Geophysical Report To Gov't of Canada

CAMERON RIVER "B" PROJECT
SWEDE CREEK "B" PROJECT
1966 - 1967

Hudson's Bay Oil & Gas Nat. Geo.

GEOPHYSICAL REPORT

TO

GOVERNMENT OF CANADA

ON

REFLECTION SEISMOGRAPH SURVEY

CAMERON RIVER "B" PROJECT

SWEDE CREEK "B" PROJECT

Shot For

Hudson's Bay Oil and Gas Company Limited

during winter of 1966 - 1967

By

National Geophysical Company of Canada Limited

On

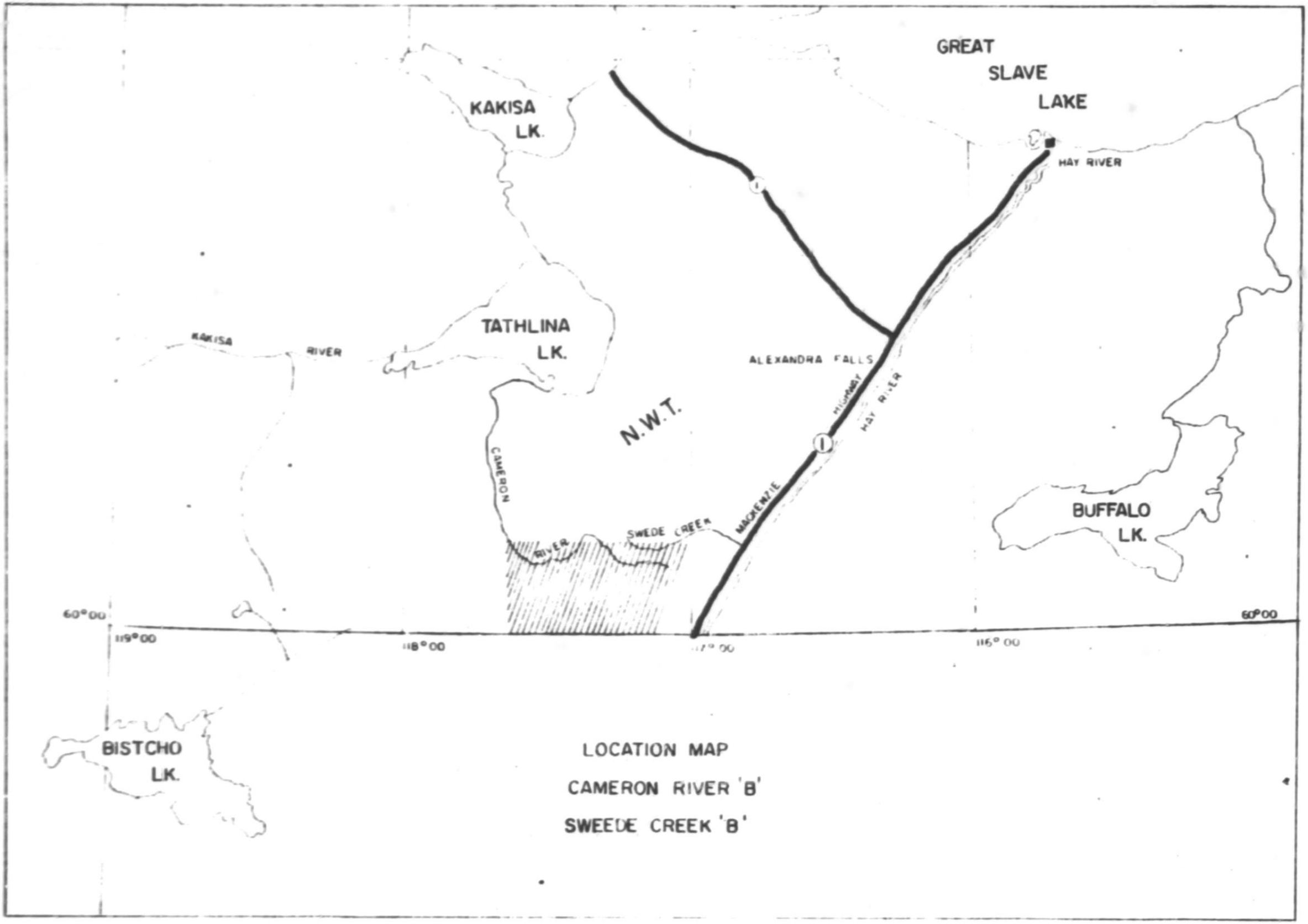
C.P.&N.G. Permits 3214 & 3216

Federal Project Number:

38-6-4-66-1

C. L. LAKE

January, 1971



LOCATION MAP

CAMERON RIVER 'B'

SWEEDE CREEK 'B'

SEISMIC REPORT

on the

"VIBROSEIS" SURVEY

of the

CAMERON RIVER "B" PROJECT

and the

SWEDE CREEK "B" PROJECT

Latitude 60° - 00' to 60° - 10'

Longitude 117° - 00' to 117° - 55'

In the Northwest Territories, Canada

Submitted to

HUDSON'S BAY OIL & GAS COMPANY, LIMITED

By

NATIONAL GEOPHYSICAL COMPANY OF CANADA, LIMITED

A TELEDYNE COMPANY

Party No. 324
Winter 1966-67

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I N D E X (Continued)

INTRODUCTION

Presented herewith are results obtained by National Geophysical Company of Canada, Limited, Party No. 324, in the seismic survey of the Cameron River "B" Project and the Swede Creek "B" Project in the Northwest Territories, Canada. The Projects are separated by 117° - 20' West Longitude. Seismic control is continuous and the data relative in the two Projects.

The Project area lies between 60° - 00' and 60° - 10' North Latitude and 117° - 00' and 117° - 45' West Longitude. The eastern boundary of the Project is approximately 12 miles northwest of the village of Indian Cabins, Alberta.

The field crew was quartered in a mobile trailer camp. The office staff was quartered in the City of Calgary, Alberta.

Field operations commenced December 19, 1966 and ceased March 15, 1967. Work continuity was interrupted for 12 days by Christmas Holidays for the field crew.

The survey was conducted with the "VIBROSEIS" system for Hudson's Bay Oil & Gas Company, Limited, by National Geophysical Company of Canada, Limited, Party No. 324. Mr. E. J. Gates was the Party Manager, Mr. J. H. Pollard the Party Chief and Mr. J. H. Jackson the Supervisor.

A total of 171.6 miles of 600% basement coverage were recorded during the winter operations: 143.7 miles in the Cameron River "B" Project and 27.0 miles in the Swede Creek "B" Project. This control included both detail of previous work in the area and additional reconnaissance lines.

The primary purpose of the assignment was to delineate more precisely possible Middle Devonian Reef trends and separations thereof as indicated by the previous shooting. The secondary purpose was to search for additional Middle Devonian trends by extension of seismic control. The control was tied to the Shell Kakisa River No. 1 well located approximately six miles west of the project boundary.

Interpretation of stacked data in the project was a joint effort of Mr. D. C. Burtt of Hudson's Bay Oil & Gas Company, Limited and Mr. J. H. Pollard of National Geophysical Company of Canada, Limited. Each party presented separate contoured versions of the same data.

