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REFLECTION SEISMOGRAPH SURVEY OF THE  
INTERMONTANE AREA, NORTHWEST TERRITORIES  
FOR SHELL CANADA LIMITED, WINTER 1963-1964

SHELL CANADA LIMITED  
NORTHERN DIVISION EXPLORATION  
JUNE, 1964

REFLECTION SEISMOGRAPH SURVEY OF THE INTERMONTANE AREA

NORTHWEST TERRITORIES FOR SHELL CANADA LIMITED, WINTER 1963-1964



SHELL CANADA LIMITED  
NORTHERN DIVISION EXPLORATION  
EDMONTON, ALBERTA JUNE, 1964

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Surface Topography Map - Intermontane (North) Area

Surface Topography Map - Intermontane (South) Area

Hume (Top Paleozoic Carbonates)

Beltian (Near Base of Cambrian)

Top Paleozoic Carbonates to Beltian Isotime

REFLECTION SEISMOGRAPH SURVEY OF THE INTERMONTANE AREA  
NORTHWEST TERRITORIES FOR SHELL CANADA LIMITED, WINTER 1963-1964

Permits #1016-#1018 inclusive, #3204, #3205, #3212, #3223-#3228 inclusive, #3247, #3250, #3251, #3471, #3473, #3474, #3371, #3447, #3413-#3419 inclusive, #3420-#3424 inclusive, #3425-#3432 inclusive.

In compliance with Section 54 (1), 2(a) (b) of the Canada Oil and Gas Land Regulations, the following is reported with regard to a geophysical exploration program performed on the subject permit and surrounding area.

The geophysical survey was conducted by Ray Geophysical Company\* Parties #1 and #5 who worked respectively in the south and north parts of the survey area and consequently this report is submitted in two parts. A gravity survey was conducted simultaneously with the reflection seismograph survey. The gravity data however have not yet been fully processed and interpreted. When this information is available it will be submitted in compliance with Section 54 (1), 2(a) (b) of the Canada Oil and Gas Land Regulations under separate cover.

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\* Division of Mandrel Industries Inc.

REFLECTION SEISMOGRAPH SURVEY OF THE INTERMONTANE (NORTH) AREA  
NORTHWEST TERRITORIES FOR SHELL CANADA LIMITED, WINTER 1963-1964

Location: 63°58'N - 64°41'N; 124°34'W - 126°03'W.

Adjacent towns: The prospect lies in unsettled country north of the Redstone River, west of the Mackenzie River, and is centered about 35 miles south of Fort Norman, Northwest Territories.

Date of Survey: Seismic recording was conducted between January 4, 1964 and April 20, 1964. The drills were operating between December 29, 1963 and April 20, 1964. Drilling was carried out from December 10, 1963 to April 20, 1964.

Extent of Survey:

Approximate Acreage Surveyed	911,840
Miles of Traverse	487
Number of Profiles	974 reflection
Total Number of Shots	1,306
Number of Shot Holes	2,628

Field Conditions:

Surface Outcrops:

Surface formations were mainly of the Cretaceous age, overlain by muskeg, glacial till, sand, and gravel. In the central part of the area surface deposits of Tertiary age were encountered. Cretaceous and Devonian formations were encountered at the surface in the west part of the area in the vicinity of the Mackenzie mountain range and in the northern part of the area in the vicinity of the Mackay mountain range.

Type of Terrain:

Elevations varied from 210 to 3266 feet above sea level.

Topography was mainly controlled by the Mackenzie mountain range in the west, the Mackay mountain range in the north, the MacKenzie River and the McConnell mountain range in the east, and by the Redstone River, the Keele River, and several smaller rivers and creeks in the surveyed area. The terrain was generally very rugged in the vicinity of the Mackenzie and the Mackay mountain ranges.

Available Roads:

No roads were present in the area, all the trails were cut by the dozers in the course of the survey operations.

Weather:

Temperatures to a minimum of -50 degrees F. were recorded during the period of the survey. Average temperature during the day was about -15 degrees F. The field crew lost one day due to extreme blizzard conditions.

