

The Summary Report of Drill Results contains confidential information or data, as described in Section 2 of the *Coal Act Regulation*, and has been excluded from this report.

Coal Act Regulation: http://www.gp.gov.bc.ca/statreg/reg/C/251_2004.htm

early approval *1970 field*
PR-QUINTETTE A.D.A.
7-14-71
CONFIDENTIAL
CONFIDENTIAL

QUINTETTE PROJECT

PHASE I

SUMMARY REPORT OF

DRILL RESULTS

MAY 1971

D.M. Parkes, P. Eng.

Coal Licences 1300 to 1427 inclusive

Coal Licences 1887 to 1907 inclusive

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 597

SUMMARY

During February 1971 four diamond drill holes were located on the Quintette project to test for seam thickness, quality and regional continuity. The location of the holes were established on the basis of field observation and the stratigraphy and structure indicated on Stott's map (GSC Bulletin 152) of the area. This procedure proved to be relatively successful as coal seams were intersected in all of the drilling. The indications are that these seams correlate reasonably well between both areas although there is considerable variation in the thickness and quality. The complete core from all seams greater than four feet thick was sent to Commercial Testing & Engineering in Chicago for analysis, however a high degree of reliability cannot be expected as the core recovery varied from 20% to 100% with an average of 73% (including the more competent muddy sections). Refer to D.M. Parkes letter attached. It is quite probable that much of the friable and soft coal which is usually of better coking quality has been lost. Both drill holes in the Quintette area also produced considerable artesian water which could have a marked effect on the coking quality of the coals if it represents oxygen bearing ground water. Wolverine #1 also intersected extensive zones in which the drill water was lost at at least two levels. This may be due to tension fractures in the anticlinal structure.

An adit was driven on the upper extension of the ten foot seam which was intersected in the Quintette No. 1 hole. Unfortunately, due to the parallel nature of the topography and the strike of the seam,

it was difficult to penetrate the hillside to a point where the rock cover was sufficient to obviate the oxidizing effects of weathering. This adit was suspended when the drill hole result indicated poor coal at depth. However, the last sample showed a slight improvement in Free Swelling Index and the other characteristics are consistently good. It is recommended that either a new adit be driven or the present adit be extended into an area with more cover. Short rotary holes might also be driven ahead of future adit sites for preliminary quality tests.

As a result of our developing familiarity with the Quintette area, it appears that some areas such as the east limit of the Wolverine No. 1 fold and an area south of Murray River would be particularly attractive areas to begin the next stage of exploration at Quintette.

D. M. Parkes, P. Eng.

QUINTETTE PROJECT

GEOLOGY.

The geological information was derived from Bulletin No. 152, 1968, of the Geological Survey of Canada. Additional information was gained by using a bulldozer and two sites were selected for drilling. These are shown on the index map.

WOLVERINE SECTION.

WDH #1

Wolverine Hole No. 1 was placed at the crest of an anticline so that the section penetrated was practically perpendicular to the strike of the strata. The succession is as follows: (See drill hole sections for lithological details).

| | |
|------|---|
| 23' | Overburden |
| 126' | Gates Member (lower part of Commotion Formation). |
| 162' | Moosebar Formation. |
| 409' | Gething Formation. |
| 22' | Cadomin (continued). |

Total depth - 742'

Coal seam details.

Gates Seam C.

| | |
|-------|--|
| 10.0' | Mostly bright, friable coal, thin mudstone layers. |
| 4.0' | Mudstone, highly carbonaceous. |
| 0.5' | Shaly coal. |
| 6.5' | Well laminated coal. |
| 2.0' | Bright, friable coal. |
| <hr/> | |
| 23.0' | |

Gething Seam A (Chamberlain)

3.5' Bright coal.
2.0' Bright, muddy coal.
2.0' Bright coal, hard and friable.
3.5' Dominantly bright, core form coal with thin intervals
of friable coal.
7.5' Mudstones, hard and very carbonaceous.
2.0' Bright, core form coal.
2.0' Black, carbonaceous mudstone.
4.0' Bright, friable coal.

26.5'

Gething Seam B.

1.6' Bright coal, solid core.
1.9' Black, carbonaceous mudstone.
1.5' Very clean core form coal.

5.0'

WDH #2

Wolverine No. 2 hole was located to intersect the down-dip extension of a coal outcrop. The following succession was encountered.

26.0' Overburden
196.0' Gates Member.
152.2' Moosebar Formation.
216.8' Gething Formation (continued).

Total Depth 591.0'

Coal seam details.

Seam B.

This seam has apparently been ground out by the drillers. The gamma ray/neutron logs indicate about 15' of coal seam of which 4' are carbonaceous mudstones (i.e. 8' and 3' separated by mudstones).

Seam C.

3.5' Coal: bright, clean, solid core.

Gething Seam A - Chamberlain zone?

0.7' Poorly laminated, hard coal.
1.0' Carbonaceous mudstones with stringers of coal.
2.3' Hard, laminated coal (dominance of bright laminae).
0.3' Bony coal.

4.3'

Gething Seam B.

1.5' Distinctly bony coal, badly fractured.
8.5' Bright, friable coal.
2.0' Mudstones, richly carbonaceous.
1.0' Friable coal, appears shaly.
2.0' Carbonaceous mudstone.
5.5' Bright coal, some well laminated.
1.0' Mushy coal, very dirty in the middle.
1.5' Carbonaceous mudstone/shale.
0.5' Shaly coal.
1.5' Bright, friable coal.

25.0'

QUINETTE SECTION.

QDH #1

Following succession was encountered:

44.0' Overburden.
114.0' Moosebar Formation.
397.5' Gething Formation.
22.5' Cadomin.

Total Depth 478.0'

Coal seam details.

Seam A - Chamberlain zone?

5.0' Apparently bright friable coal (recovered).
2.0' Bright and clean coal.
3.0' Bright, friable coal.
1.0' Coal, mostly fusain.
0.5' Hard, laminated coal.

11.5'

Seam B.

2.5' Hard, dull coal.
0.5' Bright, core form coal.

3.0'

QDH#2

Quintette Hole No. 2 was located to intersect the down-dip extension of coal outcrops exposed in a road cut. The following succession was encountered:

28' Overburden.
578' Gates Member (continued).

606'

Coal seam details.

Seam A

0.2' Bony coal.
7.0' Bright coal.
0.1' Carbonaceous shales.
2.0' Mushy bright coal.
0.3' Well laminated coal.
0.7' Bright core, solid core.

10.3'

Seam B.

0.3' Dominantly shaly coal.
0.4' Evenly laminated coal.
0.3' Mushy bright coal.
1.0' Bright core form coal.

2.0'

Seam C.

4.0' Bright, but badly fractured coal.
2.8' Bright (hard & mushy) coal.
0.3' Coal, bright, slightly shaly.
1.2' Bright, mushy coal.
2.0' Dominantly bright coal (mushy in the middle).

10.3'

Morgan

for:

Analysis of sample 2 from Face of
No. 1 Adit, Quintette Project
(81 ft. from mouth of adit - Mar. 3, 1971)
- raw coal analysis
- washed coal analysis

Refer to: PR - QUINTETTE 71 (A) A
CONFIDENTIAL ANALYSIS FILE

QUINTETTE PROJECT

GEOLOGICAL REPORT

MAY 1971

A.C. Chowdry

INTRODUCTION

The Lower Cretaceous sedimentary belt in the Foothills region has long been known to contain large deposits of coal. It is mainly confined to the Gething and Lower Commotion (Gates Member) sediments. Although Stott (1968) had geologically mapped the area (as part of regional scheme of mapping) and appended two stratigraphic sections in his report, large intervals were shown to be concealed by drift. No precise information on localization of coal horizons was therefore available.

A brief drilling program was undertaken during February and early March, 1971. Two holes were drilled in the Wolverine River area and two in the Quintette Mountain region (see map) to gain information on coal horizons, their lateral extensions and the quality of coal. One adit was driven just above QDH #1. The results of this exploration are summarized in this report.

ACCESS

The area is situated west of ^{the} Alberta - British Columbia border. Coal licences extend for about 30 miles in a northwesterly direction between Latitudes 54°50' to 55°05' W and Longitudes 121°30' to 120°45' N. Access to the Wolverine River area is 23 miles of 4-wheel drive road and 51 miles of 2-wheel drive gravel road from Chetwynd, British Columbia. The access ends at dirt airstrip in Wolverine River Valley. Additional 7 miles of road was built to the drill sites. Access to the Quintette area is via Beaverlodge, Alberta, a distance of about 100 miles along the dirt road to Kineuso Falls, B. C. Denison Mines Limited then constructed a road, about 6 miles long, to the farthest drillsite.

ROCKS OF QUINTETTE & WOLVERINE AREAS

The rocks in the above areas of the Foothills region record a succession of intertonguing marine and non-marine shales and sandstones of Lower Cretaceous age. Sediments in the lower part of the succession are coal-bearing and contain significant conglomerates with tongues of carbonaceous sandy sediments. The lower part of the sequence records ubiquitous fluvial conditions that prevailed after initial deposition of conglomeratic sedimentation. The upper sequence entails intertonguing of marine, intertidal and flood plain environments (deltaic) of early Cretaceous seas.

The succession is as follows:

| | | |
|-----------------------|---|---------------------|
| Dunvegan Formation |) | |
| Shaftesbury Formation |) | |
| Commotion Formation |) | Fort St. John Group |
| Moosebar Formation |) | |
| Gething Formation |) | |
| Cadomin Formation |) | Bullhead Group |
| Nikanassin Formation |) | |

NIKANASSIN FORMATION

These are the oldest rocks exposed in this region belonging to the lower Cretaceous. The formation is dominantly marine and is composed of siltstones, shales and some medium-grained sandstones towards its top. Coal occurs as thin layers (none exceeding a few feet in thickness). The succession is commonly very disturbed (structurally) and often displays chevron type of folding. The upper contact with the overlying Cadomin conglomerates is disconformable but regionally there is a marked angular discordance. The formation is several thousand feet in thickness and is laterally equivalent to Kootenay shales (non-marine).

CADOMIN FORMATION

This formation is massive in nature and more resistant than contiguous lithologies and hence serves as the best stratigraphic marker.

It is composed of pebbles, cobbles and boulders of several kinds of cherts, quartzites and quartzitic sandstones. Banded siliceous siltstone, dolomites and fossiliferous limestones (mainly colonial corals of Silurian/Devonian age) are occasionally encountered. Colour of these phenoclasts ranges from white through various shades of grey to bluish black. Average size of pebbles is over 1" across and clasts of 3" across are not uncommon. No definite gradation in pebble size has been noted although in certain sections there is a tendency towards coarsening bottomwards. The clasts are usually closely packed almost to the exclusion of sandy matrix. The conglomerates incorporate thin (up to 10' to 15' thick) sandstone beds that are essentially lenticular in nature and pinch out (laterally) to nothing within very short distances. Carbonaceous and coaly layers are also found. Thickness varies from 150' - 200' in this region.

GETHING FORMATION

These rocks are not as resistant as the Cadomin conglomerates but their boundaries (in the field) can be easily delineated because of their occurrence between marine conglomerates (below) and overlying recessive Moosebar shales. The formation consists of sandstones, carbonaceous shales and mudstones, some coal and one massive conglomerate bed. The sediments are generally fine-grained and carbonaceous, grey-brown weathering and cross-laminated. Commonly, the beds are thin bedded to platy (occasionally massive) and exhibit a variety of crossbedding patterns (small-scale, low-angled and wedge-shaped). Festoon crossbedding is rife and the beds incorporating such cross-bedding weather into platy stacks. Mudstones are generally usually structureless and are blocky to rubbly. Plant debris, large logs, rootlets and some palaeosoil have been noted.

Coal occurs in the Formation as three distinct seams - minor seams are also present which may laterally develop into significant coal zones.

The thickness of the Gething sediments varies between 450' - 550'. The upper boundary is distinct and is probably disconformable - invariably marked by a pebbly zone, 1' - 3' in thickness. This conglomeratic zone appears to record an initial transgressive phase.

MOOSEBAR FORMATION

These are marine shales that occur as a recessive zone between the resistant formations of Gething and Commotion. The lower junction with the Gething Formation is abrupt although no evidence of erosion and scouring of any significance has been found. The upper boundary of the formation is very gradational with the Gates Member and is placed at the first significant sandstone bed. These features are very characteristic of the formation:

1. Rapid changes of facies (on a scale of inches) from siltstones to shales - their mutual boundaries invariably being erosional. There is abundant evidence of microchanneling and penecontemporaneous erosion. Such zones are associated with shaly intraclasts.
2. Rusty weathering intervals rich in concretions. Careful examination of these nodules reveals intricately weathered burrowing structures.
3. Distinct bioturbated zones characterized by both small and large burrows. At places the primary sedimentary structures are completely obliterated giving rise to chaotic fabrics.
4. Dolomitic and calcareous lenses which weather out preferentially and impart a banded appearance to the sequence.
5. Bentonite layers - these are only few inches thick and are particularly noted towards the bottom of the sequence (mostly confined to lowermost 40 feet).

