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AUTHORITY

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LONG RANGE SEISMIC MEASUREMENTS

AUK

2 OCTOBER 1964

Prepared for

AIR FORCE TECHNICAL APPLICATIONS CENTER

Washington, D. C.

28 JANUARY 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. 524

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AND WERE NOT
FILMED

LONG RANGE SEISMIC MEASUREMENTS

AUK

2 October 1964

SEISMIC DATA LABORATORY REPORT NO. 134

AFTAC Project No.:	VE A T/2037
Project Title:	Seismic Data Laboratory
ARPA Order No.:	624
ARPA Program Code No.:	5810
Name of Contractor:	UED EARTH SCIENCES DIVISION TELEDYNE, INC.
Contract No.:	AF 33(657)-12447
Date of Contract:	17 August 1963
Amount of Contract:	$ 5,382,624
Contract Expiration Date:	17 February 1966
Project Manager:	Robert Van Nostrand (703) 836 - 7644

P. O. Box 334, Alexandria, Virginia

AVAILABILITY

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AUK

EVENT DESCRIPTION

DATE: 2 October 1964

TIME OF ORIGIN: 20:03:00.0Z

YIELD:

MAGNITUDE: 4.89 ± 0.34

LOCATION:

SITE: Nevada Test Site, Area U7b

Geographic Coordinates:

Lat: 37°04'41.00" N

Long: 116°00'31.00" W

ENVIRONMENT:

Geologic Medium:	Tuff
Shot Depth:	1495 ft.
Surface Elevation:	4201 ft.
Shot Elevation:	2706 ft.

COMPUTED EPICENTER: All Stations

Geographic Coordinates:

Lat: 37°07'26" N

Long: 116°06'00" W

Time of Origin:	20:03:04.8Z
Depth:	39.1 km
Epicenter Shift:	9.5 km, N 57° W

Coda	Station	Final							
		SPZ	SPR	SPT	LPZ	LPR	LPT	Tape	Timing
EK-NV	Eureka, Nevada	+	+	+	+	+	+	*	P
MN-NV	Mina, Nevada	+	+	+	+	+	+	*	P
KN-UT	Kanab, Utah	+	+	+	+	+	+	*	P
SG-AZ	Seligman, Arizona	+	+	+	+	+	+	*	P
JR-AZ	Jerome, Arizona	+	+	+	+	+	+	*	P
LJ-AZ	Long Valley, Arizona	+	+	+	+	+	+	*	P
TFSO	Tonto Forest Observatory, Arizona	+	+	+	+	+	+	*	P
SN-AZ	Sunflower, Arizona	+	+	+	+	+	+	*	P
WO-AZ	Winslow, Arizona	+	+	+	+	+	+	*	P
HR-AZ	Heber, Arizona	+	+	+	+	+	+	*	P
NL -AZ	Nazlini, Arizona	+	+	+	+	+	+	*	P
GE-AZ	Globe, Arizona	+	+	+	+	+	+	*	P
UBSO	Uinta Basin Observatory, Utah	+	+	+	+	+	+	*	P
OR-CO	Durango, Colorado	+	+	+	+	+	+	*	P
HL2IO	Hailey, Idaho	+	+	+	+	+	+	*	P
BMSO	Blue Mountain Observatory, Oregon	+	+	+	+	+	+	*	P
LC-NM	Las Cruces, New Mexico	+	+	+	+	+	+	*	P
RT-NM	Raton, New Mexico	+	+	+	+	+	+	*	P
FO-TX	Fort Stockton, Texas	+	+	+	N	N	N	*	P
TS-ND	Trottars, North Dakota	+	I	+	N	N	N	*	P
WMSO	Wichita Mountain Observatory, Oklahoma	+	+	+	+	+	+	*	P
RY-ND	Ryder, North Dakota	+	+	-	-	-	-	*	P
GV-TX	Grapevine, Texas	-	-	-	+	N	N	*	P
VO-IO	Vinton, Iowa	?	-	+	-	-	-	*	P
WF-MN	Wykoff, Minnesota	+	+	+	+	+	+	*	P
GP-MI	Grand Rapids, Minnesota	?	?	?	-	-	-	*	P
JE-LA	Jena, Louisiana	+	+	-	-	-	-	*	P
RK-ON	Red Lake, Ontario, Canada	+	+	+	-	-	-	*	P
EU-AL	Eutaw, Alabama	?	?	?	-	-	-	*	P
CPSO	Cumberland Plateau Observatory, Tennessee	+	+	+	+	+	+	*	P
BL-WV	Beckley, West Virginia	+	+	-	-	-	-	*	P
BR-PA	Berlin, Pennsylvania	?	?	?	+	+	-	*	P
HD-PA	Howard, Pennsylvania	-	-	-	N	N	N	*	P
OH-NY	Delhi, New York	+	+	-	-	-	-	*	P
LS-NH	Lisbon, New Hampshire	-	-	-	-	-	-	*	P
HN-ME	Houlton, Maine	+	+	-	-	-	-	*	P
SV2QB	Schefferville, Quebec, Canada	+	+	-	?	-	-	*	P
HW-IS	Kamuela, Hawaii	-	-	-	-	-	-	*	P
NP-NT	Mould Bay, Northwest Territories, Canada	+	+		-	-	-	*	P
AD-IS	Adak Island, Alaska	I	I	I	I	I	I		
LZ-BV	La Paz, Bolivia	+	-	-	-	-	-	*	P
OO-NW	Oslo, Norway	+	-	-	-	-	-	*	S
GG-GR	Grafenburg, Germany	+	-	-	-	-	-	*	P

I Inoperative + Signal

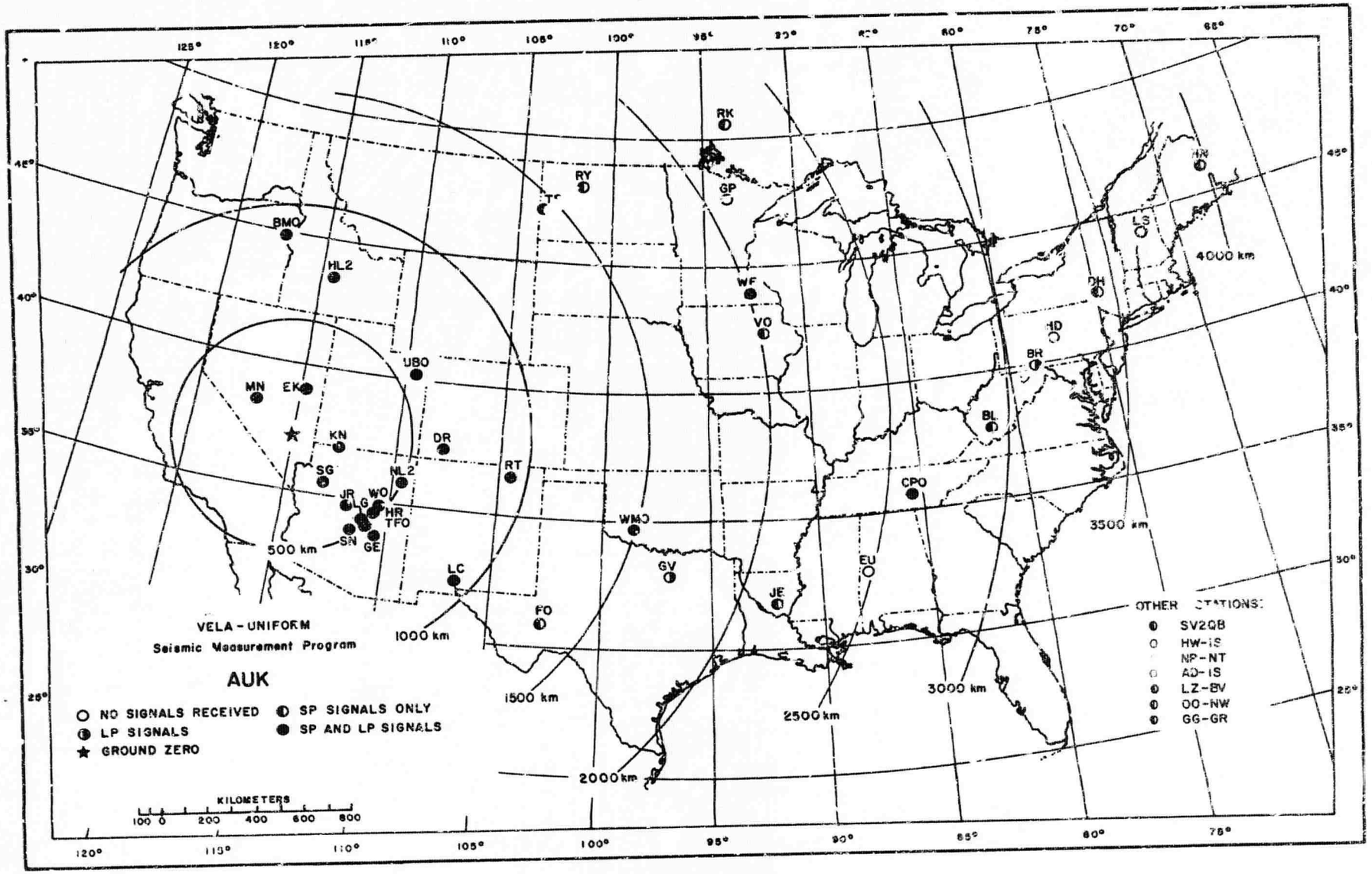
N No Instruments - No Signal

P Primary Timing * Magnetic Tape Available

S Secondary Timing ? Possible Signal

Station Status Report - AUK

Table I



Recording Stations and Signals Received

Figure 1

Introduction

A long range seismic measurements (LRSM) program was established under VELA-UNIFORM to record and analyze short-period and long-period data from a planned series of U. S. underground nuclear tests. These, and other data, will be used by VELA-UNIFORM participants for studying and developing methods for distinguishing between explosive and earthquake sources.

The purpose of this report is to provide an analysis of data resulting from the AUK event from the LRSM film seismograms from operating mobile field teams; Wichita Mountain Observatory, Oklahoma (WMSO), Uinta Basin Observatory, Utah (UBSO), Blue Mountain Observatory, Oregon (BMSO), Cumberland Plateau Observatory, Tennessee (CPSO), and Tonto Forest Observatory, Arizona (TFSO); and from several experimental or temporary stations operated in connection with other research programs.

Instrumentation and Procedure

Instrumentation at each of the mobile stations consists of three-component short-period Benioff and three-component Sprengnether long-period seismographs. Data are recorded on 35 millimeter film and on one-inch 14-channel

magnetic tape. All of these stations are equipped to record WWV continuously in order to provide accurate time control. Calibration is accomplished once each day and just prior to each shot at operating settings. Specific details of the instrumentation and operating procedures for these stations are given in Field Manual, Long Range Seismic Measurement Program, Technical Report No. 63-17, which can be obtained from the Geotech Division of Teledyne Industries, Inc., Dallas, Texas. All the observatories have both long-period and short-period, three-component instrumentation, in addition to their other specialized facilities.

Station site information is presented in Appendix I(A). 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.

A status report for AUK is included in Table 1, placed opposite the operations map, Figure 1. This report gives the names of 43 stations and indicates which instruments were operational and which recorded usable signals.

An explanation of the procedure for amplitude measurements used in this report is illustrated in Appendix II. The

unified magnitude (m) computations for distances less than 16° are based on AFTAC/VSC extensions of Gutenberg's Tables*. For this purpose, points from 10° to 16° were read from a curve in the Gutenberg-Richter paper and an inverse cube relationship was used to extrapolate from two to ten degrees. A table of the distance factors (B) is provided in Appendix I(B).

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

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

nation of depth or location. Results are shown on the Event Description page.

Data and Results

Table 2 summarizes the measurements made of the principal phases from the AUK event. Included are the Pn and P arrival times, the maximum amplitudes (A/T) of Pn or P and Pg motion as seen on the short-period vertical instruments, and the maximum amplitudes (A/T) of the Lg phase as measured on the short-period horizontal tangential component. Long-period Love and Rayleigh wave motion are also tabulated in (A/T) form. Thirty-five stations recorded short-period signals. Long-period signals from this event were recorded by 23 stations.

In addition, Table 2 and Figure 2 show the unified magnitudes (m) where measurable. The average magnitude for AUK is 4.89.

The travel-time residuals from the Pn and P phase are within the usual limits (see Figure 3). The amplitudes of Pn and P, Pg and Lg are shown in Figures 4, 5 and 6. Lines proportional to the inverse cube of the distance visually fitted through the observed points are shown on these graphs. Rayleigh wave and Love wave amplitudes are shown in Figures 7

and 8.

Attached to the report are illustrative sesimograms showing the signals recorded at three locations. The most distant station analyzed that recorded AUK was GG-GR at a distance of 9098 kilometers.

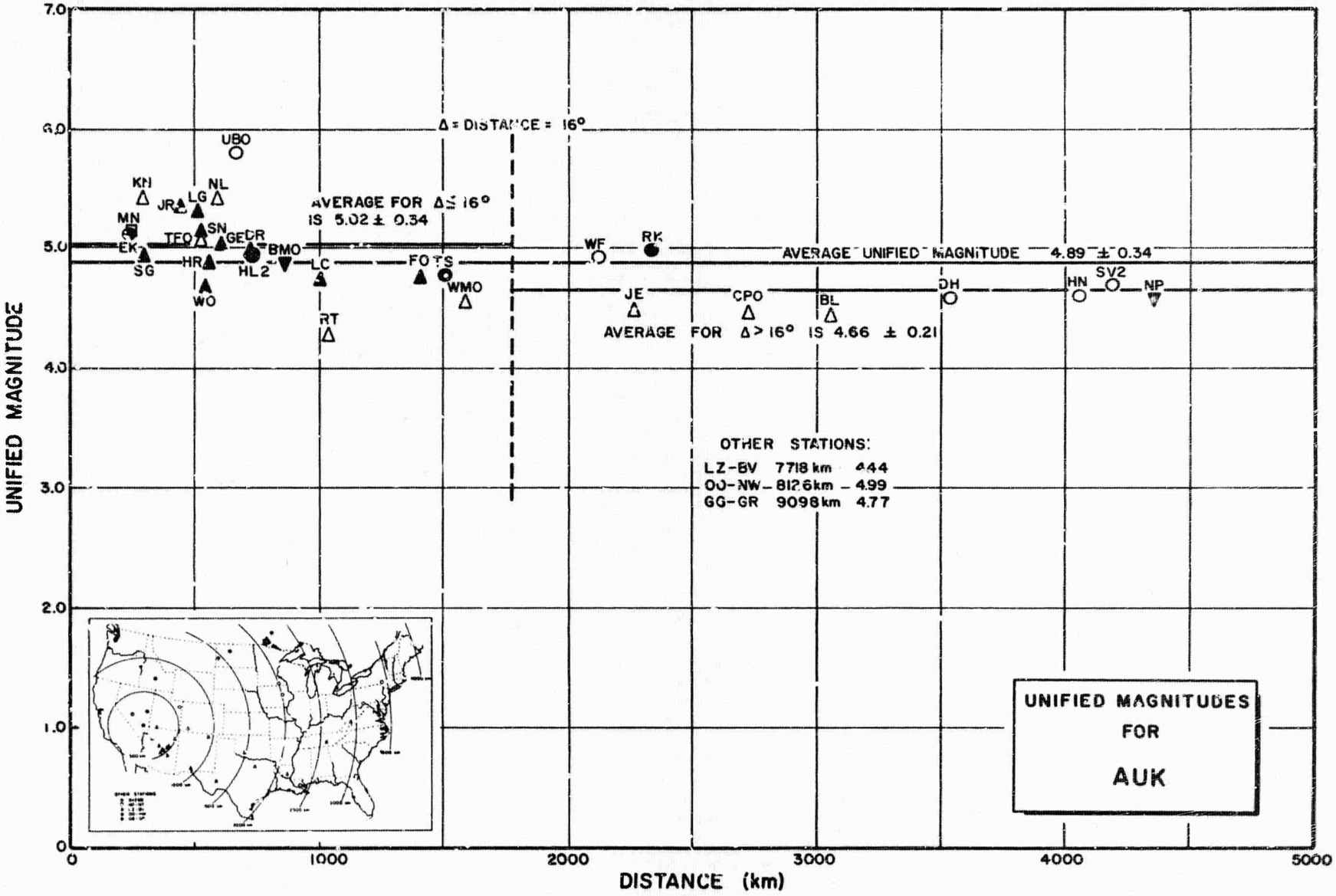
Principal Phases
AUK
2 October 1964
20:03:00.0Z

