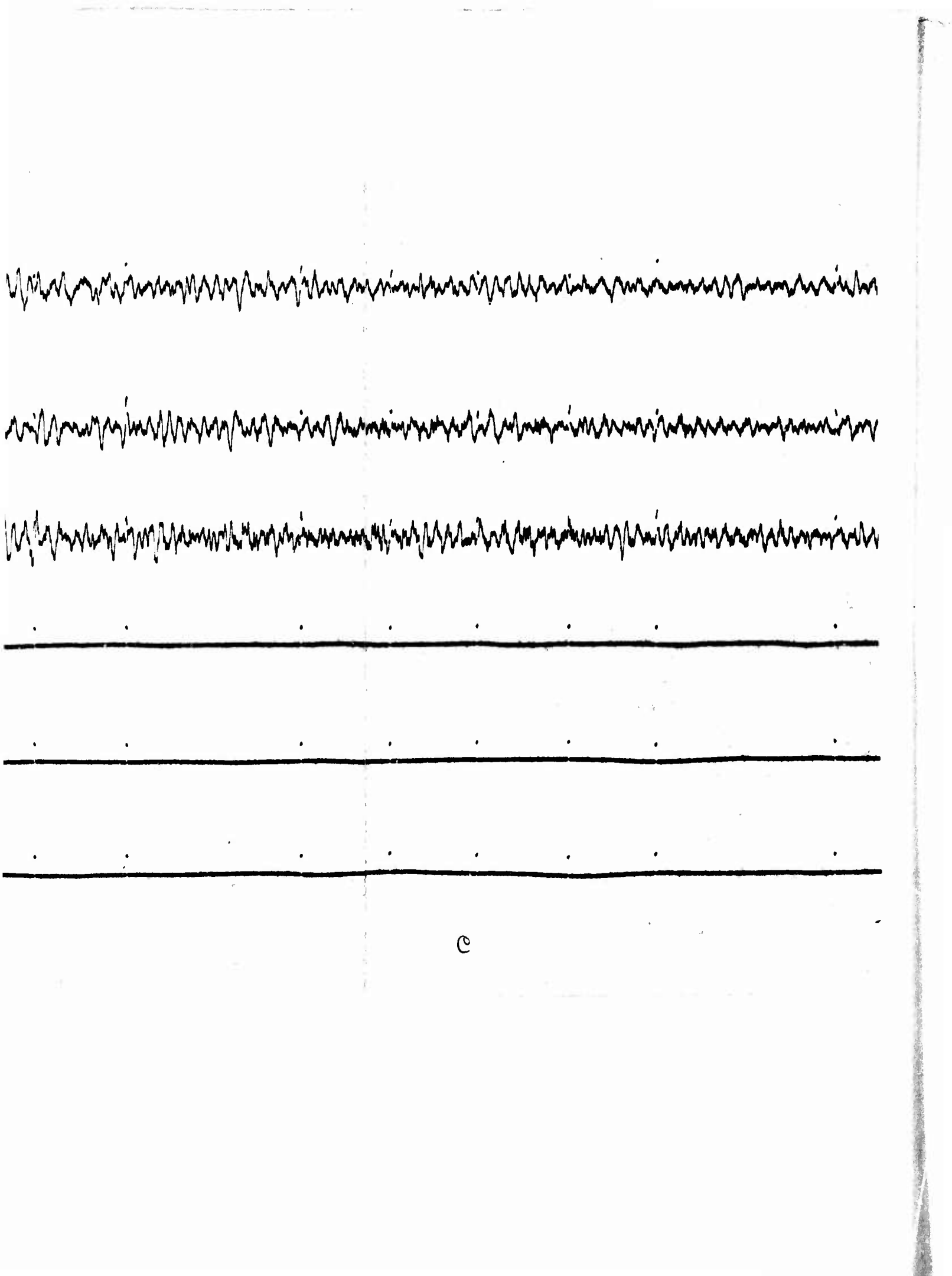
JASPER, ALBERTA, CANADA

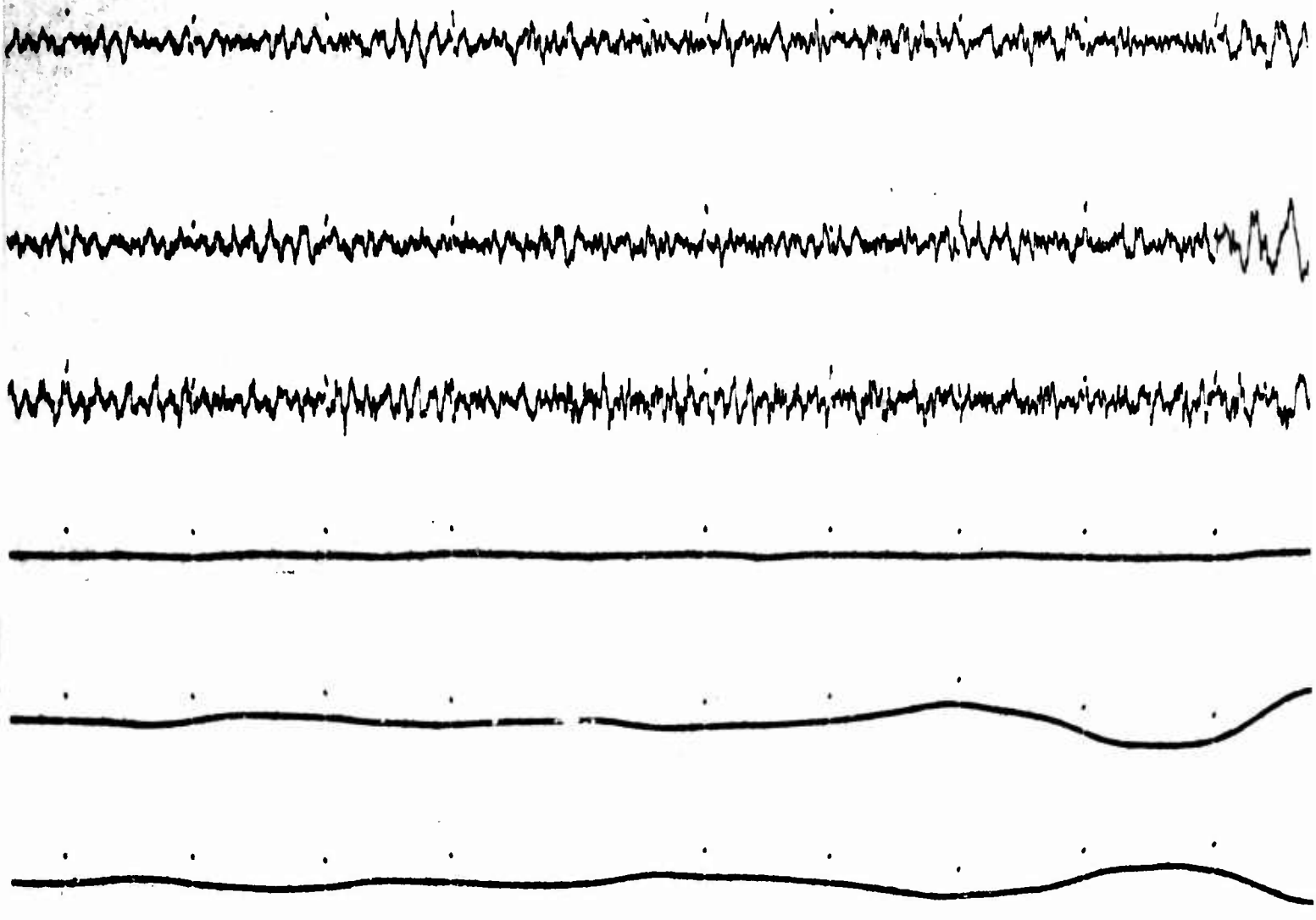
19 MAY 1966