6. Thin sandstones of greenish hue, rich in Glauconite.
7. Almost total absence of carbonaceous matter. The formation appears to vary in thickness from 150' - 250' in this region.

COMMOTION FORMATION

It is composed of sandstones, shales, carbonaceous shales and conglomerates. It has 3 members. The lowest member is Gates, Hulcross in middle and Boulder Creek at top.

Gates Member: Consists of group of sandstones, siltstones and various types of shales. The sandstones in the lower part of the member are generally clean, well-sorted and fine-grained. Planar type of cross-sets are characteristic of the sandstones. Intraclasts are common in the bottom-most 100' and a definite burrowed zone, 20' - 30' thick, occurs within 150' - 200' of the lower sandstones. Very few thin shaly bands occur. Higher in the sequence there is a cyclothem sequence of sandstones, siltstones, shales and coal. The sandstones are commonly medium-to coarse-grained, festoon-to trough cross-bedded and well sorted. Few conglomerate intervals also occur. Important coal seams occur in the upper half of the Gates member. The thickness of the member may vary from 750' - 1000' or even more.

Hulcross Member: This is a marine member of the Commotion Formation. It is dominantly shaly in nature with subordinate amounts of silts. The siltstones impart a very characteristic look to the gross lithology. There are delicate silty laminations interlayered with argillaceous laminae. Parallel lamination, low-angled, small-scale cross-lamination are very characteristic. The rocks weather to blocky and rubbly debris, commonly with stains of limonite. Sideritic concretions are quite abundant. The lower contact of Hulcross with Gates is characterized by a layer of chert pebbles in the matrix of coarse sandstones. Some erosion and small-scale channeling is also evidenced.

Towards the top of the succession the silty content increases and the lithology changes to siltstones and fine sandstone with an intrinsic reddish tinge in the matrix. Thickness of the member may vary from 300' to 400' in the region.

Boulder Creek Member: This is the highest member of the Commotion Formation and forms conspicuous ridges that constitute mappable horizons. The lower contact is transitional with the Hulcross Member. Lower part of the member is composed of massive, fine-grained, well sorted sandstones. These are overlain by 40' - 50' thick massive conglomerates that are essentially lenticular in nature. The conglomerates have well sorted pebbles (dominantly of green chert) usually under $\frac{1}{4}$ " in diameter with little or no matrix. Carbonaceous shales with thin long lenses also occur in the member. The upper part of the Boulder Creek is composed of siltstones, mudstones and carbonaceous sandstones. They are usually ill-sorted and have greyish brown look. Carbonaceous fragments are common in some horizons of the sandstones. Total thickness of the member is probably between 400' - 450'.

SHAFTESBURY FORMATION

The formation is entirely marine and is grey to dark grey in colour. Silts are uniformly disseminated in shaly matrix and hence absence of well-defined lamination. Fish scales are encountered at 200' - 300' from the base of the formation. North of Murray River, the formation is divisible into three lithologies - Hasler at the base, Goodrich in middle (sandstones) and Cruiser at the top. The Hasler and Cruiser are very similar lithologically but can be isolated only because of the intervention of Goodrich sandstones. Goodrich sandstones are fine-grained, cross-bedded with subordinate amounts of mudstones and shales. Cruiser and Hasler formations have sideritic concretions. Minor conglomerates may sometimes

be seen in the lower part of Hasler formation. Combined thickness of the three formations may exceed 2000'.

DUNVEGAN FORMATION

This formation consists of marine and non-marine sandstone/shale sequence with minor amounts of coal. No exposures of this formation have been observed within the confines of the region under investigation.

CORRELATION & DISTRIBUTION OF COAL

Three angle holes and one vertical hole (WDH #1) were drilled as indicated on the accompanying map. The holes in the Wolverine River area were mainly intended to intersect the Gething coal seams. One of the Holes (QDH #2) in the Quintette area was placed in the lower 2/3rds of the Gates. This was based on previous knowledge of the Saxon area where the upper 1/3rd of the Gates was barren of coal.

Using the base of Moosebar Formation as a horizontal datum, lithological columns were placed accordingly for correlation. Notwithstanding the considerable distance involved among the 4 holes, quite a reasonable correlation of coal zones seems apparent.

There are two main coal horizons in the Gething coal measures. The first one, designated as Zone A, occurs between 100 to 150 feet from the base of Moosebar. Its thickness is very variable - 11.5 feet in QDH #1 and 26.5 feet (with shaley intercalations) in WDH #1.

The second coal level, designated as Zone B, occurs at about 300 feet below the Moosebar. Its thickness varies between 3.5 and 5 feet. This interval was not penetrated in WDH #2 - stopped about 120 feet too short because of mechanical troubles.

In addition to the above zones, there are a few thin coal seams, but because of enormity of distance, it would be meaningless to attempt a correlation.

More coal zones in the Commotion Formation were encountered; correlation among the zones is less reliable. The lowermost, Zone C is thinnest in WDH #1 with a total thickness of 23 feet including 5 feet of mudstone. The equivalent horizon in WDH #2, though about the same thickness, occurs at approximately the same stratigraphic position, has only 5 feet of coal interspersed with sandstones and shales. It should be noted that in this latter hole, marked facies change and increase in thickness of equivalent strata has taken place - a dominantly sandy / conglomeratic facies. This high energy environment may have been responsible for inhibiting coal development. Zone C in QDH #2 is 10 feet thick and in spite of its remoteness, shows remarkable correspondence of facies and coal horizon. Zone B in WDH #2, about 15 feet thick (including some mudstone) has no unequivocal lateral equivalent. It may be correlated with either of the zones - Zone B or Zone B' - both being extremely thin. Zone A in QDH #2 is over 10 feet thick and its possible lateral equivalent zones were not penetrated in other holes.

SUMMARY AND CONCLUSIONS

1. The results of the brief drilling program reveal definite coal horizons in the Gething and Gates.
2. There are two major coal zones in the Gething and three coal zones in the Gates. The correlations among the various Gething / Gates zones seems quite tenable.
3. Assuming regional continuity of the zones, the areas under investigation promise large reserves of coal.
4. Analyses from both the areas show that the coal is of good coking quality.

RECOMMENDATIONS

The prospect merits further exploration. In view of the structural complexities encountered during drilling in some of the holes, it is imperative that detailed geological mapping be done. Geologically favourable areas should then be isolated and further investigation by drilling programmed.

March 8th, 1971.

Mr. W. Walsh,
Canadian Longyear, Limited,
60 West 7th Avenue,
Vancouver 10, B.C.

Dear Mr. Walsh,

Now that our preliminary drilling programme is completed, we have had an opportunity to study the results of the drilling. As the main object of the exploration expenditures is to obtain coal cores for analysis and study, the percentage recovery is of the utmost importance.

Unfortunately, there are sections where large pieces of core are missing. I am enclosing a copy of the log through the coal seams. The average recovery works out at only 72.3%. I would ask for your comments on what we consider a poor performance and give your recommendations for improving this figure.

Very truly yours,

DENISON MINES LIMITED

David H. Parkes

David H. Parkes, P. Eng.

/Bg

cc- Mr. K.L. Perry
Mr. C. Maberry.

STATEMENT OF QUALIFICATIONS

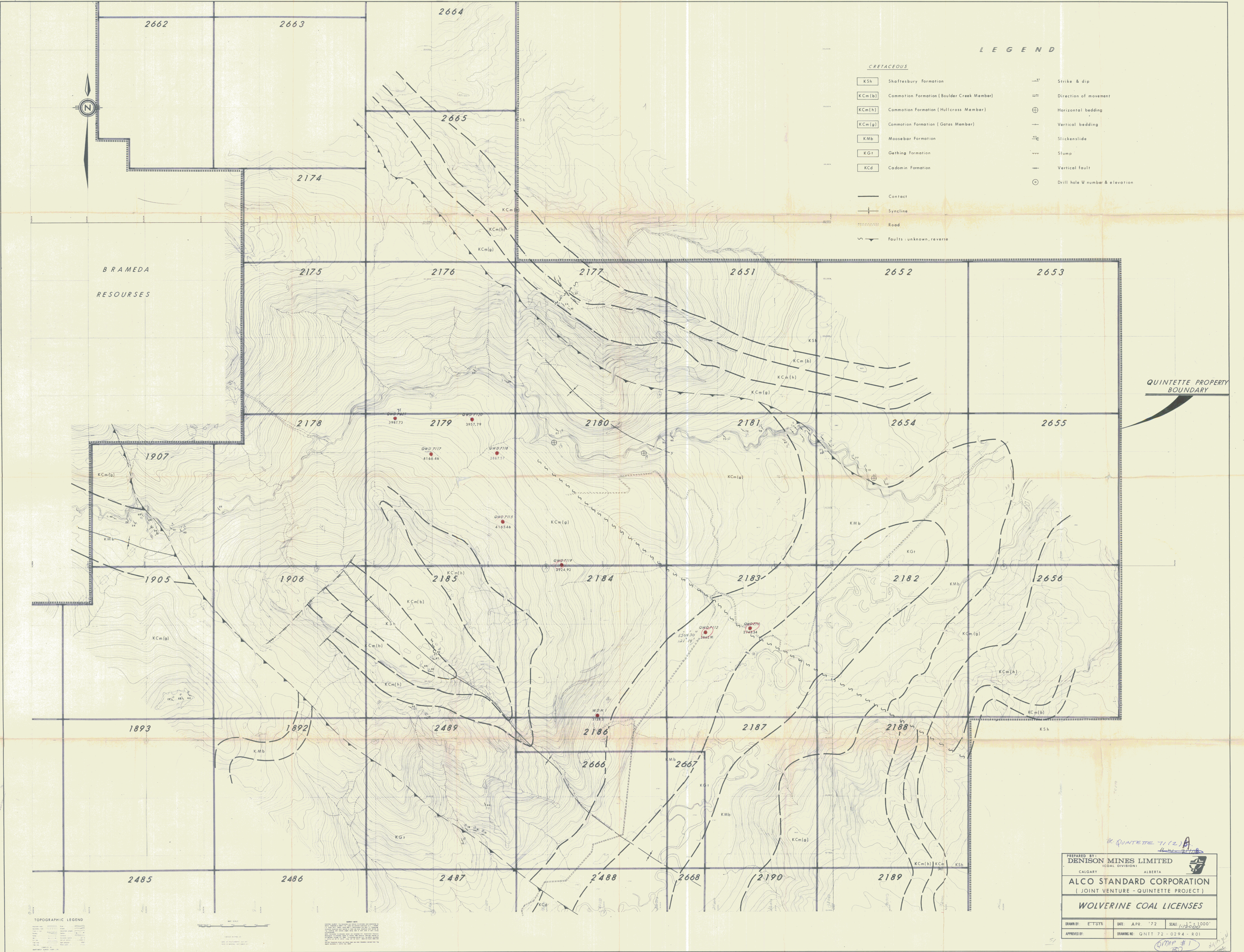
The exploration of Denison Mines Limited's Quintette project between January and May 1971 was planned and directed by the undersigned and Mr. I.P. Dyson, P. Geol. The field work was done by Dr. A.C. Chowdry as directed.

Ali C. Chowdry, Phd., graduated in geology from Panjab University, Lahore, West Pakistan in 1957 with the degree of Bachelor of Science, and in 1959 with a Master of Science degree. He received his Doctorate from Reading University in Berkshire, England in 1967.

I consider Dr. Chowdry well qualified to undertake the responsibilities assigned to him with respect to this project. I am satisfied that the attached report dated 1 May, 1971 has been competently prepared and fairly represents the information obtained from this program.



D.M. Parkes, P. Eng.