Field Procedure:

Drilling:

a) Formations:

Formations encountered during the drilling operations included clay, sand, gravel, shale, sandstone, and limestone.

b) Hole Depths:

Hole depth varied from ten to eighty five feet. The average hole depth was about 38 feet.

c) Casing, Anchors, Etc.:

No casing or anchors were required.

d) Drilling Equipment:

Drilling equipment consisted of two Mayhew 1000 drills equipped for air or water circulation, mounted on an International 1962, R-193 truck, and an International 1962, R-195 truck. Two water trucks were used in conjunction with the drill units. Drilling was generally accomplished using air circulation. Both rock and insert type bits were used.

e) Drilling Problems:

Gravel and boulders were the main problems encountered in the drilling operations, however steep hills and the necessity of using a dozer to pull the drills up the hills slowed the drilling operations.

## Recording:

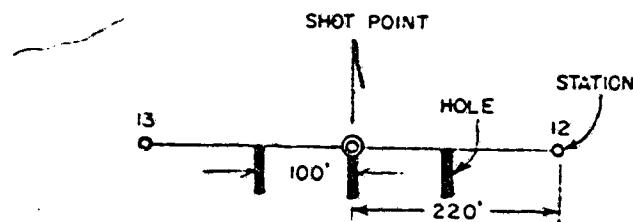
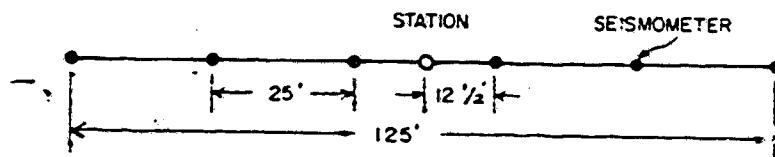
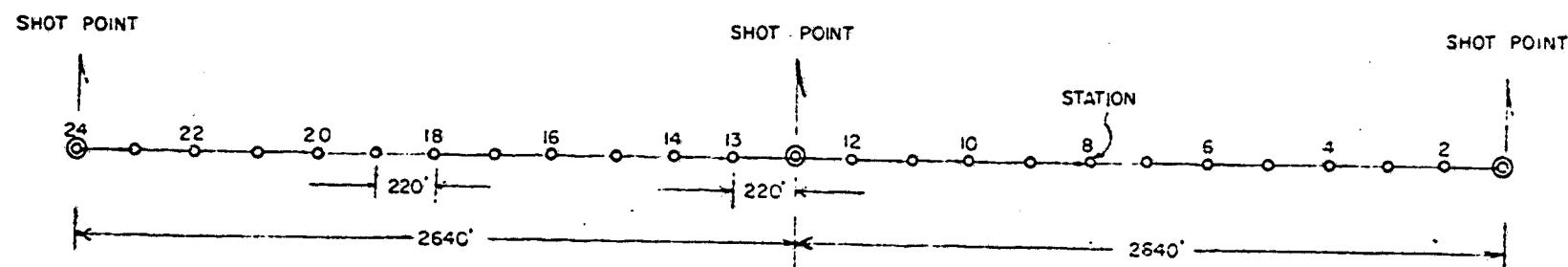
a) Type Shooting, Spread Length, Shooting Distance, Seismometer Interval, etc.:

Seismic recording was accomplished using the continuous profiling method with a 24 trace recording unit. Shot points were located at the centre of 5,280 foot instrument spreads, consisting of 24 seismometer groups spaced 220 feet apart, with the distance from the shot to the closest station being 220 feet. Six seismometers per group at intervals of 25 feet were symmetrically arrayed about each station.

The number of holes per shot point ranged from one to six depending on the drilling conditions and the hole depths obtained.

# INTERMONTANE NORTH AREA

## SPREAD LAYOUT



Generally two holes per shot point at a spacing of 75 feet between the holes were drilled east of the 5-110 line, and 3 holes spaced 100 feet apart drilled west of the 5-110 line. Where drilling was difficult and only very shallow holes could be drilled, six holes per shot point drilled in two groups of three holes per group with the groups spaced 10 feet apart and the holes spaced 100 feet apart were used.

b) Weathering Spreads:

A weathering spread was normally shot every 3 miles to check the depth of the weathered layer. This was performed by shooting into the spread from shot points located at either stations 1 or 24.

c) Influence of Hole Depth:

Generally holes loaded at a depth of 30 feet or less produced very poor results, holes loaded at 40 feet or below usually produced fair results where a record could be obtained. An increase in hole depth below 40 feet appeared to give very little improvement in record quality.

d) Charges:

The average charge loaded per hole for reflection records was 25 pounds and the average charge loaded per hole for a weathering shot was 50 pounds.

e) Type Amplifier, Filter Setting, Etc.:

Amplifiers used were of the General Geophysical Company JMH model, with seismometers manufactured by the Electro-technical Labs.

