N-Okay Mountain
80(1)A

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GEOLOGICAL REPORT OF OKAY MOUNTAIN

B.C. COAL LICENCES 6200 - 6214

DUNSMUIR AND NANOOSE LAND DISTRICTS

92 F1

BY

ALLISTER RAYMOND PEACH

PROJECT GEOLOGIST

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ESSO MINERALS CANADA - COAL
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CALGARY, ALBERTA

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INTRODUCTION

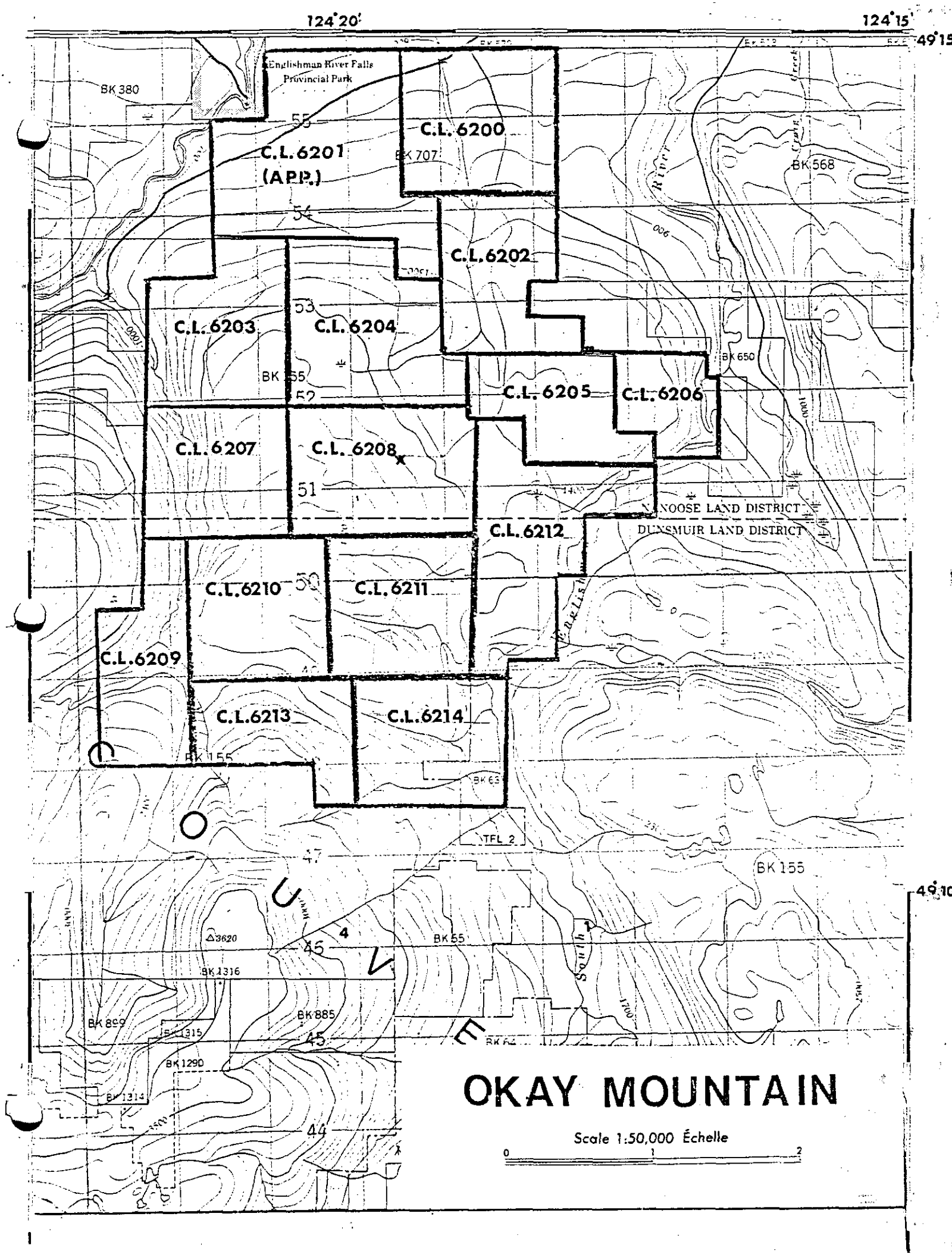
On July 30, 1980, Esso Resources Canada Limited was granted coal licences on a property called Okay Mountain. The property is located about 20 kilometres southwest of the town of Parksville on the east central coast of Vancouver Island (Map 1). Access to the property was by way of forestry roads owned by McMillan-Bloedel Northwest Bay Division.

The licences cover an area of 3276 hectares upon which there is an outlier of sediments of the coal-bearing Nanaimo Group.

In August 1980 a reconnaissance geological mapping program was conducted on the licenced area. A combined geological mapping and drilling program was completed in October and November of 1980. The drilling program consisted of 5 drillholes totalling 1096 metres, geophysical logging and reclamation. The drillholes were completed using a combination downhole hammer and rotary method. Geophysical logs used during the course of the program consisted of a coal combination sonde including gamma ray, long space density and caliper, focused electric log, sonic log and a dipmeter.

A thin (20 cm) intersection of very high ash coal was encountered in drillhole 11. Proximate analysis and a calorific value test was conducted on a sample of the coal (Appendix 6). Palynology and elemental spectrographic analysis were used to establish a correlation with the Comox Formation of the Nanaimo Group (Appendix 5).

The economic potential of the Okay Mountain is considered negative due to the absence of significant coal thicknesses and the apparently difficult structural geology.


124°20'
124°15'
49°15'
49°10'
Englishman River Falls Provincial Park
BK 380
C.L. 6200
C.L. 6201 (APP.)
BK 707
BK 568
C.L. 6202
C.L. 6203
C.L. 6204
BK 650
C.L. 6205
C.L. 6206
C.L. 6207
C.L. 6208
C.L. 6209
C.L. 6210
C.L. 6211
C.L. 6212
C.L. 6213
C.L. 6214
NANOOSE LAND DISTRICT
DUNSMUIR LAND DISTRICT
TFL 2
BK 155
BK 55
BK 1316
BK 885
BK 1315
BK 1290
BK 1314
BK 63
△3620
OKAY MOUNTAIN
Scale 1:50,000 Échelle
0
1
2

GEOLOGY

The Okay Mountain property is considered to be an outlier of Nanaimo Group sediments that exist between the Cumberland Coalfield and the Nanaimo Coalfield. Exposure on the property is considered moderate with outcrop occurring along ridges, access roads and streams. Glacial sediments form a thin (0-12 metres) veneer of cover throughout the area.

Five major stratigraphic units have been identified on the basis of drillhole and geological mapping data (MAP 2).

The Karmutsen Formation is assumed to be the oldest unit on the property. The lithology in drillholes 6, 11, 12 and 14 consist predominantly of dark to medium-green basalt. Light pink to cream colored felsic volcanic rocks occur in drillhole 2. Exposures of the Karmutsen formation are andesite to basalt in composition. Abundant pillow structures exist at location AP-11 and AP-12. Brecciated volcanics are found in the northwest portion of the property where faulting and intrusion are in evidence. The Karmutsen Formation is considered to be of the middle late Triassic period (Dolmage et al, 1973).

The second major stratigraphic unit on the property has been called the Island Intrusive Complex. The lithology consists mainly of fine to medium grained granite and granodiorite which is medium to light cream in color. Brecciated portions of the Karmutsen Formation have been incorporated into the intrusion in the northwest area. No evidence of the intrusion affecting Nanaimo Group sediments was found. The intrusion is considered to be of the late Jurassic to early Cretaceous period.

The Comox Formation is recognized as the oldest stratigraphic unit of the Nanaimo Group sediments. Its occurrence both in outcrop and drillholes 11, 12 and 14 on the western half of the property, indicates

it is the basal unit and was deposited upon basement rocks consisting of both volcanic rocks of the Karmutsen formation and igneous rocks of the Island Intrusive Complex.

The lithology consists predominantly of moderate grey to buff arkosic to lithic sandstone, minor pebble conglomerate and dark grey to black siltstone and shale. A thick (30 metres) unit of polymictic conglomerate was intersected in drillhole 12. This unit forms the basal sedimentary unit in this drillhole and is composed mainly of grey to green volcanic and igneous fragments. The conglomerate is considered to be equivalent to the Benson conglomerate which occurs as an intermittent basal lithology of the Comox Formation in both the Cumberland and Nanaimo basins.

The thickness of the Comox Formation ranges from 43 metres to 212 metres as intersected in drillholes 14 and 12 respectively. Continuous outcrop to estimate thickness was scarce.

Bedding orientation trends northeasterly with dips of 3° to 12° southeasterly on the west flank and central portion of the property. Bedding trends southeasterly and dips northeasterly 5° to 12° on the south flank. Bedding at one location (AP-4) strikes southeasterly and dips 70° to the northeast. This outcrop exists on the edge of an escarpment and structure is considered to be fault related.

Locally along the northwest margin and in the central area, the Comox formation appears 'baked' indicating low grade metamorphism. The occurrence of two northeasterly trending felsic dykes with vertical orientation intruding sandstone at AP-12 and one felsic sill intruding sandstone and pebble conglomerate 0.6 kilometres northeast of outcrop AP-1 indicate post-depositional tectonism which may have resulted in localized areas of intrusion and metamorphism. Faulting and northeasterly and southeasterly trending vertical jointing (AP-12) gives further indication of post-depositional structural events.

The contact between the Comox Formation and underlying basement rock is unconformable. (Drillhole 11, 12 and 14 and outcrop AP-12). Analysis of shale and a thin (20 cm) coal occurrence indicate deposition in a non-marine delta plain environment. The coal was composed entirely of wood fragments in a deposit of rafted wood. The shale contained spores and pollen that were thermally altered. (Pocock, 1980 pers. comm.). Plant fossils and unidentified ammonoid fossils were located at AP-4.

An Upper Cretaceous age is indicated from spores in the shale and elemental spectrographic analysis for the shale correlates to similar analysis for the Comox formation along the Trent River (Pocock, 1980: pers. comm. Appendix 5).

The Haslam Formation occurs in outcrop on the southwestern corner of the property. A minor occurrence exists along a fault in the northeastern corner of the map area. Intersections of this formation occur in all drillholes.

The lithology of the Haslam Formation consists of dark grey to black siltstone and shale and is considered marine in origin. Locally the formation consists of very hard, dark grey to green argillite (Drillholes 2 and 6).

Thickness of the Haslam Formation ranges from 29 metres to 118 metres as intersected in drillholes 11 and 12 respectively.

Bedding orientation of the formation was determined to be striking 140° to 150° with dips 10° to 18° northeasterly. Dipmeter logs for drillholes 11 and 12 show bedding dip to be 5° to 12° with a north-northeasterly orientation.

The contact relationship of the Haslam Formation to the underlying lithologies is variable. The formation in the northeastern and eastern portions of the property directly overlies the basement volcanic of the Karmutsen Formation (drillholes 2 and 6). The contact between the

Haslam and Karmutsen Formations is unconformable (Section B-B' Appendix 3).

The contact between the Haslam Formation and the Comox Formation in the west and southwest sectors of the property is transitional and conformable (drillholes 11, 12 and 14).

The Extension-Protection Formation is the youngest stratigraphic unit found on the property. It occurs on the eastern part of the property and is preserved as a down faulted block of sediments and associated basement rock.

The lithology of the Extension-Protection Formation consists of buff to grey brown lithic to feldspathic sandstone and minor grey siltstone.

The thickness of the Extension-Protection Formation ranges from 82 to 163 metres as intersected in drillholes 2 and 6 respectively. The lower 25 metres contains more grey siltstone and shale beds and is considered to be transitional from the Haslam formation below.

Bedding orientations on the east central part of the map area had strike ranges of 10° to 30° with westerly dips of 5° to 6°. In the northeast corner strikes ranged from 150° to 170° with dips of 7° to 12° northeasterly.

GEOLOGICAL HISTORY

The geological history of the Okay Mountain property appears to be rather complex. Based upon previous geological investigation (Dolmage et al, 1973), volcanic activity in the middle to late Triassic period deposited the Karmutsen Formation, a predominatly basic volcanic rock. Minor occurrence of felsic volcanics (drillhole 2) are indicative of more than one stage of vulcanism. The unit likely formed a positive relief area and became a source for sediments through various erosional agents.

