250-6-4-1

EVALUATION

FROM SEISMOGRAPH DATA

OF THE

REDSTONE "G" 847 AREA

NORTHWEST TERRITORIES

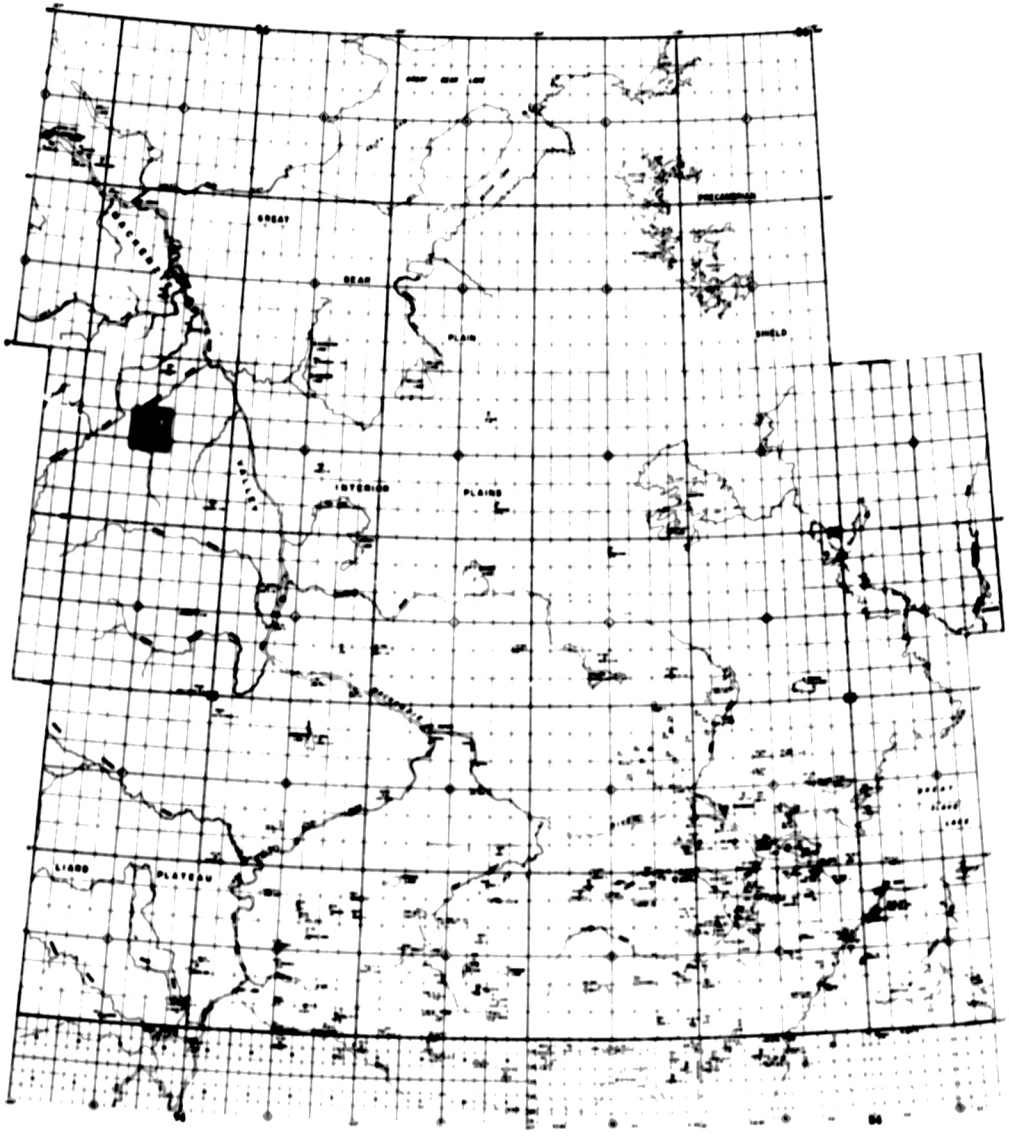
FOR

GOBLES OIL AND GAS LIMITED

PALLISTER and ASSOCIATES

Calgary, Alberta, Canada

November, 1968


GREAT
BEAR
PLAIN
PRECAMBRIAN
SHIELD