Δ = 1762 km

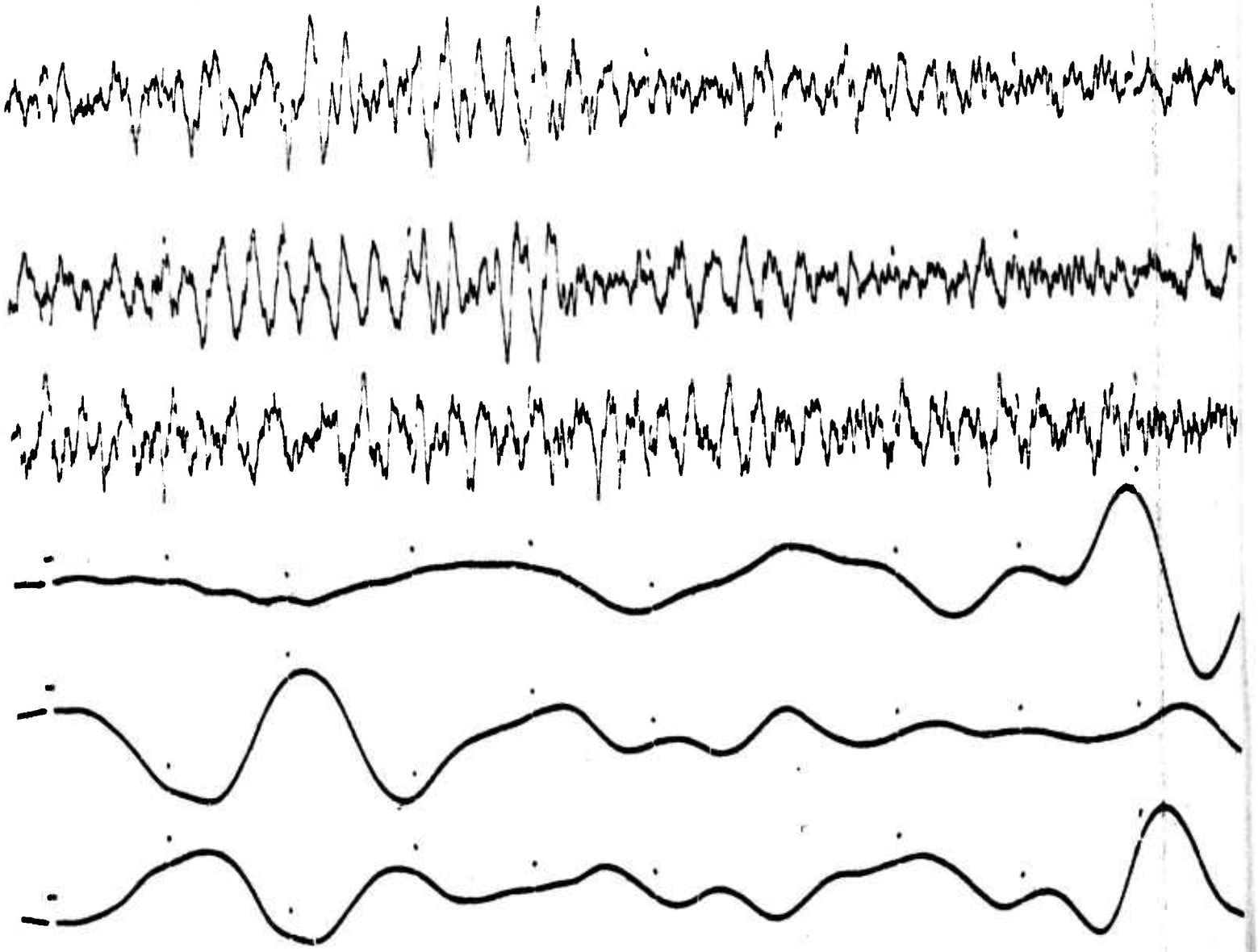




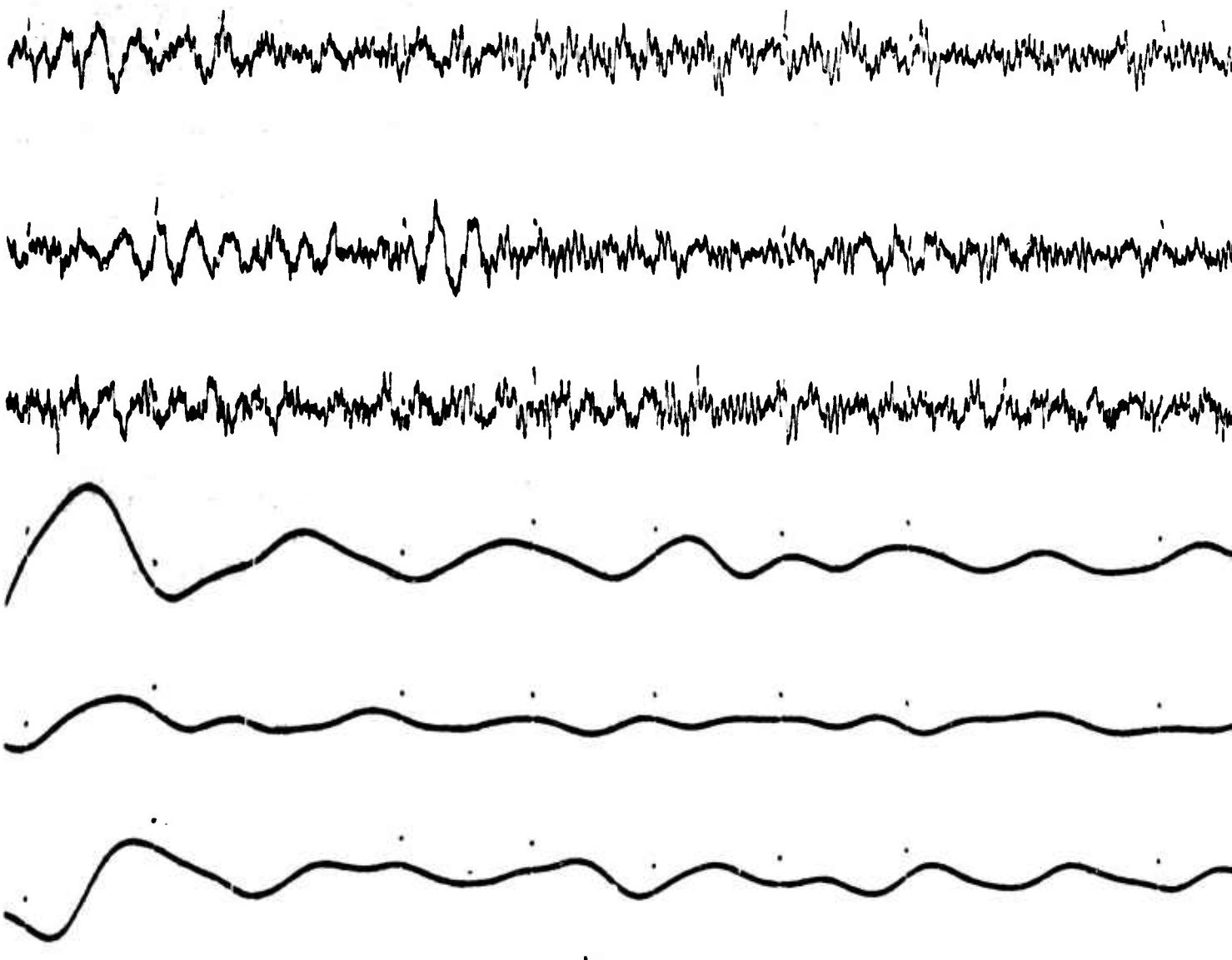




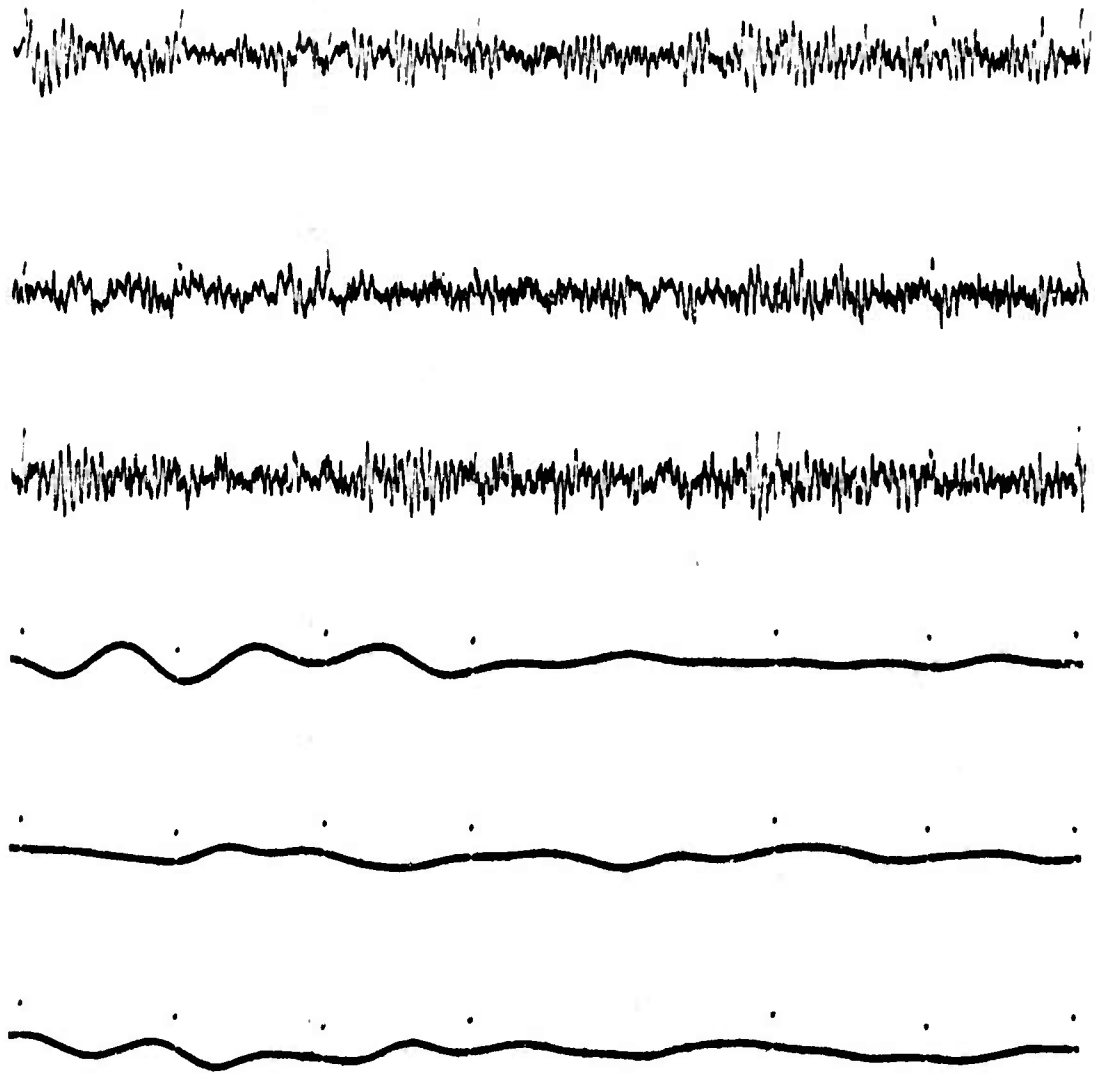