In addition to the National Geophysical data, about 83 miles of data in the Cameron River Project and 3 miles in the Swede Creek Project were reviewed and incorporated into the interpretation. This work was 600% shooting done by Seismograph Service Corporation, Party 149-A during the winter of 1966. (1965-66 season)

DISCUSSION

The results of the seismic survey in the Cameron River "B" and Swede Creek "B" Projects are presented herewith by the following maps:

1. Alexander Falls to Slave Point Isochron
2. Slave Point to Precambrian Isochron

A surface elevation map was also submitted.

All program recorded during the winter's operations was in the form of continuous common depth point (600%) recording. The final interpretation was made from the record sections of the stacked data. Reviewed and integrated in this interpretation is 86 miles of 600% SSC conventional sections from the previous winter. It was necessary to apply corrections to the SSC data of +.008 second for the Alexander Falls - Slave Point interval and -.002 second for the Slave Point - Precambrian interval.

Of the two isopach maps submitted, the Alexander Falls - Slave Point interval map is considered to be the more reliable, due to the superior reflection quality of the Slave Point event to that of the Precambrian event.

The identification of horizons used for mapping purposes was obtained by correlating record sections to the synthetic record from the Shell Kakisa

River No. 1 well tied by VP 4015, Line 60° 06.5 at the extreme western portion of the project. The geographical co-ordinates of this well are 60° 06' 22" N. Latitude and 117° 54' 49" W. Longitude.

The most prominent feature shown is Anomaly "A", which is located near the central portion of the Cameron River "B" Project with the apex located near VP 1289 of Line 60° 04'.

The Alexander Falls - Slave Point isochron map indicates about .025 second thinning and the Slave Point - Precambrian isochron map about .035 second thickening at VP 1289, Line 60° 04'. The areal extent of 1200 feet and seismic closure of this feature are confirmed by two nearby cross lines, 117° 28' - 31' (National) and 117° 30' (SSC). With this existing seismic control, the apex of this anomaly is considered to be well defined.

Anomaly "A" appears to have about .040 seconds east-west turnover in the Keg River zone, where reef build up would be expected. Extremely steep Keg River dips are present to the east near VP 1287. All these factors suggest the possible presence of a Keg River reef, with the windward side to the east.

The quality and continuity of the Precambrian event deteriorated somewhat across this anomaly. An alternate interpretation is possible, which would show a Precambrian high across the anomaly.

Of secondary importance is Anomaly "B", located in the south-central portion of the project with the apex located near VP 1622, Line 117° 27.5'.

About .030 second of thinning is indicated for the Alexander Falls - Slave Point interval and about .020 second thickening for the Slave Point - Precambrian interval. Steep dips in the Keg River zone are present, but much less continuous than those observed at Anomaly "A".

Of interest in the project are several widely scattered leads, where critical thickening and thinning occur, but lack sufficient seismic control to be classed as anomalies. The two most promising leads are:

Lead "A", Line 117° 32' near VP 2422. Desired seismic thickening and thinning are present, the Precambrian event continuous, and good continuous steep dips in the Keg River Zone are indicated.

Lead "B", Line 117° 25' near SP238. Substantial amount of Slave Point - Precambrian thickening, good steep dips in Keg River zone and continuous Precambrian reflection. Unlike other features in the project, very little thinning for the Alexander Falls - Slave Point interval exists.

Other leads which warrant attention are as follows:

Line No.	Near VP or SP
60° 10'	2815
60° 00'	112

Line No.	Near VP or SP
117° 20'	383
117° 20'	46
117° 29' - 33'	4774
117° 40'	4093

The isochron maps indicate a general northwest-southeast trending of the anticlinal and synclinal axis. Alternate contouring is possible, due to the relatively large seismic loops. The Alexander Falls - Slave Point Isochron map shows a general thickening to the northeast. This is probably due to a decreasing interval velocity to the east. (Refer to Velocity Data).

Structurally, this project appears to have a number of areal closures of 1000 feet or smaller. Probably many more of these closures exist, and can only be detected by detailed seismic control.

On both anomalies and some of the leads mentioned, the Precambrian event appears to "sag" in the critical locales. One possible explanation of this "sagging" could be that structural closure is present on the flattened reflection, the Alexander Falls, with the amount of turnover being shown as a low on the Precambrian event. If this is true, then structural dips on events below the Alexander Falls are greater than indicated on the stacked sections.

Initial processing of data involved the flattening of the Hay River Limestone event. No reasonable data presentation resulted. The Alexander Falls event was then flattened, with good results. From geological information available in and near the project, it is evident that the Hay River Limestone is an erosional surface, and if flattened would not present a true picture of the structural configuration of any event deeper.

RECOMMENDATIONS

Anomaly "A" has the desirable seismic conditions for a test of the Slave Point formation and the Keg River zone. The best location appears to be at VP 1289, Line 60° 04'.

Should a test at Anomaly "A" prove to be successful, east-west control would be necessary over Anomaly "B" to determine a drilling site.

Lead "A" would require additional north-south and east-west control due to alternate contouring possibilities.

Lead "B" should be detailed further, to determine if the desirable Alexander Falls - Slave Point thinning is present in this vicinity.

Since the size of the closures in the project appear to be about 1000 feet, detailing of the project, or portions thereof, should be done by a grid of not greater than 1000 feet.

OPERATIONS

1. General Accessibility

Field work for the entire winter's operations was conducted from one campsite. The accessibility of this campsite from the village of Indian Cabins on the MacKenzie Highway is as follows:

North 3 miles on the MacKenzie Highway, west 9 miles on a trail, 6 miles north to the Alberta-N.W.T. Boundary, 2 miles west, 5 miles northwest and then 3 miles north. The campsite was located on SSC Line 117° 25' near SP 265.

The village of Indian Cabins is located 80 miles south of the town of Hay River, N.W.T. on the MacKenzie Highway.

(a) Surface Conditions

The portions of the project in which work was conducted were very lightly wooded with small trees and shrubs, interlaced with tracts of muskeg. The existing drainage patterns did not restrict field operations.

(b) Topography

The terrain, in general, was gently rolling hills with few extreme changes in elevation being encountered. Both projects are located on a regional plateau, the Cameron Hills. Numerous lakes and creeks are present atop this plateau in both projects.

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The maximum elevation surveyed during the course of the winters operation was 2772 feet above sea level located at VP 540, Line 117° 10'-18', Swede Creek "B" Project.

The minimum elevation surveyed was 2143 feet above sea level at VP 2649, Line 60° 10', Cameron River "B" Project.

The principal source of drainage of the project is the Cameron River, which is in the central portion of the Cameron River "B" Project, and flows to the northwest, emptying into Tathlina Lake. Drainage in the eastern portion of the Swede Creek area is eastward, eventually emptying into the Hay River.

(c) Logistics

A mobile trailer camp consisting of five units and a trailer mounted power plant provided accommodations for the field crew at the campsite. Refer to the previous discussion under "General Accessibility" for details regarding the location of the campsite and distance for the supply route to the town of Hay River, N. W. T.

The average driving time to and from the field for a 10 hour day was 2.1 hours.

Initially, a two-way single-side band radio was installed in the party manager's office; the reception was sometimes poor or contact impossible. A mobile radio was installed, and reception and contact

with the camp was generally good.

2. Surveying

(a) Permits and Releases

A permit from the Department of Lands and Forests was obtained by the Client.

(b) Surveying Instruments

Surveying in the project was accomplished by use of a T-1A Wilde Theodolite. Ground stations were posted by the surveyor on a sepia with a scale of 1" = 4000'.