INTERIOR
PLAINS
CANADIAN
LABRADOR
PLATEAU

REPORT AREA

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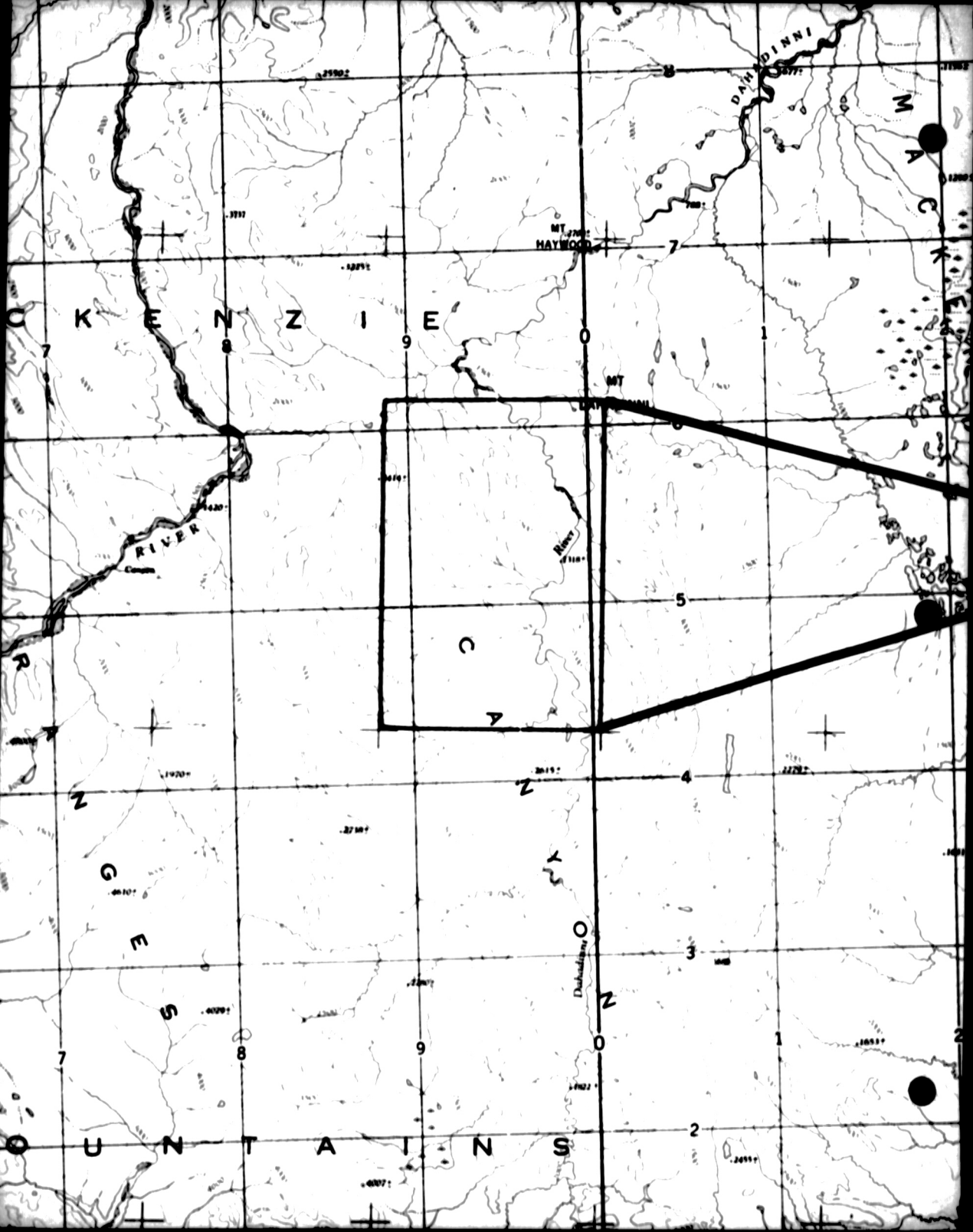
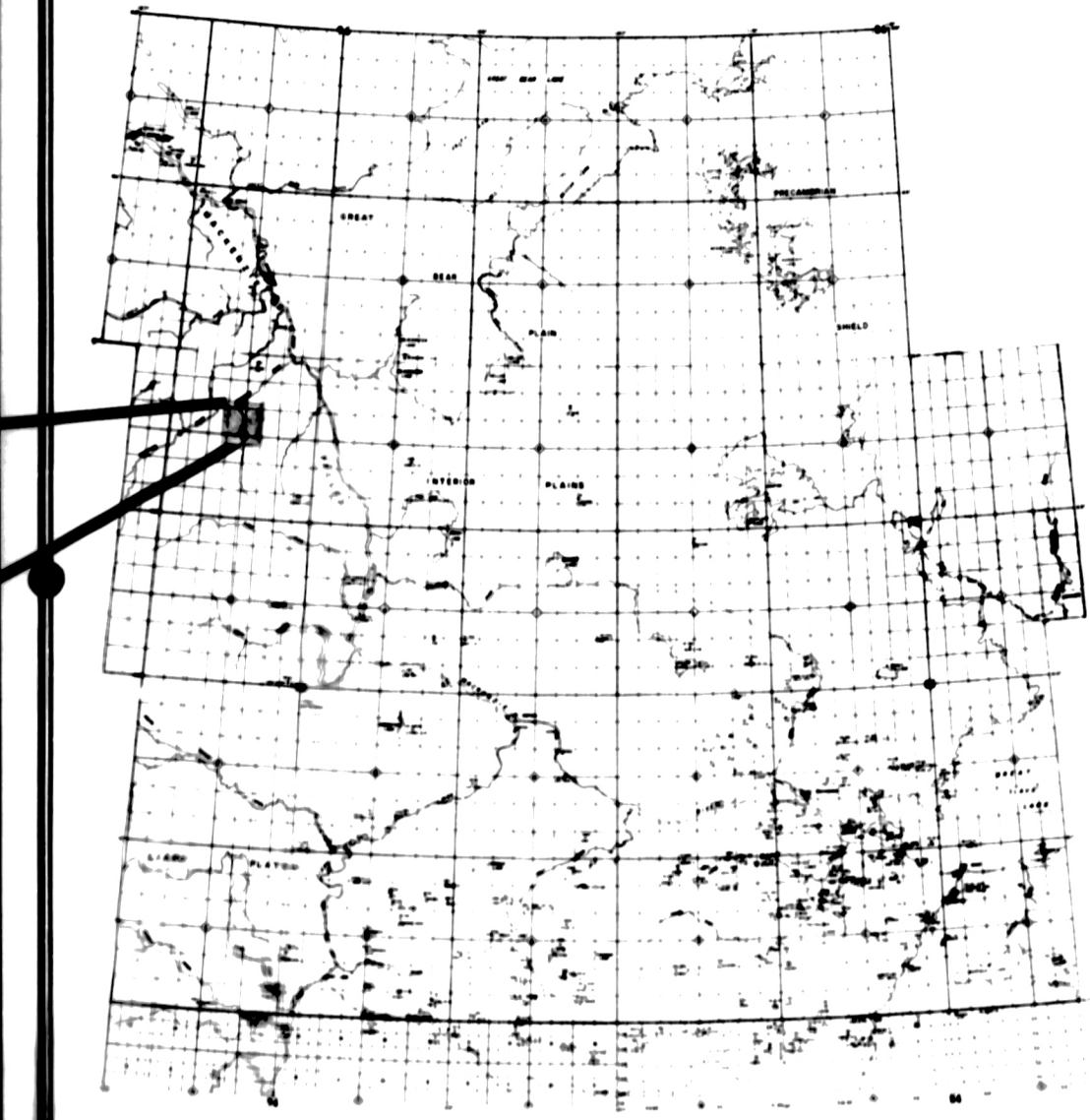
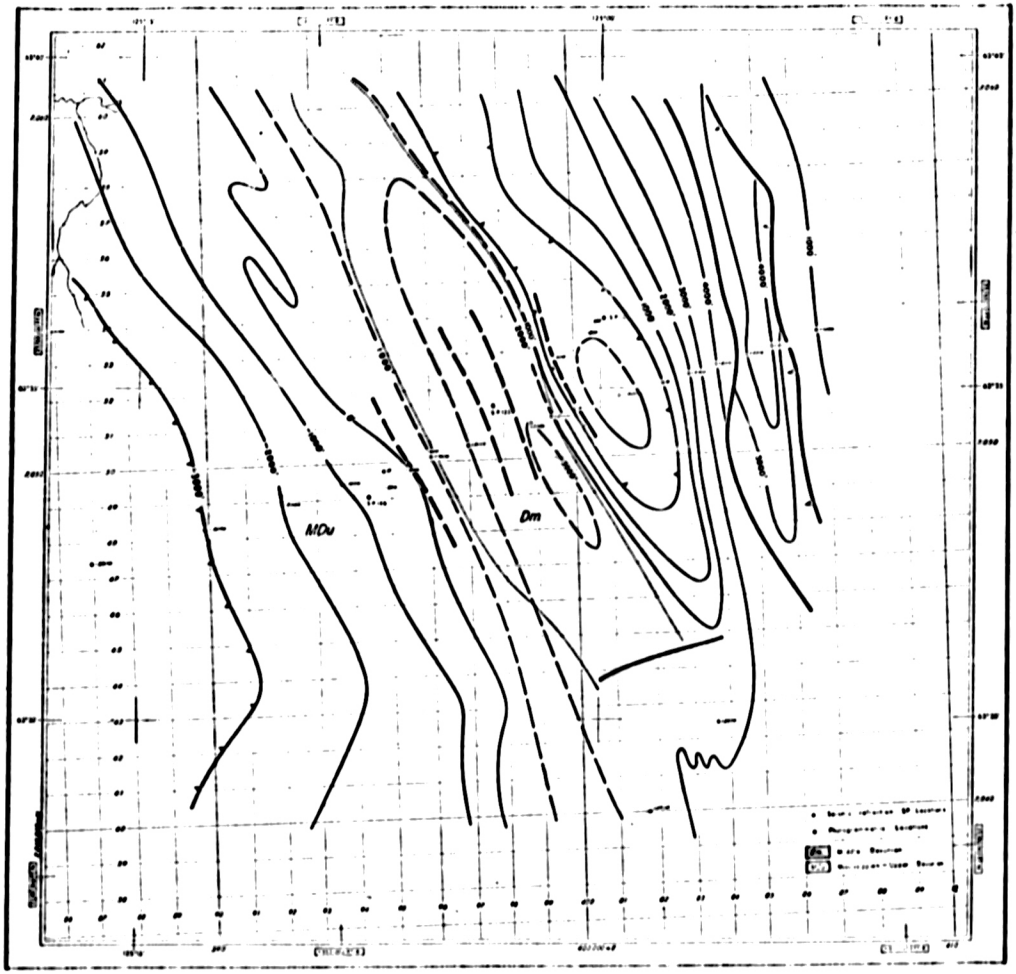
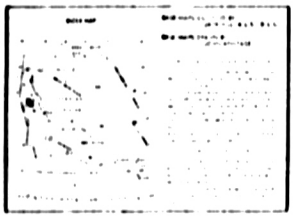

