

# MAR 19780011: KEANE RIVER

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BP MINERALS LIMITED

1978 DIAMOND DRILL PROGRAM  
ON QUARTZ MINERAL EXPLORATION

PERMITS #229, 230, 231  
near Keane River in Northern Alberta

NTS 74L/7

58°15' - 30' North Latitude      110°45' - 111° West Longitude

AN ASSESSMENT REPORT

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M.D. Bradley  
BP MINERALS LIMITED  
Vancouver, B.C.  
December, 1978

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## SUMMARY

From October 16 to November 8, 1978 a total of 805 m. diamond drilling was completed in 3 holes within Permits #229, 230, and 231. The holes were sited one per permit, on 1976-1977 Track Etch anomalies having nearby water supplies. The program was to determine: -

1. the local depth of overburden,
2. the depth and nature of Athabasca Sandstone Formation overlying granitic basement,
3. the nature of the Archean basement unconformity,
4. the nature of Archean basement rocks.

Results of the program are as follows: -

1. Depth of overburden is approximately 61 m. comprised of unconsolidated sand with 0.3 - 3 m. diameter boulders of fine-grained sandstone at the overburden-bedrock interface.

2. Basement regolith was intersected at 259 m. in KDH 78-3. In excess of 200 m. of generally fine-grained (variable medium- to coarse-grained down hole), gently dipping Athabasca sandstone overlies the basement unconformity.

3. The angular unconformity, intersected in KDH 78-3, is marked by a sharp gradation between coarse-grained to conglomeratic, hematitic sandstone and coarse- to medium-grained, siliceous and hematitic metaclastics.

4. Basement composed of garnet bearing granitic gneiss and augen gneiss was intersected at 282 m. in KDH 78-3. Gneissic and metaclastic rocks are intruded by numerous, narrow, coarse-grained granite to pegmatite dykes throughout.

5. Gamma Ray probe logging of the three holes did not detect anomalous concentrations of radioactive minerals.

6. The total cost of the drilling program including mobilization and demobilization and geophysical services is approximately \$150,000.

## I INTRODUCTION:

In 1976 three contiguous permits were granted to BP Minerals Limited in northeast Alberta on the west edge of the Helikian Athabasca Basin. The permit areas were selected for uranium exploration using a geological model that predicts the favourability of certain areas of Archean/Proterozoic basement rocks at the Athabasca Formation unconformity. The Rabbit Lake, Key Lake and Cluff Lake deposits in Saskatchewan are examples of the type of target being sought.

During the period October 16 to November 8, 1978, 3 diamond drill holes were cored in the permit areas to an aggregate depth of 805 m. The drilling was contracted to D. W. Coates Enterprises Ltd. from Kamloops. The drill employed was a Longyear 38, mobilized throughout the program by a Bell 204 helicopter. All drill holes were geophysically logged using a Scintrex GSD-4 probe (contains a 22 c.c. crystal) interfaced to a Scintrex GAD-1 Differential Gamma Ray Spectrometer. Instrumentation and geophysical services were supplied by Gledhill Consultants Inc. of Don Mills, Ontario.

This report briefly discusses the drill program and describes the bedrock geology intersected by each diamond drill hole. Geological logs for drill holes KDH 78-1, 2, 3 are presented in figures 6,7,8 (text) and total count gamma logs are summarized in figure 9 (map pocket).

## 2 LOCATION AND ACCESS:

The permit area is located in northeastern Alberta, 115 miles north-northeast of Fort McMurray, 30 miles southeast of Fort Chipewyan between the Maybelle and Keane Rivers near the west end of Lake Athabasca. This area is some 50 miles west of the Cluff Lake uranium deposits (see Figure 1, 2, 4).

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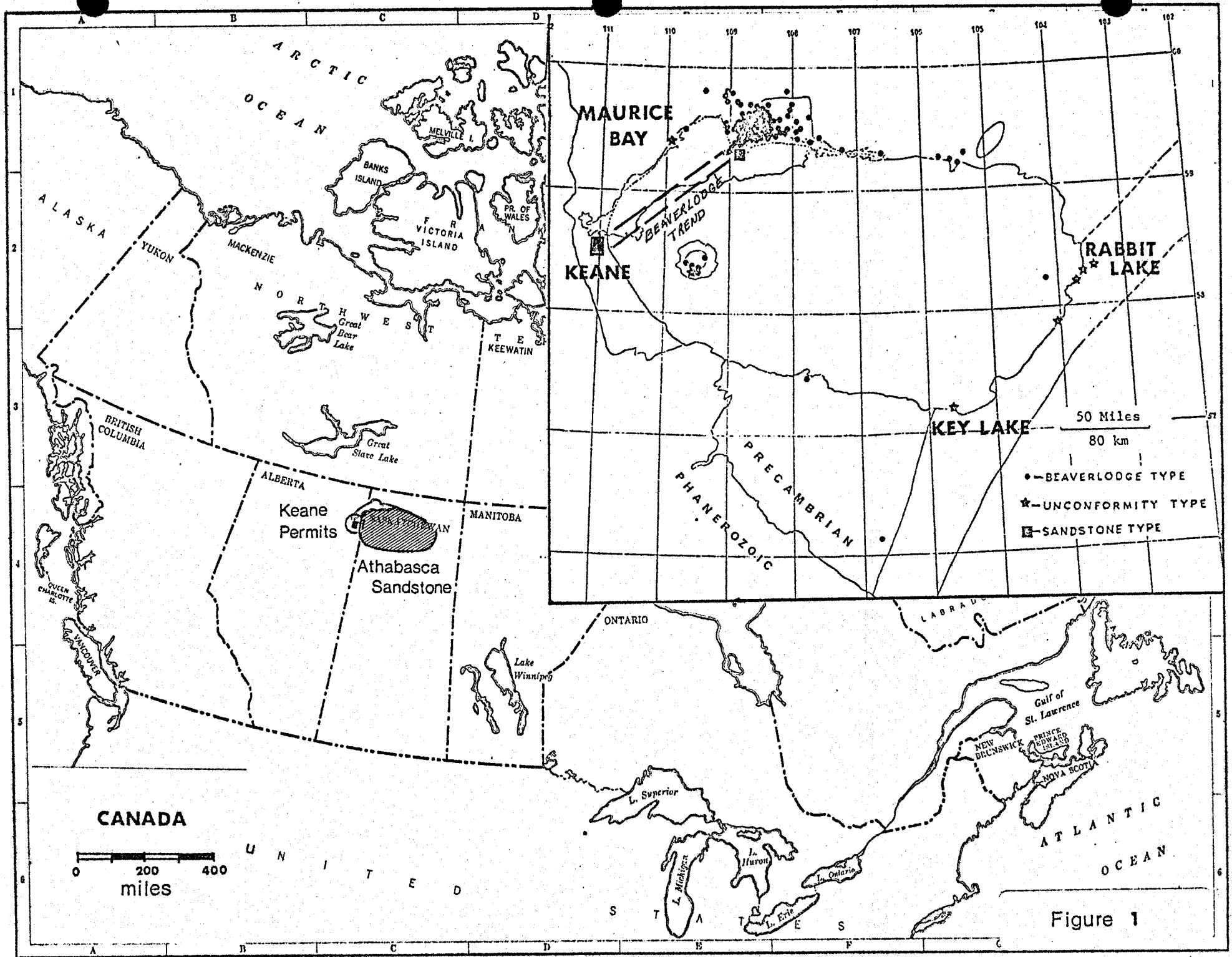


Figure 1

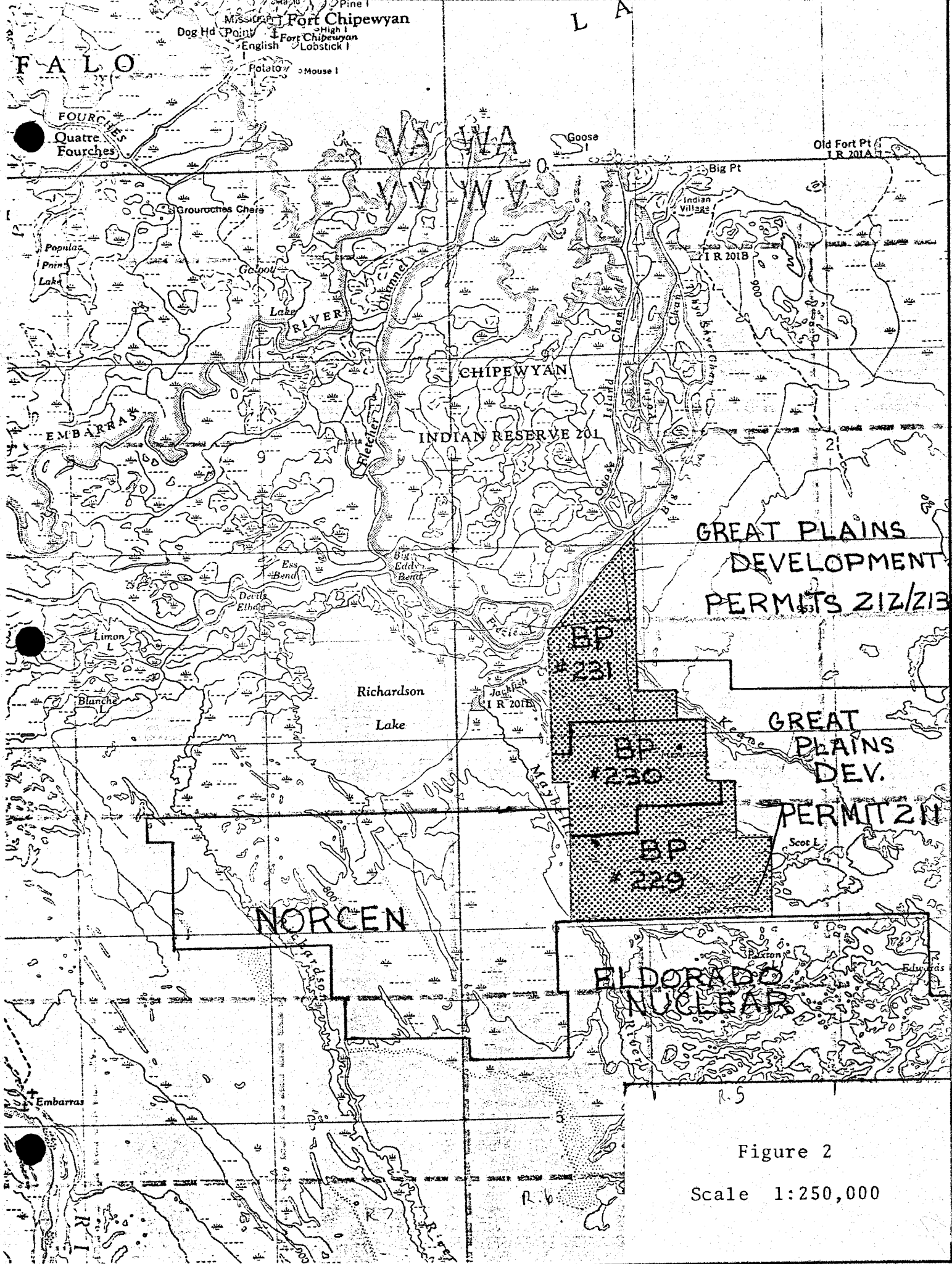


Figure 2

Scale 1:250,000

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TWP. 109

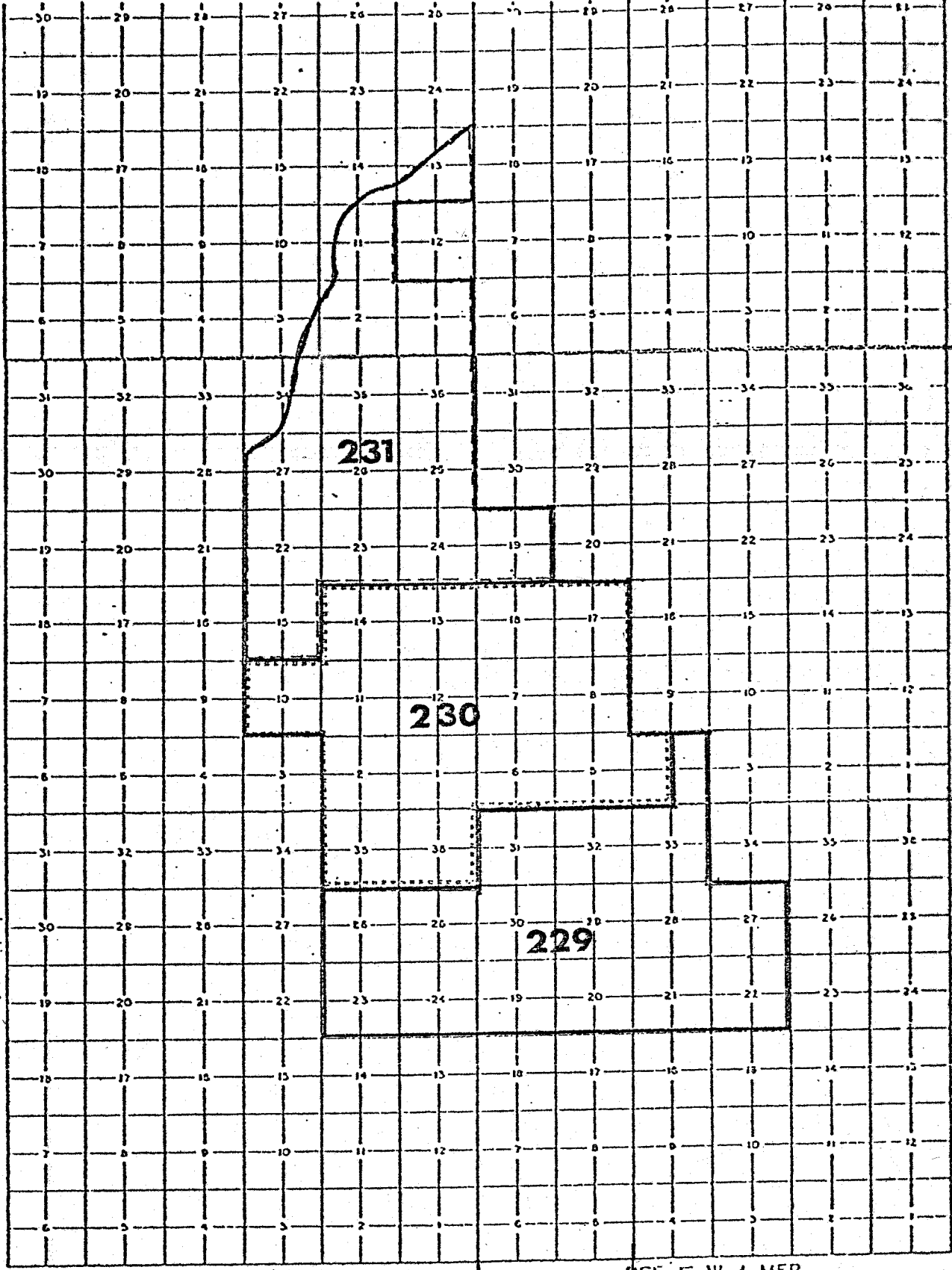
TWP. 108

TWP. 107

Twp  
109

Twp  
108

Twp  
107



RGE. 6 W 4 MER.

RGE. 5 W 4 MER.



QME PERMIT NO. 229



QME PERMIT NO. 230



QME PERMIT NO. 231

Figure 3

Access to the permits is by helicopter and float plane chartered out of Fort McMurray and Fort Chipewyan respectively. Landing strips suitable for DC-3 mobilization are located at Fort Chipewyan, Embarras and Richardson Tower.

### 3 PHYSIOGRAPHY - SURFICIAL GEOLOGY:

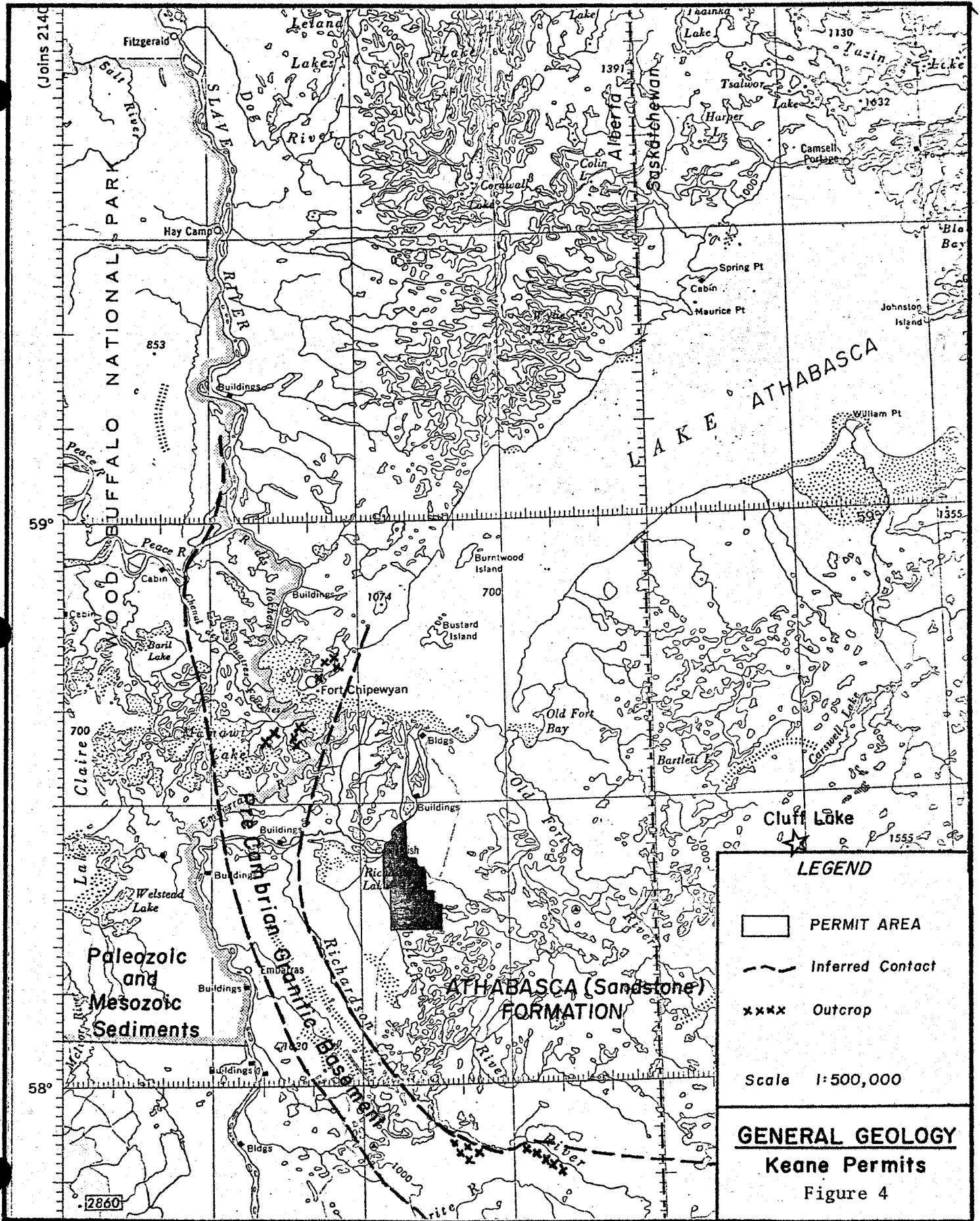
The permits are located in an area of extensive outwash plains which have a gently undulating topography. The outwash material consists almost exclusively of fine- to medium-grained quartz sand. The sands are considerably modified by winds to form aeolian sheets and dunes. Active dune fields are well developed in two areas south and southwest of the Permits. Dunes in the permit area are stabilized by jack pine trees and a carpet of caribou-moss.

The Permit area is drained along the southwestern boundary by the Maybelle River and on the eastern boundary by the Keane River. The river channels are 0.4 to 1 km. wide near their mouths in Richardson Lake and the Athabasca River, but narrow to canyons downcut 40 to 80 m., a few kilometres upstream.

Henrietta Lake is the only lake within the permits. It is a 1.6 km. long, 0.4 km. wide shallow swamp located on permit #230. The lake drains southward into an extensive boggy area then westward by a downcut stream into the Maybelle River.

Outwash sands are known to be approximately 61 m. thick in the permit area and no bedrock is locally exposed.

The direction of ice movement in the last glaciation is locally inferred to have been from the northeast to the southwest.



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#### 4 LAND STATUS:

Permits Nos. 229, 230, 231 comprise (29,391 acres) 11,854 hectares. These permits were granted to BP Minerals Limited on January 28, 1978 and will expire on January 28, 1979.

BP Minerals Limited has made an application to go to lease from permits Nos. 229, 230, 231.

#### 5 HISTORY:

In 1969, a regional airborne radiometric survey was conducted over the area. The results show a uniformly flat radioactivity demonstrating the masking effect of the overburden.

BP Minerals Limited were granted permits 229, 230, 231 in January 1976 and conducted extensive Trach Etch and thoron filtered Trach Etch surveys in the summers of 1976 and 1977.

Norcen Energy drilled a series of stratigraphic holes in the area of the permits in 1977. One of these holes was drilled near the western edge of Permit 229 in the Maybelle River Valley and another was drilled on Scott Lake near the eastern boundary of Permit 229.

Eldorado Nuclear and Shell are actively engaged in a joint venture program to the southeast of the BP permits.

#### 6 GEOLOGICAL MODEL OF TARGET (by B. E. Marten):

The major epigenetic vein-type uranium deposits of Saskatchewan are all located at or directly beneath the basal unconformity of the Athabasca Formation. An almost identical empirical relationship is observed in Australia (Jabiluka, Ranger, etc.). The common denominator

is the presence of a middle to late Proterozoic fluvial sandstone sequence resting on an ancient peneplained erosion surface. Other controlling elements of the "Unconformity Model" are: (1) presence of regolith at the unconformity; (2) a source of uranium in the basement (high background granitoids, mineralized pegmatites, etc.); (3) zones of suitable host or "trap" rocks in the basement: metasediments (preferable semipelitic and pelitic), with pyritic, graphitic and dolomitic units; (4) permissive structural zones in the basement: dilational faults, fracture zones, etc., in which uranium can be precipitated.

