EVALUATION OF

EXPLORATION AND TESTWORK

JULY 1975 - APRIL 1976

ON THE

ELK RIVER COAL PROPERTY

VOLUME I (a)

GEOLOGY

CALGARY / DUSSELDORF

MAY 1976

274

ELCO MINING LIMITED

REPORT TO
B.C. DEPARTMENT OF MINES
& PETROLEUM RESOURCES
ACCORDING TO REGULATIONS UNDER THE
COAL ACT, 1974
ON
EVALUATION OF EXPLORATION & TESTWORK
JULY 1975 - APRIL 1976

COAL LICENSES 421 - 434, inclusive
481 - 489, inclusive
515
771 - 779, inclusive
951 - 957, inclusive

NTS 82 - J - 7

BY: _____

H. Gruss, P.Geol.

August 26, 1976

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ELCO MINING LTD.

ELCO MINING LIMITED

CONTENTS

APPENDIX 1 - Vol 2
APPENDIX 2 - Vol 2
} OPEN FILE

FOR APPENDICES 3-7, REFER TO CONFIDENTIAL COAL ANALYSIS FILE

ELCO MINING LIMITED

VOLUME I (a)

GEOLOGY

Table of Contents:

ELCO MINING LIMITED

FOR THIS SECTION, REFER TO CONFIDENTIAL COAL ANALYSIS FILE.

Page

Page

VOLUME I (a) Geology

Figures and Tables:

Page

VOLUME I (b)

COAL PREPARATION

Table of Contents:

cont.....

Page

VOLUME II

APPENDICES (DOCUMENTATION)

Table of Contents:

VOLUME II

APPENDIX I - MAPS AND DRAWINGS

TABLE OF CONTENTS:

VOLUME II

APPENDIX 2 - GEOLOGICAL MAPPING

TABLE OF CONTENTS:

ELCO MINING LIMITED PAGE

VOLUME II

APPENDIX 3 - Sampling & Analyses Summary

TABLE OF CONTENTS:

VOLUME II

APPENDIX 3

TABLE OF CONTENTS / continued

ELCO MINING LIMITED PAGE

VOLUME II

APPENDIX 4 - Sampling & Analyses Summary

TABLE OF CONTENTS:

VOLUME II

APPENDIX 4

Page

TABLE OF CONTENTS / continued

ELCO MINING LIMITED

VOLUME II

APPENDIX 5 - COAL LABORATORY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 5 - COAL LABORATORY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 5 - COAL LABORATORY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

ELCO MINING LIMITED

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

VOLUME II

APPENDIX 6 - COAL WASHABILITY TESTWORK

TABLE OF CONTENTS:

LIST OF FIGURES

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

ELCO MINING LIMITED

VOLUME II

APPENDIX 7 - COAL QUALITY ANALYSIS

TABLE OF CONTENTS:

TABLE OF CONTENTS, cont.

APPENDIX 7 - COAL QUALITY ANALYSIS

TABLE OF CONTENTS

LIST OF TABLES

VOLUME II

APPENDIX 7 - COAL QUALITY ANALYSIS

TABLE OF CONTENTS:

LIST OF FIGURES

1. SUMMARY

1.1 Introduction and Objectives

Exploration-activities on the ELK RIVER COAL DEPOSIT carried out last by EMKAY CANADA NATURAL RESOURCES, LTD., and SCURRY-RAINBOW OIL LTD., were suspended by the middle of 1971.
The results of this and previous investigations were laid down and assessed in a comprehensive report

"ELK RIVER METALLURGICAL COAL
ELK RIVER VALLEY
BRITISH COLUMBIA, CANADA
March, 1971".

Field-exploration, coal quality testwork and feasibility-studies as presented in that report were orientated to a development of the property as a future supplier of the Japanese market for coking coal.

However, attempts to enter into a long term delivery contract with Japanese consumers failed and the property remained undeveloped.

In 1973, and through EXPLORATION UND BERGBAU GmbH (E+B), a group of European consumers showed serious interest in the Elk River coal project. A consortium of European steelmills was formed and negotiations with EMKAY CANADA NATURAL RESOURCES LTD. were successfully completed in April, 1975, to purchase EMKAY's share in the venture.

Due to the fact that the quality requirements of the new owners were different to the ones of Japanese consumers, the investigations, data and results as contained in the 1971 EMKAY/SCURRY report proved insufficient to a certain extent for the European group.

Therefore, before entering into a commitment initiating a full scale feasibility study and a subsequent development of the property the ELK RIVER CONSORTIUM still had to ascertain that future deliveries of coking coal from the Elk River property would satisfy their requirements. This was mainly in regards to the coking-quality of the Elk River coal, in particular when blended with coking coals of different origin the individual European steel-mills are using.

Besides of the ELK RIVER CONSORTIUM in 1975 also THE STEEL COMPANY OF CANADA, LTD. through SCURRY showed an increasing interest in a participation in the development of the property and as a potential major consumer. For STELCO the quality-problem of the Elk River coal proved of the same importance as to the European Consortium.

Therefore, the necessity of additional field and laboratory-testwork became evident to update information and to satisfy the requirements of the future consumers.

For this purpose a supplementary exploration-and testing-program was developed. It was targeted on the objectives as below:

(1) Additional exploration by diamond drilling in the upper part of the coal measures,

to obtain more information on development and quality of the upper coal seams (beyond No. 12) there,

which due to their good coking quality might be suitable to improve substantially the quality of an overall blend recovered from a future mine.

(2) Reopening of the existing and driving of new tunnels to recover a sufficient quantity of bulk-samples from Seams No's 2 - 10,

opening of two new trenches to recover sufficient quantities of bulk-samples from Seams No's 12-19,

under inclusion of partings and sterile rocks from the hanging and footwalls of the individual seams and splits,

to simulate a raw-coal composite similar to the average over the life-time of a future open-pit mine.

(3) Washability-testing of the above raw-coal bulk samples considering the simulated dilution and sizing of a future ROM-coal, as required for the flow-sheet designs of a preparation plant,

to obtain more reliable information on recovery and quality of a washed product in a future commerical plant.

(4) Washing of the bulk-samples in a pilot plant, to obtain sufficient quantities of washed coals from the individual seams and possible blends for carbonization tests.

(5) Carbonization tests at a laboratory scale of the individual seams and composite clean coals on their own and in blend with coals of different origin,

to obtain satisfactory information to what extent Elk River coal(s) can be blended with other coals supplied currently and in future to the potential consumers,

without deteriorating the quality of the coke as received from other coals used on their own.

(6) Additional exploration by diamond drilling on the western slope of Big Weary Ridge (supplementary program),

to obtain more reliable information on seams development, quality and structure of the area,

to possibly establish a situation for hydraulic coal mining,

to explore the possibility of improving the quality of an overall open-pit coal blend with good quality coals mined selectively from underground by hydraulic means.

Upon having gained this particular information and assessed its results with all their consequences for a future use of Elk River coals by the consumers, a definite decision would become possible as to whether or not, when, to what extent and with what objectives a full scale feasibility-study should be initiated.

1.2 History and Volume of Investigations

When the Elk River Consortium showed first interest in the property the Coal Licenses proved in good standing. However, the Reclamation Permit issued by the B.C. Mines Department and being necessary to conduct any further fieldwork had expired.

Regardless of this fact, the European steelmills entrusted E+B to negotiate a purchase and three supplementary agreements with EMKAY.

Simultaneously the "Elk River Consortium" comprising

1.) AG der Dillinger Huettenwerke, Dillingen (Germany)
2.) August Thyssen-Huette AG, Due-seldorf (Germany)
3.) Hoesch Werke AG, Dortmund, (Germany)
representing also
Hoogovens, Ijmuiden (Netherlands)
4.) Italsider S.P.A., Genoa (Italy)
5.) Mannesmann AG, Duesseldorf (Germany)
6.) Ruhrkohle AG, Essen (Germany)
7.) Stahlwerke Peine-Salzgitter AG, Peine (Germany)

constituted itself in Germany, and ELCO MINING LIMITED to act as the future operator of the mine was incorporated in British Columbia on October 11, 1974, and registered in Alberta on July 10, 1975.

On May 23, 1975, the purchase and three supplementary agreements were signed between ELCO on behalf of the ELK RIVER CONSORTIUM and EMKAY.

Meanwhile, efforts were undertaken to obtain a renewal of the expired Reclamation Permit No. 49.

This, the B.C. Department of Mines and Petroleum Resources made dependant on the submission of a viable mining and reclamation concept being acceptable also to the public.

The development of such a concept was assigned to TECHMAN LTD. in November, 1974, completed and presented to the B.C. Deputy Minister for Mines and Petroleum Resources on May 26, 1975, in Victoria, and published in a preliminary public hearing one day later in Fernie, B.C.

This concept proved to the satisfaction of the B.C. Government and upon this a renewal of the reclamation permit was issued to ELCO and SCURRY on June 25, 1975.

Subsequently ELCO and SCURRY approved a joint budget on the expenditure of Can. $ 1,700,000 and two supplementary budgets of Can. $ 240,000,000 and Can. $ 400,000 respectively on additional exploration and testing programs.

Fieldworks were initiated and commenced on July 8, 1975, with the establishment of a field-camp to accomodate max. 39 employees at Weary Creek.

In the period from middle of July 1975 to the middle of February, 1976, the following fieldwork was conducted and brought successfully to completion.

(a) Administrative Works:

Application for the below permits granted by:

o	Free Miner's Certificate (No. 142113 & No. 93191)	- Department of Mines and Petroleum Resources, Victoria
o	Reclamation Permit (No. 49)	- Department of Mines and Petroleum Resources, Victoria
o	Special Land Use Permit (File No. 02400)	- B.C. Forest Service, Nelson
o	License to cut Timber (YNO 63)	- B.C. Forest Service, Nelson
o	Water License (File No. 0329148)	- B. C. Water Rights Branch, Victoria
o	Sewage Disposal	- B.C. Health Branch, Fernie
o	Radio Station License (No. 223-645009)	- Department of Communications Cranbrook
o	Road Permit	- Kanelk Transmission Co. Ltd. Calgary

(b) Base Camp Operation:

Establishment of a field-camp rented from and operated by CROWN CATERERS, Edmonton,

consisiting of:	to accomodate up to:
1 kitchen	31 contractors employees
1 diner	4 executives and visitors
1 utility-unit	4 cooks & Maintenance personnel
5 sleepers	
1 wash-car	
1 recreation room	39
1 office	
1 power-plant (50 KW)	
1 power-plant (35 KW) as stand-by unit	

(c) Supporting Services:

The equipment listed below operated by McMEEKIN CONSTRUCTION, Red Deer, was engaged in:

One D8 bulldozer One D6 bulldozer	462.5 hours 1037 hours	preparation and reclamation of 38 drill-pads, construction of approx. 10 (16 km) of new access roads, rehabilitation of approx. 7.8 miles (12.6 km) of existing access roads, moving the drill-rig, cleaning works at tunnel-entrances and camp-site;
one frontend-loader	222 hours	coal-loading on truck, cleaning of tunnel-entrances camp-site;
one grader	301 hours	maintaining approx. 40 miles (65 km) of access roads;
one tandem-truck	699.5 hours	to haul approx 409 st of bulk samples to Calgary;
one reclamation-crew	1,028 men-hours	reclaiming access-roads, trench sites and drill pads.

(d) Geological Fieldwork:

BURNETT RESOURCE SURVEY Ltd. of Calgary was employed to survey:

14 new drill pads
2 new tunnel-sites and directions
2 new trench-sites

of the initial exploration program west of Little Weary Ridge.

For the supplementary drilling program McELHANNEY SURVEYING AND ENGINEERING of Calgary surveyed

25 new drill pads

at Big Weary Ridge.

Geologists of PAUL DYSON CONSULTANTS & HOLDINGS LTD. of Calgary performed

geological mapping (structure and stratigraphy) of
Big Weary Ridge,
Little Weary Ridge,
Valley Floor,
Western Elk Valley slopes,

covering an area of approx. 14,000 acres (approx. 57 sq km),

A set of geological maps at scales of 1" :200' (approx. 1:2,400) and 1":400' (approx. 1:4,800) with cross sections was developed.

Geologists of ELCO logged and mapped new trenches, tunnels and diamond-cores, supplemented by channel-sampling of trenches/tunnels and drill-core sampling.

(e) Diamond Drilling:

TONTO DRILLING LTD. of Vancouver was hired as a contractor to diamond-drill

14 holes (NO's EB-6 - EB-19)
with a total length of 9,307' (2,836.8 m)

in the valley floor west of Little Weary Ridge from July to October, 1975.

Within a first supplementary drilling program during the months of November and December, 1975, additional

6 holes (NO's EB-27,31,33,36,39,42)
with a total length of 5,348 ' (1,603.1 m)

were drilled on the western slope of Big Weary Ridge and on the adjacent valley floor.

A second supplementary drilling program followed in January / February, 1976, with

4 holes (No's EB 47, 51, 52, 53)
totalling with 2964' (903.4 m)

situated on the upper slope of Big Weary Ridge. CANADIAN LONGYEAR Ltd. joined TONTO DRILLING Ltd. in completing this latter part of the program.

(f) Trenching and Bulk-Sampling:

Personnel and equipment of McMEEKIN CONSTRUCTION, Red Deer, was employed to operate:

one CAT 225-backhoe	563.5 hours	excavating two new trenches (No's EB-16/75 and 17/75) of total length: approx. 2,641' (805.5 m) av. width: 10' (3.0 m) av. depth: 10' (3.0 m) and various access ramps into seams;
one CAT-D6-bulldozer	371.5 hours	refilling and reclaiming the trenches.

Personnel of TRINA MAREE MINING Ltd. of Blairmore employed

one miners crew	229 hours	with extracting a total of 209 st (189.6 tonnes) of coal bulk samples from seams No's 12, 13, 14, 15, 16, 17 and 18.

(g) Tunneling and Bulk-Sampling

Personnel of TRINA MAREE MINING Ltd., Blairmore, was employed to:

- reopen existing tunnels No's 2, 6, 7, 8 and 9,

  drive ahead a total of 168.1' (51.3 m) in coal

  intersecting the various seams by 112.3' (34.2 m) of cross cuts,

- drive ahead 2 new tunnels in seams No's 3 and 10

  totalling with 177' (54 m) in coal besides and parallel to the old (collapsed) tunnels

  intersecting the seams by 51' (15.5 m) of cross cuts,

- drive a new tunnel into seams No's 4 + 4A across 188.9' (57.6 m) of rock, and across 50' (15.2 m) of coal.

- extract a total of 201 st (182.4 tonnes) of bulk samples.

The total footage driven amounted to:

558.4'	(170.3 m)	in coal
188.9'	(57.6 m)	in rock
747.3'	(227.9 m)	total

During this period and the following four months (November, 1975 - February, 1976) laboratory test-work as described below was carried out on the raw coals and washed products received from them.

(h) Laboratory Testwork (Coal Washing):

The laboratory and pilot washing plant of BIRTLEY ENGINEERING (CANADA) Ltd., Calgary, was engaged to

- perform washability testwork of all the individual coal seams (15) and two raw coal composites (proportioned according to the expected blend in mining plans "A" and "C")
- wash 15 raw coal bulk samples as supplied from individual seams and two raw coal composites
- test a total of 231 core samples recovered by diamond drilling
- test a total of 52 channel samples taken from coal faces in tunnels and trenches before and after bulk sampling.

The laboratory of RUHRKOHLE AG, Essen, West Germany, received minor quantities of raw coals to carry out supplementary and control testing as

- 15 raw coal samples (180 kg each) of each individual seam, and

  2 raw coal composites (180 kg each), for additional washability testing;
- 52 channel samples taken from coal faces in tunnels and trenches for supplementary quality-testing.

(i) Laboratory Testwork (Coal Quality):

THE CANADIAN METALLURGICAL RESEARCH LABORATORY, of DEPARTMENT OF MINES ENERGY AND RESOURCES Ottawa, was to carry out additional tests on clean coals obtained from 15 individual seams and 2 composites.

- o To double-check and supplement results of clean coals analysis as performed by BIRTLEY ENGINEERING (CANADA) LTD. and RUHRKOHLE A.G.,
- o to arrive to a comparison with test-results of earlier testwork carried out on behalf of EMKAY/ SCURRY,
- o to supplement the above quality testwork,

(j) Consultants Activities

A coal-preparation engineer of TECHMAN LTD. was employed to monitor extraction of bulk samples in the field and their treatment (washability-testing, coal washing) by BIRTLEY ENGINEERING (CANADA) LTD., Calgary.

At a later stage of the program TECHMAN's coal preparation engineer prepared a report

- o COAL QUALITY ANALYSIS (Appendix 7)

representing an updated full scale interpretation of all new and previous drill-hole and bulk-samples based on the results and experiences of this exploration program. After quality considerations this report arrives to conclusions and recommendations for a future plant design.

1.3 Exploration and Test Results

Geology:

The coal measures explored in the project area lie within the Lower Cretaceous Kootenay Formation of British Columbia.

The coal bearing strata approximately 3000' (900m) thick are overlain unconformably by the Cadomin conglomerate of the marine Blairmore group.

The bottom of the coal measures is formed by a terrestric basal sandstone of 200' (60m) thickness overlying the dark gray sequence of marine shales of the Fernie group.

The lower part of the coal measures sequence approximately 2000' (600m) thick contains up to 20 coal seams subdivided into a total of 60 minable coal splits. The combined coal thickness (minable) amounts to approximately 300' (90m).

Structurally the project area forms a wide NNW-SSE striking syncline with its axis underlying the Elk Valley bottom and exposing the coal bearing strata on both the sides of the valley.

On the western slope of the valley representing the western flank of the syncline the coal measures show a vertical dip. They are overthrusted by Palaeozoic rocks over an outcropping length of several miles.

Stratigraphy of Project Area

Strat. Unit	Thickness	Lithology
Top		
Blairmore Group: with basal Cadomin Conglomerate (Cretaceous)	200-300' (60-90m)	marine conglomerate, hard
---------- Unconformity ----------		
Kootenay Formation (Cretaceous) with:		
Coal Measures	3000' (900m)	1000' (300m) of shales with several thin coal seams; continental, with marine ingressions
		2000' (600m) of sand - and siltstones and shales with several thick coal seams; continental
Basal Sandstone	200' (60m)	light coloured, poorly cemented, friable sandstones; continental
Fernie Group: (Jurassic)		dark gray, marine shales
Bottom		

The eastern slope of the valley (Big and Little Weary Ridges) is underlain by the coal measures again dipping to the west with approximately 38° on the average. No major and significant folding and faulting could be recorded within the Little Weary Ridge area. The Big Weary Ridge, however, appears structurally disturbed by several thrust faults cutting up section from west to east accompanied by minor amounts of

of folding. This is relevant in particular for the central part of Big Weary Ridge.

The valley floor covered by glacial tills to a varying depth and extent is underlain mainly by the upper part of the coal measures and the Blairmore group. Recent mapping indicates the Kootenay/Blairmore contact diving down under the valley floor to a depth of approximately 1,500' (450m) in the syncline axis.

This would bring the lower and productive part of the coal measures down to a depth of approximately 2,000 - 4,000' (600 - 1,200m) below the valley floor.

During recent mapping no evidence could be recorded suggesting major (thrust) faulting below the valley floor.

Due to a significant lateral variation of lithology in the Kootenay formation it proved very difficult to follow any stratigraphic unit, either coal seam or sandstone, for more than a few thousand feet. No detailed stratigraphic correlation was possible e.g. between the western flank of the valley and Big and Little Weary Ridges as well as between both the ridges themselves.

However, based on the relatively closely spaced drilling conducted in Big and Little Weary Ridges and the availability of geophysical logs for each of the boreholes a relative reliable seam stratigraphy could be developed already at an earlier stage of investigation and was confirmed by ELCO's exploration work.

Helpful for the correlation proved a number of individual seams used as marker-horizons.

In total up to 21 individual coal seams of varying thickness (1 - 35'/0.3-12m), development and quality could be identified mostly within the lower part of the Kootenay formation and traced across the envisaged mining areas with satisfactory accuracy.

Seam Development and Coal Quality:

Assessment of ELCO's borehole data confirmed the existing seam stratigraphy and contributed to its extension into previously less or unexplored areas on the western side of the envisaged open pit mine and Big Weary Ridge.

In particular for the higher numbered seams the anticipated coal thickness was confirmed as well as the coal quality expected, thus eliminating earlier factors of uncertainty from new coal reserves and quality calculations.

On the average no significant differences in coal quality could be recorded between ELCO's and existing borehole analyses on a seam-individual basis.

Channel samples extracted from the various seams, taking into account the dilution as expected in a future mine, produced a clean coal very similar in its quality to the average of the relevant borehole analyses. This also proved applicable to the diluted bulk samples recovered at the same sites as the channel samples but treated and washed after different methods. Substantial differences only became evident in ash - levels and yields which are due to treatment and adjustable by the preparation process.

Composite bulk samples containing the raw coals of the individual seams proportionate to their reserve figures (according to mining plans "A" and "C") were washed with a CC ash target of 9.5% and resulted in the below clean coal products:

	Alternative "A"	Alternative "C"	M.K. Report "Contract Period" (Alternative "C" approx.)
Volatile Matter (d.b.)	21.4%	19.8%	19.15%
Ash (d.b.)	8.3%	9.5%	9.75%
F.S.I.	7½	7	6
Fixed Carbon (d.a.b.)	69.8 %	70.3%	
Sulphur (d.b.)	0.65%	0.48%	0.51%
Phosphorous (d.b.)	-	0.05%	
Dilatation (max.)	20	-8	
Contraction (max.)	16	17	
G-Value	1.007	0.866	
Hardgrove-Index	97	99	
Yield (actual)	52.7%	50.0%	77.6%
Yield (ash bal.)	65.1%	66.7%	
CC - Reserves:			
in 1000 st	106.869	80.503	
in 1000 tonnes	99.037	73.097	
in 1000 lt	97.477	71.946	63.635

F.S.I. values for both the composites as well as the individual bulk samples proved higher as in comparable samples extracted and washed earlier. This suggests that the M.K./SCURRY samples probably were oxidixed in some instances.

The difference in plant yields between both the generations of bulk samples results from the dilution being substantially higher in ELCO's samples than in EMKAY/SCURRY's.

Representativity of ELCO's bulk samples can be considered granted for section 190+00 and adjacent blocks where the samples actually were extracted. Comparison with channel and borehole samples applicable for mining areas "A" and "C", however, shows that there is little difference only between clean coal quality received from those on the average and the bulk samples. This suggests that ELCO's composite samples "A" and "C" may be considered fairly representative also for the relevant mining areas outweighing existing variations on a seam by seam basis across the entire mining area and within the calculated total coal reserves.

Coal Reserves Calculation:

ELCO's coal reserve calculation was based on information already existing (drillholes, tunnels and trenches) supplemented by own exploration works in particular on the western side of the envisaged open pit area as well as in Big Weary Ridge.

For coal reserves definition the terms generally applied in Western Canada (B.A. Latour/L.P. Chrismas, 1970) were used.

Parameters employed for raw coal in place, raw coal recoverable, run of mine product and clean coal are the same as used by Western Canada's coal industry at the present.

For the open pit areas "A" and "C" the results of the reserves calculation are listed in summary as below:

Non Oxidized Coal

In 1000	Alternative "A"	Alternative "C"
Raw Coal in Place	178,875 st (162,240 tonnes)	136,126 st (123,466 tonnes)
Recovered Raw Coal	157,081 st (142,472 tonnes)	117,630 st (106,690 tonnes)
Run of Mine Product	174,589 st (158,352 tonnes)	130,476 st (118,342 tonnes)
Total Waste (incl. ox. coal)	1,043,401 bcy (792,985 cbm)	704,530 bcy (535,443 cbm)
Ratio	5.98 bcy/st 5.00 cbm/tonne	5.40 bcy/st 4.52 cbm/tonne

These figures compare favourably with EMKAY/SCURRY's results. (Area "A" comparable to ELCO's alternative "C"):

ELK RIVER COAL PROJECT

TABLE 1

PROVEN CLEAN OPEN PIT RESERVES - ALTERNATIVE "A" (NON-OXIDIZED)

ELCO ASSESSMENT, BASED ON ASSUMPTION (PLANT-YIELD) OF KAISER AND TECHMAN

(IN METRIC TONS (TONNES)

Seam No.	Average Combined True Seam Thickness (m)	Raw Coal In Place	Run of Mine Product	Plant Yield Weight - %	Clean Coal Product
2	4.33	14,032,773	13,825,475		
3	2.32	7,328,114	7,129,905		
4 - 4A	8.30	23,529,069	23,197,956		
5	0.91	1,195,072	1,125,485		
6	1.91	4,644,855	4,481,810		
7	1.63	3,749,857	3,633,731		
8 - 8A	6.80	14,239,213	13,927,530		
9	4.92	10,660,479	10,521,648		
10	8.85	17,000,455	16,835,692		
11	5.42	4,060,210	3,990,728		
12	6.12	11,323,400	11,115,204		
13	5.68	11,089,589	10,757,474		
14	4.40	7,604,677	7,296,050		
15	6.04	9,935,635	9,744,305		
16	4.46	7,093,625	6,849,206		
17	3.78	5,855,110	5,686,867		
18	4.17	5,280,556	5,072,409		
19	2.94	2,411,011	1,386,784		
20	2.31	775,089	456,702		
21	1.93	379,542	364,737		
22	2.03	63,261	59,954		
24	0.97	23,630	19,203		
		162,275,222	157,478,855		

Plant Yield as Per Assumption of:

TECHMAN		60.05	94,566,052
Kaiser Canada:	Minimum	59.0	92,912,525
Kaiser Canada:	Average	64.7	101,888,819
Kaiser Canada:	Maximum	70.4	110,865,114

ELK RIVER COAL PROJECT TABLE 2

PROVEN CLEAN COAL RESERVES - ALTERNATIVE "C" (NON-OXIDIZED)

ELCO ASSESSMENT, BASED ON ASSUMPTION (PLANT-YIELD) OF KAISER AND TECHMAN

(IN METRIC TONS (TONNES)

Seam No.	Average Combined True Seam Thickness (m)	Raw Coal In Place	Run of Mine Product	Plant Yield Weight - %	Clean Coal Product
2	4.40	12,499,541	12,333,170		
3	2.21	6,722,192	6,203,973		
4 + 4A	8.43	20,628,508	18,707,215		
5	0.91	1,195,072	1,125,485		
6	1.91	4,438,873	3,506,699		
7	1.63	3,683,312	3,572,688		
8 + 8A	6.56	12,965,249	12,737,909		
9	4.95	9,592,821	9,465,103		
10	9.13	15,013,091	14,865,836		
11	5.27	2,252,915	2,212,134		
12	6.03	9,773,890	9,589,495		
13	5.90	10,260,573	9,968,787		
14	3.77	5,326,407	5,159,549		
15	5.75	5,712,788	5,596,442		
16	4.39	2,110,259	2,041,902		
17	3.88	1,088,710	1,057,120		
18	6.17	229,153	224,317		
		123,493,354	118,367,824		
Plant Yield as Per Assumption:					
		TECHMAN (at 9.5% ash)		60.96	72,157,026
		" 9.0% "		58.8	69,600,278
		Kaiser Canada: Minimum		59.0	69,837,016
		Kaiser Canada: Average		64.7	76,583,982
		Kaiser Canada: Maximum		70.4	83,330,948

In situ coal:	109,172,000 st (99,019,000 tonnes)
Ratio	4.88 bcy/ 1 st (4.10 cbm/tonne)

These figures exclude pit losses, oxidized and waste coal and are comparable to ELCO's recovered raw coal.

Another double-check of the above ELCO figures represent TECHMAN's reserve calculation based on earlier data (ELCO's drilling results were not available at that time):

in 1000:	Alternative "A"	Alternative "C"
Recovered Raw Coal	162,581 st (147,462 tonnes)	110,632 st (100,343 tonnes)

This confirms that three independent reserve evaluations for raw coal based on slightly different data and parameters practically arrived to the same results within accuracy of calculation.

Due to the quoted definitions these reserves may be considered as

p r o v e n.

In order to arrive from run of mine coal to clean coal reserves a percentage figure for plant yield has to be applied.

This is a matter to be dealt with in detail in Volume I (b) COAL PREPARATION.

For comparison the below established yield figures had to be considered:

In Tests:	Yield
From washability tests:	
Alternative "A"	61.1%
" "C"	61.7%
From Bulk Samples:	
Alternative "A"	52.7% (Actual)
	65.1% (Ash balance)
" "C"	50.0% (Actual)
	66.7% (Ash balance)

In Commercial Plant (expected):	
TECHMAN's Evaluation:	61.0% (9.5% ash)
KAISER CANADA's Evaluation:	58.8% (9.0% ash)
Minimum	59.0%
Average	64.7%
Maximum	70.4%

Coal reserves in terms of clean coal and based on yields as expected in a commercial plant become evident on Tables 1 and 2.

For possible future underground mining areas (hydraulic) the below reserve figures for clean coal were established in Big Weary Ridge:

Section	Number of good quality Coking Coal Seams (FSI 7)	Average Seam (m)	Thickness Coal (m)	Recoverable CC-Reserves (FSI 7) In Thousands
1. Elco Lease, above drainage	1	4.0	2.9	1,800 tonnes 1,985 st
2. Elco Lease	7	4.8	4.2	11,000 tonnes 12,128 st
3. Fording Lease,(*) above drainage	6	3.6	3.4	8,000 tonnes 8,820 st
TOTAL:				20,800 tonnes 22,933 st

*) 1/3 of reserves in ELCO's lease

Due to heavy faulting and widely spaced drilling these reserves have to be considered drill indicated.

As an alternative, however, also open pit coal mining appears possible in Big Weary Ridge. Drilling conducted within two supplementary programs in this area indicate open pit reserves in the category of

130,000,000 st of raw coal recoverable, and

70-80,000,000 st of clean coal

alone within ELCO's license area. This figure might double if FORDING COAL LTD's license area could be included into the same project.

1.4 Conclusions

With reference to the objectives of this exploration and testing program as outlined earlier the below conclusions can be drawn and statements made:

(a) Individual data and results of earlier exploration and testwork could be confirmed. They represent reliable information for the assessment of the property and future technical planning.

(b) Results of exploration and testwork of the 1975/76 season were in line with earlier results and assessments as well as with expectations raised by them.

This is particularly the case in regards to:

(c) Coal reserves minable by open pit methods at a favourable overburden ratio.

Coal reserves established earlier could be confirmed, and there is potential to double or even triple these figures under the same or similar mining conditions.

There appears to be sufficient coal reserves to provide not only the base for one large scale open pit mine (4-5 million st p.a.) but at least for another one more.

This potential can hardly be met by any other coal property in Western Canada.

(d) Coal reserves minable by underground methods are available for selective mining of high quality coal seams at a satisfactory scale above valley floor and at moderate depths in Big Weary Ridge.

The potential for deep underground coal mining remains unexplored.

(e) Coal quality of individual seams and as an average for the areas under consideration could be confirmed by sampling and testing of boreholes, tunnels and trenches. In certain instances the treatment and washing of bulk-samples even arrived at results somewhat better than expected regardless of the fact that a higher and more realistic amount of dilution was included into the samples.

(f) Bulk samples and composites as tested may be considered sufficiently representative of the envisaged open pit areas.

Washability data and clean coal obtained in the course of their treatment (together with borehole information) provide a sufficiently reliable basis for the planning of a commercial plant as well as for the quality of product to be expected in such a plant.

2. COAL LICENSES, GENERAL

2.1 Location and Access

The Elk River coal property is located in the Rocky Mountains of southeastern British Columbia, Canada, within the upper valley of the Elk River (see Fig. 1).

Approximate center of the property, consisting of 19,200 acres (77.7 sq.km) of coal licenses on Crown Forest Land, is near

50 degrees, 24 minutes north, and
114 degrees, 56 minutes west.

The project's site is located approximately 27 miles (43 km) north of Elkford, British Columbia, the nearest township (population approx. 3,000), which is also the townsite of FORDING COAL Ltd.'s Fording River coal mine, located approx. 10 miles (16 km) to the south (see Fig. 1) of the property.

Year round access from Elkford to the south exists over 22 miles (35 km) of bitumen road to Highway No. 3 going from Sparwood east to Fort McLeod/Calgary and west to Vancouver. Access to the project's site out of Elkford exists over 27 miles (43 km) of improved gravel Forest Service road.

The total road distance from the project's site to Calgary (city limits) through Elkford amounts to 220 miles (354 km), and the trip can be made in approximately 5 hours.

Fair weather access (4 wheel drive vehicles only) to the north is possible over 21 miles (34 km) of unimproved power-line maintenance road which connects to the Kananaskis Lakes road. This and the Kananaskis road are improved and partially sealed gravel roads running 42 miles (68 km) further north to the Trans Canada Highway No. 1. This is the principal national

ELCO MINING LIMITED

ELK RIVER COAL PROJECT

BRITISH COLUMBIA, CANADA

REGIONAL LOCATION MAP 82J/7W.

⚒ – OPERATING COAL MINE

SCALE: 1:1,000,000		DRAWING NO. M-1
DATE: MAY 1975	DRAWN BY:	PROJECT NO. TM-113
TECHMAN LTD.		

coast-to-coast highway and provides a four-lane freeway to Calgary. During good weather the trip from the project's site to Calgary over a total distance of 101 miles (163 km) to the city-limits can be made in approximately 3 hours.

The nearest rail line, owned by CANADIAN PACIFIC RAILROADS, is a spur-line serving the Fording River coal mine from Sparwood. Another spur branching off from this line approx. 5.5 miles (9 km) north of Sparwood and to serve the Elk River coal project would have a total length of 44 miles (71 km) and follow the Elk Valley up through Elkford to the project's site.

From there the total rail distance to Vancouver and its coal-loading port (Robertsbank) amounts to approx. 743 miles (1196 km).

2.2 History of earlier Investigations

In 1883 Dr. G.M. Dawson of the CANADIAN GEOLOGICAL SURVEY examined first the Elk Valley coal deposits.

In 1905 Prospectors uncovered 22 coal seams on Big Weary Ridge between Aldrige and Weary Creeks.

In 1910 Three coal companies had acquired leases in the area.

In 1920 Coal Exploration started in a systematic way (Aldridge tunnel, 650'/198m).

After 1920 interest in Elk River coal waned and most coal licenses were dropped. The property was idle then until:

1952 when WEST CANADIAN COLLIERIES LTD. did some sampling on Weary Ridge seam exposures

1967 In December, SCURRY-RAINBOW OIL CO. LTD. began acquiring leases of property containing inferred reserves of coal.

1968 In summer, NORTH AMERICAN COAL CORPORATION began an exploration program on Elk River coal licenses property under an option agreement with SCURRY-RAINBOW OIL LTD.

The area explored during this period was, primarily, the Big Weary Ridge. NORTH AMERICAN, however, did not exercise its option.

1969 In summer, SCURRY independently extended exploration of the deposits to include Little Weary Ridge.

1969 In December, EMKAY CANADA NATURAL RESOURCES LTD., a wholly owned subsidiary of MORRISON-KNUDSON Co. Inc., acquired an undivided one-half interest in the SCURRY licenses.

1970 In July, exploration by the joint owners resumed under the direction of EMKAY, with exploration being performed by ELK RIVER EXPLORATION LTD., a wholly owned subsidiary of EMKAY, and ceased in 1972.

1975 In May, ELCO MINING LIMITED, a wholly owned company of a consortium of European steelmills acquired EMKAY's share in the property.

1975 In July, field exploration and testwork was resumed by ELCO/SCURRY under direction of ELCO.

Today, the Elk River coal property comprises 42 coal licenses of 19,200 acres (77.7 sq.km) held jointly by SCURRY/ELCO and being in good standing. Their numbers are:

421 through 434 inclusive
481 " 489 "
515
771 through 779 inclusive
951 " 957 "

These British Columbia Mining Act licenses are renewable from year to year. When coal production is in excess of 100 st a day a "Limited Production Permit" becomes necessary (Bill # 92 Coal Act, 1974, Para. 3, (1). This is only to provide a quantity of coal reasonably required for testing purposes.

For production at an industrial scale application for a "Coal Lease" (Bill # 92, Coal Act, 1974, Para. 26, (1) has to be filed. This lease is renewable after 21 years.

At the present, royalties of Can. $ 1.50 per short ton are payable for metallurgical coals and Can. $ 0.50 per short ton of thermal coal (F.S.I.<4).

3. METHODS OF INVESTIGATION

3.1 Geological Fieldwork

3.1.1 Surveying

Standard tellurometer methods were used by BURNETT RESOURCES SURVEY LTD. and McELHANNEY SURVEYING AND ENGINEERING to survey drill-pads, tunnels, trenche etc.

This work was based on ground-control and coordinates points established during previous periods of exploration.

For all points surveyed and marked in the field coordinates were calculated in accordance to the existing grid-system and recorded on lists and maps at scales 1":200' (1:2,400) and 1":1,000' (1:12,000)respectively.

3.1.2 Geological Mapping

Extensive geological surface-mapping had been performed in the course of previous periods of investigation in particular in Big and Little Weary Ridges. However, a systematic record and compilation of all surface data available did not exist.

Therefore, the entire lease area was traversed systematically by a team of one or two geologists supported by one field assistant between July and October, 1975.

All significant outcrops of the area are believed to be mapped and stratigraphic and structural features recorded now.

This information compiled by PAUL DYSON CONSULTANTS, Calgary, was recorded on:

(a) one set of 14 geological surface maps at a scale of 1" : 200' (1:2,400)

(b) 16 measured sections 75 A - 75 P (written descriptions)

(c) 15 measured sections 75 A - 75 P (stratigraphic logs)

(d) one set of structural sections at scales of 1":200' (1:2,400) and 1":400' (4,800).

From this basic information synoptical maps at scales of 1":400' (1"4,800) and 1":1,000' (1:12,000) were developed.

3.1.3 Coal Stratigraphy

Cross sections were developed for the entire open pit area (alternatives "A" and "C") at a scale of 1":50' (1"600) and a spacing of 2,000' (600m) in NS-direction. A subdivision into 50' (15m) benches proved adequate. Alltogether 10 cross-sections are existing covering the area between positions 180+00 and 360+00. These are mainly based on drilling work performed earlier, and the missing information in particular in the western part of the area was gained by ELCO's 1975 drilling program. As an example one complete cross-section (No.260+00) is contained in Appendix 1. Then, the attempt was made to develop a bench map for the lowest level of a future open pit (400' = 120 m below valley floor) and for its widest bench (No. 7 = 100' = 30 m below valley floor). Both the bench-maps show the seam development along strike in the future pit.

3.1.4 Drilling and Sampling

Most of the diamond drilling was performed by LONGYEAR 44-rigs (operated by TONTO DRILLING LTD. and LONGYEAR CANADA LTD.) as contractors. To complete the supplementary drilling programs in time up to two more rigs of the same type were called in early November, 1975.

The rigs were established on pads prepared by a bulldozer exactly on or as close as possible to the survey-mark for the relevant hole.

Bentonite-mud was used for drilling, and water generally could be supplied by pumping from nearby little water courses. Only a few holes located on Big Weary Ridge required water-trucking.

Drilling commenced with tricone-bits through the overburden (glacial tills) down to the bedrock of the coal measures

(between 10 and 90'/3-27m).

Casing of 3 15/16" (100 mm) was built in, and diamond drilling continued with HQ (63.5 mm) wireline coring equipment. Average life-time of a bit was 400 - 600' (120 - 180 m).

Average core-recovery with approximately 100% in rock and 90 - 100% in coal proved satisfactory.

After completion of each hole

gamma-ray/neutron logging
sidewall-densilogging

was conducted by ROKE OIL ENTERPRISES Ltd., Calgary.

Then, the rig was moved to the next location with the assistance of a bulldozer.

Casings were lifted from the hole with the shield of the bulldozer, and the exact location of the drill-hole was marked for later surveying by placing a log into the hole.

To prevent uncontrolled circulation of water, air and gas in a potential underground mining situation bore-holes from section 150+00 to the South were refilled with cement from the bottom to surface.

Reclamation of the drill-pads was performed by the bulldozer again. Later the access-roads and drill-pads were fertilized and seeded according to instruction received from the reclamation branch of the B.C. Department for Mines and Petroleum Resources.

During the drilling diamond-cores were placed in wooden core-boxes and marked durably.

The cores were logged by a geologist, and stratigraphical, sedimentological and structural features recorded in a core-description.

Intersections of coal seams and splits after recording their depths, recovery and geological features were packed into heavy duty plastic-bags, labelled and dispatched to the coal-laboratory for further testing. Generally each seam or split was treated as a unit and, therefore, any analysis results received later are to be considered representative for an entire seam or split as recovered. The average sample represents a coal thickness of approximately 5' (1.5 m) including partings of up to 3' (90 cm).

For documentation and to comply with the relevant regulations of the B.C. Mines Department the core-boxes were hauled to SCURRY's core-storage facilities located at Blairmore, Alberta, and stored there.

A complete documentation for each borehole was established comprising

- stratigraphic log (core description),
- coal analyses sheets,
- gammaray / neutron log,
- densilog,
- coal laboratory assay-sheets,
- daily drilling records of the contractor.

3.1.5 Tunneling & Sampling

Tunneling work and combined bulk-sampling was performed by TRINA MARIE MINING LTD., Blairmore, as a contractor.

For this purpose

- o existing tunnels had to be reopened,
- o new adits had to be driven to replace collapsed old tunnels,
- o new tunnels had to be driven at new locations.

At existing tunnels work generally commenced with cleaning the site and rehabilitating the portal structure. At new tunnel-sites a vertical face was cut into the ground by the bulldozer creating the site for the tunnel entrance and a platform with an access road in front of it. New adit-sites, elevations and directions were surveyed before or upon completion of tunneling.

Then, in existing adits the water was drained, collapsed sections cleaned and rotten support replaced by fresh timber until the tunnel's face was reached.

New tunnels required timbering and support of the portal and the area adjacent to it.

From the existing i.e. old coal-face tunnels were driven ahead along the strike of the seams between 19 and 60' (5.8 - 18 m) to secure extraction of bulk samples from an entirely onoxydized site. To ascertain this, coal-samples in 5' (1.5 m) intervals were taken along the new adits and lab-tested for F.S.I.

Cross-cuts for bulk-sampling were driven at a distance from the old face (portal respectively with new adits), where F.S.I.-testing showed at least the same or even better results than obtained by previous work.

Before extraction of a bulk sample the face of the relevant cross-cut was put vertical and cleaned. The floor was lined with plastic foil, and then a channel sample was taken including partings of up to 3' (90 cm) thickness. To simulate dilution in a future open pit mine ½' (15 cm) of the hanging wall rock regardless of its hardness was included into the sample. In case of a hard footwall i.e. sandstone no footwall-rock was sampled. In case of a soft footwall-rock (shale), however, also ½' (15 cm) were included into the sample. In case of partings thicker than 3' (90 cm) the same regulation was applied.

Simultaneously with taking the channel sample the petrographic, stratigraphic and structural features were mapped and recorded.

In preparation of taking the bulk sample the existing floor of the cross-cut was cleaned and a few holes were drilled into the face and charged with explosives. Due to instruction of the Mines-Inspector MONOBEL # 4 had to be used in coal, and FORSITE 40% in rock.

The purpose of the blasting was to loosen the coal for later recovering of the material with the air-pick.

Particular care was taken to secure that the sample was extracted at correct proportions i.e. that the thickness of the block was everywhere the same, the floor and roof, the hanging wall and footwall-faces were parallel. The bulk-sample included all partings and hangingwall/footwall material as included in the precedent channel-sample.

No loose material was left in the cross cut after extraction of the bulk-sample.

Then, for control another channel-sample was taken from the new face under the same procedures as outlined above.

The bulk-sample was loaded and hauled to the tunnel entrance on a wheel-barrow. The material was dumped on a site approx. 15 x 15' (4.6 x 4.6 m) covered with strong plastic foil to prevent dilution from the ground. To facilitate reloading of the sample on a truck by a 1 cby (0.76 cbm) frontend loader and to prevent penetration of the foil by loading operations the foil again was covered by 10 x 10' (3 x 3 m) of ½" (12 mm) plywood.

Channel-samples were packed into strong sample-bags, labelled and dispatched to the coal lab.

The bulk-sample after loading on a tandem truck (13 tons capacity) was covered with a tarpolin to prevent loss of fine-material during transport, and hauled to the lab. On its way the loaded truck passed a weight-scale, and the quantity of each individual load was established.

Upon completion of sampling the tunnel-portal was closed according to the prevailing regulations, the tunnel-sites cleaned and reclaimed as requested by the authorities.

A complete documentation on each adit sampled was compiled comprising

- updated map of tunnel and extraction site,
- stratigraphic log of the seam tested,
- coal laboratory assay-sheets on:
  FSI-testing along strike of seam,
  channel samples,
  bulk samples.

3.1.6 Trenching & Sampling

Trenching work was performed by McMEEKIN CONSTRUCTION Ltd., Rocky Mountain HOuse, and the extraction of bulk samples by personnel of TRINA MAREE MINING Ltd.

Work commenced with surveying the ends of each trench and marking the line connecting both the ends.

Then, a caterpillar first cleared wood and timber from the trench area piling up the material close to one edge of the trench.

Upon that approximately 1' (30 cm) top-soil was removed and pushed away approximately 100' (30m) to the opposite side. On that strip about 100' (30 m) wide a backhoe commenced with excavating a trench approximately 10' (3 m) wide through the overburden into the solid bedrock opening the trench approximately 10' (3 m) deep on the average.

The excavated material was dumped immediately besides of the trench.

Then, the entire trench was mapped geologically, and stratigraphic, lithologic and structural features recorded in a drawing scaled at 1":10' (1:120).

Later selected sections of the trenches bearing coal seams and splits considered workable were deepened to the extent that entirely unoxidized coal was encountered.

To control the grade of oxidation channel samples were taken at intervals of approximately 3' (1 m) depth and tested in the field-lab for F.S.I.

When the optimum coal quality was uncovered, i.e. when F.S.I.-values proved optimal (8+) or better than recorded in M.K.'s trenches the relevant coal seam/split was prepared for extraction of the bulk sample.

The face was cleaned and put vertical. An access ramp was cut into the trench close to the sampling-site, and a platform prepared.

Before extraction of the bulk sample the floor in front of the face was covered with plastic foil, and a channel sample taken across the entire seam. In case of several splits within one seam the channel sample representing one seam was composed from several individual split-samples recovered at correct proportions i.e. due to split thickness.

In order to simulate dilution in a future open cast mine a thickness of ½ (15 cm) of the hanging wall rock was included into the sample. In case of a hard rock footwall no material of this kind was added to the sample. However, in case of soft rock underlying a seam or split ½' (15 cm) of this rock was included. Partings of up to 3' (90 cm) thickness were treated as part of the seam and sampled entirely. In case of partings of plus 3' (90 cm) in thickness the above rule was applied.

Then, the quantity of coal required for the bulk sample was extracted with the pickhammer and the material shovelled to the platform covered with plastic-foil and plywood. In case of several splits making up one seam, the splits were sampled individually at the proportion of split thickness inclusive dilution. Then, the individual split-samples were composed to one bulk-sample representing the relevant seam.

Particular care was taken to secure that the samples were extracted at correct proportions within each of the splits i.e. that thickness and depth of the block recovered everywhere was the same, the lateral faces were parallel and hanging and footwalls as well.

Each bulk sample contained all partings and hangingwall / footwall material as included into the precedent channel sample. No loose and surplus material was left at the sampling face.

Then, for control another channel sample was taken from the new face of each seam / split under the same procedures as outlined above.

Channel samples were packed into heavy-duty samplebags, labelled and dispatched to the coal lab.

The bulk sample was loaded with the 1 cby (0.75 cbm) frontend loader from the platform into the tandem-truck carrying up to 13 st per load at the maximum and hauled to the coal lab. To prevent the loss of fine material during transport the load was covered by a tarpolin. On its way to the lab the truck passed a weight-scale and the quantity of the load was established.

Upon completion of sampling refilling of the trench commenced sectionwise. First, the bulldozer pushed back any wood and timber piled up at one side of the trench. On top of that the bulldozer dumped the loose material excavated from the trench by the backhoe. After levelling the site the topsoil piled up at a distance from the trench was pushed and distributed at equal proportions over the entire area.

Where necessary the actual situation of the trench was surveyed again.

Later, the entire disturbed surface was spread with 16-20-0 or 23-23-0 fertilizer respectively, at a rate of 300 lbs / acre (336 kg / ha) and seeded with grass and clover at a rate of 40 lbs / acre (99 kg / ha) as requested by the Reclamation Branch of the B.C. Department of Mines.

A complete documentation on each trench and seam sampled was compiled comprising

- face-map of the trench
- stratigraphic log of the seam tested
- coal laboratory assay-sheets on:

  F.S.I. testing from surface to depth,
  channel samples,
  bulk samples.

3.2 Coal Analysis

3.2.1 Borehole - Samples

The flowsheet for the borehole samples is largely self-explanatory, but this brief commentary may clarify some areas.

Both borehole and channel samples arrived in closed plastic bags containing from 6 kg to 20 kg of coal. This coal was first air dried prior to being crushed in a jaw crusher and sub-sampled for the further work outlined.

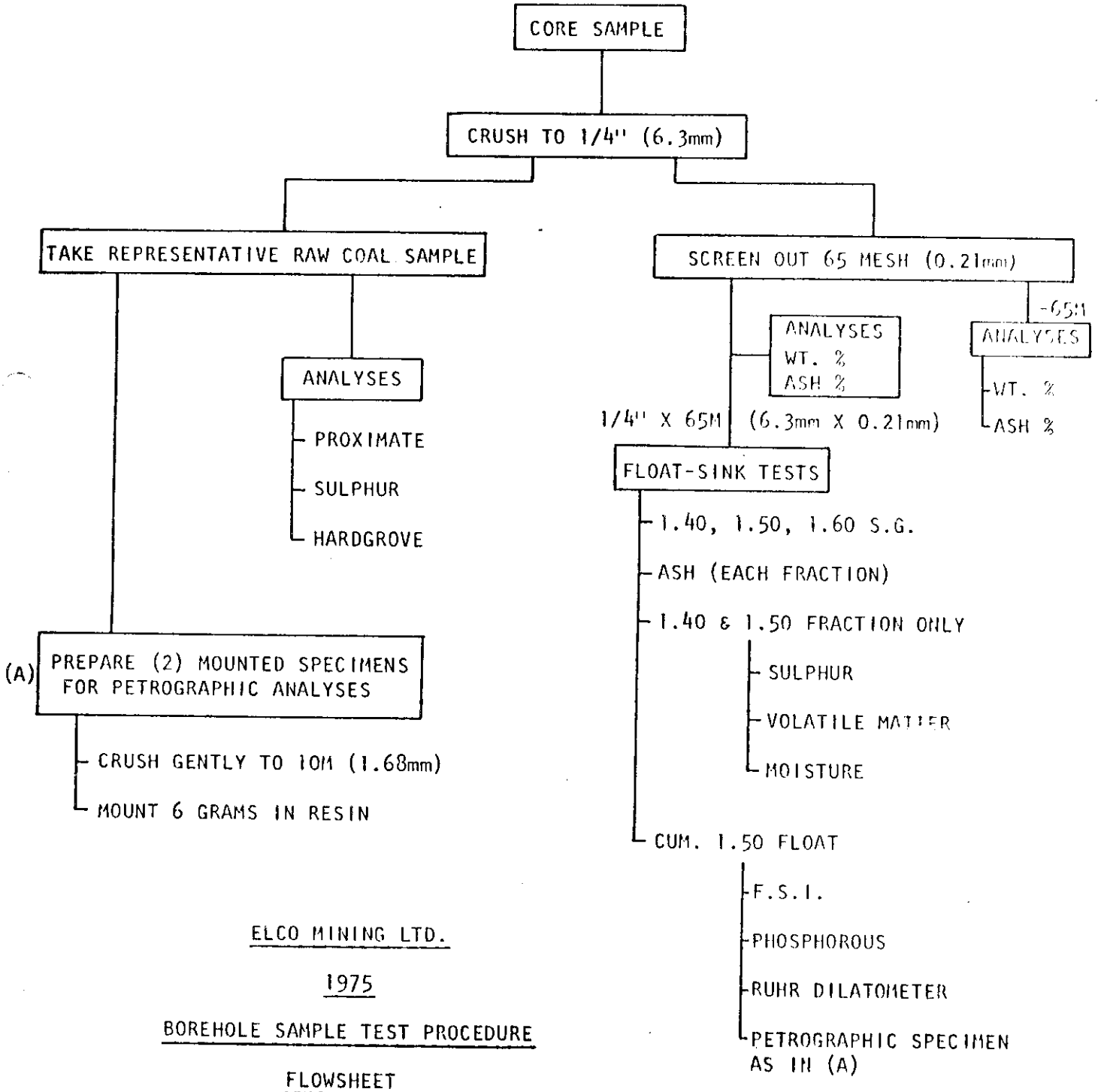
Any coal of ¼" x 0 (0-6 mm) size was pulverized in a cornmill to minus 10 mesh (1.68 mm) before being split to a lesser quantity. Samples for petrographic and Hardgrove Grindability analyses were pulverized in stages from ¼" x 0 (0-6 mm) by using the cornmill at progressively smaller and smaller settings between screening to the appropraite sizes.

At first the top-size requested by Elco for petrographic analysis was 16 mesh (1 mm) but was later changed to 10 mesh (1.68 mm). The analytical size for the Hardgrove is ¼" x 0 (0-6 mm) coal stage, crushed so that the portion passing through a 14 mesh (1.19 mm) screen and being retained on a 28 mesh (0.66 mm) screen is used for the test.

Prepared coal for petrographic analysis which was left over from preparing pellets was sealed in plastic containers and sent to R.A.G. in Germany for possible later testing.

The floats at 1.50 S.G. composite was made up from, a) the ¼" x 0 (0-6 mm) floats for dilatometer and petrographic tests, and b) the pulverized minus 60 mesh (0.25 mm) for the remaining tests.

All the results were tabulated on forms.



ELCO MINING LTD.

1975

BOREHOLE SAMPLE TEST PROCEDURE

FLOWSHEET

3.2.2 Channel-Samples

Channel-samples as received from Canada (Birtley Engineering) were air-dryed and the moisture determined.

Then the sample was split for raw-coal and clean-coal analysis.

Raw Coal Analysis: The material was crushed to minus 2.0 mm and split. From one part of the sample the 1.2-0.6 mm fraction was recovered for grindability testing. The other split was further crushed to minus 0.2 mm, followed by a full scale raw-coa analysis (moisture, ash, vol. matter, sulphur, phosphorous, cal. value, ash fusion and ash analysis).

Clean Coal Analysis: The material was screened at 0.2 mm, and undersize analysed for ash and sulphur. From the oversize a certain proportion was set aside for possible double-checking. Then the oversize material underwent sink-float analysis, separating at gravities of 1.45 and 1.8 S.G. respectively. Following that the resulting three gravity fractions were crushed to minus 2.0 mm first.

The 1.45 S.G. fraction was split into three parts. One was further reduced to minus 1.0 mm for later maceral analysis and reflection measurements. The second was reduced to minus 0.4 mm for Gieseler fluidity testing. The third part was crushed to minus 0.2 mm for a subsequent full scale clean coal analysis (ash, sulphur, vol. matter, phosphorous, F.S.I., Ruhr-Dilatometer testing, carbon, hydrogen, nitrogen, cal. value and ash fusion).

The 1.45 - 1.8 and + 1.8 S.G. fractions were crushed to minus 2.0 mm and finally 0.2 mm for subsequent ash and sulphur analysis.

Analyses results (sizing, gravity, assay) were recorded on form sheets.

ELK RIVER COAL PROJECT

Flow Sheet for Laboratory Testing
of Channel Samples by R.A.G.

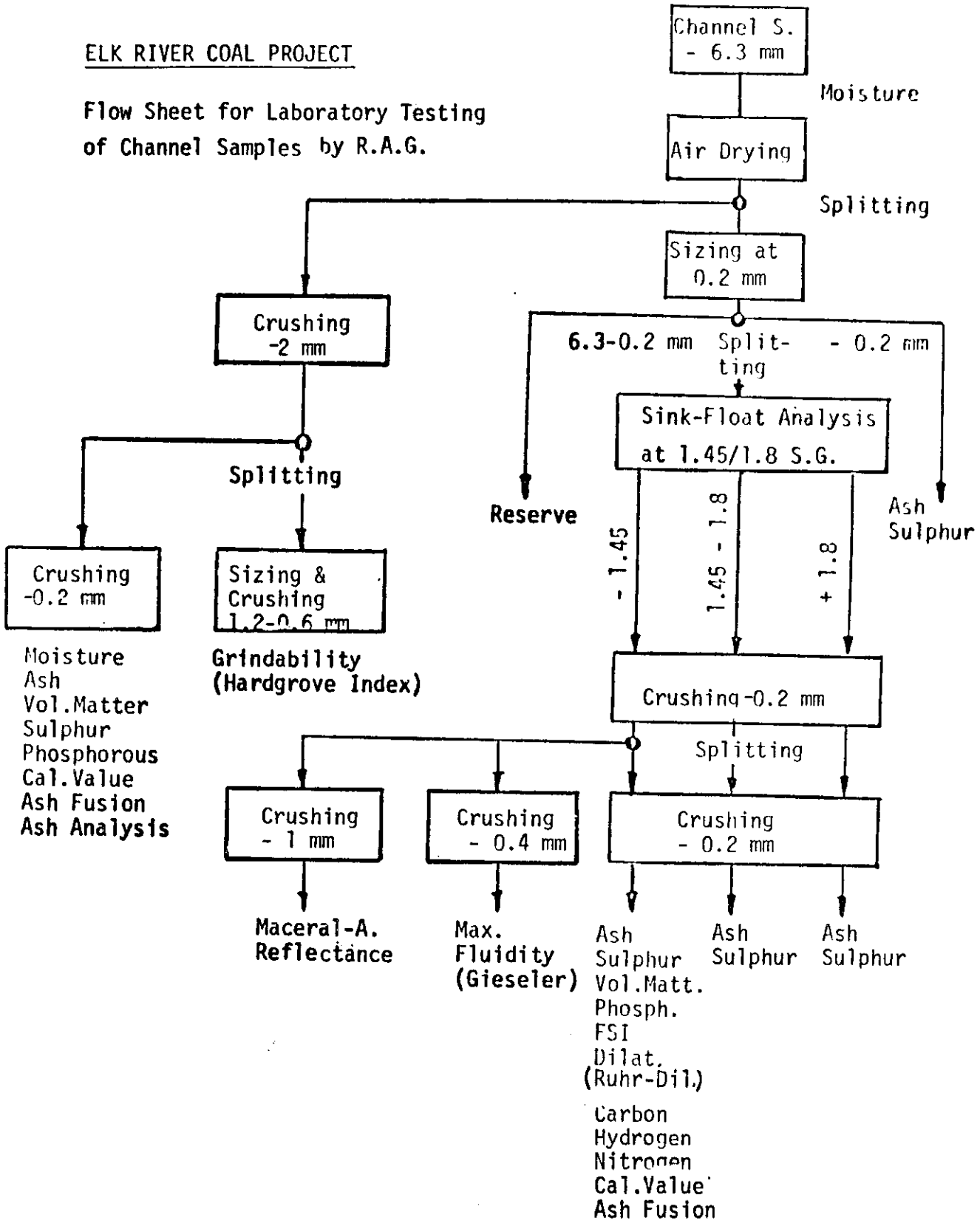


Figure 3

3.2.3 Bulk - Samples

Sampling:

The responsibility for the handling of the bulk samples began for BIRTLEY ENGINEERING (CANADA) Ltd., upon delivery to the Coal Science & Minerals Testing Division plant site. A steel mixing plate, 10 m x 12 m, was made available for reception of the truck load lots. Upon completion of delivery, the bulk sample was thoroughly homogenized by using a front end loader in a fashion simulating the coning and quartering technique until the desired splits were extracted.

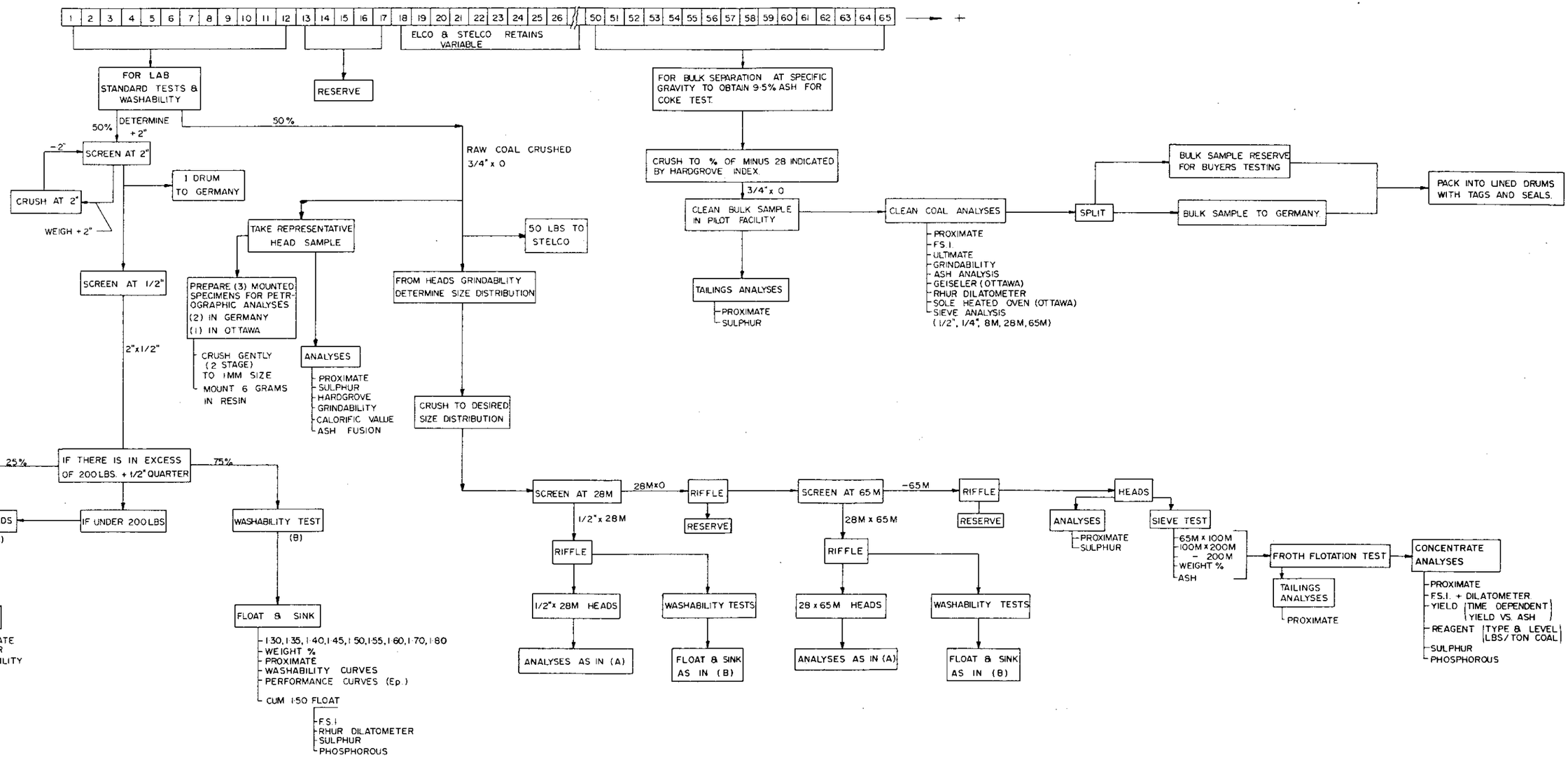
The reserve raw split and the retained coal for the Elco and Stelco composite washes was placed in poly-lined barrels with dry-ice, and stored outdoors. (The dry-ice was later omitted upon being advised by Elco). A total of 588 drums of raw coal were in storage before any composites were made.

The twelve barrels for coal reserved for washability work were processed according to the flow sheet (Figure 4) as soon after sampling as was practicable The remaining coal was washed immediately after sampling in the three circuit pilot plant.

Washability Work:

Prior to primary screening, the samples were weighed on a TOLEDO platform scale with a capacity of 250 kg. The large (5 cm range) size analysis was performed manually on square opening, wire mesh screens 120 cm x 240 cm in dimension. Fine screening, i.e. 28 M x 0 (.60 mm x 0) was performed on a vibrating deck screen or by using standard 8" (20.3 cm) diameter testing sieves in conjunction with a ro-tap.

NOTE : FOR "BULK" OR LARGE SCALE TEST THE FOLLOWING PROCEDURES APPLY FOR EACH SEAM.
ORIGINAL BULK SAMPLE TO BE DELIVERED FROM FIELD IN SCALED TRUCKS
SAMPLES TO BE BLENDED BY LABORATORY & PRODUCTS STORED IN DRUMS (APPROX. 400 LBS. EACH)



NOTE : (1) ALL HEAD SAMPLES WILL BE RETAINED AND STORED IN A MANNER TO INHIBIT OXIDATION.
(2) DRUM COSTS AND PACKING FOR HEAD SAMPLES AND CLEAN COAL TO BE INCLUDED.
(3) LABELS TO BE INSIDE LINER, ATTACHED TO LINER SEAL AND TO BE PAINTED ON BARRELS.

Figure 4

GWS
BIRTLEY ENGINEERING CANADA LTD

THE FINAL BULK SAMPLE FLOWSHEET
FOR ELCO MINING LTD. FOR
1975 ELK RIVER PROGRAMME

N.T.S.
BB Butler 13 JAN 76
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Drying was accomplished by using a fan circulated cabinet or a concrete drying pad with electric heating coils imbedded below the surface. In either case the heat generated did not exceed 35^{0} - 40^{0} C.

To subsample coal larger than the 0.5" (1.27 cm) top-size, the manual coning and quartering method was used whereas for smaller top-size coal, totally enclosed splitters with stainless steel grids 3/4" (1.90 cm) or 3/8" (0.95 cm) apart were used as dictated by sample bulk and top-size.

Coarse coal (+ 3/4" / 1.90 cm) was crushed for the purpose of subsampling by either a 3" x 5" laboratory jaw crusher or the 5" x 8" plant jaw crusher. Comminuation of coal with a top-size of less than ¼" (0.64 cm) was effected by use of a serrated plate motorized cornmill. This cornmill was also used for stage crushing of samples slated for petrographic analysis and Hardgrove Grindability tests.

Samples which required the analytical size consist of minus 60 M (0.25 mm) were pulped by using a Holmes perforated screen, impeller type pulverizer, totally enclosed to eliminate dusting loss. These pulverized samples were placed in plastic containers with air tight snap tops, on which the identification was recorded.

Float-sink liquids of appropriate gravities were made up by using proportions of iosol 2429 (0.78 S.G.), perchlorethylene (1.62 S.G.) and certigrav (2.20 S.G.). (Certigrav is a dibromo-ethane based organic liquid). The size of the apparatus for performing float-sink separations necessarily varies with the top-size of the coal being treated and the top-size dictates the minimum weight of sample to be used. The float-sink for this program was performed using containers as large as

75 litre capacity for the 2" top-size coal, and as small as separatory funnels of 2 litre capacity for 28 M top-size coal.

Washability curves were drawn from primary data for the 2" x ½" (5.1 cm x 1.27 cm) raw coal as well as for the 3/4" x 28 M (1.90 cm x 0.59 cm) and 28M x 65M (0.59 cm x 0.21 cm) crushed to minus 3/4" raw coal.

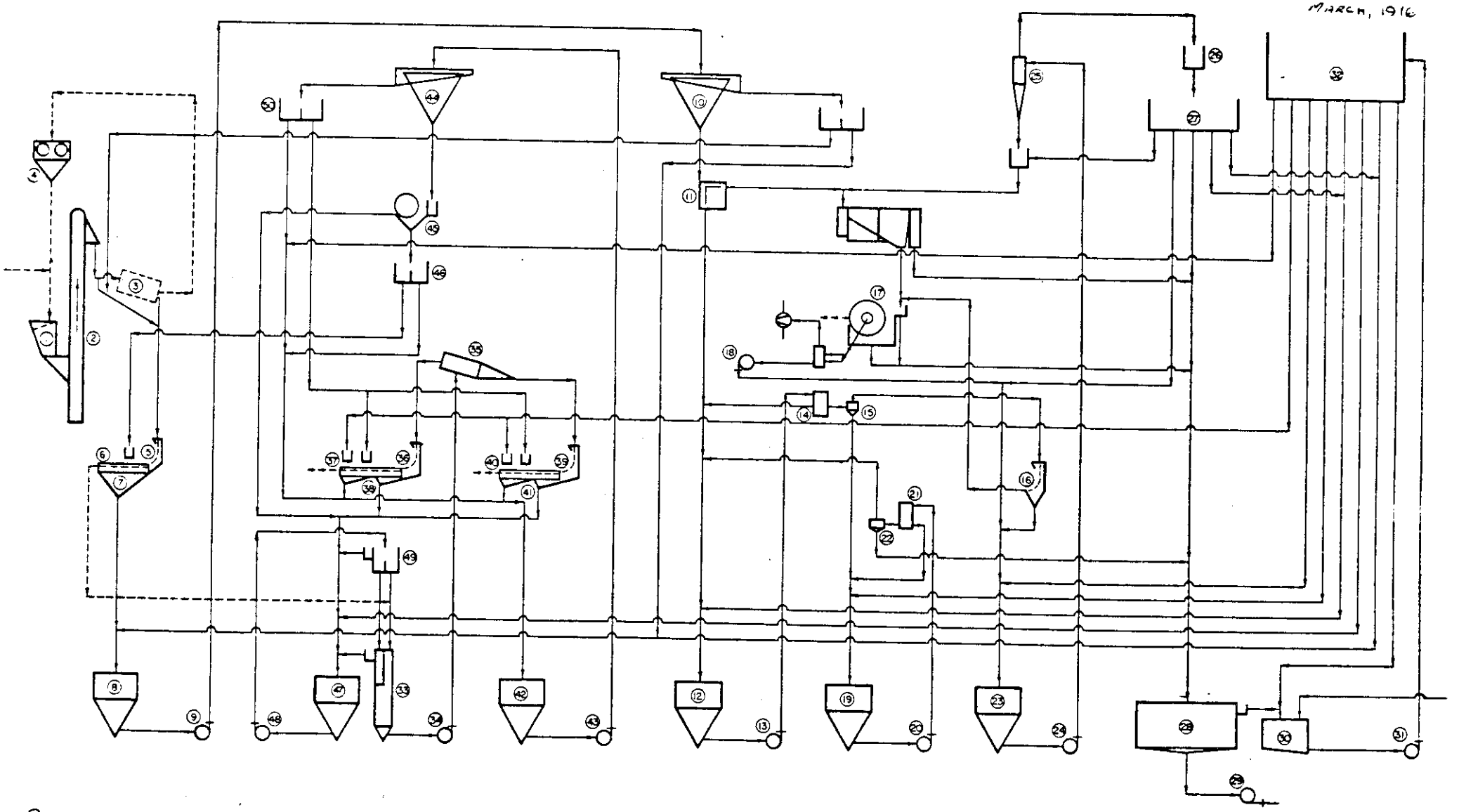
The ½" x 28 M (1.27 cm x 0.59 cm) raw curves were drawn from calculations derived from the washability results aforementioned, and simulate the removal of material from the 3/4" x 28 M coal which was introduced from the 2" x 3/4" raw coal being crushed to minus 3/4". Prior to accepting this procedure, it was found that the amount of 3/4" x ¼" material found in the raw, crushed to minus 3/4", was in the range of 2% and could be considered negligible. It was also assumed for the purpose of the calculations, that the amount of ½" x 28 mesh raw would be in the same range as the 3/4" x 28 mesh crushed and the total of the 2" x ½" and 3/4" x 28 mesh would equal 100%.

The washability for 3/4" x 28 mesh, 28 mesh x 65 mesh and the 65 mesh x 0 raw crushed coal was deemed necessary in order to compare the results of the plant washed for which 3/4" x 0 coal forms the feed. These sizes dovetail with the plant heavy-media, water cyclone and froth flotation circuits.

Pilot Plant Washing:

Figure 5 is the flowsheet of the Coal Science & Minerals Testing pilot plant. Raw coal is dumped by a frontend loader into a hopper at ground level, which has a heavy 2" square screen installed to ensure that the bucket elevator receiving the feed does not handle oversize

MARCH, 1976



1. Feed Bin
2. Elevator
3. Rotary Screen
4. Jaw Crusher
5. Sieve Bend
6. Desliming Screen
7. Underflow Collector
8. 28M³ Raw Coal Collection Tank
9. Pump
10. Settling Cone
11. Diverter
12. Primary Water Only Cyclone Feed Tank
13. Pump
14. Distributor
15. Primary Water Only Cyclone
16. Sieve Bend
17. Vacuum Filter
18. Filtrate Water Pump
19. Secondary Water Only Cyclone Feed Tank
20. Pump
21. Distributor
22. Secondary Water Only Cyclone
23. Thickening Cyclone Feed Tank
24. Pump
25. Thickening Cyclone
26. Overflow Distributor
27. Head Box
28. Thickener
29. Waste Disposal Pump
30. Clarified Water Collection Tank
31. Clarified Water Pump
32. Clarified Water Head Box
33. Cyclone Feed Tank
34. Pump
35. DSM Cyclone
36. Sieve Bend
37. C.C. Drain and Rinse Screen
38. Underflow Collector
39. Sieve Bend
40. Discard Drain and Rinse Screen
41. Underflow Collector
42. Dilute Medium Tank
43. Pump
44. Settling Cone
45. Magnetic Separator
46. Splitter Box
47. Correct Medium Tank
48. Pump
49. Distribution Box
50. Splitter Box

TEST PLANT FLOWSHEET

COAL SCIENCE & MINERALS TESTING

DIV. OF BIRTLEY ENGINEERING (CANADA) LTD, CALGARY, ALTA.

material. The 2" oversize coal is crushed manually to pass the 2" screen, but "rock" is collected in barrels and reported as shale for the heavy media circuit. The bucket elevator discharges the minus 2" feed at a rate of 5 to 7 metric tons per hour, into a rotary 3/4" screen on the third deck. The 3/4" oversize falls via a chute into a 5" x 8" jaw crusher where it is crushed to minus 3/4" and recycled through the feed system. The 3/4" x 0 screen underflow is washed with water onto a 28 mesh sieve bend and slot screen for desliming.

The 3/4" x 28 mesh coal is the feed to the 14" DSM Heavy Media come on the second deck. The slurry of coal and correct medium is pumped to the cyclone from the mixing tube at a pressure of 9 to 10 P.S.I. The overflow and underflow products are discharged onto a common, but split 28 M slot screen preceded by a 28 mesh sieve bend where the magnetite is washed off into the correct and dilute medium tanks directly below. Additional clean spray water and baffles across the clean coal stream ensure that a minimum of magnetite is retained on the clean product. The clean coal and shale are collected in barrels by means of individual chutes for weighing.

The dilute medium is pumped to a thickening cone on the third deck from where it is fed to a 30" magnetic separator. The recovered magnetite is sluiced back to the correct medium tank. The specific gravity of the medium is monitored manually, using a density meter, and adjusted for loss by adding cyclone grade magnetite directly to the correct medium tank.

The 28 M x 0 coal collected in the slimes tank ground level, is pumped to the thickening cone on the third deck. From this point it can be fed directly to the froth circuit or as is usual, to the water cyclone system.

Coal to the 6" DSM water cyclone is pumped at a pulp density of 10% to 20% from the cyclone feed tank at a pressure of 20 F.S.I., and a flow rate of 85 Imperial gallons per minute. A mechanically adjustable vortex finder facilitates settings for a desired ash content.

The underflow or waste product is routed to the static thickness while the overflow is fed by gravity to a rapped 0.25 mm sieve bend. The sieve bend overflow is the water cyclone product at approximately 65M oversize, and directed to the Eimco disc filter for dewatering.

The sieve bend underflow flows by gravity to the thickening cyclone feed tank, from where it is pumped to the 20^{0} - 8" cyclone. This thickening cone serves a dual purpose; 1) it removed undesireable - 325 M slimes from the flotation feed. 2) it provides a feed of proper density (20% - 30% solids) to the froth cells.

The flotation circuit consists of two Birtley-Humboldt multi-wobble cells in series. Since these cells were installed on September 12, 1975, there appears to be a marked improvement in tailings ash contents, indicating excellent recovery of froth product. A rotary reagent feeder introduced 4:1 kerosene: Methylisobutylcarbinol into the circuit at the feed entry point for better conditioning.

The tailings join the water cyclone underflow in the static thickener to form the thickener tails. The froth enters the Eimco disc filter and is dewatered along with the sieve bend overflow to form the filter cake or fines product. This and the heavy media clean coal are combined to form the clean coal product or clean mix. This product is analysed as outlined in the flow sheet (Figure 4).

Each circuit was sampled for feed, product and waste in addition to the 0.25 mm sieve bend overflow and filter cake. Each sample was analysed for ash content and Free Swelling Index. Size analyses were performed on fines circuit samples at 65 M and 100 M. Float-sink of the Heavy Media Clean Coal and Shale, and the water cyclone plus 100M overflow and underflow provide the necessary data to calculate the probable error curves for the two circuits. A detailed summary of the washing results is provided for each seam.

Unavoidably, due to the high pressure aspect of the program, some analytical determinations are missing, as will be evident from the blank spaces on the forms. Some of these determinations will be completed where samples are available and the replacement sheets will be forwarded at that time.

The heavy media clean coal and the filter cake were thoroughly homogenized and the resultant clean mix sampled and analysed. A clean coal analysis sheet contains the requested determinations.

For shipping purposes, clean 45 gallon drums were double lined with polyethylene bags, the coal placed into the barrels, a tag fixed inside, and lids securely put on. The destination was stencilled on the outside of the drums, and all the drums save the initial shipment placed in bulk containers for overseas transport.

3.3 Seam Development and Coal Quality

In order to summarize ELCO's test and exploration results and to compare them with earlier findings a description of the features for each individual seam was prepared.

This comprises data on seam development across the envisaged mining areas as well as the entire property with regards to seam thickness, number and thickness of splits, rocktype and thickness of partings, nature of contacts.

Also reference was made to coal quality, dilution and representativity of bulk samples taken. This information is supported by a summary analysis sheet comparing results of borehole, channel and bulk samples (arithmetic averages).

Coal reserves in place, recoverable and clean product were reported for mining alternatives "A" and "C". The clean coal figures result from the recovery expected for the relevant seam when a 9.5% ash product is targeted for in a commercial plant. For comparison TECHMAN and ELCO figures were recorded.

The same was done for each composite coal.

Finally, general conclusions were drawn from an overall comparison of borehole, channel and bulk samples analyses arriving to certain thumbrules with regards to prediction of clean coal quality as received in a commercial plant from borehole sample analyses.

3.4 Coal Reserves Calculations

3.4.1 Open Pit Reserves

Within the scope of a prefeasibility-study prepared by TECHMAN Ltd. in 1975 mining concepts for an open pit were outlined between

sections 180+00 and 370+00 (Alternative "A")
sections 180+00 and 335+00 (Alternative "C")

A coal reserves & overburden calculation was performed by TECHMAN Ltd. for both the areas. This, however, was based on substantial interpolations for seams 12 to 20 due to lack of sufficient drilling data available at that time.

ELCO's 1975 diamond-drilling program eliminated these gaps of information, and a new coal reserves calculation was undertaken by ELCO based on firm and reliable data.

For both the alternatives "A" and "C" coal and overburden volumes were computed section by section at a 2,000' (600m) spacing, and seam by seam within each of the sections. All measurements were taken from sections at a scale of 1":50' (1:600).

With reference to standards of reserves classification introduced for Canadian Coal Resources by B.A. Lator & L.P. Chrismas in 1970 (see foot note) the coal reserves as calculated and established for mining areas "A" and "C" in this report may be considered measured or proven reserves.

Note:

Measured or Proven Resources

Measured resources are those for which tonnage is computed from dimensions revealed in outcrops, trenches, mine workings and drillholes. The points of observation and measurement are so closely spaced, and the thickness and extent of the coal are so well defined, that the computed tonnage is judged to be accurate within 20 percent of the true tonnage. Although the spacing of the points of observation necessary to demonstrate continuity of coal differs from region to region according to the character of the coal beds, the points of observation are, in general, about half a mile apart.

This report only contains the summary check of the voluminous calculations, and handwritten detail sheets have been filed with ELCO's Calgary headoffice, for future and individual inspection.

On the methods of calculation applied the below explanations and remarks are of importance.

(a) Oxidation Level

The coal reserves were subdivided into coal below oxidation level (non-oxidized coal) and coal above oxidation level (oxidized coal). The level of oxidation was chosen 50' (15 m) below the surface.

In case the glacial till proved thicker than 50' (15 m) no oxidized coal was calculated for these locations, and only non-oxidized coal applies.

An oxidation zone of that depth has not yet been confirmed by bulk sampling nor by drilling. The 50' (15m) zone, however, was chosen to allow for unknown variances.

(b) Mineable Seam / Split

A seam or split of a seam was determined mineable if the true thickness proved more than two feet. Dilution rock was added to the seam thickness if one parting was less than three feet in true thickness between two mineable seams or splits respectively. Otherwise the parting was treated as waste.

This method of calculation was chosen because it simulated and reproduces the method of ELCO's bulk

sampling. Therefore, the washability yield obtained from each of the bulk samples could be directly applied for the clean coal calculation.

(c) Average Length Along Dip

For coal volume calculations the length down dip of the seam was measured along its foot - and hanging - walls and the arithmetic average was used. The same applies to the wast volume calculation.

(d) Average True Thickness

The vertical penetration thickness of coal in a drill hole multiplied by the cosinus of the seam's dip equals the true seam thickness. If the seam was penetrated by more than one bore-hole in the same section, an arithmetic average was calculated from the available individual data.

(e) Distance of Seam Along Strike

For volume calculations a distance of 1000 feet on either side of the section was taken (2000' / 600 m block width). This is due tothe 2000' (600 m) spacing of the cross sections. Only at the southern and northern ends of the pit this width is different because the slope of the pit wall and the cross section are not parallel, and the pit wall is not rectangular to the base line.

(f) Raw Coal Volume and Raw Coal Tonnage in Place

The raw coal volume was obtained by multiplication of

- o seam length along dip
- o average true seam thickness and
- o block width.

To convert the raw coal volume into short tons a specific gravity factor of 1.22 was applied. This factor is the same as used by TECHMAN Ltd.

(g) Mining Loss

A mining loss of one foot of coal per mineable seam/split was applied. Also here the same conversion factor of 1.22 was used.

(h) Recovered Raw Coal

Recovered raw coal was determined as raw coal tonnage in place minus the mining loss.

(i) Dilution Rock

To each mineable seam/split an amount of 0.5' (0.15 m) of dilution rock was added. To convert the dilution volume into short tons the same factor of 2.02 was used as by TECHMAN.

(k) Recovered Raw Coal Plus Diltuion Rock Equals Run of Mine Product (ROM)

The ROM product (in short tons) was calculated by adding the recovered raw coal and dilution rock.

(l) Waste

Rock thicker than 3.0 feet between two mineable seams/splits was considered waste.

(m) Recovered Waste

Recovered waste was determined as waste minus dilution rock.

(n) Total Waste

Total waste was determined as recovered waste plus the mining loss.

(o) Oxidized Raw Coal

Same as (f), but above oxidation level.

(p) Mining Loss (Oxidized Coal)

Same as (g), but above oxidation level.

(q) Recovered Oxidized Raw Coal

Same as (h), but above oxidation level.

(s) Recovered Oxidized Raw Coal Plus Dilution Rock Equals Run of Mine Product (ROM)

Same as (k), but above oxidation level.

(t) Overburden = Glacial Till and Slope Debris

This layer covering the coal measures was calculated separately.

(u) Rock Overburden

Rock overburden was defined as waste rock between mineable seams/splits but above oxidation level.

(v) Recovered Overburden

Recovered overburden has been defined as overburden (glacial till, slope debris plus rock overburden) minus dilution rock, but above oxidation level.

(w) Total Overburden

This material is defined as recovered overburden, plus the mining loss above the oxidation level.

3.4.2 Underground Reserves (HYDRAULIC)

The best area suitable for hydraulic underground mining appears to be Big Weary Ridge situated on the southeastern flank of the Elk River syncline direct south of open pit areas "A" and "C" respectively.

In 1975/76 the area was drilled on a widely spaced reconnaissance pattern, so that the reserves established, can be classified as drill-indicated or probable (see foot note). An accurate seam - correlation is not possible in all instances yet, but the available information proves sufficient to calculate the minimum amount of U/G reserves.

The reserves were calculated for three different departments (areas) according to seam selection:

Department 1: Between cross-sections 100 and 180. Mining of seam No. 2 only, above drainage level.

Department 2: Situated locally as Department 1. Mining of seam 2 and other suitable seams from No. 10 upwards to 270 m below drainage level.

Department 3: Between cross-sections 40+00 and 100+00. Mining of seam No. 2 and other suitable seams

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Note:

Indicated or Probable Resources

Indicated resources are those for which tonnage is computed partly from specific measurements and partly from projection of visible data from a reasonable distance on the basis of geologic evidence. In general, the points of observation are about 1 mile apart, but they may be as much as 1 1/2 miles apart for beds of known continuity.

from No. 10 upwards, above drainage level. This department is located mainly in the Fording-lease, and it is estimated that 2/3 of the reserves are located in the Fording-lease and 1/3 in the Elco-lease.

The following parameters were used for the clean coal reserve calculation:

1. Minimum Seam Thickness: 8' (2.5m)
2. Spez. Gravity raw coal: 1.45
3. Underground mining recovery: 70%
4. Washability yield varying as per individual seam: 50 - 70%
5. Reduced underground recovery caused by structural irregularities: 75 - 90%

4. ASSESSMENTS AND RESULTS

4.1 Geology *)

4.1.1 Stratigraphy (Fig.4-8, Appendix 1)

The coal measure sequence lies within the Lower Cretaceous Kootenay formation. This formation extends throughout southeastern British Columbia and southern Alberta and everywhere contains significant coal seams. In areas where the rock sequence is well exposed, it is underlain by the marine shales of the Fernie group, and unconformably overlain by the basal conglomerate (Cadomin formation) of the Blairmore group. It varies widely in thickness from 200 to 300' (60 - 90m) up to in excess of 3,000' (900 m) in its more westerly exposures.

In the Elk Valley the underlying Fernie Group is well exposed along the east side of Big Weary Ridge and succeeding ridges to the south. Some probable exposures of Fernie group have also been recognized on Little Weary Ridge.

The conglomerate that overlies the Kootenay formation was never found in contact with a continuous section of coal measures. However, numerous exposures of a conglomerate were found along the west side of the Elk Valley in positions indicating apparent stratigraphic continuity with the coal measures. The conglomerate appears lithologically identical to the typical Cadomin conglomerate of adjacent regions and is assumed to be in fact this congomerate.

The Kootenay formation is a highly variable coal measure sequence underlain by a massive basal sandstone containing

*) Details see Appendix 2

several thick (more than 10' (3m) coal seams in its lower 600' (180m) of coal measures. (The basal sandstone was not measured on the property but is assumed to be approximately 200' (60m) thick.) The remainder of the coal measure sequence contains a multiplicity of coal seams generally less than 10' (3m) thick although notable exceptions in seam thickness do exist. Indications are that the total coal measure sequence is approximately 3,000' (900m) thick.

The information gathered from the surface sections and boreholes assist greatly in defining a more detailed picture of the stratigraphy:

Fernie-Kootenay Contact: The contact between the Fernie group and the basal sand unit of the Kootenay formation is reasonably abrupt in this area. The dark grey to black marine shales of the Fernie meet rather sharply with a light colored, poorly cemented and friable sandstone unit of the basal sandstone.

The Basal Sandstone: The basal sandstone may be divided at outcrop into two mappable units. Contained within the lower unit are light colored, poorly cemented or friable sandstones. These are about 100' (30m) thick and have an extremely sharp, probably erosional, upper contact with the dark unit of the basal sand. The upper dark unit is about 50 - 100' (15 - 30 m) thick. It is mainly composed of chert and quartz, is well cemented with a siliceous cement and is extremely hard to fracture. It owes its dark color to the high percentage of dark chert grains. The basal sand has previously been described as a marine sequence (as it contains marine ammonites in the Fernie area), but it appears to be a continental sequence for the most part in this area.

General Trends in the Kootenay Formation: As mentioned, the Kootenay formation in this area is about 3,000' (900 m) thick. It overlies a marine shale sequence called the Fernie Group and is overlain unconformably by the Cadomin conglomerate of the Blairmore group.

The lower 2,000' (600 m) of the Kootenay, i.e. from the basal sandstone to seam "A" or "18", is non-calcareous and is indicative of a truly continental sequence. The lowest 600' (180 m) is generally sandier than the upper part of the Kootenay and contains most of the thick (more than 10' 3 m) coal seams. It has been found that some of the coal seams contain ironstone beds as well as zones (up to 2' 0.6 m) of small heavily concentrated (1 - 3 mm) ironstone pellets. These are presumed to have been derived locally and they are questionable as a reliable marker horizons. Some attempts were made to correlate seams using them but without success. Furthermore, it is not certain whether they would be apparent in unoxidized zones (i.e. drill holes or fresh surface cuts).

The upper 1,000' (300 m) of the Kootenay formation consists mainly of thin coal seams and shales. Several marine bands are present as evidenced by the appearance of small (generally less than ½ inch) pelecypods, ostracods and ammonites found in the black shales, but no fossil zonation for the basis of correlation has been established as yet. The nature of the upper sequence being partly marine may explain the numerous thin coal seams and the poor development of any thick ones. That is to say, the coal measures may have been derived close to a fluctuating and inundating sea. Due to the lack of any persistent marker beds anywhere in the Kootenay formation in the Elk Valley, correlation has been based on stratigraphic interval in combination with coal seam sequence.

4.1.2 Structure (Fig. 6, 7, 8, Appendix 1)

The general structure of the east side of the Elk Valley is well known to be a series of west dipping beds ranging from the Fernie group to a stratigraphic position high in the coal measures of the Kootenay formation. Similarly, the west side of the valley is known to be underlain by near vertical coal measures. It has been suggested that the valley is underlain by a fault or alternatively that a syncline underlies the valley bottom. The new work tends to prove the second interpretation and this will be discussed below.

For ease of understanding, the different portions of the project area are discussed separately and a general summary ties the overall interpretation together. The separate areas discussed are:

(a) Big Weary Ridge
(b) Little Weary Ridge
(c) the "West Side" of the Elk Valley
(d) the Cadorna Creek area.

By far the most detail is available for the Big Weary Ridge area.

Big Weary Ridge: Big Weary Ridge is a striking topographic feature underlain by predominantly west dipping beds. Excellent exposures are available along the ridge itself and in the valley of Weary Creek.

Structurally, the area is characterized by a series of thrust faults cutting up section from west to east

accompanied by minor amounts of folding. Faulting is observable throughout, though the area appears to be most highly faulted between sections 120 - 170. A more detailed look at this area shows the basal sand (closest to the ridge) dipping steeply to the west above the most easterly major fault. The strata down dip in this area assumes a similar profile in that it is also generally steeply dipping. The steep dips here are accompanied by extensive thrust faulting and contortion of the strata. Tectonic thickening and thinning of the coal seams was observed here in the field.

As one continues north past section 170, minor faulting is observable, though the area is generally devoid of any major structural complexities. This is best evidenced by the Weary Creek section. Here, minor thrusting is apparent at approximately the six seam horizon. Micro-folding and shear zones are also noticeable in a few of the coal seams at this location.

To the south from section 120, one encounters a relatively regular westerly dipping sequence. Faulting and folding were observed though they appear to be quite minor and localized.

It should be noted that the most easterly major fault that cuts through the basal sand on the ridge has a minimum displacement of approximately 1,600 feet in a northerly direction.

Little Weary Ridge: This area is typified by a quite regular sequence of westerly dipping beds, the average dip which is approximately 40^{0}. The area may be considered to be devoid of significant structural complications, though minor irregularities were encountered. There is some possibility of faulting below the basal sand here as evidenced on the north end of the ridge, but this does not affect the coal bearing strata.

"West Side": The coal measures on the west side of the Elk Valley are essentially vertical from a point due west of Aldridge Creek north to Cardorna Creek where some overturning is recognized.

The outcrop except for a tributary of Bleasdell Creek is essentially limited to the old exploratory trenches. These trenches are for the most part overgrown and collapsed but wherever possible, attempts were made to measure the exposed rocks.

Little evidence of any major structural discordances could be found although the more westerly outcrops tended to show minor faulting and slickensiding. Some of the thicker coal occurenced in this area are probably tectonically thickened. This minor structural complexity is associated with the overthrust Palaeozoic rocks in the west.

Cadorna Creek: This area while not of great significance from an economic standpoint is nevertheless of structural importance in that it provides the key to the interpretation of the valley bottom.

A syncline flanked by Cadomin formation containing Blairmore group in its axial area is readily mapped along Cadorna Creek. The west limb (Cadomin formation) is traceable all

along the west side of the project area.

This syncline is projected throughout the project area essentially parallel to and west of the Elk River.

Conclusions: The conclusions can be broadly broken into two categories - stratigraphic and structural.

From a stratigraphic point of view approximately 3000' (900 m) of coal measures are present in the Elk Valley. The seams are not persistent over significant lateral distances and correlation for more than a few thousand feet of any seam is difficult although coal zones may persist. No apparent correlation can be made between the major measured sections, i.e. Weary Creek (75-B)*, Big Weary Ridge (75-A)* and the sections on the west side of the valley. This lack of correlation undoubtedly reflects stratigraphic variation rather than structural complexity.

In fact it is very difficult to follow individual stratigraphic units, either coal or sandstone, for more than a few thousand feet. This makes correlation of seams across Weary Ridge from Weary Creek to the ridge itself questionable with the present data, although an interpretation is shown on the maps.

Structurally, the Elk Valley is believed to be underlain by a major syncline. It is exposed at Cadorna Creek. No significant faulting is recognized on the west side of the valley with the notable exception of the Palaeozoic overthrust.

*See Appendix 2

Big Weary Ridge contains at least two major overthrusts which involve the Kootenay formation. Additionally, a major zone of disturbance is present in the Aldridge tunnel area and this zone would significantly effect any attempt at underground mining in that area.

4.1.3 Coal Stratigraphy

Seam stratigraphy is primarily based on correlations established by SCURRY RAINBOW OIL Ltd. and MORRISON KNUDSON. This system was only adjusted when new information became available leading to a different assessment. It is understood that seams primarily are correlated due to their stratigraphic position relative to the basal sandstone member of the Kootenay Formation, the intervals between the coal seams and their thickness.

Geophysical logs measured for all boreholes of ELCO's 1975 drilling program and also available for most of the previous diamond and rotary holes proved the best means for seam correlation. These were gammaray, neutron and sidewall density logs. A sufficiently tight spacing of boreholes provided seam correlation proved easy by mere comparison of the relevant logs.

Applying this method no problems were envolved with correlation of seams No. 2 to 12. Correlation of seams No. 13 to 20 proved possible but more difficult due to extensive seam - splitting even between closely spaced boreholes.

However, no complications were recorded arising from structural dislocations like folding, faulting etc. If existing at all they have to occur in dimensions not easily discoverable by boreholes spaced as at the present.

Helpful for the correlation proved a few seams used as "marker-horizons" described as below:

Seam No. 2: This seam is to identify due to its development in minable thickness and good quality just above the basal Kootenay sandstone.

Seam No. 4: This seam is characterized by its position relative to the basal Kootenay Sandstone and its thickness of up to 37' (11.3 m).

Seam No. 8+8A: This seam represents an ideal marker due to its always present split between seam 8 and 8A. The split may vary in thickness but could be traced across the entire open pit area.

Seam No. 10+12: Both the seams can be used as a marker horizon due to their sudden and abrupt change in their quality representing a characteristic feature.
Generally seam No. 10 proves to be of better quality than seam No. 12.

Seam No. 18: This seam proves tracable due to its relative high thickness in comparison to the other seams in the upper part of the measures.

Summarizing the present stage of seam correlation it is believed that the sequence from Seams No. 2 to 12 is properly correlated and that only minor discrepancies would be discovered by future drilling and mining.

But further drilling is required for exact seam location due to the fact that the drill hole spacing as existing now still is considered too wide.

In particular the upper part of the measures between Seam No. 13 to 20 requires more research and fill-in drilling to confirm present seam correlation and location. This is deemed necessary in particular with regards to the tendency of the upper seams to split intensively and lense out laterally.

For statistical reasons on the following tables Nos.3 & 4 the combined true seam thicknesses (incl. partings less than 3' / .9 m) are listed in comparison to the average true split thicknesses (incl. partings less than 3'/.9 m) of each individual seam sectionwise and across open pit areas "A" and "C"

Both the combined true seam thickness and the average true split thickness deserve particular attention: The first one merely reflects the coal thickness per seam in the ground, whereas the second figure rather gives the actual average mining condition one has to cope with.

Both the tabulations also give exact information on seam development and splitting for each seam sectionwise and across the mining areas.

TABLE 3

COMBINED TRUE SEAM AND SPLIT THICKNESSES PER CROSS-SECTION ALTERNATIVE "A"

CROSS SECTION:	180+00	200+00	220+00	240+00	260+00	280+00	300+00	320+00	340+00	360+00	Average Combined True Seam Thickness (Including Partings Less Than 3 Feet)	Average True Thickness of all Individual Splits (Including Partings Less Than 3 Feet)
Seam No. 2:	15.97	12.98	11.02	11.00	14.97	13.89	13.90	13.64	15.97 6.46	5.90 2.95 3.28		
Comb:	15.97	12.98	11.02	11.00	14.97	13.89	13.90	13.64	22.43	12.13	14.19	10.92
Seam No. 3:	6.54	5.33	9.39	9.00	5.26	4.98	8.04 5.58	6.67 2.17	2.28	1.97 8.86		
Comb:	6.54	5.33	9.39	9.00	5.26	4.98	13.62	8.84	2.28	10.83	7.61	5.87
Seam No. 4A:			2.33	5.75	10.55	4.60	4.39 4.39	7.66	6.08	4.92		
Comb:			2.33	5.75	10.55	4.60	8.78	7.66	6.08	4.92	6.33	5.63
Seam No. 4:	20.07	23.33	13.02	8.50 11.00	22.85	17.62	18.83	25.75	29.66	18.37		
Comb:	20.07	23.33	13.02	19.50	22.85	17.62	18.83	25.75	29.66	18.37	20.90	19.00
Seam No. 5:		3.19	3.06	2.76								
Comb:		3.19	3.06	2.76							3.00	3.00
Seam No. 6:	3.96 2.08 3.40	5.08 9.58	8.04	4.73	3.15			4.66	3.55	1.97		
Comb:	9.44	14.66	8.04	4.73	3.15			4.66	3.55	1.97	6.28	4.56
Seam No. 7:	6.37	5.60	4.60	5.99	8.67	5.36	4.12		2.08			
Comb:	6.37	5.60	4.60	5.99	8.67	5.36	4.12		2.08		5.35	5.35
Seam No. 8A:	8.32	6.00	9.19	7.19 8.74	7.09	8.43	4.18	5.66	8.05 6.37	15.74		
Comb:	8.32	6.00	9.19	15.93	7.09	8.43	4.18	5.66	14.42	15.74	9.50	8.05
Seam No. 8:	9.85	14.50	9.96 10.96	11.85 11.70	10.24	7.66	7.98	12.08	7.68	4.59 9.18		
Comb:	9.85	14.50	20.92	23.55	10.24	7.66	7.98	12.08	7.68	13.77	12.82	9.82
Seam No. 9:	15.94	17.85	16.35 2.94	15.82	14.18	8.43 14.55	10.19	11.70	18.32	15.09		
Comb:	15.94	17.85	19.29	15.82	14.18	22.98	10.19	11.70	18.32	15.09	16.14	13.45
Seam No. 10:	5.36 3.13 10.80	2.40 23.10	7.37 20.07	26.78	3.08 3.75 23.25	29.11	38.30	33.21	29.73	11.15 19.68		
Comb:	19.29	25.50	27.44	26.78	30.08	29.11	38.30	33.21	29.73	30.83	29.03	17.07
Seam No. 11:						19.15	12.64 4.98	15.35	2.23 2.23 12.63	2.62 17.06		
Comb:						19.15	17.62	15.35	17.09	19.68	17.78	9.88
Seam No. 12:	3.94 10.80	3.19 3.19 11.18	16.88	18.55	20.32	5.36 16.85 2.68	11.49 2.68	7.50 17.10 2.91 2.14 2.33	2.21 5.35 11.43	22.83		
Comb:	14.74	17.56	16.88	18.55	20.32	24.89	14.17	31.98	18.98	22.83	20.09	9.13
Seam No. 13:	6.22 3.89 4.66 9.91 6.56 3.11	3.19 8.39 2.40 4.58 2.40 2.40	3.97 3.97 2.83 6.47 2.43 6.47 2.43	5.90 17.21	2.87 13.11 2.46	11.88	2.30 12.26	9.71	5.55 4.66	12.07		
Comb:	34.35	23.36	28.57	23.11	18.44	11.88	14.56	9.71	10.21	12.07	18.63	6.01
Seam No. 14:	7.09 3.94	5.73 6.37 3.02	5.66 7.28	6.31 3.38	3.28 6.55 2.55	4.05 7.69	6.89 7.88	2.35 7.43 4.70	14.55	2.95 17.06 1.97 5.83		
Comb:	11.03	15.12	12.94	9.69	12.38	11.74	14.77	14.48	14.55	27.81	14.45	6.02
Seam No. 15:	9.71 3.13 7.04	11.55	5.66	7.29 10.43 8.66	3.28 6.43 7.46 10.78 7.05	8.04 9.65 6.03	19.37	2.31 11.47	7.09 7.49	28.34		
Comb:	19.88	11.55	5.66	26.38	35.00	23.72	19.37	13.78	14.58	28.34	19.83	9.01
Seam No. 16	8.96 5.44 4.21 4.19	2.36 2.87 5.14 2.36 2.19 4.47	3.22 5.57 9.34 4.75	4.72 8.25	2.46 7.46 4.15 4.15 6.71	8.49	7.59	4.23	2.33 4.27 4.66	11.81		
Comb:	22.80	19.39	22.88	12.97	24.93	8.49	7.59	4.23	11.26	11.81	14.64	5.09
Seam No. 17	6.43 6.29	1.86 3.37	5.32	9.97 4.20 2.93	4.57 9.80	8.09 2.18 2.18	2.67 2.43	2.05 16.53 3.37	19.17 2.40	8.33		
Comb:	12.72	5.23	5.32	17.10	14.37	12.45	5.10	21.95	21.57	8.33	12.41	5.91
Seam No. 18	3.00 13.58	4.64	4.59	12.16 3.85 2.01	2.94	8.17 3.35 3.24	13.26 3.60 3.87	15.50	3.39 16.37	15.02 4.20		
Comb:	16.58	4.64	4.59	18.02	2.94	14.76	20.73	15.50	19.76	19.22	13.67	7.20
Seam No. 19	2.41		2.29 2.13	8.35	2.52 3.35 2.52 2.94 2.52	4.05 2.91 2.99	4.00 2.51 3.20	2.43 2.43 2.43 2.66 2.58 2.11 3.13	5.25 2.91	2.56 8.86 5.77 4.79		
Comb:	2.41		4.42	8.35	13.85	9.95	9.71	17.77	8.16	21.98	9.66	3.45
Seam No. 20	2.46 3.75		6.80		4.19		8.17		5.83 4.05	2.23 4.46 1.38 2.23		
Comb:	6.21		6.80		4.19		8.17		9.88	10.30	7.59	4.14
Seam No. 21:	2.47 2.47						8.17		3.06 2.80			
Comb:	4.94						8.17		5.86		6.32	3.79
Seam No. 22:									3.59 3.06			
Comb:									6.65		6.65	3.33
Seam No. 24:									3.19			
Comb:									3.19		3.19	3.19

TABLE 4

274

COMBINED TRUE SEAM AND SPLIT THICKNESS PER CROSS-SECTION, ALTERNATIVE "C"

CROSS SECTION	180+00	200+00	220+00	240+00	260+00	280+00	300+00	320+00	340+00	Average Combined True Thickness Per Seam (Including Partings Less Than 3 Feet)	Average True Thickness Of All Individual Splits (Including Partings Less Than 3 Feet)
Seam No. 2:	15.97	12.98	11.02	11.00	14.97	13.89	13.90	13.64	15.97 6.46		
Comb:	15.97	12.98	11.02	11.00	14.97	13.89	13.90	13.64	22.43	14.42	12.98
Seam No. 3:	6.54	5.33	9.39	9.00	5.26	4.98	8.04 5.58	6.67 2.17	2.28		
Comb:	6.54	5.33	9.39	9.00	5.26	4.98	13.62	8.84	2.28	7.25	5.95
Seam No. 4A			2.33	5.75	10.55	4.60	4.39 4.39	7.66	6.08		
Comb:			2.33	5.75	10.55	4.60	8.78	7.66	6.08	6.54	5.72
Seam No. 4	20.07	23.33	13.02	8.50 11.00	22.85	17.62	18.33	25.75	29.66		
Comb:	20.07	23.33	13.02	19.50	22.85	17.62	18.33	25.75	29.66	21.13	19.06
Seam No. 5		3.19	3.06	2.76							
Comb:		3.19	3.06	2.76						3.00	3.00
Seam No. 6	3.96 2.08 3.40	5.08 9.58	8.04	4.73	3.15			4.66	3.55		
Comb:	9.44	14.66	8.04	4.73	3.15			4.66	3.55	6.28	4.82
Seam No. 7	6.37	5.60	4.60	5.99	8.67	5.36	4.12		2.08		
Comb:	6.37	5.60	4.60	5.99	8.67	5.36	4.12		2.08	5.35	5.35
Seam No. 8A	8.32	6.00	9.19	7.19 8.74	7.09	8.43	4.18	5.66	8.05 6.37		
Comb:	8.32	6.00	9.19	15.93	7.09	8.43	4.18	5.66	14.42	8.80	6.99
Seam No. 8	9.85	14.50	9.95 10.96	11.85 11.70	10.24	7.66	7.98	12.08	7.68		
Comb:	9.85	14.50	20.92	23.55	10.24	7.66	7.98	12.08	7.68	12.72	10.41
Seam No. 9	15.94	17.85	16.35 2.94	15.82	14.18	8.43 14.55	10.19	11.70	18.32		
Comb:	15.94	17.85	19.29	15.82	14.18	22.98	10.19	11.70	18.32	16.25	13.30
Seam No. 10	5.36 3.13 10.80	2.40 23.10	7.37 20.07	26.78	3.08 3.75 23.25	29.11	38.30	33.21	29.73		
Comb:	19.29	25.50	27.44	26.78	30.08	29.11	38.30	33.21	29.73	29.94	17.30
Seam No. 11						19.15	12.64 4.98	15.35	2.23 2.23 12.63		
Comb:						19.15	17.62	15.35	17.09	17.30	9.89
Seam No. 12	3.94 10.80	3.19 3.19 11.18	16.88	18.55	20.32	5.36 16.85 2.68	11.49 2.68	7.50 17.10 2.91 2.14 2.33	2.21 5.35 11.43		
Comb:	14.74	17.56	16.88	18.55	20.32	24.89	14.17	31.98	18.98	19.79	8.48
Seam No. 13	6.22 3.89 4.66 9.91 6.56 3.11	3.19 8.39 2.40 4.58 2.40 2.40	3.97 3.97 2.83 6.47 2.43 6.47 2.43	5.90 17.21	2.87 13.11 2.46	11.88	2.30 12.26	9.71	5.55 4.66		
Comb:	34.35	23.36	28.57	23.11	18.44	11.88	14.56	9.71	10.21	19.35	5.81
Seam No. 14	7.09 3.94	5.73 6.37 3.02	5.66 7.28	6.31 3.38	3.28 5.36 2.55	4.05 7.67	6.89 7.88	2.35 7.43 4.70	14.55		
Comb:	11.03	15.12	12.94	9.69	11.27	11.72	14.77	14.48	14.55	12.38	5.76
Seam No. 15	9.71 3.13 7.04	11.55	5.66	7.29 10.43 8.66	3.28 6.43 7.46 10.78 7.05	8.04 9.65 6.03	19.37	2.31 11.47	7.09 7.49		
Comb:	19.88	11.55	5.66	26.38	35.00	23.72	19.37	13.78	14.58	18.88	8.09
Seam No. 16	8.96 5.44 4.21 4.19	2.36 2.87 5.14 2.36 2.19	3.22 5.57 9.34 4.75	4.72 8.25	2.46 7.46 4.15 4.15 6.15	8.49	7.59	4.23	2.33 4.27 4.66		
Comb:	22.80	14.92	22.88	12.97	24.37	8.49	7.59	4.23	11.26	14.39	4.98
Seam No. 17	6.43			9.97 4.20 2.93	4.57	8.09 2.18 2.18	2.67 2.43	2.05 16.53 3.37	19.17 2.40		
Comb:	6.43			17.10	4.57	12.45	5.10	21.95	21.57	12.74	5.94
Seam No. 18							13.26 3.60 3.87		3.39 16.37		
Comb:							20.73		19.76	20.25	8.10

K-ELK RIVER 76(3)#B-1

CONFIDENTIAL

EVALUATION OF
EXPLORATION AND TESTWORK
JULY 1975 - APRIL 1976
ON THE
ELK RIVER COAL PROPERTY

VOLUME II
APPENDIX 4

SAMPLING & ANALYSES SUMMARY
BOREHOLES

CALGARY/DUSSELDORF
MAY 1976

ELCO MINING LIMITED

VOLUME II

APPENDIX 4 - Sampling & Analyses Summary

TABLE OF CONTENTS:

VOLUME II

APPENDIX 4

TABLE OF CONTENTS / continued

K-BLK River 76(5)G-1

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD SEC TWP RGE M

COMPANY ESSO MINING LIMITED

WELL BX - 6

LOCATION

FIELD KEK RIVER VALLEY

Other Services:

Permanent Datum: GROUND LEVEL Elev.:
Log Measured from: BIG FLOOR 2 Ft. Above Perm. Datum
Drill Depths Measured from: DRC FLOOR

K.B. 0.00
C.S.G.
G.L.