MACKENZIE
MOUNTAINS
RANGE
MT
HAYWOOD
DAHADINNI
RIVER
Dahadinni
7
8
9
0
1
2
3
4
5



REPORT AREA





GOBLES OIL AND GAS LIMITED

NORTHWEST TERRITORIES OF CANADA

[illegible] OSTONE G AREA

SCALE 1 INCH

[illegible] PRESTER and ASSOCIATES

PROJECT [illegible] O 847

MAP NO 1

PART I

ABSTRACT

This report presents the results of the refraction survey in the Redstone "G" area of the Southwest Northwest Territories, Canada. The program was conducted in August, 1968, for Gobles Oil and Gas Limited by Pallister and Associates.

The refraction shooting consisted of a five-mile surface spread profile recorded in-line and broadside from shotpoint locations selected to ensure reception of a high-speed marker believed associated with Middle Devonian carbonates. The objective was to investigate subsurface attitudes to determine if surface structural conditions persisted at depth.

The results of the interpretation suggest that the outcropping carbonates tend to mask deeper structure; however, there is no information which indicates that the surface expression does not persist with depth.

The structural form of the refraction may express a series of thrust sheets or imbrications building up from the west to the main structure of the Dahadinni Range.

EXPLORATION PROGRAM

During August, 1968, a seismic refraction survey was conducted in the Redstone "G" project of the southwestern part of the Northwest Territories, Canada, for Gobles Oil and Gas Limited by Pallister and Associates. Field work was performed by Huntec Limited, Petroleum Geophysics Division, under supervision of Mr. H. E. Bowman; interpretation was by Mr. Bowman and Mr. D. G. Mould of Canwest Geophysical Limited.

The program consisted of two adjacent detector spreads each two and one-half miles long, shot from in-line and broadside shotpoint locations offset a sufficient distance to ensure maximum penetration and to carry a strong refraction believed related to Middle Devonian carbonates.

The area is located immediately west of the Dahadinni Range, about 40 miles west of the Wrigley settlement on the Mackenzie River. The camp was situated near the mouth of the Dahadinni River and travel to and from the area, as well as along the line, was facilitated by helicopters.

Surface topography in the area is characterized by low-lying muskeg and bush-covered countryside dissected by the headwaters of the Dahadinni River.

CONCLUSIONS

The objectives of the survey have been satisfied by the data gathered. The presence of continuing subsurface structure has been shown as well as the complexity of its profile. In addition, some information has been gained as to the extent and structural nature of the overlying material which appears to be faulted.

RECOMMENDATIONS

This seismic refraction survey further substantiates the structural northeast-southwest dip previously mapped and reported by V. Zay Smith Associates Ltd.

The northwest-southeast closure is relatively uncontrolled. However, in view of the structural evidence and potential reservoir formations of Ordovician and Silurian age, this area is considered highly prospective and worthy of further exploratory work.

Respectfully submitted,

C. I. Klipfel

C. I. Klipfel, B.S., P.Geoph.
Senior Geophysicist

STRATIGRAPHIC CORRELATION CHART

ERA	PERIOD		NORMAN WELLS	REDSTONE G AREA
CENOZOIC	QUATERNARY		alluvium and glacial drift	alluvium and glacial drift
	TERTIARY		LARAMIDE OROGENY — cgl, ss, sh, lignite	
MESOZOIC	CRETACEOUS	Upper	EAST FORK sh; LITTLE BEAR ss	
		Lower	SLATER RIVER sh; SANS SAULT ss, sh	sh / ss — K_s
	JURASSIC			
	TRIASSIC			
PALEOZOIC	PERMIAN			
	PENNSYLVANIAN			
	MISSISSIPPIAN			
	DEVONIAN	Upper	IMPERIAL ss, sh	Dsh / Dss — sh / ss; Du / D — sh / ss; FORT
		Middle	CANOL bit. shale; KEE SCARP ? lst limestone; HARE INDIAN (BEAVER RIVER); HUME limestone; BEAR ROCK carbonate breccia / dol & evaporite	HORN RIVER sh — SIMPSON sh & silt; HUME (NAHANNI) ls; HEADLESS ls; LANDRY ls — FUNERAL sh — MANETOE dol; ARNICA dolomite; BEAR ROCK dol, ls, anhyd. breccia
		Lower		SOMBRE dol; CAMSELL ls breccia; DELORME ls & dol-ls; sh
	SILURIAN		RONNING GROUP — MT KINDLE ls	WHITTAKER dol & minor ls
	ORDOVICIAN		GROUP — FRANKLIN MTN sh / ls	? ? ? ?
	CAMBRIAN	Upper	MACDOUGAL GROUP — SALINE R sh & gyp	shale & sandstone ?
		Middle	MACDOUGAL GROUP — MOUNT CAP sh	
		Lower	KATH. GP. — MOUNT CLARK ss, qtz	? ?
PRECAMBRIAN			congl, sh, ss, ls & dol	sh, ss, sltst, congl & dol ?

eroded surface — facies change

PART II

GEOLOGIC CONTROL

A structural and stratigraphic evaluation of this area was previously made by V. Zay Smith Associates Ltd. This interpretation consisted of detailed photogeologic mapping.