The major known orebodies are related to these features and are also associated with extensive chloritisation of host rocks. They appear to have formed at temperatures of 150-205°C under the influence of a high geothermal gradient beneath a considerable thickness of sandstone cover.

#### 7 GEOLOGICAL SETTING AND FAVOURABILITY:

Northeast Alberta lies on the edge of the Canadian Shield in the Churchill Structural Province. The Precambrian rocks consist of a basement complex of Archean-early Proterozoic age, unconformably overlain by the flat-lying Athabasca Formation (fluvial sandstone) of Helikian age. The basement complex consists of gneisses and metasediments (Tazin Group) that were internally deformed, metamorphosed and intruded by granites during the Hudsonian orogeny. The structure is dominated by linear belts of intensely deformed and mylonitised gneiss and metasediments pinched between broad more homogeneous batholiths.

On published geological maps (Green and Mellon, 1962, 1970), the permits are indicated to lie just west of the basal unconformity of the

Athabasca Formation. It is now thought, from 1978 drilling, that the unconformity lies further to the west, as in the indicated position of figure 4. Bedrock is not exposed in the region so the true position of the unconformity and the exact nature of the basement complex are unknown.

Other criteria were applied in area selection using the framework of the unconformity model. A seismic survey of the Athabasca Basin by the G.S.C. revealed the presence of a northeast-trending graben that appears to be controlled by a continuation of the structure of the Beaverlodge area into Alberta. The Permits are believed to lie on the continuation of this favourable basement geology. There is also a possibility that northerly trending fault structures in the Chipewyan belt north of Lake Athabasca extend into the area.

## 8 GENERAL GEOLOGY (after G.J. Campbell):

### Description of Formations

#### i) Precambrian Basement:

Rocks of the Precambrian basement range in age from 1.7 to 2.3 billion years and comprise a complex of igneous and metamorphic units. Granitic gneiss forms the oldest unit and is composed of a strongly foliated assemblage of biotite, hornblende, quartz and feldspars. The gneiss encloses minor bands of metasediments and amphibolites. The metasediments consist of quartzite, paragneisses, meta arkose and biotite, hornblende and sericite schists. In some areas the metasediments form the dominant basement rocks.

In the loop of the Marguerite River, the basement complex is composed of metasedimentary rocks which strike  $040^{\circ}$ . The metasediments

TABLE 1: Geological Formations

ERA	PERIOD	FORMATION	LITHOLOGY
MESOZOIC	LOWER CRETACEOUS	Loon River	Dark grey silty shale, laminated siltstone
		McMurray	Shale, siltstone; fine to coarse grained sand, in part oil saturated
Unconformity			
PALEOZOIC	Devonian	Waterways	Grey shale, argillaceous limestone, fine grained clastic limestone
		Slave Point	Limestone, dolomitic lime- stone, minor shale, gypsum
		Middle Devon. (undivided)	Dolomite, gypsum, anhydrite
Unconformity			
PRECAMBRIAN	Paleohelikian	Athabasca	Quartz sandstone, minor conglomerate, shale
	Unconformity		
	Aphebian to Archean		Basement complex of granite gneiss, metasediments, migmatites

are intruded by granites which, in turn, have been cut by quartz, pegmatite and aplite dikes. Basement rocks near Fort Chipewyan consist of migmatites and granites.

ii) Athabasca Formation:

This Formation covers approximately 40,000 square miles in northern Saskatchewan and Alberta and is composed predominantly of quartz sandstone with minor shale and conglomerate beds. Measurements of crossbeds indicate that the sands were deposited in a low lying basin from a source in the east and southeast. Crossbedding is in the form of narrow troughs. The sandstone is mature with a small heavy metal content and considerable chert. Locally the Formation is folded and intruded by diabase dikes. The basal Athabasca is usually, but not always, conglomeratic. The conglomerate consists of quartz pebbles or cobbles with a dark reddish to purplish hematitic matrix. It is sometimes weakly radioactive, from two to four times background. Radioactivity is caused by thorium. Age dates on rocks in the Athabasca area indicate that the Formation is on the order of 1,200 to 1,400 million years old.

iii) Paleozoic and Mesozoic Rocks:

The Middle Devonian unconformably overlies the Precambrian basement west of the Permit area. Outcrops of bedrock along the Slave River, 40 miles northwest of the Permits, consist of dolomitic limestone and dolomite which grade down into sandstone and regolithic igneous material which rests on Precambrian rocks. Outcrops along the Marguerite and Firebug Rivers, about 40 miles southwest of the Permits, consist of locally fossiliferous, fine-grained dolomite.

The Upper Devonian Slave Point and Waterways Formation overlie the Middle Devonian and outcrop west of the Permits. The Slave Point consists of brownish dolomitic limestone and limestone and is overlain by greenish grey calcareous shale and argillaceous limestone of the Waterways Formation.

The Cretaceous McMurray Formation lies unconformably upon the Devonian rocks of the Waterways Formation and is well exposed along the valley of the Athabasca River. The unit is 150 to 300 feet thick and is composed of deltaic, thickly crossbedded, oil impregnated, quartz sands with interbeds of laminated grey silt and silty shale. The Loon River Formation rests conformably upon the McMurray Formation and consists of an 800 foot thick sequence of dark grey, marine shales and siltstones.

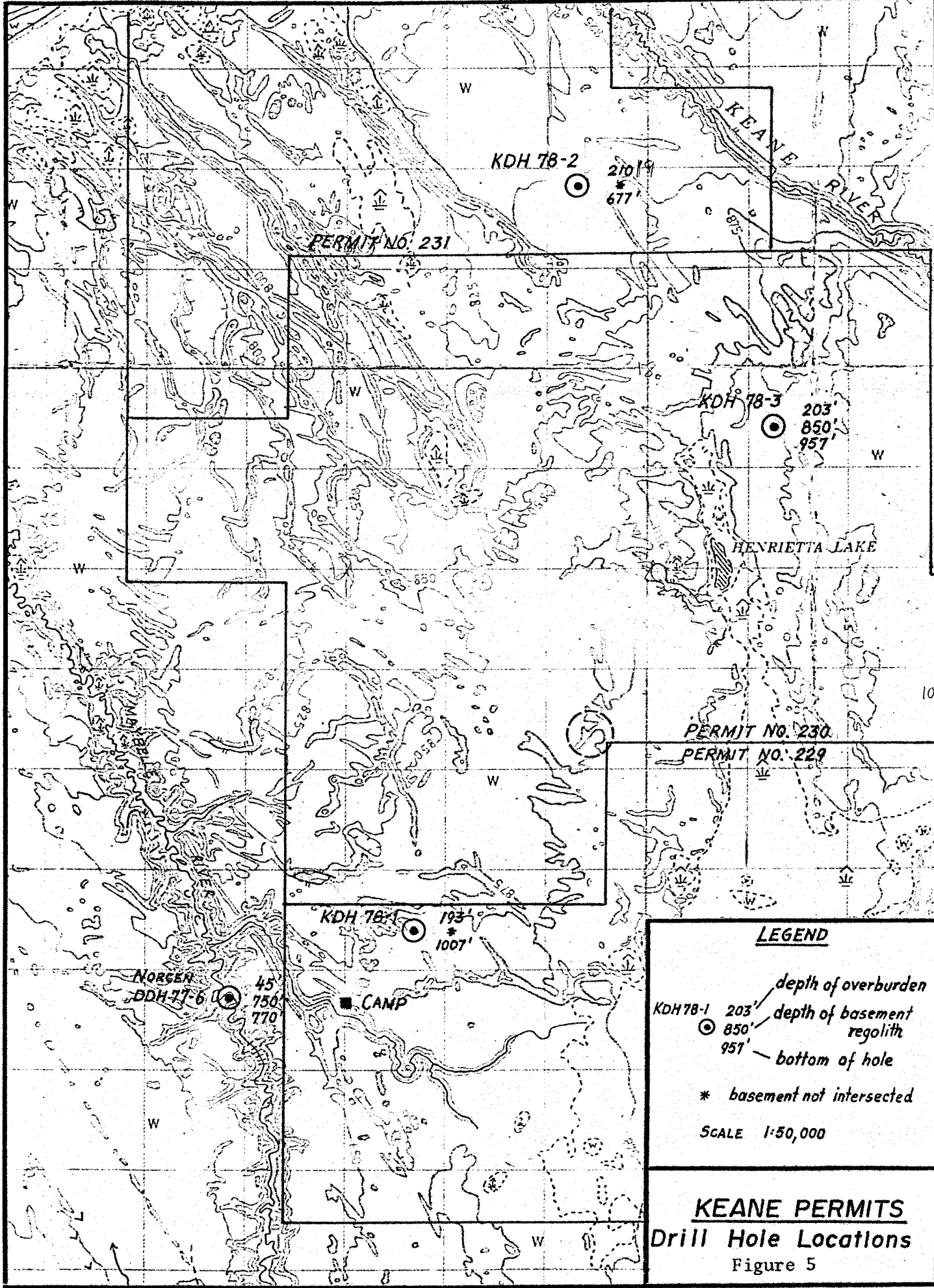
#### 9 1978 DIAMOND DRILL PROGRAM:

##### i) Preamble:

Drilling contractor for the 1978 program was D.W. Coates Enterprises Ltd. of 2560 A Simpson Road, Richmond, B.C. The drill employed for the job was a Longyear 38.

The drill, equipment and camp were mobilized from Uranium City and Fort McMurray by DC-3 to Embarass airstrip on the Athabasca River (see figure 4). Mobilization from Embarass - onsite, subsequent drill moves and demobilization were by Bell 204 helicopter from Associated Helicopters in Fort McMurray.

A base camp was established 915 m. southwest of kDH 78-1 near the confluence of the Henrietta Lake tributary and Maybelle River (see figure 5). Drill crews were ferried to holes kDH 78-2 and kDH 78-3 from base camp by a



**LEGEND**

KDH 78-1 203' — depth of overburden  
 850' — depth of basement  
 957' — depth of regolith  
 — bottom of hole

\* basement not intersected

SCALE 1:50,000

**KEANE PERMITS**  
**Drill Hole Locations**  
 Figure 5

Bell 47 (G3B2) helicopter on contract from Lift Air International Ltd. of Calgary. Two 12-hour shifts were operated on kDH 78-1. A 14-hour night shift and a 10-hour day shift were employed on holes kDH 78-2, 3, to accommodate available day light for the helicopter shift changes.

Water supply for drilling was pumped through 3" diameter rubber waterline: 976 m. long from Henrietta Lake tributary to kDH 78-1; 1585 m. long from Keane River to kDH 78-2; 488 m. from Henrietta Lake to kDH 78-3. Freezing temperatures throughout the program required two diesel fired coil stoves operating continuously on the water lines.

Overburden was triconed and cased with NW diameter casing. Where drilling difficulties were encountered; e.g. in mixed boulder and sand conditions, at the overburden-bedrock interface, the hole was cased with NQ rod and drilling completed using BQ rod.

The drill holes were geophysically probed using a Scintrex GSD-4 gamma probe, containing a 22 cm. detector crystal, interfaced to a Scintrex GAD-1 Differential Gamma Ray Spectrometer which was slaved to a chart recorder. Electronics, recorder and D.C. winch were powered by a Honda generator. Metric markers on the chart recorder were triggered electronically by a switch operating off a worm-gear driven by the winch cable. The holes were logged through casing and rod hole with the spectrometer in the total count mode. Had areas of anomalous radioactivity been encountered in the first pass probing, these specific areas would have been reprobed, analyzing for uranium, thorium, and potassium concentrations. No total count anomalies were observed in the three holes.

Core recovery from all holes was near 100 per cent with the exception of few very short sections of unconsolidated sand within the



TABLE 2: SUMMARY OF DRILL RELATED DATA

	<u>KDH 78-1</u>	<u>KDH 78-2</u>	<u>KDH 78-3</u>
Collar Elevation (a.m.s.l.)	267 m (875')	259 m (850')	274 m (900')
Hole Attitude	90°	90°	90°
Total Depth	307 m (1007')	206 m (677')	292 m (957')
Depth of Overburden	59 m (203')	64 m (210')	62 m (203')
Depth of Basal Unconformity	?	?	259 m (850')
Apparent Thickness of Sandstone Fm.	?	?	197 m (647')
Average Dip of Sandstone Fm.	5°	5°	5°
Interval of "significant" tar occurrence in Sandstone Fm.	59 m-161.6 m (203'-530')	64 m-113 m (210'-370')	62 m-91 m (203'-300')
Number of hours drilling o/b (coring)	15 hours (70 hours)	29 hours (39 hours)	14 hours (51 hours)
Rate of Progress: Night Shift	40 m (130') /shift	36.6 m (120') /shift	33.5 m (110') /shift
(Av. good coring) Day Shift	79.3 m (260')	67 m (220')	79.3 m (260')
Mobilization	- day shift average equivalent 61 m (200'), in basement rocks		
Demobilization	- 6 days including camp & hole 1 setup		
Moving - Site prep. - setup		60 hours hole 1-2	54 hours hole 2-3
Reduction NQ to BQ coring	67.4 m (221')	107 m (351')	64.3 m (211')
Drill Steel left down hole			
NW casing	54.9 m (180') hole	18.3 m (60') dynamited	12.2 m (40') dynamited
NQ rod	39.6 m (130') stabilized	15.2 m (50') dynamited	12.2 m (40') dynamited
Radioactive signatures:	Sandstone: 20 - 40 counts	Unconformity: 30 - 50 counts	
	Basement: 50 - 70 counts		

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Athabasca formation where recovery was approximately 60%, and in a section rereamed during reduction from NQ to BQ coring in hole KDH 78-1 (17% recovery), and at the overburden - bedrock interface.

The equipment and operator were mobilized from the Uranium City area at the completion of each hole. Geophysical instrumentation and services were supplied by Gledhill Consultants Inc. of Don Mills, Ontario.

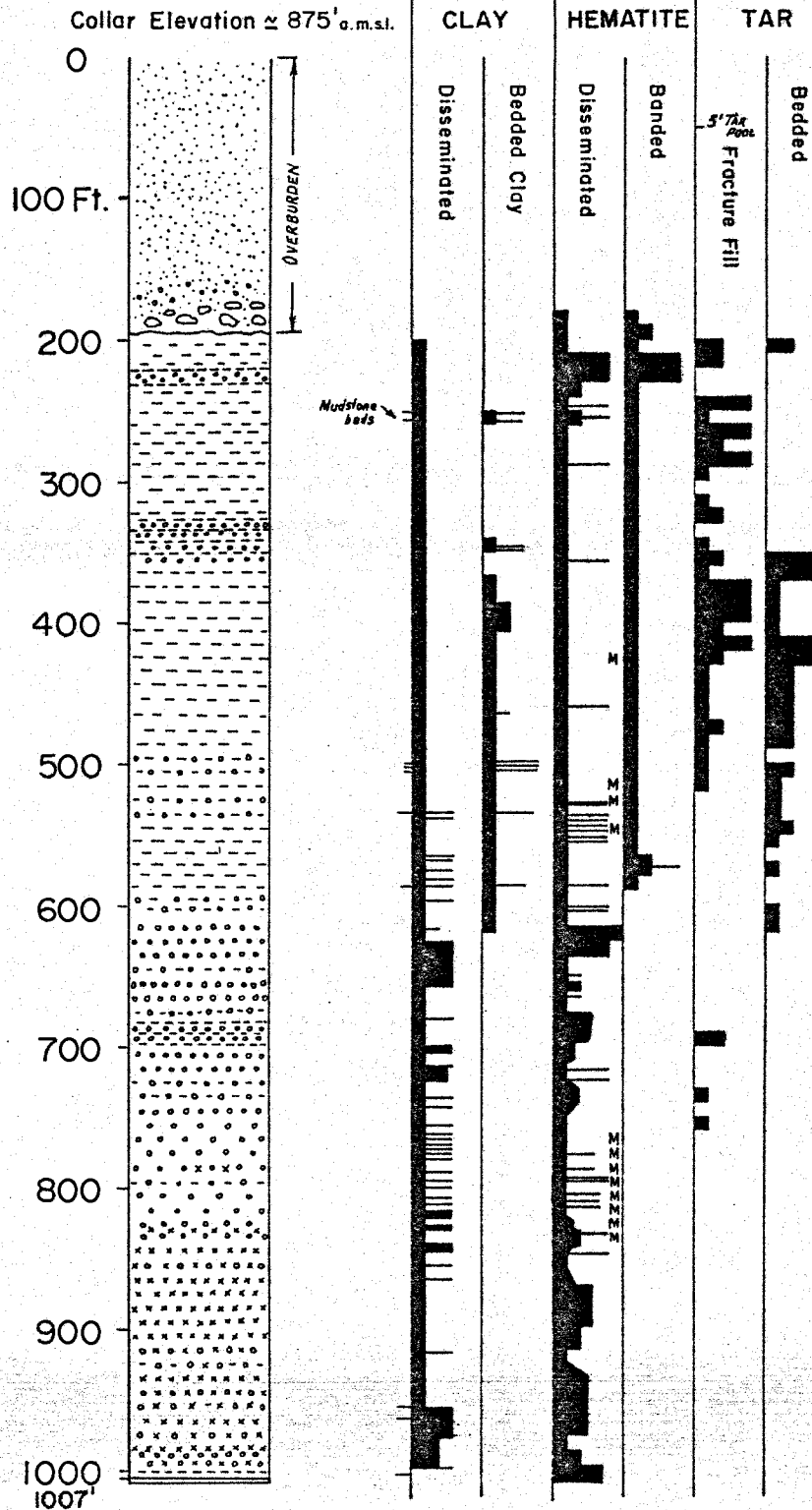
Near completion of the drill program, a site inspection was performed by a Fort Chipewyan forestry officer. All sites were cleared as per his instructions and all drill cores have now been removed from the permit area. All garbage and empty fuel drums have been removed to Fort McMurray. The diamond drill and pumps have been demobilized.

ii) Summary of Diamond Drill Hole Geology:

(a) Overburden: Approximately 59 m. (203') of sand overlies bedrock in the permit areas. The sand is fine-grained, white to maroon in colour, and composed of 90% quartz with minor clay, mafic and feldspar minerals. At the overburden - sandstone interface lie 3-6 m. (10'-20') of 0.5 - 3 m. diameter sandstone boulders set in a sandy matrix. There is a tendency for water and mud pumped down hole to wash away this matrix material creating voids, thereby allowing drilled boulders to shift and trap the casing. Approximately 1 m. of tar impregnated, unconsolidated sand was encountered, in overburden, in each of the three holes.

(b) Athabasca Sandstone Formation: (refer to Figure 6,7,8)  
Bedrock in the permit areas is composed of fine-grained, well sorted, moderately competent sandstone. The sandstone formation contains only

KDH 78-1



- PRECAMBRIAN ATHABASCA FORMATION:**
- F.g. sandstone
  - o-o-o- F.m.g. sandstone
  - oooooo m.g. sandstone
  - xoxoxox m. with some c.g. sandstone
  - xxxxxxx coarse grained sandstone
  - M Mottled Hematite