A second stage of tectonic activity occurred during the late Jurassic to early Cretaceous period (Buckham 1947). Granite and granodiorite, called the Island Intrusive Complex, intruded the existing volcanic rocks encorporating fragments of basalt and andesite. Faulting likely accompanied the intrusive stage.

Through erosion and/or graben faulting an elongate geosynclinal basin, presently oriented to the northeast, was formed. This event likely occurred in the early to middle Cretaceous period.

Terrestrial sediments called the Comox Formation with provenance that included the Karmutsen Formation and Island Intrusive Complex, were deposited likely in a fluvial-deltaic sedimentary sequence.

Through a marine transgression or subsidence of a delta region the marine sequence called the Haslam Formation was deposited. Due to the erosional nature of the marine environment, areas existed where deltaic sediments of the Comox Formation were eroded and marine sediments were deposited directly upon the basement rocks. In other areas of the basin the erosional forces of the marine trangression did not eliminate the deltaic sequence and marine sediments were deposited upon remnant terrestrial deposits.

Through a marine regression or a progradation of deltaic material, fluvial-deltaic sedimentation reoccurred with the deposition of the Extension-Protection Formation upon the underlying marine and terrestrial sedimentary sequence.

Subsequent tectonic activity in the post Cretaceous time span caused graben faulting and associated dyke and sill intrusion. As a result of the intrusive series, areas of the existing sedimentary sequence became slightly metamorphosed creating the "baked" feature of the sandstone of the Comox and Extension-Protection Formations and the localized slatey features of the Haslam Formation. Faulting caused the geological configuration of various contacts between sedimentary and non sedimentary rocks.

Erosional features through geological history have resulted in the presently existing geological configuration.

DRILLING SPECIFICATIONS

Two drilling rigs were utilized during the drilling phase of exploration on the Okay Mountain property. The contractors and specifications regarding each rig are listed below.

Ken's Drilling Limited, Brentwood Bay, B.C.

Canadian Pneumatic T-650 w

- 450 C.F.M. at 250 P.S.I.
- 30,000 pounds pull down capacity
- 36,000 inch pounds of rotary torque
- Drill-Thru casing hammer model 662
- Downhole hammer and rotary capabilities

En-Air Drilling Ltd. Calgary, Alberta (subcontracted through Ken's Drilling Ltd.)

Schramm T685H Rotadrill

- 850 C.F.M. at 350 P.S.I.
- 35,000 pounds pull down capacity
- 41,000 to 89,500 in lbs. constant torque
- Downhole hammer and rotary capabilities

List of Expenditures

Drilling	$ 49,147.00
Bits	7,907.00
Casing	237.00
Fuel	4,385.00
Geophysical Logging	11,068.40
Accomodation	3,589.00
Rental Vehicles and Repairs	5,812.00
Reclamation	637.00
Land Use	1,000.00
Travel	2,417.00
Analysis	104.00
	$ 86,303.40

CONCLUSION

The area encompassing the coal licenses (6200-6214) called Okay Mountain was investigated using a reconnaisance geological mapping and exploration drilling program.

The occurrence of a sedimentary sequence of Nanaimo Group lithologies was confirmed. The geological history of the area is complex with faulting and intrusion and subsequent erosion creating the present geological setting.

A rafted coal deposit was found in one locality but its continuity was limited. The absence of a continuous coal seam combined with a complex tectonic history of the property negates its potential as a economical coal occurrence and as of July 30, 1981 it is recommended that the licenses be dropped.

References

Buckham, A.F.
1947b — Preliminary map, Nanaimo Coal Field; Geol. Surv. Can., Paper 47-22

Dolmage, Campbell and Associates
1973: — Report on Reserves and Mining Costs of the Comox Coalfield, Vancouver Island; B.C. Dept. Mines Open File CX-COMOX-73(6)A

Muller, J.E. and Jelitzky, J.A.
1970: — Geology of the Upper Cretaceous Nanaimo Group, Vancouver Island and Gulf Islands, British Columbia; Geol. Surv. Can., Paper 60-25

Muller, J.E.
1977: — Geology of Vancouver Island Geol. Surv. Can. Open File 463

Statement of Author's Academic and Professional Qualifications

I, Allister Raymond Peach, received a Bachelor or Science degree from the University of New Brunswick on May 19, 1977. The degree consisted of a major in Geology with curriculum concentration on Stratigraphy and Sedimentary Geology.

My professional qualifications include 2 years and 5 months, commencing May 1977, as a Testhole Geologist with the Carboniferous Drilling Project, a federal-provincial project exploring for coal in the Pennsylvanian age strata of New Brunswick. Since October of 1979 I have been employed as a geologist with Esso Minerals Canada. My experience with E.M.C. includes coal exploration in the west central foothills of Alberta and on Vancouver Island in British Columbia.

Allister Raymond Peach

Allister Raymond Peach

RECONNAISSANCE GEOLOGY FIELD NOTES

OKAY MOUNTAIN

AP1 - Sandstone, arkosic - feldspathic, fine to medium grained. Light brown fresh/weathers dark brown in color. Cross bedded. No bedding orientation possible, contains abundant plant fossil fragments (1-2 cm x 0.25-0.50 cm) and ovoid to round concretions, calcareous and very resistant.

Outcrop occurs in road bed and on south side of road.

AP2 - Sandstone, arkosic - feldspathic, medium grained. Light brown fresh/ medium to dark brown weathered. Bedding $120^{0}/7^{0}$ NE. Crossbedding orientation not possible.

Outcrop on and alongside of road.

AP3 - Sandstone, very silty, very fine grained medium grey fresh/grey-brown weathered, massive. Outcrop on roadside.

AP4 - Sandstone, feldspathic, fine to medium grained, light grey fresh/ weathered light grey-brown. Very hard (baked?) bedding $126^{0}/70^{0}$ S badly fractured. Plant fossils including small fragments (30 cm x 4 cm) removable fossil. Outcrop runs on N side of road. Deep gully to N of outcrop detailing possible fault zone. Crinoid stems and ammonite present, fresh weathers.

AP5 - Sandstone, feldspathic, fine grained brown/brown. Massive. Outcrop on south side of road.

AP6 - Sandstone, feldspathic, medium grained light brown fresh/dark brown weathered massive. Outcrop along road bed.

AP7 - Sandstone, feldspathic, medium grained dirty, massive. Medium brown fresh, dark brown weathered. Bedding $118/5^{0}$ N cross bedding $140^{0}8^{0}$ N. Abundant plant fossils.

AP8 - Sandstone, feldspathic? fine to medium grained, very dirty. Weathers dark reddish brown, medium brown fresh. No orientation possible. Outcrop on roadside.

AP9 - Same as AP8. Very massive not as dirty.

AP10 - Same as above

AP11 - Outcrop is covered with variable sizes (15 x 20 to 50 x 80 cm) ovoid structures. They are in concentric layers and appear concretionary. However they are soft but very heavy. Possible pillow lava structures. Remainder of outcrop is fine to medium grained or similar composition. Sample taken.

AP12 - Outcrop has volcanics, intrusives and sediments. Sediments are medium grained light grey sandstone feldspathic in comp. Bedding is slightly variable but average is $110^{0}/12^{0}$ NE. Sediments appear to overlie the volcanics. Volcancis are dark grey fairly weathered pillow structure. Soft to make the remainder appear sedimentary.

AP12 continued

Pillows variable in size. Medium grained feature would suggest slow cooling and possibly suggest subaquaeous cooling. Both units have been intruded by dykes (2 observed). Composition appears dacite. Very fine grained. One type about 30 cm wide and trends 040° and is nearly vertical. The other appears coarser grained with some quartz eyes with similar trend. Sample of finer grained natural taken. Jointing trend similar to dyke orientation (possible correlation?) Crinoid fossil found.

AP13 - Similar pillow type structure, not sure of composition. Appears overlain by sandstone. Minor plant fossils.

AP14 - Similar pillow type very heavy, massive abundant. Appears to be volcanic nature. Badly weathered and very soft.

AP15 - Massive brown feldspathic sandstone

AP16 - Sandstone, feldspathic light brown fresh/weathered red-brown, massive

AP17 - Same as above

AP18 - Volcanic - red dirty pillowed rhyolite? Very dense too dense for sediment, weathered badly

AP19 - Volcanic - medium grey mafic felsic pillowed structure

AP20 -Same as above

AP21 - Mafic volcanic, dull grey very dense and weathered pillowed structure

AP22 - Medium grained feldspathic sandstone weathers yellow brown/fresh grey brown. No orientation possible. Outcrop on road bed.

AP23 - same as AP22

AP24 - Medium grained feldspathic sandstone weathers brown/grey brown fresh Bedding 120°/6° NE. Matrix very fine grained sandstone to siltstone.

AP25 - Medium grained feldspathic sandstone weathers rusty brown/grey brown fresh. Massive with no orientation possible.

AP26 - Medium to coarse grained cross-bedded feldspathic sandstone cross-bedding trends 100°15° N. Bedding 116°/10°NE

AP27 - Medium - coarse sandstone - feldspathic, weathers light grey brown/ red grey brown fresh. Outcrop along ridge. Cross bedded sandstone, Bedding 146°8° NE and 110°12° NE cross bedding 220°-200° and 12°-20° NE.

Jointing 110 near vertical
020 near vertical

APPENDIX 2

Hole # 6 , Prospect Okay Mtn. Vanc. Island

Elevation 1500' A.S.L.

Latitude 49° 12' 8" , Longitude 124° 18' 58"

Date Oct. 18-21/80 , _____

Total Depth 842 Feet

Depth (ft)	Lithology	Color	Grain Size
0-6	Glacial Material	Brown	Coarse
6-200	Sandstone	Med. to Dk. Grey (Last 10' of interval is Reddish Grey	Medium to Fine
200-220	Siltstone	Reddish Grey	Fine
220-320	Sandstone	Med. to Dk. Grey	Medium to Coarse
320-335	Siltstone	Reddish Grey	Fine
335-340	Sandstone	Dk. Grey	Coarse
340-410	Shale	Green (w/minor Reddish intervals)	Fine
410-455	Siltstone	Red-Grey	Fine
455-485	Sandstone	Grey	Medium
485-577	Siltstone/Shale Intercalations	Green	Medium to Fine
577-605	Argillite	Green	Fine
605-625	Siltstone	Grey	Fine
625-810	Argillite	Dk. Green	Fine
810-842	Gabbro (Basement)	Dk. Green	Fine to Medium

T.D. 842 Feet

Hole # 11 , Prospect Okay Mtn. Vanc. Island
Elevation 1800' A.S.L.
Latitude 49° 10' 57" , Longitude 124° 19' 45"
Date Oct. 22-24/80 ,
Total Depth 850 Feet

Depth (ft)	Lithology	Color	Grain Size
0-25	Glacial Material	Brown	Coarse
25-105	Slate	Dk. Grey to Black	Fine
105-152	Shale	Green Grey to Grey	Fine
152-572	Sandstone	Med. To Dk. Grey	Medium
572-595	Shale	Dk. Grey to Black	Fine
595-650	Sandstone	Lt. Grey to Med. Grey/brown	Fine to Medium
650-705	Shale	Dk. Grey to Black	Fine
705-790	Sandstone	Med. Grey	Medium to Fine
790-850	Gabbro	Green	Fine
T.D. 850 Feet			

Hole # 12 , Prospect Okay Mtn. Vanc. Island

Elevation 2400' A.S.L.

Latitude 49° 10' 29" , Longitude 124° 20' 52"

Date Nov. 6-9/80 ,

Total Depth 1105 Feet

Depth (ft)	Lithology	Color	Grain Size
0-364	Siltstone	Med. Grey to Grey-Brown	Fine
364-985	Sandstone	Lt. Grey (Salt & Pepper) to Med. Grey	Medium to Fine
985-1080	Polymictic Conglomerate	Grey-Green	Fine
1080-1090	Sandstone	Emerald Green	Medium
1090-1105	Altered Gabbro (Basement)	Emerald Green	Medium

T.D. 1105 Feet

Hole # 14 , Prospect Okay Mtn. Vanc. Island

Elevation 950' A.S.L.