D



E



F



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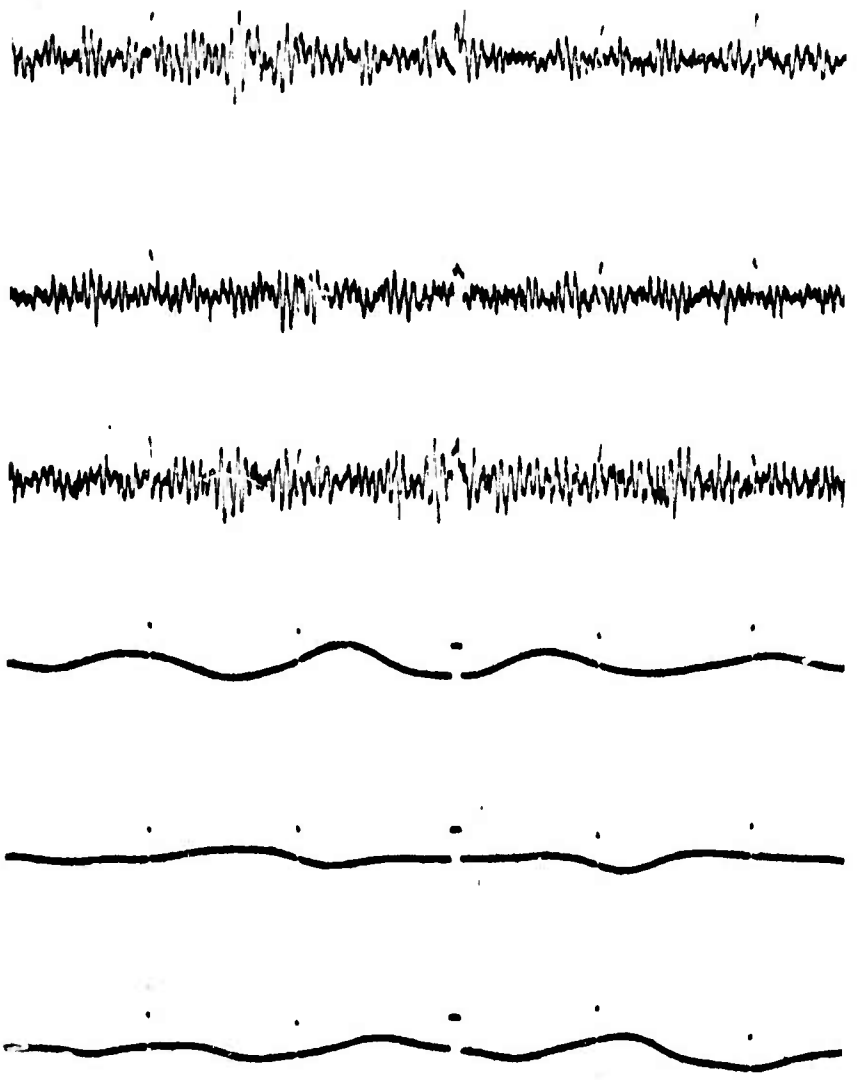