(c) Bench Marks

The take-off elevations for the work conducted during the winter's operations were established from bench marks on the Alberta-N.W.T. Boundary.

(d) Elevation and Traverse Ties

Survey ties were established by ties to previous control in the area, closed loops or double run stub lines. Ties were considered to be within the limits of error.

3. Outside Services

(a) Bulldozing

Three to four bulldozers as warranted by field operations were

contracted from Bain Brothers of Edmonton, Alberta, for the purpose of cutting line, cleaning line, snow plowing, and towing vehicles over the more rugged terrain.

(b) Camp and Catering

Five mobile trailer units contracted from Atco Services, Ltd., of Calgary, Alberta, provided living accommodations for the field crew.

Catering services were contracted from Crown Caterers Company, Ltd., of Edmonton, Alberta.

4. Recording

(a) Equipment

Description of the "VIBROSEIS" System

The "VIBROSEIS" System and the conventional seismograph are similar in that both methods transmit energy from or near the surface of the earth. This energy is refracted, reflected and diffracted and is received by a receptor. Both systems measure events in terms of time.

The distinguishing difference is the method of providing the energy source. When dynamite is used, the energy comes from an explosion which generates many seismic frequencies. With the "VIBROSEIS" System, a vibrator is used for the energy source. The output "sweep" of the vibrator is a continuous signal of constant amplitude. The frequency change of the sweep is linear with time. The frequency content and

time duration of the sweep can be controlled. The use of the continuous signal as the energy source necessitates special recording and data processing techniques which are quite different from those of the conventional seismograph. Recording is accomplished in such a manner that several individual "sweeps" are composited into one record.

Recording on the magnetic tape is the basic step in compositing. The time resolution of events is accomplished by a process called cross correlation. The correlation process is a means of transforming continuous energy "sweeps" into normal impulses or wavelets. Refer to Figure I, Block Diagram of the "VIBROSEIS" System.

Definition of Terms

Sweep	A signal with continually increasing or decreasing frequencies.
Spectrum	A given range of frequencies; usually the frequency range of a vibrator sweep.
Nest	A group or array of geophones
Source Array or Drag	The distance traversed by the vibrators while imparting a set number of vibrations into the earth.
VP - Vibrator Point	Center of vibrator pattern.

Offset-in-line Spread	Recording spread removed from vibrator patterns are interchanged from their normal positions. (2 LT on H.B.O.G. Terminology)
Readout Tape	The tape containing the correlated data
Field Tape	The tape containing the uncorrelated field data

Instruments

Recording Truck	No. R-466
No. of field recording channels	24
Type of recording amplifiers	Applied Magnetics Model-II tube type
Record heads	24 sigma flux, 20 positions each
Recording tape	Mandrel type 3M-713, white screen 7.313 inches wide
Recording tape speed	Half speed Techno 1.795 IPS
Record filter response	See Figure II
Geophones	Hall-Sears Model L-2, 14 cycle, wired 10 per string in series, individual damping resistors. D.C. resistance per string approximately 400 ohms.
CDP Cables	10 (24 pair) 1320 feet long
Spread types	Continuous common depth point split (in-line offset)

Standard spread length	2420 feet
Effective group interval	220 feet
Spread arrangements	See Figure III
Filters used	Wideband - 60
Correlator	Sequential Applied Magnetics Model I tube type
Readout tape	Mandrel type 3M-713 green screen, 7.313 inches wide
Readout tape spread	Techno 3.590 IPS
Readout format left to right	0.375 inches to first track No. 1 - timing No. 2 -25 - seismic data No. 26 - zero time No. 27 - zero time No. 28 - timing Refer to Figure IV
Transfer and Correlation Amplifier Response	See Figure V
Field Playback Amplifiers	National 26A
No. of amplifiers	12
Amplifier frequency response	See Figure VI
Camera Speed	10 IPS
Playback filter	BH-CL (18-30-57)

Vibrators	2 to 3 Failing Phase Compensated Servo-Hydraulic
Sweep length	7 seconds
Sweep spectrum used	56-17
Sweep pattern	440 feet (in-line)
Sweeps per drag	20 per vibrator
Data Processing	Continental Oil Company Ponca City, Oklahoma

(b) Experimentation

Optimium spread length, offsets, drag and nest lengths were determined at the start of the project on the eastern end of Line 60° 04' in the Cameron River "B" Area.

(1) Noise-interference Spread

Four nests consisting of 20 geophones each were laid side-by-side. Nest lengths were 0, 200, 300 and 400 feet. The source consisted of two vibrators, zero drag length, ten sweeps/vibrator and a 58-12 sweep spectrum. Sources were located 100 feet apart, with 36 traces per receptor nest recorded from an offset distance of 500 to 4000 feet.

(2) Expanding Spread

Laid out 45 stations, 200 foot group interval.

Laid out 45 receptor stations, 20 seis/trace over 380' linear.

Source: 2 vibrators, 20 sweeps/vibrator over 400' linear drag length.

Sweep: 58-12

Recording Procedure:

Source	Receptors
12	23-45
23	12-34 (#23 disconnected)
34	1-23

Result: Common sub-surface coverage of 2200 feet from offsets of 200 to 6600 feet. Three 11 trace records and three 12 trace records.

(3) Sweep Comparisons with varying source & receptor lengths

(A) Laid out 24 stations - 200' intervals from offset of 200 - 4800 feet

Laid out 24 receptor stations, 20 seis/trace over 380'

Source: 2 vibrators, 20 sweeps/vibrator over 400' linear drag length.

Sweeps: 58-12, 56-17 and 47-15.

Result: Six 12 trace records.

(B) Same receptor nest as (A)

Source: 2 vibrators, 20 sweeps/vibrator over 200' linear drag length.

Sweep: 56-17

Result: Two 12 trace records.

(C) Same receptor nest as (A).

Source: 1 vibrator, 20 sweeps over 400' linear drag length

Sweep: 56-17

Result: Two 12 trace records

(D) Re-arranged receptor nest to 20 seis/trace over 200'

Source: 2 vibrators, 20 sweeps/vibrator over 200' linear drag length

Sweep: 56-17

Result: Two 12 trace records.

(E) Same receptor nest as (D)

Source: 2 vibrators, 20 sweeps/vibrator over 400' linear drag length

Sweep: 56-17

Result: Two 12 trace records.

Discussion of Experimental Spreads

From the experimental sweep, drag and receptor comparisons it was determined that the 56-17 sweep produces slightly better results. Secondly, the near trace offset had to be as near as possible to the source, due to the excessive normal moveout and attenuation of shallow events with distance. The comparison of records with the

200 feet versus 380 feet linear nests revealed more clearly defined frequency content for the shorter nest, due to very rapid changes in the weathered layer. Since there was little difference between the 200 and 400 foot linear sources, it was deemed advisable to use the longer drag, to reduce vibrator diesel noise and to better attenuate refraction breaks which sometimes interfered with the Hay River event on the far traces. The following parameters were determined and adhered to over the entire project:

Recording: Always use 2 vibrators, 20 sweeps per vibrator
440 foot linear drag;
220 foot station interval;
20 seismometers/trace over 220 foot linear nest;
56-17 sweep frequency;
770-3190 foot offsets, balanced split spread; and
never less than 6 fold coverage.

Correlation: Expander settings:

Delay: 0 7/8 (.300 second from zero time)
Rate: 750 MFO
Ratio: 4.5 (6/1 expansion)
These settings are applicable only for double speed correlation.