WEAK  
MODERATE  
STRONG  
INTENSE

BP Minerals Limited

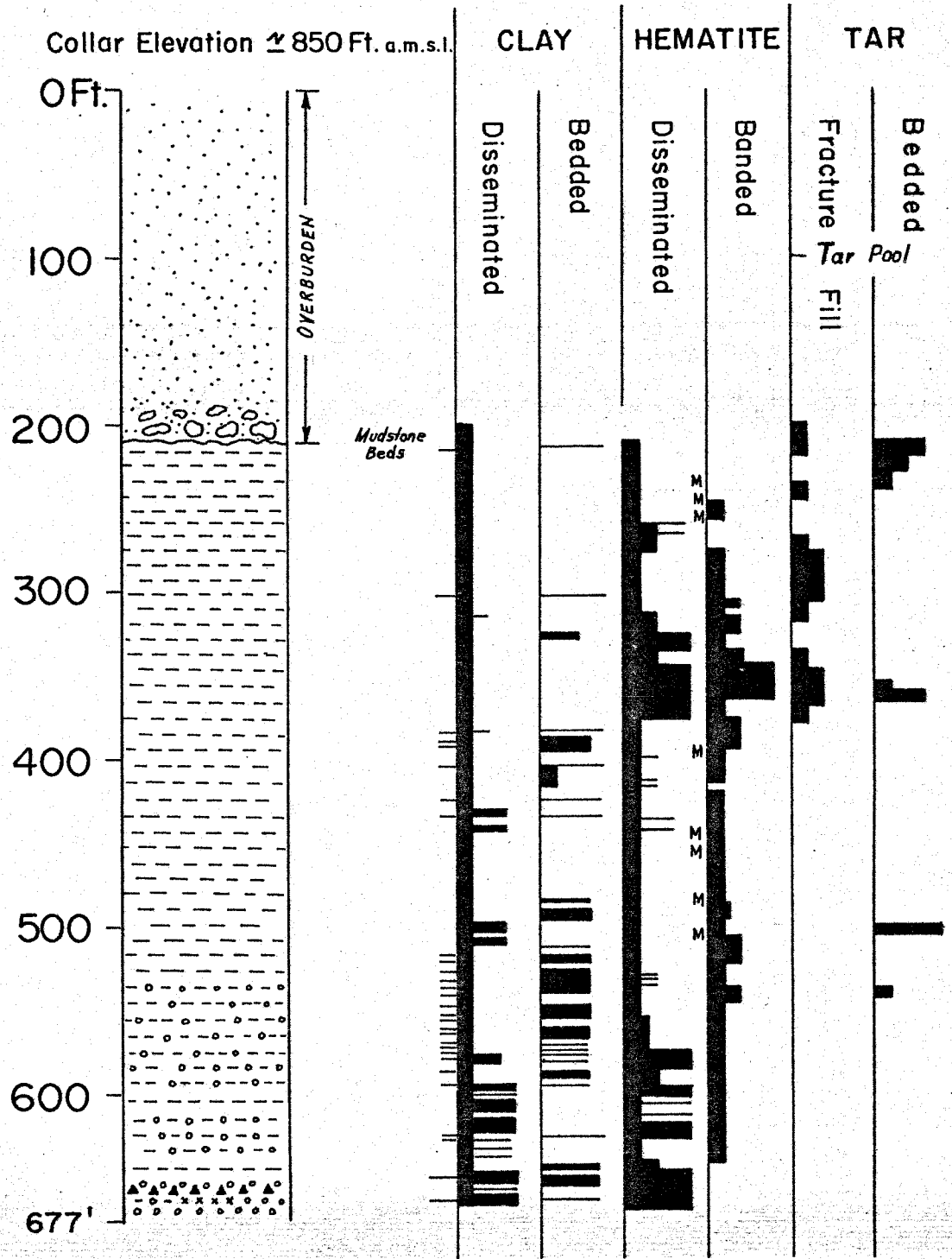
**GEOLOGICAL CROSS SECTION OF DIAMOND DRILL HOLE KDH 78-1**

SCALE	INTS 94L7	FIG 6
DATE DEC. 1978	PROJ	

To accompany report

19780011

KDH 78-2



**PRECAMBRIAN ATHABASCA FORMATION:**

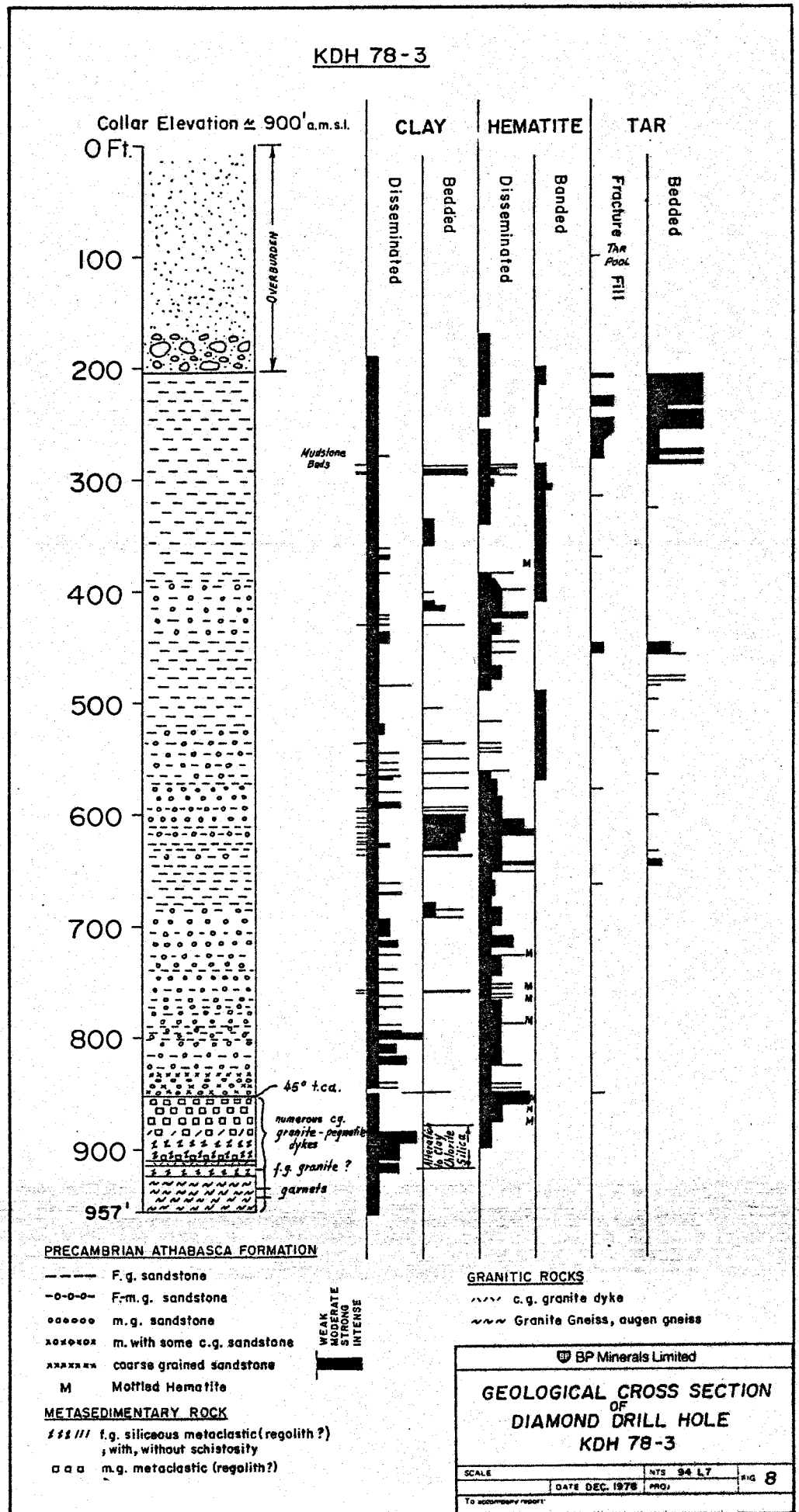
- F. g. sandstone
- o-o-o- F. m. g. sandstone
- oooooo m. g. sandstone
- xoxoxox m. with some c. g. sandstone
- xxxxxxx coarse grained sandstone
- M Mottled Hematite
- ▲ Sandstone breccia



BP Minerals Limited		
<b>GEOLOGICAL CROSS SECTION OF DIAMOND DRILL HOLE KDH 78-2</b>		
SCALE	NTS 94 L7	FIG. 7
DATE DEC. 1978	PROJ.	
To accompany report:		

1978001

KDH 78-3



PRECAMBRIAN ATHABASCA FORMATION

- F.g. sandstone
- o-o-o- F.m.g. sandstone
- ooooo m.g. sandstone
- xoxox m. with some c.g. sandstone
- xxxxx coarse grained sandstone
- M Mottled Hematite

METASEDIMENTARY ROCK

- ||||| f.g. siliceous metaclastic (regolith?)  
; with, without schistosity
- m.g. metaclastic (regolith?)

GRANITIC ROCKS

- ||||| c.g. granite dyke
- ||||| Granite Gneiss, augen gneiss

WEAK  
MODERATE  
STRONG  
INTENSE

BP Minerals Limited

**GEOLOGICAL CROSS SECTION  
OF  
DIAMOND DRILL HOLE  
KDH 78-3**

SCALE	DATE DEC. 1978	NTS 94 L7 (MO)	FIG 8
To accompany report			

19780011

minor disseminated feldspathic minerals. The formation has a uniform apparent dip of  $5^{\circ}$  ( $85^{\circ}$  t.c.a. - to core axis) with the exception of occasional crossbedding in the upper 61-91 m. (200'-300') and in some more steeply dipping ( $15^{\circ}$ - $25^{\circ}$ ), medium- and coarse-grained to conglomeratic sections.

Thin subparallel bands composed of fine-grained hematite are found throughout the upper 122 m. (400') of the formation. The hematite bands frequently parallel bedding, but more often cross cut bedding planes; apparently indicating post depositional transport of iron-rich groundwater. Below 183 m. (600') depth in each hole, hematite is more common as pervasively weak to intense disseminations rather than as thin bands. Hematite is preferentially intense in coarser-grained beds apparently due to good porosity and in, or adjacent to, shale (mudstone) beds.

Another characteristic of the formation's upper 61-122 m. (200'-400') is the presence of fracture fill and bedding impregnated tar. The tar is similar in appearance and consistency to cold roofing tar and occurs in visibly significant amounts in hole KDH 78-1 from 59-162 m. (203'-530'), in hole KDH 78-2 from 64-113 m. (210'-370') and in hole KDH 78-3 from 62-91 m. (203'-300'). A single tar filled fracture was noted at the unconformity (259.8 m. - 851.5') in KDH 78-3. Tar was apparently introduced from overlying Devonian-Mississippian formations (no local erosion remnants) along steeply dipping fractures and laterally impregnated more porous sections of the Athabasca Formation.

The sandstone formation is coarser-grained below 152 m. (500'). Interbeds of medium-grained and fine-grained sandstone with occasional sub-rounded fragments of quartz and sandstone are common between 152-183 m.

(500'-600'). Below 183 m. the formation is predominantly medium-grained with numerous fine-grained and occasional coarse-grained sandstone interbeds. Below 213 m. (700') the formation is commonly coarse-grained to conglomeratic with some medium- and fine-grained interbeds, but considerable lateral variation is evident; e.g. between kDH 78-1 and 2. Graded bedding, cut and fill features and abrupt contacts between fine- and coarse-grained beds are found throughout the formation below 183 m. (600') in each drill hole. The coarse-grained to conglomeratic beds are composed of rounded to subrounded clasts of sandstone, quartz and weakly foliated quartzite set in a fine- to medium-grained, sandy matrix.

A sandstone breccia was intersected in kDH 78-2 from 200.5-201.2 m. (657.7'-660'). The breccia occurs within a bed of fine-grained sandstone which interbeds with medium- to coarse-grained sandstone near the bottom of the hole. It consists of 3-5 cm. diameter angular fragments of weakly altered, gray-green, fine- to medium-grained sandstone and 1 cm. diameter fragments of hematitic quartz set in an altered fine-grained matrix of sand and green clay (sericite?). The breccia is unique to hole 2.

Shale beds (mudstone) 0.5-3 cm. thick occur infrequently throughout the sandstone formation. The shales contain thinly bedded silty partings, are always flat lying ( $90^{\circ}$  t.c.a. - to core axis) and are commonly green or red brown in colour. The beds are rare in hole kDH 78-1, but are common in holes kDH 78-2 and 3 between 160 m. and 198 m. (525'-650'), interbedded with fine- to medium-grained sandstone. There is an irregular but perceptible increase in disseminated clay content and argillaceous sandstone beds toward the bottom of the sandstone formation. A general increase with depth of fine-grained disseminated chlorite and sericite (?) was noted in the sandstone.

The Athabasca Formation has a characteristic radioactivity in the range of 20 - 40 counts.

(c) Angular Unconformity: The unconformity was intersected at 259.27 m. (850.4') in KDH 78-3. It dips  $45^{\circ}$  and marks an irregular abrupt transition between; a light orange, coarse-grained sandstone of the overlying Athabasca Formation ( $5^{\circ}$  dip), and a siliceous, intensively hematitic, metaclastic containing coarse-grained, rounded clasts of quartz. The highly altered metaclastic constitutes a basement paleo-regolith overlying gneissic rocks.

The unconformity has a radioactivity of 30 to 50 counts.

(d) Basement Rocks

1) Metaclastic Regolith: Approximately 20 m. (66') of dark grey maroon, fine- to medium-grained, strongly altered metaclastic rock overlies gneissic rocks below the unconformity. The metaclastic, in the interval 259.3 m. - 267.4 m. (850.6'-877') is medium-grained, siliceous and strongly hematitic with an indistinct schistosity. It is predominantly fine-grained and distinctly schistose with a  $15^{\circ}$  dip ( $75^{\circ}$  t.c.a.) in the interval 267.4 m. - 279.6 m. (877'-917') and variably but commonly strongly altered to clay and chlorite. The metaclastic is cut by numerous steeply dipping quartz veins and narrow, coarse-grained granitic to pegmatitic dykes. The granite dykes have variably but commonly intensively altered the unit to orthoclase, chlorite and clay. These highly altered selvages are strongly schistose and friable.

The metaclastic has a characteristic radioactivity of 50 -70 counts.



2) Granite Gneiss: Fine-grained, siliceous metaclastic containing 1% very fine-grained biotite is in sharply gradational contact with coarse-grained granite gneiss at 281.6 m. (923.7'). The gneiss is dark gray in colour and variably fine- to medium-grained throughout. It contains much disseminated fine- to medium-grained biotite on schistosity and numerous zones of medium- to coarse-grained quartz and feldspar "augen". The gneiss is cut by several dykes of coarse-grained granite and pegmatite. The dykes commonly have narrow quartz sericite selvages with broad friable aureoles of chloritized biotite in the gneiss. The granite dykes commonly contain medium-grained "blobs" of chlorite. Feldspars in the dykes and adjacent gneiss are strongly altered to clay.

The granite gneiss has a characteristic radioactivity of 60 - 70 counts.

APPENDIX 1

Geological Logs KDH 78-1



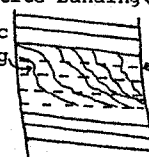
KEANE PERMITS

## DRILL LOG HOLE #1

Vertical Hole

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		1	19			
DATE STARTED		DATE COMPLETED		SURVEYS			HOLE SIZE	TOTAL DEPTH	HOLE NO.			
October 16, 1978		October 21, 1978					NQ	1007'	D.D.H. 78-1			
DEPTH		CORE		LITHOLOGY			ALTERATION	MINERALIZATION	STRUCTURE			
From	To	Length	% Rec						F	V/F1	F/F1	Log
0'	180'	180'	0	Overburden: f.-g. unconsolidated aeolian sand locally forming dune topography. Composed predominantly of rounded quartz grains with very minor feldspar & mafics visible. Cream coloured to very light orange brown at surface varying medium orange brown, grey & maroon at depth. O/h triconed - 3 5/8" tricone.			Note: casing very tight in suspected bedrock at 180'. Lost circulation at 179' - returned at 180' - coring NQ begins.	Approximately 5 feet of black material - thought to be tar intersected at around 50' in overburden. Causes drilling to slow, water pressure to rise - coats casing.				
180'	185'	4.5'	90%	Sandstone (Athabasca Formation): f.-g., well sorted, competent rock. Interbedded medium-grey mottled and light grey-maroon varieties. Thin (1 mm) hematite bands along bedding plane, moderate spacing 181'-181.2'; close spaced 183'-184.5'. Bedding plane 60° core axis. Broken core at 184.5'.			- hematite banding					
185'	195'	4'	40%	Sandstone: f.-g. white to light maroon in colour. Variably competent & unconsolidated. Broken core, sand & cave recovered Section 180'-185' probably a boulder laying on bedrock. Loose sand & small boulders 185'-193'.			- hematite banding	Fracture fill tar noted in cave material.				
195'	207'	12'	100%	Sandstone: f.-g., well sorted, competent, varying light to dark maroon in colour. Colouration due to very closely spaced 1 mm thick hematite bands on bedding planes. Wavy banding (hematite) superimposed on cryptic bedding at 197' & 202'. Bedding plane 80° - 90° core axis. Banding - 30°. Slump fracture at 206'-0', 2-5 mm displacement.			- hematite banding cryptic bedding	Fracture fill tar at 195' (25°), 195.5' (25°), 198.5' (25°), 199.5' (10°, 25°), 203' (10°); 205-205.5' (10°) - heavy bedding impregnation adjacent to fracture.				.5
207'	217'	10'	100%	Sandstone: As above. White coloured sections at 207.4' - 208', 208.5', 208.9'. A few f.-g. rounded clasts in f.-g. matrix 216'-217'. Bedding commonly 85° but cross cut bedding noted 210'-211', 215.5'-216' with slight reworking of material & coarsening of grain size.			- hematite banding and disseminations throughout.	Fracture fill tar at 207'-208' (5°), 209' (50°), 210' (90°), 213'-214' (10°) 214.5' (5°)				.5



DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.					
DATE STARTED		DATE COMPLETED		SURVEYS						2 19					
								HOLE SIZE		HOLE NO.					
								BQ		D.D.H. 78-1					
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE		GRAPHIC	
From	To	Length	% Rec									F	V/FI	F/FI	Log
217'	221'	4'	100%	<p>Sandstone: Mainly f.-g., dark maroon in colour &amp; rather porous. Several angular quartz fragments in f.-g. matrix 217'-219'. Four 2 inch wide beds of m.-g. sandstone from 219'-221'. Bedding commonly 80° t.c.a., except 219'-220.2' - cross cuts on 50°.</p>				<p>- hematite banding, banding &amp; dissemination through - strong, pervasive.</p>		<p>none.</p>					0
221'	231'	1.7'	17%	<p>Sandstone: Predominantly m.-g., dark maroon in colour &amp; dense rock though apparently more friable in strongest hematite zones. Bedding 80° with cross cutting beds at 50°.</p> <p>Hole 1st drilled 221'-231' with NQ before setting as casing for BQ rods - no core barrel used. Section was redrilled with BQ rods on through NQ bit. Recoring of section accounts for substantial core loss.</p>				<p>- strong pervasive hematite disseminations &amp; banding.</p> <p>- minor carbonate fracture fill.</p>		<p>- pyrite bleb noted on one fracture.</p> <p>- no tar.</p>					?
231'	237'	7'	100%	<p>Sandstone: Predominantly f.-g., medium maroon in colour dense and competent rock. Well sorted with small scale graded bedding throughout. Section 236'-237' m.-g., somewhat porous. Cut and fill (60°) c.-g. sandstone at 233.1'-233.4' with numerous poorly sorted subangular - subrounded sandstone fragments to 6 mm. diameter</p>				<p>- hematite strong 231'-233.4', weak-moderate thereafter.</p>		<p>- no tar.</p> <p>-*subcontinuous 10° fracture 233.4'-237' in part vuggy contains massive f.-g. &amp; f.-g. blebby pyrite in quartz-carbonate gangue. See also next section.</p>					2/7
237'	247'	10'	100%	<p>Sandstone: Mainly f.-g., very light maroon in colour, dense &amp; competent rock. Sections 237'-237.5', 239.8'-241' variable fine-to medium-grained. Well sorted throughout except 237.3' &amp; 237.9' containing 3-5 mm diameter subrounded quartz fragments. Bedding commonly 80°, 65° at 237.5' &amp; 246-247'.</p>				<p>- hematite weak throughout.</p> <p>- clay on fractures 90° &amp; 10° with quartz frags at 237.9' also 232.2'</p>		<p>Fracture fill tar at 237.6'-239.6' (10°) subcontinuous. 241.2' (10°); 242.8' (10°, 20°)</p> <p>- substantial amount 246' (20°)</p> <p>-*pyrite fracture fill 237.5'-238.7' (10°)</p>					

DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS						3	19
										HOLE NO. D.D.H. 78-1	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE	
From	To	Length	% Rec							F	V/FI
247'	257'	BQ	100%	Sandstone: f.-g. throughout. Medium maroon in colour except medium gray 249'-251' & dark maroon 247'-247.3', 254'-255'. Medium-grained bedded & cross bedded section 248.6'-249.1'. (55°) 0.1 inch wide, medium gray-green, mudstone beds (85°) at 251.7' & 255.1'. Bedding variable throughout 75-90° - rapid changes.		- hematite throughout but note irregular mud crack (?) appearing zones cross cutting bedded hematite zones 250.3';-250.7', 251.8'-253'.		-Fracture fill pyrite blebs at 253' (10°). -Fracture fill tar (10°) 256.7'-257.6'.			.5
257'	267'	10'	100%	Sandstone: f.-g., very light maroon in colour, well sorted, dense, competent rock. Small scale graded bedding. Medium-dark maroon, fine-to medium-grained sections 257'-257.7', 258.3'-258.6', 260'-260.8', 262.8'-263.8'. Bedding commonly 80-90°.		- hematite throughout - Quartz-clay-carbonate fracture fill (5°-10°) at 260.7'-261.8'.		Tar fracture fill 256.7'-257.6'. - substantial			1
267'	277'	10'	100%	Sandstone: As above. Bedding commonly 80°, variable 70°-90°.		- weak hematite disseminations & banding.		Tar fracture fill (10°-20°) subcontinuous 274'-278' 1 fr. only - moderately abundant.			1
277'	287'	10'	100%	Sandstone: As above, though only moderately dense & competent. 5°-20° & 90° fracturing common throughout. Bedding 80° but variable 60°-80° from 283'-284'.		- weak hematite banding - (green) & white clay noted on 10° fracture.		- minor f.-g. pyrite on fractures. - tar as isolated 1-2 mm blebs on most fractures. - tar mod. substantial as thin fr. fill coatings (10°) 277'-278', 280.3', 280.7'-281.1', 283'-285'.			3
287'	297'	10'	100%	Sandstone: f.-g., very light maroon, dense & competent with small scale graded bedding; well sorted throughout. Bedding 80°-90° minor cross bedding 287.7'-288.6', 290.6'-291.4' & 293' (60°).		- very strong hematite alt <sup>n</sup> 288'-288.2' & minor hematite concretions 2 mm diameter 291.5' - 292'.		- Tar fracture fill (50°) at 288.6' & 289.4'.			1

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		SHEET NO.		
								4	19	
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.		
						BQ	1007'	D.D.H. 78-1		
DEPTH		CORE		LITHOLOGY	ALTERATION	MINERALIZATION	STRUCTURE			
From	To	Length	%Rec				F	V/F	F/F	Log
297'	307'	10'	100%	Sandstone: As above. Vug at 300.8'. Bedding regular at 80°.	- weak hematite. - minor clay on fracture.	none				.4
307'	317'	10'	100%	Sandstone: As above.	- weak hematite.	- Tar fracture fill coating 315' (10°), 315.5' (30°).				3/10
317'	327'	10'	100%	Sandstone: As above, core substantially broken & friable along tar coated fractures from 321'-323.8'.	- weak hematite. - possibly clay along walls of tar in filled fractures.	- Tar fracture fill: minor at 317' (10°), 320' (30°) 325'-326' (40°). - very substantial 1 cm wide plus seams 321'-323.8'				5
327'	337'	10'	100%	Sandstone: As above. Less dense and moderately porous from 334.5'-337' with variable fine- to medium-grain size. Bedding variable 70°-85°. Clay seam (85°) at 328.3'. Clay inclusion at 335.3'.	- weak hematite throughout. - clay on fractures					5
337'	347'	10'	100%	Sandstone: Alternating interbedded fine- & medium-grained sandstone, light maroon in colour, moderately dense and competent. Small scale graded bedding. Cross bedding at 338.4'-338.9'. Bedding 75°-85° except 345.5' - 346.6' - (55°).	ditto	- Tar fracture filling 342.2' (60°).				
347'	357'	10'	100%	Sandstone: As above. More medium-grained 355'-357'. Strongly hematized sections rather friable. Mudstone seams at 347.6' & 348.7' bedded on 90° - 1 cm wide. Bedding 80°-90°. Section 347.7'-348.3' appears to a large inclusion. See diagram over.	- weak hematite dissem. & banded throughout - strong hematite alt <sup>n</sup> in 1 inch bands 355.8-357 - talc after clay 90° fractures at 347.6', 348.7'	- Tar fracture filling 349' (20°), 350.8' (30°), 352' (30°), 352.4' (55°) - minor (80° bedded) 8 bands, 5-8 mm wide 355.8'-356.5' substantial				1