H

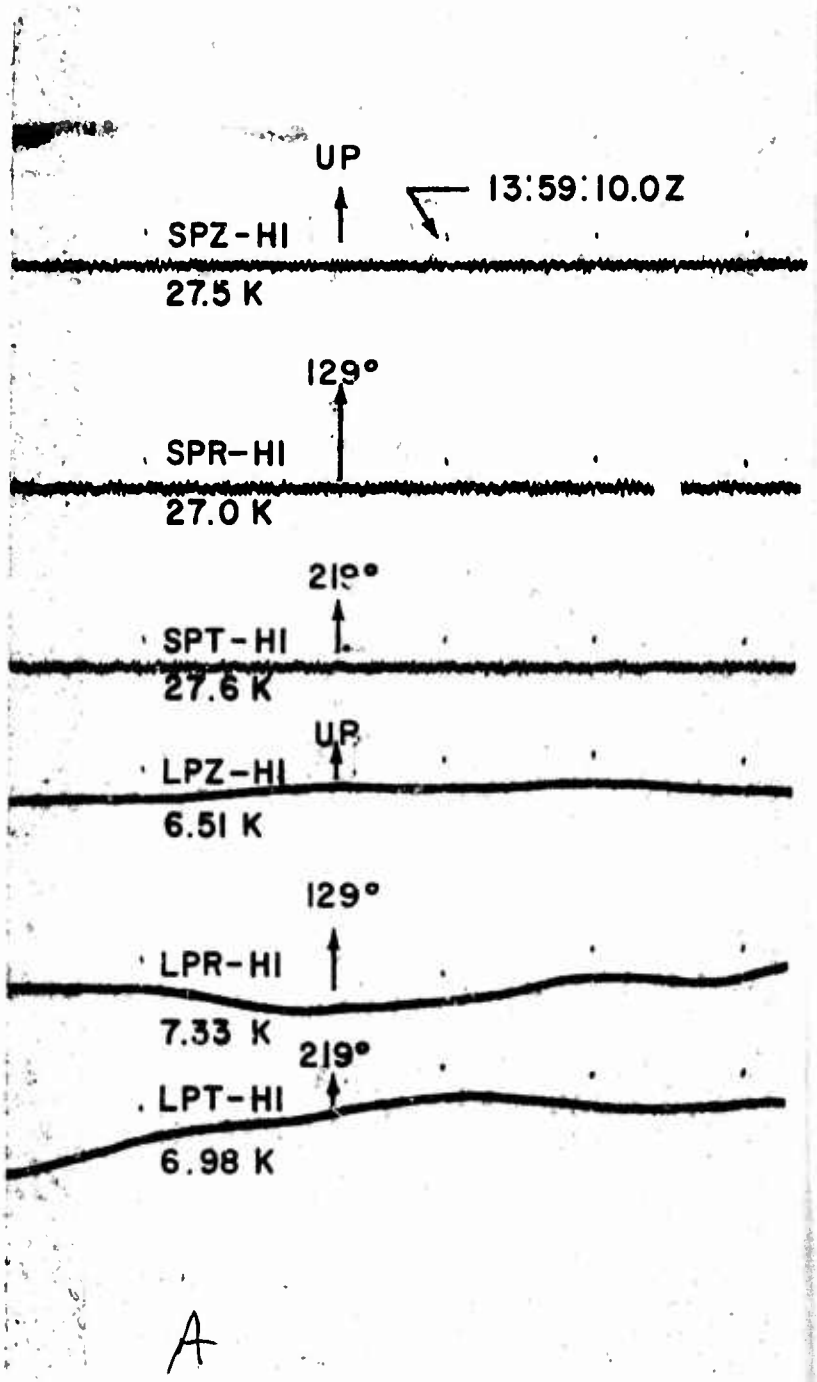
DUMONT

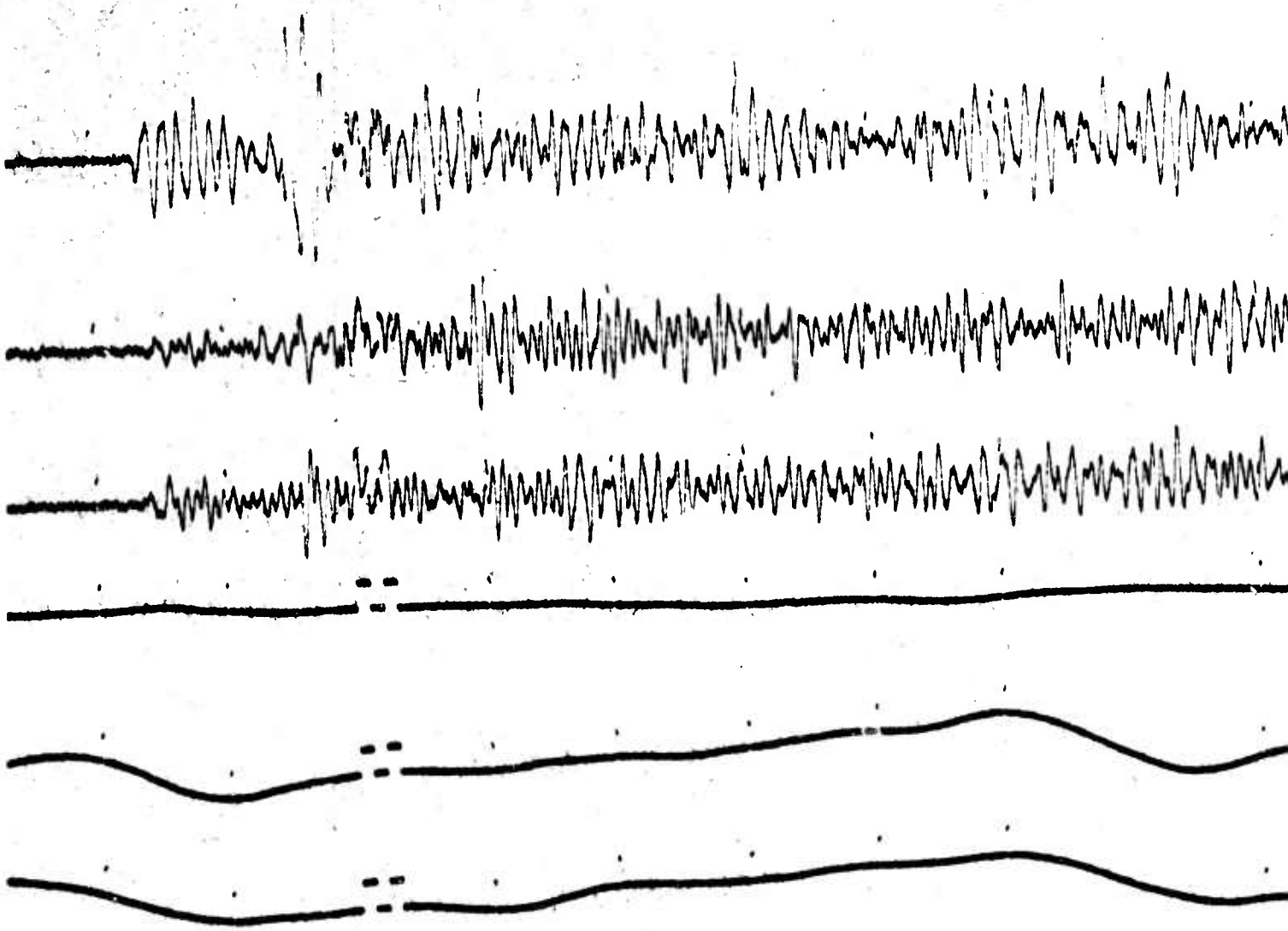
WN-SD

WINNEP[illegible]UTH DAKOTA

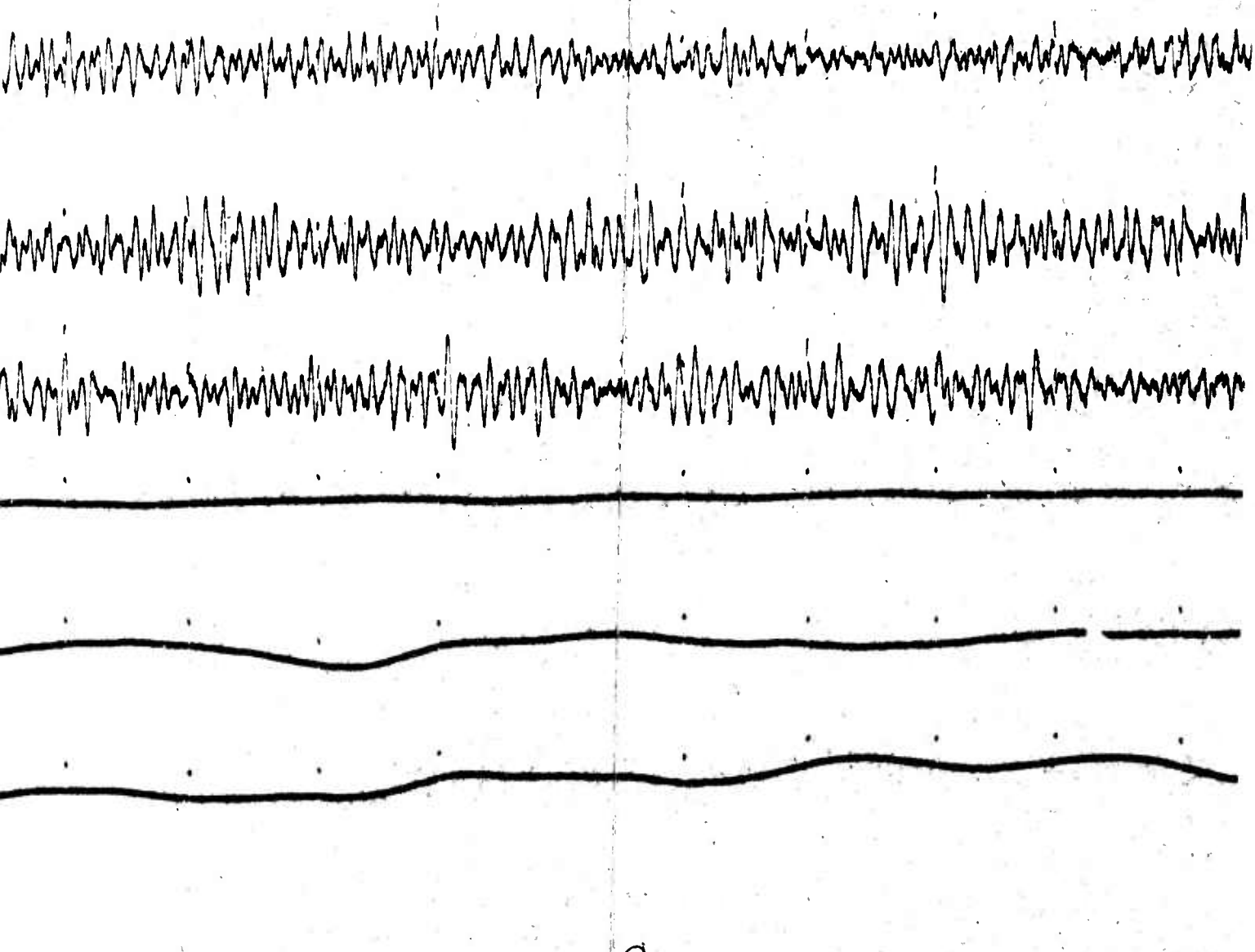