Rec'orded By PETERSON Witnessed By STORONSKI

Run No. One
Date 23 OCTOBER 1975
Last Reading 635
Casing Logged 635
Footage Logged
Bit Depth Reached 638
Depth Driller 638
Depth Logger 638
Casing Driller
Casing Logger
Fluid Type WATER
Fluid Density 1.0
Fluid Level FULL
Max. Rec. Temp. RT °
Operating Time
Truck No. # 2-1/2 HOURS
35

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	CPS/ DIV
1	00	635	12					3	1000	1.38	21.1

REMARKS LOGGED THROUGH HQ DRILL ROD - NO SCALE

DENSITY TOOL SERIAL NO 128

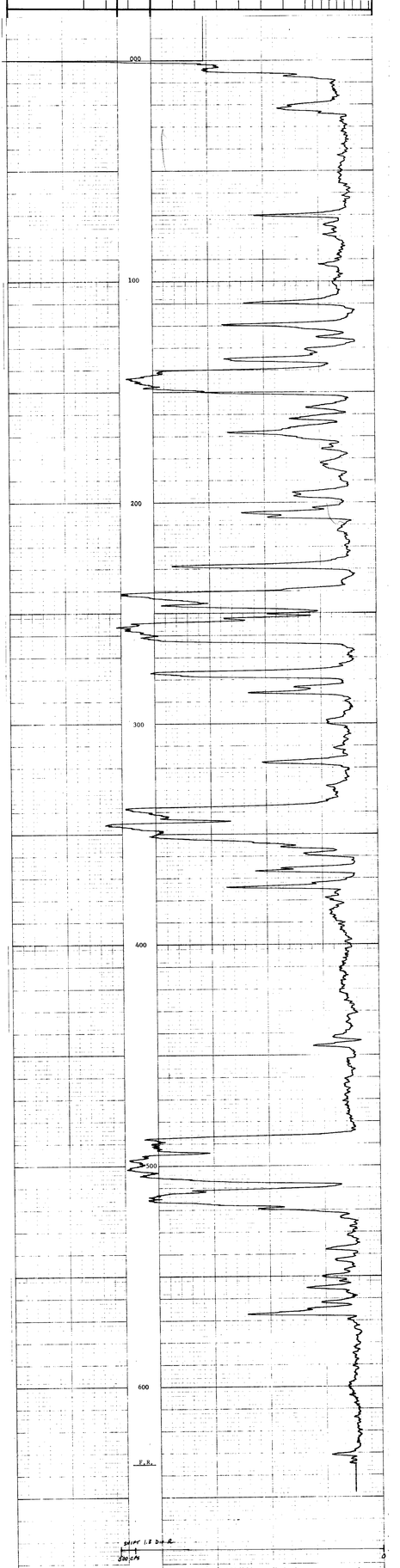
DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)



SCALE 1:2 DRL R

20 CPS

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

K-Elk River 76(93)-1

LSD SEC TWP RGE W M — FILE NO.

COMPANY BLOCO MINING LIMITED

WELL EE - 6

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev.

Log Measured From KELLY BUSHING 2 Ft. Above Perm. Datum

K.B. 6.0

D.F.

G.L.

Other Services: NONE

274

Run. No.	ONE
Date	23 OCTOBER 1975
First Reading	637
Last Reading	00
Footage Logged	637
Bottom Logged	637
Log Driller's Depth	650
Log Datum	KELLY BUSHING
Casing Driller	
Casing Logger	
Depth Logged	METRES
Liquid Level	00
Max. Recorded Temp.	80
Max. Diam.	
Rm. @ °F	
Operating Time	2 HOURS
Truck No.	35

Recorded By PETERSON

Witnessed By STOVENAUCK

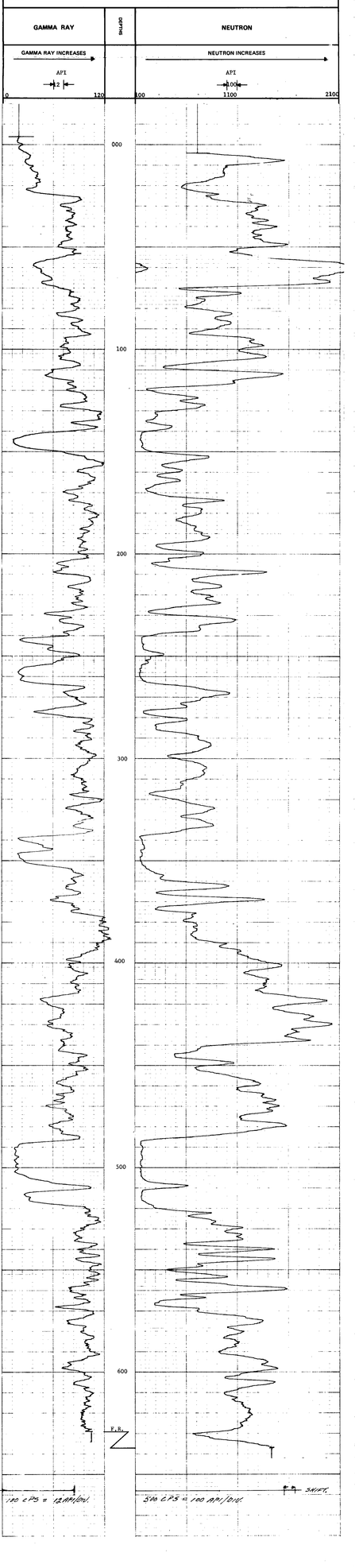
EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.56 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	50
HOIST TRUCK NO.	35	SPACING	17 INCH
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	177	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY					NEUTRON				
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN.	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	637	12	4	500	OL	12 API	3	1000	1L	100 API

REMARKS LOGGED THROUGH HQ DRILL ROD



ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD SEC TWP RGE W4M

COMPANY ROKE MINES LIMITED

WELL HS - 7

LOCATION

FIELD BIG RIVER VALLEY

PROVINCE SASKATCHEWAN COUNTRY CANADA

Permanent Datum: GROUND LEVEL Elev.: 0

Log Measured from: KB 0 Ft. Above Perm. Datum

Other Services: DENSITY

Run No. ONE

Date 23 OCTOBER 1975

First Reading 630

Last Reading 46

Feet Logged 584

Depth Reached 630

Casing Driller 6 5/8 @ 631

Casing Logged 631

Bit From 135

Bit To

Fluid Type WATER

Fluid Level 46

Max. Rec. Temp. 10°C

Rm @ °F

Operating Time 1-1/2 HOURS

Truck No. 35

Recorded By PETERSON

Witnessed By STOREHOUSE

K-Elk River 76(3)8-1

7

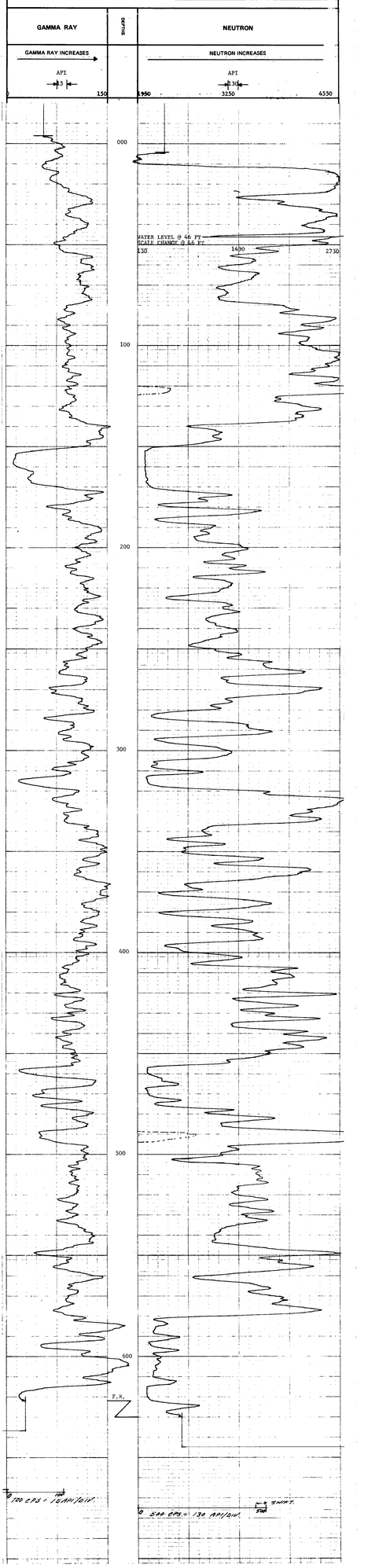
EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.	12	LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 1/2	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 1/2
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	8 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	50
HOIST TRUCK NO.	35	SPACING	17 INCH
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	177	STRENGTH	3 CURIES

LOGGING DATA

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	GAMMA RAY T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV. L OR R	GAMMA RAY API G. R. UNITS PER LOG DIV.	NEUTRON T. C. SEC.	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV. L OR R	NEUTRON API N. UNITS PER LOG DIV
1	00	46	12	4	500	0L	15 API	3	1000	15L	130 API
	46	630	12	4	500	0L	15 API	3	1000	1L	130 API

REMARKS



ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD SEC TWP RGE W. M

COMPANY ESSO MINES LIMITED

WELL EB-7

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL Elev. 2247 ft. Above Perm. Datum

Log Measured from: KELLY BUSHING 20 ft. Above Perm. Datum

Run Depth Measured from: RIG FLOOR

Other Services: CPD AC DIL GL

K-ELK RIVER 76/3/05

Recorded By: PEARSON

Witnessed By: SCHERBERT

Bulk No.	4105		
Dns.	2.55	CCT	FC
Last Reading	655		
Last Reading	655		
Logged Interval	655		
Depth Reached	655		
Depth Logged	655		
Casing Driller	13 3/8		
Casing Logger	13 3/8		
Fluid Type	WATER		
Liquid Level			
Max. Temp.	46		
Operating Time	2 HRS		
Truck No.	33		

GENERAL

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN
1	800	626	12

GAMMA RAY

T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	API G.R. UNITS PER LOG DIV.

SIDEWALL DENSILOG

T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	CPS/ DIV
3	1000	1.32	4732

REMARKS

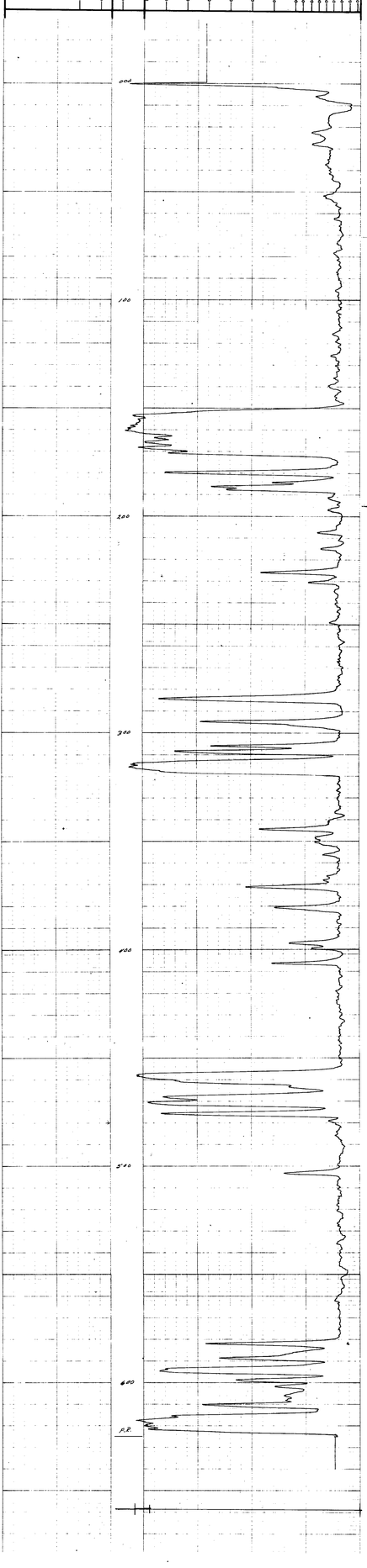
DEPTHS

CALIPER
(DIAMETER — INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

100 150 1.25 1.30 1.35 1.40 1.45 1.50 1.55 2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50



ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD SEC TWP RGE M

WELL E.R.E. 274

COMPANY E.C.O. MINING LIMITED

LOCATION

FIELD E.R.E. RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL — Elev. 0 — Other Services: P.D.C.

Log Measured from: GROUND LEVEL — Ft. Above Perm. Datum — CSG

Rig Depths Measured from: GROUND LEVEL — G.L.

Run No. 1
Date 9 OCT 74
First Reading 0
Last Reading 698
Footage Logged 698
Depth Reached 698
Driller 698
Logger 698
Bit From Surface
Bit To
Casing Driller
Casing Logger
Bottom Logged Interval
Top Logged Interval
Type Fluid in Hole
Salinity, PPM Cl
Density
Level
Max. Rec. Temp. Deg. F.
Operating Rig Time
Recorded By
Witnessed By

K-ELK RIVER 76(3)G-1 B

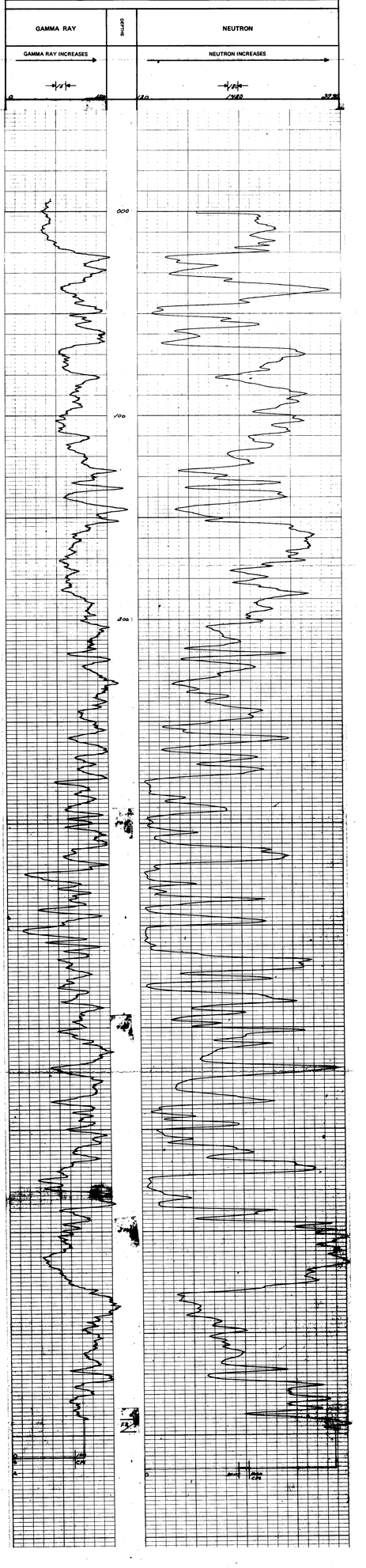
EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.		RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	8 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	
HOIST TRUCK NO.		SPACING	AmBe
INSTRUMENT TRUCK NO.	86	TYPE	3 CURIES
TOOL SERIAL NO.		STRENGTH	

LOGGING DATA

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	GAMMA RAY T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV. L OR R	GAMMA RAY API G. R. UNITS PER LOG DIV.	NEUTRON T. C. SEC.	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV. L OR R	NEUTRON API N. UNITS PER LOG DIV.
1	0	698	12	5	100	0	15	8	5600	11	180

REMARKS



ROKE

SIDEWALL DENSLOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

COMPANY ESSO MINING LIMITED

WELL ES - 8

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev.

Log Measured From GROUND LEVEL Ft. Above Perm. Datum

Drilling Measured From GROUND LEVEL

K.B.

D.F.

G.L.

Other Services

SEC TWP RGE W

M

Recorded By CARLSON

Witnessed By STORRENAKE

Operating Time From / To 1-1/2 HOURS 3-1/2 HOURS

Truck No.

Location

Rig No.

Type Log

Bit Size

Type Fluid in Hole

Max. Rec. Temp.

Equip. Location

Recorded By

Witnessed By

Run No. ONE

Date 9 OCTOBER 1975

Last Reading 596

Last Bhoreing 00

Footage Logged 596

Depth Reached 596

Bit From 599

Casing Size 5500

Casing Driller

Casing Logger

Liquid Level METER

Max. Rec. Temp. DEG. F

Equip. Location

Recorded By

Witnessed By

K. ELK RIVER 76/9/8-1

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN.	T.C. SEC.	SENS SETTINGS	ZERO DIV'S. OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV'S. OR R	CPS/ DIV
1	00	596	12					3	1000	1.68	44.16

REMARKS

DENSITY TOOL SERIAL NO 829

DEPTHS

CALIPER
(DIAMETER — INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600

1.90 | 1.80 | 1.70 | 1.60 | 1.50 | 1.40 | 1.30

000

100

200

300

400

500

F.P.

MUD CAKE

REMOTE

0

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.

COMPANY BECO MINING LIMITED

WELL ER - 9

LOCATION

FIELD ELK RIVER JAMAX

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev.

Log Measured From GROUND LEVEL Ft. Above Perm. Datum

Date Run No. Depth-Driller Depth-Logger Btm. Log Interval Top Log Interval Casing-Driller Casing-Logger Bit Size Type Fluid in Hole Dens. Visc. pH Fluid Loss Source of Sample Rm @ °F Rmf @ °F Rmc @ °F Source of Rmf & Rmc Rm @ BHT Time Since Circ. Max. Rec. Temp. Equip. No. Location Recorded By Witnessed By

Date	9-10-1975	
Run No.	ONE	
Depth-Driller	597	
Depth-Logger	600	
Btm. Log Interval	595	
Top Log Interval	SURFACE	
Casing-Driller	5 1/2 @ 598	
Casing-Logger	598	
Bit Size	4 3/4	
Type Fluid in Hole	GEL	
Dens.	9.0	
Visc.	50	
pH	9.5	
Fluid Loss	6.0	
Source of Sample	FLOWLINE	
Rm @ °F	1.00 @ 70	
Rmf @ °F	0.80 @ 70	
Rmc @ °F	1.20 @ 70	
Source of Rmf & Rmc	MEASURED	
Rm @ BHT	0.50 @ 120	
Time Since Circ.	3 1/2 HOURS	
Max. Rec. Temp.	120	
Equip. No.	3	
Location		
Recorded By	CARLSON	
Witnessed By	STEVENSON	

Permanent Datum GROUND LEVEL Elev. K.B.

Log Measured From GROUND LEVEL Ft. Above Perm. Datum D.F.

G.L.

RUN NO. 1 2 3

Other Services

K-ELK R UNE 76(3)B-1

6

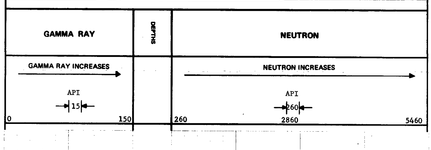
EQUIPMENT DATA

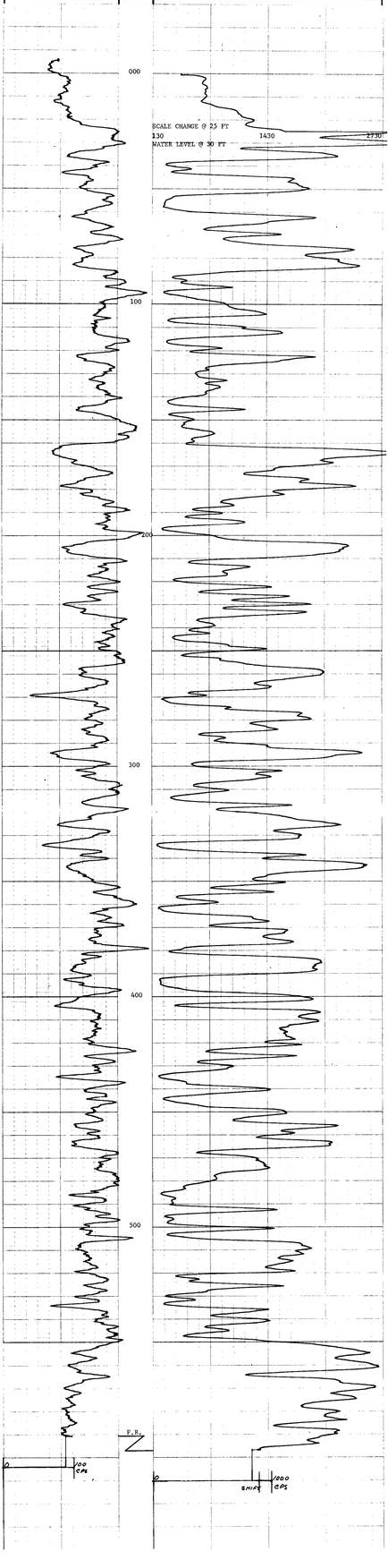
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	36	TYPE	AmBe
TOOL SERIAL NO.	R GRN 169-002	STRENGTH	3 CURIES

LOGGING DATA

GENERAL			GAMMA RAY					NEUTRON				
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTING	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTING	ZERO DIV. L OR R	API N. UNITS PER LOG DIV
1	00	25	12	3	100	0	15 API	3	1000	1L	260 API
	25	597	12	5	100	0	15 API	3	500	1L	130 API

REMARKS





ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

K-Elk River 76(3)3-9

274

LSD
SEC
TWP
RGE
M

FILE NO

COMPANY ESSO MINING LIMITED

WELL EM - 9

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Ft. Above Perm. Datum
Drill Pipe Measured from GROUND LEVEL

K.B.
D.F.
G.L.

Other Services
GSN

Run No. ONE
Date 5 OCTOBER 1975
First Reading 596
Last Reading 00
Footage Logged 596
Depth Reached 596
Bit Size 5 7/8
Casing Size 596
Casing Driller
Casing Logger
Liquid Level
Liquid Type
Max. Temp.

RECORDED BY CAMERON

OPERATING TIME 1-1/2 HOURS

WITNESSED BY STODDARD/MACK

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	CPS/ DIV
1	00	596	12					3	1000	1.68	44.16

REMARKS

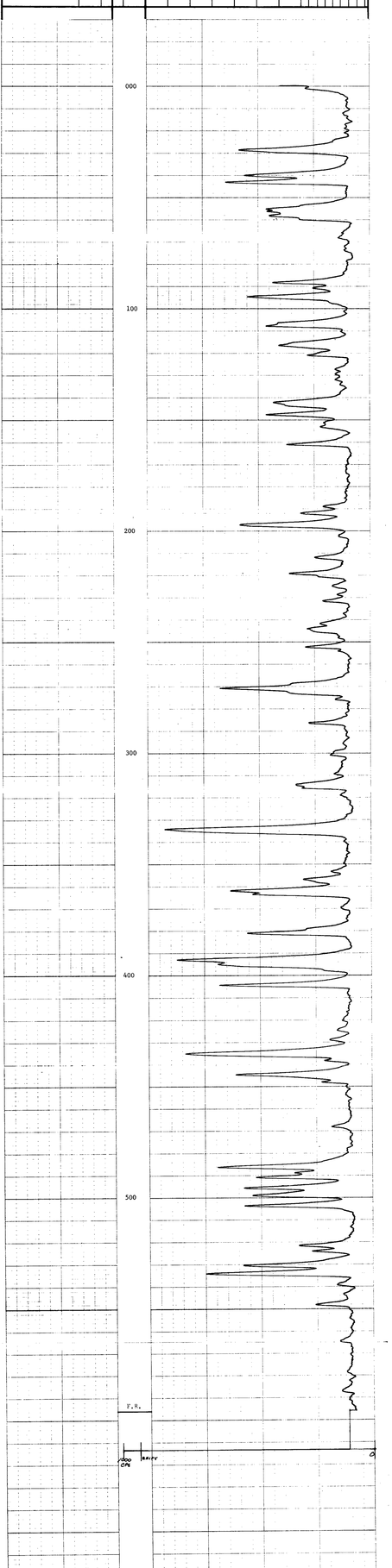
DENSITY TOOL SERIAL NO 829

DEPTHS

CALIPER
(DIAMETER — INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)



K-ELK RIVER 76(3)B-1

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG
CALIPER
DENSILOG

FILE NO.
LSD
SEC
TWP
RGE
W M

COMPANY FLCO MINING LIMITED
WELL EB-10
LOCATION
FIELD ELK RIVER VALLEY
PROVINCE BRITISH COLUMBIA

274

Other Services: DENS.

Permanent Datum GROUND LEVEL. Elev.
Log Measured from RIG FLOOR 1. Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR.

K.B.
CSG
G.L.

Run. No.	ONE
Date	16 NOV/75
First Reading	564
Last Reading	000
Footage Logged	564
Depth Reached	565
Depth Driller	635
Logging Roke	12
Casing Driller	12
Fluid Type	AIR/WATER
Liquid Level	7
Min. Diam.	H.8.
Rm @ °F	
Operating Time	1.5 HRS.
Truck No.	35

Recorded By PETERSON
Witnessed By OSLUND.

10

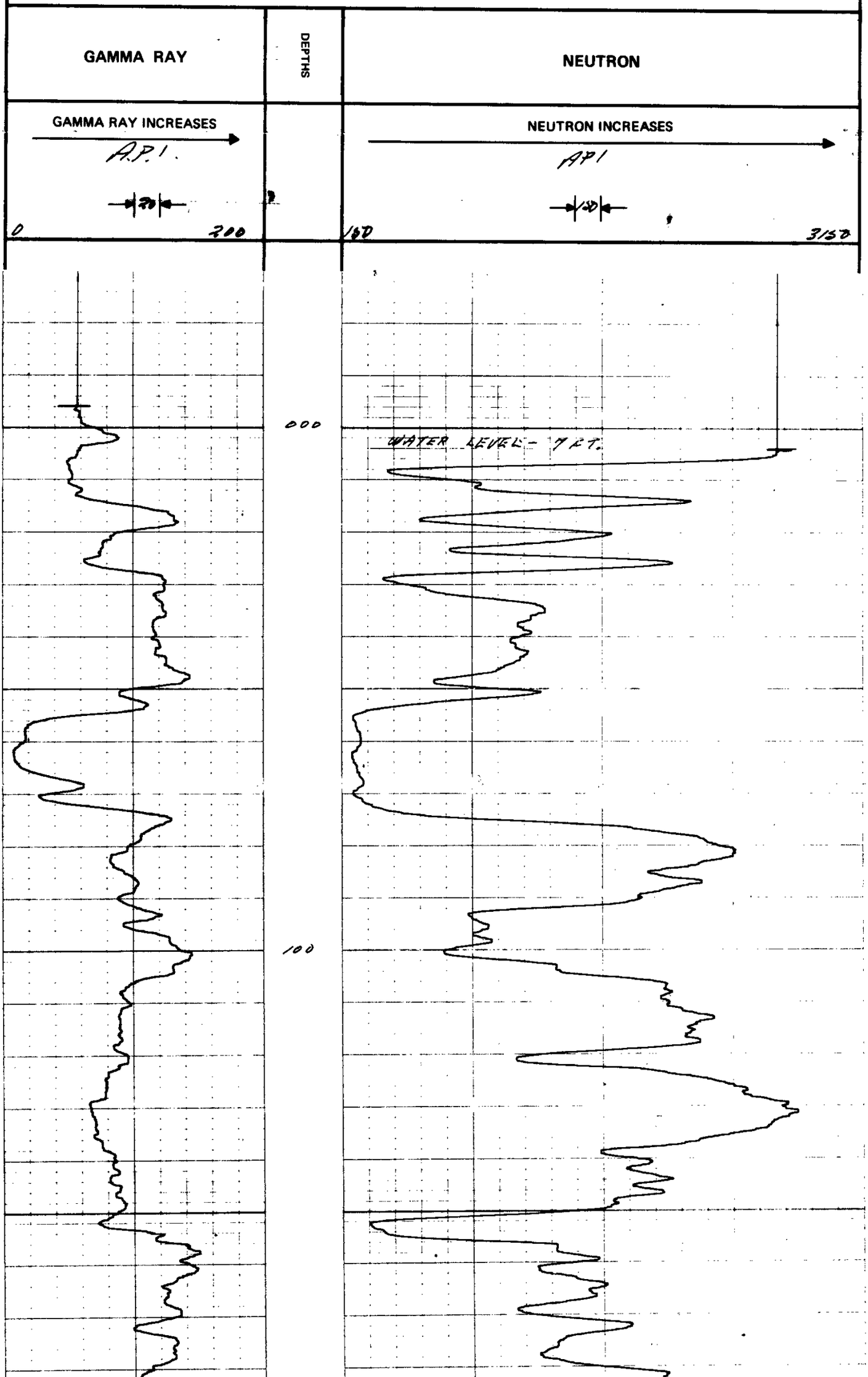
EQUIPMENT DATA

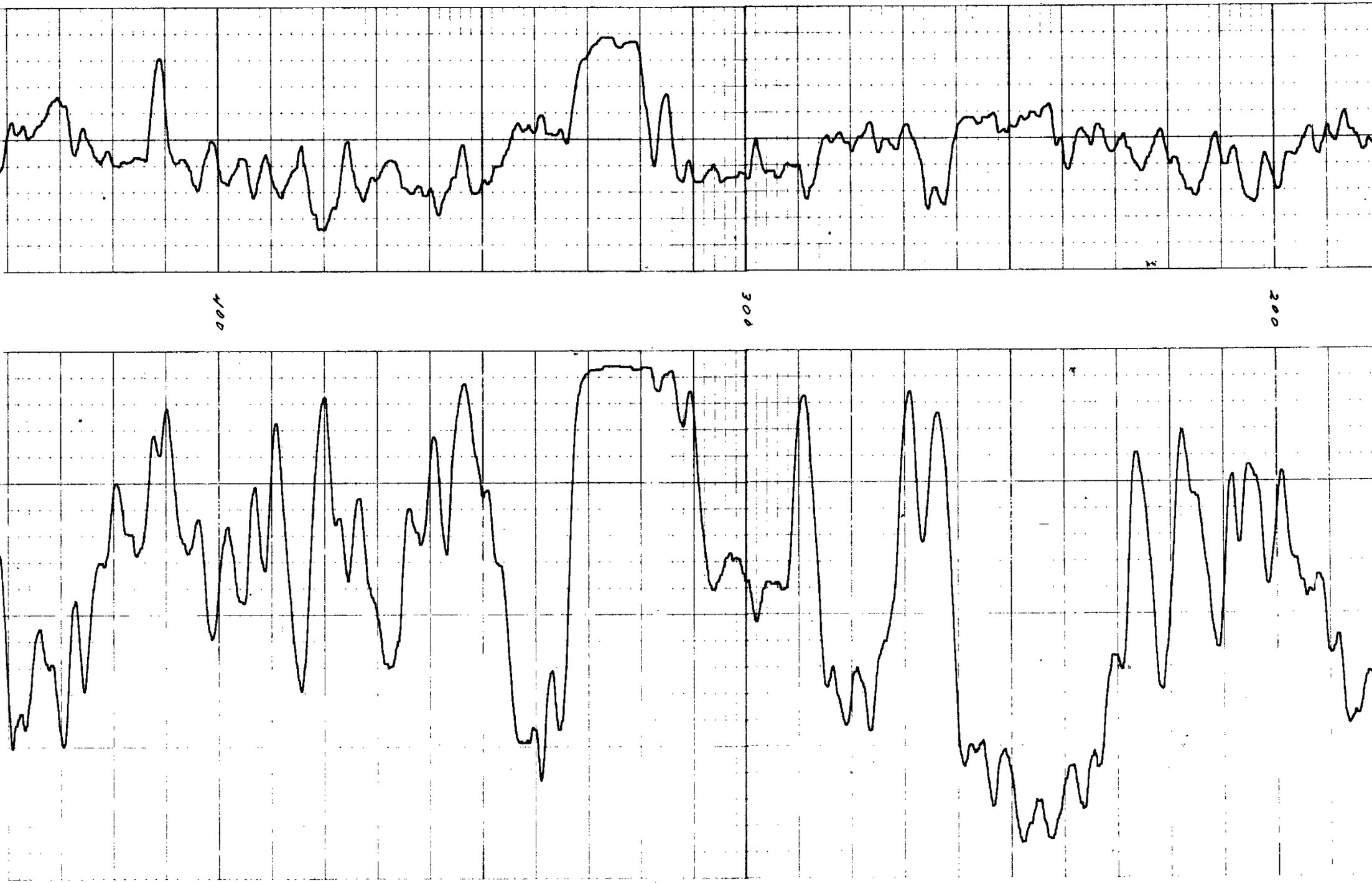
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	50
HOIST TRUCK NO.		SPACING	17 INCH.
INSTRUMENT TRUCK NO.	35	TYPE	AmBe
TOOL SERIAL NO.	177	STRENGTH	3 CURIES.

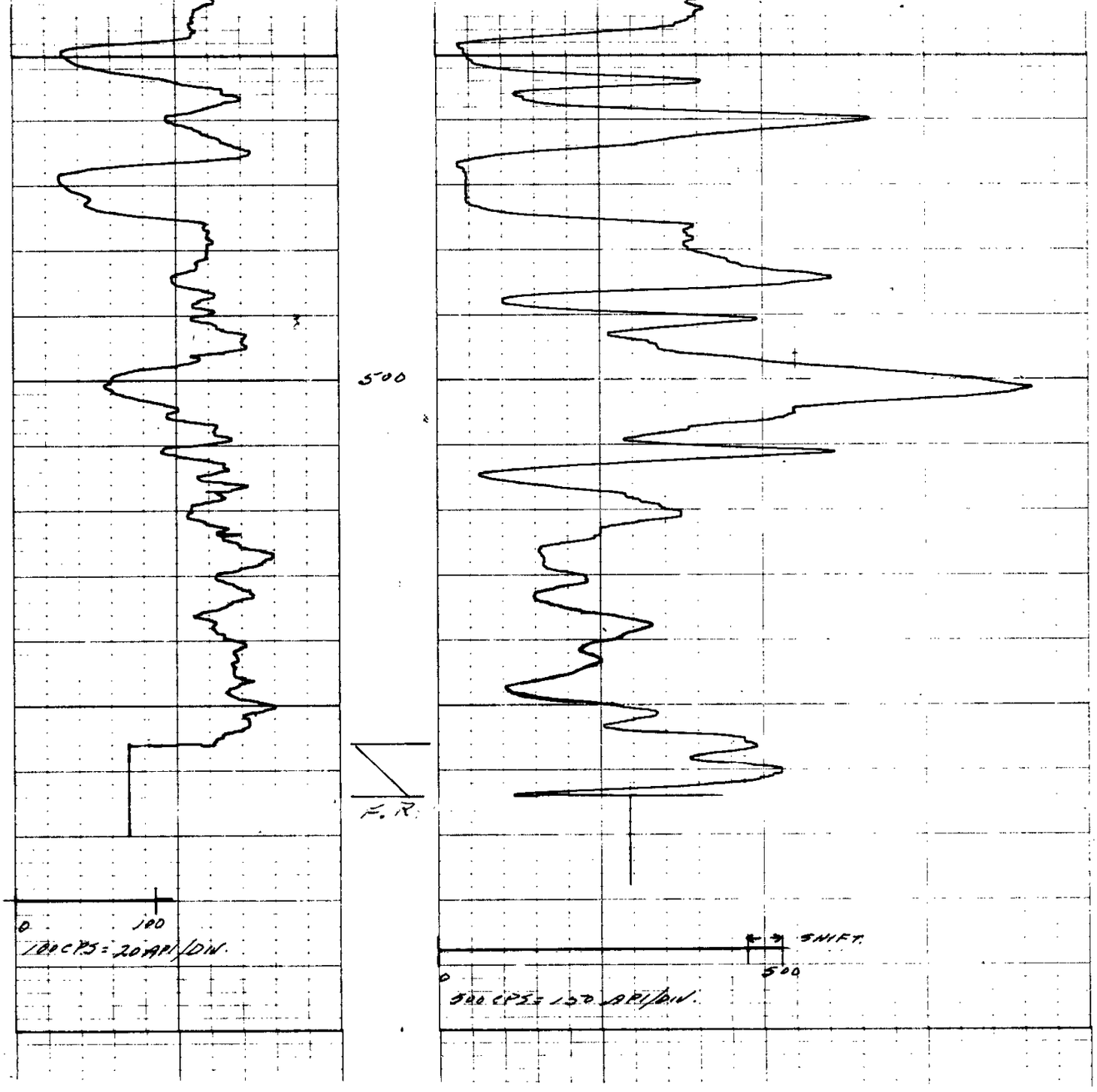
LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	000	564	12	4	500	0.L.	20	3	1000	1.L.	150

REMARKS BRIDGED AT 565 FT.


GAMMA RAY
DEPTHS
NEUTRON
GAMMA RAY INCREASES
A.P.I.
20
0
200
NEUTRON INCREASES
API
150
150
3150
000
WATER LEVEL - 7 FT.
100


400
300
200


500
F. R.
0
100
100 CPS = 20 API/DIV.
SHIFT
500
0
500 CPS = 150 API/DIV.

K-ELK R. WEA 76(13)(3-)

ROKE

SIDEWALL DENSILOG

FILE NO.

COMPANY OIL ENTERPRISES LTD. CALGARY, ALBERTA

WELL ER - 10

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: CBL

Permanent Datum: GROUND LEVEL Elev.

Log Measured From: KEE FLOOR 1 Ft. Above Perm. Datum

Drill Depth Measured From: KEE FLOOR

Run No.	ONE
Date	16 NOVEMBER 1975
Last Reading	562
First Reading	000
Footage Logged	562
Depth Reached	565
Depth Logged	565
Casing Driller	565
Casing Logger	565
Casing Size	12
Bit Size	7 7/8
Type Fluid in Hole	AIR/WATER
Max. Rec. Temp.	110
Operating Time	1-1/2 HOURS
Truck No.	35

Recorded By PETERSON Witnessed By MCCLUTE

GENERAL				GAMMA RAY					SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV. OR R	CPS/ DIV
1	000	562	12					3	1000	1.68	48

REMARKS

DENSITY TOOL SERIAL NO 128

DEPTHS

CALIPER
(DIAMETER — INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

000
100
200
300
400
500

F.R.

K-ELK RIVER 76(3)B-1

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.

LSD
SEC
TWP
RGE
W M

COMPANY ELCO MINING LIMITED

WELL EB - 11

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Ft. Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Other Services: DENS

Run. No.	ONE
Date	2 OCTOBER 1975
First Reading	665
Last Reading	00
Footage Logged	665
Depth Reached	666
⅂ Driller	666
Casing Roke	10
Casing Driller	
Fluid Type	WATER/AIR
Liquid Level	446
Min. Diam.	HQ
Rm @ °F	
Operating Time	2 HOURS
Truck No.	36

Recorded By CARLSON Witnessed By STOBERNACK

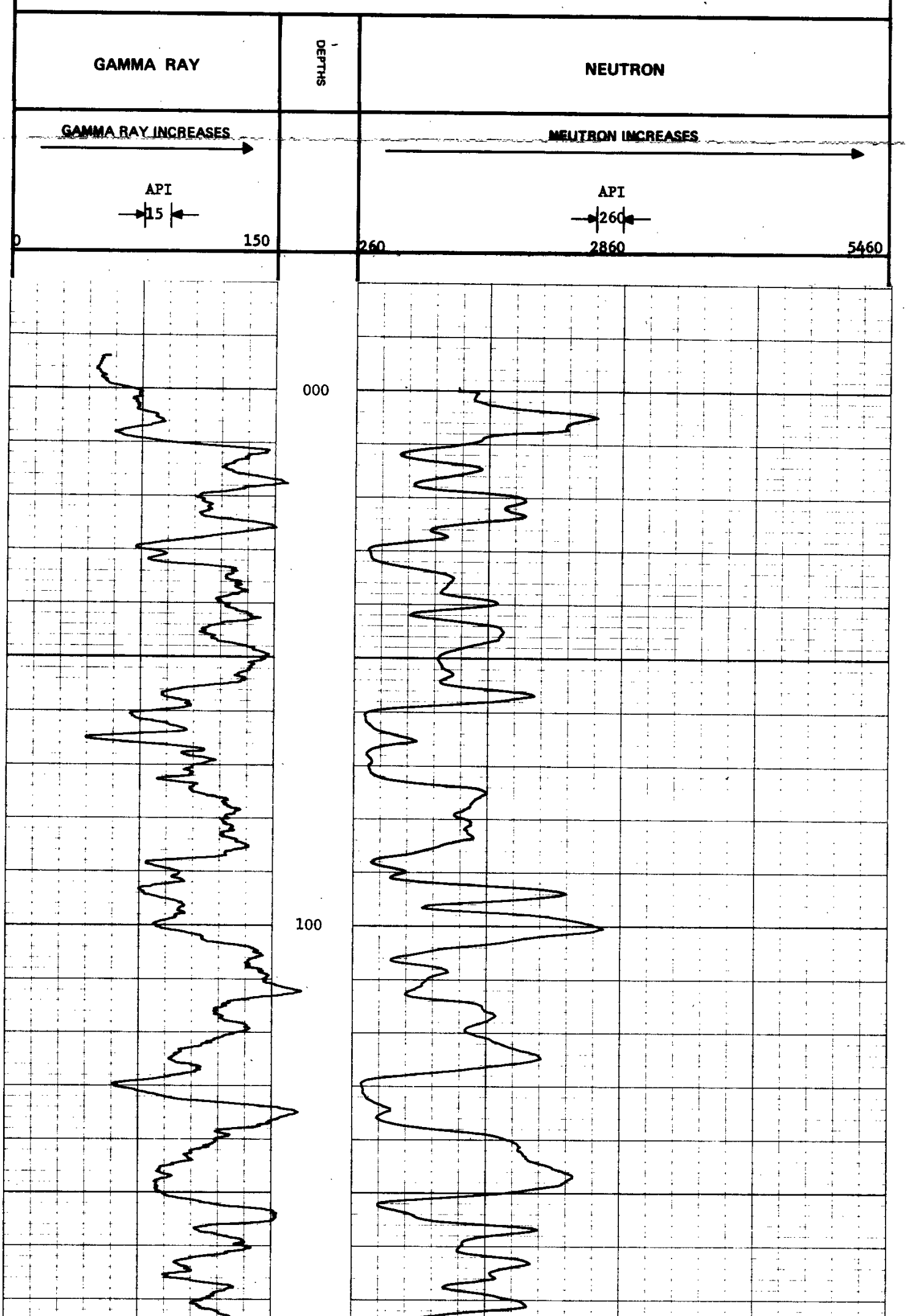
EQUIPMENT DATA

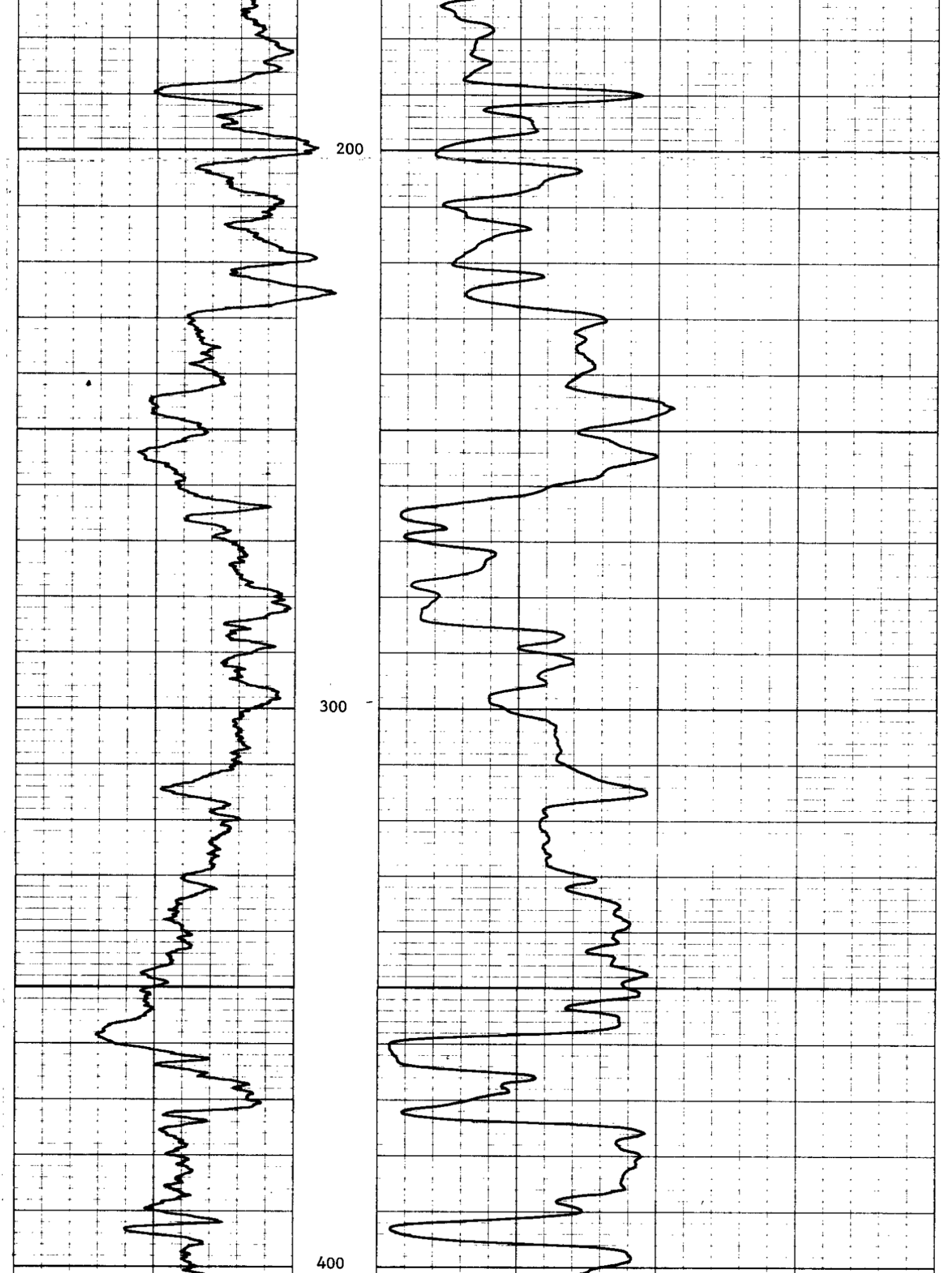
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	36	TYPE	AmBe
TOOL SERIAL NO.	R GRN 169-001	STRENGTH	3 CURIES

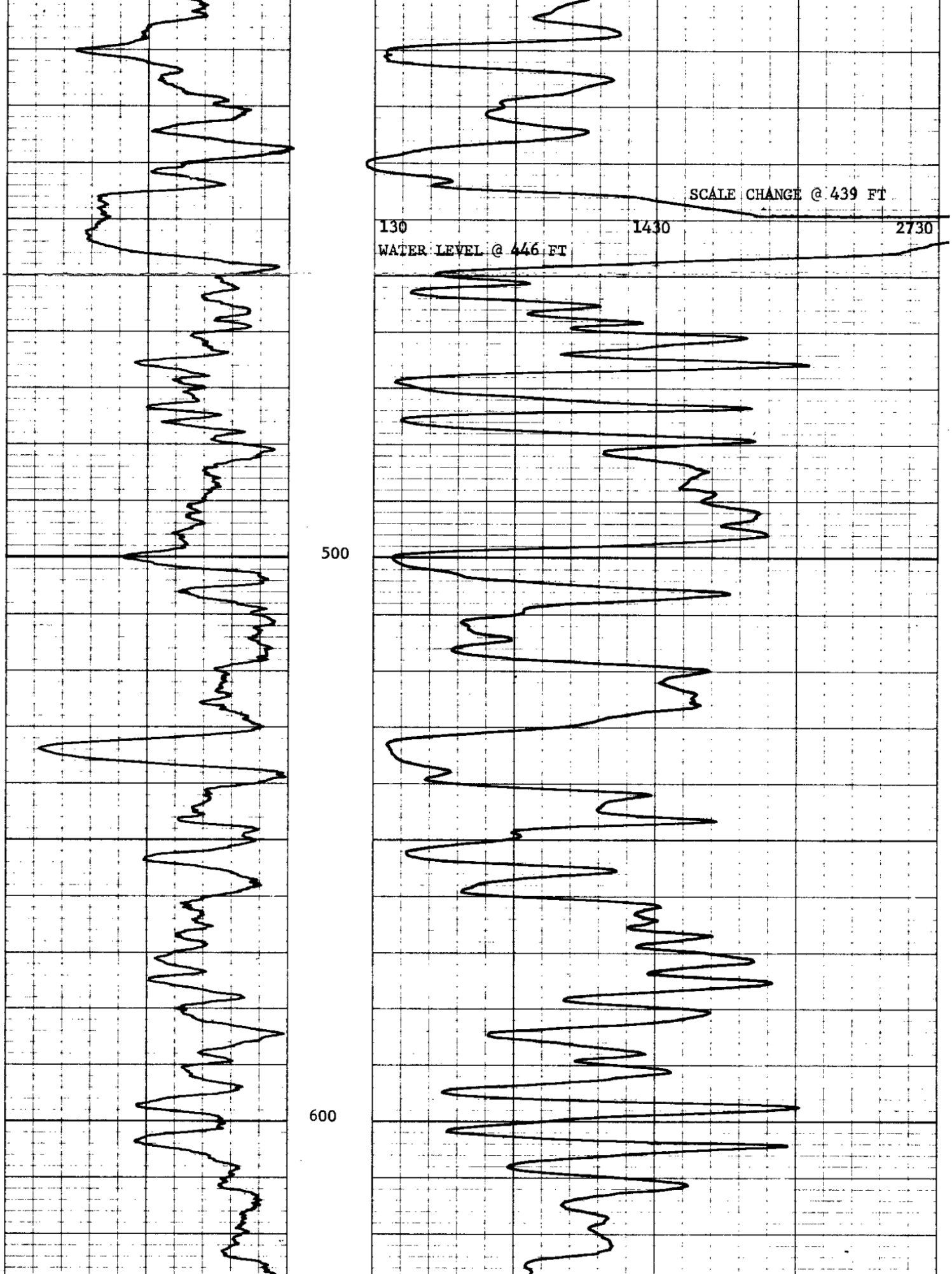
LOGGING DATA

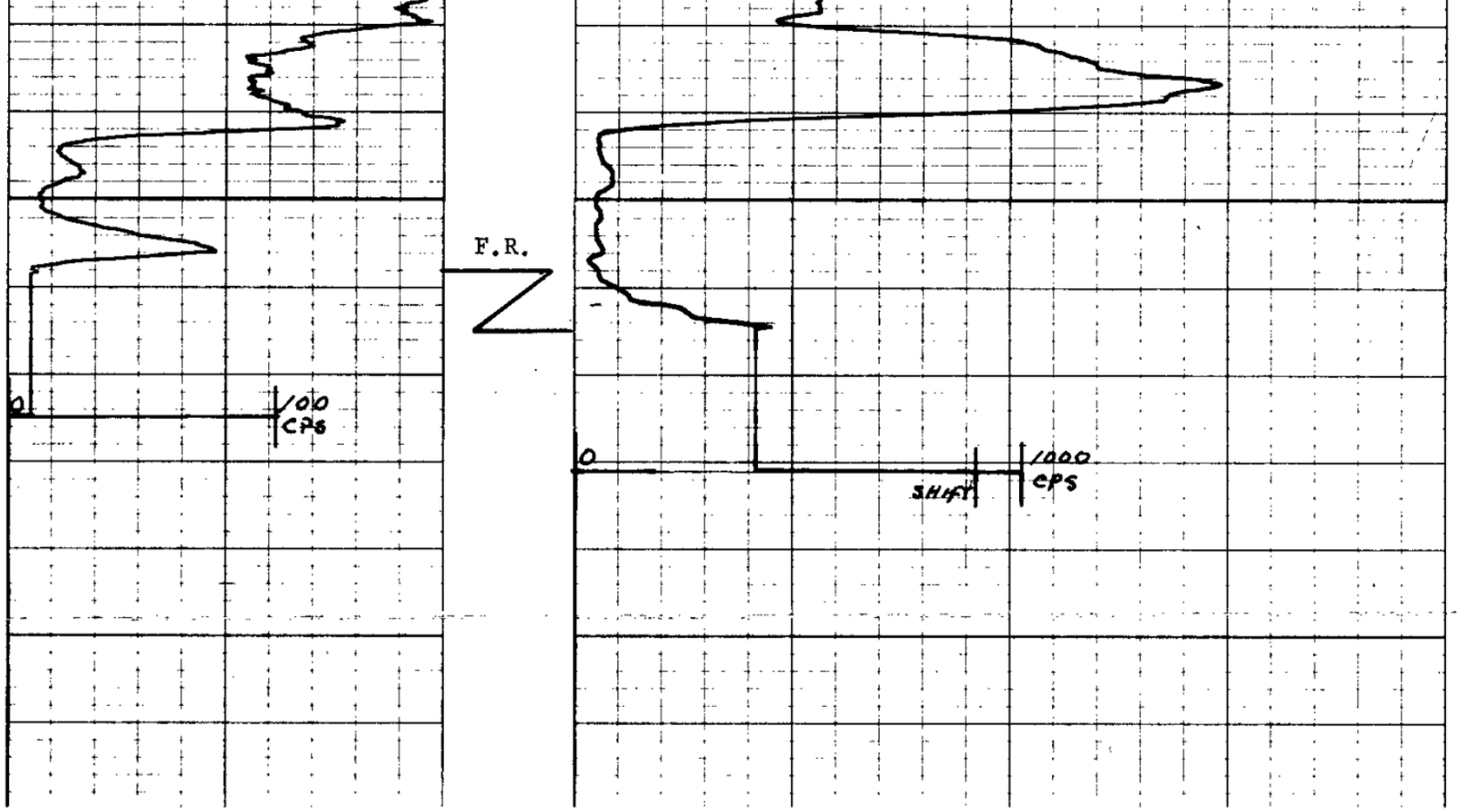
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	439	12	5	100.	0	15 API	3	1000	1L	260 API
	439	665	12	5	100	0	15 API	3	500	1L	130 API

REMARKS


GAMMA RAY
DEPTHS
NEUTRON
GAMMA RAY INCREASES
API
15
0
150
NEUTRON INCREASES
API
260
260
2860
5460
000
100


200
300
400


SCALE CHANGE @ 439 FT
130
1430
2730
WATER LEVEL @ 446 FT
500
600


F.R.
0
100
CPS
0
1000
CPS
SHIFT

ROKE

SIDEWALL DEVSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 274

COMPANY ROKE WESTERN LIMITED

WELL 23 - 11

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: CNL

Permanent Datum: GROUND LEVEL — Elev. 1 Above Perm. Datum

Log Measured from: GROUND LEVEL — 1 Ft. Above Perm. Datum

Drilling Measured from: GROUND LEVEL

Elev.: K.B. — D.F. — G.L.

Rec. No. —

Date Recorded: 2 OCTOBER 1975

Date Read: —

Last Reading: 00

Footage Logged: 663

Depth Driller: 666

Depth Logger: 665

Bottom Log Interval: 665

Top Log Interval: 00

Casing Driller: 10

Casing Logger: —

Bit Size: —

Type Fluid in Hole: WATER/GEL

Max. Rec. Temp.: 46

Equip. Location: 161

Recorded By: CARLSON

Witnessed By: STEVENSMOK

Truck No.: 3

Unit No.: 3-80288

Date: 26

Time: —

K. ELK R. area 76(8) D-1

11

GENERAL

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN
1	00	663	12

GAMMA RAY

T.C. SEC.	SENS SETTINGS	ZERO D/V.L OR R	API G.R. UNITS PER LOG DIV.

SIDEWALL DENSILOG

T.C. SEC.	SENS SETTINGS	ZERO D/V.L OR R	CPS/ DIV
3	1000	1.68	44.16

REMARKS

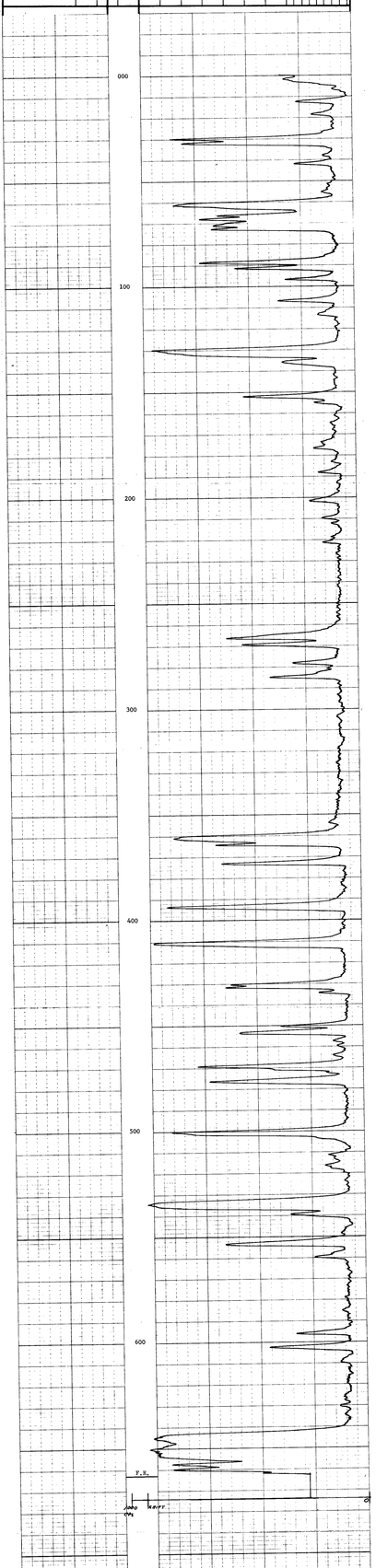
DENSITY TOOL SERIAL NO 829

DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)



K-Elk River 76(3)B-1

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.

LSD
SEC
TWP
RGE
W ____ M

COMPANY ELCO MINING LIMITED

WELL EB - 12

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev.

Log Measured from RIG FLOOR 1.2 Ft. Above Perm. Datum

Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

274

Run. No.	ONE	
Date	15 SEPTEMBER 1975	
First Reading	660	
Last Reading	00	
Footage Logged	660	
Depth Reached	661	
D Driller	661	
Casing Roke		
Casing Driller		
Fluid Type	WATER	
Liquid Level	5	
Min. Diam.	HQ	
Rm @ °F		
Operating Time	2 HOURS	
Truck No.	36	

Recorded By FUNK-BANKS Witnessed By STOBERNACK

12

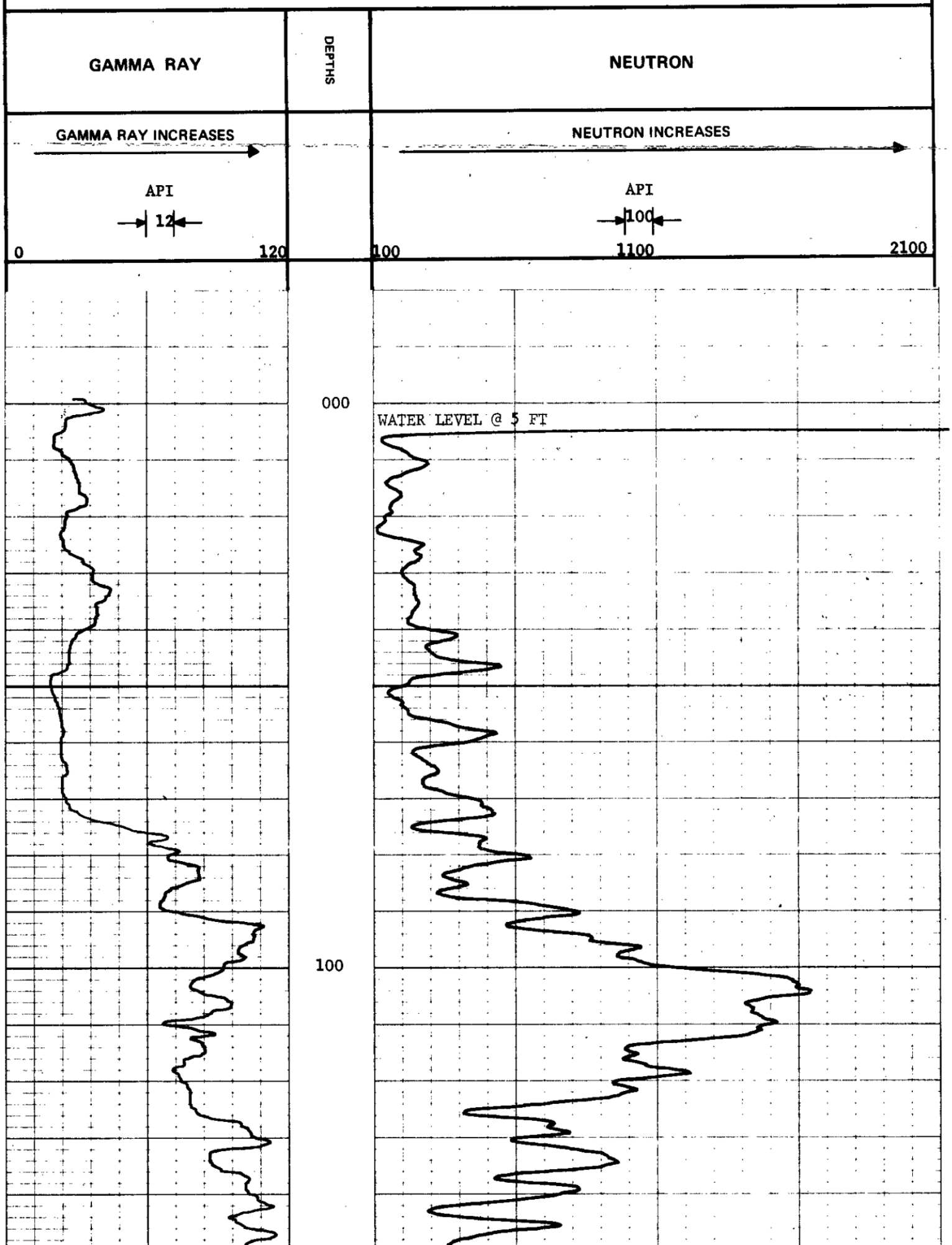
EQUIPMENT DATA

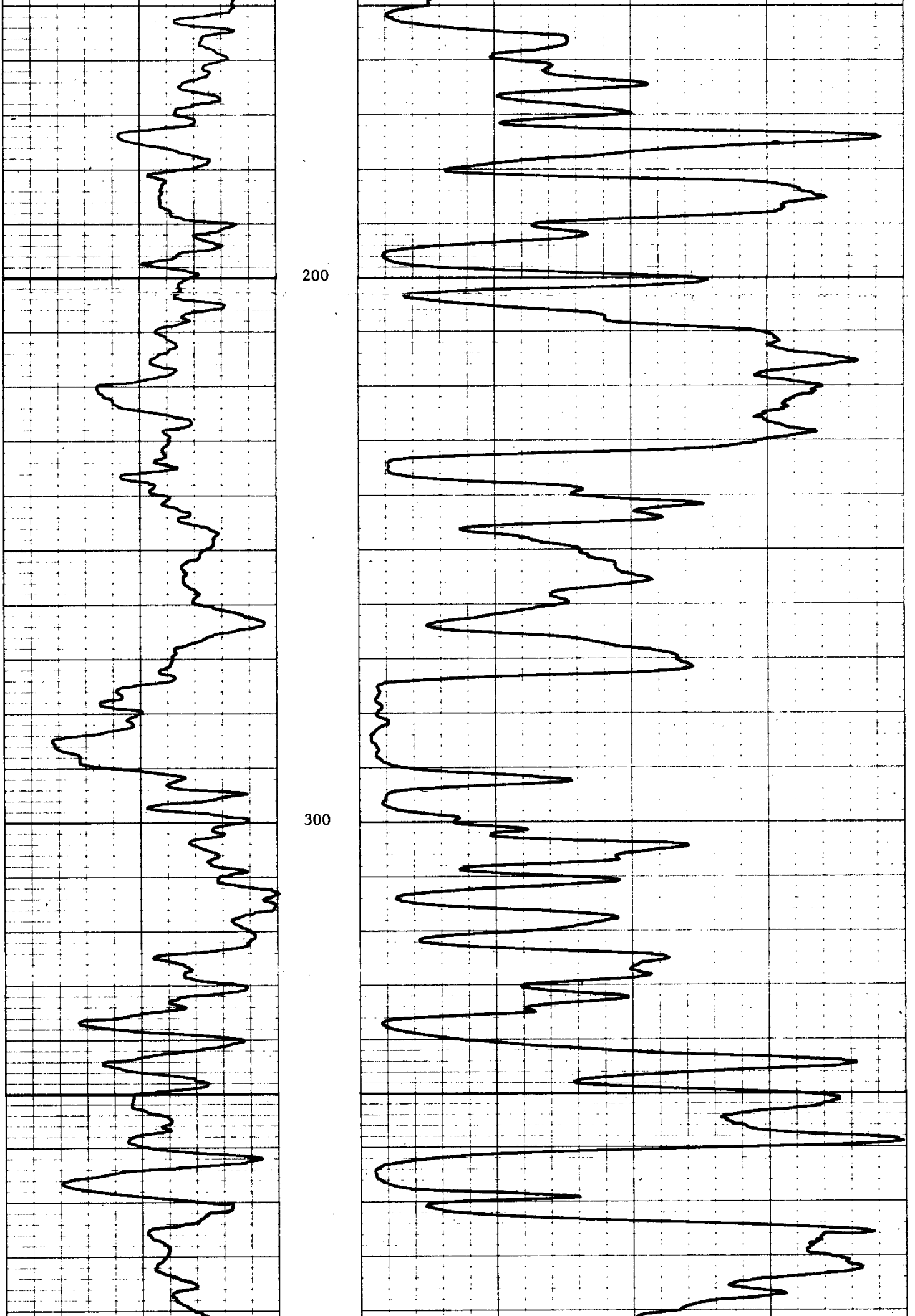
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.	36	SPACING	17 INCH
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	R GRN 169-002	STRENGTH	3 CURIES

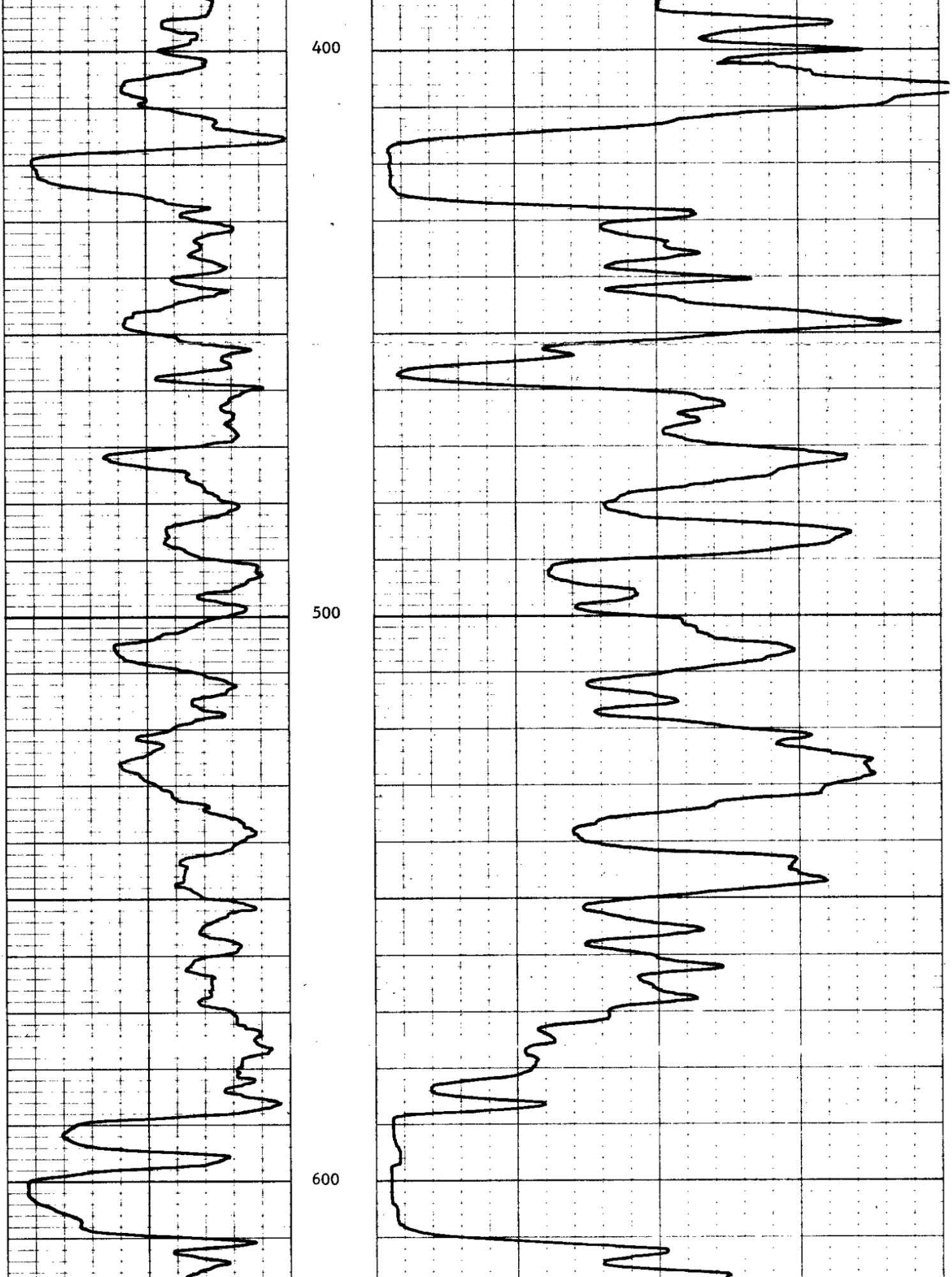
LOGGING DATA

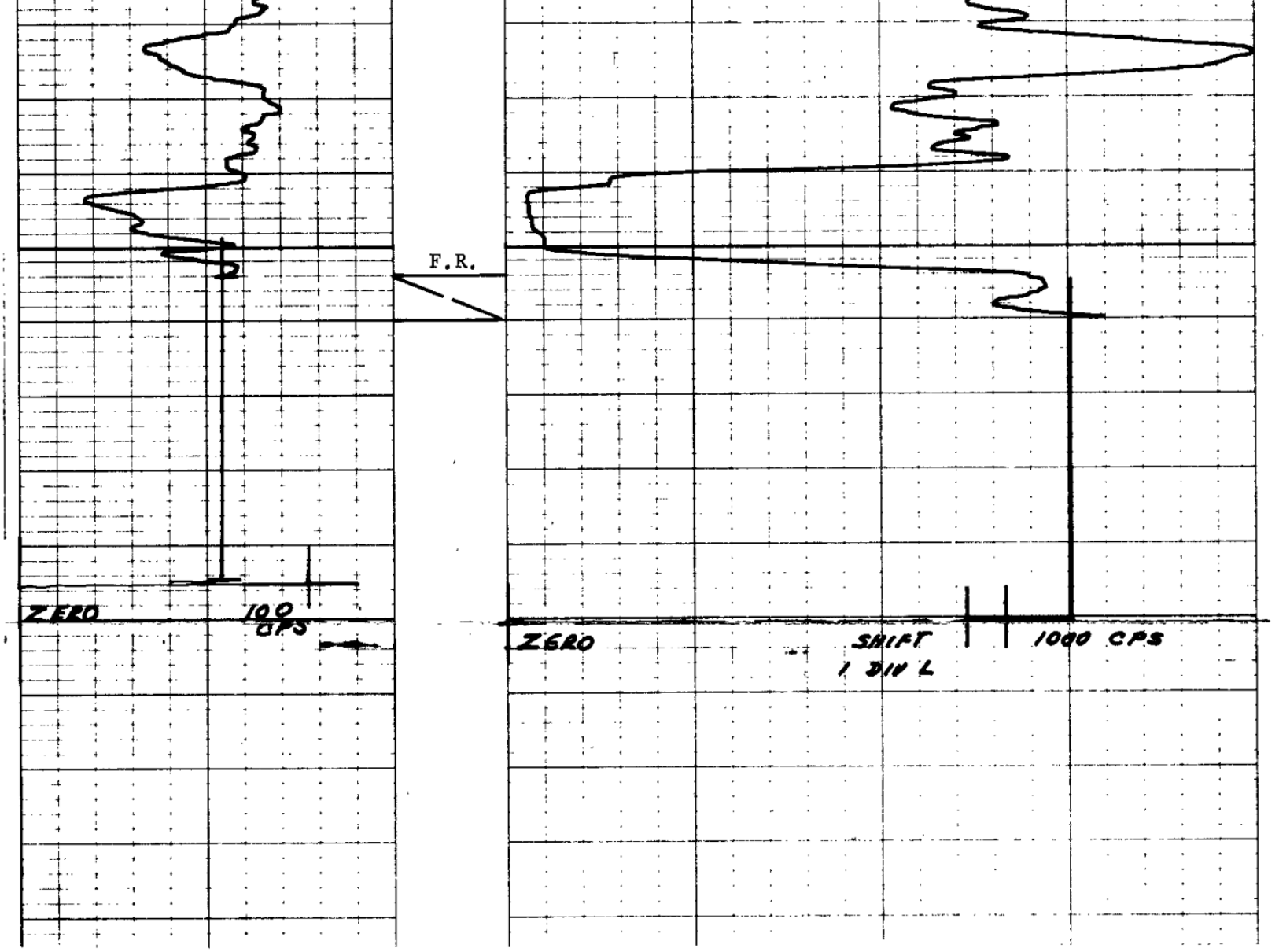
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	660	12	5	100	0L	12 API	3	500	1L	100 API

REMARKS LOGGED THROUGH HQ DRILL ROD


GAMMA RAY
DEPTHS
NEUTRON
GAMMA RAY INCREASES
API
12
0
120
NEUTRON INCREASES
API
100
100
1100
2100
000
WATER LEVEL @ 5 FT
100


200
300


400
500
600


F.R.
ZERO
100 CPS
ZERO
SHIFT
1 DIV L
1000 CPS

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

COMPANY ESSO RESOURCES (ARCTIC) LIMITED

WELL BS - 12

LOCATION

FIELD BEAR ISLANDS (ARCTIC)

Permanent Datum: GROUND LEVEL Elev. 0 ft. Above Perm. Datum
Log Measured From: KELLY BUSHING 14 ft. Above Perm. Datum
Drill Measured From: KELLY BUSHING

Other Services: CBHC

Recorded By: PETRO-JAMES

Witnessed By: RODRIGUEZ

Operating Time			
Truck No.			
	1-1/2" DOUBLE		
	36		
Run No.		ONE	
Date		3 - JULY - 1975	
First Reading		651	
Last Reading		00	
Depth Reached		651	
Depth Driller		651	
Depth Logger		651	
Btm. Log Interval		651	
Top Log Interval		00	
Casing Driller			
Casing Logger			
Bit Size			
Type Fluid		WATER	
Density			
Level			
Max. Temp.		70	
Est. Cement Top			
Max. Rec. Temp.			
Equip. No. & Location			
Recorded By			
Witnessed By			

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV'S. OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV'S. OR R	CPS/DIV
1	00	651	10					3	300	1.48	19.43

REMARKS LOGGED THROUGH HQ DRILL ROD

DENSITY TOOL SERIAL NO A 829

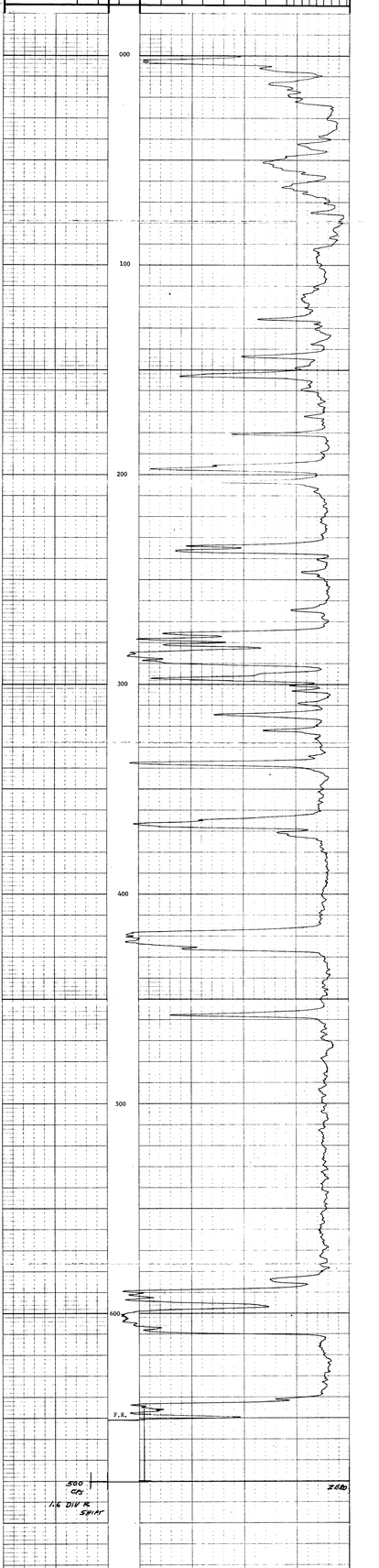
DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)



K-ELK RIVER 76(3) B-1

13

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD
SEC
TWP
RGE
W M

COMPANY ELCO MINING LIMITED

WELL EB - 13

274

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev.
Log Measured from CASING 1 Ft. Above Perm. Datum
Well Depths Measured from

K.B.
CSG
G.L.

Run. No.	ONE		
Date	26 SEPTEMBER 1975		
First Reading	598		
Last Reading	00		
Footage Logged	598		
Depth Reached	599		
Depth Driller			
Casing Roke			
Casing Driller			
Fluid Type	WATER		
Liquid Level	6		
Min. Diam.			
Rm @ °F			
Operating Time	1 HOUR		
Truck No.	36		

Recorded By FUNK Witnessed By STOBERNACK

EQUIPMENT DATA

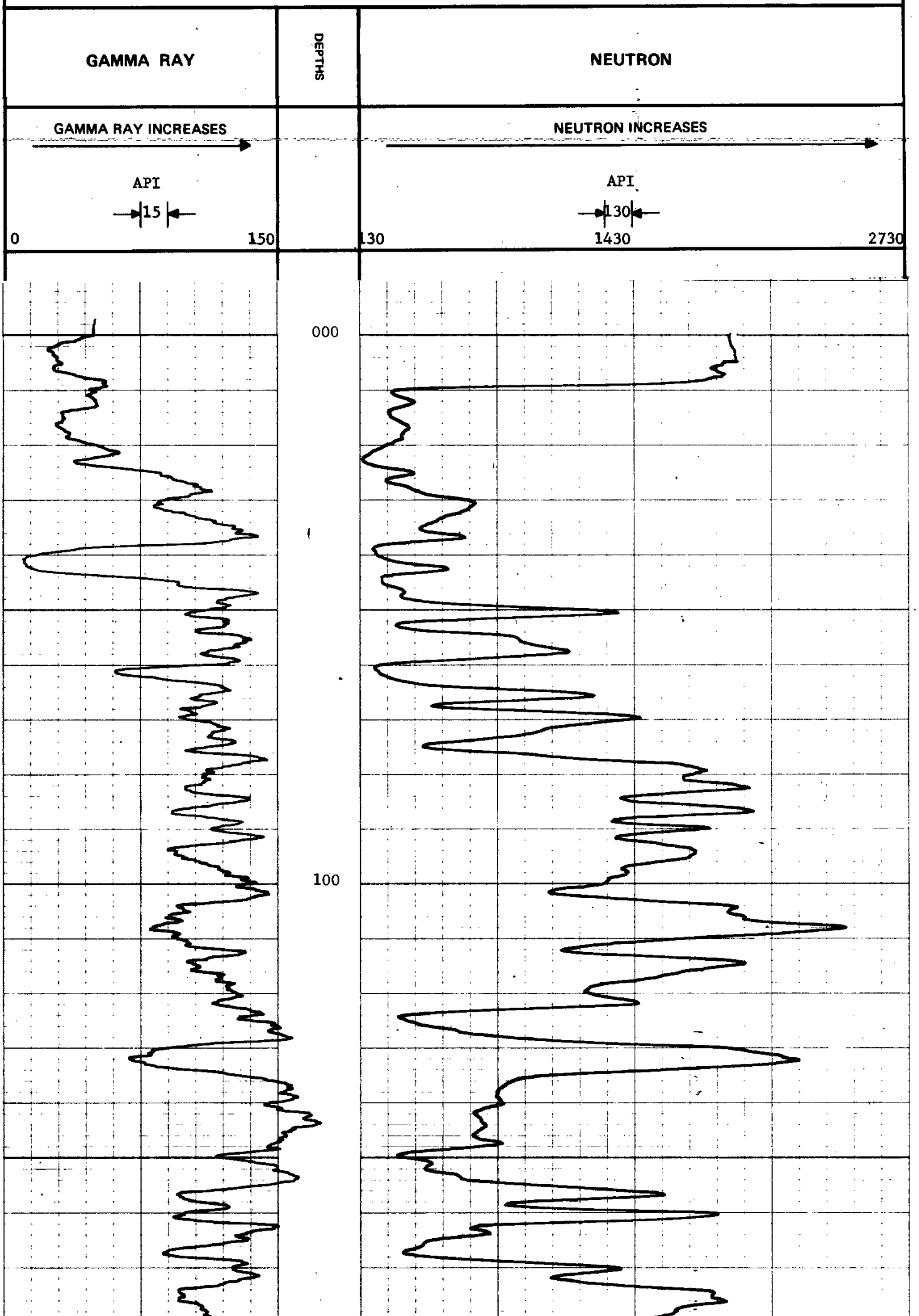
	GAMMA RAY	NEUTRON
RUN NO.	ONE	ONE
LOG TYPE		NEUTRON/NEUTRON
TOOL MODEL NO.	$1\frac{11}{16}$	$1\frac{11}{16}$
DIAMETER		
DETECTOR MODEL NO.	SCINTILLATION	PROPORTIONAL
TYPE	4 INCH	6 INCH
LENGTH	6.7 FT.	MRC-N-SS-W
DISTANCE TO N. SOURCE		

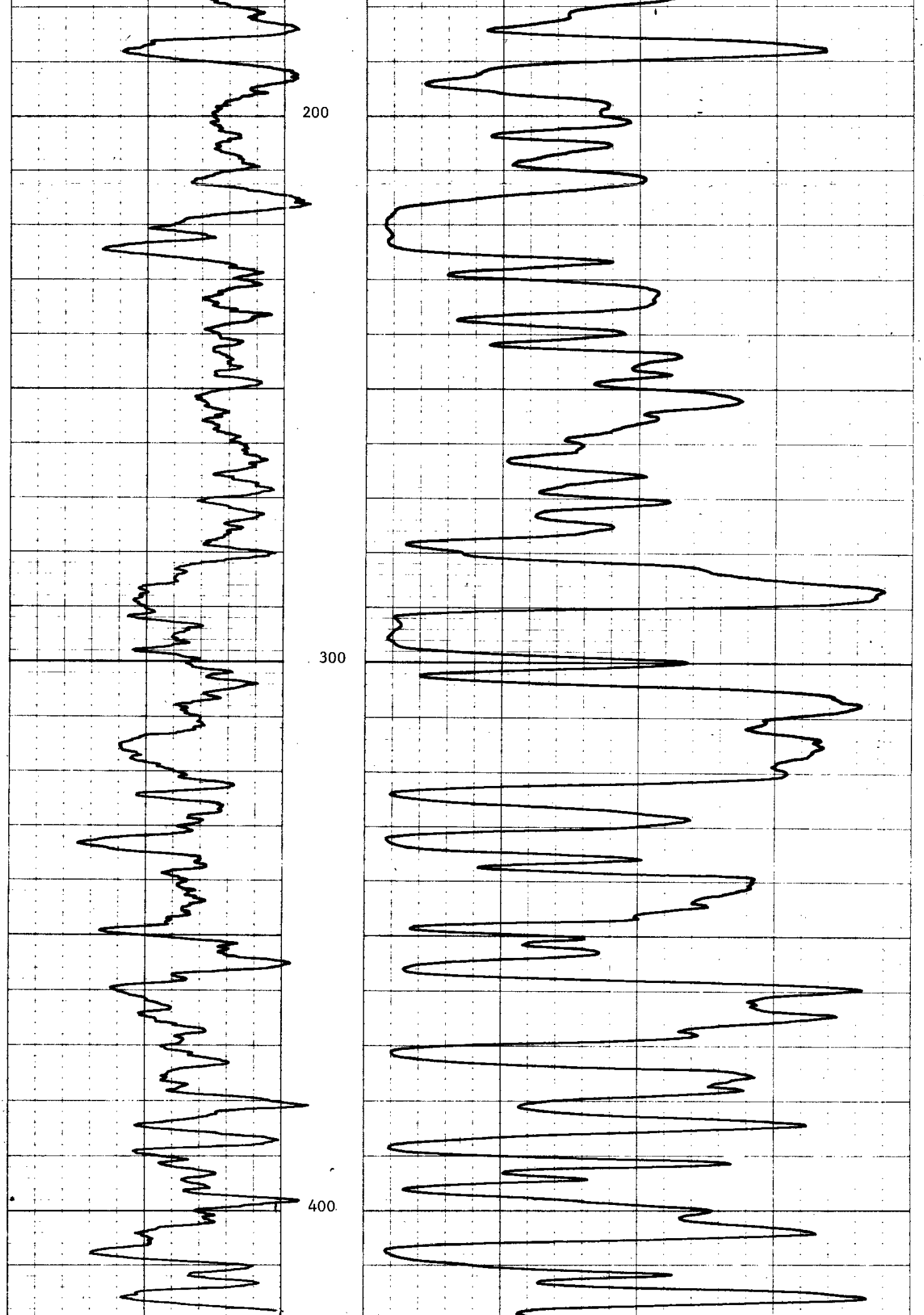
GENERAL	
SERIAL NO.	
SPACING	36
TYPE	AmBe
STRENGTH	R GRN 169-002 3 CURIES
HOIST TRUCK NO.	
INSTRUMENT TRUCK NO.	
TOOL SERIAL NO.	

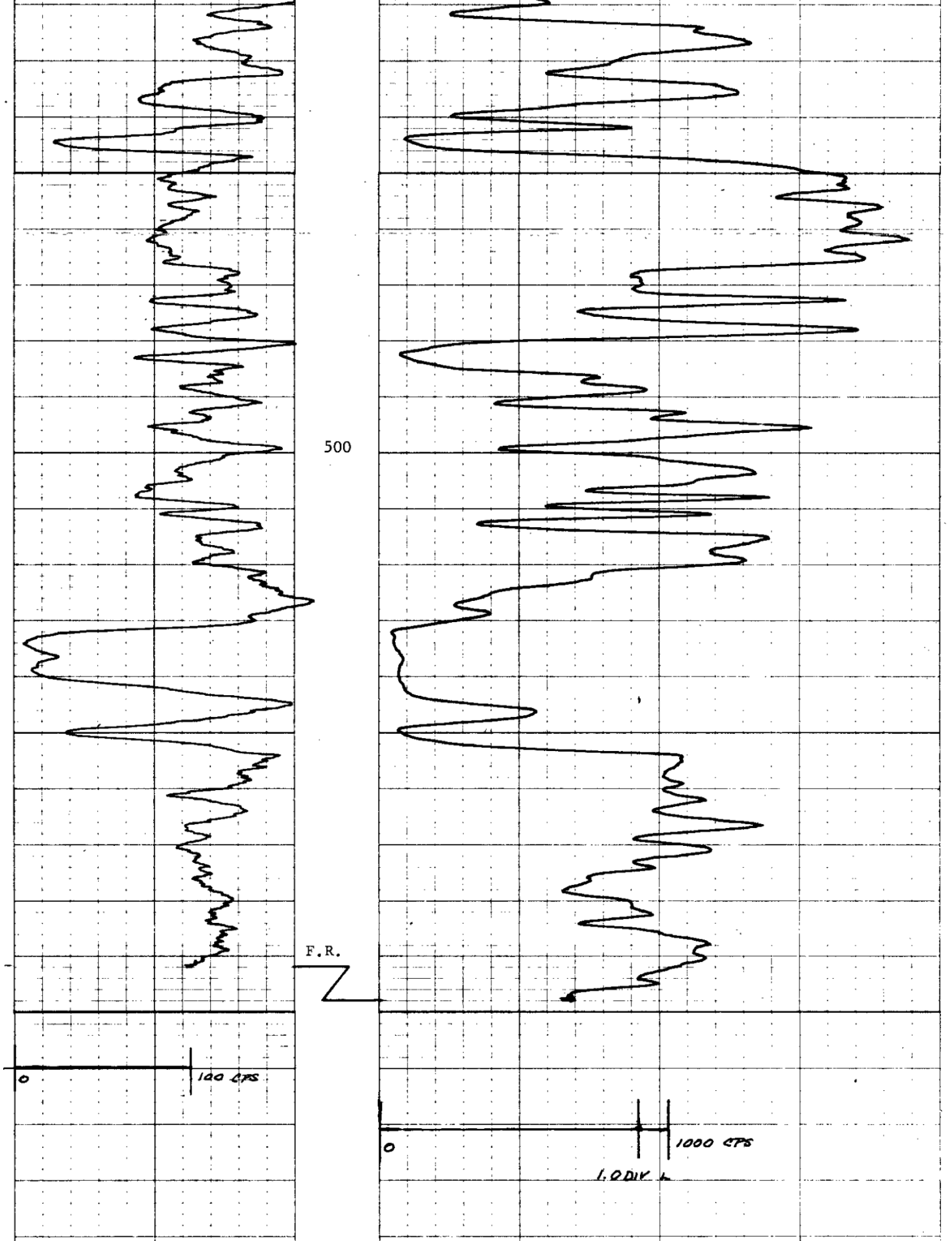
LOGGING DATA

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	GAMMA RAY T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV. L OR R	GAMMA RAY API G. R. UNITS PER LOG DIV.	NEUTRON T. C. SEC.	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV. L OR R	NEUTRON API N. UNITS PER LOG DIV.
1	00	598	12	5	100	-	15 API	3	1000	1L	130 API

REMARKS


GAMMA RAY
DEPTHS
NEUTRON
GAMMA RAY INCREASES
API
15
0
150
NEUTRON INCREASES
API
130
130
1430
2730
000
100


200
300
400


500
F.R.
0
100 CPS
0
1000 CPS
1.0 DIV.

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD
SEC
TWP
RGE
W.____M

COMPANY ESSO MINING LIMITED

WELL ES - 13

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL
Log Measured from: CASING
Drilling Measured from: KELLY

Elev.
K.B.
D.F.
G.L.

Other Services:

GEN

Run No. ONE
Date 26 SEPTEMBER 1975
First Reading 596
Last Reading 00
Feet Logged 596
Depth Reached 599
Bit From Surface
Csg. Shoe
Csg. Driller
Csg. Logger
Bottom Logged Interval
Top Logged Interval
Type Fluid in Hole WATER
Salinity, PPM Cl
Fluid Level FULL
Max. Rec. Temp. 6 DEG
Equip. No.
Location
Recorded By P.YORK
Witnessed By STEVENSON/K

Operating Time 1-1/2 HOURS
Truck No. 36

K-Elk River 74(3)8-13

274

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/ DIV
1	00	596	12					3	1000	1.68	44.16

REMARKS

DENSITY TOOL SERIAL NO 829

DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

100 150 | 150 | 140 | 130 | 120 | 110 | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10

000
100
200
300
400
500

F.B.

1.6 DIV SHIFT

1000 CPS

2 No 4

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 274

COMPANY ACCO RESOURCES LIMITED

WELL 8-8 -W

FIELD 8-8 WILDCAT

LOCATION

PROVINCIAL ALBERTA COUNTY/Mun.

Permanent Datum: GROUND LEVEL Elev. 2,845

Log Measured From: K.B. 8 Ft. Above Perm. Datum

D.F.

G.L.

Other Services

Recorded By: FRANC

Witnessed By: STOREFANCK

Run No.	One	Two	Three
Date	4-OCT-76		
Depth Driller	4,670		
Depth Logger	4,670		
Bottom Logged Interval	4,670		
Top Logged Interval	4,200		
Casing Driller	8 5/8 @ 4,200		
Casing Logger	8 5/8 @ 4,200		
Bit Size	7 7/8		
Type Fluid in Hole	GAS/OIL		
Density	8.8		
Viscosity	40		
pH			
Fluid Loss			
Source of Sample			
Rm @ Meas. Temp.			
Rmf @ Meas. Temp.			
Rmc @ Meas. Temp.			
Source of Rmf & Rmc			
Rm @ BHT			
Time Since Circ.	2 HRS		
Max. Rec. Temp.	125		
Equip. No. & Location	274		
Recorded By	FRANC		
Witnessed By	STOREFANCK		

K-Elm River, 76/83-01

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-66-W
GENERAL		SERIAL NO.	
HOIST TRUCK NO.	36	SPACING	
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	R GEN 47-002	STRENGTH	2 CURIES

LOGGING DATA

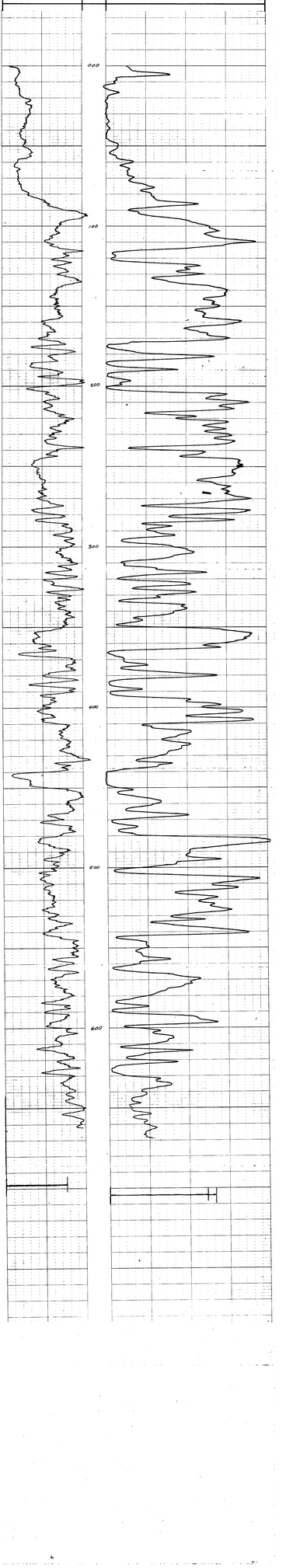
RUN NO.	GENERAL SECTIONS FROM	TO	SPEED FT/MIN	GAMMA RAY T.C. SEC.	SENS ZERO SETTINGS	API G. R. UNITS DIV. L OR R	PER LOG DIV.	NEUTRON T.C. SEC.	SENS ZERO SETTINGS	DIV. L OR R	API N. UNITS PER LOG DIV.
1	0	4700	12	6	140	0	12	3	1400	1 L	100

REMARKS

GAMMA RAY | DEPTH | NEUTRON

GAMMA RAY INCREASES →

NEUTRON INCREASES →



K-Elk River 74(2)B-1

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 274

COMPANY ROCO MINING LIMITED

WELL EB - 14

LOCATION SEC. TWP. RGE. W. M

FIELD ELK RIVER VALLEY

Permanent Datum: GROUND LEVEL Elev. 1337 ft. Above Perm. Datum

Log Measured from: KELLY BUSHING 7 ft. Above Perm. Datum

Date Run No. ONE

Depth Driller 670

Depth Logger 670

Bottom Logged Interval 670

Top Logged Interval 00

Casing Driller 9 5/8" @ 20' 13 3/8" @ 670

Casing Logger

Bit Size 8 1/2"

Type Fluid in Hole WATER

Salinity, PPM Cl

Density

Level Full

Max. Rec. Temp. Deg. F

Equip. Location

Recorded By FINK

Witnessed By STEVENSON

Operating Time

Truck No. 3-172, 20285

Other Services: CBL, GDN

R. Gl. ft. above Perm. Datum

D.F. ft. above Perm. Datum

G.L. ft. above Perm. Datum

GENERAL

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN.
1	00	670	12

GAMMA RAY

RUN NO.	T.C. SEC.	SENS SETTINGS	ZERO DIV'S. OR R	API G.R. UNITS PER LOG DIV.
1				

SIDEWALL DENSILOG

RUN NO.	T.C. SEC.	SENS SETTINGS	ZERO DIV'S. OR R	CPS/DIV.
1	3	500	1.68	19.43

REMARKS LOGGED THROUGH NO DRILL ROD

DENSITY TOOL SERIAL NO 829

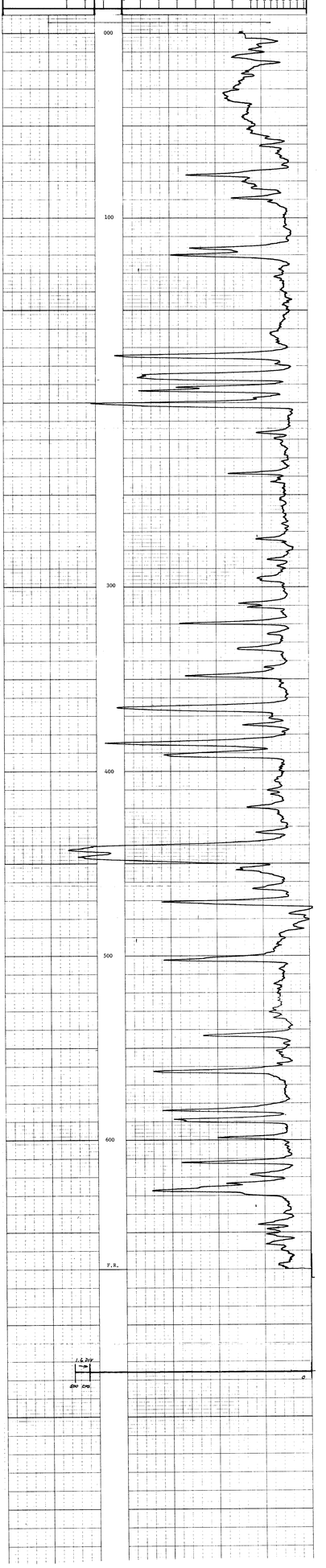
DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)



ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

COMPANY ROKE MEDIO (1977)

WELL 29 35

LOCATION 274

FIELD BIG RIVER VALLEY

PROVINCE WESTERN CANADA

Permanent Datum: GROUND LEVEL — Elev. 0

Log Measured from: GROUND LEVEL — Ft. Above Perm. Datum

Drill Measured from: GROUND LEVEL — G.L.

Other Services: DISKS

Run No. ONE

Date 5 SEPTEMBER 1979

Last Reading 458

First Reading 100

Footage Logged 358

Depth Driller 459

Depth Logger 459

Casing Driller 30

Casing Logger 30

Fluid Type WATER

Fluid Level 80

Max. Temp. 80

Rm @ °F

Operating Time 2 RECRD 38

Truck No.

Recorded By SAMSON/BARES

Witnessed By STROBRIDGE

K-ELK RIVER 76(2)8-1

45

EQUIPMENT DATA

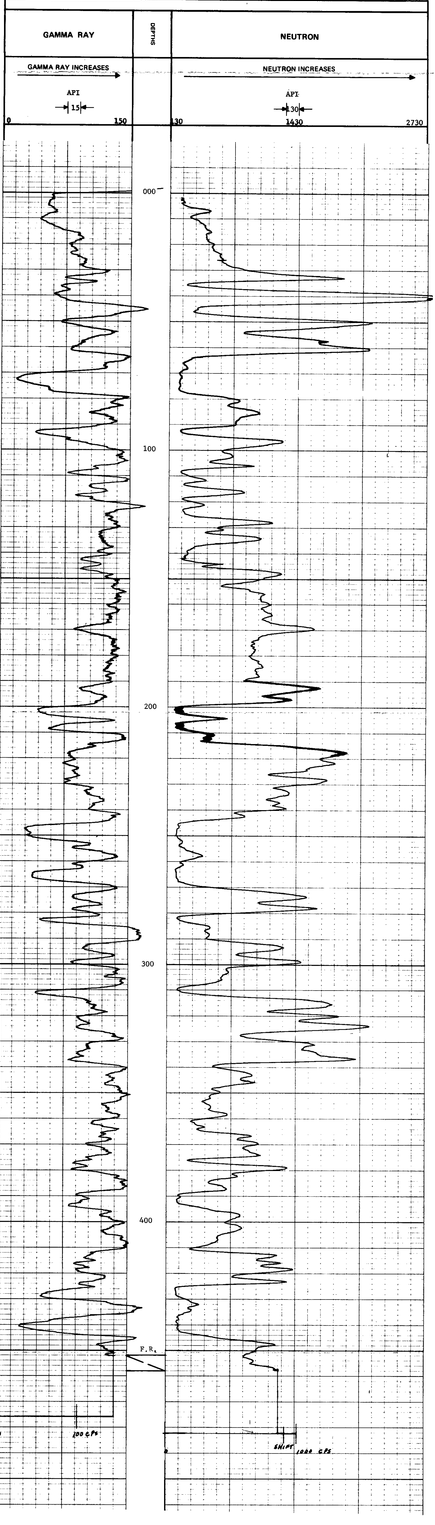
GAMMA RAY	ONE	NEUTRON	ONE
RUN NO.		RUN NO.	
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	7.0 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
		SERIAL NO.	187
		SPACING	17 INCH
		TYPE	AmBe
		STRENGTH	3 CURIES

GENERAL	
HOIST TRUCK NO.	36
INSTRUMENT TRUCK NO.	
TOOL SERIAL NO.	R GRN 169-002

LOGGING DATA

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	GAMMA RAY T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV. L OR R	GAMMA RAY API G. R. UNITS PER LOG DIV.	NEUTRON T. C. SEC.	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV. L OR R	NEUTRON API N. UNITS PER LOG DIV.
1	00	458	12	5	100	0	15 API	3	500	11	130 API

REMARKS



ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

FILE NO. 274

COMPANY: ESSO MINING LIMITED

WELL: 23 15

FIELD: ELK RIVER VALLEY

LOCATION: LSD SEC TWP RGE W M

PROVINCE: BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL Elev. 0

Log Measured from: K.B. 0 Ft. Above Perm. Datum

Other Services: CGR

Rec. No. ONE

Date 5 SEPTEMBER 1975

Last Reading 457

Footage Logged 457

Depth Reached 460

Dr. Driller 460

Log Driller 460

Casing Driller

Fluid Type WATER

Liquid Level 00

Max. Temp. Deg. F.

Min. Diam. HQ

Operating Time 3-1/2 HOURS

Truck No. 36

Recorded By CARLSON/BANKS

Witnessed By STOBBENACK

K-Elk River 76/3/8-1

15

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/ DIV
1	00	457	10					3	1000	1.6R	44.16

REMARKS

DENSITY TOOL SERIAL NO A829

DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250

000
100
200
300
400

F.R.

