38-6-4-12

S E I S M I C   S U R V E Y   R E P O R T

of the

W E S T   D O G F A C E   P R O J E C T

NORTHWEST TERRITORIES

60° - 60° 15' North Latitude

119° 15' - 119° 35' West Longitude

FIELD WORK AND COMPUTATIONS CONDUCTED BY

C A N W E S T   G E O P H Y S I C A L   L I M I T E D

JANUARY AND FEBRUARY, 1969

LEASE BLOCKS NO.: 68-65 to 77-65 inclusive

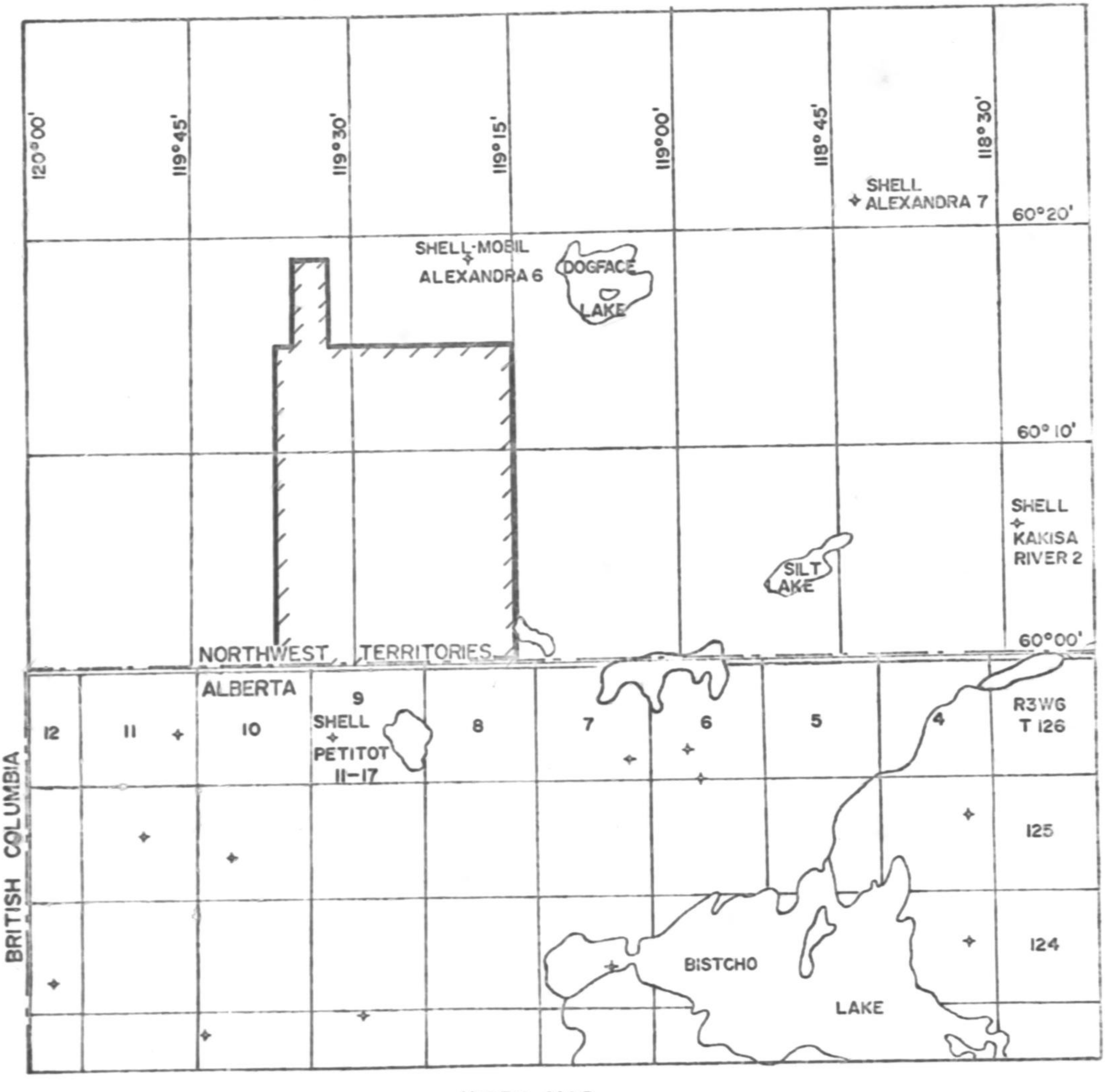
PROJECT NO. 38-6-4-69-3

SUBMITTED TO

HUDSON'S BAY OIL AND GAS COMPANY LIMITED

BY

C. L. H A R T & A S S O C I A T E S L T D.



INDEX MAP
WEST DOGFACE PROJECT

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A B S T R A C T

A seismic survey was conducted for Hudson's Bay Oil and Gas Company Limited in the West Dogface area of the Northwest Territories during the months of January and February, 1969, by Canwest Geophysical Limited party number 4. Digital recording equipment with binary gain amplifiers was used to record six-fold coverage. Weathering computations and trace editing were provided by Canwest personnel in Calgary. Petty Geophysical Engineering Company of San Antonio, Texas, was responsible for all data processing. Final 600% stacked sections were interpreted by C.L. Hart & Associates Limited of Calgary.

The objective of the survey was to ascertain the structural attitudes of as much as possible of the sedimentary section. Particular emphasis was placed on the Middle Devonian zone, where the Keg River, Muskeg, and Slave Point formations are believed to be the most prospective reservoirs for hydrocarbon accumulation.

Data from line shot by Shell Canada Limited were incorporated in the interpretation.