The stratigraphic correlation chart on the opposite page illustrates the gross stratigraphic column in this area and is related to that of the Norman Wells area to the northwest.

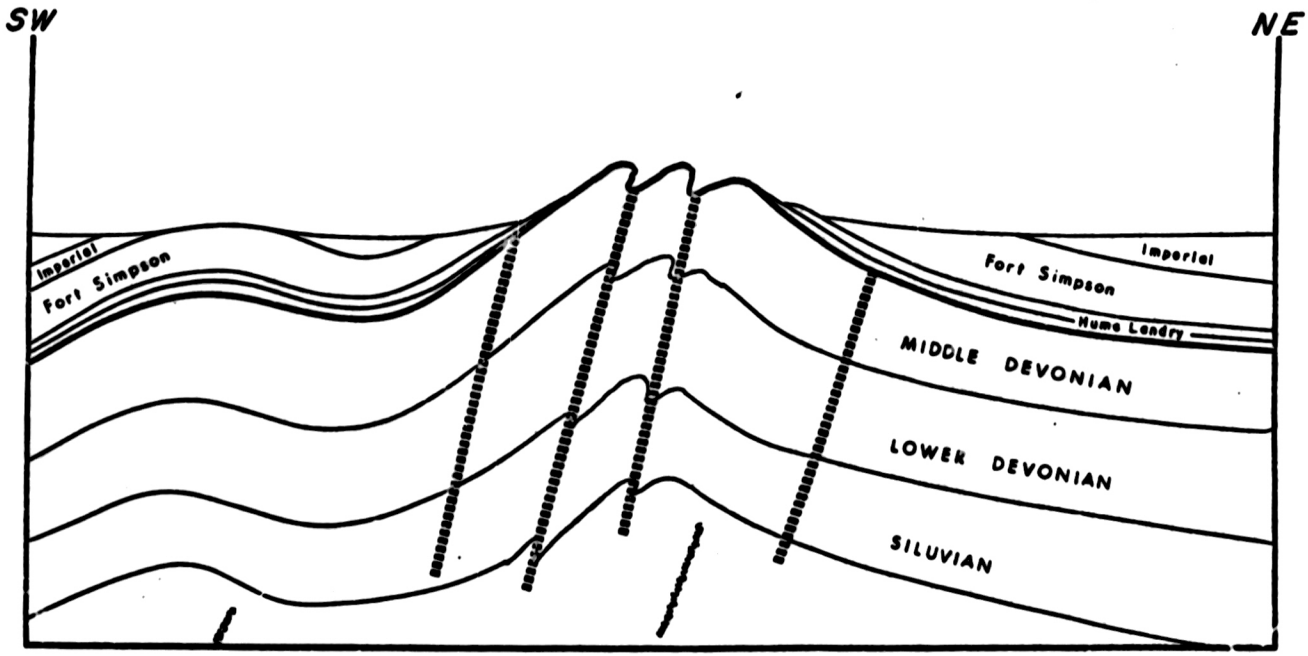
The project is located in the south-central Dahadinni Range trending north-northwesterly. This range is bounded on the west by the Mackenzie Mountains and on the east by the gently folded sediments of the Mackenzie Plain.

Steeply dipping beds of the Hume Formation define the outer flanks and indicate an essentially symmetrical structure.

Oldest rocks exposed in the area are those of the Arnica Formation. Drilling objective would be the Lower Devonian, Silurian and Ordovician Formations.

SEISMOGRAPH APPRAISAL

The quality of the data acquired is considered good. The area was well suited to this type of survey at least to the extent that the Middle Devonian carbonate section was massive, provided a good velocity contrast to the overlying formation, and could be expected to act as a good refraction marker bed. Penetration through the massive carbonate was not achieved.



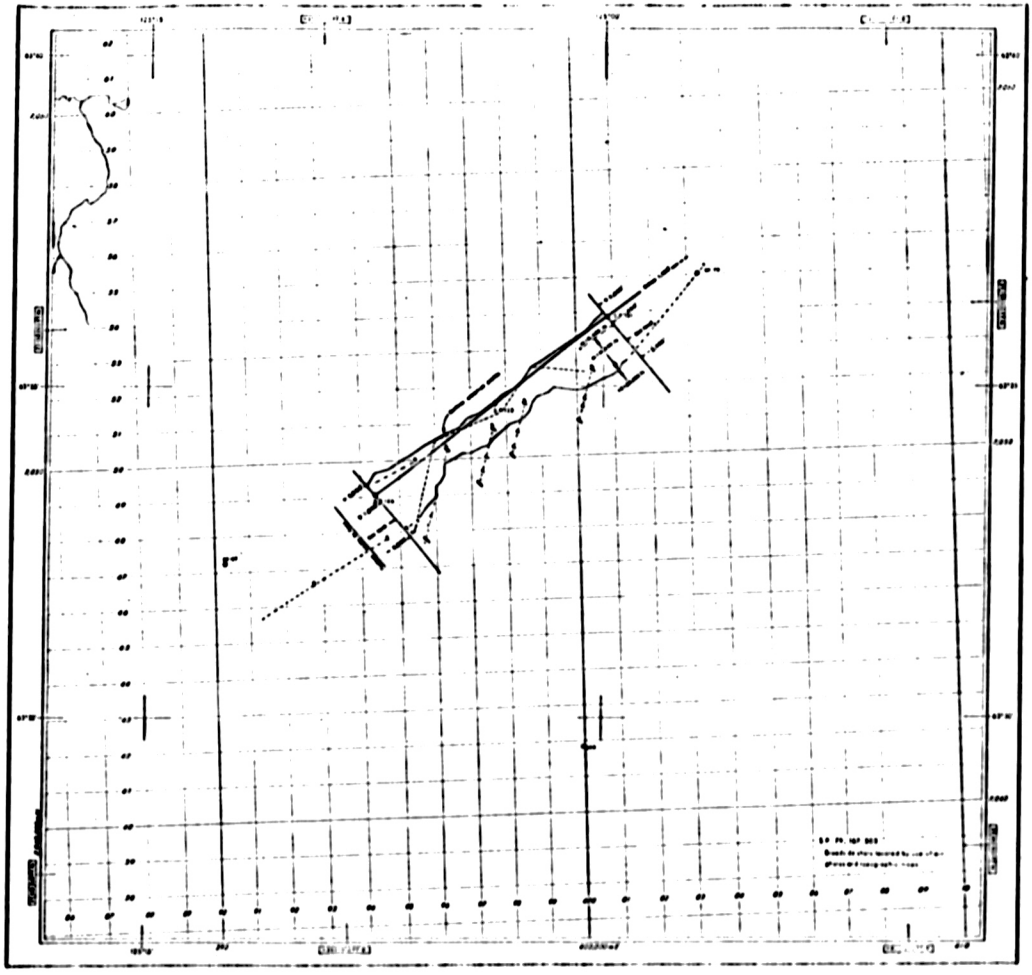
DIAGRAMMATIC X-SECTION OF REDSTONE G AREA N.W.T.

