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SCROLL
220

AD836661

LONG RANGE SEISMIC MEASUREMENTS

SCROLL

23 APRIL 1968

Prepared for

AIR FORCE TECHNICAL APPLICATIONS CENTER
Washington, D. C.

18 JULY 1968

By

TELEDYNE, INC.

Under

Project VELA UNIFORM

Sponsored By

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

34

LONG RANGE SEISMIC MEASUREMENTS

SCROLL

23 April 1968

SEISMIC DATA LABORATORY REPORT NO. 220

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
Date of Contract:	2 March 1968
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., D.C. 20333

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SCROLL

EVENT DESCRIPTION

DATE:	23 April 1968
TIME OF ORIGIN:	17:01:30.0Z
YIELD:	
MAGNITUDE: UNIFIED:	4.45 ± 0.44
ADJUSTED:	3.89 ± 0.46
LOCATION:	
SITE:	Nevada Test Site, Area U19n
	GEOGRAPHIC COORDINATES: Latitude: 37° 20' 16.0" N Longitude: 116° 22' 32.0" W
ENVIRONMENT:	GEOLOGIC MEDIUM: Vitric Tuff
	SURFACE ELEVATION: 6754 ft.
	SHOT ELEVATION: 6004 ft.
	SHOT DEPTH: 750 ft.
COMPUTED EPICENTER:	ALL STATIONS
LOCATE: (Herrin 61 Surface)	GEOGRAPHIC COORDINATES: Latitude: 37° 18' 21.6" N Longitude: 116° 25' 01.2" W
	TIME OF ORIGIN: 17:01:30.8Z
	DEPTH CONSTRAINED TO: 0 km.
	EPICENTER SHIFT: 4.2 km S 31° W
HYPO I (Herrin 66 Surface)	GEOGRAPHIC COORDINATES: Latitude: 37° 18' 36.0" N Longitude: 116° 24' 25.2" W
	TIME OF ORIGIN: 17:01:31.3Z
	DEPTH CONSTRAINED TO: 0 km.
	EPICENTER SHIFT: 4.6 km S 48° W

LRSM STATUS REPORT - SCROLL

Code	Station	SPZ	SPR	SPT	LPZ	LPR	LPT	TAPE	TIMING
		Final							
MN-NV	Mina, Nevada	+	+	+	+	+	+	*	P
BP-CL	Bishop California	+	+	+	-	-	-	*	P
AT-NV	Austin, Nevada	+	+	+	+	+	-	*	P
EY-NV	Ely, Nevada	+	+	+	-	-	-	*	P
WW-UT	Wah Wha Mountains, Utah	+	+	+	-	-	I	*	P
KM-CL	Kramer, California	I	+	+	-	-	-	*	P
KG-AZ	Kingman, Arizona	+	+	+	+	+	-	*	P
BF-CL	Bakersfield, California	+	+	+	-	-	-	*	P
ND-CL	Needles, California	+	+	+	+	+	-	*	P
KN-UT	Kanah, Utah	+	+	+	+	+	-	*	P
CP-CL	Campo, California	+	+	+	-	-	-	*	S
TFSO	Tonto Forest Observatory, Arizona	+	+	+	+	+	-	*	P
UBSO	Uinta Basin Observatory, Utah	+	+	+	-	-	-	*	P
BMSO	Blue Mountain Observatory, Oregon	+	+	+	-	-	-		P
LC-NM	Las Cruces, New Mexico	+	+	+	+	+	-	*	P
CC-WA	Cascade Tunnel, Washington	+	+	+	-	-	-	*	P
LAO	Subarray AO-10, Montana	-	N	N	-	-	-		P
WMSO	Wichita Mountain Observatory, Oklahoma	-	-	-	-	-	-	*	P
PG-BC	Prince George, British Columbia, Canada	-	-	-	-	-	-	*	P
RK-ON	Red Lake, Ontario, Canada	+	+	+	-	-	-	*	P
CPSO	Cumberland Plateau Observatory, Tennessee	+	-	-	-	-	-		P
WH2YK	Whitehorse, Yukon Territory, Canada	-	-	-	-	-	-	*	P
HN-ME	Houlton, Maine	-	-	-	-	-	-	*	P
SV3QB	Schefferville, Quebec, Canada	-	-	-	-	-	-	*	P
NP-NT	Mould Bay, Northwest Territories, Canada		DATA NOT RECEIVED						

+ Signal

- No Signal

* Magnetic Tape Available

N No Instrument

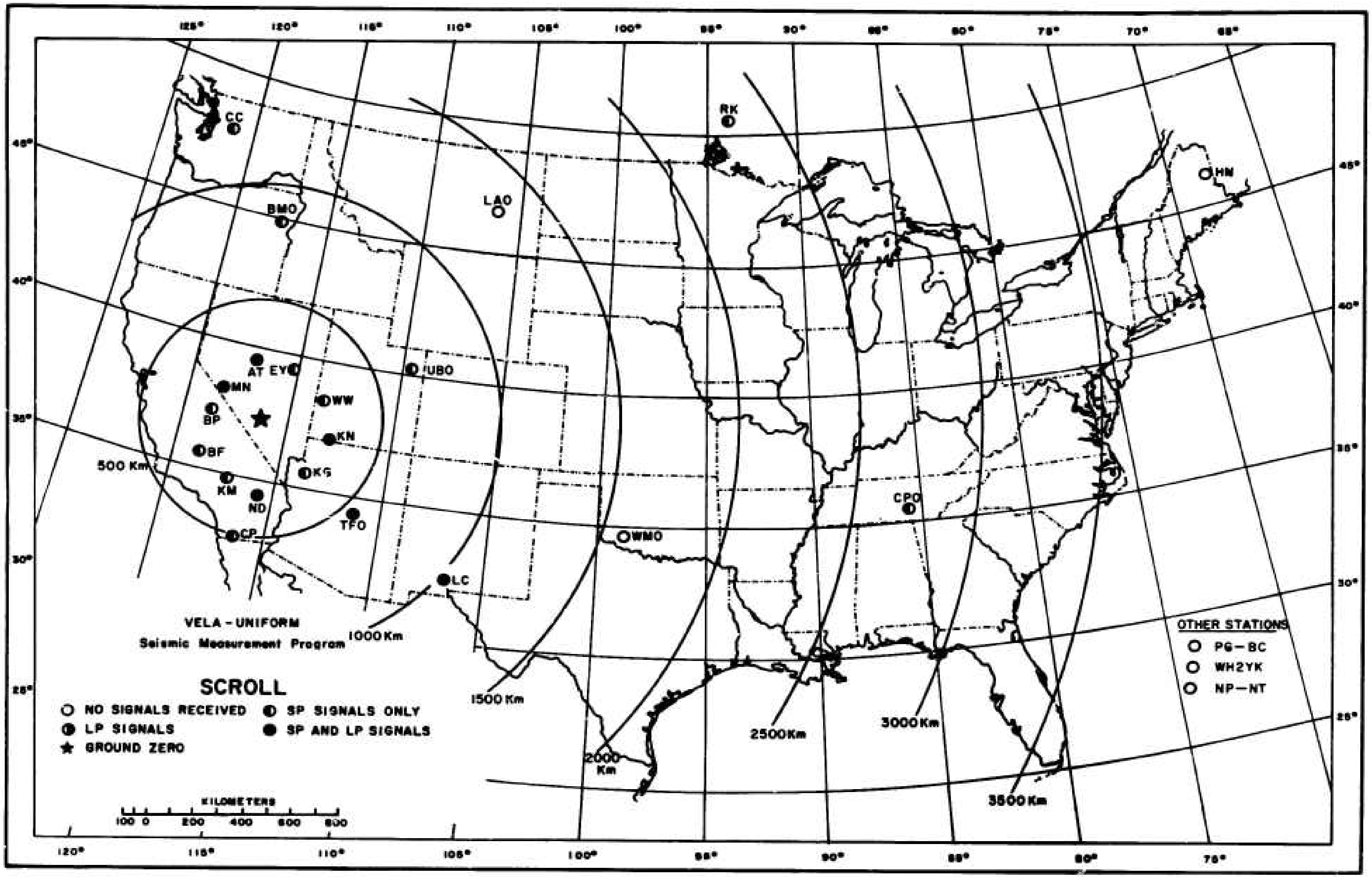
P Primary Timing

S Secondary Timing

I Instrument Inoperative

STATION STATUS REPORT - SCROLL

Table 1



Recording Stations and Signals Received

Figure 1

INTRODUCTION

A long range seismic measurement (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

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

Station information is presented in Table 3. This includes the station name and code, the geographic coordinates, the 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), II(C), and II(D) of the BOURBON shot report, SDL Report No. 186, available from DDC as AD 816273.

The procedures used in measuring amplitudes and the unified magnitude are shown in Appendices II(A) and I(B), respectively, of the BOURBON shot report. The distance factors (B) beyond 16° are from Gutenberg and Richter*. For distance less than 16° values were read from a curve in the Gutenberg and Richter paper

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

back to 10° and then extrapolated to 2°, using an inverse cube relationship. An additional magnitude for less than 16° was computed using a method described by Evernden*. (Figure 3)

A standard hypocenter location program for a digital computer was used to determine the location using data from all stations analyzed. Best-fit values of latitude, longitude, 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. An additional location was made using a program called HYPO I. 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. These methods are based on P-wave arrivals with depth constrained to zero.

DATA AND RESULTS (LRSM AND VELA OBSERVATORIES)

The parameters of the SCROLL event and a summary of the seismic evaluation is shown on the Event Description page. The operational status of the 25 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 SCROLL event at the LRSM and VELA stations. Included are the Pn and P arrival times, the maximum amplitudes (A/T) of the Pn and P motion, "b" amplitudes as defined in Appendix II(A) of the BOURBON shot report, and other phases as seen on the short-period instruments. Long-period Rayleigh wave motion is

*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.

also tabulated in (A/t) form. In addition, the individual station Rayleigh wave areas (mm^2) are indicated as measured on the LPZ only. Although reduced to 1K magnification, they have not been normalized to any magnitude. Eighteen stations recorded short-period signals and six recorded long-period signals.

The unified magnitudes determined from the LRSM and VELA observatories are shown in Figure 2. The average unified magnitude is 4.45 ± 0.44. The average adjusted magnitude is 3.89 ± 0.46.

The travel-time residuals from the Pn and P phases are shown in Figure 4. Figures 5 through 8 illustrate plots of the amplitudes of P, Pg, Lg, and LR.

Attached to the report are illustrative seismograms showing the signals recorded at five stations. The most distant station analyzed that recorded SCROLL was CPSO at a distance of 2756 kilometers.

Principal Phases
SCROLL
23 April 1968
17 01 30.02

CODE	STATION	DISTANCE (KM)	INST	MAGNIFICATION (K) 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	MAGNITUDE (m) M_b	MAGNITUDE (m) M_s	AREA (mm^2) LPZ
MN-NV	Mina, Nevada	198	SPZ	11.5*	Pn		32 2		32.42	0 5	346	4 58	3 98$_{7,9}$	
			SPZ	11 5*	Pn$_b$						522			
			SPZ	11.5*	Pg		33 7			0 45	2196			
			SPT	11.9*	Lg					(0 6)	(760)			
			P1	29 2*	LQ					(7 5)	(163)			
			LPZ	19 7	LR					9 5	1.9			5 96
BP-CL	Bishop, California	205	SPZ	24 25	Pn		33 4		33 44	0 55	207	4 42	3 85$_{7,9}$	
			SPZ	24 25	Pn$_b$						392			
			SPZ	5 83*	Pg		34 8			(0 6)	(1055)			
			SPT	5 7	Lg					0.8	(698)			
AT-NV	Austin, Nevada	246	SPZ	9 0*	Pn		38 9		38 65	0 5	473	4 97	4 48$_{7,9}$	
			SPZ	9 0*	Pn$_b$						556			
			SPZ	9 0*	Pg		(41 2)			0 5	652			
			SPT		Lg					---	---			
			LPZ	28 4	LR					(12 0)	(4 7)			4 62
EY-NV	Ely, Nevada	248	SPZ	48.0	Pn		38 7		38 97	0 55	(56 8)	(4 07)	(3 36)$_{7,9}$	
			SPZ	48 0	Pn$_b$						156			
			SPZ	48 0	Pg		(44 6)			---	---			
			SPT	5 94*	Lg					0 7	965			
WW-UT	Wah Wah Mountains, Utah	278	SPZ	10 8	Pn		(42 0)		42 77	0 4	64 2	4 26	3.62$_{7,9}$	
			SPZ	30 0*	Pn$_b$						(107)			
			SPZ	9 35*	Pg		(46 4)			0 45	1425			
			SPT	12 1*	Lg					(0 5)	(606)			
KM-CL	Kramer, California	284	SPZ	DATA QUESTIONABLE										
			SPT	41 6	Lg					(0 8)	(169)			
KG-AZ	Kingman, Arizona	290	SPZ	10 0	Pn		43 8		44 31	0 4	154	4 70	4 15$_{7,9}$	
			SPZ	10 0	Pn$_b$						265			
			SPZ	10 0	e		45 6			0 4	61 6			
			SPZ	10 0	e		46 6			0 4	77 0			
			SPZ	10 0*	Pg		(48 6)			0 45	518			
			SPT	10 0*	Lg					0 55	266			
BF-CL	Bakersfield, California	291	SPZ	28 75	Pn		44 5		44 32	0 5	102	4.52	3 91$_{7,9}$	
			SPZ	28.75	Pn$_b$						95 7			
			SPZ	28.75	Pg		49 5			0 6	294			
			SPT	56 25	Lg					0 8	(236)			
NO-CL	Needles, California	313	SPZ	88 3	Pn		46 7		47 10	0 6	12 .	3 70	2 96$_{7,9}$	
			SPZ	88 3	Pn$_b$						31 1			
			SPZ	16 7*	Pg		53 4			0 55	265			
			SPT	17.3*	Lg					0 6	427			
			LPZ	14 45	LR					11 0	44 9			6 06
KN-UT	Kanab, Utah	317	SPZ	15 8*	Pn		47 3		47 80	0 5	183	4,89	4 38$_{7,9}$	
			SPZ	15 8*	Pn$_b$						253			
			SPZ	15.8*	e		49 6			0 45	122			
			SPZ	15 8*	Pg		52 9			0 5	779			
			SPT	52 0*	Lg					0 6	479			
			LPZ	50 1	LR					(11 0)	(31 5)			2 05
CP-CL	Campo, California	511	SPZ	45 0*	Pn	1	[illegible]		12 52	0 5	84 8	5 21	4 74$_{7,9}$	
			SPZ	45.0*	Pn$_b$						88 9			
			SPZ	45 0*	Pg	1	(27 4)	1		0 55	59 0			
			SPT	46 25*	Lg					(0 5)	(50 8)			
TFSO	Tonto Forest Observatory, Arizona	572	SPZ 60	260	Pn	1	20 2	1	20 31	0 35	9 6	4 41	3 79$_{7,9}$	
			SPZ 60	260	Pn$_b$						11 5			
			SPZ-60	260	e	1	26 3			0 45	9 1			
			SPZ-60	260	Pg	1	35 8			0 7	44.3			
			SPN	30 0	Lg					0 8	32 0			
			SPE	30 0	Lg					0 8	28 0			
			LPZ	51	LR					14 5	8 9			3 24
UBSO	Uinta Basin Observatory, Utah	677	SPZ-10	140	Pn	1	(35 1)	1	33 69	0 6	20 9	4 9	3 71$_{8,5}$	
			SPZ 10	140	Pn$_b$						19 6			
			SPZ-10	140	Pg	1	57 5			0 7	77 9			
			SPN	140	Lg					1 2	88 5			
			SPE	140	Lg					1 1	57 8			
BMSO	Blue Mountains Observatory, Oregon	838	SPZ-3	680	Pn	1	(55 1)	1	53 94	0 5	1 5	4 09	3 41$_{7,9}$	
			SPZ-3	680	Pn$_b$						(2 2)			
			SPZ 3	680	e	1	57 2			0 9	1 4			
			SPZ 3	680	e	2	02 0			0 6	3 6			
			SPZ-3	680	Pg					..				
			SPE		Lg					..				
LC-NM	Las Cruces, New Mexico	1047	SPZ	392	Pg	2	(54 4)			0 7	6 1			
			SPT	388	Lg					(1 0)	(7 4)			
			LPZ	61 3	LR					10 0	41.0			5 13
CC-WA	Cascade Tunnel, Washington	1221	SPZ	125 5	e	2	44 6			0 8	4 5			
RK-ON	Red Lake, Ontario, Canada	2342	SPZ	287	P	4	45 9	4	47 89	0 55	5 4	1 84		
			SPZ	287	P$_b$						5 2			
			SPZ	287	e	4	47 6			0 7	7 2			
CPSO	Cumberland Plateau Observatory, Tennessee	2756	SPZ	400	P	5	(25 3)	5	24 75	0.6	(4 9)	(4 15)		