## DRILL LOG

LOCATION				CO-ORDINATES			NORTH			EAST			ELEVATION		SHEET NO.	
															5	19
DATE STARTED		DATE COMPLETED		SURVEYS			HOLE SIZE			TOTAL DEPTH		HOLE NO. D.D.H.78-1				
DEPTH		CORE		LITHOLOGY			ALTERATION			MINERALIZATION		STRUCTURE		GRAPHIC Log		
From	To	Length	% Rec									F	V/FI		F/FI	Log
357'	367'	10'	100%	Sandstone: Commonly f.-g., very light maroon in colour. Well sorted, quite dense and competent. Thin beds of fine- to medium-grained sandstone throughout. Concentric (?) bedding at 366.5'. Bedding 70°-80°. Fracturing restricted to bedding planes.			- weak hematite banding.			- Tar impregnated bedding @ 360.7' (1½ inch wide), 362.3'-.5', 363.5' (2"); 365.6', 365.8', 366', 366.2', 366.4'. - Fracture fill @ 363.9' (25°).					1	
367'	377'	10'	100%	Sandstone: As above. Bedding 60°-80°. Moderately fractured throughout. Fractures 0°-10°, 20°-30°, 90° - healed with light green clay and in part, by tar.			- hematite as disseminations throughout. - green (& white) clay noted ± tar healing 0°-10° fractures.			- Substantial tar fracture fill subcontinuous 367'-372' (6 mm wide seam @ 371') also 375'-376', 376.6'-.9'.					5	
377'	387'	9.8'	98%	Sandstone: As above. Bedding 75° except 25° cross cutting at 384'-384.5' then 80° to 387'. Minor green clay noted on isolated bedding & fracture planes throughout. Fracturing on 10°, 25°-30°, 70°-80°.			- weak hematite banding. - green clay on fracture & bedding.			- Tar fracture fillings: - 10 fr, 337.4'-379.4'. 26 fr. 380.1'-385.7'. - Substantial @ 379.2', 380.3', 380.7' (6 mm seam), 385.4', 383', 383.3'.					4	
387'	397'	10'	100%	Sandstone: As above. Bedding 85°. Moderately fractured on 25° from 388.6'-395.4'. Green clay noted on bedding planes & fractures throughout; prominent on bedding (85°) @ 388.7'-389.2', 392.4', 393.4'-395'.			- weak hematite banding. - green clay on bedding & fractures. - white clay, 25° fractures only.			- Tar bedding impregnation at 388.2' & .6'. - Tar fracture fill coatings mainly 25° fr.: 10 fr. from 389.2'-390.4'; 17 fr. from 391'-393.1'; 11 fr. from 394.4'-395.4'.					6	
397'	407'	10'	100%	Sandstone: As above. Light maroon to white in colour. Green clay moderate on bedding throughout. Bedding 85°. Fracturing 10°, 20°-30°, 85°.			- weak hematite banding, except moderate at 405.2' - green clay on fracture & bedding.			- Tar bedding impregnation at 402.1'-.4'; 398.3' - Tar fr. fill: 8 fr. 397.7-400'; 2 fr. 402.6'-405.1'.					4	

## DRILL LOG

LOCATION				CO-ORDINATES			NORTH		EAST		ELEVATION		SHEET NO.			
													6	19		
DATE STARTED		DATE COMPLETED		SURVEYS			HOLE SIZE		TOTAL DEPTH		HOLE NO.					
													BQ		1007'	
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE			GEP/PRC	
From	To	Length	%Rec									F	V/FI	F/FI		Log
407'	417'	9.8'	98%	Sandstone: As above. Very light maroon in colour. Bedding regularly 80°-85°. Substantial impregnation and fracture fill tar in this section. Broken core 415.5'-417'.				- weak hematite banding. - weak green clay on bedding @ 407.2'.		- Substantial fracture fill (10°-20°) tar with associated tar impregnated bedded sands, subcontinuous 408.3'-417'. - Specimen taken 414'-414.8'.					4	
417'	427'	9.8'	98%	Sandstone: As above. Bedding commonly 80°-85° varying 70°-75°. Very minor green clay on bedding planes throughout.				- ditto  - a few 5 mm diameter hematite "mottles" (concretions?) throughout.		- Tar impregnated bedding: 417.1', 417.5', 418.3', 419.7'. - substantial & subcontinuous 422.6'-425.7' - Speciman taken (Utah) 422.6'-423.1'.					.5	
427'	437'	10'	100%	Sandstone: As above. Light to medium maroon in colour. Bedding 85° to 426.4' then irregularly 70° with much "concentric" and cross cutting bedding.				- weak to moderate hematite banding. - green & white clays on fractures. - minor bedded green clay throughout section.		- Tar impregnated bedding (85°) @ 427.2', 427.6', 429', 430.6'-431', 432.4', 432.8', 433', 433.4', 434', 434.2', 435.4', 435.8', 436.5', 436.7'. - Fracture fill 430.4'-432.7'.					.5	
437'	447'	10'	100%	Sandstone: As above. Irregular bedding as per last 10' from 437'-441' then regular at 80°.				- ditto  - green clay more common on fractures.		- Tar impregnated bedding (80°) @ 429', 430.7', 440.1', 440.3'. - Substantial from 441.8'-442.3', 445.6'-.8'.					.5	





## DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.					
										7	19				
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE		TOTAL DEPTH		HOLE NO.					
												BQ	1007'	D.D.M. 78-1	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE					
From	To	Length	%Rec							F	V/FI	F/FI	LOG		
447'	457'	10'	100%	Sandstone: As above. White to very light maroon in colour. Bedding 80° 447'-450.6'; 90° 450.6'-457'. A few rounded, 3 mm diameter, sandstone fragments at 454.2'.		- very minor hematite banding. - green & white clay on fractures & bedded at 450.6'.		- Tar fracture filling (5°) 452.3'-453.6'. - Tar bedding impregnation 447.8', 451.3', 451.8', 453.3-.6', 454.4', 455.1', 455.6', 456.9'.							.3
457'	467'	10'	100%	Sandstone: As above. Bedding fairly regular at 85°. Slight increase in grain size in strongly hematized sections.		- weak hematite throughout except strong @ 459.1'-.3', 459.8'-460.4', 461.4'-.6'. - minor hematite mottles - minor bedded & fr. fill green clay throughout except 464-.3 prominent bedded.		- Tar bedding impregnations @ 457', 457.3'-.5', 461.8'-462.1 all substantial.							.5
467'	477'	10'	100%	Sandstone: As above. Light maroon in colour. Bedding rather irregular on 70° 467'-474' with much cross cutting & some concentric bedding then regular to 477' on 80°.		- weak hematite banding. - minor small hematite "mottles" throughout. - green & white clay on fractures.		- Tar bedding impregnations (80°) @ 471.2', 471.3', 471.5'-472.2', 472.8', 473.6'-.8', 475.5'. - All substantial! - Tar fracture filling 471.5'-472.2', 472.7'-473.8'.							.5
477'	487'	10'	100%	Sandstone: As above. Bedding regular on 85°. 1 inch wide, green, sandy mudstone beds @ 485.3', 486', 486.5' (with 3 inch m.-g. sandstone band, strongly hematized, above). 1 inch diameter sandstone fragment at 486.7'.		- ditto		- Tar bedding impregnations @ 477.4', 477.9', 478.7'.							1

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		8		19	
DATE STARTED		DATE COMPLETED		SURVEYS						HOLE NO.		D.O.H. 78-1	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE		GRAPHIC	
From	To	Length	%Rec							F	V/FI	F/FI	Log
487'	497'	10'	100%	Sandstone: As above. Light to medium maroon in colour, 1 inch wide, 90° mudstone bed (dark green) at 496.3'. Angular unconformity between cross bedded sandstones shows as m.-g. sandstone fragments at 491.8' (2 mm wide). Bedding fairly regular 80°-85° but several cross bedded & concentric banded sections over narrow width.		- weak hematite throughout rather stronger altered bands 491'-492', 493' (1"), 493.9' (1"), 494.5'-.7', 495'-495.6'.		- Tar bedding impregnations @ 488.1'-488.3', 488.9', 489.3', 490.5', 494.7', 495.9' all 80°-90°.					.2
497'	507'	10'	100%	Sandstone: Fine- to medium-grained, medium to dark maroon, competent, moderately dense rock, somewhat porous in appearance in m.-g. bands. Bedding regular on 80°-85°. Muddy sandstone bed 1" wide at 500.5', 502'; sandy mudstone, dark green, well bedded (85°) at 506.3'. 1 cm diameter sandstone fragment at 502.3'.		- numerous 1' long sections showing moderate-strong hematite alteration. - mudstones may be altered to talc (sericite?). - very soft, shiny, light green in colour - not chlorite.		- Tar fracture fill at 502.8'.					.3
507'	517'	10'	100%	Sandstone: As above only mainly f.-g.; bedding regular on 80°-85°. Several narrow fine- to medium-grained bands throughout (70°).		- numerous moderate-strong hematite altered sections throughout also 2-3 mm diameter hematite scattered throughout - probably outline sandstone clasts. - green clay on fractures. - & sericite - talc		- Tar bedding impregnations @ 507.6', 510.4', 511' (substantial), 512.5' (& 10° fracture 512.2-513'), 514.4'.					.4

**DRILL LOG**

SHEET NO.  
9 19

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION	HOLE NO.				
DATE STARTED	DATE COMPLETED	SURVEYS				HOLE SIZE	TOTAL DEPTH	D.O.M. 78-1			
DEPTH		CORE		LITHOLOGY	ALTERATION	MINERALIZATION	STRUCTURE				
From	To	Length	% Rec				F	V/Fi	F/Fi	Log	
517'	527'	10'	100%	Sandstone: As above. Bedding 70°-80°. 1 inch wide green mudstone bed (90°) at 517.8', 518.3' (3 mm). Commonly f.-g. but numerous narrow m.-g. - f.-g. bands throughout section. The slightly coarser grained bands appear to be more porous than the f.-g. and are preferentially tar impregnated in this section.	- ditto - several hematite "mottles" throughout. - mudstones apparently altered to sericite (?)	- Fracture fill tar at 517.4'-.8', 524.3'-527' (5°). - bedding impregnated tar at 517.4', 518.6', 523.7', 525', 525.4', 526.5'.					.3
527'	537'	10'	100%	Sandstone: As per last 10' section. Bedding regular 75°-85° Note that hematite banding cross cuts (overprints) bedding at 70°. Alternating f.-g. and m.-g. - f.-g. beds. M.-g. beds tend to be more strongly hematized than f.-g. beds. 1 cm wide green mudstone band at 534.8' with muddy sandstone 534.6'-.9' and 535'-535.1'.	- weak hematite banding throughout. - strongly hematized section 527.8'-529.5'. - mudstone altered weakly to sericite.	- Tar impregnated bedding (80°-85° fine- to medium-grained) 533.7'.					.3
537'	547'	10'	100%	Sandstone: As above 10'. Light maroon alternating dark maroon bands, also f.-g. alternating m.-g. - f.-g. bands. Medium-coarse grained sandstone & quartz clasts at 537', 537.4', 539', 540', 540.5', 542.6', 545.9'. Muddy green sandstone bed - 1" wide at 538.7'.	- weakly alternating moderate-strongly hematized bands. - green clay (±sericite?) on fracture. - a few hematite "mottles" throughout.	- Tar impregnated bedding (75°) at 539.1'-.3', 539.6' 545.9'-546.1'.					
547'	557'	10'	100%	Sandstone: As above 10'. Mainly light maroon in colour with a few moderately-strongly hematized bands. Green muddy sandstone 555.6'-555.9'. Hematite banding frequently overprints bedding (80°) at 60°-70°.	- ditto	- Tar impregnated bedding (85°) 555.1' & .2', 556', 556.5', 557'.					0
557'	567'	10'	100%	Sandstone: As above. Muddy sandstone at 566.2' (1") and at 566.5'-.7' containing minor true mudstone.	- hematite - light moderate throughout. - sericite? after clay in mudstone.	- no tar					1/10

## DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.			
										10	19		
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE BQ		TOTAL DEPTH 1007'		HOLE NO.	
												D.D.H. 78-1	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE			
From	To	Length	%Rec							F	V/FI	F/FI	Log
567'	577'	10'	100%	Sandstone: As above. Mainly f.-g. Bedding 75°-85°. Mainly light maroon in colour. ¼ inch wide muddy (green) sandstone bed at 569.3', 575.1'.		<ul style="list-style-type: none"> <li>- weak to moderate hematite banding except at 575.3' (85° m.-g.)</li> <li>- moderate - strong.</li> <li>- white clay in vugs 568.1', 570.7'.</li> <li>- minor green clay on bedding occasional throughout.</li> <li>- sericite in muddy sandstone.</li> </ul>		- tar impregnated bedding					1/10
577'	587'	10'	100%	Sandstone: As above 10'. Bedding 80°-75°. Minor quantity of disseminated clay noted throughout. Green, muddy sandstone at 577.8', 582.7', 586.2'-.4', 586.7'-.8'.		<ul style="list-style-type: none"> <li>- weak hematite banding.</li> <li>- sericite (?) in green clay.</li> </ul>		<u>no tar</u>					1/10
587'	597'	10'	100%	Sandstone: As above. Green mudstone, 2" wide & strongly hematized over 1 cm at 589.4'; green muddy sandstone at 594.3', 596.9'-597'. Bedding 70°-80°.		<ul style="list-style-type: none"> <li>- weak hematite throughout except moderate - strong 587.1'-589.3'.</li> <li>- sericite (?) in mudstone.</li> </ul>		<u>no tar</u>					.4
597'	607'	10'	100%	Sandstone: As above. Numerous ¼"-1" wide beds of fine-medium grained sandstone. Mainly light maroon in colour. Bedding 80°-85° variable 70°-80°. Green muddy sandstone at 597'-.1'.		<ul style="list-style-type: none"> <li>- moderate-strong hematite @ 501.3-602.4', 603.3'-603.9'.</li> <li>- minor green clay on occasional bedding plane</li> <li>- sericite in mudstone.</li> </ul>		- tar impregnated bedding (80°) at 598.8'.					.3

DRILL LOG

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION	SHEET NO.			
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.		
DEPTH		CORE		LITHOLOGY	ALTERATION	MINERALIZATION	STRUCTURE			
From	To	Length	% Rec				F	V/F	F/F	Log
607'	617'	10'	100%	<p><u>Sandstone</u>: Transitional zone. 607'-609.8' as above 10', with 1" wide cross cutting bed at 609.1'. Bedding 75°-80°. Light maroon to white in colour. 609.8'-617' is mainly m.-g. with thin f.-g. bands and some c.-g. quartz and sandstone fragments at 613'-613.5'. Section 609.8'-612.3', 612.8'-613.2' medium gray colour. 615.6'-617' dark maroon; rest of section is light orange-maroon in colour. Bedding 80° - some 70°.</p>	<ul style="list-style-type: none"> <li>- grey colouration due to oxidation - MnO<sub>2</sub> or ?</li> <li>- weak hematite throughout except intense 615.9'-616.2' &amp; 617'.</li> <li>- green clay on bedding planes conspicuous throughout section.</li> </ul>	<ul style="list-style-type: none"> <li>- tar impregnated bedding at 615.4' &amp; .5'.</li> </ul>				.2
617'	627'	10'	100%	<p><u>Sandstone</u>: Mainly m.-g., dark grey maroon in colour. Somewhat porous generally, quite porous in intensely hematite cemented sections. Green &amp; green mottling 617.4'-.9', 624'-625.5' due to irregular green clay content. Bedding regular on 85°. Section 624'-625' medium- to coarse-grained, gray-green in colour.</p>	<ul style="list-style-type: none"> <li>- strong pervasive hematite throughout except intense at 617'-617.4', 617.9'-619', 621'-622', 622.5'-624'.</li> <li>- gold-green clay? on fracture @ 617.4'.</li> <li>- green clay dissemination 617.4'-.9'.</li> </ul>	<p><u>no tar</u></p>				.4
627'	637'	10'	100%	<p><u>Sandstone</u>: Similar to above 10'. M.-g., dark grey-maroon throughout, with minor light grey patches. Bedding regular on 85°. Some coarse-grained, rounded clasts of sandstone at 630'-630.5'. Clay rich sections 627.6-.8', 631.5'-.8', 634.7'-635.5'.</p>	<ul style="list-style-type: none"> <li>- moderate-strong hematite in discontinuous but commonly pervasive sections.</li> <li>- gray-green coloured sections contain disseminated clay &amp; sericite.</li> </ul>	<p><u>no visible tar</u></p>				.2
637'	647'	10'	100%	<p><u>Sandstone</u>: Predominantly fine- to medium-grained, medium gray-green in colour with occasional light orange bands and "mottling". Hematite banding 644'-645'. Bedding regular 85°. Rock is well sorted, moderately dense &amp; slightly porous in appearance.</p>	<ul style="list-style-type: none"> <li>- weak hematite disseminations throughout.</li> <li>- green colour due to clay content.</li> </ul>	<p><u>no visible tar</u></p>				.2

DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS						12	19
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		HOLE NO.	
From	To	Length	%Rec							D.D.H. 78-1	
										HOLE SIZE	
										TOTAL DEPTH	
										BQ	
										1007'	
										STRUCTURE	
										F V/FI F/FI Log	
647'	657'	10'	100%	Sandstone: As above. Predominantly m.-g., gray green in colour except 651.7-652.9', 655.7'-656.2' dark maroon-green; and 656.6'-657' light orange. Clay content imparts green colouration. Bedding 80°. Coarse grained fragments (subangular) 654.6', 655'-656'. Section 656.5'-657' medium-coarse-grained.		- moderate hematite in maroon sections. - green clay ± sericite throughout.		- suspect minor f.-g. blobs of disseminated interstitial tar?!			.2
657'	667'	10'	100%	Sandstone: Mainly m.-g., light orange-light orange-green in colour. Bedding regular on 80°. Mottled maroon-gray sections at 658'-659', 660.6'-661.8', 663.9'-665.7'. Coarse-grained, subrounded, white sandstone clasts at 657'-.4', 668.1'.		- moderate hematite matrix material in maroon sections. - weak green & white matrix clays (±sericite) throughout. - white clay on fractures.		no tar visible			.2
667'	677'	10'	100%	Sandstone: Mainly m.-g. variable to f.-g., very light maroon in colour, well sorted, quite dense & competent. Bedding regular at 85°. Mottled dark grey section 672.9'-675.1'.		- weak disseminated hematite throughout. - Moderate fracture fill 669.7'-670.1' (5°), 676' 676.5'. - minor white matrix clay throughout.		no tar visible			.2
677'	687'	10'	100%	Sandstone: M.-g. variable to f.-g. Light maroon 677'-679.5', 684.4', 686.7'. Light green, clay enriched section 680'-682'. Rest of section dark gray maroon in colour.		- moderate-strong disseminated hematite in maroon section. - intense hematite alt <sup>n</sup> introduced by 5°-10° fractures at 677', 681', 684.3'-.9', 685.4'-686.6' - porous - sericite with clay.		no tar visible			.2

### DRILL LOG

LOCATION				CO-ORDINATES				NORTH		EAST		ELEVATION		SHEET NO.		
														13	19	
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE		TOTAL DEPTH		HOLE NO.				
								BQ		1007'		D.D.N.78-1				
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE			Stamp	
From	To	Length	% Rec									F	V/Fi	F/Fi		Log
687'	697'	10'	100%	<p><u>Sandstone:</u> M.-g. 687'-691' then closely interbedded m.-g. and f.-g. material. Light maroon orange colouration (except dark grey-maroon 688.1'-.4', 688.9'-689.5', 690.2'-691') gradational to light orange beginning 693.5'. Bedding regular on 85°. M.-g. orange sandstone contains 10-20% f.-g. white disseminated clay. It is somewhat friable and looks porous.</p>				<p>- moderate-strong hematite in maroon sections. - intense hematite along 30° fracture @ 690'-.3'.</p>		<p>- Tar fracture fill from 691.9'-695.8', 696.8'.</p>					1	
697'	707'	10'	100%	<p><u>Sandstone:</u> F.-g. 697'-698', 699'-705.4' with minor thinly bedded m.-g. bands. Rest of section more m.-g. Colouration:- light maroon-orange 697'-698', 699.6'-701.5'. Light green from 701.5'-705.4'. Rest of section is grey maroon. Green section &amp; 697.2'-.4' are clay enriched. Bedding regular on 80°. Angular fragment (6 mm diameter) orange f.-g. sandstone at 706.5'.</p>				<p>- hematite moderate-strong 698.4'-699.5' - sericite in clay rich sections.</p>		<p>- Tar fracture fill from 697'-697.8'.</p>					.1	
707'	717'	10'	100%	<p><u>Sandstone:</u> Mainly m.-g. with minor f.-g. thinly bedded bands from 707'-712', 716'-717'. Rest of section f.-g. with minor thin m.-g. bedding. Bedding regular on 85°. Clay enriched green section 716'-717'. Section is cream white except hematite rich segments 707'-707.3', 710.5'-712'.</p>				<p>- moderate-strong hematite in maroon grey sections. - sericite in clay sections.</p>		<p>- <u>no visible tar</u></p>					0	
717'	727'	10'	100%	<p><u>Sandstone:</u> Fine to medium-grained becoming distinctly medium-grained 726.6'. Green, clay enriched section 717'-723.1'. Maroon, hematite rich sections 719'-720', 723.4'-724.6'. Bedding regular at 80°.</p>				<p>- ditto! - weak green clay noted on bedding throughout.</p>		<p>- <u>no visible tar</u></p>					2/10	
727'	737'	10'	100%	<p><u>Sandstone:</u> M.-g. throughout except 735.6'-737' f.-g. and clay enriched. Distinctive light orange (brown) sandstone with 1-2 mm. light orange brown (FeO<sub>2</sub>?) bands 727'-731.6'. Rest of section is medium - dark green-maroon. Several rounded 4 mm diameter clasts at 734.9'-735.7'.</p>				<p>- hematite moderately pervasive in maroon sections. - sericite in green sections. - moderate amounts of white matrix clay in orange section.</p>		<p>- Tar fracture fill (15°) 731.8'-732.3', 732.2'-732.6' (15°)</p>					2/10	

## DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.				
										14	19			
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE	TOTAL DEPTH	HOLE NO.				
								BQ	1007'	D.D.H. 78-1				
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE		Log
From	To	Length	%Rec									F	V/FI	
737'	747'	10'	100%	Sandstone: M.-g. with occasional c.-g. rounded fragments of sandstone 741'-741.5'; except, f.-g., green, clay rich sections at 738.2'-739.4', 742.3'-745.1'. M.-g. sections are medium gray-maroon with segments of light orange or light orange mottling. Bedding regular 80°.				- ditto - green clay pervasive. - weak to strong disseminated in section (+sericite?)		no visible tar				.2
747'	757'	10'	100%	Sandstone: M.-g. throughout with occasional subrounded c.-g. clasts of quartz & f.-g. sandstone 750'-753'. Commonly very light maroon to light orange in colour. Generally well sorted, competent. Gray maroon mottling 747'-748' & minor throughout section.				- ditto - matrix white clay moderate quantities throughout. - green clay, bedded disseminated 753.2'-.8'.		- Tar fracture filling (15°-20°) at 751.7'-752.4'. - minor very f.-g. disseminated blebs suspected throughout.				.4
757'	767'	10'	100%	Sandstone: As above. Green clay rich sections 758.9'-761', 766'-766.7'. Round, c.-g. clasts occasional throughout. Massively bedded except thinly bedded in green sections 80°.				- f.-g. hematite "mottles" throughout - white matrix clay throughout section.		_____				0
767'	777'	10'	100%	Sandstone: Commonly m.-g. with small scale fine- to medium-grained graded bedding. Light maroon in colour except: 767'-768.7', 771.1'-772.1', 774.1'-775.1', gray maroon. Greenish, clay enriched sections 768.8'-770', 772.6'-773.1', 775'-775.4'. Bedding 80°-85°. Minor rounded, c.-g. clasts of sandstone at 767', 771.6', 774'-777'. Medium- to coarse-grained 776.5'-777'.				- fine- to medium-grained hematite mottles conspicuous throughout - moderate f.-g. matrix white clay throughout		_____				1/10
777'	787'	10'	100%	Sandstone: Commonly m.-g. - f.-g. throughout except m.-g. - c.-g. 776.5'-779.6', 786.7'-787'. Light orange maroon in colour except 778.7'-779.6' medium grey maroon. Green, clay rich section 779.6'-780'. Commonly massively bedded 80°-85°. Gradational changes between m.-g. & c.-g. sections.				- ditto - green clay +sericite on fractures.		_____				.4



## DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
										15	19
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE		TOTAL DEPTH		HOLE NO.	
										BQ	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE	
From	To	Length	% Rec							F	V/FI
787'	797'	10'	100%	<p><u>Sandstone:</u> Commonly m.-g. - f.-g., light maroon in colour except 788'-789', 791.5'-794' grey maroon in colour. Greenish clay rich sections at 789'-790.4', 794', 796.4'-797'. Bedding massive on 85°.</p>		<p>- hematite "mottles" 787'-788' - intense hematization of sandstone on fracture at 794' (40°), 795.4'-796' (10°)-vuggy - matrix white clay, bedded green clay throughout.</p>		<p>- specimen taken 787'-787.5'</p>			0
797'	807'	10'	100%	<p><u>Sandstone:</u> Predominantly m.-g. with 1 cm + red and/or white quartz, subrounded clasts occasional from 797'-797.5', 799.5'-800', 802.4', 802.6', 806.6'. Light maroon-orange in colour except medium grey maroon 797.5', 799.5'-800.4', 803.6'-804.6'. Greenish clay enriched sections at 798.3'-799.2', 800.5'-806'. Bedding regular massive on 85°.</p>		<p>- minor f.-g. hematite mottling throughout - matrix white, bedded green clay.</p>					0
807'	817'	10'	100%	<p><u>Sandstone:</u> Predominantly m.-g., light orange in colour, well sorted, moderately dense but rather porous in appearance &amp; friable on fractures (due to matrix clay). Medium gray-maroon sections 807.3', 807.7'-.9', 810'-811', 812.6'-814', 815'-817' (mottled). Green clay enrichment 808'-809', 811'-812.2'. C.-g. subrounded quartz, clasts at 807.8'-.9', 808.7', 810.8'. Bedding massive 85°.</p>		<p>- intense hematization of clast at 807.5' and on fracture at 811'. - green bedded &amp; white matrix clay.</p>					.2
817'	827'	10'	100%	<p><u>Sandstone:</u> M.-g., light gray maroon throughout with minor light orange mottling &amp; patches except 817'-818.2', 825.5'-826.4' light orange-maroon. Green clay enrichment 817.4'-.7', 821'-.7'. Massively bedded 85°. Occasional c.-g. subrounded clast &amp; minor medium- to coarse-grained graded bedding.</p>		<p>- moderate-strong disseminated &amp; m.-g. hematite mottling. - weak bedded green clay - white matrix clay not so abundant there.</p>					1/10

# DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
										16	19
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE		TOTAL DEPTH		HOLE NO. D.D.H.78-1	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE	
From	To	Length	%Rec							F	V/F
827'	837'	10'	100%	Sandstone: M.-g. 827'-830.4'. Rather c.-g. thereafter with interbedded m.-g. bands of variable width. Commonly medium to dark grey-maroon in colour except 827.9'-830.4', coloured light green orange due to clay enrichment. C.-g. fragments are ≤ 8mm diameter, subrounded-subangular, white-blue quartz & sandstone clasts. Moderately well sorted. Bedding 85°.		- minor hematite mottling. - intense hematization of vugs, fracture and clasts at 832.6'-833'.		_____			3/10
837'	847'	10'	100%	Sandstone: Poorly sorted section of medium alternating coarse-grained beds with minor graded bedding. Large white, subangular subrounded, .5-2 inch diameter (quartz?) clasts at 837.7', 839', 839.5', 839.8', 843', 846'. Green clay enriched section fine- to medium-grained 840.5'-842.9'. Mainly light orange in colour with patches of grey maroon. Bedding crude on 80°-85°.		- ditto - sericite? with green clay. - intense hematization around clast at 839.8'.		- specimen taken 844.8' - _____			0
847'	857'	10'	100%	Sandstone: Poorly sorted section of medium- to coarse-grained mainly light orange sandstone. Clasts ≤ 8 mm diameter, are angular to subrounded quartz & orange m.-g. sandstone. Massive bedding on 85°. Green, clay enriched sections 848.3'-.9', 854.7'-857'.		- ditto - intense fracture controlled hematite alt <sup>n</sup> 849.7'-850.8' - very porous.		_____			68850'
857'	867'	10'	100%	Sandstone: Commonly c.-g. (m.-g. matrix) with interbedded m.-g. sandstone 857'-857.9', 864.8'-866', 861'-863'. 2" subrounded clasts at 861' (f.-g. grey quartz), 861.5', 864.4' (white quartz). Light orange with 1' bands of grey maroon colouration. Green clay enriched sections 857'-858', 865.5'-866.6'.		- variable hematite throughout. - weak to moderate white matrix clay. -sericite with green clay.		_____			1/10
867'	877'	10'	100%	Sandstone: Predominantly m.-g. with some c.-g. clasts and light orange-maroon in colour from 867' to 872.4' grading to 872.9' into predominantly c.-g., medium gray-maroon sandstone. Moderately well sorted, competent but porous appearance. 2" sub-rounded quartz clast at 872.5'.		-hematite weak-moderate throughout. - intense hematite vug infilling at 874.1' & .6' -matrix white clay moderate throughout - green clay enrichment 872'-.4'		_____			1/10

DRILL LOG

LOCATION				CO-ORDINATES			NORTH			EAST			ELEVATION			SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS									17		19		
DEPTH		CORE		LITHOLOGY			ALTERATION			MINERALIZATION			STRUCTURE				
From	To	Length	%Rec										BO	TOTAL DEPTH	HOLE NO.	F V/FI F/FI Log	
877'	887'	10'	100%	Sandstone: Predominantly c.-g. with poorly defined gradational zones of m.-g. material. Most of larger clasts are 1/4" - 2" diameter, angular to subangular grey & white quartz. C.-g. segments mainly dark grey-maroon in colour while m.-g. sections are light orange-maroon in colour. Poorly sorted. Massive bedding 80°-85°.			- hematite throughout. - white matrix clay more prominent in c.-g. than m.-g. sections. - very minor green clay on fractures.			_____			3/10				
887'	897'	10'	100%	Sandstone: As above. Large 2" diameter, rounded quartz grey-white clast, at 893.3'. Clasts more subrounded in this section			- ditto - hematite replacing sandstone fragments at 893.6'. - green clay enriched section 892.6'-.7'.			- specimen taken 893.4'-893.8'. _____			2/10				
897'	907'	10'	100%	Sandstone: As above. Very poorly sorted. Quartz clasts subangular-subrounded. 3" - 4" round quartz clast, at 801.7'. Fine- to medium-grained section at 898.4'-899.6', 902'-903.9'. C.-g. sections of ten quite porous in appearance but competent. Bedding gradational on 80°.			- ditto - white clay in c.-g. sections prominent. - green clay enrichment 902.8'-903.5'.			_____			1/10				
907'	917'	10'	100%	Sandstone: Predominantly medium- to coarse-grained grain size throughout with narrow graded beds of c.-g. material. Uniformly medium maroon colour throughout. No clasts larger than 5mm diameter - most subrounded.			- hematite disseminated throughout - moderate. - weak f.-g. white matrix clay. - no green clay.			_____			1/10				
917'	927'	10'	100%	Sandstone: Predominantly medium- to fine-grained with medium- to coarse-grained narrow beds throughout. M.-g. at 925' gradational to c.-g. beginning 926'. No clasts > 6 mm diameter - most subrounded. Moderately well sorted. Light to medium maroon in colour except green-maroon in clay enriched section 918.5'-919.5'. Bedding & cross cutting beds 70° & 80°.			- hematite disseminated throughout. - weak matrix clay. - sericite with green clay.			_____							

**DRILL LOG**

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		18	19	
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.		
						BQ	1007'	D.O.M.78-1		
DEPTH		CORE		LITHOLOGY	ALTERATION	MINERALIZATION	STRUCTURE			
From	To	Length	%Rec				F	V/FI	F/FI	Log
927'	937'	10'	100%	Sandstone: Predominantly c.-g. with poorly defined zones of fine- to medium-grained material (particularly 934'-935.5'). Generally poorly sorted through graded sections are present. Clasts mainly subangular-subrounded quartzose. No clasts >10 mm. Bedding 85°-90°. Medium maroon colouration throughout.	- hematite throughout. - blood red hematite banding 932.2'-933.8'. - green clay 934'-935.5' - matrix clay prominent only in c.-g. sections.	_____				1/10
937'	947'	10'	100%	Sandstone: C.-g. 937'-939.8'. M.-g. 939.8'-940.9', 943.1'-945.3', 946.2'-7', rest is f.-g. with minor m.-g. material. Contacts are sharply gradational on 90°. Section medium-dark grey maroon. Medium- to fine-grained sections well sorted.	- hematite disseminated throughout. - minor green clay in section 940.9'-943.1'.	_____				0
947'	957'	10'	100%	Sandstone: F.-g. 947'-5', 949.9'-951.7'. Predominantly c.-g. 952.3'-957', rest is well sorted m.-g. Contacts are rather gradational - poorly defined. No clast >5 mm diameter. Medium brown mudstone bed (90°) 956.2'-3'. F.-g. sections light orange maroon, medium- & coarse-grained sections medium grey maroon in colour. Bedding on 85°.	- hematite as above. - sericite in mudstone - clay matrix moderate in medium- & coarse-grained sections.	_____				1
957'	967'	10'	100%	Sandstone: Predominantly c.-g., medium-dark grey-maroon in colour except light maroon 957.5'-958.4'. Predominantly f.-g. 960.6'-961.5' (gradational c.-g.) 963'-963.6' (including 2" wide bed of medium red brown mudstone) 964.7'-965.5', 966.7'-967'. F.-g. sections contain much green & brown clay. Clasts mainly subangular quartz. Bedding 85°.	- strong hematite in maroon sections - green & white clay on fractures.	- c.-g. sections well sorted contacts with f.-g. sections - commonly sharply gradational.				3/10
967'	977'	10'	100%	Sandstone: Medium- to coarse-grained, medium grey-maroon throughout, except 967'-7', 971.1'-8', 975.8'-977' f.-g.(m.-g.) and green-red-brown in colour due to high green & brown clay content. Medium- to coarse-grained sections poor to moderately well sorted, fairly dense, porous but competent. Fine-grained/coarse contacts sharply gradational. Bedding 85°. Vuggy 3 mm wide quartz vein at 374.6' (30°)	- moderate hematite disseminated throughout. - weak matrix white clay - green (sericite?) clay & brown (Fe rich) in noted sections.	- Specimen taken 976.3'-977'. _____				5/10

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		19	19		
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE	TOTAL DEPTH	HOLE NO.			
								BQ	1007'	D.D.H. 78-1			
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE			
From	To	Length	% Rec							F	V/FI	F/FI	Log
977'	987'	10'	100%	Sandstone: C.-g., light orange maroon in colour. Moderate to strong white, disseminated matrix clay. Moderately well sorted porous, fractured & rather friable throughout. Core broken into 3" sections below 977.8'. F.-g. dark brown-green-maroon, clay rich 977'-977.3'. Bedding sharp on 85°. C.-g. section massive.		- hematite weak through- - white & greenish clay - on fractures		- specimen taken ~ 985'-.3'					2
987'	997'	10'	100%	Sandstone: Quite variable section: mainly m.-g., green orange-maroon in colour with f.-g. light orange sections at 988.9'-989.4', 995.5'-996.7'. C.-g. sections 988.3'-.8', 991'-993.6'. Well sorted except poorly in c.-g. sections. Gradational contacts throughout on 85° bedding. Green & brown clay variable throughout - strong in f.-g. sections. Blue-gray unidentified veinlet (clay) 25° fractures at 988.3', 989.2'.		- hematite pervasive weak - moderate throughout. - green & red brown clay - strong in f.-g. sections.							6/10
997'	1007' END	9.7'	97%	Sandstone: Predominantly m.-g., dark maroon-grey in colour. F.-g., green-brown in colour 997.7'-998.2', 999.1'-.4'. Medium red brown mudstone with minor very f.-g. sand bands at 1004.3'-1005.4'. C.-g. moderately well sorted, light orange to medium maroon in colour 1000.5'-1002'. Sharply defined contacts on 85°-90°.		- blood red hematite - mottling 1005.5'-1006'. - green & brown clay in - noted sections. - white clay on fracture & minor in matrix of - medium- to coarse-grained - sections.		- specimen taken 1005'-.3'					6/10

APPENDIX 2

Geological Logs KDH 78-2



KEANE PERMITS

## DRILL LOG HOLE #2

Vertical Hole

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		1	12
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE		TOTAL DEPTH		HOLE NO.	
October 27, 1978		October 29, 1978				NQ		677'		D.D.H.78-2	
DEPTH		CORE		LITHOLOGY	ALTERATION	MINERALIZATION	STRUCTURE				
From	To	Length	% Rec				F	V/F	F/F	Log	
0	210'	210'	0	<u>Overburden:</u> Unconsolidated white, cream and orange to light maroon sand. A few 5'-10' diameter boulders near the o/b - bedrock interface.	- zones of disseminated hematite	- Tar in substantial quantities at approximately 100'.					
210'	217'	6.7'	96%	<u>Sandstone:</u> F.-g., white in colour, well sorted, moderately dense & competent overall with narrow zones of more porous sandstone - preferentially tar impregnated. Bedding regular at 85°-90°. 1" band of light green-white mudstone at 215.7'. Some hematite & tar impregnation in broken core 210'-210.5'.	- minor disseminated hematite in 1" wide band at 211.6'.	- fracture fill tar at 211.4', 215.2', 216'. - Tar impregnated bedding 213', 213.3'-.8', 214.2', 214.5', 214.9', 215', 215.2', 215.4', 215.7', 216.3'.				6/10	
217'	227'	10'	100%	<u>Sandstone:</u> As above.	- zone of minor disseminated hematite 223.3'-.8'.	-fracture fill tar 218'-222' (5°, 10°) subcontinuous. - bedding impregnated tar 223.6', 225.4', 225.5', 225.7', 226.6', 226.7'-.9' (75°)				1	
227'	237'	10'	100%	<u>Sandstone:</u> As above.	- irregular zones containing minor disseminated hematite - subcontinuous throughout.	- bedding impregnated with tar at 228.7', 229.4', 232.2'. - minor disseminated f.-g. tar throughout.					2/10
237'	247'	10'	100%	<u>Sandstone:</u> As above. (Only light grey-maroon in colour. Narrow clay bed (90°) at 238.1'.)	- disseminated hematite throughout. -possible sericite with mudstone bed. - f.-g. disseminated hematite "mottles" throughout.	- fracture fill tar (10°) 239'-240'.					2/10

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE		TOTAL DEPTH	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION	
From	To	Length	%Rec					STRUCTURE	
								F	V/Fi
247'	257'	10'	100%	Sandstone: F.-g., light grey maroon in colour, otherwise as above. Bedding 85° except 248'-249' 70°-75° t.c.a.		- weak disseminated hematite throughout also conspicuous fine- to medium-grained hematite "mottles". - minor hematite banding			
257'	267'	10'	100%	Sandstone: As above except 264.7'-267', dark maroon predominantly m.-g. with interbedded f.-g. material. White m.-g. subrounded mottles (grains?) 260'-264'. Bedding 85°.		- as above - minor green clay on fractures. - intense pervasive hematization 264.7'-267', also strong at 261.5', 263.1'.			
267'	277'	10'	100%	Sandstone: As above except 267'-267.4', 268'-272.6', 276.6' strongly hematized, dark maroon in colour & alternating thinly bedded fine- and medium-grained sandstone. Bedding 80° regular except 269'-270' cross bedding. A few c.-g. subrounded quartz clasts at 267.2', 270.6'. Much thinly bedded green clay 270.3' 270.9', 267.5' & .8'.		- strong to intense hematite in noted sections. sericite (in part chlorite) with green clay		- fracture fill tar (10°) 272.5'-273'.	
277'	287'	10'	100%	Sandstone: F.-g., cream in colour with much thin, cross-cutting hematite banding 277'-278.5', 280.6'-284'.		- moderate to weak hematite in cross cutting bands. - minor white clay on fractures.		- hair line fracture fill tar 284.2', 284.6'-285.3', 285.5', 286.7' (5°)	
287'	297'	10'	100%	Sandstone: F.-g., cream coloured with irregular light grey zones containing disseminated hematite. Bedding commonly 80° regular but 287'-289' much cross bedding on 70°.		- weak hematite in disseminated zones also banding, discontinuous 293.6'-295'.		-substantial fracture fill tar 290.4'-291.7', 293.7'-294.3', 295'-296'.	