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 (m)
EK-NV	Eureka Nevada	238	SPZ	3.29	Pn	0	36.9	0.5	688	5.12
			SPZ	3.29	Pg	0	40.8	0.6	2076	
			SPT	1.07	Lg			0.6	14840	
			LPZ	12.6*	LR			10.0	498	
MN-NV	Mina, Nevada	241	SPZ	3.34	Pn	0	37.2	0.55	740	5.16
			SPZ	3.34	Pg	0	39.9	0.6	3065	
			SPT	2.41	Lg			0.7	4483	
			LPT	39.9	LQ			12.0	115	
			LPZ	30.6	LR			14.0	165	
KN-UT	Kanab, Utah	283	SPZ	8.32	Pn	0	42.6	0.6	852	5.41
			SPZ	8.32	Pg	0	48.4	0.5	(5656)	
			SPT	8.26	Lg			0.5	4886	
			LPT	30.1	(LQ)			9.0	98.8	
			LPZ	26.3	LR			12.0	268	
SG-AZ	Seligman, Arizona	294	SPZ	8.7	Pn	0	44.0	0.5	270	4.95
			SPZ	8.7	Pg	0	49.2	0.6	3101	
			SPT	9.0	Lg			0.8	3042	
			LPT	13.4	LQ			9.0	178	
			LPZ	13.58	LR			12.0	218	
JR-AZ	Jerome Arizona	440	SPZ	21.4	Pn	01	02.9	0.5	199	5.37
			SPZ	21.4	e	01	06.0	0.6	327	
			SPZ	8.9*	Pg	01	16.0	0.5	2156	
			SPT	9.7*	Lg			0.8	1710	
			LPT	16.5	LQ			10.0	83.7	
			LPZ	19.3	LR			13.0	149	
LG-AZ	Long Valley, Arizona	501	SPZ	23.5	Pn	01	11.5	0.6	116	5.31
			SPZ	23.5	e	01	15.6	0.5	177	
			SPZ	23.5	Pg	01	26.1	0.6	872	
			SPT	35.7	Lg			0.9	(538)	
			LPT	15.81	LQ			11.0	51.0	
			LPZ	12.25	LR			12.0	175	
TFSO	Tonto Forest Observatory, Arizona	529	SPZ1	100*	Pn	01	14.3	0.8	55.9	5.08
			SPZ-31	52.2	Pg			---	---	
			SPN		Lg			---	---	
			LPZ	3.0	LR			16.0	74.7	
SN-AZ	Sunflower, Arizona	530	SPZ	31.4	Pn	01	14.1	0.7	65.5	5.15
			SPZ	31.4	Pg	01	30.4	0.6	348	
			SPT	31.4	Lg			0.7	289	
			LPZ	12.52	LR			(12.0)	(176)	
HR-AZ	Heber, Arizona	540	SPZ	39.4	Pn	01	16.2	0.6	32.5	4.88
			SPZ	39.4	e	01	19.0	0.5	36.8	
			SPZ	39.4	Pg	01	29.0	0.8	(937)	
			SPT	40.9	Lg			0.8	485	
			LPZ	19.2	LR			13.0	110	
WO-AZ	Winslow, Arizona	544	SPZ	30.2	Pn	01	17.2	0.5	24.0	4.70
			SPZ	30.2	e	01	19.7	0.5	30.0	
			SPZ	30.2	Pg	01	29.4	0.7	1760	
			SPT	30.4	Lg			0.8	774	
			LPZ	21.0	LR			(12.0)	(165)	
NL-AZ	Nazlini, Arizona	591	SPZ	46.2	Pn	01	21.5	0.6	89.0	5.41
			SPZ	46.2	Pg	01	43.0	0.7	768	
			SPT	38.6	Lg			0.7	(906)	
			LPZ	6.86	LR			12.0	220	
GF-AZ	Globe, Arizona	618	SPZ	48.1	Pn	01	25.3	0.55	32.4	5.02
			SPZ	48.1	e	01	32.0	0.6	53.2	
			SPZ	48.1	Pg	01	43.0	0.6	493	
			SPT	43.5	Lg			0.8	199	
			LPZ	13.03	LR			13.0	140	
UBSO	Uinta Basin Observatory, Utah	666	SPZ10	9.6	Pn	01	34.3	0.5	159	5.80
			SPZ10	9.6	Pg	01	52.4	0.8	350	
			SPN	9.9	Lg			1.1	396	
			LPZ	43.5	LR			14.0	66.6	
OR-CO	Durango, Colorado	730	SPZ	64.7	Pn	01	40.9	0.6	18.5	4.99
			SPZ	64.7	Pg	01	59.5	0.6	725	
			SPT	59	Lg			0.8	187	
			LPZ	11.3	LR			16.0	207	

Principal Phases
AUK
2 October 1966
20:03:00.0Z

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 (m)
HL?IO	Hailey, Idaho	733	SPZ	39.5	Pn	01	38.9	0.7	17.4	4.96
			SPZ	39.5	Pg	01	45.7	0.6	268	
			SPT	64.5*	Lg			0.8	262	
			LPZ	40.3	LR			13.0	120	
BMSO	Blue Mountain Observatory, Oregon	870	SPZ3	57.5	Pn	01	58.0	0.85	8.45	4.09
			SPZ3	57.5	Pg	02	33.0	0.85	106	
			SPE	60	Lg			0.7	136	
			LPZ	28.6	LR			(10.0)	(153)	
LC-NM	Las Cruces, New Mexico	1005	SPZ	20?.5	Pn	02	15.5	0.8	3.50	4.74
			SPZ	209.5	Pg	02	49.4	0.6	107	
			SPT	208	Lg			1.2	66.1	
			LPT	121.2	LQ			(16)	(10.6)	
			LPZ	120	LR			15.0	63.0	
RT-NM	Raton, New Mexico	1030	SPZ	246	Pn	02	(19.6)	(0.8)	(1.1)	(4.28)
			SPZ	246	Pg	03	03.4	0.9	74.4	
			SPT	253	Lg			0.9	56.5	
			LPZ	13.95	LR			15.0	36.1	
FO-TX	Fort Stockton, Texas	1406	SPZ	324	P	03	(06.5)	(1.0)	(5.4)	(4.77)
			SPZ	324	e	03	07.7	0.8	(4.5)	
			SPZ	324	Pg	04	09.0	0.7	12.7	
			SPT	362	Lg			1.6	103	
TS-ND	Trotters, North Dakota	1508	SPZ	49.1	P	03	(13.0)	(0.6)	(10.4)	(4.79)
			SPT	53.6	Lg			0.8	20.6	
WMSO	Wichita Mountain Observatory, Oklahoma	1592	SPZ6	200	P	03	28.5	1.0	11.3	4.55
			SPZ6	200	e	03	34.0	0.8	8.4	
			SPZ6	200	Pg	04	33.9	1.0	38.4	
			SPN	200	Lg			1.5	56.7	
			LPZ	19	LR			16.0	21.1	
RY-ND	Ryder, North Dakota	1703	SPZ	32.9	(PP)	03	45.6	0.75	148	
GV-TX	Grapevine, Texas	1794	LPZ	17 2	LR			13.0	61.2	
VO-IO	Vinton, Iowa	2121	SPT	82	Lg			(1.6)	(35.5)	
WF-MN	Wykoff, Minnesota	2131	SPZ	122.9	P	04	26.4	0.8	85.2	4.93
			SPZ	122.9	e	04	34.4	0.8	68.8	
			SPZ	122.9	e	04	37.1	0.8	49.3	
			SPT	141.8	Lg			0.8	19.4	
			LPZ	5.34	LR			14.0	53.6	
GP-MN	Grand Rapids, Michigan	2185	SPZ		P		OBSCURED BY NOISE			
JE-LA	Jena, Louisiana	2275	SPZ	61.3	P	04	(43.0)	0.65	27.7	4.49
RK-ON	Red Lake, Ontario, Canada	2341	SPZ	175	P	04	45.6	0.6	70.3	4.95
EU-AL	Eutaw, Alabama	2604	SPZ		P		OBSCURED BY NOISE			
CPSO	Cumberland Plateau Observatory, Tennessee	2726	SPZ8	315	P	05	(22.3)	(0.75)	(11.4)	(4.46)
			SPN	315	Lg			1.8	47.6	
			LPZ	16.0	LR			16.0	25.0	
BL-WV	Beckley, West Virginia	3055	SPZ	57.2	P	05	(50.8)	(0.7)	(7.5)	(4.42)
BR-PA	Berlin, Pennsylvania	3235	SPZ		P		OBSCURED BY NOISE			
			LPZ	19.53	LP			13.0	9.3	
DL-NY	Delhi, New York	3541	SPZ	62.2	(P)	05	(27.5)	1.0	8.00	4.60
HN-ME	Houlton, Maine	4064	SPZ	130	P	07	(08.0)	1.0	11 7	4.61
SV2Qu	Schefferville, Quebec, Canada	4187	SPZ1	94.6	P	07	15.2	1.0	15.9	4.73
			SPZ	94.6	e	07	20.2	0.8	15.6	
NP-NT	Mould Bay, Northwest Territories, Canada	4370	SPZ	137	P	07	31.1	0.8	15.8	4.59
LZ-BV	La Paz, Bolivia	7718	SPZ	258	P	11	12.0	0.6	3.80	4.44
OO-NW	Oslo, Norway	9126	SPZ3	101.4	P	11	33.6	1.0	12.3	4.99
GG-GR	Grafenburg, Germany	9098	SPZ	78.4	P	12	21.6	0.8	7.20	4.77

A/T mu/sec
C Compressional
( ) Doubtful Values or Phases
* Measurements Made From Playouts
e Phases Reported But Not Identified
--- Clipped on Film and Tape


UNIFIED MAGNITUDE
DISTANCE (km)
Δ = DISTANCE = 16°
AVERAGE FOR Δ ≤ 16° IS 5.02 ± 0.34
AVERAGE UNIFIED MAGNITUDE 4.89 ± 0.34
AVERAGE FOR Δ > 16° IS 4.66 ± 0.21
UBO
KN
NL
LG
JR
MN
SN
TEQ
GE
DR
EK
BMO
SG
HR
HL2
LC
FO
TS
WO
RT
WMO
WF
RK
JE
CPO
BL
DH
HN
SV2
NP
OTHER STATIONS:
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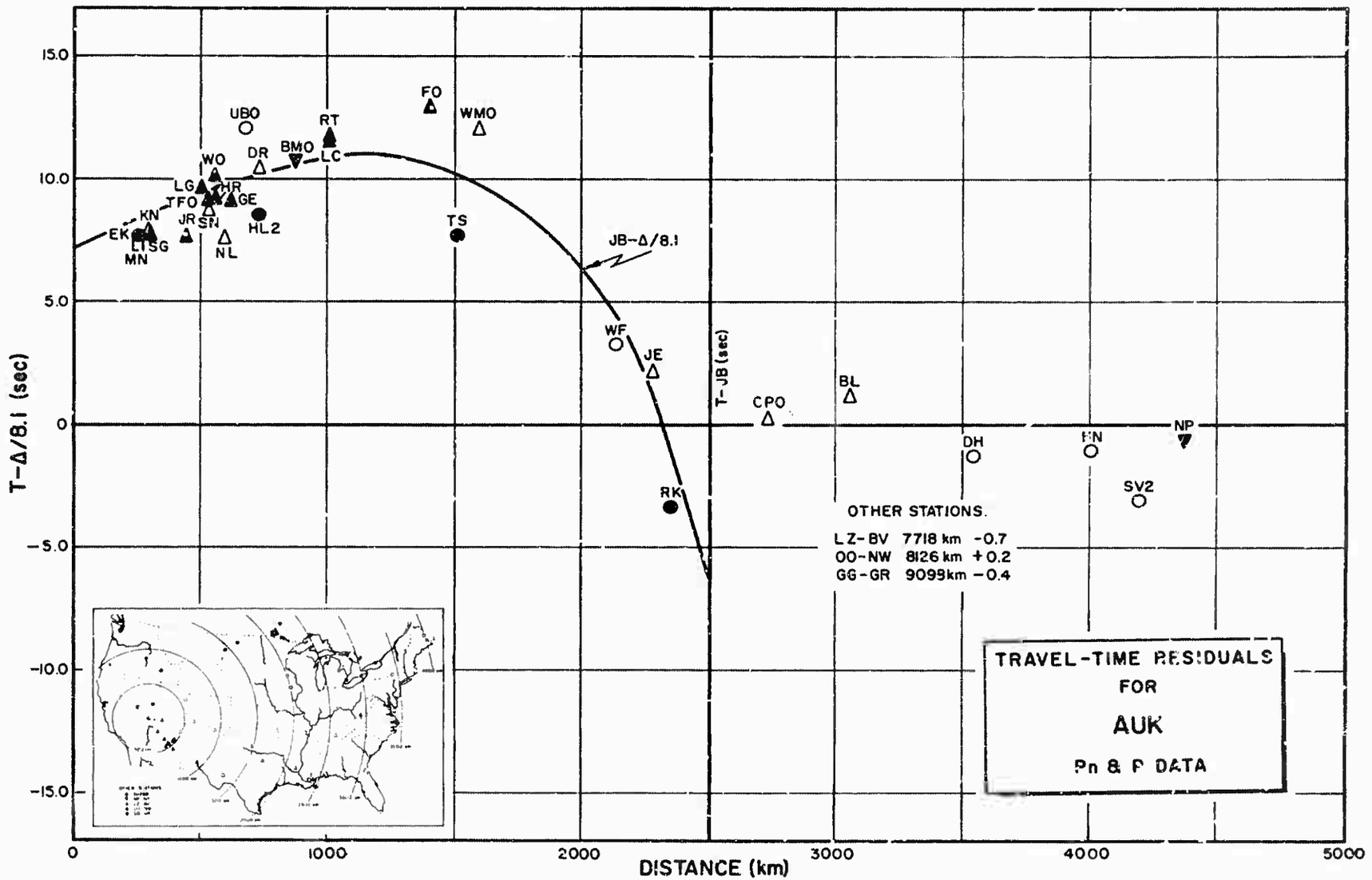
OO-NW- 812.6km - 4.99
GG-GR 9098 km 4.77
UNIFIED MAGNITUDES FOR AUK

Figure 2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4000
5000
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T-JB (sec)
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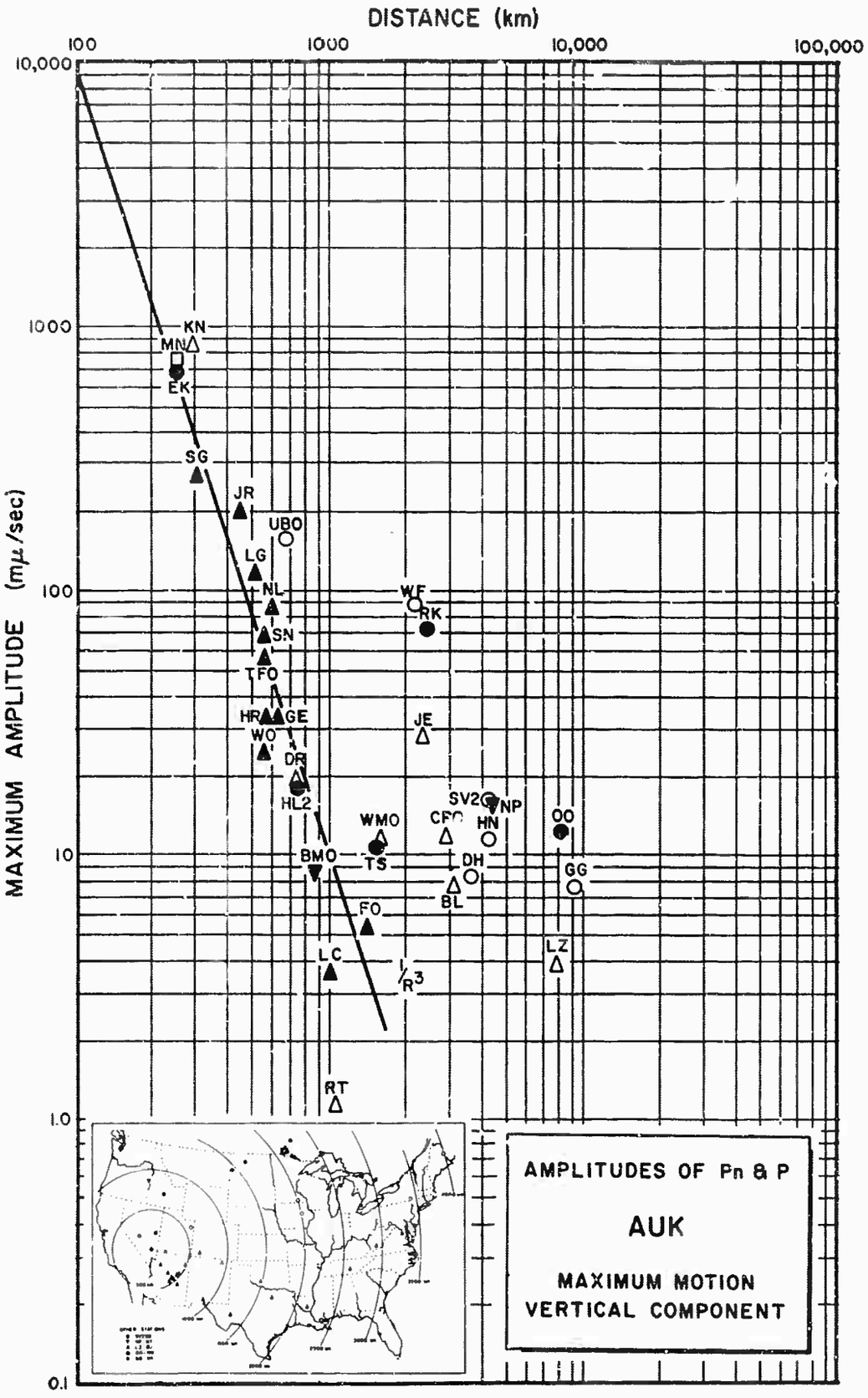
RT
FO
WMO
DR
BMO
LC
WO
LG
HR
TFO
GE
KN
EK
JR
SN
HL2
TS
NL
LTSG
MN
JB-Δ/8.1
WF
JE
BL
CPO
DH
HN
NP
SV2
RK
OTHER STATIONS.
LZ-BV 7718 km -0.7
OO-NW 8126 km +0.2
GG-GR 9099km -0.4
TRAVEL-TIME RESIDUALS
FOR
AUK
Pn & P DATA