A/T mu/sec (o-p)
() Doubtful Values or Phases
* Measurements made from Playouts
--- Maximum Amplitudes Clipped on Film & Tape
.. Unreadable on Film, Tape Not Received
P- Second half-cycle of Signal, P-P in mu (Assuming T=1.0 Seconds)

PRINCIPAL PHASES - SCROLL

Table 2

Code	Station	Distance (km)	Geographic Latitude	Geographic Longitude	Elev. (km)	Computed Azimuth		Installed Azimuth		SP INST.	LP Inst.
						Epi. Sta.	Sta. Epi.	Radial	Tang.		
MN-NV	Mina, Nevada	198	38° 26' 10" N	118° 08' 53" W	1.52	309°	127°	308°	38°	L	**
BP-CL	Bishop, California	205	37° 21' 36" N	118° 41' 25" W	2.32	271°	90°	274°	4°	PS	**
AT-NV	Austin, Nevada	246	39° 28' 53" N	117° 04' 26" W	1.98	346°	165°	343°	73°	PS	**
EY-NV	Ely, Nevada	248	39° 24' 36" N	115° 18' 46" W	2.01	22°	202°	18°	108°	PS	**
WW-UT	Wah Wah Mountains Utah	278	38° 30' 50" N	113° 35' 20" W	1.83	61°	243°	58°	148°	PS	**
KM-CL	Kramer, California	284	34° 52' 52" N	117° 15' 24" W	0.85	196°	16°	200°	290°	PS	**
KG-AZ	Kingman, Arizona	290	35° 38' 30" N	113° 54' 28" W	1.07	130°	311°	130°	220°	PS	**
BF-CL	Bakersfield, Calif.	291	35° 38' 53" N	118° 51' 27" W	0.57	231°	49 °	234°	324°	PS	**
ND-CL	Needles, California	313	34° 35' 57" N	115° 33' 05" W	0.37	166°	346°	169°	259°	PS	**
KN-UT	Kanab, Utah	317	37° 01' 22" N	112° 49' 39" W	1.74	95°	277°	95°	185°	L	**
CP-CL	Campo, California	511	32° 43' 44" N	116° 22' 16" W	1.19	180°	360°	162°	272°	PS	**
*TFSO	Tonto Forest Observatory, Arizona	572	34° 17' 12" N	111° 16' 03" W	1.49	125°	308°	90°	0°	JM	**
*UBSO	Uinta Basin Observatory, Utah	677	40° 19' 18" N	109° 34' 07" W	1.60	59°	243°	90°	0°	JM	**
*BMSO	Blue Mountain Observatory, Oregon	838	44° 50' 56" N	117° 18' 20" W	1.19	355°	174°	0°	90°	JM	**
LC-NM	Las Cruces, New Mexico	1047	32° 24' 08" N	106° 35' 58" W	1.59	119°	304°	133°	223°	S	**
CC-WA	Cascade Tunnel, Wash.	1221	47° 46' 09" N	121° 05' 01" W	1.04	343°	160°	311°	41°	PS	**
*LAO	Subarray AO-10 Montana	1335	46° 41' 19" N	106° 13' 20" W	0.90	36°	223°	0°	90°	HS	**
*WMSO	Wichita Mountain Observatory, Oklahoma	1627	34° 43' 05" N	98° 35' 21" W	0.51	95°	285°	90°	0°	JM	**
*PG-BC	Prince George, British Columbia, Canada	1912	53° 59' 50" N	122° 31' 23" W	0.91	348°	163°	110°	200°	L	**
RK-ON	Red Lake, Ontario Canada	2342	50° 50' 20" N	93° 40' 20" W	0.37	43°	239°	58°	148°	S	**
*CPSO	Cumberland Plateau Observatory, Tennessee	2756	35° 35' 41" N	85° 34' 14" W	0.57	85°	283°	90°	0°	JM	**
WH2YK	Whitehorse, Yukon Territory, Canada	2911	60° 41' 41" N	134° 58' 02" W	0.85	339°	145°	325°	55°	L	**
HN-ME	Houlton, Maine	4078	46° 09' 43" N	67° 59' 09" W	0.21	60°	274°	93°	183°	S	**
*SV3QB	Schefferville, Quebec Canada	4190	54° 48' 39" N	66° 45' 00" W	0.58	46°	263°	139°	229°	S	**
MP-NT	Mould Bay, Northwest Territories, Canada	4341	76° 15' 08" N	119° 22' 18" W	0.06	359°	176°	356°	86°	JMZ S	**

* Seismometers Not Orientated Toward N.T.S.

L Large Benioff

S Small Benioff

JM Johnson-Matheson

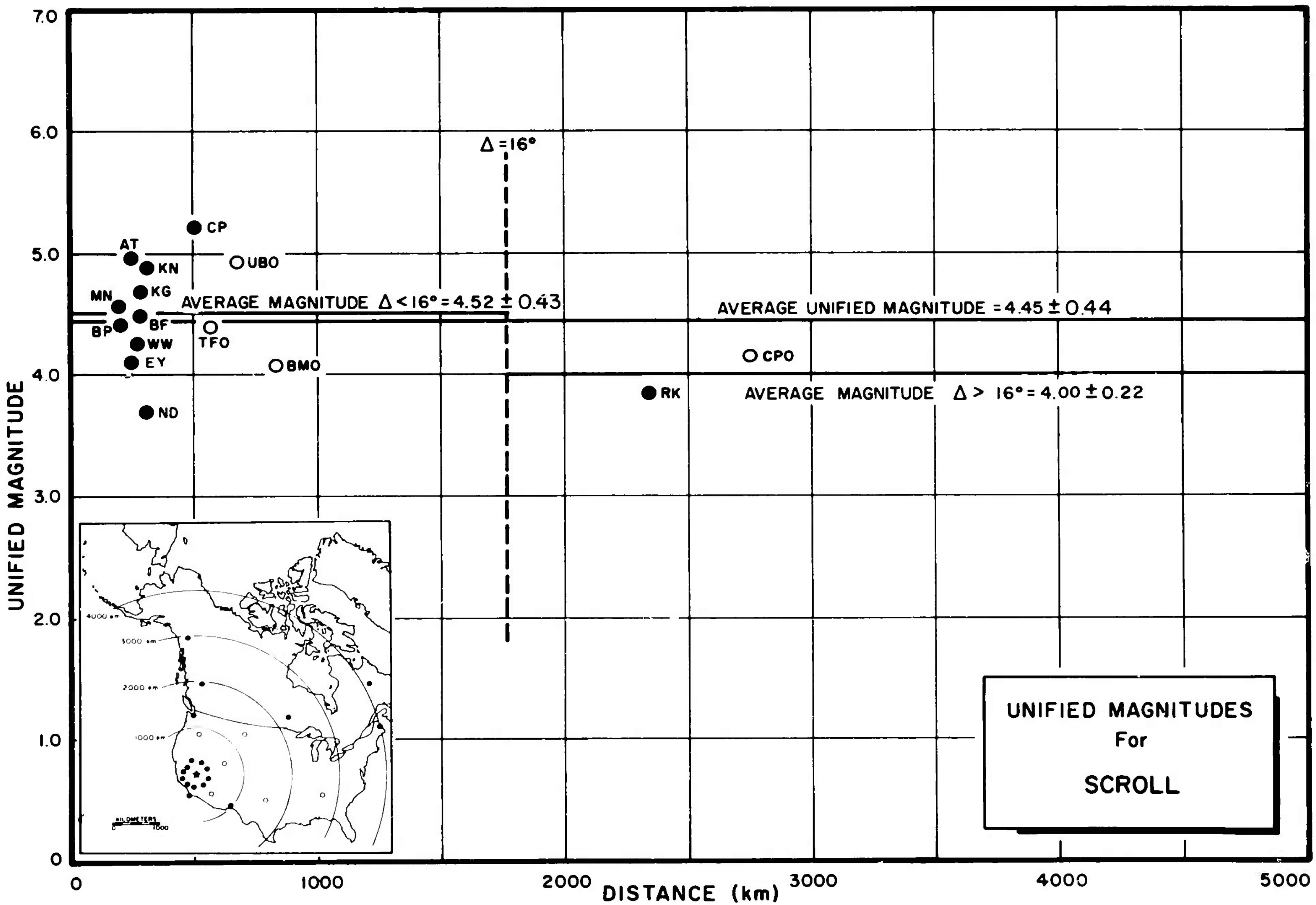
HS Hall Sears

PS Geotech Portable System

** Long Period Instruments At Site

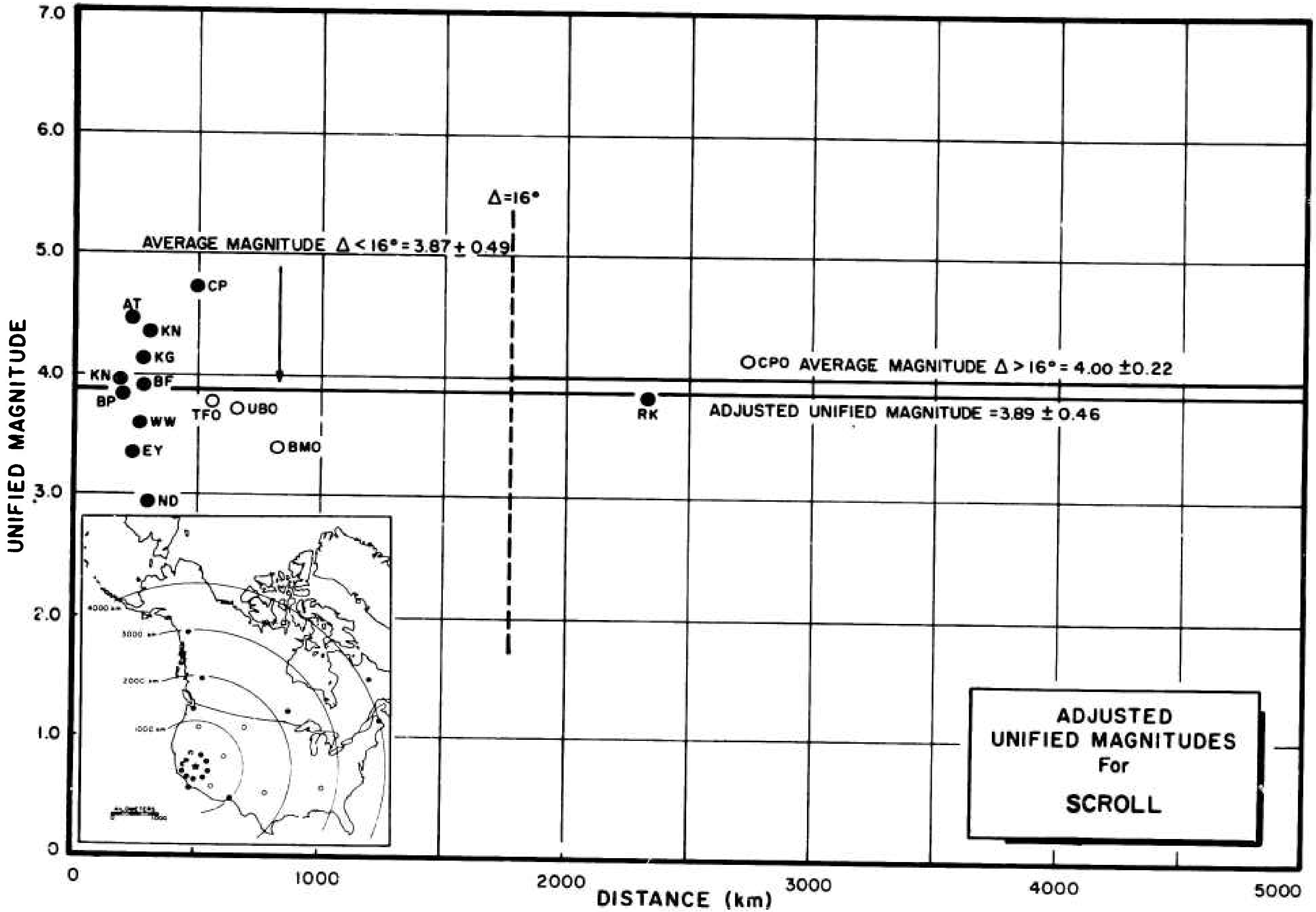
RECORDING SITE INFORMATION - SCROLL

Table 3



UNIFIED MAGNITUDES
For
SCROLL
UNIFIED MAGNITUDE
DISTANCE (km)
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
0
1000
2000
3000
4000
5000
Δ =16°
AVERAGE MAGNITUDE Δ < 16° = 4.52 ± 0.43
AVERAGE UNIFIED MAGNITUDE = 4.45 ± 0.44
AVERAGE MAGNITUDE Δ > 16° = 4.00 ± 0.22
CP
AT
KN
UBO
KG
MN
BF
BP
TFO
WW
EY
BMO
ND
CPO
RK

Figure 2



7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
UNIFIED MAGNITUDE
0
1000
2000
3000
4000
5000
DISTANCE (km)
Δ=16°
AVERAGE MAGNITUDE Δ < 16° = 3.87 ± 0.49
CP
AT
KN
KG
KN
BF
BP
WW
EY
ND
TFO
UBO
BMO
RK
CPO AVERAGE MAGNITUDE Δ > 16° = 4.00 ±0.22
ADJUSTED UNIFIED MAGNITUDE =3.89 ± 0.46
ADJUSTED
UNIFIED MAGNITUDES
For
SCROLL