19 MA[illegible]66

Δ = 1510 km





B



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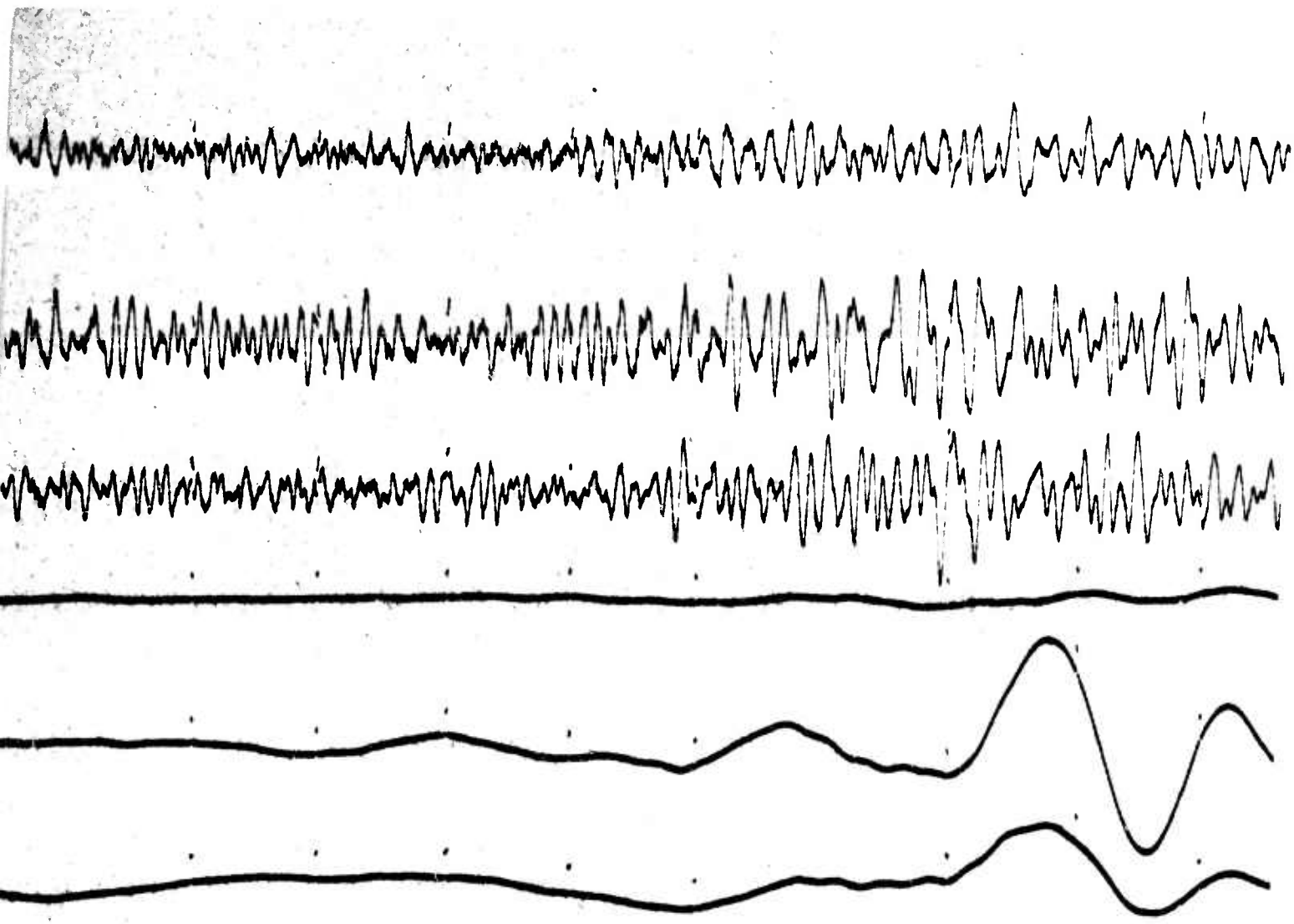