7000 CPS

WHITE

ROKE

SIDEWALL DENSILOG

Kelly River 7(1)3-1 16

FILE NO.	
LSD SEC TWP RGE W	M
COMPANY	ROKE ENTERPRISES LTD. CALGARY, ALBERTA
WELL	ES 14
FIELD	BEAR RIVER SOUTH
LOCATION	
PROVINCE	NORTHERN SASKATCHEWAN
Permanent Datum: GROUND LEVEL	Elev.: K.B. D.F. G.L.
Log Measured from: GROUND LEVEL	8 Above Perm. Datum
Drill Measured from: GROUND LEVEL	

Other Services: GDL

277

Rec. No.	
Date	5 SEPTEMBER 1975
Run No.	ONE
Depth Driller	877
Depth Logger	877
Bottom Logged Interval	880
Top Logged Interval	SURFACE
Casing Size	40
Casing Depth	
Fluid Type	MOISTWATER
Fluid Density	80
Fluid Level	80

Recorded By: CHARRY/FISHER

Witnessed By: MR. PERFORMANCE

Operating Time	
Truck No.	
	2 HOURS
	3/4

GENERAL				GAMMA RAY				SIDEWALL DENSILOG		
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTING	ZERO DIV./ GR	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTING	ZERO DIV./ GR	CPS/ DIV
1	00	877	10					1	500	1.66	19.43

REMARKS: LOGGED THROUGH NO DRILL ROD

DENSITY TOOL SERIAL NO A 829

DEPTHS

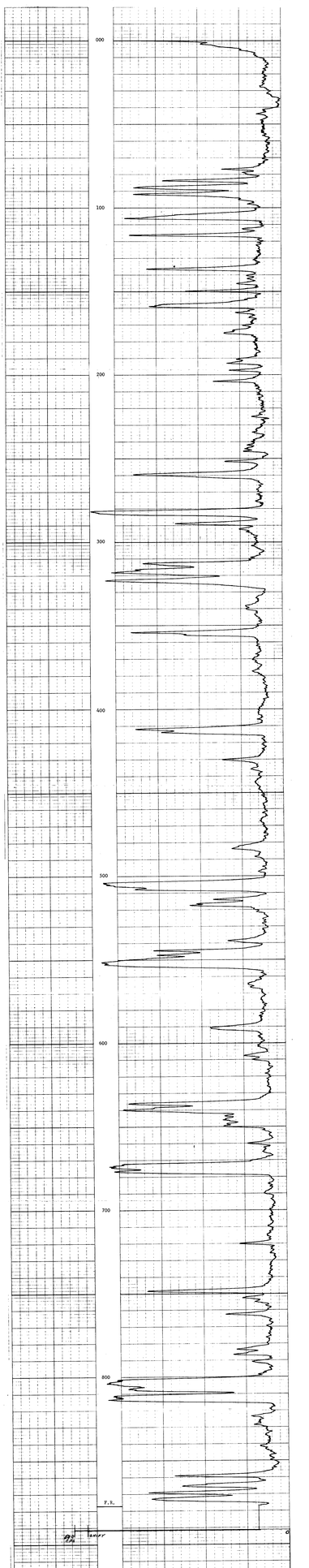
CALIPER
(DIAMETER — INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)

1.95 2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95



K - ELK RIVER 76(3)B-1

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD
SEC
TWP
RGE
W_____M

COMPANY ELCO MINING LIMITED

WELL EB 16

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: NIL

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Ft. Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Run. No.	ONE		
Date	28 AUGUST 1975		
First Reading	879		
Last Reading	797		
Footage Logged	82		
Depth Reached	880		
D' Driller			
Casing Roke			
Casing Driller			
Fluid Type	WATER		
Liquid Level			
Min. Diam.	HQ		
Rm @ °F			
Operating Time	3 HOURS		
Truck No.	33		
Recorded By	JOHNSON	Witnessed By	STOBERNACK

EQUIPMENT DATA

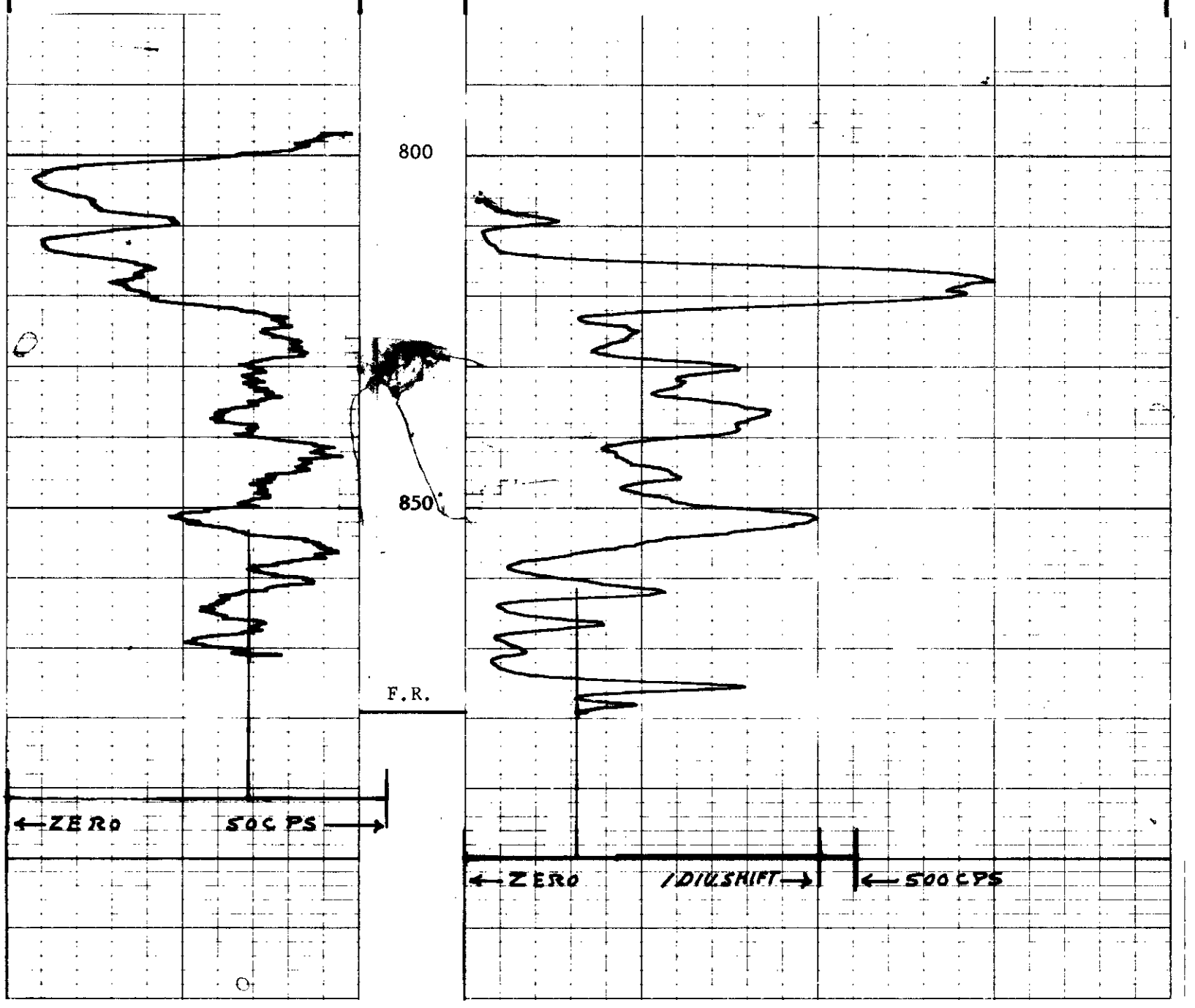
GAMMA RAY		NEUTRON	
RUN NO.	ONE+	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	GEIGER	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	606
HOIST TRUCK NO.	33	SPACING	17 INCH
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	CGN 27U4A-74	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV
1	797	879	12	5	100	0L	17 API	3	500	1L	130 API

REMARKS TOOL STUCK IN HOLE AT 797 FEET

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API		API
17		130
0 — 170		130 — 1430 — 2730



K-ELK RIVER 76(3)B-1

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD
SEC
TWP
RGE
W_____M

COMPANY ELCO MINING LIMITED

WELL EB 16

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: NIL

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Ft. Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Run. No.	ONE		
Date	28 AUGUST 1975		
First Reading	879		
Last Reading	797		
Footage Logged	82		
Depth Reached	880		
Driller			
Cas. / Roke			
Casing Driller			
Fluid Type	WATER		
Liquid Level			
Min. Diam.	HQ		
Rm @ °F			
Operating Time	3 HOURS		
Truck No.	33		
Recorded By	JOHNSON	Witnessed By	STOBERNACK

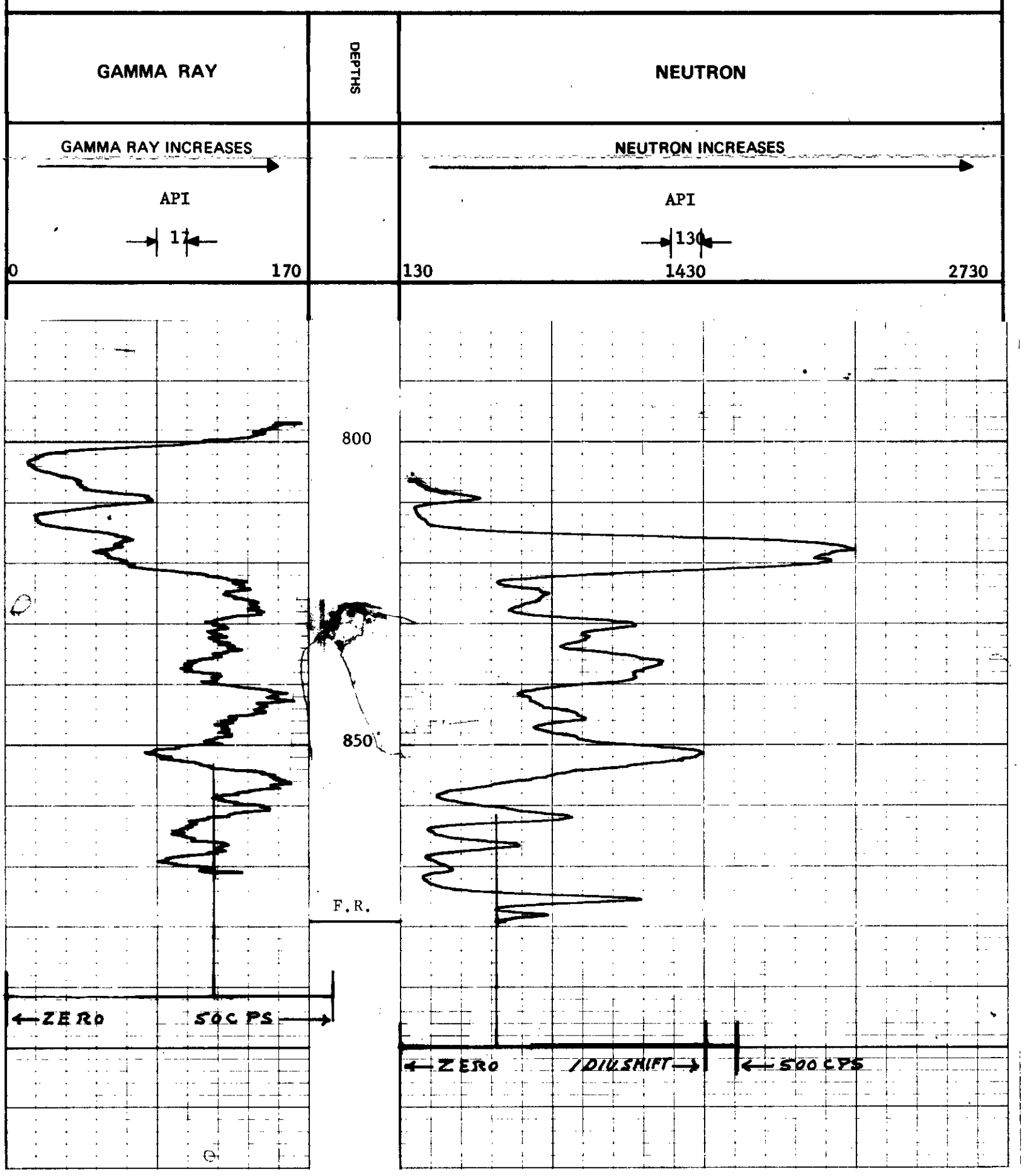
EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE+	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	GEIGER	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	606
HOIST TRUCK NO.	33	SPACING	17 INCH
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	CGN 27U4A-74	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	797	879	12	5	100	0L	17 API	3	500	1L	130 API

REMARKS TOOL STUCK IN HOLE AT 797 FEET



ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

FOCUSED BEAM LOG

FILE NO.
COMPANY ESSO MINERAL LTD.
SEC
TWP
RGE
M
WELL 33-17
LOCATION
FIELD ELK RIVER AMAY

K. Elk River Pt. (3) 9-17

274

Other Services: CBHD & BHRS

Permanent Datum: GROUND LEVEL Elev.
Log Measured from: GROUND LEVEL ft. Above Perm. Datum
Drilling Measured from: GROUND ALBERTA

Rec. No.	ONE
Date	13-JUNE-1975
First Reading	2726
Last Reading	00
Depth Driller	2726
Depth Logged	2725
Casing Driller	500
Casing Logged	500
Bit From	SURFACE
Type Fluid in Hole	WBM
Salinity, PPM Cl	
Density	
Level	
Max. Rec. Temp. deg. F	
Operating Time	1 HOURS
Truck No.	36

Recorded By CARLSON
Witnessed By STONEHOUSE

Remarks	A ZERO ELECTRODE 8 INCHES
	BEAN 9 INCHES
	GUARD LENGTH 14.65 INCHES
	EXPERIMENTAL TOOL (3)

Depths

RESISTIVITY
Ohm-Meters
0 5000

RESISTIVITY
Ohm-Meters
0 1250 2500

000
100
200
300
400
500
600
700

F.R.

CAL/SONIC 800 TAP

DEL 2080

BHR 2080

GR 2880

ROKE [redacted]

OIL ENTERPRISES LTD. CALGARY, ALBERTA

K-ELK RIVER 76(3)B-1

17

FILE NO.

LSD
SEC
TWP
RGE
W M

COMPANY ELCO MINING LIMITED

WELL E8 17

LOCATION

FIELD

PROVINCE BRITISH COLUMBIA

Other Services: NEUTRON

Permanent Datum GROUND LEVEL Elev.

Log Measured from GROUND LEVEL Ft. Above Perm. Datum

Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Run. No.	ONE
Date	13 AUG 25
First Reading	224
Last Reading	00
Footage Logged	224
Depth Reached	225
Driller	500
Casing Rokes	
Casing Driller	
Fluid Type	AIR/WATER
Liquid Level	0
Min. Diam.	NO
Rm @ °F	
Operating Time	2 HRS
Truck No.	36
Recorded By	CARLSON
Witnessed By	STORGEHAGE

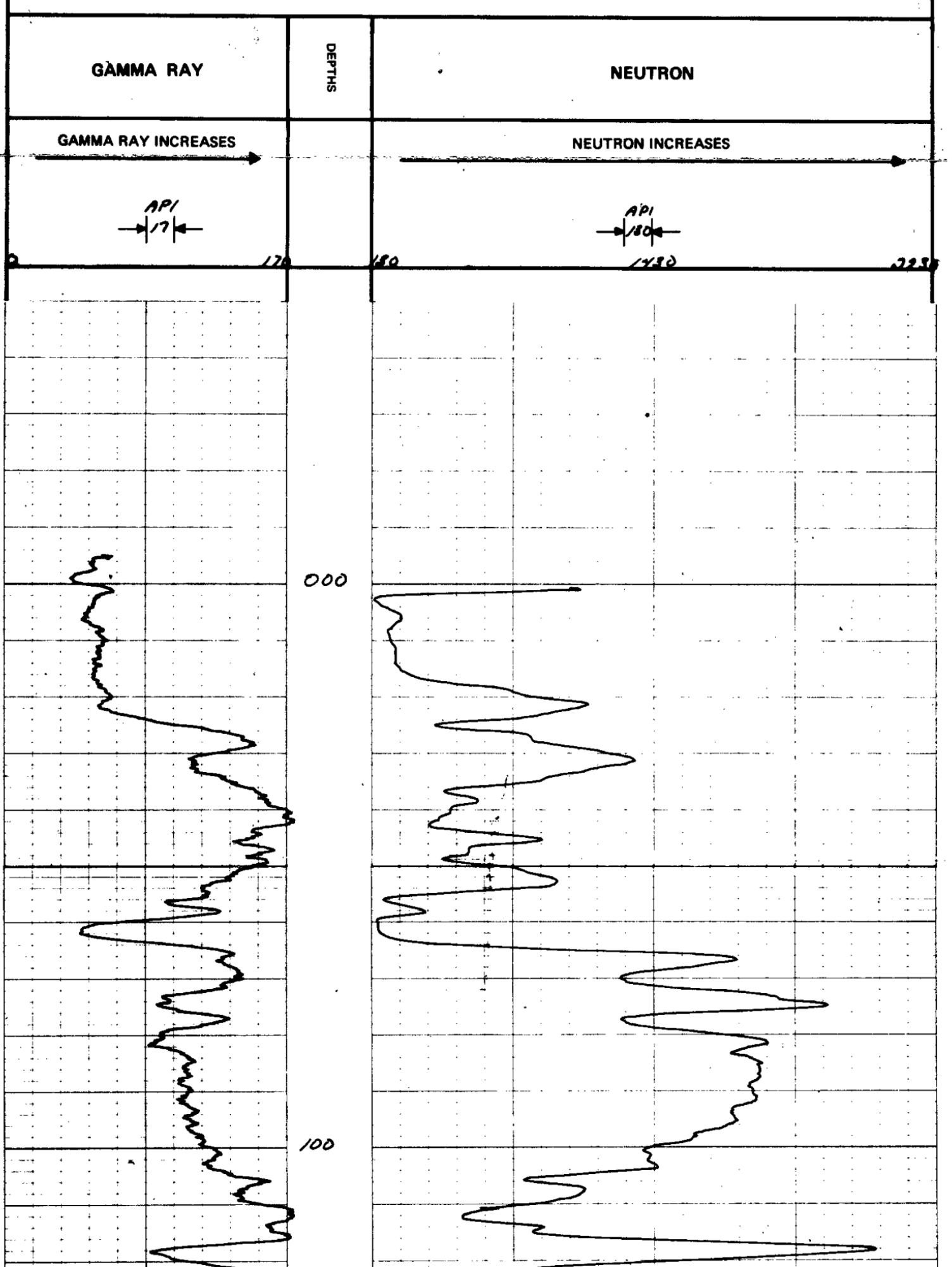
EQUIPMENT DATA

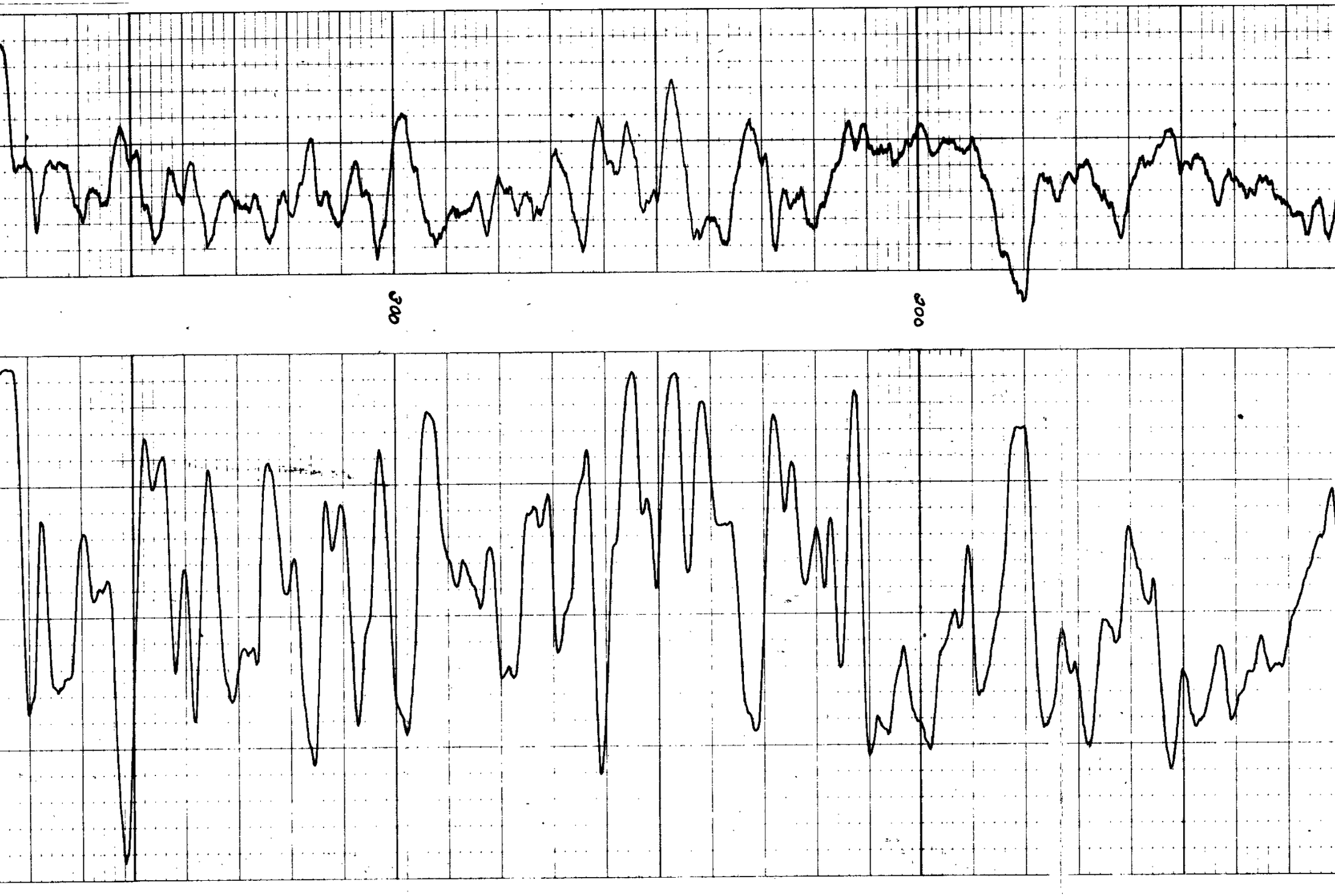
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.	36	SPACING	
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	R GRN 162-002	STRENGTH	3 CURIES

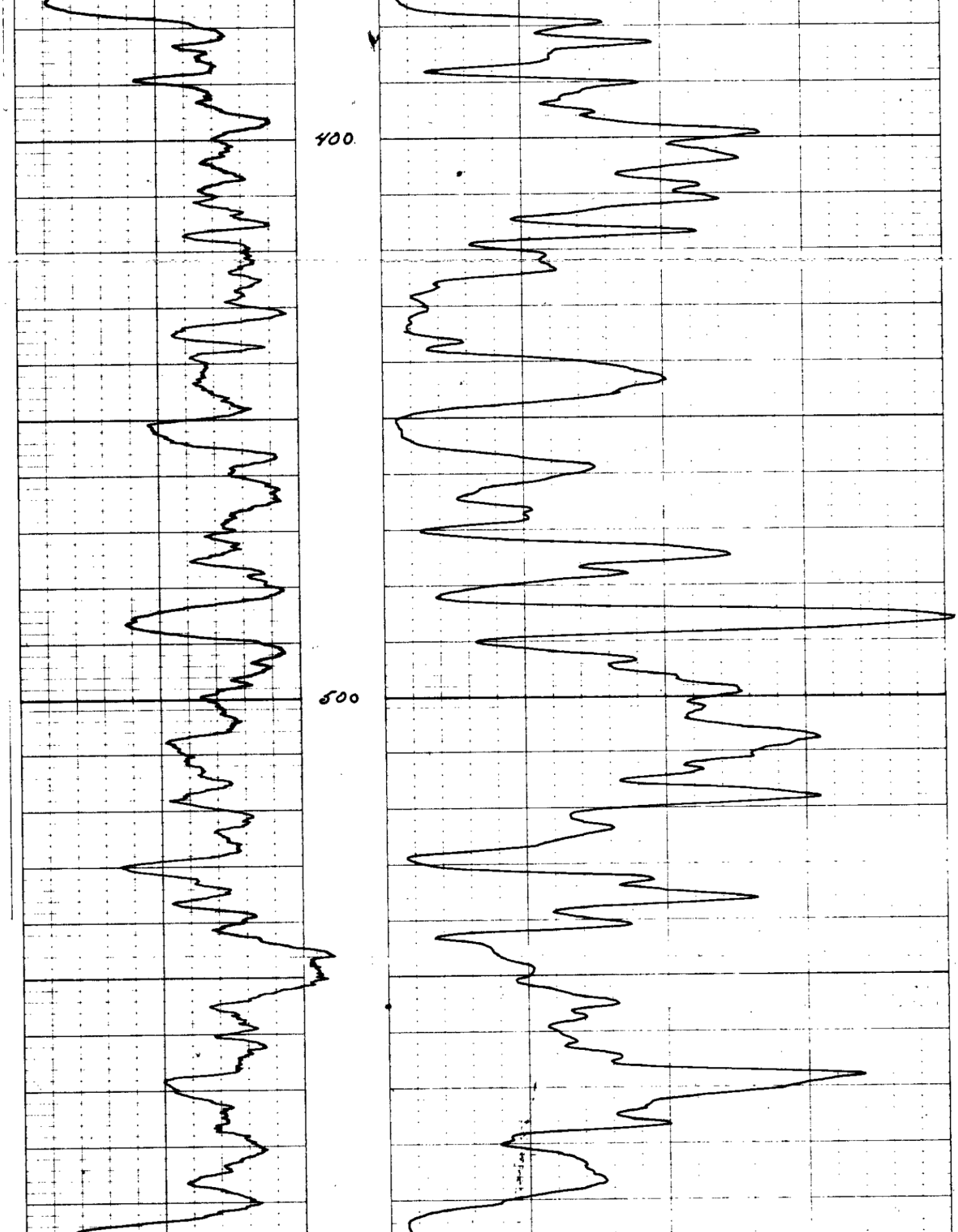
LOGGING DATA

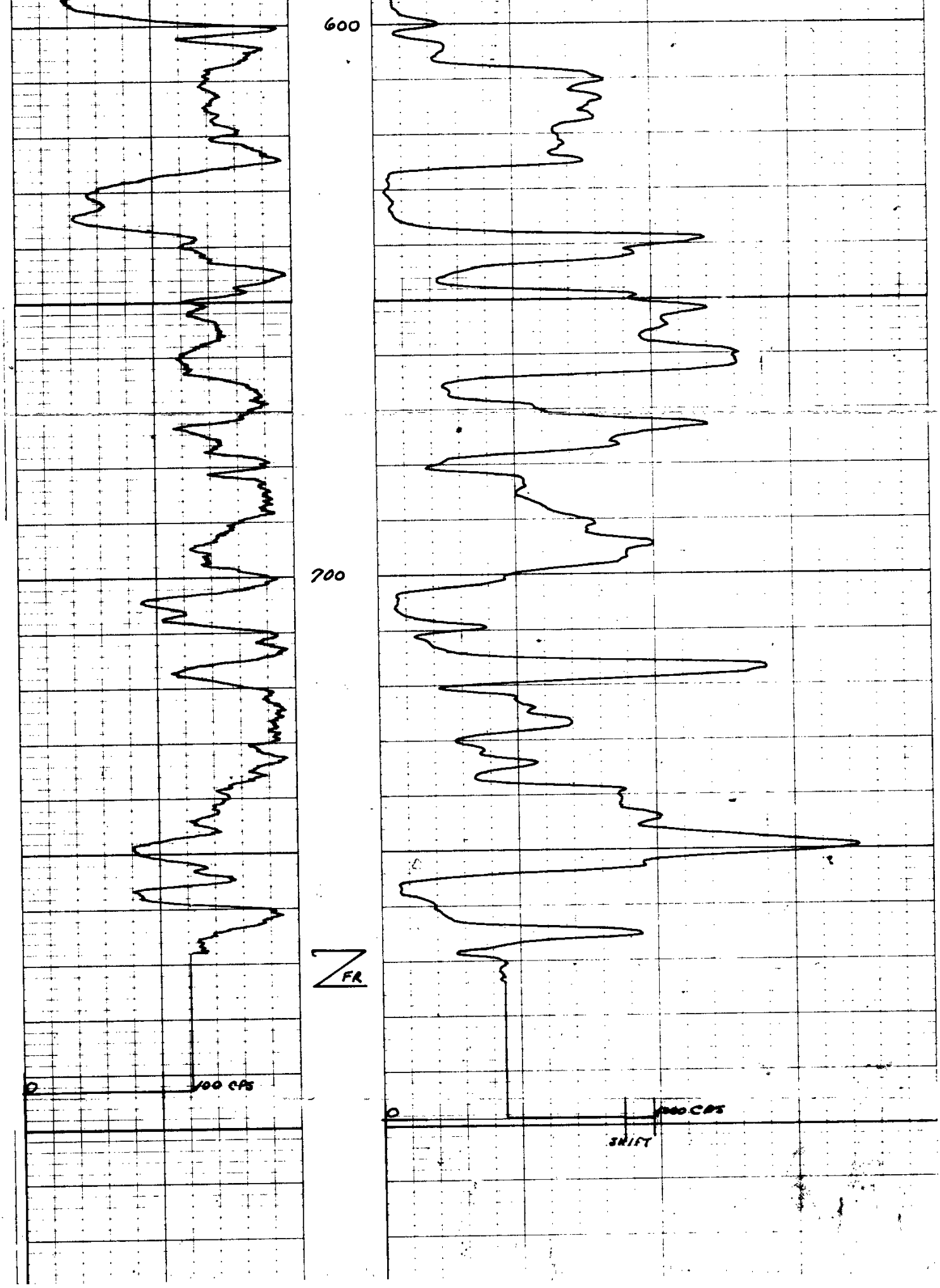
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	0	224	12	5	100	–	12 API	3	1000	1 L	130 API

REMARKS


GAMMA RAY
DEPTHS
NEUTRON
GAMMA RAY INCREASES
NEUTRON INCREASES
API
17
0
170
API
180
180
1430
2230
000
100


300
900


400
500


600
700
Z FR
0
100 CPS
0
1000 CPS
SHIFT

KELM RIVER

ROKE

SCHLUMBERGER

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

COMPANY ROKE OIL ENTERPRISES LTD.

WELL No. 17

LOCATION FOX RIVER SHARPE

FIELD

PROVINCE SASKATCHEWAN

COUNTY

Permanent Datum: GROUND LEVEL Elev. 1770
Log Measured from: GROUND LEVEL 0 Ft. Above Perm. Datum
Drilling Measured from: K.B. 0

Elev.: K.B. 1776
D.F.
G.L.

Other Services

Date: 13 AUGUST 1973
Run No.: ONE
Depth-Driller: 770
Depth-Logger: 770
Bottom Logged Interval: 770
Top Logged Interval: SURFACE
Type Fluid in Hole: WATER
Salinity, PPM Cl: 500
Density: 9.0
Level: FULL
Max. Rec. Temp. Deg. F.: 90
Operating Rig Time:
Recorded By: GAYLNOR
Witnessed By: STEVENSON

Truck No.: 3
Truck No.:

GENERAL				GAMMA RAY				BIORAWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN.	T.C. SEC.	SENS SETTING	ZERO DIV'S. OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTING	ZERO DIV'S. OR R	CPS/ DIV
1	00	770	10					3	1000	1.68	44.16

REMARKS

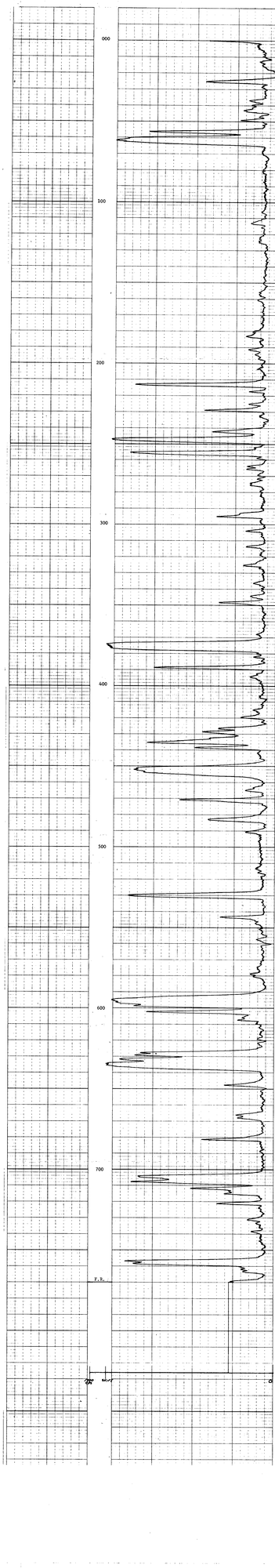
DENSITY TOOL SERIAL NO 829

DEPTH

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAM/CC)



K-ELK River 76(39)-1 18

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

COMPANY ROKE OILS (1970) LIMITED

WELL 13-18 SEC 18 TWP 26 RGE 7 W5M

LOCATION

FIELD BIG RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL Elev.
Log Measured From: K.B. Elev. Derrick Floor Elev.
Ref. Datum Measured From: GROUND LEVEL

Other Services: DENS. & DIFL.

Date: 13 MARCH 1975
Run No.: ONE
Depth Driller: 659
Depth Logger: 659
Bottom Logged Interval: 659
Top Logged Interval: 400
Casing Driller: 5" @ 400
Casing Logger: 5" @ 400
Bit Size: 4 3/4"
Type Fluid in Hole: WATER
Dens. Visc.:
pH Fluid Loss:
Source of Sample:
Rm @ Meas. Temp.:
Rmf @ Meas. Temp.:
Rmc @ Meas. Temp.:
Source of Rmf & Rmc:
Rm @ BHT:
Time Since Circ.:
Max. Rec. Temp.:
Equip. Location: 36
Recorded By: CALLAGHAN
Witnessed By: STOSSEKNECK

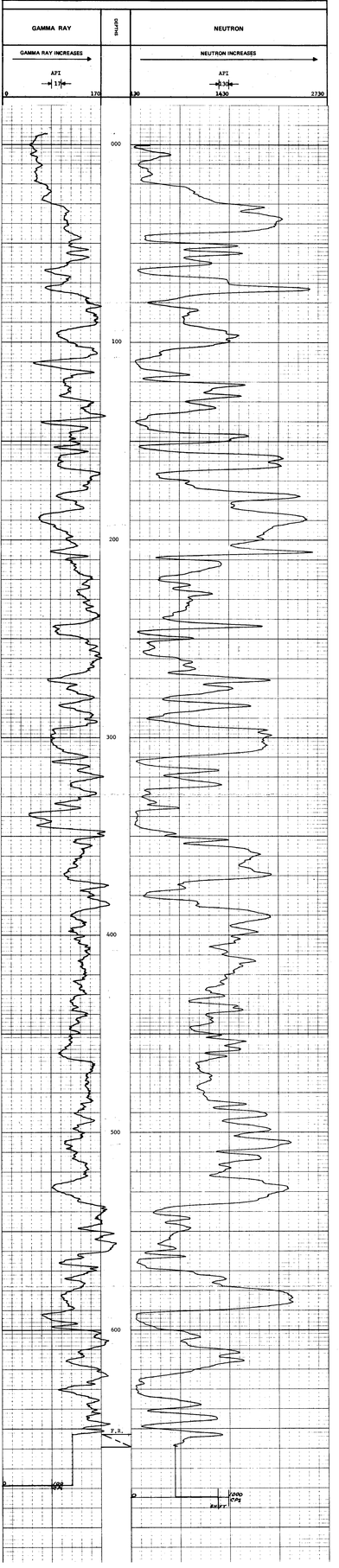
EQUIPMENT DATA

GAMMA RAY	ONE	NEUTRON	ONE
RUN NO.		RUN NO.	
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	8 INCH
		SOURCE MODEL NO.	MRC-N-88-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.	36	SPACING	
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	R GRN 169-002	STRENGTH	3 CURIES

LOGGING DATA

RUN NO.	GENERAL DEPTHS FROM	TO	SPEED FT/MIN	T.C. SEC.	GAMMA RAY SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	NEUTRON T. C. SEC.	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	659	12	5	100	-	17 API	3	500	11L	130 API

REMARKS FISHING HOLE



K-ELK RIVER 76(3)(b-) 18

ROKE

SIDEWALL DEVSLOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 274

COMPANY BEAR RESERVE LIMITED

WELL 89 38

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev. K.B. DRILL & TOOL
Log Measured from GROUND LEVEL ft. Above Perm. Datum D.F. DRILL
Drill Measured from GROUND LEVEL G.L.

Other Services

Rec. No. 008
Run No. 1
Date 13 AUGUST 1975
First Reading 657.00
Last Reading 00.00
Depth Driller 657.00
Depth Logger 660
Bottom Logged Interval 660
Top Logged Interval
Casing Driller
Casing Logger
Bit Size
Type Fluid WATER
Density Viscosity
pH Fluid Loss
Source of Sample
Rm @ Meas. Temp.
Rmf @ Meas. Temp.
Rmc @ Meas. Temp.
Source of Rmf Rmc
Rm @ BHT
Time Since Circ.
Max. Rec. Temp. 80
Equip. Location
Recorded By CAMERON
Witnessed By STEVENSON

Operating Time
Truck No. 34 70005

GENERAL

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV/L OR R	GAMMA RAY API G.R. UNITS PER LOG DIV.
1	00	657	10				

SIDEWALL DENSILOG

T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	CPS/ DIV
3	1000	1.68	44.16

REMARKS FLOWING HOLE

DENSITY TOOL SERIAL NO 829

DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

000
100
200
300
400
500
600
F.R.

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

K-ELK RIVER 76(3)B-1 19

FILE NO.

LSD
SEC
TWP
RGE
W M

COMPANY ELCO MINING LIMITED

WELL EB 19

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Ft. Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

274

Run. No.	ONE
Date	29 AUGUST 1975
First Reading	642
Last Reading	00
Footage Logged	642
Depth Reached	643
Depth Driller	645
ing Roke	30
Casing Driller	
Fluid Type	WATER
Liquid Level	00
Min. Diam.	HQ
Rm @ °F	
Operating Time	2 HOURS
Truck No.	36
Recorded By	CARLSON
Witnessed By	STOBERNACK

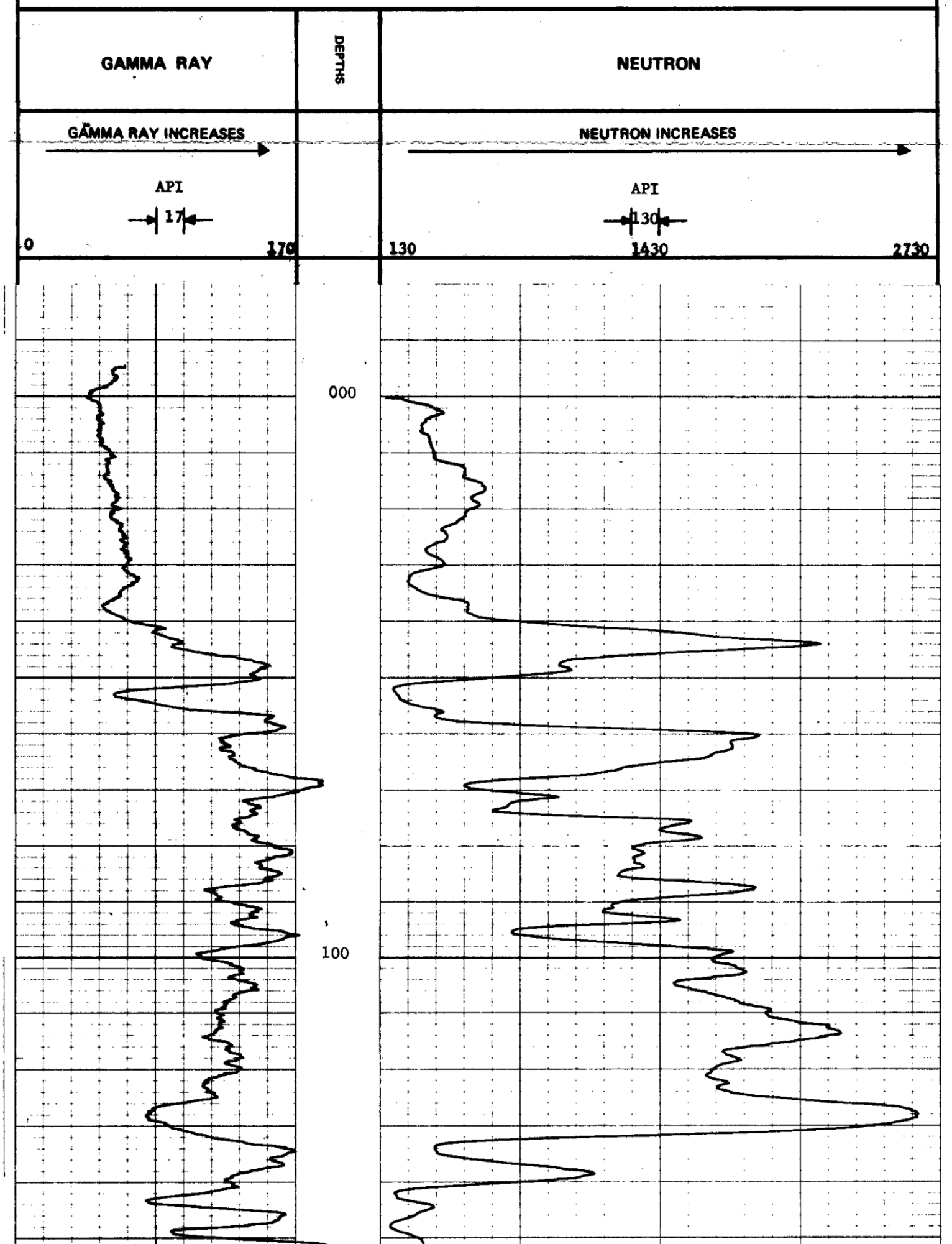
EQUIPMENT DATA

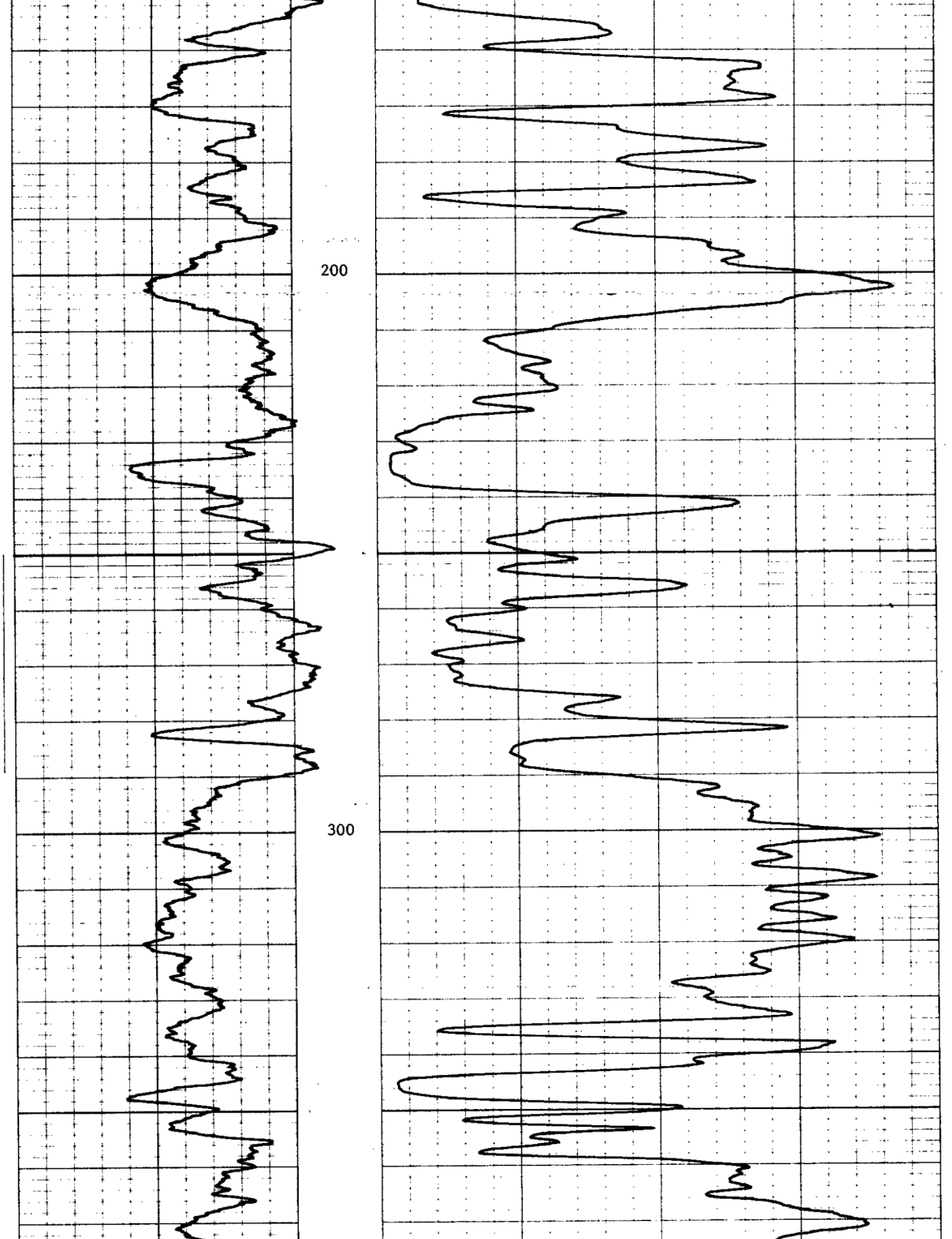
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.	36	SPACING	
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	R GRN 169-002	STRENGTH	3 CURIES

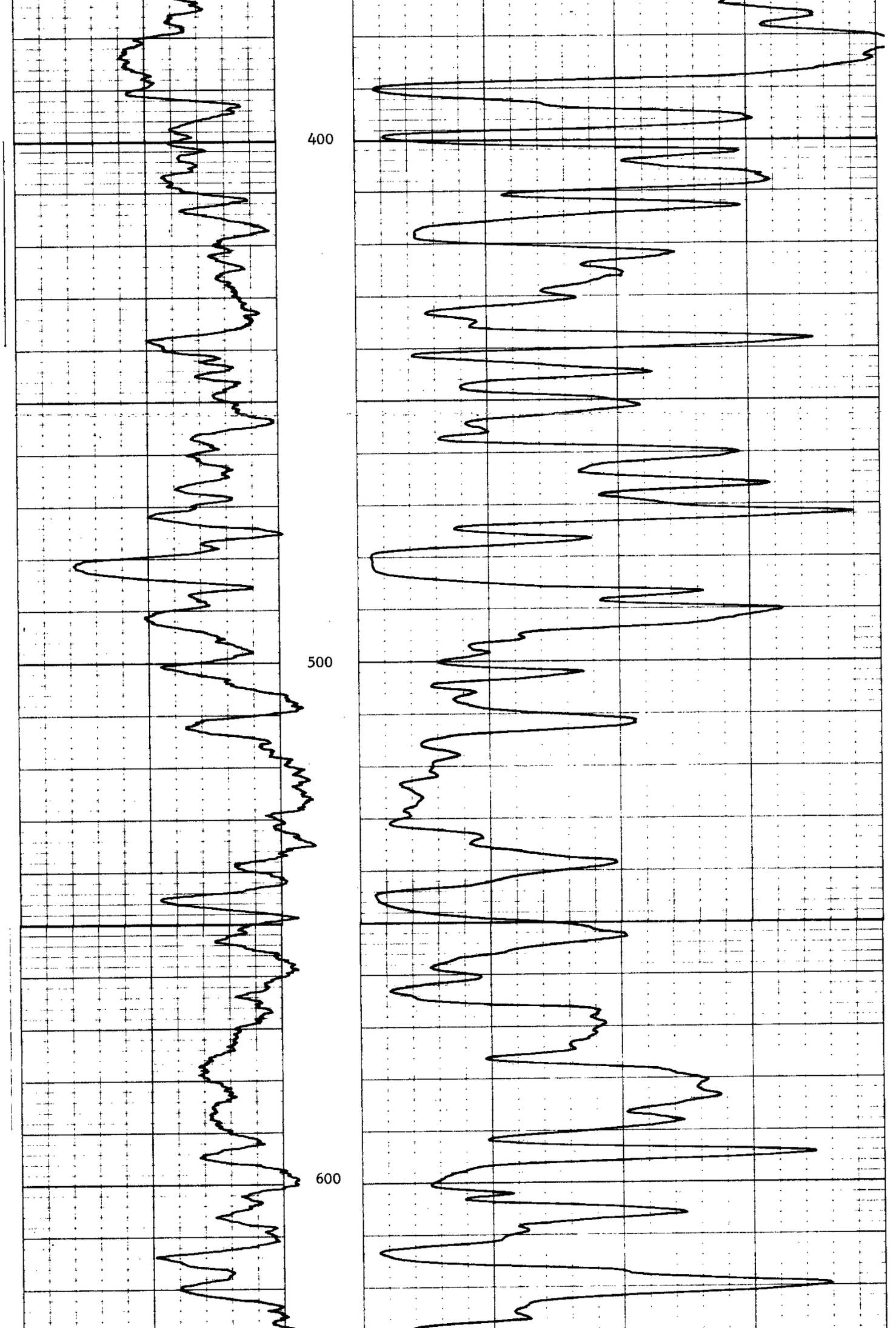
LOGGING DATA

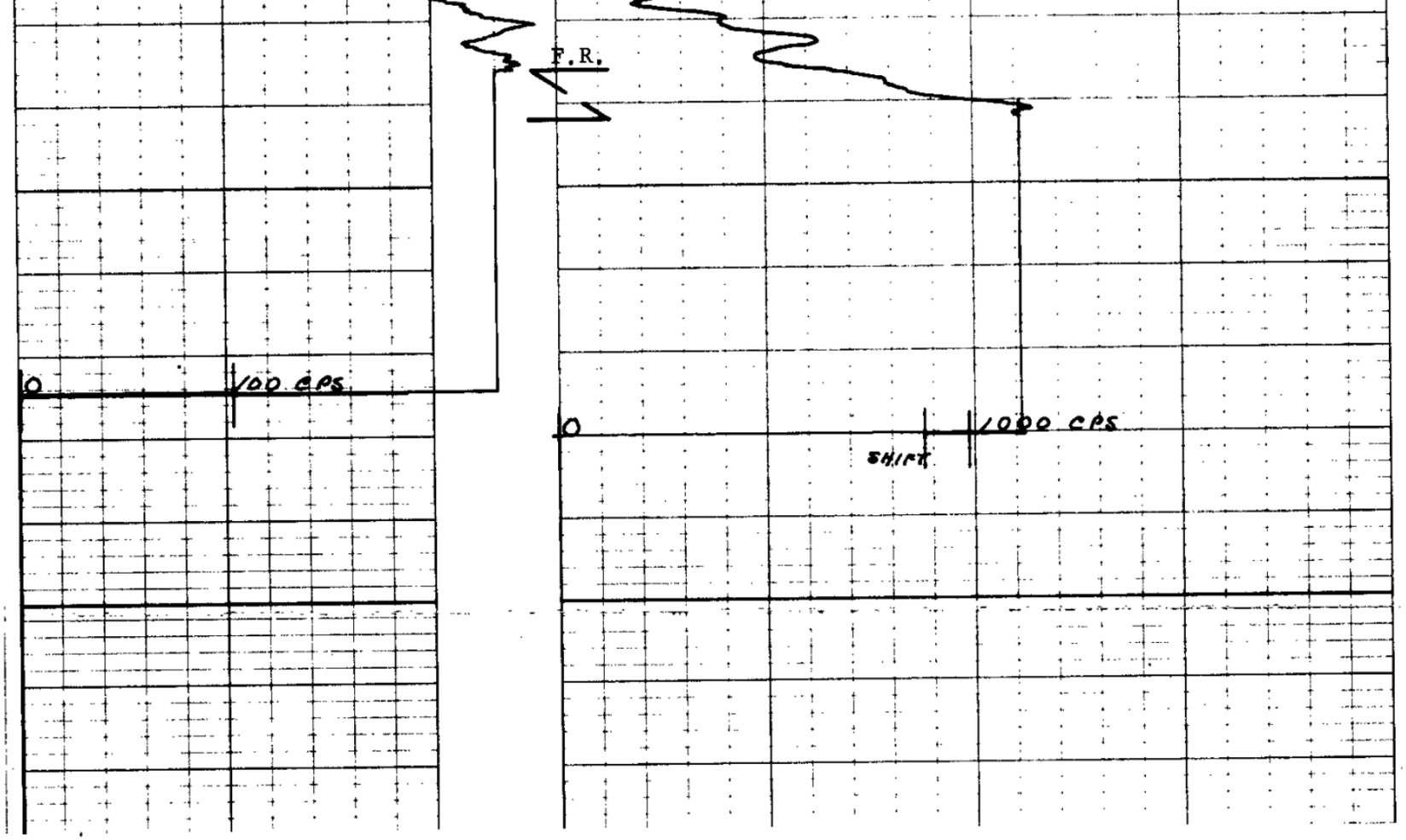
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	642	12	5	100	0	17 API	3	500	1L	130 API

REMARKS FLOWING HOLE


GAMMA RAY
DEPTHS
NEUTRON
GAMMA RAY INCREASES
NEUTRON INCREASES
API
17
0
170
API
130
130
1430
2730
000
100


200
300


400
500
600


F.R.
0
100 CPS
0
1000 CPS
SHIFT

K-ELK RIVER 7(2)(3) B-1 53

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

[redacted]

FILE NO.

LSD
SEC
TWP
RGE
W M

COMPANY ELCO MINING LIMITED

WELL EB 53

LOCATION 274

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: DEBS

Permanent Datum GROUND LEVEL Elev.
Log Measured from RIG FLOOR 2 Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

Run. No.	ONE		
Date	28 JAN 76		
First Reading	725		
Last Reading	0		
Footage Logged	725		
Depth Reached	726		
Depth Driller	726		
Carr. Broke			
Cas. Driller			
Fluid Type	AIR		
Liquid Level	DRY		
Mir. Tam.	HQ		
Rm @ °F			
Operating Time	2 HRS		
Truck No.	36		

Recorded By CARLSON Witnessed By OGILVIE

EQUIPMENT DATA

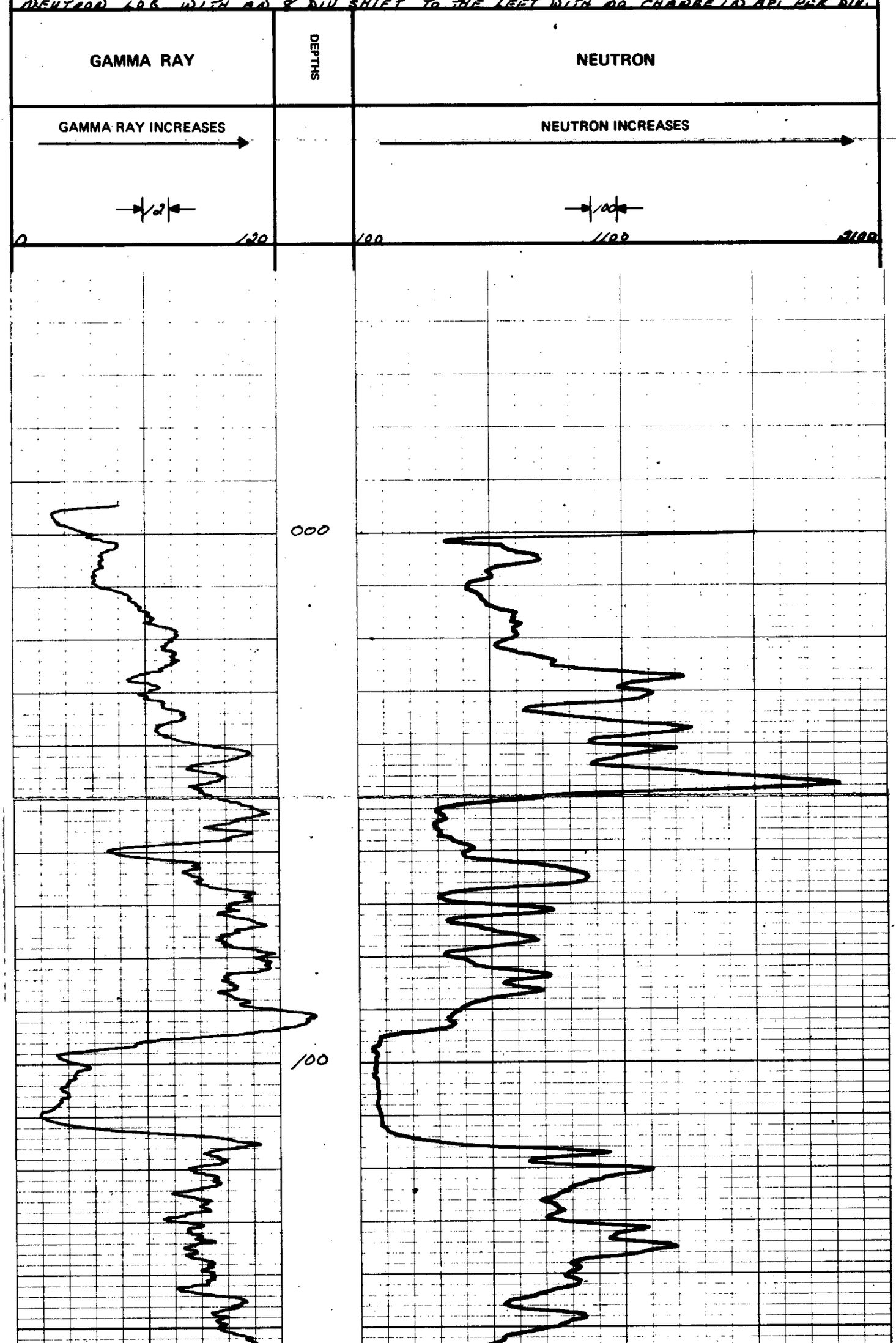
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	36	TYPE	AmBe
TOOL SERIAL NO.	169002	STRENGTH	3 CURIES

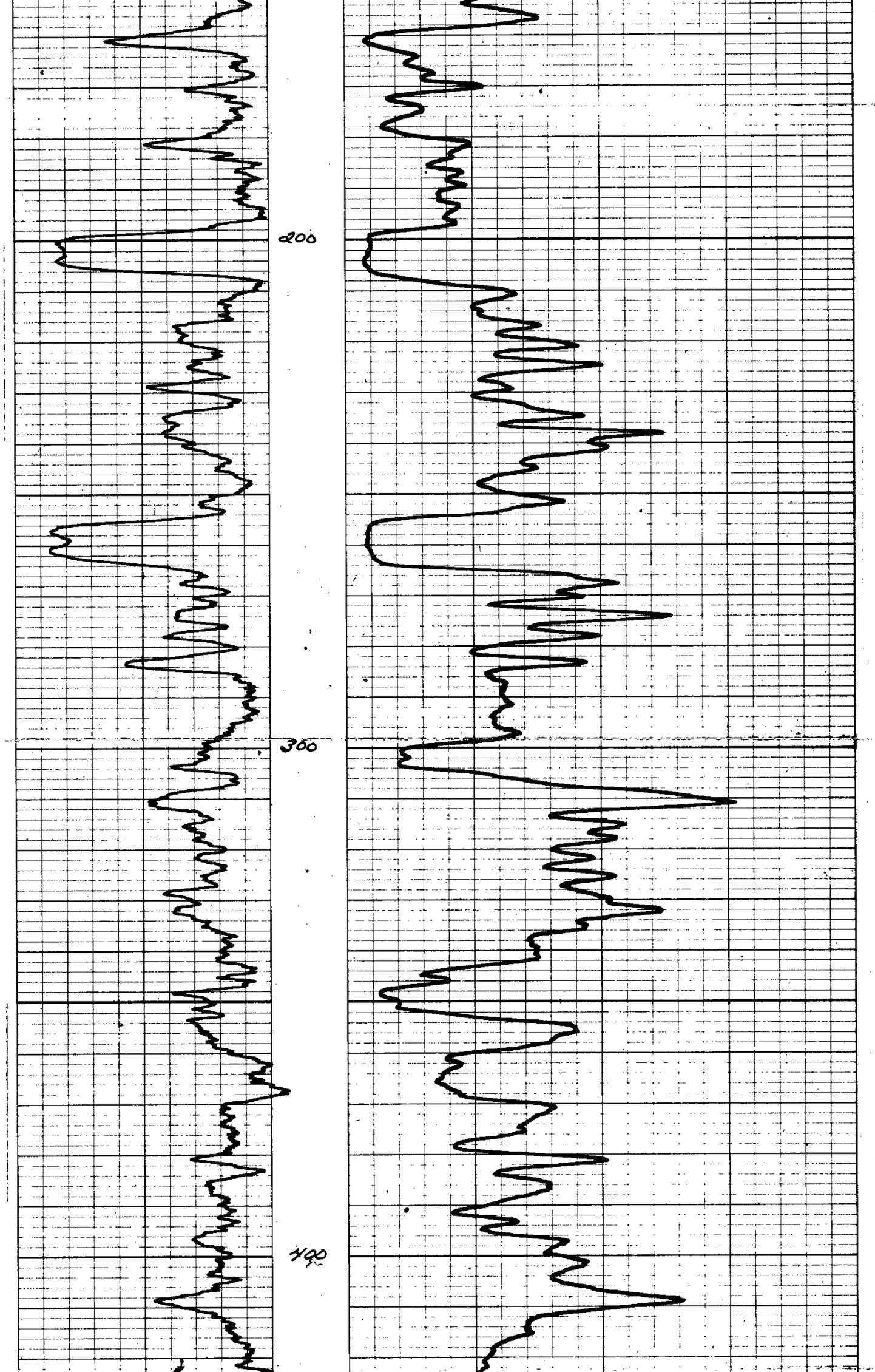
LOGGING DATA

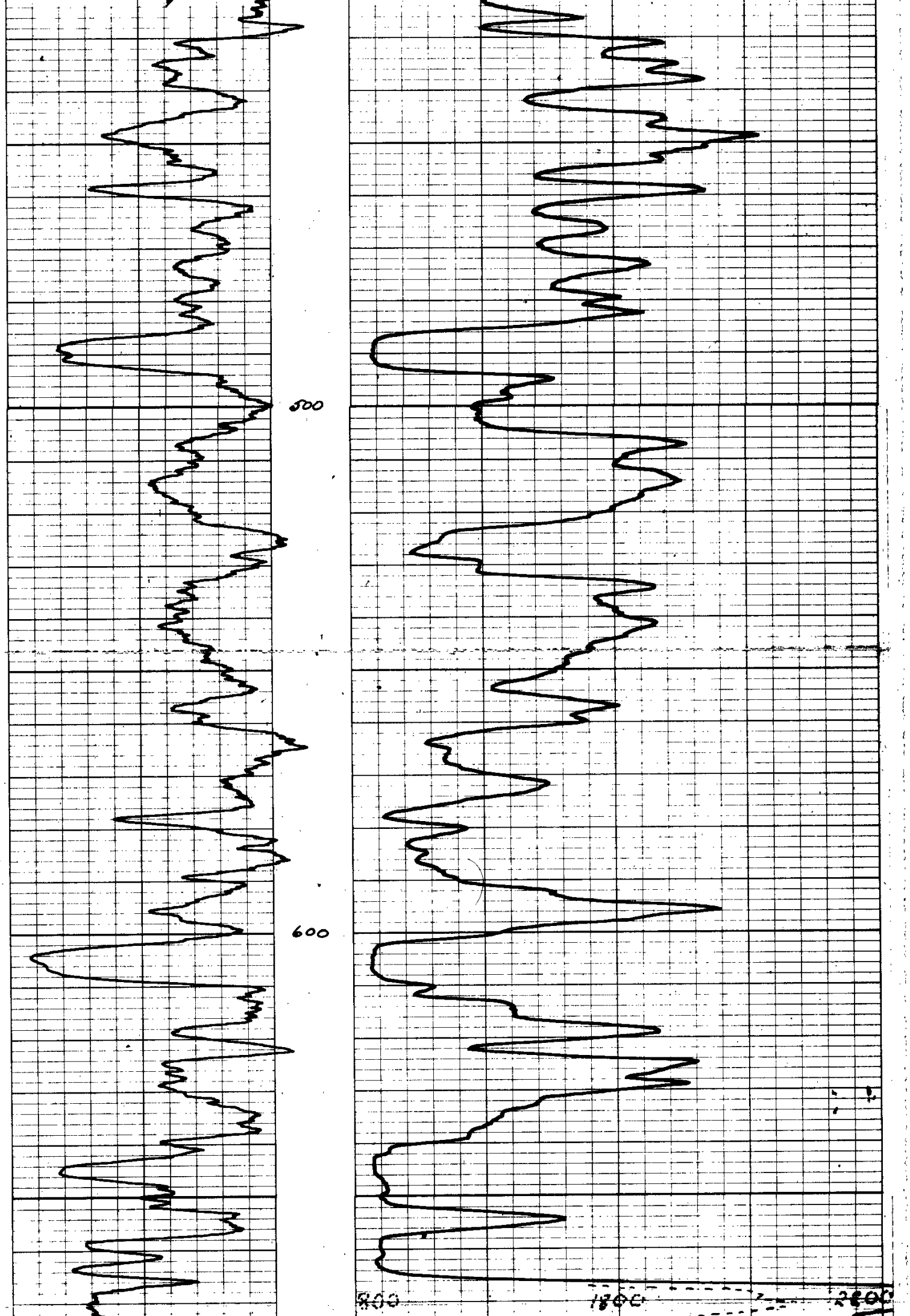
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	0	725	12	5	100	0	12	3	1000	16	100
	LOGGED THROUGH NO DRILL ROD.										

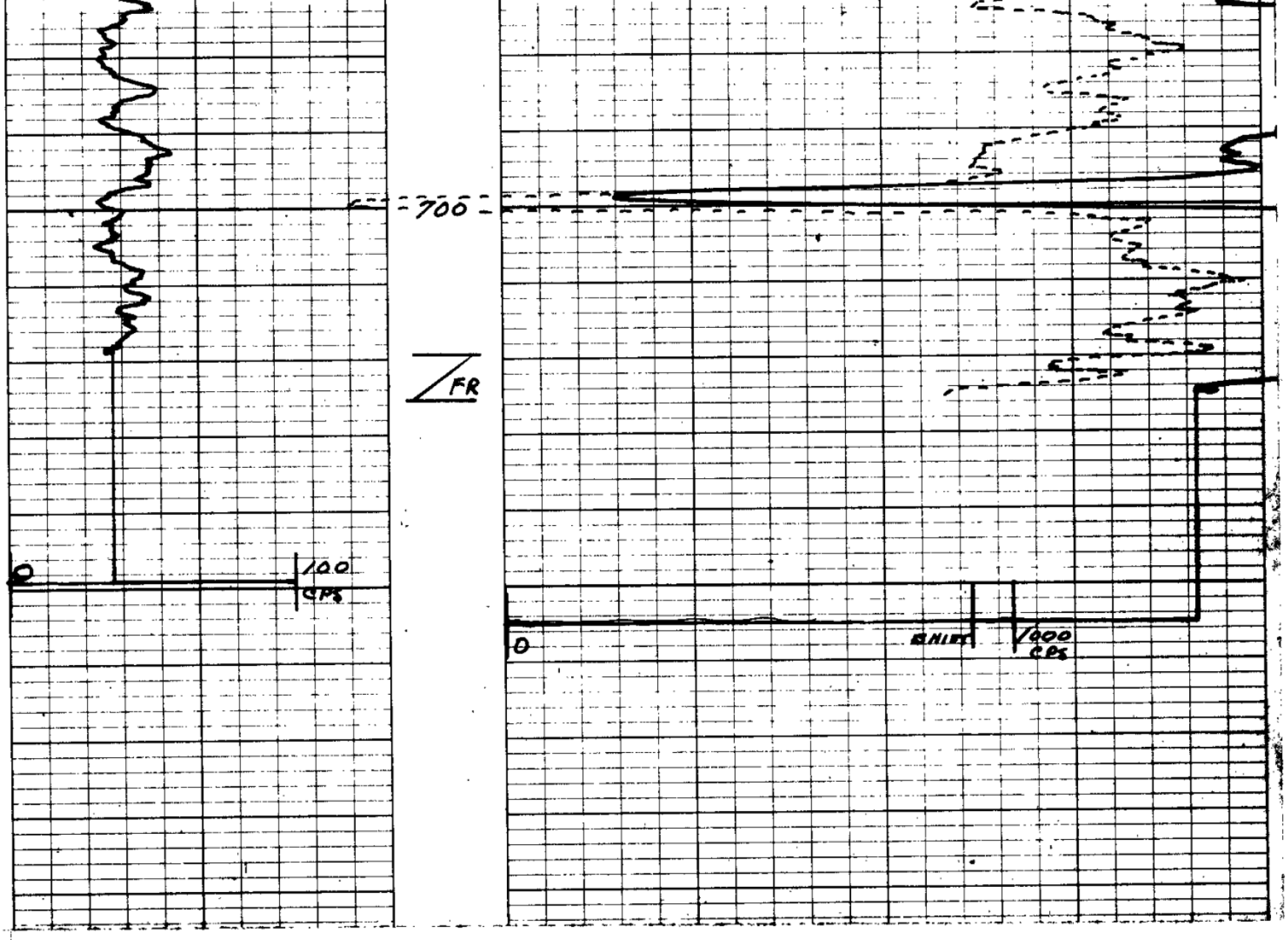
REMARKS PORTION FROM 666' TO 725' OFF THE TRACK WITH NORMAL SHIFT. DOTTED LINE SHOWS

NEUTRON LOG WITH NO 8 DIV SHIFT TO THE LEFT WITH NO CHANGE IN API PER DIV.




200
300
400


500
600
500
1800
2800


700
FR
0
100
CPS
0
1000
CPS

K-Elk River 76(3)8-19

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

COMPANY BLOCO PETROLEUM LIMITED

WELL E.R. 19

274

LOCATION

FIELD ELK RIVER KRAUSE

PROVINCE BRITISH COLUMBIA

Other Services

GR(A)

Permanent Datum: G.L. Elevation: 1000 ft. Above Perm. Datum
Log Measured from: KELLY BUSHING
Drilling Measured from: KELLY

Rec. No. 6412
Date 2-5-AUG-74
Depth-Driller 1000
Depth-Logger 1000
Bottom Logged Interval 1000
Top Logged Interval 0
Type Fluid in Hole GEL CHEM
Salinity, PPM Cl 1000
Density 9.6
Level FULL
Max. Rec. Temp. Deg. F. 70
Operating Time
Truck No. 66

Recorded By R.KELLAND
Witnessed By E.D.BRADBURN

GENERAL RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	GAMMA RAY T.C. SECS	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV'S. OR R	GAMMA RAY API G.R. UNITS PER LOG DIV.	SIDEWALL DENSILOG T.C. SECS	SIDEWALL DENSILOG SENS SETTINGS	SIDEWALL DENSILOG ZERO DIV'S. OR R	CPM/DIV
1	0	640	12					8	1000	66 R	

REMARKS FLOWLINE MALE

DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

000
100
200
300
400
500
600
FR

BASE
1000
0.00

BOTTOM
0

ROKE

OIL ENTERPRISES LTD. · CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

K-Elk River 76(3)B-1 27

FILE NO.

LSD
SEC
TWP
RGE
W M

COMPANY ELCO MINING LIMITED

WELL EB - 27

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev.
Log Measured from RIG FLOOR 1.5 Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

274

Run. No.	ONE
Date	3 DECEMBER 1975
First Reading	937
Last Reading	000
Footage Logged	937
Depth Reached	938
Depth Driller	951
Casing Roke	10
Driller	10
Fluid Type	AIR/WATER
Liquid Level	00
Min. Diam.	HQ
Rm @ °F	
Operating Time	2-1/2 HOURS
Truck No.	35

Recorded By PETERSON Witnessed By OGILVIE

EQUIPMENT DATA

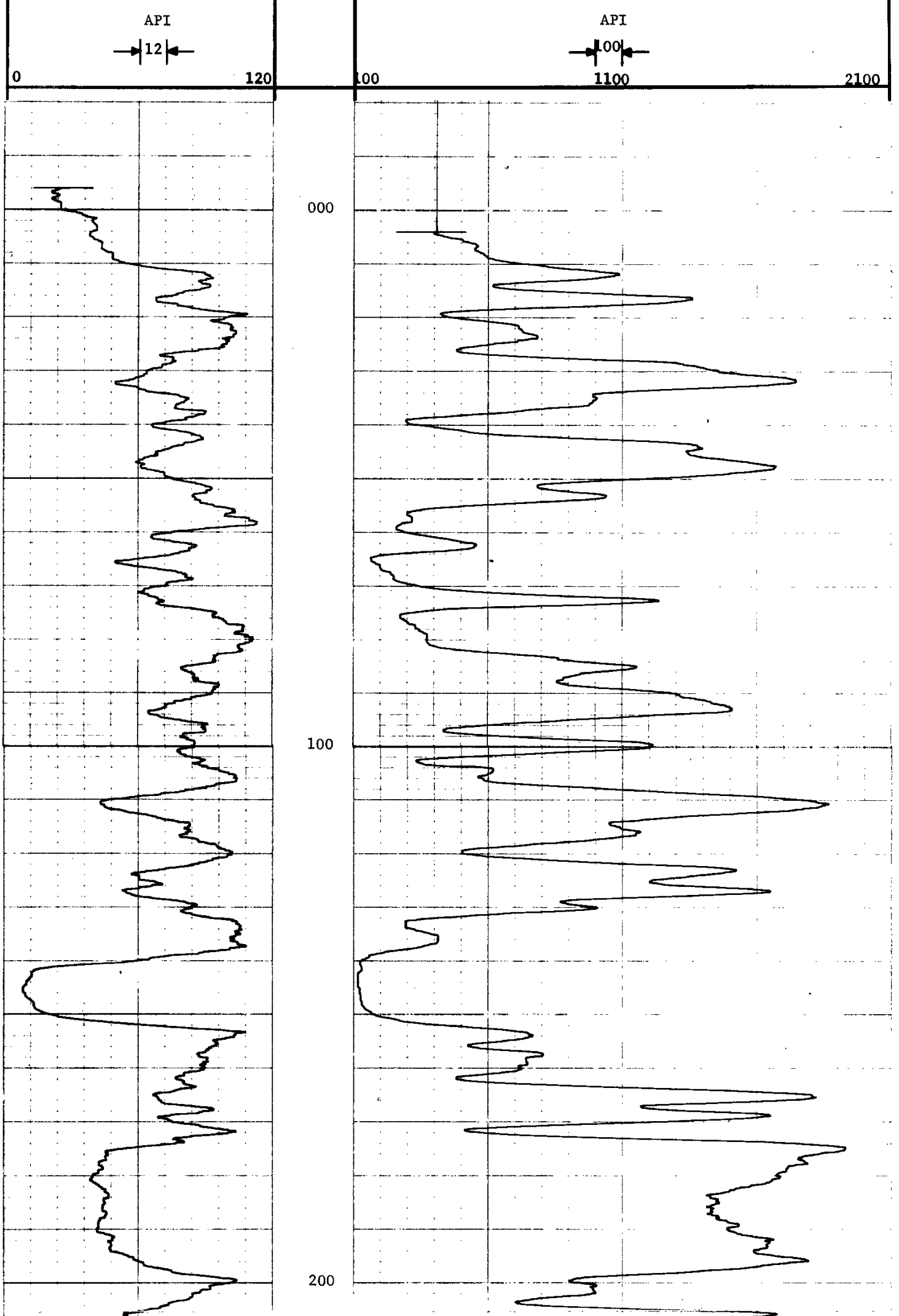
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	50
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	35	TYPE	AmBe
TOOL SERIAL NO.	177	STRENGTH	3 CURIES

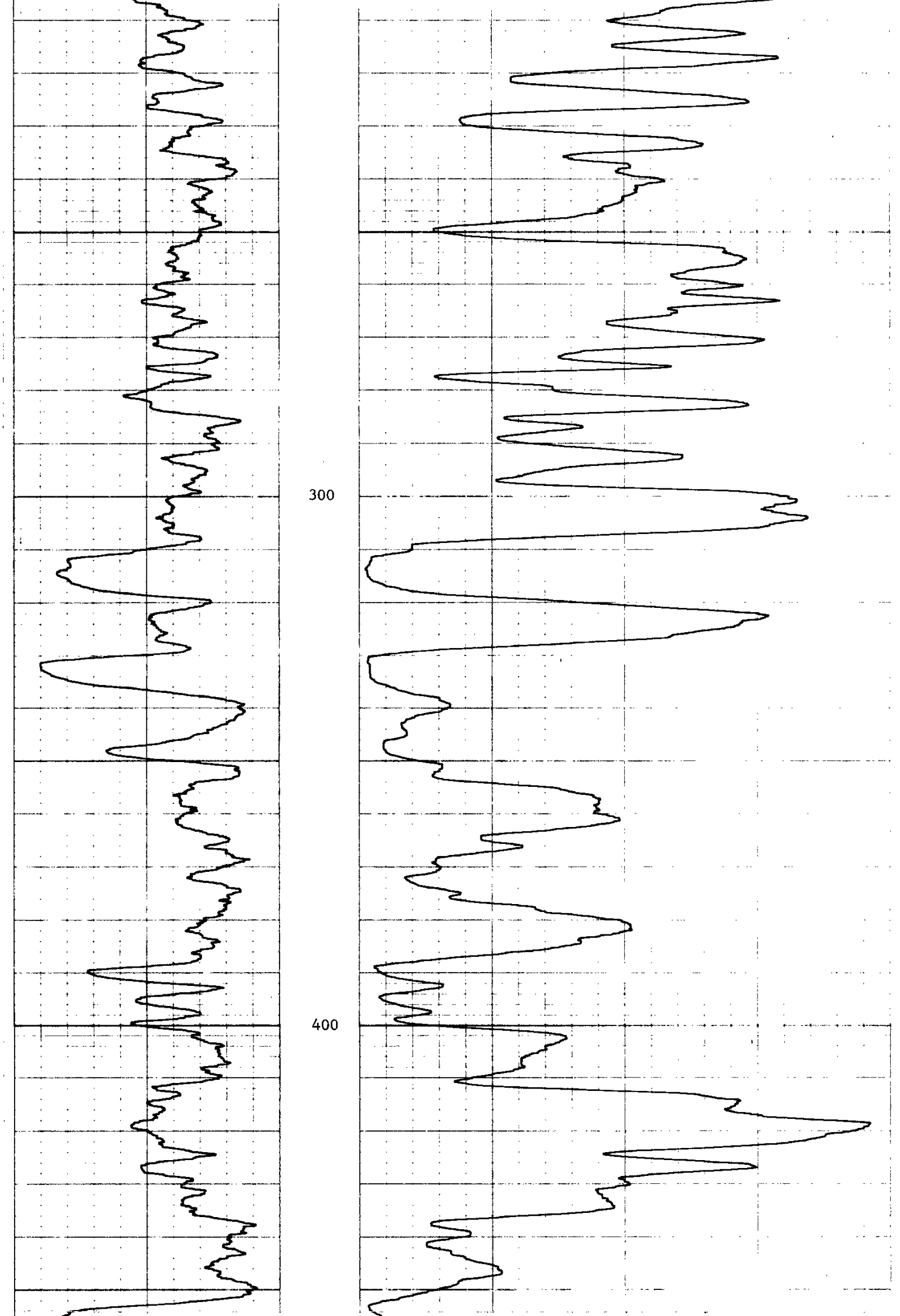
LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	937	12	4	500	0L	12 API	3	1000	1L	100 API

REMARKS LOGGED THROUGH DRILL ROD
GAMMA RAY RUN WITH TOOL SERIAL NO 280

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →


API
12
0
120
API
100
100
1100
2100
000
100
200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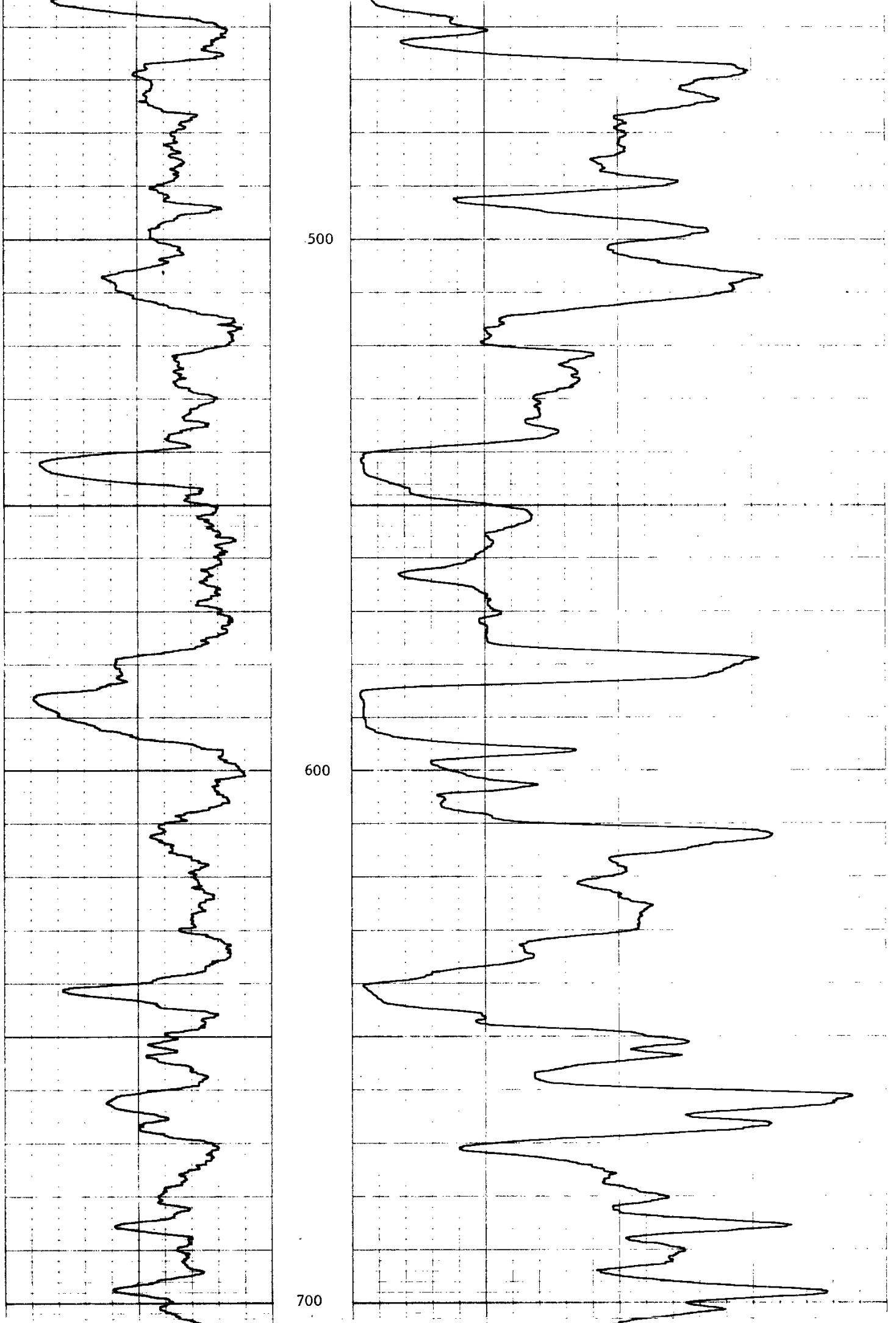
400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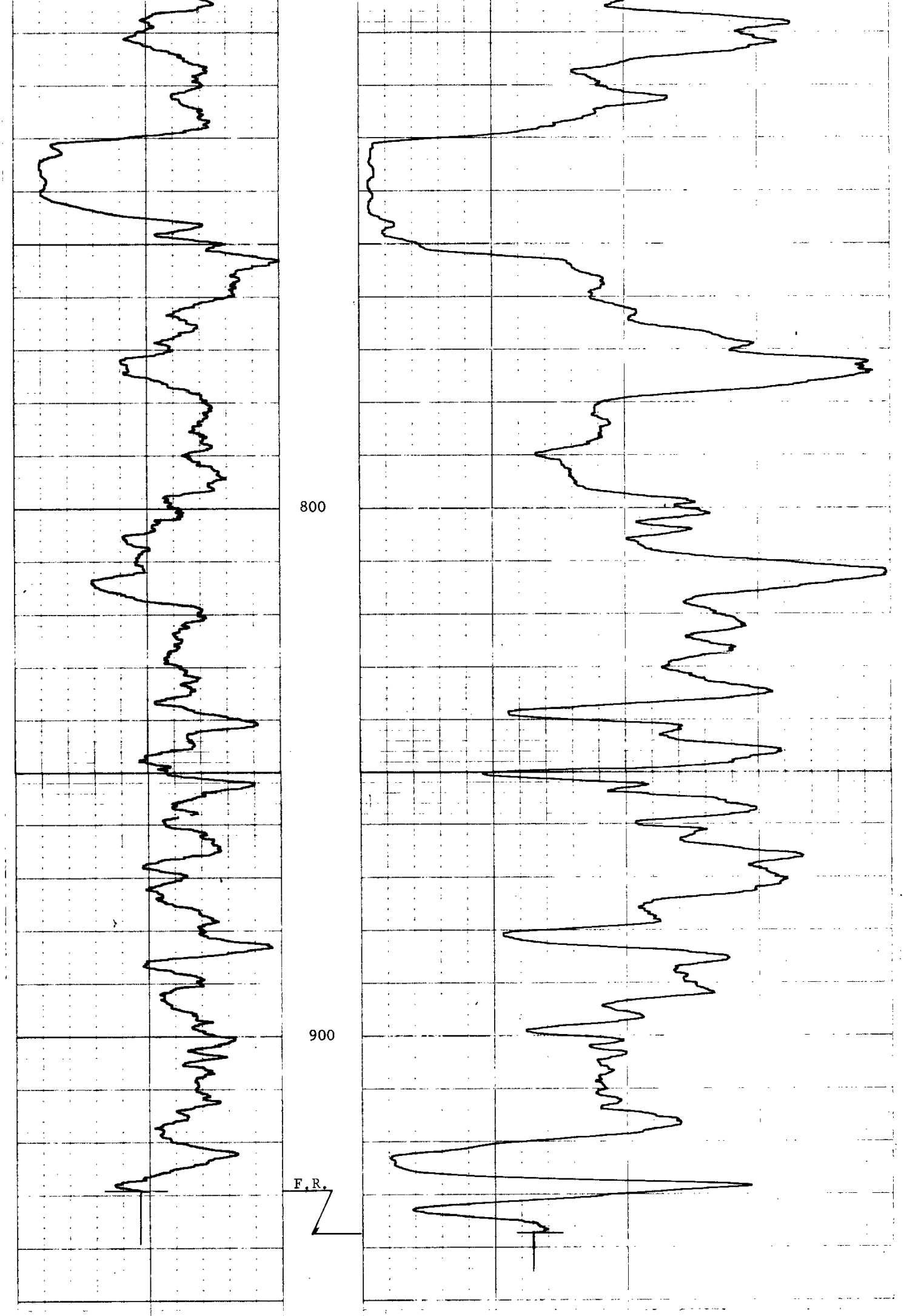
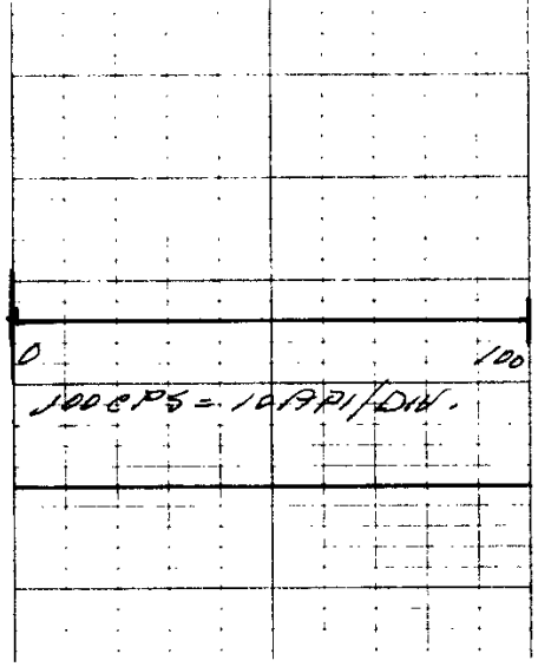
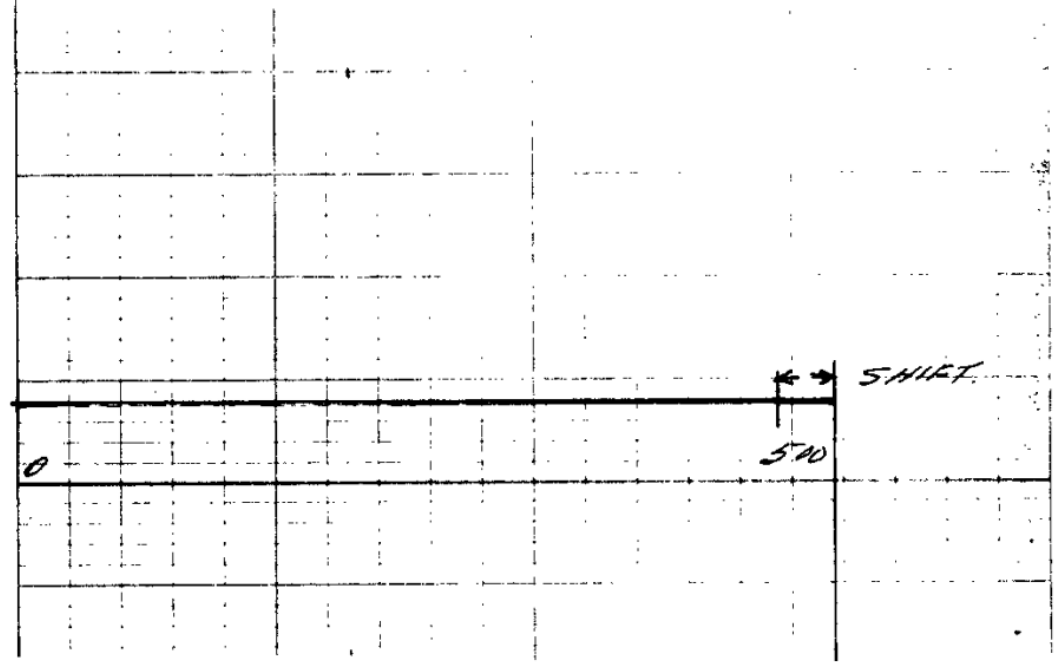
600
700


800
900
F.R.


0
100
100 CPS = 10 API/DIV.


SHIFT
0
500

KEELER RIVER 76/08/27

ROKE OIL ENTERPRISES LTD.

COMPANY: ROKE ROCKY LIMITED

WELL: 03-27

LOCATION: SE 27-

FIELD: ELK VALLEY

PROVINCE: BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL — Elev.: 3,274 ft.

Log Measured from: KELLY BUSHING — 10 ft. Above Perm. Datum

Drilling Measured from: KELLY BUSHING

Date: 27 AUGUST 1976

Run No.: ONE

Depth-Driller: 935 ft.

Depth-Logger: 933 ft.

Bottom Logged Interval: 933 ft.

Top Logged Interval: 000 ft.

Casing-Driller: 8 5/8" @ 000 ft.

Casing-Logger: 000 ft.

Bit Size: 7 7/8 in.

Type Fluid in Hole: GEL CHEM

Density: 9.1 LB/GAL

Viscosity: 38 SEC

pH: 10.0

Fluid Loss: 5.0 ML/30 MIN

Source of Sample: FLOWLINE

Rm @ Meas. Temp.: 1.45 @ 70 °F

Rmf @ Meas. Temp.: 1.10 @ 70 °F

Rmc @ Meas. Temp.: 2.20 @ 70 °F

Source of Rmf & Rmc: MEAS. CHARTS

Rm @ BHT: 1.00 @ 100 °F

Time Since Circ.: 5 HOURS

Max. Rec. Temp.: 100 °F

Equip. No. & Location: 1353 CSTD

Recorded By: STEVENSON

Witnessed By: SCOTTI

GENERAL				GAMMA RAY			NORMAL DRIVELOG		
RUN NO.	DEPTH FROM	DEPTH TO	SPEED FT/MIN.	T.C. SEL.	SENS SETTING	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEL.	SENS SETTING
1	00	935	12					3	1000

ZERO DIV.L OR R	CPS/ DIV
1.36	21.1

REMARKS LOGGED THROUGH NO DRILL ROD

DENSITY TOOL SERIAL NO 128

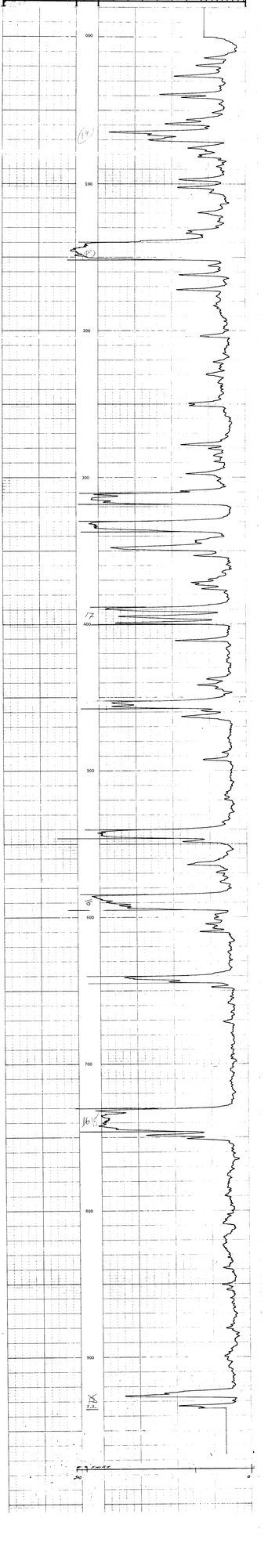
DEPTH

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)



ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

K-ELK RIVER 76(3)B-1 31

FILE NO.

LSD
SEC
TWP
RGE
W ____ M

COMPANY ELCO MINING LIMITED

WELL EB - 31

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev.
Log Measured from RIG FLOOR Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

Other Services: DENS

Run. No.	ONE
Date	18 NOVEMBER 1975
First Reading	1242
Last Reading	000
Footage Logged	1242
Depth Reached	1243
Depth Driller	1250
Roke	
Casing Driller	12
Fluid Type	WATER
Liquid Level	FULL
Min. Diam.	HQ
Rm @ °F	
Operating Time	2-1/2 HOURS
Truck No.	33

Recorded By JOHNSON Witnessed By OGILVIE

EQUIPMENT DATA

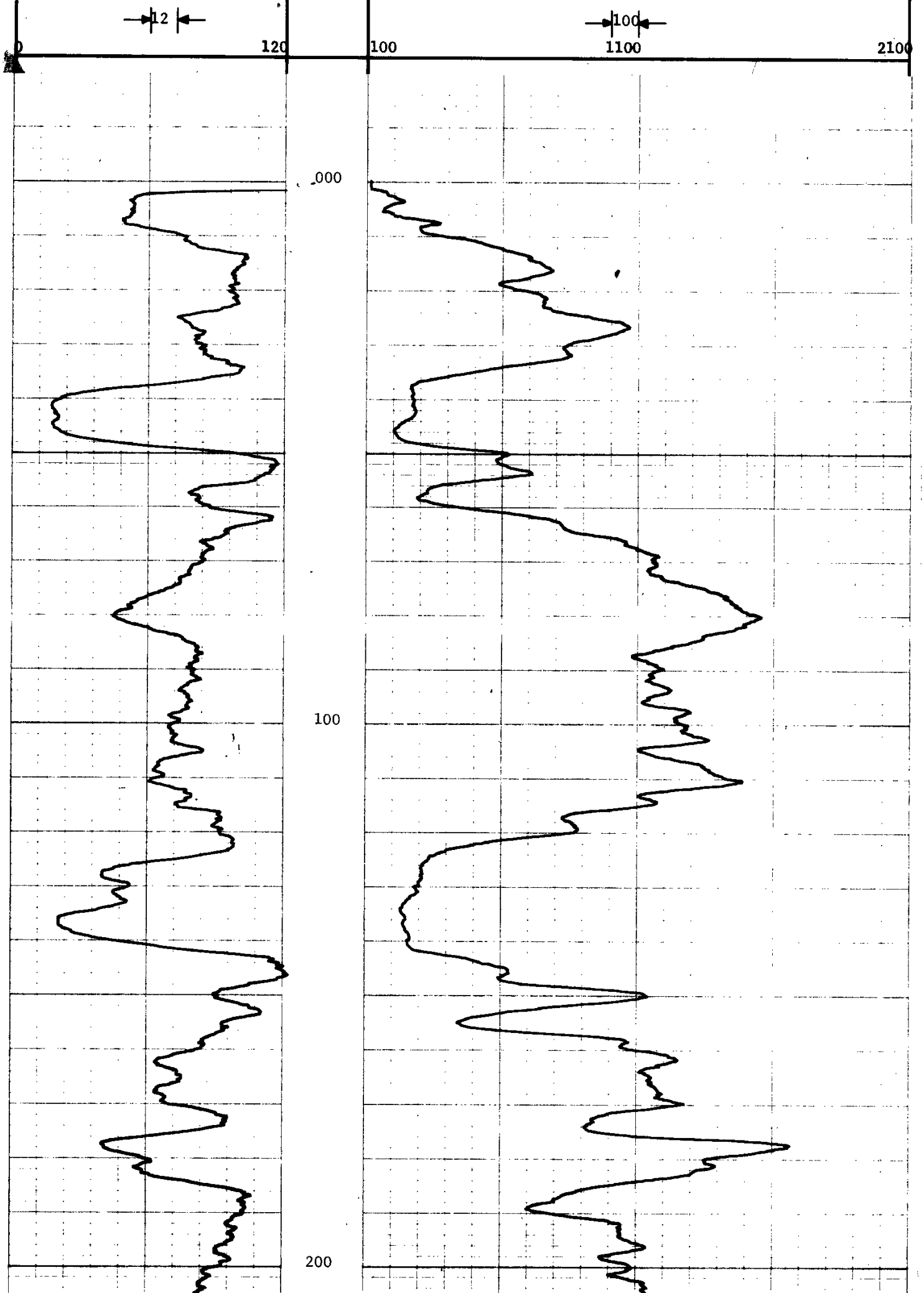
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.	33	SPACING	17 INCH
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	R GRN 169-002	STRENGTH	3 CURIES

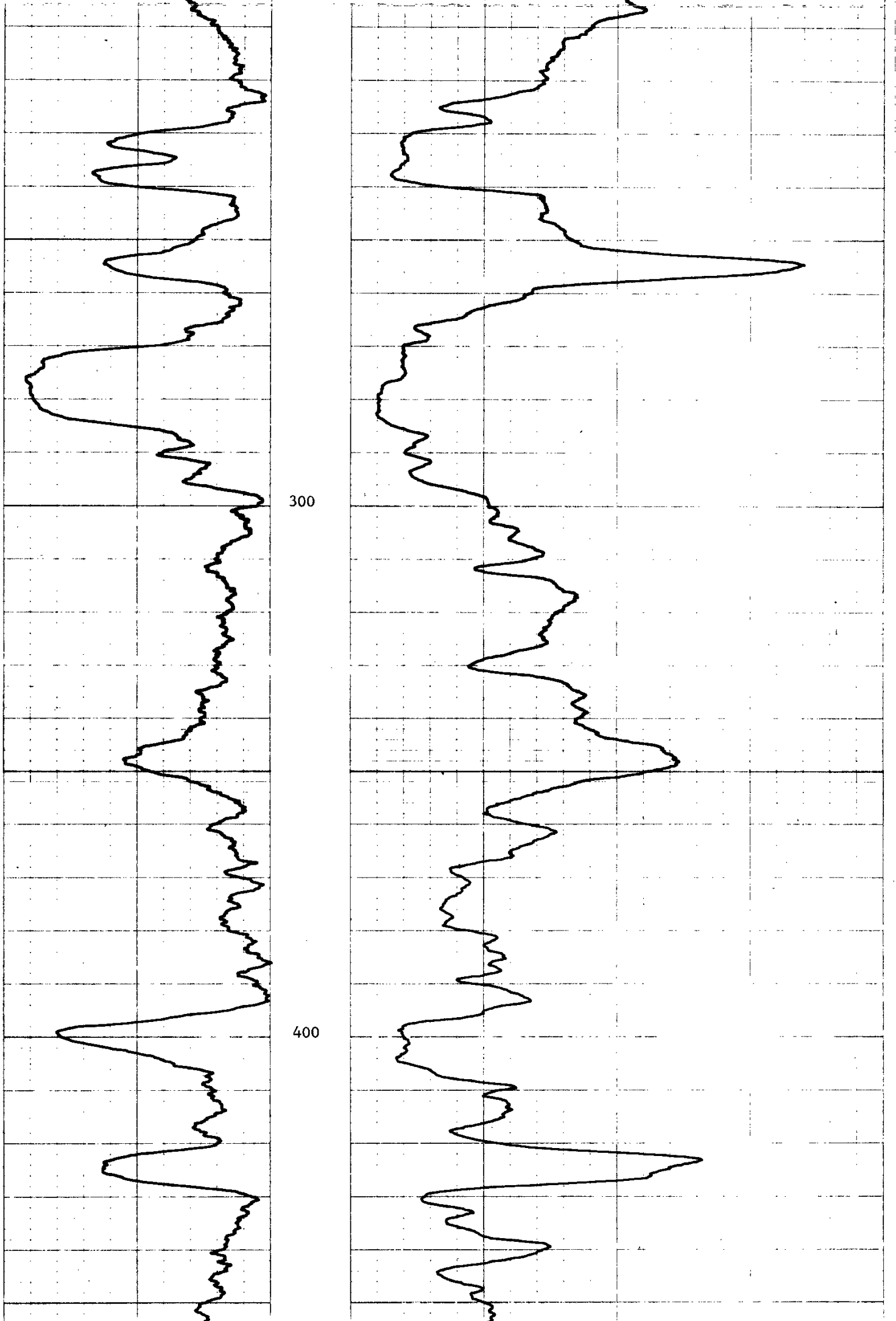
LOGGING DATA

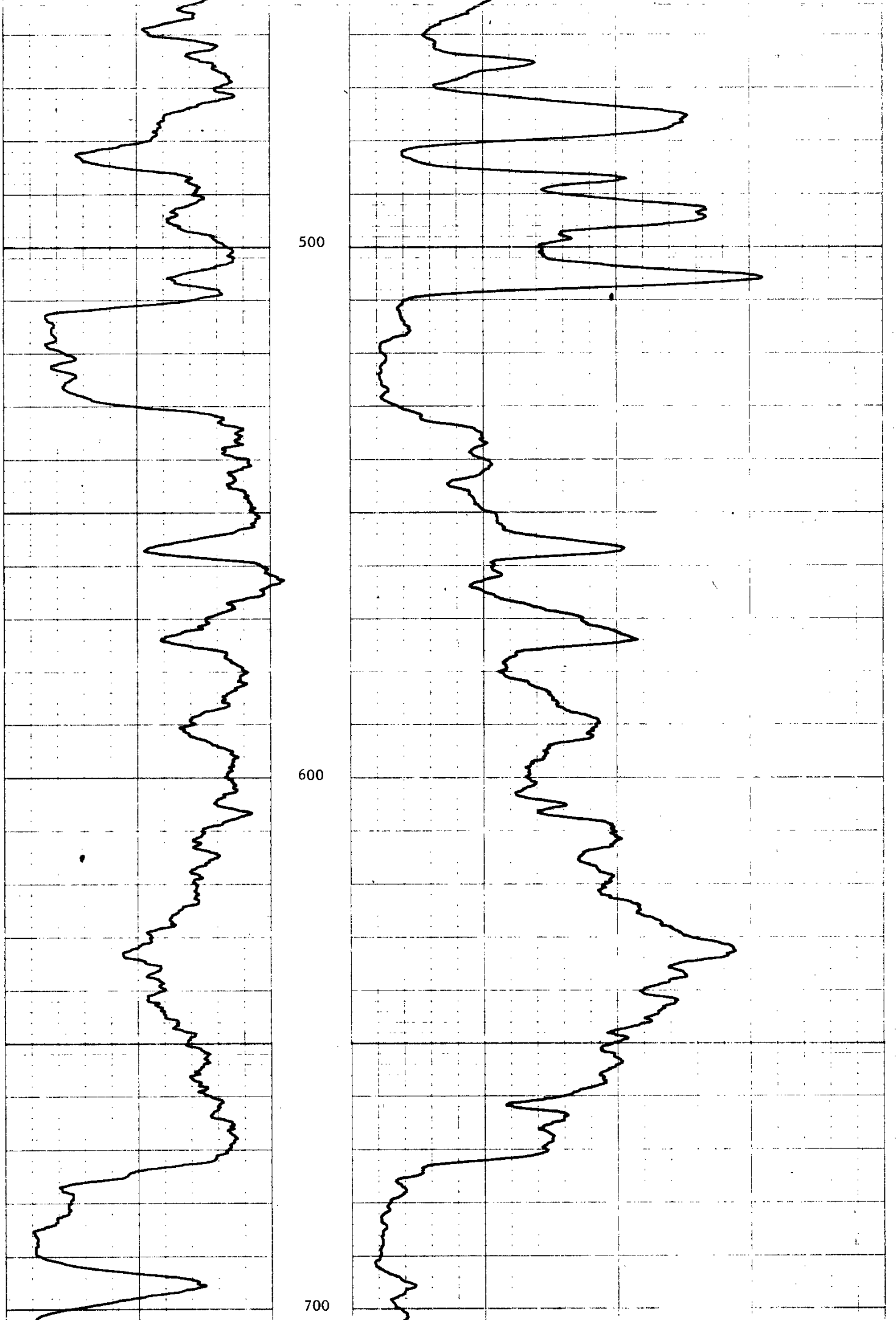
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	1242	12	5	100	0L	12 API	3	1000	1L	100 API

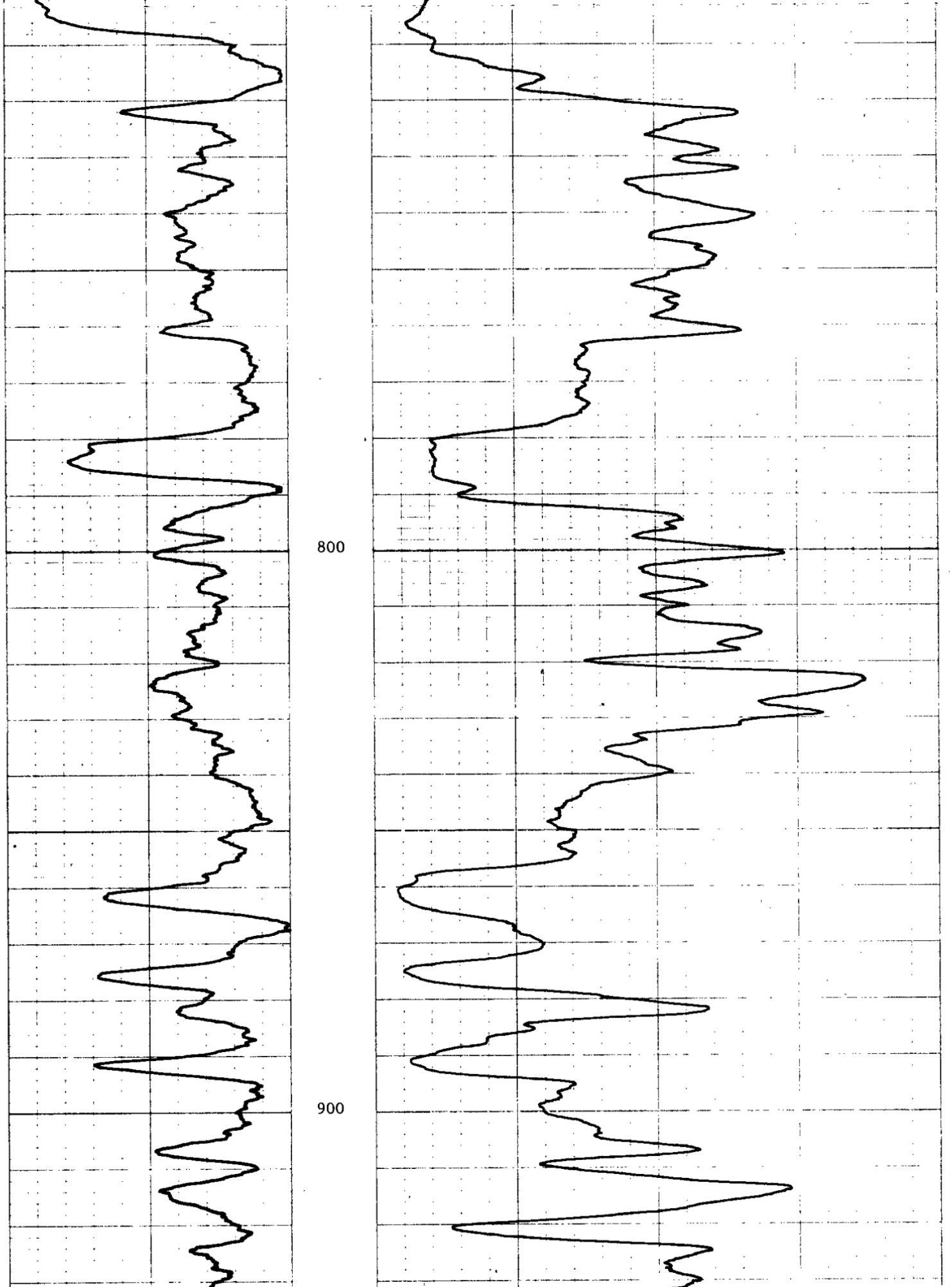
REMARKS LOGGED THROUGH HQ DRILL ROD
DRILL STUCK IN HOLE AT 1250 FEET

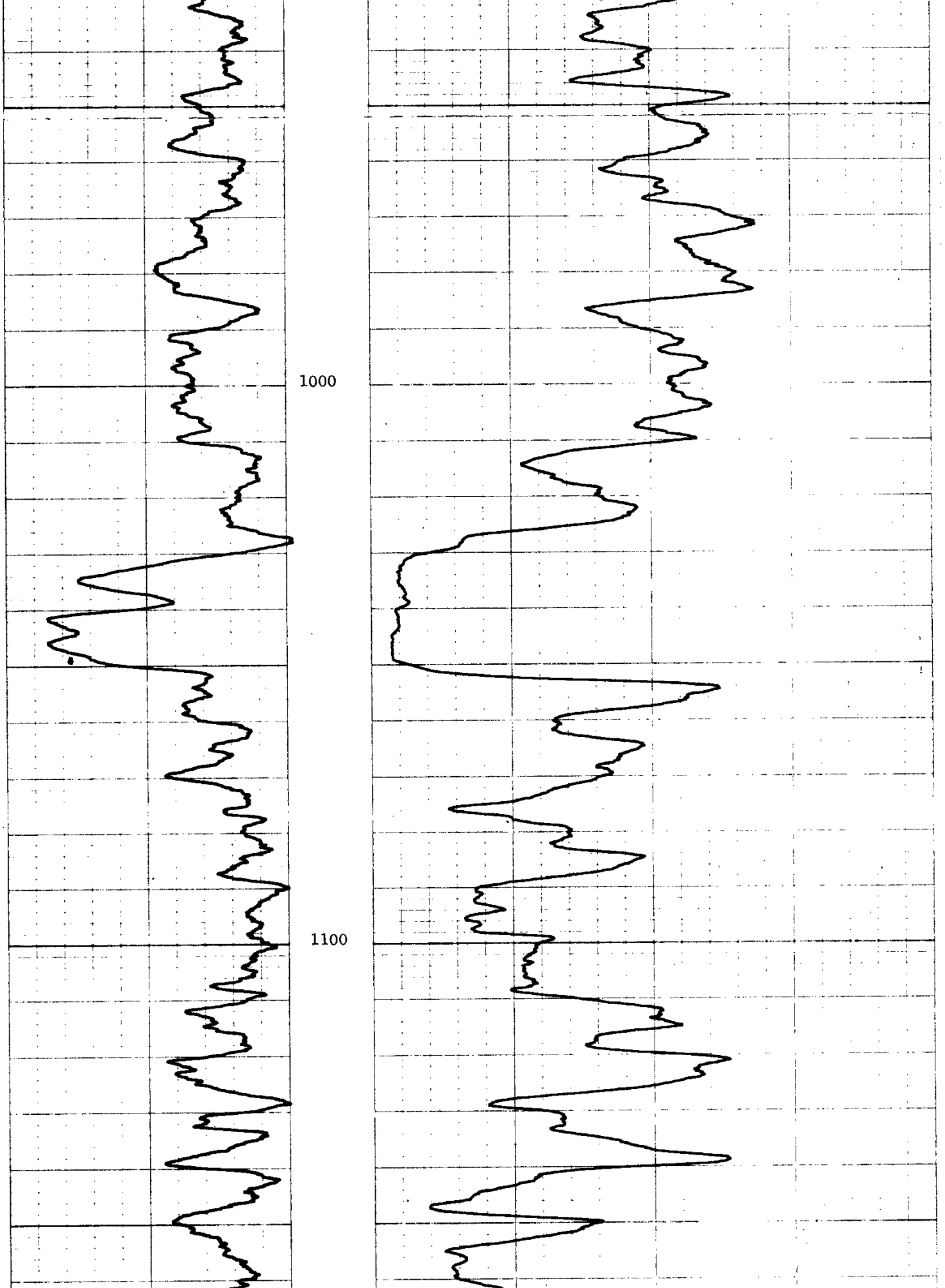
GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API		API