LEGEND

CRETACEOUS

- KSh Shaftesbury Formation
- KCm(b) Commotion Formation (Boulder Creek Member)
- KCm(h) Commotion Formation (Hullcross Member)
- KCm(g) Commotion Formation (Gatas Member)
- KMb Moosebar Formation
- KGf Gething Formation
- KCd Cadomin Formation
- Strike & dip
- Direction of movement
- Horizontal bedding
- Vertical bedding
- Slickenside
- Slump
- Vertical fault
- Drill hole w number & elevation
- Contact
- Syncline
- Road
- Faults: unknown, reverse

BRAMEDA
RESOURCES

QUINETTE PROPERTY
BOUNDARY

TOPOGRAPHIC LEGEND

PREPARED BY:
DENISON MINES LIMITED
(LOCAL DIVISION) CALGARY ALBERTA

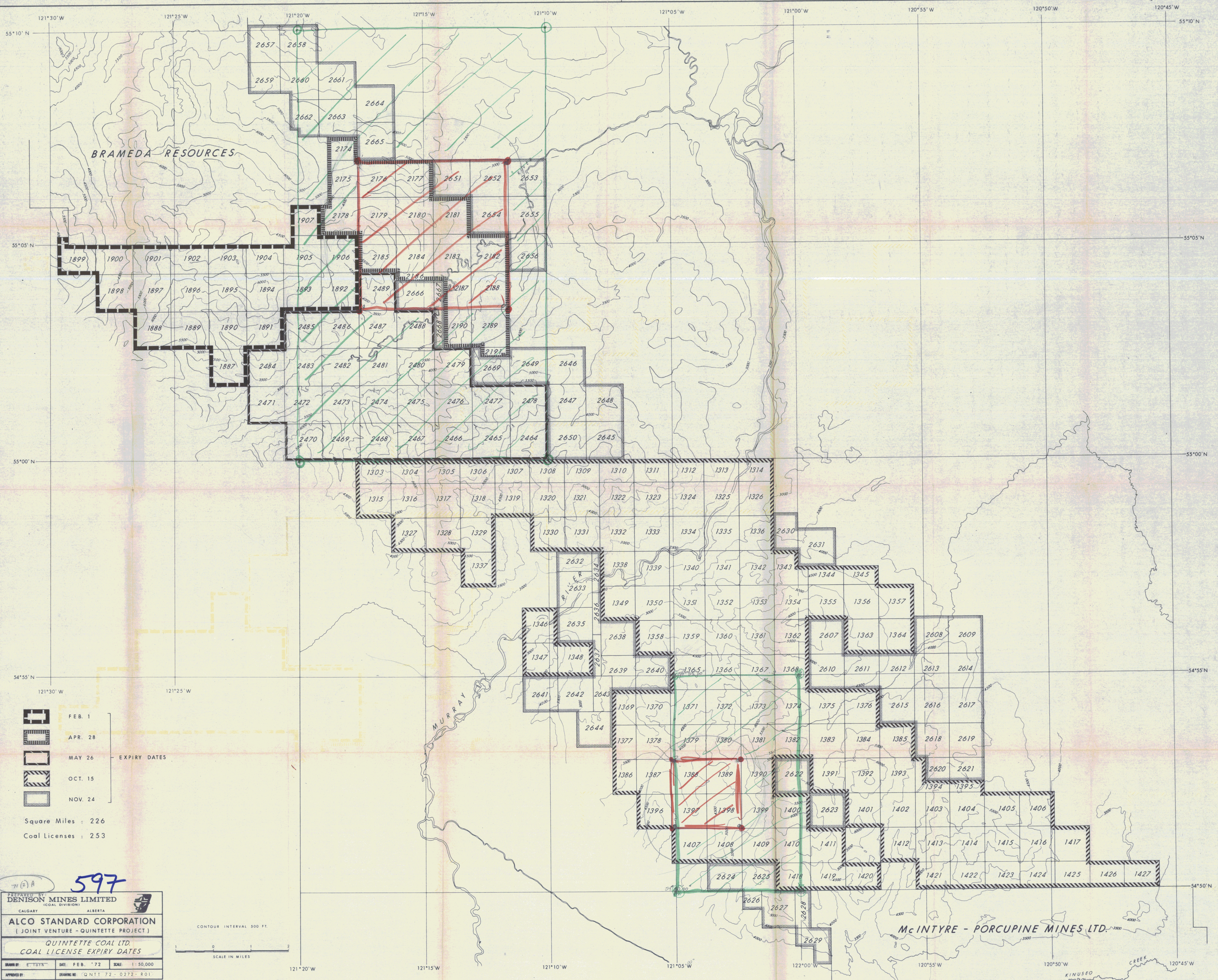
ALCO STANDARD CORPORATION
(JOINT VENTURE - QUINETTE PROJECT)

WOLVERINE COAL LICENSES

DRAWN BY: ETOH DATE: APR '72 SCALE: 1:250,000


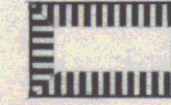



APPROVED BY: GNTT 72-0294-R01

QMP #1



BRAMEDA RESOURCES

McINTYRE - PORCUPINE MINES LTD.

-  FEB. 1
 -  APR. 28
 -  MAY 26
 -  OCT. 15
 -  NOV. 24
- EXPIRY DATES

Square Miles : 226
Coal Licenses : 253

71 (2) A 597

PREPARED BY:
DENISON MINES LIMITED
(COAL DIVISION) CALGARY ALBERTA

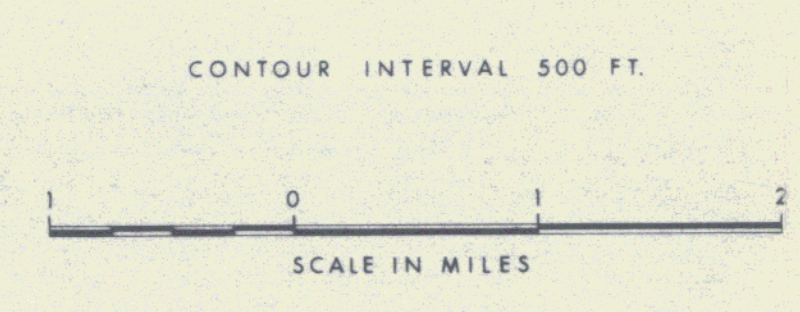
ALCO STANDARD CORPORATION
(JOINT VENTURE - QUINTETTE PROJECT)

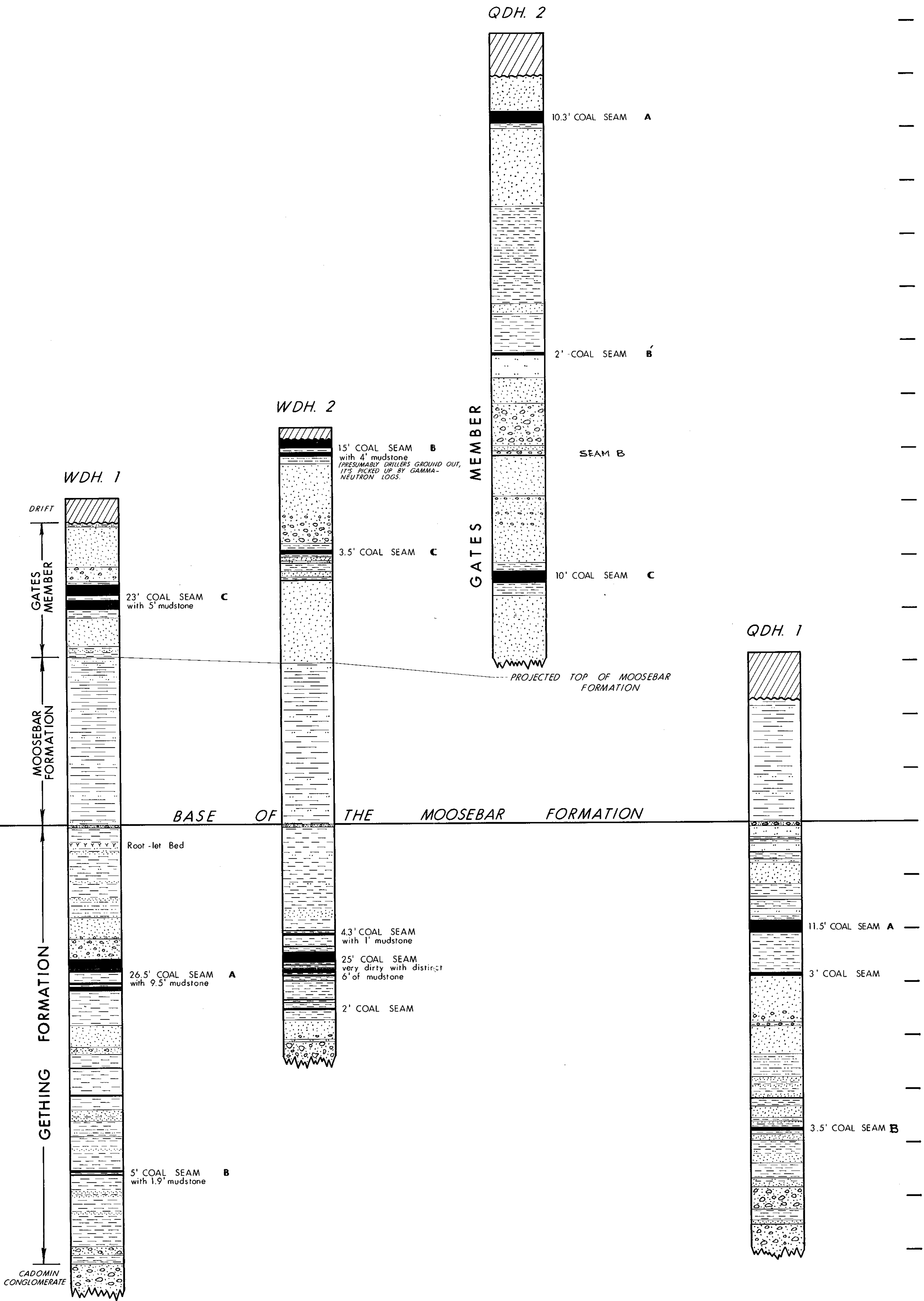
QUINTETTE COAL LTD.
COAL LICENSE EXPIRY DATES

SCALE IN MILES
0 1 2

CONTOUR INTERVAL 500 FT.

SCALE: 1:50,000
DATE: FEB. '72
DRAWING NO.: QNTT 72-0272-R01





WDH. 1

DRIFT

GATES MEMBER

MOOSEBAR FORMATION

GETHING FORMATION

CADOMIN CONGLOMERATE

WDH. 2

15' COAL SEAM B
with 4' mudstone
(PRESUMABLY DRILLERS GROUND OUT,
IT'S PICKED UP BY GAMMA-
NEUTRON LOGS.)

3.5' COAL SEAM C

10' COAL SEAM C

4.3' COAL SEAM
with 1' mudstone

25' COAL SEAM
very dirty with distinct
6' of mudstone

2' COAL SEAM

QDH. 2

10.3' COAL SEAM A

2' COAL SEAM B

SEAM B

GATES MEMBER

PROJECTED TOP OF MOOSEBAR FORMATION

QDH. 1

11.5' COAL SEAM A

3' COAL SEAM

3.5' COAL SEAM B

BASE OF THE MOOSEBAR FORMATION

LEGEND

- Drift
- Coal
- Shale
- Siltstone / Mudstone
- Mudstone
- Siltstone
- Sandstone
- Conglomerate