S T A T I S T I C A L   D A T A

1.	Commencement date, bulldozers	Jan. 22, 1969
2.	Recorders, first shot	Feb. 7, 1969
3.	Completion date, last shot	Feb. 25, 1969
4.	Total number of profiles shot	1043
5.	Total number of shots	1254
6.	Total recording hours in field..................	181.5
7.	Total number of driving hours	48.0
8.	Total recording hours	229.5
9.	Move time, hours	27
10.	Average profiles per ten hour day	45.5
11.	Miles of continous 600% coverage	94
12.	Average miles per ten hour day	4.1
13.	Total dynamite used	2555 lbs.
14.	Dynamite used per profile	2.45 lbs.
15.	Dynamite used per shot	2.04 lbs.
16.	Total number of caps used	1419
17.	Caps used per profile	1.36
18.	Caps used per shot	1.13
19.	Total number of holes drilled	1247
20.	Total footage drilled	59,585
21.	Total drill hours, field	848.5
22.	Total drill hours, driving	254.5

23.	Total drill hours................................	1103.0
24.	Drill time, moving...............................	142.5
25.	Average holes per 10 hour shift.................	9.8
26.	Average feet drilled per hour...................	70.1
27.	Rock bits used...................................	3
28.	Insert bits used.................................	189
29.	Bits used per foot...............................	.00315
30.	Total mud used...................................	950 lbs.
31.	Total bran used..................................	400 lbs.
32.	Extra water truck hours.........................	331.5
33.	Water truck move hours..........................	28
34.	Bulldozer hours..................................	3546
35.	Recording breakdown time........................	1 day
36.	Drill breakdown time.............................	1 shift

F I E L D   P R O C E D U R E S

RECORDING

Instruments:

Texas Instruments, DFS 111

Binary Gain amplifiers

Geophones:

Mark L-10

Natural Frequency: 10 Hz

Interval between geophones: 20 feet

10 geophones per trace

Instrument Settings:

Low cut filter, 12 Hz

High cut filter, 124 Hz

Spread Arrangement:

Total Length: 2530 feet

Coverage: 600%

Shot Point Spacing: 440 feet

Hole Spacing: Single holes

Group Spacing: 220 feet

Configuration: Overlapping split spread
(2530 - 330 - 110 - 0 -
110 - 330 - 2530)

Distance to nearest Geophone: 10 feet

Shot Points: Between stations

Shot Holes:

Average hole depth: 45 feet

Average charge: 2 lbs.

In addition to the 600% coverage with split spreads, a single-ended 24-trace record was taken at every sixth shot point (every ½-mile). This spread was offset, in line, 8 traces (1760 feet), giving a total spread length of 6930 feet.

DATA PROCESSING

Good quality refracted events were recorded on the offset single-ended spreads throughout the area. Penetration was routinely achieved to a high-velocity layer of a least 15,000 feet per second. Average velocities above this layer approximated 7000 feet per second. The depth of the high speed layer, which was assumed to represent the Wabamun formation, was computed using a critical-distance method. A time correction was computed based on this depth below the surface and the difference between the observed velocity in the low velocity layer and a constant refraction velocity. An additional time correction was added to this to compensate for variations in elevation based on a + 1900 foot datum. Static corrections were determined for each trace position by summing these corrections.

The velocity function was based initially on the velocity survey at the Shell Kakisa River No. 2 dry hole, located east of the project, at 60° 06.3' North Latitude and 118° 28.5' West Longitude. The function was modified as required. Paper variable area galvanometer playouts were made from a tape taken at each shotpoint, with normal moveout removed and LVL statics applied. These playouts were used to edit the tapes, by elimination of poor traces before final stack. Deconvolution was applied prior to stack on Lines 11 and 28, with little apparent improvement.

Final presentation was a 600% CDP structure section recorded in variable area - galvanometer mode on film. A 12 - 38 digital bandpass filter was used with medium AGC action and no mix between the traces. An automatic residual statics program was used for final smoothing on some sections. All processing was done by Petty Geophysical Engineering Company in San Antonio, Texas.

R E S U L T S   A N D   I N T E R P R E T A T I O N

OVERALL QUALITY

Quality of the final sections was generally fair to good. The field parameters, however, were not adequate to achieve significant attenuation of multiples. Multiple interference is evident on the horizons identified as Slave Point and Precambrian. A theoretical plot of the simple Wabamun - Surface multiple was made on sections where interference was suspected. A strong apparent reflection coincided with this plot quite consistently. Through most of the West Dogface project, this multiple falls in close proximity to the primary event believed to represent the Slave Point formation. Evidence is also present of a second multiple trailing the first by approximately the Wabamun to Fort Simpson interval. This places it in the vicinity of the assumed Precambrian reflection. Other multiples arrive at times greater than the Precambrian primary and cause no trouble.

Sections supplied by Shell Canada Limited and incorporated in this report indicate much less multiple interference. The spread design was close to optimum for the area and coverage was 1200%. This combination achieved quite good attenuation of multiples. The shell

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Plotting theoretical multiple times on the sections assists in the interpretation of the primary reflections. Knowing the probable multiple pattern, it is often possible to discriminate the primary events from multiple events where the two diverge. Where the two apparently coincide, some error in section times may be assumed due to unknown phase shifts.

ENCLOSURES

The following maps are submitted with this report:

1. Shot Point Location
2. Surface Elevation
3. Wabamun Structure
4. Slave Point Structure
5. Keg River Structure
6. Precambrian Structure
7. Wabamun to Slave Point Isochron
8. Slave Point to Keg River Isochron
9. Slave Point to Precambrian Isochron

HORIZON IDENTIFICATION AND QUALITY

There being no deep tests in the area, horizon identification is tentative. However, it is anticipated that strong, continous events should originate at the shale - carbonate contacts at the top of the Wabamun and Slave Point formations. Other horizons, such as the Fort Simpson shale and the Precambrian might be expected to generate reflections of lesser amplitude. Since the Wabamun is the shallowest carbonate expected, it should be reasonable to so identify the 15,000 feet per second layer on the long refraction records. The same layer is represented by a very strong, good quality reflection throughout the area. A structure map of this event, labelled "Wabamun Structure", is enclosed.

The Wabamun to Slave Point isopach is 3263 feet at the Shell Mobil Alexandra No. 6 test to the north of the project (60° 20' North, 119° 15' West), and 3200 feet at the Shell Petitot 11-17 test to the south (Lsd 11-17-126-09 W6). Applying interval velocities from the Shell Kakisa No. 2 dry hole, the approximate two-way travel times are .527 and .519 seconds, respectively. Interval times on the enclosed Wabamun to Slave Point Isochron map range from about .530 to .580 seconds. Allowing for possible velocity variations, this agreement should fairly reliably support the identification of the Slave Point reflection. With few exceptions, the Slave Point reflection has good continuity. However, apparent character changes seem to result from the proximity of the Wabamun to surface multiple. This multiple may also contribute to the few locations where the Slave Point reflection is broken up.