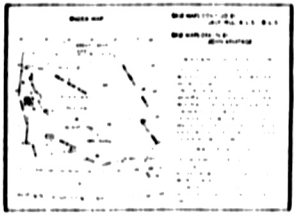
INTERPRETATION PROCEDURES

Raw refraction times were picked and plotted in the field as the first step in the interpretation and to control the offset distances required to follow the primary marker. Velocities recognized on this plot were the basis for preliminary computations for datum corrections, delay time calculations, and mid-point depth estimates.

Datum corrections were made to convert each refraction to a horizontal velocity reference surface established at +1400 feet using a correctional velocity of 8000 feet per second along the angular entrance and emergent path. No effort was made to correct for weathering variations at this stage.

Corrected refraction times were plotted versus distance-from-shot to form time-distance curves of all events noted. The slopes of the various segments were registered and averages were determined from reversed profiles to estimate the true refracting velocity. (See time-distance plots enclosed). Delay times were then computed by removing the theoretical horizontal time at the appropriate marker velocity between shot and detector from corrected refraction times to leave a residual entrance and emergent delay time. The delay times were, firstly, plotted in their respective surface positions, then related to adjacent spreads to form a continuous relative delay time curve. At this stage, two curves in surface position extending over the line were compared to identify the residual effects of surface conditions (weathering and elevation). Manageable computing disorders were removed to smooth the curves.





GOBLES OIL AND GAS LIMITED

NORTHWEST TERRITORIES OF CANADA

REDSTONE G AREA

SCALE 1:50 000

E. J. PRILISTER AND ASSOCIATES

REFRACTION PROFILE

PROJECT NO. B-17 MAP NO. 2

The corrected delay times were checked for reciprocity and the reverse time law and then substituted into multi-layer mid-point formula to determine the depths and thicknesses of refractors noted. Velocity functions were computed and the migration distance from emergent point to surface detector calculated.

Using the migration distances gained from the preceding, the two relative delay time curves were shifted to place the delay times in their true subsurface emergent position. Note that migration is a function of depth and velocity and is variable; migration distance variations between adjacent mid-point computations were treated linearly and prorated over the intervening distance.

The two migrated relative continuous delay time curves were averaged when appropriate to form a single average migrated continuous delay time or relative time-depth curve. In this process up-dip components measured from up-dip shot hole environments were preferred to the opposite due to the geometry of the paths; this is particularly evident in steep dip zones.

The mid-point depth estimates were placed on the depth profile and the relative depth curves from delay times were superimposed to measure coherence. Differences observed were identified as ambiguities and attempts were made to reconcile by a system of second approximation.

In the preceding, steps were taken to check the accuracy of the initial estimate of the true horizontal velocity. The reversed delay time curves in subsurface positions offer a simple check on the original velocity assumption since the two curves when correctly migrated should show similar dip attitudes and be parallel; if not, then the horizontal velocity used in their calculation was wrong and the measure of divergence between the curves is a measure of the error.

This formula was used:

$$\frac{1}{V_{true}} = \frac{1}{V_h} + \frac{dt}{dx}$$

Where:

Vtrue is the true horizontal refracting velocity

Vh is the horizontal velocity assumed

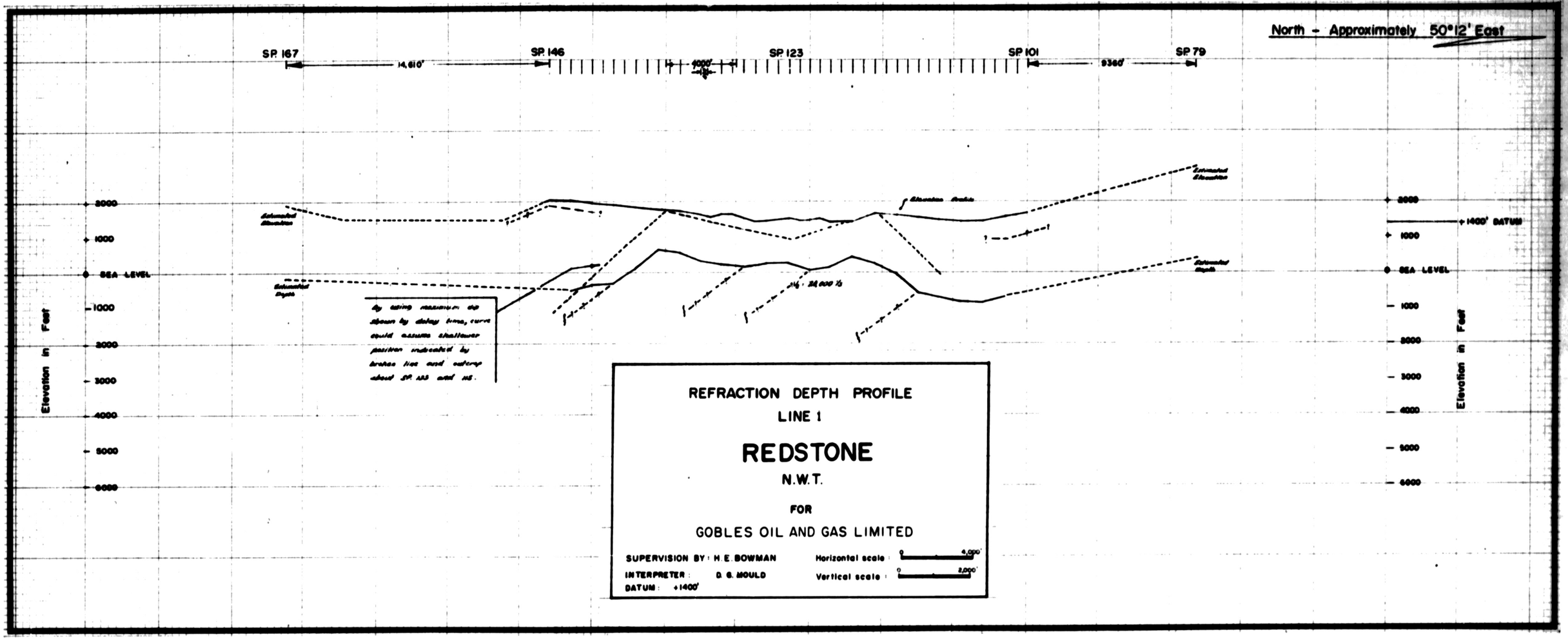
dt is the difference in time between one migrated curve and the averaged curve over

dx the distance such time difference was measured

The identifications of the various refracting events were based on the survey in the Shell Cloverleaf well which occupies a position about the mid-point of line A in the Redstone project within Operation Geoquest, an Operation of the Kenting group of companies and V. Zay Smith Associates Ltd.