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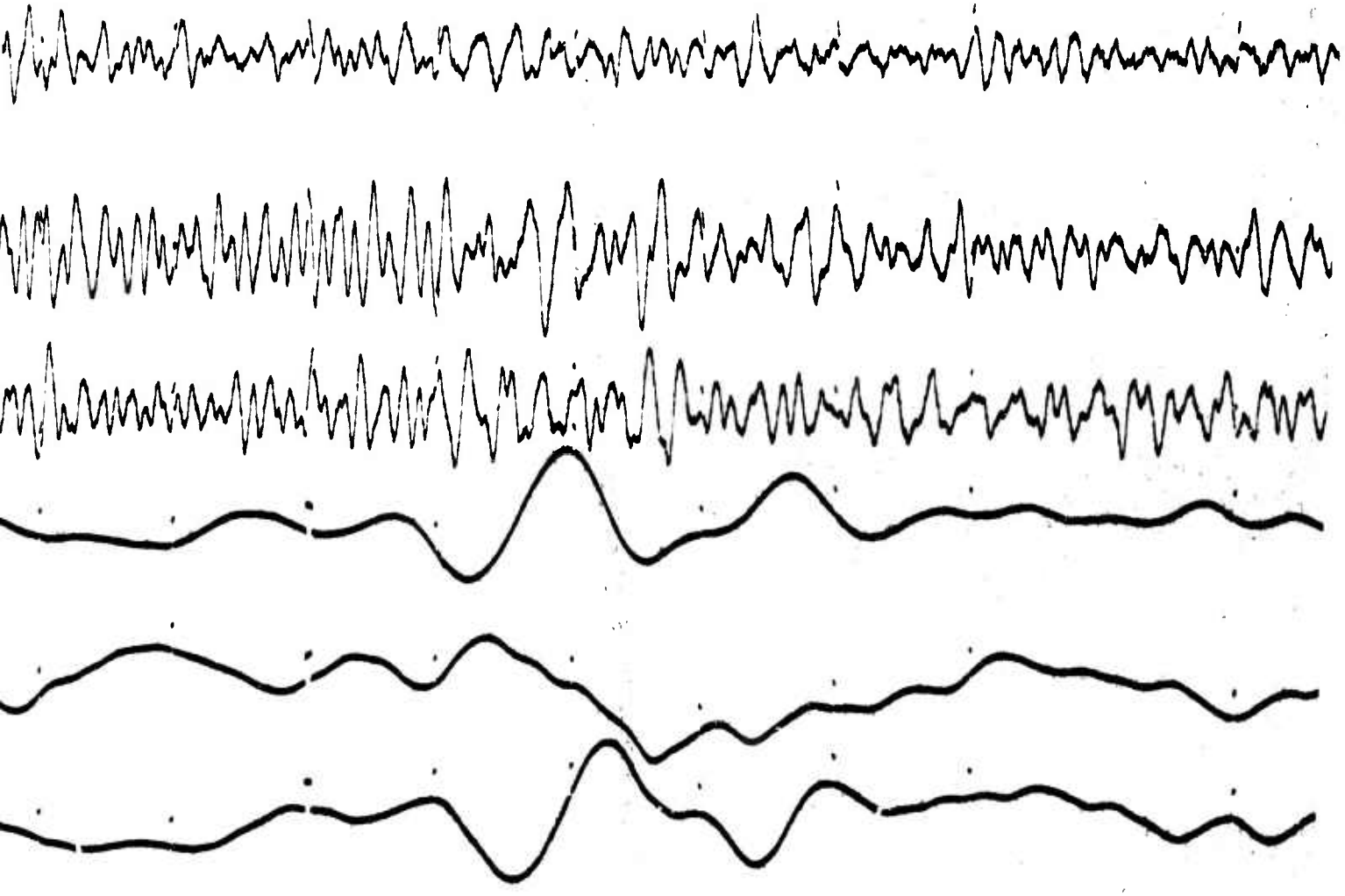