Figure 3

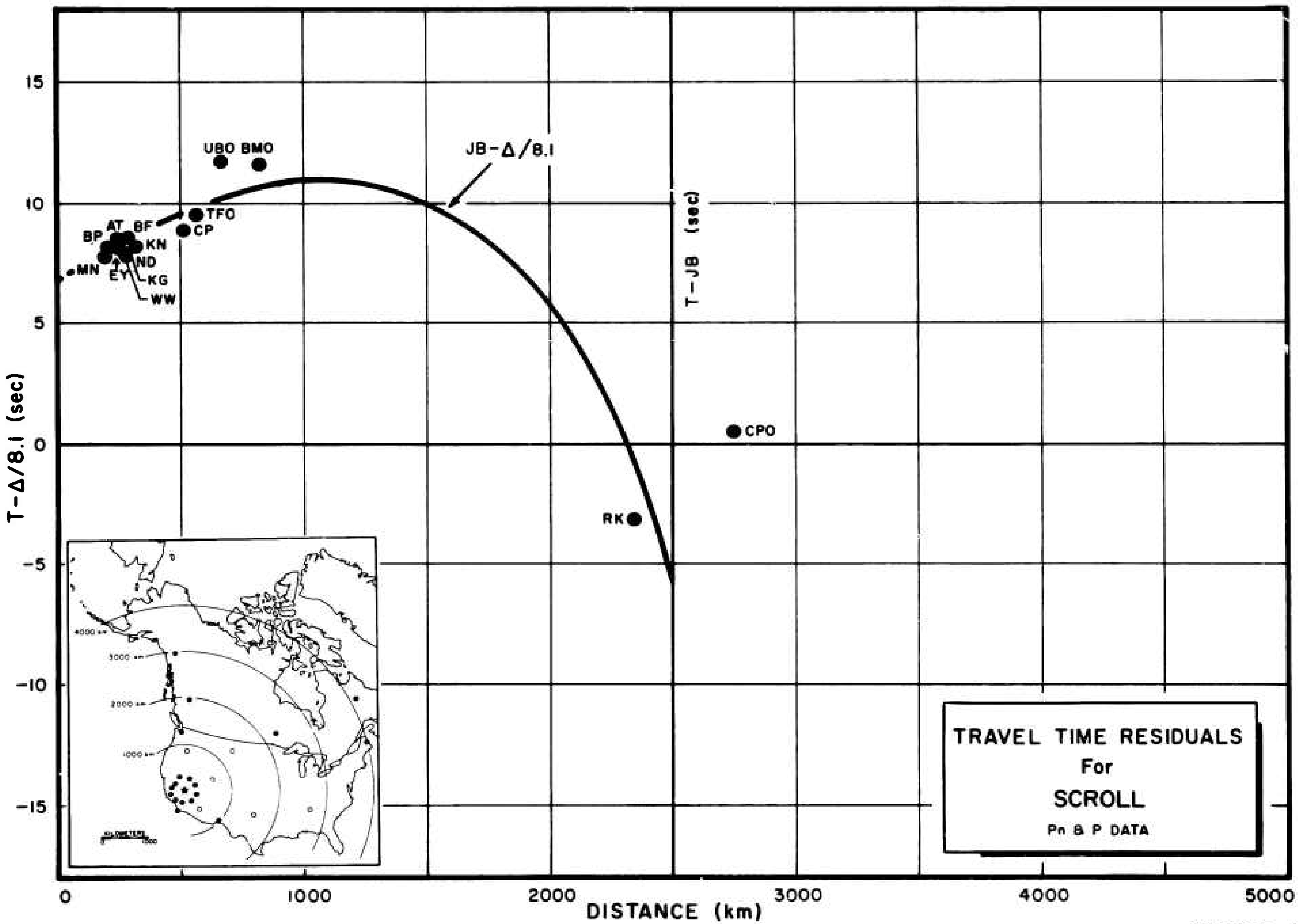

TRAVEL TIME RESIDUALS
For
SCROLL
Pn & P DATA
T-Δ/8.1 (sec)
DISTANCE (km)
T-JB (sec)
JB-Δ/8.1
UBO BMO
TFO
CP
BP
AT
BF
KN
ND
KG
WW
EY
MN
CPO
RK
15
10
5
0
-5
-10
-15
0
1000
2000
3000
4000
5000

Figure 4

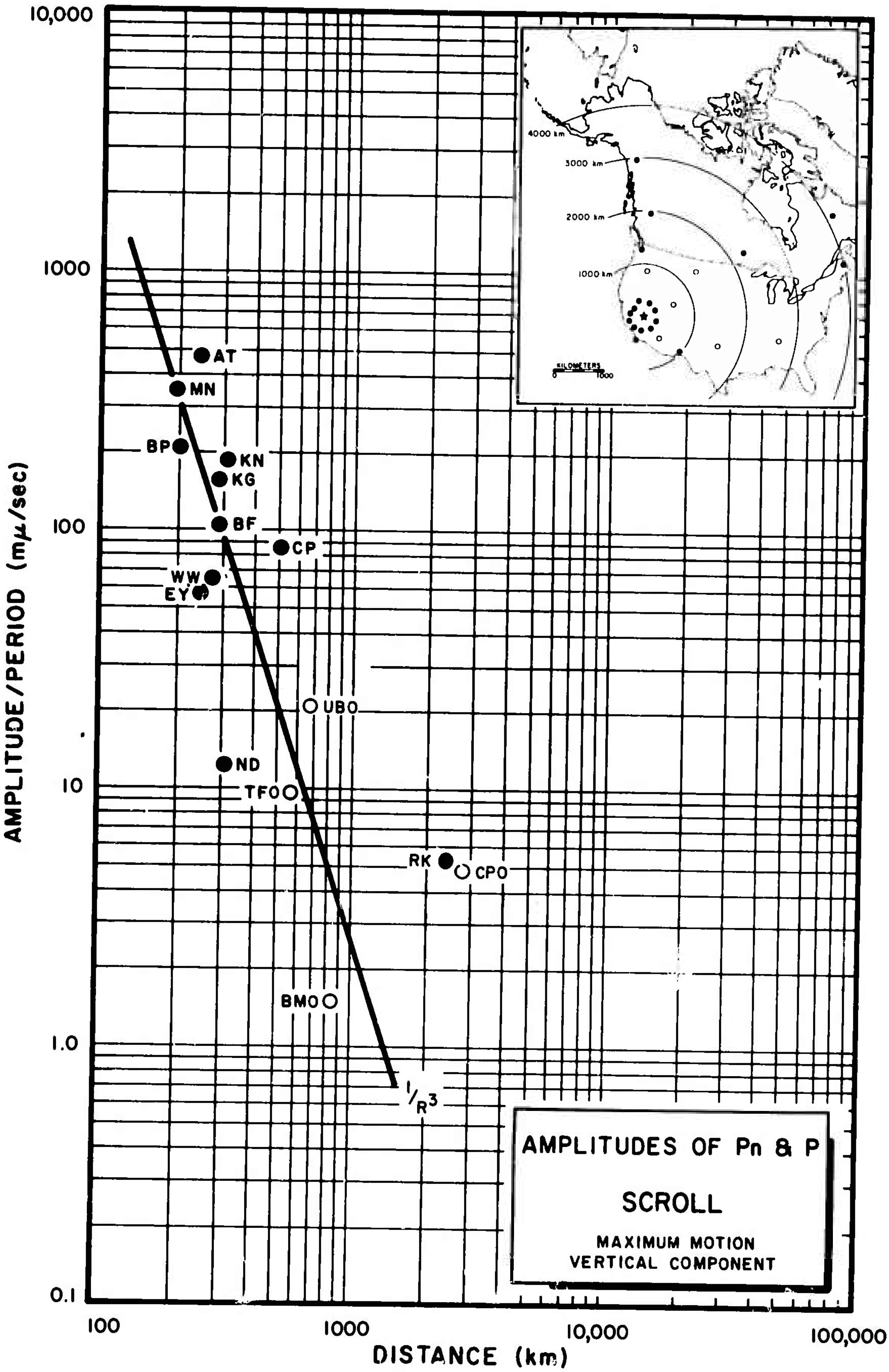
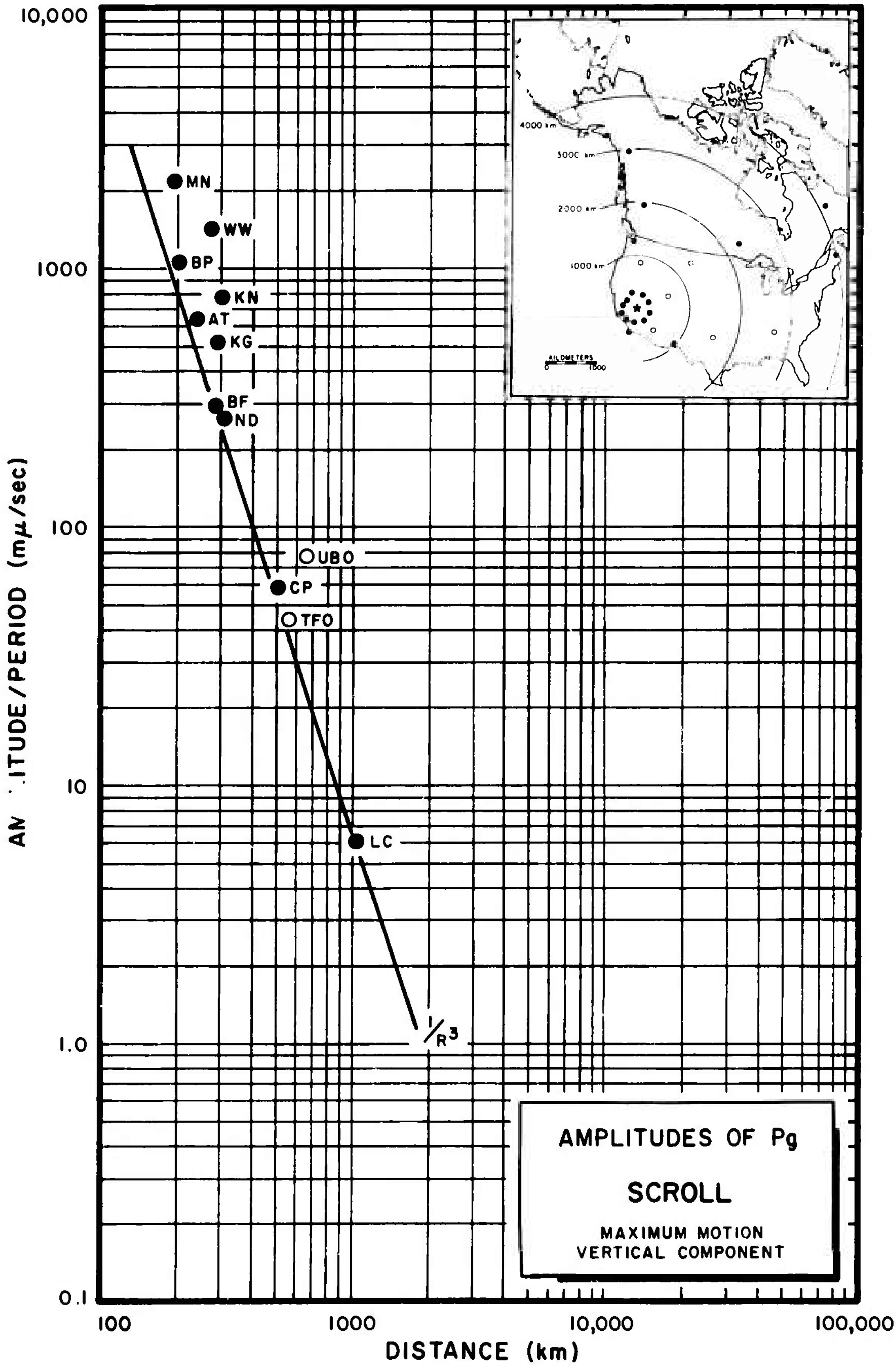
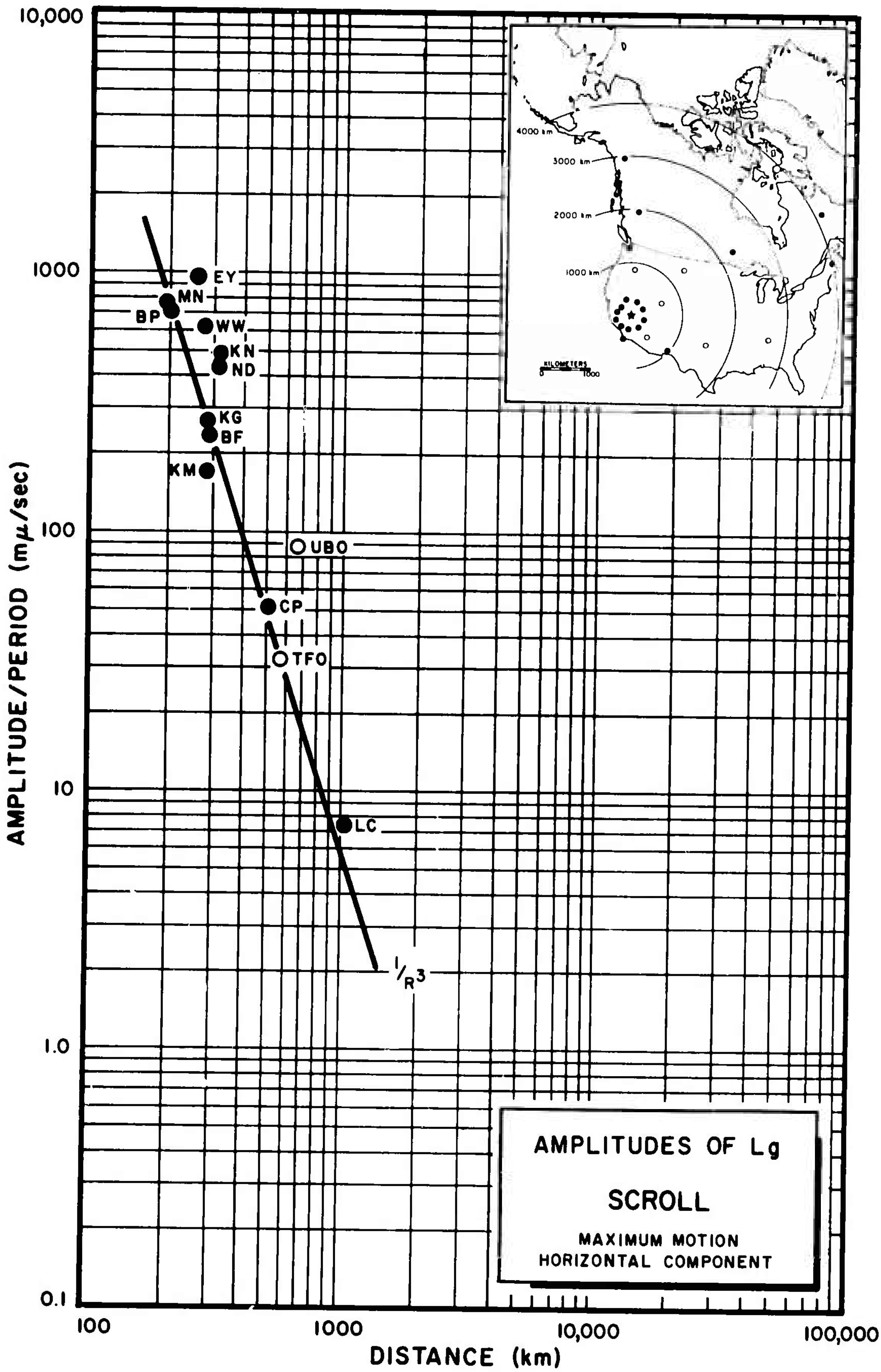

AMPLITUDES OF Pn & P
SCROLL
MAXIMUM MOTION
VERTICAL COMPONENT
AMPLITUDE/PERIOD (mμ/sec)
DISTANCE (km)
10,000
1000
100
10
1.0
0.1
100
1000
10,000
100,000
AT
MN
BP
KN
KG
BF
CP
WW
EY
UBO
ND
TFO
RK
CPO
BMO
1/R3
4000 km
3000 km
2000 km
1000 km
KILOMETERS