SEISMOGEOLOGICAL INTEGRATION

The marker horizon, interpreted to represent the Middle Devonian carbonate section, appears to be highly disturbed by faulting. The faulting tended to confuse the data and made marker identification difficult, particularly in the middle of the line. An estimate of marker depths at the ends of the line indicates the depth to be about 500 to 550 feet below sea level at the west end and about the same at the east end. At shotpoint 123 in the centre of the line, the nebulous nature of the data indicates that the marker could lie from 500 feet below sea level to nearly 1000 feet above sea level depending on the data used in the calculations.


North - Approximately 50°12' East
SP 167
14,610'
SP 146
1000'
SP 123
SP 101
9360'
SP 79
Elevation in Feet
3000
1000
SEA LEVEL
1000
2000
3000
4000
5000
6000
Estimated Elevation
Elevation Profile
Estimated Depth
Estimated Elevation
Estimated Depth
+1400' DATUM
SEA LEVEL
Elevation in Feet
By using maximum dip shown by delay time, curve could assume shallower position indicated by broken line and outcrop about SP 155 and 115.
REFRACTION DEPTH PROFILE
LINE 1
REDSTONE
N.W.T.
FOR
GOBLES OIL AND GAS LIMITED
SUPERVISION BY : H. E. BOWMAN
INTERPRETER : D. G. MOULD
DATUM : +1400'
Horizontal scale : 0 4,000'
Vertical scale : 0 2,000'

The profile of the section was presented as a structural minimum involving an average of all dips seen on the delay time plots. By employing some of the more extreme dips displayed and a shallower estimate of the marker at shotpoint 123, an alternate picture of the profile could be formed. The basic shape of the profile would remain but the features would be more exaggerated and the profile subjected to a bulk shift to a shallower position, causing the marker to coincide with the surface at about shotpoints 135 and 115.

The marker bed was seen to be overlain at the ends of the line by material having a velocity of between 10,000 and 14,000 feet per second. Thickness of these beds over the marker appeared to be about 1500 feet toward the east end of the line and as much as 2500 to 2600 feet at the west end where the low-velocity overburden is appreciably thinner.

This section overlying the carbonate could be correlatable to the Upper Devonian Imperial Formation and beds of Upper and Middle Devonian age common in the area. If so, it indicates a thin section of Cretaceous and younger sediments to the west but thickening to the east.

FIELD RECORDING AND SHOOTING TECHNIQUES

Both lines were shot utilizing a full cable layout of 24 traces over 13,800 feet. Two group overlaps were used to maintain continuity between adjacent spreads. Shots were recorded from shotpoints sufficiently offset (usually two or three time shotpoint interval from near detector) to record the marker over the length of the spread and in addition, other shots were placed at cable end locations and other intermediate offset

distances to record the full refraction spectrum to the marker. For a more complete study of the shots fired, refer to time-distance, delay time and depth section (enclosed).

Submitted by,

H. E. Bowman

FIELD TECHNIQUES

1. Recording

Instruments:

Amplifiers	Geospace-111 B 24 channel
Tape Transport	Geospace AM-200
Geophones	
Natural frequency:	7.5 c.p.s.
Number per trace:	4
Interval between geophones:	15 feet

Instrument Settings:
(Standard)

	Monitor	Playback
Filters - low cut:	Refraction out	out
high cut:	1-60	1-60

AGC - attack:	Normal
release:	Normal
Final Gain:	85-100%
Suppression (initial):	Minimum
Spread Arrangement:	Total length - 13,800 feet 2-group overlap between adjacent spreads

Coverage:	100%
Shotpoint spacing:	13,200 feet
Single Holes	
Group spacing:	600 feet
Geophones:	4 per trace, buried in nest 15 by 15 feet

2. Surveying

Seismometer stations and shotpoints chained at intervals of 600 and 13,200 feet, respectively

Horizontal control:	Wiide, Theodolite
Vertical control:	Wilde, Theodolite

3. Drilling

Drills: Two Mayhew 200 Model Helidrills

Hole depth: 80 to 100 feet

4. Line Cutting

All line cutting was done by hand axe and power saw. Usually, two crews of about five to eight men each were utilized with one cutting narrow, walkable seismic line while the other was clearing and constucting heliports at shotpoint locations, recorder locations (spread midpoint) and line crew drop points (quarter spread locations).

5. Transportation

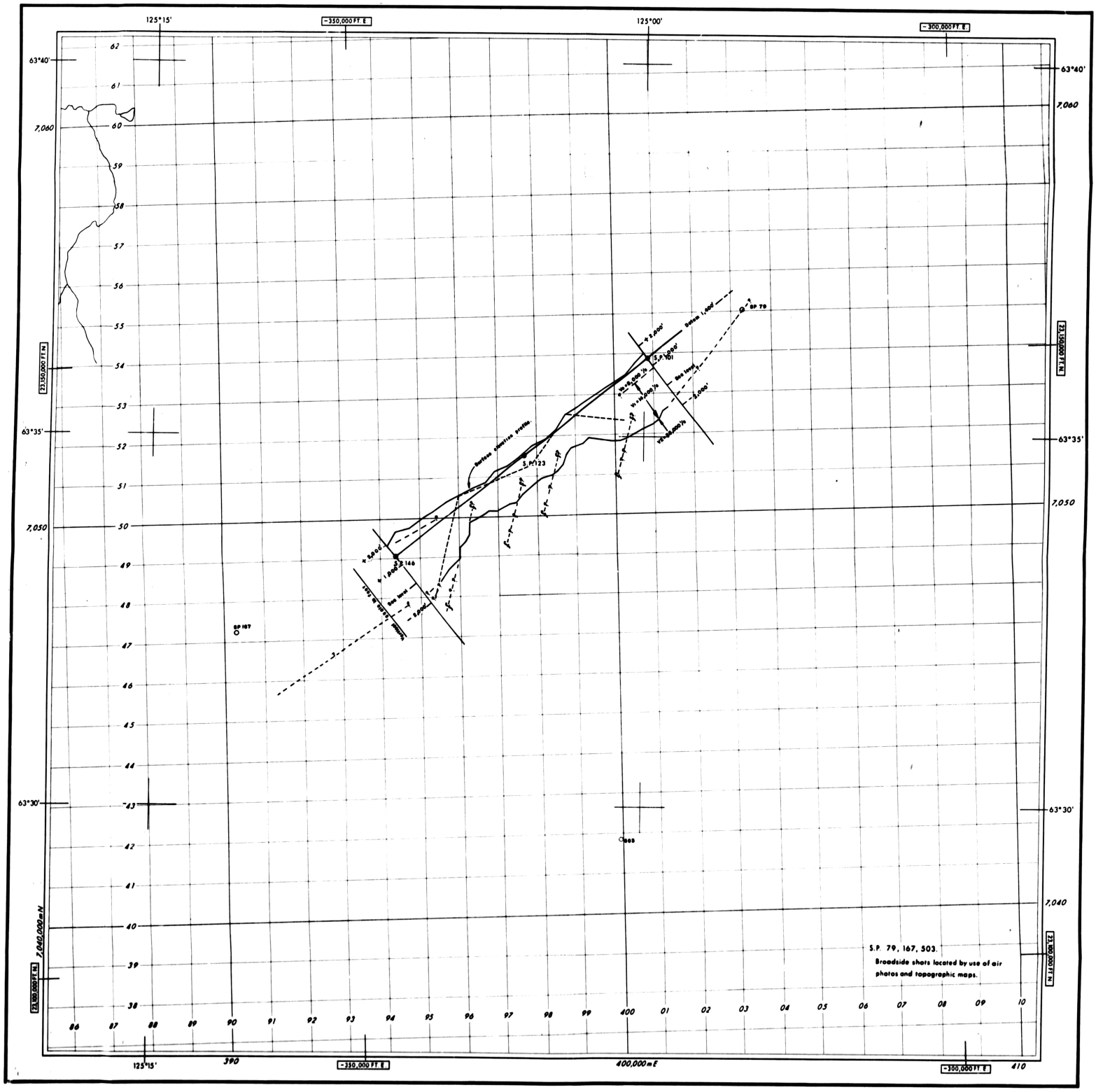
All material, supplies and personnel were transported to and from the line by Bell 204-B or 206 model helicopters. The larger helicopter (204-B) was used to move helidrills between locations, assist in spread layout and pickup while the smaller one was best utilized for scouting, shooting, layout and pickup when travel distances for the 204-B were unreasonable.