1/10

3/10

2/10

4/10

4/10



DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS						3	12
								HOLE SIZE	TOTAL DEPTH	HOLE NO.	
								NQ	677'	D.D.H. 78-2	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE	
From	To	Length	%Rec							F	V/FI
297'	307'	10'	100%	Sandstone: F.-g., cream coloured, well sorted, competent dense and not porous in appearance. Bedding regular at 80°-85°. Mudstone bed (90°) 0.1" wide at 302.8' in zone of generally increased clay (light green) content.		- zones of weak disseminated hematite 297'-299'. - narrow hematite bands some cross cutting 301'-307', widely spaced.		- fracture fill tar in substantial quantities: 297.6', 298.5', 299'-299.5', 300.5'-301.1', 302.4'-.8', 303'-304', all 10' fracture.			1
307'	317'	10'	100%	Sandstone: F.-g. light maroon in colour. Slightly coarser grained & more porous in appearance 314.5'-316.5'. Coarse-grained clay clasts at 307.6', 316.8'. Hematite banding throughout - very close spaced 310.5'-314.5', thereafter hematite is moderate pervasive. Hematite exhibits cross cutting & cross bedding. Bedding apparently 75°-85°.		- hematite as noted - some white clay in sandstone matrix at 316.8'.		- minor fracture fill tar at 313.8', 316.6'.			2/10
317'	327'	10'	100%	Sandstone: F.-g. medium maroon in colour. Bedding variable 75°-85°. Some clay (light green) bedding 326.4'-.6'. Hematite as close spaced, subcontinuous bands and pervasive in moderate disseminated quantities.		- hematite as noted		_____			2/10
327'	337'	10'	100%	Sandstone: As above. Medium to dark maroon in colour. Fine & fine- to medium-grained interbeds. Disseminated & discontinuous thinly bedded light green clay 327'-329', 1" diameter clay clast at 326' surrounded by intense blood red hematite alteration. 1/4" subrounded f.-g. sandstone clast with hematite alteration halo 332.6'. Bedding regular on 85° but obscured by hematite banding.		- hematite as noted; also strongly pervasive 327'-335' - hematite banding clearly crosscuts bedding throughout. - concentric alt <sup>n</sup> bands 335'-336'.		_____			1/10

## DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.		
										4	12	
DATE STARTED		DATE COMPLETED		SURVEYS						HOLE NO.		
										D.D.H. 78-2		
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE		Log
From	To	Length	% Rec							F	V/FI	
337'	347'	10'	100%	Sandstone: As per 327'-337'. Bedding regular on 80°. F.-g. overall with fine- to medium-grained interbeds at 336.9'-337.2' 338.4' (1" wide), 345'. A ½" diameter subrounded clay clast at 338'.		- hematite moderate throughout in very close spaced bands which parallel & cross cut bedding. - intense hematite in coarser grained more porous sections.		- fracture fill tar at 339.5' (5°).				1/10
347'	357'	9.8'	98%	Sandstone: F.-g. medium to dark maroon in colour with more cream coloured zones at 347'-348', 348.2'-.5', 351.6'-352.4'. Bedding regular on 85°. Reduce from NQ to BQ at 351.2'.		- virtually pervasive strong hematite in maroon sections though composed of closely spaced bands. - concentric hematite bands 347.2'-348'.		- fracture fill tar (5°, 10°) 347.9'-348.1', 348.3', 348.9', 351.8', 355.7'. - bedded tar at 356.4'.				5/10
357'	367'	10'	100%	Sandstone: As per 347'-357'. Fine- to medium-grained interbeds at 362.3', 362.7', 366.6'-367'; all strongly hematized. Lenticular c.g. clay clasts at 363.1', 366', 366.1'. Bedding regular on 85°.		- as above. - intense pervasive hematite at 362.7'.		- fracture fill tar at 358.9', 360.5', 361.3'-362'. (5°) - thinly bedded tar (85°) 358.9', 360.3', 360.6', 361.3', 366.9' (substantial)				3/10
367'	377'	10'	100%	Sandstone: F.-g., medium maroon in colour, with numerous thinly bedded fine- to medium-grained bands. Finer grained sections tend to be light maroon in colour. Bedding regular on 80°-85°. Coarse-grained clay fragment at 375.5' in fine- to medium-grained section.		- strong pervasive hematite in fine- to medium-grained sections. - intense hematization at 367', 371.2', 371.7', 372.4'.		- fracture fill tar (10°) at 369.4', 370.9'. - tar impregnated bedding 367.8' (75°).				3/10

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		5	12
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE		TOTAL DEPTH	
								BO		677'	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE	
From	To	Length	%Rec							F	V/F
377'	387'	10'	100%	Sandstone: F.-g. medium maroon throughout with narrow light maroon sections. Bedding regular at 85°. Clay fragment, 1/4" diameter at 380.1'. Clay rich section with a 0.1" light green mudstone band at 384.1'-.3'.		- close spaced hematite bands subcontinuous throughout contain weak-moderate hematite. - strong pervasive hematization 382.7'-384', 384.3'-385.1'.		_____			2/10
387'	397'	10'	100%	Sandstone: F.-g. light maroon in colour with occasional sections of medium grey maroon (e.g. 387.2'-.9'). Minor thin beds of fine- to medium-grained material. Bedding 85° with minor 70° beds. 0.1" wide bed of light green mudstone with irregular sharp contacts with f.-g. material below, fine- to medium-grained strongly hematized material above.		- weak disseminated hematite throughout. Discontinuous but moderately close spaced bands 387'-391'. - minor bedded green clay occasional 389'-396.2'.		_____			1/10
397'	407'	10'	100%	Sandstone: As above. 3" bands of interbedded fine- & fine- to medium-grained material at 401.1', 402.1', 403.2'. Bedding 80°-85° regular. Mudstone band, 0.2" wide, medium green in colour at 404.1'. Occasional minor bedded green clay throughout but conspicuous at 406.9'.		- hematite weak throughout disseminated. Irregular sections of close spaced banding - M.-g. hematite mottles 399.8'-400.8'. - minor light green clay on fractures.		_____			3/10
407'	417'	10'	100%	Sandstone: F.-g., light maroon with a few narrow beds of fine- to medium-grained material. Bedding quite regular on 85°. Hematite bands are close to widely spaced throughout.		- hematite moderate pervasive in fine- to medium-grained sections. - bands cross cut bedding & other hematite bands. - minor thinly bedded green clay occasional throughout.		_____			0

STRUCTURE  
F V/F F/F Log

## DRILL LOG

LOCATION		CO-ORDINATES			NORTH			EAST			ELEVATION		SHEET NO.			
													6	12		
DATE STARTED		DATE COMPLETED			SURVEYS						HOLE SIZE	TOTAL DEPTH	HOLE NO.			
											BQ	677'	D.D.H.78-2			
DEPTH		CORE		LITHOLOGY					ALTERATION		MINERALIZATION		STRUCTURE			
From	To	Length	%Rec										F	V/FI	F/FI	Log
417'	427'	10'	100%	Sandstone: As above. 1½" wide medium green, clay rich band at 423.1'.					- ditto - hematite banding absent 417.5'-419.6'.		_____					0
427'	437'	10'	100%	Sandstone: As above. Greenish-white, clay enriched section 432.3'-433.3'. Also 0.1" sandy mudstone bed (85°) at 434.8'.					- ditto.		_____					0
437'	447'	10'	100%	Sandstone: As above. Greenish-light maroon, clay enriched section 440.5'-440.8'.					- ditto - hematite "mottles" 442'-443', also 446.5'-447'. - moderate-strong pervasive hematite 438'-.3' 441', 441.5'-442.3'.		_____				1/10	
447'	457'	10'	100%	Sandstone: As above. Cross bedding 70° over 85° at 455.6'-.9'. Bedding regular at 85°.					- ditto - thinly bedded green clay generally more conspicuous.		_____				1/10	
457'	467'	10'	100%	Sandstone: F.-g., light maroon throughout with a few irregular zones of medium maroon, closely spaced hematite bands. Bedding regular 85°. Very minor interbedded fine- to medium-grained material.					- hematite weakly disseminated throughout. - 1"-2" wide sections of closely spaced hematite bands occasional throughout. - occasional light green clay in minor amounts on bedding.		_____				2/10	

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE		TOTAL DEPTH	
								BQ		677'	
DEPTH		CORE		LITHOLOGY	ALTERATION	MINERALIZATION	STRUCTURE				
From	To	Length	%Rec				F	V/Fi	F/Fi	Log	
467'	477'	10'	100%	Sandstone: As above 10' section. Generally less hematite present.	- As above.	_____					2/10
477'	487'	10'	100%	Sandstone: As above. Greenish, thinly bedded clay conspicuous 484.9'-485.3'.	- As above. - hematite mottles 480'-481', 482'-484'. - some cross cutting hematite bands.	_____					1/10
487'	497'	10'	100%	Sandstone: As above. Greenish, thinly bedded clay conspicuous at 489', 489.8'-490.1', 491.6'-492.3', 495.3'-496', 496.2'-497'. Lenticular white clay fragments at 489.7'. Bedding regular at 85° t.c.a.	- commonly weakly disseminated hematite with a few 1"-2" wide zones of moderate hematite in closely spaced bands. - green bedded clay.	_____					1/10
497'	507'	10'	100%	Sandstone: As above. Greenish-white clay enrichment conspicuous at 499.7'-500', 501.6'-502', 504.3'-.6'. Fine- to medium-grained band at 506.9' is moderately hematized.	- generally weak hematite alt <sup>n</sup> - banding very subdued. - green clay thinly bedded throughout in minor occasional occurrences	- substantial tar impregnated bedding at 504.1', 505.6', 505.7', 506', 506.6', 506.8'.					2/10
507'	517'	10'	100%	Sandstone: As above. Greenish-maroon clay enrichment at 508.6'-509', 511.2'-.4'; also medium green sandy-mudstone at 512.7' (1" wide - 85°). 1/8" - 1/2" white, f.-g. sandstone clasts at 509', 509.8', 510.2', 516.6', 516.9'.	- moderate hematization in closely spaced bands 508'-510.2'. - .1" diameter hematite "mottles" 507'-508', 514'-515'.	_____					4/10

**DRILL LOG**

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		8	12	
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.		
						BQ	677'	D.D.H. 78-2		
DEPTH		CORE		LITHOLOGY	ALTERATION	MINERALIZATION	STRUCTURE			
From	To	Length	% Rec				F	V/F	F/F	Log
517'	527'	9.9'	99%	Sandstone: F.-g., light maroon in colour except 519.9'-521.1', 522.3'-523.3' medium-dark grey maroon. Green and maroon mudstone & sandy mudstone 517.8'-518.4', 520.8'-521.1'. Fine- to medium-grained band 519.9'-520.4'. Bedding regular on 85°, 517'-523.8' then 75° to 527'.	- weak hematite banding throughout except closely spaced & moderately pervasive in dark maroon sections. - minor sericite in mudstone sections.	_____				2/10
527'	537'	9.9'	99%	Sandstone: F.-g. with narrow interbeds of fine- to medium-grained material. Light maroon with coarser grained bands medium-dark maroon. M.-g. interbeds with sharply gradational contacts 529.1', 531.4', 533.9', 535.2'-.6'. Medium green mudstone, siliceous mudstone bands at 528.9' (1"), 529.5' (2"), 532.9' (2"), 533.4' (2"), 533.8', 534.5'-.8', 535.8'-536.1'. Bedding 80°-85°, cross cutting beds 533.5'.	- hematite banding throughout. - pervasive moderate hematite in m.-g. sections. - green clay ± SiO <sub>2</sub> ± sericite? as noted.	_____				2/10
537'	547'	10'	100%	Sandstone: F.-g., very light maroon with a few medium maroon sections. Numerous very thin (.05") beds of fine- to medium-grained material. 1" bed greenish muddy sandstone 540.9'. Intensely hematized halo to c.-g. clasts at 537.4' (sandstone) 546.1' (clay). Bedding variable 75°-85°.	- hematite banding weak to moderate, wide to closely spaced. - intense hematization as noted. - minor occasional bedded green clay noted throughout.	- tar bedding impregnation at 542.5'.				2/10
547'	557'	10'	100%	Sandstone: As above. 1" wide green, muddy sandstone bed (90°) at 548.4'; irregular green & white clay infillings along bedding at 551.1', 554.9'. Green muddy sandstone beds at 553' (2"), 555.8' (1"). 1/4" diameter rounded sandstone clasts at 547', 547.2'. Bedding regular 85°.	- hematite banding as above. - pervasive moderate hematite in fine- to medium-grained sections - minor occasional bedded green clay throughout. - minor white & green matrix clay in fine- to m.-g. sections.	_____				2/10

## DRILL LOG

LOCATION				CO-ORDINATES				NORTH		EAST		ELEVATION		SHEET NO.	
														9	12
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE		TOTAL DEPTH		HOLE NO.			
								BQ	677'	D.D.H. 78-2					
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE		CORRECTION	
From	To	Length	%Rec									F	V/FI		F/F
557'	567'	10'	100%	<p><u>Sandstone:</u> As above. Narrow m.-g. beds - graded well sorted at 565.4', 565.6', 566.8'. Green mudstone &amp; sandy mudstone beds (90°) 561.1'-.4', 561.8'-562.1'. Minor cut &amp; fill fracture at 561.1'. Green clay, c.-g. subangular fragments at 564.5', 565.1', 565.7'. Cross bedding on 70° at 565.8'. Bedding regular 85°.</p>				- As above.		_____					2/10
567'	577'	10'	100%	<p><u>Sandstone:</u> As last 10' section. Bedding variable 70°-85°. Medium green muddy sandstone beds at 569'-.7', 571'-.2', 576.4'. Angular c.-g. green-white clay fragments 570.1', 570.9', 571', 571.8', 574'-.3', 576.1', 576.7'.</p>				- As above. - concentric cross cutting hematite banding 567'-569', 574.8'-575.2' - intense hematite 575.3' (1" wide).		_____					1/10
577'	587'	10'	100%	<p><u>Sandstone:</u> F.-g. medium maroon in colour with numerous fine- to medium-grained very narrow interbeds throughout. M.-g. sections: 579'-.2', 582' (1"), 582.9' (2"), 584'-.5' (1"), 585.5' (1"), 586.5'-587.1'. C.-g. section 586'-.2'. Green muddy sandstone at 577'-.2', 579.2'-.4', 580.4'-.8', 582.1' (.02"). C.-g. clay fragment at 584.4'. Bedding regular 85°.</p>				- disseminated & banded hematite subcontinuous throughout. - intensely hematized, vuggy porous sections 582' (1"), 582.9'-583.1', 585.4'-.6', 585.9'-586.1', 586.5'-587.1'. - green & white matrix clay weak in medium- to coarse-grained sections		_____					2/10
587'	597'	10'	100%	<p><u>Sandstone:</u> F.-g. light maroon with several narrow fine- to medium-grained interbeds. Green muddy sandstone beds at 587.4' (2"), 588.4' (2"), 595.2'. Somewhat porous in appearance 590'-596'. C.-g. angular clay fragments at 589.7', 590.1', 591.4'-6' 593', 594.1'. Bedding 85°-90° regular.</p>				- banded hematite 587.7'-588.2'. - elsewhere hematite weak-moderate pervasive.		_____					2/10

# DRILL LOG

LOCATION				CO-ORDINATES				NORTH		EAST		ELEVATION		SHEET NO.	
														10	12
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE		TOTAL DEPTH		HOLE NO.			
														BQ	
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE			Log
From	To	Length	% Rec									F	V/FI	F/FI	
597'	607'	10'	100%	<p><u>Sandstone</u>: F.-g. light maroon in colour except light green-maroon in sections of disseminated clay enrichment: 597.1'-599', 602'-.3', 605'-607'. Numerous narrow fine- to medium-grained interbeds throughout. M.-g. well sorted, graded sections at 603.6'-604', 606'-606.4'. Angular-lenticular fine- to coarse-grained clay fragments at 597.5', 598.3', 602.8', 603.1'-.3', 605'-.5', 606.3'. Bedding regular 85°-90° rather porous in appearance.</p>				<p>- weakly banded hematite. - intense pervasive hematite 598.1' (1"), 602.2' (2"), 601.1'-.5', 602.7' (3"), 603.6' (3") - weak disseminated matrix white clay throughout.</p>		_____					2/10
607'	617'	10'	100%	<p><u>Sandstone</u>: As per last 10' section. Porous in appearance. Green clay enriched sections at 610'-.2', 615.4'. <u>Green-orange</u> mud &amp; iron (± hematite) rich sections 615.8'-616', 616.9'-617.3'. Graded bedding f.-g. to m.-g. over narrow intervals.</p>				<p>- close spaced hematite banding. - intensely hematized sections 608'-.6', 608.9'-609.7', 612.9'-613', 613.5'-614', 614.3', 614.7'-615.2, 615.8'-617'. - weak matrix clay.</p>		_____					2/10
617'	627'	10'	100%	<p><u>Sandstone</u>: F.-g., with numerous fine- to medium- grained interbeds (very narrow). Medium to dark maroon with several 1" white to light maroon bands. Section 621.1'-.8' shows light green maroon clay enrichment also 617'-617.3', 617.8', 623.4', &amp; several narrow green mudstone beds 624'-627'. C.-g. angular-lenticular clay fragments 618.4', 619', 623.4', 626.1'-.4'. Bedding regular 85°.</p>				<p>- hematite banding close spaced. - strong-intense pervasive hematite subcontinuous throughout except 624'-627' continuous. - note orange iron stain with hematized sandstone &amp; clay 624'-.3', 626'.</p>		_____					2/10



## DRILL LOG

LOCATION				CO-ORDINATES				NORTH			EAST			ELEVATION		SHEET NO.							
								DATE STARTED			DATE COMPLETED			SURVEYS			HOLE SIZE		TOTAL DEPTH		HOLE NO.		
DEPTH		CORE		LITHOLOGY										ALTERATION			MINERALIZATION			STRUCTURE			
From	To	Length	%Rcc																	BQ	677'		D.D.H.78-2
627'	637'	10'	100%	<p><b>Sandstone:</b> F.-g. with several narrow fine- to medium-grained interbeds except 627'-628', 634.1'-636.8' fine- to medium-grained with f.-g. interbeds also dark maroon in colour. F.-g. sections light maroon to white in colour. Green clay enriched sections 628.1'-.3', 633.4'-.6'. F.-g. lenticular clay fragments on bedding planes, occasional throughout. Bedding regular 85°.</p>										<p>- closely spaced hematite banding throughout - subcontinuous strong-intense hematite 627'-628.4', 633'-636.6'. - weak matrix clays.</p>									
637'	647'	10'	100%	<p><b>Sandstone:</b> As above. Green clay enriched section 637'-.4' also discontinuous irregular beds, seams, fragments &amp; fracture fill 642.8'-643.3', 644.6'-645.5'. Predominantly dark maroon &amp; intensively hematized 642.8'-647'. Fine- to medium-grained section 645.6'-647'. Light maroon in colour 637'-642.8'. Bedding regular 85°.</p>										<p>- hematite banding 637' to 641.1'. - moderate pervasive hematite 641.1'-642.8' then intensive maroon &amp; blood red to 647'.</p>			<p>- specimen taken 642.8'-643.1'.</p>						
647'	657'	10'	100%	<p><b>Sandstone:</b> Predominantly m.-g. with graded fine- to very fine-grained intervals and 647'-650' mainly fine- to very fine-grained. Green &amp; red clay enrichment from 647'-655'. Green clay enriched sections 647.6' (m.-g.), 650'-.3', 650.9'-651.5', 652.9'-653.3', 653.9'-654.7'. Clay is bedded, disseminated fracture fill &amp; in irregular seams. Dark maroon in colour, except green 654'-655'. Bedding regular 75°. C.-g. angular-subangular fragments 651', 652.3' (1"), 653.8', 656.8' (2" f.-g. sandstone with hematite mottles).</p>										<p>- hematite <u>pervasive intense</u> throughout - green clay carries sericite?</p>			<p>specimens taken 656.2'-657', 648'-648.5'</p>						
657'	667'	10'	100%	<p><b>Sandstone &amp; Bx:</b> F.-g. 657'-657.7', 660'-661.8'. M.-g. 661.8'-667'. Sandstone breccia 657.7'-660' consists of 1/2" - 1 1/4" diameter angular clasts of gray green fine- to medium-grained sandstone, and c.-g. subangular quartz clasts in green clay (?chlorite?sericite?) rich sandy matrix. Matrix and fragments hematized 658.3'-.5', 657.7'-658'. M.-g. section hematized &amp; porous in appearance. Bedding 80° t.c.a.</p>										<p>- strong pervasive hematite as noted, also 660.2'-667'. - green alteration of bx sericite? saussurite?</p>			<p>- specimen taken 659' - 659.7'.</p>						

## DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
										12	12
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE		TOTAL DEPTH		HOLE NO. D.D.H78-2	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE	
From	To	Length	% Rec							F	V/FI
667'	677' END	10'	100%	<p>Sandstone: Predominantly m.-g. with a few f.-g. graded intervals, particularly 676.1'-677'. Green clay enrichment at 667'-668.1', 669.6'-670.1', 662.3', 666.1'-667'. Mainly dark grey maroon in colour 668'-672', 663.6'-664.8', otherwise light orange or green. C.-g. sandstone clasts at 658.4', 664.9'.</p>		<p>- hematite pervasive strong in dark maroon sections. - minor banding - green alt<sup>n</sup> sericite? talc?</p>					.3

APPENDIX 3

Geological Logs KDH 78-3

KEANE PERMITS

DRILL LOG HOLE #3

Vertical Hole

SHEET NO.