Figure 5



10,000
1000
100
10
1.0
0.1
AMPLITUDE/PERIOD (mμ/sec)
100
1000
10,000
100,000
DISTANCE (km)
MN
WW
BP
KN
AT
KG
BF
ND
UBO
CP
TFO
LC
1/R3
4000 km
3000 km
2000 km
1000 km
KILOMETERS
AMPLITUDES OF Pg
SCROLL
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 6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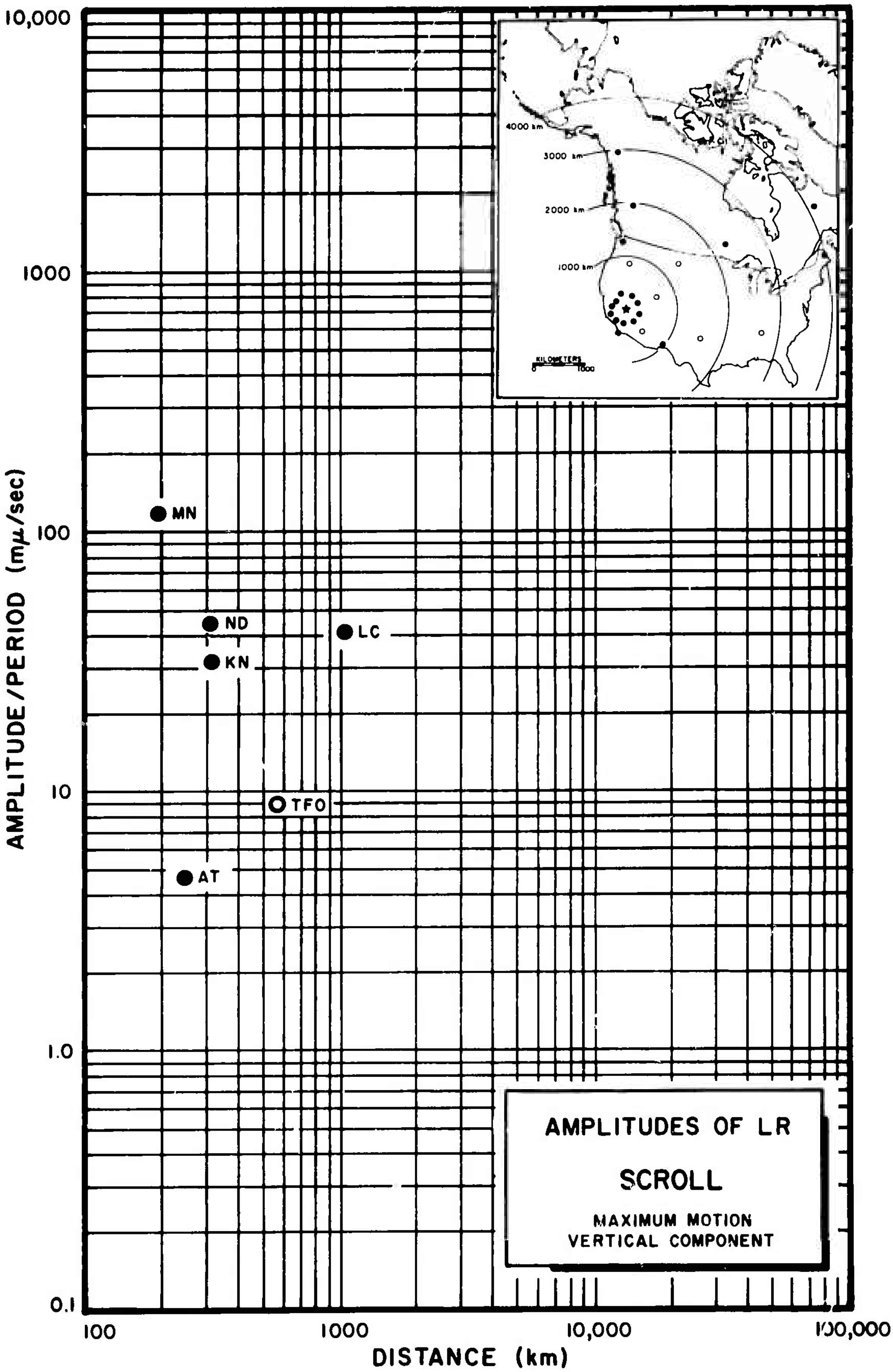
1000
100
10
1.0
0.1
AMPLITUDE/PERIOD (mμ/sec)
100
1000
10,000
100,000
DISTANCE (km)
EY
MN
BP
WW
KN
ND
KG
BF
KM
UBO
CP
TFO
LC
1/R3
4000 km
3000 km
2000 km
1000 km
KILOMETERS
AMPLITUDES OF Lg
SCROLL
MAXIMUM MOTION
HORIZONTAL COMPONENT

Figure 7



10,000
1000
100
10
1.0
0.1
AMPLITUDE/PERIOD (mμ/sec)
100
1000
10,000
100,000
DISTANCE (km)
MN
ND
KN
LC
TFO
AT
4000 km
3000 km
2000 km
1000 km
KILOMETERS
0
1000
AMPLITUDES OF LR
SCROLL
MAXIMUM MOTION
VERTICAL COMPONENT

Figure 8

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Unclassified
Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

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11 SUPPLEMENTARY NOTES	12 SPONSORING MILITARY ACTIVITY ADVANCED RESEARCH PROJECTS AGENCY NUCLEAR TEST DETECTION OFFICE WASHINGTON, D. C.

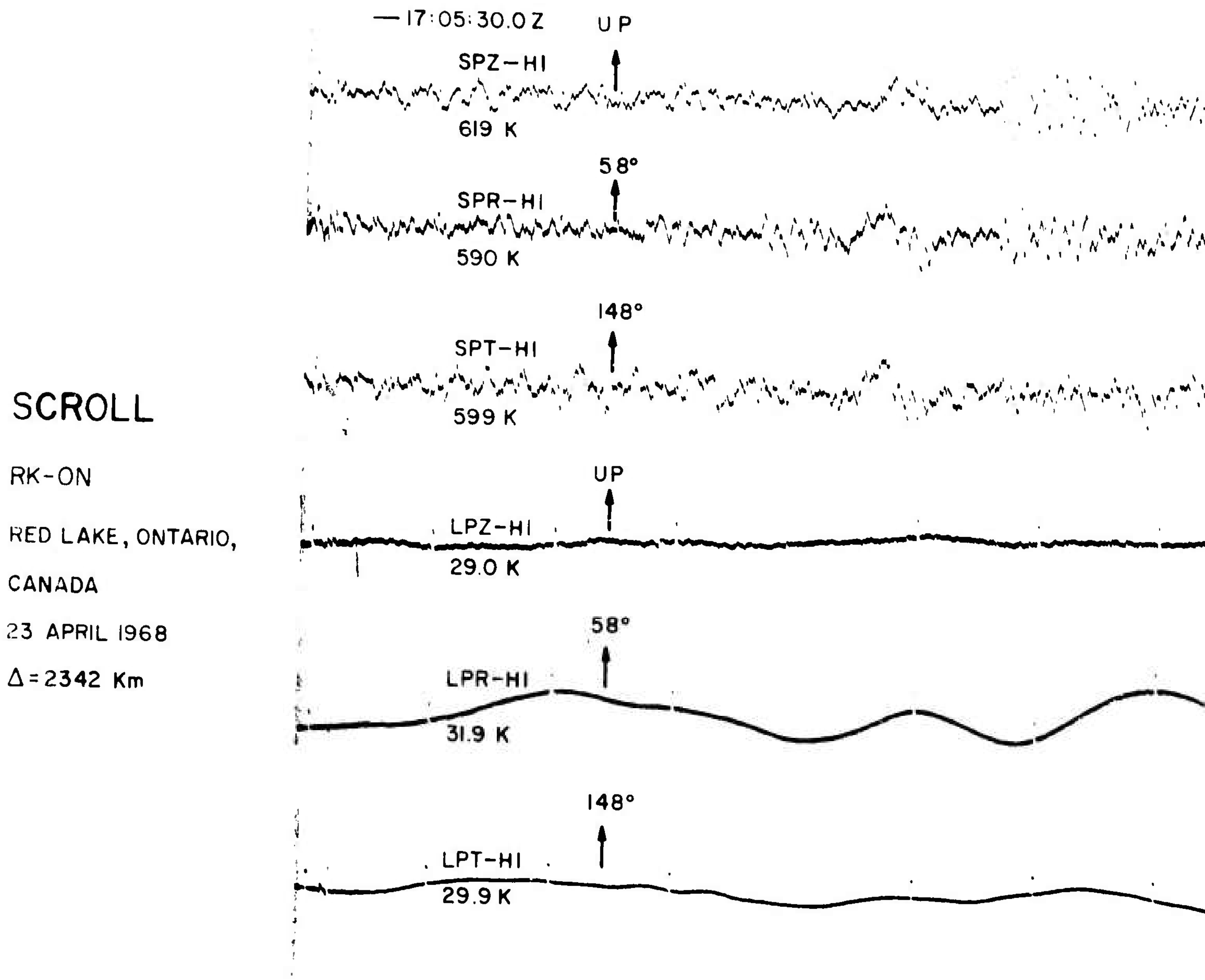
13 ABSTRACT

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

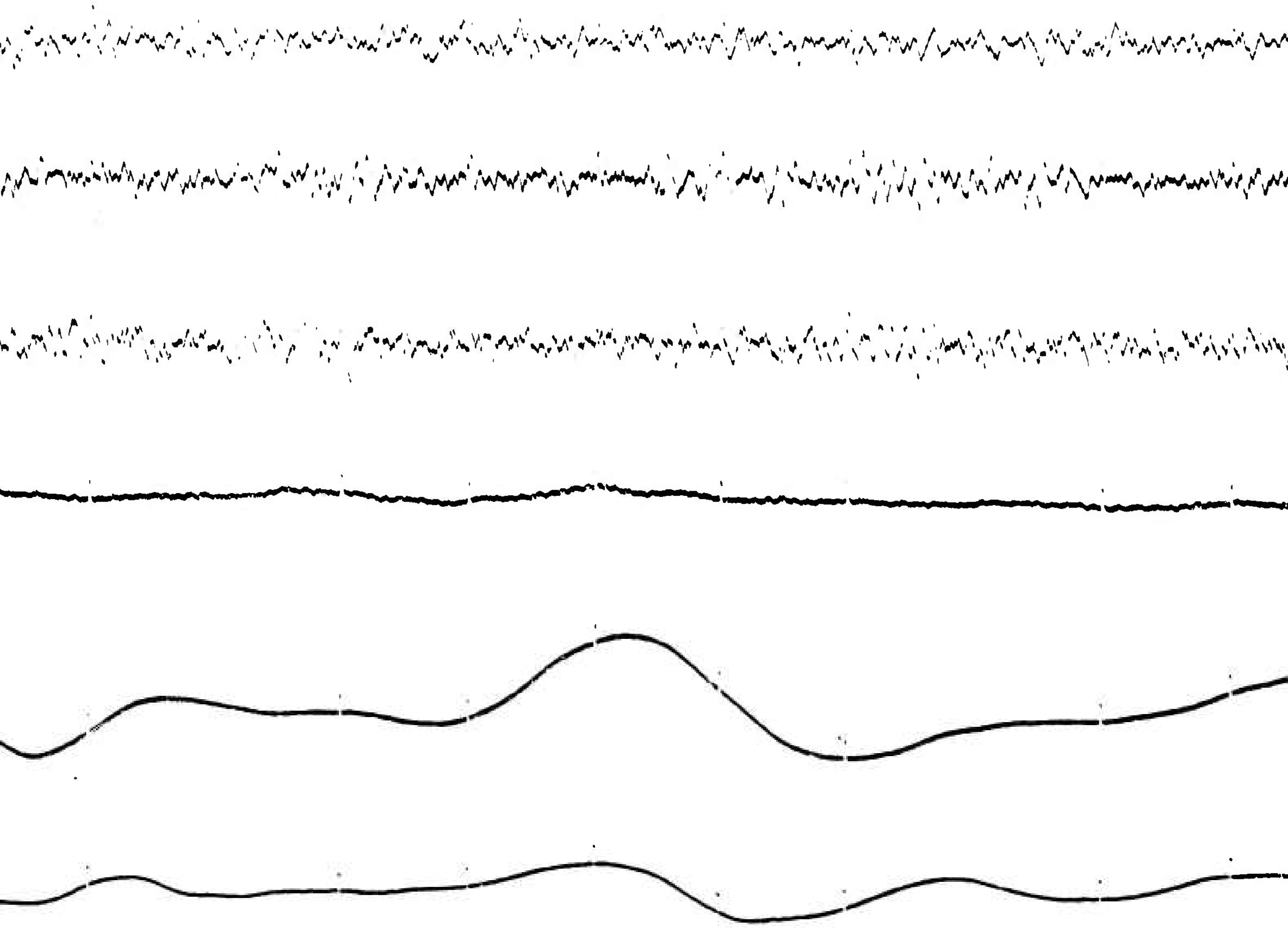
Seismic Magnitude
Seismic Travel-Time
Seismic Amplitude
Vela-Uniform
Nuclear Tests

Unclassified
Security Classification



— 17:05:30.0 Z
UP
SPZ-HI
619 K
58°
SPR-HI
590 K
148°
SPT-HI
599 K
SCROLL
RK-ON
RED LAKE, ONTARIO,
CANADA
23 APRIL 1968
Δ = 2342 Km
UP
LPZ-HI
29.0 K
58°
LPR-HI
31.9 K
148°
LPT-HI
29.9 K

A.



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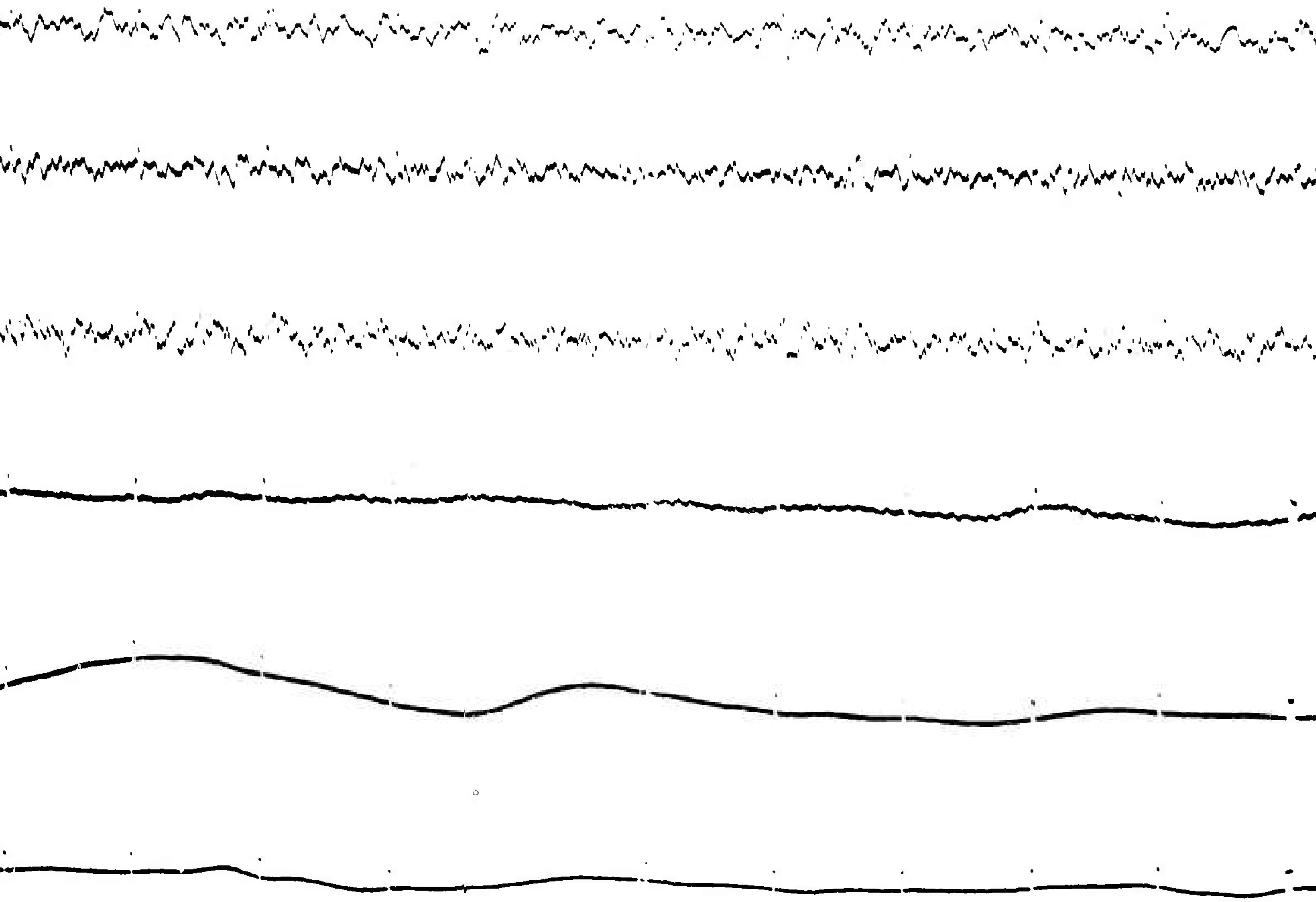