Figure 3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100,000
10,000
1000
100
10
1.0
0.1
MAXIMUM AMPLITUDE (mμ/sec)
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MN
EK
SG
JR
UBO
LG
NL
SN
TFO
HR
GE
WO
DR
HL2
BMO
WMO
TS
FO
LC
RT
WF
RK
JE
SV2
NP
CPO
HN
DH
BL
OO
GG
LZ
1/R3
AMPLITUDES OF Pn & P
AUK
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 4

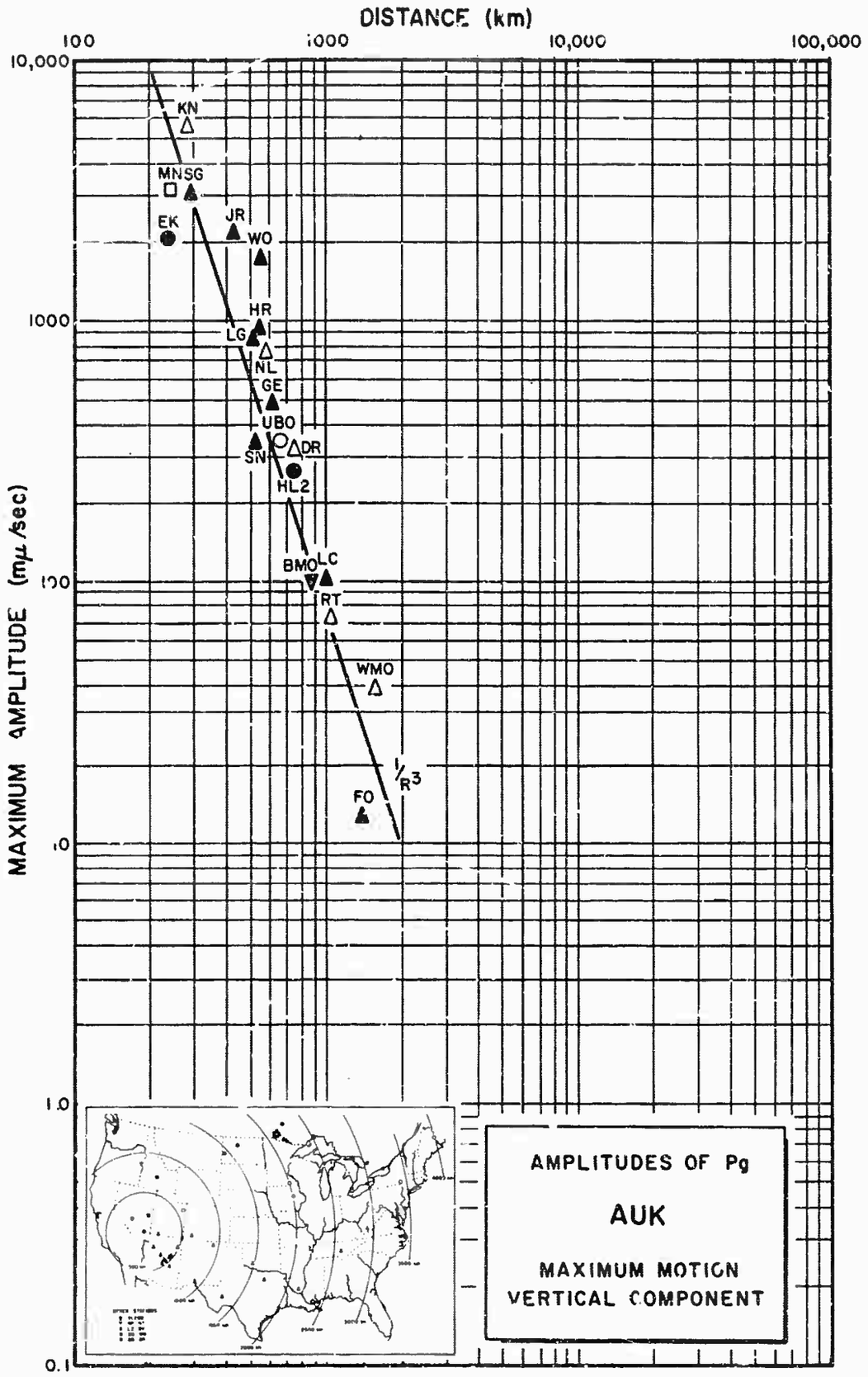
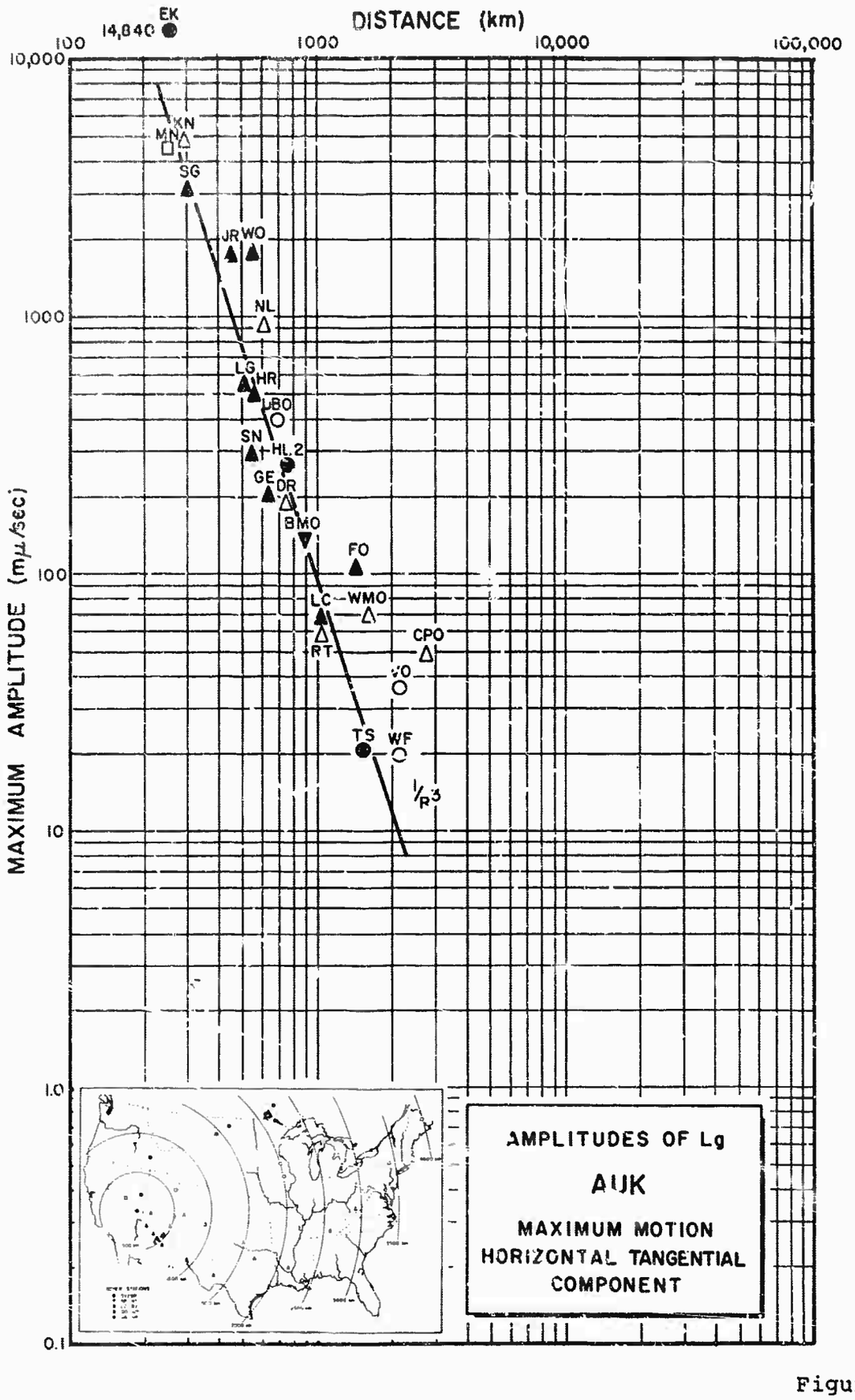

DISTANCE (km)
100
1000
10,000
100,000
10,000
1000
100
10
1.0
0.1
MAXIMUM AMPLITUDE (mμ/sec)
KN
MNSG
EK
JR
WO
HR
LG
NL
GE
UBO
DR
SN
HL2
BMO
LC
RT
WMO
FO
1/R3
AMPLITUDES OF Pg
AUK
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 5


DISTANCE (km)
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1000
10,000
100,000
14,840
EK
10,000
1000
100
10
1.0
0.1
MAXIMUM AMPLITUDE (mμ/sec)
KN
MNA
SG
JR
WO
NL
LG
HR
UBO
SN
HL 2
GE
DR
BMO
FO
LC
WMO
RT
CPO
VO
TS
WF
1/R3
AMPLITUDES OF Lg
AUK
MAXIMUM MOTION
HORIZONTAL TANGENTIAL
COMPONENT

Figure 6

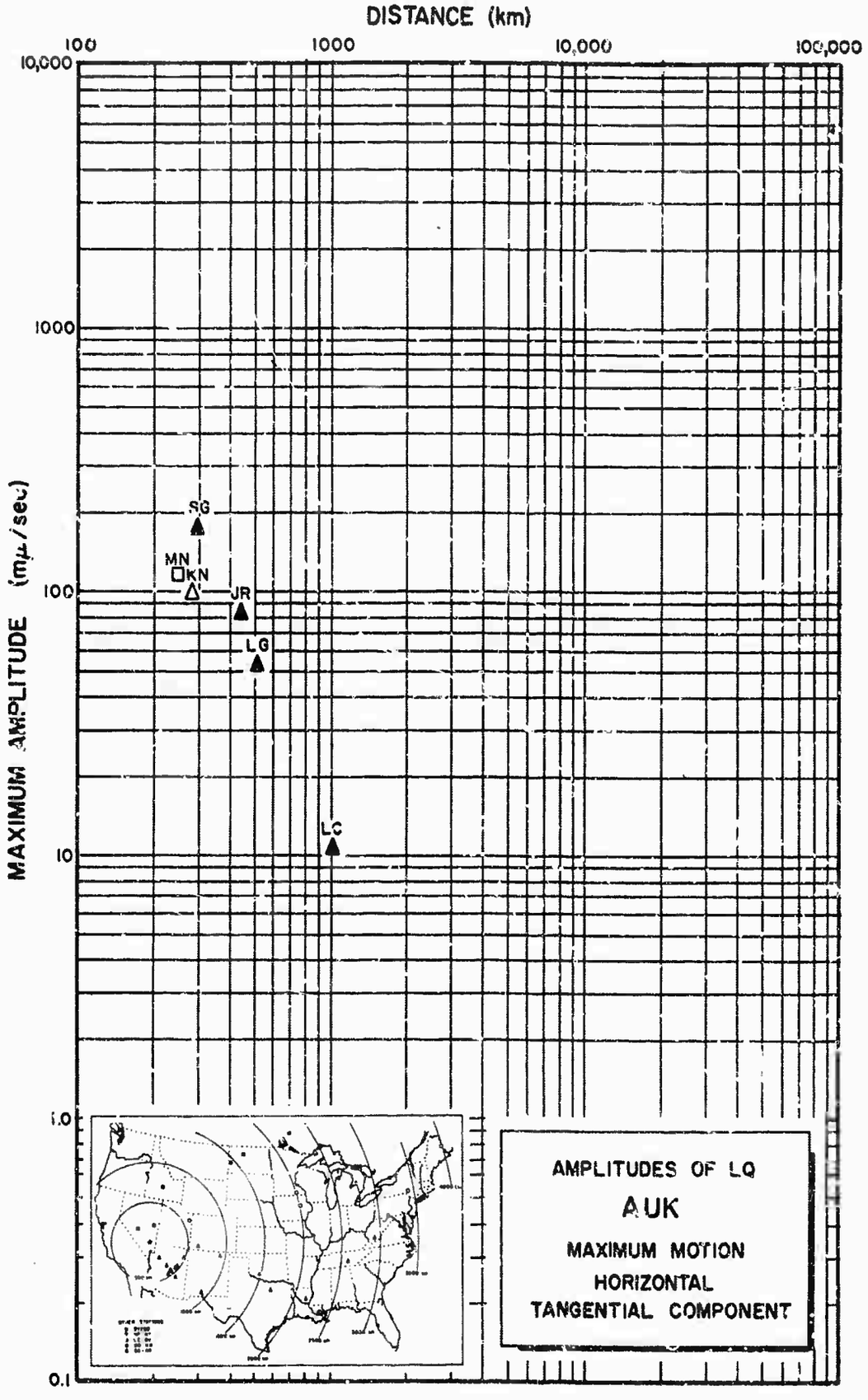

DISTANCE (km)
100
1000
10,000
100,000
10,000
1000
100
10
1.0
0.1
MAXIMUM AMPLITUDE (mμ/sec)
SG
MN
KN
JR
LG
LC
AMPLITUDES OF LQ
AUK
MAXIMUM MOTION
HORIZONTAL
TANGENTIAL COMPONENT

Figure 7

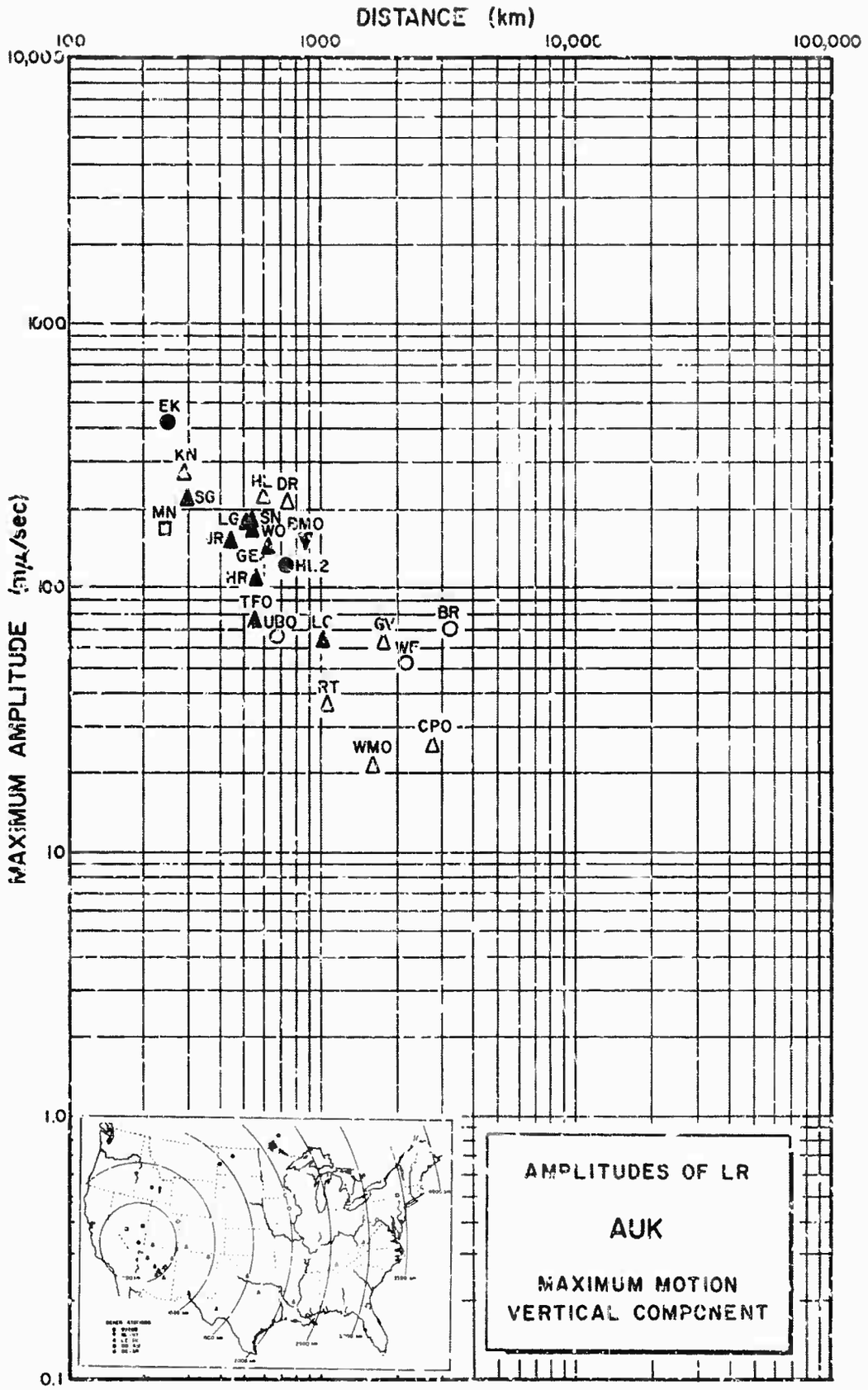

DISTANCE (km)
100
1000
10,000
100,000
10,000
1000
100
10
1.0
0.1
MAXIMUM AMPLITUDE (mμ/sec)
EK
KN
SG
MN
HL
DR
LG
SN
WO
BMO
JR
GE
HL2
HR
TFO
UBO
LC
GV
BR
WF
RT
CPO
WMO
AMPLITUDES OF LR
AUK
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 8