Latitude 49° 14' 57" , Longitude 124° 20' 00"

Date Nov. 5-7/80 , _____

Total Depth 432 Feet _____

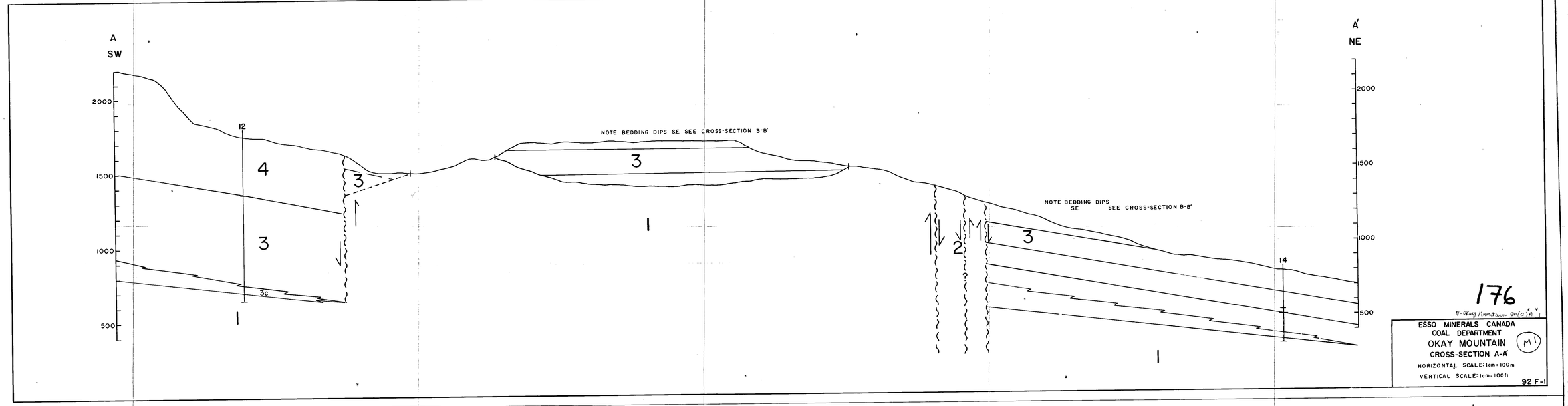
Depth (ft)	Lithology	Color	Grain Size
0-36	Glacial Material (Clay, Sand & Rock)	Brown	Medium
36-280	Shale	Med. To Dk. Grey	Fine
280-407	Sandstone	Light to Med. Grey	Medium
407-432	Feldspathic Igneous Intrusive	Light To Dk.	Medium

T.D. 432 Feet

Hole # 2 , Prospect Okay Mtn. Vanc. Island
Elevation 1160' A.S.L.
Latitude 49° 13' 44" , Longitude 124° 18' 40"
Date Oct. 16-17/80 , November 10, 1980
Total Depth 395 Feet

Depth (ft)	Lithology	Color	Grain Size
0-213	Sandstone	Lt. Grey (Salt & Pepper to White	Fine
213-215	Shale	Green	Fine
215-269	Sandstone	Lt. Grey	Fine
269-343	Shale (With Minor Grey Siltstone)	Green	Fine
343-385	Argillite	Dark Green	Fine
385-395	Felsic Volcanics	Cream to Lt. Pink	Fine

T.D. 395 Feet



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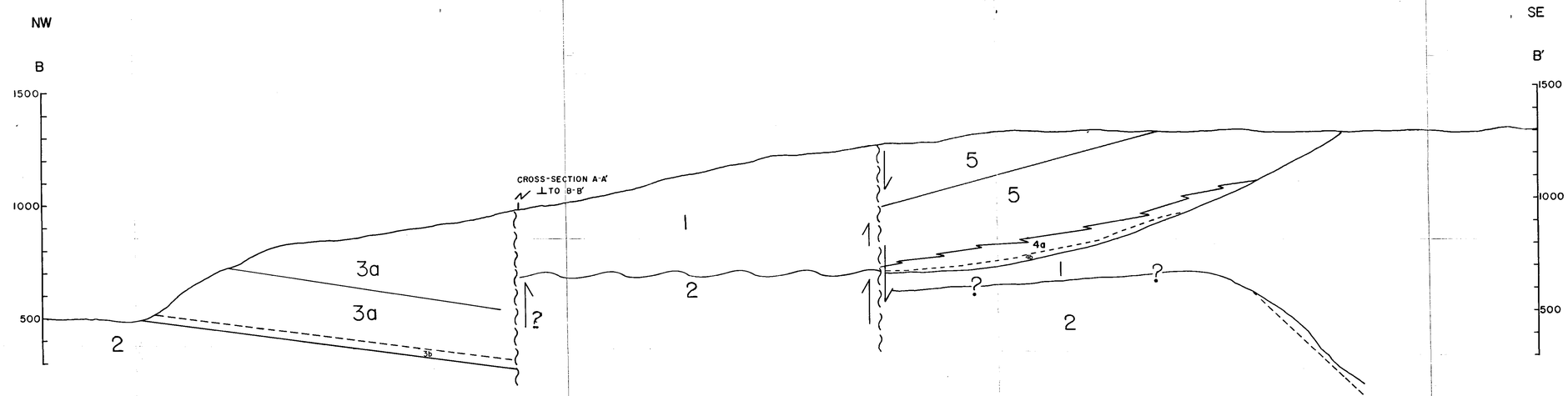
N-Okay Mountain 50(a)(i) 4

ESSO MINERALS CANADA
COAL DEPARTMENT
OKAY MOUNTAIN
CROSS-SECTION A-A'
HORIZONTAL SCALE: 1cm = 100m
VERTICAL SCALE: 1cm = 100m
92 F-1

OKAY MOUNTAIN CROSS-SECTION A-A' 92F-1



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ESSO MINERALS CANADA
COAL DEPARTMENT
OKAY MOUNTAIN
CROSS-SECTION B-B'
HORIZONTAL SCALE: 1cm = 100 m
VERTICAL SCALE: 1cm = 100 ft
92 F-1

OKAY MOUNTAIN CROSS-SECTION B-B', 92F-1

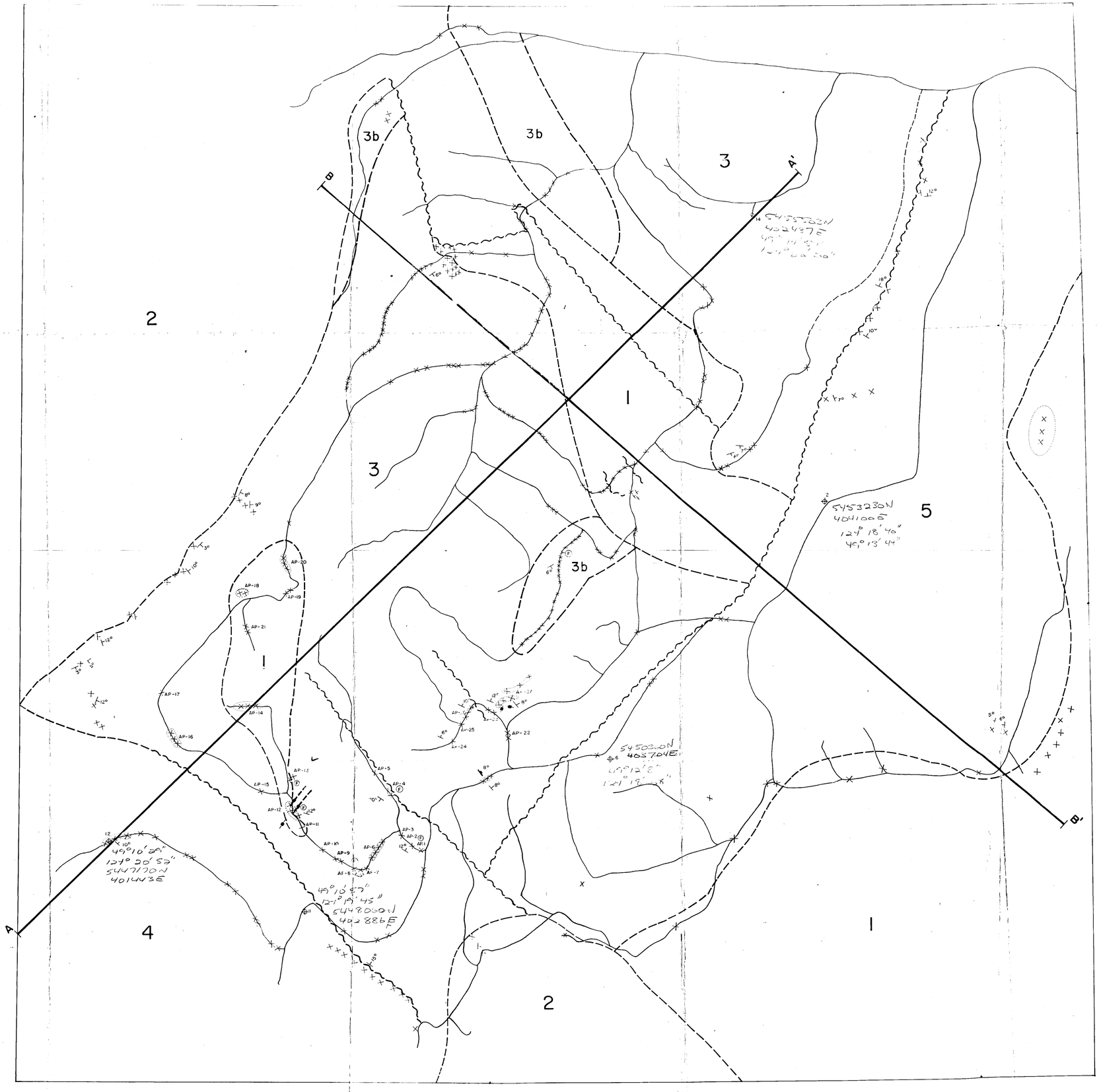

TABLE OF FORMATIONS

5	EXTENSION - PROTECTION FORMATION	BUFF TO GREY BROWN LITHIC TO FELDSPATHIC SANDSTONE, MINOR SILTSTONE
4	HASLAM FORMATION	4a : DARK GREY TO BLACK SHALE AND SILTSTONE 4b : DARK GREY GREEN TO BLACK ARGILLITE
3	COMOX FORMATION	3a : BUFF TO GREY LITHIC TO FELDSPATHIC SANDSTONE, MINOR SILTSTONE AND CONGLOMERATE 3b : METAMORPHOSED FELDSPATHIC SANDSTONE 3c : LITHIC PEBBLE TO COBBLE CONGLOMERATE POSSIBLY BENSON FM.
2	ISLAND INTRUSIVE COMPLEX	GRANODIORITE AND GRANITE
1	KARMUTSEN FORMATION	ANDESITIC TO GABBROIC VOLCANICS, ABUNDANT PILLOW STRUCTURES

LEGEND

- OUTCROP
- AP-2 OUTCROP WITH DETAILED DESCRIPTION (SEE APPENDIX)
- 6° BEDDING - DIP
- FAULT
- JOINTING
- SILL
- DYKE
- INFERRED CONTACT
- FOSSIL LOCATION
- DRILLHOLE
- A — A' CROSS-SECTION LINE

1 0 1 2
1:10,000

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N-Okay Mountain 50(1)A

ESSO RESOURCES CANADA LIMITED
COAL DEPARTMENT

OKAY MOUNTAIN
GEOLOGICAL MAP

AUGUST 1981

92-F-1

M E M O R A N D U M

ESSO RESOURCES CANADA LIMITED
RESEARCH DEPARTMENT

1980 11 24

Mr. A.R. Peach
Minerals - Coal

Samples from Vancouver Island

The two samples sent to Dr. Staplin for determination have been passed to me for examination. Both appear to be rolled and to have suffered surface weathering, possibly on a beach. Microscope examination yielded the following results:

Coal

This sample is entirely composed of wood fragments (65% structured wood fragments and 35 % charcoal). It contains no spores or pollen and probably represents a deposit of rafted wood in a delta-plain environment. Such deposits are common in meander cores and, when fossilised, frequently form lenticular coals of limited areal extent.