MAP - 2 PR-Q 710A

DENISON MINES LIMITED
CALGARY, ALBERTA

BRITISH COLUMBIA FOOTHILLS
QUINTETTE PROJECT

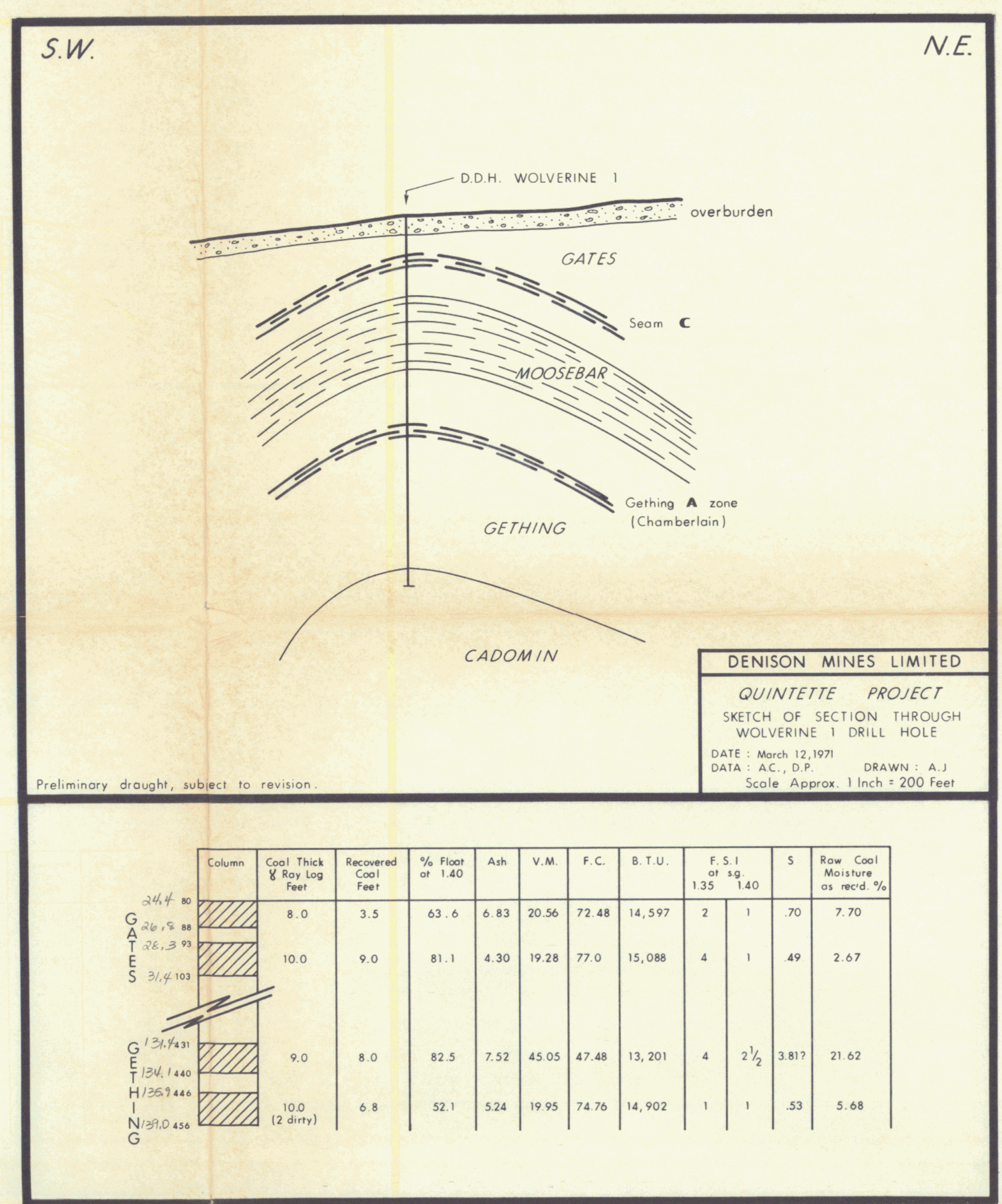
DRILL LOG SECTIONS
WOLVERINE - QUINTETTE AREA
FEBRUARY 1971

DATE : March 1971 A. CHOWDRY

VERTICAL SCALE : 1 INCH = 50 FEET

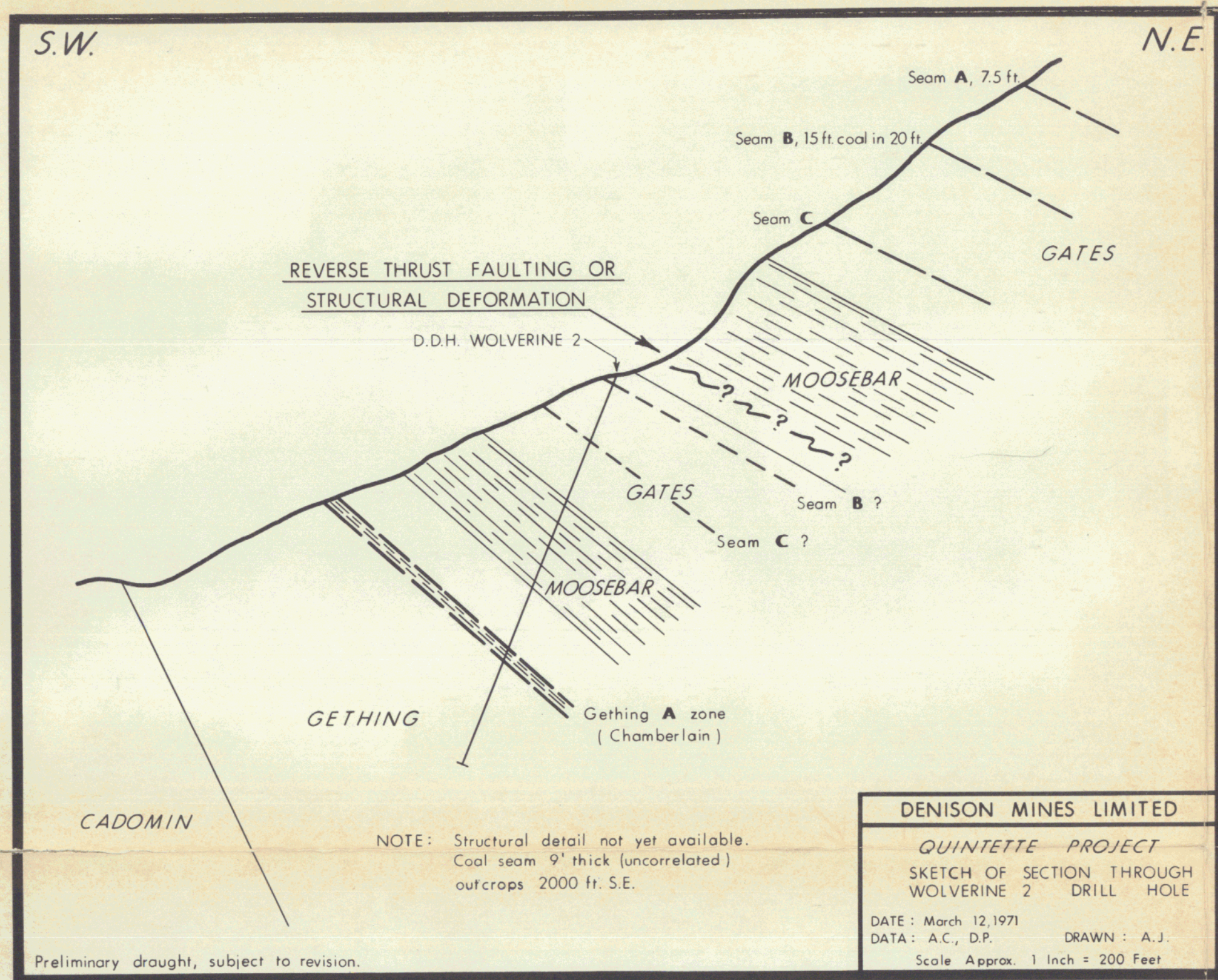
NOTE: Preliminary Draught, Subject To Minor Revision.

597



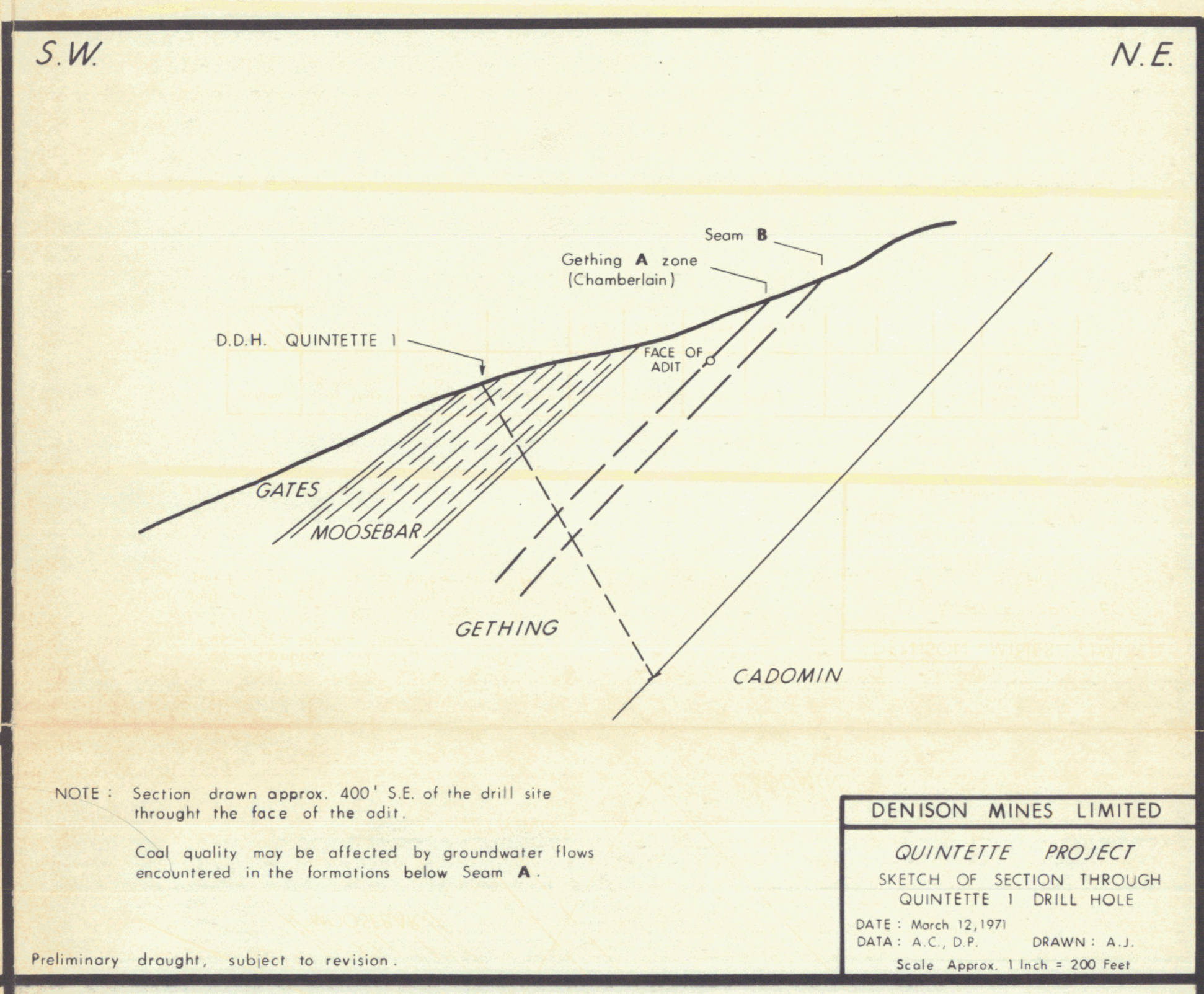
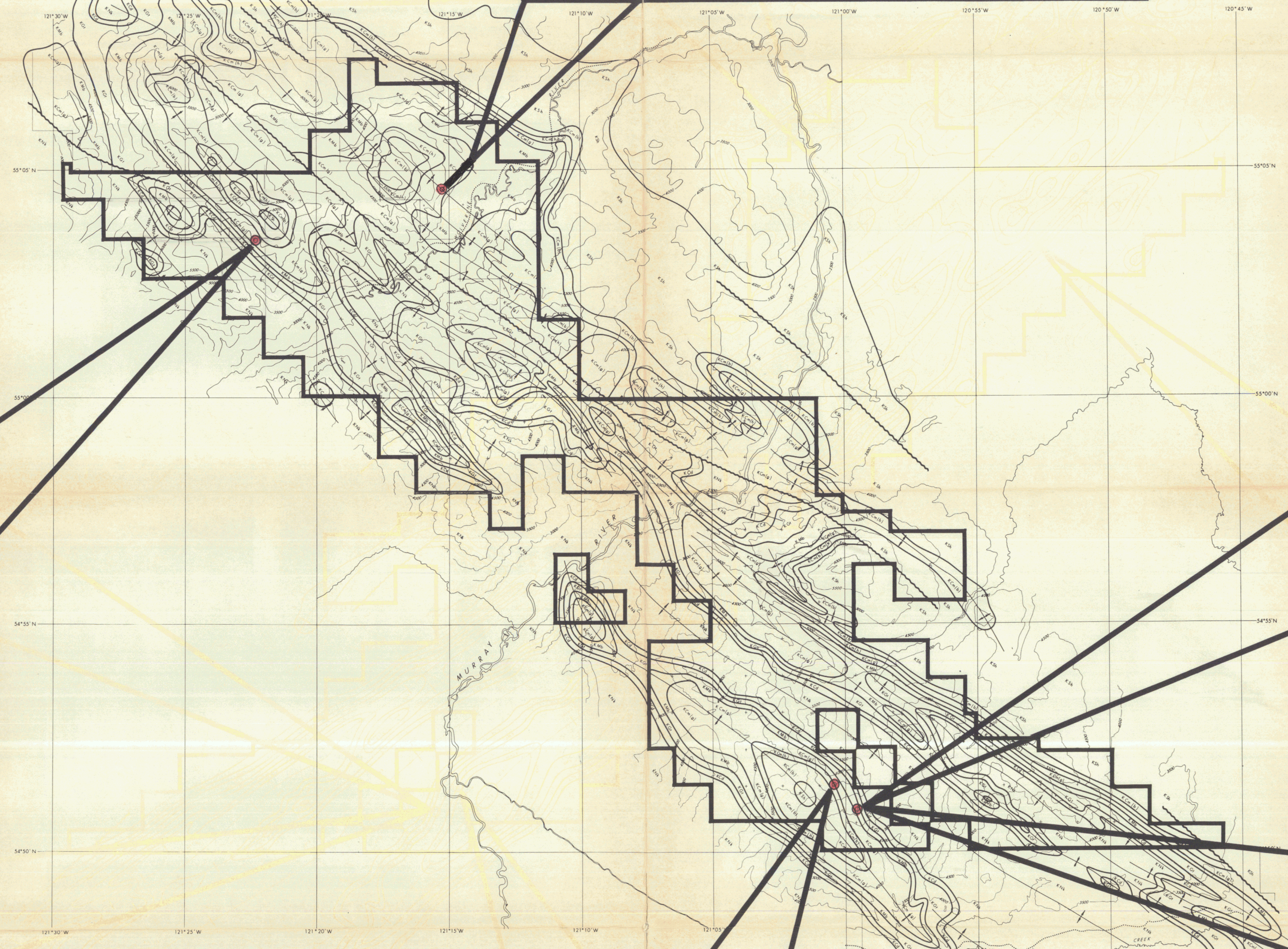
Preliminary draught, subject to revision.