Coda	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.		
EK-NV	Eureka, Nevada	238	39°12'32" N	115°42'37" W	1.95	[illegible]°	183°	11°	101°	L	X
MN-NV	Mina, Nevada	241	38°26'10" N	118°08'53" W	1.52	309°	128°	308°	38°	L	X
KN-UT	Kanab, Utah	283	37°01'22" N	112°49'39" W	1.74	90°	272°	95°	185°	L	X
SG-AZ	Seligman, Arizona	294	35°38'27" N	113°15'39" W	1.68	122°	304°	131°	221°	[illegible]	X
JR-AZ	Jarome, Arizona	440	34°49'32" N	111°59'25" W	1.31	123°	306°	131°	221°	L	X
LG-AZ	Long Valley, Arizona	501	34°24'29" N	111°32'40" W	1.77	125°	308°	131°	221°	S	X
TFSO-Z1	Tonto Forest Observatory, Arizona	529	34°17'12" N	111°16'03" W	1.49	124°	307°	0°	90°	JM	X
SN-AZ	Sunflower, Arizona	530	33°51'49" N	111°41'34" W	0.88	131°	314°	131°	221°	L	X
LO-AZ	Winslow, Arizona	544	34°52'53" N	110°37'15" W	1.59	115°	298°	131°	221°	L	X
HR-AZ	Heber, Arizona	544	34°40'11" N	110°45'59" W	1.88	118°	301°	131°	221°	L	X
NL-AZ	Nazlini, Arizona	591	35°54'05" N	109°34'10" W	1.77	101°	285°	131°	221°	L	X
GE-AZ	Globe, Arizona	618	33°46'32" N	110°31'41" W	1.48	125°	308°	131°	221°	L	X
UBSO-Z10	Uinta Basin Observatory, Utah	666	40°19'18" N	109°34'07" W	1.60	55°	239°	0°	90°	JM	X
DR-CO	Durango, Colorado	730	37°27'53" N	108°47'00" W	2.23	84°	269°	90°	180°	S	X
HL2ID	Hailey, Idaho	733	43°33'40" N	114°25'08" W	1.83	10°	191°	13°	103°	L	X
BMSO-Z3	Blue Mountain Observatory, Oregon	870	44°50'56" N	117°18'20" W	1.19	353°	172°	0°	90°	JM	X
LC-NM	Las Cruces, New Mexico	1005	34°24'08" N	106°35'58" W	1.59	118°	304°	124°	214°	L	X
RT-NM	Raton, New Mexico	1038	36°43'46" N	104°21'31" W	1.95	89°	276°	96°	186°	S	X
FO-TX	Fort Stockton, Texas	1406	30°54'06" N	102°41'52" W	0.88	115°	303°	122°	213°	S	-
TS-ND	Trottara, North Dakota	1505	47°06'25" N	103°40'23" W	0.82	38°	227°	90°	180°	L	-
WMSO-Z6	Wichita Mountain Observatory, Oklahoma	1592	34°43'05" N	98°35'21" W	0.51	94°	284°	0°	90°	JM	X
RY-ND	Ryder, North Dakota	1703	48°05'50" N	101°29'40" W	0.64	39°	229°	50°	140°	S	X
GV-TX	Grapevine, Texas	1794	32°53'09" N	96°59'54" W	0.15	99°	290°	111°	201°	L	X
VO-IO	Vinton, Iowa	2121	42°13'30" N	92°07'37" W	0.27	57°	262°	83°	173°	S	X
WF-MN	Wykoff, Minnesota	2131	43°48'05" N	92°22'23" W	0.38	62°	258°	78°	168°	S	X
GF-MN	Grand Rapids, Minnesota	2185	47°39'52" N	93°29'22" W	0.43	50°	246°	66°	156°	S	X
JE-LA	Jena, Louisiana	2275	31°47'05" N	92°00'55" W	0.05	98°	292°	112°	202°	L	X
RK-ON	Red Lake, Ontario, Canada	2341	50°50'20" N	93°40'20" W	0.37	42°	238°	58°	148°	S	X
EU-AL	Eutaw, Alabama	2604	32°47'10" N	87°52'00" W	0.05	92°	288°	109°	199°	S	X
CPSO-Z8	Cumberland Plateau Observatory, Tennessee	2785	35°35'41" N	85°34'13" W	0.57	84°	282°	0°	90°	JM	X
BL-WV	Beckley, West Virginia	3095	37°47'56" N	81°18'36" W	0.61	78°	279°	100°	190°	S	X
BR-PA	Barlin, Pennsylvania	3235	39°55'27" N	78°50'41" W	0.66	73°	276°	97°	187°	L	X
ED-PA	Howard, Pennsylvania	3328	40°59'44" N	77°35'44" W	0.37	70°	275°	-	-	S	-
DH-NY	Delhi, New York	3541	42°14'39" N	74°53'18" W	0.65	68°	275°	95°	185°	S	X
LS-NH	Lisbon, New Hampshire	3767	44°14'18" N	71°55'21" W	0.29	64°	273°	94°	184°	S	X
HN-ME	Houlton, Maine	4064	46°09'43" N	67°59'09" W	0.21	60°	273°	93°	183°	S	X
SV2QB	Schefferville, Quebec, Canada	4187	54°48'54" N	66°45'31" W	0.58	46°	263°	-	-	S	X
HW-HI	Kamuela, Hawaii	4280	19°58'49" N	155°42'20" W	0.71	255°	55°	235°	325°	L	X
MP-NT	Mould Bay, Northwest Territories	4370	76°15'08" N	119°22'18" W	0.06	359°	176°	356°	86°	JMZ S	X
AD-IS	Adak Island, Alaska	4942	51°52'30" N	176°40'45" W	0.06	309°	85°	0°	90°	L	X
LZ-BV	La Paz, Bolivia	7718	16°15'31" S	68°28'47" W	3.99	131°	321°	141°	231°	JMZ L	X
OO-NW	Oslo, Norway	8126	61°03'17" N	10°51'58" E	0.56	24°	318°	138°	228°	L	X
GG-GR	Grafenburg, Germany	8098	49°41'32" N	11°12'55" E	0.53	31°	320°	140°	230°	L	X

Recording Site Information - AUK
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

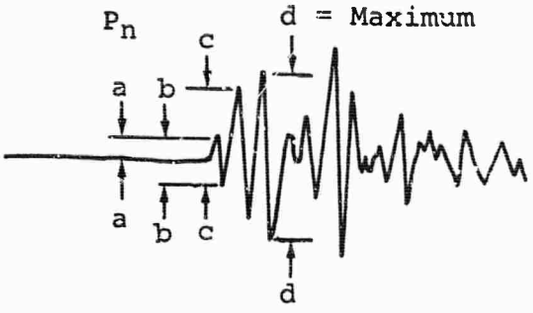
B = distance factor (see Table below)

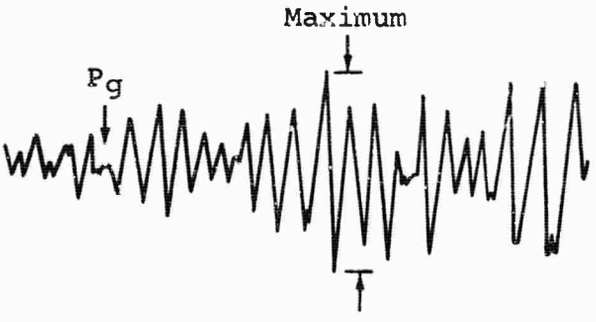
mm = record amplitude in millimeters zero to peak

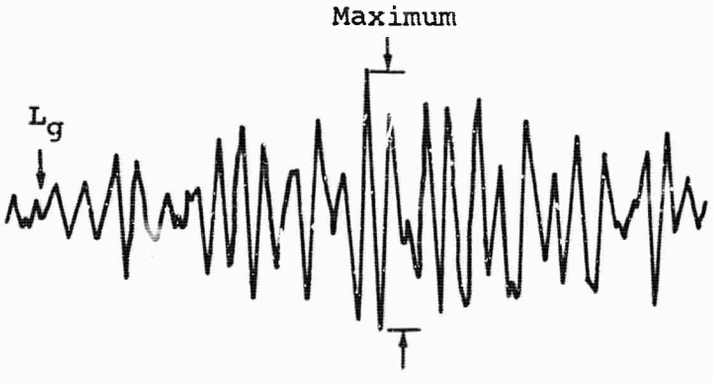
K = magnification in thousands at signal frequency

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

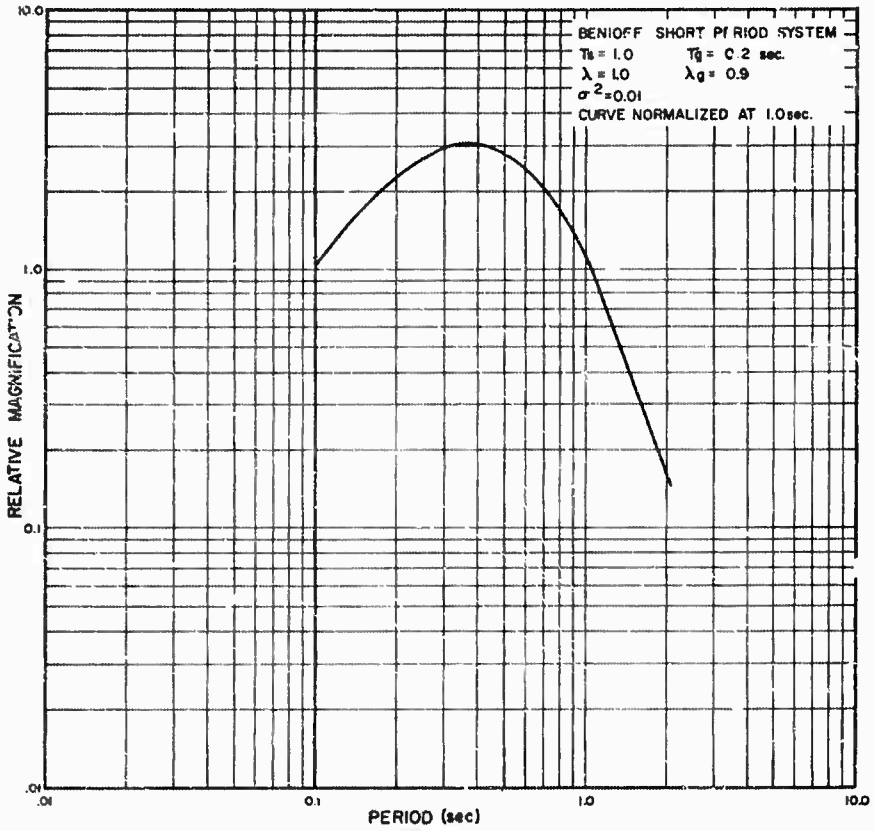
Pick <u>time</u> of <u>Pn</u> at beginning of "a" half cycle.

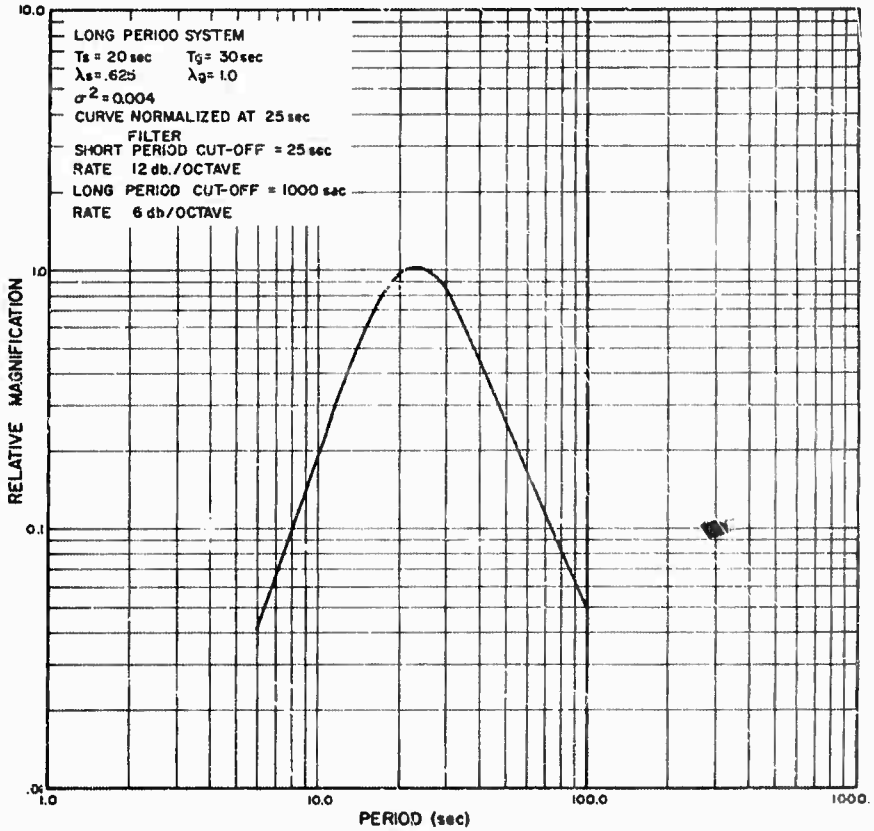
Pick <u>amplitude</u> of <u>Pn</u> as maximum "$d/2$" within 2 or 3 cycles of "c".

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

Seismic Analysis Diagram

APPENDIX II(A)