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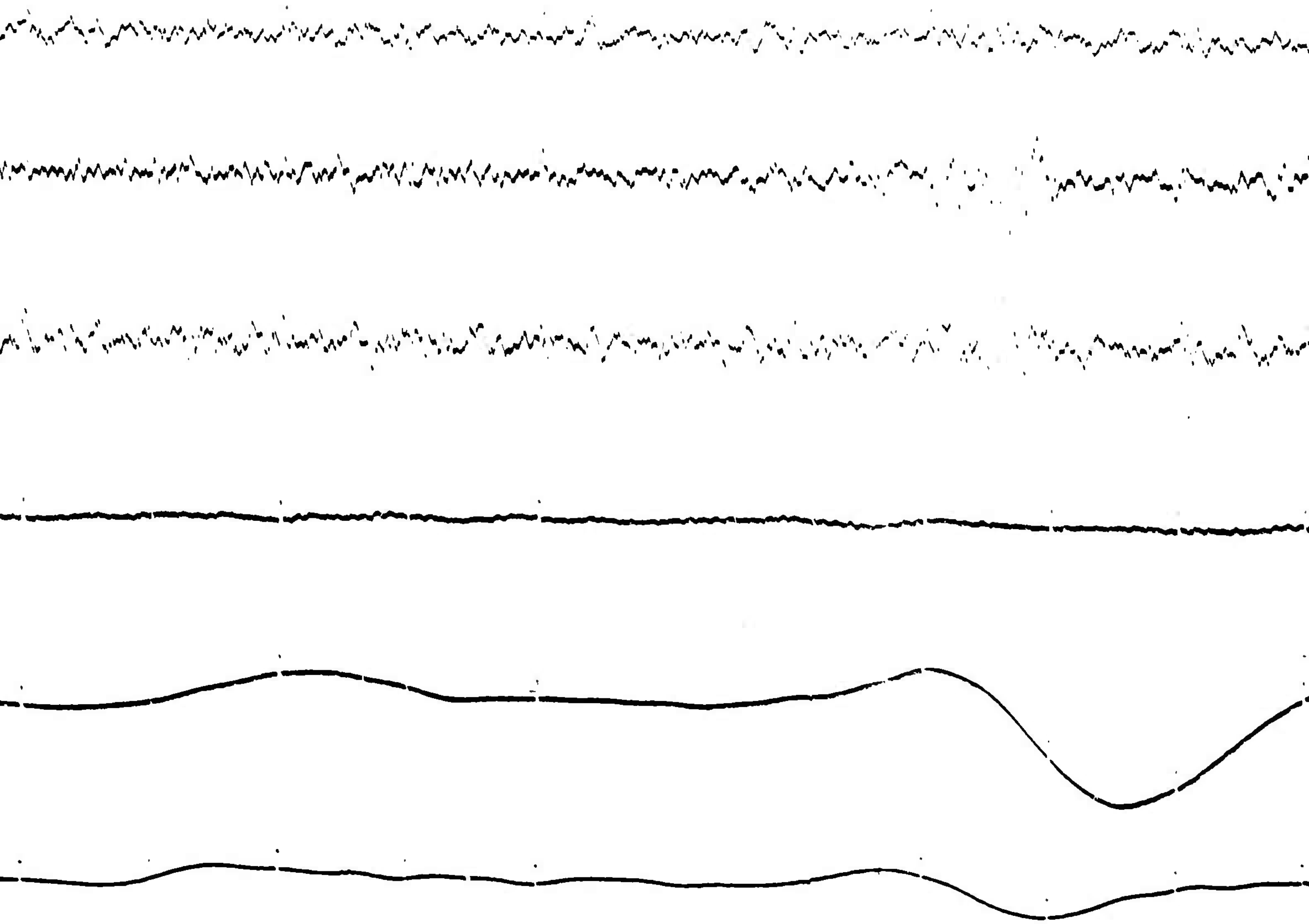

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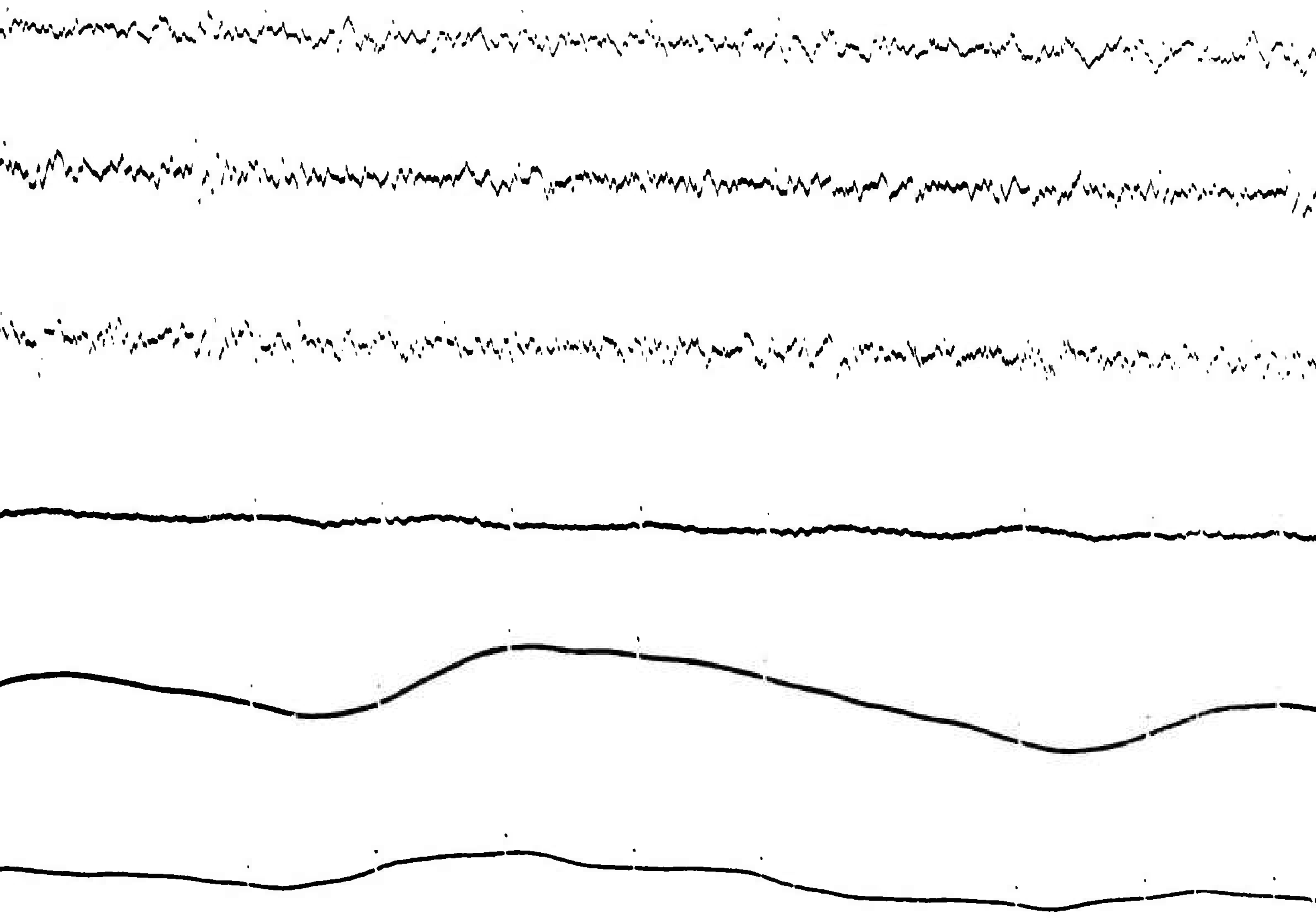

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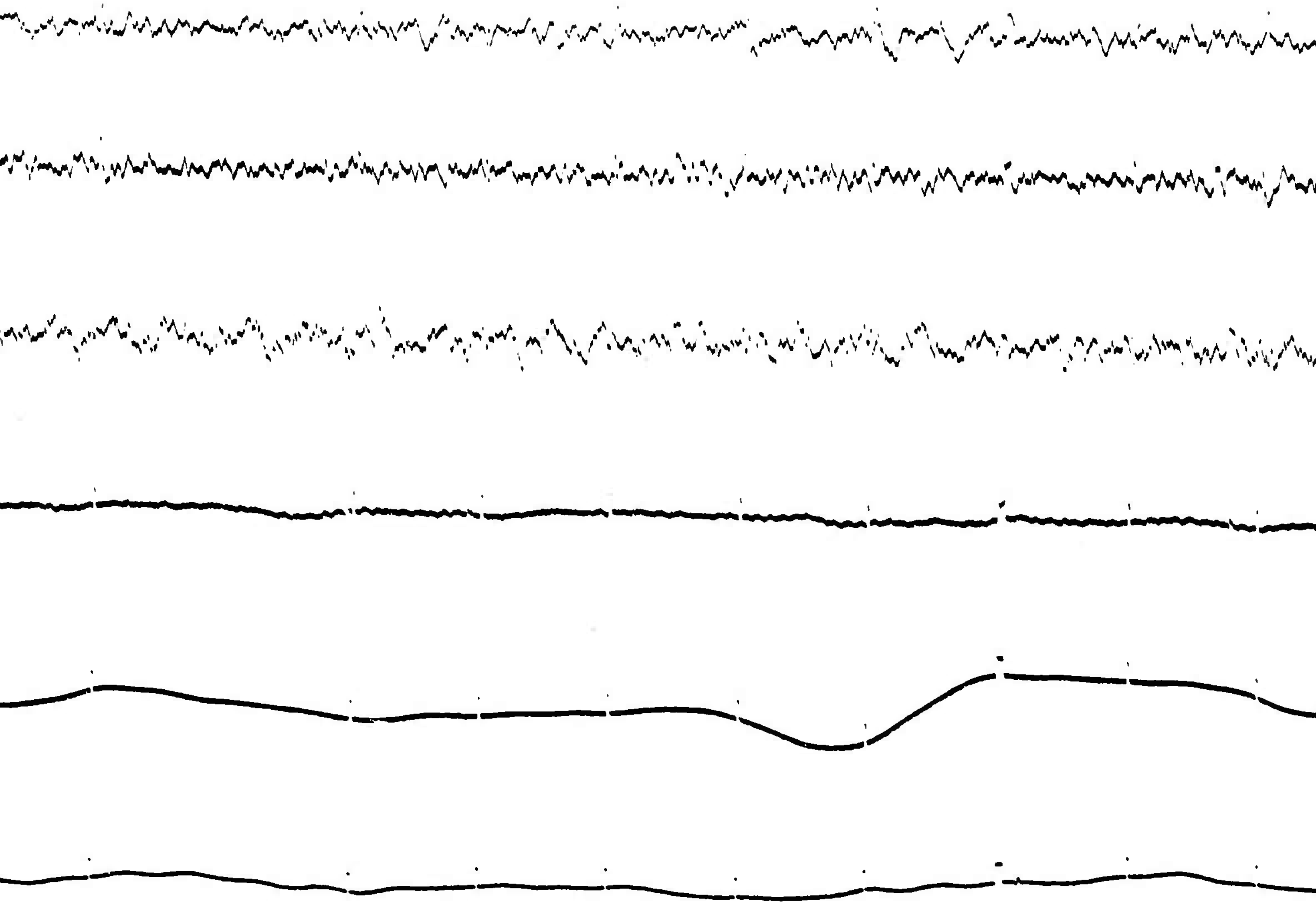

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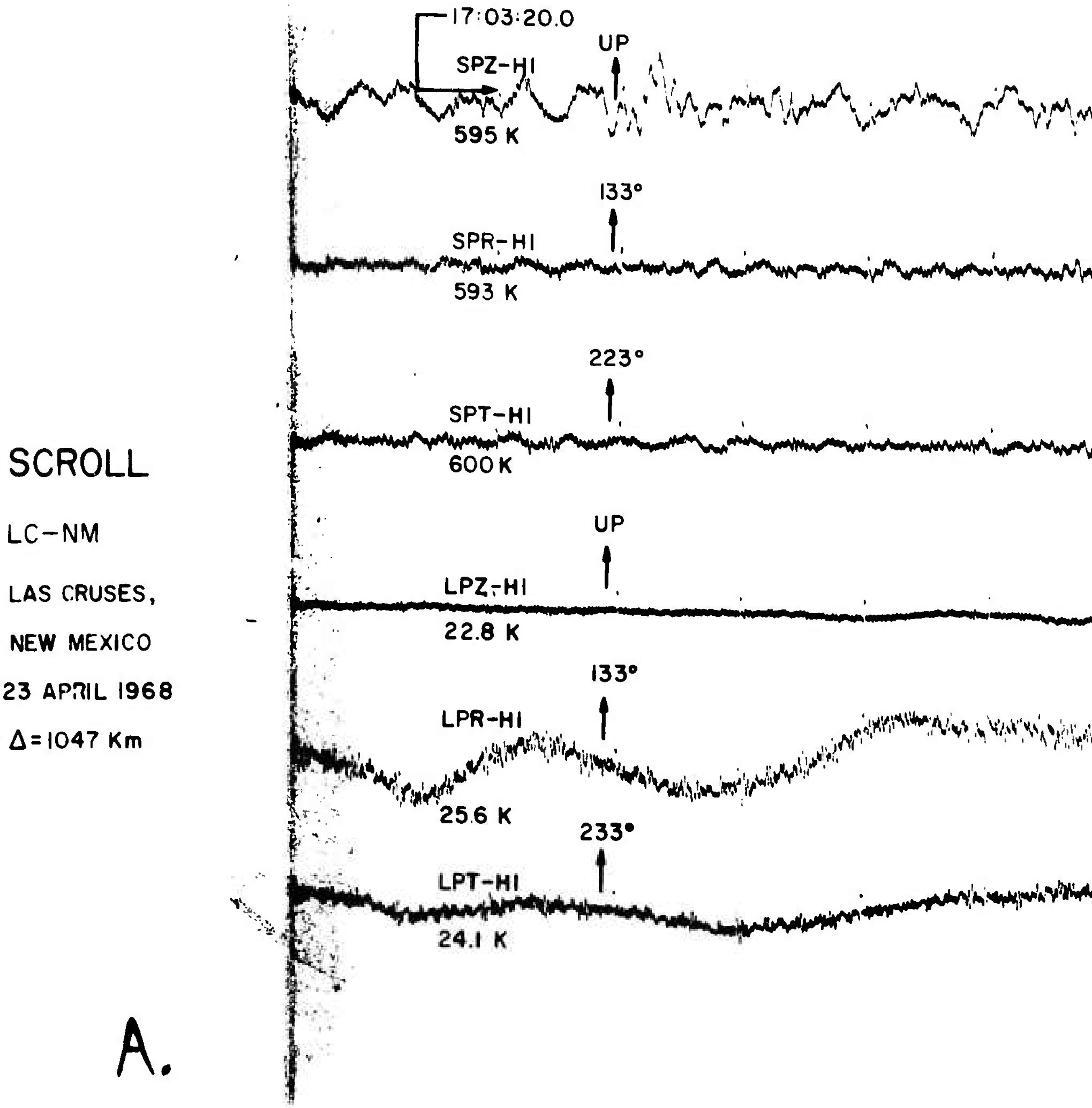
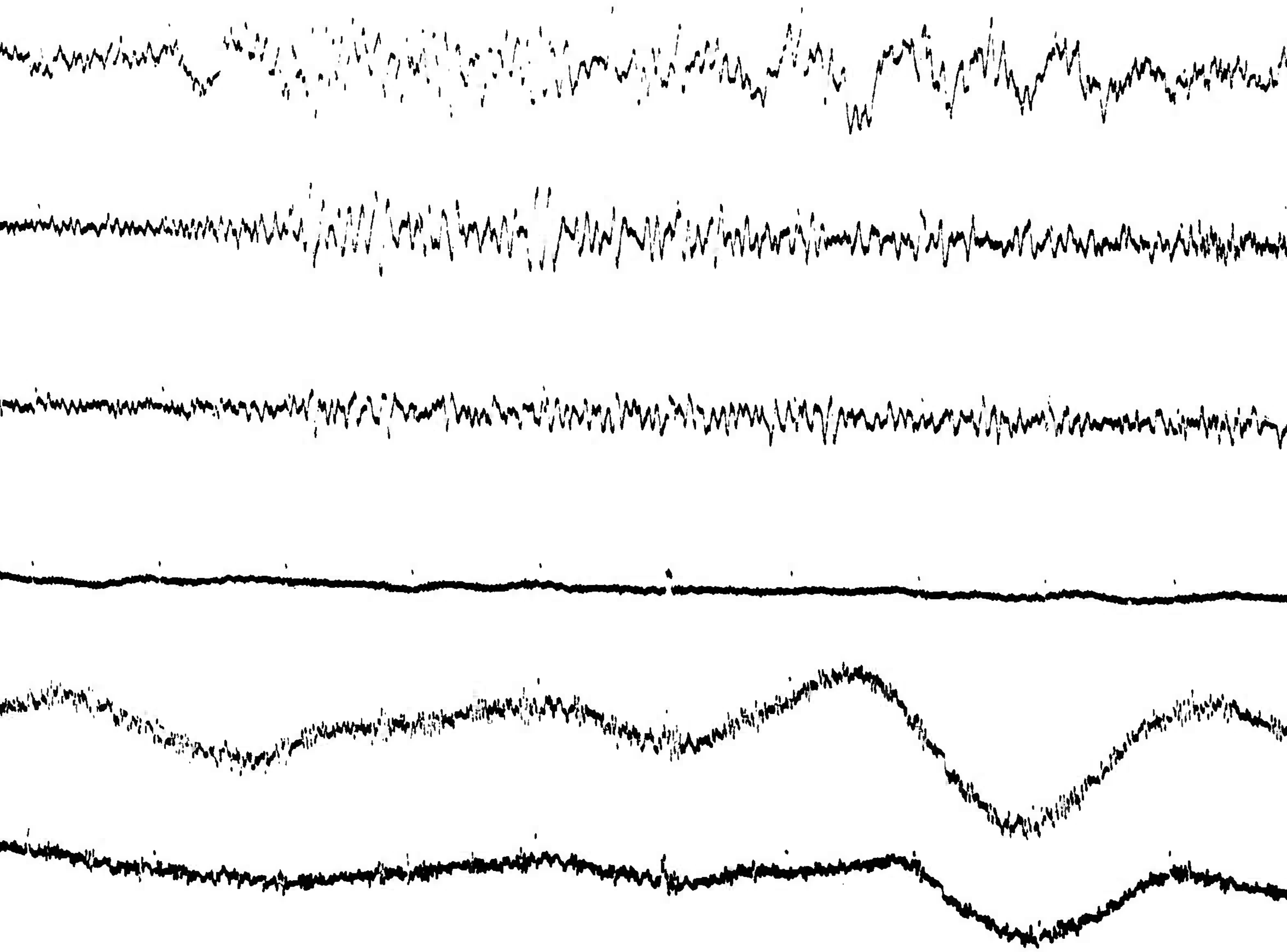