Field record playback:

Paper speed:	10IPS
Filter:	Bi-CL (18-30-57)
AGC:	Yes
Mix:	None (1 circuit)

(c) Routine Instrument Checks

At the start of the project, before any field work was performed, the following equipment checks were made:

1. Head alignment checks for readout and recording heads;

2. Modulation level similarity;
3. Head tracking similarity in correlator;
4. Amplifier similarity on final readout amplifiers;
5. Seismometer similarity (by use of shaker table);
6. Vibrator similarity; and,
7. Complete system check (recording, correlation and playback). In this test a signal from an index is sent through each of the recording channels. The resultant field tape is correlated and played back. This checks the complete system trace by trace from recording to correlation to readout.

After commencing field operations, the following tests were conducted monthly or more frequently:

1. Index bridle;
2. Head alignment checks for the readout and recording heads;
3. Vibrator similarity (weekly).

COMPUTATION

Due to the nature of the digital program set up by Continental Oil Company in Ponca City, no computations were necessary for stacking of data in the project.

1. Preparation of Data for Digital Processing

As nearly as possible, readout tape numbers were kept sequential to avoid confusion in the playback center.

Each line of readout tapes sent to Ponca City was accompanied by a stack diagram. This diagram indicated surface positions of stations, sub-surface positions and source numbers of all reflecting points. The surface elevations were plotted above their respective ground points. When applicable, sub-surface reflecting points were deleted and noted when surface sources were skipped.

A blueline print of 100% coverage of field data in sectional form was forwarded to Ponca City with each line.

2. Digital Processing

All lines were stacked by the use of a reflection character window of about .300 seconds in time. Each trace to be stacked was then correlated against this window and aligned in time to the other traces on a "best fit" basis. Percentage limitations of overall phase coherence were set up, so traces that correlated below this limitation were automatically deleted from the stack. The resulting stacked data were then run through the deconvolution process and played out in sections, called Automatic Trace Correlation (ATC's). These sections differ from the final presentation in that statics necessary for flattening and compositing were not yet applied.

The Reflection Alignment (RA) program was then applied to the stacked tapes with a .300 second character window, resulting in corrected sections flattened near the Alexander Falls event. Mixing (25G) was applied after flattening.

Two lines were of such poor reflection quality that the RA program would not work. Line 60° 06.5' was flattened manually, while the ATC sections on Line 60° 10' were used for interpretation.

It is noteworthy that the "VIBROSEIS" data over such a large area was quite adaptable to this method of digital processing, probably due to the reasonably constant frequency content of reflected events. From experience with shot records in this area, it is doubtful that comparable results could be obtained using this same digital process. The stacking program, in particular, is many times faster than any known manual method; and in that it seeks out an overall correlation over a period of time, undoubtedly more accurate.

INTERPRETATION

1. Velocity Data

(A) Source of reflection identification was a synthetic record from the Shell Kakisa River No. 1 well in the western portion of

the Cameron River "B" Area. The co-ordinates are 60° 06' 22" N. Latitude and 117° 54' 49" W. Longitude, N. W. T. Initial sections were correlated to the synthetic records, and identifications later confirmed by a tie on Line 60° 06.5'.

Also available was a synthetic record from Hudson's Bay - Cameron Hills 12-30 well to the south of the project. Location is LSD 12, T125, R19, W5M, Alberta.

(B) CVL Times from wells:

SHELL KAKISA RIVER NO. 1

Reference: Surface

Surface Elevation: +2548

Formation	Depth (ft.)	2 Way Time	Interval Velocity	Interval Time	Seismic Interval Time at well
Hay River Ls.	1838	.522			
Ft. Simpson Sh.	2638	.614			
Alexander Falls	3168	.720			
			11,917'/s	.266	.295 at VP4015 Line 60° 06.5'
Slave Point	4753	.986			
Muskeg	4958	1.008			
Keg River	5308	1.046	19,468'/s		Precambrian event not usable at VP4015
Chinchaga	5538	1.070			
Precambrian	5668	1.080			

II. B. CAMERON HILLS 12-30

Reference: Surface
Surface Elevation: +1315

Formation	Depth (ft.)	2 Way Time	Interval Velocity	Interval Time	Seismic Interval Time at Well
Hay River Ls.	528	.144			
Ft. Simpson Sh.	968	.210			
Alexander Falls	1318	.280			
			10,755'/s	.318	Alexander Falls NR at SP99 SSC Line 117° 20'
Slave Point	3028	.598			
Muskeg	3238	.620			
Keg River	3728	.670	19,907'/s	.108	.111 at SP99 SSC Line 117° 20'
Chinchaga	3963	.692			
Precambrian	4102	.706			

Both the sonic log and the velocity survey reference shot times check out excellently for the Shell Kakisa No. 1 well, after the shots were computed to a surface reference.

Only the CVL log was used for the times in the H.B. Cameron Hills well. This log provided good character correlations with the Shell Kakisa River No. 1 CVL log. Due to erratic near surface conditions reference shots in the H.B. Cameron River velocity survey would not agree with times from the CVL when computed to a surface reference.

(C) Well Ties

The Shell Kakisa River No. 1 well was tied by Line 60° 06.5', a "VIBROSEIS" line. The seismic interval for the Alexander Falls - Slave Point interval is thicker by .020 second than the CVL time. This can be explained by the fact that according to the synthetic record from this survey, the Alexander Falls formation top is a trough, while both the Slave Point and Precambrian tops are shown to occur on seismic peaks; since all reflections picked in the project were troughs, both the Slave Point and Precambrian seismic events are one-half cycle below their respective geologic tops. A Precambrian pick at the tie point was not usable.

The H. B. Cameron Hills 12-30 well was tied by SSC SP 99, Line 117° 20'. The Alexander Falls pick was not usable at this point. The Slave Point - Precambrian interval tied the CVL log within .003 second. (See CVL Times)

(D) Velocity Changes

The two CVL logs indicate decreasing interval velocities to the east. No velocity information is available in the northeastern portion of the area where the Alexander Falls - Slave Point seismic intervals are relatively thicker; since this portion of the area is regionally up-dip and geologic intervals thinner, the overall time intervals are probably not a true representation of the relative geologic thickness over the

geologic interval could be thinner at Anomaly "A" than near the Shell Kakisa No. 1 well, the thinnest seismic points in the project for that interval.

(E) Source of NMO Curve

After trial and error with NMO curves computed from both CVL logs, it was decided that a better curve could be made by analyzing initial field data on Line 60° 04'. Four reversed profiles with common surface positions were used, and moveout times were plotted for a maximum offset of 3190 feet versus two-way record time at zero distance. This curve was used in data processing, and checked with field data over the project. The NMO curve used is as follows:

X M X = 3190 Feet

2 Way Time	.400	.450	.500	.550	.600	.650	.700	.750	.800	
NMO	.225	.190	.167	.140	.122	.105	.092	.085	.071	
2 Way Time	.850	.900	.950	1.00	1.050	1.100	1.150	1.200	1.250	1.300
NMO	.064	.058	.055	..053	.052	.051	.050	.050	.049	.049

2. Field Records

A preliminary interpretation was made from field records for the Alexander Falls-Slave Point interval. Poor reflection quality of the Precambrian event did not permit the making of a deep isochron map. Every sixth source was used. (1320 feet sub-surface). It was necessary to apply a -.005

interval correction to the "VIBROSEIS" data to tie SSC shot data. Ties with the SSC lines were very good, and with two exceptions the preliminary map agreed reasonably with the final interpretation.