INSTRUMENT RESPONSE CURVES - LRSM

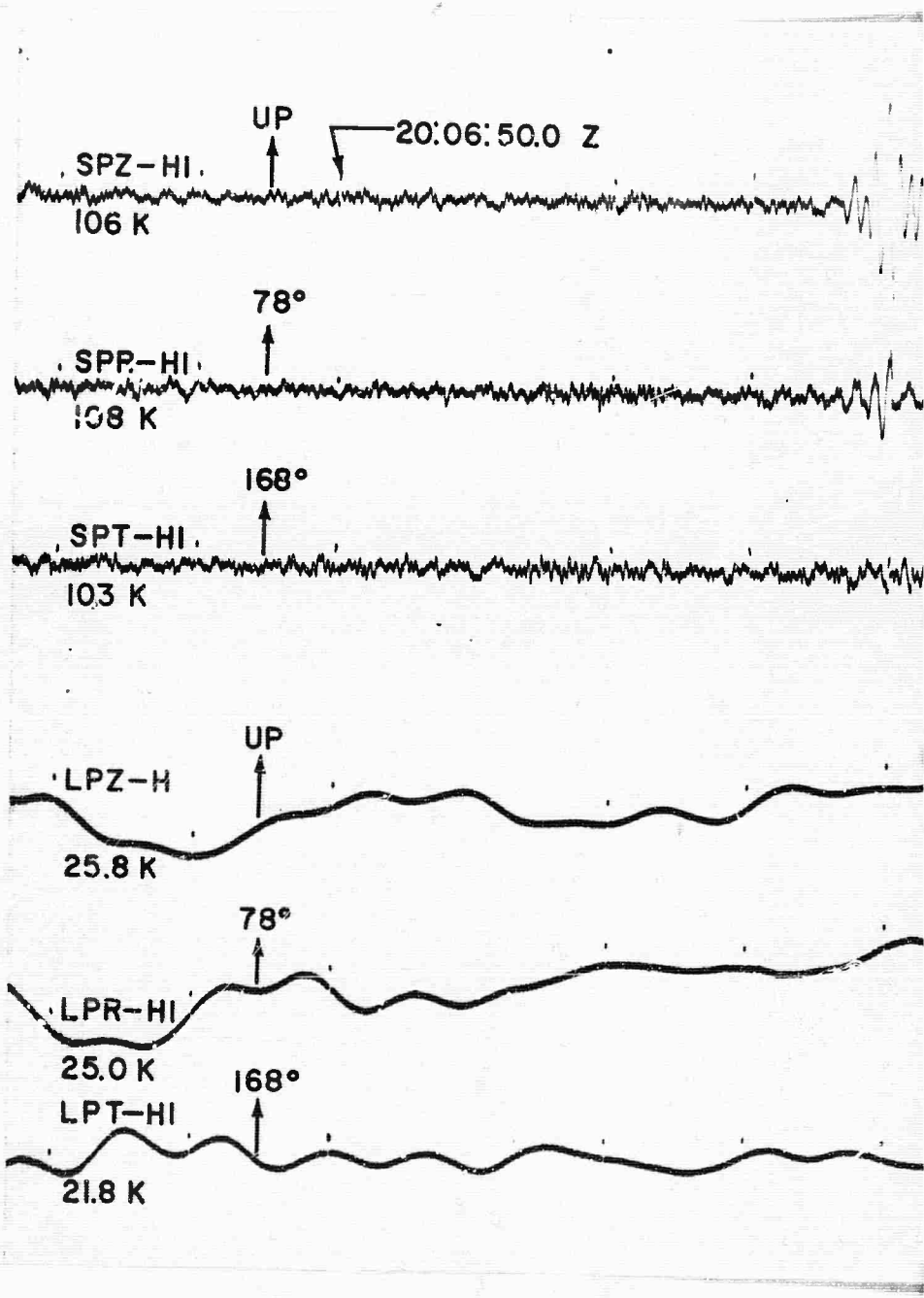
AUK

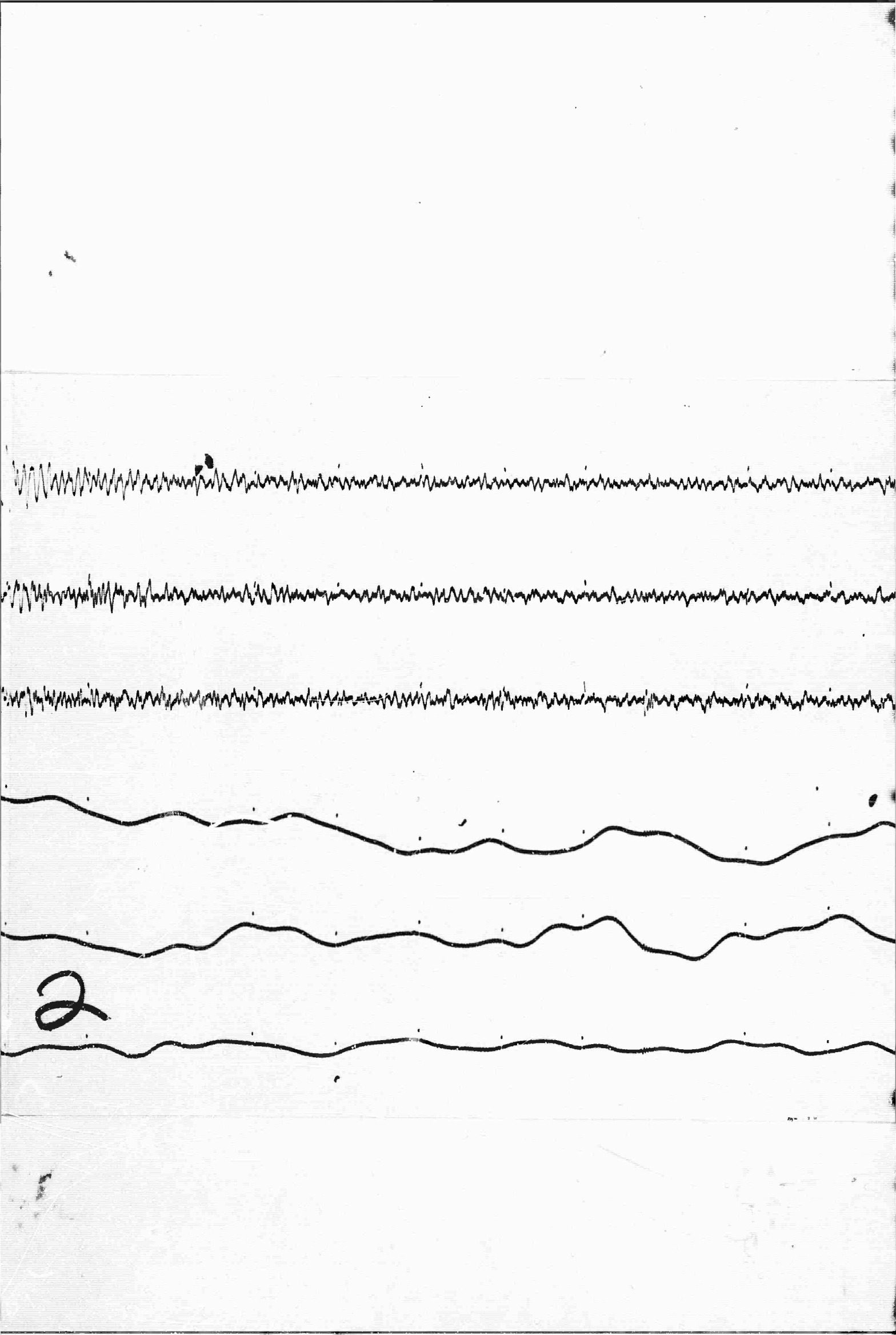
WF–MN–

WYKOFF, MINNESOTA

2 OCTOBER 1964

Δ = 2131 km

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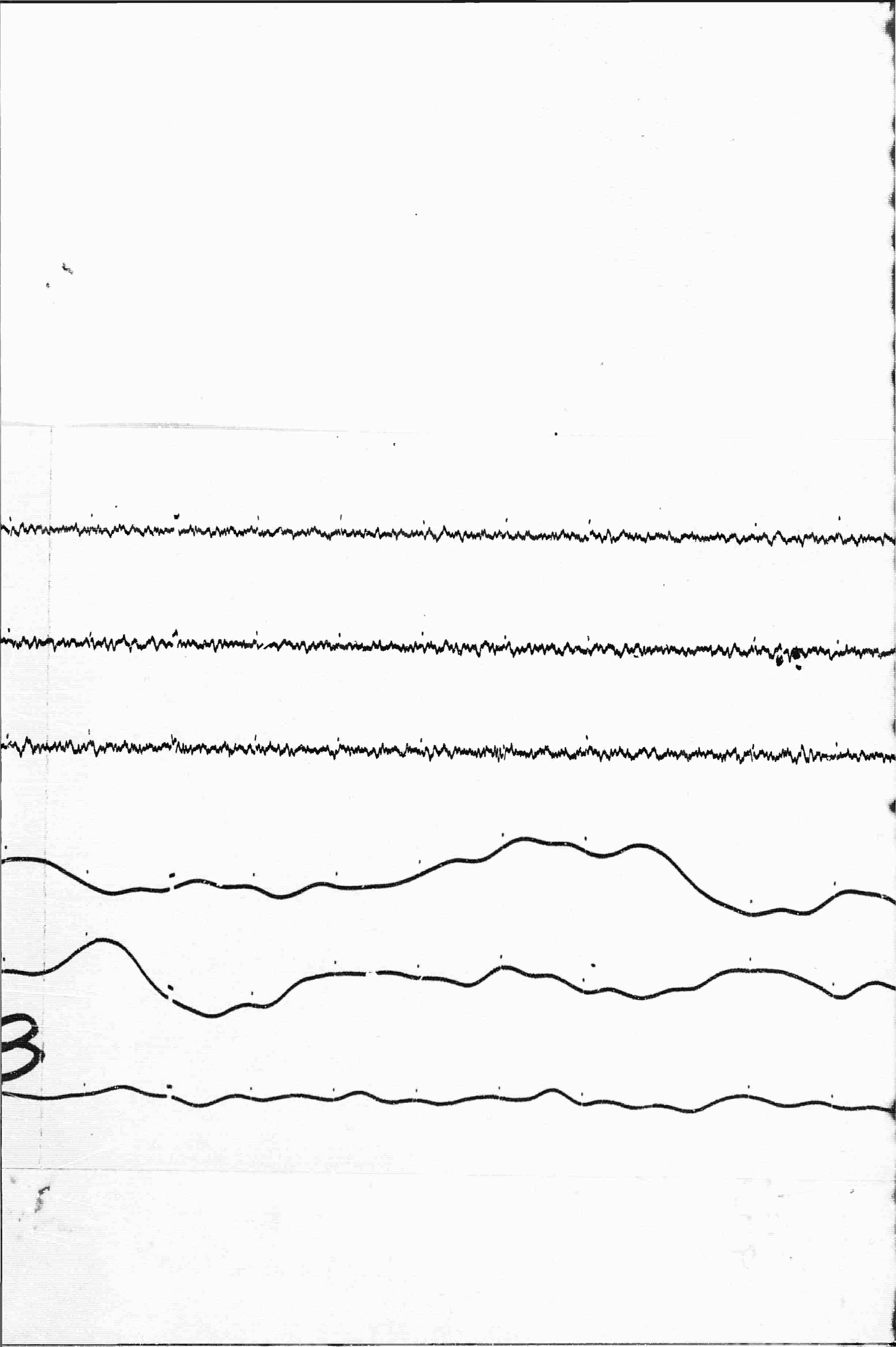

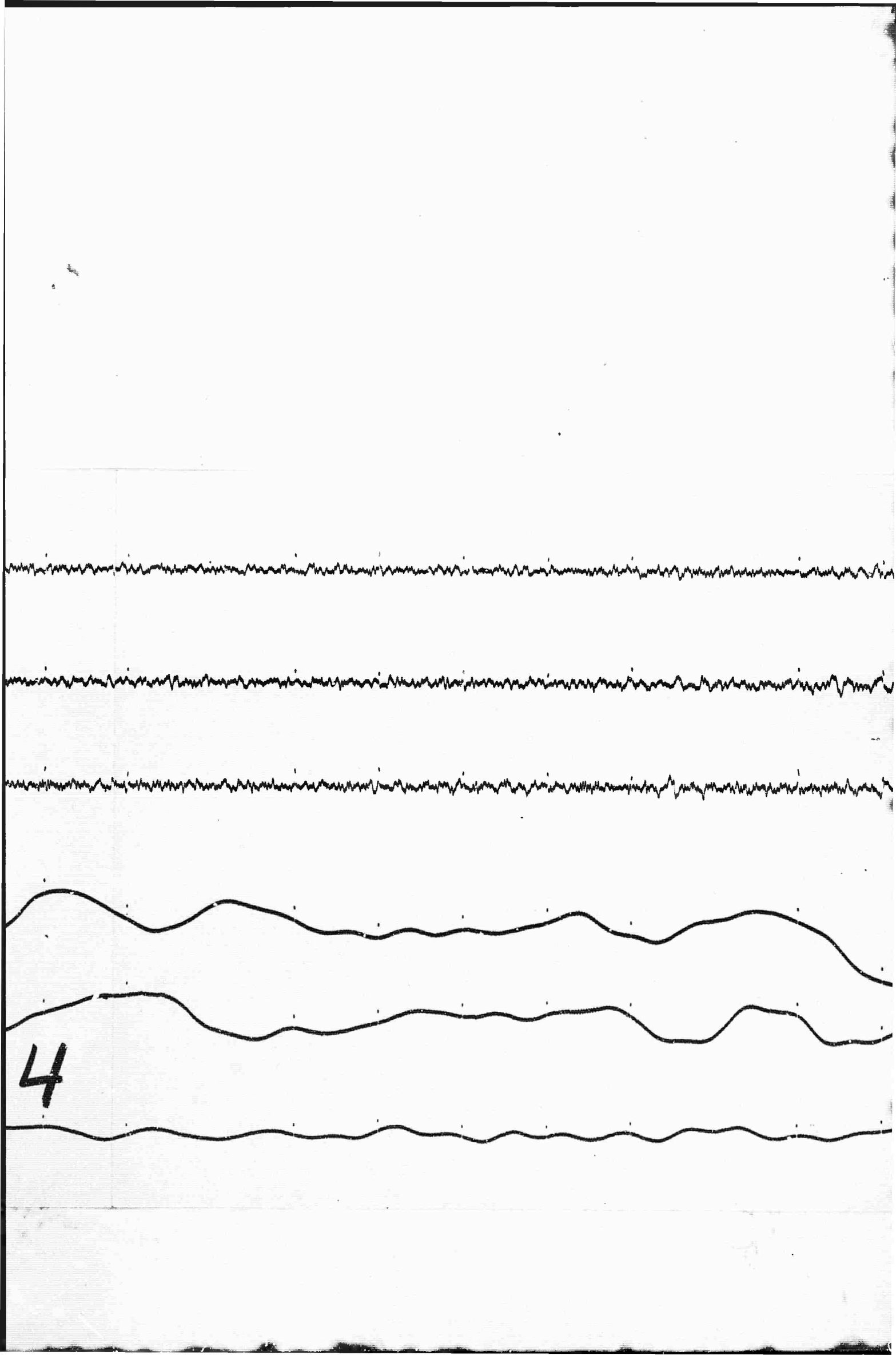