The Slave Point to Precambrian isochron should be approximately .085 seconds and .130 seconds at the Alexandra and Petitot tests, respectively. The values mapped range from .093 seconds in the north to .130 seconds at the south. This thickening in the proper direction lends confidence to the identification of both horizons. The Precambrian reflection is of lower amplitude than the Slave Point and is more subject to interference. A major source of interference is believed to be a complex multiple involving the surface, Wabamun, and Fort Simpson contacts. On the north-south lines, a plot of this theoretical travel path follows line-ups that diverge downward (to the south) from the reflection mapped as Precambrian. In the very northern part of the area, where the multiple apparently coincides with the Precambrian primary, the probable result is amplitude reinforcement of the primary with an indeterminate phase shift. The apparent basement faulting near the north end of lines 47 and 51 may simply be the point at which the multiple is sufficiently out of phase with the primary to split the cycle. This is only one example of possible erroneous interpretation that may result from this multiple. Consequently the Precambrian horizon is considered to be of only fair reliability.

The Lower Keg River platform should fall one cycle above the Precambrian pick. Any valid anomalous events between this cycle and the Slave Point should represent changes in the Keg River or Muskeg formations. The horizon identified as Keg River represents an attempt to map observed anomalies in this zone. Where dips occur, they generally appear to build up from this conjectured platform, and are presented as Keg River anomalies. Facies changes in the Muskeg could also account for dips in this zone, but would probably appear somewhat higher in the section. It is postulated that anomalous conditions immediately above the Keg River platform accompanied by Slave Point drape (with a consequent thick on the Slave Point to Precambrian isochron) are more likely to be indicative of Keg River reef buildup than of Muskeg Stratigraphic changes.

The Middle Devonian Keg River is believed to be the most prospective horizon. Other possible productive zones include Muskeg dolomite, particularly the Bistcho member, and the Slave Point.

DISCUSSION OF RESULTS

Geological interpretation of this area is speculative, but it is generally believed that no significant salt deposition took place in Muskeg time. The Muskeg formation is presumed to consist primarily of anhydrite and/or dolomite. If this is in fact the case, then the Slave Point drape over a Keg River anomaly would not be expected to be of comparable magnitude to that observed at Rainbow Lake and Zama, where Slave Point structure is due in large measure to salt collapse on the flanks of Keg River reefs. In the West Dogface area, minimal Slave Point drape over suspected Keg River anomaly could be significant. Therefor, although the Wabamun to Slave Point isochron is the most reliable map, by itself it is probably not diagnostic of Keg River structure.

Evidence of faulting is present on several sections. Evaluation of the evidence is difficult because of the generally small apparent throw and the possibility of multiple interference. Logical projections from one line to another are scarce, leading to the impression that faulting, if present, is of a very local nature. The one exception to this is the indicated northeast-southwest striking fault through the southeast part of the area. The crossing to the south, on line 192-732, is questionable, but at all others shown, there is a distinct and abrupt isochron change on the Wabamun to Slave Point across the discontinuity on the Slave Point. All apparent faulting in the area, except for that near the north end of lines 47 and 51, appears to extend upward through the Slave Point. On these two lines the Keg River reflection is affected, but not the Slave Point. The Wabamun horizon shows no indication of faulting.

Apart from the Wabamun structure, the most reliable maps should be the Wabamun to Slave Point isochron and the Slave Point structure. Anomalous features apparent on these maps will be discussed in order of the alphabetical letter by which they are identified on the Slave Point structure map. Other maps and the sections will be related to the Slave Point structure.

ANOMALY 'A'. - Apparently reliable dips in the Keg River - Muskeg zone are the dominant aspects of this anomaly. The Slave Point reflection is broken up on line 51, possibly due to multiple interference. The values mapped are considered conservative. On line 162-762 the Slave Point is good, and the anomaly considered reliable. The Precambrian is also high here, but the thick on the Slave Point to Precambrian isochron supports the possibility of Keg River buildup. This anomaly is considered the most desirable location for a test.

ANOMALY 'B' - There is some evidence of Keg River dip on line 46, shot points 115 to 110, but this may be interference near the apparent fault. Indications are absent on line 162-762, where quality is good. The thin Slave Point to Precambrian isochron implies basement structure.

ANOMALY 'C' - Control is sparse, so the extent of this feature is unknown, but Shotpoints 75 to 95 show dips and character change in the Keg River zone, Slave Point high, and Slave Point to Precambrian thick. More data would be required for evaluation.

ANOMALY 'D' - This appears to be a Slave Point anomaly. Relief is greater on the Slave Point than on the deeper horizons, and there is no evidence of anomalous conditions in the Keg River.

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ANOMALY 'D' - This appears to be a Slave Point anomaly. Relief is greater on the Slave Point than on the deeper horizons, and there is no evidence of anomalous conditions in the Keg River.

ANOMALY 'E' - The Keg River appears anomalous here, with a well defined character change on the north flank on line 48. The Slave Point is also high, but its character is distorted by the Wabamun to surface multiple immediately above it. The Wabamun to Slave Point isochron thins north of the Slave Point anomaly, primarily due to a low on the Wabamun. The Slave Point to Precambrian isochron is not sufficiently thick to lend support to the interpretation.

The southward extent of the anomalous Keg River character suggests the possibility that this anomaly may represent the barrier reef that defined the Western limit of the Black Creek Basin. Lack of control to the west (and of well ties for character evaluation) precludes any assessment of this possibility.

ANOMALY 'F' - There is some evidence of moderate thickening in the Keg River zone and fair west dip on line 162-763, shotpoints 1084 - 1055.

ANOMALY 'G' - The greatest relief appears to be on the Precambrian horizon.

ANOMALY 'H' - Probable Precambrian anomaly.

ANOMALY 'I' - Probable Precambrian anomaly.

SUMMARY AND CONCLUSIONS

The lack of direct geological information in the area is a limiting factor in interpretation. Horizon identification is believed to be reliable, but the value of the Slave Point horizon in reflecting Keg River structure is in question. No strong evidence of salt collapse was observed. It is therefore believed that anomalous conditions within the Keg River Zone itself, where supported by even minor Slave Point drape and Slave Point to Precambrian thickening, offer the best criteria for a test. Anomaly 'A' which best represents these criteria, is recommended.