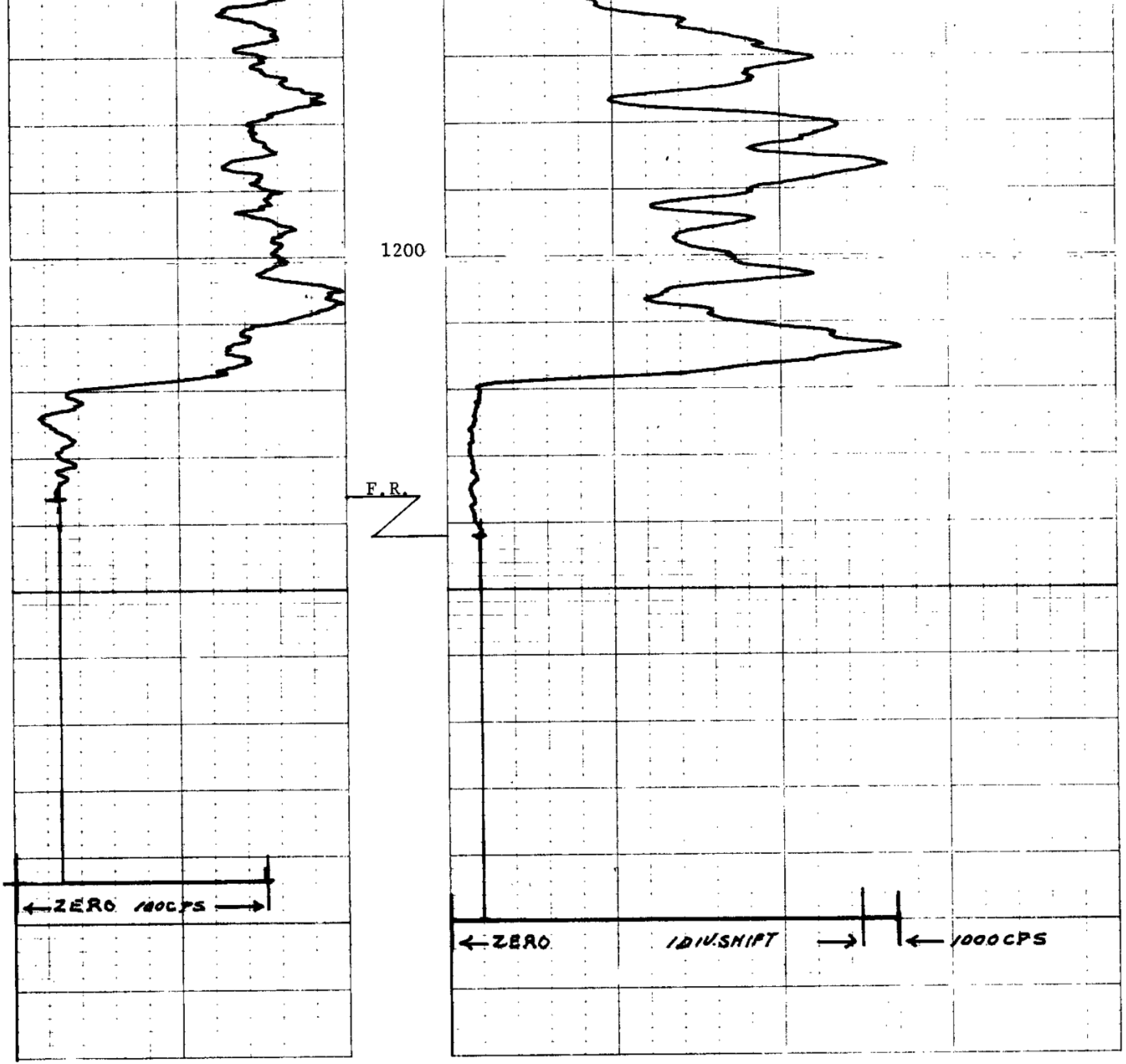

12
0
120
100
100
1100
2100
000
100
200


300
400


500
600
700


800
900


1000
1100


1200
F.R.
ZERO 100CPS
ZERO
1DIV.SHIFT
1000CPS

ROKE [redacted]

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD
SEC
TWP
RGE
W ____ M

COMPANY ELCO MINING LIMITED

WELL EB - 31

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum GROUND LEVEL Elev. ____
Log Measured from RIG FLOOR Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B. ____
CSG ____
G.L. ____

Run. No.	ONE
Date	18 NOVEMBER 1975
First Reading	1240
Last Reading	000
Footage Logged	1240
Depth Reached	1243
Depth Driller	1250
Casing Driller	12
Fluid Type	WATER
Liquid Level	FULL
Min. Diam.	HQ
Operating Time	3 HOURS
Truck No.	33

Recorded By JOHNSON Witnessed By OGILVIE

K-ELK RIVER 76(3)B-13

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/ DIV
1	00	1240	10					3	500	2.53R	27.26

REMARKS LOGGED THROUGH HQ DRILL ROD
DRILL STUCK IN HOLE AT 1250 FEET

DENSITY TOOL SERIAL NO 249

DEPTHS

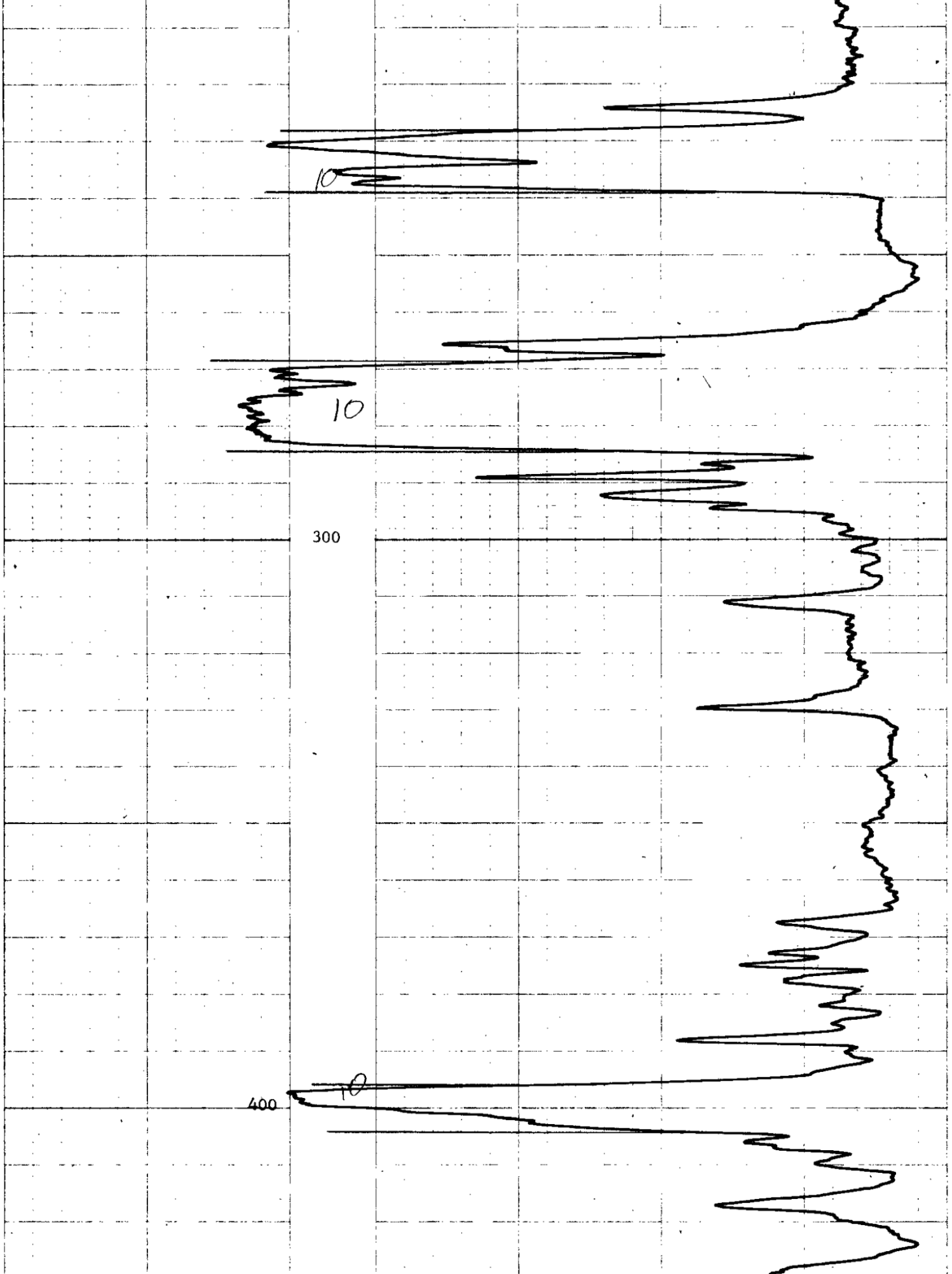
CALIPER
(DIAMETER – INCHES)

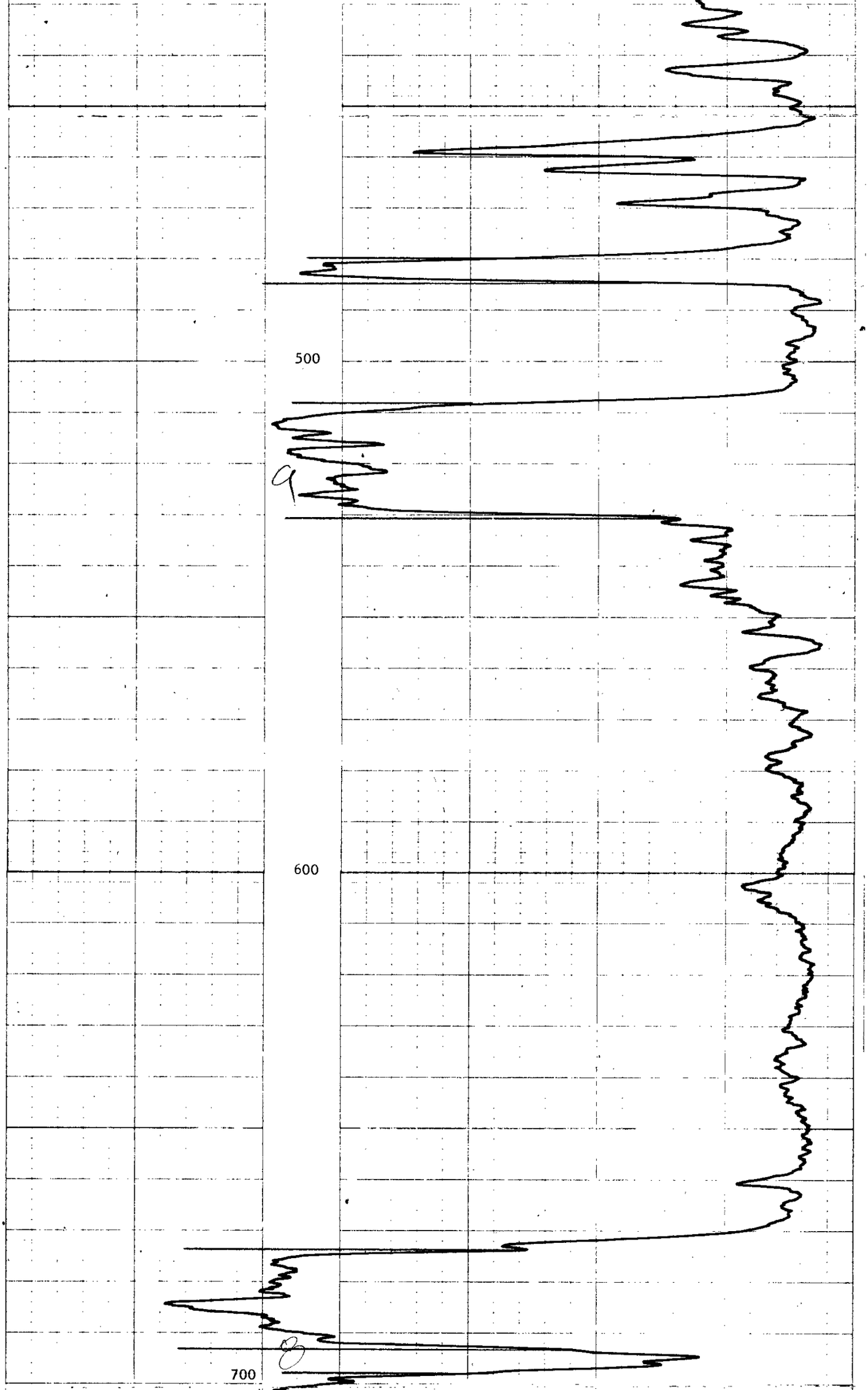
GAMMA RAY
API

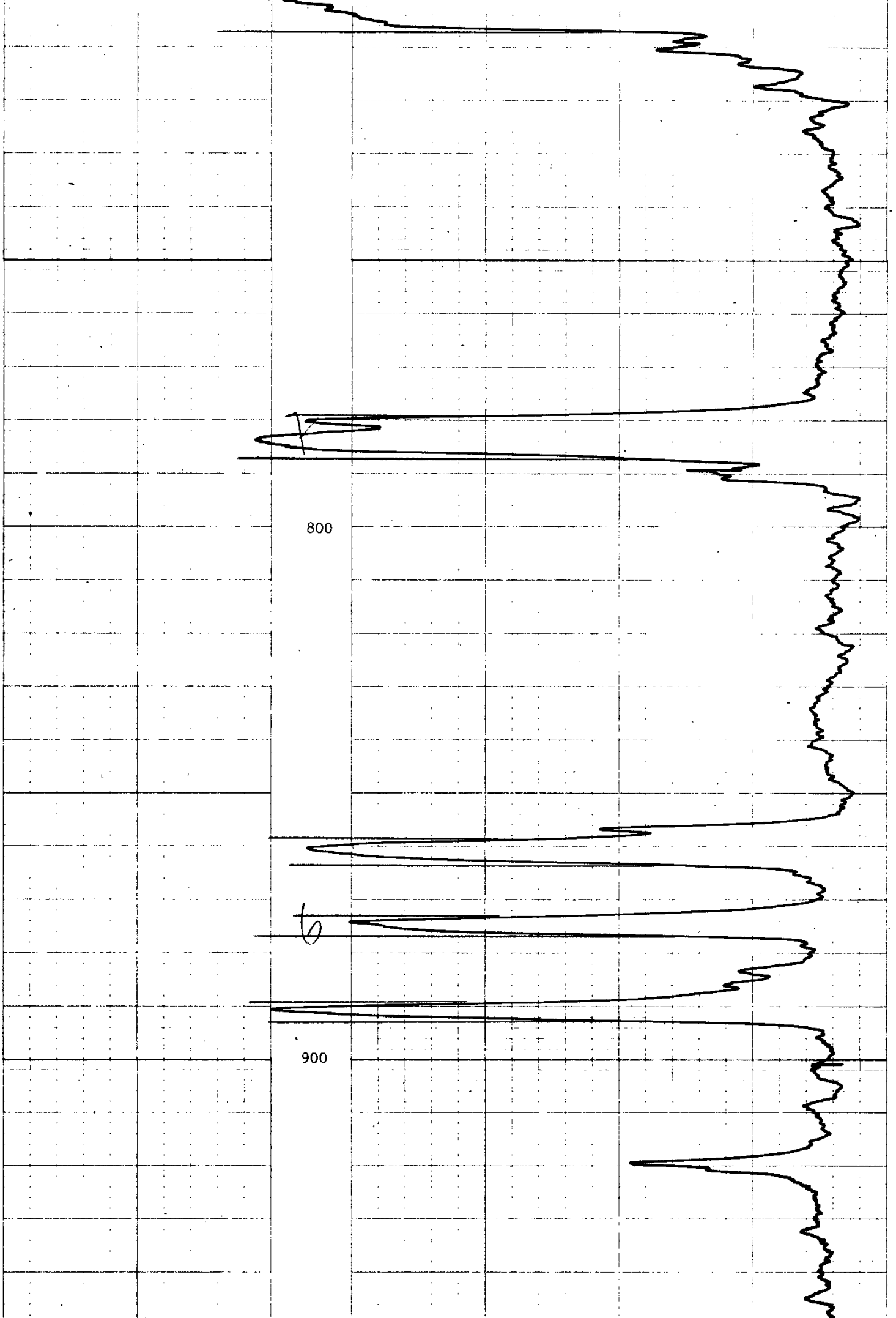
CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

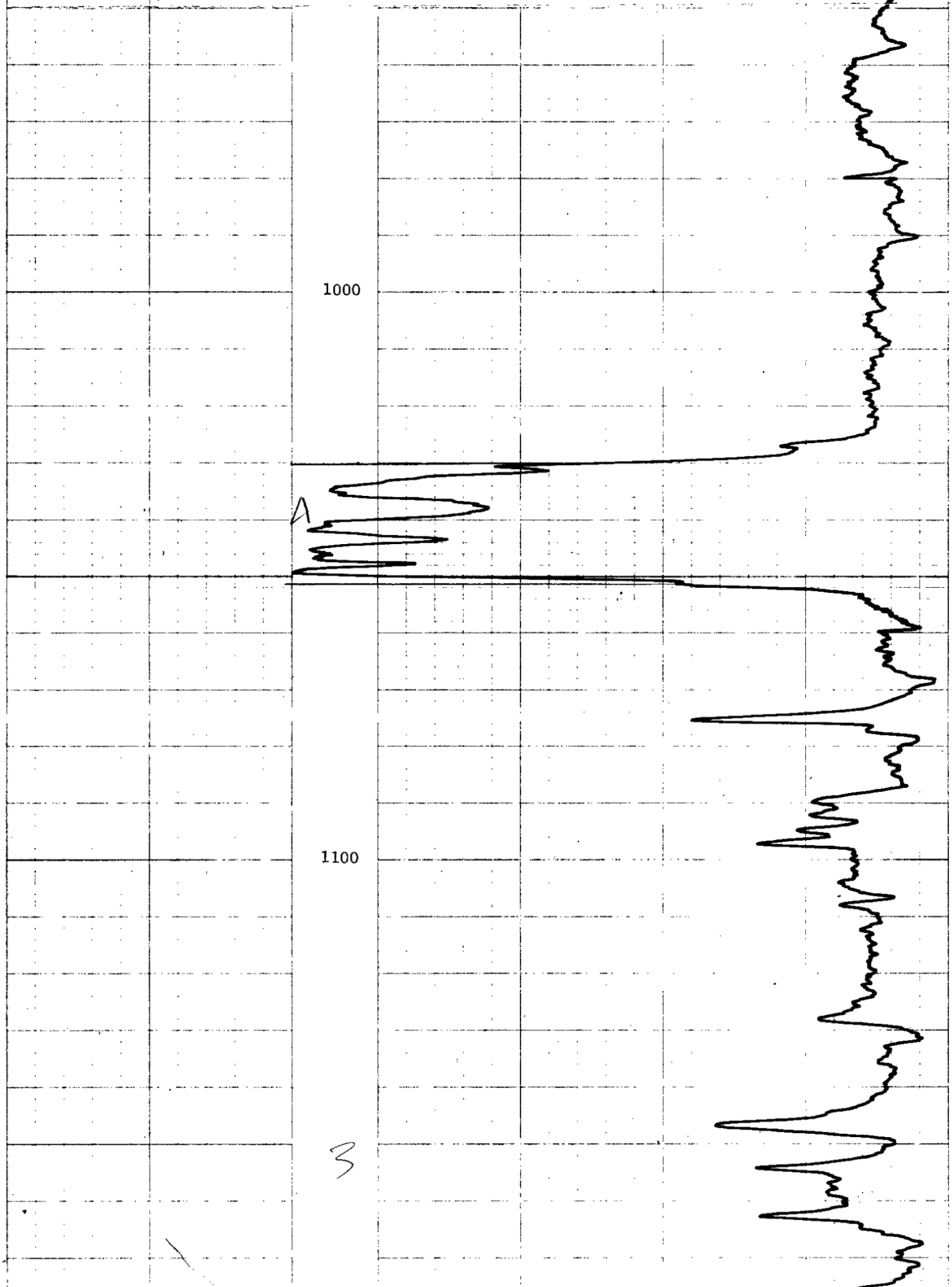
BULK DENSITY
(GRAMS/CC)

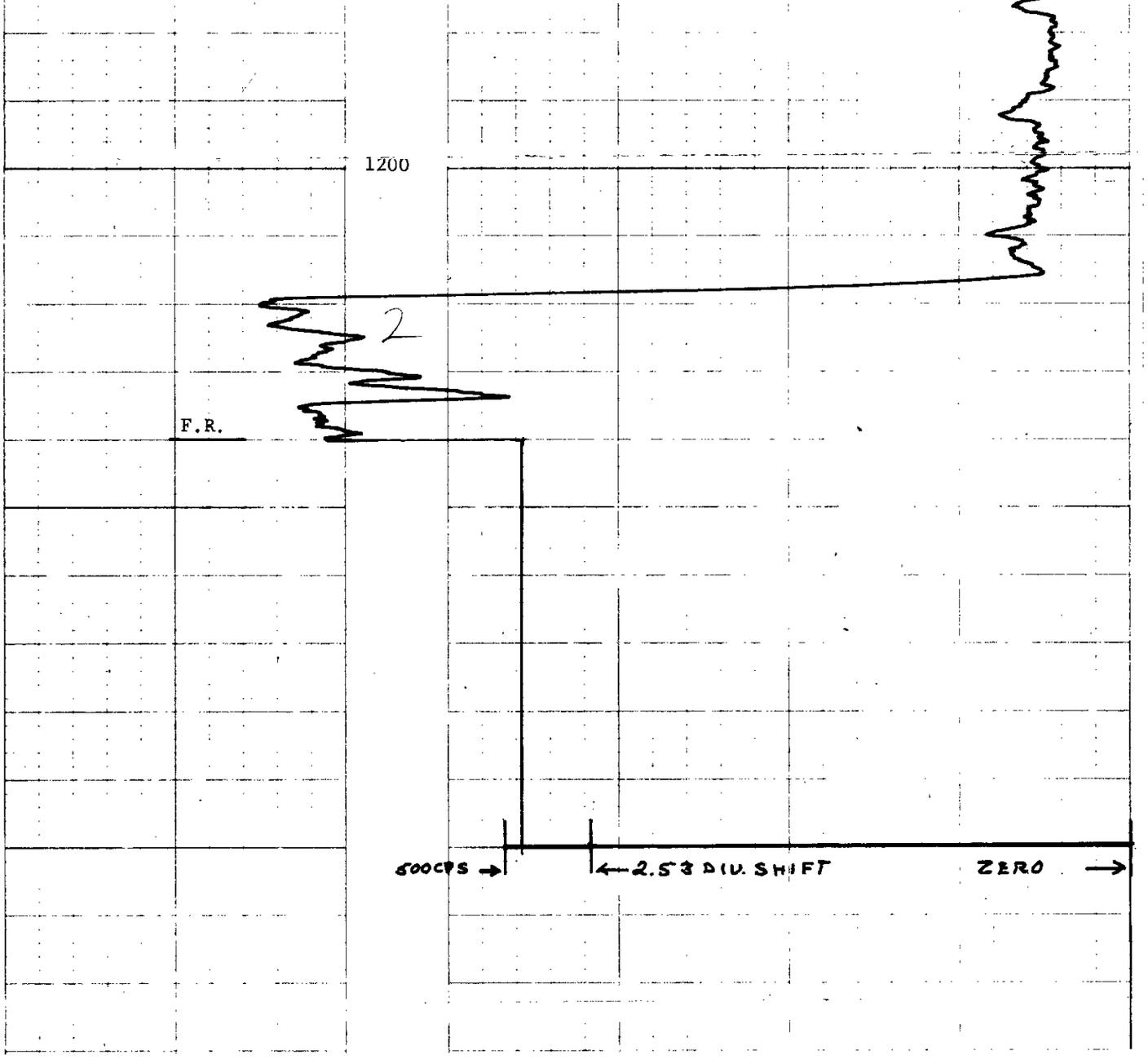
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60
2.70
2.80
000
12
100
11
200


10
10
300
10
400


500
9
600
8
700


800
900


1000
A
1100
3


1200
2
F.R.
500CPS
2.53 DIV. SHIFT
ZERO

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD
SEC
TWP
RGE
W.M.

COMPANY ESSO MINING LIMITED

WELL ES - 33

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL
Log Measured From: K.B.
Drilling Measured From: K.B.

Elev.: K.B. 2,476 Ft. Above Perm. Datum
G.L.

Other Services: CBHC

Rec. No.	
Run No.	32
Date	08 DECEMBER 1975
First Reading	604
Last Reading	000
Casing Logged	000
Casing Logged	000
Depth Driller	607
Depth Logger	607
Bottom Logged Interval	604
Top Logged Interval	000
Type Fluid in Hole	WATER
Salinity, PPM Cl	48
Density	
Level	
Max. Temp. Recorded	3.0625
Operating Time	2 HOURS
Truck No.	35

Recorded By: BAILEY
Witnessed By: OUELETTE

K-Elk River 76/3/8-35

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV./L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV./L OR R	CPS/ DIV
1	00	604	10					3	500	1.3R	21.1

REMARKS LOGGED THROUGH NO DRILL ROD
FLOWING HOLE

DENSITY TOOL SERIAL NO 128

DEPTHS

CALIPER
(DIAMETER — INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)

100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260

000
100
200
300
400
500
600
F.R.

SHIFT

500 CPS

ZERO

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 274

COMPANY: ROKE MINING LIMITED

WELL:

LOCATION: SEC 22 TWP 33 RGE W4M

FIELD: FOX RIVER VALLEY

PROVINCE: NORTHERN SASKATCHEWAN

Permanent Datum: GROUND LEVEL Elev. 1618 ft. Above Perm. Datum

Log Measured From: KELLY BUSHING 2.0 ft. Above Perm. Datum

Drilling Measured From: KELLY BUSHING

Run No.	ONE
Date	12 DECEMBER 1975
First Reading	618
Last Reading	000
Feet Logged	618
Depth Driller	619
Depth Logged	619
Bottom Log Int.	617
Top Log Int.	48
Fluid Type	WATER
Liquid Level	00
Max. Depth	31.0625
Rm @ °F	
Rmf @ °F	
Rmc @ °F	
Source: Rm / Rmf / Rmc	
Operating Time	2 HOURS
Truck No.	35

Recorded By: BARNEY

Witnessed By: MCELWAYN

Other Services: NONE

K-Ent&Wtr 76(3)9-1

33

EQUIPMENT DATA

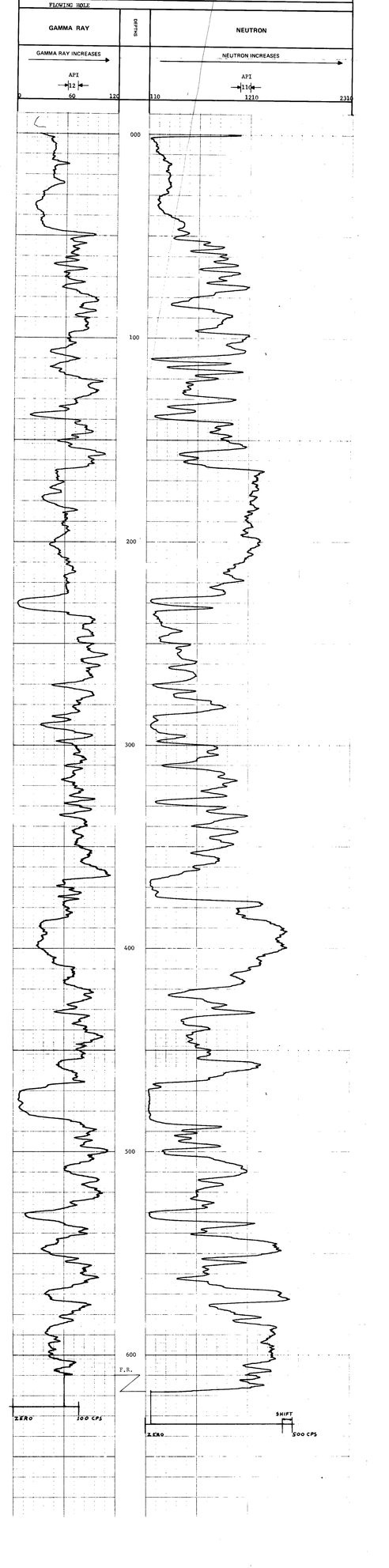
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	DIAMETER	1 11/16
DETECTOR MODEL NO.		TOOL MODEL NO.	
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
GENERAL		SOURCE MODEL NO.	MRC-N-SS-W
HOIST TRUCK NO.	35	SERIAL NO.	50
INSTRUMENT TRUCK NO.	35	SPACING	17 INCH
TOOL SERIAL NO.	177	TYPE	AmBe
		STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT./MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	618	12	5	100	01	12 API	3	500	1L	110 API

REMARKS LOGGED THROUGH NO DRILL ROD

FLOWING HOLE



ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

K-ELK RIVER 76(3)B-136

FILE NO.

LSD
SEC
TWP
RGE
W M

COMPANY ELCO MINING LIMITED

WELL EB - 36

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev.

Log Measured from TOP OF DRILL STEM 2'8" Above Perm. Datum

Well Depths Measured from GROUND LEVEL

Other Services: GRN

K.B.
CSG
G.L.

Run No.	ONE
Date	13 JANUARY 1976
Time Recording	1250
Time Reading	00
Footage Logged	1250
Depth Reached	1253
Depth Driller	1516
Rig	Roke
Casing Driller	
Fluid Type	AIR
Liquid Level	DRY HOLE
Min. Diam.	NQ ROD
	IN AN HQ HOLE
Operating Time	3 HOURS
Truck No.	36

Recorded By CARLSON

Witnessed By OGILVIE

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/ DIV
1	00	1250	12					3	500	2.5R	27.26

REMARKS WHEN RE-SETTING THE ROD IN THE HOLE IT WAS FOUND TO BE BRIDGED AT 1300 FEET
LOGGED THROUGH NQ DRILL ROD
HOLE SIZE HQ. NO WATER IN HOLE
DENSITY TOOL SERIAL NO 249

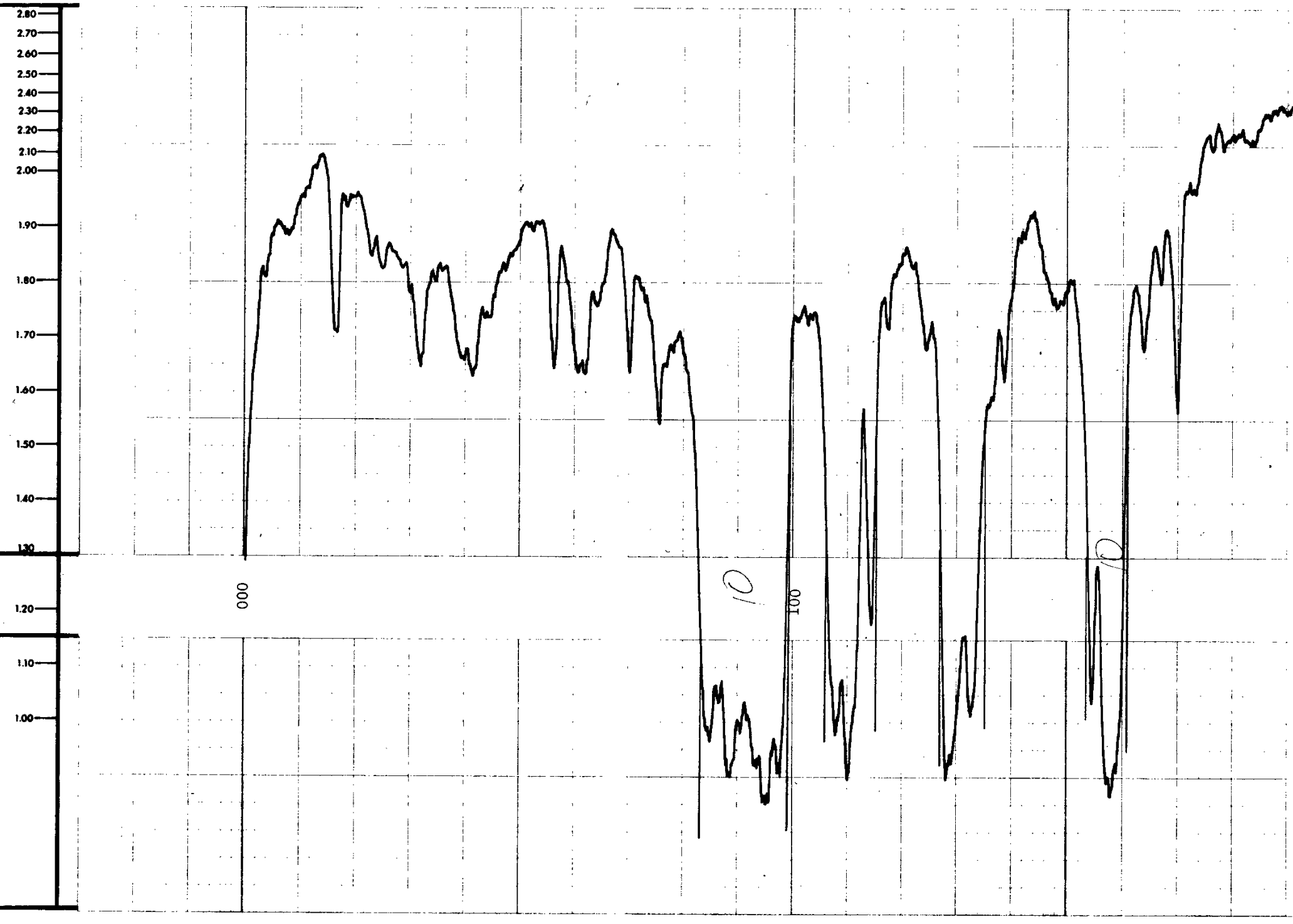
DEPTHS

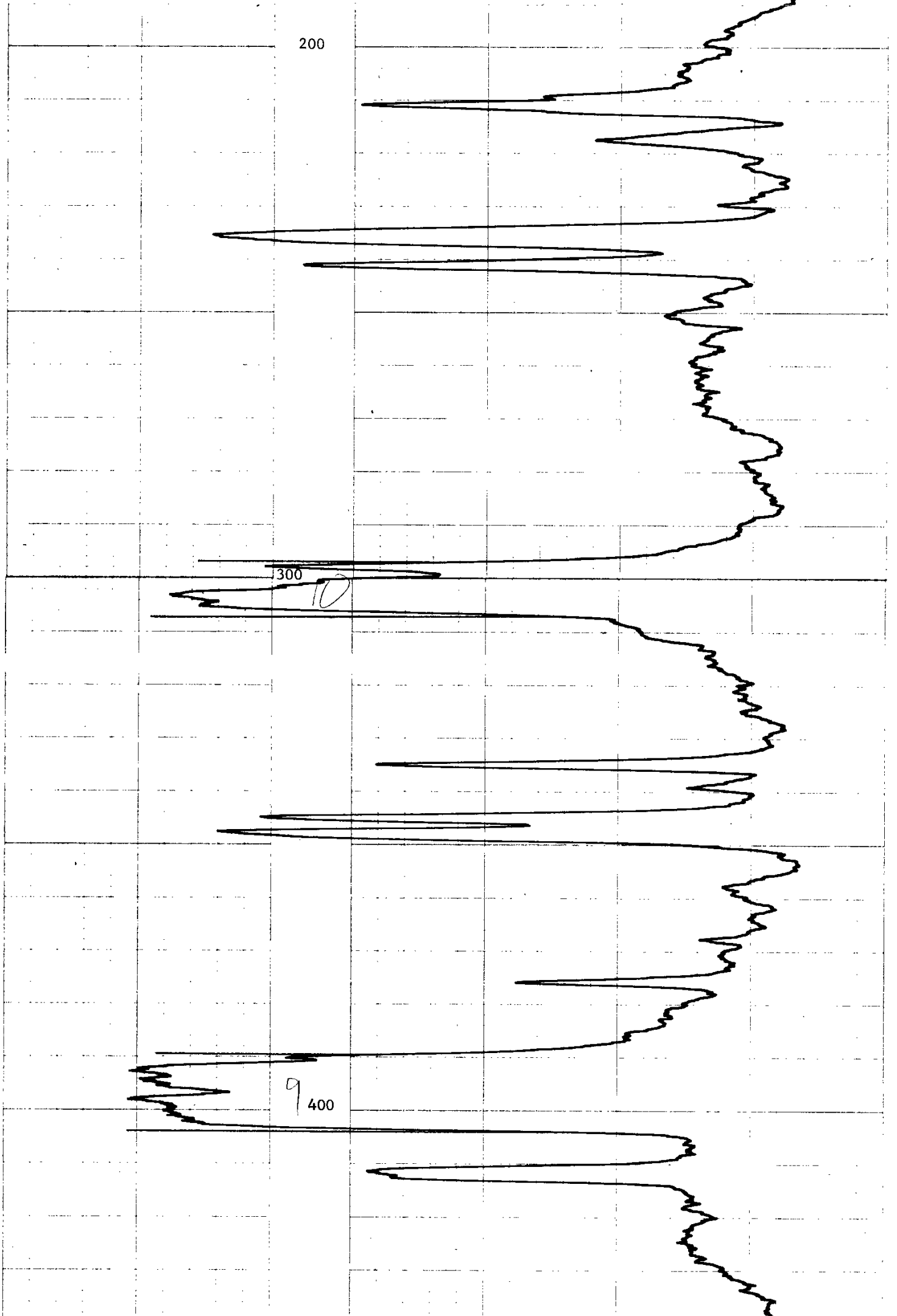
CALIPER
(DIAMETER – INCHES)

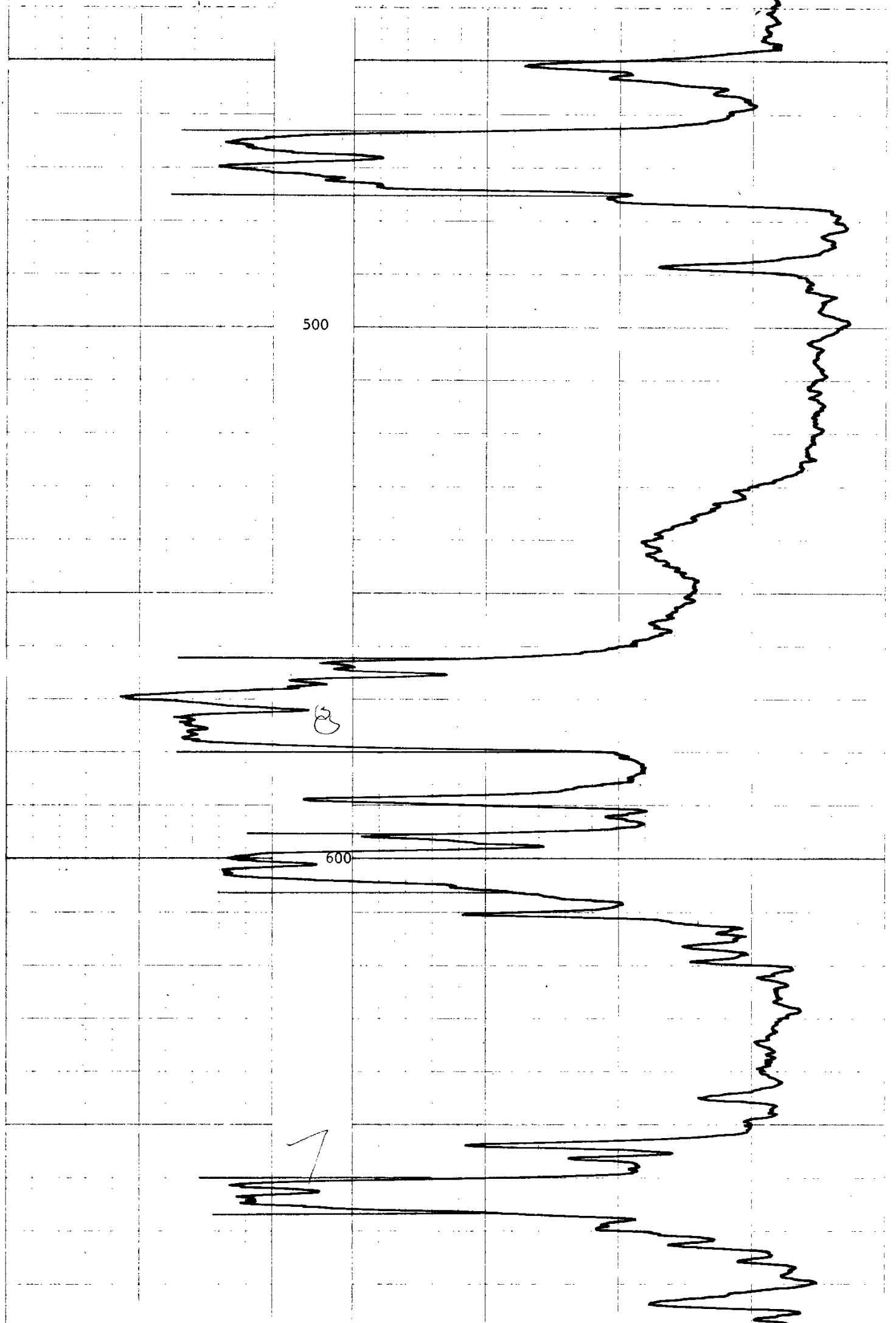
GAMMA RAY
API

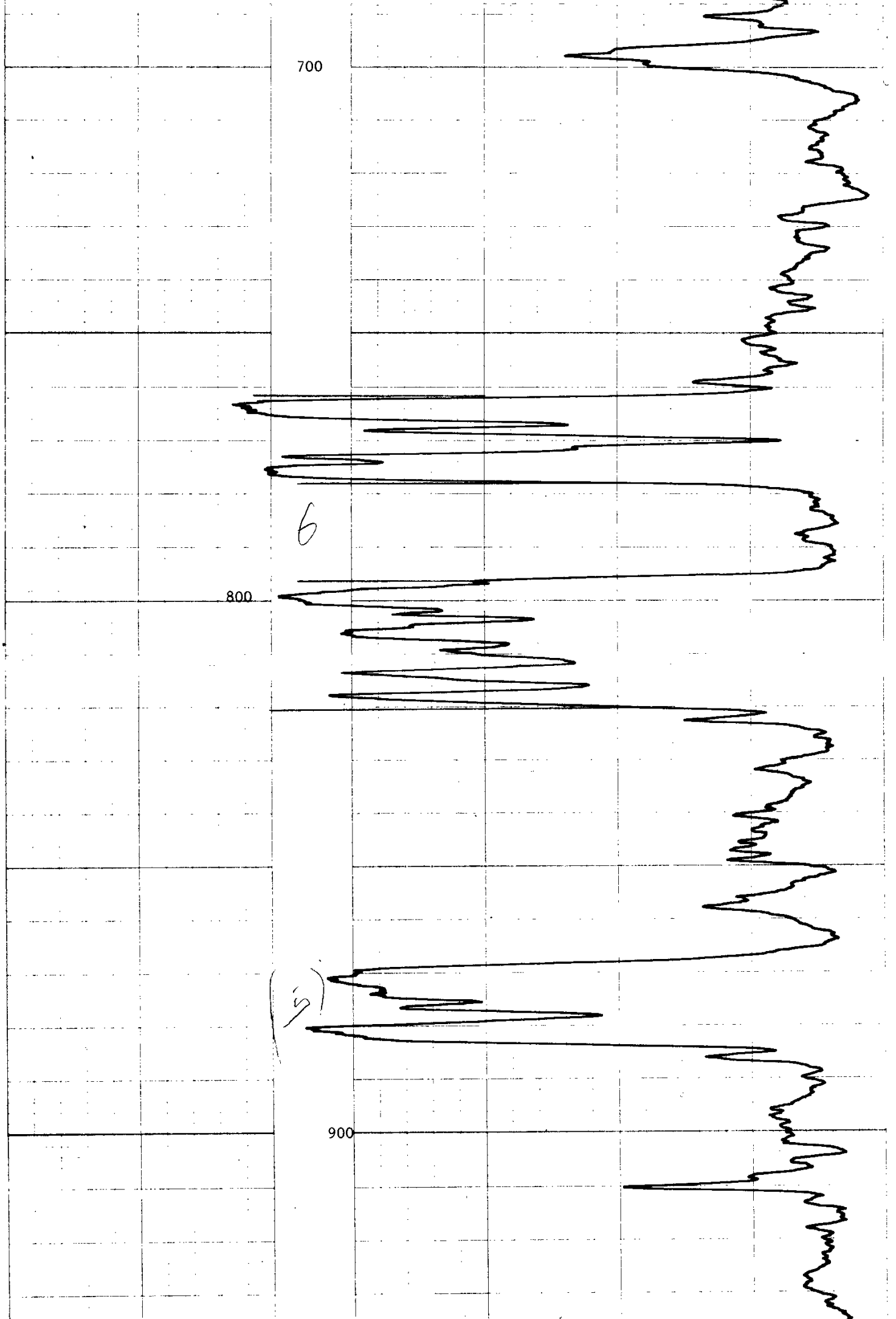
CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

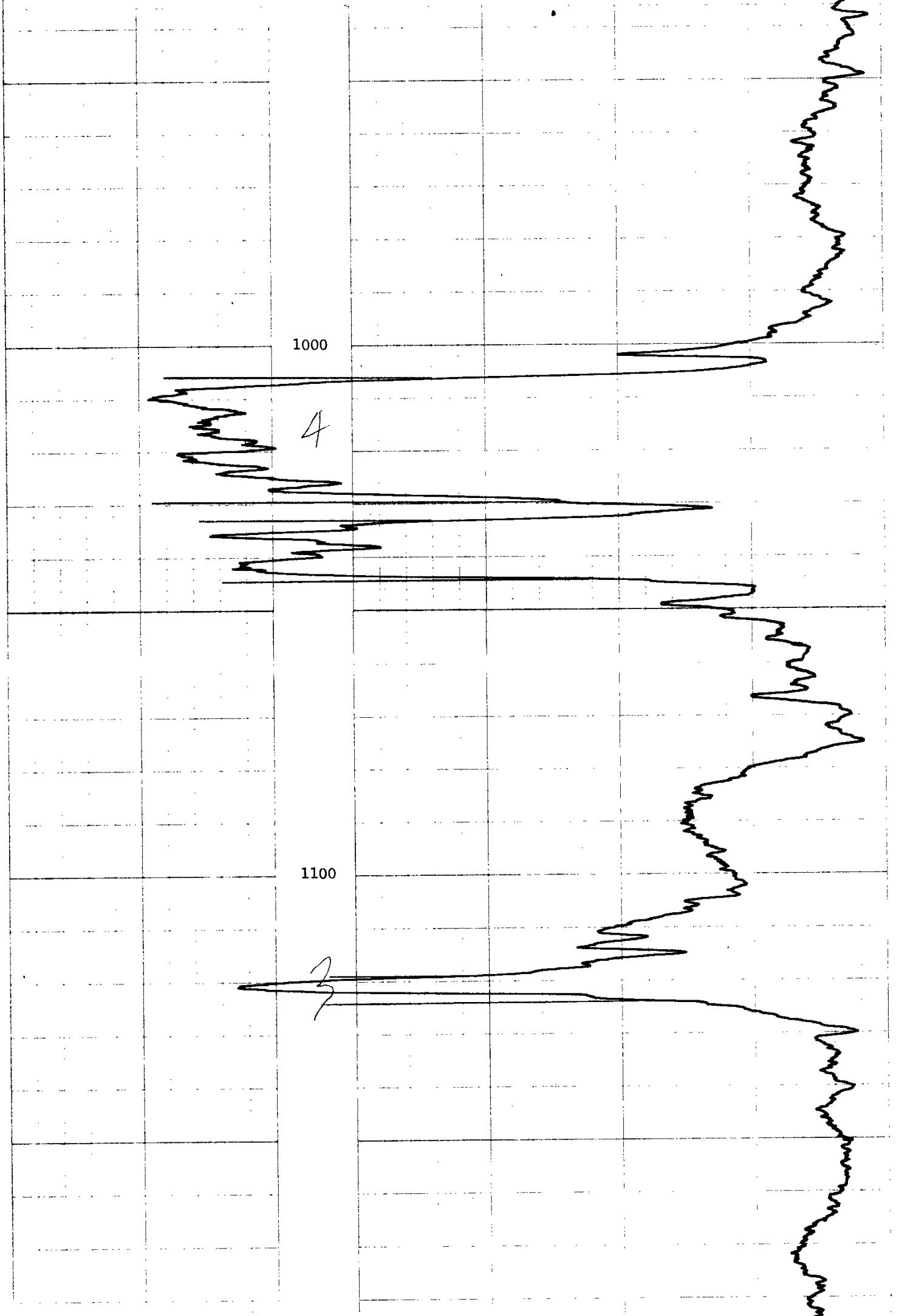
BULK DENSITY
(GRAMS/CC)

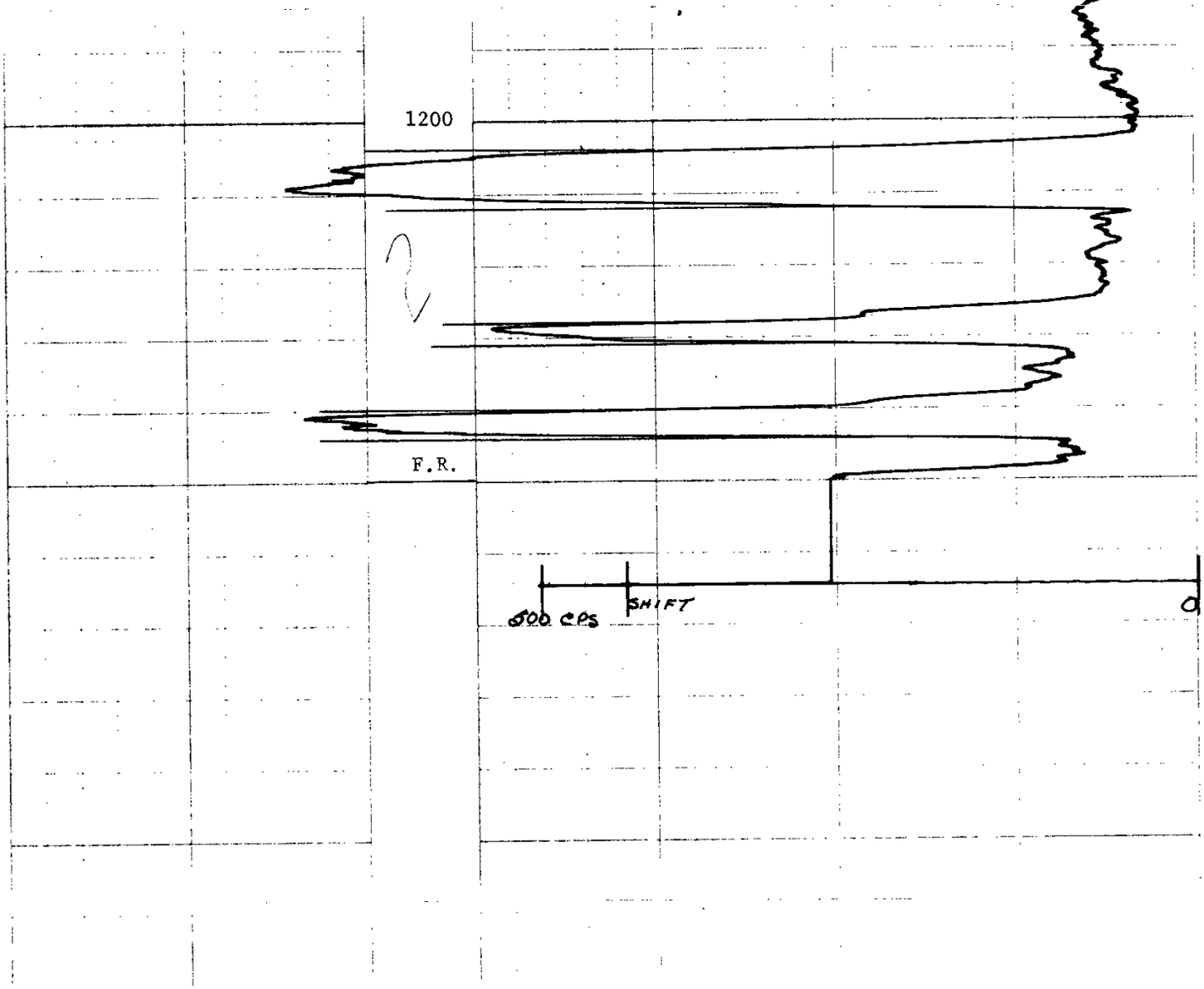

2.80
2.70
2.60
2.50
2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
000
001


200
300
10
9
400


500
600
8
7


700
6
800
(5)
900


1000
4
1100
2


1200
F.R.
500 cps
SHIFT
0

K-ELK RIVER 76(3)B-1

36

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD
SEC
TWP
RGE
W ____ M

COMPANY ELCO MUDLOG LIMITED

WELL ER 96

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev.
Log Measured from TOP OF DRILL STEM 4'8" Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Other Services:

Run. No.	ONE
Date	18 MAR 76
First Reading	1250
Last Reading	0
Footage Logged	1250
Depth Reached	1251
Depth Driller	1516
Casing Driller	
Fluid Type	AIR
Liquid Level	DRY HOLE
Min. Diam.	NO 12
Rm @ °F	HQ HOLE
Operating Time	3 HRS
Truck No.	36

Recorded By CARLSON Witnessed By OSLUND

EQUIPMENT DATA

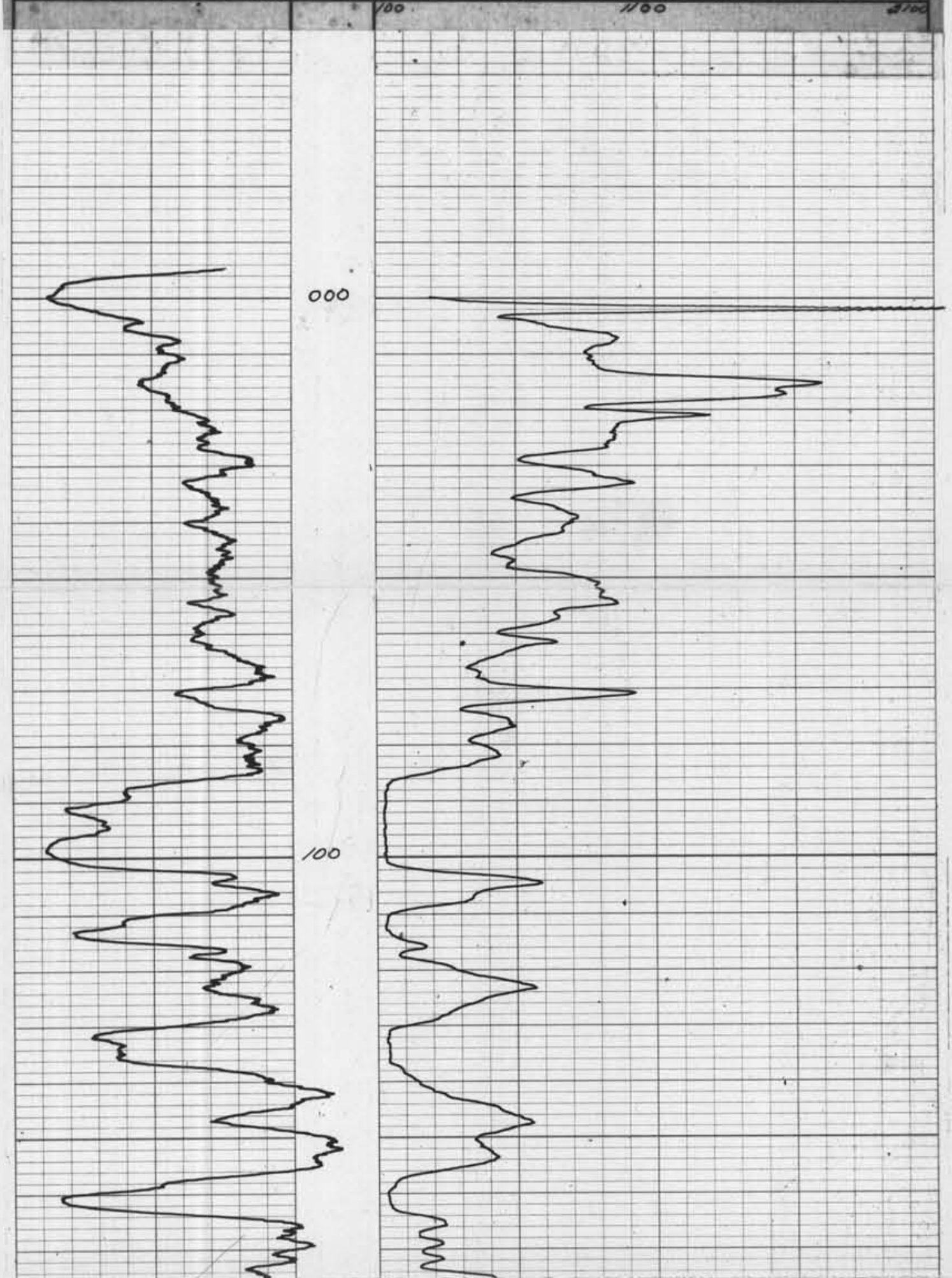
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	36	TYPE	AmBe
TOOL SERIAL NO.	169002	STRENGTH	3 CURIES

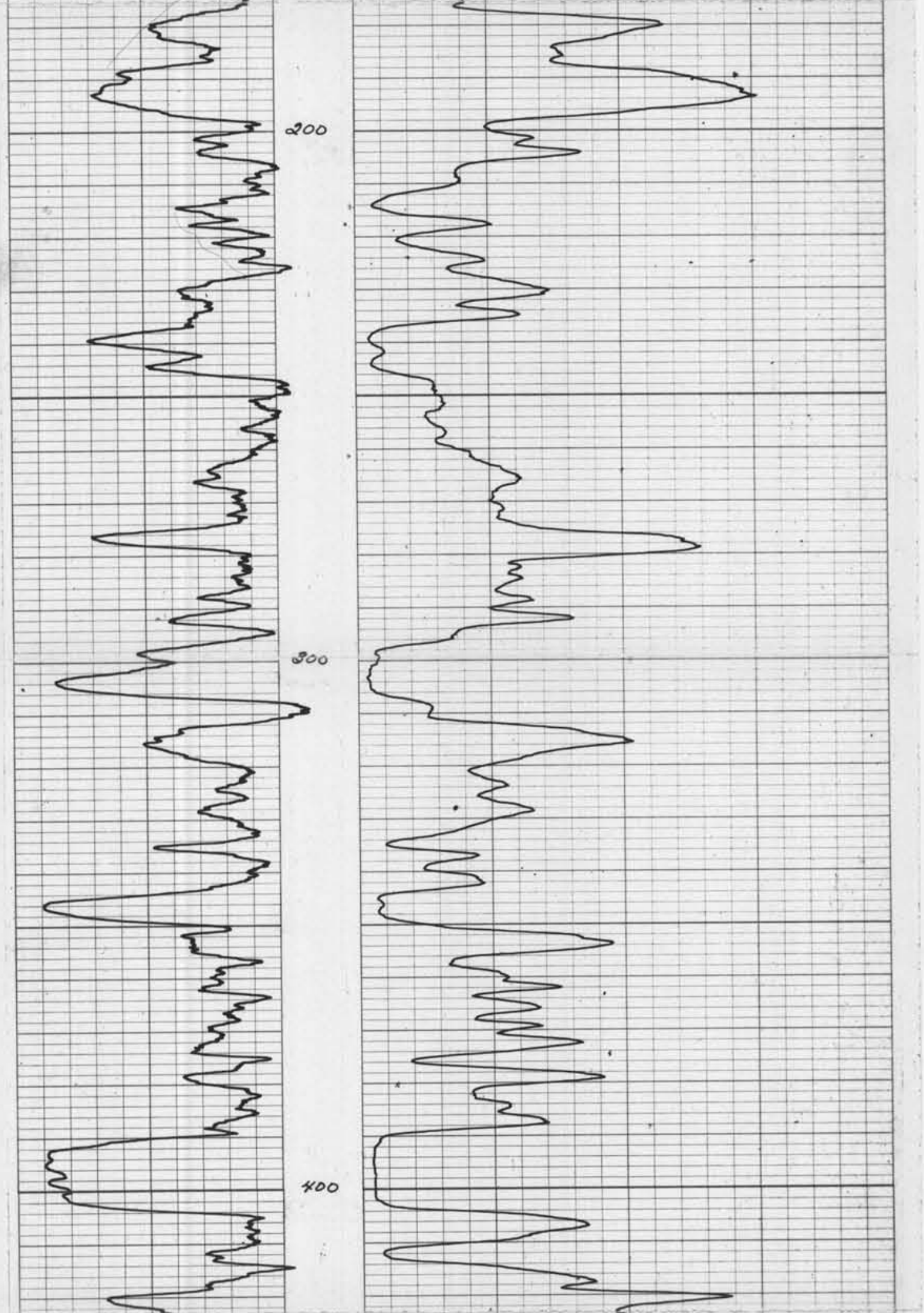
LOGGING DATA

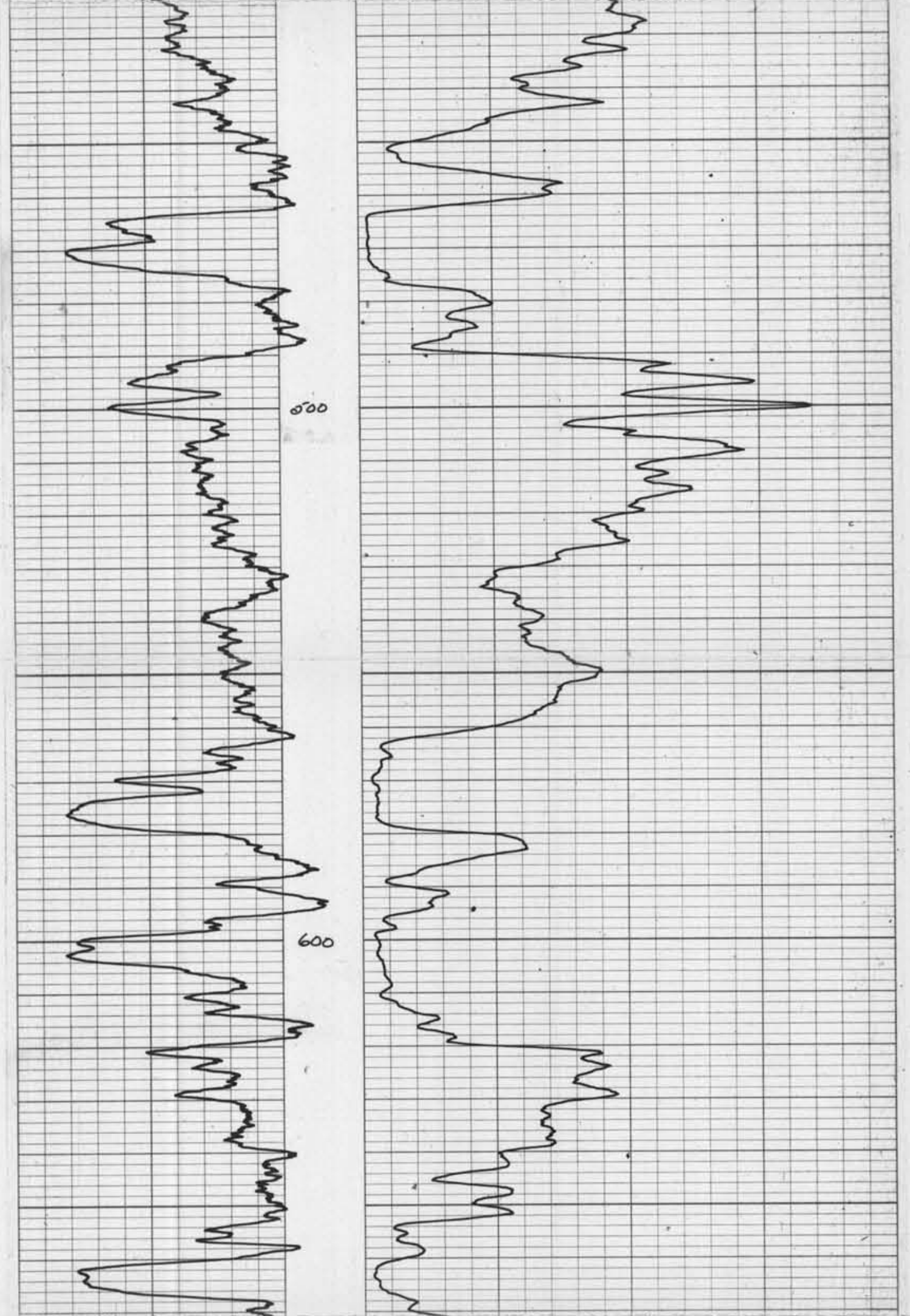
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	0	1250	12	5	100	0	12	3	1000	1L	100

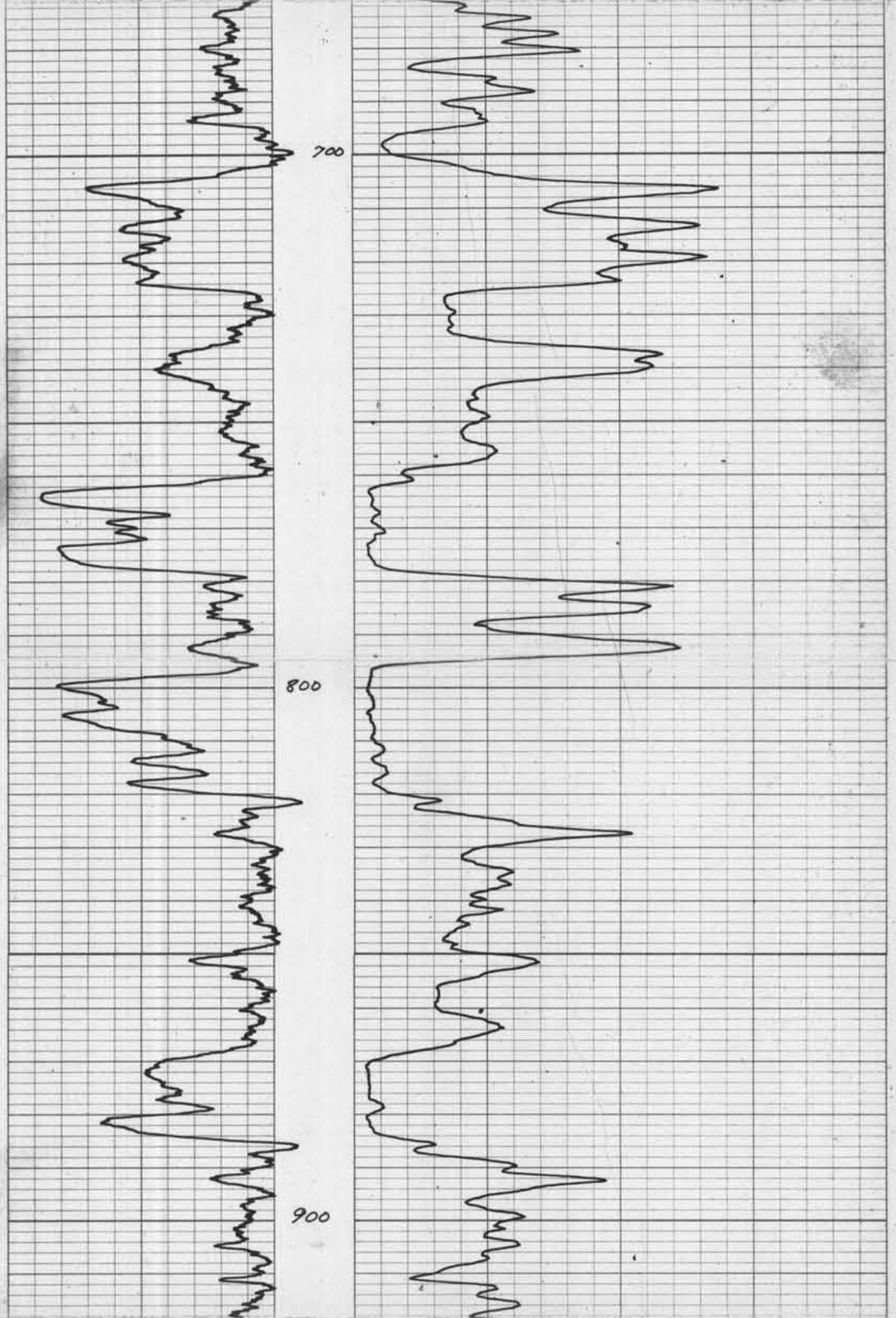
REMARKS LOGGED THROUGH NO DRILL STEM. WHEN RE-SETTING DRILL STEM HOLE WAS FOUND TO BE BRIDGED AT 1200'. HOLE SIZE HQ. NO WATER IN HOLE

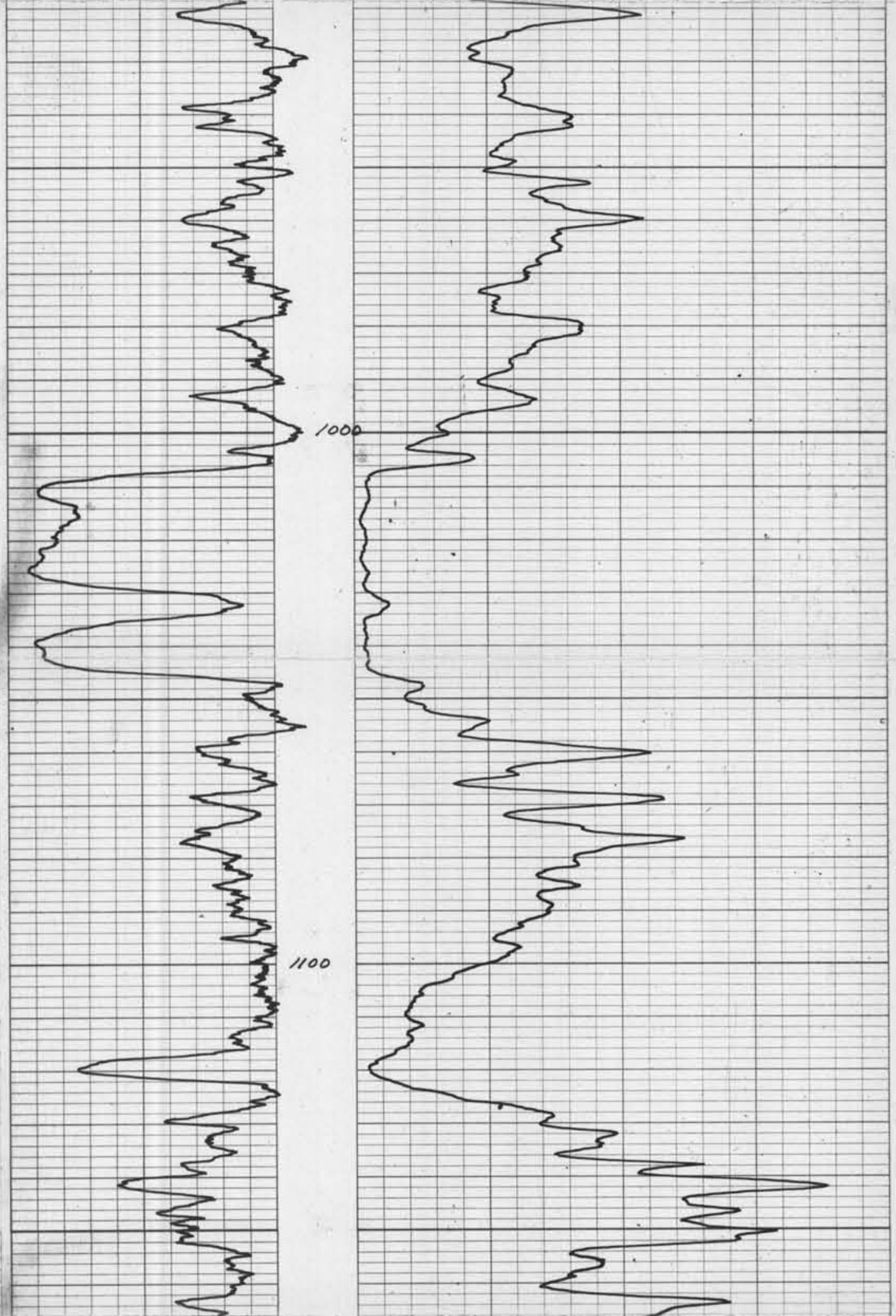
GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
12		100
0 1250		

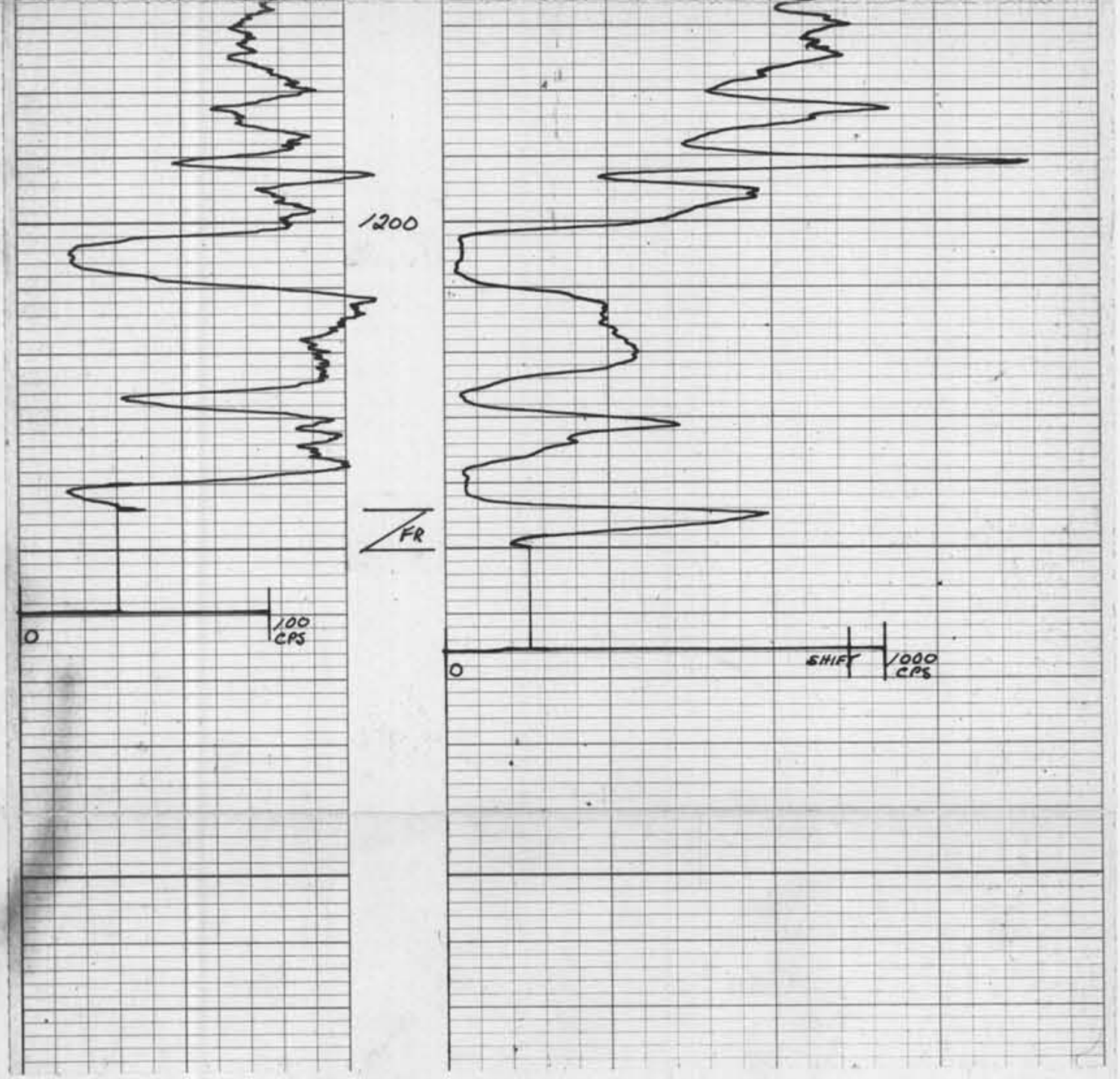

100
1100
000
100


200
300
400


500
600


700
800
900


1000
1100


1200
FR
0
100 CPS
0
SHIFT
1000 CPS

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

LSD SEC TWP RGE W. ____ M

COMPANY ESSO MINING EXPITED

WELL ER - 39

LOCATION

FIELD ELK RIVER VALLEY

274

PROVINCE BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL Elev.: K.B. 2 ft. Above Perm. Datum

Log Measured from: GROUND LEVEL 2 ft. Above Perm. Datum

Drilling Measured from: GROUND LEVEL G.L.

Other Services: NONE

Run No.	ONE
Date	9 JANUARY 1976
First Reading	590
Last Reading	000
Casing Driller	590
Depth Logged	591
Depth Driller	590
Bit Size	NQ
Type Fluid in Hole	WATER
Fluid Level	00
Max. Rec. Temp.	
Source Strength	
Equipment No.	
Recorded By	CARRARO
Witnessed By	SCHLEYER
Operating Time	2 HOURS
Truck No.	35

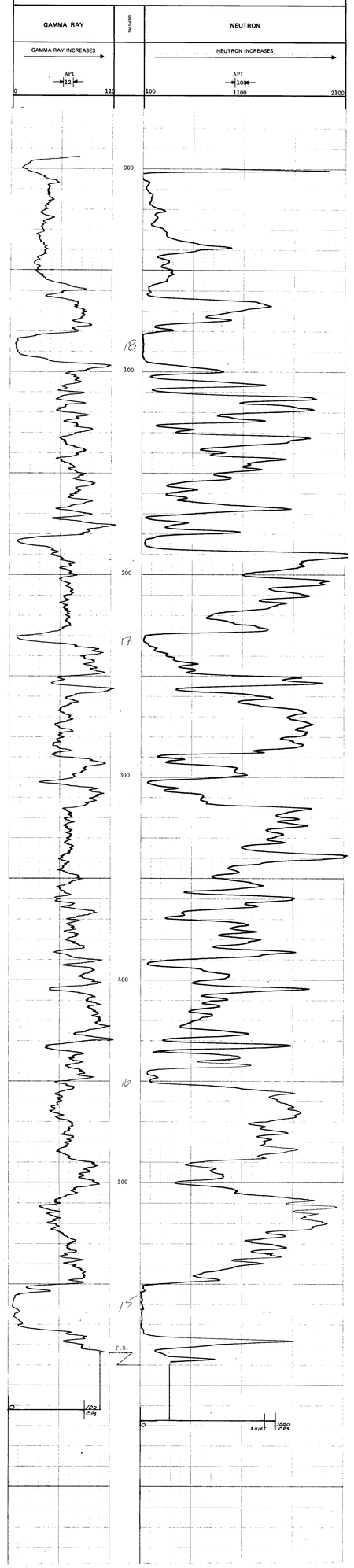
EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	36	TYPE	AmBe
TOOL SERIAL NO.	169-002	STRENGTH	3 CURIES

LOGGING DATA

GENERAL					GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN.	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	590	12	5	100	0	12 API	3	1000	1L	100 API

REMARKS LOGGED THROUGH HQ DRILL ROD



K-Elk River 76/8/27 39

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

K-ELK RIVER 76/10-

LSD
SEC
TWP
RGE
M

FILE NO.

COMPANY EXXO MINING LIMITED

WELL EX - 39

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: CNS, CDS, G.L.

Permanent Datum: GROUND LEVEL
Log Measured from: 20ft. ABOVE DRILL FLOOR
Ref. Depths Measured from: GROUND LEVEL

Elev.: K.B. 2
D.F.
G.L.

Ft. Above Perm. Datum

Run No. ONE
Date 9 JANUARY 1976
First Reading 590
Last Reading 000
Footage Logged 590
Depth Reached 593
Depth Driller 593
Depth Logger 590
Casing Size
Casing Driller
Fluid Type MUD/WATER
Fluid Level FULL
Max. Recorded Temp.
Operating Time 2 HOURS
Truck No. 36

Recorded By CARLSON
Witnessed By GOLLIVER

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/ DIV
1	00	590	12					3	500	2.5R	27.26

REMARKS LOGGED THROUGH HQ DRILL ROD

DENSITY TOOL SERIAL NO 249

DEPTHS

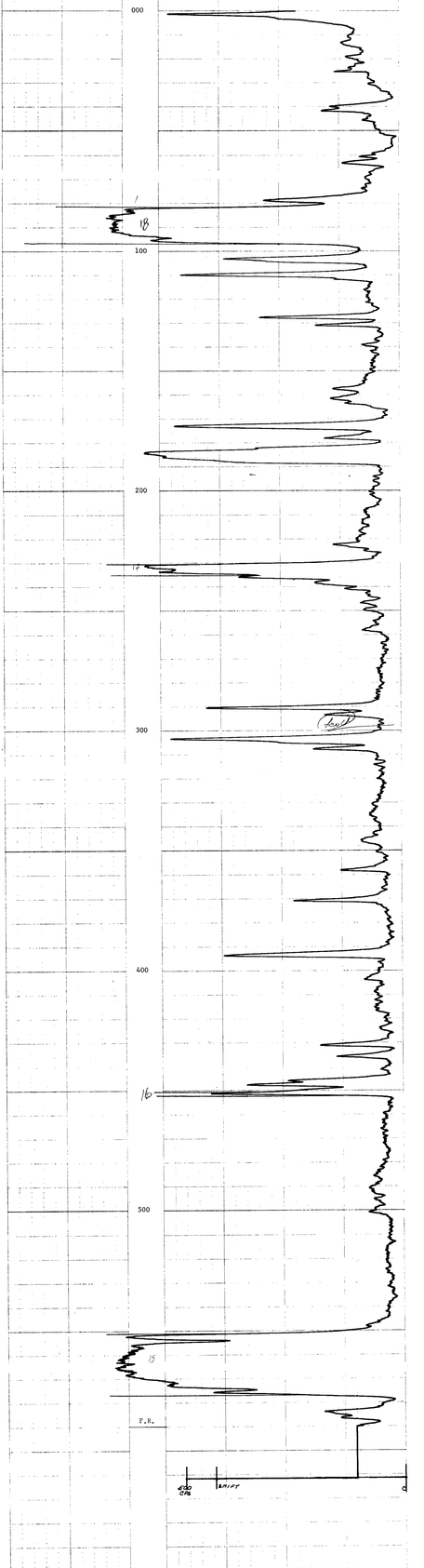
CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)

100 110 120 130 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90



ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

K-ELK RIVER 76(2)B-1/42

FILE NO.	274
LSD	
SEC	
TWP	
RGE	
W M	
COMPANY	ELCO MINING LIMITED
WELL	EB - 42
FIELD	
LOCATION	ELK RIVER VALLEY
PROVINCE	BRITISH COLUMBIA
Permanent Datum	GROUND LEVEL Elev.
Log Measured from	RIG FLOOR 2 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
G.L.	
Other Services	DENS
Run. No.	ONE
Date	15 JANUARY 1976
First Reading	365
Last Reading	000
Footage Logged	365
Depth Reached	366
Depth Driller	370
Casing Driller	31
Fluid Type	AIR
Liquid Level	DRY
Min. Diam.	HQ
Rm @ °F.	
Operating Time	1-1/2 HOURS
Truck No.	36
Recorded By	CARLSON
Witnessed By	OGILVIE

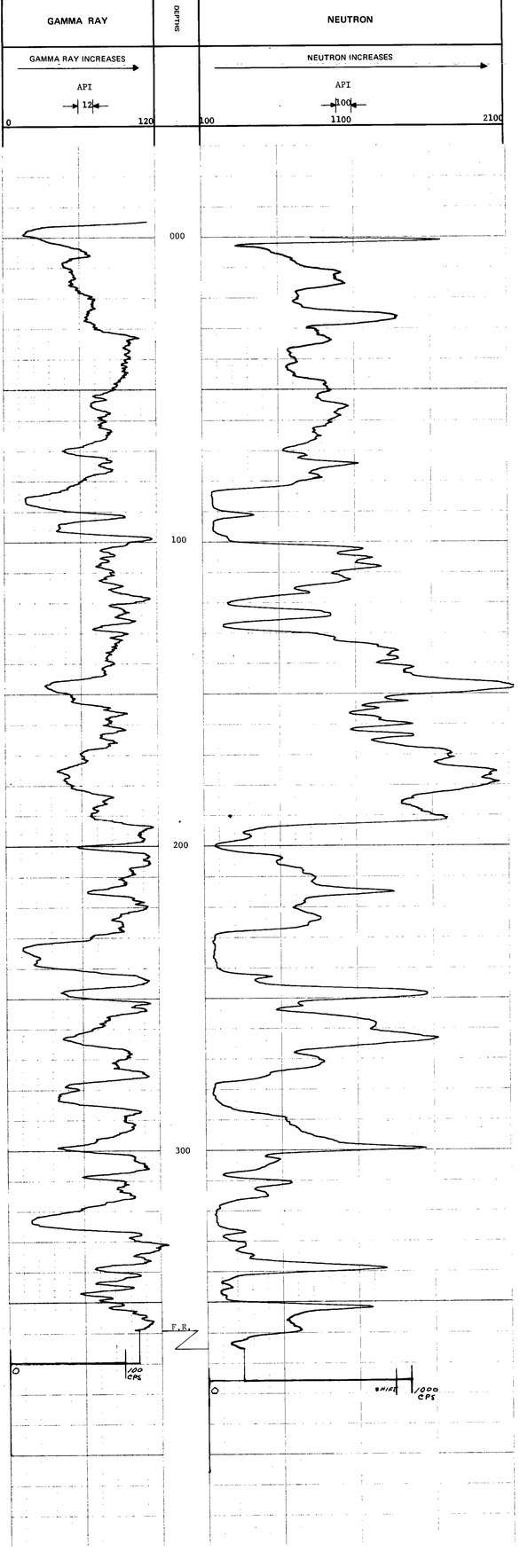
EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	36	TYPE	AmBe
TOOL SERIAL NO.	169-002	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV
1	00	365	12	5	100	0	12 API	3	1000	1L	100 API

REMARKS LOGGED THROUGH HQ DRILL ROD
NO WATER IN HOLE



ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

K-ELK RIVER 76/13-8-1-2

FILE NO.
COMPANY ESSO MINING LIMITED
WELL EB - 42
FIELD
LOCATION ELK RIVER VALLEY
PROVINCE BRITISH COLUMBIA
Other Services: GRN

LSD SEC TWP RGE W M

Permanent Datum GROUND LEVEL Elev.
Log Measured from KB FLOOR 2 Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR K.B.
CSG
G.L.

Run No.	ONE
Date	15 JANUARY 1976
First Reading	350
Last Reading	00
Footage Logged	350
Depth Reached	353
Bit Size	370
Casing Driller	
Casing Logger	31
Fluid Type	AIR
Liquid Level	DRY
Max. Temp.	
Min. Diam.	HQ
Operating Time	1-1/2 HOURS
Truck No.	36
Recorded By	CARLSON
Witnessed By	OGILVIE

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV/L OR R	CPS/ DIV
1	00	350						3	500	2.5R	27.26

REMARKS LOGGED THROUGH HQ DRILL ROD
DRY HOLE
LOG READS 1 FOOT TOO DEEP COMPARED TO GRN LOG
DENSITY TOOL SERIAL NO 249

DEPTHS

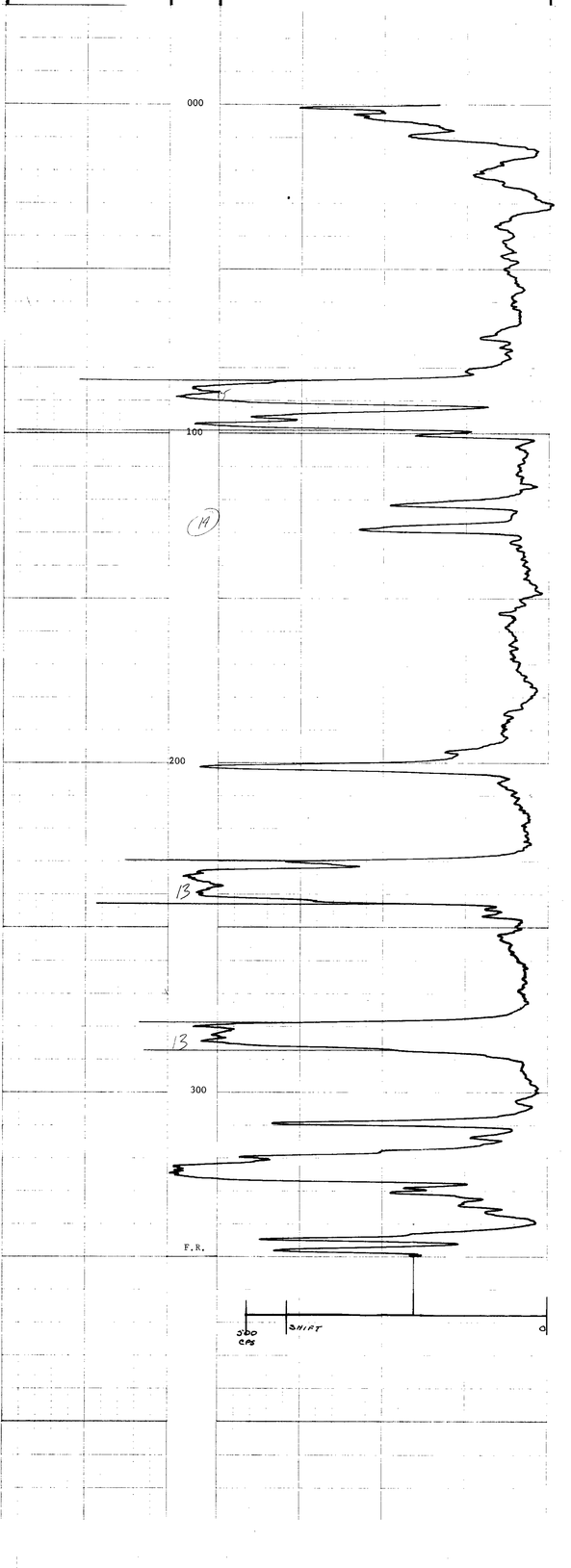
CALIPER
(DIAMETER — INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)

100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280



ROKE

OIL ENTERPRISES LTD.

CORRELATION LOG

CALGARY, ALBERTA

K.B. 5.6 ft. above G.L. Elev. 3477

Recorded By	MAYER
Witnessed By	LISTER

Permanent Datum	G.L.
Log Measured From	K.B.
Drilling Measured From	K.B.

Elev.	K.B. 3477
	D.F.
	G.L. 3471

Date	1-3-72
Run No.	ONE
Depth Driller	5000
Depth Logger	5000
Bottom Logged Interval	4999
Top Logged Interval	3470
Casing Driller	9 5/8 @ 3470
Casing Logger	3470
Bit Size	8 3/4
Type Fluid in Hole	GEL CHEM
Density	10.1
Viscosity	45
Fluid Loss	10.6
Source of Sample	FLOWLINE
R_m @ Meas. Temp.	.76 @ 70°F
R_mf @ Meas. Temp.	.57 @ 70°F
R_mc @ Meas. Temp.	.95 @ 70°F
Source of R_mf	MEASURED
Source of R_mc	CALCULATED
R_m @ BHT	.38 @ 150°F
Time Since Circ.	12 HRS
Max. Rec. Temp.	150°F
Equip. Location	3470
Recorded By	MAYER
Witnessed By	LISTER

Run No.	ONE
Service Order No.	2 078393
Permanent Datum	G.L.
Log Measured From	K.B.
Drilling Measured From	K.B.

Elev.	K.B. 3477
	D.F.
	G.L. 3471

Date	1-3-72
Run No.	ONE
Depth Driller	5000
Depth Logger	5000
Bottom Logged Interval	4999
Top Logged Interval	3470
Casing Driller	9 5/8 @ 3470
Casing Logger	3470
Bit Size	8 3/4
Type Fluid in Hole	GEL CHEM
Density	10.1
Viscosity	45
Fluid Loss	10.6
Source of Sample	FLOWLINE
R_m @ Meas. Temp.	.76 @ 70°F
R_mf @ Meas. Temp.	.57 @ 70°F
R_mc @ Meas. Temp.	.95 @ 70°F
Source of R_mf	MEASURED
Source of R_mc	CALCULATED
R_m @ BHT	.38 @ 150°F
Time Since Circ.	12 HRS
Max. Rec. Temp.	150°F
Equip. Location	3470

PROPRIETARY CORRELATION LOG

RUN ONE

RECORDED 2000' NORMAL

Elev.: K.B. 3477 ft.
D.F.
G.L. 3471 ft.

Log Measured From K.B. 6 ft. Above Perm. Datum

Drilling Measured From K.B.

Date 1-3-72

Run No. ONE

Depth-Driller 5000

Depth-Logger 5000

Bottom Logged Interval 4999

Top Logged Interval 3470

Casing-Driller 9 5/8 @ 3470

Casing-Logger 3470

Bit Size 8 3/4

Type Fluid in Hole GEL CHEM

Density 10.1

Viscosity 45

Fluid Loss 10.6

Source of Sample FLOWLINE

R_m @ Meas. Temp. .76 @ 70°F

R_mf @ Meas. Temp. .57 @ 70°F

R_mc @ Meas. Temp. .95 @ 70°F

Source of R_mf MEASURED

Source of R_mc CALCULATED

R_m @ BHT .38 @ 150°F

Time Since Circ. 12 HRS

Max. Rec. Temp. 150°F

Equip. Location 3470

Recorded By MAYER

Witnessed By LISTER

TEL NO. 277-3611

COMPANY ROKE OIL ENTERPRISES LTD.

WELL 8-17

LOCATION

FIELD

M

R

PROVINCE ALBERTA

274

EQUIPMENT DATA

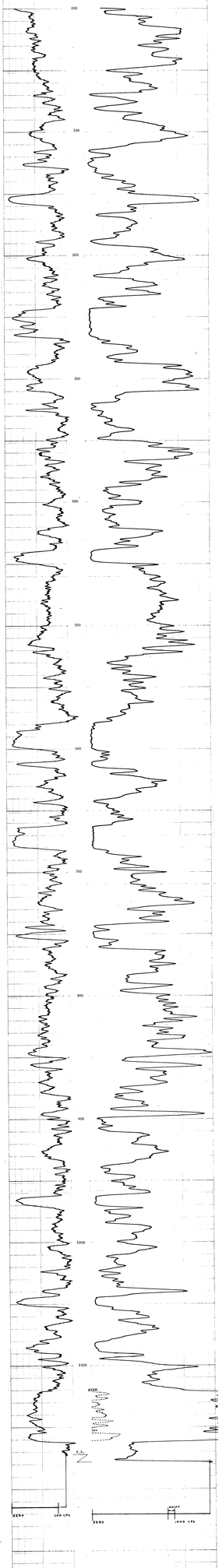
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		TOOL NAME	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO SOURCE	9 - 7 FT.	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N 55 W
GENERAL		SERIAL NO.	167
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	35	TYPE	Curie
FUEL SERIAL NO.	149-002	STRENGTH	2 078393

LOGGING DATA

	GENERAL				GAMMA RAY				NEUTRON			
Run No.	LOGGING INTERVAL FROM	TO	SPEED FT/MIN	T.C. SEC	SENS SETTINGS	SPC & R. UNITS DIV. / CPS	PER LOG DIV.	T.C. SEC	SENS SETTINGS	SPC & R. UNITS DIV. / CPS PER LOG DIV.	
1	500	5179	30	3	100	20	57 API	3	5000	24	100 API

REMARKS: PUMPING ROKE LTD GAS FREE MCA + ACTIVATE
GROUND TEMPERATURE NO DRILL ROD

GAMMA RAY	SCALE	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API		API
0 — 15 — 30 — 60 — 120		100 — 1100 — 2100



ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD.
CALGARY, ALBERTA

Elev. Perm. Datum	GL
Log Measured From	KB 4.27 m above Perm. Datum
Drilling Measured From	KB

COMPANY: ROKE OIL ENTERPRISES LTD.
WELL: 8B - 1 - 47
FIELD: WILD HORSE LAKE
LOCATION: 8B - 1 - 47 - 6 - W5M
PROVINCE: ALBERTA

Permanent Datum: GROUND LEVEL
Elev.: 1 m
Log Measured From: K.B.
4.27 m above Perm. Datum
Drilling Measured From: K.B.

Other Services: SBHC

Date: 2-7-74
Run No.: ONE
Depth-Driller: 1170
Depth-Logger: 1170
Bottom Logged Interval: 1170
Top Logged Interval: 100
Casing-Driller: 9 5/8" @ 101
Casing-Logger: 101
Bit Size: 8 3/4"
Type Fluid in Hole: GEL CHEM
Density: 1.200
Viscosity: 54
pH: 10.5
Fluid Loss: 10.4
Source of Sample: FLOWLINE
Rm @ Meas. Temp.: 1.267 @ 21°C
Rmf @ Meas. Temp.: .
Rmc @ Meas. Temp.: .
Source of Rmf & Rmc: .
Rm @ BHT: .
Time Since Circ.: 3 HOURS
Max. Rec. Temp.: 21°C
Equip. Location: 3 KNOX
Recorded By: T. JOHNSON
Witnessed By: MR. MOORE

RUN NO. ONE

	GAMMA RAY	NEUTRON
Type Log	GAMMA RAY	NEUTRON
Scale Up	100	1500
Scale Down	0	100
Tension	1	1
Speed	1	1
Time Constant	3	3
Log Sensitivity	1	1
Log Offset	0	0
Gamma Ray Calibrator	100	100
Neutron Calibrator		1000

Primary Depth Control: CASING COLLAR LOG
Secondary Depth Control: CASING COLLAR LOG
Type Run: MAIN
Run No.: ONE
Date: 2-7-74
Depth-Driller: 1170
Depth-Logger: 1170
Bottom Logged Interval: 1170
Top Logged Interval: 100
Casing-Driller: 9 5/8" @ 101
Casing-Logger: 101
Bit Size: 8 3/4"
Type Fluid in Hole: GEL CHEM
Density: 1.200
Viscosity: 54
pH: 10.5
Fluid Loss: 10.4
Source of Sample: FLOWLINE
Rm @ Meas. Temp.: 1.267 @ 21°C
Rmf @ Meas. Temp.: .
Rmc @ Meas. Temp.: .
Source of Rmf & Rmc: .
Rm @ BHT: .
Time Since Circ.: 3 HOURS
Max. Rec. Temp.: 21°C
Equip. Location: 3 KNOX
Recorded By: T. JOHNSON
Witnessed By: MR. MOORE

RUN NO. TWO

	GAMMA RAY	NEUTRON
Type Log	GAMMA RAY	NEUTRON
Scale Up	100	1500
Scale Down	0	100
Tension	1	1
Speed	1	1
Time Constant	3	3
Log Sensitivity	1	1
Log Offset	0	0
Gamma Ray Calibrator	100	100
Neutron Calibrator		1000

Primary Depth Control: CASING COLLAR LOG
Secondary Depth Control: CASING COLLAR LOG

Other Services: SBHC

247

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		TOOL MODEL NO.	NEUTRON/NEUTRON
DIAMETER	1 5/8	DIAMETER	1 5/8
DETECTOR MODEL NO.		DETECTOR MODEL NO.	
TYPE	SCINTILLATOR	TYPE	PROPORTIONAL
LENGTH	6 INCH	LENGTH	6 INCH
DISTANCE TO N. SOURCE	1.7 FT.	SOURCE MODEL NO.	MNC N 85 W
		SERIAL NO.	161
		SPACING	12 INCH
HEAT TRACK NO.		TYPE	AmBe
INSTRUMENT TRACK NO.	76	STRENGTH	3 CURIES
TOOL SERIAL NO.	169-002		

LOGGING DATA

RUN NO.	GENERAL FROM	GENERAL TO	GENERAL SPEED FT/MIN	GENERAL T.C. SEC.	GENERAL SENS SETTINGS	GAMMA RAY DEFLO DIV. L OR R	GAMMA RAY API-G. R. UNITS PER LOG DIV	NEUTRON T.C. SEC.	NEUTRON SENS SETTINGS	NEUTRON DEFLO DIV. L OR R	NEUTRON API-N UNITS PER LOG DIV
1	000	1179	15	3	100	OL	12 API	3	1000	1L	100 API

REMARKS: PUNCHED HOLE (25 SAL PER HOLE - APPROX)
LOGGED THROUGH 90 (METAL ROD

GAMMA RAY | NEUTRON

GAMMA RAY INCREASES →
API
0 — 60 — 120

NEUTRON INCREASES →
API
100 — 1100 — 2100

000
100
200
300
400
500
600
700
800
900
1000
1100

#100

ZERO — 200 CPS

SHIFT

ZERO — 1000 CPS

ROKE
ROKE OILFIELD SERVICES LTD.
CALGARY, ALBERTA

DOWNHOLE SURVEY

Rig No. 214
Well No. 10-35-47-25W4M
Location
Field
Province
Country

DOWNHOLE SURVEY DATA

Run No. 1
Date
Time
Recorded By
Witnessed By

Type Log
Max. Rec. Temp. Deg. F.
Equip. Location
Recorded By
Witnessed By

BOREHOLE RECORD

No.	Bit From	Bit To	Size	Type Fluid	Density	Visc.	Loss
1	SURF	1173	7 7/8				

CASING RECORD

No.	Size	Wgt.	Grade	Type Joint	Top	Bottom
1	5 1/2	15.5	K-55		SURF	1173

Logging Measured From KB
Drilling Measured From KB
Elev.: K.B. 2214
G.L. 2209

RUN NO.	GENERAL CASING DEPTH	SPEED FEET/MIN	GAMMA RAY T.C. SENS SETTINGS	API U.A. UNITS PER LOG DIV.	SONIC T.C. SENS SETTINGS	SONIC DELTA-T SPACING	CPS/DIV
1	1173	30			300	2.0	27.36

REMARKS: FLUSHING HOLE / 30 GAL. PER MIN + APPROX
SONDES TRAVELLED NO DRILL ROD

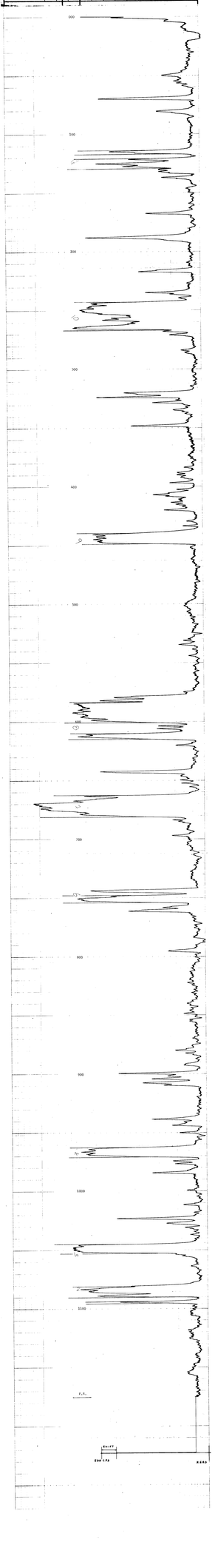
DENSITY TOOL SERIAL NO 215

CALIPER
(DIAMETER - INCHES)

GAMMA RAY
API

COMBINATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)



ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

SEC. TWP. RGE. W... M

COMPANY ESSO MINING LIMITED

WELL ES - 51

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum: GROUND LEVEL Elev. ...

Log Measured From: K.B. 4'4" Above Perm. Datum

Drilling Measured From: G.L.

Rig No. ONE

Date 31 JANUARY 1976

Run No. ONE

Depth-Driller 511

Depth-Logger 511

Bottom Logged Interval 511

Top Logged Interval 000

Casing Size 5½

Casing Wgt. & Depth 526

Drill Fluid Type WATER

Fluid Level FULL

Max. Rec. Temp. ...

Operating Time ...

Recorded By CARLSON

Witnessed By OCULYZE

Elk River 76(5) B-1

51

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/ DIV
1	00	511	12					3	500	2.58	27.26

REMARKS LOGGED THROUGH HQ DRILL ROD

DENSITY TOOL SERIAL NO 249

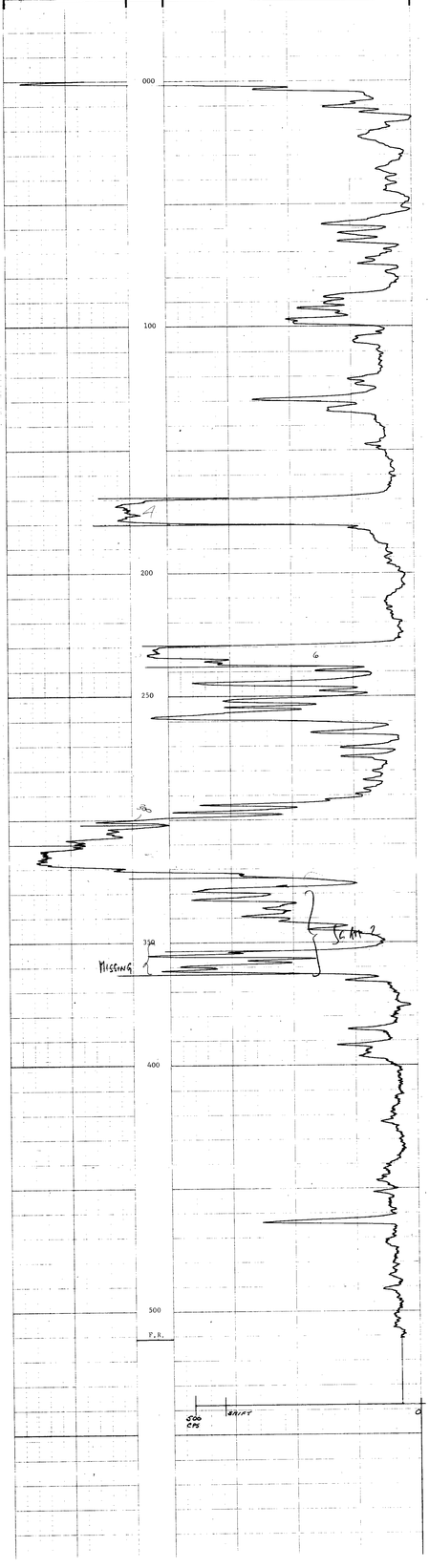
DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY
(GRAMS/CC)



ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

K-ELK RIVER 76(3)B-1 51

FILE NO.