Unmixed incoming energy from the shot was simultaneously recorded on magnetic tape by an S.I.E. MR - 4 frequency modulated recorder, and monitored to produce a conventional paper record. The incoming energy was filtered through a 1-25-75 filter and automatic volume control was applied one way fast. The energy recorded on magnetic tape for each shot was played back in the field using no further filter or automatic volume control to provide a field playback record.

The S.I.E. MR-4 magnetic tape recorder was unserviceable from April 4 to April 7.

Traces number 1 to 24 on the record were connected to the corresponding stations of the instrument spread. Trace 25 indicated the shot break and the release of the front end suppression. Trace 26 indicated the uphole time. The uphole seismometer was usually placed 5 feet from one of the holes. Traces 27 and 28, the constant sensitivity traces, show energy bypassed from trace 21 with no automatic volume control applied. Trace 29 indicated a 100 cycle per second timing signal with the frequency derived from a timing fork.

The monitor record was recorded at a paper speed of one foot per second.

On most split profiles a tap check was recorded on the first shot ahead of the first breaks to ensure that the cables were not reversed.

#### Surveying:

Surveying was performed using two Wild TLA theodolites, spreads were laid out using a 1320 foot calibrated chain. Vertical

and horizontal control were obtained from tellurometer stations located by Shell Canada Limited and by ties to previous seismic stations established during the 1962 helicopter operations. All survey data were forwarded to the Shell Canada Limited survey department. There were no major survey problems.

Office Procedure:

Weathering Corrections:

First arrival surface to surface times were plotted continuously on rectilinear paper for each profile shot. Very little  $V_1$  material (assumed to be 2,000 feet per second) was present. The lowest refracted velocity ( $V_2$ ) present ranged from 5,000 to 9,700 feet per second. The second refracted velocity ( $V_3$ ) ranged from 9,200 to 16,000 feet per second. In the west part of the area, where the Hume horizon is at the surface, velocities to 20,000 feet per second were observed. Where the  $V_2$  was not apparent, or where first arrivals were not useable, the uphole time method of weathering corrections was employed. Elsewhere the two layer method of weathering corrections was used.

Due to very poor first arrival information, there were some misties in the delay time values. Weathering sections were later checked where these misties occurred. As any changes made were about  $\pm .010$  seconds, no corrections of the migrated sections were made.

**Velocity Data:**

A migration chart from the Many Beavers area was used in migrating the corrected reflection times. This migration chart was constructed using a constant velocity of 11,000 feet per second and a scale of 1 inch = .100 seconds vertically and 1 inch = 550 feet horizontally.

**Cross Sections, Maps, Etc.:**

Correlations of reflections were established on the best monitor record obtained at each shot point. The customary weathering delay time and elevation corrections to a datum of 1,000 feet above sea level were applied at the shot point and at each of the recording stations, using an elevation correction velocity of 10,000 feet per second. All monitors were shot using a 1-25-75 filter, so no filter corrections were necessary. Each corrected reflection was then migrated and plotted on a cross section profile using the Many Beavers migration chart.

**Results:**

The purpose of the survey was to extend a reconnaissance program initiated in 1962 and to delineate any structural or stratigraphic anomalies found.

Record quality ranged from good to "no reflection". Generally record quality was good to fair east of the 5-110 line and poor to "no reflection" west of the 5-110 line, as the lines approached the Mackenzie mountain range. Record quality was also very poor in the northern part of the area in the vicinity of the Mackay mountain range.

The following maps are being submitted:

- (1) Surface Topography Map
- (2) Hume (Top Paleozoic Carbonates)\*
- (3) Beltian (Near Base of Cambrian)\*
- (4) Top Paleozoic Carbonates to Beltian Isotime \*

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\*NOTE To facilitate examination the maps from Intermontane South and Intermontane North have been joined together and submitted as one map.

REFLECTION SEISMOGRAPH SURVEY OF THE INTERMONTANE (SOUTH) AREA  
NORTHWEST TERRITORIES FOR SHELL CANADA LIMITED, WINTER 1963-1964

Location: 62°52'N - 64°05'N; 123°45'W-125°15'W.