The potential of the area, particularly with respect to observed character changes in the Middle Devonian section, should be re-evaluated after the initial test.

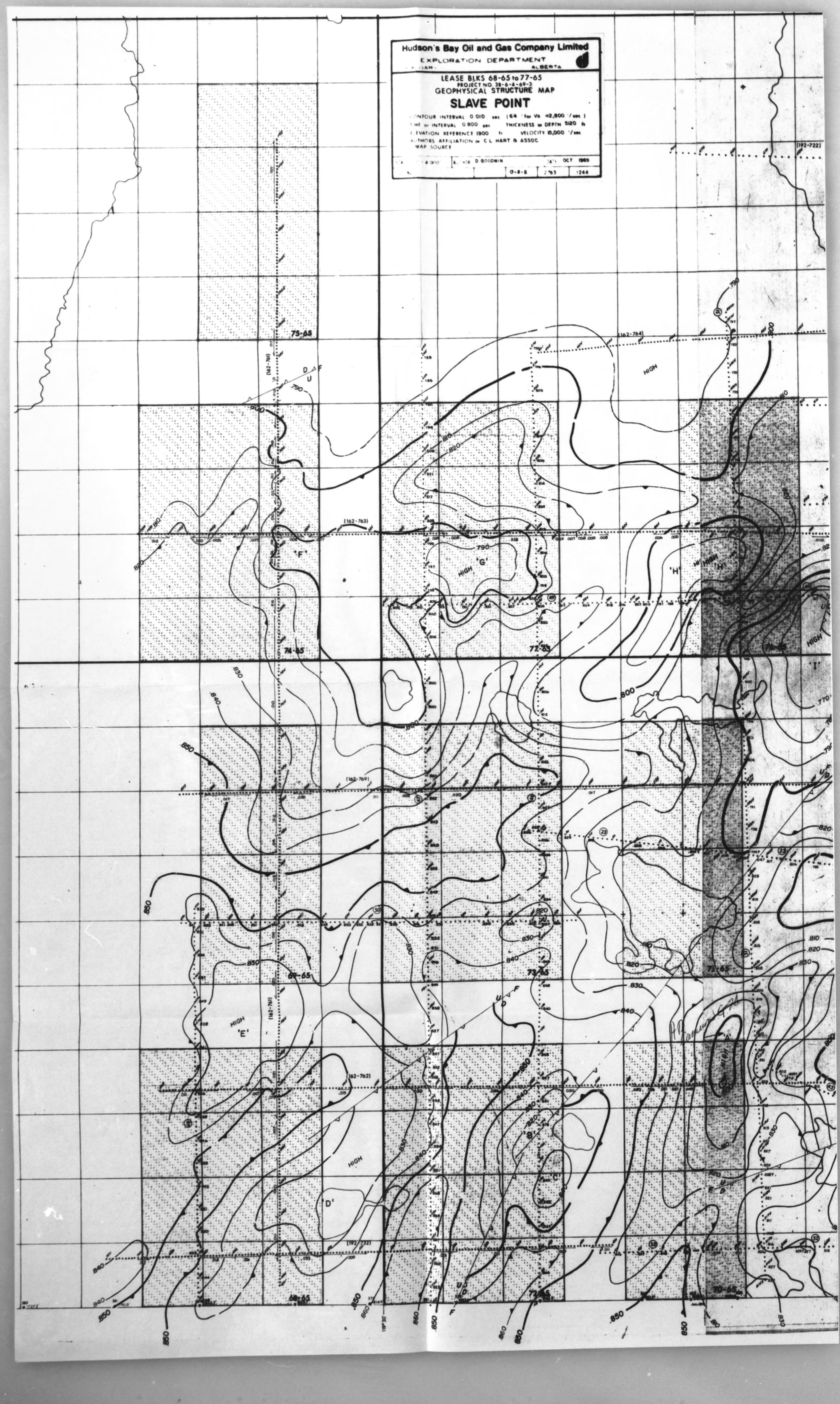
Parameters for any future seismic control in this area should be designed specifically to attenuate the shallow multiples.