17:03:20.0
UP
SPZ-HI
595 K
133°
SPR-HI
593 K
223°
SPT-HI
600 K
UP
LPZ-HI
22.8 K
133°
LPR-HI
25.6 K
233°
LPT-HI
24.1 K
SCROLL
LC-NM
LAS CRUSES,
NEW MEXICO
23 APRIL 1968
Δ=1047 Km
A.



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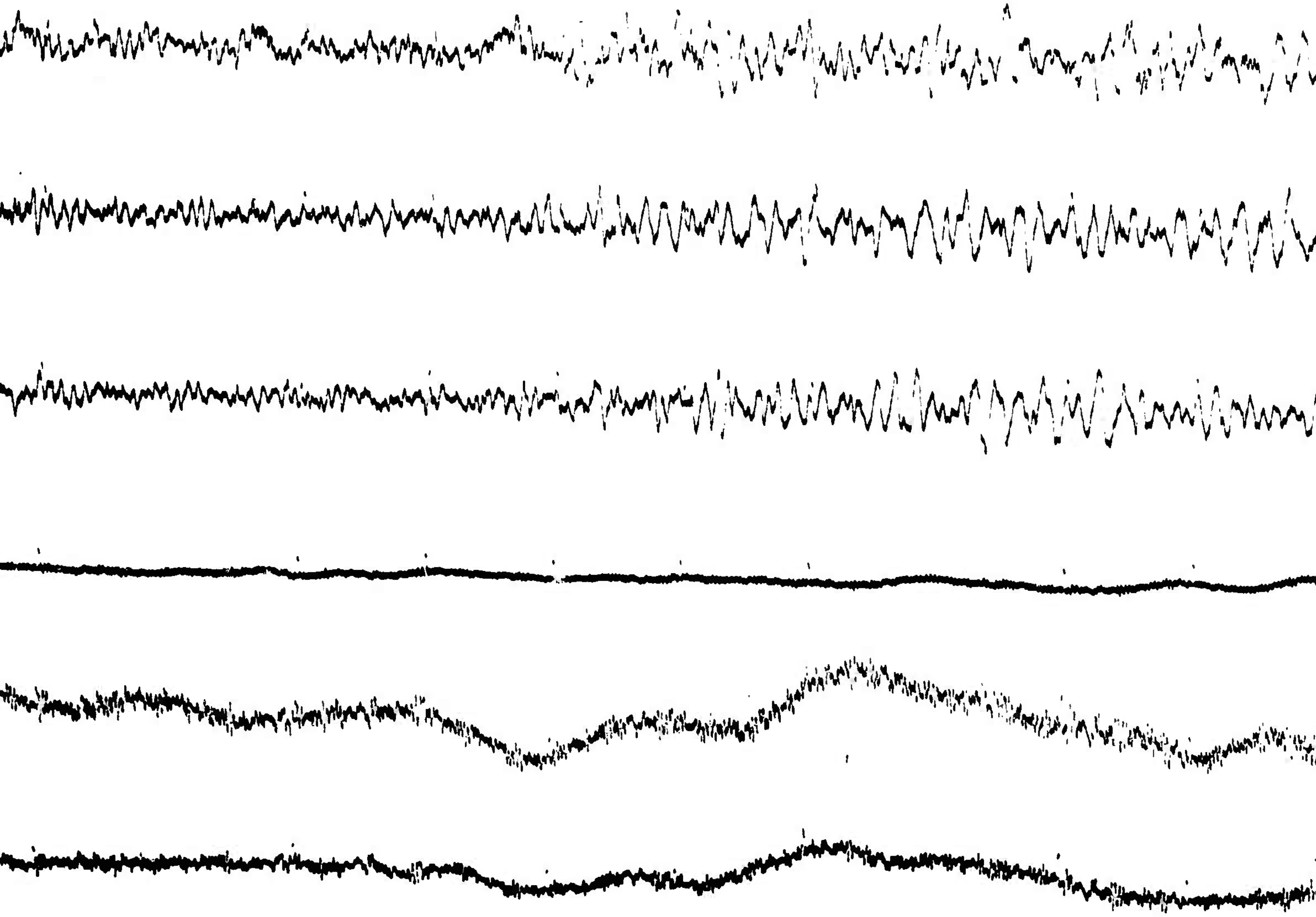

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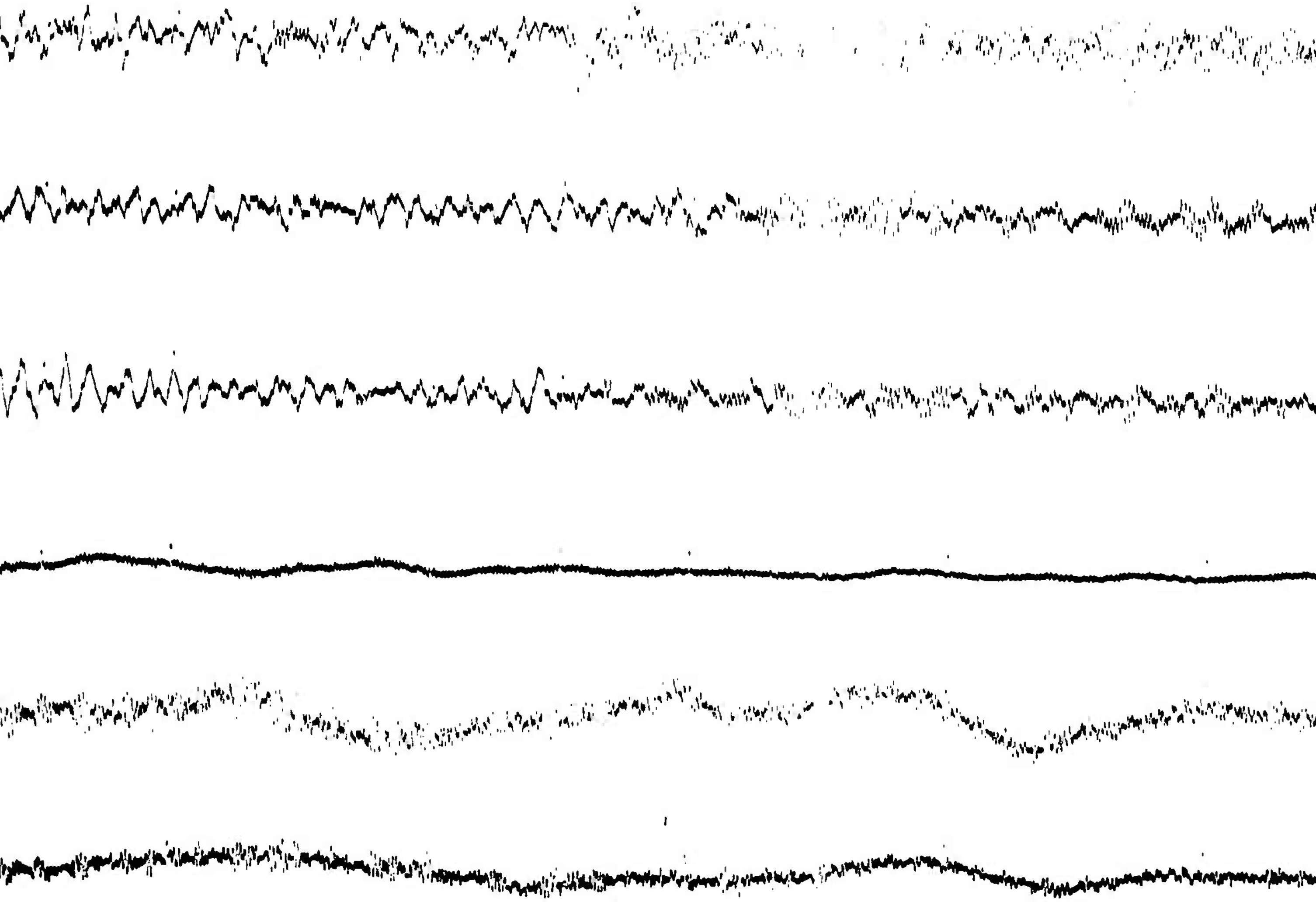

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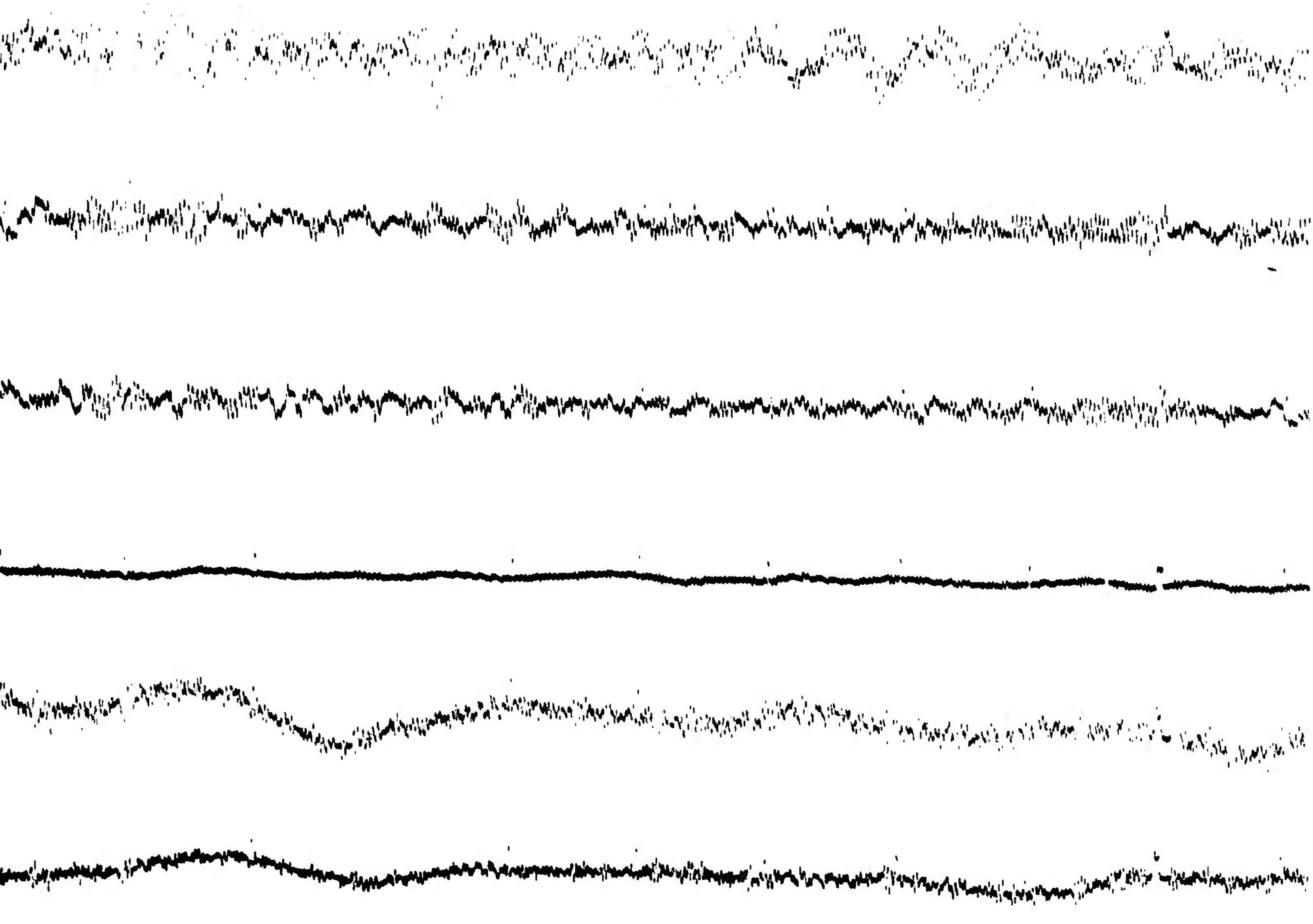


E.