LOCATION				CO-ORDINATES				NORTH		EAST		ELEVATION		1		17	
DATE STARTED		DATE COMPLETED		SURVEYS				HOLE SIZE		TOTAL DEPTH		HOLE NO.					
November 3, 1978		November 8, 1978						BQ		957'		D.D.H. 78-3					
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE					
From	To	Length	%Rec									F	V/F	F/F	Log		
0	203'	NQ	0%	<p><u>Overburden:</u> Unconsolidated, white to maroon, f.-g. aeolian sand &amp; small boulders of sandstone. NW casing to 177' - sticks in large boulder of white f.-g. sandstone. Drill ahead to 211' NQ. From 177'-203' a series of 1/4' to 3' diameter boulders of f.-g. white sandstone, in part pervasively hematized. Bedrock at 203.5'.</p>				<p>- pervasive weak hematization in some boulders.</p>		<p>- tar intersected approximately 100' in o/b - fracture fill tar in boulder 185' also 187'-197'.</p>					?		
203'	207'	3.5'	88%	<p><u>Sandstone:</u> F.-g., light maroon in colour, competent, dense well sorted. Thinly and closely bedded hematite alteration throughout. Bedding regular 85°-90° t.c.a.</p>				<p>- closely spaced hematite banding-weak to medium concentration.</p>							2/10		
207'	217'	9.4'	94%	<p><u>Sandstone:</u> As above. Major feature - total tar impregnation of sandstone 214.2'-218.9'. Bedding 85°.</p>				<p>- as above with cross bedding fracture on 0° at 203.4'.</p>		<p>- 17 tar impregnated bedding occurrences 207'-209.1', 214', 214.1', continuous total impregnation 214.2'-217' - fracture fill tar 209.5', 210' (5°), 210.1' (90°), 210.6'-211.2 (5°), 213.1' (85°).</p>							
				<p>Reduce at 211' from NQ to BQ. Core loss at 211'.</p>													
217'	227'	10'	100%	<p><u>Sandstone:</u> As above. Very light maroon in colour except 217'-218.9' total tar impregnated. Bedding 85°.</p>				<p>- very subdued hematite banding. minor green bedded clay at 226.7'-227'</p>		<p>- pervasive, complete tar impregnation 217'-218.9' - subcontinuous closely spaced bands of tar impregnated sandstone 219'-221', 222'-223', 224'-226' - minor impregnations in rest of section.</p>					2/10		

## DRILL LOG

LOCATION		CO-ORDINATES			NORTH		EAST		ELEVATION		SHEET NO.					
											2	17				
DATE STARTED		DATE COMPLETED			SURVEYS			HOLE SIZE		TOTAL DEPTH		HOLE NO.				
								BQ		957'		D.O.H. 78-3				
DEPTH		CORE		LITHOLOGY					ALTERATION		MINERALIZATION		STRUCTURE			Log
From	To	Length	%Rec										F	V/F	F/F	
227'	237'	10'	100%	Sandstone: As above 10' section. Major feature is pervasive complete tar impregnation of sandstone 228'-233'. Bedding 85°.					- as above except weak pervasive hematite 235.8'-237'.		- fracture fill tar 228' (10°), 233'-234' (10°), 234.2'-.4' (10°), 235'-236'. - tar impregnated bedding 228'-229', 233' pervasive complete, also 236.7'-237.1'.					
237'	247'	10'	100%	Sandstone: As above. White to light maroon in colour except 239'-242' light to medium maroon in colour. Bedding regular 85°.					- pervasive weak hematite 239'-242'. - subdued widely spaced hematite banding elsewhere.		- tar impregnated bedding 237'-.2', 244'-.1', 244.3'-244.5', 244.7'. - subcontinuous impregnation 245'-246', 246.2'-247'.				2/10	
247'	257'	9.8'	98%	Sandstone: F.-g., white in colour. Major feature; pervasive, complete tar impregnation of sandstone 247'-252.5', 254'-255'. Bedding regular 85°.					- no hematite alteration		- total tar impregnation 247'-252.5', 254'-255'. - subcontinuous impregnation 252.2'-253.6', 255.2'-.7'. - minor elsewhere - fracture fill tar (10°) 247'-248', 251' (50°), 254' (15°), 256.6' (5°).				2/0	
257'	267'	10'	100%	Sandstone: As above 10' section. Bedding 80°-85° regular.					- weak pervasive hematite 258'-.6', 266.6'-266.9'. - very minor subdued hematite banding.		- fracture fill tar (5°) 257', 258' (20°), 262.6'-.8', 263.8'-265'.				2/10	

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES.		NORTH	EAST	ELEVATION		HOLE NO.		
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	3 17		
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		
From	To	Length	%Rec					STRUCTURE		
								F	V/FI	
								F <sub>1</sub>	Log	
267'	277'	10'	100%	Sandstone: As above 10' section. Bedding 80°-85°. Light maroon in colour. Major feature complete tar impregnation 275.7'-277.9'.		- weak pervasive hematite 267.2'-.8', 268.8'-270.3', 270.9'-272', 276'. - thinly bedded minor green clay noted occasionally 270.5'-276'.		- tar impregnation of bedding 268.9', 269.7'. Continuous pervasive 275.7'-277.9' with fracture control. - fracture fill tar 270.5' 271.3', 272.4'.		2/10
277'	287'	10'	100%	Sandstone: F.-g., medium maroon in colour except 278'-280' light maroon. Weak green clay enrichment 279.3'-.6' & occasionally minor throughout the section.		- pervasive weak-medium hematite in light-medium maroon sections. - sericite? with clay?		- complete tar impregnation 277'-277.9', 284.8'-285.1' - fracture fill tar 279' (90), 281'-281.7' (5').2.		3/10
287'	297'	10'	100%	Sandstone: F.-g., medium to dark maroon throughout. Green and maroon mudstone bands showing cut & fill contacts with fine- to medium-grained well sorted, graded material - strongly hematized at 288.9'-289.2', 293.4' (1"-90°), 293.9'-294.1', 294.2'-.3', 295', 295.6'. Fine- to medium-grained, strongly hematized section 290.8'-292'. Bedding regular 85°-90°.		- strong to intense pervasive hematite 288.2'-289.2', 290.8'-292', 293.9'-.4', 296.7'-297', otherwise weak to medium pervasive. - closely spaced hematite banding.				1/10
297'	307'	10'	100%	Sandstone: F.-g. with numerous narrow beds of fine- to medium-grained material. White to light maroon in colour. Bedding 85°.		- pervasive weak-moderate hematite 297-.2', 302.2'-303', 304.2'-.6', 306'. - weak closely spaced hematite banding.				2/10

DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS						4	17
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE	
From	To	Length	%Rec							F	V/Fi
307'	317'	10'	100%	Sandstone: F.-g., light maroon in colour. Very narrow fine-to medium-grained interbeds occasional throughout. Bedding 80°-90°.		- closely spaced hematite bands throughout - some cross cutting - Concentric banding 315.5'-316', 316.2'-317'		- fracture fill tar (5°) 316.7'-317'. - specimen taken 316'-316.5'.			2/10
317'	327'	10'	100%	Sandstone: As above 10'.		- ditto - concentric hematite banding 324.9'-327'.		- tar impregnated bedding 325.3'-.6'.			2/10
327'	337'	10'	100%	Sandstone: F.-g., medium maroon throughout with characteristic closely spaced hematite banding which forms parallel to, cross-cutting & crosscutting concentric to bedding. Bedding regular on 80°-85°.		- closely spaced hematite bands also weak-moderate disseminated hematite. - concentric banding 328.3'-329.2', 331'-333.4'.		_____			2/10
337'	347'	10'	100%	Sandstone: F.-g. As above 10' section. Bedding 85°. Lenticular medium- to coarse-grained clay clasts bedded at 340', 340.4', 342.2', 342.7', 344.6', 345', 345.9'.		- as above - concentric & crosscutting hematite banding 339'-347'.		_____			2/10
347'	357'	10'	100%	Sandstone: F.-g. As above. Occasional minor green bedded clay throughout. Bedding 75°-85°.		- as above - hematite banding less distinct 352'-357'. - concentric at 355.3'-356.5'.		_____			2/10
357'	367'	10'	100%	Sandstone: F.-g. As above though light maroon in colour. Minor green clay enrichment 361'-.5'. Bedding 85°.		- as above - hematite banding less distinct. A few weak - moderate pervasive sections.		_____			1/10

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION	SHEET NO.			
							5	17		
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.		
						BQ	957'	D.O.H. 78-3		
DEPTH		CORE		LITHOLOGY	ALTERATION	MINERALIZATION	STRUCTURE			
From	To	Length	%Rec				F	V/F:	F/Fi	Log
367'	377'	10'	100%	Sandstone: F.-g. As above 10' section. Sandy mudstone bed .1" thick at 370.4' also minor green clay enrichment 369.2'-.4'. Bedding 85°.	- hematite banding present but indistinct. - hematite "mottles" conspicuous 372'-377'.	- fracture fill tar (0°) 370'-.4', 370.7'.				2/10
377'	387'	10'	100%	Sandstone: F.-g. As above 10' section. Light maroon to white in colour. Sandy mudstone band 0.3" (90°) 384.1'.	- as above. - hematite mottles 377'-383'. - moderately pervasive hematite 385.2'-386.1'.					2/10
387'	397'	10'	100%	Sandstone: F.-g. with narrow fine- to medium-grained bands occasional throughout. Light to medium maroon in colour. Bedding regular 85°-90°.	- weak to moderate pervasive throughout. - hematite banding indistinct.					3/10
397'	407'	10'	100%	Sandstone: F.-g. alternating fine- to medium-grained throughout. Medium maroon in colour throughout. Bedding regular 85°. C.-g. subangular clay fragments at 402.8'. Somewhat porous in appearance throughout.	- moderate pervasive throughout occasional intense hematization: 398', 399.6', 400.5', 401.8', 406.6'. - weak matrix clay dissemination in fine- to medium-grained beds.					3/10
407'	417'	10'	100%	Sandstone: F.-g. alternating fine- to medium-grained throughout. As above. Minor bedded green clay occasional throughout section, prominent 413.1'-.7'.	- as above					3/10



DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		6		17		
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.				
						BQ	957'	J.D.H. 78-3				
DEPTH		CORE		LITHOLOGY		ALTERATION	MINERALIZATION		STRUCTURE			
From	To	Length	%Rec						F	V/FI	F/FI	Lcg
417'	427'	10'	100%	Sandstone: As above. Section 420'-423' is fine- to medium-grained dark maroon in colour. Section 423.6'-426.5' is f.-g. light maroon in colour. Bedding 85°. Minor green clay enrichment 423.6'-426.5'.		- moderate hematization except weak in 423.6'-426.5' and strong 420'-423'.	_____					2/10
427'	437'	10'	100%	Sandstone: As above. Medium maroon, fine- to medium-grained sections 427.2'-430', 429.8'-431', 435.9'-436.6', 436.9'-437' otherwise f.-g. light maroon. Minor green clay enrichment 429.1'-.8', hematized green-maroon mudstone bed 429.8'-430'.		- moderate-strong hematite in medium maroon sections.	_____					2/10
437'	447'	10'	100%	Sandstone: F.-g. light maroon to white with fine- to medium-grained interbeds medium to dark maroon in colour at 437'-.5', 439'-.4', 444.4'-.8', 445.1'-447'. Minor bedded green clay 437'-444'. Bedding regular 80°-85°.		- moderate-strong hematite pervasive in medium-dark maroon sections.	_____					3/10
447'	457'	10'	100%	Sandstone: As above. Fine- to medium-grained medium maroon sections 447'-.5', 448.1'-.4', 453.6'-.8', 454.9'-455.1', 455.4'-456.2'.		- ditto	- tar impregnated bedding 448.1', 448.5', 448.8', 450', 450.3', 450.6', 451', 454.6', 455'. fracture fill tar 448.6' 453.3', 453.7', 454.5'-455'.					3/10
457'	467'	10'	100%	Sandstone: As above, very minor fine- to medium-grained interbeds. Light maroon & white in colour with a few 4" wide sections of medium maroon.		- weak disseminated hematite except moderately pervasive over 4" sections. - very minor banding.	- subcontinuous tar impregnated sandstone 457.9'-458.3'.					1/10

## DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
										7	17
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE		TOTAL DEPTH		HOLE NO.	
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE	
From	To	Length	%Rec							F	V/Fi
467'	477'	10'	100%	<p><u>Sandstone:</u> As above 10'. Medium maroon f.-g. 467'-469', 470'-473', 475.5'-477' otherwise white to light maroon in colour. Bedding 85° except 474.5'-476', 70°-75°. Fracture (mudcrack?) infilled with white clay 468.9'.</p>		<p>- pervasive moderate hematization in medium maroon sections - banding 471'-473'. - concentric banding 476'-477'.</p>		—————			2/10
477'	487'	10'	100%	<p><u>Sandstone:</u> F.-g. with narrow fine- to medium-grained interbeds occasional throughout. Light to medium maroon throughout. 1/2" white, sandy mudstone bed (90°) at 485.4'. Bedding variable 75°-85°.</p>		<p>- pervasive weak to moderate hematization. - minor indistinct hematite banding.</p>		<p>- tar impregnated bedding 11 bands 447.8'-479.5', 10 bands 481.3'-482.5', also 483.7'.</p>			2/10
487'	497'	10'	100%	<p><u>Sandstone:</u> As above 10' section. Light maroon in colour.</p>		<p>- ditto - some subdued hematite banding - concentric at 492'-493'.</p>		—————			1/10
497'	507'	10'	100%	<p><u>Sandstone:</u> F.-g. with a few fine- to medium-grained narrow interbeds. Light maroon in colour throughout. C.-g. hematized clast at 497.5'. Green clay lenticular fragment at 503.3'. Bedding 80°-90°.</p>		<p>- pervasive weak hematite in thin closely spaced bands. - concentric banding 497.7'-498.3', 506'-507'.</p>		<p>- narrow tar impregnated bed at 497.1'.</p>			0
507'	517'	10'	100%	<p><u>Sandstone:</u> As above 10' section. Bedding 85°.</p>		<p>- ditto - strong hematite at 519.4'.</p>		—————			0

DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.			
DATE STARTED		DATE COMPLETED		SURVEYS						8	17		
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE			
From	To	Length	%Rec							BQ	957'	HOLE NO.	
										D.D.H. 78-3			
										F	V/Fi	F/Fi	Log
517'	527'	10'	100%	Sandstone: Predominantly fine- to medium-grained starting 517.8' with numerous interbeds of f.-g. material. Very light maroon in colour. Minor green clay enrichment at 521.4', 523.7'. Bedding 75°-85°.		- weak semicontinuous hematite banding. - strong hematite alt <sup>n</sup> at 519.4'.		- minor bedding impregnated with tar at 526.1'.					3/10
527'	537'	10'	100%	Sandstone: As above. Minor green clay enrichment at 527'-.2', 529.9', 530.7', 530.9' (1"). M.-g. bed at 534.1' (1"). Fracture (mudcrack?) fill green clay 536.9'. Bedding regular 80°-85°.		- weak pervasive hematite throughout as closely spaced bands.		- specimen taken 534'-534.6'.					2/10
537'	547'	10'	100%	Sandstone: As above. More m.-g. bands at 538'-.3', 539.5'-.7', 540.5' (1"), 542' (1"), 544.2' (3"). Sericite rich sandy mudstone bed 538.6' (1"). Green clay enrichment 545'-.3'. Bedding 75°-85°. Very light maroon in colour throughout section.		- as above. - "sericite" with green clay. - strong hematization of m.-g. bands.							2/10
547'	557'	10'	100%	Sandstone: As above. More m.-g. sections at 548'-549', 549.9'-550.8', 553.8'-554.1', 556.3' (1"), 556.8' (1"). Minor green clay enrichment 547'-547.8', 554.1'. Green sandy mudstone 551.4' (2" - 90°). Bedding 75°-80°. Very light maroon throughout.		- pervasive weak hematite in closely spaced bands; rather indistinct - minor bedded green clay occasional throughout.							2/10
557'	567'	10'	100%	Sandstone: As above but greater f.-g. component. Minor green clay enrichment 561.8'-562', 565.4' (1") also green sandy mudstone band at 563.9' (1", 90°). More m.-g. with f.-g. interbeds 566'-567'. Bedding 85°.		- ditto - intense hematization of 1" m.-g. bed 561.7'.		- tar impregnated bedding 1" band at 564.9'.					2/10

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION	SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.
DEPTH		CORE		LITHOLOGY		ALTERATION	MINERALIZATION	STRUCTURE
From	To	Length	% Rec					F V/Fi F/Fi Log
567'	577'	10'	100%	Sandstone: As above. Medium maroon more m.-g. sections 567'-567.7', 575'-577'. Moderate green clay enrichment 569.4'-569.8'. Bedding 75°-85°.		- pervasive weak hematite except moderate-strong in m.-g. sections - sericite? in clayly sections.	_____	2/10
577'	587'	10'	100%	Sandstone: Predominantly m.-g., medium maroon in colour with interbedded narrow f.-g. bands. F.-g. green clay enriched section 580.1'-582.3', also green sandy mudstone 578.9' (2").		- pervasive moderate-strong hematite in m.-g. sections. - sericite in clay? - matrix clay in m.-g. sections.	- fracture fill tar at 577'-577.6' (5")	2/10
587'	597'	10'	100%	Sandstone: Predominantly m.-g. with interbedded f.-g. bands. Minor green clay enrichment 589.8' (1"), 592.3'-.7', 593'-.2'; 596.9' (2") green sandy mudstone with irregular contacts. Bedding regular 80°. Medium- to coarse-grained section 598.6'-.9'. Medium maroon throughout. M.-g. sections well sorted, rather porous in appearance.		- As above.	- specimen taken 492.3'-.6".	3/10
597'	607'	10'	100%	Sandstone: As above 10' section. Minor green clay enrichment occasional throughout. Maroon-green hematized mudstone & sandy mudstone 598.3'-.9' also 603' (1"), 604.3'-604.8'. Green clay clasts at 606.1'.		- as above.	- tar impregnated bedding 4 bands 600.1'-.4'.	3/10
607'	617'	10'	100%	Sandstone: As above. Numerous 1"-3" wide beds of green-dark maroon mudstone & sandy mudstone throughout. Medium maroon in colour throughout. Bedding regular 85°.		- moderate-strong pervasive hematization throughout - intense above & below mudstone beds.	_____	4/10

## DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.			
										10	17		
DATE STARTED		DATE COMPLETED		SURVEYS						HOLE NO.			
								HOLE SIZE		D.D.H. 78-3			
								TOTAL DEPTH					
								957'					
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		STRUCTURE			
From	To	Length	% Rec							F	V/FI	F/FI	Log
617'	627'	10'	100%	Sandstone: M.-g. 617.4'-619.1' otherwise fine- to medium-grained with green-maroon sandy mudstone beds at 617.1'-.4', 619.1'-.6', 621.1' (1"), 621.4'-.9', 623.8'-624.1'. Green clay enrichment 625.5'-.7'. Bedding 85°-90°, except 621.9'-623.2' (60°-70°).		- weak to moderate pervasive hematization except intense in & immediately adjacent mudstone beds. - sericite with clay?							3/10
627'	637'	10'	100%	Sandstone: Predominantly f.-g., with sandy mudstone (siltstone?) beds at 627.3'-628.3', 631.9'-633.7'. M.-g. 633.7' 635.3'. Fine- to medium-grained 635.3'-637'. Bedding regular on 85°-90°.		- moderate pervasive throughout except strong intense hematization in m.-g. sections. - hematite mottling 630'-630.2'.		- bedding impregnated with tar 633.7'-.8'.					4/10
637'	647'	10'	100%	Sandstone: Predominantly fine- to medium-grained maroon in colour except m.-g. 642.9'-647' & 637'-637.7' dark maroon and 637.9'-638.3', 638.8'-639' sandy green mudstone beds. Bedding 90°. Cut & green clay infill at 639.3'.		- strong to intense hematization in m.-g. sections & otherwise weak to moderate pervasive.		- (tar impregnation suspected 642.9'-647' pervasive hematite.)					3/10
647'	657'	10'	100%	Sandstone: Predominantly f.-g. to very f.-g. throughout except m.-g. & strongly hematized 648.3'-.7', 651.8'-652.2'. M.-g. sections are very friable due to intense hematization. Whole 10' section well sorted with gradational contacts. Moderate - substantial green clay enrichment (bedded) 649'-651.3'. Bedding regular 85°.		- intense hematite in m.-g. sections. - sericite with clay? - M.-g. sections rather porous in appearance.							3/10
657'	667'	10'	100%	Sandstone: Predominantly f.-g. with very narrow beds of fine- to medium-grained material 660.8'-663'. Light grey throughout except light green with moderate clay enrichment 663.4'-.9'. Bedding regular 80°-90°.		- weak disseminated hematite throughout.		- fracture fill tar 663.9'-664.2'.					3/10

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		11	17			
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.				
DEPTH		CORE		LITHOLOGY		ALTERATION	MINERALIZATION	STRUCTURE				
From	To	Length	%Rec					F	V/FI	F/FI	Log	
667'	677'	10'	100%	Sandstone: F.-g. medium maroon in colour with graded zones of fine- to medium-grained material up to 6" long rather medium maroon in colour. C.-g. quartz clast at 671.3'. Bedding regular 85°. Green clay enrichment (minor) 670.9'-671.6'.		- moderate hematite in m.-g. zones otherwise weak disseminated pervasive.	_____					2/10
677'	687'	10'	100%	Sandstone: Fine- to medium-grained, medium gray maroon in colour throughout, well sorted. Bedding 85°-90°.		- ditto	_____					2/10
687'	697'	10'	100%	Sandstone: M.-g. well sorted throughout. Bedding 85° except 692.1'-693.1'. Cross bedding on 67°-75°. Moderate bedded clay enrichment 688.4'-689.9', 693.2'-694'. Medium-dark grey maroon in colour except light green in clayly sections.		- moderate pervasive hematite except weak in clayly sections. - intense hematite 690.1'-690.5', 691.9'-692.1', 693.1'.	_____					2/10
697'	707'	10'	100%	Sandstone: Fine- to medium-grained 697'-698.6', 701.4'-703.5' with weak to moderate green clay enrichment. M.-g. elsewhere with discontinuous green clay enrichment & maroon gray hematite alt <sup>n</sup> forming alternating irregular zones. C.-g. quartz fragments at 698.9'.		- pervasive weak hematite except moderate irregular in m.-g. sections.	- specimen taken 703.5'-704'.	_____				2/10
707'	717'	10'	100%	Sandstone: Predominantly m.-g. well sorted with a few fine- to medium-grained beds up to 6" wide. Rather porous in appearance except dense, light green in colour with moderate clay enrichment 707.2'-710', 714.8'-715.5', 716'-716.6'. Medium gray maroon in colour. Bedding 85°.		- pervasive moderate to intense in m.-g. sections - sericite with clay?	_____					3/10
717'	727'	10'	100%	Sandstone: Fine- to medium-grained throughout with a few 2"-3" bands of m.-g. material. Well sorted throughout, contacts gradational. Green, moderate clay enrichment 718.4'-720', 726.5'-727'.		- irregular weak to intense (m.-g. sections) hematite pervasive. - hematite mottling 721.8'-724', 726'-727'.	_____					3/10

DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.				
DATE STARTED		DATE COMPLETED		SURVEYS						12	17			
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE		GRAPHIC Log
From	To	Length	%Rec									F	V/FI	
727'	737'	10'	100%	Sandstone: M.-g., medium gray maroon in colour except 730.6'-732.1' f.-g. light brown. Several thinly bedded f.-g. beds throughout. Bedding 85°-90°.				- pervasive moderate hematite in m.-g. sections except intense irregular 727'-728'. - hematite mottling in m.-g. sections.						3/10
737'	747'	10'	100%	Sandstone: Variable grain size. F.-g. 737'-737.9' (70° contact m.-g.) 739.8'-743.8'; very light maroon in colour except green clay enrichment 739.8'-740.2', 737'-737.9'. Rest of section is m.-g., mottled medium gray maroon in colour, moderately well sorted. Bedding 85°.				- moderate to intense hematite in m.-g. sections. - weak pervasive hematite in f.-g. sections. - sericite with green clay?						2/10
747'	757'	10'	100%	Sandstone: Fine- to medium-grained light marron-grey in colour except 752.1'-.8', 754.5'-755.3', 756.1'-757' m.-g. medium gray maroon in colour. Massively bedded 80°-85°. Green moderate clay enrichment 751.6'-752.1'.				- ditto - minor green bedded clay throughout f.-g. sections.						4/10
757'	767'	10'	100%	Sandstone: Variable. F.-g. to very f.-g. 759.8'-763.6'. Section 759.8'-761.8' is a light brown sandy mudstone. 762.8'-763.8' contains moderate green clay enrichment. Rest of section is m.-g., moderately well sorted, mottled grey maroon in colour. C.-g. angular clast at 757.1'.				- moderate - strong hematite in m.-g. sections. - weak hematite dissemination elsewhere. - hematite medium- to coarse-grained intense mottling in m.-g. sections.						3/10

DRILL LOG

SHEET NO.

LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		SHEET NO.		
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.		
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		
From	To	Length	%Rec					STRUCTURE		
								F	V/Fi	
767'	777'	10'	100%	Sandstone: M.-g., mottled medium gray-maroon except f.-g., light maroon-green with minor clay enrichment 773.9'-775.1'. Bedding 85°.		- medium maroon sections contain moderate pervasive hematite. - intense hematite mottling throughout m.-g. sections.				2/10
777'	787'	10'	100%	Sandstone: Variable but predominantly m.-g. mottled grey-maroon sandstone. F.-g. light maroon in colour 780.9'-786' with minor interbedded m.-g. material. Bedding 85°.		- Ditto				3/10
787'	797'	10'	100%	Sandstone: As above (m.-g. mottled); except 789'-790.7', 795.9'-796.9' - f.-g. light green gray with minor clay enrichment. C.-g. sandstone fragments, rounded at 790.8'-.9'.		- moderate pervasive hematite also intense hematite mottling in m.-g. sections.				2/10
797'	807'	10'	100%	Sandstone: As above; except 798.1'-801.8' f.-g. light gray-maroon. Substantial green & brown clay enrichment, 798.1'-.6', 801'-.6'. Contacts sharply gradational. Facies well sorted. Bedding massive 85°.		- ditto				2/10
807'	817'	10'	100%	Sandstone: As above; except 808.1'-810', 811.1'-.2', 813.9'-815', 816'-.5', f.-g. light grey green with minor green clay enrichment. C.-g., subrounded sandstone clasts at 811.8', 815'. Bedding regular 80°-85°.		- ditto - mottling subdued				3/10
817'	827'	10'	100%	Sandstone: As above; except 817.5'-.9', 821'-.4', 823.9'-824.6' f.-g., light to medium gray maroon with moderate green clay enrichment. A few c.-g. subangular-subrounded clasts 818.2', 823'. Bedding 90°. Well sorted, gradational contacts.		- moderate to intense hematite pervasive in m.-g. sections.				2/10



## DRILL LOG

LOCATION				CO-ORDINATES				NORTH		EAST		ELEVATION		SHEET NO.	
								DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH
DEPTH		CORE		LITHOLOGY				ALTERATION		MINERALIZATION		STRUCTURE		Graphic Log	
From	To	Length	% Rec									F	V/Fi		F/Fi
827'	837'	10'	100%	Sandstone: M.-g. to f.-g. 827'-832.9' becoming m.-g. (c.-g. section 834'-835.1') 832.9'-837'. Light grey maroon except medium-dark maroon in c.-g. section. Bedding massive 85°; gradational contacts ¼" subangular f.-g. sandstone clast at 829.1'.				- weak to moderate pervasive hematite throughout. - intense hematite 833', 833.1' & in c.-g. section.						0	
837'	847'	10'	100%	Sandstone: F.-g. 841.1'-842.1, 846.5'-847', light maroon in colour with some green clay enrichment. Elsewhere m.-g. with occasional narrow c.-g. bands except c.-g., medium to dark maroon in colour 840.2'-841.1', 845.4'-9', 846.2'-5'. Bedding regular 85° t.c.a.				- strong pervasive hematite in c.-g. sections		- specimen taken 846'-846.5'				3/10	
847'	857'	10'	100%	Basement Regolith: C.-g. sandstone, light orange in colour 847'-850.4'. Contact at 850.4' with c.-g. regolith of basement (approximately 45° t.c.a. - irregular sharp). Regolith has a very siliceous matrix, is pervasively-intensively hematized and contains c.-g. rounded clasts of quartz. Gradational contact at 850.6' to m.-g., siliceous and strongly hematized granular rock, continuous to 857'. Irregular 1" quartz vein? clast? with interstitial hematite at 856.7'. Suggestion of bedding on 85°. Very hard rock - slow drilling. Bit life 90'.				- intensive pervasive hematization 850.4'-857'. - disseminated f.-g. clay or chlorite (?) matrix alt <sup>n</sup> . - intensive medium- to coarse-grained hematite "mottling".		- fracture fill tar 851.5'-852.9' (10°) - specimen of c.-g. sandstone 849.9'-850.6', - specimen of regolith(?) 850.6'-851', 856'-8'.				5/10	
857'	867'	10'	100%	Regolith: Predominantly m.-g. granular (clastic?) rock, dark maroon in colour 857'-862.5' gradational to dark grey in colour 862.5'-867'. White quartzose bands contain c.-g. interstitial hematite - may be clastic interbeds but more probably are pegmatite dykelets - found at 860.3' (¼", 90°), 861.4' (¼", 90°), 862.1', 861.3' (1"), 862.4' (1"), 864.7'-865', 865.7' (¼"). Suggestion of bedding on 85°. Siliceous matrix throughout.				- moderate-strong, f.-g. disseminated & medium- to coarse grained hematite mottling 857'-862.5' becoming weak to moderate 862.5'-867'. - minor f.-g. disseminated chlorite on bedding(?) throughout.		- specimen taken 862.3'-863'.				7/10	

DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS						15	17
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		HOLE NO.	
From	To	Length	% Rec					BQ	957'	D.O.H. 78-3	
										STRUCTURE	
										F	V/Fi
										F/Fi	Log
867'	877'	10'	100%	<p><u>Regolith:</u> Predominantly m.-g. clastic textured rock with f.-g. matrix material. Dark grey-maroon in colour. Medium- to coarse-grained hematite mottles &amp; discontinuous, indistinct bands throughout. C.-g. granite to pegmatite dykelets carrying minor m.-g. muscovite at 870.5'-9' (70°), 871'-2', 872.9'-873', 874.5' (2"). Bedding (?) 85°.</p>		<p>- hematite mottles &amp; indistinct banding throughout, may be in whole or part be feldspathization due to dykes - disseminated f.-g. chlorite on bedding (?) &amp; adjacent to dykes.</p>		<p>- blue-green bedded chlorite? 876.5'-877'. - specimen taken 870'-870.7'.</p>			1
877'	887'	10'	100%	<p><u>Regolith:</u> Highly altered fine- to medium-grained granular textured rock; grey-maroon in colour. General increase in clay &amp; chlorite (?) thinly banded after 881.5' - rather soft &amp; friable along these closely spaced bands. C.-g. granite dyke (70°) at 884.5'-885.1' with intensely altered contacts. A few narrow c.-g. granite dykes throughout section. Distinct foliation - closely spaced partings (70°) throughout clastics.</p>		<p>- thinly bedded intense hematite &amp; pervasive c.-g. hematite mottling decreasing to bottom of section. - f.-g. disseminated clay intense throughout. - clay altered feldspars in granite dykes.</p>		<p>- specimen taken 884.2'-884.8'.</p>			5
887'	897'	10'	100%	<p><u>Regolith:</u> F.-g. clastic rock except medium- to coarse-grained 887.9'-890', dark green-gray in colour. Rock is soft &amp; friable along closely spaced foliation. C.-g. granite dykes at 889.3' (1/4"), 890.9' (1/4"), 891.7' (1/4"), 892.9', 893.1' (1"), 893.9' (1") 895' (2"). Foliation 70°-75°. Highly altered throughout.</p>		<p>- thin chlorite bands on foliation. - much f.-g. disseminated clay after feldspar (?) throughout. - weak disseminated f.-g. hematite.</p>		<p>- specimen taken 887'-887.3'.</p>			5

DRILL LOG

LOCATION		CO-ORDINATES		NORTH		EAST		ELEVATION		SHEET NO.	
DATE STARTED		DATE COMPLETED		SURVEYS						16	17
DEPTH		CORE		LITHOLOGY		ALTERATION		MINERALIZATION		HOLE NO.	
From	To	Length	% Rec					BQ	TOTAL DEPTH	D.D.M. 78-3	
									957'		
										STRUCTURE	
										F	V/Fi
										F/Fi	Log
897'	907'	10'	100%	<p><u>Regolith:</u> F.-g. clastic rock, dark green in colour, containing much disseminated clay, chlorite &amp; hematite (in part hematite bearing orthoclase?), 897'-903.8'. Cut by narrow dykes of red brown c.-g. granite at 898.6', 898.9', 899' (1/4"), 890.8' (2"). Dark green-brown, m.-g., feldspathized (?) and intensively chloritized in sections 903.8'-904', 905.9'-907'. Cut by dyke of c.-g. red brown granite 904'-905.9' which contains a 2" diameter inclusion of chlorite. Distinct foliation apparent in clastic section on 80° - altered bedding?</p>		<p>- feldspathization? - intensely chloritized contact area to granite dykes. - hematite, disseminated blobs of chlorite &amp; moderately intense saussauratization of feldspars in granite dykes.</p>		<p>- specimen of granite 905.3'-.7'.</p>			15
907'	917'	10'	100%	<p><u>Regolith:</u> Dark green-brown, m.-g. highly altered clastic rock cutting a dyke of medium red brown, chlorite bearing c.-g. granite at 907.8' (2") &amp; 910.9'-915.1'. Minor f.-g. disseminated biotite noted in granite. Clastic is apparently feldspathized and highly chloritized resulting in soft crumbling texture. Granite composed of anhedral orange-brown feldspar crystals in siliceous matrix - contains m.-g. blobs of dark green mineral thought to be chlorite. Foliation in clastic section on 80°.</p>		<p>- feldspathization in clastics. - intensive chloritization of clastic adjacent to granite. - hematite bearing orthoclase &amp; possible chlorite blobs in granite.</p>		<p>- specimen of granite 913.7'-914'</p>			10
917'	927'	10'	100%	<p><u>Regolith(?)</u>: F.-g., dark grey, dense, siliceous rock containing 1% very f.-g. biotite showing slight alignment. Possibly a f.-g. clastic but more probably a f.-g. granite. Cut by c.-g. granite dykes at 917.3'-.8', 920'-.2', 920.9', 921.8', 922.8' (2"), 923.3'. Narrow quartz-sericite selvages adjacent-subadjacent to dykes. Rock is sharply gradational to c.-g. granite gneiss at 923.7'-927'. Gneiss contains orange-brown quartz &amp; feldspar augen with biotite schistosity.</p>		<p>- weak chlorite throughout - clay &amp; saussaurite dissemination &amp; fracture fill in clastics (?)</p>		<p>- specimen at 921.2'-.8' - also augen gneiss at 924.6'-925.4'.</p>			7

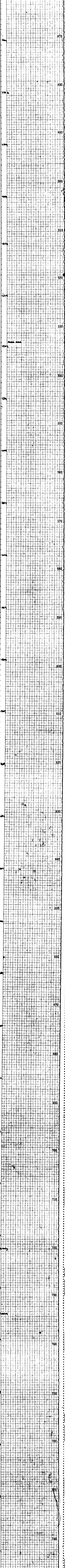
DRILL LOG

SHEET NO.

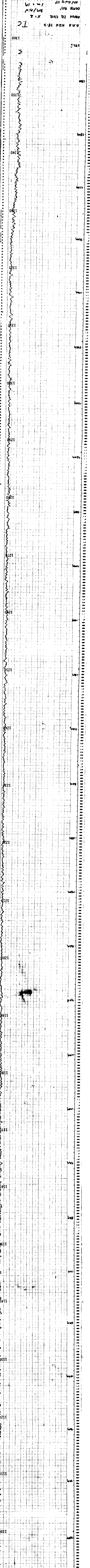
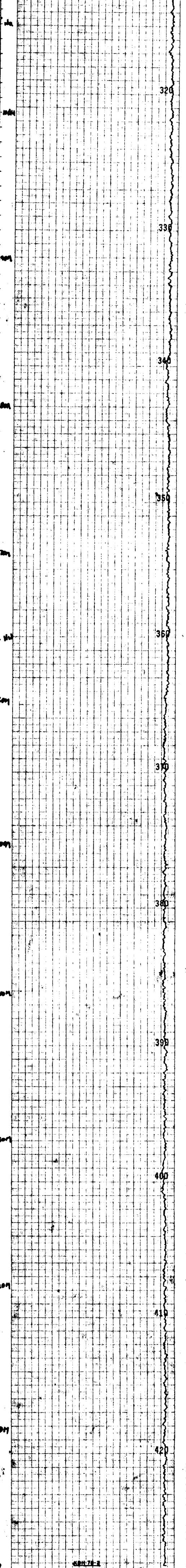
LOCATION		CO-ORDINATES		NORTH	EAST	ELEVATION		SHEET NO.				
DATE STARTED		DATE COMPLETED		SURVEYS		HOLE SIZE	TOTAL DEPTH	HOLE NO.				
DEPTH		CORE		LITHOLOGY		ALTERATION	MINERALIZATION		STRUCTURE			
From	To	Length	%Rec						F	V/F	F/F	Log
927'	937'	10'	100%	<p><u>Granitic Augen Gneiss:</u> Fine- to medium-grained augen gneiss, dark grey-green in colour; fine- to medium-grained disseminated biotite on schistosity. Numerous fractures infilled with quartz &amp; sericite (?) 932'-933'. Cut by medium- to coarse-grained granite dykes at 931'-.9', 934.8'-935.3'.</p>		<p>- quartz-sericite(?) - saussaurite (?) fracture fill as noted.                      - minor disseminated blood red hematite                      - intense alternation of feldspar to clay adjacent to dykes.</p>	<p>- f.-g. pyrite with biotite on schistosity adjacent to dykes.                      - specimen of granite dyke 930.9'-931.4'.</p>					5
937'	947'	10'	100%	<p><u>Augen Gneiss:</u> Fine- to medium-grained dark grey granite gneiss containing poorly developed m.-g. "augen" 937'-938.1'. Cut by medium orange brown granite dykes at 938.3' (2"), 938.8'-939.5', 940' (1"), 940.8' (1"), 943.4' (1"), 945.4' (1"), 946' (2"), 946.6' (2"). Very soft and friable in intensively chloritized zones throughout gneiss, with a profusion of quartz-sericite veinlets along fractures &amp; schistosity.</p>		<p>- chlorite and clay prominent on schistosity throughout gneiss.                      - quartz-sericite-clay infilled fractures and schistosity.</p>	<p>- specimen taken 946.4'-947'.</p>					2
947'	957' END	10'	100%	<p><u>Augen Gneiss:</u> Light orange brown, medium- to coarse-grained augen gneiss. Cut by c.-g. granite &amp; pegmatite dykes at 950.1' (2"), 951', 952'-952.6', 953.1'-.3', 956.6' (1"). Strongly fractured and fractures infilled with clay +sericite &amp; quartz at 951.8'-952.1', 953.7'-954.2', 955'-.2', 955.3'-956.1', 956.8'-957'.</p>		<p>- strong chlorite on schistosity.                      - clay-sericite-quartz fracture fill zones.</p>	<p>- specimen taken 953.1'-.7'</p>					10



GENERAL INFORMATION	
PROJECT	NO. 100
LOCATION	100
DATE	10/10/50
DRILLER	...
...	...



GENERAL INFORMATION	
PROJECT	NO. 100
LOCATION	100
DATE	10/10/50
DRILLER	...
...	...



DRILL HOLE #	KDH 78-1	KDH 78-2	KDH 78-3
SCALE	1 in = 40 feet	1 in = 20 feet	1 in = 20 feet
DRILL SPEED	20 ft/min	20 ft/min	20 ft/min
DRILL TIME	00:00:00	00:00:00	00:00:00

Approved: \_\_\_\_\_

19780011





Atomic Energy  
Control Board

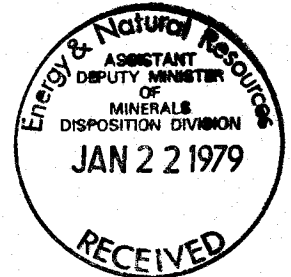
Commission de contrôle  
de l'énergie atomique

OPERATIONS DIRECTORATE  
Safeguards & Nuclear  
Materials Branch

Your file Votre référence

Our file Notre référence 22-B-62

January 8, 1979



BP Minerals Limited  
Suite 1401  
25 Adelaide Street East  
Toronto, Ontario  
M5C 1Y2

Attention: R.D. Moss  
Exploration Manager

Dear Sir:

With reference to your letter of January 2, 1979 please be advised that Surface Exploration Permits MX 1/71(c) - Newfoundland, MX 1/71(d) - Northwest Territories, and MX 1/71(e) - Ontario, have been revised to bring the properties listed under these permits up to date. Enclosed herewith are the originals and copies of Revisions 1.

This will also acknowledge and thank you for forwarding duplicate copies of the report of work carried out during 1978 under Surface Exploration Permit MX 1/71(a) - Alberta. Your prompt attention to this reporting requirement is greatly appreciated.

Yours sincerely,

*M. J. Blackman*

Mrs. N.S. Blackman  
Licensing Officer

NSB:rp

Encs.

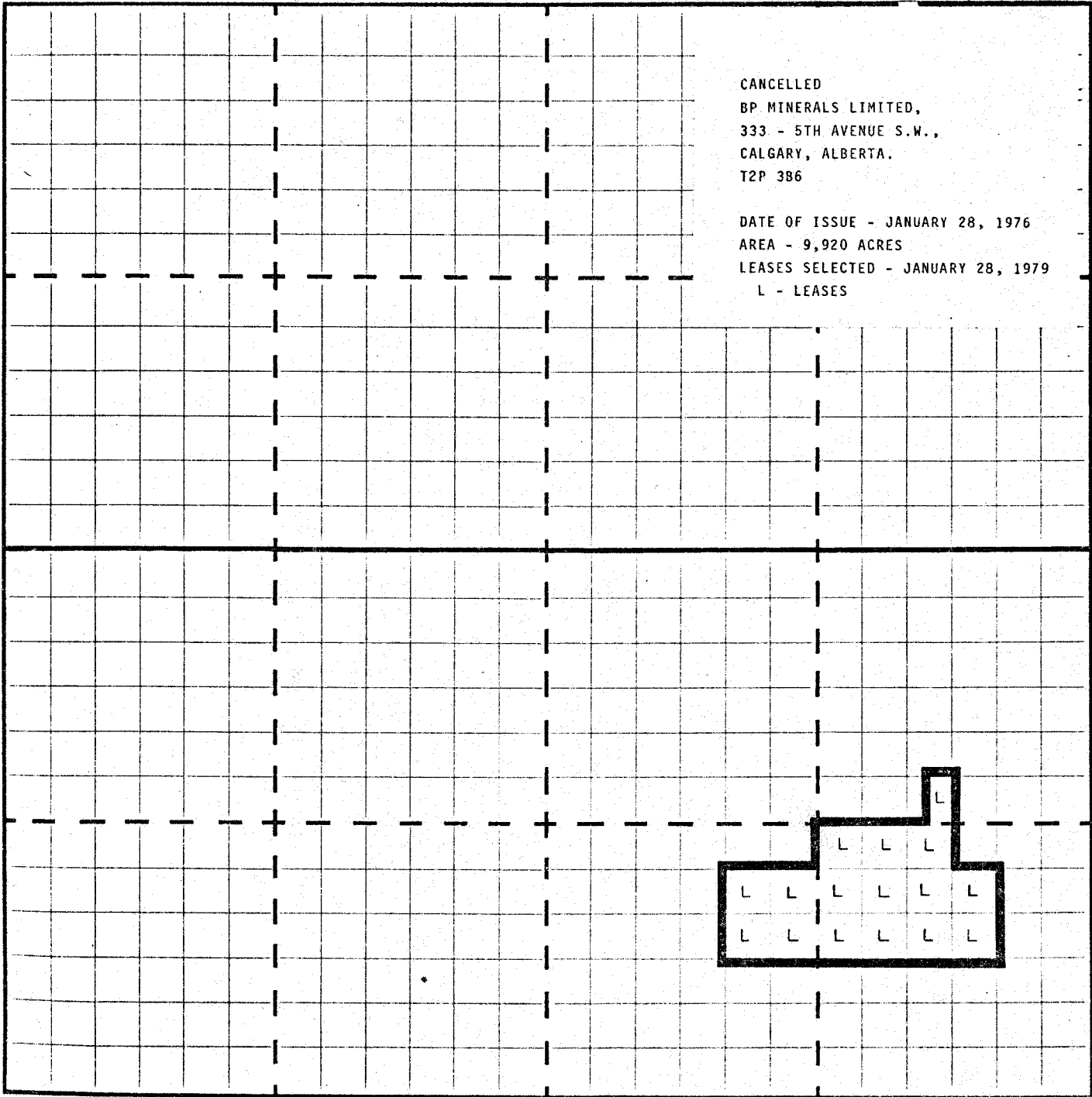
cc: Geological Survey of Canada  
Ontario Ministry of Natural Resources (MX 1/71(e))  
Dept. of Mines & Energy, Newfoundland (MX 1/71(c))  
Alberta Energy & Natural Resources (MX 1/71(a) - Reports)  
Dept. of Indian & Northern Affairs (MX 1/71(d))

P.O. Box 1046  
Ottawa, Canada  
K1P 5S9

C.P. 1046  
Ottawa, Canada  
K1P 5S9

*19780011*

# QUARTZ MINERAL EXPLORATION PERMIT No. 229



CANCELLED  
BP MINERALS LIMITED,  
333 - 5TH AVENUE S.W.,  
CALGARY, ALBERTA.  
T2P 3B6

DATE OF ISSUE - JANUARY 28, 1976  
AREA - 9,920 ACRES  
LEASES SELECTED - JANUARY 28, 1979  
L - LEASES

TP.

TP.

TP.108

TP.107

R.

R.

R.6

R. 5 W. 4 M.

19780011