Respectfully submitted,

D.W. GOODWIN

C.L. HART

C.L. HART & ASSOCIATES LTD. DECEMBER 1969


Hudson's Bay Oil and Gas Company Limited
EXPLORATION DEPARTMENT
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PROJECT NO. 38-6-4-69-3
GEOPHYSICAL STRUCTURE MAP
SLAVE POINT
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TIME or INTERVAL 0.800 sec THICKNESS or DEPTH 5120 ft
ELEVATION REFERENCE 1900 ft VELOCITY 15,000 '/sec
AUTHORS AFFILIATION or C.L. HART & ASSOC.
MAP SOURCE
D. GOODWIN
OCT. 1969
2763
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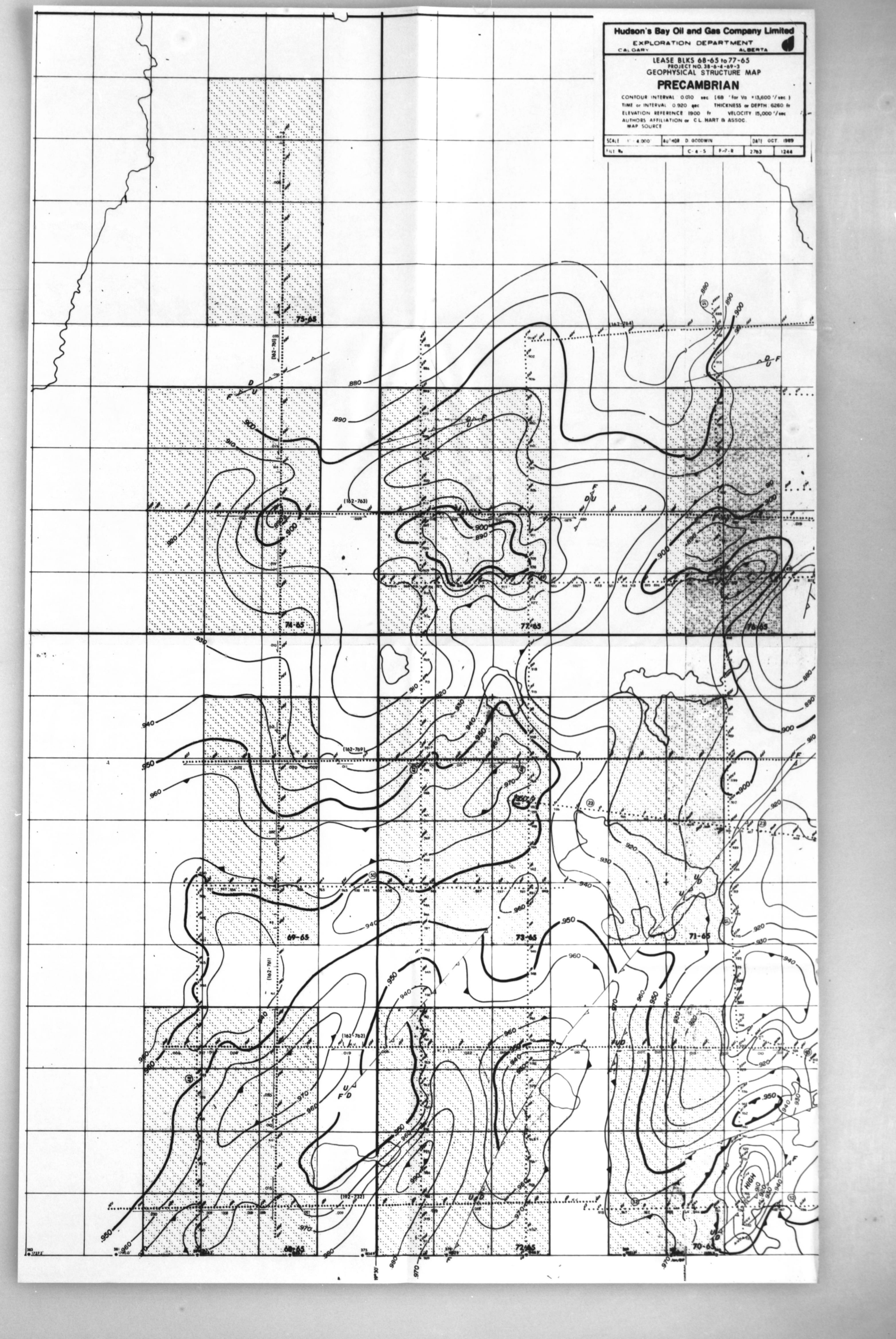
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EXPLORATION DEPARTMENT
CALGARY ALBERTA
LEASE BLKS 68-65 to 77-65
PROJECT NO. 38-6-4-69-3
GEOPHYSICAL STRUCTURE MAP
PRECAMBRIAN
CONTOUR INTERVAL 0.010 sec (68 ' for Va =13,600 '/sec)
TIME or INTERVAL 0.920 sec THICKNESS or DEPTH 6260 ft
ELEVATION REFERENCE 1900 ft VELOCITY 15,000 '/sec
AUTHORS AFFILIATION or C.L. HART & ASSOC.
MAP SOURCE
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AUTHOR D. GOODWIN
DATE OCT. 1969
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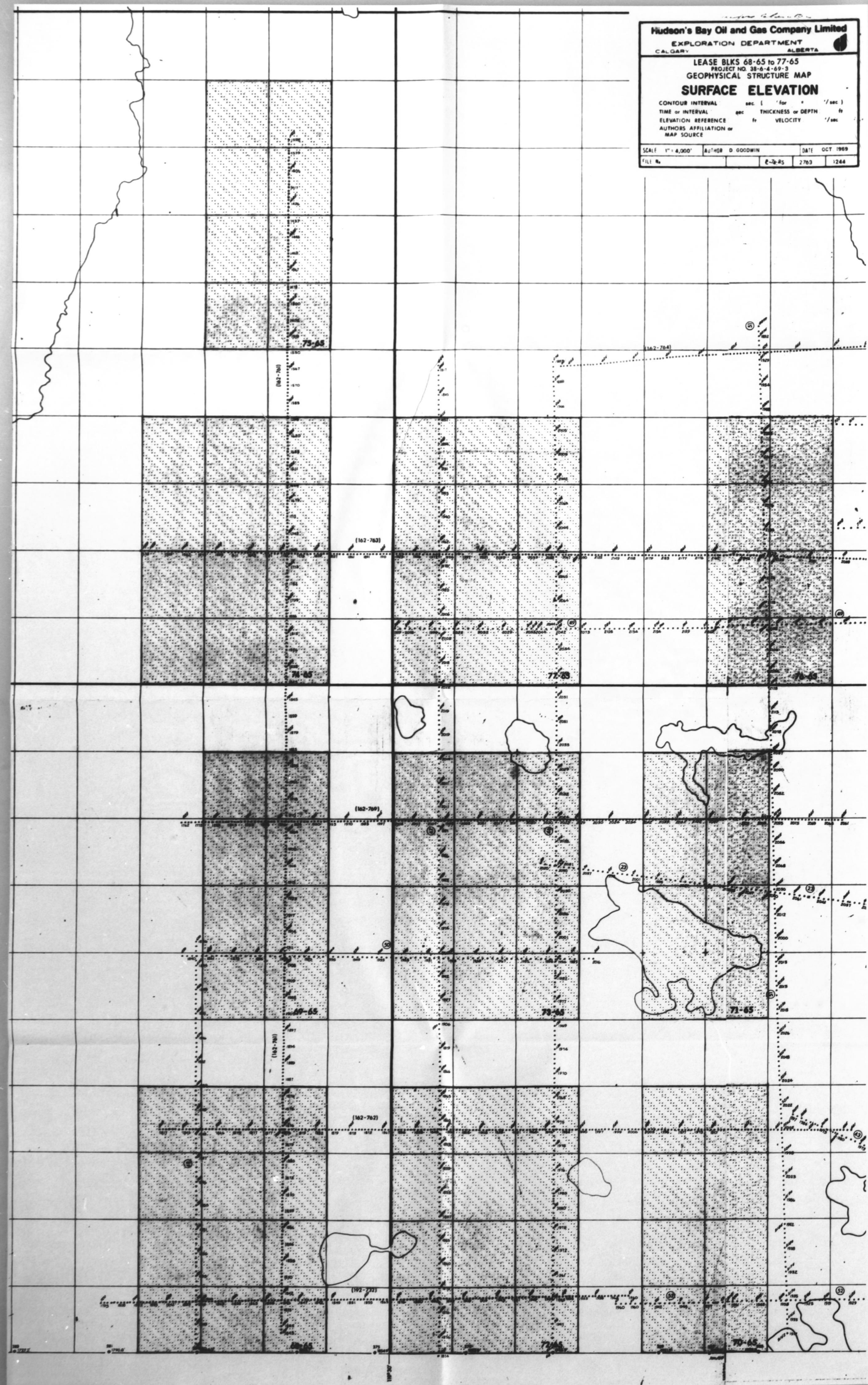
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EXPLORATION DEPARTMENT
CALGARY ALBERTA
LEASE BLKS 68-65 to 77-65
PROJECT NO. 38-6-4-69-3
GEOPHYSICAL STRUCTURE MAP
SURFACE ELEVATION
CONTOUR INTERVAL sec. ('for " '/sec)
TIME or INTERVAL sec THICKNESS or DEPTH ft
ELEVATION REFERENCE ft VELOCITY '/sec
AUTHORS AFFILIATION or MAP SOURCE
SCALE 1" = 4,000'
AUTHOR D. GOODWIN
DATE OCT. 1969
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77-65
76-65
69-65
73-65
72-65
70-65