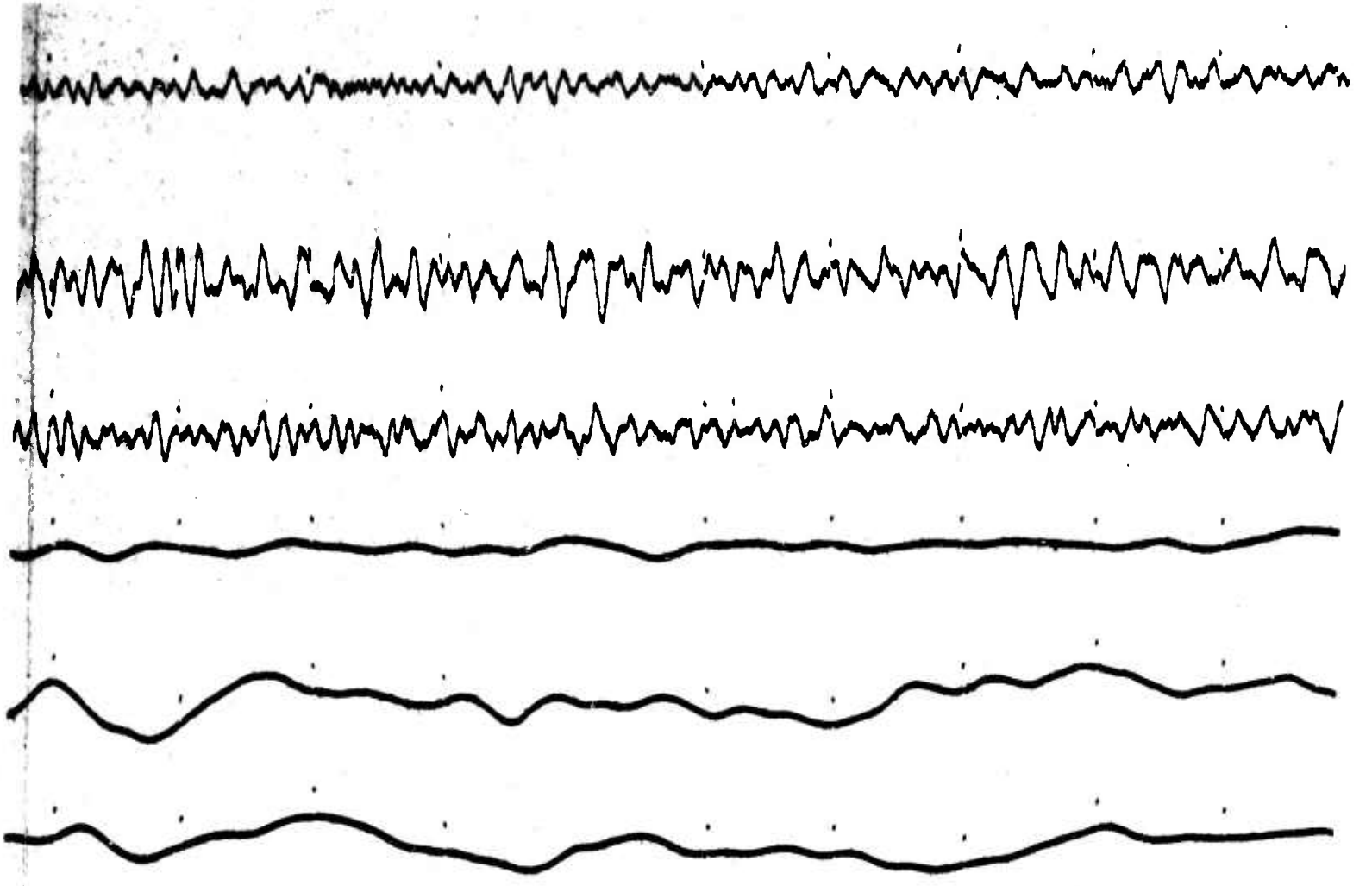

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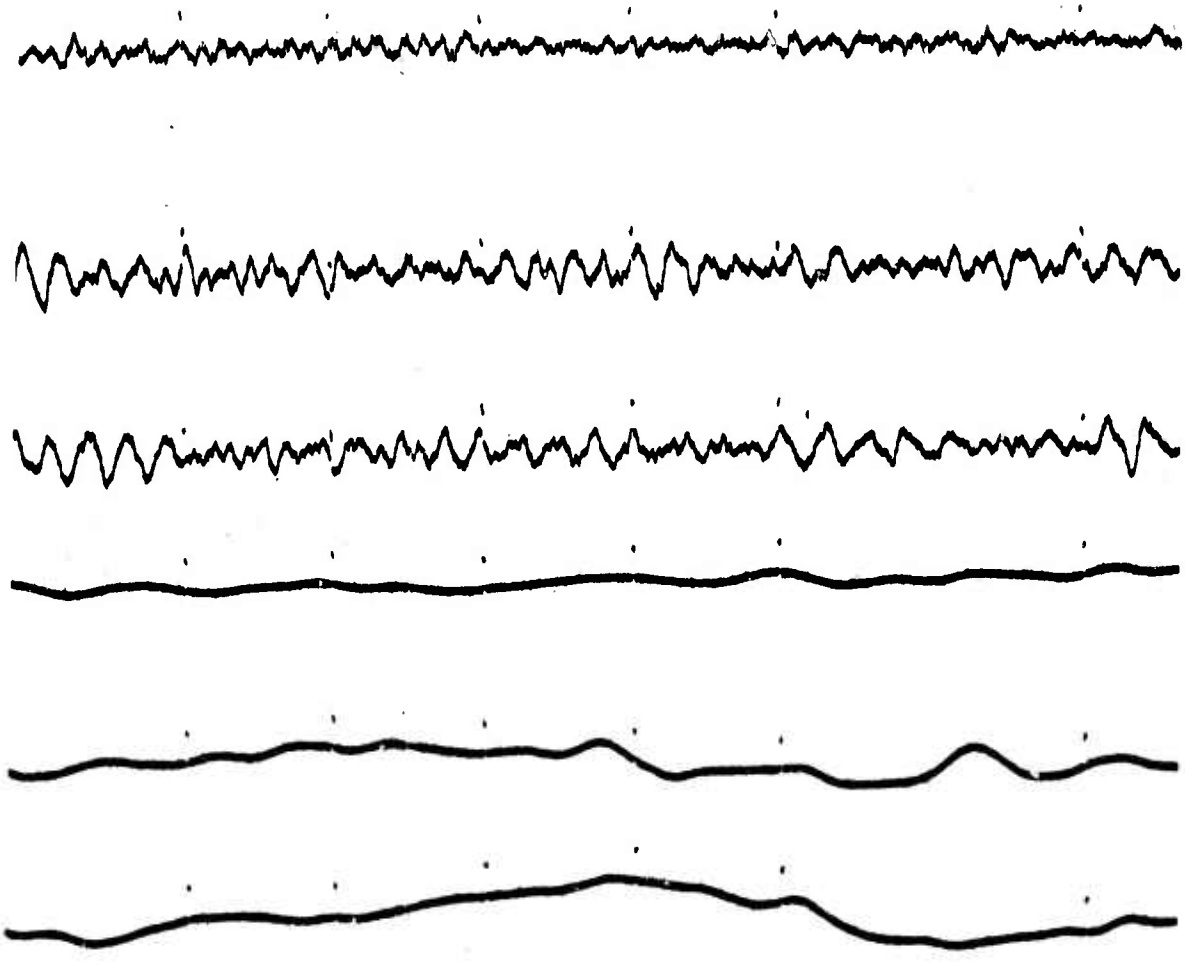