LSD.
SEC
TWP
RGE
W M

COMPANY ELCO MINING LIMITED

WELL FB 51 274

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev. 4"
Log Measured from TOP OF DRILL ROD 4' Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

Run. No.	ONE
Date	31 JAN 76
First Reading	525
Last Reading	0
Footage Logged	525
Depth Reached	526
Driller	526
Roke	
Casing Driller	
Fluid Type	WATER
Liquid Level	0
Min. Diam.	HQ
Rm @ °F	
Operating Time	2 HRS
Truck No.	36

Recorded By CARLSON

Witnessed By O GILLIE

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	1 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.7 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	36	TYPE	AmBe
TOOL SERIAL NO.	169002	STRENGTH	10 CURIES

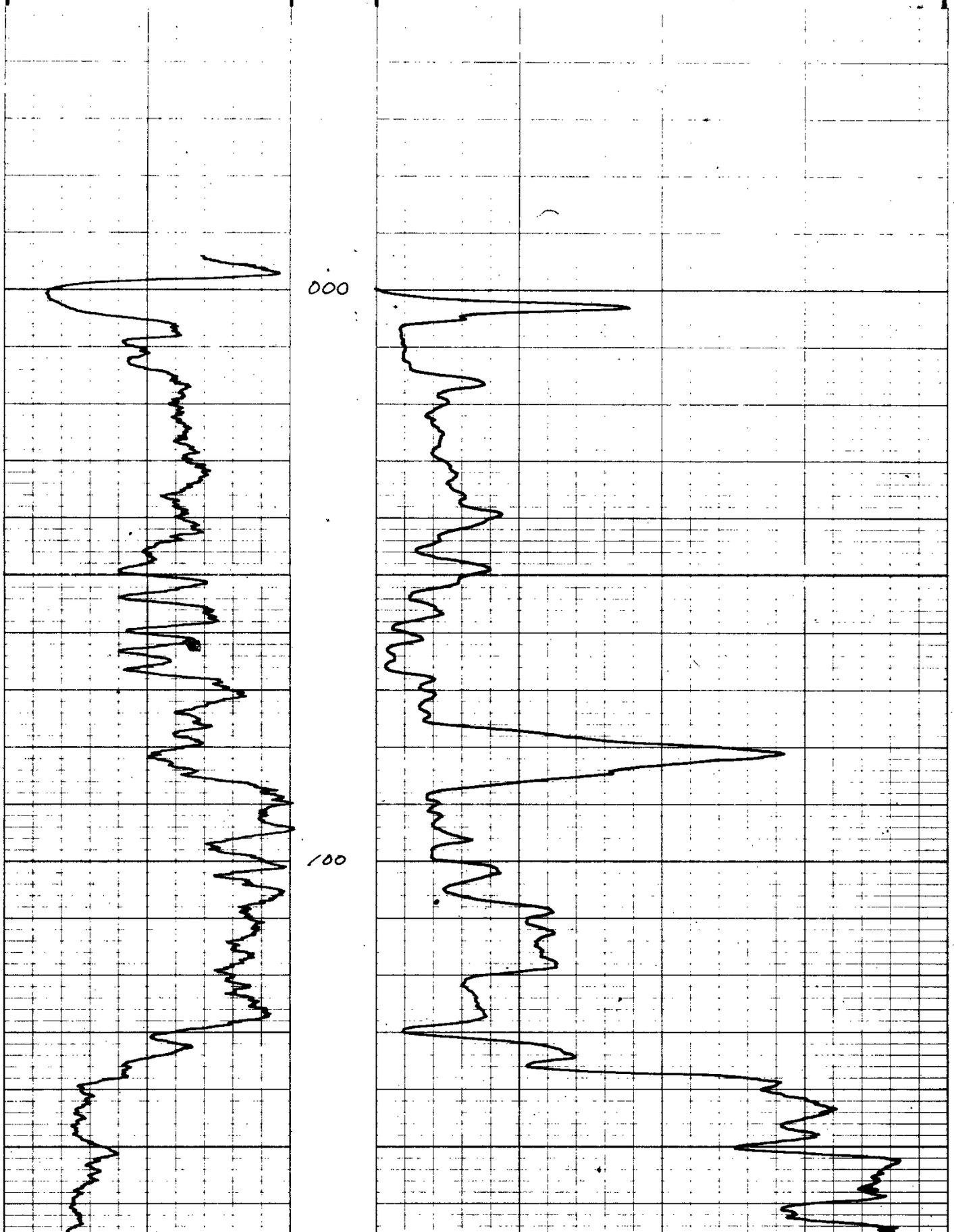
LOGGING DATA

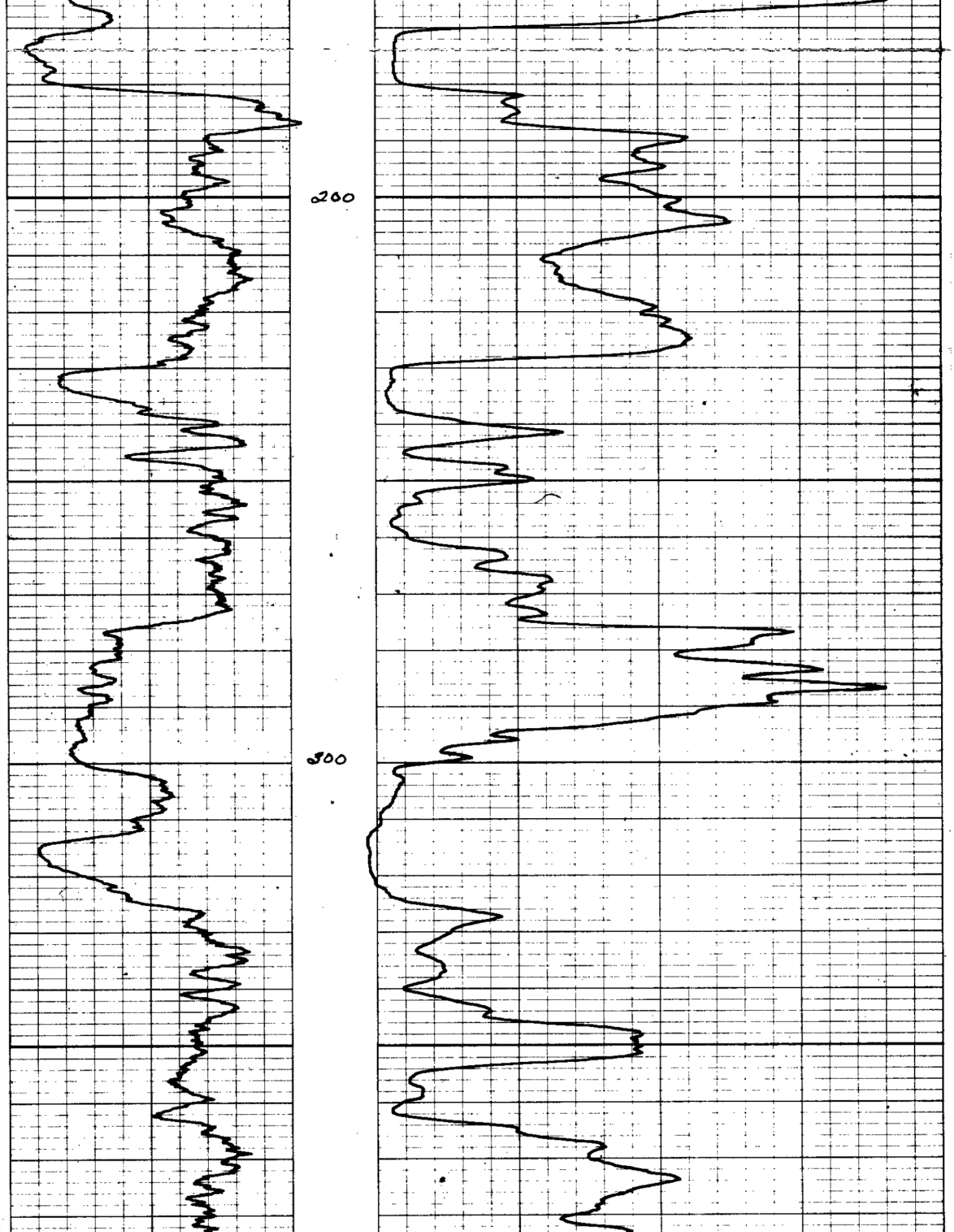
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	0	525	12	5	100	0	12	3	1000	1 L	100

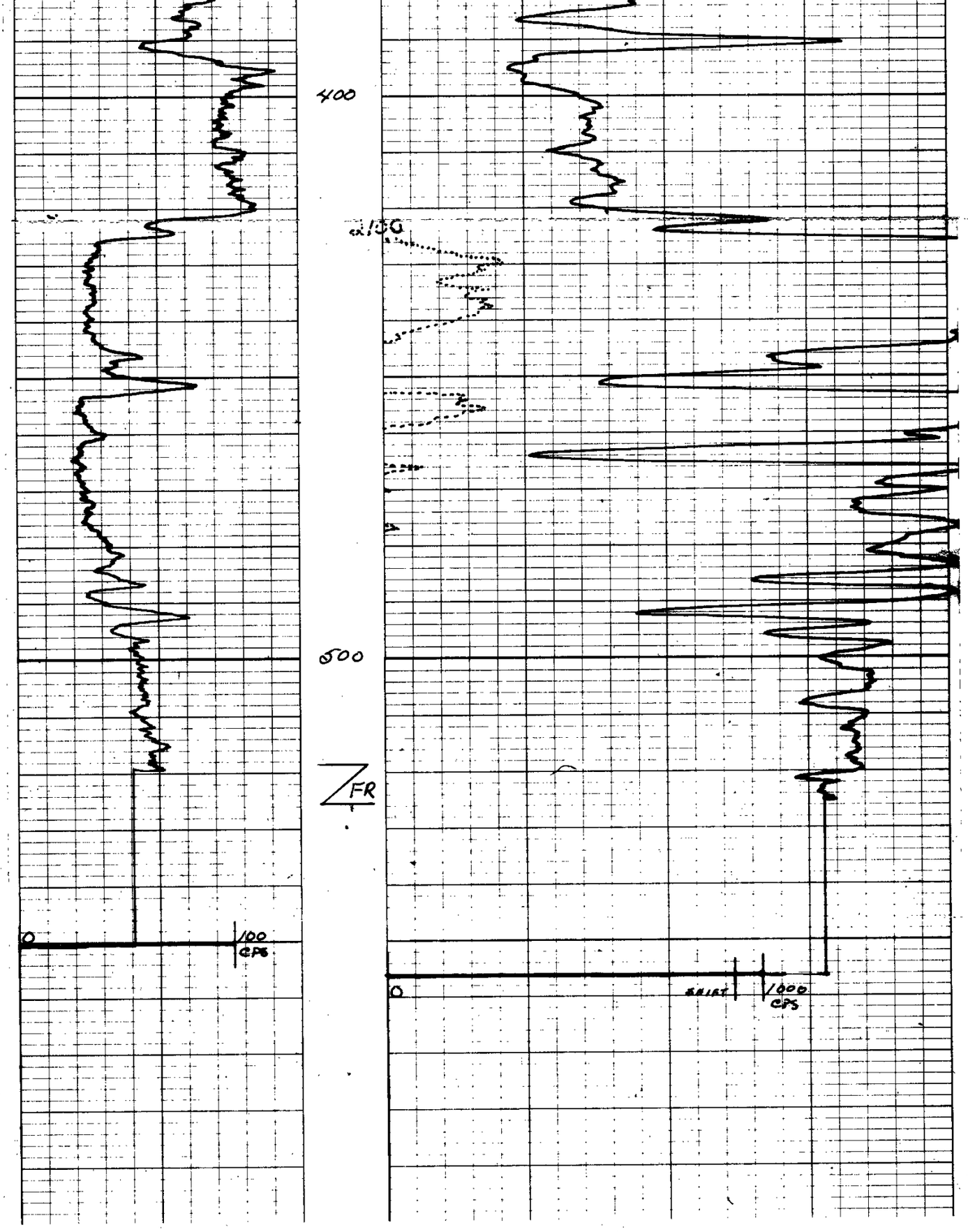
REMARKS LOGGED THROUGH HQ DRILL ROD. DOTTED LINE SHOWS NEUTRON WITH 40 & DIV

SHIFT

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
0 — 120		100 — 1100 — 2100




200
300


400
450
500
ZFR
0
100 CPS
0
SHIFT
1000 CPS

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

K-ELK RIVER 76(3)B-1 52

FILE NO.

LSD
SEC
TWP
RGE
W ____ M

COMPANY ELCO MINING LIMITED

WELL FB 52 274

LOCATION

FIELD ELK RIVER VALLEY

PROVINCE BRITISH COLUMBIA

Other Services: GRA

Permanent Datum GROUND LEVEL Elev.

Log Measured from TOP OF DRIVE ROD 8' Ft. Above Perm. Datum

Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

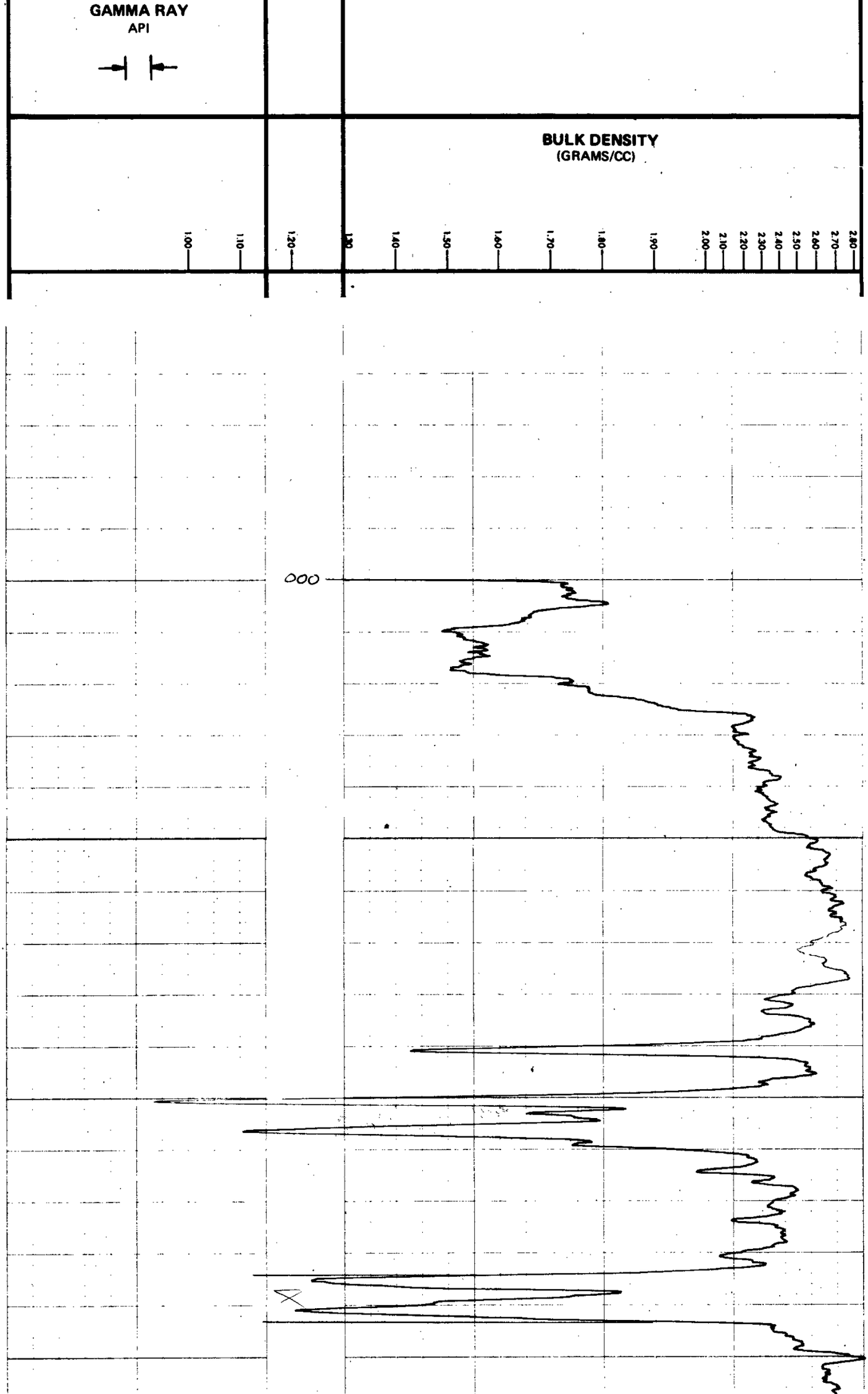
Run. No.	ONE
Date	21 JAN 76
First Reading	522
Last Reading	0
Footage Logged	522
Depth Reached	525
Depth Driller	526
Casing Roke	
Casing Driller	80
Fluid Type	AIR
Liquid Level	DRY HOLE
Min. Diam.	HQ
Operating Time	2 HRS
Truck No.	86
Recorded By	CARLSON
Witnessed By	OBLINE

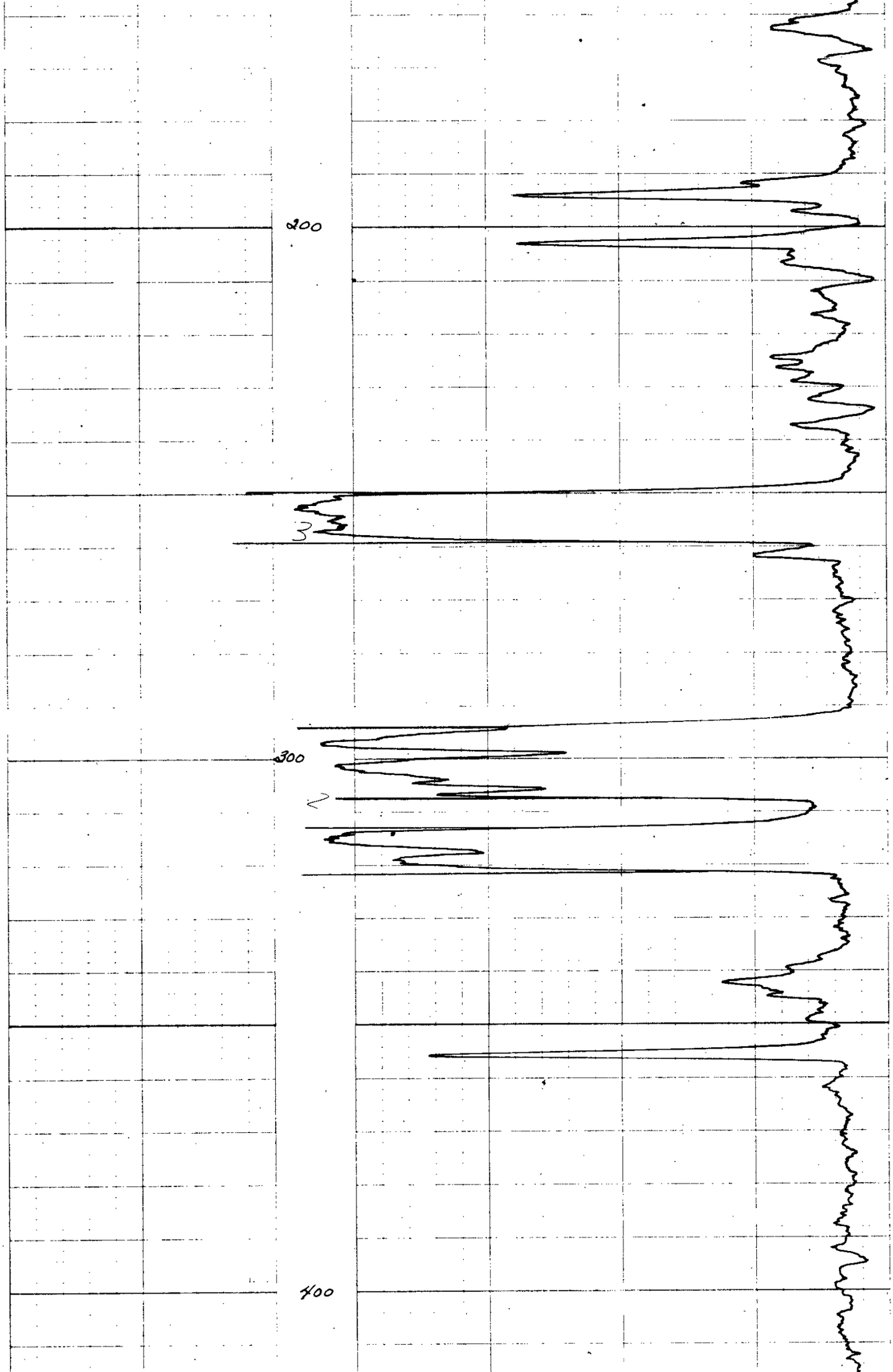
GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/ DIV
1	0	522	12					8	200	2.5 R	27.26

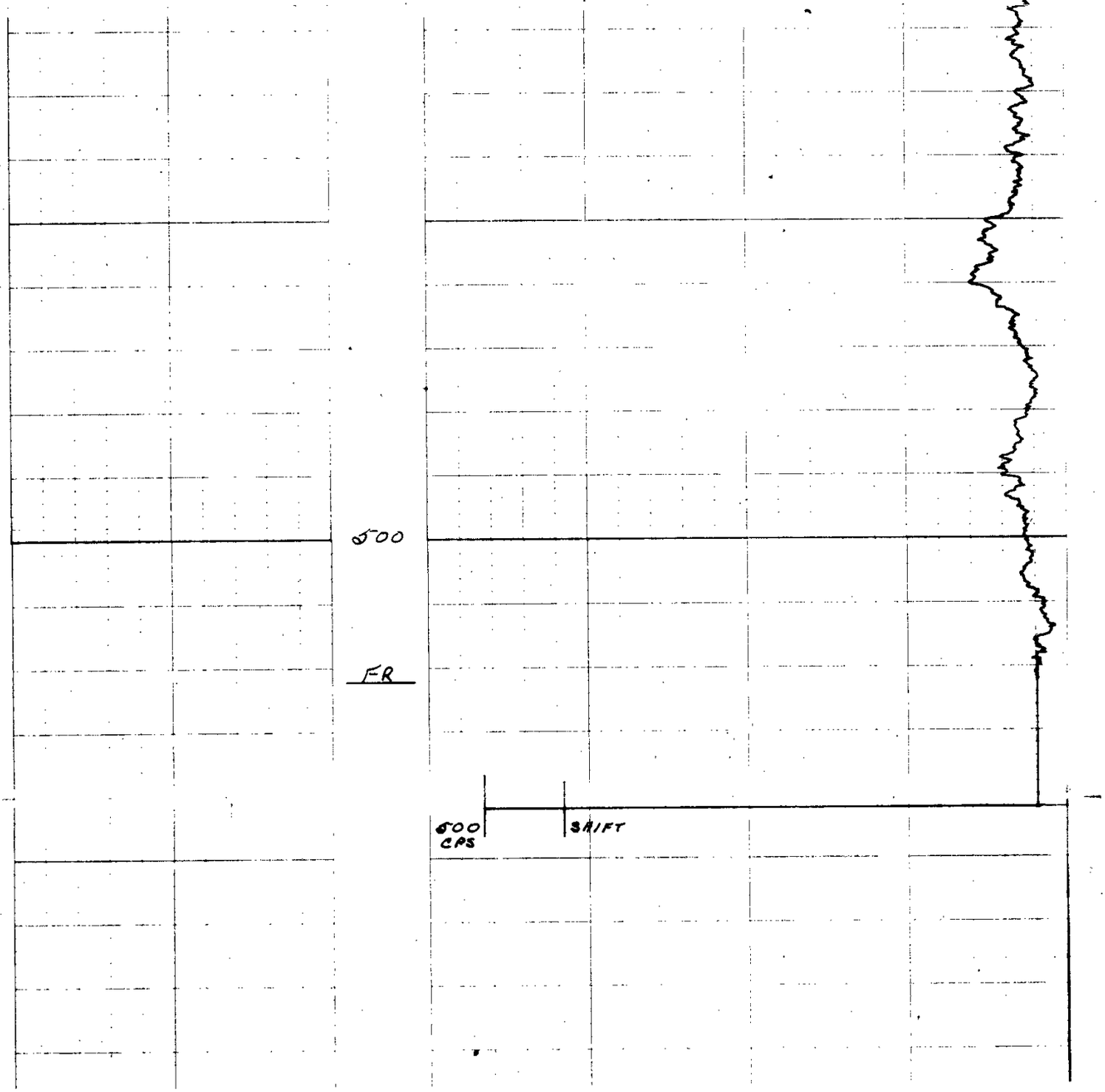
REMARKS LOGGED THROUGH HQ DRILL ROD.
NO WATER VISIBLE EITHER ON CABLE OR TOOL
DENS TOOL # 249

DEPTHS

CALIPER
(DIAMETER – INCHES)


GAMMA RAY
API
BULK DENSITY
(GRAMS/CC)
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60
2.70
2.80
000


200
3
300
2
400


500
FR
500
CPS
SHIFT

K-Elk Ridge 74(13)-1-32

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.

COMPANY ESSO RESOURCES LIMITED

WELL K-E-32

LOCATION SEC TWP RGE W.... M

FIELD ELK RIDGE PROJECT

274

PROVINCE BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev. K.B.

Log Measured from 20.0 FT. ABOVE PERM. DATUM D.F.

Drilling Measured from R.K.B. CASING G.L.

Other Services: SONIC

Run. No.	ONE		
Date	8-FEB-74		
Log Bottom	1780		
Log Interval	1780		
Casing Logged	4 1/2		
Bit From	SURF.		
Depth Driller	1780		
Depth Logger	1780		
Btm. Log Interval	1780		
Top Log Interval	SURF.		
Open Hole Size	6 3/4		
Type Fluid in Hole	GEL CHEM		
Density	9.2		
Viscosity	50		
pH	9.5		
Fluid Loss	8.4		
Source of Sample	CIRC.		
Rm @ Meas. Temp.	.62 @ 70°F		
Rmf @ Meas. Temp.	.49 @ 70°F		
Rmc @ Meas. Temp.	.82 @ 70°F		
Source of Rmf and Rmc	CALC.		
Rm @ BHT	.31 @ 150°F		
Time Since Circ.	24 HRS		
Max. Rec. Temp.	150°F		
Equip. Location	82		
Recorded By	A.R. CARASSO		
Witnessed By	A. CLAUSEN		

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	NEUTRON/NEUTRON
TOOL MODEL NO.		TOOL MODEL NO.	
DIAMETER	1 11/16	DIAMETER	1 11/16
DETECTOR MODEL NO.		DETECTOR MODEL NO.	
TYPE	SCINTILLATION	TYPE	PROPORTIONAL
LENGTH	4 INCH	LENGTH	6 INCH
DISTANCE TO N. SOURCE	4 FT.	SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	187
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	84	TYPE	AmBe
TOOL SERIAL NO.	168003	STRENGTH	5 CURIES

LOGGING DATA

GENERAL RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	GAMMA RAY T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV. L OR R	GAMMA RAY API G. R. UNITS PER LOG DIV.	NEUTRON T. C. SEC.	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV. L OR R	NEUTRON API N. UNITS PER LOG DIV
1	0	1777	12	5	100	0	10	5	1000	L	100

REMARKS LOGGED THROUGH NO DRILL ROD
NO WATER VISIBLE EITHER ON CABLE OR TAIL

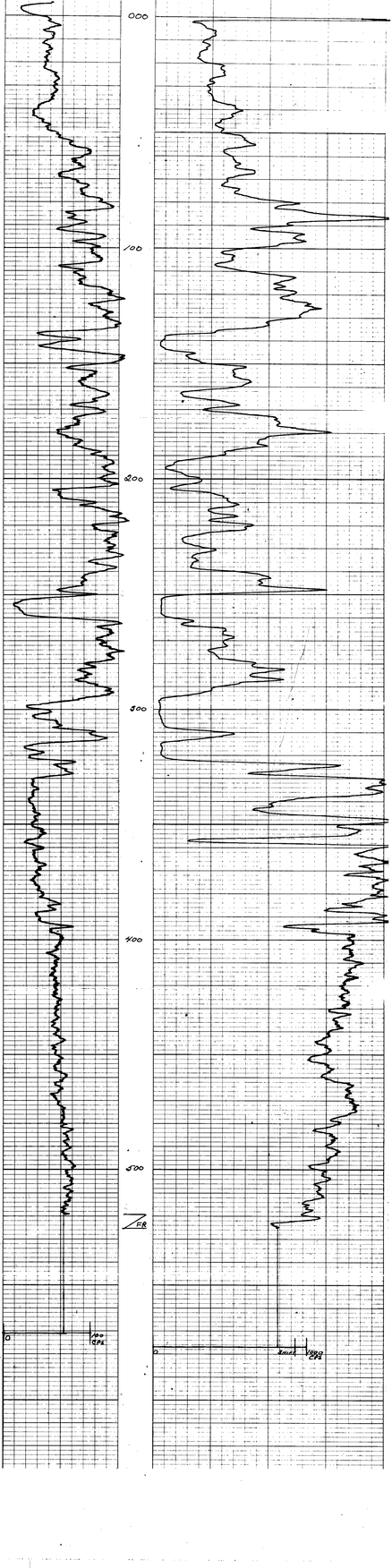
GAMMA RAY | DEPTHS | NEUTRON

GAMMA RAY INCREASES

NEUTRON INCREASES

0 100 1700

100 1700 3400



KERR-ROKE 7613 0-1 53

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.

LSD SEC TWP RGE W.M.

COMPANY ESSO RESOURCES LIMITED

WELL ES 53 LOCATION 23-1

FIELD ELK RIDGE EXTN

PROVINCE OF ALBERTA

Permanent Datum: GROUND LEVEL Elev. 3148 FT. K.B.

Log Measured from: GROUND LEVEL 8 FT. Above Perm. Datum

Date Run No. First Reading Last Reading Depth Driller Depth Logger Casing Driller Fluid Type Fluid Level Max. Temp. Rec. @ °F Operating Time Truck No.

Other Services: CBL G.L.

Recorded By: A.B. CRAIGEN Witnessed By: MR. LUX

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATOR	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	4.7FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	182
HOIST TRUCK NO.		SPACING	AmBe
INSTRUMENT TRUCK NO.	86	TYPE	
TOOL SERIAL NO.	169.003	STRENGTH	4 CURIES

LOGGING DATA

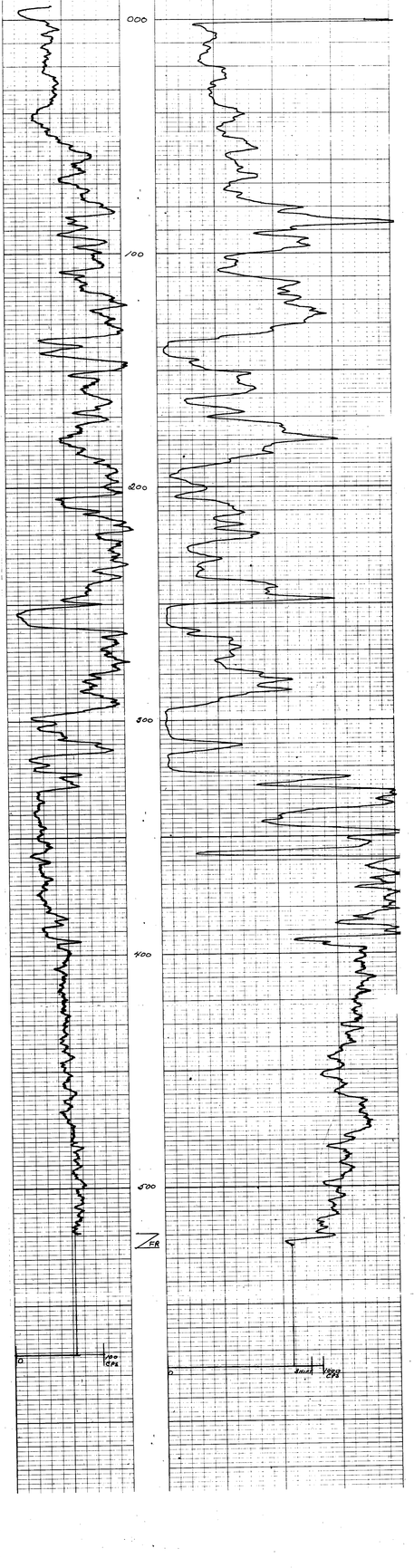
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV. L OR R	GAMMA RAY API G. R. UNITS PER LOG DIV.	NEUTRON T. C. SEC.	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV. L OR R	NEUTRON API N. UNITS PER LOG DIV.
1	0	8225'	12	5	100	0	12	8	1000	12	100

REMARKS LOGGED THROUGH HD DRILL ROD
NO WATER VISIBLE EITHER ON CABLE OR TOOL

GAMMA RAY | DEPTHS | NEUTRON

GAMMA RAY INCREASES → 0 100 200

NEUTRON INCREASES → 100 1100 2100



KELSEY RIVER 76(5)G-1-53

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 274

COMPANY ESSO RESOURCES CANADA LTD.

WELL ROKE

LOCATION LSD SEC TWP RGE M

FIELD KELSEY RIVER

PROVINCE OF ALBERTA

Other Services: S.F.D. G.R. CBL G.L.

Permanent Datum: G.L. Elev. 1245.0 ft. Above Perm. Datum

Log Measured from: R.K.B. 5.0 ft. Above Perm. Datum

Drilling Measured from: R.K.B.

Run. No.	ONE
Date	25-JAN-74
Depth Driller	10
Depth Logger	998
Bottom Logged Interval	998
Top Logged Interval	300
Type Fluid in Hole	GEL
Salinity, PPM Cl	300
Density	9.1
Level	FULL
Max. Rec. Temp. Deg. F.	72
Operating Time	3.5
Truck No.	36

Recorded By CRAGGS/D.

Witnessed By O'LEARY/C

GENERAL RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV. OR R	GAMMA RAY API O.R. URITS PER LOG DIV.	SIDEWALL DENSILOG T.C. SEC.	SIDEWALL DENSILOG SENS SETTINGS	SIDEWALL DENSILOG ZERO DIV. OR R	SIDEWALL DENSILOG CPS/DIV
1	0	211	12					2	200	25.2	22.26

REMARKS DENS TOOL # 349

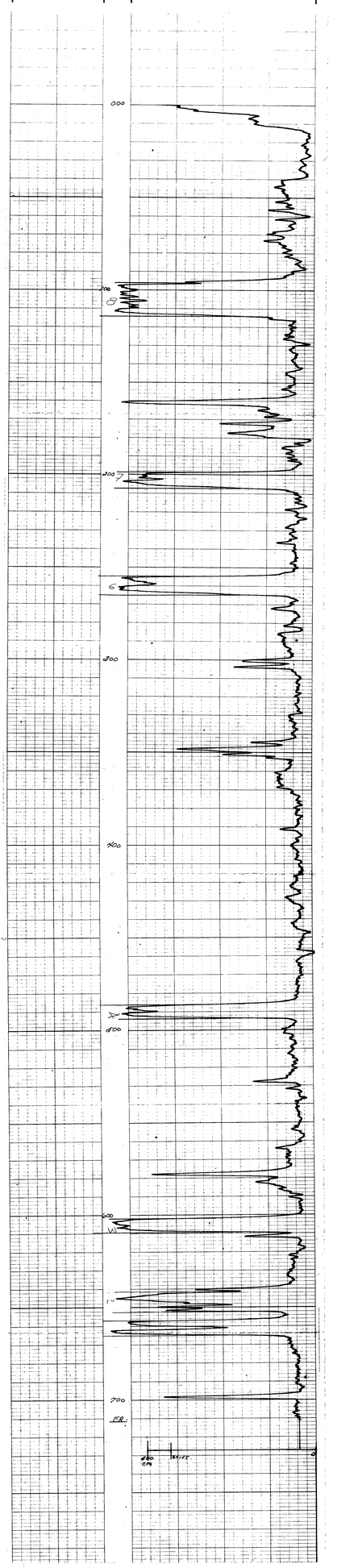
LOADED THROUGH NQ DRILL ROD

CALIPER (DIAMETER – INCHES)

GAMMA RAY API

DEPTHS

BULK DENSITY (GRAMS/CC)



IDENTIFICATION NO.
FOR SURVEY DIAGRAM
FILE LISTING

CORRECTION FACTORS: 1

POINT #	NORTH	EAST	ELEVATIONS	POINTS
10	584758. 54000	61129. 87000	5502.0	Ex. pt. 3602
11	580769. 52304	62843. 98470	5491.9	Ex. pt. 3611
12	580373. 96102	63914. 04830	5478.98	T.P.
13	575765. 82900	64095. 61900		T.P.
14	574911. 60984	64333. 19030	5307.8	Ex. pt. 3603
15	574218. 39036	64517. 18610	5302.19	T.P.
16	568316. 79553	65911. 90139	5204.63	T.P.
17	565523. 23814	66981. 60145	5271.71	T.P.
18	564562. 54117	67349. 46850	5329.52	T.P.
19	564125. 96067	67470. 96370	5327.48	T.P.
20	562904. 32730	67941. 69755	5285.35	R.P.
21	560054. 74211	69039. 73257	5308.30	R.P.
22	559271. 06000	69341. 71000	5318.60	Ex. pt. 1307
23	560241. 99915	68134. 02797	5191.86	R.P.
24	559834. 93837	68049. 86698	5172.02	R.P.
25	560257. 67038	68058. 23105	5194.92	E. End trench
26	559973. 38831	66995. 60049		W. End trench
27	562560. 88200	67450. 39964		R.P.
28	562631. 08284	67460. 47381		W. end trench
29	563408. 38636	68572. 43947	5448.54	W. end trench
30	563542. 44043	68740. 18475	5558.34	R.P.
31	563645. 88359	66658. 94419	5172.54	T.P.
32	563343. 12626	66546. 16704	5149.61	T.P.
33	563086. 94552	65982. 26046	5120.97	T.P.
34	563556. 08296	65895. 18472	5143.70	T.P.
35	563548. 12418	65943. 97992	5137.2	R.P.
36	563596. 05396	65650. 12308	5144.67	EB 17
37	563612. 15182	65551. 42729	5147.62	R.P.
38	562557. 57962	66409. 06035	5159.70	R.P.
39	562317. 02599	66603. 00609	5183.23	R.P.
40	561834. 77435	66991. 82023	5182.63	T.P.
41	561855. 38038	67089. 67416	5189.07	EB 18
42	561659. 62312	66160. 06182	5136.66	EB 19
43	565820. 21856	66622. 51930	5215.83	T.P.
44	565687. 09830	65874. 06553	5148.06 (Original Pos.)	EB 15
45	565532. 57089	65140. 15731	5154.27	EB 16
46	565617. 47711	65087. 32802	5159.71	R.P.
47	565702. 38333	65034. 49873	5160.90	R.P.
48	568702. 30768	67593. 83323	5578.21	T.P.
49	568297. 79661	67494. 99964	5531.46	ADIT ENTRY
50	568334. 98102	67561. 10971	5561.83	R.P. + adit dir. pt
51	568258. 35220	67424. 87154	5489.67	R.P. " " " "
52	568760. 27924	65807. 09344	5209.09	T.P.
53	572321. 44400	64965. 48863	5235.25	T.P.
54	572134. 20323	64066. 88900	5224.98	T.P.
55	577286. 14234	63738. 78756	5319.42	T.P.
56	577416. 65565	63708. 15489	5331.29	R.P.
57	578139. 08035	63559. 09920	5366.36	Concr. Mon.
58	576581. 30355	63887. 27587	5334.72	Concr. Mon
59	576995. 19972	61700. 99552	5245.13	R.P.
60	572984. 04195	64808. 89783		T.P.
61	573118. 61592	64485. 37959		T.P.
62	573331. 38982	64269. 92874		T.P.
63	573377. 05050	63935. 93545		T.P.
64	573221. 68328	63727. 58719		T.P.
65	573263. 08241	63527. 32137		T.P.
66	573235. 44099	63128. 27757		T.P.
67	573285. 32146	63124. 62239	5248.36	R.P.
68	573312. 96289	63523. 86619	5238.68	R.P.
69	573213. 29814	62808. 61356	5233.43	EB 10

71	572604.09850	63184.88261		T.P.
72	572784.58478	62852.45585	5223.67	R.P.
73	572942.12630	62506.65147	5216.40	R.P.
74	573081.06163	62249.36810		R.P.
75	573295.56487	61967.82066		
76	572119.87713	63998.13570	5223.77	T.P.
77	571843.40029	63993.36488		T.P.
78	571747.63441	63875.02477	5195.47	T.P.
79	571598.24666	63680.55337		T.P.

FILE LISTING CORRECTION FACTOR= 1

POINT #	NORTH	EAST		
94	571498.62373	63741.02557		T.P.
95	571359.37824	63832.92921		T.P.
96	571302.30882	63548.22266		T.P.
97	571328.81427	63562.57122	5194.03	EB 12
98	571262.00534	62933.90333		T.P.
99	571254.31735	62970.83155	5201.09	R.P.
100	571174.34153	62828.67454	5203.25	EB 13
101	571314.43736	62682.05329	5202.73	R.P.
102	569582.71597	63556.15518	5184.89	EB 14
103	569761.41024	63519.52507	5182.32	R.P.
104	569852.25057	63640.54481	5184.35	R.P.
105	577067.81291	61700.00146		R.P.
106	577086.36596	61788.06839	5241.81	EB 6 Revised
107	576993.60071	61347.73374	5319.68	EB 7
108	576890.52820	60858.47301	5373.49	EB 8
109	576786.09720	60362.76383	5475.64	EB 9
110	573007.22254	62386.10489	5217.60	EB 11 (Revised)
111	562904.60723	67941.58969		T.P.
112	562545.11558	67050.95510		T.P.
113	562434.66739	67074.16235	5204.31	Concr. Mon.
114	563172.72085	66919.08339	5211.26	Concr. Mon.
			5158.01	New. Pos. of EB 15

These are co-ordinates as required in letter from Elco.

FILE LISTING CORRECTION FACTOR= 1

POINT #	NORTH	EAST	
80	571328.48767	63561.28987	EB 12
81	561851.81452	67088.70622	EB 18
82	561656.15490	66159.07332	EB 19
83	571174.01955	62827.36917	EB 13
84	565683.67528	65873.45187	EB 15
85	563529.20716	65139.53116	EB 16
86	563592.68103	65649.30224	EB 17
87	569303.57854	63679.63658	EB 14
88	573059.05630	62072.95785	EB 11
89	573213.52442	62806.87855	EB 10
90	576787.93831	60368.42303	EB 9
91	576890.91706	60857.70350	EB 8
92	576993.89580	61346.98397	EB 7
93	577096.87455	61836.26444	EB 6

T.P. = Traverse point. R.P. = Reference Point. Ex. pt. = Existing Point.

Line 110+00. N.

Station	Grid Northing	Base Line Northing	Grid Easting	Base Line Easting	Elevation
EB 47	553681	109+99	72277	35+01	5807
30	553715		72435		5845
31	553749		72597		5876
EB 50	553785	110+00	72766	40+00	5917
32	553785		72771		5917
33	553812		72899		5954
34	553834		73002		5979
35	553872		73181		6069
36	553910		73363		6145
37	553940		73505		6203
38	553963		73613		6238
39	553976		73679		6244
EB 53	553991	110+00	73745	50+00	6245
40	554006		73818		6256
42	554167		74585		6545
EB 55	554197	110+00	74723	60+00	6545

Line 130+00. N.

Station	Grid Northing	Base Line Northing	Grid Easting	Base Line Easting	Elevation
EB 46	555637	129+99	71858	34+93	5739
60	555648		71913		5756
61	555672		72024		5782
62	555694		72132		5826
63	555738		72337		5912
EB 49	555742	130+00	72354	40+00	5912
64	555763		72452		5952
65	555809		72672		6013
66	555854		72884		6043
EB 52	555866	130+00	72941	46+00	6043
67	555909		73151		6093
EB 54	555948	130+00	73333	50+00	6142

Line 150+00. N.

Station	Grid Northing	Base Line Northing	Grid Easting	Base Line Easting	Elevation
EB 45	557505	150+12	70960	29+99	5692
70	557596		71345		5747
EB 48	557596	150+00	71453	35+00	5747
71	557644		71550		5786
72	557698		71778		5859
73	557735		71934		5922
EB 51	557699	150+00	71942	40+00	5922

SEAM NO. 1

AREA: BIG WEARY RIDGE		
SAMPLE NO.:		EB-53-8
LAB. NO.:		7083
SAMPLE INTERVAL (FROM-TO) (FT.):		702.0-704.5
SEAM DESIGNATION		SEAM 1
RAW COAL		
INHERENT MOISTURE	% ad	0.6
ASH	% db	25.8ad 25.9
VOLATILE MATTER	% db	18.3ad 18.4
FIXED CARBON	% ad	55.4 55.7dg
SULPHUR	% db	1.73
HARDGROVE GR. INDEX		89
SIZE FRACTION		
1/4"x65M	weight %	94.6
65Mx0	weight %	5.4
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)		
YIELD 1/4"x65M	weight %	75.5
TOTAL YIELD, EXCL. 65Mx0	weight %	71.4
INHERENT MOISTURE	% ad	0.7
ASH	% db	7.5
VOLATILE MATTER	% dab	24.4
FIXED CARBON	% dab	75.7
SULPHUR	% db	0.99
PHOSPHORUS	% db	Trace
FSI		9
SOFTENING TEMP.	°C.	379
RESOLIDIFC. TEMP.	°C.	466
CONTRACTION	%	27
DILATATION	%	225
G-VALUE		1.088

SEAM NO. 2

AREA: BIG WEARY RIDGE							
SAMPLE NO.:		EB-31-13	EB-47-10	EB-52-3	EB-52-4	EB-53-6	EB-53-7
LAB. NO.:		5121	7226	6618	6619	7081	7082
SAMPLE INTERVAL (FROM-TO) (FT.):		1216.8-1250.6	1081.3-1095.0	296.0-309.0	314.3-322.0	643.0-652.5	657.0-666.0
SEAM DESIGNATION:		SEAM 2	SEAM 2	SEAM 2	SEAM 2	SEAM 2	SEAM 2
RAW COAL							
INHERENT MOISTURE	% ad	0.5	0.6	0.7	0.6	0.9	0.8
ASH	% db	24.2	81.7	38.4	21.9	44.5	28.0
VOLATILE MATTER	% db	18.3	7.0	19.2	17.8	13.6	18.8
FIXED CARBON	% ad	57.2	11.2	42.1	59.9	41.5	52.8
SULPHUR	% db	0.35	0.22	0.35	0.58	0.25	0.44
HARDGROVE GR. INDEX		120	63	86	82	86	77
SIZE FRACTION							
1/4"x65M	weight %	82.0	92.3	86.8	91.1	82.3	92.3
65MxO	weight %	18.0	7.7	13.2	8.9	17.7	7.7
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)							
YIELD 1/4"x65M	weight %	73.5	8.9	57.2	74.6	48.8	70.2
TOTAL YIELD, EXCL. 65MxO	weight %	60.3	8.2	49.7	68.0	40.2	64.8
INHERENT MOISTURE	% ad	1.2	1.0	0.7	0.6	0.9	0.6
ASH	% db	7.1	8.4	7.4	9.1	9.2	9.2
VOLATILE MATTER	% dab	20.8	21.1	20.3	20.6	20.4	21.8
FIXED CARBON	% dab	79.3	79.0	79.8	79.5	79.7	78.3
SULPHUR	% db	0.36	0.57	0.58	0.50	0.44	0.57
PHOSPHORUS	% db		0.03	0.02	0.02	0.01	Trace
FSI		8-1/2	7-1/2	9	8-1/2	8-1/2	9
SOFTENING TEMP.	^{o}C.	408	414	401	412	397	392
RESOLIDIFC. TEMP.	^{o}C.	478	469	469	476	466	466
CONTRACTION	%	28	19	27	25	25	27
DILATATION	%	12	10	54	43	28	75
G-VALUE		0.970	0.981	1.027	1.019	1.004	1.042

SEAM NO. 3

AREA: BIG WEARY RIDGE							
SAMPLE NO.:		EB-31-12	EB-36-19	EB-47-9	EB-51-3	EB-52-2	EB-53-5
LAB. NO.:		5120	5977	7225	7228	6617	7080
SAMPLE INTERVAL (FROM-TO) (FT.):		1031.0-1048.5	1309.5-1329.0	1046.0-1053.0	311.0-323.0	250.0-260.0	607.0-611.0
SEAM DESIGNATION:		SEAM 3 OR 4	SEAM 3 OR 4	SEAM 3	SEAM 3 OR 4	SEAM 3 OR 4	SEAM 3
RAW COAL							
INHERENT MOISTURE	% ad	0.3	0.7	0.8	0.8	0.9	0.3
ASH	% db	30.3	40.7	64.3	42.4	16.4	8.2
VOLATILE MATTER	% db	15.6	13.9	10.0	7.7	21.1	18.8
FIXED CARBON	% ad	54.0	45.1	25.5	49.5	62.0	72.8
SULPHUR	% db	0.33	0.29	0.16		0.78	0.41
HARDGROVE GR. INDEX		79		78	98	93	139
SIZE FRACTION							
1/4"x65M	weight %	91.8	88.8	92.2	65.7	92.1	88.8
65Mx0	weight %	8.2	11.2	7.8	34.3	7.9	11.2
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)							
YIELD 1/4"x65M	weight %	67.8	51.6	30.7	38.0	85.8	97.7
TOTAL YIELD, EXCL. 65Mx0	weight %	62.2	45.8	28.3	25.0	79.0	86.8
INHERENT MOISTURE	% ad	0.5	0.9	1.3	1.5	0.9	2.9
ASH	% db	8.6	8.6	6.1		6.6	5.7
VOLATILE MATTER	% dab	19.1	18.9	21.4		25.2	21.2
FIXED CARBON	% dab	80.9	81.2	78.7		74.9	78.7
SULPHUR	% db	0.40	0.47	0.54		0.82	0.39
PHOSPHORUS	% db		0.05	0.02		0.06	0.06
FSI		3-1/2	3-1/2	9	3	9	8
SOFTENING TEMP.	°C	417	425	409	406	390	402
RESOLIDIFC. TEMP.	°C	477	478	469		455	465
CONTRACTION	%	21	13	22	23	29	25
DILATATION	%	-21	-13	43		173	8
G-VALUE				1.023		1.058	0.964

SEAM NO. 4

AREA: BIG WEARY RIDGE							
SAMPLE NO.:		EB-31-12	EB-36-19	EB-47-8	EB-51-3	EB-52-2	EB-53-4
LAB. NO.:		5120	5977	7224	7228	6617	7079
SAMPLE INTERVAL (FROM-TO) (FT.):		1031.0-1048.5	1309.5-1329.0	963.0-972.0	311.0-323.0	250.0-260.0	487.0-493.0
SEAM DESIGNATION:		SEAM 3 OR 4	SEAM 3 OR 4	SEAM 4	SEAM 3 OR 4	SEAM 3 OR 4	SEAM 4
RAW COAL							
INHERENT MOISTURE	% ad	0.3	0.7	0.3	0.8	0.9	0.7
ASH	% db	30.3	40.7	20.1	42.4	16.4	19.8
VOLATILE MATTER	% db	15.6	13.9	16.8	7.7	21.1	15.7
FIXED CARBON	% ad	54.0	45.1	63.0	49.5	62.0	64.0
SULPHUR	% db	0.33	0.29	0.42		0.78	0.46
HARDGROVE GR. INDEX		79		84	98	93	85
SIZE FRACTION							
1/4"x65M	weight %	91.8	88.8	92.1	65.7	92.1	91.6
65Mx0	weight %	8.2	11.2	7.9	34.3	7.9	8.4
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)							
YIELD 1/4"x65M	weight %	67.8	51.6	81.5	38.0	85.8	80.6
TOTAL YIELD, EXCL. 65Mx0	weight %	62.2	45.8	75.1	25.0	79.0	73.8
INHERENT MOISTURE	% ad	0.5	0.9	0.5	1.5	0.9	0.9
ASH	% db	8.6	8.6	7.9		6.6	10.7
VOLATILE MATTER	% dab	19.1	18.9	19.1		25.2	18.9
FIXED CARBON	% dab	80.9	81.2	80.9		74.9	81.1
SULPHUR	% db	0.40	0.47	0.48		0.82	0.45
PHOSPHORUS	% db		0.05	0.08		0.06	0.12
FSI		3-1/2	3-1/2	2	3	9	3
SOFTENING TEMP.	°C.	417	425	423	406	390	416
RESOLIDIFC. TEMP	°C.	477	478			455	469
CONTRACTION	%	21	13	16	23	29	8
DILATATION	%	-21	-13			173	-8
G-VALUE						1.058	

SEAM NO. 6

AREA: BIG WEARY RIDGE							
SAMPLE NO.:		EB-31-11	EB-36-18	EB-47-7	EB-51-2	EB-52-1	EB-53-3
LAB. NO.:		5119	5976	7223	7227	6616	7078
SAMPLE INTERVAL (FROM-TO) (FT.):		858.0-864.0	1202.0-1210.0	744.0-760.5	230.0-236.0	138.0-144.5	231.7-234.0
SEAM DESIGNATION:		SEAM 6	SEAM 6	SEAM 6	SEAM 6	SEAM 6	SEAM 6
RAW COAL							
INHERENT MOISTURE	% ad	0.6	0.5	0.5	0.8	0.9	0.7
ASH	% db	39.5	28.0	74.2	60.9	47.2	12.9
VOLATILE MATTER	% db	14.3	16.3	9.1	15.1	13.0	17.4
FIXED CARBON	% ad	45.9	55.4	16.7	23.8	39.4	69.2
SULPHUR	% db	0.50	0.64	0.16		0.37	0.49
HARDGROVE GR. INDEX		79		64	85	90	81
SIZE FRACTION							
1/4"x65M	weight %	92.9	85.3	92.0	67.0	78.9	90.9
65Mx0	weight %	7.1	14.7	8.0	33.0	21.1	9.1
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)							
YIELD 1/4"x65M	weight %	54.2	78.4	15.7	11.4	45.8	93.4
TOTAL YIELD, EXCL. 65Mx0	weight %	50.4	66.9	14.4	7.6	36.1	84.9
INHERENT MOISTURE	% ad	0.5	1.6	0.4	1.6	1.6	0.5
ASH	% db	16.2	7.3	9.7		5.7	8.3
VOLATILE MATTER	% dab	21.2	21.0	20.7		20.1	19.9
FIXED CARBON	% dab	78.9	79.1	79.3		80.0	80.1
SULPHUR	% db	.70	0.75	0.56		0.69	0.55
PHOSPHORUS	% db		0.04	0.03		0.06	0.07
FSI		8	9	3	8	8-1/2	3-1/2
SOFTENING TEMP.	°C.	408	411	413	406	392	425
RESOLIDIFC. TEMP.	°C.	475	472		467	459	465
CONTRACTION	%	18	19	17	21	18	19
DILATATION	%	28	17		45	166	-19
G-VALUE		1.017	0.996		1.026	1.068	

SEAM NO. 7

AREA: BIG WEARY RIDGE						
SAMPLE NO.:		EB-31-10	EB-36-17	EB-47-6	EB-51-1	EB-53-2
LAB. NO.:		4533	5975	7222	7075	7077
SAMPLE INTERVAL (FROM-TO) (FT.):		778.5-787.0	1115.2-1124.0	663.0-684.0	170.6-178.0	202.0-208.0
SEAM DESIGNATION:		SEAM 7	SEAM 7	SEAM 7	SEAM 7	SEAM 7
RAW COAL						
INHERENT MOISTURE	% ad	0.6	0.8	0.7	0.7	0.7
ASH	% db	22.0	66.5	45.7	14.3	32.6
VOLATILE MATTER	% db	16.0	10.7	13.5	18.0	16.5
FIXED CARBON	% ad	61.6	22.6	40.5	67.2	50.5
SULPHUR	% db	0.52	0.26	0.42	0.48	0.43
HARDGROVE GR. INDEX		101		89	122	84
SIZE FRACTION						
1/4"x65M	weight %	92.2	91.1	90.7	89.2	78.2
65Mx0	weight %	7.8	8.9	9.3	10.8	21.8
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)						
YIELD 1/4"x65M	weight %	65.0	11.1	54.0	87.4	59.4
TOTAL YIELD, EXCL. 65Mx0	weight %	59.9	10.1	49.0	78	46.5
INHERENT MOISTURE	% ad	3.1	1.4	2.0	1.9	0.7
ASH	% db	7.8	8.4	8.1	3.3	9.7
VOLATILE MATTER	% dab	20.7	20.8	22.1	20.3	21.3
FIXED CARBON	% dab	79.2	79.2	77.9	78.4	78.7
SULPHUR	% db	0.79	0.87	0.64	0.54	0.55
PHOSPHORUS	% db		0.19	0.10	0.03	0.15
FSI		2-1/2	+9	7	+9	7-1/2
SOFTENING TEMP.	°C.	421	412	409	401	420
RESOLIDIFC. TEMP.	°C.	450	470		467	478
CONTRACTION	%	12	26	18	22	23
DILATATION	%		24		46	-7
G-VALUE			0.997		1.028	0.892

SEAM NO. 8

AREA: BIG WEARY RIDGE

SAMPLE NO.:		EB-31-8	EB-36-16	EB-47-4	EB-53-1
LAB. NO.:		4531	5974	7220	7076
SAMPLE INTERVAL (FROM-TO) (FT.):		509.3-533.5	1008.0-1047.0	585.0-599.0	96.0-116.5
SEAM DESIGNATION:		SEAM 8	SEAM 8	SEAM 8	SEAM 8
RAW COAL					
INHERENT MOISTURE	% ad	0.6	0.7	0.3	0.6
ASH	% db	33.2	29.8	10.1	10.8
VOLATILE MATTER	% db	24.1	16.3	19.8	19.4
FIXED CARBON	% ad	42.4	53.5	69.9	69.4
SULPHUR	% db	0.37	0.37	0.39	0.46
HARDGROVE GR. INDEX		73		108	102
SIZE FRACTION					
1/4"x65M	weight %	94.0	86.3	90.3	87.3
65MxO	weight %	6.0	13.7	9.7	12.7
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)					
YIELD 1/4"x 65M	weight %	54.4	62.8	90.1	91.7
TOTAL YIELD, EXCL. 65MxO	weight %	51.1	54.2	81.4	80.1
INHERENT MOISTURE	% ad	0.9	1.3	0.9	1.0
ASH	% db	9.2	8.4	7.0	8.1
VOLATILE MATTER	% dab	20.5	20.8	21.7	21.3
FIXED CARBON	% dab	79.6	79.1	78.4	78.7
SULPHUR	% db	0.55	0.45	0.43	0.46
PHOSPHORUS	% db		0.12	0.12	0.14
FSI		3-1/2	4-1/2	7	6
SOFTENING TEMP.	°C.	423	418	407	415
RESOLIDIFC. TEMP.	°C.	477		456	
CONTRACTION	%	12	18	24	16
DILATATION	%			-24	
G-VALUE					

SEAM NO. 8A

AREA: BIG WEARY RIDGE

SAMPLE NO.:		EB-31-9	EB-47-5
LAB. NO.:		4532	7221
SAMPLE INTERVAL (FROM-TO) (FT.):		675.5-708.0	609.6-615.0
SEAM DESIGNATION:		SEAM 8A	SEAM 8A
RAW COAL			
INHERENT MOISTURE	% ad	0.6	0.4
ASH	% db	30.5	29.8
VOLATILE MATTER	% db	17.6	19.5
FIXED CARBON	% ad	51.2	50.5
SULPHUR	% db	0.33	0.60
HARDGROVE GR. INDEX		85	85
SIZE FRACTION			
1/4"x65M	weight %	91.0	94.5
65MxO	weight %	9.0	5.5
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)			
YIELD 1/4"x65M	weight %	64.8	64.2
TOTAL YIELD, EXCL. 65MxO	weight %	59.0	60.7
INHERENT MOISTURE	% ad	2.0	0.4
ASH	% db	8.0	7.4
VOLATILE MATTER	% dab	20.8	23.3
FIXED CARBON	% dab	79.3	76.6
SULPHUR	% db	0.53	0.73
PHOSPHORUS	% db		0.11
FSI		6-1/2	9
SOFTENING TEMP.	^{o}C.	422	408
RESOLIDIFC. TEMP.	^{o}C.		476
CONTRACTION	%	12	29
DILATATION	%	-12	116
G-VALUE			1.048

SEAM NO. 9

AREA: BIG WEARY RIDGE						
SAMPLE NO.:		EB-27-9	EB-31-6	EB-31-7	EB-36-15	EB-47-3
LAB. NO.:		5138	4529	4530	5148	7219
SAMPLE INTERVAL (FROM-TO) (FT.):		938.5-940.5	396.7-406.0	481.0-485.5	868.1-885.2	440.5-449.5
SEAM DESIGNATION		Seam 9	Seam 9	Seam 9	Seam 9	Seam 9
RAW COAL						
INHERENT MOISTURE	% ad	0.4	0.8	0.6	0.5	0.4
ASH	% db	21.2	30.0	30.7	53.5	24.0
VOLATILE MATTER	% db	21.2	16.8	16.1	12.9	18.1
FIXED CARBON	% ad	57.4	52.7	52.9	33.5	57.7
SULPHUR	% db	0.78	0.66	0.37	0.39	0.50
HARDGROVE GR. INDEX		89	83	74	76	81
SIZE FRACTION						
1/4"x65M	weight %	94.5	92.2	94.3	87.4	93.1
65Mx0	weight %	5.5	7.8	5.7	12.6	6.9
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.						
YIELD 1/4"x65M	weight %	81.6	59.8	64.0	25.1	70.8
TOTAL YIELD,EXCL. 65Mx0	weight %	77.1	55.1	60.4	21.9	65.9
INHERENT MOISTURE	% ad	0.6	1.1	1.1	1.7	0.5
ASH	% db	6.2	7.2	7.1	14.5	9.1
VOLATILE MATTER	% dab	26.4	22.1	20.6	22.4	21.1
FIXED CARBON	% dab	73.5	77.9	79.4	77.6	78.9
SULPHUR	% db		0.83	0.65	0.62	0.61
PHOSPHORUS	% db	0.05			0.04	0.08
FSI		9	9	5	8	3
SOFTENING TEMP.	^{o}C	393	407	429	415	419
RESOLIDIFC. TEMP.	^{o}C	457	465	468	441	
CONTRACTION	%	26	20	13	5	22
DILATATION	%	247	89		-5	
G-VALUE		1.065	1.044			

SEAM NO. 10

AREA: BIG WEARY RIDGE									
SAMPLE NO.:	EB-27-6	EB-27-7	EB-27-8	EB-31-3	EB-31-4	EB-31-5	EB-36-13	EB-36-14	EB-47-2
LAB. NO.:	4893	4894	5137	4526	4527	4528	5146	5147	7218
SAMPLE INTERVAL (FROM-TO) (FT.):	598.0-607.0	653.5-657.7	748.2-760.5	125.2-142.6	229.1-239.5	268.5-286.0	759.0-779.8	800.0-812.0	244.0-268.0
SEAM DESIGNATION:	Seam 10	Seam 10	Seam 10	Seam 10	Seam 10	Seam 10	Seam 10	Seam 10	Seam 10
RAW COAL									
INHERENT MOISTURE % ad	0.3	0.3	0.6	0.7	0.7	0.7	0.5	0.4	0.5
ASH % db	14.9	36.5	25.3	25.4	25.6	12.8	52.0	34.6	32.5
VOLATILE MATTER % db	25.0	22.8	20.8	19.0	18.0	18.8	21.0	18.2	1.82
FIXED CARBON % ad	59.9	40.6	53.6	55.2	56.0	67.7	26.9	47.0	49.1
SULPHUR % db	0.52	0.78	0.48	0.68	0.70	0.55	0.26	0.37	0.44
HARDGROVE GR. INDEX	87	73	92	87	88	93	71	71	81
SIZE FRACTION									
1/4"x65M weight %	89.8	94.3	89.9	90.3	90.5	89.2	86.1	90.1	92.5
65Mx0 weight %	10.2	5.7	10.1	9.7	9.5	10.8	13.9	9.9	7.5
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)									
YIELD 1/4"x65M weight %	86.3	61.2	86.6	67.0	70.3	88.5	32.9	50.1	60.5
TOTAL YIELD,EXCL. 65Mx0 weight %	77.5	57.7	77.9	60.5	63.6	78.9	28.3	45.1	56.0
INHERENT MOISTURE % ad	0.8	0.8	1.1	1.4	1.0	1.5	1.3	1.1	0.6
ASH % db	5.3	6.6	5.2	8.6	8.1	5.6	6.4	9.0	7.1
VOLATILE MATTER % dab	29.4	29.0	26.0	23.2	22.6	21.7	20.4	21.0	22.1
FIXED CARBON % dab	70.7	76.1	74.1	75.3	77.3	79.1	79.7	79.1	77.8
SULPHUR % db	0.09	0.14	0.04			0.73	0.64	0.54	0.57
PHOSPHORUS % db							0.03	0.10	0.06
FSI	8 1/2	9	9	8 1/2	8	7	3	3	7 1/2
SOFTENING TEMP. °C	390	390	403	405	413	414	421	466	405
RESOLIDIFC. TEMP. °C	456	456	458	462	468		464	488	465
CONTRACTION %	7	16	25	21	18	12	10	2	25
DILATATION %	163	184	49	69	22	-12	-10	-2	2
G-VALUE	1.077	1.070	1.021	1.036	1.004				0.994

SEAM NO. 12

AREA: LITTLE WEARY RIDGE		EB-6-7	EB-6-8	ARITH-
SAMPLE NO.:		4487	4489	METIC
LAB. NO.:		485.8-509.0	511.5-520.6	AVERAGE
SAMPLE INTERVAL (FROM-TO) (FT.):		Seam 12	Seam 12	
SEAM DESIGNATION:				
RAW COAL:				
INHERENT MOISTURE	% ad	1.2	0.8	
ASH	% db	17.7	41.1	
VOLATILE MATTER	% db	22.9	18.7	
FIXED CARBON	% ad	58.7	39.9	
SULPHUR	% db	0.62	0.55	
HARDGROVE GR. INDEX		12.8	84	49
SIZE FRACTION				
1/4"x65M	weight %	80.6	88.6	
65MxO	weight %	19.4	11.4	
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)				
YIELD 1/4x65M	weight %	80.9	49.1	
TOTAL YIELD,EXCL. 65MxO	weight %	65.2	43.5	54.35
INHERENT MOISTURE	% ad	2.9	1.3	
ASH	% db	5.1	8.1	6.6
VOLATILE MATTER	% dab	27.1	29.4	28.25
FIXED CARBON	% dab	72.7	70.4	71.55
SULPHUR	% db	0.65	0.74	0.70
PHOSPHORUS	% db			
FSI		8	8 1/2	8
SOFTENING TEMP.	^{o}C	408	396	
RESOLIDIFICATION TEMP.	^{o}C	453	454	
CONTRACTION	%	7	24	15
DILATATION	%	13	171	92
G-VALUE		1.016	1.054	1.035

SEAM NO. 12

		EB-27-4	EB-27-5	EB-31-1	EB-31-2	EB-36-8	EB-36-9	EB-36-10	EB-36-11	EB-36-12	EB-47-1
AREA: BIG WEARY RIDGE											
SAMPLE NO.:		4891	4892	4524	4525	5141	5142	5143	5144	5145	7217
LAB. NO.:											
SAMPLE INTERVAL (FROM-TO) (FT.):		456.0-460.5	543.5-551.5	41.0-50.8	58.3-61.6	390.0-405.0	463.0-478.0	564.0-581.0	600.0-606.5	657.3-673.7	125.0-128.0
SEAM DESIGNATION:		Seam 12	Seam 12	Seam 12	Seam 12	Seam 12	Seam 12	Seam 12	Seam 12	Seam 12	Seam 12
RAW COAL											
INHERENT MOISTURE	% ad	0.3	0.4	0.7	0.7	0.5	0.6	0.6	0.5	0.6	0.5
ASH	% db	16.0	40.5	15.7	31.7		78.6	28.8	46.4	61.7	40.4
VOLATILE MATTER	% db	27.8	19.1	21.4	18.2		8.8	17.1	13.3	11.8	19.6
FIXED CARBON	% ad	56.1	39.7	62.5	49.7		12.6	53.8	40.1	26.4	39.8
SULPHUR	% db	1.00	0.56	1.06	0.95		0.13	0.44	0.57	0.31	4.80
HARDGROVE GR. INDEX		81	80	107	88	112	50	100	58	64	73
SIZE FRACTION											
1/4"x65M	weight %	96.6	91.8	86.4	90.7	80.6	93.5	79.7	94.4	84.7	93.5
65Mx0	weight %	3.4	8.2	13.6	9.3	19.4	6.5	20.3	5.6	15.3	6.5
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)											
YIELD 1/4"x65M	weight %	79.4	58.2	82.9	61.8	91.2	3.6	71.0	0.5	20.5	46.6
TOTAL YIELD,EXCL. 65Mx0	weight %	76.7	53.4	71.6	56.0	73.5	3.4	56.5	0.5	17.4	43.6
INHERENT MOISTURE	% ad	0.8	1.1	1.9	1.8	1.3	0.9	1.5	1.6	1.3	0.6
ASH	% db	6.2	7.0	6.1	5.7	5.5	10.4	6.7	22.4	6.6	7.6
VOLATILE MATTER	% dab	29.6	29.3	23.7	25.9	25.4	24.4	22.5		22.0	23.6
FIXED CARBON	% dab	70.5	70.9	75.8	74.2	74.7	75.6	77.6		78.0	76.5
SULPHUR	% db			0.99	1.27	0.68		0.78		0.74	0.87
PHOSPHORUS	% db	0.10	0.08			0.08	0.10	0.04		0.09	0.09
FSI		8 1/2	9	9	9	9	9	7		9	9
SOFTENING TEMP.	°C	381	394	411	402	393	393	399		406	398
RESOLIDIFC. TEMP.	°C	455	456	457	457	458	460	470		423	460
CONTRACTION	%	28	16	7	15	26	27	23		26	19
DILATATION	%	198	190	54	167	79	53	20		0	100
G-VALUE		1.071	1.066	1.043	1.057	1.040	1.026	0.461		0.929	1.052

SEAM NO. 13

AREA: LITTLE WEARY RIDGE					
SAMPLE NO.:			EB-6-6	EB-15-14	ARITH-
LAB. NO.:			4486	3810	METIC
SAMPLE INTERVAL (FROM-TO) (FT.):			338.0-356.4	425.9-444.8	AVERAGE
			Seam 13	Seam 13	
RAW COAL					
INHERENT MOISTURE	% ad		1.1	0.8	
ASH	% db		27.7	52.2	
VOLATILE MATTER	% db		21.7	16.1	
FIXED CARBON	% ad		50.2	31.4	
SULPHUR	% db		0.60	0.54	
HARDGROVE GR. INDEX			97	85	91
SIZE FRACTION					
1/4"x65M	weight %		91.0	86.8	
65Mx0	weight %		9.0	13.2	
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)					
YIELD 1/4"x65M	weight %		67.6		
TOTAL YIELD,EXCL. 65Mx0	weight %		61.5	37.9	49.7
INHERENT MOISTURE	% ad		1.7	2.0	
ASH	% db		6.1	5.4	5.7
VOLATILE MATTER	% dab		28.8	25.9	27.35
FIXED CARBON	% dab		71.1	73.9	72.5
SULPHUR	% db		0.76	1.28	1.02
PHOSPHORUS	% db				
FSI			8 1/2	7	8
SOFTENING TEMP.	^{o}C		394	397	
RESOLIDIFC. TEMP.	^{o}C		451	456	
CONTRACTION	%		24	25	24
DILATATION	%		127	111	119
G-VALUE			1.048	1.046	1.047

SEAM NO.: 13

AREA: BIG WEARY RIDGE													
SAMPLE NO.:		EB-27-2	EB-27-3	EB-36-1	EB-36-2	EB-36-3	EB-36-4	EB-36-5	EB-36-6	EB-36-7	EB-42-3	EB-42-4	EB-42-5
LAB. NO.:		4889	4890	4895	4896	4897	4898	4899	4900	5140	6613	6614	6615
SAMPLE INTERVAL (FROM-TO) (FT.):		313.5-320.5	332.0-339.5	86.0-101.0	108.0-120.0	128.0-139.0	157.3-162.5	241.5-245.0	301.0-308.7	345.0-351.3	278.0-285.0	315.5-320.0	326.0-329.8
SEAM DESIGNATION:		Seam 13	Seam 13	Seam 13	Seam 13	Seam 13	Seam 13	Seam 131	Seam 13	Seam 13	Seam 13	Seam 13	Seam 13
RAW COAL													
INHERENT MOISTURE	% ad	0.5	0.5	0.3	0.5	0.7	0.4	0.5	0.4	0.4	0.6	0.9	1.0
ASH	% db	8.8	17.0	20.2	59.0	47.7	13.4	36.1	43.8	46.5	29.8	42.1	68.6
VOLATILE MATTER	% db	27.5	26.8	24.7	15.4	16.9	23.1	18.4	17.0	21.4	19.2	16.3	11.8
FIXED CARBON	% ad	63.3	55.9	55.0	25.5	35.1	63.3	45.3	39.1	32.0	50.7	41.3	19.4
SULPHUR	% db	0.46	0.44	0.68	0.55	0.61	0.81	0.65	0.55	0.39	0.74	0.57	1.08
HARDGROVE GR. INDEX		73	73	108	79	81	114	98	102	76	87	98	64
SIZE FRACTION													
1/4"x65M	weight %	95.4	97.6	82.9	88.0	89.7	81.7	80.4	84.4	91.2	89.3	82.6	92.0
65MxO	weight %	4.6	2.4	17.1	12.0	10.3	18.3	19.6	15.6	8.8	10.7	17.4	8.0
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)													
YIELD 1/4"x65M	weight %	93.3	84.3	76.5	33.6	38.9	87.8	69.9	55.3	43.3	68.2	49.2	19.4
TOTAL YIELD,EXCL. 65MxO	weight %	89.0	82.3	63.4	29.6	34.9	71.7	56.2	46.7	39.5	60.9	40.6	17.8
INHERENT MOISTURE	% ad	1.0	0.8	1.2	1.0	1.1	1.1	0.9	1.1	1.3	0.6	1.1	1.0
ASH	% db	4.3	4.1	7.8	5.5	11.1	3.6	9.5	6.3	5.2	9.2	8.9	8.9
VOLATILE MATTER	% dab	29.5	30.5	27.3	26.3	27.0	26.0	23.0	25.6	24.1	28.7	24.7	20.6
FIXED CARBON	% dab	70.8	69.4	72.7	73.8	73.0	74.0	68.1	74.5	76.0	71.3	75.4	57.4
SULPHUR	% db			0.92	0.80	0.85	0.97	1.06	0.81	0.76	0.99	0.92	2.76
PHOSPHORUS	% db	0.07	0.06	0.06	0.06	0.12	0.04	0.08	0.10	0.09	0.07	0.11	0.04
FSI		9	9	9	9	8 1/2	9	9	9	9	9	8 1/2	8 1/2
SOFTENING TEMP.	oC	374	386	385	387	388	399	392	396	411	392	410	410
RESOLIDIFC. TEMP.	oC	452	456	453	454	453	457	457	459	473	460	459	474
CONTRACTION	%	27	30	24	16	28	26	26	25	19	23	27	29
DILATATION	%	109	185	198	183	150	177	134	104	15	155	37	6
G-VALUE		1.060	1.064	1.068	1.072	1.056	1.053	1.054	1.047	0.992	1.063	1.009	0.995

SEAM NO. 14

AREA: LITTLE WEARY RIDGE.

SAMPLE NO.:		EB-6-1	EB-6-2	EB-6-3	EB-6-4	EB-6-5	EB-12-10	EB-14-8	EB-15-11	EB-15-12	EB-15-13	EB-18-8	EB-18-9	EB-18-10	
LAB. NO.:		4481	4482	4483	4484	4485	3972	4082	3807	3808	3809	3586	3587	3588	
SAMPLE INTERVAL (FROM-TO) (FT.):		141.5-149.7	168.0-171.0	240.0-248.5	250.0-266.4	275.3-279.8	643.0-652.5	440.4-450.5	282.3-285.1	309.8-313.6	390.4-395.8	564.5-568.0	591.2-597.9	628.6-632.4	
SEAM DESIGNATION:		SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	SEAM 14	ARITHMETIC AVERAGE
RAW COAL															
INHERENT MOISTURE	% ad	1.0	0.8	0.9	1.0	0.8	0.7	1.0	0.5	0.7	1.0	0.8	0.9	0.9	
ASH	% db	15.3	42.7	34.7	39.4	30.9	21.3	17.6	7.8	35.7	41.0	21.6	14.8	34.7	
VOLATILE MATTER	% db	26.8	19.7	20.6	21.5	22.7	23.1	27.3	24.1	20.0	17.0	22.4	24.3	20.6	
FIXED CARBON	% ad	57.4	37.3	44.3	38.7	46.1	55.3	54.6	67.7	44.0	41.6	55.6	60.3	44.3	
SULPHUR	% db	0.66	0.77	0.51	0.70	1.01	0.73	0.46	0.94	0.72	0.72	0.75	0.65	0.65	
HARDGROVE GR. INDEX		92	67		93	95	85	109	87	85	76				88
SIZE FRACTION															
1/4"x65M	weight %	91.2	93.0	87.1	84.9	76.8	93.1	86.9	92.4	90.9	92.2	92.0	85.8	92.9	
65MxO	weight %	8.8	7.0	12.9	15.1	23.2	6.9	13.1	7.6	9.1	7.8	8.0	14.2	7.1	
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)															
YIELD 1/4"x65M	weight %	85.8	40.2	61.3	50.3	55.5	72.1	82.7	93.8	51.0	42.0	70.3	85.8	43.7	
TOTAL YIELD, EXCL. 65MxO	weight %	78.2	37.4	53.3	42.7	42.6	67.1	71.9	86.7	46.4	38.7	64.7	73.6	40.6	57.22
INHERENT MOISTURE	% ad				2.8		0.8	2.2	0.8	0.8	0.8	0.8	1.3	0.6	
ASH	% db				4.7		5.3	5.6	5.0	4.4	9.8	5.0	8.4	9.7	6.4
VOLATILE MATTER	% dab				29.8		28.4	33.3	27.1	28.2	25.2	27.5	28.2	27.9	28.4
FIXED CARBON	% dab				70.0		71.5	66.7	73.0	73.1	74.7	72.5	72.0	72.0	71.7
SULPHUR	% db				0.73		0.83	0.89	0.97	0.91	0.96	0.94	0.93	0.90	0.89
PHOSPHORUS	% db														
FSI		9	8-1/2	8	9	8-1/2	8-1/2	8-1/2	8	8	7-1/2	9	8	7-1/2	8-1/2
SOFTENING TEMP.	°C.	393	388	408	392	386	364	382	397	388	394	376	383	382	
RESOLIDIFC. TEMP.	°C.	450	455	453	447	450	443	445	456	454	456	448	454	448	
CONTRACTION	%	21	22	7	24	23	27	17	23	26	24	27	16	27	22
DILATATION	%	185	284	159	123	232	267	139	252	258	164	223	217	230	210
G-VALUE		1.057	1.073	1.050	1.046	1.067	1.086	1.063	1.061	1.068	1.057	1.074	1.079	1.067	1.065

SEAM NO. 14

AREA: BIG WEARY RIDGE				
SAMPLE NO.:		EB-27-1	EB-33-5	EB-42-2
LAB'S NO.:		4888	5973	6612
SEAM INTERVAL (FROM-TO) (FT.):		144.5-152.5	620.0-?	227.5-241.5
SEAM DESIGNATION:		SEAM 14	SEAM 14	SEAM 14
RAW COAL				
INHERENT MOISTURE	% ad	0.6	0.9	0.6
ASH	% db	9.2	10.3	9.6
VOLATILE MATTER	% db	29.8	23.7	18.3
FIXED CARBON	% ad	60.7	65.4	71.7
SULPHUR	% db	0.69	0.37	0.44
HARDGROVE GR. INDEX		111		111
SIZE FRACTION				
1/4"x65M	weight %	83.8	90.6	84.9
65MxO	weight %	16.2	9.4	15.1
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.6 SINK-FLOAT S.G.)				
YIELD 1/4"x65M	weight %	93.0	92.5	91.5
TOTAL YIELD, EXCL. 65MxO	weight %	77.9	83.8	77.7
INHERENT MOISTURE	% ad	2.0	[illegible]	1.2
ASH	% db	3.4	[illegible]	6.3
VOLATILE MATTER	% dab	32.5	25.[illegible]	20
FIXED CARBON	% dab	67.5	74.2	
SULPHUR	% db		0.44	
PHOSPHORUS	% db	0.06	0.02	
FSI		9	9	8-1/2
SOFTENING TEMP.	^{o}C.	366	388	417
RESOLIDIFC. TEMP.	^{o}C.	444	458	470
CONTRACTION	%	30	24	24
DILATATION	%	168	61	20
G-VALUE		1.072	1.037	0.995

SEAM NO. 15

AREA: LITTLE WEARY RIDGE

SAMPLE NO.:		EB-7-9	EB-10-8	EB-12-9	EB-15-7	EB-15-8	EB-15-9	EB-15-10	EB-16-12	EB-16-13	EB-18-5	EB-18-6	EB-18-7	ARITH-
LAB. NO.:		4489	4518	3971	3803	3804	3805	3806	3775	3776	3583	3584	3585	METIC
SAMPLE INTERVAL (FROM-TO) (FT.):		583.4-626.6	565.0-579.0	588.7-610.7	201.0-205.0	206.7-211.0	245.2-257.5	261.4-270.0	800.9-814.2	868.8-874.5	312.7-314.2	334.5-336.0	338.4-348.2	AVERAGE
SEAM DESIGNATION:		SEAM 15	SEAM 15	SEAM 15	SEAM 15	SEAM 15	SEAM 15	SEAM 15	SEAM 15	SEAM 15	SEAM 15	SEAM 15	SEAM 15	
RAW COAL														
INHERENT MOISTURE	% ad	1.1	0.7	0.8	0.6	0.6	0.6	0.7	0.8	0.7	0.8	0.8	0.9	
ASH	% db	64.7	40.3	19.5	11.8	32.8	26.1	31.5	34.7	33.6	12.7	17.9	19.8	
VOLATILE MATTER	% db	14.1	20.5	23.1	23.7	19.9	20.8	19.5	22.0	21.2	25.7	23.7	23.2	
FIXED CARBON	% ad	21.0	NA	57.0	64.1	47.0	52.8	48.6	43.0	44.9	61.1	57.9	56.5	
SULPHUR	% db	0.52	0.44	0.46	0.71	0.58	0.63	0.67	0.77	0.72	1.09	0.84	0.65	
HARDGROVE GR. INDEX		18	94	93	66	71	79	97	81	71				74
SIZE FRACTION														
1/4"x65M	weight %	92.7	91.0	89.0	87.3	93.6	89.3	88.2	95.3	92.3	94.4	91.0	89.3	
65MxO	weight %	7.3	9.0	11.0	12.7	6.4	10.7	11.8	4.7	7.7	5.6	9.0	10.7	
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)														
YIELD 1/4"x65M	weight %	25.5	54.8	74.4	90.1	59.0	66.7	56.6	66.1	58.2	90.7	78.1	75.1	
TOTAL YIELD, EXCL. 65MxO	weight %	23.6	49.9	66.2	78.7	55.2	59.6	49.9	63.0	53.7	85.6	71.1	67.1	52.7
INHERENT MOISTURE	% ad	1.5	1.4	1.0	0.9	0.7	0.8	3.4	1.0	1.0	0.7	0.9	1.2	
ASH	% db	5.2	5.2	4.6	6.3	5.7	4.9	6.4	5.4	9.8	9.1	9.7	6.1	6.8
VOLATILE MATTER	% dab	30.7	30.4	28.5	26.5	27.7	28.0	27.3	28.1	28.4	30.1	28.0	27.0	28.4
FIXED CARBON	% dab	69.2	NA	71.5	72.7	72.4	72.1	72.7	72.0	71.6	69.8	72.0	72.9	71.7
SULPHUR	% db	0.97	0.65	0.67	0.88	0.80	0.67	1.37	0.75	0.76	1.13	0.82	0.84	0.86
PHOSPHORUS	% db													
FSI		9	9	8-1/2	9	9	8-1/2	8	8-1/2	8-1/2	8	7	8-	8-1/2
SOFTENING TEMP.	°C.	398	398	370	391	391	394	394	384	375	371	377	382	
RESOLIDIFC. TEMP.	°C.	454	450	444	456	460	462	453	453	449	455	450	456	
CONTRACTION	%	17	15	24	24	24	19	24	24	25	25	25	24	23
DILATATION	%	208	257	198	208	233	227	101	118	219	281	143	97	179
G-VALUE		1.059	1.058	1.076	1.065	1.071	1.072	1.045	1.058	1.082	1.092	1.066	1.056	1.067

SEAM NO. 15

AREA: BIG WEARY RIDGE

SAMPLE NO.:		EB-33-4	EB-39-7	EB-42-1
LAB. NO.:		5972	6621	6611
SAMPLE INTERVAL (FROM-TO) (FT.):		468.3-487.3	547.0-574.0	81.6-99.2
SEAM DESIGNATION:		SEAM 15	SEAM 15	SEAM 15
RAW COAL				
INHERENT MOISTURE	% ad	0.9	1.0	0.9
ASH	% db	25.0	7.6	47.0
VOLATILE MATTER	% db	22.8	26.8	16.0
FIXED CARBON	% ad	51.7	65.0	36.6
SULPHUR	% db	0.46	0.89	0.59
HARDGROVE GR. INDEX			88	75
SIZE FRACTION				
1/4"x65M	weight %	87.5	93.4	88.7
65MxO	weight %	12.5	6.6	11.3
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)				
YIELD 1/4"x65M	weight %	85.3	94.0	47.5
TOTAL YIELD, EXCL. 65MxO	weight %	74.6	87.8	42.1
INHERENT MOISTURE	% ad	1.8	1.0	1.6
ASH	% db	4.3	3.1	4.9
VOLATILE MATTER	% dab	28.8	29.0	26.1
FIXED CARBON	% dab	71.2	71.0	74.0
SULPHUR	% db	0.64	1.09	0.84
PHOSPHORUS	% db	0.04	0.03	0.07
FSI		+9	9	9
SOFTENING TEMP.	^{o}C.	383	392	399
RESOLIDIFC. TEMP.	^{o}C.	452	453	454
CONTRACTION	%	26	27	25
DILATATION	%	93	143	84
G-VALUE		1.149	1.052	1.036

SEAM NO. 16

AREA: BIG WEARY RIDGE

SAMPLE NO.:		EB-33-1	EB-33-2	EB-33-3	EB-39-6
LAB. NO.:		5139	5970	5971	6620
SAMPLE INTERVAL (FROM-TO) (FT.):		234.4-238.2	287.0-293.5	366.4-372.7	443.0-449.0
SEAM DESIGNATION:		SEAM 16	SEAM 16	SEAM 16	SEAM 16
RAW COAL					
INHERENT MOISTURE	% ad	0.6	0.7	0.9	0.7
ASH	% db	57.0	52.4	51.5	70.8
VOLATILE MATTER	% db	15.6	19.7	17.6	12.0
FIXED CARBON	% ad	27.2	27.8	30.7	17.1
SULPHUR	% db	0.37	0.31	0.76	0.37
HARDGROVE GR. INDEX		60			56
SIZE FRACTION					
1/4"x65M	weight %	92.5	95.5	94.9	94.6
65MxO	weight %	7.5	4.5	5.1	5.4
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)					
YIELD 1/4"x65M	weight %	32.2	41.3	43.1	22.0
TOTAL YIELD, EXCL. 65MxO	weight %	29.8	39.4	40.9	20.8
INHERENT MOISTURE	% ad	1.1	0.8	0.8	0.4
ASH	% db	8.6	8.1	8.3	6.6
VOLATILE MATTER	% dab	26.9	32.1	29.8	28.1
FIXED CARBON	% dab	73.2	68.0	70.3	71.8
SULPHUR	% db	0.68	0.53	1.26	0.47
PHOSPHORUS	% db	0.11	0.14	0.09	0.05
FSI		9	9	+9	8
SOFTENING TEMP.	^{o}C.	389	381	379	374
RESOLIDIFC. TEMP.	^{o}C.	456	454	455	460
CONTRACTION	%	22	12	18	29
DILATATION	%	110	25	239	68
G-VALUE		1.056	1.086	1.085	1.043

SEAM NO. 17

AREA: LITTLE WEARY RIDGE

SAMPLE NO.:		E3-7-4 4432	E8-7-5 4433	E8-10-2 4512	E8-10-3 4513	E8-10-4 4514	E8-10-5 4515	E8-12-6 3962	E8-12-7 3963	E8-13-0 4032	E8-13-9 4033	E8-14-9 4083	E8-14-10 4084	E8-14-11 4085	E8-14-12 4086	E8-16-6 3686	E8-16-7 3770	E8-16-8 3771	E8-17-7 3507	E8-17-8 3508	E8-17-9 3509	E8-17-10 3510	E8-19-2 3687	E8-19-3 3688	E8-19-4 3689	
LAB. NO.:																										
SAMPLE INTERVAL (FROM-TO) (FT.):		303.0-311.6	314.0-320.7	151.2-155.5	290.0-292.0	314.1-333.8	354.0-356.5	337.2-340.2	365.7-369.0	549.3-551.8	598.3-605.0	626.3-629.0	708.8-711.0	712.7-714.7	758.3-769.4	412.05-415.4	504.3-509.1	543.6-555.0	429.4-431.0	436.6-437.6	451.0-457.5	530.6-532.2	446.0-450.0	363.9-365.4	391.1-393.3	ARITHMETIC AVERAGE
SEAM DESIGNATION:		SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	SEAM 17	
RAW COAL																										
INHERENT MOISTURE	% ad	0.9	1.0	0.7	0.7	0.8	0.7	0.8	0.9	0.7	0.6	0.9	0.7	0.7	0.9	0.9	1.0	0.8	0.7	0.8	1.0	0.8	1.0	1.0	0.9	
ASH	% db	26.0	12.2	49.1	61.5	22.5	53.7	18.5	6.2	17.8	43.1	28.2	26.0	32.8	43.9	33.8	17.7	33.9	53.7	12.6	34.1	17.6	26.0	24.6	12.4	
VOLATILE MATTER	% db	25.4	26.0	19.7	15.4	25.2	17.7	25.9	29.0	26.5	21.0	23.5	23.1	21.0	19.0	23.6	23.6	22.6	29.3	27.2	22.6	26.7	26.4	28.6	30.2	
FIXED CARBON	% db	48.1	59.1	NA	NA	NA	NA	55.5	64.3	55.3	35.7	47.9	50.6	45.5	NA	42.5	58.1	43.2	29.1	59.7	42.8	55.2	47.2	46.6	56.9	
SULPHUR	% db	0.96	0.71	0.40	0.95	NA	0.52	NA	1.03	0.43	0.42	0.75	0.71	0.67	0.65	0.65	0.55	0.67	0.46	0.72	0.63	1.00	1.16	1.11	1.09	
HARDGROVE GR. INDEX		70	125	61		78	50	78	115	80	71		80	70		112	68	73	55	75	97	NA	105	112	81	83
SIZE FRACTION																										
1/4"x65M	weight %	90.6	71.3	92.5	88.3	90.4	94.2	95.0	91.3	93.5	92.9	89.7	88.9	94.4	96.0	92.2	90.6	90.3	94.5	95.6	89.3	85.6	82.8	73.0	94.0	
65MxO	weight %	9.4	28.7	7.5	11.7	9.6	5.8	5.0	8.7	6.5	7.1	10.3	11.1	5.6	4.0	7.8	9.4	9.7	5.5	4.4	10.7	81.1	17.2	27.0	6.0	
CLEAN COAL (SIZE FRACTION 1/4"x65Mg																										
1.5 SINK-FLOAT S.G.)																										
YIELD 1/4"x65M	weight %	69.8	87.2	40.9	13.2	76.2	28.7	78.6	95.6	80.4	47.2	58.3	72.6	56.2	61.9	58.4	81.7	53.2	27.0	89.6	60.2	94.8	68.4	75.6	85.4	
TOTAL YIELD, EXCL. 65MxO	weight %	63.2	62.2	37.8	11.6	68.9	27.0	74.7	87.3	75.2	43.8	52.3	64.5	53.1	59.4	53.8	74.0	48.0	25.5	85.7	53.8	91.2	56.6	55.2	80.3	55.0
INHERENT MOISTURE	% ad	1.1	1.3	1.4	NA	1.7	1.3	0.8	1.3	1.6	1.4	1.1	0.9	1.1	1.0	1.1	1.1	1.3	0.9	0.8	1.8	0.7	2.3	1.9	1.4	
ASH	% db	4.5	3.5	4.7	NA	4.0	3.5	3.6	4.7	5.4	9.6	6.9	12.0	9.8	5.4	6.7	3.3	7.5	15.8	9.5	7.0	4.2	4.6	4.6	3.7	6.4
VOLATILE MATTER	% db	32.5	33.4	33.5	NA	30.0	28.4	30.7	30.9	32.0	33.1	31.0	31.5	31.7	30.4	32.5	29.6	31.3	33.8	33.2	32.8	32.3	33.5	34.9	32.9	32.0
FIXED CARBON	% db	67.5	66.5	NA	NA	NA	NA	69.2	69.0	67.0	66.8	68.1	68.6	68.2	69.6	67.6	70.3	68.7	66.1	67.5	67.0	NA	66.5	65.1	67.0	67.7
SULPHUR	% db	0.89	0.67	0.95	NA	0.64	0.98	0.96	1.06	0.99	0.76	1.04	0.93	0.96	0.99	0.96	0.81	0.99	0.94	0.85	1.43	1.02	1.72	1.45	1.22	0.95
PHOSPHORUS	% db																									
FSI		3-1/2	9	9	8-1/2	8-1/2	8-1/2	8-1/2	9	8	8-1/2	8	8-1/2	8	9	7	7-1/2	9	7-1/2	8-1/2	8	8-1/2	8-1/2	8	8-1/2	8-1/2
SOFTENING TEMP.	°C.	388	385	384	390	389	391	370	366	373	378	376	369	376	376	372	388	367	351	359	348	362	372	376	364	
RESOLIDIFC. TEMP.	°C.	454	442	450	455	447	444	448	439	448	454	448	444	444	445	448	453	443	398	426	401	426	450	449	453	
CONTRACTION	%	17	27	26	21	27	24	24	27	23	24	19	18	15	18	23	22	21	30	29	29	28	27	23	26	25
DILATATION	%	230	87	255	296	227	153	241	209	171	200	207	210	233	199	250	37	152	243	203	218	191	202	215	223	211
G-VALUE		1.072	1.038	1.069	1.072	1.058	1.049	1.085	1.075	1.075	1.077	1.078	1.084	1.079	1.075	1.084	1.020	1.076	1.051	1.068	1.057	1.064	1.078	1.077	1.094	1.072

SEAM NO. 17

AREA: BIG WEARY RIDGE

SAMPLE NO.:		EB-39-3	EB-39-4	EB-39-5
LAB. NO.:		5985	5986	5987
SAMPLE INTERVAL (FROM-TO) (FT.):		171.0-174.0	180.0-188.0	228.0-240.0
SEAM DESIGNATION:		SEAM 17	SEAM 17	SEAM 17
RAW COAL				
INHERENT MOISTURE	% ad	0.8	0.7	0.9
ASH	% db	42.2	46.7	50.5
VOLATILE MATTER	% db	22.7	16.6	18.9
FIXED CARBON	% ad	34.8	36.4	30.4
SULPHUR	% db	1.48	0.37	0.30
HARDGROVE GR. INDEX		61	67	56
SIZE FRACTION				
1/4"X65M	weight %	94.7	94.2	96.2
65MxO	weight %	5.3	5.8	3.8
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)				
YIELD 1/4"x65M	weight %	49.4	49.1	35.8
TOTAL YIELD, EXCL. 65MxO	weight %	46.8	46.3	34.4
INHERENT MOISTURE	% ad	1.3	1.2	1.2
ASH	% db	6.3	5.4	5.00
VOLATILE MATTER	% dab	33.3	28.0	31.3
FIXED CARBON	% dab	66.7	72.2	68.8
SULPHUR	% db	1.46	0.51	0.54
PHOSPHORUS	% db	0.12	0.13	0.13
FSI		8-1/2	3-1/2	8
SOFTENING TEMP.	^{o}C.	379	396	382
RESOLIDIFC. TEMP.	^{o}C.	450	455	455
CONTRACTION	%	22	11	19
DILATATION	%	253	18	211
G-VALUE		1.078	1.017	1.078

SEAM NO. 18

AREA: LITTLE WEARY RIDGE																					
SAMPLE NO.:		EB-7-1	EB-7-2	EB-7-3	EB-8-7	EB-10-1	EB-11-12	EB-12-2	EB-12-3	EB-12-4	EB-12-5	EB-13-6	EB-13-7	EB-14-6	EB-14-7	EB-16-3	EB-16-4	EB-16-5	EB-17-6	EB-19-1	
LAB. NO.:		4429	4430	4431	4443	4511	4194	3958	3959	3960	3961	4030	4031	4039	4040	3682	3683	3684	3506	3686	
SAMPLE INTERVAL (FROM-TO) (FT.):		150.6-173.5	180.0-182.2	187.0-189.7	474.8-481.2	55.8-75.6	642.7-662.5	195.6-199.8	234.2-238.6	275.4-291.9	297.3-299.6	443.2-446.2	531.7-544.2	366.3-370.3	388.7-391.6	258.7-261.0	281.0-285.4	312.8-326.7	374.3-379.9	235.5-241.0	ARITHMETIC
SEAM DESIGNATION:		SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	SEAM 18	AVERAGE
RAW COAL																					
INHERENT MOISTURE	% ad	1.0	0.9	0.9	1.0	0.8	1.1	1.1	1.1	1.1	0.9	0.9	0.9	0.9	0.8	1.0	1.1	0.9	0.9	0.9	
ASH	% db	13.3	8.3	28.8	29.3	12.0	18.2	40.0	35.4	33.0	21.4	6.3	20.2	19.9	15.4	44.8	10.0	39.1	7.3	34.9	
VOLATILE MATTER	% db	28.7	30.4	24.6	23.7	27.1	27.8	21.2	22.4	22.1	23.6	26.9	25.5	23.5	27.2	20.4	29.5	21.6	29.6	24.1	
FIXED CARBON	% ad	57.4	60.8	46.2	46.5	NA	53.4	38.3	41.8	44.4	54.5	66.2	53.8	56.1	56.9	34.4	59.8	39.0	62.6	40.6	
SULPHUR	% db	0.41	1.19	0.66	0.71	0.37	0.25	0.82	0.90	0.58	0.75	0.71	0.34	0.62	0.84	0.88	1.05	0.52	0.79	0.61	
HARDGROVE GR. INDEX		108	71	58	66	97	88	59	66	74	74	75	99	69	76	64	82	69	76	63	75
SIZE FRACTION																					
1/4"x65M	weight %	75.3	92.5	95.3	89.6	88.3	94.1	93.2	94.4	91.7	94.1	94.2	84.5	93.8	93.8	91.0	90.5	90.1	92.4	94.0	
65MxO	weight %	24.7	7.5	4.7	10.4	11.7	5.9	6.8	5.6	8.3	5.9	5.8	15.5	6.2	6.2	9.0	9.5	9.9	7.6	6.0	
CLEAN COAL (SIZE FRACTION 1/4"x65M;																					
1.5 SINK-FLOAT S.G.)																					
YIELD 1/4"x65M	weight %	89.7	94.7	52.1	63.8	90.5	78.9	38.2	55.7	58.6	66.7	94.8	74.1	77.0	80.2	31.9	90.7	46.3	93.8	55.9	
TOTAL YIELD, EXCL. 65MxO	weight %	67.5	87.6	49.7	57.2	79.9	74.2	35.6	52.6	53.7	62.8	89.3	62.6	72.2	75.2	29.0	82.1	41.7	86.7	52.5	63.8
INHERENT MOISTURE	% ad	5.1	1.1	0.9	1.6	2.6	1.2	0.8	0.7	1.0	0.7	NA	2.4	1.2	1.2	1.1	1.2	1.3	1.1	1.3	
ASH	% db	4.5	5.8	7.2	7.4	4.5	4.8	8.4	6.2	6.9	5.0	NA	5.4	2.3	4.8	9.5	3.5	7.9	3.0	9.3	5.9
VOLATILE MATTER	% dab	35.0	32.9	33.0	32.8	30.6	32.3	31.9	33.0	31.2	31.0	NA	32.4	29.7	32.5	34.4	32.5	32.4	32.3	34.3	32.4
FIXED CARBON	% dab	64.7	67.0	66.9	67.2	NA	67.7	68.1	67.0	68.7	69.0	NA	67.5	70.2	67.6	65.1	67.6	67.5	64.9	65.5	67.2
SULPHUR	% db	0.59	1.03	0.87	0.83	0.45	0.47	1.14	1.18	0.91	0.99	NA	0.61	0.79	0.94	1.32	1.08	0.81	0.98	0.79	0.88
PHOSPHORUS	% db																				
FSI		8	8-1/2	9	8	7-1/2	8-1/2	8-1/2	8-1/2	8-1/2	9+	6	8	6	8	8	8-1/2	7-1/2	8-1/2	7-1/2	8
SOFTENING TEMP.	°C.	390	381	381	411	398	377	374	358	364	367	394	382	382	381	362	364	368	363	366	
RESOLIDIFC. TEMP.	°C.	449	453	453	454	446	448	447	444	445	450	450	445	442	441	449	446	449	452	451	
CONTRACTION	%	24	22	22	8	21	16	20	24	26	23	15	22	16	17	27	27	26	28	25	22
DILATATION	%	173	190	190	33	60	89	236	272	207	252	182	107	13	141	257	194	239	160	233	170
G-VALUE		1.056	1.073	1.073	1.031	1.028	1.063	1.081	1.099	1.084	1.092	1.060	1.053	0.993	1.061	1.096	1.083	1.087	1.083	1.092	1.068

SEAM NO. 18

AREA: BIG WEARY RIDGE

SAMPLE NO.:		EB-39-1	EB-39-2
LAB. NO.:		5983	5984
SAMPLE INTERVAL (FROM-TO) (FT.):		77.0-96.0	108.3-110.5
SEAM DESIGNATION:		SEAM 18	SEAM 18
RAW COAL			
INHERENT MOISTURE	% ad	1.0	0.9
ASH	% db	21.8	40.0
VOLATILE MATTER	% db	26.5	22.6
FIXED CARBON	% ad	51.2	37.1
SULPHUR	% db	0.51	0.52
HARDGROVE GR. INDEX		77	63
SIZE FRACTION			
1/4"x65M	weight %	92.2	95.6
65MxO	weight %	7.8	4.4
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)			
YIELD 1/4"x65M	weight %	78.0	55.6
TOTAL YIELD, EXCL. 65MxO	weight %	71.9	53.2
INHERENT MOISTURE	% ad	2.9	1.2
ASH	% db	4.0	5.4
VOLATILE MATTER	% dab	32.4	31.6
FIXED CARBON	% dab	67.8	68.6
SULPHUR	% db	0.62	0.88
PHOSPHORUS	% db	0.05	0.04
FSI		8-1/2	7-1/2
SOFTENING TEMP.	^{o}C.	385	385
RESOLIDIFC. TEMP.	^{o}C.	446	453
CONTRACTION	%	23	12
DILATATION	%	183	200
G-VALUE		1.060	1.078

SEAM NO. 19

AREA: LITTLE WEARY RIDGE

		E8-8-1	E8-8-2	E8-8-3	E8-8-4	E8-8-5	E8-8-6	E8-11-5	E8-11-6	E8-11-7	E8-11-8	E8-11-9	E8-11-10	E8-11-11	E8-12-1	E8-13-5	E8-13-4	E8-14-2	E8-14-3	E8-14-4	E8-14-5	E8-16-1	E8-16-2	E8-17-3	E8-17-4	E8-17-5	
SAMPLE NO.:		4437	4438	4439	4440	4441	4442	4187	4188	4189	4190	4191	4192	4193	3957	4029	4028	4035	4036	4037	4038	3680	3681	3503	3504	3505	
LAB. NO.:																											
SAMPLE INTERVAL (FROM-TO) (FT.):		280.0-287.3	324.0-329.5	331.3-333.8	342.1-344.8	351.5-363.5	379.0-382.9	361.0-365.0	394.0-396.7	410.6-413.9	469.6-473.0	476.0-479.1	500.0-503.1	523.5-538.2	182.4-156.7	386.9-390.0	295.3-298.5	171.6-175.3	183.0-186.6	190.0-195.0	200.7-203.0	83.95-93.5	158.6-160.65	213.8-216.4	248.0-250.0	256.2-259.0	
SEAM DESIGNATION:		SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	SEAM 19	
RAW COAL																											
INHERENT MOISTURE	% ad	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	0.8	0.9	0.9	1.1	1.2	1.0	0.8	0.9	0.9	0.9	1.0	0.7	0.9	0.9	0.8	0.9	1.0	
ASH	% db	47.0	19.2	32.9	12.3	31.9	26.7	33.1	23.9	22.2	44.5	37.8	16.2	9.3	37.8	37.7	34.1	33.0	13.5	49.1	17.0	51.7	30.6	21.0	22.6	15.9	
VOLATILE MATTER	% db	20.4	29.5	23.9	30.1	25.1	27.4	24.8	28.0	18.0	21.7	23.2	30.4	27.4	21.2	23.6	23.6	25.3	30.0	19.7	29.3	19.2	26.7	27.1	25.4	26.8	
FIXED CARBON	% db	32.3	50.8	42.7	57.0	42.6	45.5	41.2	47.6	59	33.3	38.6	53.0	62.3	40.6	38.4	41.9	41.3	56.0	30.9	53.3	28.9	42.3	51.3	51.5	52.8	
SULPHUR	% db	0.47	0.62	0.72	0.88	0.62	1.03	0.62	0.79	0.32	0.73	0.84	1.13	0.64	0.88	0.86	0.75	0.58	0.92	0.56	0.86	0.68	2.32	0.95	0.78	1.66	
HARDGROVE GR. INDEX		72	66	62	72	78	62	64	75	114	60	56	73	72	65	59	67	64	88	80	105	53	57	129	65	79	73
SIZE FRACTION																											
1/4"x65M	weight %	93.6	91.3	91.7	88.2	84.4	90.3	95.7	93.4	89.1	96.1	96.6	94.0	94.5	92.8	94.9	94.3	91.5	92.8	86.7	85.2	88.9	87.9	85.0	95.1	90.0	
65MxO	weight %	6.4	8.7	8.3	11.8	15.6	9.7	4.3	6.6	10.9	3.9	3.4	6.0	5.5	7.2	5.1	5.7	8.5	7.2	13.3	14.8	11.1	12.1	15.0	4.9	10.0	
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)																											
YIELD 1/4"x65M	weight %	36.3	78.0	52.2	89.2	63.6	56.3	58.2	65.4	81.0	50.2	43.9	91.1	92.4	56.9	46.9	52.3	54.0	90.0	42.4	84.0	26.6	64.0	80.4	79.8	84.4	
TOTAL YIELD, EXCL. 65MxO	weight %	32.1	71.2	47.5	78.7	53.7	50.8	55.8	61.1	72.2	48.2	42.4	86.6	87.3	52.8	44.8	49.3	49.4	83.5	36.8	71.6	23.6	56.3	68.3	75.9	76.0	59.0
INHERENT MOISTURE	% ad	1.5	1.3	1.5	1.8	3.0	1.8	1.2	1.2	2.3	0.9	0.9	1.1	1.0	0.8	1.0	1.2	1.1	1.9	3.1	2.3	1.0	0.8	1.9	0.9	1.0	
ASH	% db	9.2	5.8	12.9	4.3	4.6	8.5	7.5	7.0	5.2	10.0	10.6	7.2	4.9	9.3	9.4	10.2	3.8	7.7	10.1	4.3	9.9	12.0	5.9	3.6	7.6	7.5
VOLATILE MATTER	% db	37.0	35.9	34.5	35.5	36.7	37.1	35.9	36.0	36.1	36.5	34.7	34.9	30.7	30.6	34.9	34.3	34.5	34.8	35.2	35.6	34.4	37.7	32.0	31.6	35.6	34.9
FIXED CARBON	% db	63.0	64.0	65.4	64.4	63.0	62.7	64.2	63.9	63.7	63.4	65.2	65.0	69.2	69.3	65.0	65.5	67.0	65.0	64.5	64.3	65.5	63.1	66.3	68.4	64.3	65.0
SULPHUR	% db	0.74	0.65	0.81	0.86	0.83	0.72	0.68	0.97	1.32	1.13	1.20	1.15	0.67	1.03	1.13	1.00	0.89	1.08	0.97	1.09	0.96	1.97	1.62	0.96	1.86	1.05
PHOSPHORUS	% db																										
FSI		7	8	7-1/2	8	8-1/2	7-1/2	8	8	9	8	8	8	7	8	7-1/2	8-1/2	8-1/2	8-1/2	8	8	8	6-1/2	8	8-1/2	7-1/2	8
SOFTENING TEMP.	°C.	387	390	393	393	393	389	377	379	398	385	370	373	375	376	388	387	374	377	373	376	364	360	367	377	361	
	°F.	447	450	445	445	442	452	446	445	452	454	447	445	448	452	451	446	447	447	437	436	435	438	412	412	448	
RESOLIDIFC. TEMP.	°C.	10	21	10	21	25	17	19	17	6	18	21	21	15	18	18	14	22	24	15	25	14	12	23	28	28	19
CONTRACTION	%	157	158	133	123	113	179	151	203	192	236	225	204	45	139	276	164	198	167	148	190	207	242	53	57	241	170
DILATATION	%		1.059	1.053	1.046	1.039	1.066	1.070	1.073	1.064	1.076	1.085	1.081	1.046	1.076	1.071	1.063	1.077	1.068	1.069	1.060	1.084	1.097	1.050	1.015	1.093	1.066
G-VALUE		1.058	1.058																								

SEAM NO. 20

AREA: LITTLE WEARY RIDGE

SAMPLE NO.:		EB-9-1	EB-9-2	EB-9-3	EB-9-4	EB-9-5	EB-11-1	EB-11-2	EB-11-3	EB-11-4	EB-13-3	EB-14-1	EB-17-1	EB-17-2	
LAB. NO.:		4406	4407	4408	4409	4410	4087	4088	4089	4090	4027	4034	3501	3502	
SAMPLE INTERVAL (FROM-TO) (FT.):		271.8-275.2	335.0-337.8	390.7-397.5	435.1-437.6	495.3-498.9	29.5-33.5	59.9-64.4	66.5-69.0	130.2-135.0	217.1-225.5	114.9-121.6	61.2-65.5	57.2-59.5	
SEAM DESIGNATION:		SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	SEAM 20	ARITHMETIC AVERAGE
RAW COAL															
INHERENT MOISTURE	% ad	0.9	1.0	0.9	1.0	0.9	1.0	1.2	0.9	1.1	0.8	0.9	0.9	0.7	
ASH	% db	47.3	14.2	32.9	18.4	68.9	30.1	30.7	45.9	30.4	41.8	63.6	20.0	25.4	
VOLATILE MATTER	% db	21.4	32.4	25.7	30.5	14.4	26.6	26.2	22.0	27.3	22.2	14.7	28.3	28.3	
FIXED CARBON	% ad	31.0	52.8	41.0	50.6	16.5	42.9	42.6	31.8	41.8	35.7	21.5	51.3	46.0	
SULPHUR	% db	0.51	2.47	0.79	0.93	0.39	0.73	0.54	0.42	0.73	0.45	0.43	0.70	0.70	
HARDGROVE GR. INDEX		59	61	59	86	50	69	85	66	80	62	83	68	50	68
SIZE FRACTION															
1/4"x65M	weight %	92.1	93.3	91.4	94.4	91.6	93.3	88.9	95.0	92.4	94.4	94.6	93.1	97.2	
65MxO	weight %	7.9	6.7	8.6	5.6	8.4	6.7	11.1	5.0	7.6	5.6	5.4	6.9	2.8	
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)															
YIELD 1/4"x65M	weight %	32.6	86.4	59.7	83.1	18.3	64.1	55.3	59.5	67.2	43.7	23.9	80.0	76.1	
TOTAL YIELD, EXCL. 65MxO	weight %	30.0	80.6	54.6	78.4	16.8	59.8	49.2	56.5	62.1	41.3	22.6	74.5	74.0	53.88
INHERENT MOISTURE	% ad	1.3	1.1	1.3	1.2	1.4	1.5	1.6	1.4	1.3	1.2	1.1	0.9	0.8	
ASH	% db	13.6	5.9	8.6	9.4	8.8	6.7	9.3	8.4	8.9	11.2	8.5	6.1	16.6	9.4
VOLATILE MATTER	% dab	37.1	38.1	37.8	36.9	37.7	36.5	37.3	36.3	35.3	36.0	34.4	33.9	36.6	36.4
FIXED CARBON	% dab	62.8	61.7	62.2	62.9	62.1	63.4	62.5	63.6	64.7	63.8	65.4	66.0	63.3	63.4
SULPHUR	% db	1.17	1.13	0.85	1.01	1.07	1.06	0.89	0.80	0.93	0.75	1.00	0.87	0.89	0.96
PHOSPHORUS	% db														
FSI		7-1/2	6	7	6-1/2	7	7-1/2	7	8-1/2	8	7	NA	8	6	7
SOFTENING TEMP.	°C.	421	380	388	412	388	388	367	376	373	373	387	367	363	
RESOLIDIFC. TEMP.	°C.	478	436	442	476	442	448	433	442	448	443	449	448	449	
CONTRACTION	%	13	9	10	9	15	14	24	21	16	24	17	24	22	17
DILATATION	%	95	138	99	135	155	172	182	153	150	178	130	237	204	156
G-VALUE		1.051	1.064	1.056	1.067	1.057	1.065	1.068	1.065	1.073	1.070	1.060	1.088	1.093	1.067

SEAM NO. 21

		EB-13-1	EB-13-2	ARITH-METIC AVERAGE
AREA: LITTLE WEARY RIDGE				
SAMPLE NO.:		4001	4002	
LAB. NO.:				
SAMPLE INTERVAL (FROM-TO) (FT.):		38.5-46.7	60.4-64.5	
SEAM DESIGNATION:		Seam 21	Seam 21	
RAW COAL				
INHERENT MOISTURE	% ad	0.7	1.0	
ASH	% db	30.8	40.6	
VOLATILE MATTER	% db	32.9	22.6	
FIXED CARBON	% ad	36.0	36.4	
SULPHUR	% db	0.30	0.71	
HARDGROVE GR. INDEX		67	59	63
SIZE FRACTION				
1/4"x65M	weight %	95.5	95.5	
65Mx0	weight %	4.5	4.5	
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)				
YIELD 1/4"x65M	weight %	56.7	48.6	
TOTAL YIELD, EXCL. 65MxO	weight %	54.1	46.4	50.25
INHERENT MOISTURE	% ad	1.7	1.0	
ASH	% db	6.7	9.4	8.1
VOLATILE MATTER	% dab	37.1	36.2	36.6
FIXED CARBON	% dab	57.7	63.7	60.7
SULPHUR	% db	0.75	0.98	0.86
PHOSPHORUS	% db			
FSI		7 1/2	7 1/2	7 1/2
SOFTENING TEMP.	°C.	371	368	
RESOLIDIFC. TEMP.	°C.	446	447	
CONTRACTION	%	27	26	26
DILATATION	%	144	175	160
G-VALUE		1.067	1.077	1.072

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-6 Size of core: HQ 63.5 mm Total depth: 650.0 ' 198.3 m

Location: N 577086.36596
W 61788.06839
Elevation of collar: 5241.81 '
1598.75 m

Dip of Hole: -90 o
Bearing " : - N - o

Date of starting: October 18, 1975
Date of completion: October 23, 1975

Logging by: R. Ogilvie
" on: October 20, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-6

Footage		Recovery		Description
from	to	feet	%	
0	23.3			Overburden.
23.3	29.5			Mudstone, dark grey, occasional thin sand- and siltstone bands.
29.5	77.9			Sandstone, light grey to grey, fine to medium grained, occasional beds of sandstone and siltstone, occasional thin coalseams and small pieces of coal. Crossbedding, bedding 50^{o} with core axis.
77.9	141.5			Mudstone, grey to dark grey, interbeds of fine sandstone and siltstone, interbeds of small coal-seams, numerous small pieces of coal.
141.5	149.7			Coalseam, sampled EB-6-1, no partings.
149.7	168.0			Mudstone, dark grey, occasional thin coalseams, small pieces of coal, pyritization.
168.0	171.0	$\frac{1.5}{3.0}$	50	Coalseam, sampled EB-6-2.
171.0	205.9			Mudstone, dark grey, small coalseams, numerous small pieces of coal, few interbeds of silt and sandstone, coaly mud 204.0 - 205.3.
205.9	207.9	2.0	100	Coalseam, partings 205.9 - 206.3, 207.2 - 207.6.
207.9	209.5			Sandstone, grey color, fine to medium grain, interbeds of silt and sand.
209.5	228.3			Mudstone, as above.