Shale

This shale contains an organic residue including 70% of biodegraded (rotted) vegetable material and 1% charcoal. Some spores and pollen are present, but they have been thermally altered and somewhat leached, making identification difficult. The following were recognised:

Podocarpidites sp.
Deltoidospora spp.
Fungi and fungal spores
Taxodiaceaepollenites spp.
Proteacidites sp.

The shale appears to represent a non-marine, lower flood plain deposit. Apart from indicating a general Upper Cretaceous age, the flora gives no accurate indication of age for either sample.

Elemental Spectrographic Analysis

Chemically, the coal appears to be characterised by the presence of high silica, sulfur, calcium, titanium, nickel and copper. The organic residue from the shale is similar, but lacking in the high

proportion of silica and calcium. Chlorine in both analyses appears to be probably due to contamination of the sample with sea-water. These analyses match those from samples from the Comox Formation, exposed along the Trent River and, particularly at Haslam Creek, west of Storms (49°8'N - 123°54'W) (see analysis of sample 42-208 attached). Coals and residues from shales of the Protection Formation are much less rich in silicon, sulfur and titanium (see analyses #3150 and #3151).

From these results correlation of this coal with the upper part of the Comox Formation (see section 8 in the attached section) appears probable.

Stanley A.J. Pocock

SAJP/bm
Attach.
xc: R. Sarmiento


VAN. ISLE. (COAL) Z=00
PR= 200KI 98SEC 200000 INT
V=1024 H=10KEV 1:1H AQ=10KEV 1H
80-11-20
CL
S
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AL P K CA
NI
FE CO ZN
MO
NI
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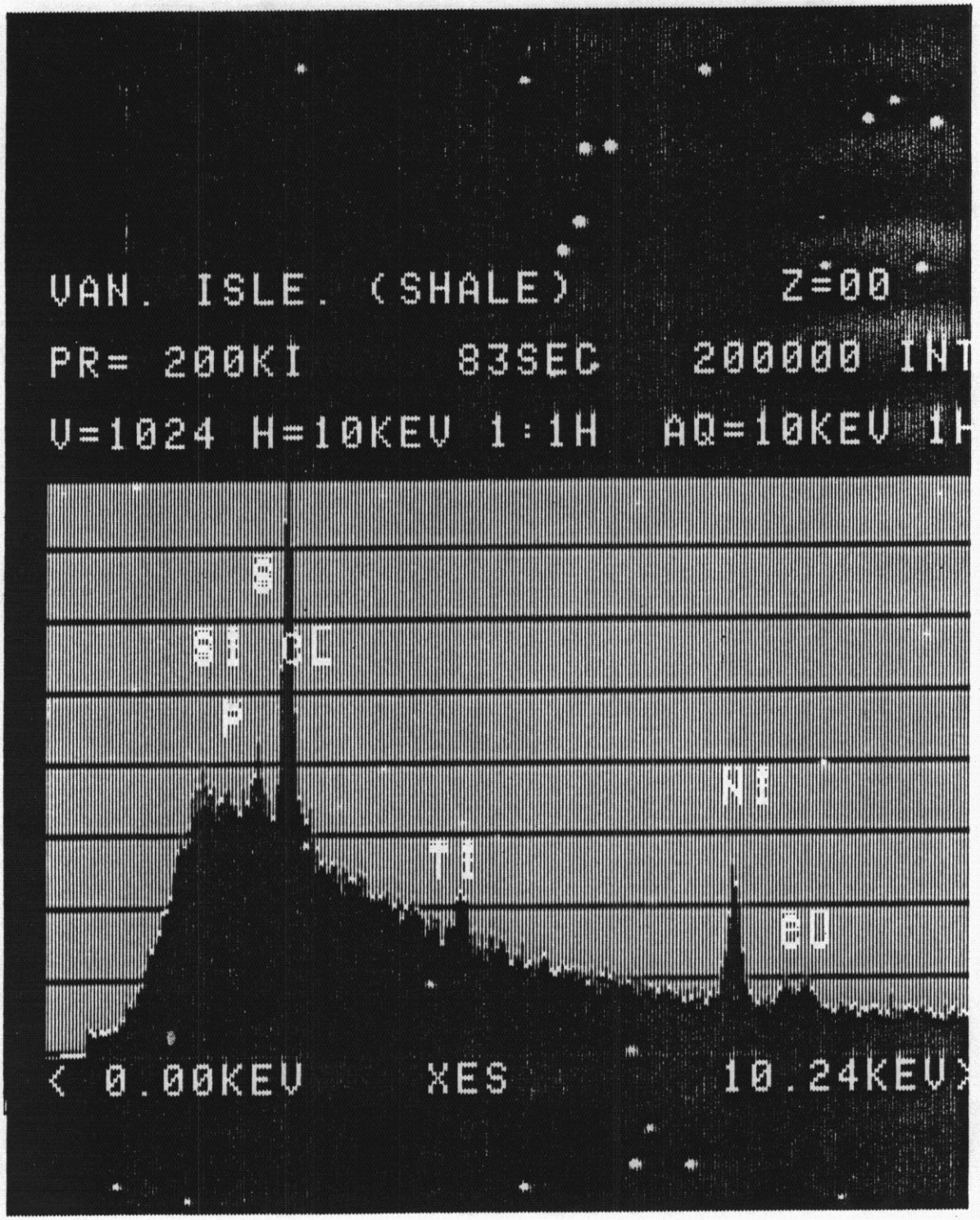
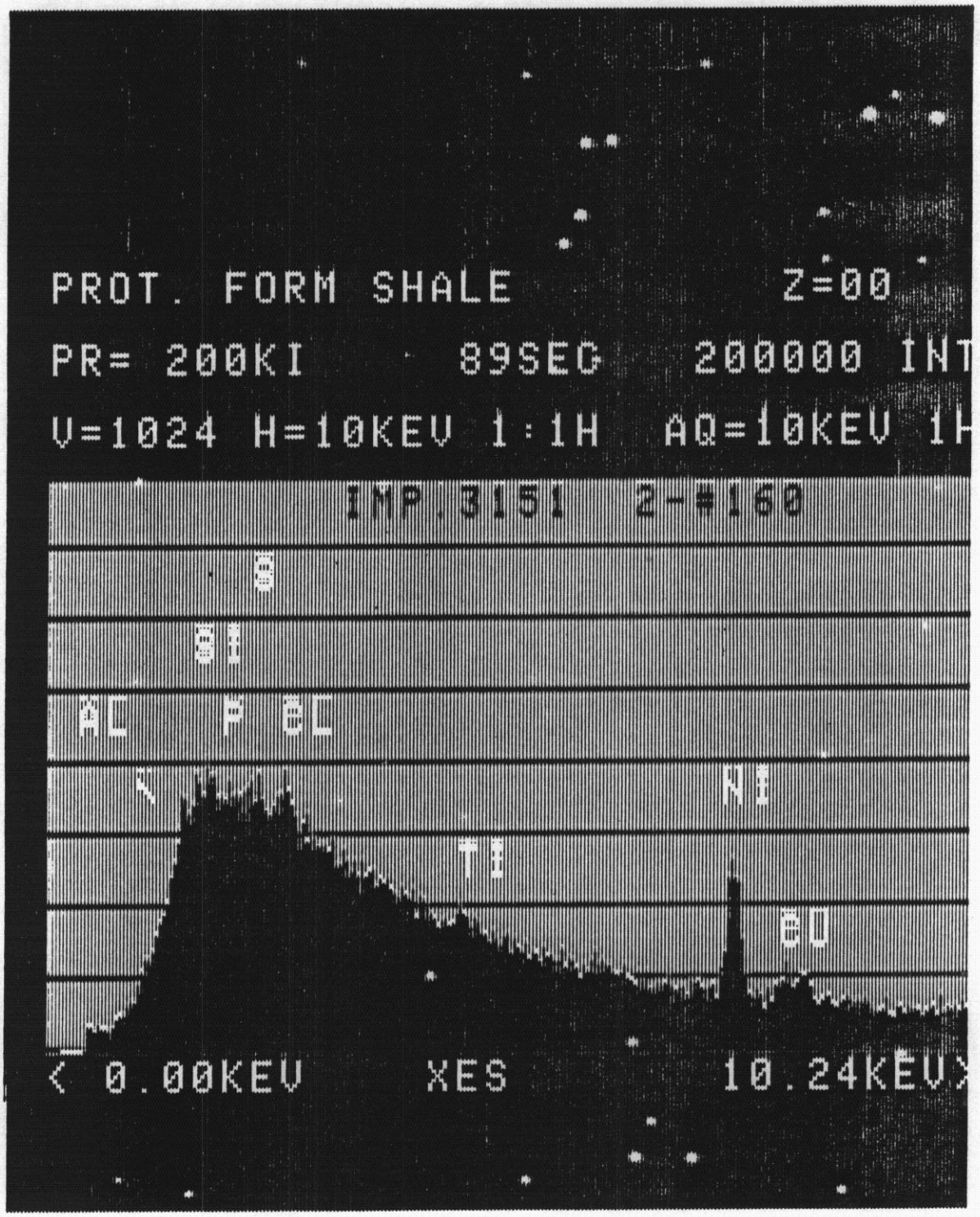
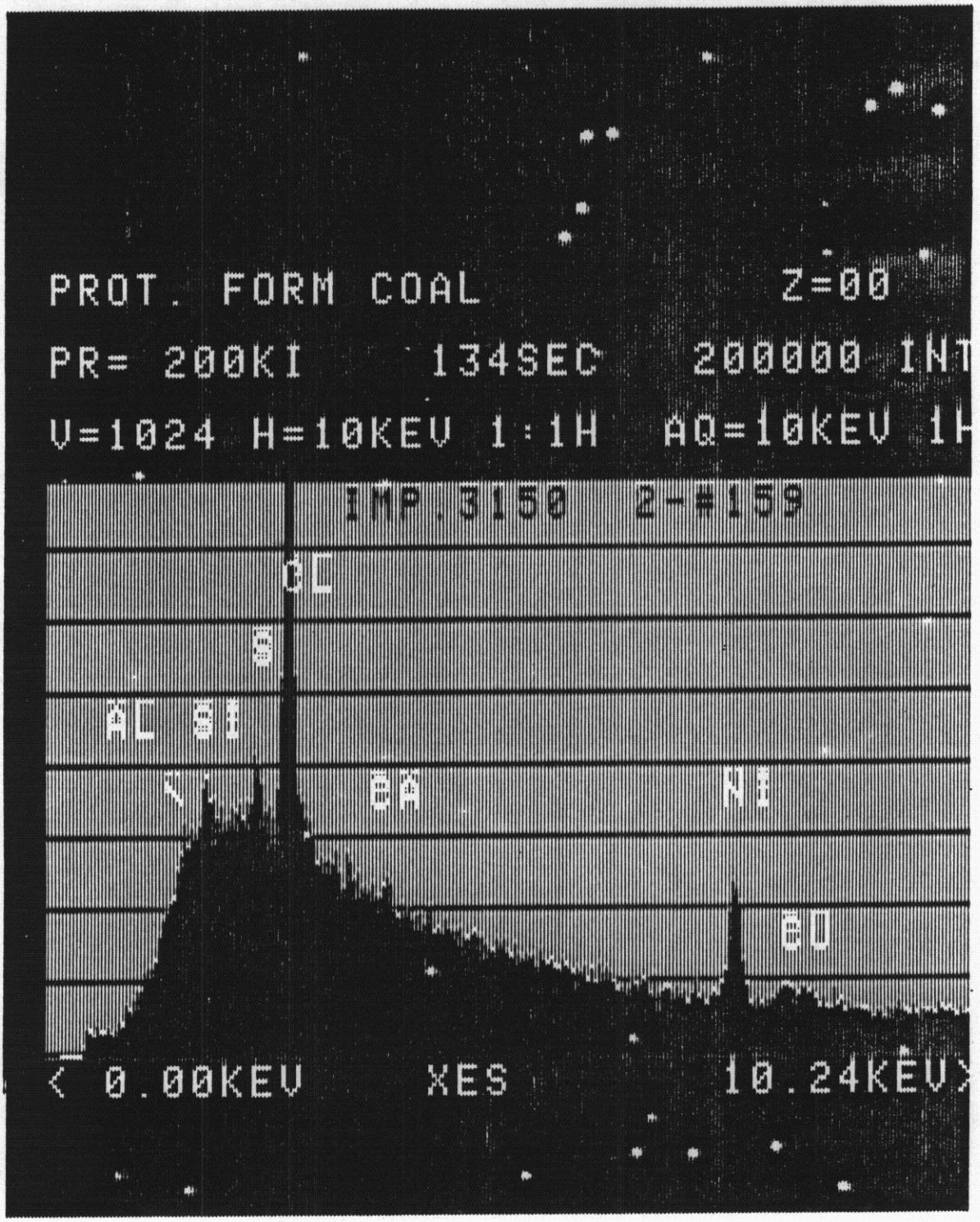