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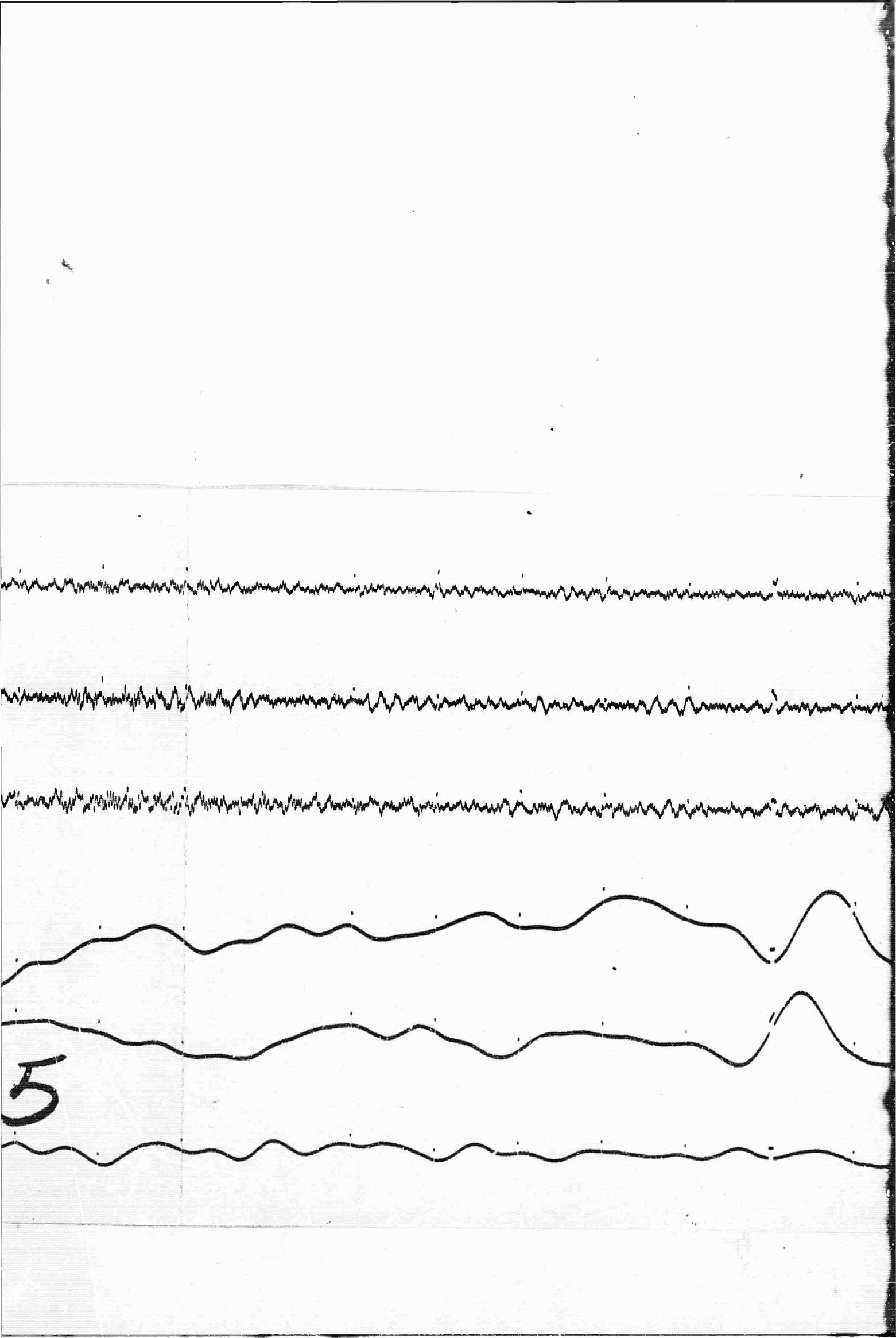
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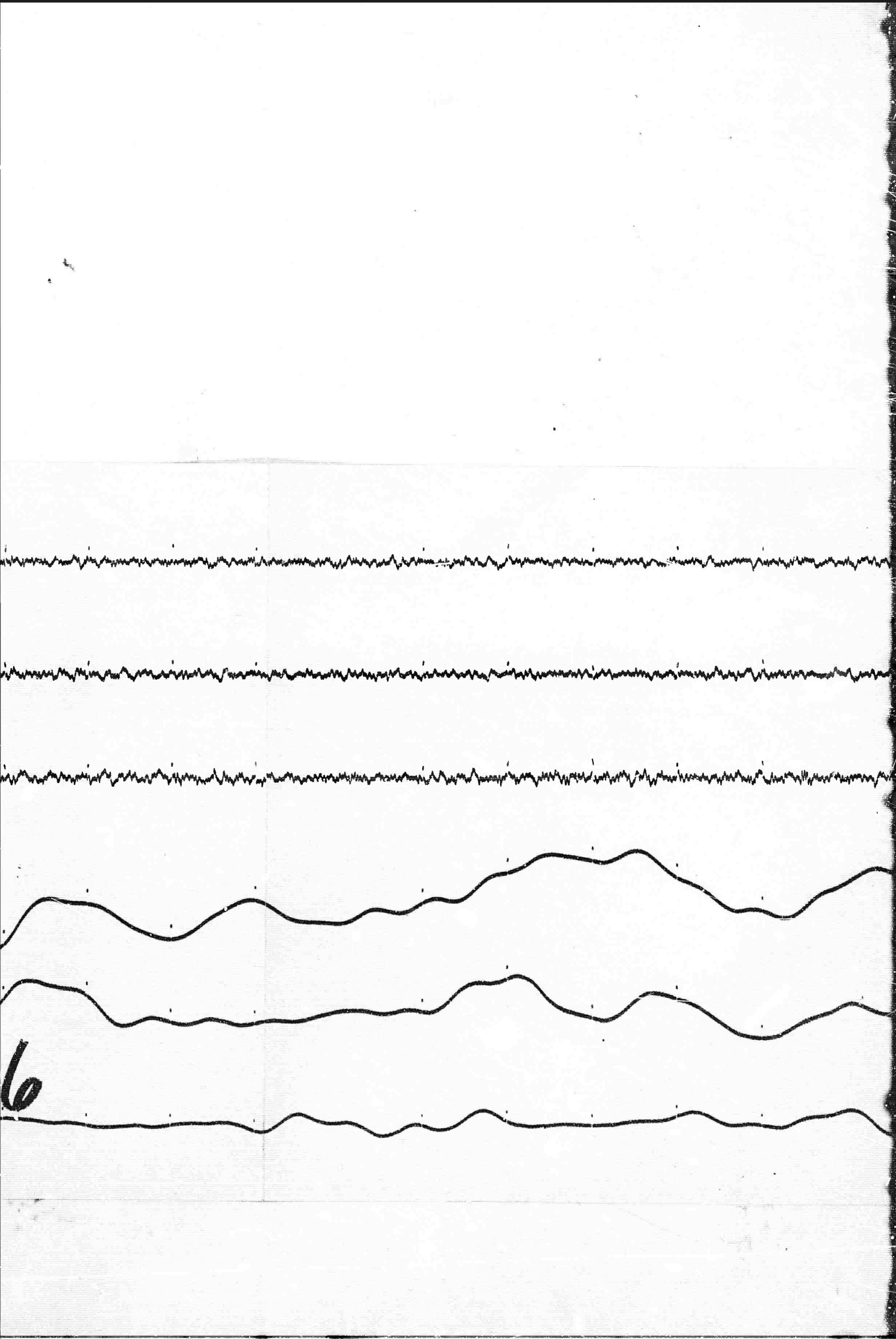
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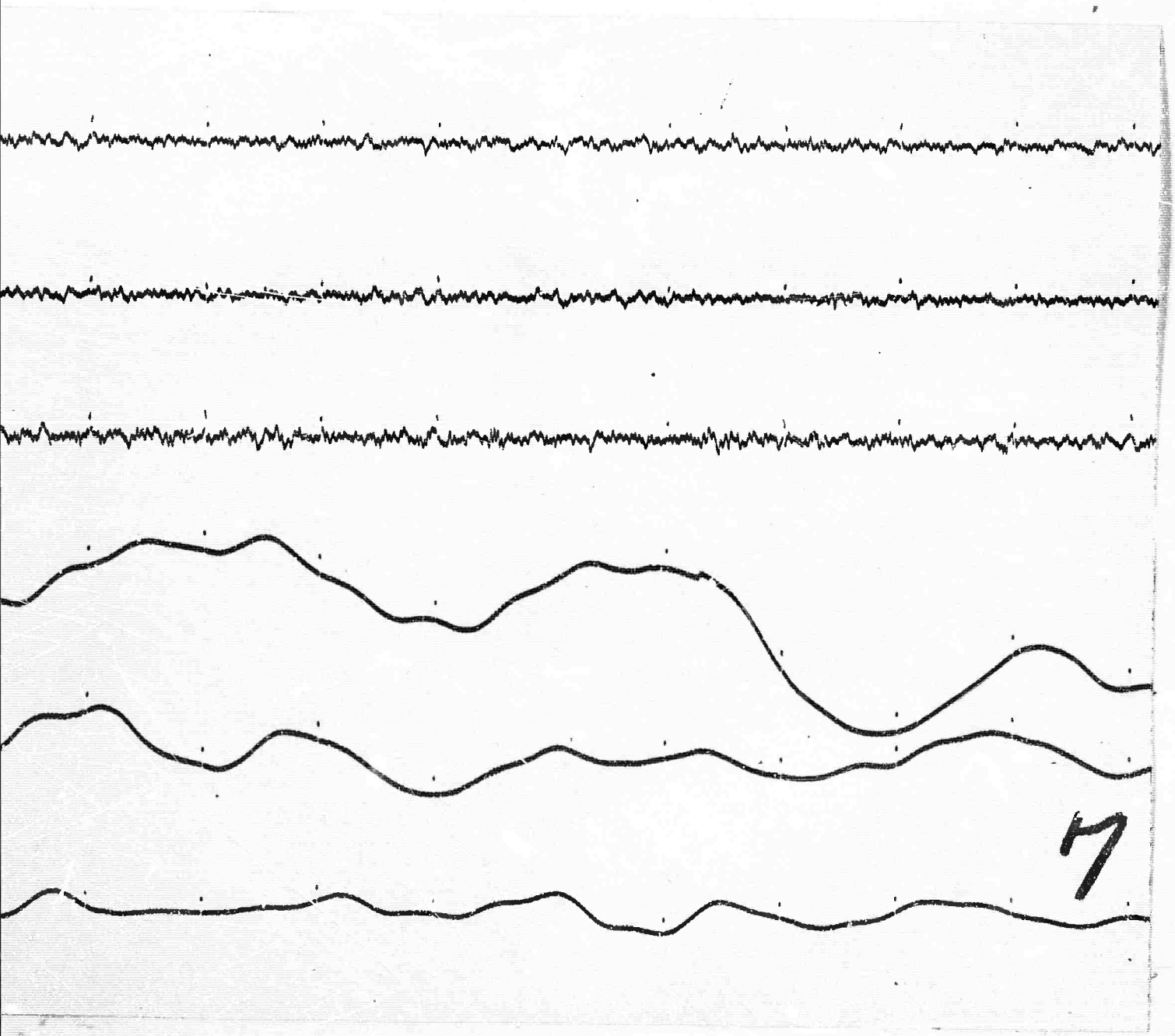