Hudson's Bay Oil and Gas Company Limited
EXPLORATION DEPARTMENT
ALBERTA
LEASE BLKS 68-65 to 77-65
PROJECT NO. 38-6-4-69-3
GEOPHYSICAL STRUCTURE MAP
WABAMUN
CONTOUR INTERVAL 0.010 sec (75 'for Va =15,000 '/sec)
TIME or INTERVAL 0.280 sec THICKNESS or DEPTH 2100 ft
ELEVATION REFERENCE 1900 ft VELOCITY 15,000 '/sec
AUTHORS AFFILIATION or MAP SOURCE C.L. HART & ASSOC.
SCALE 1" = 4,000'
AUTHOR D. GOODWIN
DATE OCT. 1969
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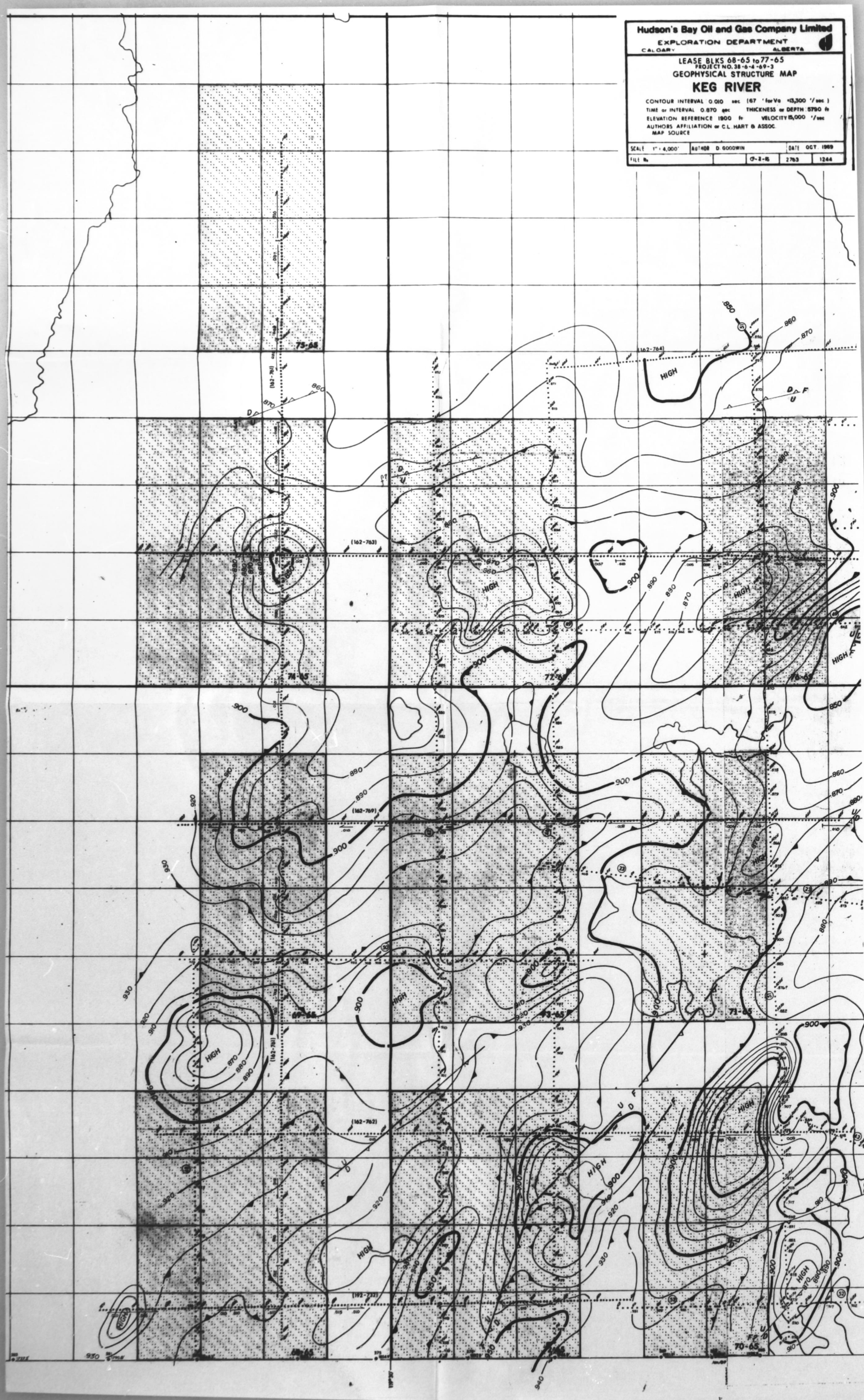