VAN. ISLE. (SHALE)
Z=00
PR= 200KI
83SEC
200000 INT
V=1024 H=10KEV 1:1H
AQ=10KEV 1H
Si
Fe
Ni
Ti
Ca
0.00KEV
XES
10.24KEV


COMOX FORMN. 42-208 Z=00
PR= 200KI 80SEC 200000 INT
V=1024 H=10KEV 1:1H AQ=10kEV 1H
< 0.00KEV XES 10.24KEV>


PROT. FORM SHALE Z=00
PR= 200KI 89SEC 200000 INT
V=1024 H=10KEV 1:1H AQ=10KEV 1H
IMP.3151 2-#160
Ca
Si
AL P CL
Fe
Ti
Ni
Cu
< 0.00KEV XES 10.24KEV>


PROT. FORM COAL Z=00
PR= 200KI 134SEC 200000 INT
V=1024 H=10KEV 1:1H AQ=10KEV 1H
IMP.3150 2-#159
CL
S
AL SI
CA
NI
EU
< 0.00KEV XES 10.24KEV>

ESSO MINERALS CANADA

ATTN: A. Peach

LORING LABORATORIES LTD.

CERTIFICATE of COAL TESTING

FILE NO.: 20557

DATE: November 7, 1980

P.O. # 02-S-766632

SAMPLE NO.	IDENTIFICATION	SAMPLE TYPE	% RECOVERY			REC'D % H_2O	% H_2O	% VCL MATTER	% ASH	% FIXED CARBON	% S	BTU /LB.	F.S.I.	
			SINK	FLOAT										
VI-1		Raw Coal			As Received	1.27	[illegible]	14.71	70.80	13.22	2.62	3,245		
					Air Dried	[illegible]	0.63	14.81	71.26	13.30	2.63	3,266		
					Dry Basis	[illegible]	[illegible]	14.90	71.71	13.39	2.65	3,287		

D Ereland

To: ESSO MINERALS CANADA,
Coal Dept.,
[illegible] - 6th Avenue S.W.,
Calgary, Alberta T2P 0S1
ATTN: A. Peach

File No. 20557
Date November 7, 1980
Samples Coal
P.O. # 02-S-766632

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	% H2O	% C	% H	% N	% Ash	% S	% O (diff)
"Ultimate Analysis" "Air Dried"							
VI-1	0.56	18.90	1.81	0.20	71.31	2.64	4.58

* Hydrogen value includes hydrogen from H2O.

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

D. Eyles

Assayer

BOREHOLE #2
CLIENT ESSO RESOURCES LTD
AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 17/10/80

DEPTH SCALE 200:1

1 OF 1 LOGS

N-Okay Mountain 80(3)A

COAL LITHOLOGY LOG

SONDE TYPE:
COAL COMBINATION SONDE

LOG SUITE:
GAMMA RAY
L.S. DENSITY
CALIPER

BOREHOLE DATA

	BPB	DRILLER
PERMANENT DATUM	GROUND LEVEL	
ELEVATION OF P.D.	GROUND LEVEL	
MEASUREMENTS FROM	GL	GL
DEPTH REACHED	103.5m	103.9m
CASING SHOE	4m	
BIT SIZES	1 TO	2 TO
	3 TO	4 TO
CASING SIZES	1 TO	2 TO

FLUID DATA

NATURE	WATER QUIK FOAM
SG	
LEVEL	18m
VISCOSITY	
Rm at meas temp	
BHT	

OPERATION DATA (11)

FIRST READING	103m
LAST READING	0
INTERVAL LOGGED	103m
UNIT-TRUCK No.	24/42
ENGINEER	DM/RB
WITNESS	

176

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	TC SECS	NORM	CAL COEFF	FROM	TO	INTERVAL	SEAM LOG RUN
CCS	101	5822												
GAMMA RAY			292	Y	9m/M	R	9m/M	1	-	1.5	103	0	103m	
L.S. DENSITY	SIDEWALL POSITION		5985	Y	9m/M	R	9m/M	1	7.3	-	104	1	103m	
CALIPER				Y	9m/M	R	9m/M	.3	-	-	104	1	103m	

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM		INTERVAL TOTAL
TO		
INTERVAL		

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
117	FE	200:1	--

REFER TO ADDITIONAL HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. 91 VALUE 292 @ 2 DIAM	JIG CAL DATE 17/10/80	g/cm³	7 ins 820 cps
JIG MARK SHOWN AT ABOVE VALUE - 10	JIG No 002 SPAN 1200 NORM SDL/CPS 7.3		2 ins 312 cps

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

HOLE SIZE CORRECTION DATA

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

BOREHOLE #2 AREA OKAY MOUNTAIN
CLIENT ESSO RESOURCES LTD. COUNTRY CANADA

COAL LITHOLOGY LOG

MY A50261 R

FOCUSSED ELECTRIC LOG

BOREHOLE # 2
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 21/10/80
DEPTH SCALE 200:1
SHEET 2 OF 2 LOGS

BOREHOLE DATA

PERMANENT DATUM GROUND LEVEL
ELEVATION OF PD 0 m
LOG MEASUREMENTS FROM GL
DEPTH REACHED 105.2m
BIT SIZES 1 3" TO 6" TO TD
2 4½" TO TD
CASING SIZES 1 10" TO TD
2 TO
CASING SHOE GL
DRILLER 103.5m

FLUID DATA

SOURCE WATER/QUIK FOAM
S.G.
LEVEL 15m
VISCOSITY
PH
RM @ MEAS TEMP
BHT

OPERATION DATA

FIRST READING 16m
LAST READING 15m
TIME STARTED
TIME FINISHED
UNIT + TRUCK No. 24/02
ENGINEER D. MACKENZIE
WITNESS

L3

79

Okay Mountain 68(3)A #1

EQUIPMENT AND RECORDING DATA

LOG	EQUIPMENT			TAPING			PANEL		CAL COEFF	DEPTHS		
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C. SECS	NORM	FROM	TO	INTERVAL
FE	117	-	-	Y	5m/M	D	5m/M	.3	-	104	15	89m

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
101	CCS	200:1	20:1

REFER TO ADDITIONAL HEADINGS

REMARKS

FOCUSSED ELECTRIC LOG RUN 2
FULL DAYS AFTER CCS, DUE TO LACK OF FLUID IN BOREHOLE.

DEPTH | FOCUSSED ELECTRIC LOG
5 OHM-METERS 5000
10 100 1000

WATER LEVEL

20
40
60
80
100
104

REPEAT SECTION

5 OHM-METERS 5000
DEPTH FOCUSSED ELECTRIC LOG
10 100 1000

BOREHOLE #2
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA

MF 93160 B

BOREHOLE #2
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 17/10/80

DEPTH SCALE 200:1

1 OF 1 LOGS

N-Okay Mountain *

COAL LITHOLOGY LOG

SONDE TYPE: COAL COMBINATION SONDE

LOG SUITE: GAMMA RAY, L.S. DENSITY, CALIPER

BOREHOLE DATA

PERMANENT DATUM	GROUND LEVEL			
ELEVATION OF P.D.	GROUND LEVEL			
	BPB		DRILLER	
MEASURMENTS FROM	GL		GL	
DEPTH REACHED	103.5m		103.9	
CASING SHOE	4m			
BIT SIZES	1	6" TO TD	2	TO
CASING SIZES	3	TO	4	TO
	1	TO	2	TO

FLUID DATA

NATURE	WATER/QUIK FOAM
SG	
LEVEL	16m
VISCOSITY	
Rm at meas temp	
BHT	

OPERATION DATA

FIRST READING	103m
LAST READING	0
INTERVAL LOGGED	103m
UNIT-TRUCK No.	24/42
ENGINEER	DM/RB
WITNESS	

176

L3

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C. SECS	NORM	CAL COEFF	FROM	TO	INTERVAL	SEAM LOG RUN
CCS	101	5822												
GAMMA RAY			292	Y	9m/M	D	9m/M	1	-	1.5	103	0	103m	
L.S. DENSITY			5985	Y	9m/M	D	9m/M	.3	7.3	-	104	1	103m	
CALIPER	SIDEWALL POSITION			Y	9m/M	D	9m/M	.3	-	-	104	1	103m	

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM		INTERVAL
TO		TOTAL
INTERVAL		

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG

REFER TO ADDITIONAL HEADINGS

REMARKS

NO FOCUSSED ELECTRIC LOG RUN ON THIS HOLE DUE TO LACK OF FLUID IN BOREHOLE.

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. 81 VALUE 292 @ 2" DIAM	JIG CAL DATE 17/10/80 JIG VALUE 5985 SDU @ g/cm³	7 ins 820 cps
JIG MARK SHOWN AT ABOVE VALUE -10	JIG No. C02 SPAN 6000 NORM SDU/CPS = 7.3	2 ins 312 cps

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

HOLE SIZE CORRECTION DATA

2" 4" 6" 8" 10" 1.2 1.25 1.3 1.35 1.4 1.45 1.5 1.55 1.6 1.7 1.8 1.9 2.0 2.1 2.3 2.5 3.0

0 API 150 | 6000 sdu | 0 7" 2"

0 API 150 | 6000 sdu | 0 7" 2"

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

BOREHOLE #2 AREA OKAY MOUNTAIN
CLIENT ESSO RESOURCES LTD. COUNTRY CANADA

COAL LITHOLOGY LOG

MY A50261 R

N-Okay Mountain 80(3)A*1

SONIC LOG

BOREHOLE #6
CLIENT ESSO RESOURCES LTD
AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 21/10/80

DEPTH SCALE 200:1

2 OF 3 LOGS

BOREHOLE DATA

	B.P.B.	DRILLER
PERMANENT DATUM	GROUND LEVEL	
ELEVATION OF P.D.	GROUND LEVEL	
MEASUREMENTS FROM	GL	GL
DEPTH REACHED	256m	256m
CASING SHOE		
BIT SIZES	1 6" TO / 3 TO	2 5 5/8 TO TD / 4 TO
CASING SIZES	1 TO	2 TO

FLUID DATA

NATURE	WATER/QUIK FOAM
S G	
LEVEL	22m
VISCOSITY	
Rm at meas temp.	
B H T	

OPERATION DATA

(44)

176

FIRST READING	255m
LAST READING	22m
INTERVAL LOGGED	233m
UNIT-TRUCK No.	24/42
ENGINEER	D. MACKENZIE
WITNESS	

EQUIPMENT AND RECORDING DATA

LOG	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C. SECS	NORM	CAL. COEFF.	FROM	TO	INTERVAL
SONIC	--	--	--	Y	9m/M	D	9m/M	1	-	-	255	22	233

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG	
101	CCS	200:1	20:1	REFER TO ADDITIONAL HEADINGS

REMARKS

DEPTH	SONIC LOG
	140 micro-seconds/foot 40

	140 micro-seconds/foot 40
DEPTH	

BOREHOLE #6
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA

MY 95160 R

N-Okay Mountain 80(3)A

COAL LITHOLOGY LOG

BOREHOLE	#6
CLIENT	ESSO RESOURCES LTD
AREA	OKAY MOUNTAIN
COUNTRY	CANADA
DATE LOGGED	21/10/80
DEPTH SCALE	200:1
	1 OF 3 LOGS