| Column | Coal Thick Ray Log Feet | Recovered Coal Feet | % Floor at 1.40 | Ash | V.M. | F.C. | B.T.U. | F.S.I. of 1.40 1.35 1.40 | S | Raw Coal Moisture as rec'd. % |
|---------|-------------------------------|---------------------------|--------------------|------|-------|-------|--------|--------------------------------|-------|-------------------------------------|
| 149.75 | 8.0 | 3.5 | 43.0 | 6.83 | 20.56 | 73.48 | 14,597 | 2 | 1 | 7.70 |
| 152.25 | 10.0 | 9.0 | 81.1 | 4.30 | 19.28 | 77.0 | 15,088 | 4 | 1 | 4.9 |
| 156.75 | 9.0 | 8.0 | 82.5 | 7.52 | 45.05 | 47.48 | 13,201 | 4 | 2 1/2 | 3.817 |
| 158.144 | 10.0 | 6.8 | 52.1 | 5.24 | 19.95 | 74.76 | 14,902 | 1 | 1 | 5.8 |



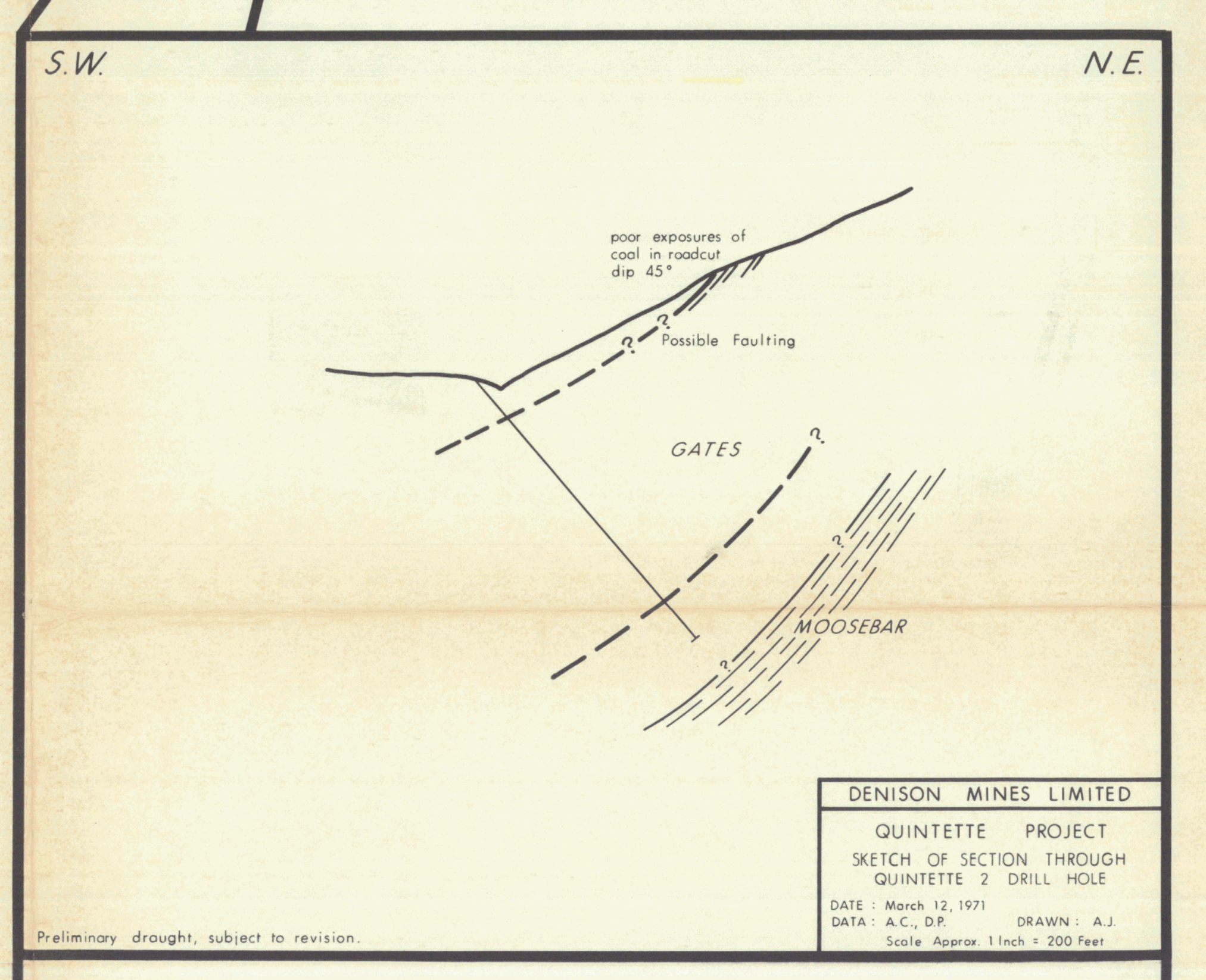
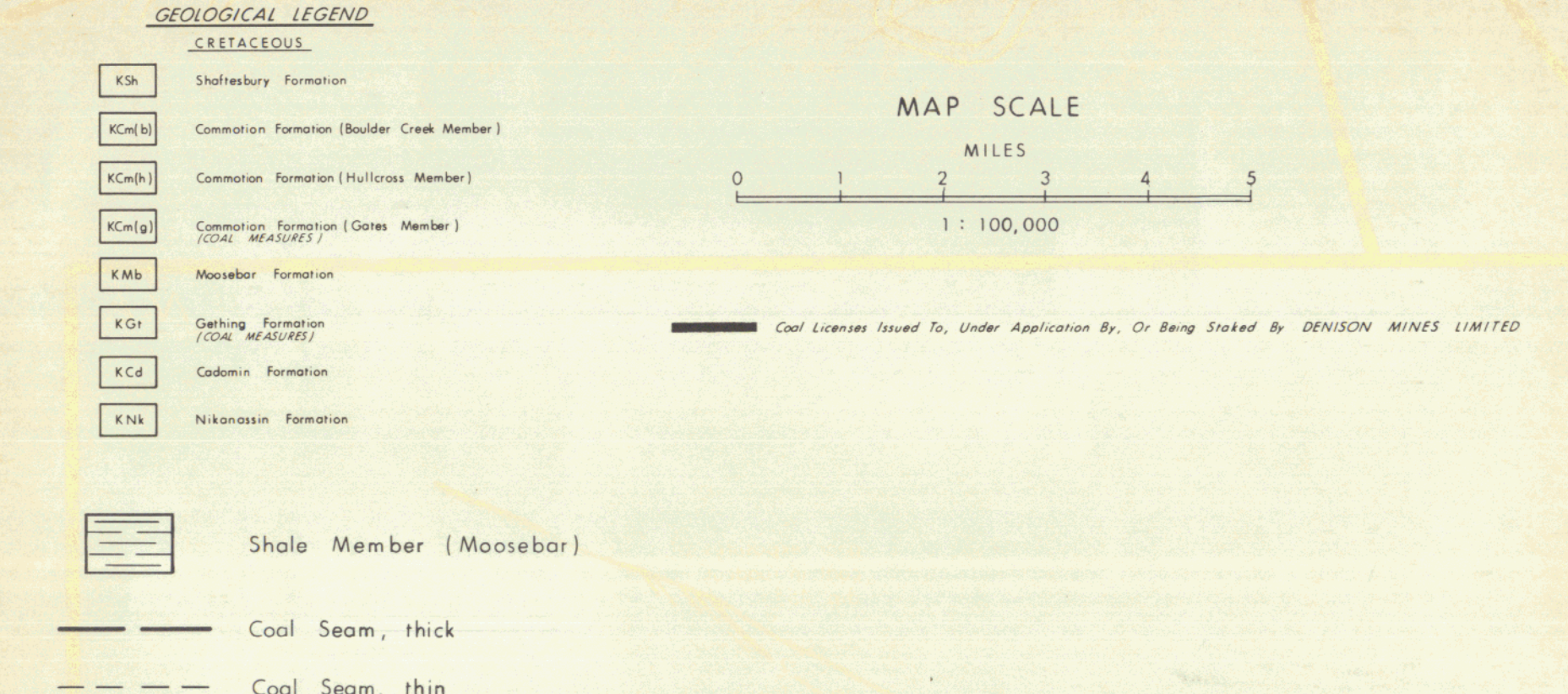
Preliminary draught, subject to revision.

| Column | Coal Thick Ray Log Feet | Recovered Coal Feet | % Floor at 1.40 | Ash | V.M. | F.C. | B.T.U. | F.S.I. of 1.40 1.35 1.40 | S | Raw Coal Moisture as rec'd. % |
|---------|-------------------------------|--|--------------------------------------|------|-------|-------|--------|--------------------------------|---|-------------------------------------|
| 149.75 | 8.0 | not sampled or collected - triconed through this high Seam Gates B | | | | | | | | |
| 152.25 | 6.0 | not analysed - too thin Seam Gates C | | | | | | | | |
| 156.75 | 4.0 | 3.5 | not analysed - too thin Seam Gates C | | | | | | | |
| 158.144 | 10.0 | 4.5 | 18.2 | 8.17 | 20.24 | 73.59 | 14,655 | 1 | 1 | 3.4 |
| 159.521 | 13.0 | 9.5 | 40.2 | 6.17 | 19.96 | 73.81 | 14,701 | 2 1/2 | 1 | 4.7 |



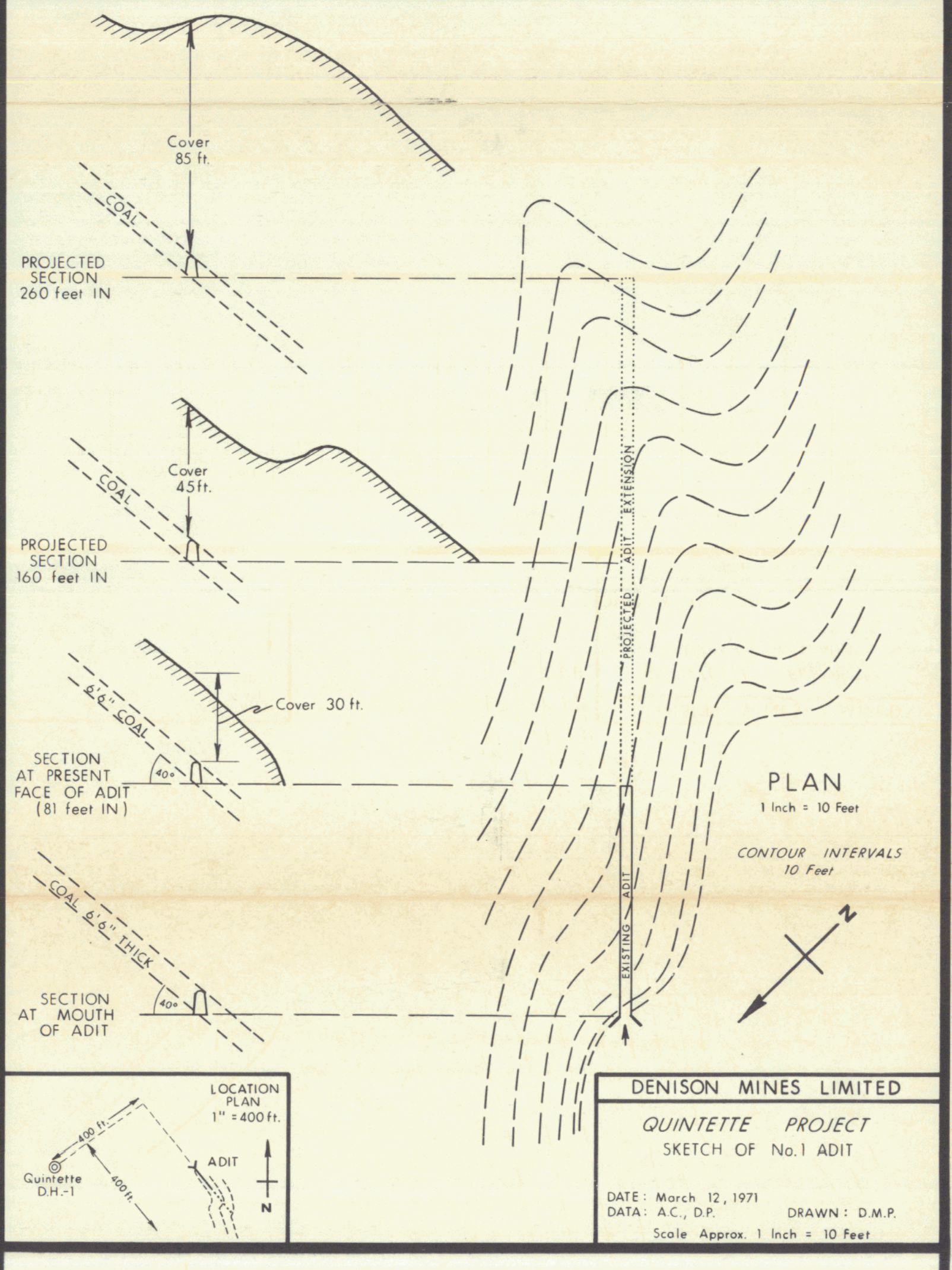
Preliminary draught, subject to revision.