7

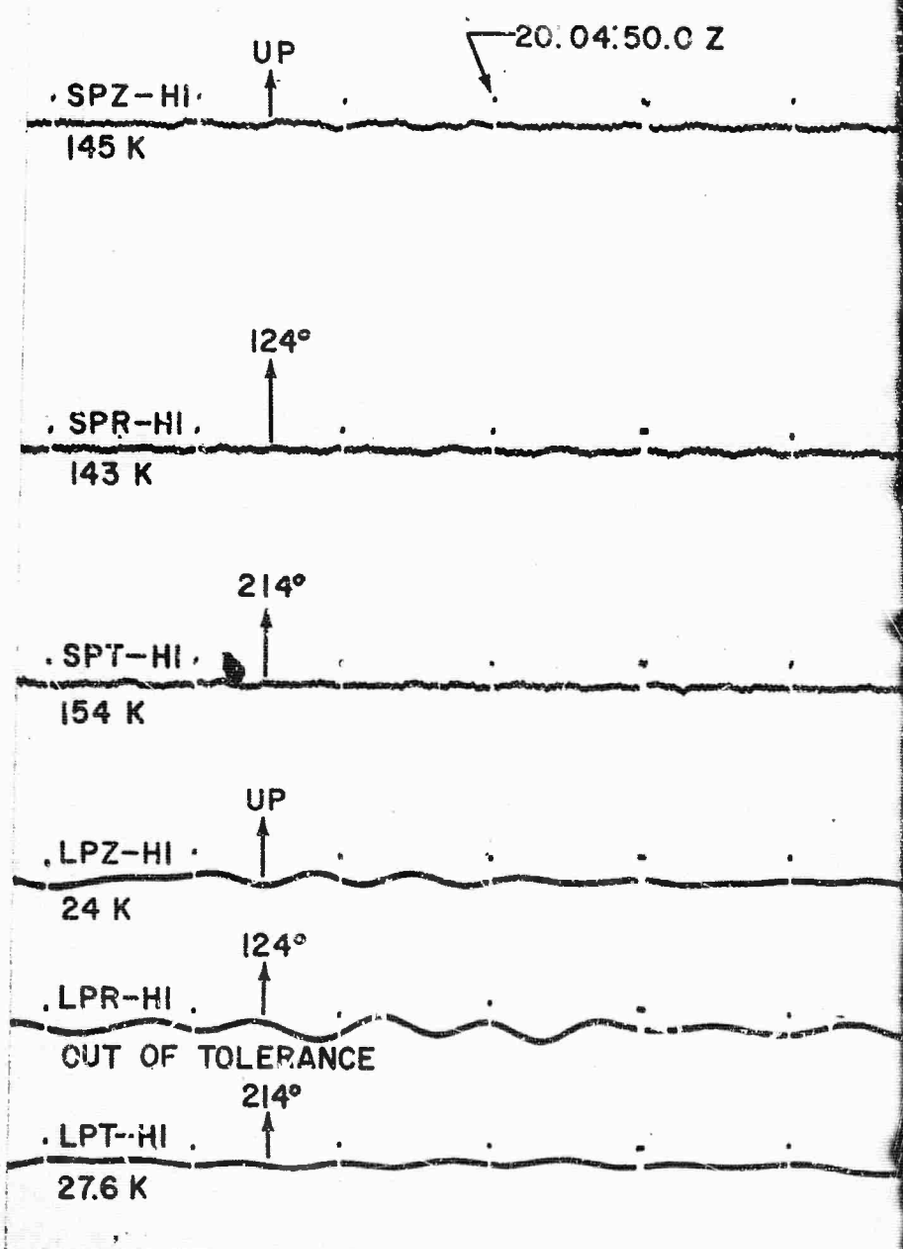
AUK

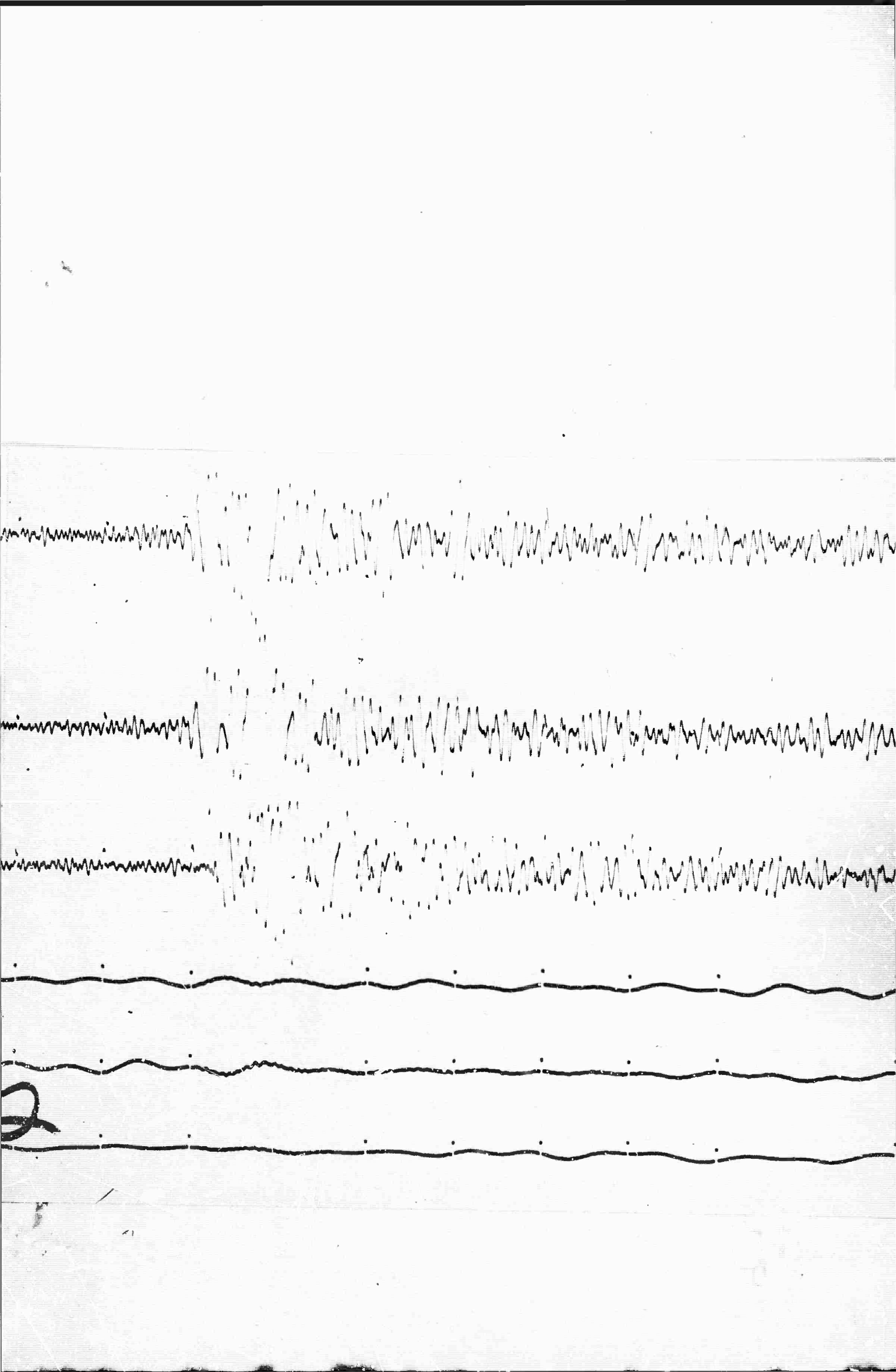
LC-NM

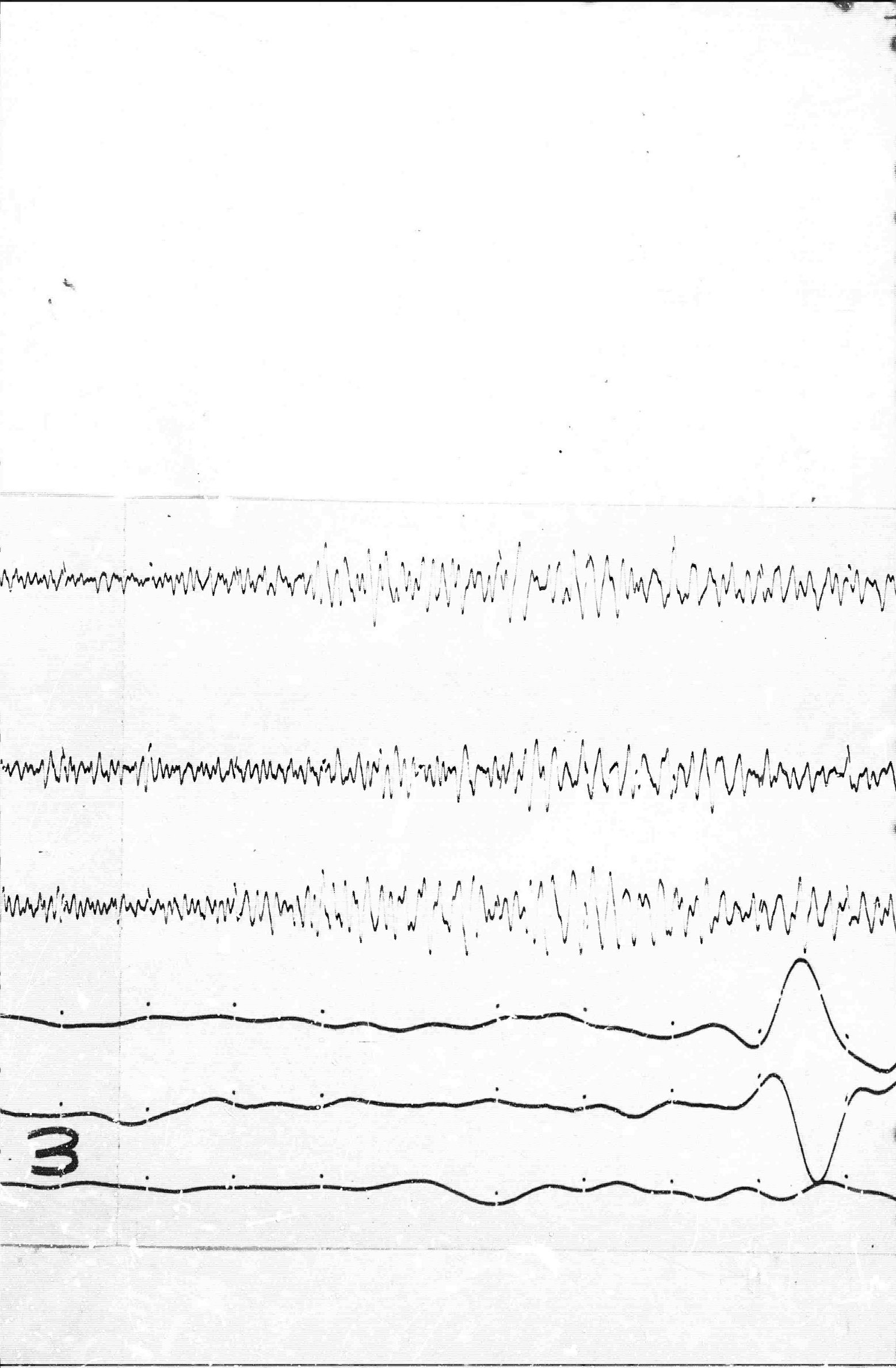
LAS CRUCES, NEW MEXICO

2 OCTOBER 1964

Δ ° = 1005 km



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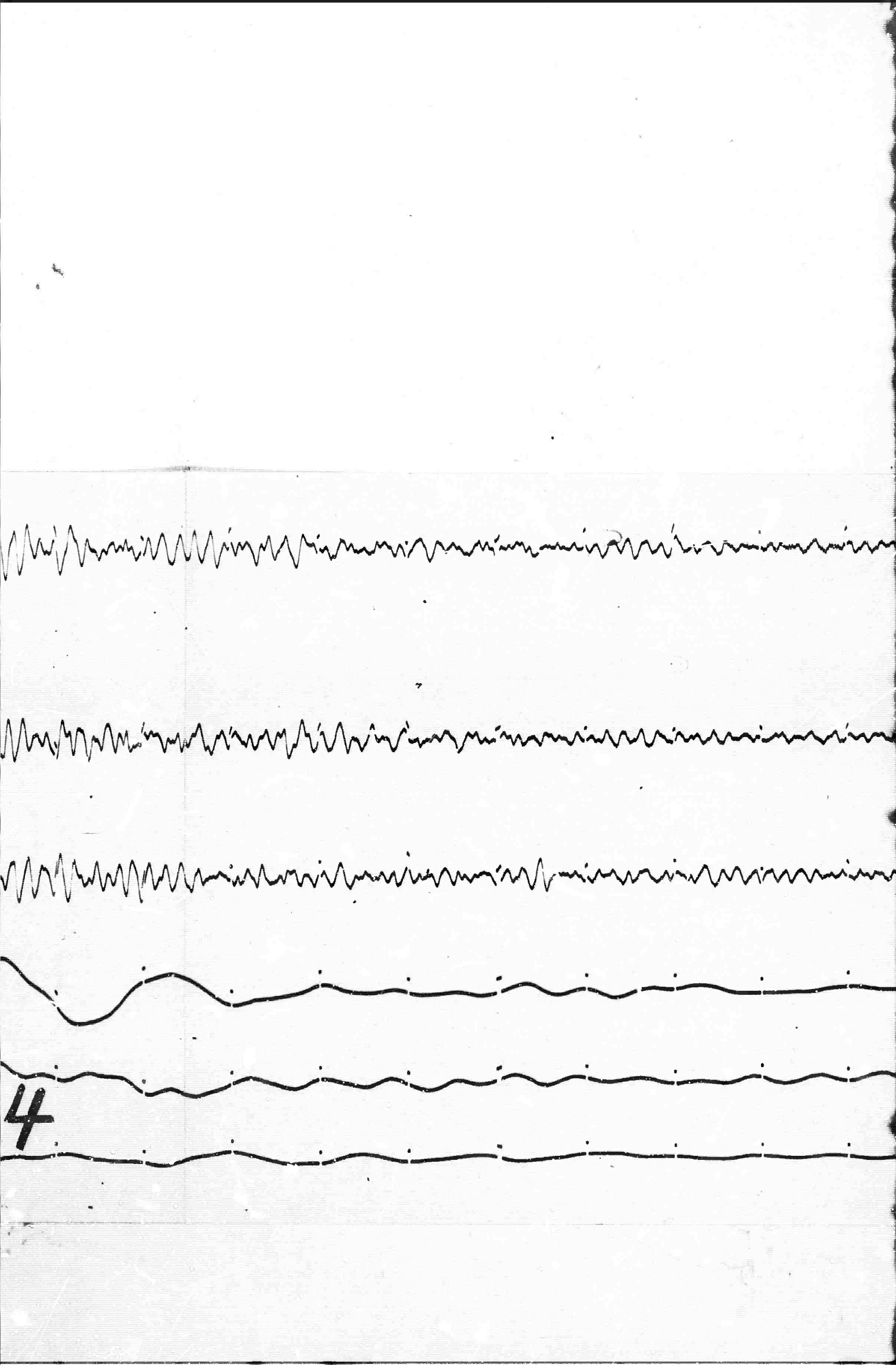
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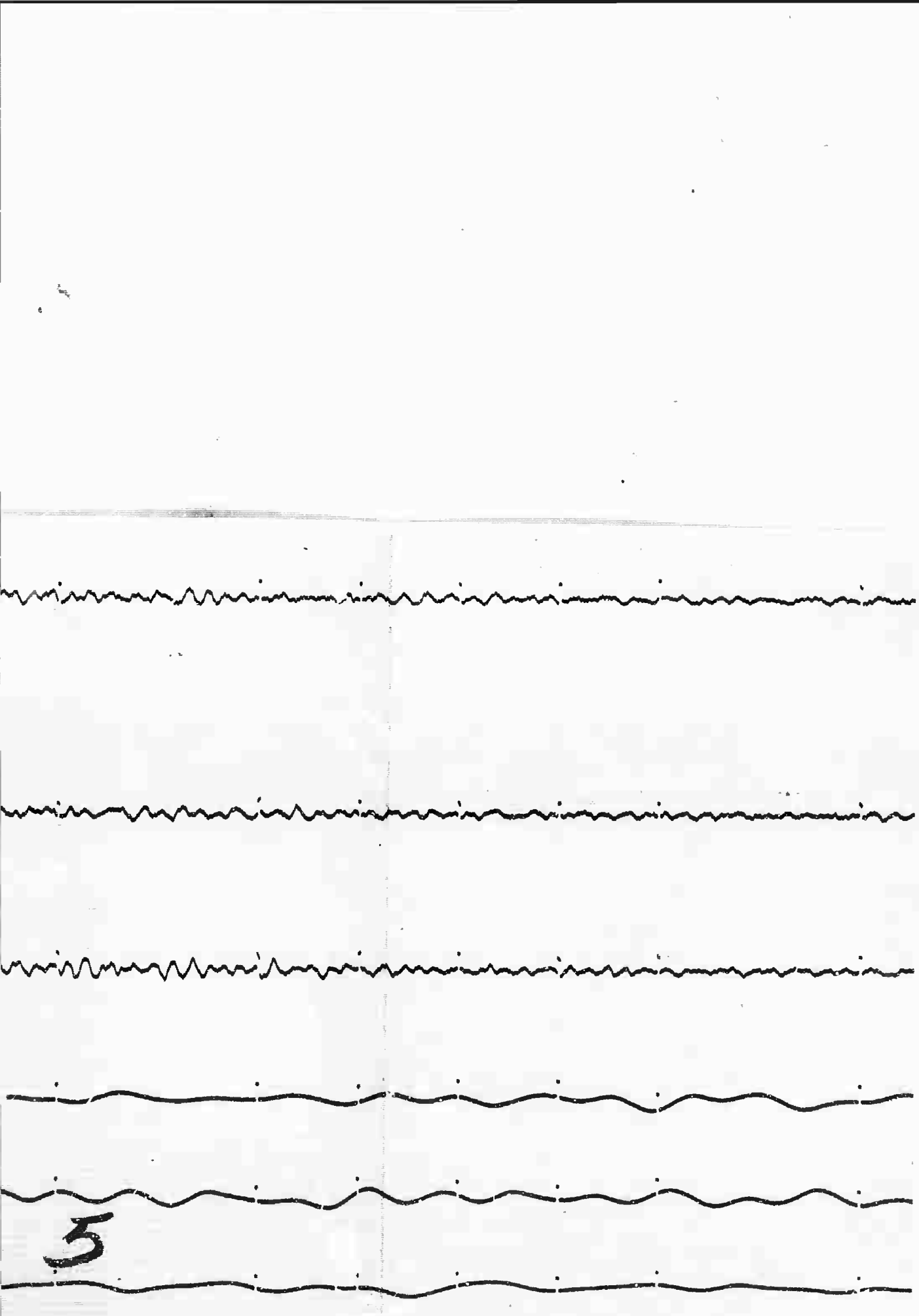