SONDE TYPE: COAL COMBINATION SONDE

LOG SUITE: GAMMA RAY, L. S DENSITY, CALIPER

BOREHOLE DATA

PERMANENT DATUM	GROUND LEVEL	
ELEVATION OF P.D.	GROUND LEVEL	
	BPB	DRILLER
MEASUREMENTS FROM	GL	GL
DEPTH REACHED	255.5m	256m
CASING SHOE		
BIT SIZES	1 6" TO TD	2 5 5/8 TD
	3 TO	4 TO
CASING SIZES	1 TO	2 TO

FLUID DATA

NATURE	WATER / QUIK FOAM
S.G.	
LEVEL	22M
VISCOSITY	
Rm at meas temp.	
BHT	

OPERATION DATA

FIRST READING	255m
LAST READING	22m
INTERVAL LOGGED	233m
UNIT-TRUCK No	24/42
ENGINEER	D.MACKENZIE
WITNESS	

176 (L5)

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	TC SECS	NORM	CAL COEFF.	FROM	TO	INTERVAL	SEAM LOG RUN
CCS	101	5822												
GAMMA RAY			292	Y	9m/M	R	9m/M	1	-	1.5	255	22	233m	
L.S. DENSITY	SIDEWALL POSITION		5985	Y	9m/M	R	9m/M	.3	7.3	-	256	23	233m	
CALIPER			-	Y	9m/M	R	9m/M	.3	-	-	256	?	233m	

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM		INTERVAL TOTAL
TO		
INTERVAL		

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
	SONIC	200:1	
	FE	200:1	

REFER TO ADDITIONAL HEADINGS

REMARKS

DIP METER FAILED ON HOLE, ATEMPTS AT REPAIR ON SITE NOT SUCCESSFUL

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. 81 VALUE 292 @ 2" DIAM	JIG CAL DATE 17/10/80 G VALUE 5985 SDU @ g/cm³	7 ins 820 cps	
JIG MARK SHOWN AT ABOVE VALUE - 10	JIG No 002 SPAN 6000 NORM SDU/CPS = 7.3	2 ins 312 cps	

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

HOLE SIZE CORRECTION DATA

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

BOREHOLE #6 AREA OKAY MOUNTAIN

CLIENT ESSO RESOURCES LTD. COUNTRY CANADA

COAL LITHOLOGY LOG

MY A50261 R

N-OKayMountain 80/3 #1

BOREHOLE #11
CLIENT ESSO RESOURCES LTD

AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 28/10/80

DEPTH SCALE 20:1

3 OF 5 LOGS

COAL QUALITY LOG

BOREHOLE DATA — REFER TO LITHOLOGY LOG
OPERATION DATA — REFER TO LITHOLOGY LOG
EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

SIDEWALL POSITION

LOG	TAPING			PANEL			CAL COEFF
	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C SECS	NORM	
GAMMA RAY	Y	3m/M	R	3m/M	2	-	1.5
LS DENSITY	Y	3m/M	R	3m/M	.3	7.3	-

SOURCE. SONDE AND CALIBRATION

REFER TO LITHOLOGY LOG

COAL QUALITY LOG INTERVALS

FROM	177m
TO	173m
INTERVAL	4m
FROM	
TO	
INTERVAL	

INTER-VAL TOTAL 4

REMARKS

176

SONDE TYPE:
COAL
COMBINATION
SONDE

LOG SUITE:
GAMMA RAY
L.S. DENSITY

B P B COAL QUALITY LOG

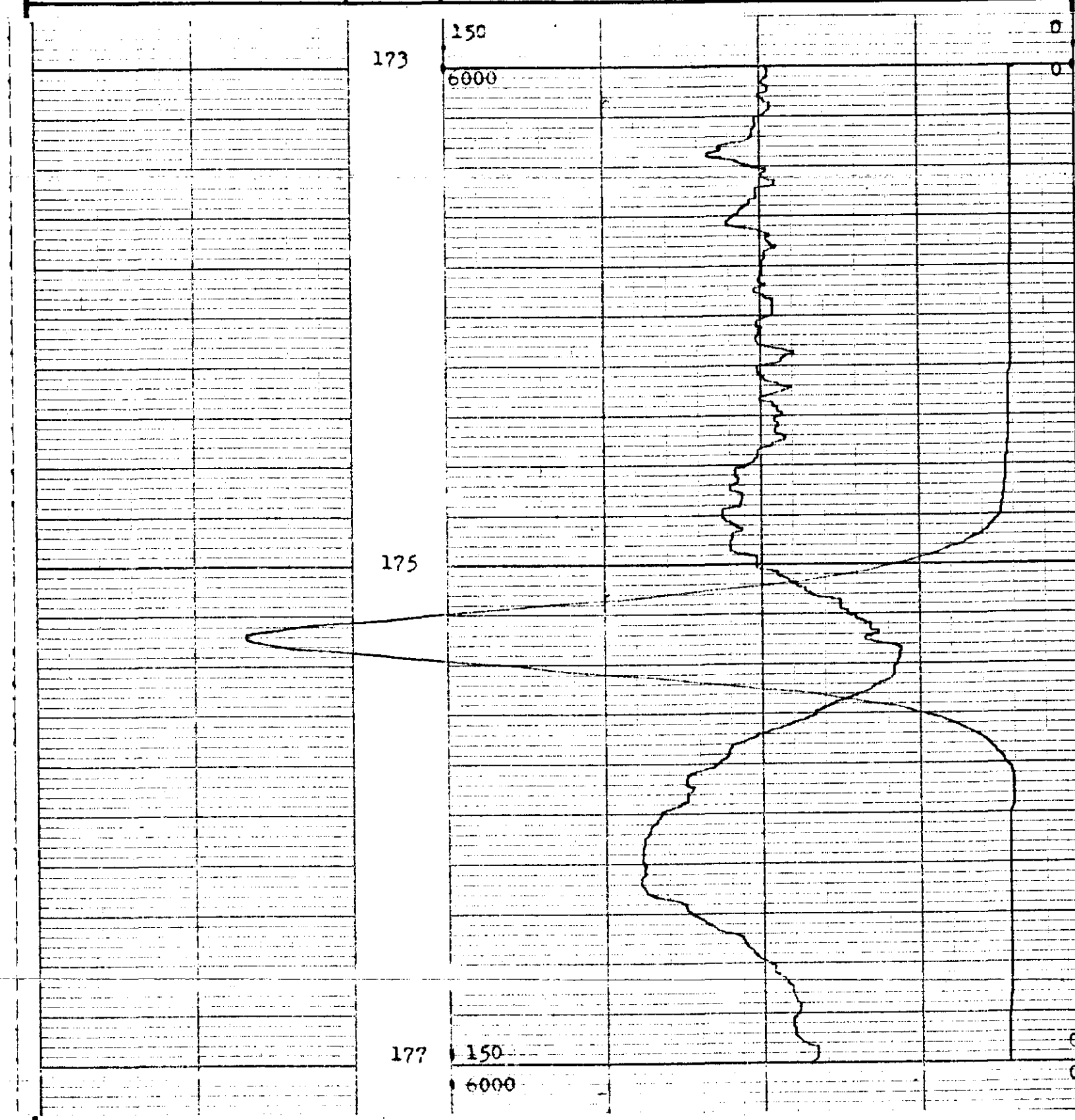
	DEPTH	
		GAMMA RAY
		COAL BULK DENSITY g/cm³

HOLE SIZE CORRECTION DATA

1.2 1.25 1.3 1.35 1.4 1.45 1.5 1.55 1.6 1.7 1.8 1.9 2.0 2.2 2.4 3.0

2" 4" 6" 8"

		150 API	0
		6000 sdu	0



		6000 sdu	0
		150 API	0
		COAL BULK DENSITY g/cm³	
	DEPTH	GAMMA RAY	

BOREHOLE #11
CLIENT ESSO RESOURCES LTD.

AREA OKAY MOUNTAIN
COUNTRY CANADA

COAL QUALITY LOG

MY 80028

COAL LITHOLOGY LOG

BOREHOLE #11
CLIENT ESSO RESOURCES LTD
AREA CKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 20/10/86

DEPTH SCALE 200:1
1 OF 4 LOGS

N-Okay Mountain 80(3)A *1

SONDE TYPE: COAL COMBINATION SONDE

LOG SUITE: GAMMA RAY, L.S. DENSITY, CALIPER

BOREHOLE DATA

PERMANENT DATUM	GROUND LEVEL
ELEVATION OF P.D.	GROUND LEVEL
MEASUREMENTS FROM	BPB GL / DRILLER GL
DEPTH REACHED	256 / 257m
CASING SHOE	14m
BIT SIZES	1 TO 2 TO
CASING SIZES	3 TO 4 TO

FLUID DATA

NATURE	WATER QUIK FOAM
SG	
LEVEL	130m
VISCOSITY	
Rm at meas temp	
BHT	

OPERATION DATA

FIRST READING	256m
LAST READING	0
INTERVAL LOGGED	256m
UNIT-TRUCK No.	24/42
ENGINEER	DM
WITNESS	

176 (L3)

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	TC SECS	NORM	CAL COEFF	FROM	TO	INTERVAL	SEAM LOG RUN
CCS	101	5822												
GAMMA RAY			292	Y	9m/M	D	9m/M	1	-	1.5	256m	0	256m	
L.S. DENSITY	SIDEWALL POSITION		5985	Y	9m/M	D	9m/M	.3	7.3	-	257m	1	256m	
CALIPER				Y	9m/M	D	9m/M	.3	-	-	257m	1	256m	

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	177m	INTERVAL TOTAL
TO	173m	
INTERVAL	4m	

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG	
	SONIC	200:1		REFER TO ADDITIONAL HEADINGS

REMARKS

SECOND ATTEMPT LOGGING HOLE

FIRST ATTEMPT. HOLE COLLAPSED

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. 81 VALUE 292 @ 2" DIAM	JIG CAL DATE 17/10/86 JIG VALUE 5985 SDU @ g/cm³	7" ins 816 cps
JIG MARK SHOWN AT ABOVE VALUE - 10	JIG No. 002 SPAN 6000 NORM SDU/CPS 7.3	2 ins 312 cps

GAMMA RAY | DEPTH | BULK DENSITY g/cm³ | CALIPER INCHES

HOLE SIZE CORRECTION DATA

0 API 150 | 6000 sdu | 0 7" 2

GAMMA RAY | DEPTH | BULK DENSITY g/cm³ | CALIPER INCHES

BOREHOLE #11 AREA CKAY MOUNTAIN
CLIENT ESSO RESOURCES LTD. COUNTRY CANADA

COAL LITHOLOGY LOG

MY A50261 R

COAL LITHOLOGY LOG

N-Okay Mountain 80(3)A

BOREHOLE #11
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 28/10/80
DEPTH SCALE 200:1
1 OF 4 LOGS

SEE ORIGINAL COAL LITHOLOGY BOREHOLE DATA

	BPB	DRILLER
PERMANENT DATUM		
ELEVATION OF P.D.		
MEASUREMENTS FROM		
DEPTH REACHED		
CASING SHOE		
BIT SIZES	1 TO 2 TO	
CASING SIZES	3 TO 4 TO	

SONDE TYPE: COAL COMBINATION SONDE

LOG SUITE: GAMMA RAY, L. S. DENSITY, CALIPER

FLUID DATA: NATURE, SG, LEVEL, VISCOSITY, Rm at meas temp, BHT

OPERATION DATA (L8): FIRST READING, LAST READING, INTERVAL LOGGED, UNIT-TRUCK No., ENGINEER, WITNESS

176

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	TC SECS	NORM	CAL COEFF	FROM	TO	INTERVAL	SEAM LOG RUN
GAMMA RAY														
L.S. DENSITY	SIDEWALL POSITION			SEE ORIGINAL COAL LITHOLOGY										
CALIPER														

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

		INTERVAL TOTAL
FROM		
TO		
INTERVAL		

ADDITIONAL SONDES RUN				REMARKS
SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG	REFER TO ADDITIONAL HEADINGS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. VALUE @ 2" DIAM.
JIG MARK SHOWN AT ABOVE VALUE –
JIG CAL DATE SEE ORIGINAL LITHOLOGY LOG JIG VALUE SDU @ g/cm³ ins cps
JIG No SPAN NORM SDU/CPS = ins cps

GAMMA RAY | DEPTH | BULK DENSITY g/cm³ | CALIPER INCHES

HOLE SIZE CORRECTION DATA

0 API 150 | 1200 sdu | 0 2

GAMMA RAY | DEPTH | BULK DENSITY g/cm³ | CALIPER INCHES

BOREHOLE #11
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA

COAL LITHOLOGY LOG

MY A50261 R

N-Okay Mountain 8(3)A *1

BOREHOLE #11
CLIENT ESSO RESOURCES LTD.

AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 28/10/80

DEPTH SCALE 20:1

2 OF 5 LOGS

SEAM THICKNESS LOG

BOREHOLE DATA — REFER TO LITHOLOGY LOG

OPERATION DATA — REFER TO LITHOLOGY LOG

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	TAPING			SIDEWALL POSITION		
	LOG TAPED	RECORD SPEED	DIRECT OR REPLAY	PANEL SPEED	TC SECS	NORM CAL COEFF
CALIPER	Y	3m/M	R	3m/M	.1	- -
B R DENSITY	Y	3m/M	R	3m/M	.3	8.21 -

SOURCE, SONDE AND CALIBRATION

REFER TO LITHOLOGY LOG

SEAM THICKNESS LOG INTERVALS

	FROM	TO	INTERVAL
	177m	173m	4m
	FROM	TO	INTERVAL
TOTAL			

REMARKS

SONDE TYPE:
COAL
COMBINATION
SONDE

LOG SUITE:
CALIPER
B.R. DENSITY

L9

177

B P B SEAM THICKNESS LOG

CALIPER INCHES	DEPTH	BED RESOLUTION DENSITY
7" 6" 5" dia 4" 3" 2"		29000 SBRDU 15000

CALIPER INCHES	DEPTH	BED RESOLUTION DENSITY
7" 6" 5" dia 4" 3" 2"		29000 SBRDU 15000

BOREHOLE #11
CLIENT ESSO RESOURCES LTD.

AREA OKAY MOUNTAIN
COUNTRY CANADA

SEAM THICKNESS LOG

MY 88002 R

SONIC LOG

BOREHOLE #11
CLIENT ESSO RESOURCES LTD.
AREA CRAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 27/10/80
RUN No. ONE
DEPTH DRILLER 1754m
DEPTH LOGGER 1754m
BTM. LOG INTERVAL 1754m
TOP LOG INTERVAL 175m
CASING SIZE 1 13⅜" TO 72'
2 9⅝" TO 1250m
3 TO
CASING SIZE 1 TO
2 TO
BIT SIZE 12¼"
CASING SIZE 1 TO
2 TO
MEASURED FROM RT
ELEVATION OF PERM. DATUM (GROUND LEVEL)
ELEVATION OF RT (DRILLER)
ELEVATION OF GL (LOGGER)
PANEL No.
GAIN
CAL COEFF
DEPTHS FROM TO
1 175 0
2
3
4
BOREHOLE DATA
PERMANENT DATUM (GROUND LEVEL)
LOG MEASURED FROM RT
DRILLING MEASURED FROM RT
FLUID DATA
SALINITY
LEVEL
MATRIX/CALCITE
MUD
OPERATION DATA
RECORDED BY
WITNESS
ENGINEER
OPR. RIG No.
EQUIPMENT NUMBERS
SONDE
GAUGE
CALIBRATION
LOG TAPED
RECORDED SPEED
DIRECTION
REPLAY
GAIN
PANEL No.
CAL COEFF
DEPTHS FROM TO
1 SONIC ** ** Y 5m/M 0 5m/M 1 - - 175 0 1754
2
3
4
ADDITIONAL SONDES RUN
SONDE 101
LOG OCS
GENERAL SCALE LOG 200:1
DETAIL SCALE LOG 20:1
REFER TO ADDITIONAL HEADINGS
REMARKS
SONIC LOG FROM 175m DUE TO UNSTABLE NATURE OF BOREHOLE.
DEPTH
SONIC LOG
140 MICRO SECONDS/FOOT 40
140 MICRO SECONDS/FOOT 40
00
20
40
60
80
100
120
140
160
175
140 MICRO SECONDS /FOOT 40
DEPTH
SONIC LOG
BOREHOLE #11
CLIENT ESSO RESOURCES LTD.
AREA CRAY MOUNTAIN
COUNTRY CANADA
MY 51160 E

FOCUSSED ELECTRIC LOG

*N-Okay Mountain 80(3)A *1*

BOREHOLE OKAY MOUNTAIN # 12
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 10/11/80

DEPTH SCALE 200:1

1 OF 2 LOGS

BOREHOLE DATA

	B.P.B.	DRILLER
PERMANENT DATUM	GROUND LEVEL	
ELEVATION OF PD	GROUND LEVEL	
MEASUREMENTS FROM	GL	GL
DEPTH REACHED	300m	334m
CASING SHOE		
BIT SIZES	1 6" TO TD	2 TO
	3 TO	4 TO
CASING SIZES	1 TO	2 TO

FLUID DATA

NATURE	WATER QUIK FOAM
S.G	
LEVEL	84m
VISCOSITY	
Rm at meas. temp	
BHT	

OPERATION DATA

FIRST READING	300m
LAST READING	84m
INTERVAL LOGGED	216m
UNIT-TRUCK No.	24/42
ENGINEER	D. M.
WITNESS	

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L11

EQUIPMENT AND RECORDING DATA

LOG	EQUIPMENT			TAPING			PANEL			CAL. COEFF.	DEPTHS		
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C. SECS	NORM		FROM	TO	INTERVAL
FE		-	-	Y	5m/M	D	5m/M	.3	-	-	300	84	216

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG	
101	CCS	200:1		REFER TO ADDITIONAL HEADINGS
208	DIP	----------	----------	

REMARKS

DEPTH	FOCUSSED ELECTRIC LOG
	OHM-METERS

	OHM-METERS
DEPTH	FOCUSSED ELECTRIC LOG

BOREHOLE # 12
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA

MY 95160 R

COAL LITHOLOGY LOG

BPB

BOREHOLE DATA	
BOREHOLE	# 12
CLIENT	ESSO RESOURCES LTD.
AREA	OKAY MOUNTAIN
COUNTRY	canada
DATE LOGGED	10/11/80
DEPTH SCALE	200:1
	2 OF 2 LOGS
PERMANENT DATUM	GROUND LEVEL
ELEVATION OF P.D.	GROUND LEVEL
MEASUREMENTS FROM	GL (BPB) / GL (DRILLER)
DEPTH REACHED	298m (BPB) / 334m (DRILLER)
BIT SIZES	6"

SONDE TYPE: COAL COMBINATION SONDE

LOG SUITE: GAMMA RAY, L S DENSITY, CALIPER

FLUID DATA

NATURE	WATER QUIK FOAM
LEVEL	85m

OPERATION DATA

FIRST READING	298m
LAST READING	8.5m
INTERVAL LOGGED	213m
UNIT-TRUCK No	24/42
ENGINEER	D.MacKENZIE
WITNESS	

176 L12

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	TC SECS	NORM	CAL COEFF	FROM	TO	INTERVAL	SEAM LOG RUN
CCS	101	5822												
GAMMA RAY			292	Y	9m/M	D	9m/M	1	-	1.5	298	85	213	
L S DENSITY	SIDEWALL		5985	Y	9m/M	D	9m/M	1	7.3	-	299	86	213	
CALIPER	POSITION			Y	9m/M	D	9m/M	.3	-	-	299	86	213	

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM / TO / INTERVAL — INTERVAL TOTAL

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
	FE	200:1	
	DIP	----------	

REFER TO ADDITIONAL HEADINGS

REMARKS: UNABLE TO REACH DRILL DEPTH.

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. 81 VALUE 292 @ 2 DIAM — JIG MARK SHOWN AT ABOVE VALUE - 10

JIG CAL DATE 17/1./80 JIG VALUE 5985 SDU @ g/cm³ — JIG No 002 SPAN 6000/ NORM SDU/CPS = 7.3

7 ins 816 cps — 2 ins 310 cps

GAMMA RAY | DEPTH | BULK DENSITY g/cm³ | CALIPER INCHES

HOLE SIZE CORRECTION DATA

GAMMA RAY | DEPTH | BULK DENSITY g/cm³ | CALIPER INCHES

BPB

BOREHOLE # 12 AREA OKAY MOUNTAIN

CLIENT ESSO RESOURCES LTD. COUNTRY CANADA

COAL LITHOLOGY LOG

MY A50261 R

N-Okay Mountain 80(3)A* *1

SONIC LOG

BOREHOLE #14
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 06/11/80
DEPTH SCALE 200:1
3 OF 3 LOGS

BOREHOLE DATA

PERMANENT DATUM	GROUND LEVEL	
ELEVATION OF P.D.	GROUND LEVEL	
	B.P.B.	DRILLER
MEASUREMENTS FROM	GL	GL
DEPTH REACHED	129m	130m
CASING SHOE	10m	10m
BIT SIZES	1 6" TO TD	2 TO
	3 TO	4 TO
CASING SIZES	1 TO	2 TO

FLUID DATA

NATURE	WATER QUIK FOAM
S.G.	
LEVEL	00m
VISCOSITY	
Rm at meas. temp.	
B.H.T.	

(L13)

OPERATION DATA

FIRST READING	129m
LAST READING	0m
INTERVAL LOGGED	129m
UNIT-TRUCK No.	24/42
ENGINEER	D.M.
WITNESS	

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EQUIPMENT AND RECORDING DATA

LOG	EQUIPMENT			TAPING			PANEL			CAL. COEFF.	DEPTHS		
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C. SECS	NORM.		FROM	TO	INTERVAL
SOMIC		--	--	Y	6m/M	D	6m/M	1	--	--	129m	0	129m

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG	
208	DIP	----	----	REFER TO ADDITIONAL HEADINGS
	FE	200:1	20:1	
101	CCS	200:1	20:1	

REMARKS

DEPTH	SONIC LOG
	140 micro-seconds/foot 40

	SONIC LOG
	140 micro-seconds/foot 40
DEPTH	SONIC LOG

BOREHOLE #14
CLIENT ESSO RESOURCES LTD.
AREA OKAY MOUNTAIN
COUNTRY CANADA

MY 95160 R

FOCUSSED ELECTRIC LOG

BOREHOLE #10
CLIENT ESSO RESOURCES LTD.
AREA CRAY MOUNTAIN
COUNTRY CANADA

DATE LOGGED 06/11/80
RUN NO. ONE
DEPTH-DRILLER 130m
DEPTH-LOGGER 130m
BTM. LOG INTERVAL 130m
TOP LOG INTERVAL 20m
CASING-DRILLER 130m @ SURFACE
CASING-LOGGER 130m @ SURFACE
BIT SIZE 6" to TD
TYPE FLUID IN HOLE WATER WITH FLUX
DENSITY
VISCOSITY
PH
FLUID LOSS
SOURCE OF SAMPLE
RM @ MEAS. TEMP.
RMF @ MEAS. TEMP.
RMC @ MEAS. TEMP.
SOURCE OF RMF
SOURCE OF RMC
RM @ BHT
TIME SINCE CIRC.
MAX. REC. TEMP.
EQUIP. LOCATION
RECORDED BY
WITNESSED BY

OPERATION DATA
RECORDED BY D.M.L.
WITNESSED BY

EQUIPMENT AND RECORDING DATA

LOG	EQUIPMENT			TAPING			PANEL			CAL. COEFF.	DEPTHS		
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT/REPLAY	SPEED	T.C. SECS	NORM		FROM	TO	INTERVAL
FS		--	--	Y	5m/H	D	5m/H	1	--	-	130	10	120

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
208	DIF	----------	
101	CCS	200:1	20:1
	SONIC	200:1	20:1

REFER TO ADDITIONAL HEADINGS

REMARKS

DEPTH	FOCUSSED ELECTRIC LOG
	5 OHM-METERS 5000
	10 100 1000
20	
30	
50	
70	
90	
110	
130	REPEAT SECTION
	10 100 1000
	5 OHM-METERS 5000
DEPTH	FOCUSSED ELECTRIC LOG