.../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-6

Footage		Recovery		Description
from	to	feet	%	
228.3	230.0	1.7	100	Coalseam, not sampled.
230.0	240.0			Mudstone, as above.
240.0	248.5	8.0/8.5	94	Coalseam, sampled EB-6-3.
248.5	250.0			Mudstone, as above.
250.0	266.4	15.7/16.4	96	Coalseam, sampled EB-6-4, partings 250.6 - 251.4, 252.7 - 254.0, 266.2 - 266.4.
266.4	275.3			Mudstone, dark grey, occasional bands of sand and siltstone, interbeds of thin coalseams, numerous small coal pieces, bedding 65° with core axis.
275.3	279.8	4.5	100	Coalseam, sampled EB-6-5.
279.8	282.5			Mudstone, as above.
282.5	287.0			Shaly Coal, coalseam 286.6 - 287.0.
287.0	318.0			Mudstone, very coaly, shaly coal 285.4 - 301.0, 309.0 - 310.8, shaly coal continues to 318.0.
318.0	338.0			Mudstone, dark grey with occasional small bands (0.1) of fine grained sandstone, numerous calcite veins throughout core.
338.0	356.4	18.1/18.4	98	Coalseam, partings at: mudstone from 344.0 - 344.5, shaly coal from 350.0 - 351.7, shaly coal from 355.5 - 356.0, sample No. EB-6-6.

..../3

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-6

Footage		Recovery		Description
from	to	feet	%	
356.4	365.5			Mudstone,-0.5' coalseam from 343.3 - 343.8.
365.5	367.1			Minor coalseam,-1.6' thick.
367.1	414.5			Mudstone, -1.6' sandstone from 368.1 - 369.7 - 1.8' coalseam from 372.7 - 374.5, parting in coalseam from 373.4 - 373.9.
414.5	440.0			Sandstone, medium grained, crossbedding observed, numerous calcite veins.
440.0	441.5			Mudstone, very carbonaceous.
441.5	443.5			Sandstone, medium grained, coaly portion from 442.0 - 442.5.
443.5	464.0			Mudstone, coaly portion from: 443.5 - 444.2 , 446.2 - 446.7, 451.5 - 453.7, some calcite veins up to 0.5 inches, thick seam in core at 460.0'.
464.0	483.5			Sandstone, medium grained, crossbedding observed.
483.5	485.8			Mudstone, some small bands of siltstone seen throughout this mudstone unit.
485.8	509.0		99	Coalseam, sample EB-6-7, no partings observed.
509.0	511.5			Mudstone, coaly near upper contact of coalseam.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-6

Footage		Recovery		Description
from	to	feet	%	
511.5	520.6	8.5/9.1	93	Coalseam, sample EB-6-8, coaly mudstone parting at 517.8 - 518.4.
520.6	544.5			Mudstone, coaly portion from 537.3 - 539.5, and from 543.0 - 543.6.
544.5	546.8			Sandstone, crossbedding observed.
546.8	553.8			Mudstone.
553.8	555.0			Sandstone, crossbedded.
555.0	558.0			Mudstone.
558.0	563.0			Sandstone, crossbedded.
563.0	650.0			Mudstone, coalseam from 565.0 - 566.0 and 567.6 - 568.2, crossbedded sandstone from 596.0 - 596.8, and 604.7 - 624.3. Other thin sandstone beds throughout balance of core.
End of Hole: TD		650 feet		Signed: R. Ogilvie

DRILL HOLE: EB-6								
SAMPLE NO.:		EB-6-1	EB-6-2	EB-6-3	EB-6-4	EB-6-5	EB-6-6	EB-6-7	EB-6-8
LAB.NO.:		4481	4482	4483	4484	4485	4486	4487	4489
SAMPLE INTERVAL (FROM-TO) (FT.):		141.5-149.7	168.0-171.0	240.0-248.5	250.0-266.4	275.3-279.8	338.0-356.4	485.8-509.0	511.5-520.6
SEAM DESIGNATION:		Seam 14	Seam 14	Seam 14	Seam 14	Seam 14	Seam 13	Seam 12	Seam 12
RAW COAL:									
INHERENT MOISTURE	% air dry	1.0	0.8	0.9	1.0	0.8	1.1	1.2	0.8
ASH	% wf	15.3	42.7	34.7	39.4	30.9	27.7	17.7	41.1
VOLATILE MATTER	% wf	26.8	19.7	20.6	21.5	22.7	21.7	22.9	18.7
FIXED CARBON	% air dry	57.4	37.3	44.3	38.7	46.1	50.2	58.7	39.9
SULPHUR	% wf	0.66	0.77	0.51	0.70	1.01	0.60	0.62	0.55
HARDGROVE GR. INDEX		92	67		93	95	97	12.8	84
SIZE FRACTION									
¼"x65M	weight %	91.2	93.0	87.1	84.9	76.8	91.0	80.6	88.6
65MxO	weight %	8.8	7.0	12.9	15.1	23.2	9.0	19.4	11.4
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)									
YIELD ¼"x65M	weight %	85.8	40.2	61.3	50.3	55.5	67.6	80.9	49.1
TOTAL YIELD, EXCL. 65MxO	weight %	78.2	37.4	53.3	42.7	42.6	61.5	65.2	43.5
INHERENT MOISTURE	% air dry				2.8		1.7	2.9	1.3
ASH	% wf				4.7		6.1	5.1	8.1
VOLATILE MATTER	% waf				29.8		28.8	27.1	29.4
FIXED CARBON	% waf				70.0		71.1	72.7	70.4
SULPHUR	% wf				0.73		0.76	0.65	0.74
PHOSPHOR	% wf								
FSI		9	8½	8	9	8½	8½	8	8½
SOFTENING TEMP.	^{o}C	393	388	408	392	386	394	408	396
RESOLIDIFICATION TEMP.	^{o}C	450	455	453	447	450	451	453	454
CONTRACTION	%	21	22	7	24	23	24	7	24
DILATATION	%	185	284	159	123	232	127	13	171
G-VALUE		1.057	1.073	1.050	1.046	1.067	1.048	1.016	1.054

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-7 Size of core: HQ 63.5 mm Total depth: 634.0 ' 193.4 m

Location: N 576993.60071
W 61347.73374
Elevation of collar: 5319.68 '
1622.50 m

Dip of Hole: -90°
Bearing " : - N - °

Date of starting: October 9, 1975
Date of completion: October 17, 1975

Logging by: Wayne Radant
" on: October 19, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-7

Footage		Recovery		Description
from	to	feet	%	
0	12.5			Overburden.
12.5	26.9			Sandstone, light grey, fine to medium grained, occasionally interbed of silt. Numerous small coalseams and occasional coal pieces. Crossbedding. Pyritization at 20.0 - 20.2, bedding 25° to 40° with core axis.
26.9	29.5			Mudstone, dark grey, occasional small coal-seams.
29.5	43.7			Siltstone, grey color, occasional interbeds of fine sandstone. Occasional small coal pieces, gradational downward to sandstone.
43.7	56.0			Sandstone, as above, bedding 55° with core axis, no pyritization as above.
56.0	80.0			Siltstone, as above.
80.0	137.5			Sandstone, light grey to grey, fine to medium grained, crossbedded, occasional inter-beds of mud and silt. Occasional small coal seams and pieces. Bedding 55° with core axis.
137.5	150.6			Mudstone, dark grey, occasional interbeds of sand and silt. Occasional small coal pieces.
150.6	173.5	$\frac{21.4}{22.9}$	93	Coalseam, sampled EB-7-1, no partings.

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DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-7

Footage		Recovery		Description
from	to	feet	%	
173.5	180.0			Mudstone, grey to dark grey, interbedded with fine sandstone and silt, occasional coalseams and pieces.
180.0	182.2	2.0/2.2	91	Coalseam, sampled EB-7-2.
182.2	187.0			Sandstone, as above.
187.0	189.7	2.5/2.7	92	Coalseam, sampled EB-7-3, parting 188.2 - 189.0.
189.7	199.8			Mudstone, as above.
199.8	216.0			Sandstone, fine grained, grey, interbedded, with siltstone and mudstone, occasionally small pieces of coal, and coalseams, cross-bedding. Bedding 50^{o} with core axis.
216.0	285.5			Siltstone, interbedded with fine sandstone, and mudstone, grey color. Coalseam 226.9 - 227.3, 231.6 - 232.0. Minor pyritization, interbedded with small coal seams and pieces of coal.
285.5	286.7			Coalseam, not sampled.
286.7	295.3			Sandstone, as above.
295.3	297.7	2.1/2.4	86	Coalseam, not sampled, parting 295.3 - 296.0.

.../3

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-7

Footage		Recovery		Description
from	to	feet	%	
297.7	308.0			Mudstone, dark grey, interbedded with fine sandstone, and silt, interbedded with small coal seams and pieces of coal, coalseam 306.3 - 307.0.
308.0	311.6	$\frac{3.1}{3.6}$	86	Coalseam, sampled EB-7-4.
311.6	314.0			Sandstone, fine grained, grey color, cross-bedded, occasional bed of mudstone and silt-stone. Occasional small coalseams and pieces of coal.
314.0	320.7	6.7	100	Coalseam, sampled EB-7-5.
320.7	338.0			Sandstone, as above, bedding 50^{o} to 55^{o}, with core axis.
338.0	353.9			Mudstone, as above. Coalseam 345.4 - 346.0.
353.9	366.5			Sandstone, as above. Coalseam 357.5 -358.1.
366.5	372.3			Mudstone, as above.
372.3	373.3	1.0	100	Coalseam, not sampled.
373.3	448.5			Sandstone, light grey to dark grey, fine to medium grain. Interbedded with mudstone and siltstone. Occasional thin coalseams and pieces of coal. Crossbedded. Bedding 50^{o} - 60^{o} with core axis.

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DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-7

Footage		Recovery		Description
from	to	feet	%	
448.5	460.0			Mudstone, grey, interbedded with light grey fine sandstone, occasional thin coalseams. Gradational upper contact. Bedding 50° with core axis.
460.0	465.6	4.7/5.6	84	Coalseam, sampled EB-7-6, 1partings 463.5 - 464.4.
465.6	468.0			Mudstone, dark grey, interbedded with thin coalseams and pieces of coal. Gradational contact above and below.
468.0	473.9	5.4/5.9	92	Coalseam, sampled EB-7-7
473.9	476.0			Mudstone, as above.
476.0	478.7	2.7	100	Coalseam, sampled EB-7-8.
478.7	483.0			Mudstone, grey color, interbedded small coalseams, sandstone with 479.3 - 480.0.
483.0	497.0			Sandstone, light grey, finely bedded with mudstone, interbed of mudstone and siltstone. 486.0 - 489.5. Occasional thin coalseams, bedding 40° with core axis.
497.0	506.5			Siltstone, grey, occasional interbeds of sandstone and siltstone, occasional interbeds of coal. Numerous small coal pieces.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-7

Footage		Recovery		Description
from	to	feet	%	
506.5	514.0			Sandstone, as above. Bedding 50^{o} with core axis.
514.0	553.4			Siltstone,as above.
553.4	560.1			Sandstone, grey to dark grey, fine - medium grained, finely interbedded with silt and mudstone. Occasional coal pieces, bedding 60^{o} with core axis.
560.1	577.0			Mudstone, dark grey, occasional interbeds of fine sandstone and siltstone. Occasional thin coalseams and small coal pieces. Bedding 60^{o} with core axis.
577.0	581.4			Sandstone, as above.
581.4	583.4			Mudstone, dark grey, to black, thin coalseams, small pieces of coal.
583.4	626.6	$\frac{33.0}{43.2}$		Coalseam, partings of mudstone with coal pieces. 585.0 - 585.7, 587.8 - 588.0, 591.2 - 594.0, 597.2 - 598.5, 613.0 - 613.4, 615.6 - 616.6, sampled EB-7-9.
626.6	634.0			Mudstone, dark grey to black, numerous small pieces of coal. Gradational with coal above.
				Oct. 19, 1975, signed: Wayne Radant.

DRILLE HOLE: EB 7										
SAMPLE NO.:		EB-7-1	EB-7-2	EB-7-3	EB-7-4	EB-7-5	EB-7-6	EB-7-7	EB-7-8	EB-7-9
LAB. NO.:		4429	4430	4431	4432	4433	4434	4435	4436	4489
SAMPLE INTERVAL (FROM-TO) (FT.):		150.6-173.5	180.0-182.2	187.0-189.7	308.0-311.6	314.0-320.7	460.0-465.6	468.0-473.9	476.0-478.7	583.4-626.6
SEAM DESIGNATION:		Seam 18	Seam 18	Seam 18	Seam 17	Seam 17	Seam 16	Seam 16	Seam 16	Seam 15
RAW COAL										
INHERENT MOISTURE	% air dry	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9	1.1
ASH	% wf	13.3	8.3	28.8	26.0	12.2	39.2	19.6	10.7	64.7
VOLATILE MATTER	% wf	28.7	30.4	24.6	25.4	28.0	19.4	24.0	26.5	14.1
FIXED CARBON	% air dry	57.4	60.8	46.2	48.1	59.1	41.1	55.9	62.2	21.0
SULPHUR	% wf	0.41	1.19	0.66	0.96	0.71	0.44	0.64	0.79	0.52
HARDGROVE GR. INDEX		108	71	58	70	125	64	80	79	18
SIZE FRACTION										
¼"x65M	weight %	75.3	92.5	95.3	90.6	71.3	92.6	91.8	93.8	92.7
65MxO	weight %	24.7	7.5	4.7	9.4	28.7	7.4	8.2	6.2	7.3
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)										
YIELD ¼"x65M	weight %	89.7	94.7	52.1	69.8	87.2	40.7	78.0	90.5	25.5
TOTAL YIELD, EXCL. 65MxO	weight %	67.5	87.6	49.7	63.2	62.2	37.7	71.6	84.9	23.6
INHERENT MOISTURE	% air dry	5.1	1.1	0.9	1.1	4.3	1.0	1.3	1.2	1.5
ASH	% wf	4.5	5.8	7.2	4.5	3.5	6.1	5.7	3.9	5.2
VOLATILE MATTER	% waf	35.0	32.9	33.0	32.5	33.4	30.3	29.8	29.9	30.7
FIXED CARBON	% waf	64.7	67.0	66.9	67.5	66.5	69.6	70.1	70.1	69.2
SULPHUR	% wf	0.59	1.03	0.87	0.89	0.67	0.68	0.69	0.84	0.97
PHOSPHORUS	% wf									
FSI		8	8½	9	8½	9	8½	8½	8½	9
SOFTENING TEMP.	°C	390	381	381	388	385	386	378	397	398
RESOLIDIFC. TEMP.	°C	449	453	453	454	442	447	443	458	454
CONTRACTION	%	24	22	22	17	27	17	23	20	17
DILATATION	%	173	190	190	230	87	158	157	174	208
G-VALUE		1.056	1.073	1.073	1.072	1.038	1.063	1.063	1.060	1.059

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 8 Size of core: HQ 63.5 mm Total depth: 600.2 ' 183.1 m

Location: N 576890.52820
W 60858.47301
Elevation of collar: 5373.49 '
1638.91 m

Dip of Hole: -90 °
Bearing " : - N °

Date of starting: October 5, 1975
Date of completion: October 8, 1975

Logging by: Wayne Radant
" on: October 17, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-8

Footage		Recovery		Description
from	to	feet	%	
0	19.4			Overburden.
19.4	22.4			Sandstone, fine grained. Grey to dark grey. Thin beds of silt and mudstone, cross-bedding. Bedding 60° with core axis.
22.4	33.9			Mudstone. Dark grey to black, small coal pieces throughout. Small seams of coal, interbedded with fine sandstone and silt.
33.9	47.2			Sandstone. Grey to light grey, fine to medium and coarse sandstone. Cross-bedding, lower contact apprupt, bedding 55° with core axis and interbeds of silt.
47.2	52.7			Mudstone. Dark grey to black, interbedded with coal and silt. Coal seam: 48.0 - 48.7, 51.0 - 52.1. Some Pyritization.
52.7	60.0			Sandstone. Grey color, fine to medium grained. Interbedded with small coal seams, interbedded with silt and mudstone. Bedding 50° with core axis.
60.0	66.6			Mudstone. As above.
66.6	144.8			Sandstone. Light grey to grey. Coarse to fine grain, cross-bedding, numerous small coal seams and coal pieces, bedding 45o - 65° with core axis. Coal seam 136.7 - 137.4.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB 8

Footage		Recovery		Description
from	to	feet	%	
144.8	150.1			Mudstone. Dark grey to black. Minor interbedding of silt, pyritization.
150.1	227.5			Sandstone, light grey to grey. Coarse grained to fine grained. Interbedded with silt and mudstone. Interbedded with small coal seams, minor pyritization. Small coal pieces, cross bedding. Gradually coarsening towards top of fining. Towards bottoms of bedding at 185, 45° axis at 225 - 60° with core axis.
227.5	243.0			Mudstone. Grey to dark grey. Interbedded with silt and fine sands. Pyritization minor, small coal pieces and interbeds of coal.
243.0	262.5			Sandstone. Grey to fine - medium - grey, interbedded with mud and silt, cross-bedding. Occasional small coal seams, mudstone 256.5 - 258.0, bedding 50° with core axis.
262.5	267.5			Mudstone. Dark grey, occasional small coal seams, coal seam 265.0 - 265.6.
267.5	280.0			Sandstone. Grey to dark grey, fine to medium grain. Occasional mud-silt bands.
280.0	287.3	7.3	100	Coal Seam. sampled EB 8-1. Verty dirty coal, partings 282.6 - 284.4, 284.9 - 286.1.
287.3	293.1			Mudstone. Grey color, numerous small coal pieces. Interbeds of silt and coal.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-8

Footage		Recovery		Description
from	to	feet	%	
293.1	295.7			Sandstone. Light grey, medium grained, occasiona silt bands, cross-bedding. Bedding 60° to core . axis.
295.7	298.0			Mudstone. As above.
298.0	299.0	1.0	100	Coalseam.
299.0	302.0			Mudstone. Dark grey, numerous small coal seams, numerous coal pieces.
302.0	303.8	1.8	100	Coalseam. Not sampled, partings 302.0 - 302.3, 303.1 - 303.8.
303.8	307.9			Mudstone. Grey color, interbeds of fine sand, small coal pieces and seams.
307.9	309.3			Shaly coal, dark grey.
309.3	313.0			Mudstone, as above.
313.0	320.6			Sandstone, as above.
320.6	324.0			Mudstone, as above. Coal seam 321.1 - 321.5.
324.0	329.5	$\frac{4.5}{5.5}$	82	Coal seam. Sampled EB 8-2.
329.5	331.3			Sandstone. Light grey, medium to coarse grained. Numerous small coal seams, cross bedded. Interbeds of silt, bedding 60° to core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB 8

Footage		Recovery		Description
from	to	feet	%	
331.3	333.8	$\frac{2.0}{2.5}$	80	Coal seam. Sampled EB-8-3.
333.8	337.0			Mudstone, dark grey, abundant coal pieces. Coal seam 335.8 - 336.2.
337.0	342.1			Sandstone. Light grey , cross bedding. Fine to medium grained. Numerous small coal seams. Bedding 60° with core axis.
342.1	344.8	2.7	100	Coal seam. Sampled EB-8-4.
344.8	351.5			Sandstone, fine grained. Grey color, cross-bedding. Interbedded with silt and mudstone. Numerous small coal seams, bedding 60° with core axis.
351.5	363.5	13.5	100	Coal seam. Sampled EB-8-5. Partings 360.3 - 361.2. 361.9 - 362.2.
363.5	366.5			Mudstone. Dark grey, sandstone interbed. 364.8 - 365.0. Numerous small pieces of coal.
366.5	379.0			Sandstone. Light grey to grey. Fine to medium grained. Crossbedding. Interbeds of silt and mudstone. Numerous small pieces of coal and coal seams. Coal seam 374.0 - 374.4. Bedding 55° with core axis. Aprupt contact at bottom at 60° with core axis.
379.0	382.9	3.9	95	Coal seam. Sampled EB-8-6. Parting 382.2 - 382.4.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-8

Footage		Recovery		Description
from	to	feet	%	
382.9	391.1			Sandstone. As above. Small coal seam, 383.5 - 383.7. Mudstone, grey to dark grey. Sandstone interbeds 392.8 - 393.2, 402.4 - 403.5.
391.1	419.5			Small interbeds of sandstone and silt. Numerous small coal pieces and seams. Bedding 60^{o} with core axis.
419.5	424.9			Sandstone. Light grey, fine to medium grained. Crossbedding, distorted bedding. Numerous small coal seams, bedding 65^{o} with core axis.
424.9	434.2			Mudstone. Dark grey, small interbeds of sand. Numerous coal seams (small) and pieces.
434.2	439.0			Sandstone, as above.
439.0	441.5			Mudstone, as above.
441.5	443.2	1.7	100	Coal seam.
443.2	445.0			Mudstone, as above.
445.0	446.5			Coalseam. Not sampled, parting 445.0 - 445.6.
446.5	450.1			Sandstone, as above.
450.1	452.0	1.9	100	Coal seam. Not sampled, parting 450.1 - 450.4, 450.9 - 451.5.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-8

Footage		Recovery		Description
from	to	feet	%	
452.0	458.0			Mudstone. Coaly mudstone, as above. Pyritization, very high percentage of coal.
458.0	474.8			Sandstone, light grey to dark grey. Occasional beds of silt and mud. Cross bedding fine to coarse grained, numerous small coal seams and pieces of coal. Bedding 60^{o} with core axis.
474.8	481.2	6.4	100	Coalseam. Sampled EB-8-7. Partings 480.8 - 481.2.
481.2	490.0			Mudstone. Grey to dark grey. Occasional inter-beds of silt and sand. Numerous small coal seams and numerous small pieces of coal.
490.0	529.4			Sandstone. As above. Coaly mudstone 494.3 - 496.0. Bedding 60^{o} with core axis.
529.4	574.0			Mudstone, as above.
574.0	600.2			Sandstone, light grey to grey, fine to medium grained. Crossbedding. Occasional small pieces of coal and small coal seams, occasional silty and mud bands. Bedding 70^{o} with core axis.
				Signed: Wayne Radant, Oct. 17/75.

DRILL HOLE: EB-8								
SAMPLE NO.:		EB-8-1	EB-8-2	EB-8-3	EB-8-4	EB-8-5	EB-8-6	EB-8-7
LAB. NO.:		4437	4438	4439	4440	4441	4442	4443
SAMPLE INTERVAL (FROM-TO) (FT):		280.0-287.3	324.0-329.5	331.3-333.8	342.1-344.8	351.5-363.5	379.0-382.9	474.8-481.2
SEAM DESIGNATION:		Seam 19	Seam 19	Seam 19	Seam 19	Seam 19	Seam 19	Seam 18
RAW COAL								
INHERENT MOISTURE	% air dry	1.0	1.0	1.0	1.0	1.0	1.0	1.0
ASH	% wf	47.0	19.2	32.9	12.3	31.9	26.7	29.3
VOLATILE MATTER	% wf	20.4	29.5	23.9	30.1	25.1	27.4	23.7
FIXED CARBON	% air dry	32.3	50.8	42.7	57.0	42.6	45.5	46.5
SULPHUR	% wf	0.47	0.62	0.72	0.88	0.62	1.03	0.71
HARDGROVE GR. INDEX		72	66	62	72	78	62	66
SIZE FRACTION								
¼"x65M	weight %	93.6	91.3	91.7	88.2	84.4	90.3	89.6
65MxO	weight %	6.4	8.7	8.3	11.8	15.6	9.7	10.4
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)								
YIELD	weight %	34.3	78.0	52.2	89.2	63.6	56.3	63.8
TOTAL YIELD, EXCL. 65MxO	weight %	32.1	71.2	47.9	78.7	53.7	50.8	57.2
INHERENT MOISTURE	% air dry	1.5	1.3	1.5	1.8	3.0	1.8	1.6
ASH	% wf	9.2	5.8	12.9	4.3	4.6	8.5	7.4
VOLATILE MATTER	% waf	37.0	35.9	34.5	35.5	36.7	37.1	32.8
FIXED CARBON	% waf	63.0	64.0	65.4	64.4	63.0	62.7	67.2
SULPHUR	% wf	0.74	0.65	0.81	0.86	0.83	0.72	0.83
PHOSPHOR	% wf							
FSI		7	8	7½	8	8½	7½	8
SOFTENING TEMP.	°C	387	390	396	393	393	389	411
RESOLIDIFCATION TEMP.	°C	447	450	445	445	442	452	454
CONTRACTION	%	20	21	10	21	25	17	8
DILATATION	%	157	158	133	123	113	179	33
G-VALUE		1.059	1.058	1.053	1.046	1.039	1.066	1.031

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-9 Size of core: HQ 63.5 mm Total depth: 600.0 ' 183.0 m

Location: N 576786.09720
W 60362.76383
Elevation of collar: 5475.64 '
1670.07 m

Dip of Hole: -90 °
Bearing " :- N - °

Date of starting: October 2, 1975
Date of completion: October 5, 1975

Logging by: G.C. Singhai
" on: October 6, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-9

Footage		Recovery		Description
from	to	feet	%	
0	24.6			Overburden
24.6	34.5			Mudstone, dark grey, with interbeds of sandstone, occasionally small pieces of coal and thin seams of coal. Bedding 70° with core axis. Lower contact parallel to bedding. Coal seam 29.9 - 30.6.
34.5	54.3			Sandstone, light grey, medium to fine grained, crossbedded, interbedded with mudstone and siltstone, small pieces of coal throughout and occasionally thin seams of coal. Bedding 70° with 43.8 - 45.3, 53.8 - 54.1
54.3	62.6			Mudstone, dark grey, with interbeds of siltstone. Occasionally thin seams of coal and small pieces of coal. Coalseam 59.2 - 60.0, 60.7 - 69.2. Lower contact 50° with core axis.
62.6	65.4			Sandstone - as above. Lower contact parallel to bedding which is 60° with core axis.
65.4	69.8			Mudstone - dark grey, with interbeds of silt and sandstone, and small pieces of coal. Lower contact gradational.
69.8	86.7			Sandstone, light grey to grey, interbedded with silt and mudstone, occasionally with small pieces of coal. Crossbedded, bedding 70° with core axis. Mudstone 73.4 - 75.6.

../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-9

Footage		Recovery		Description
from	to	feet	%	
86.7	105.0			Mudstone, dark grey, interbedded with sandstone and siltstone, occasionally liminated at 55° with core axis, small pieces of coal and pyrite throughout, and thin coal seams. Sandstone 93 - 94. Coalseam 90.2 - 90.7, 96.2 - 97.5.
105.0	120.8			Sandstone, light grey, medium grained with interbeds of silt and sandstone. Occasionally thin seams of coal. Coalseam 108.0 - 108.5, 108.9 - 109.5.
120.8	123.0			Mudstone as above, laminated at 70° with core axis, and number of thin coalseams.
123.0	127.0			Sandstone, light grey, fine to medium grained, crossbedded. Interbeds of silt and mudstone, lower contact parallel to bedding at 60° with core axis, small pieces of coal throughout core.
127.0	146.8			Mudstone, dark grey, with interbeds of silt and sandstone, small pieces of coal throughout core and number of thin coalseams. Lamination at 65° with core axis. Coalseams 135.5 - 136.0, 145.2 - 145.6.
146.8	149.0			Sandstone, as above, bedding 60° with core axis.
149.0	150.6	1.6	100	Coalseam.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-9

Footage		Recovery		Description
from	to	feet	%	
150.6	164.7			Mudstone, dark grey, with interbeds of silt and sandstone, small pieces of coal throughout. Occasionally thin seams of coal. Bedding 50^{0} to core axis. Coalseam 157.3 - 158.4.
164.7	185.0			Sandstone, light grey, fine to medium grained, with interbeds of silt and mudstone and small pieces of coal. Crossbedded, bedding 70^{0} to core axis.
185.0	204.6			Siltstone, dark grey, fine grained, with interbeds of sandstone and siltstone, bedding 65^{0} with core axis. Carbonaceous shale 190.5 - 191.2, coalseam, 198.3 - 200.0, core badly broken, 200.0 - 205.0, recovery 90%.
204.6	210.4			Sandstone, as above, bedding 80^{0} with core axis.
210.4	223.3			Mudstone, dark grey, with interbeds of silt and sandstone and small pieces of coal.
223.3	236.0			Coalseam throughout the core, coalseam 220.8 - 221.3, sandstone, li-ht grey, fine to medium grained with interbeds of silt and mudstone. Occasionally thin seams of coal and small pieces of coal, crossbedded, bedding 60^{0} with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-9

Footage		Recovery		Description
from	to	feet	%	
236.0	258.5			Mudstone, as above, with interbeds of silt and sandstone, laminated, bedding 65° with core axis. Sandstone: 250.0 - 251.4, coal seam 253.4 - 254.0.
254.0	271.8			Sandstone, light grey, fine to medium gray, interbedded with mud and siltstone, occasionally small pieces of coal, crossbedded, bedding 50° with core axis.
271.8	275.2	3.4	80	Coalseam, sampled EB-9-1, partings of carbonaceous shale, 273.6 - 274.2, 275.0 - 275.2.
275.2	278.7			Mudstone, dark grey, interbedded with silt and sandstone, small pieces of coal and occasionally thin seams of coal.
278.7	287.7			Sandstone, light grey, fine to medium grained, interbedded with silt and mustone, crossbedded, bedding 60° with core axis and occasionally small pieces of coal.
287.7	293.0			Siltstone, dark grey, very fine grained and with very small pieces of coal, coalseam 287.7 - 288.0.
293.0	314.0			Sandstone, as above, bedding 65° with core axis, mudstone 299.4 - 303.0, siltstone 311.0 - 314.0.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-9

Footage		Recovery		Description
from	to	feet	%	
314.0	317.7			Mudstone, dark grey, with interbeds of silt and sandstone, number of thin coal seams.
317.7	335.0			Sandstone, as above. Bedding 70° with core axis, small pieces of coal throughout.
335.0	337.8	2.8	100	Coalseam, EB-9-2, sampled.
337.8	356.4			Sandstone, light grey, fine to medium grain, interbeds of silt and mudstone, and small pieces of coal, occasionally thin coalseams, crossbedded, bedding 65° with core axis.
356.4	365.5			Mudstone, dark grey, with interbeds of siltstone. Occasionally laminated at 60° with core axis. Number of thin coal-seams and small pieces of coal through-out core. Coalseam 364.2 - 365.2.
365.5	379.2			Sandstone, light grey to grey, fine to medium grained. With interbeds of silt and sand-stone. Small pieces of coal. Bedding 60° with core axis.
379.2	381.5			Mudstone, as above.
381.5	383.2	1.7	90	Coalseam, dirty.
383.2	390.0			Sandstone, as above.
390.0	390.7			Mudstone, with thin coalseams.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-9

Footage		Recovery		Description
from	to	feet	%	
390.7	397.5	6.8	78	Coalseam, EB-9-3. Parting mudstone 394.8 - 395.4. Carbonaceous shale; 397.0 - 397.3.
397.5	428.7			Sandstone, light grey, fine to medium grained. Interbeds of mudstone. Small pieces of coal and occasionally thin coal seams. Crossbedded. Bedding 60° with core axis. Coalseam: 404.7 - 406.5.
428.7	435.1			Mudstone, dark grey, with interbeds of silt and sandstone. Small pieces of coal and thin seams of coal.
435.1	437.6	2.5	100	Coalseam EB-9-4, sampled. Shale: 435.1 - 435.3.
437.6	441.1			Mudstone, as above.
441.1	443.0			Sandstone, as above.
443.0	444.9			Mudstone, as above.
444.9	448.4	3.5	95	Coalseam, dirty, not sampled. Shale 446.2 - 447.4.
448.4	482.7			Sandstone, light grey, fine to medium grained, interbedded with silt and mudstone. Small pieces of coal, crossbedded. Bedding 65° with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-9

Footage		Recovery		Description
from	to	feet	%	
482.7	486.4			Siltstone, dark grey, fine grained with small pieces of coal.
486.4	488.2	1.8	100	Coal seam, not sampled.
488.2	490.7			Mudstone, as above, with thin coalseams.
490.7	491.7	1.0	100	Coalseam.
491.7	495.3			Sandstone, light grey, fine to medium grained, with interbeds of silt and sandstone. Cross-bedded. Bedding 60^{o} with core axis.
495.3	498.9	3.4	85	Coalseam, EB-9-5, sampled. Parting: carbonaceous shale 497.9 - 498.4. Shale: 498.4 - 498.9.
498.9	501.0			Shale, dark grey, fine grained, coalseam 500.0 - 500.8.
501.0	504.0			Sandstone, as above. Bedding with core axis 60^{o}.
504.0	505.5	1.5	100	Coalseam, shale 504.0 - 504.3.
505.5	508.0			Mudstone, dark grey, with small pieces of coal.
508.0	523.5			Sandstone, light grey to grey, fine to medium grained, interbedded with silt and mudstone. Crossbedded, bedding 60^{o} with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-9

Footage		Recovery		Description
from	to	feet	%	
523.5	534.0			Mudstone, dark grey, fine grained with interbeds of sandstone and siltstone. Small pieces of coal and occasionally thin coalseams. Coalseam 530.5 - 532.4.
534.0	535.5	1.5	100	Coalseam.
535.5	543.4			Siltstone, dark grey, very fine grained, interbedded with sandstone. Bedding 65° with coreaxis. Coalseam 539.9 - 540.0.
543.4	550.5			Mudstone, dark grey, with interbeds of sandstone, and siltstone, small pieces of coal.
550.5	596.5			Sandstone, light grey to grey, fine to medium grained, with interbeds of silt and mudstone. Small pieces of coal throughout core and occasionally thin coalseams. Crossbedded, bedding 60° with core axis. Coalseam 580.7 - 580.8, 592.1 - 592.2.
596.5	600.0			Mudstone, dark grey, interbedded with silt and sandstone, bedding 65° with core axis. Upper contact 70° with core axis. End of Hole at 600'. Signed: G.C. Singhai October 6, 1975.

DRILL HOLE: EB-9						
SAMPLE NO.:		EB-9-1	EB-9-2	EB-9-3	EB-9-4	EB-9-5
LAB. NO.:		4406	4407	4408	4409	4410
SAMPLE INTERVAL (FROM-TO) (FT):		271.8-275.2	335.0-337.8	390.7-397.5	435.1-437.6	495.3-498.9
SEAM DESIGNATIONL		Seam 20	Seam 20	Seam 20	Seam 20	Seam 20
RAW COAL						
INHERENT MOISTURE	% air dry	0.9	1.0	0.9	1.0	0.9
ASH	% wf	47.3	14.2	32.9	18.4	68.9
VOLATILE MATTER	% wf	21.4	32.4	25.7	30.5	14.4
FIXED CARBON	% air dry	31.0	52.8	41.0	50.6	16.5
SULPHUR	% wf	0.51	2.47	0.79	0.93	0.39
HARDGROVE GR. INDEX		59	61	59	86	50
SIZE FRACTION						
¼"x65M	weight %	92.1	93.3	91.4	94.4	91.6
65MxO	weight %	7.9	6.7	8.6	5.6	8.4
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)						
YIELD	weight %	32.6	86.4	59.7	83.1	18.3
TOTAL YIELD, EXCL. 65 MxO	weight %	30.0	80.6	54.6	78.4	16.8
INHERENT MOISTURE	% air dry	1.3	1.1	1.3	1.2	1.4
ASH	% wf	13.6	5.9	8.6	9.4	8.8
VOLATILE MATTER	% waf	37.1	38.1	37.8	36.9	37.7
FIXED CARBON	% waf	62.8	61.7	62.2	62.9	62.1
SULPHUR	% wf	1.17	1.13	0.85	1.01	1.07
PHOSPHOR	% wf					
FSI		7½	6	7	6½	7
SOFTENING TEMP.	^{o}C	421	380	388	412	388
RESOLIDIFCATION TEMP.	^{o}C	478	436	442	476	442
CONTRACTION	%	13	9	10	9	15
DILATATION	%	95	138	99	135	155
G-VALUE		1.051	1.064	1.056	1.067	1.057

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-10 Size of core: HQ 63.5 mm Total depth: 634.0 ' 193.4 m

Location: N 573213.29814
W 62808.61356
Elevation of collar: 5233.43'
1596.20m

Dip of Hole: -90 °
Bearing " : - N - °

Date of starting: October 25, 1975
Date of completion: October 28, 1975

Logging by: R.G. Ogilvie
" on: October 30, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-10

Footage		Recovery		Description
from	to	feet	%	
0	13.5			Overburden.
13.5	22.5			Mudstone, dark grey, fine-grained, some small bands of siltstone, calcite veins throughout.
22.5	28.0			Sandstone, medium grained, light grey color, cross bedding thoughout. Carbonaceous streaks common. Bedding at 48° with core axis, calcite veins common.
28.0	55.8			Mudstone, coaly portion from 28.0 - 29.4.
55.8	75.6	18.8/19.8	95	Coal seam, sample EB-10-1, partings at 60.8 - 63.0.
75.6	76.0			Coaly shale.
76.0	98.5			Sandstone, cross bedded, carbonaceous.
98.5	102.5			Coaly shale.
102.5	107.5			Siltstone, very similar to mudstone, lithology but coarser texture.
107.5	151.2			Sandstone, cross bedded, thin coaly portions common that are 0.1' thick.
151.2	155.5	4.3/4.3	100	Coal seam, sample 10-2, parting from 153.0 - 154.0.
155.5	171.0			Mudstone.

.../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-10

Footage		Recovery		Description
from	to	feet	%	
171.0	198.0			Sandstone, cross bedded. Coaly portions from 192.5 - 193.2. Carbonaceous.
198.0	233.0			Mudstone, coaly portions from 204.0 - 214.5 and 207.8 - 208.7. Thin sandstone bands from 210.3 - 214.5.
233.0	262.5			Sandstone, cross bedded, coaly portion from 251.0 - 252.1.
262.5	272.5			Mudstone, coaly from 265.0 - 266.5, and 269.5 - 271.0.
272.5	286.7			Sandstone, cross bedded.
286.7	290.0			Mudstone, thick bands of sandstone throughout.
290.0	292.0	$\frac{2.0}{2.0}$	100	Coal seam, sample EB-10-3, no parting observed.
292.0	314.1			Mudstone.
314.1	333.8	$\frac{17.9}{19.7}$	91	Coal seam, sample EB-10-4, parting at 317.0 - 318.3.
333.8	344.7			Sandstone, cross bedded, coaly throughout.
344.7	351.0			Siltstone, bands of finer grained mudstone throughout.
351.0	354.0			Mudstone.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-10

Footage		Recovery		Description
from	to	feet	%	
354.0	356.5	2.5/2.5	100	Coal seam, sample EB-10-5.
356.5	384.0			Mudstone, numerous small (0.4') coaly seams throughout.
384.0	387.0			Sandstone, cross bedded.
387.0	425.7			Mudstone, coaly portions from 389.0 - 390.0, and 411.0 - 411.8 and 412.7 - 414.0.
425.7	440.8			Sandstone, cross bedded. Bedding angle at 50^{o} with core axis.
440.8	459.4	3.2/3.2	100	Mudstone, some bands of siltstone, coal seam from 450.5 - 453.7, sample EB-10.6
459.4	467.0			Sandstone, cross bedded.
467.0	476.4	9.2/9.2	97	Coal seam, sample EB-10-7, no partings.
476.4	499.0			Mudstone, minor coal seam from 488.2 - 490.5.
499.0	503.8			Sandstone, cross bedded.
503.8	516.0			Mudstone.
516.0	517.5			Minor coal seam.
517.5	565.0			Mudstone, some coaly portions 0.2' thick, sandstone bands 0.2' thick occasionally.

.../4

~1 46

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-10

Footage		Recovery		Description
from	to	feet	%	
565.0	579.0	13.7/13.7	98	Coal seam, sample EB-10-8, parting at 570.0 - 572.3, parting.
579.0	590.6			Mudstone.
590.6	609.6			Sandstone, cross bedded, fine grained, carbonaceous.
609.6	634.0			Mudstone, coaly from 618.8 - 619.7.
				End: T.D. 634.0'
				Signed: R.G. Ogilvie.

DRILL HOLE: EB-10								
SAMPLE NO.:		EB-10-1	EB-10-2	EB-10-3	EB-10-4	EB-10-5	EB-10-6	EB-10-7	EB-10-8
LAB.NO.:		4511	4512	4513	4514	4515	4516	4517	4518
SAMPLE INTERVAL (FROM-TO)(FT):		55.8-75.6	151.2-155.5	290.0-292.0	314.1-333.8	354.0-356.5	450.5-453.7	467.0-476.4	565.0-579.0
SEAM DESIGNATION		Seam 18	Seam 17	Seam 17	Seam 17	Seam 17	Seam 16	Seam 16	Seam 15
RAW COAL									
INHERENT MOISTURE	% air dry	0.8	0.7	0.7	0.8	0.7	0.7	0.8	0.7
ASH	% wf	12.0	49.1	61.5	22.5	53.7	9.4	18.2	40.3
VOLATILE MATTER	% wf	27.1	19.7	15.4	25.2	17.1	25.5	23.6	20.5
FIXED CARBON	% air dry	NA	NA	NA	NA	NA	NA	NA	NA
SULPHUR	% wf	0.37	0.40	0.95	0.52	0.52	0.78	0.63	0.44
HARDGROVE GR. INDEX		97	61		78	50	92	86	94
SIZE FRACTION									
¼"x65M	weight %	88.3	92.5	88.3	90.4	94.2	90.6	92.1	91.0
65MxO	weight %	11.7	7.5	11.7	9.6	5.8	9.4	7.9	9.0
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)									
YIELD	weight %	90.5	40.9	13.2	76.2	28.7	90.9	78.6	54.8
TOTAL YIELD, EXCL. 65MxO	weight %	79.9	37.8	11.6	68.9	27.0	82.4	72.4	49.9
INHERENT MOISTURE	% air dry	2.6	1.4	NA	1.7	1.3	1.5	2.1	1.4
ASH	% wf	4.5	4.7	NA	4.0	3.5	3.9	3.9	5.2
VOLATILE MATTER	% waf	30.6	33.5	NA	30.0	28.4	28.2	27.9	30.4
FIXED CARBON	% waf	NA	NA	NA	NA	NA	NA	NA	NA
SULPHUR	% wf	0.45	0.95		0.64	0.98	0.81	0.67	0.65
PHOSPHOR									
FSI		7½	9	8½	8½	8½	8½	8	9
SOFTENING TEMP.	°C	398	384	390	389	391	398	399	398
RESOLIDIFICATION TEMP.	°C	446	450	455	447	444	452	449	450
CONTRACTION	%	21	26	21	27	24	25	24	15
DILATATION	%	60	255	296	227	153	128	117	257
G-VALUE		1.028	1.069	1.072	1.058	1.049	1.045	1.040	1.058

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-11 Size of core: HQ 63.5 mm Total depth: 666 ' 203.1m

Location: N 573007.22254
W 62386.10489
Elevation of collar: 5217.60
1591.37 m

Dip of Hole: -90°
Bearing " : - N -°

Date of starting: September 26, 1975
Date of completion: September 30, 1975

Logging by: G.C. Singhai,
" on: October 1st, 1975.

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-11

Footage		Recovery		Description
from	to	feet	%	
0	12.0			Overburden.
12.0	14.0			Mudstone, dark grey, with interbeds of sandstone, occasionally thin coal seams.
14.0	29.5			Sandstone, light grey, fine to medium grained, thin beds of silt and mudstone. Occasionally small pieces of coal. Crossbedded. Bedding 55^{0} to the core axis.
29.5	33.5	4.0	100	Coal seam, sampled EB-11-1, parting of mudstone 29.7 - 29.8, 30.0 - 30.1, 31.1 - 32.1.
33.5	34.7			Mudstone, dark grey, with thin coal seams.
34.7	48.3			Sandstone, light grey to dark grey, fine to medium grained, thin beds of silt and mudstone, occasionally very small pieces of coal. Bedding 55^{0} with core axis.
48.3	56.7			Mudstone, dark grey with interbeds of thin sandstone. Lower contact 70^{0} with core axis. Very thin coal sams.
56.7	59.3			Sandstone, as above.
59.3	59.9			Mudstone, with small pieces of coal.
59.9	64.4	4.5	90	Coal seam, core broken, shale 64.3 - 64.4, sampled EB-11-2.

.../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-11

Footage		Recovery		Description
from	to	feet	%	
64.4	66.5			Mudstone, dark grey, luminated and very thin seams of coal. Pyrite along fractures.
66.5	69.0	2.5	100	Coal seam, EB-11-3, sampled. Parting shale 67.3 - 67.9.
69.0	74.0			Carbonaceous shale, luminated and numerous thin coal seams.
74.0	87.1			Sandstone, grey, fine to medium grained, interbedded with mud and siltstone, small pieces of coal, bedding 55^{o} with core axis.
87.1	90.0			Mudstone, dark grey, with interbeds of sandstone, slightly carbonaceous, at the bottom.
90.0	91.0	1.0	100	Coal seam, dirty.
91.0	92.3			Sandstone, as above.
92.3	94.0	1.7	100	Coal seam.
94.0	107.3			Sandstone, light grey, fine to medium grained, with thin beds of silt and mudstone. Occasionally thin coal seams. Bedding 65^{o} with core axis, cross bedded, coal seam 98.2 - 98.8.
107.3	109.8			Mudstone, dark grey, upper contact 55^{o} with core axis, coal seam 108.8 - 109.2, occasionally thin coal seam.

.../3

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-11

Footage		Recovery		Description
from	to	feet	%	
109.8	116.0			Siltstone, dark grey, fine grained. Occasionally thin coal seams.
116.0	130.2			Sandstone, light grey to grey, fine to medium grained, interbedded with mud and siltstone. Occasionally small coal pieces, crossbedded, bedding 55° to the core axis.
130.2	135.0	4.8	100	Coal seam, sampled EB-11-4, roof of mudstone 130.2 - 130.7.
135.0	139.0		90	Mudstone, dark grey with number of thin coal seams, small pieces of coal.
139.0	152.5			Sandstone, light grey, fine to medium grained, with interbeds of thin silt and mudstone. Occasionally small pieces of coal. Cross-bedded, bedding 60° with core axis.
152.5	154.1	1.6	100	Coal seam, 152.5 - 152.6, coaly shale.
154.1	157.0			Mudstone, as above. 156.0 - 157.0, shaly coal.
157.0	181.0			Sandstone, light grey, to grey. Fine to medium with interbedding of silt and mudstone, occasionally thin coal seams, and small pieces of coal. Lower contact 60° with core axis.
181.0	190.3			Siltstone, dark grey, very fine grained, with interbeds of mudstone, occasionally thin seams of coal and small pieces of coal. Lower contact 60° with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-11

Footage		Recovery		Description
from	to	feet	%	
190.3	193.1			Sandstone, as above, massive.
193.1	204.0			Mudstone, dark grey, interbedded with silt and sandstone. Occasionally thin seams of coal.
204.0	210.7			Sandstone, light grey, fine to medium grained. Interbeds of silt and mudstone. Occasionally small pieces of coal. Crossbedded, bedding 65^{o} with core axis.
210.7	229.5			Mudstone, as above. Sandstone 222.8 - 224.1, occasionally small pieces of coal.
229.5	265.8			Sandstone, as above. Bedding 65^{o} with core axis. Occasionally thin coal seams and small pieces of coal.
265.8	286.8			Mudstone, dark grey, with interbeds of siltstone. Thin coal seams and small pieces of coal. Coal seams 267.2 - 268.5, dull coal, 270.0 - 270.7, 286.0 - 286.8.
286.8	361.0			Sandstone, light grey, fine to medium grained. With interbeds of silt and mudstone. Occasionally small pieces of coal. Crossbedded, bedding 60^{o} with core axis.
361.0	365.0	5	82	Coal seam, EB-11-5, sampled. Partings 361.0 - 361.2, shale, 364.2 - 364.6, mudstone.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-11

Footage		Recovery		Description
from	to	feet	%	
365.0	366.8			Sandstone, light grey, fine to medium grained. Interbeds of silt and sandstone. Crossbedded. Bedding 60° with core axis.
366.8	375.6			Mudstone, dark grey, with interbeds of siltstone, 374.0 - 375.6, slightly carbonaceous. Upper contact 70° with core axis and lower contact 60° with core axis.
375.6	394.0			Sandstone, light grey, medium to coarse grained, crossbedded. Occasionally small pieces of coal. Bedding 60° with core axis.
394.0	396.7	2.7	100	Coal seam, sampled EB-11-6. Footwall carbonaceous shale 396.5 - 396.7. Lower contact 60° with core axis.
396.7	410.6			Sandstone, as above. Lower contact 50° with core axis.
410.6	413.9	3.3	100	Coal seam, sampled EB-11-7.
413.9	428.0			Sandstone, light grey to grey, fine to medium grained. Occasionally with small coal pieces and thin bands of mudstone and siltstone.
428.0	435.6			Mudstone, with interbeds of sandstone and coal seam 435.3 - 435.6. Occasionally thin seams of coal.
435.6	449.0			Sandstone, light grey, coarse ot medium grained, with small pieces of coal, massive.

.../6

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-11

Footage		Recovery		Description
from	to	feet	%	
449.0	465.8			Mudstone, dark grey, with interbeds of sandstone and silt. Coal seam 451.0 - 451.9, carbonaceous shale 453.8 - 455.0.
465.8	469.0			Sandstone, as above. Lower contact gradational.
469.0	469.6			Mudstone.
469.6	473.0	3.4	100	Coal seam, sampled EB-11-8, parting shaly coal 470.8 - 471.0, shale 472.3 - 473.8.
473.0	475.6			Sandstone, as above. With interbeds of mudstone.
475.6	476.0			Mudstone, as above.
476.0	479.1	3.1	84	Coal seam, EB-11-9.
479.1	500.0			Sandstone, light grey to grey, with interbeds of silt and mudstone. Crossbedded, bedding 65° with core axis, and occasionally small pieces of coal.
500.0	503.1	3.1	100	Coal seam, EB-11-10, parting hanging wall. 500.0 - 500.4.
503.1	506.3			Mudstone, dark grey, with occasionally thin seams of coal. Small pieces of coal throughout core.
506.3	508.1			Sandstone, with interbeds of mud and sandstone. Occasionally small pieces of coal. Bedding 60° with core axis.

.../7

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-11

Footage		Recovery		Description
from	to	feet	%	
508.1	520.0			Mudstone, dark grey, with interbedding of sand and siltstone. Coal seam 518.0 - 518.4, number of thin coal seams, and occasionally small pieces of coal.
520.0	530.2			Sandstone, grey to dark grey, fine to medium grained, with interbeds of silt and mudstone. Small pieces of coal, bedding 60^{o} to core axis.
530.2	533.5			Mudstone, dark grey, laminated, small pieces of coal throughout.
533.5	538.2	4.7	90	Coal seam, sampled EB-11-11. Parting shaly coal 535.7 - 535.9. Coaly shale 534.3 - 534.7.
538.2	542.0			Mudstone, dark grey, laminated, and with thin seams of coal.
542.0	548.4			Sandstone, grey to light grey, with interbeds of silt and mudstone. Small pieces of coal throughout core.
548.4	565.0			Mudstone, dark grey, at places laminated, interbedded with sandstone, and siltstone. Numerous thin coal seams. Pieces of coal throughout. Coal seam 555.1 - 555.8.
565.0	584.7			Sandstone, light grey, fine to medium grained, with interbeds of silt and sandstone, crossbedded. Bedding 65^{o} to core axis. Small pieces of coal throughout.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-11

Footage		Recovery		Description
from	to	feet	%	
584.7	591.0			Mudstone, dark grey, laminated at places. Occasionally small pieces of coal.
591.0	600.0			Sandstone, as above, with interbeds of silt and mudstone.
600.0	620.0			Mudstone, dark grey, interbeds of sandstone and siltstone. Laminated at places, occasionally with thin coal seams, and small pieces of coal. Sandstone 604.3 - 606.0, coal seams 603.0 - 603.6, 603.8 - 604.2.
620.0	625.5			Siltstone, dark grey, fine grained with small pieces of coal.
625.5	635.6			Mudstone, dark grey, laminated. Occasionally thin seams of coal and small pieces of coal throughout core. Bedding 60^{o} with core axis.
635.6	641.8			Sandstone, light grey to grey, with interbeds of silt and mudstone. Small pieces of coal throughout. Crossbedded. Bedding 70^{o} with core axis.
641.8	642.7			Mudstone, as above.
642.7	662.5	19.8	100	Coal seam, sampled EB-11-12, parting shaly coal, 648.5 - 649.2, coaly shale 657.0 - 657.2, 649.5 - 649.8, 660.5 - 661.0.
662.5	666.0			Mudstone, dark grey, occasionally thin seams of coal, small pieces of coal throughout core.

End of Hole at 666', signed: G.C. Singhai, 1.10.75.

DRILL HOLE: EB-11

SAMPLE NO.:		EB-11-1	EB-11-2	EB-11-3	EB-11-4	EB-11-5	EB-11-6	EB-11-7	EB-11-8	EB-11-9	EB-11-10	EB-11-11	EB-11-12
LAB. NO.:		4087	4088	4089	4090	4187	4188	4189	4190	4191	4192	4193	4194
SAMPLE INTERVAL (FROM-TO) (FT):		29.5-33.5	59.9-64.4	66.5-69.0	130.2-135.0	361.0-365.0	394.0-396.7	410.6-413.9	469.6-473.0	476.0-479.1	500.0-503.1	533.5-538.2	642.7-662.5
SEAM DESIGNATION:		Seam 20	Seam 20	Seam 20	Seam 20	Seam 19	Seam 19	Seam 19	Seam 19	Seam 19	Seam 19	Seam 19	Seam 18
RAW COAL													
INHERENT MOISTURE	% air dry	1.0	1.2	0.9	1.1	1.1	1.1	0.8	0.9	0.9	1.1	1.2	1.1
ASH	% wf	30.1	30.7	45.9	30.4	33.1	23.9	22.2	44.5	37.8	14.2	9.3	18.2
VOLATILE MATTER	% wf	26.6	26.2	22.0	27.3	24.8	28.0	18.0	21.7	23.2	30.4	27.6	27.8
FIXED CARBON	% air dry	42.9	42.6	31.8	41.8	41.7	47.6	NA	33.5	38.6	54.8	62.3	53.4
SULPHUR	% wf	0.73	0.54	0.42	0.73	0.62	0.79	0.32	0.73	0.84	1.13	0.54	0.25
HARDGROVE GR. INDEX		69	85	66	80	64	75	114	60	56	73	72	88
SIZE FRACTION													
½"x65M	weight %	93.3	88.9	95.0	92.4	95.7	93.4	89.1	96.1	96.6	94.0	94.5	94.1
65xO	weight %	6.7	11.1	5.0	7.6	4.3	6.6	10.9	3.9	3.4	6.0	5.5	5.9
CLEAN COAL (SIZE FRACTION ½"x65M; 1.5 SINK-FLOAT S.G.)													
YIELD	weight %	64.1	55.3	59.5	67.2	58.3	65.4	81.0	50.2	43.9	91.1	92.4	78.9
TOTAL YIELD, ESCL. 65MxO	weight %	59.8	49.2	56.5	62.1	55.8	61.1	72.2	48.2	42.4	85.6	87.3	74.2
INHERENT MOISTURE	% air dry	1.5	1.6	1.4	1.3	1.2	1.2	2.3	0.9	0.9	1.1	1.0	1.2
ASH	% wf	6.7	9.3	8.4	8.9	7.5	7.0	5.2	10.0	10.6	7.2	4.0	4.8
VOLATILE MATTER	% waf	36.5	37.3	36.3	35.3	35.9	36.0	36.1	36.5	34.7	34.9	30.7	32.3
FIXED CARBON	% waf	63.4	62.5	63.6	64.7	64.2	63.9	63.7	63.4	65.2	65.0	69.2	67.7
SULPHUR	% wf	1.06	0.89	0.80	0.93	0.68	0.97	1.32	1.13	1.20	1.15	0.67	0.47
PHOSPHOR	% wf												
FSI		7½	7	8½	8	8	8	9	8	8	8	7	8½
SOFTENING TEMP.	°C	388	367	376	373	377	379	398	385	370	373	375	377
RESOLIDIFICATION TEMP.	°C	448	433	442	448	446	445	452	454	447	445	448	448
CONTRACTION	%	14	24	21	16	19	17	5	18	21	21	15	16
DILATATION	%	172	182	153	150	151	203	192	236	225	254	45	89
G-VALUE		1.065	1.068	1.065	1.073	1.070	1.073	1.064	1.076	1.085	1.081	1.046	1.063

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-12 Size of core: HQ 63.5 mm Total depth: 661 ' 201.6 m

Location: N 571328. 81427
W 63562. 57122
Elevation of collar: 5194.03 '
1584 2 m

Dip of Hole: -90°
Bearing " : - N -°

Date of starting: September 7, 1975
Date of completion: September 15, 1975

Logging by: G.C. Singhai
" on: September 15, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-12

Footage		Recovery		Description
from	to	feet	%	
0	91.0			Overburden, casing.
91.0	93.0			Siltstone, grey, fine grained.
93.0	101.2			Mudstone, dark grey, with thin interbeds of siltstone. Small pieces of coal. Lower contact gradational.
101.2	126.3			Sandstone, grey, fine to medium grained, with thin interbeds of silt and mudstone. Bedding 50° with core axis. Core broken. 116.0 - 120.7. Recovery 90%. Thin seams of coal along bedding plant.
126.3	127.0		100	Coal seam.
127.0	127.2			Carbonaceous shale.
127.2	131.9			Mudstone, dark grey, with thin bands of siltstone, and fine grained sandstone, occasionally thin coal seams.
131.9	143.2			Sandstone, grey, fine grained, with thin interbedding of silt and mudstone. Occasionally small pieces of coal.
143.2	152.4			Mudstone, dark grey, with interbedding of sandstone. Siltstone, sandstone 145.6 - 147.7, carbonaceous shale 144.0 - 145.6.
152.4	156.7	4.3	100	Coal seam, with parting of shale 152.8 - 153.2, sampled EB-12-1.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-12

Footage		Recovery		Description
from	to	feet	%	
156.7	167.0			Siltstone, grey, fine grained, with thin bands of mudstone and thin seams of coal. Bedding 45° with core axis. Core broken 163.1 - 166.0.
167.0	170.8			Mudstone, dark grey, with bands of siltstone.
170.8	181.0			Sandstone, light grey, fine to medium grained, with bands of silt and mudstone. Bedding 45° with core axis, 173.2 - 173.8, carbonaceous shale.
181.0	181.5			Mudstone.
181.5	182.3			Coal seam.
182.3	190.2			Sandstone, light grey, fine grained, with thin bands of silt and mudstone.
190.2	195.6			Mudstone, dark grey, upper contact parallel to bedding at 50°, with core axis. Sandstone 192.8 - 194.7.
195.6	199.8	4.2	100	Coal seam, sampled EB-12-2, parting of mudstone 195.8 - 196.0, shaly coal 196.5 - 197.4, coaly shale 199.2 - 199.8.
199.8	203.3			Sandstone, dark grey, to grey, fine to medium grained.
203.3	203.8			Siltstone, dark grey.
203.8	205.0			Coal seam.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-12

Footage		Recovery		Description
from	to	feet	%	
205.0	206.9			Mudstone, dark grey, bedding 50° with core axis. Thin coal seam.
206.9	208.5			Sandstone, grey, fine to medium grained.
208.5	210.0			Mudstone, with thin coal seams.
210.0	234.2			Sandstone, medium to fine grained, with very thin bands of silt and mudstone. Occasionally small pieces of coal, bedding 45° with core axis.
234.2	238.6	4.4	100	Coal seam, sampled EB-12-3. Parting of mudstone 235.4 - 236.2.
238.6	275.4			Siltstone, dark grey, very fine grained with thin seams of coal and bands of sandstone. Sandstone 241.0 - 243.2, 245.0 - 246.3, 272.8 - 273.8. Bedding 45° with core axis. Coal seam 265.2 - 265.6, carbonaceous shale 265.6 - 266.0.
275.4	291.9	16.5	90	Coal seam, EB-12-4, sampled. Parting of carbonaceous shale 282.8 - 283.7, 288.4 - 288.8, core broken.
291.9	297.3			Mudstone, dark grey, silty at the end. With occasionally thin coal seams. Bands of sandstone, coaly 295.3 - 296.3.
297.3	299.6	2.3	100	Coal seam, EB-12-5, 299.3 - 299.6, coaly shale.
299.6	305.0			Mudstone, dark grey, 301.2 - 301.6, coaly shale. 303.6 - 304.0 coaly shale.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-12

Footage		Recovery		Description
from	to	feet	%	
305.0	309.0			Sandstone, light grey, fine grained with interbeds of mudstone. Bedding 50° to core axis.
309.0	311.0			Mudstone, dark grey, with thin coal seams.
311.0	313.7			Sandstone, grey, medium to fine grained, with interbeds of silt and mudstone, occasionally small coal seams.
313.7	318.2			Mudstone, dark grey, with thin seams of coal. Coaly shale 315.2 - 315.6, coal seam 315.6 - 316.0.
318.2	322.4			Sandstone, light grey, fine to medium grained, with interbedding of silt and mudstone. Bedding 60° with core axis.
322.4	325.0			Mudstone, dark grey, fine grained. Carbonaceous shale 322.4 - 323.0. Occasionally thin coal seams. Core broken.
325.0	330.0			Sandstone, grey, medium to fine grained, with bands of silt and mudstone. Bedding 60° with core axis. Crossbedding, core broken.
330.0	337.2			Mudstone, dark grey, with thin bands of sandstone, and small pieces of coal.
337.2	340.2	3.0	100	Coal seam, EB-12-6, sampled. Coaly shale 339.8 - 340.2.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-12

Footage		Recovery		Description
from	to	feet	%	
340.2	341.0			Mudstone, with small pieces of coal.
341.0	344.0			Siltstone, dark grey, fine grained, low contact gradational.
344.0	361.8			Sandstone, light grey, medium to fine grained, with bands of silt and mudstone, and occasionally small pieces of coal. Mudstone 348.4 - 350.3, bedding 60^{o} to core axis.
361.8	365.7			Mudstone, dark grey, 364.7 - 365.7, carbonaceous shale. Recovery 50%.
365.7	369.0	2.5	76	Coal seam, EB-12-7, sampled.
369.0	370.5			Sandstone, light grey, fine to medium grained.
370.5	374.8			Siltstone, dark grey, very fine grained, with thin coal seams.
374.8	412.2			Sandstone, grey, medium to fine grained, with interbedding of silt and mudstone. Crossbedded. Bedding 58^{o} with core axis.
412.2	416.0			Siltstone, dark grey, fine grained, upper contact. 60^{o} with core axis.
416.0	418.2			Mudstone, out of 2.2 ' of core, only 1.2' of core is recovered.
418.2	421.0			Was coal which is grounded as core barrel was lose

lote:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-12

Footage		Recovery		Description
from	to	feet	%	
418.2	427.7	9.5	100	Coal seam, EB-12-8, sampled. 418.2 - 421.0 core of coal grounded.
427.7	428.2			Carbonaceous shale.
428.2	452.2			Sandstone, dark grey to light grey, with bands of mudstone and siltstone. Crossbedded. Bedding 60^{o} with core axis.
452.2	460.5			Mudstone, dark grey, occasionally with small pieces of coal. Coal seam 458.7 - 459.3.
460.5	492.5			Sandstone, grey, medium to fine grained, with bands of siltstone and mudstone. Crossbedded. Bedding 60^{o} to core axis.
492.5	498.6			Siltstone, dark grey, fine grained, occasionally with small pieces of coal.
498.6	499.6			Mudstone, with small pieces of coal.
499.6	504.1			Siltstone, dark grey, fine grained, interbedding of mudstone and sandstone. Occasionally thin coal seams and small pieces of coal. Bedding 60^{o} with core axis.
504.1	512.5			Sandstone, light grey, fine to medium grained, crossbedded. Core broken, 503.0 - 512.5, thin bands of siltstone and mudstone.

.../7

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-12

Footage		Recovery		Description
from	to	feet	%	
512.5	519.0			Siltstone, dark grey, fine grained with thin bands of mudstone and siltstone. Occasionally small pieces of coal, lower contact at 70° with core axis.
519.0	537.0			Sandstone, grey, medium grained, crossbedded, thin bands of silt and mudstone, core broken 525.0 - 527.0.
537.0	542.3			Siltstone, dark grey, fine grained, with interbeds of mudstone and sandstone. Occasionally small pieces of coal. Lower contact gradational.
542.3	551.3			Sandstone, grey, fine to medium grained, with bands of silt and mudstone. Crossbedded, small pieces of coal, bedding 60° with core axis.
551.3	560.0			Siltstone, dark grey, fine grained, with small pieces of coal. Bedding 60° with core axis.
560.0	570.0			Sandstone, grey, fine to medium grained, crossbedded, with bands of siltstone and mudstone. Bedding 60° with core axis. Siltstone 563.4 - 565.4.
570.0	582.2			Siltstone, dark grey, fine grained, occasionally with small coal pieces and bands of sandstone, 581.0 - 582.0.
582.0	588.7			Mudstone, dark grey, small pieces of coal and core broken. 584.8 - 587.2, coaly shale 585.3 - 586.9.

.../8

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-12

Footage		Recovery		Description
from	to	feet	%	
588.7	610.7			Coal seam, sampled EB-12-9. Shaly coal 593.2 - 593.6, mudstone parting 595.7 - 596.5, 597.5 - 598.3, recovery from 588.7 - 592.5, 58%.
610.7	612.2			Mudstone, dark grey, with small pieces of coal.
612.2	643.0			Sandstone, light grey, fine to medium grained, with crossbedding and thin bands of siltstone and mudstone. Occasionally thin seams of coal and small pieces of coal throughout core. Bedding 60^{o} with core axis. Mudstone parting 633.2 - 634.0. Coal seam 641.5 - 642.0.
643.0	652.5	9.5	100	Coal seam, sampled EB-12-10, parting of mudstone 649.5 - 650.0.
652.5	661.0			Sandstone, light grey, medium grained, crossbedding. Bedding distorted, thin bands of silt and mudstone. Occasionally small pieces of coal. Massive sandstone.
				End of Hole: 661'.
				Signed: G.C. Singhai, September 15, 1975.

ELCO MINING LIMITED

PAGE

DRILL HOLE: EB 12										
SAMPLE NO.:		EB-12-1	EB-12-2	EB-12-3	EB-12-4	EB-12-5	EB-12-6	EB-12-7	EB-12-8	EB-12-9	EB-12-10
LAB.NO.:		3957	3958	3959	3960	3961	3962	3963	3964	3971	3972
SAMPLE INTERVAL (from-to) (Ft.):		152.4-156.7	195.6-199.3	234.2-238.6	275.4-291.9	297.3-299.6	337.2-340.2	365.7-369.0	418.2-427.7	588.7-610.7	643.0-652.5
SEAM DESIGNATION:		Seam 19	Seam 18	Seam 18	Seam 18	Seam 18	Seam 17	Seam 17	Seam 16	Seam 15	Seam 14
RAW COAL											
INHERENT MOISTURE	% air dry	1.0	1.1	1.1	1.1	0.9	0.8	0.9	1.5	0.8	0.7
ASH	% wf	37.8	40.0	35.4	33.0	21.4	18.5	6.2	15.5	19.5	21.3
VOLATILE MATTER	% wf	21.2	21.2	22.4	22.1	23.6	25.9	29.0	24.7	23.1	23.1
FIXED CARBON	% air dry	40.6	38.3	41.8	44.4	54.5	55.7	64.3	58.9	57.0	55.3
SULPHUR	% wf	0.88	0.82	0.90	0.58	0.75	1.38	1.03	0.67	0.46	0.73
HARDGROVE GR.INDEX		65	59	66	74	74	78	115	112	93	85
SIZE FRACTION											
¼"x65M	weight %	92.8	93.2	94.4	91.7	94.1	95.0	91.3	88.6	89.0	93.1
65MxO	weight %	7.2	6.8	5.6	8.3	5.9	5.0	8.7	11.4	11.0	6.9
CLEAN COAL (SIZE-FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)											
YIELD ON ¼"x65M	weight %	56.9	38.2	55.7	58.6	66.7	78.6	95.6	79.8	74.4	72.1
TOTAL YIELD EXCL. 65MxO	weight %	52.8	35.6	52.6	53.7	62.8	74.7	87.3	70.7	66.2	67.1
INHERENT MOISTURE	% air dry	0.8	0.8	0.7	1.0	0.7	0.8	1.3	1.6	1.0	0.8
ASH	% wf	9.3	8.4	6.2	6.9	5.0	3.6	4.1	4.2	4.6	5.3
VOLATILE MATTER	% waf	30.6	31.9	33.0	31.2	31.0	30.7	30.9	29.3	28.5	28.4
FIXED CARBON	% waf	69.3	68.1	67.0	68.7	69.0	69.2	69.0	70.7	71.5	71.5
SULPHUR	% wf	1.03	1.14	1.18	0.91	0.99	0.96	1.06	0.89	0.67	0.83
PHOSPHOR	% wf										
FSI		8	8½	8½	8½	9+	8½	9	9	8½	8½
SOFTENING TEMP.	°C	376	374	358	364	367	370	366	373	370	364
RESOLIDIFIC.TEMP.	°C	452	447	444	445	450	448	439	439	444	443
CONTRACTION	%	18	20	24	26	23	24	27	24	24	27
DILATATION	%	139	236	272	207	252	241	209	144	198	267
G-VALUE		1.076	1.081	1.099	1.084	1.092	1.085	1.075	1.062	1.076	1.086

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-13 Size of core: HQ 63.5 mm Total depth: 622.0' 189.7 m

Location: N 571174.34153
W 62828.67454
Elevation of collar: 5203.25 '
1586.99 m

Dip of Hole: -90 °
Bearing " : - N - °

Date of starting: September 16, 1975
Date of completion: September 20, 1975

Logging by: Wayne Radant
" on: September 24, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-13

Footage		Recovery		Description
from	to	feet	%	
0	34.5			Overburden.
34.5	35.0			Siltstone, black - dark grey, very carbonaceous.
35.0	37.5			Coal seam, no sample taken.
37.5	38.5			Mudstone, black, finely laminated with silt, very carbonaceous.
38.5	46.7			Coal seam, sampled EB-13-1. Partings 38.95 - 39.0, 42.0 - 43.0, 44.0 - 44.4.
46.7	50.2			Mudstone, black, very carbonaceous,finely laminated.
50.2	52.2			Siltstone, dark grey, cross bedding, some disturbed bedding.
52.2	54.3			Mudstone, black, abundant plant fragments.
54.3	60.0			Mudstone, mud content increase upward, crossbedding, silty partings 54.6 - 54.7, 57.8 - 58.8.
60.0	64.5			Coal seam, sampled EB-13-2.
64.5	68.0			Mudstone, black, very carbonaceous, silty partings 66.0.
68.0	69.0			Coal seam, no samples taken.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-13

Footage		Recovery		Description
from	to	feet	%	
69.0	75.5			Mudstone, black color, crossbedding and distortion of bedding, silty partings 65.5 - 67.0, 70.0 - 71.0.
75.5	76.2			Coal seam, no sample taken.
76.2	128.0			Mudstone, black color, coal with pyrite partings. Crossbedding and distortion of bedding. Silty partings 115.5 - 116.5, angle with core axis at 60^{o}. Coal parting 123.5 - 125.0.
128.0	134.0			Siltstone, dark grey to black, finely laminated.
134.0	148.5			Mudstone, black, silty partings, finely laminated with silt.
148.5	149.5			Coal seam, no sample taken.
149.5	155.0			Mudstone, very carbonaceous, coaly partings 151.0 - 151.5, graduational contact.
155.0	161.0			Sandstone, dark grey to black, very fine grain, very carbonaceous, cross bedding. Graduational contact above and below, coaly parting 157.6 - 158.0.
161.0	166.0			Mudstone, finely laminated, black.
166.0	167.5			Coal seam, not sampled.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-13

Footage		Recovery		Description
from	to	feet	%	
167.5	186.0			Mudstone, black, cross bedding. High silty content.
186.0	190.8			Sandstone, fine grain, crossbedding, aprupt contact above. Carbonaceous angle with core axis 62^{0}.
190.8	195.2			Mudstone, black, pyritization 194', gradational contact below.
195.2	195.5			Coal seam, no sample taken.
195.5	217.1			Mudstone, black to grey, cross bedding. Disturbed bedding surfaces. Finely laminated, with silt. High carbonaceous content. Coal partings toward top and bottom 203.6 - 203.65, 204.2 - 204.5, 209.8 - 210.1. Angle at 200^{0}.
217.1	225.5			Coal seam, sampled EB-13-3. Partings: 217.5 - 218.4, 218.4 - 218.6, 219.1 - 219.7, 220.5 - 221.0, 222.8 - 223.1.
225.5	226.5			Sandstone, dark grey, disturbed bedding surfaces, aprupt contact.
226.5	228.9			Mudstone, dark grey, finely laminated, with silt, abundant and carbonaceous.
228.9	229.3			Coal seam, interbedded coaly mudstone.
229.3	242.0			Mudstone, finely laminated with silt and coal, cross bedding and disturbed sandy parting 233.5 - 234.0, coal parting 237.3 - 237.7.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-13

Footage		Recovery		Description
from	to	feet	%	
242.0	242.3			Coal seam, no sample taken.
242.3	278.5			Siltstone, dark grey, finely laminated with sand and mudstone. Carbonaceous, crossbedding and disturbed bedding.
278.5	279.1			Coaly partings.
279.1	280.2			Coal seam.
280.2	281.0			Mudstone, black, finely laminated with silt.
281.0	282.1			Carbonaceous shale.
282.1	283.5			Mudstone, black, finely laminated, with silt, aprupt contact below.
283.5	284.8			Sandstone, grey, crossbedding. Top contact, disturbed bedding and aprupt, carbonaceous plant fragments, 51° angle with core axis.
284.8	295.3			Mudstone, dark grey, coal partings 285.1 - 285.9, 293.0 - 293.5.
295.3	298.5		78.5	Coal seam, EB-13-4. Parting mudstone 296.3 - 296.5.
298.5	299.5			Mudstone, finely laminated with silt.
299.5	331.0			Sandstone, grey to medium grain. Finely laminated with silt and mud. Contact parallel to bedding. 60° angle with core axis. Occasional thin coal

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-13

Footage		Recovery		Description
from	to	feet	%	
				seams, crossbedding and disturbed bedding. Coal parting 302.5 - 303.5, 323.6 - 325.0, shale parting 325.0 - 325.7, mudstone parting 325.7 - 327.4.
331.0	333.0		60	Coal seam, no sample.
333.0	353.3			Sandstone, finely laminated mud and silt, cross bedding 60^{o} angle with core axis. Coal parting 347.3 - 349.0, coaly shale 350.3 - 350.6.
353.3	356.0			Mudstone, shaly.
356.0	357.8			Coal seam, no sample.
357.8	369.6			Sandstone, grey, finely laminated, silt and mud, crossbedding, disturbed bedding surfaces.
369.6	372.3			Coal seam.
372.3	374.1			Mudstone.
374.1	380.3			Sandstone, silty bands.
380.3	383.5			Siltstone, lower contact parallel with bedding, 70^{o} angle, with core axis.
383.5	385.7			Sandstone, light grey, fine to medium grain. Occasional small pieces of coal.
385.7	386.9			Mudstone, finely laminated, with silt.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-13

Footage		Recovery		Description
from	to	feet	%	
386.9	390.0			Coal seam, EB-13-5, shale parting 387.5 - 388.5.
390.0	395.4			Sandstone, light grey, fine to medium grain. Cross bedding, 60^{o} with core axis. Small coal seam 392.6 - 393.2.
395.4	396.7			Coal seam.
396.7	399.0			Mudstone, carbonaceous shale 396.7 - 397.0.
399.0	406.5			Sandstone, light grey, fine to medium grain, finely laminated with silt and mud.
406.5	409.1			Coal seam, no sample.
409.1	410.6			Siltstone, dark grey, fine grain. Occasional thin coal seams and small pieces of coal.
410.6	417.5			Sandstone, fine grain.
417.5	425.0			Mudstone, occasional coal pieces, top and bottom contact. Parallel to bedding plane. Thin coal seam 422.0 - 422.4.
425.0	431.0			Sandstone, fine to medium grain, cross bedding. Finely laminated mud and silt. Small coal pieces, 70^{o} with core axis.
431.0	433.2			Siltstone.
433.2	443.2			Sandstone, occasional coal pieces and seams. Finely laminated with silt, coal parting 439.7 - 440.5.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-13

Footage		Recovery		Description
from	to	feet	%	
443.2	446.2			Coal seam, dull coal, EB-13-6.
446.2	479.5			Sandstone, grey, fine to medium grain. Cross bedding. Disturbed bedding. Occasional small pieces of coal. Finely laminated silt and mud. 60^{o} with core axis.
479.5	482.8			Mudstone, carbonaceous.
482.8	484.0			Coal seam.
484.0	485.3			Shale, carbonaceous.
485.3	489.0			Sandstone, light grey, fine to medium grain. Crossbedding.
489.0	494.5			Siltstone, grey, sandy bands, occasional coal pieces.
494.5	496.9			Sandstone, light grey, fine grain, cross bedding, occasional coal pieces.
496.9	499.7			Mudstone, laminated with silt.
499.7	521.0			Sandstone, light grey, fine grain, crossbedding. Occasional small coal seams 80^{o} with core axis.
521.0	531.7			Mudstone, small sandy bands, coal pieces throughout. Finely laminated silt and sand.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-13

Footage		Recovery		Description
from	to	feet	%	
531.7	544.2			Coal seam, dull coal, EB-13-7, partings 537.9 - 538.3, 544.0 - 544.2.
544.2	549.3			Sandstone, fine grain, crossbedding. Laminated with silt and mud.
549.3	551.8			Coal seam, EB-13-8.
551.8	552.3			Mudstone.
552.3	552.7			Coal seam.
552.7	598.3			Sandstone, light to dark grey, 60^{o} with core axis. Fine to medium grain, occasional thin coal seams and pieces of coal. Coal seams more abundant from 571.0 - 581.0.
598.3	605.0			Coal seam, EB-13-9. Carbonaceous shale 598.3 - 599.7, mudstone parting 603.5 - 603.9.
605.0	622.0			Sandstone, light to dark grey, fine to medium grain. Finely laminated with silt and mud, cross bedding 60^{o} with core axis. Occasional small coal pieces.
				End of Hole: 622.0 '. Signed: Wayne Radant, September 24, 1975.

ELCO MINING LIMITED

PAGE

DRILL HOLE: EB-13									
SAMPLE NO.:		EB-13-1	EB-13-2	EB-13-3	EB-13-4	EB-13-5	EB-13-6	EB-13-7	EB-13-8	EB-13-9
LAB. NO.:		4001	4002	4027	4028	4029	4030	4031	4032	4033
SAMPLE INTERVAL (FROM-TO) (FT.):		38.5-46.7	60.4-64.5	217.1-225.5	295.3-298.5	386.9-390.0	443.2-446.2	531.7-544.2	549.3-551.8	598.3-605.0
SEAM DESIGNATION		Seam 21	Seam 21	Seam 20	Seam 19	Seam 19	Seam 18	Seam 18	Seam 17	Seam 17
RAW COAL										
INHERENT MOISTURE	% air dry	0.7	1.0	0.8	0.9	0.8	0.9	0.9	0.7	0.6
ASH	% wf	30.8	40.6	41.8	34.1	37.7	6.3	20.2	17.8	43.1
VOLATILE MATTER	% wf	32.9	22.6	22.2	23.6	23.2	26.9	25.5	26.5	21.0
FIXED CARBON	% air dry	36.0	36.4	35.7	41.9	38.8	66.2	53.8	55.3	35.7
SULPHUR	% wf	0.30	0.71	0.45	0.75	0.86	0.71	0.34	0.43	0.42
HARDGROVE GR. INDEX		67	59	62	67	59	75	99	80	71
SIZE FRACTION										
¼"x65M	weight %	95.5	95.5	94.4	94.3	94.9	94.2	84.5	93.5	92.9
65Mx0	weight %	4.5	4.5	5.6	5.7	5.1	5.8	15.5	6.5	7.1
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINKL-FLOAT S.G.)										
YIELD	weight %	56.7	48.6	43.7	52.3	46.9	94.8	74.1	80.4	47.2
TOTAL YIELD, EXCL. 65Mx0	weight %	54.1	46.4	41.3	49.3	44.5	89.3	62.6	75.2	43.8
INHERENT MOISTURE	% air dry	1.7	1.0	1.2	1.2	1.2	NA	2.4	1.6	1.4
ASH	% wf	6.7	9.4	11.2	10.2	9.4	NA	5.4	4.4	9.6
VOLATILE MATTER	% waf	37.1	36.2	36.0	34.3	34.9	NA	32.4	33.0	33.1
FIXED CARBON	% waf	57.7	63.7	63.8	65.5	65.0	NA	67.5	67.0	66.8
SULPHUR	% wf	0.75	0.98	0.75	1.00	1.13	NA	0.61	0.59	0.76
PHOSPHOR	% wf									
FSI		7½	7½	7	8½	7½	6	8	8	8½
SOFTENING TEMP.	°C	371	368	373	387	388	394	382	373	378
RESOLIDIFICATION TEMP.	°C	446	447	443	446	451	450	445	448	454
CONTRACTION	%	27	26	24	14	18	15	22	23	24
DILATATION	%	144	175	178	164	276	182	107	171	200
G-VALUE		1.067	1.077	1.070	1.063	1.071	1.060	1.053	1.075	1.077

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-14 Size of core: HQ 63.5 mm Total depth: 791 ' 241.3 m

Location: N 569582.71597
W 63556.15518
Elevation of collar: 5184.89 '
1581.39 m

Dip of Hole: 90 °
Bearing " : - N - °

Date of starting: September 21, 1975
Date of completion: September 26, 1975

Logging by: G.C. Singhai
" on: September 29, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
0	90.0			Overburden.
90.0	93.5			Siltstone, dark grey, fine grained, with very thin coal seam. Lower contact graduational.
93.5	113.3			Sandstone, light grey, fine to medium grained, with thin bands of mudstone and siltstone. Cross-bedded. Bedding 50° with core axis. Occasionally with small pieces of coal. Lower contact sharp at 50° with core axis.
113.3	114.9			Mudstone, dark grey, with small coal pieces.
114.9	121.0	6.1	100	Coal seam, very poor coal. Core broken, sampled EB-14-1. Parting of mudstone, 116.0 - 116.4, 117.2 - 117.9. Carbonaceous shale 118.5 - 120.0.
121.0	171.6			Sandstone, light grey to dark grey, with thin bands of silt and mudstone. Crossbedded. Bedding 60° with core axis. Occasionally small coal pieces. Very often thin coal seams, 161.0 - 171.0.
171.6	175.3	3.7	76	Coal seam, sampled EB-14-2.
175.3	178.4			Mudstone, dark grey, with small pieces of coal.
178.4	182.0			Sandstone, light grey, medium to fine grained, with bands of silt and mudstone. Crossbedded, bedding 35° with core axis.
182.0	183.0			Shale, with small pieces of coal.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
183.0	186.6	3.6	80	Coal seam, sampled EB-14-3.
186.6	188.6			Sandstone, light grey, medium to fine grained, with small pieces of coal. Crossbedded.
188.6	190.0			Mudstone, dark grey, with thin coal seam. Broken core.
190.0	195.0	5	100	Coal, sampled EB-14-4. Parting of mudstone 192.3 - 192.4, 193.5 - 193.6, broken core.
195.0	200.7			Mudstone, dark grey, very fine grained, coal seam 197.2 - 197.7, core broken.
200.7	203.0	2.3	100	Coal seam, EB-14-5, sampled. Parting mudstone 201.9 - 202.0.
203.0	285.0			Sandstone, light grey, medium to fine grained. Bands of silt and mudstone. Bedding 60^{o} to core axis. Crossbedded. Occasionally with thin coal seams. (203.0 - 205.0 core recovery 35%, core broken). Coal seam 239.4 - 240.0, 275.3 - 275.7.
285.0	301.4			Siltstone, dark grey, fine grained with interbedding of sandstone. Occasionally thin coal seams and small pieces of coal. Bedding 60^{o} with core axis.
301.4	306.0			Sandstone, as above, with small pieces of coal.
306.0	322.0			Mudstone, dark grey, occasionally with thin coal seams and small pieces of coal. Coal seam 320.3 - 321.5, sandstone 315.6 - 316.6.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
322.0	331.0			Sandstone, dark grey, fine to medium grained. Cross bedded. Bedding, interbedding of mudstone and siltstone. 326.0 - 327.5 broken core, with thin coal seams.
331.0	335.7			Mudstone, finely laminated, with interbedding of sandstone, coaly shale 334.4 - 335.6, coaly shale 334.4 - 335.6.
335.7	339.8			Sandstone, dark grey, fine to medium grained. Interbedding of siltstone, crossbedding of siltstone.
339.8	349.0			Siltstone, dark grey, fine grained with occasionally thin coalseams.
349.0	350.0		100	Coal seam, dull.
350.0	350.5			Shale.
350.5	365.3			Sandstone, grey, fine to medium grained. Occasionally very thin coal seams. Bedding 45^{o} with core axis. Crossbedding.
365.3	366.3			Carbonaceous shale.
366.3	370.3	4.0	100	Coal seam, sampled EB-14-6, 369.8 - 370.3, shaly coal.
370.3	382.0			Mudstone, dark grey, finely laminated. Occasionally thin seams of coal.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
382.0	384.8			Sandstone, with siltbands as above.
384.8	388.7			Mudstone, dark grey, with thin coal seam.
388.7	391.6	2.9	100	Coal seam, sampled EB-14-7. Parting of mudstone 391.4 - 391.6.
391.6	394.0			Siltstone, dark grey, fine grained.
394.0	397.0	3.0	100	Coal seam, very dirty, not sampled.
397.0	427.8			Sandstone, grey, medium to fine grained. Occasionally thin coal seams. Small coal pieces, cross-bedded. Bedding 50° with core axis. Coaly shale 414.2 - 414.6.
427.8	440.4			Mudstone, dark grey, with thin coal seams. Sandstone 435.0 - 438.6.
440.4	450.5	10.1	100	Coal seam, EB-14-8, sampled. Parting of mudstone 441.1 - 441.2, dirty coal.'
450.5	455.8			Mudstone, dark grey. Very fine grained with small pieces of coal. Coal seam 452.9 - 453.6, carbonaceous shale 453.6 - 454.6.
455.8	467.0			Siltstone, dark grey, fine grained. Occasionally thin coal seams. Lower contact sharp at 35° with core axis. Coal seam 464.4 - 465.4.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
467.0	469.5			Sandstone, light grey, medium grained, cross-bedded. Small pieces of coal.
469.5	471.5			Carbonaceous shale, dark grey. Fine grained, laminated.
471.5	473.2	1.7	100	Coal seam.
473.2	481.0			Mudstone, dark grey, very fine grained, with inter-beds of sandstone 475.0 - 476.0. Numerous thin coal-seams, throughout the core. Bedding 60° to core axis. Lower contact sharp.
481.0	501.0			Sandstone, light grey, medium grained. Crossbedded, with thin bands of silt and mudstone, slightly carbonaceous toward bottom. Bedding 65° with core axis.
501.0	501.7			Mudstone.
501.7	503.0	1.3	100	Coal seam.
503.0	534.0			Sandstone, light grey, medium grained. Crossbedded, and small pieces of coal and thin coal seams. Bedding 55° with core axis.
534.0	536.4			Siltstone, dark grey, fine grained, with small pieces of coal.
536.4	543.0			Sandstone, light grey to grey, fine to medium grained. Crossbedded, with thin bands of silt and mudstone. Occasionally small pieces of coal.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
543.0	545.0	2.0	100	Coal seam, mudstone parting 544.0 - 544.2, and 544.5 - 544.7.
545.0	562.2			Mudstone, dark grey, very fine grained with interbedding of silt and sandstone, 546.9 - 547.9, and 553.0 - 554.0. Bedding 60^{o} with core axis. Occasionally thin seams of coal and small pieces of coal.
562.2	564.0	1.8	100	Coal seam.
564.0	565.8			Mudstone, dark grey, with small pieces of coal. Lower at 55^{o} with core axis.
565.8	574.9			Sandstone, light grey to grey, fine to medium grained, with thin interbeds of silt and mudstone and small pieces of coal. Crossbedded. Bedding 55^{o} to core axis.
574.9	583.7			Mudstone, dark grey, with interbeds of silt and sandstone. Thin seams of coal and small pieces of coal.
583.7	585.0	1.3	100	Coal seam.
585.0	589.0			Mudstone, with thin interbeds of sandstone.
589.0	591.4	2.4	100	Coal seam, dirty seam, parting at 589.8 - 590.1, and 591.1 - 591.4.

.../7

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
591.4	611.7			Sandstone, light grey to grey, fine to medium grained, with interbedding of silt and mudstone. Crossbedded. Bedding 60° with core axis. Coal seam 598.8 - 599.2, and occasionally thin seams of coal.
611.7	613.4	1.7	100	Coal seam, dirty coal, carbonaceous shale 613.0 - 613.1.
613.4	617.0			Sandstone, as above.
617.0	620.6			Mudstone, dark grey, laminated, with thin coal-seams.
620.6	624.4			Sandstone, light grey to grey, fine to medium grained, with small pieces of coal.
624.4	626.3			Mudstone, dark grey, laminated, with thin coal seams.
626.3	629.0	2.7	82	Coal seam, sampled, EB-14-9.
629.0	636.0			Mudstone, dark grey, laminated. Interbedded with sandstone and thin seams of coal. Coal seam 631.0 - 631.4, core broken.
636.0	638.5			Sandstone, light grey, fine to medium grained, with interbeds of silt and mudstone. Bedding 65° with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
638.5	658.0			Mudstone, dark grey, with interbeds of sandstone and thin coal seams. Laminated and occasionally small pieces of coal. Bedding 65° with core axis.
658.0	661.0			Sandstone, grey, fine to medium grained. Occasionally small pieces of coal.
661.0	671.0			Mudstone, as above.
671.0	679.5			Sandstone, grey, fine to medium grained. Crossbedded, and thin bands of silt and mudstone. Occasionally small pieces of coal.
679.5	689.3			Mudstone, dark grey, thin bands of siltstone, laminated. Occasionally small pieces of coal, lower contact aprupt at 60° to core axis.
689.3	693.5			Sandstone, light grey to grey, fine to medium grained, interbeds of silt and mudstone. Occasionally thin seams of coal. Crossbedded. Bedding 55° with core axis.
693.5	699.0			Mudstone, dark grey, with thin interbeds of siltstone, and occasionally thin coal seams and small pieces of coal. Coal seam 694.4 - 694.8, 696.0 - 697.4, coal seam 697.4 - 697.6.
699.0	702.6			Sandstone, grey, fine grained, and thin interbeds of silt and mudstone, lower contact graduational.
702.6	706.4			Siltstone, dark grey, very fine grained, with interbeds of sandstone. Bedding 60° with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
706.4	708.8	2.4		Mudstone, dark grey, occasionally small pieces of coal. Core badly broken.
708.8	711.0	2.2	100	Coal seam, sampled EB-14-10. Lower contact 40° to core axis.
711.0	712.7			Sandstone, as above.
712.7	714.7			Mudstone, dark grey, very fine grained, laminated, and number of thin coal seams.
714.7	717.4	2.7	100	Coal seam, sampled EB-14-11, parting of carbonaceous shale, 716.2 - 716.6, 716.8 - 717.0.
717.8	730.0			Mudstone, dark grey, with interbeds of silt and sandstone. Laminated. Numerous thin coal seams, and small pieces of coal. Bedding 65° with core axis.
730.0	736.5			Sandstone, dark grey to grey, fine to medium grained, with interbedding of silt and mudstone. Occasionally thin seams of coal and small pieces of coal.
736.5	738.5			Mudstone, dark grey, laminated and with thin seams of coal.
738.5	757.3			Sandstone, light grey to grey, fine to medium grained, with thin bands of silt and mudstone. Occasionally thin seams of coal and small pieces of coal. Crossbedded. Bedding 65° with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-14

Footage		Recovery		Description
from	to	feet	%	
757.3	758.3			Mudstone, dark grey, upper contact parallel to bedding. Number of thin coal seams 758.0 - 758.3.
758.3	769.4	11.1	100	Coal seam, sampled EB-14-12, from758.0 - 769.4, parting, shale 761.3 - 762.3, 765.7 - 766.0, carbonaceous shale 766.8 - 767.2, 768.2 - 768.5.
769.4	791.0			Sandstone, light grey, medium to fine grained, interbedding of silt and mudstone, massive. Occasionally thin seams of coal. Very often small pieces of coal. Crossbedded. Bedding 65^{o} to core axis. End of Hole: 791' G.C. Singhai, September 29, 1975.

ELCO MINING LIMITED

PAGE

DRILL HOLE: EB-14													
SAMPLE NO.:		EB-14-1	EB-14-2	EB-14-3	EB-14-4	EB-14-5	EB-14-6	EB-14-7	EB-14-8	EB-14-9	EB-14-10	EB-14-11	EB-14-12
LAB.NO.:		4034	4035	4036	4037	4038	4039	4040	4082	4083	4084	4085	4086
SAMPLE INTERVAL (FROM-TO) (FT):		114.9-121.6	171.6-175.3	183.0-186.6	190.0-195.0	200.7-203.0	366.3-370.3	388.7-391.6	440.4-450.5	626.3-629.0	708.8-711.0	712.7-714.7	758.3-769.4
SEAM DESIGNATION:		Seam 20	Seam 19	Seam 19	Seam 19	Seam 19	Seam 18	Seam 18	Seam 18	Seam 17	Seam 17	Seam 17	Seam 17
RAW COAL													
INHERENT MOISTURE	% air dry	0.9	0.9	0.9	1.0	0.7	0.9	0.8	1.0	0.9	0.7	0.7	0.9
ASH	% wf	63.6	33.0	13.5	49.1	17.0	19.9	15.4	17.6	28.2	26.0	32.8	43.9
VOLATILE MATTER	% wf	14.7	25.3	30.0	19.7	29.3	23.5	27.2	27.3	23.5	23.1	21.0	19.0
FIXED CARBON	% air dry	21.5	41.3	56.0	30.9	53.3	56.1	56.9	54.6	47.9	50.6	45.9	NA
SULPHUR	% wf	0.43	0.58	0.92	0.56	0.86	0.62	0.84	0.46	0.75	0.71	0.67	0.65
HARDGROVE GR. INDEX		83	64	88	80	105	69	76	109		80	70	
SIZE FRACTION													
¼"x65M	weight %	94.6	91.5	92.8	86.7	85.2	93.8	93.8	86.9	89.7	88.9	94.4	96.0
65Mx0	weight %	5.4	8.5	7.2	13.3	14.8	6.2	6.2	13.1	10.3	11.1	5.6	4.0
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK FLOAT S.G.)													
YIELD	weight %	23.9	54.0	90.0	42.4	84.0	77.0	80.2	82.7	58.3	72.6	56.2	61.9
TOTAL YIELD, ESCL. 65MxO	weight %	22.6	49.4	83.5	36.8	71.6	72.2	75.2	71.9	52.3	64.5	53.1	59.4
INHERENT MOISTURE	% air dry	1.1	1.1	1.9	3.1	2.3	1.2	1.2	2.2	1.1	0.9	1.1	1.0
ASH	% wf	8.5	3.8	7.7	8.1	4.3	2.3	4.8	5.6	6.9	12.0	9.8	5.4
VOLATILE MATTER	% waf	34.4	34.5	34.8	35.2	35.6	29.7	32.5	33.3	31.8	31.5	31.7	30.4
FIXED CARBON	% waf	65.4	67.0	65.0	64.5	64.3	70.2	67.6	66.7	68.1	68.6	68.2	69.6
SULPHUR	% wf	1.00	0.89	1.08	0.97	1.09	0.79	0.94	0.89	0.104	0.93	0.96	0.99
PHOSPHOR	% wf												
FSI		NA	8½	8½	8	8	6	8	8½	8	8½	8	9
SOFTENING TEMP.	°C	387	374	377	373	376	382	381	382	376	369	376	376
RESOLIDIFICATION TEMP.	°C	449	447	447	437	436	442	441	445	448	444	444	445
CONTRACTION	%	17	22	24	15	25	16	17	17	19	18	15	18
DILATATION	%	130	198	167	148	190	13	141	139	207	210	233	199
G-VALUE		1.060	1.077	1.068	1.069	1.060	0.993	1.061	1.063	1.078	1.084	1.079	1.075

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-15 Size of core: HQ 63.5 mm Total depth: 460 ' 140.3 m

Location: N 565687.09830
W 65874.06553
Elevation of collar: 5158.01 '
1573.19

Dip of Hole: -90 °
Bearing " : - N - °

Date of starting: August 27, 1975
Date of completion: September 3, 1975

Logging by: G.C. Singhai
" on: September 5, 1975.

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-15

Footage		Recovery		Description
from	to	feet	%	
0	29.7			Overburden.
29.7	32.7			Mudstone, dark grey, very fine grained, lower contact 45° with core axis.
32.7	34.4			Sandstone, grey to light grey, medium to fine grained, with crossbedding and thin bands of siltstone and mudstone.
34.4	35.8			Mudstone as above.
35.8	38.0	2.2	100	Coal seam, sample EB-15-1.
38.0	45.0			Sandstone, light grey, medium grained with bands of mudstone, 44.1 - 44.8, sandstone massive.
45.0	45.3			Coal seam.
45.3	50.0			Mudstone, dark grey, with small pieces of coal, coal seam 47.8 - 48.5, with parting of coal shale 48.0 - 48.3.
50.0	53.3			Sandstone, light grey, with bands of siltstone and mudstone, cross bedded, upper contact at 60° with core axis.
53.3	59.8			Siltstone, grey, very fine grained.
59.8	63.7			Sandstone, light grey, medium to fine grained, with bands of silt and mudstone, bedding 50° with core axis.

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DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-15

Footage		Recovery		Description
from	to	feet	%	
63.7	66.8			Mudstone, as above, lower part 66.4 - 66.8, coaly shale, coal seam 64.9 - 65.3.
66.8	78.5	11.7	100	Coal seam, sampled EB-15-2. 66.8 - 67.1 shaly coal, mudstone parting 67.1 - 67.2, 67.7 - 67.9, 68.7 - 68.8, coaly shale 69.1 - 69.3, 70.2 - 70.3, 70.7 - 71.0.
78.5	93.4			Mudstone with small pieces of coal and thin bands of siltstone, core broken 82.6 - 84.6.
93.4	95.5	2.1	100	Coal seam, sampled EB-15-3.
95.5	99.0			Siltstone, dark grey, ver fine grained, occasionally with small pieces of coal.
99.0	106.7			Mudstone, dark grey, with small pieces of coal material, coaly shale 105.6 - 106.0, lower contact 50^{o} with core axis.
106.7	108.2			Sandstone, light grey, medium to fine grained.
108.2	108.7			Carbonaceous shale.
108.7	113.2	4.5	100	Coal seam, sampled EB-15-4, parting of mudstone 111.9 - 112.6.
113.2	119.3			Mudstone, dark grey, with small pieces of coal. Coal seam 115.4 - 115.7.

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DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-15

Footage		Recovery		Description
from	to	feet	%	
119.3	122.0	2.7	100	Coal seam, sampled EB-15-5, parting of mudstone 120.7 - 121.0, coaly shale 121.4 - 121.7.
122.0	124.8			Mudstone, carbonaceous shale, 123.6 - 124.6.
124.8	121.1			Coal seam.
125.1	127.4			Carbonaceous shale with coaly shale.
127.4	134.2			Mudstone with small pieces of coa, number of fine coal streaks,133.7 - 134.2.
134.2	136.2			Siltstone, with thin streaks of coal.
136.2	140.2			Mudstone, with coal seam 138.8 - 139.2.
140.2	142.5			Shaly coal, 141.1 - 141.8, parting of sandstone 141.8 - 142.5.
142.5	144.5	2.0	100	Coal seam, EB-15-6, sampled, parting of mudstone 143.2 - 143.3.
144.5	147.5			Mudstone, with small pieces of coal.
147.5	148.2			Coal seam.
148.2	157.7			Mudstone, with bands of siltstone and occasionally pieces of coal.
157.7	194.0			Siltstone, light grey, very fine grained.

.../4

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-15

Footage		Recovery		Description
from	to	feet	%	
194.0	201.0			Sandstone, light grey, fine to medium grained, with thin layers of siltstone and mudstone.
201.0	205.0	4.0	100	Coal seam, sampled EB-15-7.
205.0	206.7			Mudstone, with occasionally small coal pieces.
206.7	211.0	43	100	Coal seam, EB-15-8, sampled, partings 207.6 - 208.2 mudstone.
211.0	215.2			Carbonaceous shale 209.7, mudstone with streaks of coal. Coal seam 214.4 - 214.8.
215.2	238.5			Sandstone, light grey to grey, medium to fine grained, occasionally thin seams of coal, cross bedded. Bedding 60^{0} with core axis.
238.5	245.2			Mudstone, dark grey, with bands of siltstone.
245.2	257.5	12.3	100	Coal seam, sampled EB-15-9. Parting, coaly shale 254.6 - 254.8, 256.8 - 257.0.
257.5	261.4			Mudstone, shaly coal 257.5 - 257.6, 260.8 - 261.4.
261.4	270.0	8.6	100	Coal seam, very dull coal, sampled EB-15-10. Parting carbonaceous shale 264.6 - 265.6.
270.0	273.4			Mudstone, with coal streaks 270.0 - 271.0.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-15

Footage		Recovery		Description
from	to	feet	%	
273.4	276.0			Sandstone, light grey, fine grained to medium grained, with bands of silt and mudstone.
276.0	282.3			Mudstone, dark grey, fine grained, with a band of sandstone 278.2 - 279.2.
282.3	285.1	2.8	100	Coal seam EB-15-11.
285.1	292.5			Mudstone, dark grey, occasionally with thin streaks of coal, core broken 290.1 - 291.0.
292.5	301.0			Sandstone, grey, medium to fine grained, siltstone 296.0 - 298.4.
301.0	309.8			Mudstone, dark grey, occasionally with small pieces of coal.
309.8	313.6	3.8	100	Coal seam, EB-15-12.
313.6	339.2			Sandstone, light grey to grey, with bands of silt and mudstone, occasionally with very thin seams of coal.
339.2	343.0			Mudstone, with small pieces of coal.
343.0	346.0			Siltstone, grey, fine grained, with small pieces of coal.
346.0	367.5			Mudstone, dark grey, with small pieces of coal, with number of thin coal seams 349 - 350.5, core broken badly, 356 - 358, 362 - 366.6

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-15

Footage		Recovery		Description
from	to	feet	%	
367.5	371.4			Sandstone, light to dark grey, with bands of siltstone and mudstone.
371.4	376.6			Mudstone, with small pieces of coal, sandstone 374.4 - 376.0.
376.6	378.1			Coal seam.
378.1	381.2			Sandstone, massive, light grey.
381.2	390.4			Mudstone, dark grey, with small pieces of coal.
390.4	395.8	5.4	90	Coal seam, sampled EB-15-13, core broken.
395.8	397.1			Coaly shale with bands of mudstone.
397.1	414.8			Mudstone, dark grey with small pieces of coal, coaly shale with carbonaceous mudstone, 409.5 - 414.8, core broken, recovery 80%.
414.8	425.3			Sandstone, light grey, medium to fine grained, with bands of mud and siltstone. Mudstone 415 - 416.5, 421.4 - 423.2, coal seam 422.5 - 422.6.
425.3	425.9			Mudstone, 425.7 - 425.9 coaly shale.
425.9	444.8	18.8	100	Coal seam, sampled EB-15-14. Parting of mudstone 431 - 432, 432.5 - 433.1, 433.5 - 433.7, carbonaceous shale 434 - 436.5.

.../7

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-15

Footage		Recovery		Description
from	to	feet	%	
444.8	446.0			Mudstone, with number of coal streaks.
446.0	460.0			Mudstone, dark grey with bands of sandstone and small pieces of coal. End of Hole at 460. Signed: G.C. Singhai, September 5, 1975.