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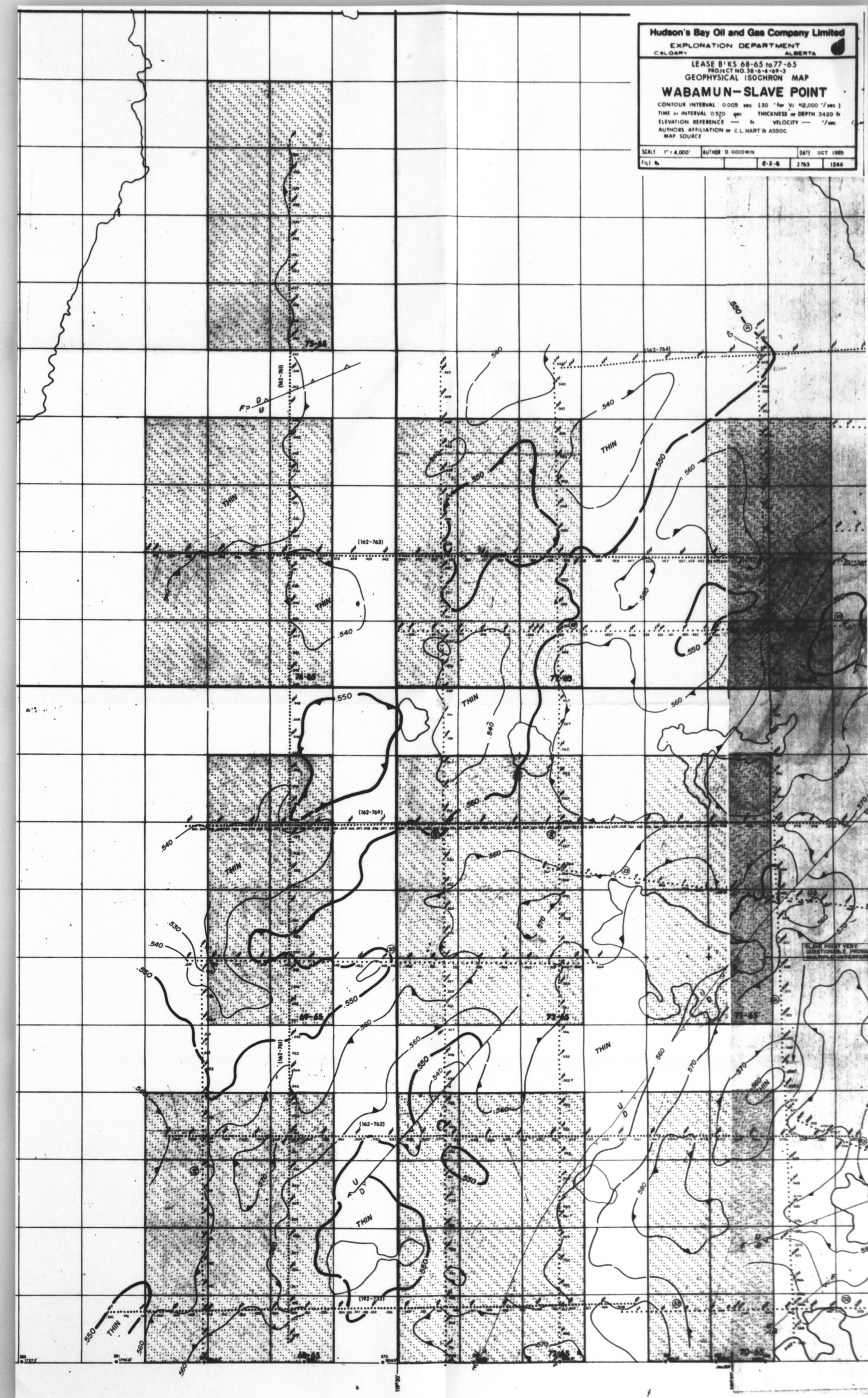
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CALGARY ALBERTA
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MAP SOURCE
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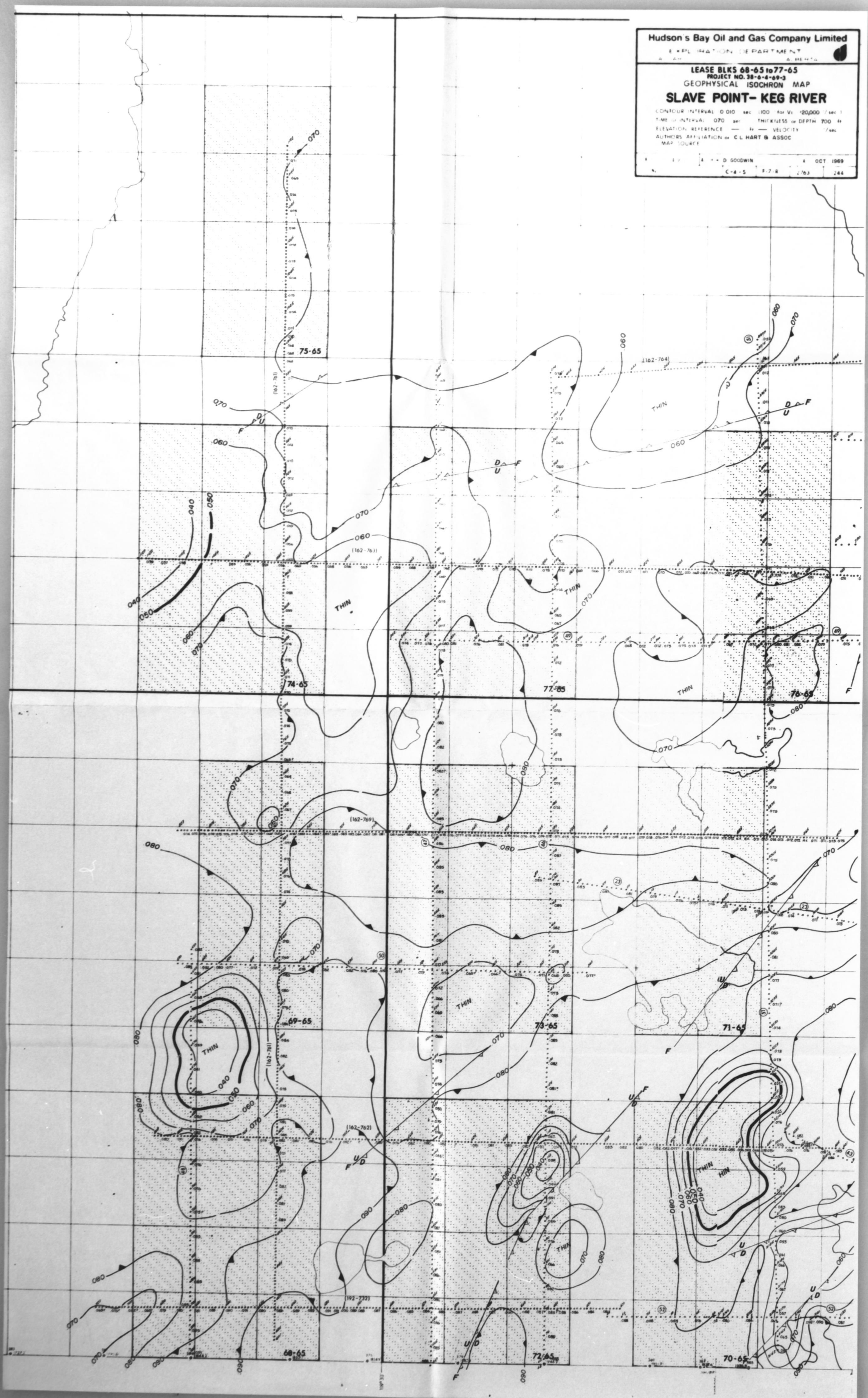
Hudson's Bay Oil and Gas Company Limited
LEASE BLKS 68-65 to 77-65
PROJECT NO. 38-6-4-69-3
GEOPHYSICAL ISOCHRON MAP
SLAVE POINT- KEG RIVER
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ELEVATION REFERENCE — ft — VELOCITY '/sec
AUTHORS AFFILIATION or C.L. HART & ASSOC