STATISTICS

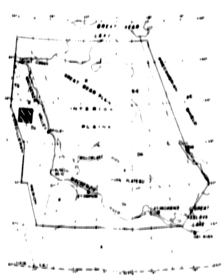
Recording commenced	-	August 26, 1968
Recording completed	-	August 26, 1968
Locations	-	6
Shots	-	12
Dynamite used	-	2000 pounds
Caps used	-	29
Average dynamite	-	167 pounds per shot
Miles shot	-	5 - seismic refraction profiles
Holes drilled	-	16
Footage	-	990 feet
Average depth	-	60 feet
Rigs	-	2 Helidrills, Mayhew 200 with 204-B helicopter
Typical hole log	-	0 - 30 feet - clay and rocks 30 - 80 feet - sandstone and shale

Respectfully submitted,

J. C. Pelletier,
Geophysicist.



INDEX MAP



BASE MAPS COMPILED BY:
JACK HILL, A.L.S., D.L.S.

BASE MAPS DRAWN BY:
JOHN ARMITAGE

GOBLES OIL AND GAS LIMITED

NORTHWEST TERRITORIES OF CANADA

REDSTONE G AREA

SCALE 1:50,000

ONE THOUSAND METER
UNIVERSAL TRANSVERSE MERCATOR GRID

PALLISTER and ASSOCIATES

REFRACTION PROFILE

CONTOUR INTERVAL

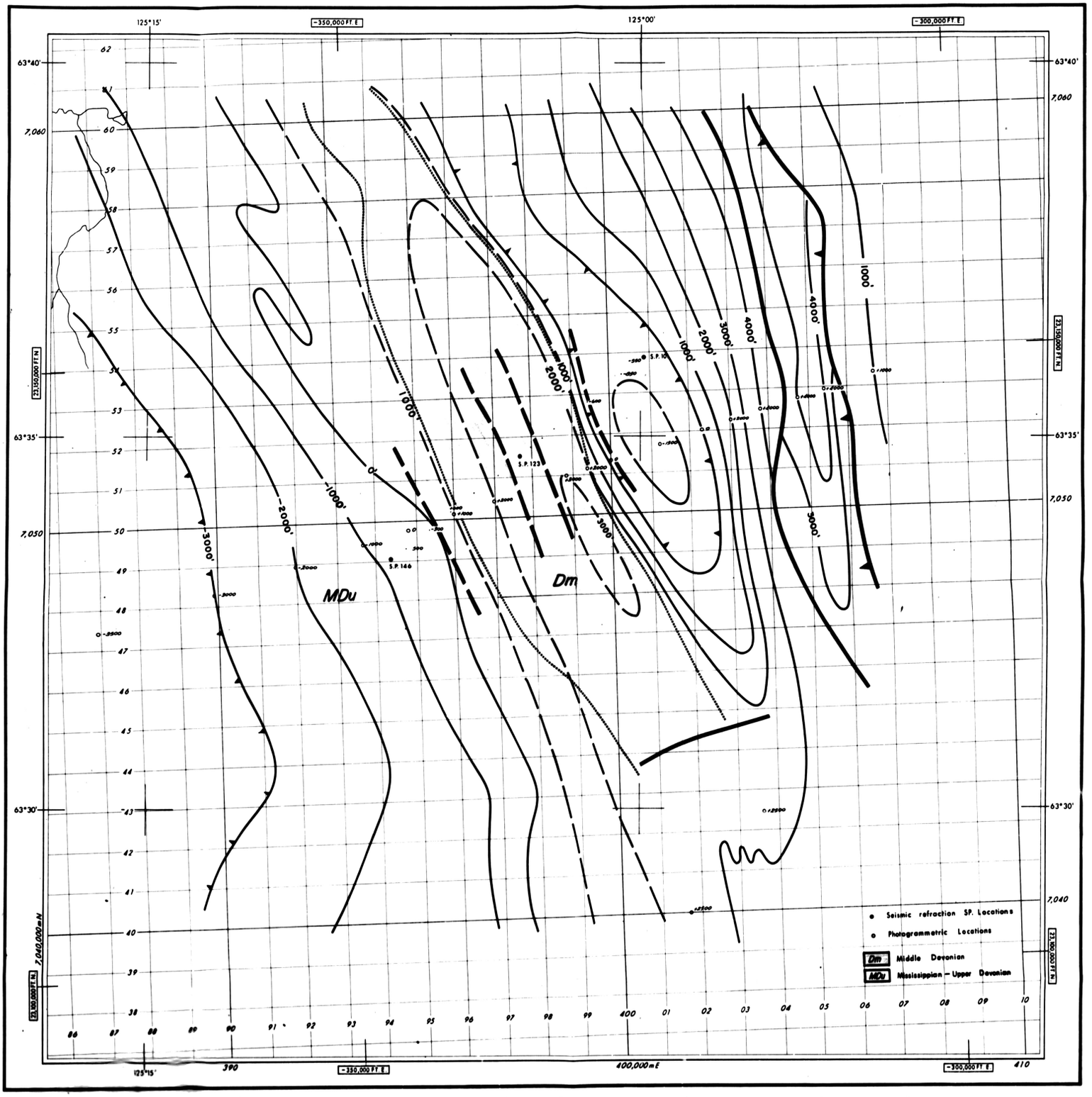
DATUM ELEVATION

DATUM VELOCITY FT /SEC.