This procedure was considered quite necessary to determine location of additional lines in the project.

3. ATC Sections

Over all anomalies and leads, the Alexander Falls event was flattened manually, and a pencil tracing made on a transparancy and printed. The resulting segment was picked and compared with the final stacked sections. This was done as a check against the flattening program (RA) used by the Continental Oil Company Playback Center.

4. Corrected Sections

In addition to the mapping horizons, a band of energy in the Keg River zone was analyzed. The reflection quality and continuity in this zone was fair to good. Whenever steep dips or possible steep dips were observed, the location of these steep dips was marked on the isochron maps, in the event these dips can be associated with reefing in the project.

RECOMMENDATIONS FOR FUTURE WORK

1. Field Procedure

It is believed that the 770 - 3190 foot trace offsets are close to

optimum distance for "VIBROSEIS" work in the project. It is recommended however, that the station intervals and receptor lengths be shortened from 220 feet to 190 feet and used in conjunction with a 380 foot source length. Use of a 4 interval near trace offset, near and far trace distances would be 760 feet and 2850 feet respectively. This would result in:

(a) Better resolution of steep dips in the Keg River zone.

(b) Improved frequency content and response of shallow events.

In areas of poor record quality and where detail work is done near anomalies, it may be advisable to obtain a 12 point stack. By shortening the vibrator drag length to 190 feet, it would not be necessary to back up the vibrators after every drag; however, this shorter drag length is not advisable during windy conditions, and should be evaluated closely to insure that increased vibrator noise does not invalidate results.

No change in the sweep frequency is recommended.

2. Interpretation of Field Records

It is recommended that closer sub-surface values be obtained by measuring intervals at every third source versus every sixth source previously used. Since the size of the anomalies in the project are quite small, the accuracy of the preliminary maps would be improved.

3. Digital Processing

As digital techniques become more sophisticated, evaluation of possible reefs will become more simple. New programs have already been developed by the Continental Oil Company Playback Center since the completion of work in the project.

One such program is the Time Varying Filter (TVF). Reef zones generally respond to higher frequencies and with application of this program it may be possible to enhance record quality in the Keg River zone. Optimum filter in this zone would have to be determined by digital frequency analysis by increasing the low cut filter at or near the Slave Point event, which possibly could result in better resolution of the Keg River event in anomalous areas.

PRESENTATION

1. Maps Submitted

Structure Maps:

There were no structure maps submitted or requested by the Client. The necessary information required for making corrections for weathering and near surface velocity variations is not normally obtained with the "VIBROSEIS" system of recording.

Isochron Maps:

Alexander Falls - Slave Point - a two way time interval between events identified as the Alexander Falls and Slave Point. Three maps cover the lines worked in the project.

Slave Point - Precambrian - a two way interval between events identified as the Slave Point and Precambrian. Three maps are submitted.

Surface Elevation Maps:

A surface elevation map was posted by the H.B.O. & G. Drafting Department.

2. Sections Submitted

All record sections have been submitted under separate cover.

NATIONAL GEOPHYSICAL COMPANY
OF CANADA, LIMITED

J. H. POLLARD - Party Chief

J. H. JACKSON - Supervisor

CONTENTS OF APPENDIX

APPENDIX

1. Transmittal of Original Data

All original data, including maps, records, tapes, record sections, synthetic records, velocity surveys, computation sheets, survey notes, plane table sheets, observer's reports, and survey monument reports were transmitted to Hudson's Bay Oil & Gas Co. Ltd., in Calgary, Alberta.

All readout tapes used in making record sections were transmitted to the Geophysical Section of Continental Oil Company at Ponca City, Oklahoma.

2. Efficiency Statistics

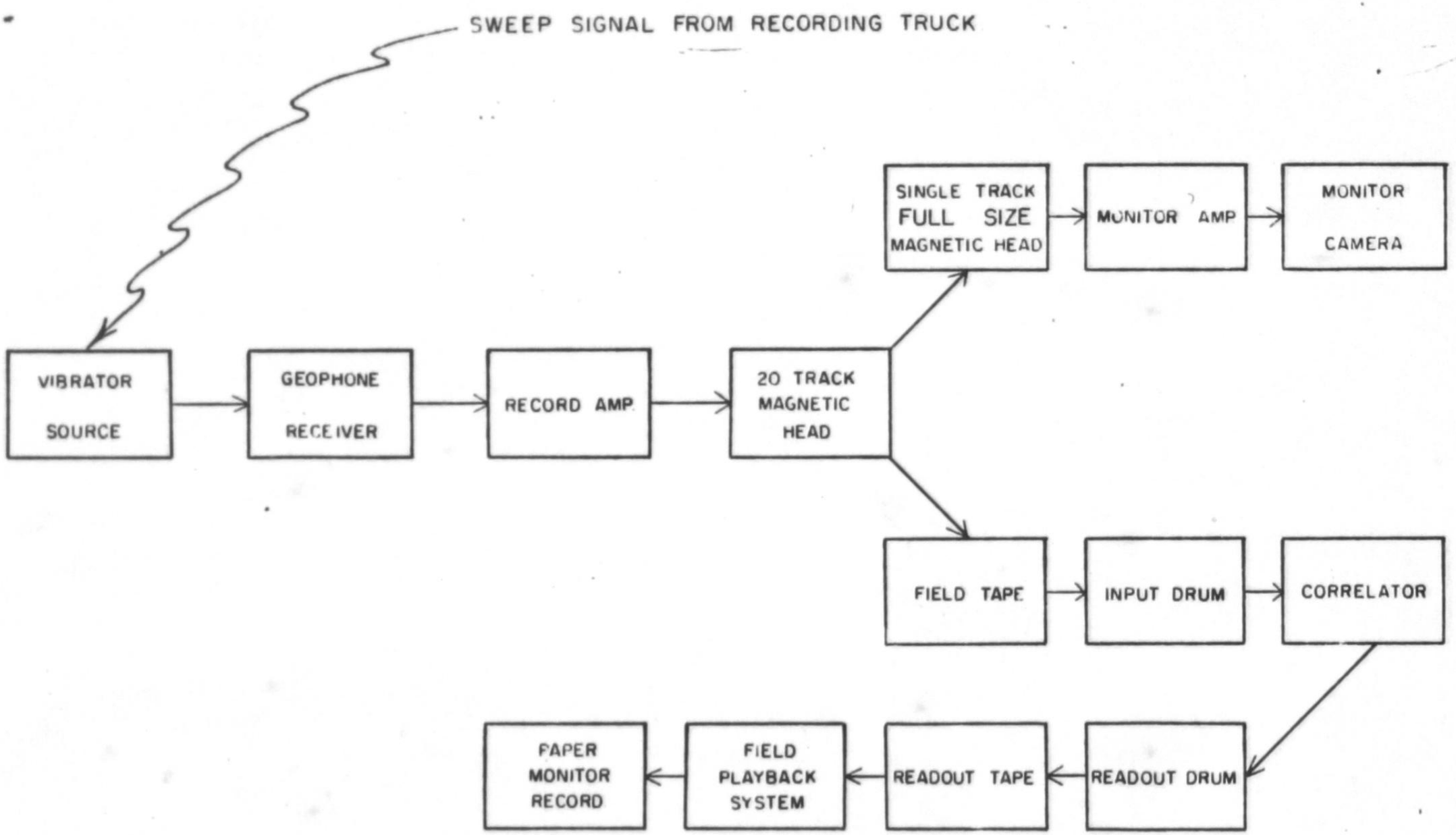
	Cameron River "B"	Swede Creek "B"	Total
Date work started	Dec. 19, 1967	Dec. 21, 1967	
Date work completed	March 15, 1967	Feb. 25, 1967	
Working days	62.40	12.65	75.05
Non-productive working days (move time & holidays)	6.9	0	6.9
Sources Vibrated	1792	320	2121
Basement traverse (miles)	143.7	27.9	171.6
Miles basement traverse per 10 hour day	2.3	2.2	2.3