SCROLL

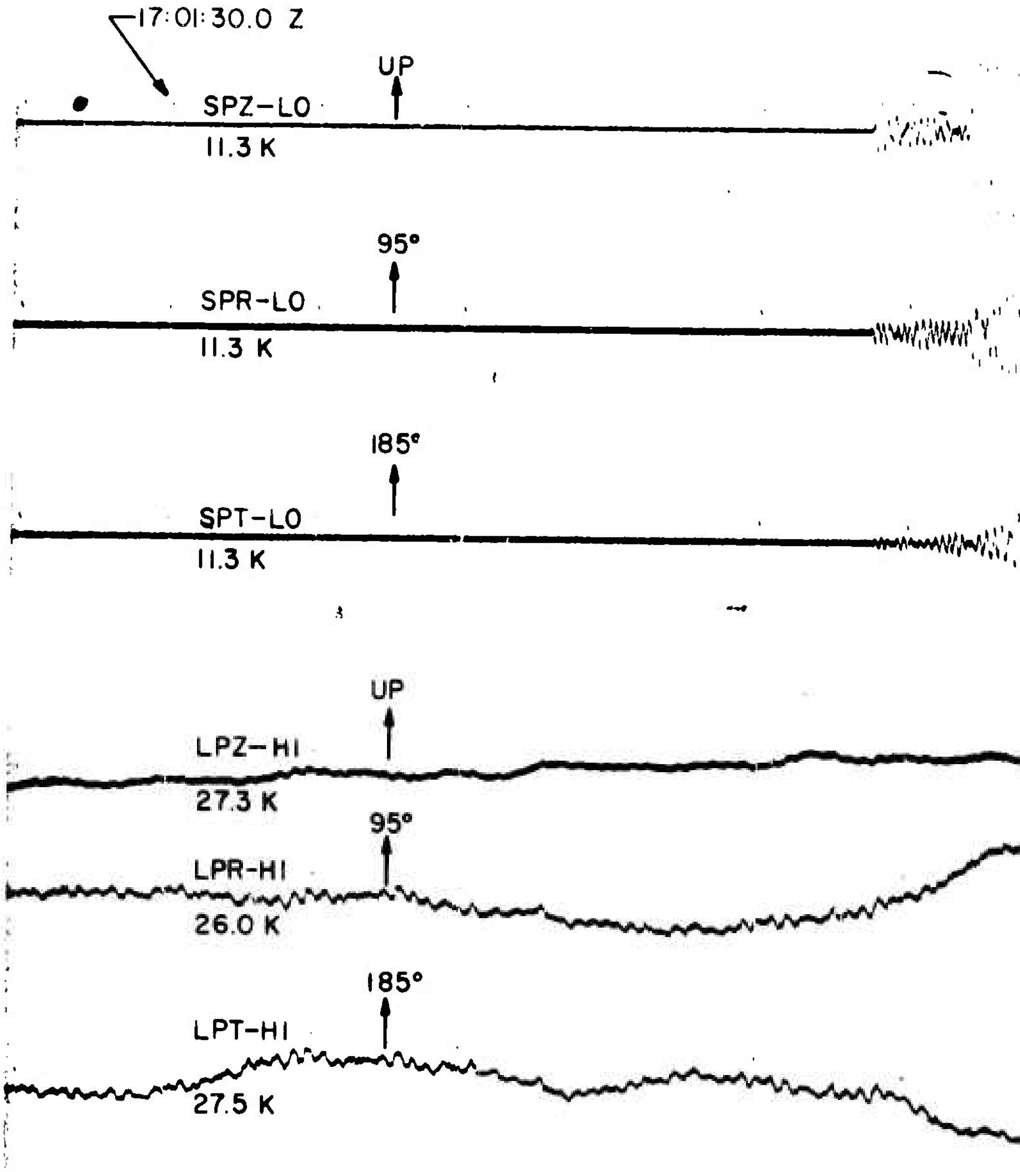
KN-UT

KANAB,

UTAH

23 APRIL 1968

Δ = 317 Km



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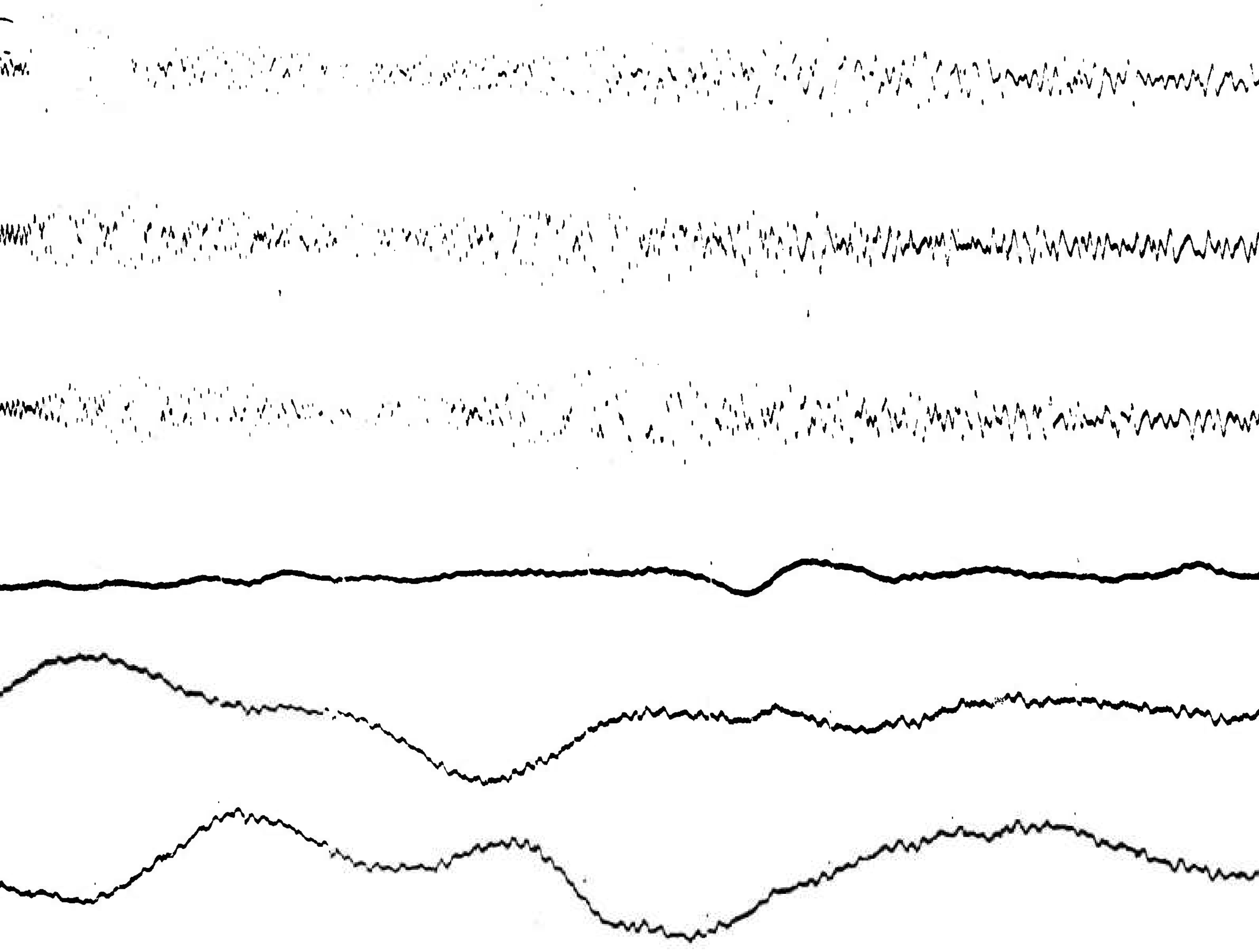

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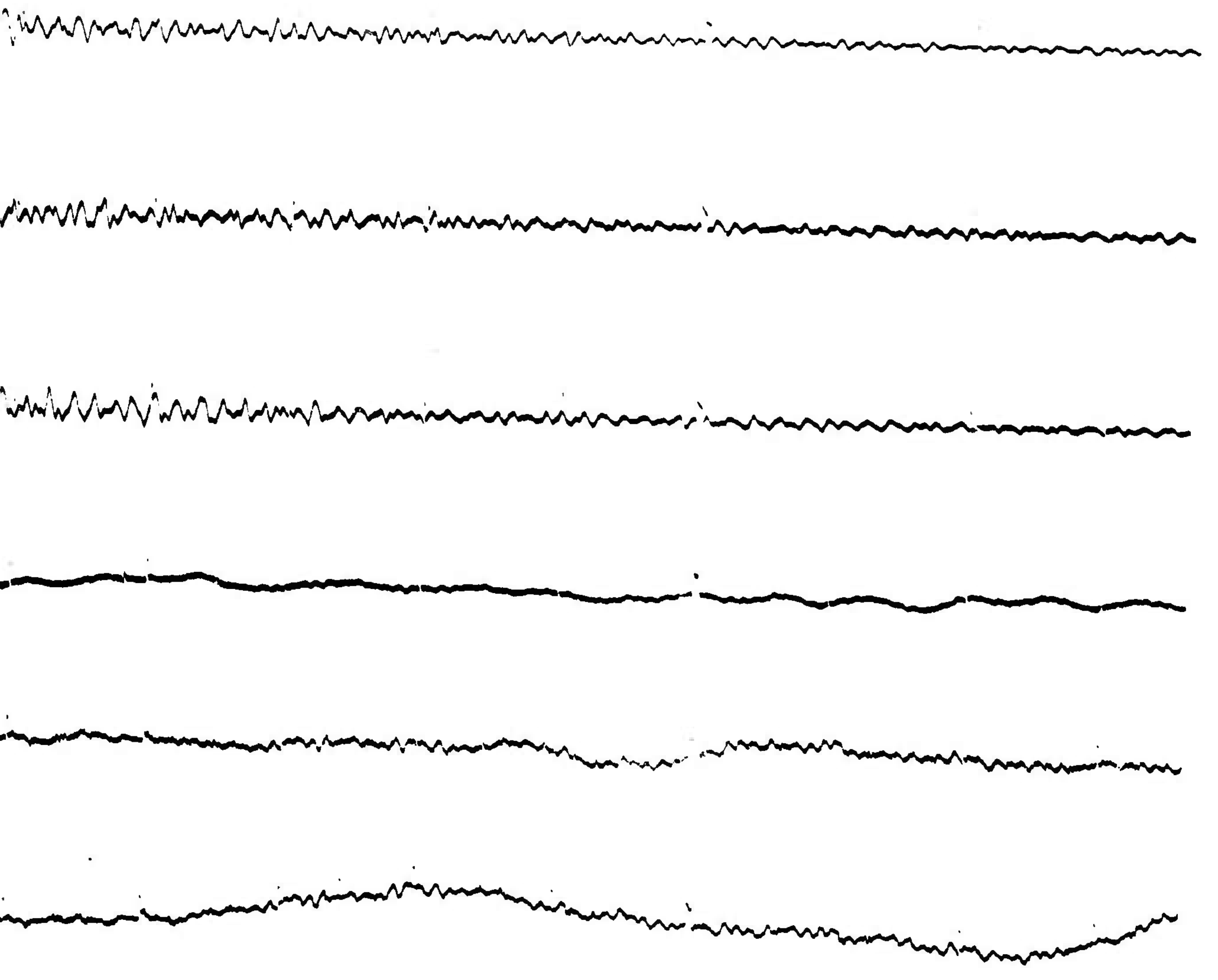
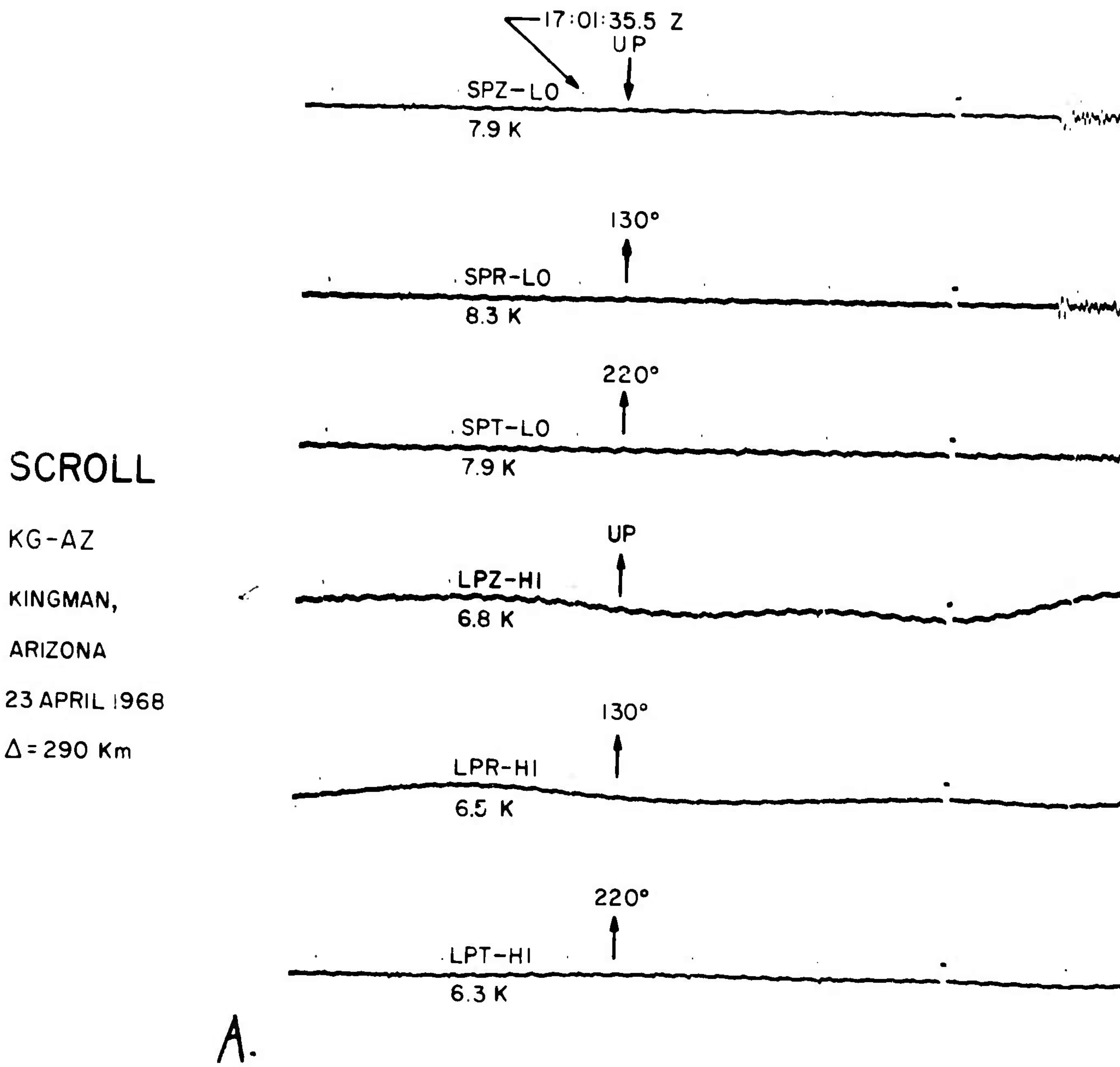
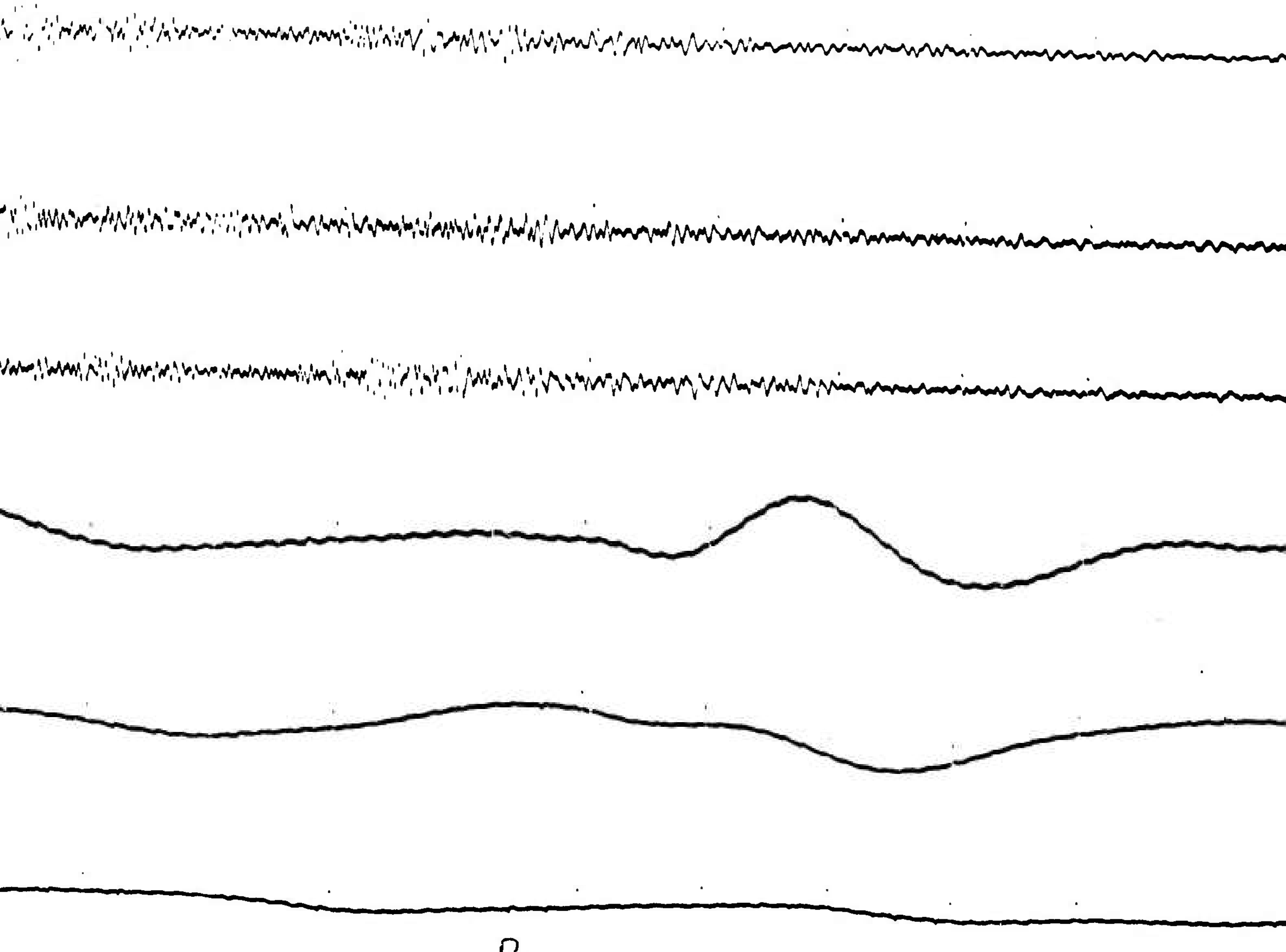


c.