| Column | Coal Thick Ray Log Feet | Recovered Coal Feet | % Floor at 1.40 | Ash | V.M. | F.C. | B.T.U. | F.S.I. of 1.40 1.35 1.40 | S | Raw Coal Moisture as rec'd. % |
|--------|-------------------------------|---------------------------|--------------------|------|-------|-------|--------|--------------------------------|---|-------------------------------------|
| 158.25 | 11.0 | 5.8 | 60.5 | 8.79 | 23.52 | 67.69 | 14,168 | 5 | 1 | 5.3 |



Preliminary draught, subject to revision.

| Column | Coal Thick Ray Log Feet | Recovered Coal Feet | % Floor at 1.40 | Ash | V.M. | F.C. | B.T.U. | F.S.I. of 1.40 1.35 1.40 | S | Raw Coal Moisture as rec'd. % |
|---------|-------------------------------|---------------------------|--------------------|------|-------|-------|--------|--------------------------------|-------|-------------------------------------|
| 159.3 | 10.0 | 10.7 | 73.4 | 3.62 | 28.43 | 67.9 | 15,085 | 2 1/2 | 1 1/2 | 4.0 |
| 159.521 | 10.0 | 6.0 | 84.7 | 4.29 | 30.63 | 65.08 | 15,017 | 8 1/2 | 4 1/2 | 5.0 |



Preliminary draught, subject to revision.

| Column | Coal Thick Ray Log Feet | Recovered Coal Feet | % Floor at 1.40 | Ash | V.M. | F.C. | B.T.U. | F.S.I. of 1.40 1.35 1.40 | S | Raw Coal Moisture as rec'd. % |
|---------|---------------------------------------|---------------------------|--------------------|-------|-------|--------|--------|--------------------------------|-------|-------------------------------------|
| 159.521 | 81 ft in, 6.5 ft thick channel sample | 66.0 | 4.47 | 22.21 | 72.16 | 14,300 | | 2 | 1 1/2 | 12 |
| 159.521 | 63 ft in, Raw sample channel sample | 5.56 | 20.17 | | | | | | | 29 |

MAP 1 PR Quintette 71 2(A)

DENISON MINES LIMITED
 CALGARY ALBERTA

BRITISH COLUMBIA FOOTHILLS
QUINTETTE PROJECT

RESULTS OF
 INITIAL DRILLING
 AND ADIT
 FEBRUARY 1971

DATE: March 12, 1971

597

PR-QUINETTE 71(3)A
QUINETTE PROJECT
GEOLOGICAL REPORT:
DRILL HOLE LOGS

MAY 1971

AC CHOWDEY

CONFIDENTIAL

GEOLOGICAL BRANCH
GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 597

- 0 - 44 No core (The driller reported that the Bed Rock could be placed at slightly shallower depth i.e. 40').
- 44 - 158 Moosebar Formation: The lithology is remarkably uniform and represents pure type of grey mudstones/shales. No interlaying of siltstones or fine sandstones. Apparently, this whole interval represents the lower parts of the Moosebar Formation which elsewhere also has similar lithologic attributes. Some Bentonitic layers between 80 - 90'. A thin bentonite band occurs just 4" above the basal conglomerate. These 4" are distinctly shale and very friable, very gradational to conglomerate below.
- 158 - 161 Conglomerate: This is the first instance that such thick bed of conglomerate at the base of Moosebar Formation has been encountered. Uniformly medium grained thoroughly crowded with pebbles dominantly of dark grey colour embedded in a muddy matrix. White quartzic pebbles are less numerous but are much larger than the coloured pebbles. Bottom contact slightly scooped out.
- 161 - 170.5 Siltstones: extremely argillaceous (homogeneously), grey, fracture in-fillings by calcitic veins bottomwards. Slightly carbonaceous at lower end (bottom 1') and small coaly streaks, gradational below.
- 170.5 - 172.5 Mudstones: dark grey, slightly carbonaceous bottomward (about 1' very coaly with streaks and lenses of coal); very gradational to coal below.
- 172.5 - 173 Coal: Bright and friable with lots of muddy chunks.
- 173 - 176.5 Mudstones: dark grey, very carbonaceous, transitional toward bottom.
- 176.5 - 184 Siltstones: grey-white, laminated, a big calcitic vein traversing the middle.

- 184 - 185 Coal Seam: Dominantly friable and bright coal, bottommost 0.3' slightly dirty and hard.
- 185 - 191 Mudstones: grey, richly silty, faint irregular lamination, very gradational below.
- 191 - 194 Siltstones: grey, slightly argillaceous; irregular criss-crossing on small scale.
- 194 - 216 Sandstones: light coloured, fine grained, very clean and well sorted laminated ubiquitously; bottommost 5 feet have thin but elongate shaly intraclasts and few coaly fragments. At 211' are 2.5" black carbonaceous sandstones with 2 m.m. coaly layer at the bottom. This lithology is odd in the sequence and appears and disappears rather suddenly. Bottommost 1 foot are sandstones, slight argillaceous, very gradational to lithology below.
- 216 - 228 Mudstones: grey to light grey, sporadically silty and at places very thin (about 1.5" each) carbonaceous and shaly layering; gradational lower end.
- 228 - 231 Siltstones: grey, highly argillaceous, irregularly laminated, abrupt below.
- 231 - 231.4 Coal: Bright, very friable and powdery.
- 231.4 - 240 Mudstones: grey, bottom 3' locally carbonaceous, transitional below.
- 240 - 245 Siltstones: grey, richly argillaceous, and thin muddy intervals, locally laminated, gradational below.
- 245 - 250 Mudstones: dark grey, apparently structureless, gradational to coal below.
- 250 - 261.5 Coal Seam: Q - 1

5.0' Apparently bright friable type of coal with shaly layers (only 1' recovered in 5').

2.0' Coal, bright and clean (moderate recovery)

3.0' Coal, very clean and friable (better recovery).

1.0' Coal, mostly fusain.

0.5' Coal, harder, laminated (good recovery).

11.5'

- 261.5 - 282 Mudstones: grey to dark grey, thin silty layering, occasionally laminated, shaly at places, gradational at the bottom.
- 282 - 299 Dominance of Mudstones with short (up to 10%) silty and shaly intervals, grey, gradational below.
- 299 - 302 Coal: only 2' of core of coal. Most of it hard dull type, and bottommost 0.5' bright and hard. (tags 296 - 302 and only 5' of core of which 2' of coal, so perhaps 1' coal lost).
- 302 - 347 Sandstones: coarse grained, clean and well sorted, light coloured, vaguely cross bedded intervals at places; bottom 4' are gritty and very finely pebbly, gradational below.
- 347 - 349 Conglomeratic Zone: initial 0.5' and bottommost 0.6' are distinctly pebbly and the middle one foot consists of mudstones and sandstones with small pebbly layers.
- 349 - 375.5 Sandstones: fine grained, light grey, very reminiscent of intertidal sands, well laminated; bottommost 5 feet almost obtain coarse silt grade level.
- 375.5 - 396.5 Mudstones/siltstones: it's a well defined sequence of shales and siltstones and at times fine sandstones with clean intraformational boundaries.
- 396.5 - 401 Sandstones: fine grained, light grey, clean, structureless, gradational below.
- 401 - 404 Mudstones with short well defined fine sandstones, erosional below.
- 404 - 406 Sandstones: fine grained, well laminated, occasionally argillaceous, gradational below.
- 406 - 412 Mudstones: grey, short well defined silty intervals, transitional lower end.

- 412 - 415.5 Sandstones: fine grained, bottommost 0.6' shaly with sand having erosional mutual boundaries.
- 415.5 - 416.3 Coal: all fragmented, slightly dirty.
- 416.3 - 424 Mudstones: grey, very slightly silty, carbonaceous here and there, structureless, gradational below.
- 424 - 435 Sandstones/mudstones: fine sands, though these two lithologic units are distinct, yet they are cyclic in nature (4 cycles), mudstones grey and structureless, gradational below.
- 435 - 437.5 Mudstones with thin coal streaks, gradational below.
- 437.5 - 439 Sandstones: fine grained, brownish grey, lots of argillaceous stringers, gradational below.
- 439 - 442.5 Mudstones: grey, structureless, gradational lower end.
- 442.5 - 446 Coal Seam: only about 0.8' of fragmented coal with thin layers of bony coal (clean type). Between markers 436 - 446 there is only 6.5' of core, so some coal (about 3') may have been lost.
- 446 - 450 Mudstones: dark grey to black, coaly streaks, the interval wholly fragmented, bottomward very silty, gradational below.
- 450 - 456.3 Sandstones: fine grained, dirty looking and argillaceous; about 0.5' of mudstones 1.5' above the base, gradational below.
- 456.3 - 466 Mudstones: dark grey, appears to be silty, gradational.
- 466 - 468 Siltstones: richly argillaceous (as distinct laminated layers), gradational
- 468 - 468.6 Mudstones: dark grey, 0.2' of coal at the base.
- 468.6 - 476 Sandstones: fine grained interlayered with thin mudstones at places, sporadic occurrence of shaly intraclasts; bottommost 2' distinctly banded, gradational.
- 476 - 490 Mudstones with thin silty layers in upper 5 feet; gradational lower boundary.

- 490 - 493.5 Mudstones/siltstones: dominance of mudstones (80%) blended with several silty intervals, laminated.
- 493.5 - 498.2 Sandstones: fine to medium grained, light coloured with occasional argillaceous streaks, gradational below.
- 498.2 - 520 Conglomerate: well packed, medium-sized, dominance of white pebbles.
- 520 - 524 Mudstones: grey, structureless, bottom 1' contains lots of fine sands.
- 524 - 542 Conglomerate: medium grained, well packed.
- 542 - 552 Mudstones: dark grey, homogeneously silty, gradational lower boundary.
- 552 - 555.8 Sandstones: fine to medium (dominantly fine grained) whitish and very hard.
- 555.8 - 578 Conglomerate: well developed and medium grained. Abandoned the whole, assuming that there be (off and on) some sandy intervals belonging to Gething Formation, but essentially it's Conglomeritic facies joining with the Cadomin Conglomerate.

Q D H #2 ✓

- 0 - 23 Sandstone: Grey, medium-grained, weathered, non-calcareous.
- 23 - 61 Sandstone/Siltstone: Alterations of the Lithologies after every 2 to 3 feet, gradational.
- 61 - 78 Shale: Dark grey, slightly carbonaceous, non-effervescent.
- 78 - 88.3 Coal: 0 - 2' Bony coal
7 - 0' Bright coal
0 - 1' Carbonaceous shale
2 - 0' Bright Mushy coal
0 - 3' Well-laminated coal
0 - 7' Bright solid coal
10 - 3'
- 88.3 - 99 Shale: Dark grey, carbonaceous, gradational below.
- 99 - 107 Siltstone: Light grey, conspicuously criss-crossed, slightly argillaceous.
- 107 - 117 Siltstone: Grey, highly argillaceous, thin shaly intervals, abrupt below.
- 117 - 125 Sandstone: Light grey, medium-grained, irregularly laminated, gradational.
- 125 - 128 Shales: Grey, very silty (as discreet lamination and layers), calcareous.
- 128 - 130 Siltstone: Light grey brown, argillaceous (disseminated), calcareous.
- 130 - 136 Sandstone: Fine-to medium-grained, argillaceous, sporadically laminated, gradational.
- 136 - 144 Siltstone: Brownish grey, shaly intervals, non-calcareous, transitional.
- 144 - 157 Sandstone: Medium-grained, light grey, argillaceous, bottom-most 4 feet very clean sandstone, gradational below.
- 157 - 159 Siltstone: Grey, richly argillaceous, slightly laminated.
- 159 - 164 Sandstone: Fine-to medium-grained, argillaceous, obscurely laminated, thin shaly/silty intervals, calcareous, gradational below.