For additional information regarding efficiency statistics refer to "Statistical Reports", Figures VIIIa through VIIIg, inclusive.
(NOT INCLUDED IN GOVT. REPORT)

A P P E N D I X (Continued)

3. Equipment

Unit No.	Type	Equipment
G-401	5301 Chevrolet 4x4	Cable and Geophone Racks
R-466	5103 Chevrolet 4x4	Electronic Recording Equipment, Radios, etc.
S-307	Apache Chevrolet 4x4	Surveying Equipment, Stadia Rod, Instruments, etc.
V-403	190 International 4x4, Single Axle	Servo-Hydraulic Vibrator run by GM Diesel Engine
V-404	190 International 4x4, Single Axle	Servo-Hydraulic Vibrator run by GM Diesel Engine
V-405	190 International	Servo-Hydraulic Vibrator run by GM Diesel Engine
CT-102	Correlator Trailer	Electronic Equipment for correlating field tapes; Record Playback System
R-14	Apache Chevrolet 4x4 pickup	Supply Truck
G-407	3/4 Ton Chevrolet 4x4	Reel Truck
C-780	Chevrolet Sedan	Party Manager's Vehicle
W-284	2 Ton Chevrolet	Water Tank for Camp Water



BLOCK DIAGRAM OF THE "VIBROSEIS" SYSTEM.

FIGURE I

SEMI-LOGARITHMIC 46 5492

KEUFFEL & ESSER CO.

+5
0
-5
-10
-15
-20
-25
-30
-35

RESPONSE — IN DB

WB - WB

WB - 45

WB - 60

WB - 60

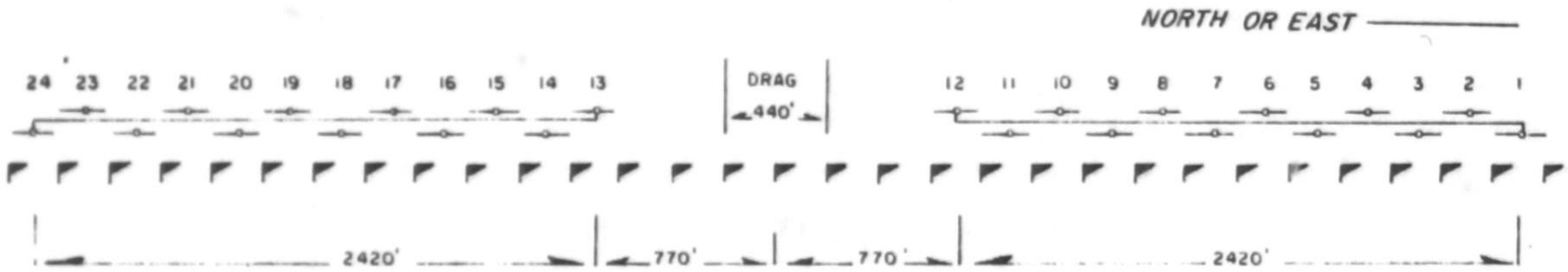
5 10 FREQUENCY (CPS) 100

TEST DATA - VIBROSEIS RECORD AMPLIFIER 6/4/63

FIGURE II

SIX - POINT STACK ROLL - A - LONG

CONTINUOUS COMMON DEPTH SPLIT SPREAD



OFFSET DISTANCE : 770'

DRAG : 20 VIBRATIONS OVER 440'

V. P. INTERVAL : 440'

SPREAD DISTANCE : 2420'

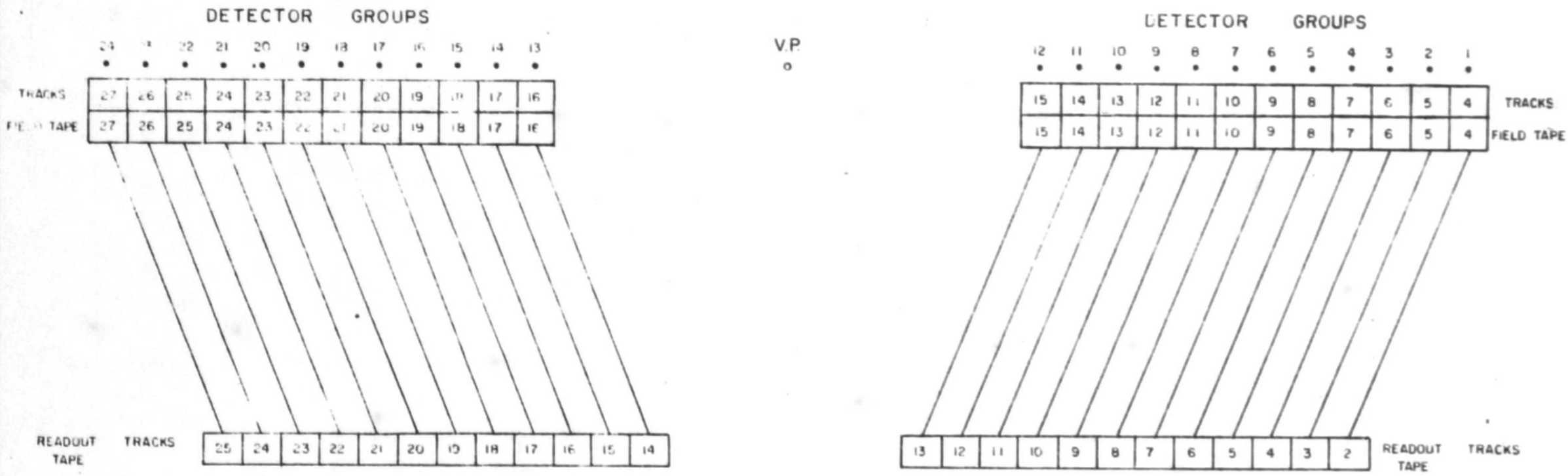
NEST : 20 SEIS OVER 220'

GROUP INTERVAL : 220'