ELCO MINING LIMITED PAGE

DRILL HOLE: EB 15													
SAMPLE NO.:		EB-15-1	EB-15-2	EB-15-3	EB-15-4	EB-15-5	EB-15-6	EB-15-7	EB-15-8	EB-15-9	EB-15-10	EB-15-11	EB-15-12	EB-15-13	EB-15-14
LAB. NO.:		3797	3798	3799	3800	3801	3802	3803	3804	3805	3806	3807	3808	3809	3810
SAMPLE INTERVAL (from-to) (Ft):		35.8-38.0	66.8-78.5	93.4-95.5	108.7-113.2	119.3-122.0	142.5-144.5	201-205	206.7-211.0	245.2-257.5	261.4-270.0	282.3-285.1	309.8-313.6	390.4-395.8	425.9-444.8
SEAM DESIGNATION		Seam 16	Seam 16	Seam 16	Seam 16	Seam 16	Seam 16	Seam 15	Seam 15	Seam 15	Seam 15	Seam 14	Seam 14	Seam 14	Seam 13
RAW COAL															
INHERENT MOISTURE	% air dry	0.7	1.0	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.5	0.7	1.0	0.8
ASH	% wf	30.3	31.8	7.2	33.9	48.6	34.8	11.8	32.8	26.1	31.5	7.8	35.7	41.0	52.2
VOLATILE MATTER	% wf	22.9	20.1	26.8	20.8	16.9	19.8	23.7	19.9	20.8	19.5	24.1	20.0	17.0	16.1
FIXED CARBON	% air dry	46.5	47.6	65.6	44.9	34.3	45.1	64.1	47.0	52.8	48.6	67.7	44.0	41.6	31.4
SULPHUR	% wf	0.95	0.52	1.07	0.74	0.49	0.63	0.71	0.58	0.63	0.67	0.94	0.72	0.72	0.54
HARDGROVE GR. INDEX		74	72	122	78	95	78	66	71	79	97	89	85	76	85
SIZE FRACTION															
¼"x65M	weight %	91.7	90.3	88.8	92.5	91.1	91.8	87.3	93.6	89.3	88.2	92.4	90.9	92.2	86.8
65MxO	weight %	8.3	9.7	11.2	7.5	8.9	8.2	12.7	6.4	10.7	11.8	7.6	9.1	7.8	13.2
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)															
YIELD ON ¼"x65M	weight %	53.7	55.4	94.3	57.6	40.6	52.4	90.1	59.0	66.7	56.6	93.8	51.0	42.0	43.7
TOTAL YIELD EXCL.65MxO	weight %	49.2	50.0	83.7	53.3	37.0	48.1	78.7	55.2	59.6	49.9	86.7	46.4	38.7	37.9
INHERENT MOISTURE	% air dry	0.8	0.9	1.2	0.8	0.7	0.7	0.9	0.7	0.8	3.4	0.8	0.8	0.8	2.0
ASH	% wf	8.4	6.3	4.6	8.8	8.4	10.8	6.3	5.7	4.9	6.4	5.0	4.4	9.8	5.4
VOLATILE MATTER	% waf	29.1	27.5	28.9	30.0	27.8	28.5	26.5	27.7	28.0	27.3	27.1	28.2	25.2	25.9
FIXED CARBON	% waf	70.8	72.3	70.9	69.9	72.2	71.4	72.7	72.4	72.1	72.7	73.0	73.1	74.7	73.9
SULPHUR	% wf	1.17	0.76	1.25	1.06	0.85	0.73	0.88	0.80	0.67	1.37	0.97	0.91	0.96	1.28
PHOSPHOR	% wf														
FSI		8½	8½	8	8½	8½	9	9	9	8½	8	8	8	7½	7
SOFTENING TEMP.	°C	376	373	369	382	386	389	391	391	394	394	397	388	394	397
RESOLIDIFIC.TEMP.	°C	448	422	416	492	494	458	456	460	462	453	456	454	456	456
CONTRACTION	%	25	21	23	27	16	24	24	24	19	24	23	26	24	25
DILATATION	%	270	271	284	235	227	223	208	233	227	101	252	258	164	111
G-VALUE		1.078	1.053	1.054	1.111	1.119	1.070	1.065	1.071	1.072	1.045	1.061	1.068	1.057	1.046

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-16 Size of core: HQ 63.5 mm Total depth: 880' 268.4 m

Location: N 565532.57089
W 65140.15731
Elevation of collar: 5154.27 '
1572.05 m

Dip of Hole: -90 o
Bearing " : - N - o

Date of starting: August 19, 1975
Date of completion: August 26, 1975

Logging by: G.C. Singhai
" on: August 30, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
0	40			Casing overburden.
40	48			Mudstone, dark grey with thin bands of siltstone, bedding 60° with core axis.
48	77.4			Siltstone, light grey, fine grained, bedding 60°, with core axis.
77.4	77.7			Coal seam.
77.7	83.95			Siltstone, dark grey, fine grained.
83.95	93.5			Coal seam, sampled EB-16-1, parting 85 - 86.9, 87.15 - 88.95, mudstone partings 90.45 - 91.9, shale with coal strike 93.5 - 94.25.
93.5	97.0			Coaly shale, dark grey, fine grained with very thin discontinuous seams of coal.
97.0	99.4			Siltstone, grey, fine grained with very thin layers of carbonaceous material.
99.4	102.7			Sandstone, light grey, medium to fine grained, bedding 60° with core axis.
102.7	105.4			Mudstone, dark grey, fine grained, core badly broken.
105.4	107.6			Coal seam, with partings 105.7 - 106 of mudstone.
107.6	109.4			Siltstone, lightly grey, fine grained.

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DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
109.4	111.8			Sandstone, light grey, medium grained.
111.8	121.0			Siltstone, grey, fine grained, coal seam 116.8 - 118.3.
121.0	135.0			Sandstone, light grey, medium to fine grained, cores bedded, bedding at 60^{o} with core axis.
135.0	141.9			Mudstone, dark grey, fine grained with thin seams of coal, thin coaly shale bands at 139.1. Coal seam 137.4 - 138.8, coaly shale 141.0 to 141.9.
141.9	144.3			Sandstone, light grey, medium to fine grained with a bedding of 60^{o} with core axis. Coal seam 143.6 - 144.0.
144.3	146.8			Siltstone, dark grey, fine grained, carbonaceous, silt at 145.2 - 146.7 and a coal seam 146.0 to 146.3.
146.8	156.4			Sandstone, light grey, medium to fine grained, with cross bedding, carbonaceous shale 149.6 - 150.1. Coal seam 150.25 - 151.15.

.../3

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
156.4	158.6			Siltstone, dark grey, fine grained,coal seam 156.4 - 156.9, 158.2 - 158.6, shaly coal.
158.6	160.65	2.05	100	Coal seam, sampled, EB-16-2.
160.65	170.4			Sandstone, light grey, medium grained, with cross-bedding, carbonaceous mudstone 162.8 - 163.4. Coal seam 162.7 - 162.8.
170.4	181.4			Mudstone, dark grey, fine grained, contact graduational to silt, coal 175.4 - 175.7.
181.4	190.5			Siltstone, grey, fine grained, bedding 60^{o} with core axis.
190.5	205.5			Mudstone, dark grey, core broken, 190.5 - 195.2 sandstone 195.7 - 199.0, 198.3 - 200.5, contact with sandstone at 60^{o} with core axis. Coal seam 204.2 - 204.8, core broken 204.3 - 204.9.
205.5	225.5			Sandstone, light grey, medium grained with cross-bedding, bedding 60^{o} with core axis. Siltstone 222.5 - 224.1.
225.5	235.7			Siltstone, dark grey, fine grained, a carbonaceous shale 235.4 - 235.7.

DIAMOND DRILL CORE LOGGING SHEET
DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
235.7	240.8			Sandstone, light grey, medium grained with bands of siltstone.
240.8	246.6			Mudstone, dark grey, fine grained with thin bands of sandstone, core broken throughout, occasionally carbonaceous shale, coal seam 245.9 - 246.9.
246.9	251.9			Sandstone, light grey, medium to fine grained with cross bedding.
251.9	258.7			Siltstone, grey, fine grained with interbedding of sandstone, a coal seam 251.9 - 252.5.
258.7	271.1	12,4	100	Coal seam sampled EB-16-3, 258.7 - 258.95, shaly coal, 260.35 - 261.0, shaly coal, 261.00 - 271.1 shale with coal streaks.
271.1	276.0			Siltstone, as above, coal seam 275.9 - 276.0.
276.0	281.0			Sandstone, light grey, medium to fine grained, bedding 60^{o} with core axis.
281.0	285.4	4.4	100	Coal seam sampled EB-16-4. Parting of mudstone 284.95 - 285.1.
285.4	288.0			Sandstone, light grey, medium to fine grained, with cross bedding, coaly shale 285.4 - 287.0.
288.0	295.3			Mudstone, dark grey, with small pieces of coal throughout.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
295.3	302.0			Sandstone as above, siltstone 298.8 - 300.0.
302.0	308.0			Siltstone, light grey, fine grained, occasionally with small coal pieces.
308.0	312.8			Mudstone, dark grey, fine grained with discontinuous coal seams.
312.8	326.7	13.9	100	Coal seam, sampled EB-16-5. 315.00 - 315.60 shale parting, 325.6 - 326.2 shaly coal.
326.7	329.0			Mudstone.
329.0	337.7			Siltstone, light grey, fine grained with small bands of sandstone.
337.7	341.4			Mudstone, dark grey, with very thin seams of coal.
341.4	351.8			Sandstone, light grey, medium to fine grained, with crossbedding, bedding 60^{o} with core axis.
351.8	353.4			Mudstone, dark grey, with very thin seams of coal.
353.4	355.8			Coal seam with partings 354.7 - 355.6.
355.8	376.6			Sandstone, light grey, medium to fine grained, bedding 60^{o} with core axis, discontinuous seams of coal, throughout.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
376.6	381.0			Mudstone, dark grey, with bedding 58° core axis, and occasionally thin seams of coal.
381.0	388.8			Siltstone, grey, fine grained.
388.8	399.0			Sandstone, light grey, fine to medium grained, lower contact parallel to bedding 60° to core axis.
399.0	401.0			Mudstone, dark grey, becomes silty towards end.
401.0	408.0			Siltstone, grey, fine grained, and graduational contact with sandstone, occasionally thin seams of coal.
408.0	412.5			Sandstone, light grey, medium grained, bedding 60° with core axis.
412.5	415.4	3.35	100	Coal sample, EB-16-6, 413.3 - 413.9 parting.
415.4	422.0			Siltstone, grey, fine grained with bands of sandstone.
422.0	429.6			Sandstone, light grey, medium to fine grained, with cross bedding, siltstone 423.6 - 426.3.
429.6	437.7			Mudstone, dark grey, with broken core 433.0 - 436.8.
437.7	458.3			Siltstone, grey, fine grained with bands of sandstone, lower contact 55° with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
458.3	481.9			Sandstone, light grey, medium to fine grained, with thin bands of silt and mudstones, occasionally with pieces of coal. 469.6 - 471.0 mudstone, 466.0 - 467.0 number of coal streaks.
481.9	485.0			Siltstone, 484.0 - 485.0 with coal streaks.
485.0	493.0			Sandstone, light grey, medium grained with cross-beddings and thin number of coal seams, 488.0 - 489.5.
493.0	500.5			Mudstone, dark grey, with occasionally thin coal seam, lower contact parallel to sandstones.
500.5	504.3			Sandstone.
504.3	509.1	4.8	100	Coal seam, sampled EB-16-7.
509.1	520.2			Mudstone, dark grey, with thin bands of siltstones, 509.1 - 510.0, coaly shale. Coal seam: 513.6- 514.2 516.2- 516.6 517.6- 518.7.
520.2	524.6			Siltstone, grey, fine grained, with thin bands of sandstone.
524.6	526.7			Sandstone, with cross bedding.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
526.7	537.7			Siltstone, grey, fine grained, lower contact parallel to bedding.
537.7	539.8			Shaley coal, coal with bands of dull and material, 537.7 - 538.4, carbonaceous mudstone, coal seam 538.9 - 539.0.
539.8	543.6			Siltstone, grey, fine grained with small pieces of coal. Coal seam 542.0 - 542.3.
543.6	555.0	11.4	100	Coal seam, sampled EB-16-8, 545.0 - 547.0, coaky shale parting.
555.0	556.4			Mudstone, with numerous thin coal seams.
556.4	561.2			Sandstone, light grey, medium to fine grained, bedding 60^{o} with core axis.
561.2	568.5			Mudstone, dark grey, a very thin coal seam at 565.5 and small coal pieces.
568.5	582.4			Sandstone, light grey, medium to fine grained, upper contact is graduational. Lower contact is sharp and parallel to bedding, which is 60^{o} with core axis. Occasionally thin seams of coal.
582.4	615.4			Mudstone, dark grey, with bands of sandstone at 596.8 - 597.2, 597.6 - 598.0, coaly shale 589.0 - 592.6.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
615.4	630.8			Siltstone, grey, fine grained, upper contact 55° with core axis, thin bands of sandstone, bedding 50° with core axis.
630.8	634.5			Mudstone, dark grey, bedding about 60° with core axis.
634.5	641.65	7.15	100	Coal seam sampled, EB-16-9, 637.1 - 637.6 parting.
641.65	650.0			Coaly shale, dark grey, core broken, thin streak of coal.
650.0	671.4			Mudstone, very dark grey, with very small coal pieces throughout, 670 - 671.5 siltstone.
671.4	677.7	6.3	100	Coal seam, sampled EB-16-10.
677.7	698.4			Sandstone, light grey, medium to fine grained, with thin bands of siltstone, occasionally very thin seams of coal, bedding 60° with core axis, lower contact parallel to bedding.
698.4	712.0			Siltstone, grey, fine grained with bands of sandstone, of variable thickness, ½-¼".
712.0	747.1			Mudstone, dark grey, with thin bands of silt and sandstone, bedding 65° with core axis, coal seam 719.9 - 720.15.
747.1	749.5	2.4	100	Coal seam, sampled EB-16-11.

.../10

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
749.5	750.5			Mudstone.
750.5	759.5			Sandstone, light grey, medium grey with bands of mudstone and siltstone, mudstone 752.7 - 755.5.
759.5	764.8			Mudstone, with discontinuous thin seams of coal, coal seam 761.9 - 762.7.
764.8	775.3			Siltstone, grey, fine grained, with bands of sandstone and mudstone, occasionally very thin coal seams.
775.3	800.9			Mudstone, dark grey, with discontinuous coal seams seams, sandstone 793.5 - 794.4, coaly shale, 783.2 - 784.1, coal seam 786.0 - 787.2.
800.9	814.2	$\frac{12.8}{13.3}$	96	Coal seam, sampled EB-16-12. 802.1 - 802.25 partings, 808.4 - 809.6 partings, 811.2 - 814.2, 3' of core recovered 2.5' coal.
814.2	823.2			Sandstone, coaly shale, 814.2 - 815.2, bedding 65^{o}, lower contact graduational.
823.2	851.0			Mudstone, with small pieces of coal throughout, thin bands of siltstones, broken core 840.8 - 844.2, core recovery 70%.
851.0	854.3			Siltstone, bedding 64^{o} with core axis.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-16

Footage		Recovery		Description
from	to	feet	%	
854.3	880.0			Mudstone, dark grey, with small pieces of coal, and occasionally with thin coal seams, badly broken core, 856 - 857, 862 - 865, layer of sandstone 861.6 - 862.9, 874.5 - 875.5.
		3.7	100	Coal seam, sample EB-16-13, from 868.8 - 874.5 coal.
				Coal seams: 858.2 - 858.55, 858.8 - 859.45, 863.6 - 864.8.
				End of hole at 880'.
				Signed: G.C. Singhai, August 30, 1975.

ELCO MINING LIMITED

PAGE

DRILL HOLE: EB 16														
SAMPLE NO.:		EB-16-1	EB-16-2	EB-16-3	EB-16-4	EB-16-5	EB-16-6	EB-16-7	EB-16-8	EB-16-9	EB-16-10	EB-16-11	EB-16-12	EB-16-13
LAB. NO.:		3680	3681	3682	3683	3684	3685	3770	3771	3772	3773	3774	3775	3776
SAMPLE INTERVAL (from-to) (Ft):		83.95-93.5	158.6-160.65	258.7-261.0	281.0-285.4	312.8-326.7	412.05-415.4	504.3-509.1	543.6-555.0	634.5-641.65	671.4-677.7	747½-749.5	800.9-814.2	868.8-874.5
SEAM DESIGNATION:		Seam 19	Seam 19	Seam 18	Seam 18	Seam 18	Seam 17	Seam 17	Seam 17	Seam 16	Seam 16	Seam 16	Seam 15	Seam 15
RAW COAL														
INHERENT MOISTURE	% air dry	0.9	0.9	1.0	1.1	0.9	0.9	1.0	0.8	0.8	0.9	0.8	0.8	0.7
ASH	% wf	51.7	30.6	44.8	10.0	39.1	33.8	17.7	33.9	31.9	9.2	32.2	34.7	33.6
VOLATILE MATTER	% wf	19.2	26.7	20.4	29.5	21.6	23.6	23.6	22.6	22.8	26.5	22.9	22.0	21.2
FIXED CARBON	% air dry	28.9	42.3	34.4	59.8	39.0	42.2	58.1	43.2	45.0	63.7	44.6	43.0	44.9
SULPHUR	% wf	0.68	2.32	0.88	1.05	0.52	0.65	0.55	0.67	0.76	1.02	0.92	0.77	0.72
HARDGROVE GR.INDEX		53	57	64	82	69	112	68	73	67	84	71	81	71
SIZE FRACTION														
¼"x65M	weight %	88.9	87.9	91.0	90.5	90.1	92.2	90.6	90.3	94.6	93.4	94.9	95.3	92.3
65Mx0	weight %	11.1	12.1	9.0	9.5	9.9	7.8	9.4	9.7	5.4	6.6	5.1	4.7	7.7
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)														
YIELD ON ¼"x65M	weight %	26.6	64.0	31.9	90.7	46.3	58.4	81.7	53.2	62.6	93.9	49.9	66.1	58.2
TOTAL YIELD EXCL.65Mx0	weight %	23.6	56.3	29.0	82.1	41.7	53.8	74.0	48.0	59.2	87.7	47.4	63.0	53.7
INHERENT MOISTURE	% air dry	1.0	0.8	1.1	1.2	1.3	1.1	1.1	1.3	0.9	1.1	0.7	1.0	1.0
ASH	% wf	9.9	12.0	9.5	3.5	7.9	6.7	3.3	7.5	8.4	5.0	12.0	5.4	9.8
VOLATILE MATTER	% waf	34.4	37.7	34.4	32.5	32.4	32.5	29.6	31.3	30.0	28.9	31.3	28.1	28.4
FIXED CARBON	% waf	65.5	63.1	65.1	67.6	67.5	67.6	70.3	68.7	70.1	70.9		72.0	71.6
SULPHUR	% wf	0.96	1.97	1.32	1.08	0.81	0.96	0.81	0.99	0.92	1.06	1.06	0.75	0.76
PHOSPHOR	% wf													
FSI		8	6½	8	8½	7½	7	7½	9	8½	8½	8	8½	8½
SOFTENING TEMP.	°C	364	360	362	364	368	372	388	367	364	364	378	384	375
RESOLIDIFC.TEMP.	°C	435	438	449	446	449	448	453	443	445	447	451	453	449
CONTRACTION	%	14	12	27	27	26	23	22	21	27	28	15	24	25
DILATATION	%	207	242	257	194	239	250	37	152	223	193	184	118	219
G-VALUE		1.084	1.097	1.096	1.083	1.087	1.084	1.020	1.076	1.085	1.083	1.081	1.058	1.082

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 17 Size of core: HQ 63.5 mm Total depth: 800' 244.0 m

Location: N 563596.05396
W 65650.12308
Elevation of collar: 5,144.67 '
1569.12 m

Dip of Hole: 90 °
Bearing " : - N - °

Date of starting: July 28, 1975
Date of completion: August 7, 1975

Logging by: Fred Riddell
" on: August 10, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB 17

Footage		Recovery		Description
from	to	feet	%	
0	23			Casing - overburden.
23	27.4			Sandstone, fine to medium, grey, very hard, contains numerous thin irregular discontinuous coal partings at 25.9 - 26.4, 0.5 coal parting at 30° to core.
27.4	57.2			Mudstone, black-grey, thin irregular interbands of coal, 44.7 - 45.1 coal 45.8 - 46.2 coal.
57.2	59.5			Coal, EB-17-2, cut 55-59 = 4', rec. 4'.
59.5	61.2			Mudstone, black.
61.2	65.5			Coal, sample EB-17-1, cut 61 - 65.5 = 4.5', recovery 4.5, 63.9 - 64.0 mudstone parting.
65.5	75.2			Siltstone, increasingly sandy towards bottom.
75.2	78.5			Sandstone, fine to medium,grey, cross-bedded.
78.5	80.5			Siltstone, black, contact at 35°.
80.5	84.5			Sandstone, fine to medium, grey, thin, irregular discontinuous coal partings.
84.5	118.8			Siltstone, black-grey, sparse scattered small coal pieces throughout,

.../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-17

Footage		Recovery		Description
from	to	feet	%	
				113 - 113.2 coal, 114.8 - 115.1 coal, 117.0 - 117.2 coal.
118.8	121.4			Sandstone, fine to medium grained, grey.
121.4	190.3			Siltstone, grey-black, scattered small pieces of coal throughout, 181.3 - 181.4 coal.
190.3	213.8			Sandstone, fine grained, grey, cross-bedded, numerous thin, irregular and discontinuous coal partings throughout, 192.6 - 192.7 coal.
213.8	216.4			Coal, 100% recovery, EB-17-3.
216.4	232.5			Siltstone, black-grey, numerous very thin coal pieces, very thin partings throughout, 230.6 - 231.3 coal.
232.5	235.9			Sandstone, fine to medium, grey-black, thin irregular coal bands throughout, dip 32^{o}.
235.9	244.2			Siltstone, black, very fine grained, coal pieces throughout.
244.2	245.0			Coal.
245.0	248.0			Siltstone, as above.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-17

Footage		Recovery		Description
from	to	feet	%	
248.0	250.0			Coal, EB-17-4, cut 249 - 252 = 3', recovery 2'.
250.0	256.2			Siltstone, as above.
256.2	259.0			Coal, 100% recovery, EB-17-5.
259.0	263.8			Sandstone.
263.8	265.0			Siltstone.
265.0	265.2			Coal.
265.2	267.0			Siltstone.
267.0	267.1			Coal.
267.1	297.1			Siltstone, black, locally contains small coaly pieces.
297.1	301.7			Sandstone, fine to medium, grey.
301.7	374.3			Siltstone, contains locally 1' bands of grey sandstone, siltstone very fine to fine, dark grey to black, scatteres small coal pieces and thin (1/8") seams.
374.3	379.9			Coal, EB-17-6.
379.9	390.0			Siltstone, interbeds of s.s. as above, 381 - 381.1 coal, 383 - 383.1 coal.

.../4

DIAMOND DRILL CORE LOGGING SHEET
DDH No. EB-17

Footage		Recovery		Description
from	to	feet	%	
390.0	390.7			Coal.
390.7	429.4			Siltstone as above, interbeds of sandstone.
429.4	431.0			Coal contains two silt partings each 0.1'. EB-17-7, cut 426 - 431 = 5', rec. 5'.
431.0	436.0			Shale, very coaly, black, 434.5 - 435.0 coal.
436.0	437.6			Coal, EB-17-8.
437.6	441.0			Shale, very coaly, black, 439 - 439.4 coal.
441.0	451.0			Siltstone, black, scattered very small pieces of coal.
451.0	457.5			Coal, cut 5.2, rec. 5.2, EB-17-9.
457.5	573.3			Siltstone, as above.
473.3	473.6			Coal.
473.6	485.0			Silstone.
485.0	490.2			Sandstone, fine to medium, grey-black.
				Note: Drillers forget to number ore box. I have labelled box 46A to follow after box 46.
490.2	495.0			Siltstone, very coaly.

.../5

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-17

Footage		Recovery		Description
from	to	feet	%	
495.0	530.6			Siltstone, black, numerous small coal pieces throughout.
530.6	532.2			Coal, EB-17-10.
532.2	568.4			Siltstone, as above, fine to very fine grained.
568.4	576.0			Sandstone, grey-black, fine grained, increasingly silty to siltstone near bottom, scattered small pieces of coal throughout silty sections.
576.0	595.0			Siltstone, grey-black, fine to very fine, local black fine mudstone, bottom 1' increasingly coaly, small irregular coal pieces and plant remains throughout.
595.0	600.8			Coal, EB-17-11, 100% rec., siltstone parting at 599.0 - 599.2.
600.8	602.3			Siltstone, black, thin interbeds of coal and coaly material.
602.3	604.7			Coal, 100% rec., EB-17-12.
604.7	628.0			Siltstone, grey-black, small pieces, bands of coal and plant remains throughout, dip 26°.
628.0	639.4			Coal, badly broken, in very small pieces, musky, recovery would appear to be close to 100%, EB-17-13, 631.5 - 632.0 sandy parting.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-17

Footage		Recovery		Description
from	to	feet	%	
639.4	682.3			Siltstone, grey-black, local areas of sandy or muddy zones, small pieces of coal throughout, dip 26°.
682.3	682.9			Coal.
682.9	704.3			Siltstone, as above. Sample EB-17-14, from 704.3 - 708.4 coal dull, 708.4 - 708.65 parting mudstone, 708.65 - 711.11 coal dull. Sample EB-17-15, from 756.1 - 760.0 = 3.9, coal without partings.
704.3	708.4			Coal dull, EB-17-14.
708.4	708.65			Mudstone parting (EB-17-14).
708.65	711.11			Coal dull (EB-17-14).
711.11	713.1			Siltstone, very fine, black, abundant/plant remains.
713.1	713.7			Coal very silty.
713.7	714.7			Siltstone, very black, and coal.
714.7	717.3			Siltstone, grey-black, abundant, coal pieces, very coaly at 716.7 - 717.3.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-17

Footage		Recovery		Description
from	to	feet	%	
717.3	722.0			Sandstone, fine to medium, grey, very silty, with abundant plant remains.
722.0	749.0			Siltstone, grey-black, abundant plant remains.
749.0	755.0			Sandstone, as above.
755.0	756.1			Siltstone.
756.1	760.0			Coal EB-17-15.
760.0	765.2			Siltstone, very black and coaly, at 761.4 a .2 band of brassy iron sulfides.
765.2	780.0			Siltstone, grey-black, 775.3 - 776.3, sandy siltstone-sandstone band.
780.0	786.5			Siltstone, very coaly, coal lenses at 779.8 - 780.4, 784.0 - 784.2.
786.5	790.2			Sandstone, fine to medium, grey, thin irregular lenses of black silt and plant remains throughout.
790.2	800.0			Siltstone, grey-black, small irregular pieces of coal and plant remains throughout.
TD 800'				completed August 7, 1975.

ELCO MINING LIMITED

PAGE

DRILL HOLE: EB 17		EB-17-1	EB-17-2	EB-17-3	EB-17-4	EB-17-5	EB-17-6	EB-17-7	EB-17-8	EB-17-9	EB-17-10	EB-17-11	EB-17-12	EB-17-13	EB-17-14	EB-17-15
SAMPLE NO.:		3501	3502	3503	3504	3505	3506	3507	3508	3509	3510	3534	3535	3536	3537	3538
LAB.NO.:		61.2-65.5	57.2-59.5	213.8-216.4	248.0-250.0	256.2-259.0	374.3-379.9	429.4-431.0	436.6-437.6	451.0-457.5	530.6-532.2	595.0-600.8	602.3-604.7	628.0-639.4	682.9-704.3	756.1-760.0
SAMPLE INTERVAL (FROM-TO) (FT):		Seam 20	Seam 20	Seam 19	Seam 19	Seam 19	Seam 18	Seam 17	Seam 17	Seam 17	Seam 17	Seam 16	Seam 16	Seam 16	Seam 16	Seam 16
SEAM DESIGNATION:																
RAW COAL																
INHERENT MOISTURE	% air dry	0.9	0.7	0.8	0.9	1.0	0.9	0.7	0.8	1.0	0.8	0.9	0.8	0.6	0.7	0.8
ASH	% wf	20.0	25.4	21.0	22.6	15.9	7.3	53.7	12.6	34.1	17.6	11.3	22.4	21.5	30.7	19.4
VOLATILE MATTER	% wf	28.3	28.3	27.1	25.4	30.8	29.6	29.3	27.2	22.6	26.7	25.6	25.7	27.3	22.9	24.4
FIXED CARBON	% air dry	51.3	46.0	51.5	51.5	52.8	62.6	29.1	59.7	42.8	55.2	62.5	51.5	50.9	44.3	54.4
SULPHUR	% wf	0.70	0.70	0.95	0.78	1.66	0.79	0.46	0.72	0.63	1.00	0.68	0.93	2.18	0.81	1.21
HARDGROVE GR. INDEX		68	50	129	65	79	76	55	75	97	NA	70	72	90	73	95
SIZE FRACTION																
¼"x65M	weight %	93.1	97.2	85.0	95.1	90.0	92.4	94.5	95.6	89.3	85.6	95.4	95.5	90.0	95.4	92.9
65MxO	weight %	6.9	2.8	15.0	4.9	10.0	7.6	5.5	4.4	10.7	81.1	4.6	4.5	10.0	4.6	7.1
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)																
YIELD ¼"x 65M	weight %	80.0	76.1	80.4	79.8	84.4	93.8	27.0	89.6	60.2	94.8	93.6	74.7	73.8	60.8	81.7
TOTAL YIELD, EXCL. 65MxO	weight %	74.5	74.0	68.3	75.9	76.0	86.7	25.5	85.7	53.8	5.2	89.3	71.3	66.4	58.0	75.9
INHERENT MOISTURE	% air dry	0.9	0.8	1.9	0.9	1.0	1.1	0.9	0.8	1.8	0.7	0.6	0.7	1.1	0.7	0.7
ASH	% wf	6.1	16.6	5.9	3.6	7.6	3.0	15.8	9.5	9.5	7.0	5.0	10.1	6.6	9.5	7.4
VOLATILE MATTER	% waf	33.9	36.6	32.0	31.6	35.6	32.3	33.8	33.2	32.8	32.3	28.3	31.8	29.9	30.5	29.2
FIXED CARBON	% waf	66.0	63.3	66.3	68.4	64.3	64.9	66.1	67.5	67.0	NA	71.7	68.1	70.1	69.5	70.7
SULPHUR	% wf	0.87	0.89	1.62	0.96	1.86	0.98	0.94	0.85	1.43	1.02	0.79	1.10	1.10	0.97	1.14
PHOSPHOR	% wf															
FSI		8	6	8	8½	7½	8½	7½	8½	8	8½	8	8½	8½	8½	8½
SOFTENING TEMP.	°C	367	363	367	377	361	363	351	359	348	362	366	373	379	368	369
RESOLIDIFCATION TEMP.	°C	448	449	412	412	448	452	398	426	401	426	448	446	451	446	421
CONTRACTION	%	24	22	23	28	28	28	30	29	29	28	31	24	26	21	28
DILATATION	%	237	204	53	57	241	160	243	203	218	191	183	239	56	260	224
G-VALUE		1.088	1.093	1.050	1.015	1.093	1.083	1.051	1.068	1.057	1.064	1.077	1.079	1.033	1.089	1.054

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-18 Size of core: HQ 63.5 mm Total depth: 661 ' 201.6 m

Location: N 561855.38038
W 67089.67416
Elevation of collar: 5189.07 '
1582.67 m

Dip of Hole: 90°
Bearing " : - N - °

Date of starting: August 7, 1975
Date of completion: August 12, 1975

Logging by: G.C. Singhai,
" on: September 1, 1975.

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
0	31.7			Overburden.
31.7	36.1			Siltstone, grey, fine grained, lower contact at 70^{o} with core axis.
36.1	46.8			Sandstone, light grey to grey, medium grained, cross bedded, bedding 65^{o} to the core axis.
46.8	51.0			Carbonaceous mudstone, dark grey, very fine with stringers of coal, coaly shale with stringer of pyrite, coal seam with occasionally minor pyrite 46.8 - 48.4, 50.1 - 50.5.
51.0	64.0			Sandstone, as above, with thin interbeds of siltstone and mudstone, crossbedded, bedding 65^{o} with core axis, mudstone 53.2 - 54.8, 52.0 - 60.9.
64.0	67.5	3.5	100	Coal seam, sampled EB-18-1.
67.5	68.0			Mudstone, with pyrite.
68.0	78.4			Sandstone, light grey to grey, medium to fine grained, with thin layers of silt and mudstones, mudstone and siltstone layers 68.0 - 72.2, 75.5 - 78.4, bedding plane 55^{o} with core axis.
78.4	80.4			Siltstone, grey, fine grained with thin bands of dark grey mudstone.
80.4	94.0			Mudstone, dark grey, with stringers of coal and occasionally pyrite with coal, coaly shale 80.3 - 80.7, banded sandstone 84.2 - 85.7, lower contact graduational.

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DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
94.0	104.5			Sandstone, light grey, fine to medium grained, with thin bands of mudstone and siltstone, thin coal stringers at 94.2 with pyrite, pyrite along fracture at 98.8 -101, core badly broken 101 - 102.8, recovery about 80%.
104.5	109.3			Mudstone, as above, with stringer of coal along bedding, coal seam 104.7 - 104.8, 106.6 - 106.8.
109.3	113.7	4.4	100	Coal seam, sampled EB-18-2.
113.7	114.4			Mudstone parting.
114.4	115.4			Coal seam.
115.4	117.0			Mudstone as above, coaly shale 115.5 - 115.9.
117.0	119.0			Sandstone as above, with thin bands of mudstone and siltstone, mudstone 118.2 - 119.0.
119.0	122.4	3.4	100	Coal seam, sampled EB-18-3, parting 120.1 - 120.2.
122.4	135.2			Sandstone, light grey, medium to fine grained, occasionally with thin coal seams and pyrite along fractures, mudstone 131.1 - 133.7.
135.2	137.3			Siltstone, grey, fine grained, band of sandstone 136.3 - 137.3.
137.3	140.8			Coaly shale, dark grey, very fine grained, with bands of dull and vitrious material, carbonaceous shale 139.5 - 139.9, badly broken core.

.../3

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
140.8	143.6	2.8	100	Coal seam, with parting 141.3 - 141.6, sampled EB-18-4.
143.6	143.8			Shaly coal.
143.8	148.2			Mudstone, occasionally with coal stringers, siltstone 147.2 - 148.2 , and core is broken. Recovery 80%.
148.2	153.1			Sandstone with bands of silt and mudstone.
153.1	154.4			Mudstone, dark grey, broken core.
154.4	156.9		70	Coal seam, not sampled, partings of carbonaceous mudstone, 155.4 - 156.6, core broken.
156.9	165.8			Sandstone, light grey, medium grained with bands of mudstone and siltstone, bedding 60^{o} with core axis.
165.8	176.8			Mudstone, dark grey, very fine grained, contact parallel to bedding at 60^{o} with core axis, 175.2 - 176.8 siltstone.
176.8	208.8			Sandstore, as above, 206.1 - 208.8, massive light grey sandstone.
208.8	211.3			Mudstone, as above, coal seam 210.2 - 211.0.
211.3	219.4			Sandstone, dark grey, fine to medium grained, occasionally with thin coal stringers.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
219.4	223.1			Mudstone, with coal stringers.
223.1	234.4			Sandstone, light grey to dark grey, with bands of silt and mudstone, mudstone 224.5 - 227.8, siltstone 230.0 - 231.6.
234.4	237.7			Siltstone, dark grey, fine grained, bedding 65^{o} with core axis.
237.7	244.2			Mudstone, dark grey, occasionally with thin bands of coal seams.
244.2	248.3			Sandstone, light grey, medium grained, stringer of coal at 246.35.
248.3	249.4			Coal seam, with partings of mudstone 247.6 - 247.8, not sampled.
249.4	251.8			Sandstone, as above.
251.8	253.3			Mudstone, sandstone 252.7 - 253.1.
253.3	253.7			Coal seam.
253.7	268.6			Mudstone, dark grey with thin coal seam, sandstone 254.8 - 255.4, 256.0 - 256.5, coal seam 259.0 - 259.6.
268.8	270.7			Siltstone, dark grey, fine grained, bedding with core axis(65^{o}).

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
270.7	279.0			Sandstone with thin bands of mudstone and siltstone.
279.0	283.0			Mudstone, core broken throughout, coal seam 281.6 - 281.8.
283.0	287.7			Sandstone, with thin bands of silt and mudstone, bedding 55^{0} with core axis.
287.7	295.5			Mudstone, dark grey, fine grained, coal seam 291.4 - 291.5.
295.5	310.6			Sandstone, light grey to grey, medium grained, bands of siltstones.
310.6	312.7			Mudstone.
312.7	314.2	1.5	100	Coal seam, sampled EB-18-5.
314.2	316.6			Coaly shale, with very thin coal seams.
316.6	319.9			Sandstone, with cross bedding.
319.9	322.6			Mudstone.
322.6	326.7			Sandstone, medium grey, light grey.
326.7	333.8			Mudstone, with coal seams and pyrite 328.1 - 328.9, 332.3 - 332.7.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
333.8	334.5			Sandstone, light grey, fine grained.
334.5	336.0	1.5	100	Coal seam, sampled, EB-18-6.
336.0	338.4			Mudstone (as parting).
338.4	348.2	9.8	100	Coal seam, sampled EB-18-7.
348.2	351.9			Mudstone, with very thin coal seams, coal seam 349.0 - 349.2, sandstone 349.2 - 350.3.
351.9	374.6			Sandstone, light grey to dark grey, medium grained to fine grained with thin bands of silt and mudstone, coal seam 373.8 - 373.9.
374.6	381.8			Mudstone, dark grey, sandstone, 377.6 - 378.4, 380.3 - 380.7.
381.8	382.8			Coal seam.
382.8	387.3			Siltstone, dark grey, fine grained with small pieces of coal.
387.3	465.5			Sandstone, light grey to grey, with very thin bands of silt and mudstone, occasionally small pieces of coal and thin coal seams. Siltstone 406.0 - 408.2, 428.8 - 431.1, 439.0 - 440.0, 441.8 - 445.5. Number of thin coal seams from 446.7 - 456.0, coal seam 452.5 - 453.0, sandstone is cross bedded and bedding 65^{o} with core axis, pyrite along fracture at 459.5.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
465.5	483.5			Siltstone, dark grey, fine grained, with very thin stringers of coal, and thin bands of sandstone.
483.5	520.4			Sandstone, light grey to grey, medium to fine grained, with bands of silt and mudstone. Crossbedded, bedding 50^{o} with core axis at 504.5, occasionally small pieces of coal. Siltstone 517.0 - 518.0.
520.4	523.5			Siltstone, dark grey, fine grained, upper and lower contact graduational.
523.5	537.8			Sandstone, light grey to medium grey, medium to fine grained, occasionally with small pieces of coal.
537.8	563.0			Mudstone, dark grey, occasionally with thin bands of siltstone and thin coal seams. Coal seams 539.4 - 539.9, 557.3 - 557.6, 561.8 - 562.5, carbonaceous shale 561.0 - 561.8.
563.0	564.5			Sandstone, light grey, medium grained.
564.5	568.0	3.5	100	Coal seam, sampled EB-18-8, parting of coaly shale 565.3 - 566.0.
568.0	569.9			Carbonaceous mudstone, very dark grey, with coal seam 569.6 - 569.9.
569.9	591.2			Sandstone, light grey to grey, medium to fine grained, with thin bands of mud and siltstone, occasionally thin seams of coal.

.../8

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
591.2	597.9	6.7	100	Coal seam, sampled EB-18-9. Parting of mudstone 593.3 - 593.35, shale 597.8 - 597.9.
597.9	600.2			Mudstone, with thin bands of siltstone and sandstone.
600.2	600.8			Coal seam.
600.8	606.0			Siltstone, dark grey, fine grained with bands of sandstone.
606.0	609.7			Mudstone, with fine bands of grey siltstone, bedding 70^{0} core axis.
609.8	619.9			Sandstone, light grey to grey with thin bands of siltstone and mudstone, core bedded, bedding 60^{0} with core axis.
619.9	623.5			Siltstone, dark grey and thin bedded.
623.5	628.6			Mudstone, dark grey, coal seam 625.2 - 626.6, with partings of mudstone 626.0 - 626.2.
628.6	632.4	3.8	78.3	Coal seam, sampled EB-18-10. Parting of coaly shale: 629.3 - 630.0, 631.0 - 631.3, 631.9 - 632.4.
632.4	635.3			Mudstone.
635.3	640.1			Siltstone with bands of mudstone and sandstone, occasionally thin seams of coal.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-18

Footage		Recovery		Description
from	to	feet	%	
640.1	641.9			Coal seam, with parting of mudstone 640.8 - 641.3.
641.9	643.5			Mudstone.
643.5	646.5			Sandstone.
646.5	650.0			Mudstone, core broken.
650.0	651.0			Coal seam with very thin layers of carbonaceous shale.
651.0	652.9			Mudstone, lower contact graduational.
652.9	654.2			Sandstone, with thin layer of siltstone and mudstone.
654.2	660.1			Mudstone, dark grey.
660.1	661.0			Siltstone.
				End of hole at 661'.
				Signed: G.C. Singhai, September 1, 1975.

ELCO MINING LIMITED

PAGE

DRILL HOLE: EB 18										
SAMPLE NO.:		EB-18-1	EB-18-2	EB-18-3	EB-18-4	EB-18-5	EB-18-6	EB-18-7	EB-18-8	EB-18-9	EB-18-10
LAB. NO.:		3579	3580	3581	3582	3583	3584	3585	3586	3587	3588
SAMPLE INTERVAL (FROM-TO) (FT.):		64.0-67.5	109.3-113.7	119.0-122.4	140.8-143.6	312.7-314.2	334.5-336.0	338.4-348.2	564.5-568.0	591.2-597.9	628.6-632.4
SEAM DESIGNATION:		Seam 16	Seam 16	Seam 16	Seam 16	Seam 15	Seam 15	Seam 15	Seam 14	Seam 14	Seam 14
RAW COAL											
INHERENT MOISTURE	% air dry	0.8	1.1	0.8	0.7	0.8	0.8	0.9	0.8	0.9	0.9
ASH	% wf	17.5	26.5	34.2	21.7	12.7	17.9	19.8	21.6	14.8	34.7
VOLATILE MATTER	% wf	26.1	23.5	23.1	27.9	25.7	23.7	23.2	22.4	24.3	20.6
FIXED CARBON	% air dry	55.9	49.5	42.4	50.1	61.1	57.9	56.5	55.6	60.3	44.3
SULPHUR	% wf	1.05	0.65	0.94	3.84	1.09	0.84	0.65	0.75	0.65	0.65
HARDGROVE GR. INDEX											
SIZE FRACTION											
¼"x65M	weight %	94.1	88.6	91.9	91.1	94.4	91.0	89.3	92.0	85.8	92.9
65MxO	weight %	5.9	11.4	8.1	8.9	5.6	9.0	10.7	8.0	14.2	7.1
CLEAN COAL (SIZE FRACTION¼"x65M; 1.5 SINK FLOAT S.G.)											
YIELD ¼"x65M	weight %	77.5	71.6	47.2	71.1	90.7	78.1	75.1	70.3	85.8	43.7
TOTAL YIELD, EXCL. 65MxO	weight %	72.9	63.4	43.4	64.8	85.6	71.1	67.1	64.7	73.6	40.6
INHERENT MOISTURE	% air dry	0.8	0.9	0.7	0.6	0.7	0.9	1.2	0.8	1.3	0.6
ASH	% wf	6.1	8.0	8.2	6.4	9.1	9.7	6.1	5.0	8.4	9.7
VOLATILE MATTER	% waf	30.2	29.9	31.7	30.2	30.1	28.0	27.0	27.5	28.2	27.9
FIXED CARBON	% waf	69.7	70.0	68.4	69.8	69.8	72.0	72.9	72.5	72.0	72.0
SULPHUR	% wf	1.07	0.77	1.24	1.01	1.13	0.82	0.84	0.94	0.93	0.90
PHOSPHOR	% wf										
FSI		7½	8	7½	7½	8	7	8	9	8	7½
SOFTENING TEMP.	°C	373	374	378	367	371	377	382	376	383	382
RESOLIDIFICATION TEMP.	°C	449	450	452	452	455	450	456	448	454	448
CONTRACTION	%	14	25	26	25	25	25	24	27	16	27
DILATATION	%	278	148	277	214	281	143	97	223	217	230
G-VALUE		1.091	1.070	1.079	1.089	1.092	1.066	1.056	1.074	1.079	1.067

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB-19 Size of core: HQ 63.5 mm Total depth: 645 ' 196.7 m

Location: N 561659.62312
W 66160.06182
Elevation of collar: 5136.66 '
1566.68 m

Dip of Hole: 90 °
Bearing " : - N - °

Date of starting: August 13, 1975
Date of completion: August 18, 1975.

Logging by: G.C. Singhai
" on: August 30, 1975.

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-19

Footage		Recovery		Description
from	to	feet	%	
0	44.0			Overburden.
44.0	52.0			Sandstone, light grey, medium to fine grained with thin layers of siltstone and mudstone, cross bedded, bedding 65° with the core axis, mudstone 47.9 - 50.0.
52.0	55.0			Mudstone, dark grey, very fine grained, upper contact parallel to bedding plane.
55.0	59.8			Coal seam with parting of mudstone 55.35 - 55.9, pyride along bedding plane at 55.7.
59.8	70.0			Sandstone, light grey, medium to fine grained, cross bedded, bedding 70° with core axis.
70.0	76.5			Mudstone, dark grey, with bands of sandstone at 73.3 - 74.6, and coaly shale 72.0 - 73.0, occasionally thin coal seams.
76.5	95.8			Sandstone, light grey to dark grey, medium to fine grained, with the bands of siltstone and mudstone crossbedded. Lower contact parallel to the bedding, bedding 60° with core axis.
95.8	100.2			Mudstone, dark grey, slightly silty at the upper contact, occasionally with thin coal seams.
100.2	135.4			Sandstone, light grey, medium grained with cross bedding at 130.0, 75° with core axis.

.../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-19

Footage		Recovery		Description
from	to	feet	%	
135.4	155.4			Mudstone, dark grey, very fine grained with carbonaceous material, badly broken core 135.4 - 137.0, recover 60% and 143.4 - 155.5, recovery 70 %, coaly shale 135.5 - 137.0, 151.0 - 155.0, number of very thin coal seams, coal seam 144.7 - 146.0, 151 - 151.3.
155.4	188.1			Sandstone, light grey, medium grained with [illegible] beddings, bedding 65° with core axis, coal [illegible] 160.9 - 161.6, mudstone 179.6 - 181.1, coal seam 173.2 - 173.6.
188.1	190.2			Coal seam with parting of mudstone 188.9 - 189.9.
190.2	196.0			Mudstone, dark grey, very fine grained with interbeds of sandstone and siltstone, bedding 65° with core axis.
196.0	209.4			Sandstone, light grey, medium to fine grained, with thin layers of silt and mudstone.
209.4	235.5			Mudstone, dark grey, upper contact gradational, core broken 12.5 - 15.4, 224.6 - 226.0, 226.0 - 234.2, coaly shale 230.3 - 232.2.
235.5	241.0	5.5	100	Coal seam, sampled EB-19-1, partings 236.5 - 236.7, 239.3 - 239.9.
241.0	242.0			Coaly shale.
242.0	245.9			Sandstone, light grey, medium to fine grained, bedding 65° with core axis.

.../3

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-19

Footage		Recovery		Description
from	to	feet	%	
245.9	252.1			Mudstone, core broken.
252.1	261.0			Sandstone, light grey, fine to medium grained, mudstone 253.9 - 256.9, core recovery 70%.
261.0	291.0			Mudstone, dark grey, with interbedding of siltstone, occasionally thin coal seams. Coaly shale 265.0 - 266.0, 273.3 - 274.5. Siltstone 277.4 - 278.7, 282.2 - 287.9. Broken core 261.0 - 264.5, 270.0 - 271.0, 273.3 - 276.0, coal seam 270.5 - 270.8.
291.0	346.0			Sandstone, light grey, medium to fine grained, occasionally thin bands of siltstone, bedding 70° with core axis. Coal seam 337.7 - 338.3.
346.0	350.0	4.0	100	Coal seam sampled, EB-19-2.
350.0	353.9			Sandstone.
353.9	355.4	1.5	100	Coal seam, sampled EB-19-3.
355.4	356.2			Sandstone.
356.2	361.7			Mudstone, dark grey, occasionally with thin seams of coal, sandstone 360.3 - 361.0. Coal seam 359.4 - 360.2.
361.7	391.1			Sandstone, light grey, medium grained, bedding 65° with core axis, lower contact parallel to bedding.

.../4

DIAMOND DRILL CORE LOGGING SHEET
DDH No. EB-19

Footage		Recovery		Description
from	to	feet	%	
391.1	393.3	2.2	100	Coal seam sampled, EB-19-4.
393.3	396.0			Siltstone, grey, fine grained with few bands of sandstone, occasionally small pieces of coal.
396.0	399.5			Sandstone as above.
399.5	401.2			Coal seam.
401.2	416.3			Sandstone, as above, bedding 65° to core axis. With interbeds of siltstone, mudstone 412.0 - 413.9. Lower contact 70° with core axis.
416.3	422.8			Mudstone, dark grey, occasionally with coal seams, coal seam 421.0 - 421.4, core broken 417.8 - 422.0, recovery 80%.
422.8	431.0			Shaly sandstone, grey, fine grained with thin bands of shale and sandstone, bedding 65° with core axis, mudstone 425.0 - 426.0.
431.0	439.4			Mudstone, dark grey, with interbedding of light, grey sandstone, occasionally thin seams of coal, coal seam 438.4 - 438.9.
439.4	455.0			Sandstone, light grey, medium to fine grained, with bands of mudstone and siltstone, mudstone 443.0 - 446.0, 447.8 - 451.0, broken core 443.0 - 446.0, coal seam 443.5 - 443.9.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-19

Footage		Recovery		Description
from	to	feet	%	
455.0	461.0			Mudstone, dark grey, coal seam 460.0 - 460.1.
461.0	481.1			Sandstone, as above. Mudstone 476.8 - 477.2, coaly shale 477.2 - 478.0, core broken and recovery 60%.
481.1	486.4	5.3	100	Coal seam, sampled EB-19-5.
486.4	487.2			Mudstone.
487.2	495.6			Sandstone, light grey, medium to fine grained.
495.6	502.6			Mudstone, dark grey, with bands of sandstone, coal seam 501.8 - 502.2.
502.6	506.0			Sandstone, as above.
506.0	511.7			Mudstone, with coal seam 508.2 - 505.5, broken core 507.9 - 509.6, recovery 80%.
511.7	516.0			Sandstone, light grey, medium to fine grained, bedding plane 65^{o} to core axis.
516.0	539.3			Mudstone, dark grey, occasionally with very thin coal seam, broken core 516.0 - 519.6, 521.0 - 523.0, 523.0 - 525.5, 531.0 - 533.7, core recovery 75%, coal seam 533.7 - 534.3.
539.3	542.7			Sandstone, light grey, with thin bands of mudstone and siltstone, lower contact graduational.
542.7	546.1			Mudstone, with small pieces of coal.

.../6

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-19

Footage		Recovery		Description
from	to	feet	%	
546.1	548.7	2.6	100	Coal seam, sampled EB-19-6.
548.7	551.1			Coaly shale, badly broken core.
551.1	553.5			Siltstone, grey, fine grained, lower contact at 65° with core axis.
553.5	556.6			Sandstone, light grey, medium to fine grained, cross bedding, bedding 65° with core axis.
556.6	568.5			Mudstone, dark grey, with interbands of sandstone, broken core 559.0 - 561.5,563.6 - 567.8, recovery 80%. Coal seam 565.3 - 565.9, coaly shale 566.4 - 567.0.
568.5	598.5			Sandstone, light grey, medium to fine grained, mudstone 592.8 - 594.7.
598.5	603.6			Mudstone.
603.6	609.9			Sandstone, 605.0 - 607.8, siltstone.
609.9	614.8			Siltstone, dark grey, fine grained.
614.8	617.6	2.8	100	Coal seam, sampled EB-19-7.
617.6	629.0			Sandstone, light grey, medium grained to fine grained, bedding 65° with core axis.
629.0	639.0			Mudstone, dark grey, very fine grained.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-19

Footage		Recovery		Description
from	to	feet	%	
639.0	645.0			Sandstone, light grey, medium to fine grained, with thin bands of silt and mudstone, bedding 65^{o} with core axis. End of hole at 645'. Signed: G.C. Singhai, August 30, 1975.

ELCO MINING LIMITED

DRILL HOLE: EB 19		
SAMPLE NO.:	19-6	EB-19-7
LAB.NO.:	691	3692
SAMPLE INTERVAL (from-to)	1-548.7	614.8-617.6
SEAM DESIGNATION:	n 16	Seam 16
RAW COAL		
INHERENT MOISTURE	0.8	0.8
ASH	0.6	15.3
VOLATILE MATTER	0.7	27.7
FIXED CARBON	8.3	56.5
SULPHUR	0.88	1.09
HARDGROVE GR.INDEX	5	63
SIZE FRACTION		
¼"x65M	6.8	95.5
65Mx0	6.2	4.5
CLEAN COAL (SIZE FRACTION 1.5 SINK-FLOA		
YIELD ON ¼"x65M	4.0	83.6
TOTAL YIELD EXCL. 65M	6.4	79.8
INHERENT MOISTURE	1.3	0.9
ASH	5.1	8.0
VOLATILE MATTER	5.5	32.3
FIXED CARBON	5.4	67.6
SULPHUR	0.08	1.11
PHOSPHOR	0	
FSI	3	7
SOFTENING TEMP.	0	366
RESOLIDIFIC.TEMP.	0	448
CONTRACTION	0	23
DILATATION	0	219
G-VALUE	.094	1.089

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 27 Size of core: HQ 63.5mm Total depth: 951.0 ' 290.1 m

Location: N 556,981.57
W 68,516.90
Elevation of collar: 5128.81 '
1564.29 m

Dip of Hole: -90°
Bearing " : - N °

Date of starting: Nov. 18, 1975
Date of completion: Dec. 3, 1975

Logging by: R.G. Ogilvie
" on: Dec. 3, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-27

Footage		Recovery		Description
from	to	feet	%	
0	13.0			Overburden.
13.0	53.0			Sandstone, crossbedded, some bands of mudstone, bedding angle of 38° with horizontal axis.
53.0	124.0			Mudstone, some thin calcite veins, coaly in places (max. thickness 0.6'), some sandstone bands.
124.0	132.0			Sandstone, crossbedded.
132.0	144.5			Mudstone, coaly near roof of coalseam.
144.5	152.5		100	Coalseam, sample EB-27-1, parting from 146.0 - 148.0.
152.5	166.0			Mudstone, some 0.5' coaly segments.
166.0	236.5			Sandstone, crossbedded, bedding angle of 40° with horizontal axis at 167.0, medium grained, non carbonaceous. Some bands of mudstone, more coaly at bottom 25 feet.
236.5	313.5			Mudstone, minor bands of medium grained sandstone. Some siltstone bands. Near 280' mark equal amounts of mudstone and sandstone.
313.5	320.5		100	Coalseam, sample EB-36-2, may be all coaly shale but sampled anyway to be sure.
320.5	332.0			Sandstone, crossbedded.

.../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-27

Footage		Recovery		Description
from	to	feet	%	
332.0	339.5			Coalseam, sample EB-27-3.
339.5	456.0			Mudstone, coaly from 349.5 - 352.0, 374.0 - 376.0, 394.0 - 395.5, and 400.3 - 402.3.
456.0	460.5		100	Coalseam, sample EB-27-4, small pyrite veins at 457.5.
460.5	543.5			Mudstone, massive nature, some bands of sandstone.
543.5	551.5		100	Coalseam, sample EB-27-5, partings at 544.1 to 544.7, and 549.0 - 550.5.
551.5	590.5			Mudstone, coaly from 574.0 - 577.0.
590.5	598.0			Sandstone, crossbedded, bedding angle of 42^{o} with horizontal axis.
598.0	607.0		96	Coalseam, sample EB-27-6.
607.0	653.5			Mudstone, some 0.5' coaly seams.
653.5	657.7		100	Coalseam, sample EB-27-7, parting from 655.0 - 656.0.
657.7	748.2			Mudstone, some sandstone bands, sandstone band at 681.0, bedding angle of 34^{o} with horizontal axis.
748.2	760.5	$\frac{12.1}{12.3}$	98	Coalseam, sample EB-27-8, parting 750.0 - 751.5, and 759.0 - 759.7.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-27

Footage		Recovery		Description
from	to	feet	%	
760.5	784.5			Mudstone, some siltstone bands.
784.5	791.0			Sandstone, crossbedded, bedding angle of 35° with horizontal axis at 789.0.
791.0	814.0			Mudstone, some siltstone bands.
814.0	863.0			Sandstone, crossbedded, bands of coarser grained and finer grained material of about equal amounts apiece.
863.0	938.5			Mudstone, coaly from 863.0 - 864.3, some siltstone bands, about the 900' mark.
938.5	940.5		100	Coalseam, sample EB-27-9, hard coal.
940.5	951.0			Mudstone, siltstone bands throughout.
End: TD	951.0			Shut down hole at 951.0, due to lack of rods.
				Signed: R. Ogilvie.

ELCO MINING LIMITED PAGE

DRILL HOLE: EB 27	EB-27-1	EB-27-2	EB-27-3	EB-27-4	EB-27-5	EB-27-6	EB-27-7	EB-27-8	EB-27-9
SAMPLE NO:	4888	4889	4890	4891	4892	4893	4894	5137	5138
LAB. NO:									
SAMPLE INTERVAL (FROM-TO) (FT.):	144.5-152.5	313.5-320.5	332.0-339.5	456.0-460.5	543.5-551.5	598.0-607.0	653.5-657.7	748.2-760.5	938.5-940.5
SEAM DESIGNATION:	Seam 14	Seam 13	Seam 13	Seam 12	Seam 12	Seam 10	Seam 10	Seam 10	Seam 9
RAW COAL									
INHERENT MOISTURE % ad	0.6	0.5	0.5	0.3	0.4	0.3	0.3	0.6	0.4
ASH % db	9.2	8.8	17.0	16.0	40.5	14.9	36.5	25.3	21.2
VOLATILE MATTER % db	29.8	27.5	26.8	27.8	19.1	25.0	22.8	20.8	21.2
FIXED CARBON % ad	60.7	63.3	55.9	56.1	39.7	59.9	40.5	53.6	57.4
SULPHUR % db	0.69	0.46	0.44	1.00	0.56	0.52	0.78	0.48	0.78
HARDGROVE GR. INDEX	111	73	73	81	80	87	73	92	89
SIZE FRACTION									
1/4"x65M weight %	83.8	95.4	97.6	96.6	91.8	89.8	94.3	89.9	94.5
65Mx0 weight %	16.2	4.6	2.4	3.4	8.2	10.2	5.7	10.1	5.5
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)									
YIELD 1/4"x65M weight %	93.0	93.3	84.3	79.4	58.2	86.3	61.2	86.6	81.6
TOTAL YIELD,EXCL.65Mx0 weight %	77.9	89.0	82.3	76.7	53.4	77.5	57.7	77.9	77.1
INHERENT MOISTURE % ad	2.0	1.0	0.8	0.8	1.1	0.8	0.8	1.1	0.6
ASH % db	3.4	4.3	4.1	6.2	7.0	5.3	6.6	5.2	6.2
VOLATILE MATTER % dab	32.5	29.5	30.5	29.6	29.3	29.4	29.0	26.0	26.4
FIXED CARBON % dab	67.5	70.8	69.4	70.5	70.9	70.7	71.1	74.1	73.5
SULPHUR % db	0.06	0.07	0.06	0.10	0.08	0.09	0.14	0.04	0.05
PHOSPHORUS % db	9	9	9	8 1/2	9	8-1/2	9	9	9
FSI	366	374	386	381	394	390	390	403	393
SOFTENING TEMP. °C	444	452	456	455	456	456	456	458	457
RESOLIDIFC. TEMP °C	30	27	30	28	16	7	16	25	26
CONTRACTION %	168	109	185	198	190	163	184	49	247
DILATATION %	1.072	1.060	1.064	1.071	1.066	1.077	1.070	1.021	1.065
G-VALUE									

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 31 Size of core: HQ 63.5 mm Total depth: 1250.6 ' 381.4 m

Location: N 557,393.19
W 70,472.54
Elevation of collar: 5434.21 '
1657.43 m

Dip of Hole: -90 o
Bearing " : _ N o

Date of starting: Oct. 31, 1975
Date of completion: Nov. 21, 1975

Logging by: R.G. Ogilvie
" on: Nov. 21, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-31

Footage		Recovery		Description
from	to	feet	%	
0	13.7			Overburden
13.7	41.0			Mudstone dark grey, fine-grained some cross-bedded sandstone bands core broken to top of coal seam
41.0	50.8		97	Coal Seam sample No. EB-31-1 no partings seen
50.8	58.3			Mudstone coaly from 57.0 to 58.3
58.3	61.6		100	Coal Seam sample EB 31-2
61.6	109.3			Mudstone numerous sandstone bands up to 0.6' max. thickness sandstone bands at 48^{0} with horizontal axis
109.3	114.0			Sandstone cross-bedded carbonaceous
114.0	125.2			Mudstone coaly and fissile from 123.0 - 125.2
125.2	142.6		98	Coal Seam sample EB 31-3 parting from 126.0 - 126.5

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-31

Footage		Recovery		Description
from	to	feet	%	
142.6	225.2			Mudstone massive with some bands of siltstone throughout
225.2	226.3		100	Coal Seam (minor)
226.3	229.1			Mudstone coaly and breaks easily
229.1	239.5		96	Coal Seam sample EB-31-4 no partings
239.5	268.5			Mudstone some siltstone bands coaly from 265.5 - 267.0
268.5	286.0		99	Coal Seam sample EB-31-5 no partings
286.0	396.7			Mudstone coaly and breaks easily coaly from 294.5 - 296.0 and 312.0 - 315.0 and 331.0 to 332.5 siltstone bands throughout areas where core is extremely broken
396.7	406.0		100	Coal Seam sample EB-31-6 roof material is massive mudstone floor is massive mudstone no parting in coal seam

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-31

Footage		Recovery		Description
from	to	feet	%	
406.0	412.8			Mudstone coaly from 411.0 to 412.5
412.8	415.2			Sandstone beds at 48° with horizontal axis cross bedded
415.2	481.0			Mudstone silty bands throughout minor coal seam from 445.6 - 446.5 and 451.0 to 452.3 and 462.0 to 464.0
481.0	485.5		100	Coal Seam sample EB-31-7 no partings roof material: fine grained, cross-bedded sandstone floor material: massive mudstone
485.5	509.3			Sandstone fine grained, carbonaceous cross bedded
509.3	533.5		97	Coal Seam sample EB-31-8 partings at 531.0 - 532.3 and other small partings
533.5	630.0			Mudstone siltstone bands throughout
630.0	635.0			Sandstone cross bedded

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-31

Footage		Recovery		Description
from	to	feet	%	
635.0	675.5			Mudstone coaly from 672.5 - 675.5 broken core, some core not recovered (approx. 0.5')
675.5	708.0		92	Coal Seam sample EB-31-9 partings at 675.5 to 676.8 687.0 - 690.5, 693.6 to 696.2
708.0	720.0			Mudstone coaly areas throughout
720.0	763.0			Sandstone cross bedded bedding angle of 45^{0} with horizontal axis
763.0	778.5			mudstone massive
778.5	787.0		75	Coal Seam sample EB-31-10
787.0	793.0			Mudstone massive
793.0	834.1			Sandstone cross bedded bedding at 53^{0} with horizontal axis at 828.0'

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-31

Footage		Recovery		Description
from	to	feet	%	
834.1	858.0			Mudstone
858.0	864.0		98	Coal Seam sample EB-31-11 parting at 858.4 - 859.0
864.0	878.2			Mudstone coaly from 872.7 to 877.0
878.2	886.0			Sandstone cross bedded carbonaceous coaly from 883.0 - 883.6
886.0	967.2			Mudstone coaly from 889.3 - 891.5 and 923.0 to 923.6 some sandstone bands (max. 3.0 thick)
967.2	973.3			Sandstone cross-bedded carbonaceous
973.3	1031.0			Mudstone some bands of sandstone (max. 3.0' thick)
1031.0	1048.5		97	Coal Seam sample EB-31-12

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-31

Footage		Recovery		Description
from	to	feet	%	
1048.5	1050.0			Coaly shale very broken 0.5' of core not recovered goes directly into a siltstone then to a sandstone
1050.0	1054.5			Siltstone very similar to mudstone but a definite texture coarsening
1054.5	1058.5			Sandstone cross bedded bedding at 46° with horizontal axis
1058.5	1183.9			Mudstone coaly from 1074.5 - 1075.2 some sandstone bands (3.0 max. thickness)
1183.9	1216.8			Sandstone cross bedded bedding angle of 55° with horizontal axis
1216.8	1250.6		63	Coal Seam sample EB-31-13 Some core lost because drillers were not drilling fast enough and the coal was being washed away. Recovery gained with faster drilling. Rods stuck in this coal seam, hole abandoned and cemented.
END T.D.	1250.6			
R.G.O.				

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-31

Footage		Recovery		Description
from	to	feet	%	
				The well was logged to the bottom of the hole after many attempts and days had passed by without success at recovering the stuck rods. 190 ft of rods and a 5 ft core barrel plus other items were cemented in the hole. The reason for the trouble was probably because the hole was making water at such a rapid pace that the mud was diluted when it reached the bottom thus letting the coal fall in the hole and jamming the drilling apparatus beyond recovery. Approx. 34' of coal was drilled but the bottom of the coal seam was never reached ant thus the Kootenay Sandstone Member was not either. R.G.O.

DRILL HOLE: EB 31

SAMPLE NO.:		EB-31-1	EB-31-2	EB-31-3	EB-31-4	EB-31-5	EB-31-6	EB-31-7	EB-31-8	EB-31-9	EB-31-10	EB-31-11	EB-31-12	EB-31-13
LAB. NO.:		4524	4525	4526	4527	4528	4529	4530	4531	4532	4533	5119	5120	5121
SAMPLE INTERVAL (FROM-TO) (FT.):		41.0-50.8	58.3-61.6	125.2-142.6	229.1-239.5	268.5-286.0	396.7-406.0	481.0-485.5	509.3-533.5	675.5-708.0	778.5-787.0	858.0-864.0	1031.0-1048.5	1216.8-1250.6
SEAM DESIGNATION:		Seam 12	Seam 12	Seam 10	Seam 10	Seam 10	Seam 9	Seam 9	Seam 8	Seam 8A	Seam 7	Seam 6	Seam 3 or 4	Seam 2
RAW COAL														
INHERENT MOISTURE	% ad	0.7	0.7	0.7	0.7	0.7	0.8	0.6	0.6	0.6	0.6	0.6	0.3	0.5
ASH	% db	15.7	31.7	25.4	25.6	12.8	30.0	30.7	33.2	30.5	22.0	39.5	30.3	24.2
VOLATILE MATTER	% db	21.4	18.2	19.0	18.0	18.8	16.8	16.1	24.1	17.6	16.0	14.3	15.6	18.3
FIXED CARBON	% ad	62.5	49.7	55.2	56.0	67.7	52.7	52.9	42.4	51.2	61.6	45.9	54.0	57.2
SULPHUR	% db	1.06	0.95	0.68	0.70	0.55	0.66	0.37	0.37	0.33	0.52	0.50	0.33	0.35
HARDGROVE GR. INDEX		107	88	87	88	93	83	74	73	85	101	79	79	120
SIZE FRACTION														
1/4"x65M	weight %	86.4	90.7	90.3	90.5	89.2	92.2	94.3	94.0	91.0	92.2	92.9	91.8	82.0
65MxO	weight %	13.6	9.3	9.7	9.5	10.8	7.8	5.7	6.0	9.0	7.8	7.1	8.2	18.0
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)														
YIELD 1/4"x65M	weight %	82.9	61.8	67.0	70.3	88.5	59.8	64.0	54.4	64.8	65.0	54.2	67.8	73.5
TOTAL YIELD, EXCL. 65MxO	weight %	71.6	56.0	60.5	63.6	78.9	55.1	60.4	51.1	59.0	59.9	50.4	62.2	60.3
INHERENT MOISTURE	% ad	1.9	1.8	1.4	1.0	1.5	1.1	1.1	0.9	2.0	3.1	0.5	0.5	1.2
ASH	% db	6.1	5.7	8.6	8.1	5.6	7.2	7.1	9.2	8.0	7.8	16.2	8.6	7.1
VOLATILE MATTER	% dab	23.7	25.9	23.2	22.6	21.7	22.1	20.6	20.5	20.8	20.7	21.2	19.1	20.8
FIXED CARBON	% dab	75.8	74.2	75.3	77.3	79.1	77.9	79.4	79.6	79.3	79.2	78.9	80.9	79.3
SULPHUR	% db	0.99	1.27	0.84	0.97	0.73	0.83	0.65	0.55	0.53	0.79	.70	0.40	0.36
PHOSPHORUS	% db													
FSI		9	9	8 1/2	8	7	9	5	3 1/2	6 1/2	2 1/2	8	3 1/2	8 1/2
SOFTENING TEMP.	°C.	411	402	405	413	414	407	429	423	422	421	408	417	408
RESOLIDIFC. TEMP.	°C.	457	457	462	468		465	468	477		450	475	477	476
CONTRACTION	%	7	15	21	18	12	20	13	12	12	12	18	21	28
DILATATION	%	54	167	69	22	-12	89			-12		28	-21	12
G-VALUE		1.043	1.057	1.036	1.004		1.044					1.017		0.970

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 33 Size of core: HQ 63.5 mm Total depth: 631.0 ' 192.5 m

Location: N 555,120.90
W 69,419.45
Elevation of collar: 5,159.18 '
1573.55 m

Dip of Hole: -90 o
Bearing " : - N o

Date of starting: Dec. 4, 1975
Date of completion: Dec. 12, 1975

Logging by: R.G. Ogilvie
" on: Dec. 12, 1975

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-33

Footage		Recovery		Description
from	to	feet	%	
0	48.3			Overburden.
48.3	63.5			Mudstone, some small sandstone bands.
63.5	71.0			Sandstone, cross bedded, some mudstone bands.
71.0	166.7			Mudstone, coaly from 115.0 to 116.0 and 138.5 to 141.0. Some sandstone bands (Max. thickness 2.0').
166.7	234.4			Sandstone, medium to coarse grained. Crossbedded. Bedding angle of 30^{0} with horizontal axis at 168.0. Abundant pyrite in coaly portions, some appear to be disseminated and also associated with the calcite veins being located on the perimeter of the veins. Some portions are very pure sandstone and generally noncarbonaceous except for a few carbonized plant remnants.
234.4	238.2	$\frac{3.6}{3.8}$	95	Coalseam, sample EB-33-1, small partings totalling o.7'.
238.2	287.0			Mudstone, coaly from 270.5 - 273.4.
287.0	293.5	$\frac{6.5}{6.5}$	100	Coalseam, sample EB-33-2, partins total 3.0'. Hard coal.
293.5	366.4			Mudstone, some thin sandstone bands.
366.4	372.7	$\frac{6.0}{6.3}$	95	Coalseam, sample EB-33-3.

.../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-33

Footage		Recovery		Description
from	to	feet	%	
372.7	420.5			Sandstone, crossbedded. Bedding angle of 28° with horizontal axis at 384.0, coarse grained.
420.5	468.3			Mudstone, massive and contains some thin sandstone bands.
468.3	487.3	18.7/19.0	98	Coalseam, sample EB-33-4. Small partings totalling 0.5'.
487.3	534.0			Mudstone, coaly from 532.3 - 534.0.
534.0	620.0			Sandstone, crossbedded, bedding angle of 30° with horizontal axis at 551.0.
620.0	?	10.0/10.0 (of recovered coal)	100	Coalseam, sample EB-33-5.
631.0 T.D.				Hole was abandoned on December 12, 1975 due to over abundance of natural water in hole.
				Signed: Rodney Ogilvie.

DRILL HOLE: EB 33		EB-33-1	EB-33-2	EB-33-3	EB-33-4	EB-33-5
SAMPLE NO.:		5139	5970	5971	5972	5973
LAB. NO.:		234.4-238.2	287.0-293.5	366.4-372.7	468.3-487.3	620.0-
SAMPLE INTERVAL (FROM-TO) (FT.):		Seam 16	Seam 16	Seam 16	Seam 15	Seam
SEAM DESIGNATION:						
RAW COAL						
INHERENT MOISTURE	% ad	0.6	0.7	0.9	0.9	0.9
ASH	% db	57.0	52.4	51.5	25.0	10.3
VOLATILE MATTER	% db	15.6	19.7	17.6	22.8	23.7
FIXED CARBON	% ad	27.2	27.8	30.7	51.7	65.4
SULPHUR	% db	0.37	0.31	0.76	0.46	0.37
HARDGROVE GR. INDEX		60				
SIZE FRACTION						
1/4"x65M	weight %	92.5	95.5	94.9	87.5	90.6
65Mx0	weight %	7.5	4.5	5.1	12.5	9.4
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)						
YIELD 1/4"x65M	weight %	32.2	41.3	43.1	85.3	92.5
TOTAL YIELD,EXCL. 65Mx0	weight %	29.8	39.4	40.9	74.6	83.8
INHERENT MOISTURE	% ad	1.1	0.8	0.8	1.8	0.7
ASH	% db	8.6	8.1	8.3	4.3	4.0
VOLATILE MATTER	% dab	26.9	32.1	29.8	28.8	25.8
FIXED CARBON	% dab	73.2	68.0	70.3	71.2	74.2
SULPHUR	% db	0.68	0.53	1.26	0.64	0.44
PHOSPHORUS	% db	0.11	0.14	0.09	0.04	0.02
FSI		9	9	9	9	9
SOFTENING TEMP.	^{o}C	389	381	379	383	388
RESOLIDIFC. TEMP.	^{o}C	456	454	455	452	458
CONTRACTION	%	22	12	18	26	24
DILATATION	%	110	25	239	93	61
G-VALUE		1.056	1.086	1.085	1.049	1.037

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 36 Size of core: HQ, NQ 63.5/47.6 mm Total depth: 1516.0 ' 462.4 m

Location: N 555,432.31
W 70,886.76
Elevation of collar: 5520.30 '
1683.69 m

Dip of Hole: -90 o
Bearing " : - N o

Date of starting: Nov. 24, 1975
Date of completion: Jan. 13, 1976

Logging by: R.G. Ogilvie
" on: Jan. 13, 1976

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-36

Footage		Recovery		Description
from	to	feet	%	
0	16.2			Overburden.
16.2	86.0			Mudstone, core very broken. Coaly at 61.0 mark. Some core not recovered (1.5 out of 4.0 recovered right above coal seam.
86.0	101.0	10.5/15.0	70	Coalseam, sample EB-36-1.
101.0	108.0			Mudstone.
108.0	120.0	10.3/12.0	86	Coalseam, sample EB-36-2, parting from 117.0 - 119.0.
120.0	128.0			Mudstone.
128.0	139.0	9.2/11.0	84	Coalseam, sample EB-36.3
139.0	157.3			Mudstone, core not broken so badly.
157.3	162.5	5.2/5.2	100	Coalseam, sample EB-36.4.
162.5	241.5			Mudstone, some small bands of sandstone.
241.5	245.0	3.3/3.5	94	Coalseam, sample EB-36-5. Core broken above seam.
245.0	301.0			Mudstone, silty zones common.
301.0	308.7	7.5/7.5	100	Coalseam, sample EB-36-6, parting from 305.0 to 306.0.
308.7	345.0			Mudstone, coaly from 310.0 to 312.2, and 335.5 to 337.0.

.../2

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-36

Footage		Recovery		Description
from	to	feet	%	
345.0	351.3	6.3/6.3	100	Coalseam, sample EB-36-7. Parting from 346.5 - 348.0.
351.3	390.0			Mudstone, coaly from 382.0 to 384.0.
390.0	405.0	15.0/15.0	100	Coalseam, sample EB-36-8.
405.0	463.0			Mudstone, some siltstone bands. Core quite broken around 450.0 mark. Coaly from 412.3 to 414.5.
463.0	478.0	1.5/15.0	10	Coalseam, sample EB-36-9.
478.0	564.0			Mudstone, coaly from 488.4 - 489.7. Very broken core from 541.0 to 547.0 (Fault zone). Core consists of rounded pebbles of which some grab samples were taken. Unbroken core above coal seam.
564.0	581.0	14.3/17.0	84	Coalseam, sample EB-36-10. Coal is very expansive and gassy. Bottom of seam lies on massive mudstone.
581.0	600.0			Mudstone, small coal seam at 587.0 to 588.2. Some other small shaly coal seams.
600.0	606.5	1.7/6.5	26	Coalseam, sample EB-36-11. Some small parting totalling 0.4'.
606.5	657.3			Mudstone, some small coalseams (0.8 max. thickness).

.../3

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-36

Footage		Recovery		Description
from	to	feet	%	
657.3	673.7	16.0/16.4	98	Coalseam, sample EB-36-12. Parting from 659.8 - 661.3.
673.7	759.0			Mudstone, frequent sandstone bands, thin coaly areas throughout.
759.0	779.8	20.2/20.8	97	Coalseam, sample EB-36-13, parting 768.0 to 769.0.
779.8	800.0			Mudstone.
800.0	812.0	9.8/12.0	82	Coalseam, sample EB-36-14. Some small partings totalling 0.9'.
812.0	868.0			Mudstone, some sandstone bands.
868.0	885.2	13.0/17.2	76	Coalseam, sample EB-36-15. Parting from 869.5 to 871.0.
885.2	1008.0			Mudstone, some sandstone bands.
1008.0	1047.0			Coalseam, sample EB-36-16. Soft coal. Small partings totalling 2.0'.
1047.0	1115.2			Mudstone, coaly from 1103.0 to 1105.5.
1115.2	1124.0	8.5/8.8	97	Coalseam, sample EB-36-17. Small partings totalling 1.0.
1124.2	1166.3			Sandstone, crossbedded. Bedding angle of 32° with horizontal axis at 1145.0.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-36

Footage		Recovery		Description
from	to	feet	%	
1166.3	1202.0			Mudstone.
1202.0	1210.0	$\frac{8.2}{10.0}$	82	Coalseam, sample EB-36-18.
1210.0	1309.5			Mudstone, massive and relatively sandstone-free.
1309.5	1329.0	$\frac{18.5}{19.5}$	95	Coalseam, sample EB-36-19. Parting at 1317.4 to 1318.6, and other small partings totalling 1.5.
1329.0	1449.0			Mudstone.
1449.0				Sandstone, crossbedded, coarse grained.
1449.0	1492.0			Sandstone, crossbedded. Medium to coarse grained.
1492.0	1506.0			Coaly shale and coalseam, only 1.0 of 14.0 of core recovered. The other 13.0 was probably a coal seam (according to the drillers). All the coal was ground up and washed away due to the "H" bit and/or core barrel unscrewing and drilling in front of the "N" bit.
1506.0	1516.0			Sandstone, coarse grained, 4.0 of core not recovered.
End: T.D. 1516.0				Signed: Rodney Ogilvie.

DRILL HOLE: EB 36

SAMPLE NO.:		EB-36-1	EB-36-2	EB-36-3	EB-36-4	EB-36-5	EB-36-6	EB-36-7	EB-36-8	EB-36-9	EB-36-10	EB-36-11	EB-36-12	EB-36-13	EB-36-14	EB-36-15	EB-36-16	EB-36-17	EB-36-18	EB-36-19
LAB. NO.:		4895	4896	4897	4898	4899	4900	5140	5141	5142	5143	5144	5145	5146	5147	5148	5974	5975	5976	5977
SAMPLE INTERVAL (FROM-TO) (FT.):		86.0-101.0	108.0-120.0	128.0-139.0	157.3-162.5	241.5-245.0	301.0-308.7	345.0-351.3	390.0-405.0	463.0-478.0	564.0-581.0	600.0-606.5	657.3-673.7	759.0-779.8	800.0-812.0	868.1-885.2	1008.0-1047.0	1115.2-1124.0	1202.0-1210.0	1309.5-1333.0
SEAM DESIGNATION:		Seam 13	Seam 13	Seam 13	Seam 13	Seam 13	Seam 13	Seam 13	Seam 12	Seam 12	Seam 12	Seam 12	Seam 12	Seam 10	Seam 10	Seam 9	Seam 8	Seam 7	Seam 6	Seam 3 or 4
RAW COAL																				
INHERENT MOISTURE	% ad	0.3	0.5	0.7	0.4	0.5	0.4	0.4	0.5	0.6	0.6	0.5	0.6	0.5	0.4	0.5	0.7	0.8	0.5	0.7
ASH	% db	20.2	59.0	47.7	13.4	36.1	43.8	46.5		78.6	28.8	46.4	61.7	52.0	34.6	53.5	29.8	66.5	28.0	40.7
VOLATILE MATTER	% db	24.7	15.4	16.9	23.1	18.4	17.0	21.4		8.8	17.1	13.3	11.8	21.0	18.2	12.9	16.3	10.7	16.3	13.9
FIXED CARBON	% ad	55.0	25.5	35.1	63.3	45.3	39.1	32.0		12.6	53.8	40.1	26.4	26.9	47.0	33.5	53.5	22.6	55.4	45.1
SULPHUR	% db	0.68	0.55	0.61	0.81	0.65	0.55	0.39		0.13	0.44	0.57	0.31	0.26	0.37	0.39	0.37	0.26	0.64	0.29
HARDGROVE GR. INDEX		108	79	81	114	98	102	76	112	50	100	58	64	71	71	76				
SIZE FRACTION																				
1/4"x65M	weight %	82.9	88.0	89.7	81.7	80.4	84.4	91.2	80.6	93.5	79.7	94.4	84.7	86.1	90.1	87.4	86.3	91.1	85.3	88.8
65MxO	weight %	17.1	12.0	10.3	18.3	19.6	15.6	8.8	19.4	6.5	20.3	5.6	15.3	13.9	9.9	12.6	13.7	8.9	14.7	11.2
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)																				
YIELD 1/4"x65M	weight %	76.5	33.6	38.9	87.8	69.9	55.3	43.3	91.2	3.6	71.0	0.5	20.5	32.9	50.1	25.1	62.8	11.1	78.4	51.6
TOTAL YIELD, EXCL. 65MxO	weight %	63.4	29.6	34.9	71.7	56.2	46.7	39.5	73.5	3.4	56.5	0.5	17.4	28.3	45.1	21.9	54.2	10.1	66.9	45.8
INHERENT MOISTURE	% ad	1.2	1.0	1.1	1.1	0.9	1.1	1.3	1.3	0.9	1.5	1.6	1.3	1.3	1.1	1.7	1.3	1.4	1.6	0.9
ASH	% db	7.8	5.5	11.1	3.6	9.5	6.3	5.2	5.5	10.4	6.7	22.4	6.6	6.4	9.0	14.5	8.4	8.4	7.3	8.6
VOLATILE MATTER	% dab	27.3	26.3	27.0	26.0	23.0	25.6	24.1	25.4	24.4	22.5		22.0	20.4	21.0	22.4	20.8	20.8	21.0	18.9
FIXED CARBON	% dab	72.7	73.8	73.0	74.0	68.1	74.5	76.0	74.7	75.6	77.6		78.0	79.7	79.1	77.6	79.1	79.2	79.1	81.2
SULPHUR	% db	0.92	0.80	0.85	0.97	1.06	0.81	0.76	0.68		0.78		0.74	0.64	0.54	0.62	0.45	0.87	0.75	0.47
PHOSPHORUS	% db	0.06	0.06	0.12	0.04	0.08	0.10	0.09	0.08	0.10	0.04		0.09	0.03	0.10	0.04	0.12	0.19	0.04	0.05
FSI		9	9	8 1/2	9	9	9	9	9	9	7		9	3	3	8	4-1/2	+9	9	3-1/2
SOFTENING TEMP.	°C.	385	387	388	399	392	396	411	393	393	399		406	421	466	415	418	412	411	425
RESOLIDIFC. TEMP.	°C.	453	454	453	457	457	459	473	458	460	470		473	464	488	441		470	472	478
CONTRACTION	%	24	16	28	26	26	25	19	26	27	23		26	10	2	5	18	26	19	13
DILATATION	%	198	183	150	177	134	104	15	79	53	-20		0	-10	-2	-5		24	17	-13
G-VALUE		1.068	1.072	1.056	1.053	1.054	1.047	0.992	1.040	1.026	0.461		0.929					0.997	0.996	

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 39 Size of core: HQ 63.5 mm Total depth: 600.0 ' 183.0 m

Location: N 553,166.50
W 69,830.99
Elevation of collar: 5,154.86 '
1,572.23 m

Dip of Hole: -90 °
Bearing " : - N °

Date of starting: Dec. 13, 1975
Date of completion: Jan. 9, 1976

Logging by: R.G. Ogilvie
" on: Jan. 9, 1976

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-39

Footage		Recovery		Description
from	to	feet	%	
0	62.5			Overburden.
62.5	77.0			Mudstone.
77.0	96.0	16.0/19.0	84	Coalseam, sample EB-39-1. Small partings totalling 0.5'.
96.0	108.3			Mudstone, some sandstone bands.
108.3	110.5	2.2/2.2	100	Coalseam, sample EB-39-2.
110.5	120.0			Sandstone, crossbedded. Bedding angle of 32° with horizontal axis at 119.0.
120.0	171.0			Mudstone, some sandstone bands.
171.0	174.0	3.0/3.0	100	Coalseam, sample EB-39-3.
174.0	180.0			Sandstone, crossbedded.
180.0	188.0	7.7/8.0	96	Coalseam, sample EB-39-4, small sandstone partings totalling 0.5'.
188.0	228.0			Sandstone, crossbedded,coarse grained.
228.0	240.0	12.0/12.0	100	Coalseam, sample EB-39-5, partings totalling 2.0'.
240.0	260.0			Mudstone.
260.0	288.0			Sandstone, crossbedded. Bedding angle of 40° with horizontal axis at 282.0'. Coarse grained.
288.0	336.5			Mudstone, some sandstone bands. Coaly from 288.0' to 289.4' and 301.0' to 302.0'.
336.5	391.0			Sandstone, coarse grained sandstone, not crossbedded while finer grained sandstone is crossbedded. Coaly from 355.0 to 356.8. Some siltstone bands.
391.0	429.0			Mudstone, some siltstone bands. Coaly from 391.0 to 392.3.
429.0	443.0			Sandstone, crossbedded.

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DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-39

Footage		Recovery		Description
from	to	feet	%	
443.0	449.0	5.7/6.0		Coalseam, sample EB-39-6. Hard coal.
449.0	457.3			Siltstone, abundant calcite.
457.3	485.0			Sandstone, crossbedded. Bedding angle of 55° with horizontal axis at 483.0.
485.0	503.5			Mudstone, some siltstone bands.
503.5	535.0			Sandstone, crossbedded.
535.0	547.0			Mudstone.
547.0	574.0			Coalseam, sample EB-39-7. Soft and bright coal. Little or no partings. Mudstone. Coaly from 582.6 - 584.0.
End: T.D. 600.0'				
				Signed: Rodney Ogilvie.

DRILL HOLE: EB 39		EB-39-1	EB-39-2	EB-39-3	EB-39-4	EB-39-5	EB-39-6	EB-39-7
SAMPLE NO.:		5983	5984	5985	5986	5987	6620	6621
LAB. NO.:								
SAMPLE INTERVAL (FROM-TO) (FT.):		77.0-96.0	108.3-110.5	171.0-174.0	180.0-188.0	228.0-240.0	443.0-449.0	547.0-574.0
SEAM DESIGNATION:		Seam 18	Seam 18	Seam 17	Seam 17	Seam 17	Seam 16	Seam 15
RAW COAL								
INHERENT MOISTURE	% ad	1.0	0.9	0.8	0.7	0.9	0.7	1.0
ASH	% db	21.8	40.0	42.2	46.7	50.5	70.8	7.6
VOLATILE MATTER	% db	26.5	22.6	22.7	16.6	18.9	12.0	26.8
FIXED CARBON	% ad	51.2	37.1	34.8	36.4	30.4	17.1	65.0
SULPHUR	% db	0.51	0.52	1.48	0.37	0.30	0.37	0.89
HARDGROVE GR. INDEX		77	63	61	67	56	56	88
SIZE FRACTION								
1/4"x65M	weight %	92.2	95.6	94.7	94.2	96.2	94.6	93.4
65Mx0	weight %	7.8	4.4	5.3	5.8	3.8	5.4	6.6
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)								
YIELD 1/4"x65M	weight %	78.0	55.6	49.4	49.1	35.8	22.0	94.0
TOTAL YIELD, EXCL. 65Mx0	weight %	71.9	53.2	46.8	46.3	34.4	20.8	87.8
INHERENT MOISTURE	% ad	2.9	1.2	1.3	1.2	1.2	0.4	1.0
ASH	% db	4.0	5.4	6.3	5.4	5.00	6.6	3.1
VOLATILE MATTER	% dab	32.4	31.6	33.3	28.0	31.3	28.1	29.0
FIXED CARBON	% dab	67.8	68.6	66.7	72.2	68.8	71.8	71.0
SULPHUR	% db	0.62	0.88	1.46	0.51	0.54	0.47	1.09
PHOSPHORUS	% db	0.05	0.04	0.12	0.13	0.13	0.05	0.03
FSI		8 1/2	7 1/2	8 1/2	3 1/2	8	8	9
SOFTENING TEMP.	°C.	385	385	379	396	382	374	392
RESOLIDIFC. TEMP.	°C.	446	453	450	455	455	460	453
CONTRACTION	%	23	12	22	11	19	29	27
DILATATION	%	183	200	253	18	211	68	143
G-VALUE		1.060	1.078	1.078	1.017	1.078	1.043	1.052

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 42 Size of core: HQ 63.5 mm Total depth: 370.0 ' 112.9 m

Location: N 553,475.43
W 71,298.83
Elevation of collar: 5,607.25 '
1,710.21 m

Dip of Hole: -90 °
Bearing " : - N °

Date of starting: Jan. 10, 1976
Date of completion: Jan. 14, 1976

Logging by: R.G. Ogilvie
" on: Jan. 14, 1976

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-42

Footage		Recovery		Description
from	to	feet	%	
0	30.0			Overburden.
30.0	81.6			Mudstone, some small sandstone bands.
81.6	99.2	17.0/17.6	96	Coal seam, sample EB-42-1, small partings totalling 20'.
99.2	162.0			Mudstone, some small sandstone bands.
162.0	190.0			Sandstone, cross bedded. Bedding angle of 48° with horizontal axis at 174.0'.
190.0	227.5			Mudstone, coaly from 198.5' to 200.0'.
227.5	241.5	11.5/14.0	82	Coalseam, sample EB 42-2, small partings totalling 3.0'.
241.5	245.0			Mudstone.
245.0	264.0			Sandstone, cross bedded.
264.0	278.0			Mudstone.
278.0	285.0	6.8/7.0	97	Coalseam, sample EB-42-3, partings totalling 1.0'.
285.0	315.5			Mudstone.
315.5	320.0	5.0/5.0	100	Coalseam, sample EB-42-4.
320.0	326.0			Mudstone.

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DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-42

Footage		Recovery		Description
from	to	feet	%	
326.0	329.8	$\frac{3.8}{3.8}$	100	Coalseam, sample EB-42-5.
329.8	370.0			Mudstone, coaly from 346.8 - 349.0
End T.D.= 370.0'				Signed: Rodney Ogilvie

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PAGE

DRILL HOLE: EB 42		EB-42-1	EB-42-2	EB-42-3	EB-42-4	EB-42-5
SAMPLE NO.:		6611	6612	6613	6614	6615
LAB. NO.:		81.6-99.2	227.5-241.5	278.0-285.0	315.5-320.0	326.0-329.8
SAMPLE INTERVAL (FROM-TO) (FT.):		Seam 15	Seam 14	Seam 13	Seam 13	Seam 13
SEAM DESIGNATION:						
RAW COAL						
INHERENT MOISTURE	% ad	0.9	0.6	0.6	0.9	1.0
ASH	% db	47.0	9.6	29.8	42.1	68.6
VOLATILE MATTER	% db	16.0	18.3	19.2	16.3	11.8
FIXED CARBON	% ad	36.6	71.7	50.7	41.3	19.4
SULPHUR	% db	0.59	0.44	0.74	0.57	1.08
HARDGROVE GR. INDEX		75	111	87	98	64
SIZE FRACTION						
1/4"x65M	weight %	88.7	84.9	89.3	82.6	92.0
65Mx0	weight %	11.3	15.1	10.7	17.4	8.0
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)						
YIELD 1/4"x65M	weight %	47.5	91.5	68.2	49.2	19.4
TOTAL YIELD,EXCL. 65Mx0	weight %	42.1	77.7	60.9	40.6	17.8
INHERENT MOISTURE	% ad	1.6	1.2	0.6	1.1	1.0
ASH	% bd	4.9	6.3	9.2	8.9	8.9
VOLATILE MATTER	% dab	26.1	20.8	28.7	24.7	20.6
FIXED CARBON	% dab	74.0	79.2	71.3	75.4	57.4
SULPHUR	% db	0.84	0.45	0.99	0.92	2.76
PHOSPHORUS	% db	0.07	0.07	0.07	0.11	0.04
FSI		9	8 1/2	9	8 1/2	8 1/2
SOFTENING TEMP.	°C	399	417	392	410	410
RESOLIDIFC. TEMP.	°C	454	470	460	459	474
CONTRACTION	%	25	24	23	27	29
DILATATION	%	84	20	155	37	6
G-VALUE		1.036	0.995	1.063	1.009	0.995

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 47 Size of core: HQ 63.5 mm Total depth: 1186.0 ' 361.7 m

Location: N 553,681.39
W 72,277.40
Elevation of collar: 5807.06 '
1771.15 m

Dip of Hole: -90 °
Bearing " : N °

Date of starting: February 1, 1976
Date of completion: February 9, 1976

Logging by: R.G. Ogilvie
" on: Feb. 9, 1976

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB 47

Footage		Recovery		Description
from	to	feet	%	
0	15.0			Overburden.
15.0	70.0			Sandstone, crossbedded.
70.0	97.0			Mudstone.
97.0	109.0			Sandstone, crossbedded.
109.0	125.0			Mudstone, 2.0 ' of core missing at 123.0' (coal). 1.0' of coal recovered but not enough for sample.
125.0	128.0	$\frac{3.0}{3.0}$	100	Coalseam. Sample EB-47-1. Some massive pyritic sections (over a 2 inch section at 127').
128.0	244.0			Mudstone. Coaly from 136.0 - 137.0' and 188.3 - 217.5' and a thin stringer at 236.0'.
244.0	268.0	$\frac{23.0}{24.0}$	95	Coalseam. Sample EB-47-2. Small partings totalling 2.0'. Gradational footwall contact.
268.0	288.5			Mudstone, some 0.3' - 0.5' coal stringers. Slickensides at 272.0'.
288.5	310.0			Sandstone. Crossbedded, interlayered thin mudstone bands.
310.0	440.5			Mudstone. Coaly from 343.0 - 344.5'. Some sandstone bands. Numerous thin coaly stringers.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-47

Footage		Recovery		Description
from	to	feet	%	
440.5	449.5	8.6/9.0	95	Coalseam. Sample EB-47-3. Hard, dull coal.
449.5	520.0			Mudstone.
520.0	534.0			Sandstone. Crossbedded. Medium grained with some coarse grained sections.
534.0	585.0			Mudstone. Some 0.5 - 1.0 ' bands of sandstone.
585.0	599.0	13.0/14.0	92	Coalseam. Sample EB-47-4. Small partings toalling 0.5'.
599.0	609.6			Mudstone
609.6	615.0	5.0/5.4	92	Coalseam, Sample EB-47-5.
615.0	663.0			Mudstone, some 0.2' coal stringers.
663.0	684.0	15.0/21.0	71	Coalseam, Sample EB-47-6. Parting from 681.6 to 682.9'. Other partings totalling 1.5'.
684.0	744.0			Mudstone, some fine-grained sandstone bands.
744.0	760.5	13.5/16.5	81	Coalseam. Sample EB-47-7. Partings 747.1 - 749.6, 754.0 - 759.5.
760.5	788.0			Mudstone.
788.0	860.0			Sandstone. Some small (0.3') coal stringers. Medium-grained, carbonaceous. Bedding angle of 25° with horizontal axis at 835.0'.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-47

Footage		Recovery		Description
from	to	feet	%	
860.0	963.0			Mudstone. Some 0.8' max. coal stringers. Coaly at 891.5 - 892.5 and 907.5 - 910.0. Medium-grained sandstone band at 900.0. Fine-grained sandstone band at 928.0.
963.0	972.0	$\frac{7.8}{9.0}$	86	Coalseam. Sample EB-47-8.
972.0	1038.0			Mudstone. Some coal stringers 0.5' max.
1038.0	1046.0			Sandstone. Crossbedded, medium-grained.
1046.0	1053.0	$\frac{2.7}{7.0}$	38	Coalseam. Sample EB-47-9.
1053.0	1067.0			Mudstone.
1067.0	1081.3			Sandstone, crossbedded, fine-grained.
1081.3	1095.0	$\frac{11.0}{13.7}$	80	Coalseam. Sample EB-47-10. Parting 1089.0 - 1093.5.
1095.0	1118.0			Mudstone. Interlayered coarse-grained sandstone.
1118.0	1162.0			Sandstone. Kootenay Sandstone. Coarse-grained, bedding angle of 43^{0} with horizontal axis at 1121.0.
1162.0	1177.0			Siltstone. Interbedded sandstone bands.
1178.5	1186.0			Sandstone, Kootenay Sandstone.
End: T.D. 1186.0'.				Signed: Rodney Ogilvie.

DRILL HOLE: EB 47		EB-47-1	EB-47-2	EB-47-3	EB-47-4	EB-47-5	EB-47-6	EB-47-7	EB-47-8	EB-47-9	EB-47-10
SAMPLE NO.:		7217	7218	7219	7220	7221	7222	7223	7224	7225	7226
LAB. NO.:		125.0-128.0	244.0-268.0	440.5-449.5	585.0-599.0	609.6-615.0	663.0-684.0	744.0-760.5	963.0-972.0	1046.0-1053.0	1081.3-1095.0
SAMPLE INTERVAL (FROM-TO) (FT.):		Seam 12	Seam 10	Seam 9	Seam 8	Seam 8A	Seam 7	Seam 6	Seam 4	Seam 3	Seam 2
SEAM DESIGNATION:											
RAW COAL											
INHERENT MOISTURE	% ad	0.5	0.5	0.4	0.3	0.4	0.7	0.5	0.3	0.8	0.6
ASH	% db	40.4	32.5	24.0	10.1	29.8	45.7	74.2	20.1	64.3	81.7
VOLATILE MATTER	% db	19.6	1.82	18.1	19.8	19.5	13.5	9.1	16.8	10.0	7.0
FIXED CARBON	% ad	39.8	49.1	57.7	69.9	50.5	40.5	16.7	63.0	25.5	11.2
SULPHUR	% db	4.80	0.44	0.50	0.39	0.60	0.42	0.16	0.42	0.16	0.22
HARDGROVE GR. INDEX		73	81	81	108	85	89	64	84	78	63
SIZE FRACTION											
1/4"x65M	weight %	93.5	92.5	93.1	90.3	94.5	90.7	92.0	92.1	92.2	92.3
65MxO	weight %	6.5	7.5	6.9	9.7	5.5	9.3	8.0	7.9	7.8	7.7
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)											
YIELD 1/4"x65M	weight %	46.6	60.5	70.8	90.1	64.2	54.0	15.7	81.5	30.7	8.9
TOTAL YIELD,EXCL. 65MxO	weight %	43.6	56.0	65.9	81.4	60.7	49.0	14.4	75.1	28.3	8.2
INHERENT MOISTURE	% ad	0.6	0.6	0.5	0.9	0.4	2.0	0.4	0.5	1.3	1.0
ASH	% db	7.6	7.1	9.1	7.0	7.4	8.1	9.7	7.9	6.1	8.4
VOLATILE MATTER	% dab	23.6	22.1	21.1	21.7	23.3	22.1	20.7	19.1	21.4	21.1
FIXED CARBON	% dab	76.5	77.8	78.9	78.4	76.6	77.9	79.3	80.9	78.7	79.0
SULPHUR	% db	0.87	0.57	0.61	0.43	0.73	0.64	0.56	0.48	0.54	0.57
PHOSPHORUS	% db	0.09	0.06	0.08	0.12	0.11	0.10	0.03	0.08	0.02	0.03
FSI		9	7 1/2	3	7	9	7	3	2	9	7 1/2
SOFTENING TEMP.	°C	398	405	419	407	408	409	413	423	409	414
RESOLIDIFC. TEMP.	°C	460	465		456	476				469	469
CONTRACTION	%	19	25	22	24	29	18	17	16	22	19
DILATATION	%	100	2		-24	116				43	10
G-VALUE		1.052	0.994			1.048				1.023	0.981

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 51 Size of core: HQ 63.5 mm Total depth: 526.0 ' 160.4 m

Location: N 557,699
W 71,942
Elevation of collar: 5922 '
1806.21 m

Dip of Hole: -90 °
Bearing " : - N °

Date of starting: Jan. 26, 1976
Date of completion: Jan. 31, 1976

Logging by: R.G. Ogilvie
" on: Jan. 31, 1976

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB 51

Footage		Recovery		Description
from	to	feet	%	
0	38.0			Overburden.
38.0	131.0			Mudstone, some coarse sandstone bands. Some small coaly sections. Broken core at 56.0' and 100.0'.
131.0	170.6			Sandstone, coarse, grained.
170.6	178.0	5.1/7.4	68	Coalseam. Sample EB-51-1.
178.0	230.0			Mudstone.
230.0	236.0	4.5/6.0	75	Coalseam. Sample EB-51-2.
236.0	261.0			Mudstone. Coaly from 253.0' to 254.0'. Broken core at 249.0' and 257.0'.
261.0	311.0			Sandstone. Coarse, grained. Broken core at 290.0'.
311.0	323.0	7.2/12.0	60	Coalseam. Sample EB-51-3.
323.0	351.0			Sandstone.
351.0	419.0			Mudstone. Some thin sandstone bands. Broken core at 358.0'.
419.0	526.0			Sandstone, coarse grained. A 1.0' coaly section at 422.0' to 423.0'.
End T.D. 526.0'				Sandstone core highly fractured (top 50' only), then is massive core near bottom.
				Signed: Rodney Ogilvie.

DRILL HOLE: EB 51				
SAMPLE NO.:		EB-51-1	EB-51-2	EB-51-3
LAB. NO.:		7075	7227	7228
SAMPLE INTERVAL (FROM-TO) (FT.):		170.6-178.0	230.0-236.0	311.0-323.0
SEAM DESIGNATION:		Seam 7	Seam 6	Seam 3 or 4
RAW COAL				
INHERENT MOISTURE	% ad	0.7	0.8	0.8
ASH	% db	14.3	60.9	42.4
VOLATILE MATTER	% db	18.0	15.1	7.7
FIXED CARBON	% ad	67.2	23.8	49.5
SULPHUR	% db	0.48		
HARDGROVE GR. INDEX		122	85	98
SIZE FRACTION				
1/4"x65M	weight %	89.2	67.0	65.7
65Mx0	weight %	10.8	33.0	34.3
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)				
YIELD 1/4"x65M	weight %	87.4	11.4	38.0
TOTAL YIELD,EXCL. 65Mx0	weight %	78	7.6	25.0
INHERENT MOISTURE	% ad	1.9	1.6	1.5
ASH	% db	3.3		
VOLATILE MATTER	% dab	20.3		
FIXED CARBON	% dab	78.4		
SULPHUR	% db	0.54		
PHOSPHORUS	% db	0.03		
FSI		9	8	3
SOFTENING TEMP.	^{o}C	401	406	406
RESOLIDIFC. TEMP.	^{o}C	467	467	
CONTRACTION	%	22	21	23
DILATATION	%	46	45	
G-VALUE		1.028	1.026	

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 52 Size of core: HQ 63.5 mm Total depth: 526.0 ' 160.4 m

Location: N 555,866
W 72,941
Elevation of collar: 6043 '
1843.12 m

Dip of Hole: -90 °
Bearing " : - N °

Date of starting: Jan. 16, 1976
Date of completion: Jan. 21, 1976

Logging by: R.G. Ogilvie
" on: Jan. 21, 1976

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-52

Footage		Recovery		Description
from	to	feet	%	
0	78.5			Overburden.
78.5	138.0			Mudstone, broken core. Some thin sandstone bands.
138.0	144.5	4.0/6.5	61	Coalseam. Sample EB-52-1.
144.5	250.0			Mudstone, 5.0' of sandstone from 176.0' to 181.0'. Only 1.0' of core recovered between 193.0 and 196.0 Broken core from 193.0 to 200.0. Coaly from 229.0 to 231.0.
250.0	260.0	9.7/10.0	97	Coalseam. Sample EB-52-2.
260.0	284.0			Mudstone.
284.0	296.0			Sandstone, crossbedded.
296.0	309.0	8.0/13.0	61	Coalseam. Sample EB-52-3.
309.0	314.3			Sandstone, crossbedded.
314.3	322.0	7.4/7.7	96	Coalseam. Sample EB-52-4.
322.0	526.0			Sandstone. Coarse-grained to 400' mark. 400' to 526' coarseness decreases to a medium-grained sandstone at 526.0. Little or no crossbedding seen in the coarse sandstone.
End T.D. 526.0'				Signed: Rodney Ogilvie.

DRILL HOLE: EB 52					
SAMPLE NO.:		EB-52-1	EB-52-2	EB-52-3	EB-52-4
LAB. NO.:		6616	6617	6618	6619
SAMPLE INTERVAL (FROM-TO) (FT.):		138.0-144.5	250.0-260.0	296.0-309.0	314.3-322.0
SEAM DESIGNATION:		Seam 6	Seam 30.4	Seam 2	Seam 2
RAW COAL					
INHERENT MOISTURE	% ad	0.9	0.9	0.7	0.6
ASH	% db	47.2	16.4	38.4	21.9
VOLATILE MATTER	% db	13.0	21.1	19.2	17.8
FIXED CARBON	% ad	39.4	62.0	42.1	59.9
SULPHUR	% db	0.37	0.78	0.35	0.58
HARDGROVE GR. INDEX		90	93	86	82
SIZE FRACTION					
1/4"x65M	weight %	78.9	92.1	86.8	91.1
65MxO	weight %	21.1	7.9	13.2	8.9
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)					
YIELD 1/4"x65M	weight %	45.8	85.8	57.2	74.6
TOTAL YIELD,EXCL. 65MxO	weight %	36.1	79.0	49.7	68.0
INHERENT MOISTURE	% ad	1.6	0.9	0.7	0.6
ASH	% db	5.7	6.6	7.4	9.1
VOLATILE MATTER	% dab	20.1	25.2	20.3	20.6
FIXED CARBON	% dab	80.0	74.9	79.8	79.5
SULPHUR	% db	0.69	0.82	0.58	0.50
PHOSPHORUS	% db	0.06	0.06	0.02	0.02
FSI		8 1/2	9	9	8 1/2
SOFTENING TEMP.	°C	392	390	401	412
RESOLIDIFC. TEMP.	°C	459	455	469	476
CONTRACTION	%	18	29	27	25
DILATATION	%	166	173	54	43
G-VALUE		1.068	1.058	1.027	1.019

DIAMOND DRILL CORE LOGGING SHEET

DDH No.: EB 53 Size of core: HQ 63.5mm Total depth: 726.0 ' 221.4 m

Location: N 553,991
W 73,745
Elevation of collar: 6245 '
1904.73 m

Dip of Hole: -90 °
Bearing " : - N °

Date of starting: Jan. 22, 1976
Date of completion: Jan. 28, 1976

Logging by: R.G. Ogilvie
" on: Jan. 28, 1976.

Remarks:

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-53

Footage		Recovery		Description
from	to	feet	%	
0	40.0			Overburden.
40.0	48.5			Sandstone. Crossbedded. Fine-grained.
48.5	96.0			Mudstone.
96.0	116.5	9.0/20.5	43	Coalseam. Sample EB-53-1. Hard coal in some places.
116.5	202.0			Mudstone. Coaly from 162' to 166'.
202.0	208.0	6.0/6.0	100	Coalseam. Sample EB-53-2.
208.0	231.7			Mudstone.
231.7	234.0	2.3/2.3	100	Coalseam. Sample EB-53-3.
234.0	307.0			Mudstone.
307.0	325.0			Sandstone.
325.0	445.0			Mudstone, some thin sandstone bands.
445.0	487.0			Sandstone. Crossbedded. Bedding angle at 40° with horizontal axis at 485.0'. Some mudstone bands.
487.0	493.0	6.0/6.0	100	Coalseam. Sample EB-53-4.
493.0	595.0			Mudstone, 1.0' coal seam at 579.0 - 580.0'.
595.0	604.0			Sandstone, crossbedded.
607.0	611.0	4.0/4.0	100	Coalseam. Sample EB-53-5.
611.0	625.0			Mudstone.
625.0	643.0			Sandstone, crossbedded.
643.0	652.5	9.1/9.1	95	Coalseam, Sample EB-53-6.
652.5	657.0			Sandstone, crossbedded.
657.0	666.0	9.0/9.0	100	Coalseam, sample EB-53-7. 1.0' of parting.

DIAMOND DRILL CORE LOGGING SHEET

DDH No. EB-53

Footage		Recovery		Description
from	to	feet	%	
666.0	702.0			Sandstone. Coarse-grained. Bedding angle of 50° with horizontal axis at 705.0'.
702.0	704.5	2.5 / 2.5	100	Coalseam, Sample EB-53-8.
704.5	726.0			Sandstone, coarse grained. Kootenay Sandstone.
End T.D. 726.0'				
				Signed: Rodney Ogilvie.