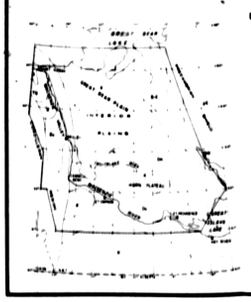
Interpretation By:
D.G. Mould & H.E. Bowman.

PROJECT NO. 847

MAP NO. 2



INDEX MAP



BASE MAPS COMPILED BY:
JACK HILL, A.L.S., D.L.S.

BASE MAPS DRAWN BY:
JOHN ARMITAGE

GOBLES OIL AND GAS LIMITED

NORTHWEST TERRITORIES OF CANADA

REDSTONE G AREA

SCALE 1:50,000

3 Miles
5 Meters

ONE THOUSAND METER
UNIVERSAL TRANSVERSE MERCATOR GRID

PALLISTER and ASSOCIATES

Contour horizon

Top Middle Devonian Carbonate

Compiled from photo geologic maps and refraction profiles

CONTOUR INTERVAL 1000'

DATUM ELEVATION Sea level

DATUM VELOCITY FT./SEC.

Interpretation By C. I. KLIPPEL, B.S., P. Geoph.

PROJECT NO. 847

MAP NO. 1

SP167 SP145 SP123 SP101 SP79

+2500'
+2000'
+1500'
+1400' Datum
+1000'
+500'
+ Sea Level
-500'
-1000'
-1500'

ELEVATION IN FEET

DELAY TIME IN SECONS

+.700
+.600
+.500
+.400
+.300
+.200
+.100
0
-.100
-.200

Continuous Relative Delay Time Curve - Surface Position →

Continuous Relative Delay Time Curve - Subsurface Position →

Average Relative Delay Time Curve →

Continuous Relative Delay Time Curve Subsurface Position →

Continuous Relative Delay Time Curve Surface Position →

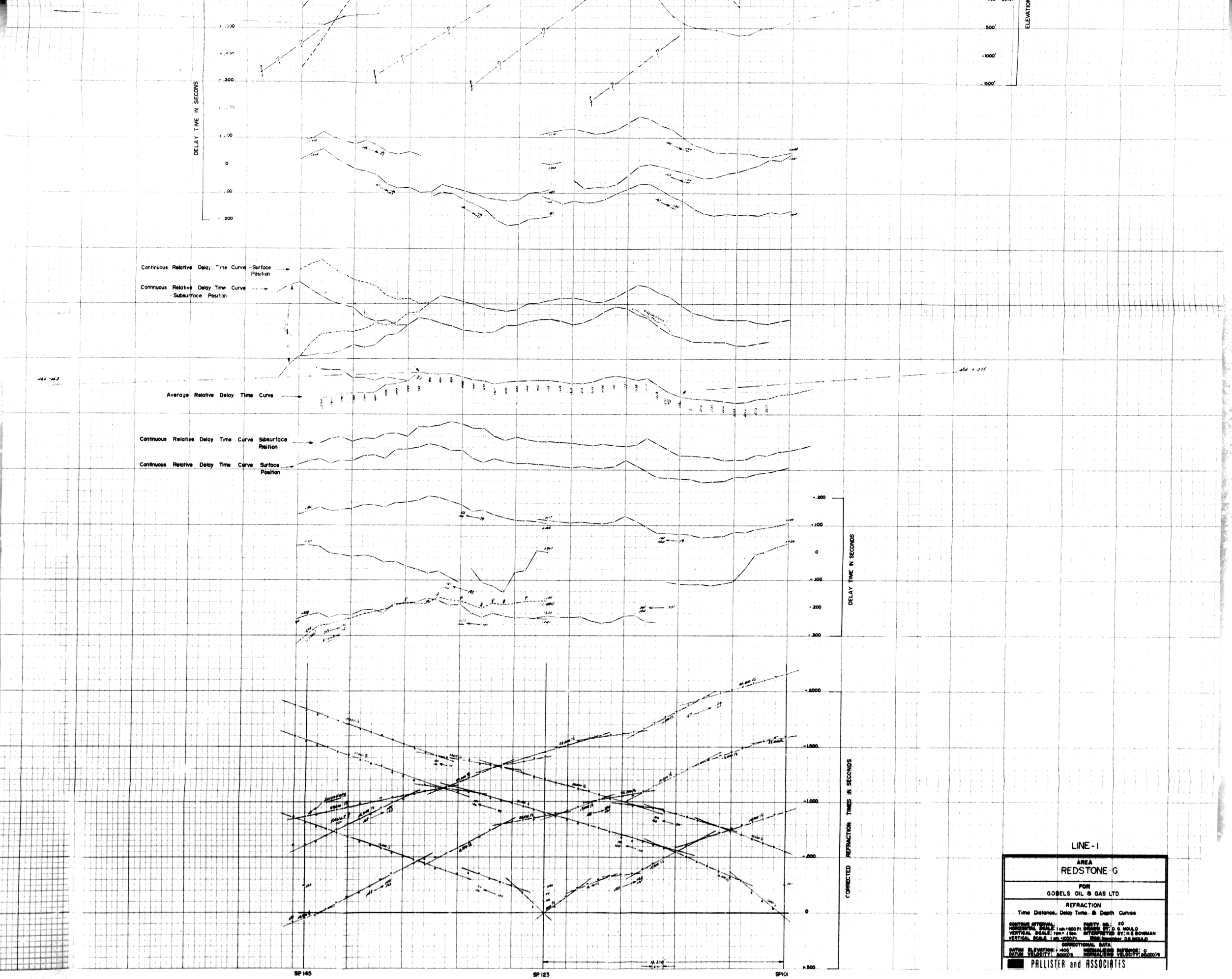
+.200
+.100
0
-.100
-.200
-.300

DELAY TIME IN SECONDS

-2000
-1500
-1000

TIMES IN SECONDS

1 of 2



LINE - 1

AREA
REDSTONE G
FOR
GOBELS OIL & GAS LTD
REFRACTION
Time Distance, Delay Time & Depth Curves
CONTOUR INTERVAL: — POSITY SEQ.: 20
HORIZONTAL SCALE: 1 cm = 500 Ft. DRAWN BY: D. G. MOULD
VERTICAL SCALE: 1 cm = .1 Sec. INTERPRETED BY: H.E. BOWMAN
VERTICAL SCALE: 1 cm = 1000 Ft. 1968 November D.G.MOULD
CORRECTIONAL DATA
DATUM ELEVATION: +400' NORMALIZING DISTANCE: 0
DATUM VELOCITY: 8000'/s NORMALIZING VELOCITY: 20000'/s
PALLISTER and ASSOCIATES

2 of