SPREAD ARRANGEMENT

FIGURE III

NO. 1 DETECTOR GROUP ALWAYS NORTH OR EAST



FIELD TAPE TRACKS

1. TIMING
2. SWEEP
3. BLANK
4. 27 SEISMIC SIGNAL

READOUT TAPE TRACKS

1. TIMING
2-25. SEISMIC SIGNAL
26. ZERO TIME PULSE
27 ZERO TIME PULSE
28 TIMING

STANDARD TAPE FORMAT

FIGURE IV

SEMI-LOGARITHMIC 46 5492

KEUFFEL & ESSER CO

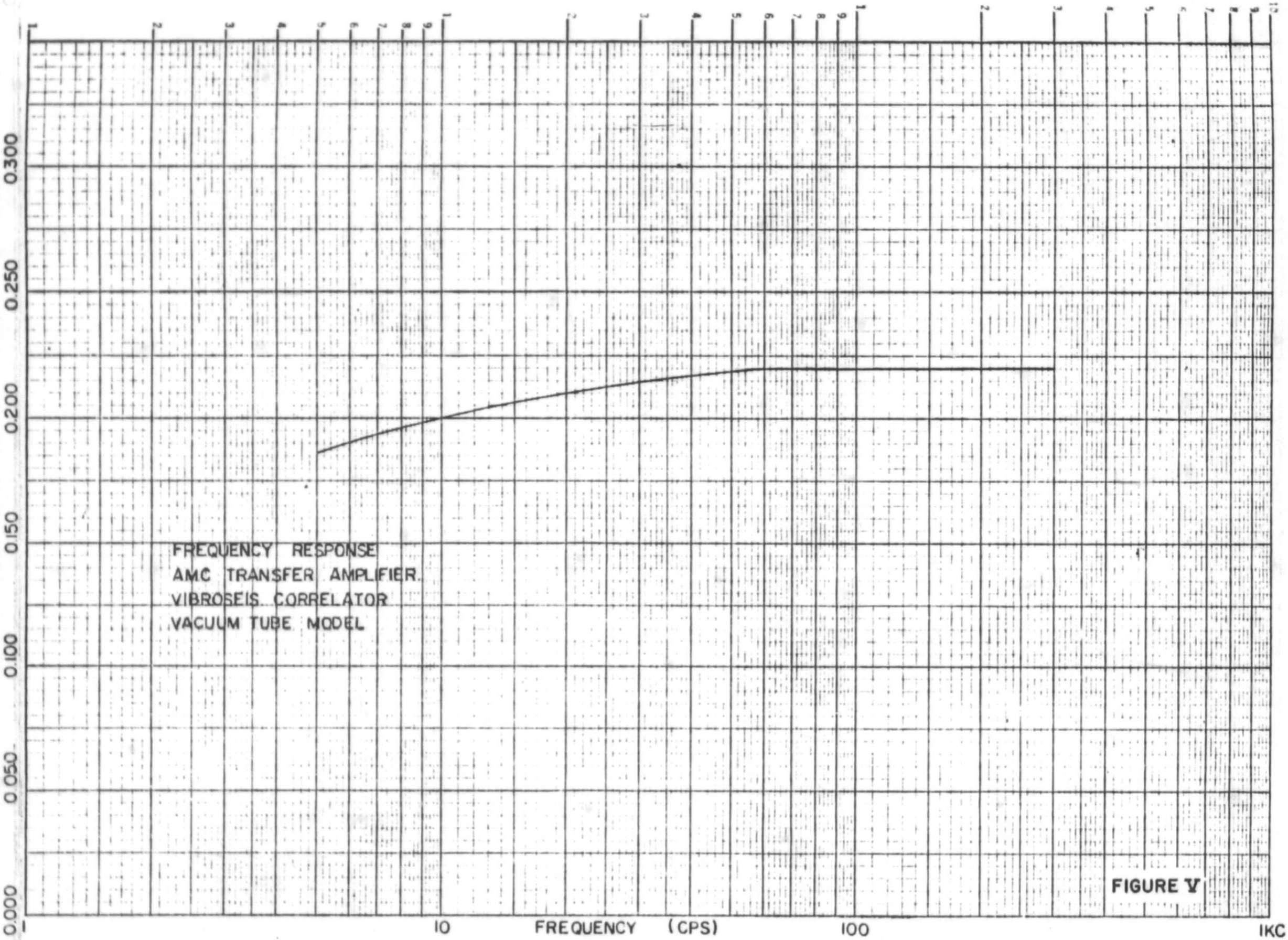


FIGURE V

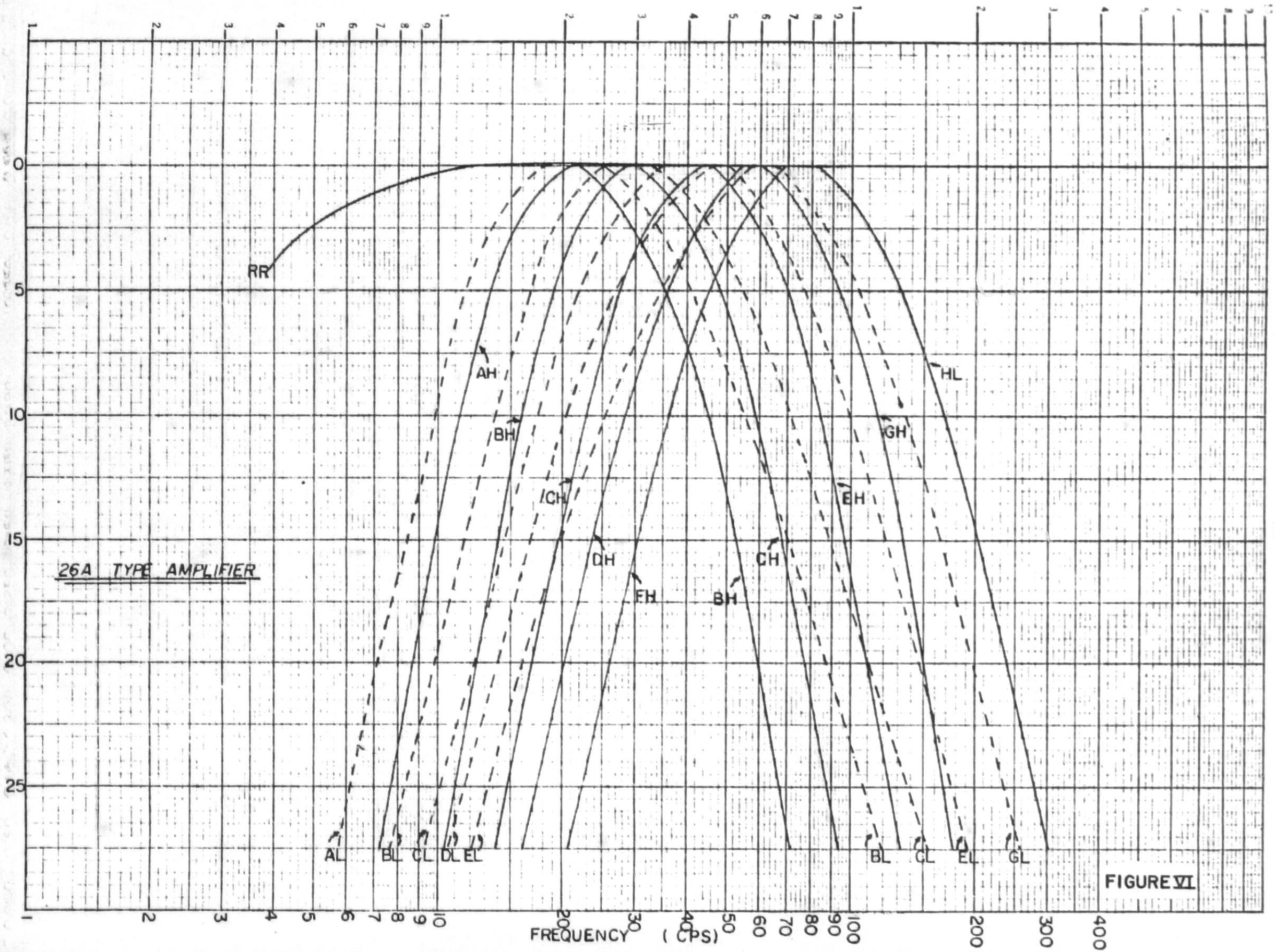
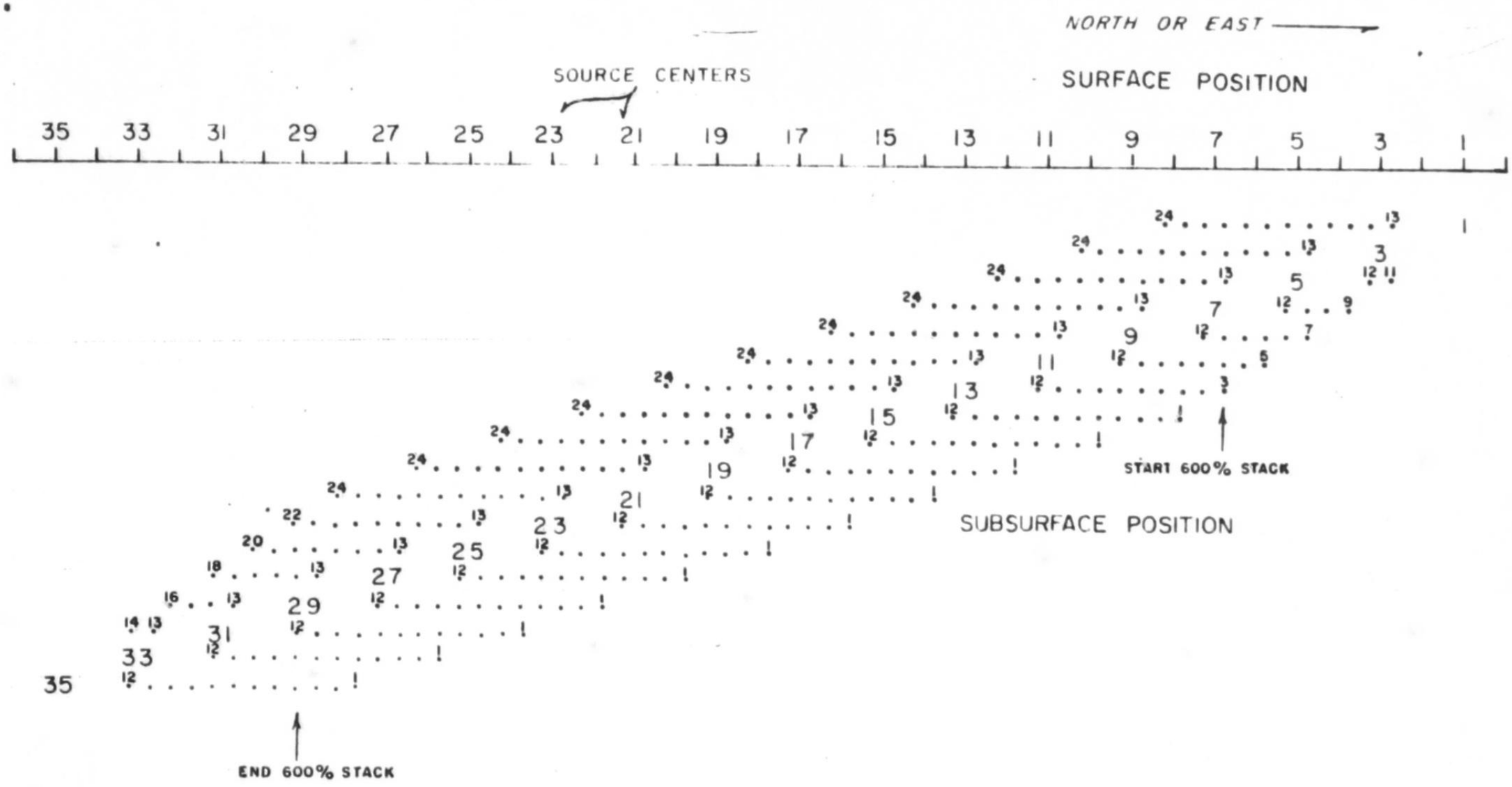


FIGURE VI



CDP STACK DIAGRAM - 600%

FIGURE VII

LINE No. 60° 04'

BASEMENT [Ø14 3/4] PROFILE TYPE 6 pt.

SOURCE 1313 W REC. LOC. Ø1618-1327Ø2

OFFSET 770 - 3190 ft. SPD. DIST. 2420 ft.

ARRAY In Line ARRAY In Line

SIZE 440 ft. SIZE 220 ft.