17:01:35.5 Z
UP
SPZ-LO
7.9 K
130°
SPR-LO
8.3 K
220°
SPT-LO
7.9 K
SCROLL
KG-AZ
KINGMAN,
ARIZONA
23 APRIL 1968
Δ = 290 Km
UP
LPZ-HI
6.8 K
130°
LPR-HI
6.5 K
220°
LPT-HI
6.3 K
A.



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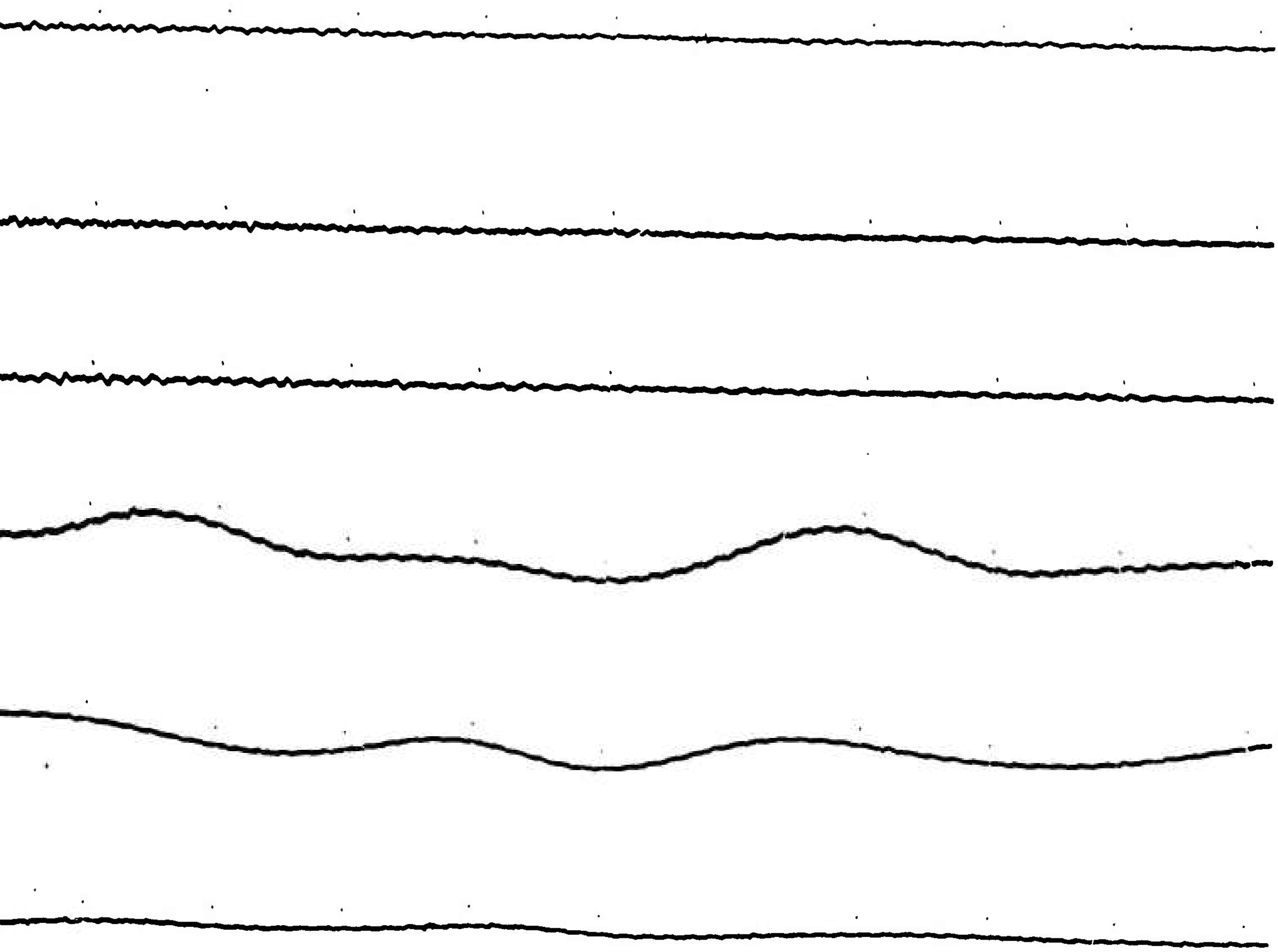

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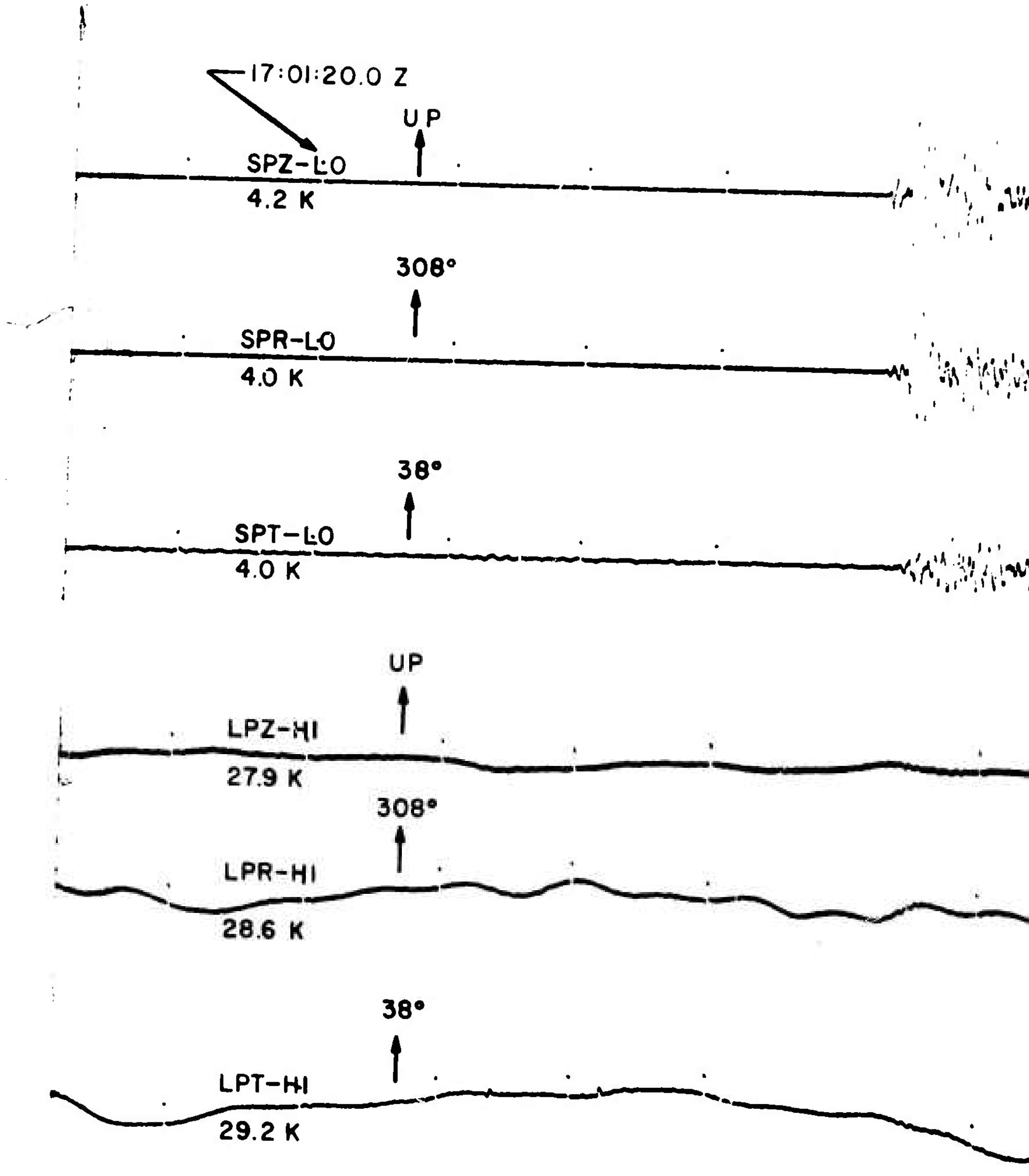


SCROLL

MN-NV

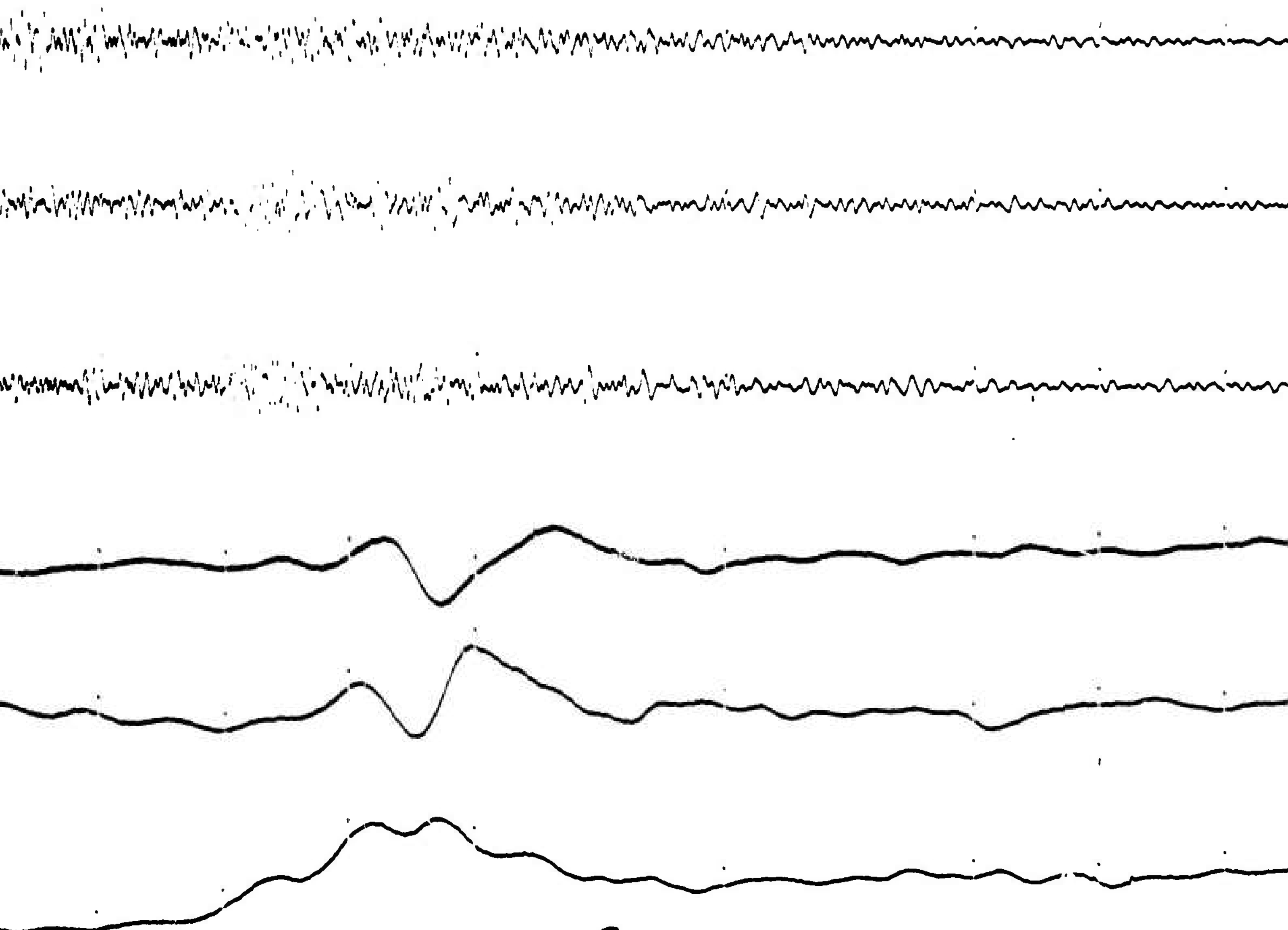
MINA,

NEVADA

23 APRIL 1968

Δ=198 Km

A.



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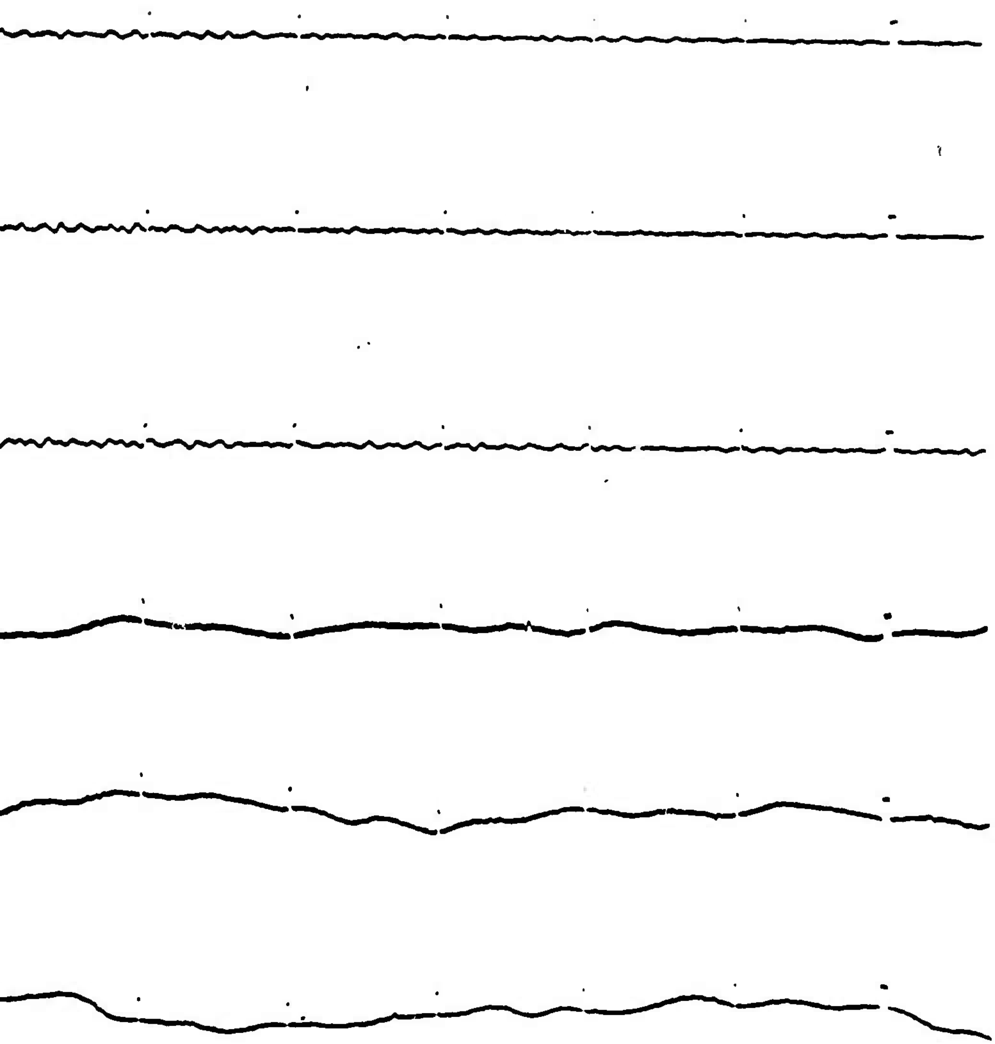

c.