G

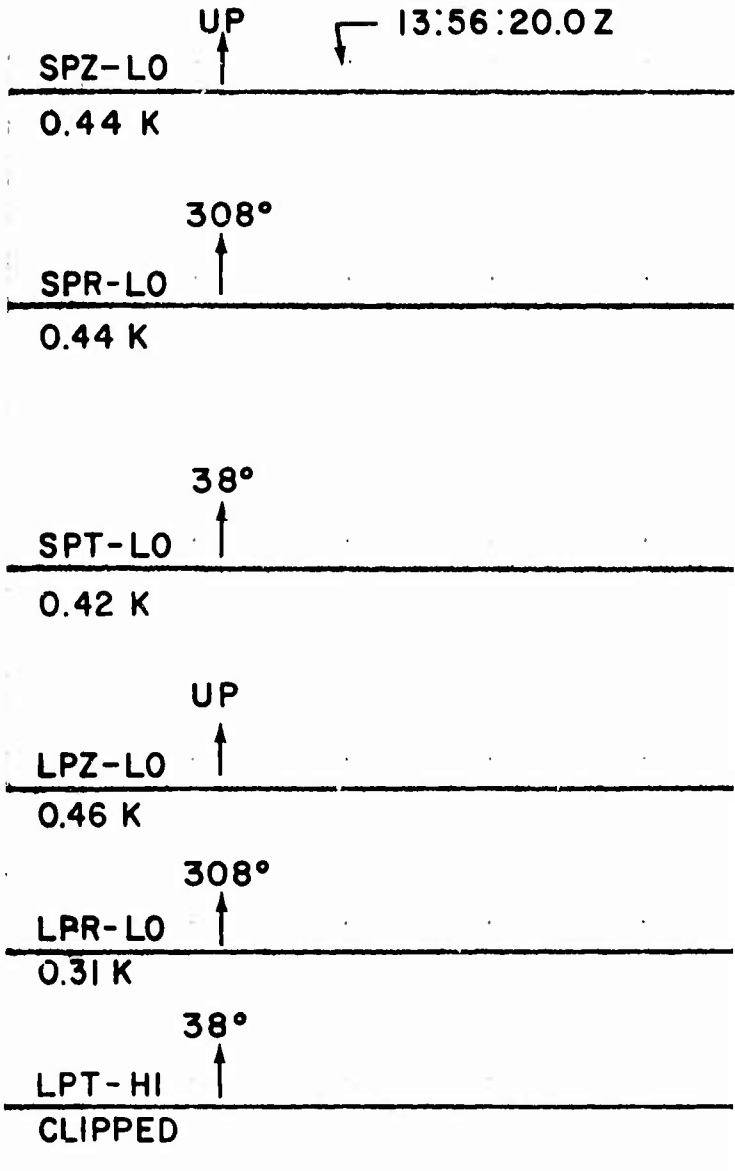
DUMONT

MN - NV

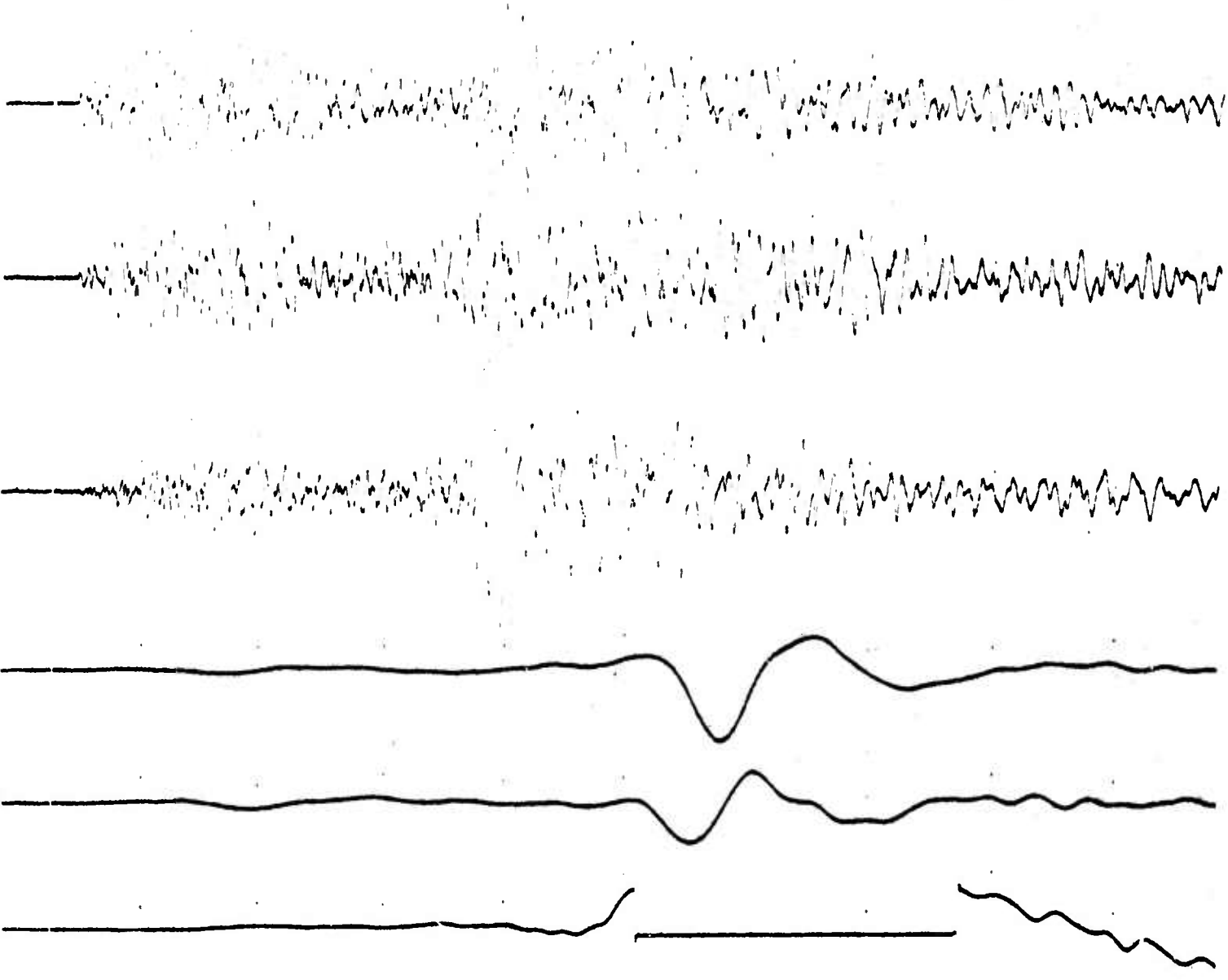
MINA, NEVADA

19 MAY 1966

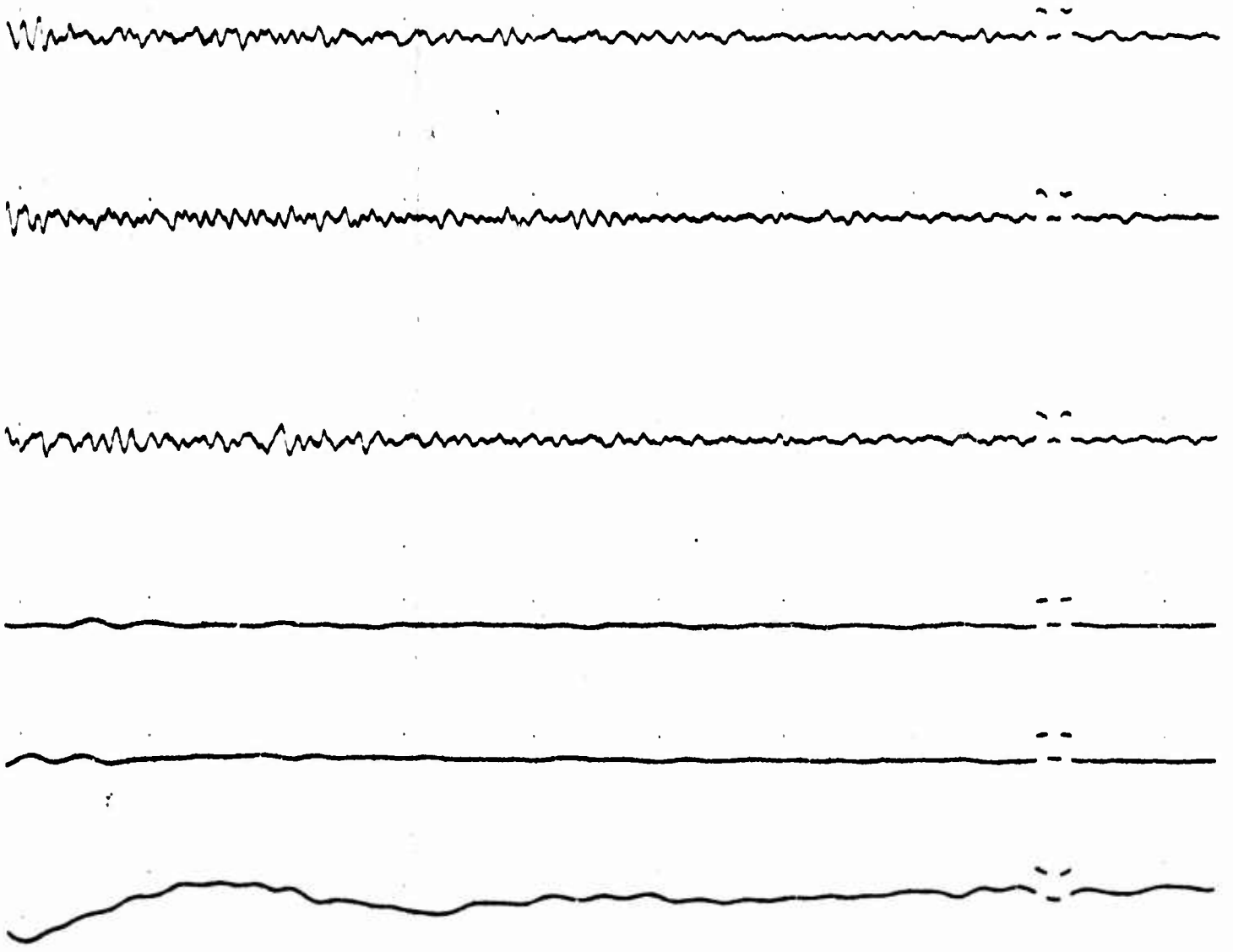
Δ = 236 km



A



B



C