Adjacent towns, etc.: Approximately 140 miles S.E. of Norman Wells, N.W.T. and approximately 50 miles N.W. of Wrigley, N.W.T.

Date of Survey: From December 26, 1963 to April 20, 1964.

Number of Working Days in Field: 105

Extent of Survey:

Approximate Acreage	2,120,000
Footage Drilled	166,426
Miles of Traverse	700.5
Number of Profiles	1,401
Number of Shot Holes	3,750

Field Conditions:

Surface Conditions:

A relatively thin covering of glacial drift exists throughout most of the area and Cretaceous and Devonian formations outcrop.

Type of Terrain:

West of the Mackenzie River, elevations ranged from 500 feet above sea level to 2,500 feet above sea level. This terrain is coursing by a dendritic pattern of rivers and large creeks with drainage into the Mackenzie River.

**Accessibility:**

There are no available roads within or near the area. The area is accessible in the summer mainly by float equipped aircraft and river transportation. A dry weather airstrip, capable of DC-3 traffic, is located near the mouth of the Redstone River. The area, with its many lakes, is readily accessible in the winter by wheel-ski equipped aircraft.

**Weather:**

Above normal temperatures prevailed throughout the operation. Average snowfall of 3 to 3-1/2 feet was encountered.

**Field Operations:****Drilling:****a) Formations:**

Approximately 80 percent of the holes were drilled through thin layers of muskeg into glacial drift with the remainder being drilled into shale. A few isolated holes logged some sandstone.

**b) Hole Depths:**

The average hole depth for the area was 45 feet. A three hole in-line pattern was dug at most shot points. The holes were spaced 100 feet apart.

**c) Casing, Charge Anchors, Etc.:**

No casing nor charge anchors were needed.

**d) Drilling Equipment, Type of Units and Type of Bits Used:**

3 - Failing CFD-1 Air-water drills mounted on 1-Chev. 5 ton, 1-GMC 5 ton and 1-G 7 ton.

2 - GMC 5 ton water trucks.

1 - Chevrolet 5 ton water truck.

Bits: 4-1/2 and 4-3/4 inch rock bits.

4-1/2 and 4-3/4 inch insert bits.

4-3/4 inch starter bits.

e) Drilling Problems and Recommendations:

No changes in the above combination of units is recommended.

No major drilling problems were encountered.

Recording:

a) Shot Point, Spread and Seismometer Arrangement:

A 5,280 foot split continuous spread with shot point arrays centered 2,640 feet apart was employed. Two 13 trace, 220 foot station interval cables with 6 seismometers per trace spaced 25 feet apart were used. A spread diagram can be found on the following page.

b) Influence of Hole Depth and Surface Conditions:

Hole depth proved to be more critical than surface conditions on record quality. Records with charges bottomed shallower than 30 feet, showed a deterioration of record quality.

c) Charges:

Most charge sizes were 10 pounds, loaded in each of the three holes of the shot array.

d) Type of Instruments:

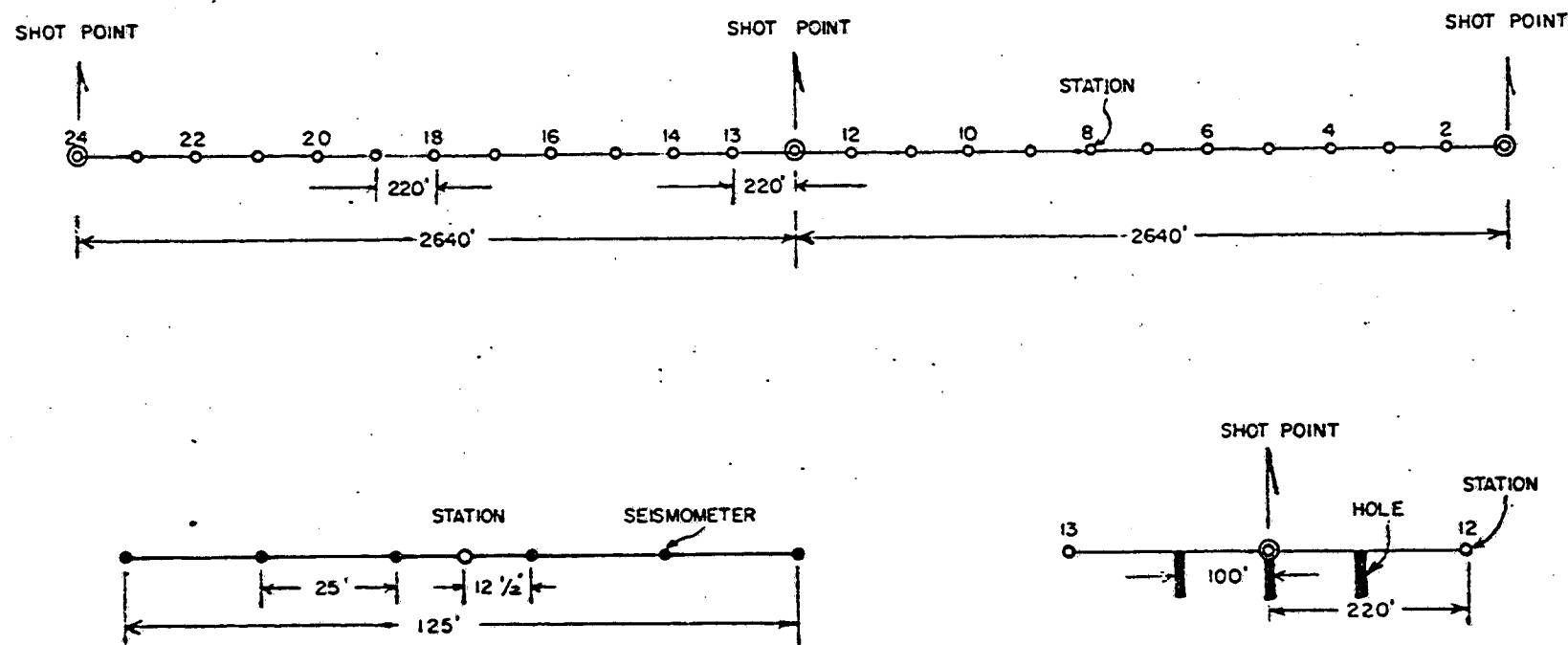
Type of Amplifiers: General Geophysical Co. "JMH"

Type of Magnetic Recorder: S.I.E. "MR-4"

Seismometers: Electro-Tech "EV-15", 27 cycle

Base Filter: 1-25-75

INTERMONTANE SOUTH AREA  
SPREAD LAYOUT



Surveying:

Two Tl-A Wild theodolites and a 1,320 foot chain were used during the survey. Horizontal and vertical control was based on tellurometer data obtained from Shell Canada Limited and triangulation stations in the area. Lines previously shot in the area were tied to this year's survey. With the exception of a few minor discrepancies the quality of the survey may be considered as fair.

Office Procedure:

Weathering Correction:

A two-layer rectilinear method of computing weathering corrections was employed. These corrections were made to a velocity of approximately 10,000 feet per second. A velocity of 10,000 feet per second was used to correct to a datum of 1,000 feet above sea level.

Other Corrections:

A shot point correction was obtained by adding algebraically the break correction, uphole time, weathering and elevation correction. The trace corrections were obtained by adding the weathering correction and the elevation. Total corrections for each trace were obtained by adding the shot point correction to the respective trace correction.

Cross Sections, Maps, Etc.:

Datum values for cross sections and maps were obtained directly from migrated time-depth cross sections which were constructed by Ray Geophysical Division.

Results:

Purpose of Survey:

The purpose of the survey was to evaluate the possible occurrences of structural and stratigraphic anomalies within the assigned prospect.

Record quality varied from very poor to very good but generally may be considered as good.


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
- (1) Surface Topography Map
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- (3) Beltian (Near Base of Cambrian)\*
- (4) Top Paleozoic Carbonates to Beltian Isotime \*


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
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
Prepared by Northern Division  
Exploration - Geophysical Division  
under the supervision of Fred A. Kidd,  
Manager, Northern Division Exploration,  
Shell Canada Limited, June 22, 1964

















SHELL OIL COMPANY  
 OF CANADA, LIMITED      EXPLORATION AND  
 NORTHERN PRODUCTION DEPT.      EXPLORATION DIVISION  
 SEISMIC STRUCTURE MAP  
**INTERMONTANE (North) AREA**  
 BASE CAMBRIAN - TOP BELTIAN


Review  Interpretation  Shell  Interpreter: R. TINLINE Supervisor: W. SEMKOW  
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 Scale: 1" 6000' Datum: 1000 ASL Contour Int.: 050 sec.  
 Grade Key: G-good, F-fair, P-poor, VB=very poor, U=unreliable, NC=no correlation, NB=abundant record,  
 NS-not shot, NV-no value, I=phantom, m=multiple interference, ~=phasing.