- 164 - 201 Shale: Grey to dark grey, very silty. There are two distinct silty layers in the lowermost 10 feet interval, gradational below.
- 201 - 210 Siltstone: Brownish grey, most of interval clean and laminated.
- 210 - 234 Siltstone/Shale: Alternating sequence, and repetitions on scale of inches, silts profusely laminated and light-coloured, calcareous, gradational.
- 234 - 242 Shale: Dark grey, very silty, slightly carbonaceous, gradational.
- 242 - 270 Fine-to medium-grained, silty and shaly intervals, gradational.
- 270 - 290 Siltstone: Light grey, argillaceous, carbonaceous specks structureless in the main, very calcareous, abrupt below.
- 290 - 294 Coal Seam: This interval is recorded as coal on the radiation logs but very little coal was recovered.
- 294 - 303 Shales: Dark grey, structureless, few rootlet-like structures.
- 303 - 307 Coal Seam: 0 - 3' Dominantly shaly coal
0 - 4' Evenly laminated coal
0 - 3' Mushy, bituminous coal
1 - 0' Bright, solid coal
2 - 0'
- 307 - 323 Siltstone: Dark grey, abundant dispersed argillaceous matter, short silty shale intervals, feeble effervescence.
- 323 - 325 Coal Seam: Nothing recovered from this interval. Shown by radiation logs.
- 325 - 327 Shale: Grey, structureless, carbonaceous, gradational lower contact.
- 327 - 329 Sandstone: Fine-grained, silty intervals, vaguely laminated.
- 329 - 333 Shale: Very silty, dark brownish grey, sporadic lamination.
- 333 - 353 Sandstone: Light grey, fine-grained, calcareous, gradational.
- 353 - 381 Conglomerate: Very coarse pebbles, closely packed with little or no interstitial sediments, gradational lower junction.
- 381 - 384 Sandstone: Medium-grained, medium-grey, cross-stratified and

very clean bottomward and last one foot finely conglomeroid and gritty.

- 384 - 385.8 Conglomerate: Coarse pebbles, tightly packed pebbles; abrupt below.
- 385.8 - 386.5 Coal Seam: Bright, clean, solid coal.
- 386.5 - 420 Sandstone: Dark grey, abundant finely comminuted carbonaceous matter in the sandy matrix, medium-to coarse-grained, lower interval clean, light coloured and well-sorted, cross-laminated.
- 420 - 472 Sandstone: Fine-to medium-grained, very clean, interval progressively fining downward so that bottommost 20 feet fine sandstones. This interval is characterized by occurrence of extremely coarse gritty zones, from few inches up to 1 foot thick, that appear rather suddenly and disappear the same way. These gritty zones occur throughout irrespective of the grain size of the sandstone.
- 472 - 483 Sandstone: Fine-grained, slightly argillaceous, very thin hair-line type carbonaceous shreds at places. Broadly the sandstones are similar to the preceding interval but devoid of gritty intervals.
- 483 - 591 Mudstone: Grey to dark grey, slightly silty (disseminated), gradational.
- 491 - 511 Sandstone/Siltstone: Highly argillaceous, grey, irregularly laminated.
- 511 - 521.3 Coal Seam: 4 - 0' Bright but badly fractured coal
2 - 8' Bright (hard and mushy) coal
0 - 3' Bright (but slightly shaly) coal
1 - 2' Bright bituminous coal
2 - 0' Dominantly bright (bituminous in middle)
10 - 3'
- 521.3 - 526 Mudstone: Black, very carbonaceous, homogeneous, non-calcareous.
- 526 - 535 Mudstone: Richly silty, grey, laminated (slightly).

535 - 547.5

Sandstone: Medium-grained, clean, laminated, appears to be disturbed syndepositionally, some calcite veining in middle 2 feet.

547.5 - 606

Sandstone: This interval represents a lithology encountered in a typical transitional sequence, between Gates and Moosebar. Brief shaly intervals with clean and sometimes erosional contacts with sandstones. Sandstone facies comprise fine-to medium-grained, clean and well-sorted lithology, very calcareous. From 606 feet it appears that there is hardly another 25 - 30 feet to the Moosebar boundary. Very transitional lower end.

~~597~~
~~697~~

- 104 - 111 Mudstones: dark grey, slight silty, non effervescent, gradational below.
- 111 - 117 Sandstones: fine to medium-grained, dominantly quartzitic clean sandstones, abrupt below.
- 117 - 117.2 Clay zone: thoroughly decayed and sticky clay.
- 117.2 - 120 Sandstones: light grey, medium-grained, clean, structureless, gradational.
- 120 - 145.5 Sandstones: generally clean, fine-grained, parallel laminated, a thin but distinct burrowed zone, clean (sharp) contact below.
- 145.5 - 147 Mudstones: grey, homogeneous, rather abrupt below.
- 147 - 148 Sandstones: fine-grained, grey, generally very clean, erosional below.
- 148 - 149 Starting 0.2' mudstones followed by slumped, fine to medium grained sandstones, very gradational below.
- 149 - 311 Moosebar Formation: In this hole, a distinctive feature of the Moosebar Formation is the occurrence throughout of suite of clean, well-sorted and laminated medium-grained sandstones that have elsewhere been designated as intertidal. These are also associated with typical sandstone/shales sequence of the same regimen displaying erosional boundaries and sporadic burrows, etc. (there are, in addition, some large vertical burrows and short homogenized zones). This feature should always be borne in mind when faced with the problem of delineating the boundary between the Commotion (Gates) and Moosebar Formations. 149 - 175 Sandstones: fine grained, light grey, abundant interlayering



of mudstones. Mutual contacts of muds and sands highly irregular and eroded. Few thin bioturbated zones between 152 - 167. 175 - 176 Mudstones/siltstones - repetition of the facies on a scale of centimeters (about 70% shales). 239 - 255.5 exclusively mudstones, dark grey with faint, extremely thin silty laminae. Pyrite is ubiquitous and occurs as uniformly disseminated specks and elongate blobs. 255 - 258.3 very distinctive sandstones facies with muddy interval. The sandstones appear silty and glauconitic (some very coarse greenish grains). Erosional bottomwards and there are a few shaly intraclasts at the base. 286.8 - 287.3 coarse gritty sandstones with occasional small quartzitic pebbles and shaly intraclasts, very gradational below.

311 - 311.3 Conglomerate: Few dark phyllitic pebbles and white quartzitic pebbles in distinctly dark muddy matrix, very gradational below.

311.3 - 311.6 Sandstones: fine-grained, light grey, laminated, erosional below.

311.6 - 326 Mudstones: dark grey to black, apparently structureless, carbonaceous and coaly streaks, an oblique coaly wedge at 318. Very coaly between 324 - 326, abrupt below.

326 - 328 Rootlet Bed (this is synonymous with the "Marlstone" Bed elsewhere). Fossil soil and the former rootlets (now carbonized) can be discerned at various angles (some bifurcated).

- 328 - 334 Mudstones/siltstones: Dominance of mudstones with subordinate interlayering of coarse siltstones that have occasional burrowed zones.
- 334 - 335 Sandstones: dirty grey, richly argillaceous, abundant burrows.
- 335 - 344.5 Mudstones with sporadic, irregularly sequenced silty bands, burrowed at places.
- 344.5 - 347.5 Mudstones: dark grey to black, very carbonaceous.
Coal 344.5 - 345.
- 347.5 - 348.5 Siltstones/mudstones, about equal representation.
Siltstones laminated, gradational below.
- 348.5 - 349.5 Siltstones: argillaceous, grey, finely laminated, bottommost 0.2' very muddy.
- 349.5 - 354.5 Mudstones: grey to dark grey, bottommost 1.5' black and has coaly streaks, gradational below.
- 354.5 - 358 Mudstones/siltstones: layered sequence of mudstones/siltstones. Mudstones constituting 85%. Banded appearance, gradational below.
- 358 - 358.4 Sandstones: thoroughly bioturbated zone. Argillaceous matter intermixed due to burrowing action (homogenized).
- 358.4 - 375 Mudstones: homogeneously silty, grey, disseminated siltstones may make up to 10% but no differentiated intervals.
- 375 - 378 Sandstones: fine-grained, admixture of silts and argillaceous matter in the middle otherwise structureless and homogeneous,
- 378 - 393.5 Homogeneous sequence of "non-descript", structureless mudstones with very high percentage of disseminated siltstones (non differentiated), bottommost 5' have vaguely differentiated irregular silty layers, gradational below.

- 393.5 - 412 Sandstones: fine to medium-grained, clean looking, light coloured, laminated, few isolated angular muddy intraclasts.
- 412 - 412.3 Conglomerate: medium-grained with sandy matrix.
- 412.3 - 414 Sandstones: medium-grained with three thin pebbly layers in the middle of the sequence.
- 414 - 430.5 Conglomerate: medium-grained, closely packed.
- 430.5 - 457 Coal Seam.
- 430.5 - 432.5 Clean and bright coal, 1.5' recovered.
- 432.5 - 434 Bright coal, about 1.25' recovered.
- 434 - 436 Bright muddy coal, about 1.5' recovered.
- 436 - 441.5 Dominantly bright core-form coal, thin intervals of friable coal, almost all of it recovered
- 441.5 - 449 Hard black mudstones with abundant coaly matter.
- 449 - 451 Bright core-form coal, fully recovery.
- 451 - 453 Black carbonaceous mudstones, lower 1.5' fractured.
- 453 - 457 Bright friable coal, about 3' recovered.
- 457 - 463 Hard black mudstones (footwall).
- 463 - 481 Mudstones: black, sporadically carbonaceous, structureless gradational below.
- 481 - 488 Mudstones: highly silty (homogeneously), silts about 35%, transitional below.
- 488 - 510 Sandstones: fine to medium grained, some coarser intervals as well, abundant shaly angular intraclasts at 492 - 492.3 in sandstones.
- 510 - 516 Sandstones: coarse and gritty, bottommost 2' fine conglomerates and have abundant coaly fragments, irregular below.

- 516 - 517.6 Sandstones: fine-grained, light coloured and clean, bottommost 0.5' medium to coarse grained, laminated throughout, erosional below.
- 517.6 - 530.5 Mudstones: grey, highly silty (homogeneously), some silty intraclasts.
- 530.5 - 532 Coal: very tarry and mushy, some carbonaceous bits.
- 532 - 557 Mudstones: grey, generally homogeneous but also some differentiated silty intervals, laminated silty bands.
- 557 - 558.2 Coal: Hard, core-form laminated coal (some boney coal).
- 558.2 - 567.5 Mudstones: Black richly carbonaceous, thin coaly lenses here and there, gradational below.
- 567.5 - 571 Mudstones: richly silty, bottommost 0.6' very sandy.
- 571 - 577.8 Sandstones: whitish grey, medium-grained, intraclastic specks here and there, last 1.5' have numerous elongated (and pointed) intraclasts, erosional below, cross bedded.
- 577.8 - 579 Mudstones: very silty, bottommost 0.5' very argillaceous and grey, slightly erosional below.
- 579 - 581.5 Sandstones: fine grained, slightly argillaceous, vaguely laminated, bottommost one foot very argillaceous and attains coarse silty character.
- 581.5 - 582 Mudstones: dark grey, few hair-line calcitic veins at the bottom, very gradational below.
- 582 - 597 Mudstones/siltstones: dominance of mudstones (about 70%), rest fine sandstones and silty but the two lithologies blending into each other; sands and silty intervals irregularly laminated, bottommost 1.5' are black mudstones and slight^{ly} carbonaceous.

- 597 - 597.3 Coal with mudstones.
- 597.3 - 604.5 Mudstones: grey to dark grey, slightly carbonaceous at places, structureless, some siltstones (both homogeneously dispersed and differentiated), very gradational below.
- 604.5 - 606 Siltstones: very argillaceous, irregularly criss crossed and grey, very thin (0.2 mm) layers of argillaceous matter within the sequence, clean bottom contact, but not erosional.
- 606 - 608 Mudstones: black, very carbonaceous with distinct coaly streaks, gradational below.
- 608 - 611.5 Sandstones: fine-grained, uppermost 1.25' richly argillaceous and also have well-differentiated thin argillaceous layers with sharp and erosional mutual boundaries, bottommost 1.5' are clean and well-sorted, well-laminated.
- 611.5 - 616.5 Mudstones: dark grey, structureless, very imperceptible below.
- 616.5 - 623.5 Mudstones: very highly silty (up to 25% silts) but very homogeneous, structureless, gradational.
- 623.5 - 630 Mudstones: dark grey to black, very carbonaceous.
- 630 - 631.6 Coal: bright, hard core-form coal.
- 631.6 - 633.5 Black carbonaceous mudstone.
- 633.5 - 635 Coal: Beautifully clean, bright, core-form.
- 635 - 649.5 Mudstones: black, bottommost 5' very carbonaceous and with coaly streaks, some silty stringers in bottommost 0.3', slumped bottom below.
- 649.5 - 650 Sandstones/mudstones: This interval appears to be slumped because of the vertical juxtaposition of both lithologies.