No. VIBS 2 X 20 No. SEIS. 20 trace

SWEEP 56 - 17 FLD. TAPE 11316

READOUT

P.B. FILTER 17 - 30 - 57 R.O. TAPE 11153 (13-24)

AGC MIX I GAIN 30

AREA CAMERON RIVER

LOCATION NORTHWEST TERRITORIES

CLIENT HUDSON'S BAY OIL & GAS

REMARKS

DATE JAN. 6/67

NATIONAL GEOPHYSICAL COMPANY OF CANADA, LTD.

PARTY No. 324

TIE BSMT	Trace No. 12	at VP / Ei / Dat / E-D / Ve / Te / Tw / T¹	Trace No. 1	TIE BSMT
	at VP		at VP	
	T¹		T¹	
	at VP		at VP	
	T¹		T¹	
	TC [ ]		TC [ ]	

X VP X VP X VP X VP

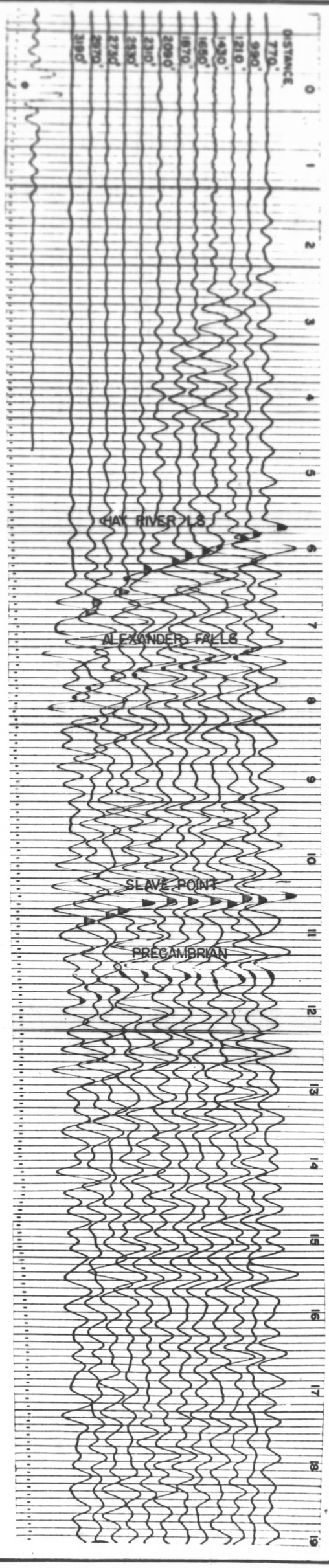


FIGURE VIII

TYPICAL SEISMIC RECORD

CAMERON RIVER "B"

AND

SWEDE CREEK "B"

NORTHWEST TERRITORIES, CANADA

NATIONAL GEOPHYSICAL COMPANY OF CANADA, LTD.