BOREHOLE #10
CLIENT ESSO RESOURCES LTD.
AREA CRAY MOUNTAIN
COUNTRY CANADA

HT 45160 B

N-Okay Mountain 80(3)A * 1

COAL LITHOLOGY LOG

BOREHOLE #14
CLIENT ESSO RESOURCES LTD
AREA OKAY MOUNTAIN
COUNTRY CANADA
DATE LOGGED 06/11/80
DEPTH SCALE 200:1
1 OF 3 LOGS

SONDE TYPE: COAL COMBINATION SONDE

LOG SUITE: GAMMA RAY, L.S. DENSITY, CALIPER

BOREHOLE DATA

PERMANENT DATUM	GROUND LEVEL	
ELEVATION OF P.D.	GROUND LEVEL	
MEASUREMENTS FROM	GL	
	BPB	DRILLER
DEPTH REACHED	128m	130m
CASING SHOE	10m	
BIT SIZES	1 6" TO TD	2 TO
CASING SIZES	3 TO	4 TO

FLUID DATA

NATURE	WATER QUIK FOAM
S.G.	
LEVEL	00m
VISCOSITY	
Rm at meas temp	
BHT	

OPERATION DATA

FIRST READING	128m
LAST READING	0m
INTERVAL LOGGED	128m
UNIT-TRUCK No	24/42
ENGINEER	D. M.
WITNESS	

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L15

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT			TAPING			PANEL			CAL COEFF	DEPTHS			SEAM LOG RUN
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T C SECS	NORM		FROM	TO	INTERVAL	
CCS	101	5822												
GAMMA RAY			292	Y	9m/M	D	9m/M	1	-	1.5	128	0	128	
L S DENSITY	SIDEWALL POSITION		5985	T	9m/M	D	9m/M	1	7.3	-	129	1	128m	
CALIPER				Y	9m/M	D	9m/M	.3	-	-	129	1	128m	

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM		INTERVAL TOTAL
TO		
INTERVAL		

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG	
208	DIP	-----	-----	REFER TO ADDITIONAL HEADINGS
	SONIC	200:1	20:1	
	FE	200:1	20:1	

REMARKS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No 81 VALUE 292 @ 2" DIAM
JIG MARK SHOWN AT ABOVE VALUE - 10
JIG CAL DATE 17/10/80 JIG VALUE 5985 SDU @ g/cm³
JIG No 002 SPAN 6000 NORM SDU/CPS = 7.3
7 ins 816 cps
2 ins 310 cps

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

HOLE SIZE CORRECTION DATA

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

BOREHOLE #14 AREA OKAY MOUNTAIN
CLIENT ESSO RESOURCES LTD. COUNTRY CANADA

COAL LITHOLOGY LOG

MY A50261 R

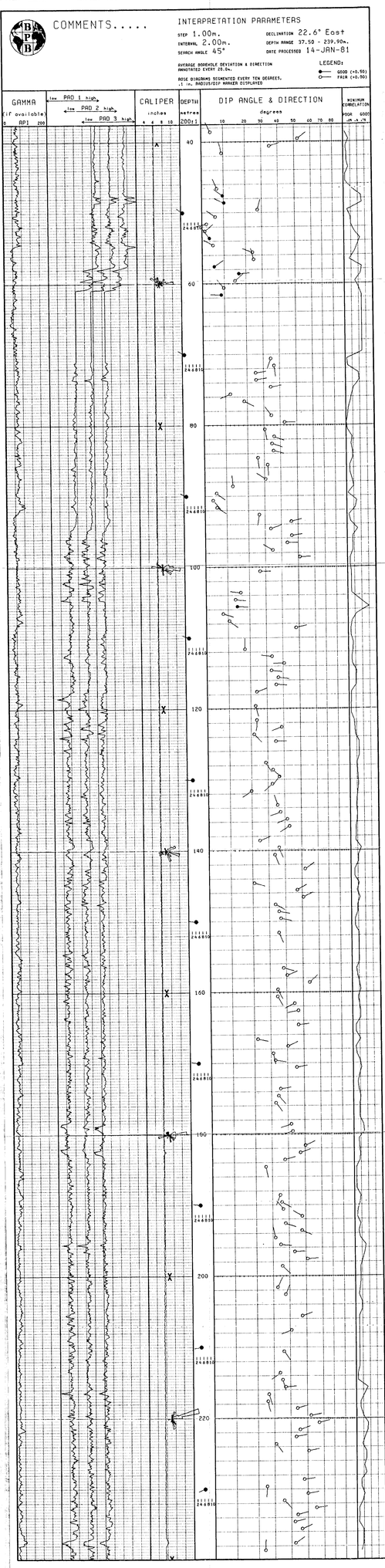
N. Okay Mountain 88(2)A #1

176

4.16

DIPMETER ANALYSIS

CLIENT—— ESSO MINERALS
BOREHOLE— #6
AREA—— OK MOUNTAIN
COUNTRY— CANADA



N-Okay Mountain 80(3)*A #1

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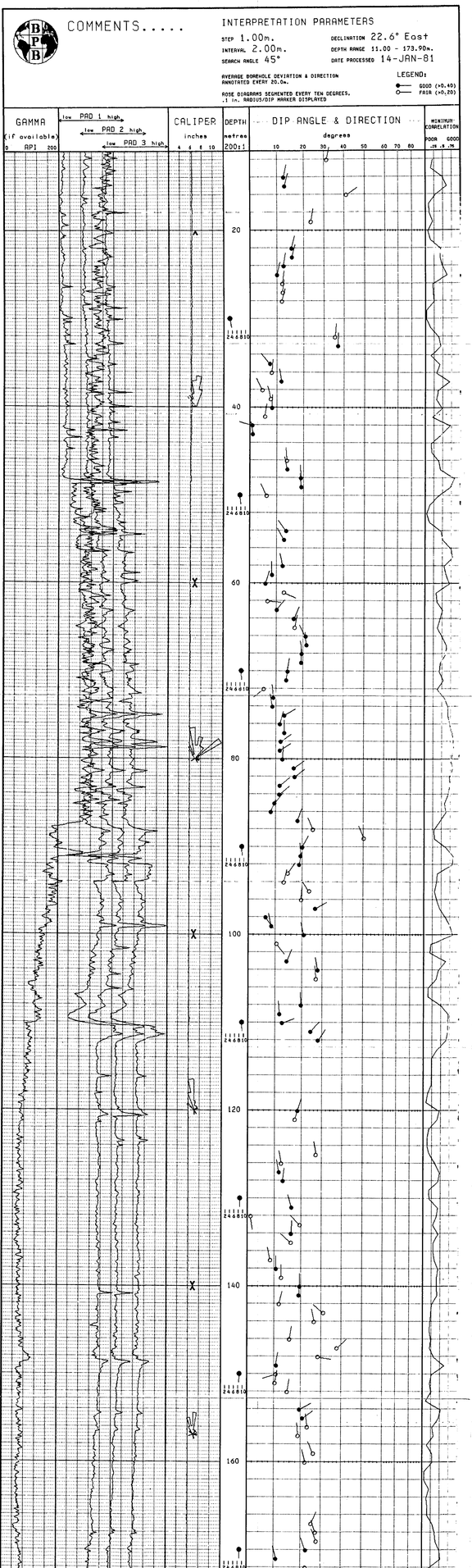
DIPMETER ANALYSIS

CLIENT--- ESSO MINERALS
BOREHOLE- #11
AREA----- OK MOUNTAIN
COUNTRY-- CANADA



N-Okay Mountain Pad(3)A #1

DIPMETER ANALYSIS

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(L18)

CLIENT--- ESSO MINERALS
BOREHOLE- #12
AREA------ OK MOUNTAIN
COUNTRY-- CANADA

COMMENTS.....

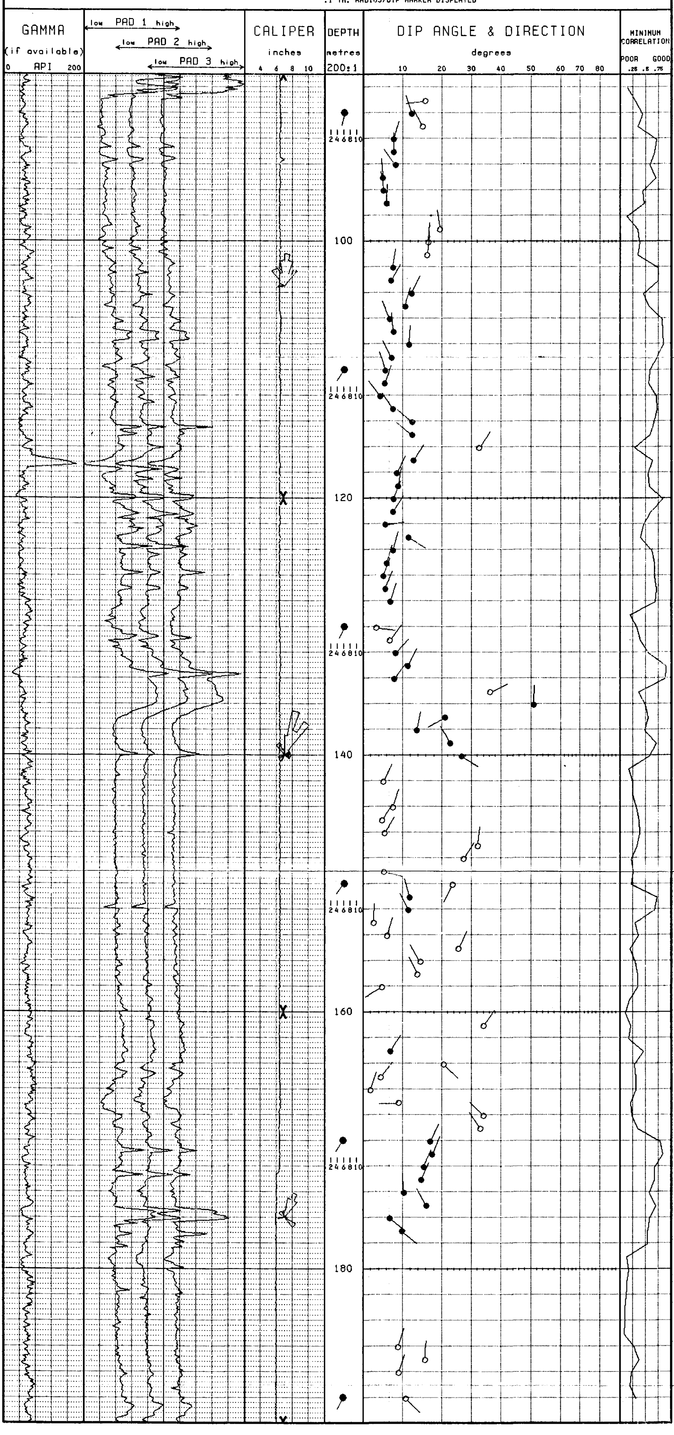
INTERPRETATION PARAMETERS

STEP 1.00m.
INTERVAL 2.00m.
SEARCH ANGLE 45°
DECLINATION 22.6° East
DEPTH RANGE 87.00 - 192.00m.
DATE PROCESSED 14-JAN-81

AVERAGE BOREHOLE DEVIATION & DIRECTION ANNOTATED EVERY 20.0m.

ROSE DIAGRAMS SEGMENTED EVERY TEN DEGREES.
.1 in. RADIUS/DIP MARKER DISPLAYED

LEGEND:
GOOD (>0.40)
FAIR (>0.20)



N-Okay Mountain 80(3)A #1

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DIPMETER ANALYSIS

CLIENT---	ESSO
BOREHOLE-	#14
AREA-----	OK MOUNTAIN
COUNTRY--	CANADA

COMMENTS.....

INTERPRETATION PARAMETERS

STEP 1.00m.
INTERVAL 2.00m.
SEARCH ANGLE 45°
DECLINATION 23.1° East
DEPTH RANGE 12.00 - 129.00m.
DATE PROCESSED 25-NOV-80

AVERAGE BOREHOLE DEVIATION & DIRECTION ANNOTATED EVERY 20.0m.
ROSE DIAGRAMS SEGMENTED EVERY TEN DEGREES, .1 in. RADIUS/DIP MARKER DISPLAYED

LEGEND:
GOOD (>0.40)
FAIR (>0.15)