5

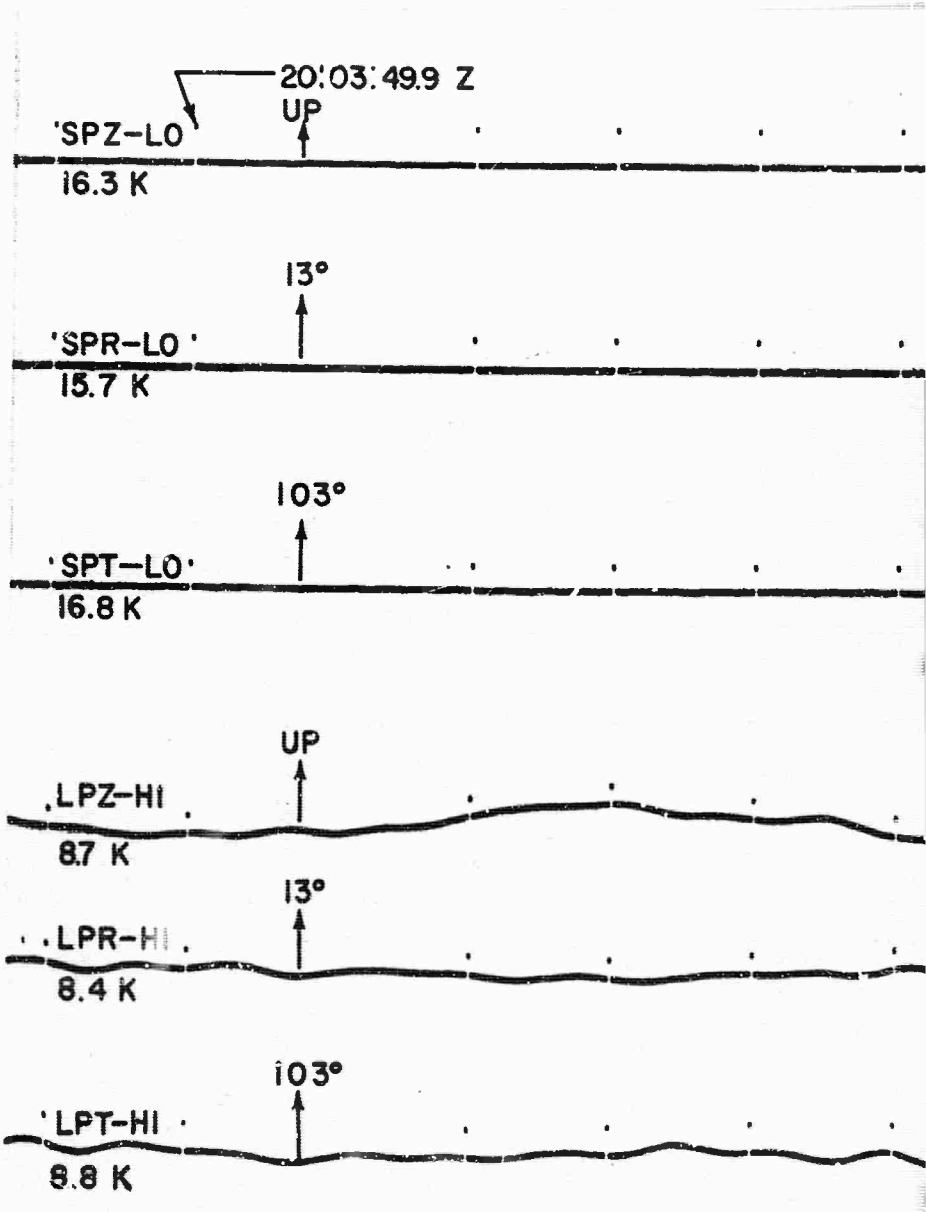
AUK

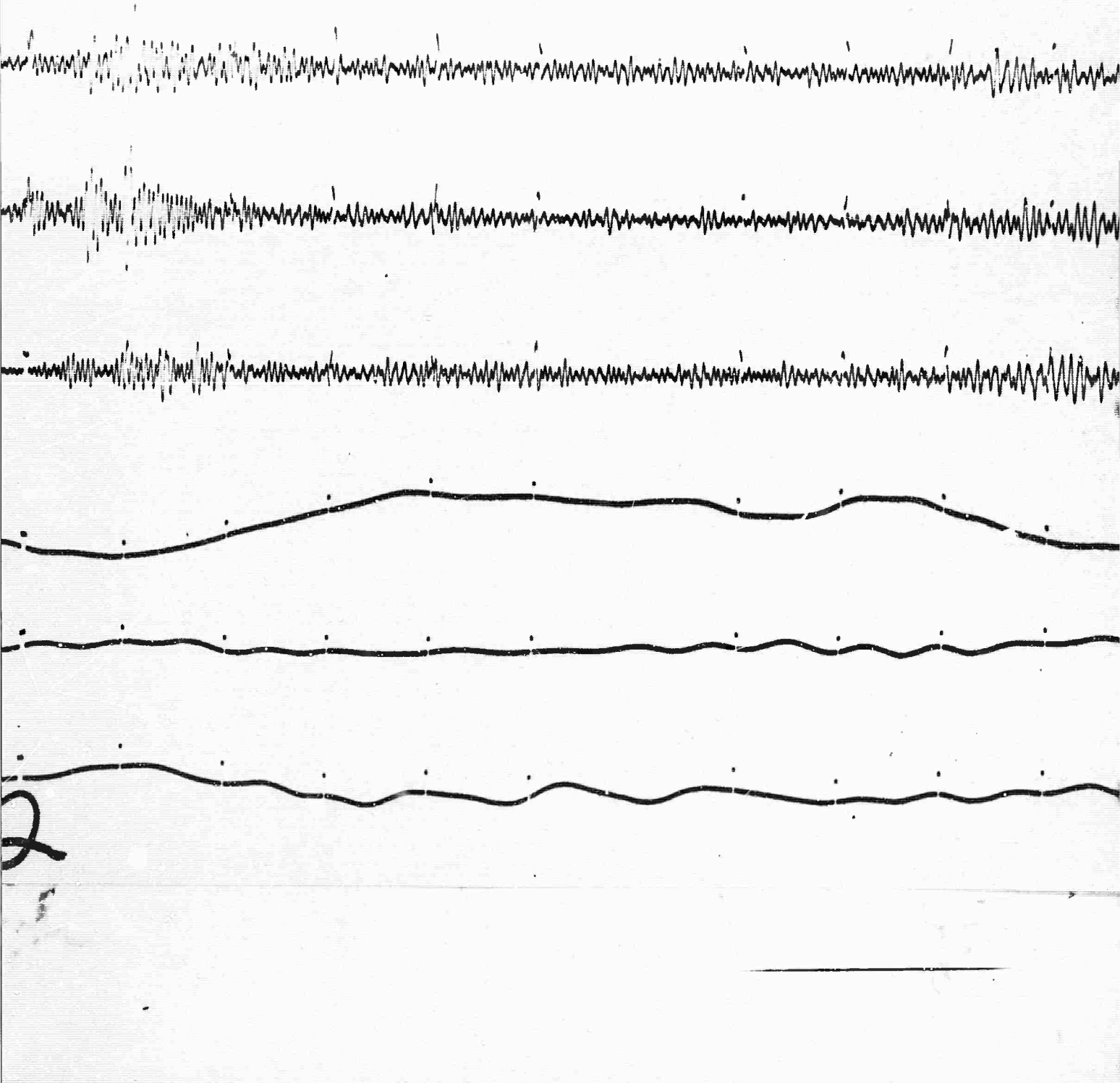
HL 2 ID

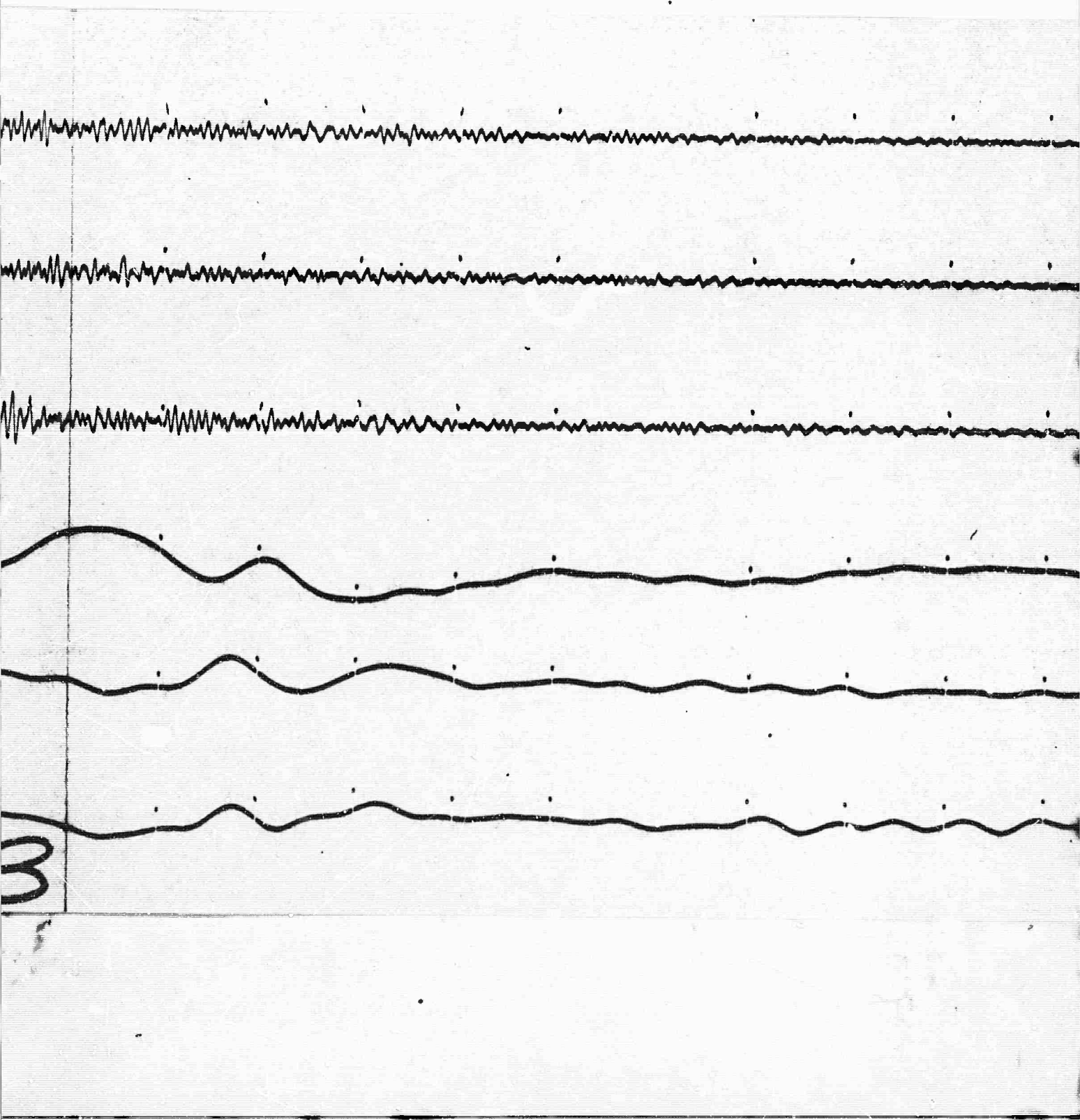
HAILEY, IDAHO

2 OCTOBER 1964

△ = 733KM



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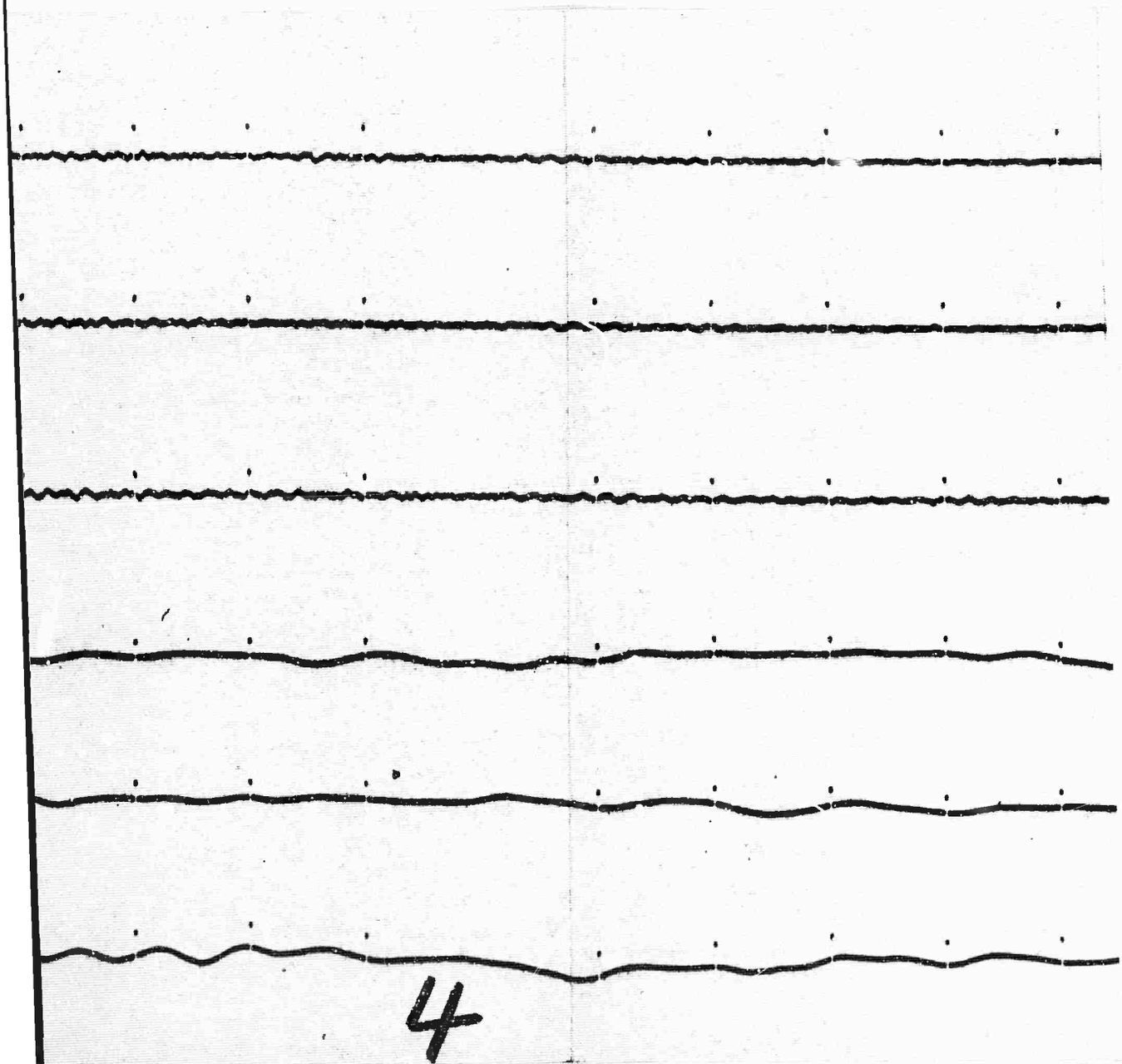

4

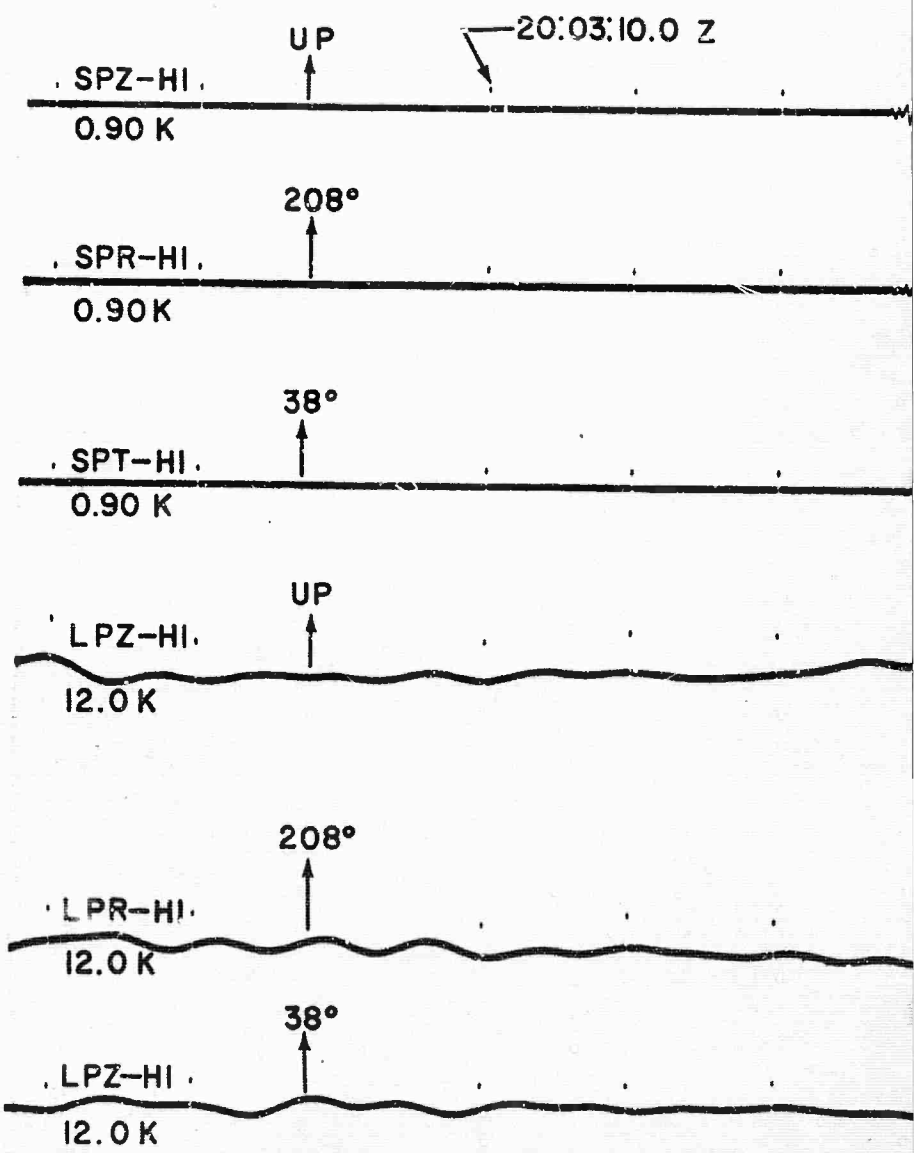
AUK

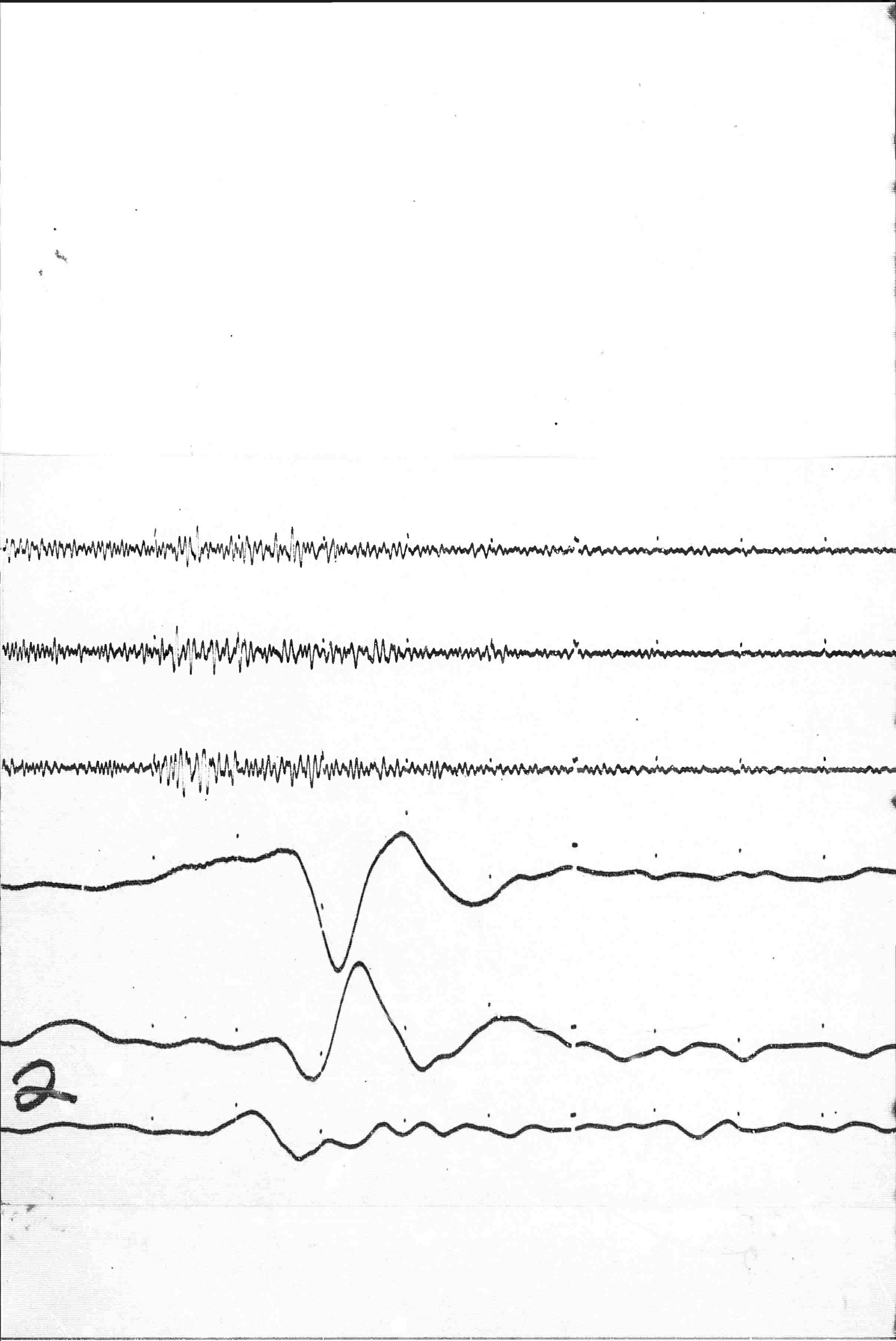
MN–NV

MINA, NEVADA

20 OCTOBER 1964

Δ = 241 km

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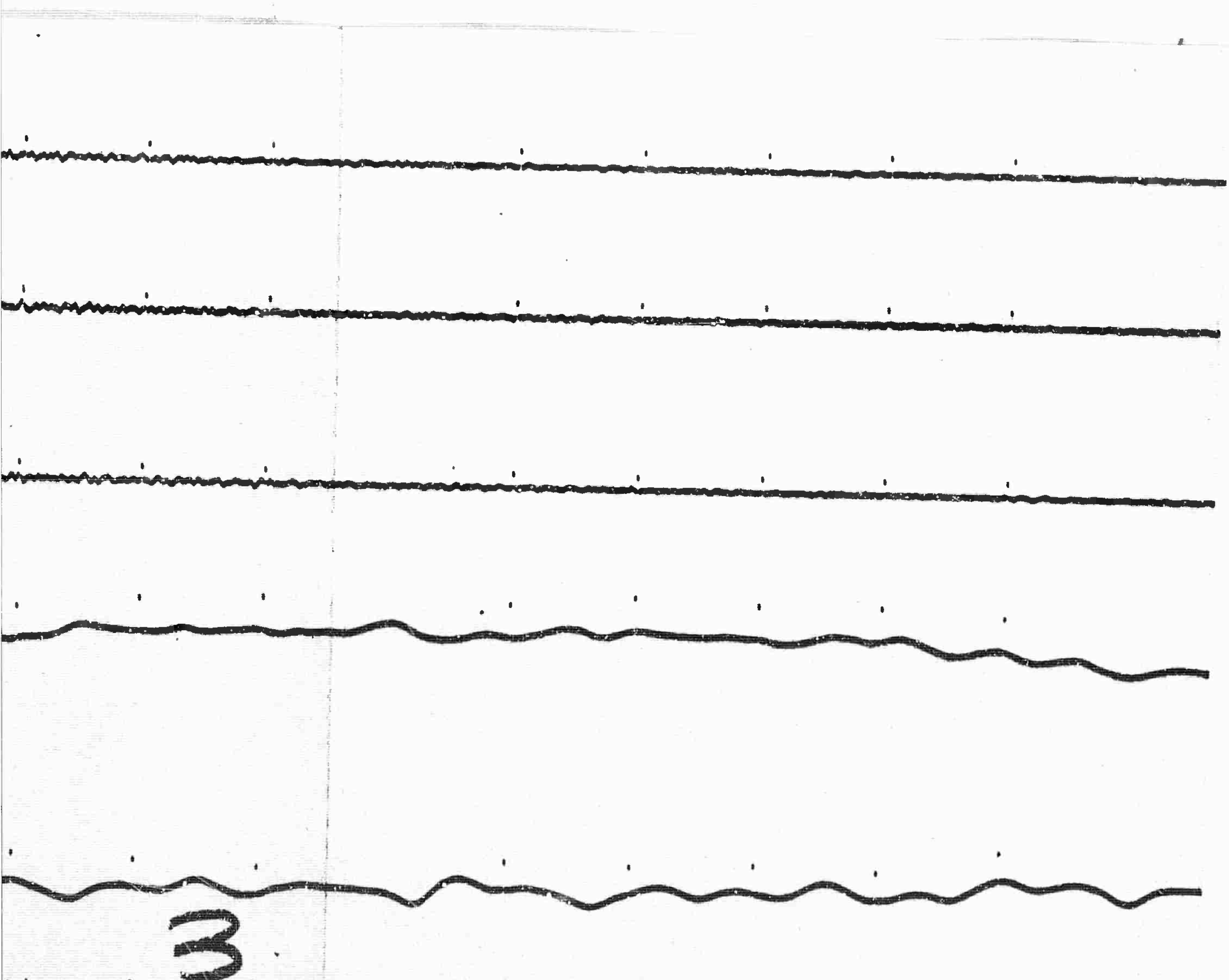
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