- 650 - 650.6 Mudstones: dark grey, structureless, irregular contact below.
- 650.6 - 650.9 Sandstone: whitish grey, argillaceous, fine-grained, transitional below.
- 650.9 - 655 Mudstones: 0.3' of silty interval, bottomward irregularly silty, transitional below.
- 655 - 656.5 Sandstone: five-grained, strongly banded, light grey to dark grey, some intervals have parallel lamination, gradational below.
- 656.5 - 672.5 Mudstones: homogeneously silty, in middle 1 - 2' slightly siltier and hence appears lighter, gradational below.
- 672.5 - 674 Sandstones: five-grained, light grey, thoroughly criss-crossed and closely spaced, gradational below.
- 674 - 674.6 Mudstones: slightly silty, slightly erosional below.
- 674.6 - 674.8 Siltstones: light grey, clean looking (very slightly argillaceous) gradational below.
- 674.8 - 701 Mudstones: greyish looking (some intervals lighter and others relatively darker apparently due to presence or absence of silty zones, gradational below.)
- 701 - 702 Mudstones: black, lightly carbonaceous, some sandy stringers and odd pebbles with lots of coaly matter, abrupt below.
- 702 - 710 Conglomerate: starting 0.7' are medium sparse conglomerate grading below to 1.25' of white clean medium sandstone, followed by 0.8' of medium to coarse clean sandstone (Whitish coloured). These are followed by 1.5' of broken up very coarse grits with carbonaceous lenses (the core is broken along these carbonaceous layers that provide zones

of weakness).

710 - 720

Mudstones: Initial 8' are darker and purer, rest very slightly silty, rootlet structures throughout, erosional below. Light bed (about 2.2' in thickness)

720 - 742

Conglomerate: initial 4' medium type with abundant interstitial sandy matter, followed by one feet of light greyish sandstone, followed by 2' of medium conglomerate with only few coarser pebbles, rest of it very coarse and have mixture of grey and whitish pebbles. This is Cadomin Formation.

- 0 - 26 No core. (Note that the Gamma/Neutron Logs show coaly interval in this column - it is probable that this sequence has been truncated).
- 26 - 26.7 Mudstones: dark grey, very carbonaceous, gradational to coal below.
- 26.7 - 27.5 Coal: bright and hard coal (in the absence of any marker, it is difficult to ascertain the exact coal interval).
- 27.5 - 28.3 Mudstones: slightly shaley, richly coaly, gradational below.
- 28.3 - 30 Mudstone: richly carbonaceous, slightly silty, gradational lower junction.
- 30 - 35.5 Siltstone/mudstones: slight dominance of siltstones, sporadically banded and well laminated, very gradational below.
- 35.5 - 48 Sandstones: fine grained, occasionally crushed, initial one foot slightly argillaceous, light grey, some distinct burrows, gradational below.
- 48 - 66 Sandstones: medium-grained, clean and well sorted, widely laminated, criss-crossed, gradational below.
- 66 - 66.8 Sandstones: as above but few pebbles (on top about 1" across), gradational below.
- 66.8 - 76 Sandstones: fine to medium grained, laminated, coaly fragments here and there especially in bottommost 3', few wispy intraclasts.
- 76 - 109.3 Conglomerate: Initial 13.5' are medium grained sandstones and have at intervals definite conglomeratic zones (short ones), otherwise have only sprinkling of pebbles throughout.

- Rest is well developed and packed medium to coarse conglomerate.
- 109.3 - 115 Mudstones: grey, thin silty layers, occasionally laminated
- 115 - 118.5 COAL SEAM. Core-form, bright clean coal - all recovered.
- 118.5 - 121 Mudstones: silty, vaguely laminated, very thin coaly streaks, gradational below.
- 121 - 125 Sandstones: clean and fine grained, laminated, thin wispy intervals in bottommost one foot, becoming argillaceous bottomwards.
- 125 - 127 Siltstones: sandy, argillaceous, abrupt below.
- 127 - 128 Coal: bright and friable.
- 128 - 135 Mudstones: richly silty (up to 15% siltstones), delicately laminated, grey to dark grey, gradational below.
- 135 - 136.4 Mudstones: grey, very slightly silty, gradational below.
- 136.4 - 142 Sandstones: fine grained, criss-crossed, slightly argillaceous, light grey, gradational.
- 142 - 143.3 Mudstones: highly silty, laminated, bottommost 0.1' carbonaceous, gradational below.
- 143.3 - 144.5 Coal: clean bright coal, some of it friable.
- 144.5 - 163 Sandstones: medium to coarse, well washed and sorted, widely cross-laminated, light coloured, initial 2' slightly greyish because of dissemination of carbonaceous matter and ensuing 5 feet very clean and whitish looking and apparently structureless (homogenous).
- 163 - 222 Intertidal Sandstones.- The uppermost 20' may be clean, fine to medium sandstones incorporating three well-defined shaley intervals (clean mutual boundaries). Rest bottomwards very clean, mostly parallel laminated fine sandstones. There are three distinct bioturbated zones; (very reminiscent

of Kakwa Intertidal sandstones) 172 - 173.5; 176 - 177;
192 - 193 (this interval has the best and well preserved
"tunnels" both in transverse and longitudinal sections).
Shales only at 210 - 210.5; 211.5 - 212; 216.6 - 216.9.

222 - 374.2

Moosebar Formation: The Moosebar sequence generally
represents (up to 270') fine sandstones/shale lithology
accompanied by occasional burrows and shaley intraclasts.
Sharp shale/sand boundaries from 270 - 312 distinctly
shaley and darker sequence. 312 - 313 distinctly coarse
sandstones - top 3" and bottommost 3" very gritty, erosional
below. This interval apparently compares favourably well
with a sandy zone at the comparable level in hole one at
Wolverine (check level for correlation). 313 - 342
shale/fine sandstones (sands 30 - 35%). 342 - 361
encompasses suite of very clean, fine sandstones with
parallel lamination - a sequence very akin to intertidal
sandstones. 361 - 363.5 shale/sandstone; bottommost
1.25' homogeneously argillaceous siltstones.

363.5 - 363.8

Sandstones: very coarse grained (whitish grains) and have
some elongated whitish shell like objects. These respond
violently with HCl. 363.8 - 366.2 mainly finely laminated
fine-grained sandstones with thin shales towards bottom.
366.2 - 374.2 shales with irregular sandy intervals.

374.2 - 374.5

Conglomerate. This interval is composed of fine sandstones
with only few pebbles. Conglomeratic zone considerably
thinner in this hole.

- 374.5 - 452 Mudstones - Gething formation. The mudstones are generally darker grey, apparently structureless. Coaly between 399.5 - 400.5. Only very thin silty intervals.
- 452 - 460 Sandstones: fine grained, grey, argillaceous, occasionally laminated, few calcite veins, gradational lower end.
- 460 - 470.7 Mudstones: dark grey, coaly streaks, structureless, gradational.
- 470.7 - 475 COAL SEAM. ? Chamberlain
- 0.7' - Poorly laminated, hard coal.
- 1.0' - Carbonaceous mudstones with stringers of siltstones.
- 2.3' - Hard, bright and some laminated coal.
- 0.3' - Boney coal.
- 4.3'
- 475 - 475.5 Siltstones: grey, highly argillaceous, gradational below.
- 475.5 - 480.5 Mudstones: greyish brown, slightly silty, gradational below.
- 480.5 - 484.5 Mudstones: black, very carbonaceous with regular streaks of coal.
- 484.5 - 485.5 Coal: rinds of mudstone (about 25% muds in all), full recovery.
- 485.5 - 490 Black carbonaceous mudstones with bits of coal.
- 490 - 515 COAL SEAM.
- 490 - 491.5 Distinctly boney coal, badly fractured, all recovered.
- 491.5 - 500 Friable bright coal, only 3 feet recovered.
- 500 - 502 Mudstones, black and richly carbonaceous.
- 502 - 503 Friable coal, appears to be slightly shaley, fully recovery.
- 503 - 505 Carbonaceous mudstones with thin interlayering of friable coal

- 505 - 510.5 Coal, bright (mushy) and some well-laminated, full recovery.
- 510.5 - 511.5 Coal, mushy but very dirty in the middle, all recovered.
- 511.5 - 513 Carbonaceous mudstones/shales.
- 513 - 515 Coal, bright and friable, initial 0.5' shaley, full recovery.
- 515 - 519 Mudstones: dark grey to black, very carbonaceous.
- 519 - 519.5 Coal: bright and mushy, full recovery.
- 519.5 - 521.5 Carbonaceous mudstones.
- 521.5 - 522.5 Mudstones with coal (50% coal), 50% coal recovered.
- 522.5 - 523.5 Mudstones: very carbonaceous and black, structureless.
- 523.5 - 535 Mudstones: black, richly carbonaceous, short coaly intervals. These mudstones are very similar to the ones described above.
- 535 - 537 Mudstones: very silty, grey (homogeneously silty), transitional below.
- 537 - 538.3 Mudstones: dark grey to black, structureless, gradational below.
- 538.3 - 539 Coal: hard and dull - appears to be very dirty.
- 539 - 540 Mudstones: black, very carbonaceous.
- 540 - 540.5 Coal: bright and mushy, gradational below.
- 540.5 - 545.5 Mudstones: black, highly carbonaceous with coaly streaks.
- 545.5 - 547.5 Coal: dominantly mushy with thin kernels of mudstones. Bottommost 0.4' hard boney coal, gradational below.
- 547.5 - 548.7 Mudstones: very carbonaceous and bits of coal, gradational lower end.
- 548.7 - 557 Mudstones: grey, slight homogenized silty content, bottommost 1' very silty.
- 557 - 576 Sandstones: medium grained, abundance of coal fragments throughout, anthracitic looking coal between 570.5 -

570.7. Bottommost 10 feet have occasional gritty zones and are pebbly (fine pebbles).

576 - 578

Siltstones: highly argillaceous, grey, structureless, abrupt below.

578 - 591

Conglomerate: Initial 2.5' interval is finely conglomeroid with abundant sandy matrix. Bottommost 5' are well developed, generally medium grained, closely packed conglomerates.

The middle 5 feet are medium grained, grey sandstones characterized by cross lamination and only initial 1' of this interval has fine pebbles sparsely dispersed. This conglomerate, most probably does not belong to Cadomin regime. Stopped too soon and there is an 8 foot seam not very far from this conglomerate.

WOLVERINE No. 1

| | | <u>Core Reclaimed</u> | <u>Core Lost</u> | <u>Recovery Percentage</u> |
|---------------|---------------------------------|-----------------------|------------------|----------------------------|
| 81 - 91 | Coal bright | 3.5 | 6.5 | 35 |
| 91 - 95 | Mudstone | - | - | - |
| 95 - 104 | Coaly, mostly bright friable | 9.0 | - | 100 |
| | Total | 12.5 | 6.5 | 70.1 |
| 430.5 - 432.5 | Coal, clean and bright | 1.5 | 0.5 | 75 |
| 432.5 - 434 | Coal, bright | 1.25 | 0.25 | 84 |
| 434 - 436 | Coal, bright | 1.5 | 0.5 | 75 |
| 436 - 438 | Coal, bright | 1.25 | 0.75 | 63 |
| 438 - 441.5 | Coal, mostly bright | 3.5 | - | 100 |
| 441.5 - 449 | Mudstone | - | - | - |
| 449 - 451 | Coal, bright | 1.8 | 0.2 | 90 |
| 451 - 453 | Black carbonaceous mudstone | - | - | - |
| 453 - 457 | Coal, mostly bright and friable | 3.0 | 1.0 | 75 |
| | Total | 13.8 | 3.2 | 81 |

WOLVERINE No. 2

| | | <u>Core Reclaimed</u> | <u>Core Lost</u> | <u>Percentage Recovery</u> |
|---------------|-------------------------------|---------------------------|----------------------|--------------------------------|
| 115.0 - 118.5 | Coal, Hard and clean | 3.5 | - | 100 |
| 484.5 - 485.5 | Coal with rinds of mudstone | 1.0 | - | 100 |
| 485.5 - 490 | Black carbonaceous mudstone | - | - | - |
| 490.0 - 491.5 | Fractured zone with bony coal | 1.5 | - | 100 |
| 491.5 - 500.0 | Friable bright coal | 3.0 | 5.5 | 35 |
| 500 - 502 | Mudstone | - | - | - |
| 502 - 503 | Friable coal, slightly shaly | 1.0 | - | 100 |
| 503 - 505 | Mudstone | - | - | - |
| 505 - 510.5 | Coal | 5.5 | - | 100 |
| 510.5 - 511.5 | Musy dirty coal | 1.0 | - | 100 |
| 511.5 - 513 | Carbonaceous mudstone | - | - | - |
| 513 - 515 | Coal, bright, friable | 2.0 | - | 100 |
| 515 - 519 | Carbonaceous mudstone | - | - | - |
| 519 - 519.5 | Coal | 0.5 | - | 100 |
| 519.5 - 521.5 | Mudstone | - | - | - |
| 521.5 - 522.5 | Mudstone with coal (50% each) | 0.5 | 0.5 | 50 |
| | Total | 16.0 | 6.0 | 72.7 |