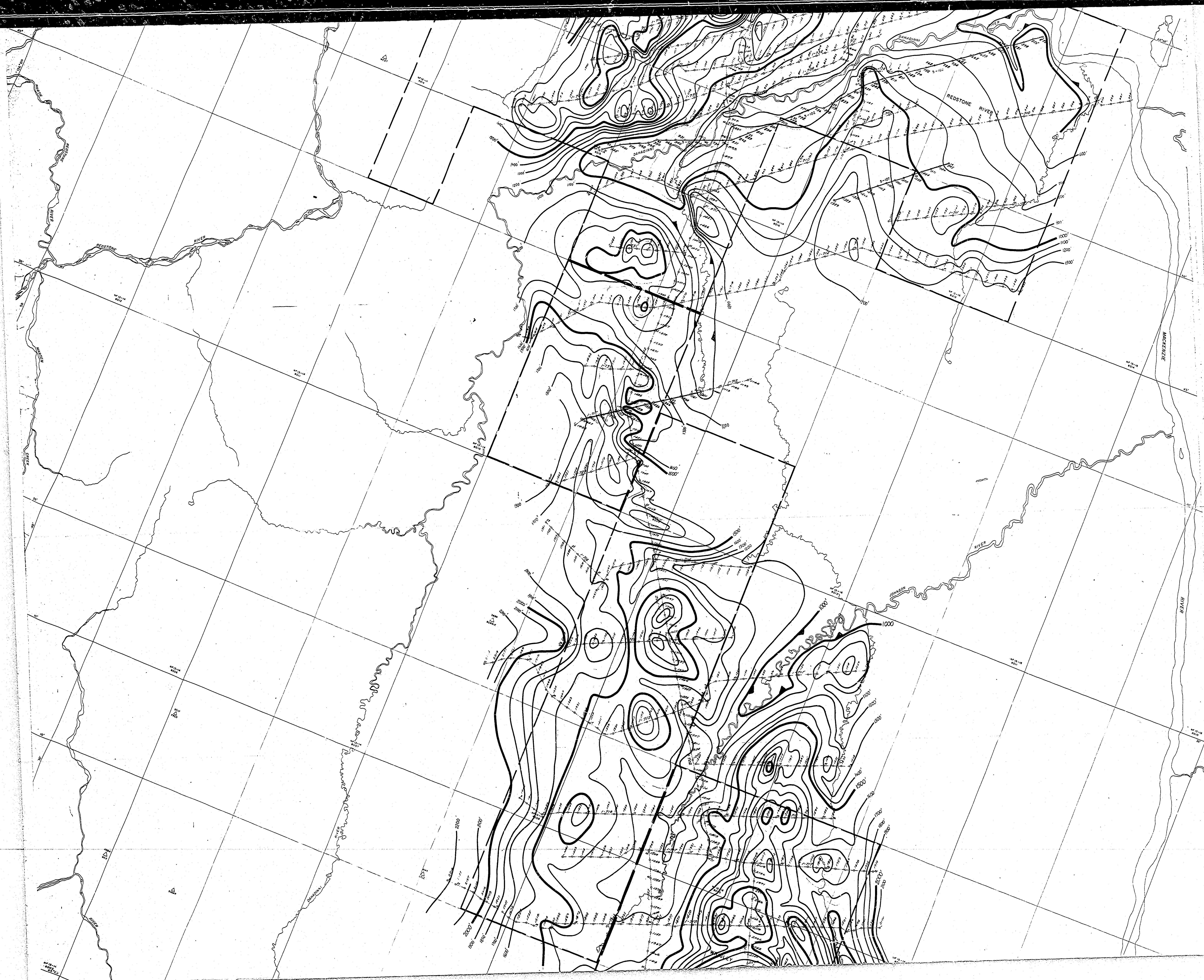
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 To Accompany  
 Enclosure No  
 Revised By  
 Date  
 Drawing No