MAP SOURCE
D GOODWIN
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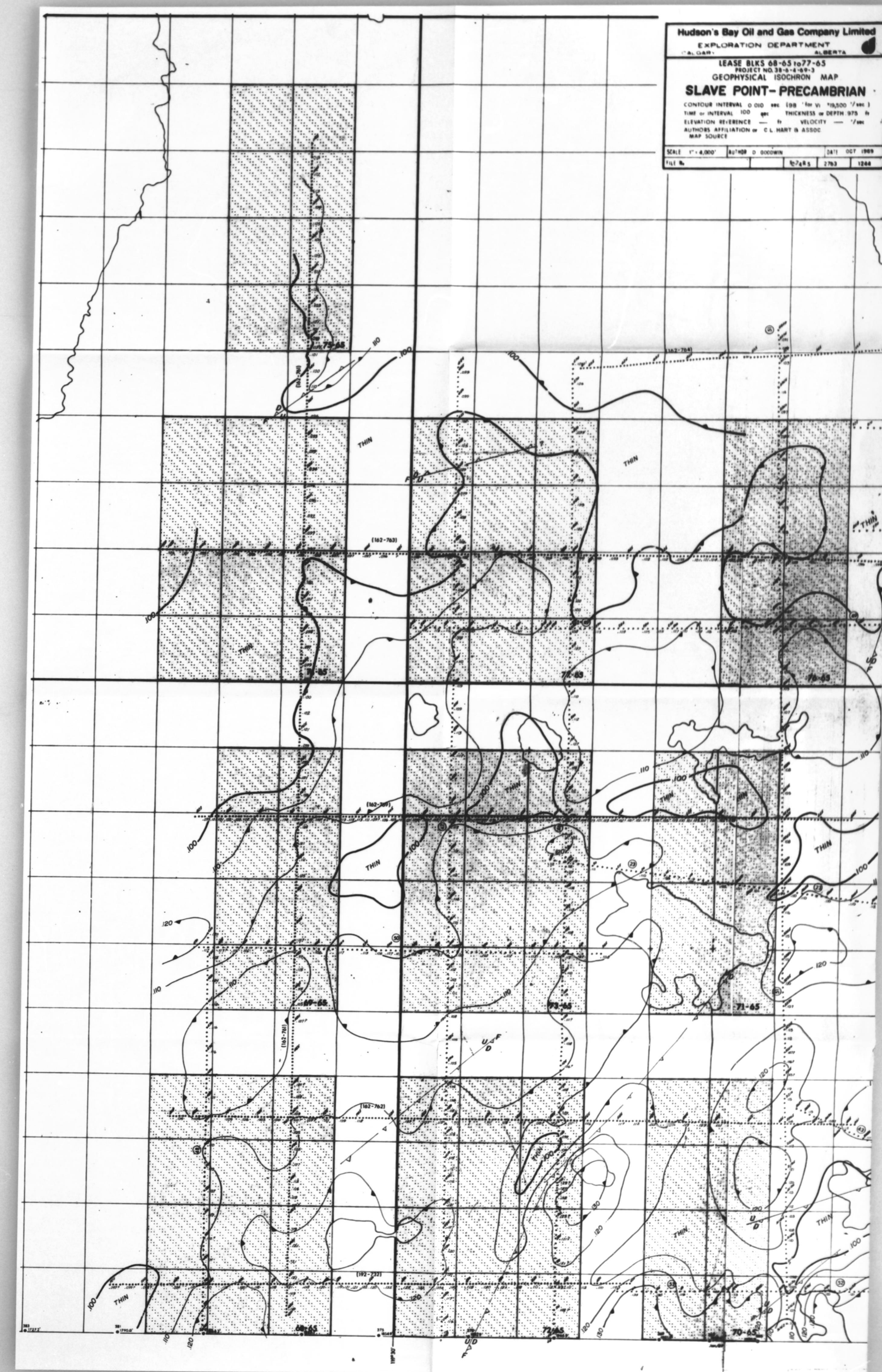
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LEASE BLKS 68-65 to 77-65
PROJECT NO. 38-6-4-69-3
GEOPHYSICAL ISOCHRON MAP
SLAVE POINT- PRECAMBRIAN
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ELEVATION REFERENCE — ft VELOCITY — '/sec
AUTHORS AFFILIATION or C.L. HART & ASSOC
MAP SOURCE
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AUTHOR D GOODWIN
DATE OCT 1969
FILE No.
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