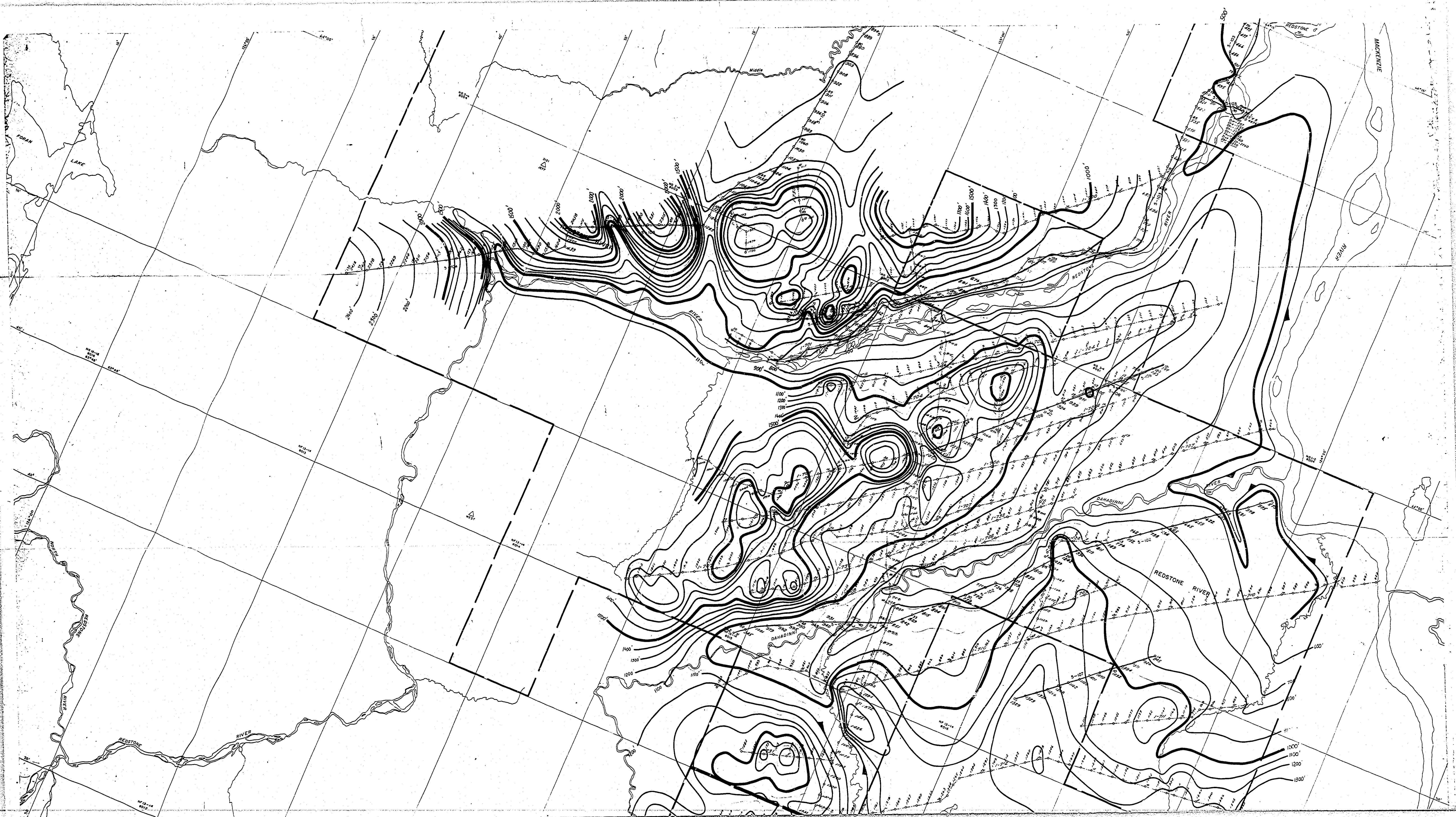


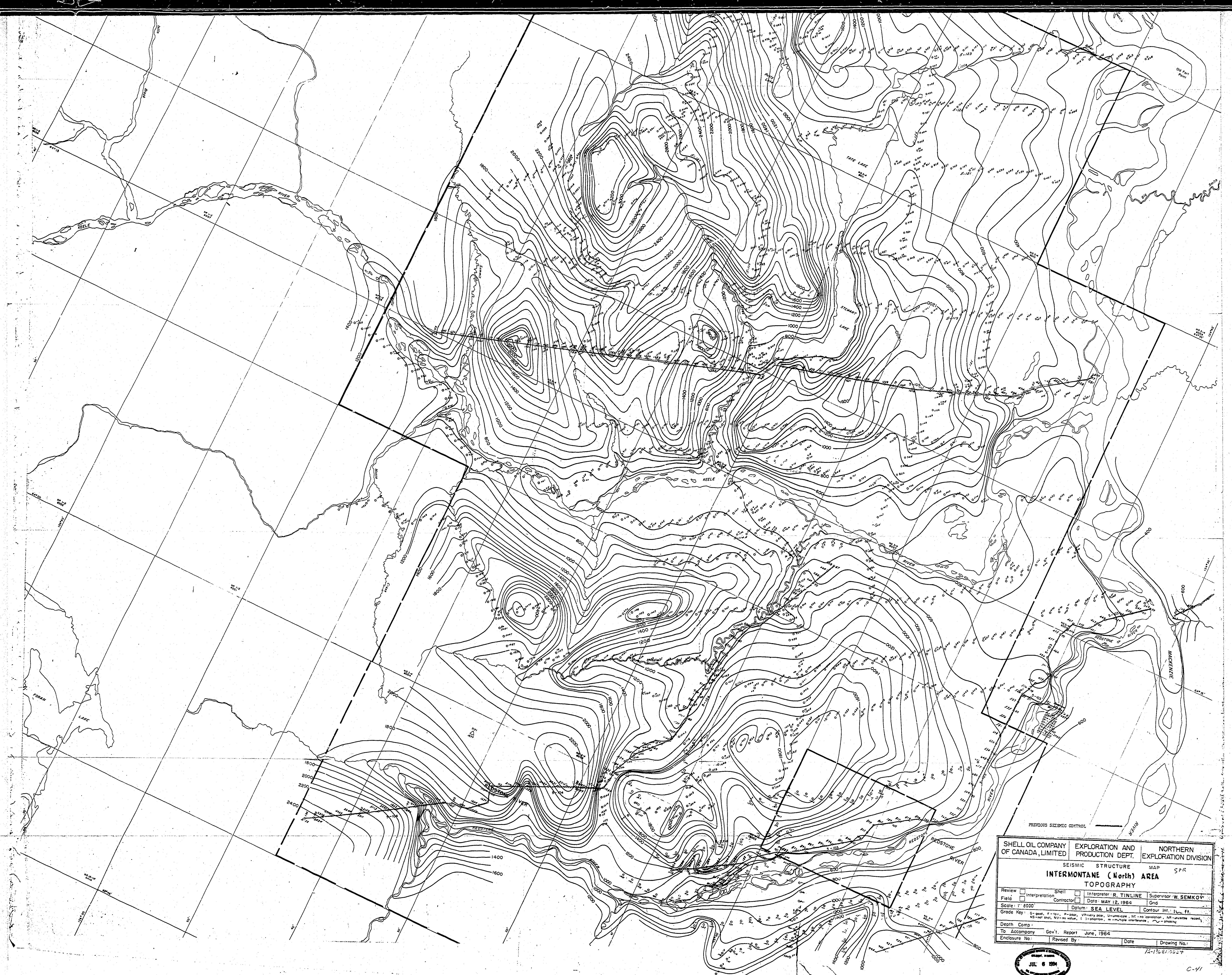












SHELL OIL COMPANY OF CANADA, LIMITED EXPLORATION AND PRODUCTION DEPT. NORTHERN EXPLORATION DIVISION  
 SEISMIC STRUCTURE MAP SPR  
 INTERMONTANE (North) AREA TOPOGRAPHY  
 Review  Shell  Interpreter: R. TINLINE  Supervisor: W. SEMKOV  
 Field  Interpretation  Contractor:  Date: MAY 12, 1964  Grid  
 Scale: 1:80000  Datum: SEA LEVEL  Contour Int: 100 ft.  
 Grade Key: G=good, F=fair, P=poor, V=very poor, U=unreliable, NC=not checked, DR=drill hole record  
 NS=not shot, NY=not yet value, I=intersection, m=multiple intersection, P=posting  
 Depth Comp:   
 To Accompany Govt. Report: June, 1964  
 Enclosure No.:  Revised By:  Date:  Drawing No.: 12-12027-32247  
 JUL 6 1964

C-41