DRILL HOLE: EB 53		EB-53-1	EB-53-2	EB-53-3	EB-53-4	EB-53-5	EB-53-6	EB-53-7	EB-53-8
SAMPLE NO.:		7076	7077	7078	7079	7080	7081	7082	7083
LAB. NO.:		96.0-116.5	202.0-208.0	231.7-234.0	487.0-493.0	607.0-611.0	643.0-652.5	657.0-666.0	702.0-704.5
SAMPLE INTERVAL (FROM-TO) (FT.):		Seam 8	Seam 7	Seam 6	Seam 4	Seam 3	Seam 2	Seam 2	Seam 1
SEAM DESIGNATION:									
RAW COAL									
INHERENT MOISTURE	% ad	0.6	0.7	0.7	0.7	0.3	0.9	0.8	0.6
ASH	% db	10.8	32.6	12.9	19.8	8.2	44.5	28.0	25.9
VOLATILE MATTER	% db	19.4	16.5	17.4	15.7	18.8	13.6	18.8	18.4
FIXED CARBON	% ad	69.4	50.5	69.2	64.0	72.8	41.5	52.8	55.4
SULPHUR	% db	0.46	0.43	0.49	0.46	0.41	0.25	0.44	1.73
HARDGROVE GR. INDEX		102	84	81	85	139	86	77	89
SIZE FRACTION									
1/4"x65M	weight %	87.3	78.2	90.9	91.6	88.8	82.3	92.3	94.6
65MxO	weight %	12.7	21.8	9.1	8.4	11.2	17.7	7.7	5.4
CLEAN COAL (SIZE FRACTION 1/4"x65M; 1.5 SINK-FLOAT S.G.)									
YIELD 1/4"x65M	weight %	91.7	59.4	93.4	80.6	97.7	48.8	70.2	75.5
TOTAL YIELD,EXCL. 65MxO	weight %	80.1	46.5	84.9	73.8	86.8	40.2	64.8	71.4
INHERENT MOISTURE	% ad	1.0	0.7	0.5	0.9	2.9	0.9	0.6	0.7
ASH	% db	8.1	9.7	8.3	10.7	5.7	9.2	9.2	7.5
VOLATILE MATTER	% dab	21.3	21.3	19.9	18.9	21.2	20.4	21.8	24.4
FIXED CARBON	% dab	78.7	78.7	80.1	81.1	78.7	79.7	78.3	75.7
SULPHUR	% db	0.46	0.55	0.55	0.45	0.39	0.44	0.57	0.99
PHOSPHORUS	% db	0.14	0.15	0.07	0.12	0.06	0.01	Trace	Trace
FSI		6	7 1/2	3 1/2	3	8	8-1/2	9	9
SOFTENING TEMP.	°C	415	420	425	416	402	397	392	379
RESOLIDIFC. TEMP.	°C		478	465	469	465	466	466	466
CONTRACTION	%	16	23	19	8	25	25	27	27
DILATATION	%		-7	-19	-8	8	28	75	225
G-VALUE			0.892			0.964	1.004	1.042	1.088

K-ELK RIVER 76 (3) B

EVALUATION OF EXPLORATION AND TESTWORK JULY 1975 - APRIL 1976 ON THE ELK RIVER COAL PROPERTY

VOLUME II
APPENDIX 2

GEOLOGICAL MAPPING

CALGARY/DUSSELDORF
MAY 1976

ELCO MINING

SUMMARY REPORT

TO ACCOMPANY

MAPS AND SECTIONS

ELK RIVER, BRITISH COLUMBIA

Prepared for: Elco Mining Ltd.
Calgary, Alberta

by: Paul Dyson Consultants
and Holdings Limited
Calgary, Alberta

December 1975

TABLE OF CONTENTS

I. INTRODUCTION

This report describes the work carried out for Elco Mining during the months of July to September 1975. The work essentially consisted of detailed surface mapping combined with the measuring of exposed coal sections wherever possible. It was mainly concentrated in the area of Big Weary Ridge.

The report consists of a set of surface maps (14) at a scale of 1" - 200', a series of Cross-sections at the same scale for the Big Weary Ridge area and numerous measured sections. The text is secondary to the maps and sections and serves mostly as a series of notes to accompany them. It should be noted that a general familiarity with the stratigraphy is assumed.

Some general conclusions regarding the stratigraphy and structure of the area are drawn. The problems which present themselves are analyzed and recommendations are made for their solution.

I.i. PREVIOUS WORK

Considerable exploration had been carried out in the Elk Valley by numerous parties from the early 1900's to the present. In particular, drilling and trenching had been extensively carried out in the past ten years by Scurry Rainbow Oil and partners. This program had resulted in a good understanding

I.i. PREVIOUS WORK (Cont'd.)

of the Little Weary Ridge area but Big Weary Ridge and the west side of the Elk Valley remained largely unknown in detail.

To enable furthur drilling and/or trenching to be conducted in these areas it was decided to complete the mapping of the properties at a scale of 1" - 200'. This scale of mapping enables essentially all outcrops to be plotted in their appropriate locations. The available topographic mapping is highly variable.

I.ii. FIELD METHODS

The work was conducted by geologists and assistants based in the Elco Mining Ltd. base camp on Weary Creek. A four wheel drive vehicle provided by Elco was used to travel within the project area.

Extensive traversing of the area is believed to have recorded all significant outcrops in the area.

I.iii. ACKNOWLEDGEMENTS

The geological personnel who complete the majority of the mapping were G. Germscheid, J. Singhai and G. Allan.

I.iii. ACKNOWLEDGEMENTS (Cont'd.)

Both G. Germscheid and G. Allan were employed by Paul Dyson Consultants while J. Singhai was working as an independent consultant under the general direction of Paul Dyson. Field assistance was given by W. Poelman, S. Travis and W. Radant of Paul Dyson Consultants.

The camp and vehicles provided by Elco are gratefully acknowledged as is the valuable guidance of Dr. J. Stobernack.

The interpretation of the data into a comprehensive form was carried out by P. Dyson and G. Germscheid and drafting completed by R.G. Salloway Consulting Ltd. The base maps used were obtained from Elco and some problems were encountered with the variability of scale and date.

II. GEOLOGY

This section of the report is divided into two sections - Stratigraphy and Structure. No general discussion of the general stratigraphy or structure of the Rocky Mountains and Foothills is included as it has been well described in previous reports on the area by both Scurry Rainbow and partners.

II.i. STRATIGRAPHY

The coal measure sequence lies within the Lower Cretaceous Kootenay formation. This formation extends throughout southeastern British Columbia and southern Alberta and everywhere contains significant coal seams. In areas where the rock sequence is well exposed, it is underlain by the marine shales of the Fernie group and unconformably overlain by the basal conglomerate (Cadomin formation) of the Blairmore group. It varies widely in thickness from 200 to 300 feet up to in excess of 3,000 feet in its more westerly exposures.

In the Elk Valley the underlying Fernie Group is well exposed along the east side of Big Weary Ridge and succeeding ridges to the south. Some probable exposures

II.i. STRATIGRAPHY (Cont'd.)

of Fernie group have also been recognized on Little Weary Ridge. The conglomerate that overlies the Kootenay formation was never found in contact with a continuous section of coal measures. However, numerous exposures of a conglomerate were found along the west side of the Elk Valley in positions indicating apparent stratigraphic continuity with the coal measures. The conglomerate appears lithologically identical to the typical Cadomin conglomerate of adjacent regions and is assumed to be in fact this conglomerate.

The Kootenay formation is a highly variable coal measure sequence underlain by a massive basal sandstone containing several thick (more than 10 feet) coal seams in its lower 600 feet of coal measures. (The basal sandstone was not measured on the property but is assumed to be approximately 200 feet thick.) The remainder of the coal measure sequence contains a multiplicity of coal seams generally less than 10 feet thick although notable exceptions in seam thickness do exist. Indications are that the total coal measure sequence is approximately 3,000 feet thick.

The information gathered from the surface sections and boreholes assist greatly in defining a more detailed picture of the stratigraphy.

II.i.a. Fernie-Kootenay Contact

The contact between the Fernie group and the basal sand unit of the Kootenay formation is reasonably abrupt in this area. The dark grey to black marine shales of the Fernie meet rather sharply with a light colored, poorly cemented and friable sandstone unit of the basal sandstone.

II.i.b. The Basal Sandstone

The basal sandstone may be divided at outcrop into two mappable units. Contained within the lower unit are light colored, poorly cemented or friable sandstones. These are about 100 feet thick and have an extremely sharp, probably erosional, upper contact with the dark unit of the basal sand. The upper dark unit is about 50 feet to 100 feet thick. It is mainly composed of chert and quartz, is well cemented with a siliceous cement and is extremely hard to fracture. It owes its dark color to the high percentage of dark chert grains.

The basal sand has previously been described as a marine sequence (as it contains marine ammonites in the Fernie area), but it appears to be a continental sequence for the most part in this area.

II.i.c. General Trends in the Kootenay Formation

As mentioned, the Kootenay formation in this area is about 3,000 feet thick. It overlies a marine shale sequence called the Fernie Group and is overlain unconformably by the Cadomin conglomerate of the Blairmore group.

II.i.c. General Trends in the Kootenay Formation (Cont'd.)

The lower 2,000 feet of the Kootenay, i.e. from the basal sandstone to seam "A" or "18", is non-calcareous and is indicative of a truly continental sequence. The lowest 600 feet is generally sandier than the upper part of the Kootenay and contains most of the thick (more than 10 feet) coal seams. It has been found that some of the coal seams contain ironstone beds as well as zones (up to 2 feet) of small heavily concentrated (1 - 3 mm) ironstone pellets. These are presumed to have been derived locally and they are questionable as reliable marker horizons. Some attempts were made to correlate seams using them but without success. Furthermore, it is not certain whether they would be apparent in unoxidized zones (i.e. drill holes or fresh surface cuts). The upper 2,000 feet of the Kootenay formation consists mainly of thin coal seams and shales. Several marine bands are present as evidenced by the appearance of small (generally less than 1/2 inch) pelecypods, ostrocods and ammonites found in the black shales, but no fossil zonation for the basis of correlation has been established as yet. The nature of the upper sequence being partly marine may explain the numerous thin coal seams and the poor development of any thick ones. That is to say, the coal measures may have been derived close to a fluctuating and

II.i.c. General Trends in the Kootenay Formation (Cont'd.)

inundating sea. Due to the lack of any persistent marker beds anywhere in the Kootenay formation in the Elk Valley, correlation has been based on stratigraphic interval in combination with coal seam sequence.

II.ii. STRUCTURE

The general structure of the east side of the Elk Valley is well known to be a series of west dipping beds ranging from the Fernie group to a stratigraphic position high in the coal measures of the Kootenay formation. Similarly, the west side of the valley is known to be underlain by near vertical coal measures. It has been suggested that the valley is underlain by a fault or alternatively that a syncline underlies the valley bottom. The new work tends to prove the second interpretation and this will be discussed below.

For ease of understanding, the different portions of the project area are discussed separately and a general summary ties the overall interpretation together. The separate areas discussed are:

(a) Big Weary Ridge

(b) Little Weary Ridge

(c) the "West Side" of the Elk Valley

(d) the Cadorna Creek area.

II.ii. STRUCTURE (Cont'd.)

By far the most detail is available for the Big Weary Ridge area which was the prime area of concern for the project. It is the only area for which cross-sections have been constructed and these should be studied in conjunction with the map and the report.

II.ii.a. Big Weary Ridge

Big Weary Ridge is a striking topographic feature underlain by predominantly west dipping beds. Excellent exposures are available along the ridge itself and in the valley of Weary Creek.

Structurally, the area is characterized by a series of thrust faults cutting up section from west to east accompanied by minor amounts of folding. Faulting is observable throughout, though the area appears to be most highly faulted between sections 120 - 170. A more detailed look at this area shows the basal sand (closest to the ridge) dipping steeply to the west above the most easterly major fault. The strata down dip in this area assumes a similar profile in that it is also generally steeply dipping. The steep dips here are accompanied by extensive thrust faulting and contortion of the strata. Tectonic thickening and thinning of the coal seams was observed here in the field.

II.ii.a. Big Weary Ridge (Cont'd.)

As one continues north past section 170, minor faulting is observable, though the area is generally devoid of any major structural complexities. This is best evidenced by the Weary Creek section. Here, minor thrusting is apparent at approximately the six seam horizon. Microfolding and shear zones are also noticeable in a few of the coal seams at this location.

To the south from section 120, one encounters a relatively regular westerly dipping sequence. Faulting and folding were observed though they appear to be quite minor and localized.

It should be noted that the most easterly major fault that cuts through the basal sand on the ridge has a minimum displacement of approximately 1,600 feet in a northerly direction.

II.ii.b. Little Weary Ridge

This area is typified by a quite regular sequence of westerly dipping beds, the average dip which is approximately 40^{o}. The area may be considered to be devoid of significant structural complications, though minor irregularities were encountered. There is some possibility of faulting below the basal sand here as evidenced on the north end of the ridge, but this does not affect the coal bearing strata.

II.ii.c. "West Side"

The coal measures on the west side of the Elk Valley are essentially vertical from a point due west of Aldridge Creek north to Cardorna Creek where some overturning is recognized.

The outcrop except for a tributary of Bleasdell Creek is essentially limited to the old exploratory trenches. These trenches are for the most part overgrown and collapsed but wherever possible, attempts were made to measure the exposed rocks.

Little evidence of any major structural discordances could be found although the more westerly outcrops tended to show minor faulting and slickensiding. Some of the thicker coal occurrences in this area are probably tectonically thickened. This minor structural complexity is associated with the overthrust Palaeozoic rocks in the west.

II.ii.d. Cadorna Creek

This area while not of great significance from an economic standpoint is nevertheless of structural importance in that it provides the key to the interpretation of the valley bottom.

II.ii.d. Cadorna Creek (Cont'd.)

A syncline flanked by Cadomin formation containing Blairmore group in its axial area is readily mapped along Cadorna Creek. The west limb (Cadomin formation) is traceable all along the west side of the project area.

This syncline is projected throughout the project area essentially parallel to and west of the Elk River.

III. CONCLUSIONS

The conclusions can be broadly broken into two categories - stratigraphic and structural.

From a stratigraphic point of view approximately 3000 feet of coal measures are present in the Elk Valley. The seams are not persistent over significant lateral distances and correlation for more than a few thousand feet of any seam is difficult although coal zones may persist. No apparent correlation can be made between the major measured sections, i.e. Weary Creek (75-B), Big Weary Ridge (75-A) and the sections on the west side of the valley. This lack of correlation undoubtedly reflects stratigraphic variation rather than structural complexity.

In fact it is very difficult to follow individual stratigraphic units, either coal or sandstone, for more than a few thousand feet. This makes correlation of seams across Weary Ridge from Weary Creek to the ridge itself questionable with the present data, although an interpretation is shown on the maps.

Structurally, the Elk Valley is believed to be underlain by a major syncline. It is exposed at Cadorna Creek. No significant faulting is recognized on the west side of the valley with the notable exception of the Palaeozoic overthrust.

III. CONCLUSIONS (Cont'd.)

Big Weary Ridge contains at least two major overthrusts which involve the Kootenay formation. Additionally, a major zone of disturbance is present in the Aldridge tunnel area and this zone would significantly effect any attempt at underground mining in that area.

IV. RECOMMENDATIONS

The complete integration of all surface data into existing and new drilling must be attempted. Such an attempt has been made in this project for the Big Weary Ridge area but some difficulties remain.

Big Weary Ridge is criss-crossed by numerous old roads and trenches which are collapsed and overgrown but not reclaimed. All these trenches and roads should be cleaned up and mapped prior to reclamation. An immense amount of invaluable information would be readily available at a minimal cost. This information would probably be adequate to confirm the surface traces of the seams as shown on the accompanying map.

The complete interpretation of Big Weary Ridge requires additional drilling on at least a 2,000 foot spacing. It is believed that a drill program on this spacing with all holes drilled to the basal sandstone would permit an excellent evaluation of Big Weary Ridge. Shallow holes should be avoided as they lead to difficult and possible erroneous correlation of the seams on this area of rapid lateral facies changes.

IV. RECOMMENDATIONS (Cont'd.)

There are no recommendations for additional work on Little Weary Ridge as the existing interpretation of Elco is believed to be complete.

The "west side" of the Elk Valley requires exploration to determine the thickness of the coal seams in the vertical coal measures present on that side of the valley. The trenches must be cleaned out and measured prior to reclamation. A prospect most certainly exists for open pit coal mining in this area if the coal seams are of adequate thickness. A program of drill holes angled east and drilled "up-section" from the upper road would establish the seam thicknesses.

December 1975

I. P. Dyson, P. Geol.

SECTION 75-A

BIG WEARY RIDGE

Section measured from basal sandstone south along the ridge. Measured "up-section".

0 - 11	Coal Zone. Carbonaceous shale from 0 - 1. Coal from 1 - 4. Shale from 4 - 6. Coal from 6 - 8. Shale from 8 - 11.
11-13	Siltstone: orange brown, 4 - 6" beds resistive.
13 - 18	Coal: transitional to shale above.
18 - 24	Siltstone: dark grey with 1 inch nodules mudstone at top, transitional to very fine grained sandstone above.
24 - 30	Sandstone: very fine grained with small scale cross lamination, thinly bedded, calcareous.
30 - 35	Shale: carbonaceous.
35 - 39	Sandstone: very fine grained, clean, cross laminated, pink grey, carbonaceous.
39 - 49	Shale: silty (6") interbedded, non calcareous.
49 - 56.5	Coal.
56.5 - 62.5	Sandstone: thinly bedded, lower, 6 - 9" at top. very fine grained, pink grey, calcareous, clean, abrupt contact above.
62.5 - 89	Shale: carbonaceous, homogeneously dark grey.
89 - 125	Shale: poorly exposed?
125 - 130	Siltstone: orange, weathered (lowest 1 foot), passing to 2 feet shale to silty mudstone at top, 9", very fine grained sandstone at top.
130 - 140	Shale: with few inches at 1975 thinly bedded siltstones.
140 - 157	Siltstone: blocky (lateral change to sandstone to shale), quite uninterrupted passes into very fine grained sandstone at 150, strongly calcareous.

157 - 164	Shale: orange weathered lower half.
164 - 165.5	Silts.
165.5 - 169.5	Shale with one foot silts.
169.5 - 174.5	Coal.
174.5 - 177	Shale.
177 - 179	Siltstone.
179 - 186	Sandstone: very fine grained, calcareous 6 - 9".
186 - 193.5	Silty mudstones: with one foot silts at 188.
193.5 - 198	Sandstone: very fine grained, massive, orange weathered, calcareous.
198 - 209	Silty mudstone: few 2 inch siltstone orange bands, strongly calcareous.
209 - 210	Very fine grained sandstone: calcareous, cross laminated, grey.
210 - 218	Shale: one foot silty in upper part.
218 - 220	Sandstone: very fine grained, strongly calcareous, small scale cross lamination, gradational upwards.
220 - 225	Mudstone: silty.
225 - 230	Mudstone: carbonaceous.
230 - 235	Mudstones: non calcareous, with dense (one foot) ironstone mudstone at 230, calcareous, silty.
235 - 240	Mudstone: becoming carbonaceous.
240 - 245	Silts: with orange weathered silty, nodular mudstone band (4").
245 - 250	Shales.
250 - 253	Shales.
253 - 258	Mudstone: orange silty, homogeneous.
258 - 268	Mudstones: silty, carbonaceous, top one foot is dirty coal.

268 - 277	Coal: abrupt contact to sandstone above.
277 - 281	Sandstone: very fine grained, massive, pink grey, strongly calcareous, interval small scale cross lamination.
281 - 282	Siltstones: muddy.
282 - 286	Sandstone: very fine grained, massive, as below.
284 - 285	Silts and shales.
285 - 289	Sandstone: very fine grained, pink grey, darker than lower unit (282-86) siliceous, 6" silty shales at 287 , appears lenticular.
289 - 294	Coal.
294 - 298	Carbonaceous mudstone.
298 - 300	Sandstone: very fine grained, interbedded with silty mudstones.
300 - 316	Coal.
316 - 317	Mudstone.
317 - 318	Sandstone: very fine grained.
318 - 321	Shale: silty.
321 - 341	Siltstone-mudstone: 4 inch interbedded with one to six inch lenticular very fine grained sandstone.
341 - 346	Sandstone at base: very fine grained to silts and muds in upper 4 feet.
346 - 351	Mudstone and Siltstone.
351 - 354	Ssandstone and siltstone: very fine grained, interbedded silts in lower 3 feet with 1 foot sandstone at top.
354 - 359	Shale: friable, carbonaceous.
359 - 364	Mudstone: carbonaceous.
364 - 375	Mudstone: carbonaceous.

375 - 380.5	Coal: Clarodurain.
380.5 - 395.5	Siltstone: carbonaceous with thin orange concretionary bands.
395.5 408	As below.
408 - 413	Siltstone: orange brown, massive, argillaceous with two 6 inch dark grey interbedded shales.
413 - 421	Shale: carbonaceous.
421 - 424	Sandstone: very fine grained, grading to shales above.
424 - 434	Siltstone: blocky.
434 - 439	Sandstone: very fine grained, dark grey, 40 to 50% argillaceous matter, abundant large scale plant impressions, non calcareous.
439 - 449	Siltstone: thinly bedded.
449 - 457	Sandstone: very fine grained, strongly calcareous with upper 5 feet silts, orange weathered.
457 - 462	Sandstone: fine grained, carbonaceous, siliceous, dark grey, bedding. * coarsest lithology from base appears correlatable to sandstone at ridge south of Aldridge Cr. - iron oxides in matrix.
462 - 472	Siltstone and very fine grained sandstone, non calcareous.
472 - 487	Siltstone: uninterrupted.
487 - 542	Mudstone- silty: dark grey shale, silty, becoming silty and very fine grained sandstone at 530, non calcareous shales become carbonaceous to top, platey sandstone.
542 - 552	Shales.
553 - 555	Coal.
555 - 556	Shale.
556 - 568	Coal with few carbonaceous (4 foot) bands - nodular, coal extremely platey and friable coal, sharp contact with muds above.

568 - 588	Dark and light grey silts, gradational above.
588 - 594	Sandstone: grey, very fine grained, small scale cross lamination, 590 - 591 shale.
594 - 600	Sandstone: very fine grained with few thin (4") shale bands (silty).
600 - 605	Silts grading to very fine grained sandstone above.
605 - 607	Sandstone: fine-medium grained, non calcareous, clean, quartzose.
607 -610	DArk grey silts and shale.
610 - 614	Sandstone: very fine grained, argillaceous, light grey, platey, non calcareous, dark grey.
614 - 615	Shales: silty.
615 - 630	Shale: silty with approximately one foot very fine grained sandstone every three feet (sandstone siliceous).
630 - 645	Shales: carbonaceous, very slightly silty, minor coal seams upwards.
645 - 650	Coal seam.
650 - 660	Sandstone: very fine grained, argillaceous, channel unit three feet thick and twelve feet long.
660 - 695	Siltstone with sandstone: approximately three foot silty zones with one foot to 6 inches very fine grained sandstone interbeds passing to carbonaceous shales below (non calcareous, very fine grained sandstone below).
695 - 705	Coal seam. Hard coal.
705 - 721	Shale: carbonaceous.
721 - 723	Sandstone: very fine grained, grey weathered to light brown (orange), very calcareous.
723 - 728	Silts: very argillaceous, dark grey.

728 - 741	Shale: silty.
741 - 742	Sandstone: very fine grained, gradational above and below to silts.
742 - 744.5	Shale.
744.5 - 745	Siltstone.
745 - 746	Sandstone: very fine grained.
746 - 747	Siltstone.
747 - 749	Coal: gradational to shale above.
749 - 753	Shale.
753 - 754	Sandstone: very fine grained.
754 - 764	Shale: dark grey, carbonaceous.
764 - 799	Shales and siltstone rubble mainly, with some siltstones and carbonaceous shale outcrop.
799 - 804	Shale.
804 - 809	Sandstone: very fine grained, cross laminated (low angle), strongly calcareous, pink grained, with abundant fossils deeply impressed.
809 - 812	Shale: carbonaceous.
812 - 813	Sandstone: very fine grained, strongly calcareous (as above).
813 - 815	Shale: carbonaceous.
815 - 827.5	Coal.
827.5 - 829	Silty muds: sharp contact with coal below.
829 - 832	Silts: argilaceous.
832 - 842	Silty muds.
842 - 847	Silty muds.
847 - 852	Silty muds.

852 - 862	Sandstone: very fine grained, cross laminated, strongly calcareous, bedding to few inches, pink grey.
862 - 874	Shales: sandstone calcareous, fine grained, cherty.
874 - 879	Lime muds: shell and plant debris, extremely calcareous.
879 - 919	Shales: (silty) mainly dark grey, some orange weathering with one foot silts (orange weathered) at 900.
919 - 920	Coal Seam - one foot.
920 - 955	Shales: mainly dark grey, carbonaceous, few orange bands, distinct shale band (923 - 930 calcareous and limy).
955 - 956	Sandstone: very fine grained.
956 - 971	Shales: with carbonaceous, silty muds (one foot) interbedded at two foot intervals.
971 - 1036	Shales and silts: approximate measurement.
1036 - 1037	Coal.
1037 - 1038	Muds: coaly.
1038 - 1064.5	Coal: quite friable and platey.
1064.5 - 1078	Shale: silty in lower becoming carbonaceous in upper.
1078 - 1083	Sandstone: upper very fine grained, calcareous.
1083 - 1143	Poorly exposed to no exposure, probably shale.
1143 - 1163	Shale: dark grey, orange weathering.
1163 - 1173	Sandstone: very fine grained plant impression, thinly bedded appearance, non calcareous, pink grey.
1173 - 1200	Silts: light grey, grades to shales in upper ten feet.

1200 - 1205	Shale.
1205 - 1230	Silts and carbonaceous shale.
1230 - 1241	Coal seam.
1241 - 1242	Shale
1242 - 1243	Coal.
1243 - 1263	Shale, gradational below.
1263 - 1268	Silts: calcareous, siliceous, laminated, channel deposits 2' to 3 feet thick and 12 inches long, maybe repeat of lower seam.
1268 - 1282	Shales.
1282 - 1283	Silts.
1283 - 1288	Shale.
1288 - 1289	Silts, calcareous.
1289 - 1339	Shales, carbonaceous with few minor coal seams in upper twenty feet.
1339 - 1350	Coal.
1350 - 1355	Shales: few thin coal seams.
1355 - 1356	Sandstone: very fine grained, laminated.
1356 - 1361	Coal, superficial oalitic appearance (top one foot).
1361 - 1364	Mudstones.
1364 - 1372	Coal.
1372 - 1375	Shale: dark grey.
1375 - 1377.5	Sandstone: very fine grained, interbedded with small scale cross laminated units, planar lamination, strongly calcareous.
1377.5 - 1390	Silts and Shales:

1390 - 1420	Incipiant exposure.
1420 - 1429	Sandstone: very fine grained, strongly calcareous, rusty weathering, very thinly bedded, cross-laminated, and planar beds with few channels, troughs.
1429 - 1436	Silts: strongly calcareous, thickly bedded and massive appearance.
1436 - 1447	Shales: 6 inches silty muds at 1440.
1447 - 1452	Sandstone: very fine grained as below (29-36).
1452 - 1459	Shales: trans. to silts and sands above.
1459 - 1463	Sandstone: very fine grained, strongly calcareous.
1463 - 1468	Sandstone: dark grey, siliceous (lense out north and south).
1468 - 1483	Mudstone: richly calcareous, limey, orange weathering.
1483 - 1508	Shales: dark grey, uniform appearance.
1508 - 1520	Silts: orange weathering, strongly calcareous.
1520 - 1545	Shales: poorly exposed.
1545 - 1554	Sandstone: very fine grained, calcareous (strongly), pinkish grey.
1554 - 1590	Unexposed, carbonaceous shales?
1590 - 1595	Coal seam.
1595 - 1599	Silt: orange weathering, massive.
1599 - 1612	Coal with 6 inches mudstone in middle.
1612 - 1616	Carbonaceous shale.
1616 - 1621	Coal with six inches shale in middle.
1621 - 1636	Shales to rubble poorly exposed, medium grained sandstone with clasts.

1636 - 1646	Sandstone: * major erosional surface at base, medium to coarse grained, dark grey, siliceous, laterally this may was out the coal seam below.
1646 - 1666	Sandstone: fine to medium grain, feebly calcareous, large scale cross bedding.
1666 - 1669	Shale-siltstone: very fine sandstone in middle (one foot).
1669 - 1674	Sandstone: fine, grey weathering strongly calcareous, massive, large scale cross lamination.
1674 - 1684	Siltstone: mainly planar lamination in upper.
1684 - 1689	Sandstone: very fine to medium grained, calcareous, moderate scale cross lamination, plant impression.
1689 - 1711	Sandstone: fine to very fine grained, pink weathering, argillaceous, planar lamination (½") minor one inch shale bands, calcareous.
1711 - 1731	Sandstone: medium grained, cherty, siliceous, massive (1 - 3 foot units).
1731 - 1736	Sandstone: fine grained, dark grey, strongly calcareous.
1736 - 1756	Silt and sandstone: lenses of very fine grained sandstone.
1756 - 1761	Silts and very fine grained sandstone: calcareous, argillaceous.
1761 - 1772	As below, calcareous.
1772 - 1773	Shale: dark grey, gradational to silts above.
1773 - 1775	Sandstone: very fine grained, calcareous (feebly).
1775 - 1805	Shales and muds: interbedded (calcareous) approximately 70% shale.
1805 - 1810	Sandstone: very fine, calcareous, laminated, passing up to light grey, cleaner, very fine grained sandstone.

1810 - 1815	Shale: carbonaceous, very sharp contact above.
1815 - 1817	Sandstone: very fine grained, pink grey, strongly calcareous, thinly bedded.
1817 - 1902	Shales and silts: poorly exposed.
1902 - 1909	Shales: dark grey.
1909 - 1911.5	Sandstone: very fine grained, medium grey, feebly calcareous, slightly argillaceous.
1911.5 - 1914.5	Shales: with 6 inches coal at base.
1914.5 - 1916	Sandstone: very fine grained, strongly calcareous, grey tootlets.
1916 - 1921	Shale with 6 inches coal one foot up from base.
1921 - 1951	Shales: clean, carbonaceous with four sandy units (6 inches to one foot), regularly spaced.
1951 - 1956	Sandstones-silts-shales: weathered one foot units.
1956 - 1973	Sandstone: fine grained, strongly calcareous.
1973 - 1976	Sandstone: very fine grained, bedding ¼ - 1/8 inch.
1976 - 1983	Very fine grained passing to medium grained, strongly calcareous.
1983 - 1987	Sandstone: medium grained, strongly calcareous, clean, uniform, brownish look.
1987 - 1990	Sandstone: medium grained, effusive.

SECTION 75-B

WEARY CREEK

Section measured downstream along south side of Weary Creek from 0 - 627 and then along north side of creek. Measured "up-section".

0 - 8	Sandstone: medium grained, rusty grey, massive, non calcareous.
8 - 13	Sandstone: as below, bedding (6inches to one foot) minor 2 inch carbonaceous shale between unit bedding thicken and thins laterally, minor structural faults here (5 feet).
13 - 18	Shale: 2 feet becomes silty and very fine grained sandstones (4 feet).
18 - 23	Shales? poorly exposed.
23 - 58	Shales to base of coal seam, poorly exposed upper contact, to sandstone above coal.
58 - 62	Sandstone: fine to very fine grained, 6 inch shale parting at base.
62 - 65	Silts: transitional to shales above, dark lamination.
65 - 67	Shales: blocky, nodular.
67 - 68.5	Silts: argillaceous, non calcareous.
68.5 - 74.5	Shaley: small scale folding 3 feet, carbonaceous, slickensides, coaly partings, plant remains.
74.5 - 82.5	Sandstone: very fine grained, non calcareous, carbonaceous, 4 - 8 foot beds.
82.5 - 88	Sandstone: as below, few shale partings (1").
88 - 98	Sandstone: light grey, becoming coaly to coal above (thin bands) fine grained, 4 inch to 1 foot beds.
98 - 101	Shales: with one foot silt channels.
101 - 108	Coal Seam: possible movement and shear zone at base, sharp contact below and above.

108 - 110	Sandstone: fine grained, laminated.
110 - 123	Sandstone-silts: interlain (¼") 2 to 4 inch units.
123 - 144	Unexposed - shales?
144 - 149	Sandstone: two to four inch units, minor shale partings, very fine grained, brown grey, cross laminated, rootlets.
184 - 153.5	Sandstone: as below, feebly calcareous, 4 inch to 1 foot units, 4 inch siltpartings (middle).
153.5 - 161.5	Shales and muds: few orange weathered 6 inch bands, carbonaceous.
161.5 - 163	Coal - dirty, intermixed with shale.
163 - 187	Coal: minor 6 inch shale band at 176.
187 - 189	Shales: silty, calcareous.
189 - 189.5	Carbonaceous shale.
189.5 - 210	Mudstone: silty, rusty brown weathering, ironstone concretions (2 inches).
210 - 215	Sandstone: fine grained, olive grey, quartzitic.
215 - 236	Mudstone: argillaceous, interbedded, feebly calcareous.
236 - 238	Siltstone: siliceous channel, pinches in and out.
238 - 240	Mudstone.
240 - 241	Silts: orange weathering.
241 - 273	Muds and Silts: interbedded, calcareous.
	* 271 - 272 - orange weathered silts, channel.
273 - 281	Muds and silts - interbedded, calcareous.
281 - 283	Silts: dark grey, lense, channel.

283 - 285	Muds: grey, brown.
285 - 290	Mudstone: dark grey.
290 - 293	As below.
293 - 296	Coal: dirty, highly sheared at base .
296 - 297	Silty: nodular, orange weathered, interbedded.
294 - 298.5	Coal: dirty.
298.5 - 316.5	Mudstone: planar bedding, slightly calcareous.
316.5 - 318.5	Sandstone: fine grained, 3 to 6 inch units.
318.5 - 320.5	Silts: laminated, thinly bedded.
320.5 - 322	Sandstone: fine grained with two 2 inch platey siltstone interbeds, calcareous (strongly).
322 - 327	As below - non calcareous (dark grey).
327 - 352	Sandstone: fine grained, silty laminated, trace calcareous.
352 - 367	Sandstone: fine grained, noticeable fault (10 foot) with change in strike, medium - dark grey, trace calcareous.
367 - 369	Coal.
369 - 378	Shale
378 - 379	Coal .
379 - 379.5	Shale.
379.5 - 380.5	Coal.
380.5 - 382.5	Shale.
382.5 - 389	Coal.
389 - 391	Silt: orange brown , calcareous.
391 - 402	Mudstone.

402 - 403	Fine grained sandstone - channel.
403 - 420	Not exposed.
420 - 428	Mudstone.
428 - 434	Coal.
434 - 456	Mudstone: minor silty (1 foot) interbeds, trace calcareous.
456 - 474	Unexposed.
474 - 476	Coal - partial exposure.
476 - 484	Unexposed.
484 - 492	Coal seam.
492 - 412	Mudstone, non calcareous.
512 - 555	Unexposed.
555 - 558	Silt: orange brown weathering, numerous plant impressions.
558 - 562	Shales: silty.
562 - 577	Shale: carbonaceous.
577 - 582	Carbonaceous shales.
582 - 588	Carbonaceous shales with few 1 inch coal bands (partings).
588 - 593	As below.
593 - 595	Coal and shale (4 inch alternate beds).
595 - 600	Extremely hard coal.
600 - 616	Coal: upper 8 feet carbonaceous interbeds (½ to 2 inches every 2 to 8 inches), transitional to mudstone above from 609.

616 - 617	Mudstone: transitional to siltstones.
617 - 624	Siltstones.
624 - 627	Sandstone: fine grained, dark grey, feebly calcareous.
627 - 636	Unexposed.

SECTION 75-C

LITTLE WEARY RIDGE

Section measured from east to west on Little Weary Ridge near Trench T-70-9 and Trench T-EB-1-75. Measured "up-section".

0 - 20	Coal - #9 seam.
20 - 55	Poor exposures, mudstone, silty unit?
55 - 60	Shale: carbonaceous.
60 - 61	Sandstone: very fine grained, bight brown grey, thinly laminated.
61 - 66	Mudstone: carbonaceous, brown with dark grey interbeds.
66 - 68	Sandstone: very fine grained.
68 - 70	Mudstone.
70 - 72	Sandstone: fine grained.
72 - 74	Mudstone: dark grey, carbonaceous (¼ inch coaly stringers).
74 - 77	Siltstone: erosional contact at base of sandstone.
77 - 78	Sandstone: medium grained, numerous plant fragments, well cemented, siliceous.
78 - 81	Sandstone: medium to coarse, massive, plant impressions.
81 - 86	Sandstone: medium to coarse, siliceous, numerous ironstone mudclasts (0 - 1").
86 - 91	Sandstone: as below.
91 - 159	Unexposed.
-	(Start of trench)
159 - 163	Silts: carbonaceous.
163 - 163.5	Coal.

163.5 - 166	Mudstone: carbonaceous.
166 - 166.5	Coal: blocky.
166.5 - 175	Mudstone: carbonaceous.
175 - 190	Coal: with one to two inch shale partings every two feet.
190 - 196.5	Coal: uninterrupted.
196.5 - 197.5	Shale with thin coaly interbeds.
197.5 - 198	Coal.
198 - 198.2	Shale.
198.2 - 198.4	Coal.
198.4 - 199	Shale.
199 - 199.5	Coal.
199.5 - 200	Shale.
200 - 200.5	Coal : dirty and sandy.
200.5 - 215	Mudstone: few coaly stringers becoming silty upper five feet (and siliceous).
215 - 252	Silts: uniform, massive, no partings, mudstones, becomes more mudstone (more thinly bedded).
252 - 260	Mudstone: 2 inch units, uniform sequence, few silty zones.
260 - 265	Mudstone: numerous plant fragments.
265 - 266	Shale: black, platey.
266 - 267	Coal.
267 - 270	Shale.
270 - 270.5	Coal.
270.5 - 271	Mudstone.
271 - 273.7	Coal.
273.7 - 274.2	Mudstone.

274.2 - 278.2	Coal_ minor one-inch shaley partings.
278.2 - 280	Shale and coal interbeds.
280 - 298.5	Coal mainly clean, few noldular shale partings.
298.5 - 310	Mudstone: massive.
310 - 276	Siltstone: minor variation.
376 - 379	Shales: coaly stringers.
379 - 382	Silts.
382 - 392	Mudstone: thinly bedded.
392 - 407	Sandstone: very fine grained, siliceous.
407 - 417	Coal: ?? poorly exposed, only top 3 feet.
417 - 427	Mudstone: few coaly stringers, numerous slickensides, heavily slickensided.
427 - 430	Coal.
430 - 435	Siltstone-mudstone: massive.
435 - 445	Poorly exposed interval - probably silts.
435 - 438.5	Coal.
438.5 - 445	Silts: coaly laminae.
445 - 450	Coal.
450 - 455	Silts.
455 - 456.5	Coal.
456.5 - 485	Silts.
485 - 486	Coal.
486 - 488	Silts.
488 - 489	Coal.
489 - 496	Silts: laminated.

SECTION 75-D

BIG WEARY RIDGE

Section measured east to west in old trench 3500 feet south southeast of Rlk River bridge. Measured "up-section".

8'	Covered.
5'	Mudstone: dark brown grey, carbonaceous.
5'	Coal zone.
0 - 13.5	Poor exposure, mainly covered. Appears to be mainly Mudstone, rubbly.
13.5 - 17	Siltstone: brown grey, thickly bedded.
17 - 19	Mudstone: dark grey brown.
19 - 24	Siltstone: argillaceous.
24 - 36	Covered.
36 - 48.5	Siltstone: grey brown in thin argillaceous interbeds at 2" to 4" inrevals. 335 x 38° W.
48.5 - 60	Coal - 12 feet approximately. Occasional interbeds of siltstone or mudstone ½" to 3" thick.
60 - 64	Shale: dark grey.
64 - 72	Covered.
72 - 75	Siltstone: argillaceous, grey, brown.
75 - 83	Covered.
83 - 85	Mudstone: silty.
85 - 89	Shale: dark grey, carbonaceous.
89 - 90	Coal.
90 - 92	Mudstone: buff grey, very finely shattered.

92 - 96.5	Coal - approximately 20% argillaceous interbeds ½" to 2" thick.
96.5 - 97.5	Shale: dark grey brown, platey.
97.5 - 117	Sandstone: light rusty brown, very fine grained with thin (approximately ½") argillaceous interbeds.
117 - 126	Covered.
126 - 130	Sandstone: buff, grey, fine grained, silty, very hard.
130 - 140	Coal.
140 - 147.5	Sandstone: rusty brown, looks to have mainly FeO matrix.
147.5 - 148.5	Shale: dark grey, platy.
148.5 - 153	Siltstone: buff grey with dark laminae.
153 - 153.5	Shale: carbonaceous, dark grey.
153.5 - 154	Coal.
154- 179	Shale: grey brown. 335 x 38° W

SECTION 75-E

BIG WEARY RIDGE

Section measured "up-section" on Big Weary Ridge.

0 - 4	Coal.
4 - 6	Shale.
6 - 8	Coal
8 - 13	Shale.
13 - 13.5	Coal.
13.5 - 14	Shale.
14 - 42	Shale
42 - 47	Coal.
47 - 49	Shale.
49 - 58	Coal.
58 - 175	Shale with minor coaly streaks.
175 - 181.5	Oolitic coal seam.

SECTION 75-F

BIG WEARY RIDGE

Section measured downstream in creek on Big Weary Ridge 7000 feet southeast of Elk River bridge. Measured "up-section".

0 - 7	Sandstone: with shale interbeds. 350 x 70° W.
7 - 13	Carbonaceous shale 1", silty interbeds.
13 - 15	Dirty Coal.
15 - 20	Mudstone: dark brown-grey, 6" dirty coal.
20 - 29	Sandstone: grey brown, very fine grained, thinly bedded. 340 x 59° W
29 - 42	Shale: dark grey, very rubbly.
42 - 45	Siltstone: buff grey.
45 - 48	Mudstone.
48 - 57	Covered recessive.
57 - 60	Sandstone: very fine grained with black cross laminations.
60 - 68	Shale: dark grey and dirty coal interbeds 2" to 6".
68 - 71	Coal (clean)
71 - 73	Coal (argillaceous)
73 - 91	Mudstone: 320 x 50° W. Shale: dark grey, very sheared.
91 - 109	Poor exposure, mudstone.
109 - 115	Coal: dirty, very weathered.
115 - 122	Mudstone: grey, brown.
122 - 123	Siltstone: verty silty, buff grey, weathered and rusty.

123 - 138	Thinly bedded sandstone, siltstone and mudstone with 2" to 4" coal stringers.
138 - 139	One foot clean coal.
139 - 142	Mudstone: silty, sheared near top.
142 - 144	Coal.
144 - 153	Dirty coal with 2" to 6" shale interbeds.
153 - 168	Siltstone: light brown, thinly bedded. 325 x 60° W.
168 - 178	Coal: 10 foot seam
178 - 183	Siltstone, argillaceous.
183	6" coal seam.
183 - 185	Mudstone: thin coaly partings.
185 - 205	Interbedded sandstone, fine grained, mudstone and silts. 330 x 59° W
205 - 206.5	Siltstone, buff grey, very hard, weathered, rusty.
206.5 - 238	Mainly mudstone, siltstone interbeds.
238 - 241	Shale: dark grey, very carbonaceous grading to dirty coal upper 16".
241 - 251	Shale: platy in plant impressions. 330 x 60° W.
251 - 269	18 feet coal.
269 - 277	Overlain by platy shale. 330 x 62° W.
277 - 315	Sandstone, rusty weathered, very fine grained and siltstone.
315 - 321	Shale: dark grey, platy, overlain by 2 to 4 feet poorly exposed coal seam.
321 - 335	Mudstones and siltstones.

335 - 341	Coal.
341 - 361	Mainly mudstone with silty interbeds.
361 - 366	Sandstone: light brown, grey, very fine grained, hard resistive unit, forms small cliffs, numerous well preserved plant fossils, could be identified. Beds undulate ,average attitude. 340 x 60° W.
366 - 388	Covered.

SECTION 75-G

WEST SIDE OF ELK VALLEY

Section measured on tributary of Bleasdell Creek from road and creek intersection downstream, i.e. "up-section" stratigraphically.

0 - 57	Unexposed.
57 - 66	Coal Seam: parting 60.3 - 61.9
66 - 75	Mudstone: strike 335°/V.
75 - 82	Carbonaceous shale: strike 335°/48 W.
82 - 90	Mudstone.
90 - 95	Shale with carbonaceous and thin coal seams.
95 - 110	Mudstone.
110 - 120	Mudstone with thin coal seam. 119.0 - 120 coaly shale.
120 - 141	Mudstone with 136 - 138 coaly shale.
141 - 142.5	Coal seam.
142.5 - 152	Mudstone.
152 - 189	Coal seam with parting. M.st. = mudstone. 154 - 154.9 M.st. 169 - 169.9 M.st. 171 - 174 M.st. 178 - 181.5 Siltstone 184 - 187 M.st.
189 - 201	Mudstone with thin coal seams.
201 - 213.5	Siltstone with interbeds of mudstone and coaly shale.
213.5 - 240	Sandstone: strike 340°/V. Sandstone with interbeds of mudstone and siltstone.
240 - 243.5	Shale.
243.5 - 245	Coaly shale.
245 - 246	Coal seam.
246 - 248	Sandstone.

248 - 250	Coal seam.
250 - 270	Sandstone.
270 - 280	Coal seam.
280 - 290	Mudstone.
290 - 291	Coal SEam.
291 - 294	Mudstone.
294 - 300	Coaly shale.
300 - 331	Coal seam with parting of mudstone/sandstone.
331 - 405	Sandstone: coarse grained,
405 - 445	Mudstone with thin coal seam.
445 - 452	Siltstone.
452 - 483	Mudstone: strike 320°/vertical.
483 - 497	Sandstone.
497 - 510	Mudstone.
510 - 515.5	Siltstone: strike 330°/vertical.
515.5-518	Coaly shale.
518 - 523.5	Mudstone.
523.5 - 530.5	Mudstone with very thin coal seams and shale.
530.5 - 533.4	Coal seam with parting. Strike 335°/ vertical.
533.4 - 535	Mudstone.
535 - 545	Coal seam with parting of mudstone.
545 - 549.8	Mudstone.
549.8 - 558.8	Coal seam.
558.8 - 564	Sandstone: strike 335°/ vertical
564- 570.6	Coal seam.
570.6 - 574.3	Mudstone.
574.3 - 577	Coal Seam.

577 - 581	Shale.
581 - 585.4	Mudstone.
585.4 - 594.4	Coal seam.
594.4 - 601	Shale.
601 - 624	Mudstone.
624 - 640	Sandstone: strike 335°/ vertical.
640 - 655.5	Mudstone with bands of sandstone.
655.5 - 657.5	Coal seam.
657.5 - 660.5	Carbonaceous shale.
660.5 - 668	Mudstone.
668 - 679	Siltstone.
679- 705	Sandstone.
705 - 719	Mudstone.
719 - 725.5	Coal Seam.
725.5 - 778	Sandstone.
778 - 782	Mudstone.
782 - 784	Coal seam.
784 - 802	Mudstone.
802 - 810	Coal Seam.
810 - 823	Mudstone.
823 - 831	Sandstone.
831 - 838	Mudstone with interbeds of sandstone and thin coal seams.
838 - 844	Mudstone.
844 - 854	Mudstone with thin coal seams.
854 - 890	Sandstone.

890 -900	Coal Seam.
900 - 915	Mudstone.
915 - 927	Sandstone.
927 - 929.5	Mudstone.
929.5 - 939.5	Coal seam parting of mudstone 937 - 937.5.
939.5 - 940.5	Mudstone.
940.5 - 952.5	Sandstone.
952.5 - 956	Shale.
956 - 961	Sandstone.
961 - 967	Shale with coal seam (thin.)
967 - 974.6	Mudstone with thin coal seam.
974.6 - 978.5	Shale with thin coal seam.
978.5 - 1000	Mudstone.
1000 = 1003.5	Shale with thin coal seam.
1003.5 - 1005.3	Mudstone.
1005.3 - 1007.8	Coal seams.
1007.8 - 1022	Mudstone.
1022 - 1036	Coal seam on north side. Strike 340°/70° W.
1036 - 1040	Mudstone.
1040 - 1046	Sandstone.
1046 - 1047.5	Shale.
1047.5 - 1055	Sandstone.
1055 - 1061	Shale.
1061 - 1066	Siltstone with mudstone interbeds.

1066 - 1088.6	Shale.
1088.6 - 1090.2	Coal seam.
1090.2 - 1098.2	Mudstone.
1098.2 - 1103	Sandstone.
1103 - 1111	Mudstone with thin coal seam.
1111- 1114.8	Siltstone.
1114.8 - 1119	Shale.
1119 - 1128	Mudstone with 5 inch coal seam.
1128 - 1140	Sandstone.
1140 -1184	Mudstone: coal seam 1182 - 1163.5 covered with soil.
1184 - 1192	Sandstone.
1192 - 1213	Mudstone.
1312 - 1213.8	Coal seam.
1213.8 - 1219.8	Mudstone.
1219.8 - 1221.8	Coal seam.
1221.8 - 1227.8	Mudstone.
1227.8 - 1228.6	Coal seam.
1228.6 - 1232	Mudstone.
1231 - 1234.7	Coal Seam.
1234.7 - 1239	Mudstone.
1239 - 1245	Sandstone.
1245 - 1254	Coal Seam. Adit 10 feet long on north side of creek along strike $330^{o}/64^{o}$ W. Shale 1252 - 1254.
1254 - 1261	Mudstone.
1261 - 1273	Siltstone.

1273 - 1281	Mudstone.
1281 - 1288	Sandstone.
1282 - 1295	Coal seam with partings of mudstone.
1295 - 1299	Mudstone.
1299 - 1301	Coal Seam.
1301 - 1304	Mudstone.
1304 - 1312	Coal seam with parting of mudstone.
1312 - 1331	Mudstone.
1331 - 1400	Sandstone.
1400 - 1401	Coal Seam.
1401 - 1404	Mudstone.
1404 - 1419	Sandstone.

SECTION 75-H

WEST SIDE OF ELK VALLEY

Measured in trench on west side of Elk Valley 4000 feet west of junction of Bleasdell Creek and Elk River. Measured "up-section".

0 - 28	Overburden
28 - 30	Coal seam.
30 - 45	Shale. Strike 340°/V.
45 - 48	Mudstone.
48-51	Shale.
51 - 52.5	Mudstone.
52.5 - 62	Shale.
62 - 64.8	Coal seam.
64.8 - 67.8	Shale.
67.8 - 69.5	Coal seam.
69.5 - 80.8	Mudstone.
80.8 - 91.8	Coal seam.
91.8 - 100.3	Shale.
100.3 - 138	Mudstone.
138 - 171	Sandstone. Strike 340°/70° W.
171 - 178	Shale.
178 - 228	Covered.
228 - 270	Mudstone.
270 - 271	Coal seam. Strike 345°/dip?
271 - 273	Shale.
273 - 283	Mudstone.
283 - 288	Shale.

288 - 291	Sandstone.
291 - 302	Shale.
302 - 308	Carbonaceous shale. Strike 345°/V.
308 - 311	Coal seam.
311 - 327	Shale.
327 - 338	Sandstone.
338 - 350	Carbonaceous shale.
350 - 363	Shale.
363 - 376	Mudstone interbeds of fine grained sandstone. Strike 340°/dip V.
376 - 379	Shale.
379 - 396	Coal seam.
396 - 402	Shale.
402 - 411	Sandstone.
411 - 497	Covered.
497 - 507	Coal seam, weathered and partly covered.
507 - 521	Mudstone.
521 - 528	Coaly shale.
528 - 541	Coal seam - trace.
541 - 554	Covered.
554 - 588	Fine to medium grained, sandstone. Strike 340°/ dip V.
588 - 598	Shale with mudstone.
598 - 603	Coal shale.
603 - 631	Very fine sandstone.

631 - 798	Covered.
798 - 806	Sandstone. Strike 340°/dip V.
806 - 812	Shale.
812 - 817	Sandstone.
817 - 823	Carbonaceous shale.
823 - 832	Coal seam? trace.
832 - 854	Sandstone.
854 - 858	Shale.
858 - 897	Sandstone.
897 - 965	Covered.
965 - 993	Coarse grained sandstone.
993 - 1026	Sandstone.
1026 - 1032	Shale.
1032 - 1055	Sandstone. Strike 335°/ dip V.
1055 - 1089	Sandstone with interbeds of shale.
1089 - 1092	Coal seam.
1092 - 1094	Shale.
1094 - 1106	Sandstone.
1106 - 1120	Shaly sandstone.
1120 - 1123	Sandstone.
1123- 1129	Carbonaceous shale.
1129 - 1134	Sandstone.
1134 - 1136	Carbonaceous shale.
1136 - 1142	Sandstone.

SECTION 75-I

WEST SIDE OF ELK VALLEY

Measured in major trench on west side of Elk Valley 9000 feet southwest of Elk Valley bridge. Measured "up-section".

0 - 20	Coarse-grained, light grey sandstone (Basal?) Strike 340'/60°W.
20 - 30	Shaly coal seam. Strike 340°/dip V.
30 - 33	Sandstone.
33 - 82	Covered.
82 - 84	Trace of coal seam.
84 - 100	Covered.
100 - 130	Coal seam.
130 - 139	Shaly mudstone.
139 - 159	Sandstone, slightly shaly.
159 - 215	Shale. Strike 335°/V.
215 - 335	Covered with coal traces.
335 - 344	Shale.
344 - 349	Coal seam.
349 - 372	Mudstone.
372 - 385	Carbonaceous shale.
385 - 476	Covered.
476 - 500	Shale mixed with coarse sandstone.
500 - 518	Coal seam, poorly exposed, mostly covered.
518 - 540	Mudstone.
540 - 574	Sandstone with interbeds of shale.
579 - 684	Covered.
684 - 727	Shaly sandstone.

727 - 752	Siltstone.
752 - 815	Covered.
815 - 820	Sandstone.
820 - 832	Coal seam. Strike 345°/V.
832 - 842	Covered.
842 - 849	Siltstone with sandstone.
849 - 874	Covered.
874 - 887	Medium grained sandstone.
887 - 900	Shale.
900 - 942	Sandstone.
942 - 993	Coaly zone with parting of sandstone, shale and mudstone.
993 - 1042	Covered
1042 - 1044	Sandstone.
1044 - 1059	Siltstone and shaly.
1059 - 1069	Coal seam.
1069 - 1144	Covered.
1144 - 1148	Trace of coal.
1148 - 1225	Covered.
1225 - 1249	Trace of coal.
1249 - 1290	Covered.
1290 - 1300	Sandstone.
1300 - 1310	Coal seam.
1310 - 1328	Fine grained sandstone.
1328 - 1344	Mudstone with siltstone.

1344 - 1400	Covered.
1400 - 1450	Covered.
1450 - 1460	Sandstone.
1460 - 1600	Covered.
1600 - 1700	Covered.
1700 - 1947	Covered.
1947 - 1970	Sandstone.
1970 - 2190	Covered.
2190 - 2200	Sandstone? Outcrop?
2200 - 2210	Sandstone.
2210 - 1400	Covered.
2400 - 2402	Sandstone with coaly partings. Strike 340°/V.
2402 - 2450	Covered.
2450 - 2452	Sandstone, massive, medium grained.
2452 - 2485	Covered.
2485 - 2489	Massive, medium grained sandstone.
2489 - 2515	Covered.
2515 - 2527	Sandstone, massive, medium grained.
2527 - 2650	Covered.
2650 - 2660	Coaly zone.
2660 - 2700	Covered.
2700 - 2705	Coarse grained, grey sandstone with plant fossils.
2705 - 2725	Covered.
2725 - 2755	Shale. Strike 345°/70° W.
2755 - 2759	Shaly coal.

SECTION 75-J

WEST SIDE OF ELK VALLEY

Measured on west side of Elk Valley in trench 1000 feet north of Bleasdell Creek. Measured "down-section".

0 - 58	Covered.
58 - 72	Siltstone with shale. Strike 340°/V dip.
72 - 94	Covered.
92 - 102	Coal seam.
102 - 140	Fine to medium grained sandstone.
140 - 162	Covered.
162 - 169	Shale. Strike 340°/70° W.
169 - 172	Sandstone with interbeds of shale.
172 - 180	Covered.
180 - 190	Carbonaceous shale.
190 - 194	Shale.
194 - 196	Coal seam with parting of 6 inches of shale.
196 - 211	Sandstone.
211 - 219	Coal trace.
219 - 236	Shale and mudstone. Strike 345°/V dip.
236 - 250	Sandstone, fine grained.
250 - 300	Covered.
300 - 317	Fine grained sandstone with interbeds of shale.
317 - 319	Carbonaceous shale. Strike 345°/V dip.
319 - 328	Sandstone, fine to medium grained with interbeds of shale.
328 - 338	Massive sandstone.

338 - 349	Sandstone with interbeds of shale.
349 - 357	Shale.
357 - 359	Sandstone.
359 - 625	Covered.
625 - 638	Sandstone.
638 - 649	Covered.
649 - 654	Shale.
654 - 876	Covered.
876 - 904	Sandstone with interbeds of shale.
904 - 909	Coal seam with parting of sandstone.
909 - 914	Sandstone.
914 - 919	Coal Seam. Strike 340°/V dip.
919 - 923	Shale.
923 - 925	Sandstone.
925 - 927	Carbonaceous shale.
927 - 935	Shale.
935 - 938	Sandstone.
928 - 952	Covered.
952 - 956	Fine grained sandstone.
956 - 961	Coaly shale.
961 - 964	Coal seam, weathered.
964 - 970	Siltstone.
970 - 975	Sandstone.
975 - 980	Shale.

980 - 983	Carbonaceous shale with thin coal seam.
983 - 1012	Covered
1012 - 1022	Sandstone.
1022 - 1075	Covered.
1075 - 1078	Shale.
1078 - 1119	Covered.
1119 - 1126	Sandstone. Strike 340°/V dip.
1126 - 1147	Covered.
1147 - 1157	Sandstone.
1157 - 1197	Covered.
1197 - 1201	Coal trace.

SECTION 75-K

WEST SIDE OF ELK VALLEY

Measured on west side of Elk Valley in trench 6000 feet west southwest of Elk River bridge. Measured "up-section".

0 - 10	Sandstone with interbedding of shale. Strike 340°/V.
10 - 23	Covered.
23- 24	Shale.
24 - 39	Coal seam with shale parting. Strike 330°/V dip.
39 - 51	Covered.
51 - 57	Shale.
57 - 64	Sandstone with interbeds of shale.
64 - 76	Covered.
76 - 83	Sandstone with interbeds of shale.
83 - 88	Massive sandstone. Strike 330°/V dip.
88 - 89	Shale.
89 - 98	Coaly outcrop.
98 - 100	Shale.
100 - 103	Sandstone.
103 - 107	Shale.
107 - 125	Sandstone with shale.
125 - 135	Shale. Strike 340°/70° W.
135 - 137	Coaly shale.
137 - 138	Shale.
138 - 140	Coaly shale.

140 - 143	Shale.
143 - 151	Sandstone with interbeds of shale.
151 - 158	Shale.
158 - 160	Sandstone.
160 - 161.5	Coal seam.
161.5 - 164	Shale.
164 - 167	Sandstone.
167 - 170	Covered.
170 - 177	Shale.
177 - 181	Coal seam.
181 - 192	Covered.
192 - 195	Mudstone.
195 - 201	Shale.
201 - 203	Coaly shale.
203 - 211	Coal seam. Covered on top.
211 - 215	Shale.
215 - 224	Coal Seam. Strike $340^{o}/73^{o}$ W.
224 - 228	Shale.
228 - 244	Shale with sandstone.
244 - 249	Shale.
249 - 253	Sandstone.
253 - 257	Shale.
257 - 260	Shaly sandstone.
260 - 267	Shale.
267 - 283	Sandstone with shale.
283 - 286	Shale.

286 - 292	Sandstone, massive.
292 - 297	Shale. Strike $340^{o}/67^{o}$ W.
297 - 307	Covered.
307 - 317	Sandstone.
317 - 330	Covered.
330 - 332	Coaly shale.
332 - 343	Shale.
343 - 350	Sandstone.
350 - 354	Covered.
354 - 378	Sandstone with shale.
3u8 - 383	Shale.
383 - 385	Sandstone.
385 - 394	Covered.
394 - 398	Shale.
398 - 413	Covered.
413 - 414.5	Coal - dirty.
414.5 - 422	Shale.
422 - 424	Coaly shale.
424 - 428	Mudstone.
428 - 429	Coaly shale.
429 - 444	Covered.
444 - 454	Mudstone.
454 - 463	Covered.
463 - 466	Carbonaceous shale.
466 - 474	Covered.

474 - 485	Fine grainded sandstone.
485 - 515	Covered.
515 - 526	Sandstone. Strike $340^{o}/80^{o}$ W.
526 - 600	Covered.

SECTION 75-L

WEST SIDE OF ELK VALLEY

Measured on west side of Elk Valley in trench adjacent to creek 7000 feet west of Elk River bridge. Measured "down-section".

0 - 33	Sandstone with shale interbeds. Strike 340°/60° W.
33 - 36	Mudstone.
36 - 40	Carbonaceous shale.
40 - 47	Mudstone.
47 - 54	Coaly shale.
54 - 59	Fine grained sandstone.
59 - 70	Covered.
70 - 75	Sandstone.
75 - 79	Shale, slightly coaly.
79 - 81	Sandstone.
81 - 84	Coaly shale.
84 - 88	Sandstone with shale.
88 - 91	Coaly shale.
91 - 93	Sandstone.
93 - 99	Shale with sand.
99 - 100	Coal seam.
100 - 110	Sandstone. Strike 340°/70° W.

SECTION 75-M

WEST SIDE OF ELK VALLEY

Measured on west side of Elk Valley in trench 8000 feet west northwest of Elk River bridge. Measured "up-section".

0 - 6	Shale.
6 - 7	Coal seam.
7 - 13	Coaly shale. Strike $340^{o}/65^{o}$ W.
13 - 15	Covered.
15-32	Sandstone with interbeds of shale.
32 - 39	Covered.
39 - 41	Sandstone.

SECTION 75-N

WEST SIDE OF ELK VALLEY

Measured on west side of Elk Valley in trench 8000 feet west northwest of Elk River bridge. Measured "up-section".

0 - 4	Sandstone with shale.
4 - 18	Covered.
18 - 20	Carbonaceous shale.
20 - 26	Covered.
26 - 38	Sandstone, fine grained with small pieces of coal.
38 - 46	Covered.
46 - 64	Sandstone with shale. Strike $335^{o}/60^{o}$ W.
64 - 68	Shale.
68 - 74	Sandstone.
74 - 77	Shale.
77 - 85	Covered.
85 - 94	Sandstone.
94 - 139	Covered.
139 - 144	Sandstone.
144 - 148	Covered.
148 - 150	Coaly out crop.
150 - 152	Sandstone.
152 - 163	Covered.
163 - 164	Sandstone.
164 - 192	Covered.
192 - 196	Sandstone.
196 - 200	Shale.
200 - 201	Carbonaceous shale.

SECTION 75-0

WEST SIDE OF ELK VALLEY

Measured on west side of Elk Valley in Gardner Creek. Measured "up-section".

0 - 4	Coaly shale outcrop covered by till.
4- 51	Sandstone. Strike 330°/V dip.
51 - 69	Shale.
69 - 76	Sandstone.
76 - 78	Shale.
78 - 83	Shale with sandstone bands.
83 - 85	Massive sandstone.
85 - 87	Carbonaceous shale.
87 - 91	Sandstone.
91 - 100	Carbonaceous shale.
100 - 102	Shale.
102- 106	Sandstone. Strike 325°/55° W.
106 - 127	Shale.
127 - 136	Covered.
136 - 245	Sandstone. Strike 340°/V dip.
245 - 247	Carbonaceous shale.
247 - 255	Sandstone.
255 - 287	Covered.
287 - 294	Sandstone.
294 - 296	Shale.
296 - 298	Sandstone. Strike 345°/V.
298 - 302	Coal seam outcrop covered by till.

302 - 308	Shale.
308 - 364	Sandstone.
364 - 375	Covered.
375 - 400	Sandstone.
400 - 441	Covered.
441 - 544	Sandstone. Strike $340^{o}/75^{o}W$.
544 - 556	Shale.
556 - 565	Sandstone.
565 - 570	Coaly outcrop.
570 - 582	Carbonaceous shale.
582 - 621	Sandstone.
621 - 638	Covered.
638 - 656	Sandstone.
656 - 658	Coal seam - dirty.
658 - 666	Shale.
666 - 700	Sandstone, with shale. Strike $345^{o}/V$.

SECTION 75-P

WEST SIDE OF ELK VALLEY

Measured on west side of Elk Valley in trench on north side of creek 12,000 feet northwest of Elk River bridge. Measured "up-section".

0 - 29	Sandstone, fine grained. Strike N-south 60° W.
29 - 31	Coaly outcrop not exposed.
31 - 43	Covered.
43 - 45	Sandstone.
45 - 49	Shale.
49 - 51	Coal seam.
51 - 60	Shale.
60 - 63	Sandstone.
63 - 80	Covered.
80 - 87	Shale.
87 - 104	Sandstone.
104 - 108	Coaly shale.
108 - 164	Light grey, coarse grained sandstone with plant fossils.
164 - 186	Coal trace.
186 - 191	Carbonaceous shale.
191 - 195	Shale.
195 - 198	Sandstone. Strike 340°/55°W.
198 - 218	Shale with interbedding of shale.
218 - 262	Sandstone, light coloured, medium grained.
262 - 267	Shale.

267 - 300	Covered.
300 - 320	Sandstone with shale.
320 - 326	Covered.
326 - 336	Sandstone with shale.
336 - 338	Coal seam.
338 - 342	Sandstone. Strike $340^{o}/50^{o}W$.
342 - 346	Shale.
346 - 352	Coaly shale.
352 - 360	Sandstone.
360 - 362	Covered.
362 - 265	Coal trace.
365 - 378	Covered.
378 - 390	Sandstone.
390 - 468	Covered.
468 - 478	Sandstone.
478 - 480	Shale.
480 - 482	Coal Seam.
482 - 485	Shale.
485 - 501	Sandstone.
501 - 525	Covered.
525 - 536	Sandstone with shale interbeds. Strike $350^{o}/37^{o}W$.
536 - 551	Shale.
551 - 567	Sandstone with shale.
567 - 575	Covered.

575 - 578	Coal trace.
578 - 591	Covered.
591 - 594	Coal trace.
592 - 601	Shale.
601 - 604	Sandstone. Strike $342^{o}/70^{o}W$.
604 - 607	Covered.
607 - 610	Coaly shale.
610-612	Sandstone.
612 - 614	Shale.
614 - 620	Coal seam.
620 - 621	Shale.
621 - 623	Sandstone. Strike $340^{o}/80^{o}$ W.
623 - 625	Carbonaceous shale.
625 - 653	Sandstone, light coloured, medium grained with plant fossils.
653 - 668	Covered.
668 - 671	Sandstone.
671 - 673	Coal seam.
673 - 676	Sandstone.
676 - 684	Shale.
684 - 689	Sandstone. Strike $350^{o}/57^{o}W$.
689 - 690	Carbonaceous shale.
690 - 694	Shale.
694 - 706	Sandstone with shale interbeds.
706 - 712	Carbonaceous shale.
712 - 730	Covered.

730 - 731	Carbonaceous shale.
731 - 756	Shale.
756 - 786	Sandstone with shale.
786 - 804	Covered.
804 - 808	Sandstone.
808 - 825	Covered.
825 - 831	Sandstone.
831 - 841	Shale.
841 - 862	Covered.
862 - 867	Sandstone.
867 - 874	Covered.
874 - 876	Carbonaceous shale.
876 - 891	Sandstone.
891 - 900	Covered.

PAUL DYSON
CONSULTANTS

STRATIGRAPHIC LOG

K-ELK RIVER 76(37B.

274

DRILL HOLE: SECTION 75-A

AREA: Elk Valley

COMPANY: Elco Mining Ltd.

COORDINATES: ---

GROUND ELEVATION: N/A

TOTAL DEPTH: 1990

MECHANICAL LOGS RUN: N/A

DRILLING METHOD: Surface Section

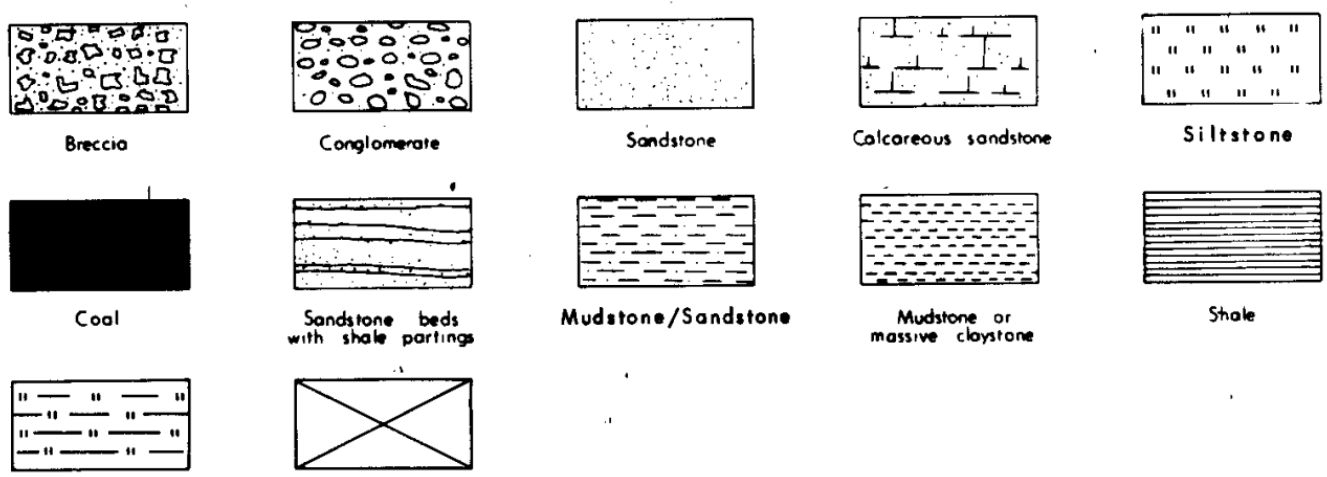
HOLE SIZE: N/A

DATE OF COMPLETION: July 1975

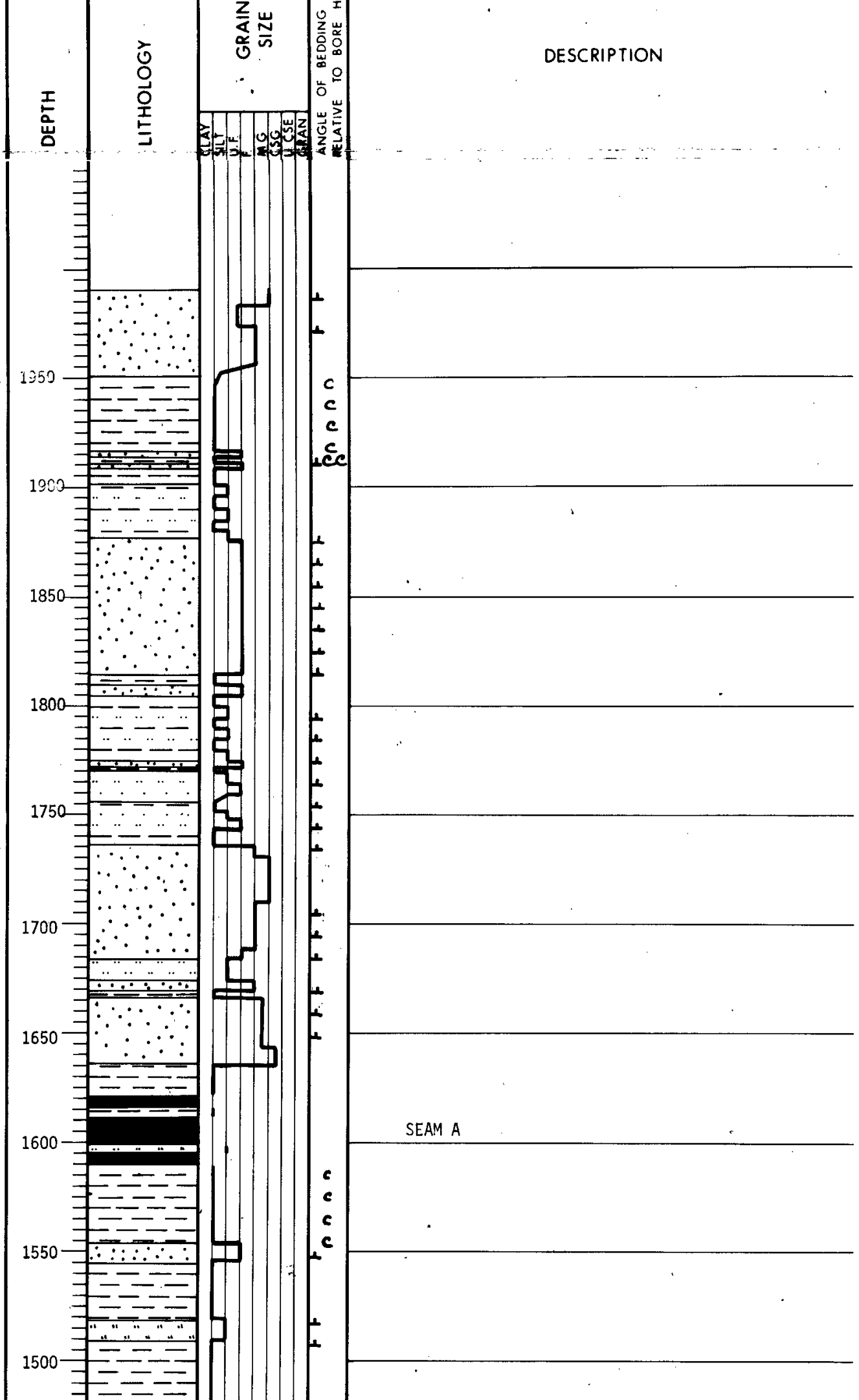
LOGGED BY: G. Germscheid

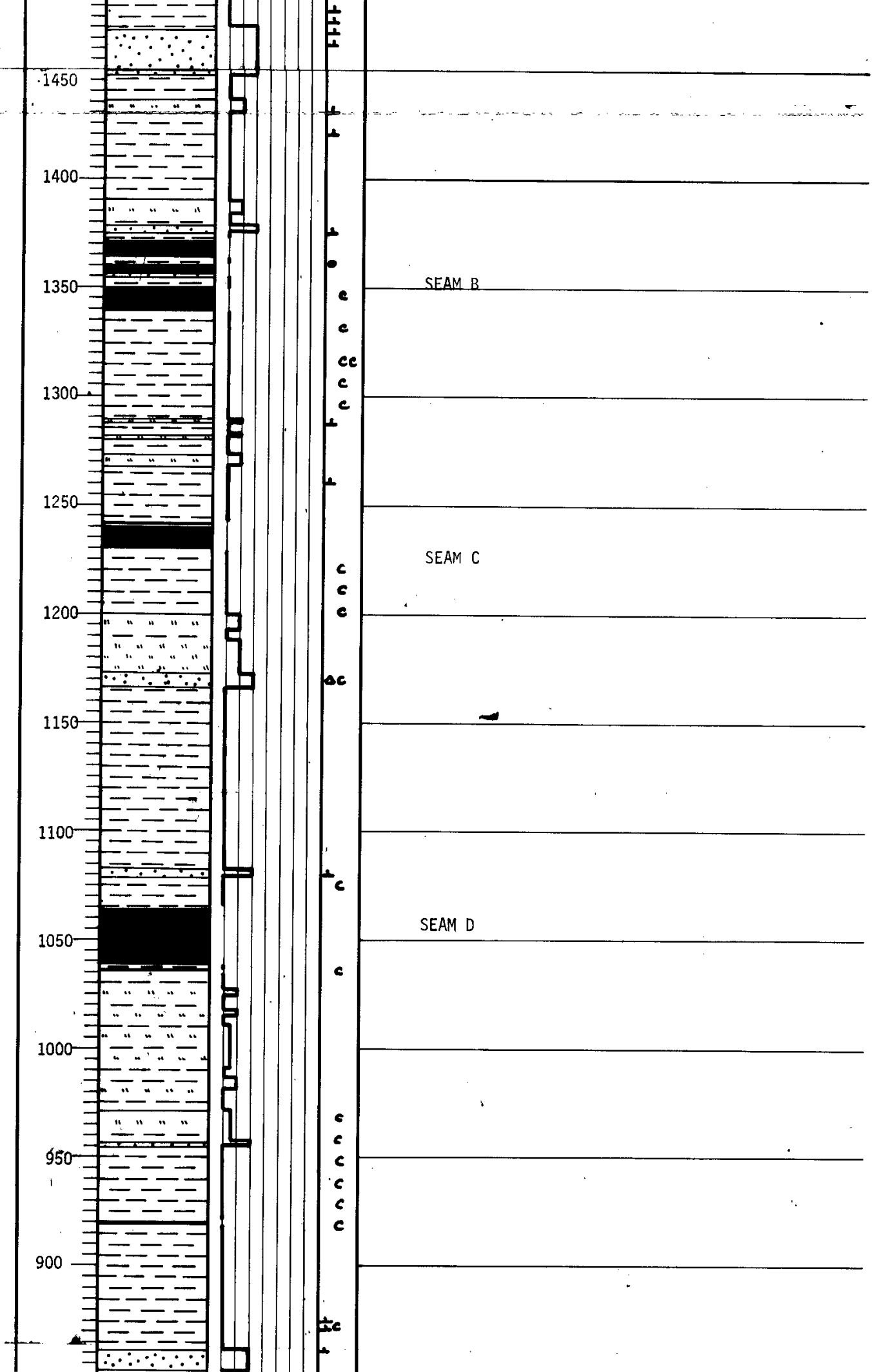
REMARKS: Measured along top of Big Weary Ridge.

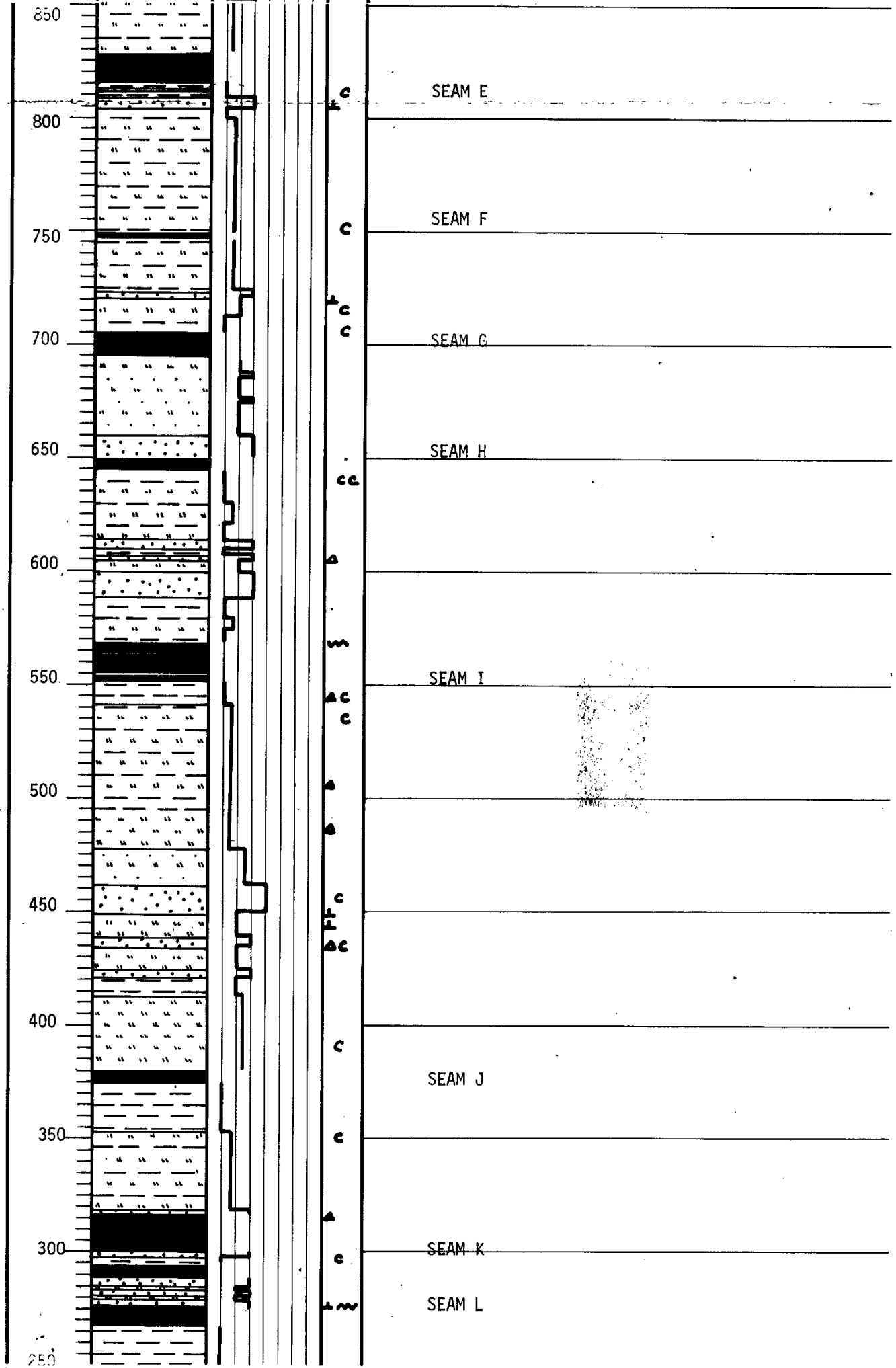
LITHOLOGIC SYMBOLS

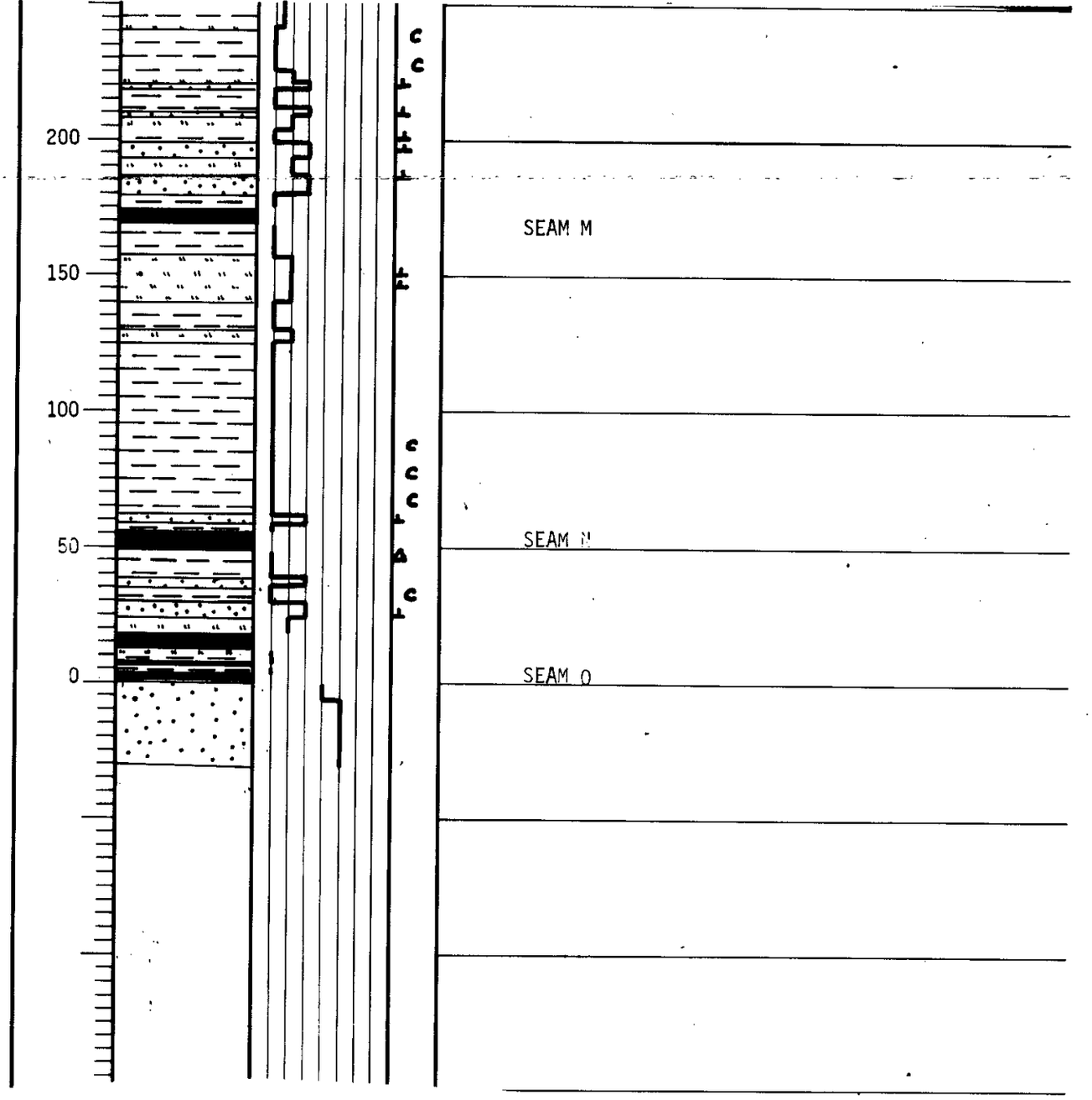


				OLE


FORMATION
DEPTH
LITHOLOGY
GRAIN SIZE
CLAY
SILT
U.F.
F.
M.G.
C.S.G.
U.CSE
GRAN
ANGLE OF BEDDING RELATIVE TO BORE H
DESCRIPTION
1950
1900
1850
1800
1750
1700
1650
1600
1550
1500
SEAM A


1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
SEAM B
SEAM C
SEAM D


850
800
750
700
650
600
550
500
450
400
350
300
250
SEAM E
SEAM F
SEAM G
SEAM H
SEAM I
SEAM J
SEAM K
SEAM L



BY: _____

H. Gruss, P.Geol.

May, 1976

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CONSULTANTS

STRATIGRAPHIC LOG

R ELK RIVER 76(3)B.

274

DRILL HOLE SECTION 75-B AREA Elk Valley

COMPANY Elco Mining Ltd.

COORDINATES ---

GROUND ELEVATION N/A TOTAL DEPTH 734

MECHANICAL LOGS RUN N/A

DRILLING METHOD Surface Section

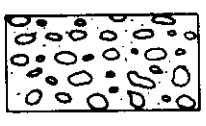
HOLE SIZE N/A DATE OF COMPLETION July 1975

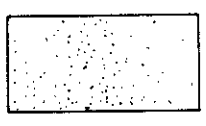
LOGGED BY G. Germscheid

REMARKS 0 - 627 measured on south side of creek, 627 - 734 on north side.

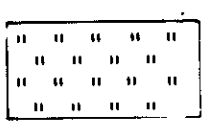
LITHOLOGIC SYMBOLS


Breccia


Conglomerate


Sandstone

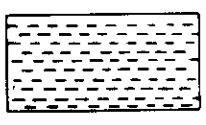

Calcareous sandstone


Siltstone

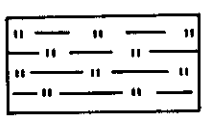

Coal

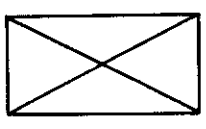

Sandstone beds with shale partings

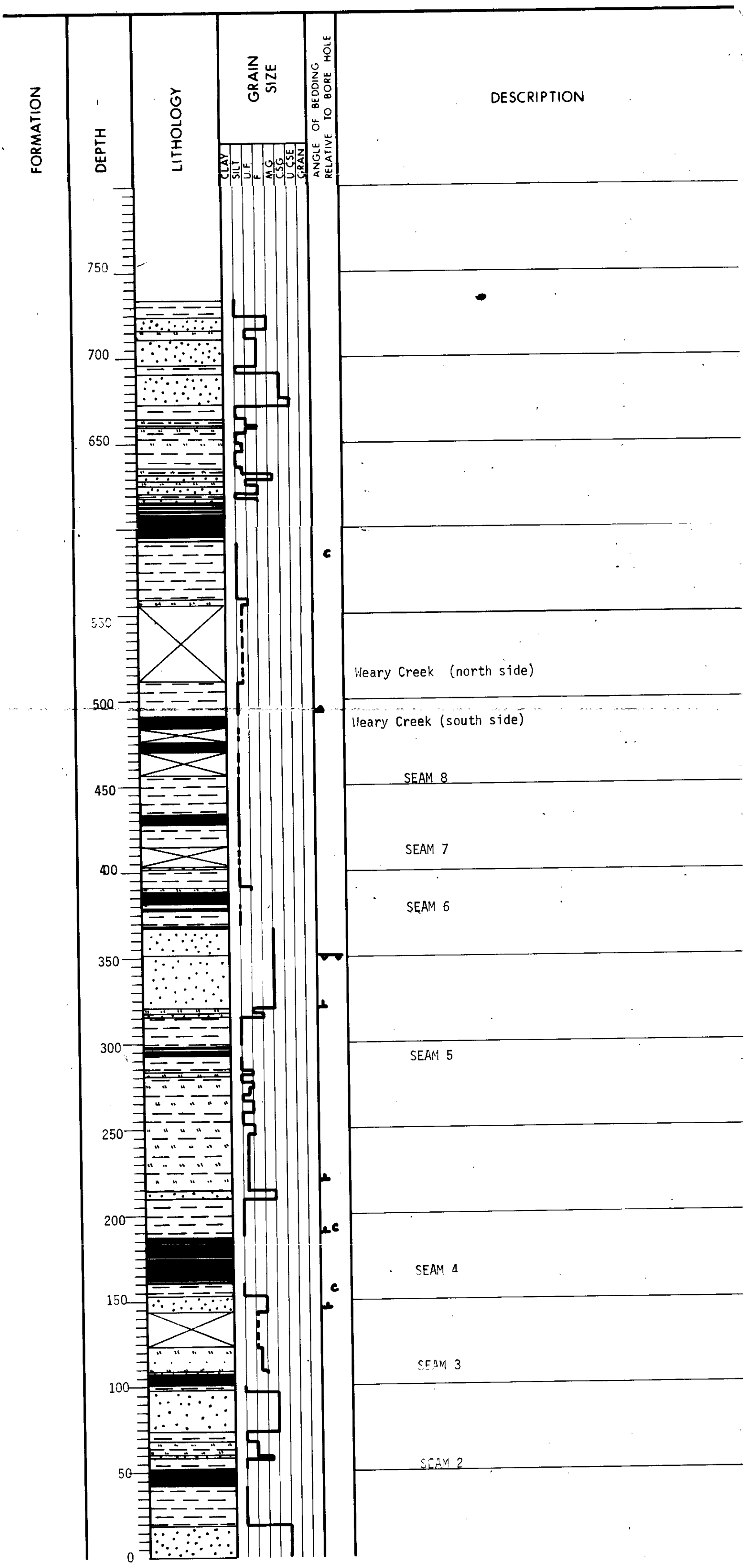

Mudstone/Sandstone


Mudstone or massive claystone


Shale


Mudstone/Siltstone


Unexposed



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K-ELK RIVER 74(3)B.

274

DRILL HOLE SECTION 75-C AREA Elk Valley

COMPANY Elco Mining Ltd.

COORDINATES ---

GROUND ELEVATION N/A TOTAL DEPTH 496

MECHANICAL LOGS RUN N/A

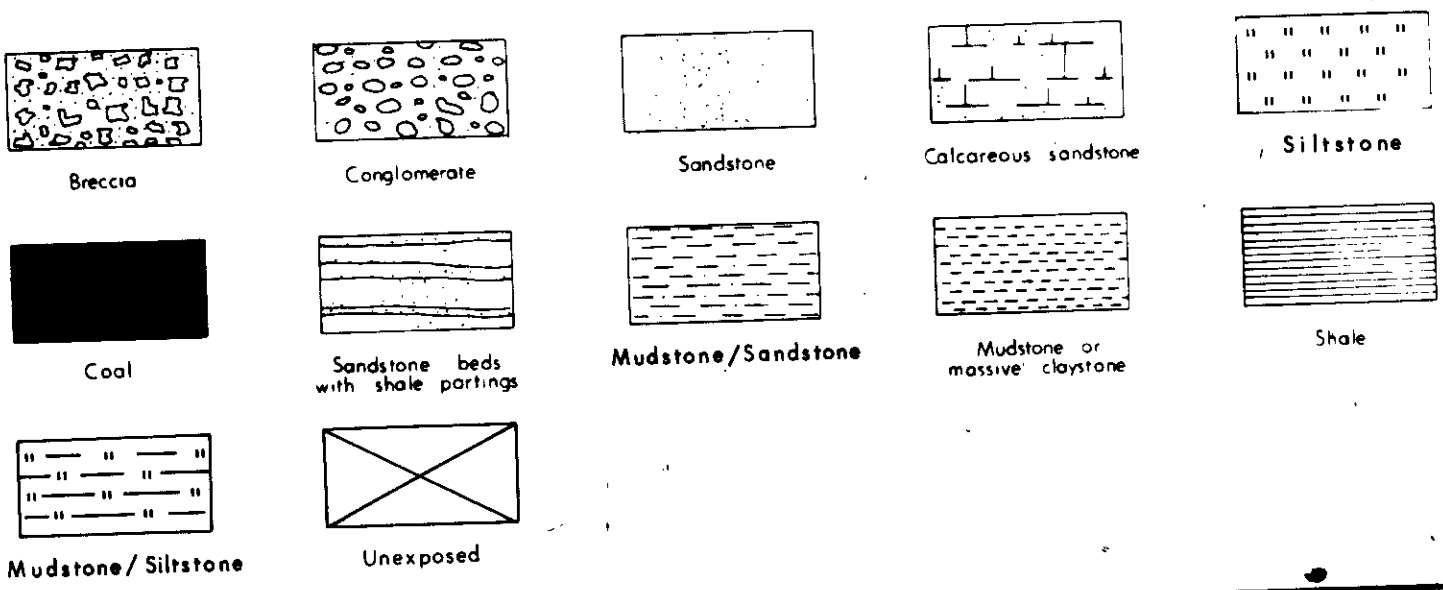
DRILLING METHOD Surface Section

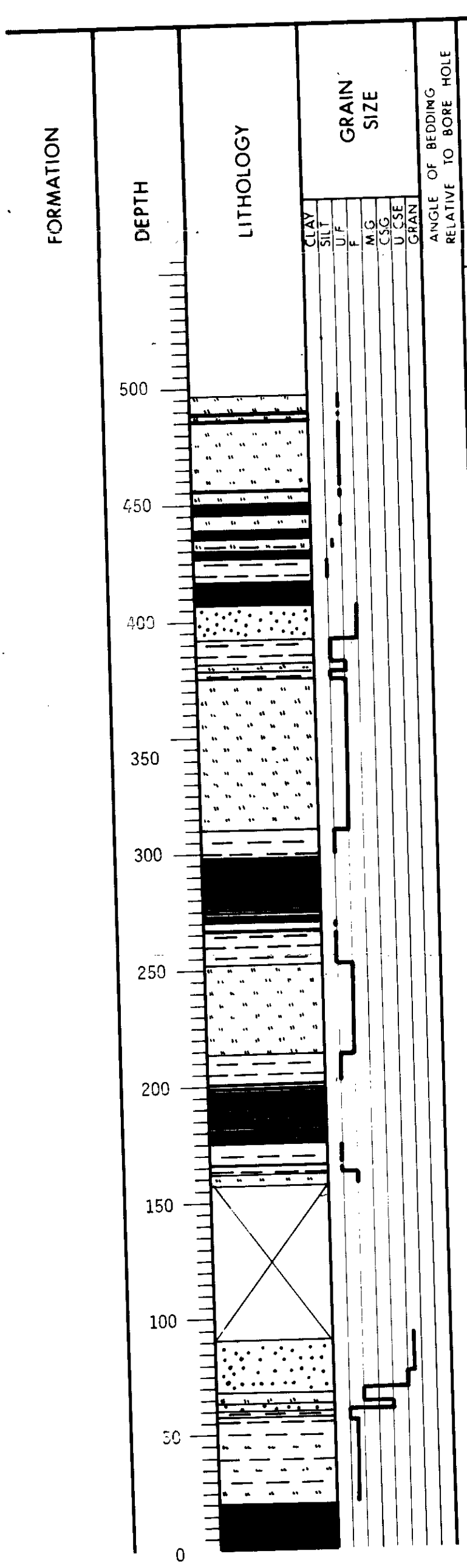
HOLE SIZE N/A DATE OF COMPLETION July 1975

LOGGED BY G. Gernscheid

REMARKS Measured in trench on Little Weary Ridge.

LITHOLOGIC SYMBOLS





DESCRIPTION

Approximately 100 feet north of I-78-16

Trench runs E-W

Measured at north side of Weary Creek.in trench. Section presumed to begin at "9" SEAM

SEAM 12

SEAM 10

Trench starts at 150 feet.

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SEAM 9

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K-Elk River 76(3)B

274

DRILL HOLE Section 75-D AREA Elk River

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 179

MECHANICAL LOGS RUN N/A

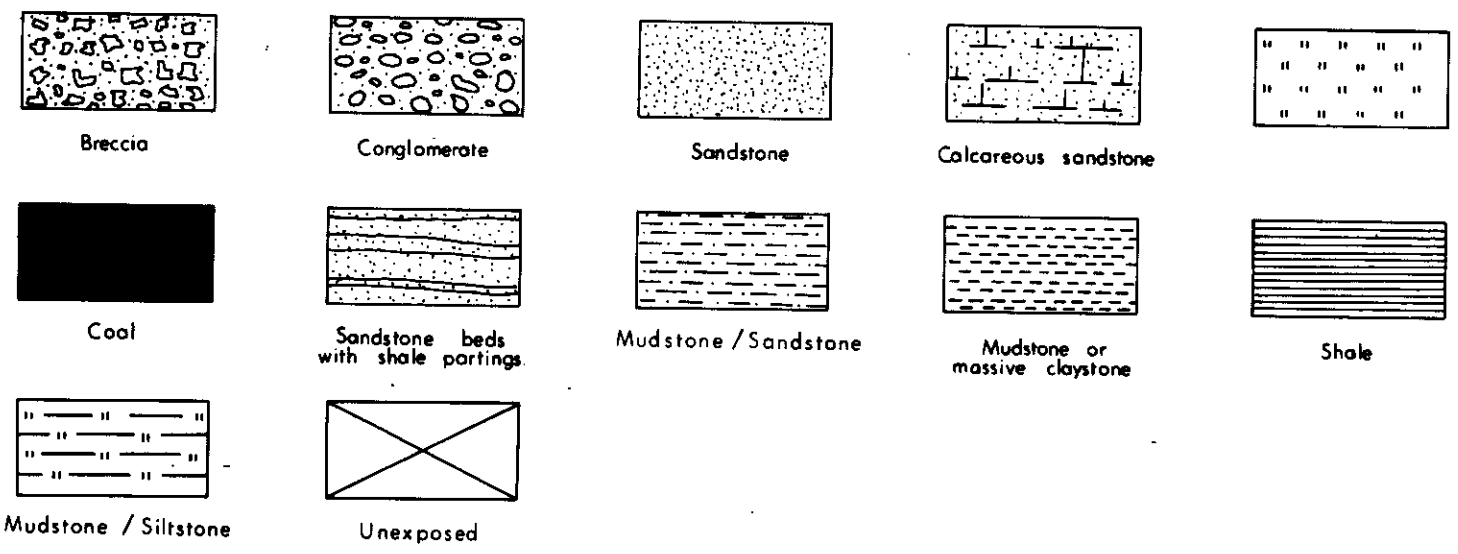
DRILLING METHOD Surface Section

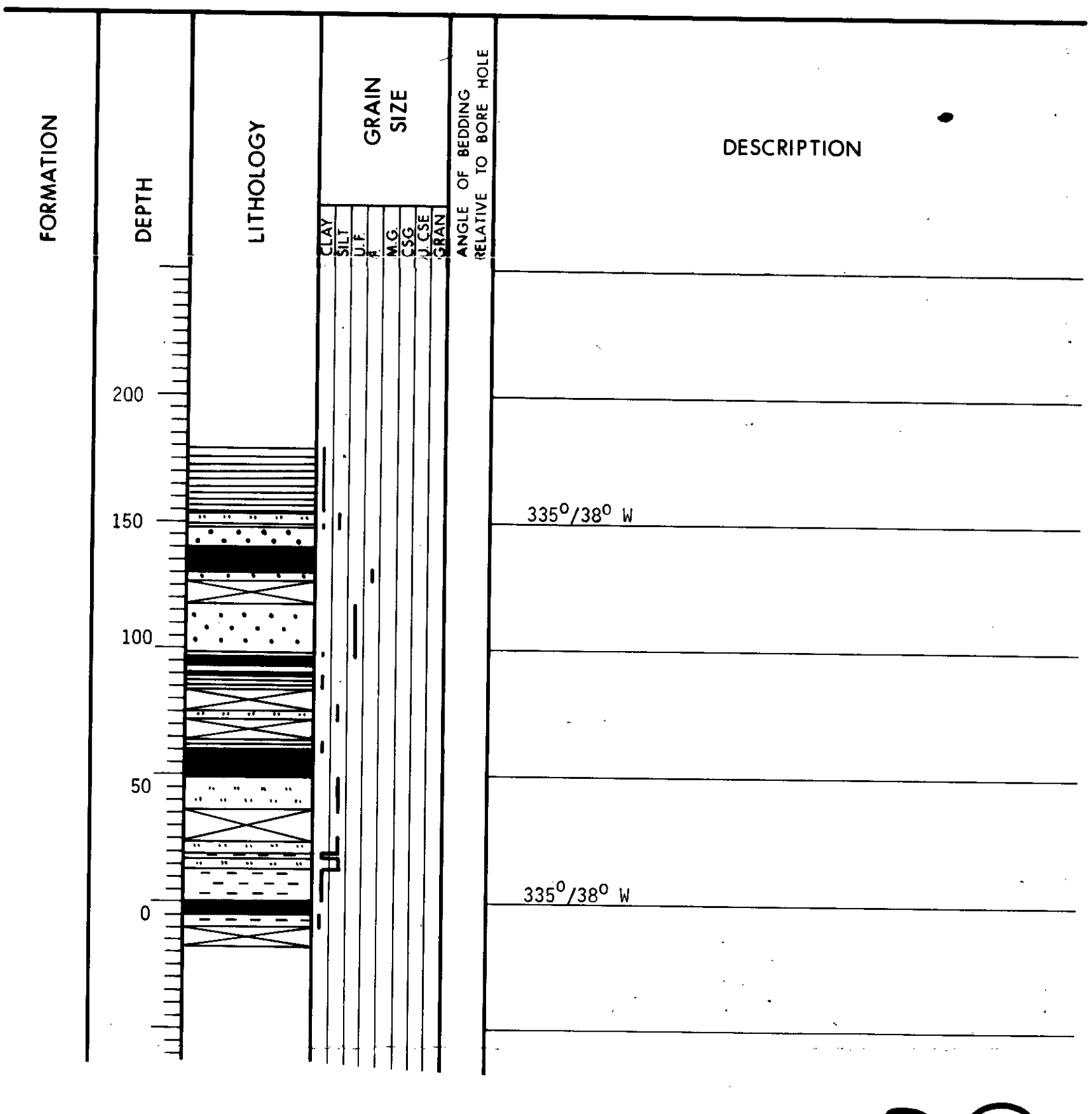
HOLE SIZE N/A DATE OF COMPLETION August 1975

LOGGED BY W. Poelman

REMARKS Section measured east to west in old trench 3500 feet south southeast of ~~Elk River bridge.~~

LITHOLOGIC SYMBOLS





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K- ELK RIVER 76 (32B

274

DRILL HOLE SECTION 75-E AREA Elk Valley

COMPANY Elco Mining Ltd.

COORDINATES ---

GROUND ELEVATION N/A TOTAL DEPTH 181.5

MECHANICAL LOGS RUN N/A

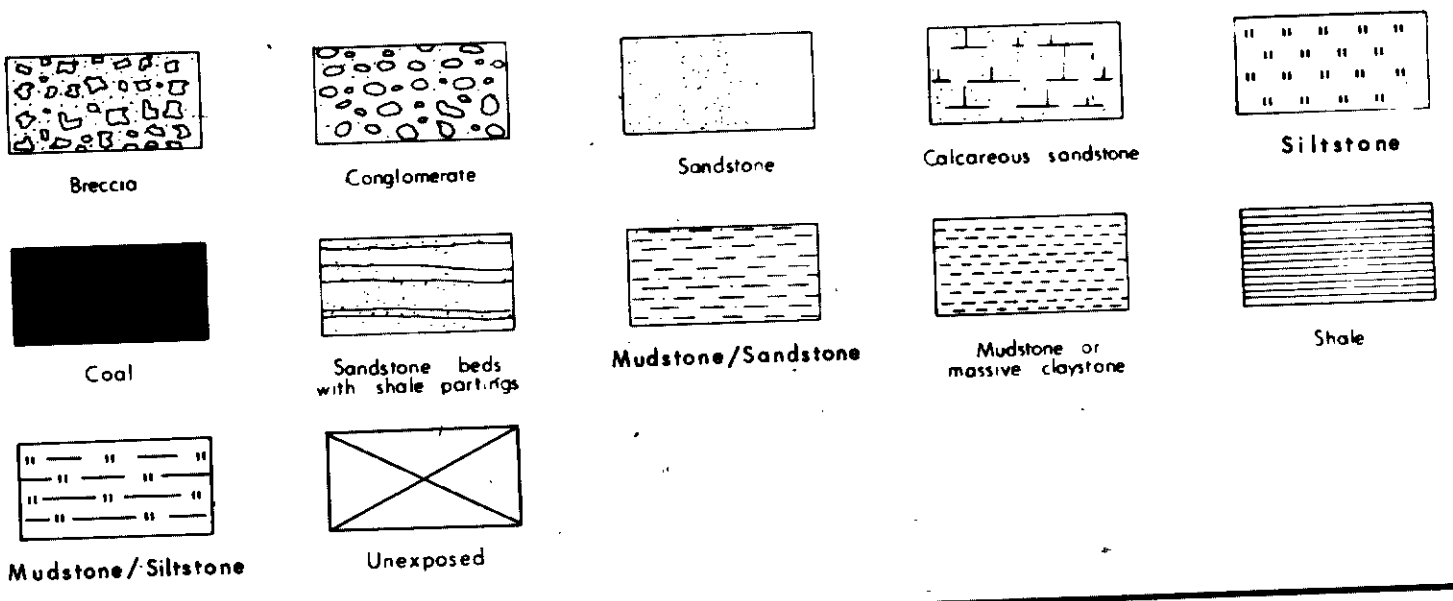
DRILLING METHOD Surface Section

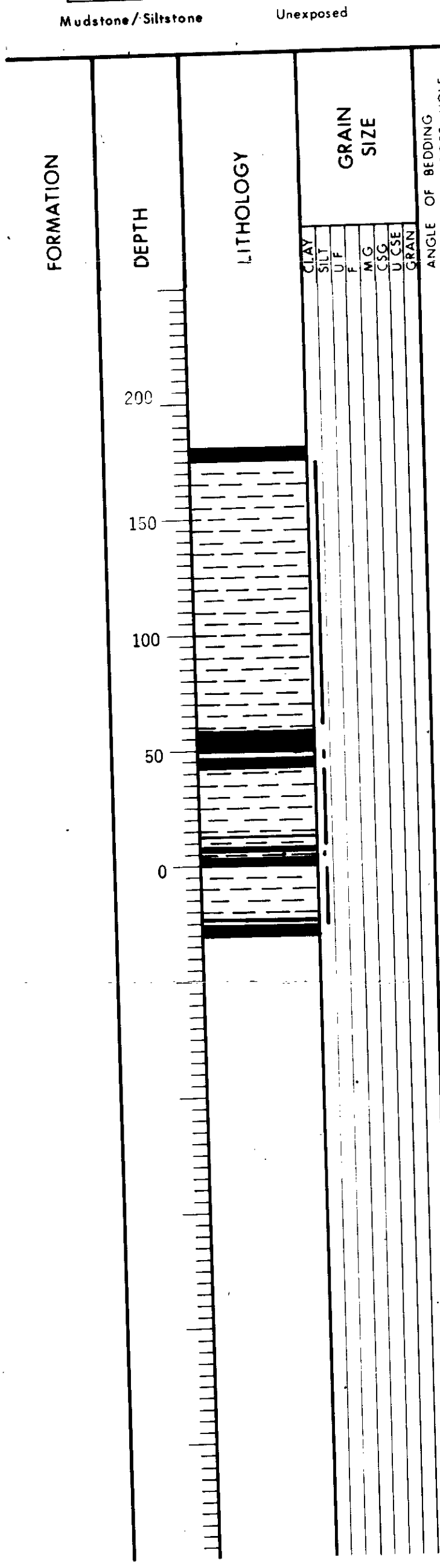
HOLE SIZE N/A DATE OF COMPLETION July 1975

LOGGED BY G. Germscheid

REMARKS Field Notes Stn. G363

LITHOLOGIC SYMBOLS





DESCRIPTION

One of these is correlatable to 13.5 foot seam at #G19C.

Adit seam in creek.

BY: H. Gruss, P.Geol.

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STRATIGRAPHIC LOG

K-ELK RIVER 76 (3) B.

274

DRILL HOLE Section 75-F AREA Big Vleary Ridge

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 388' ±

MECHANICAL LOGS RUN N/A

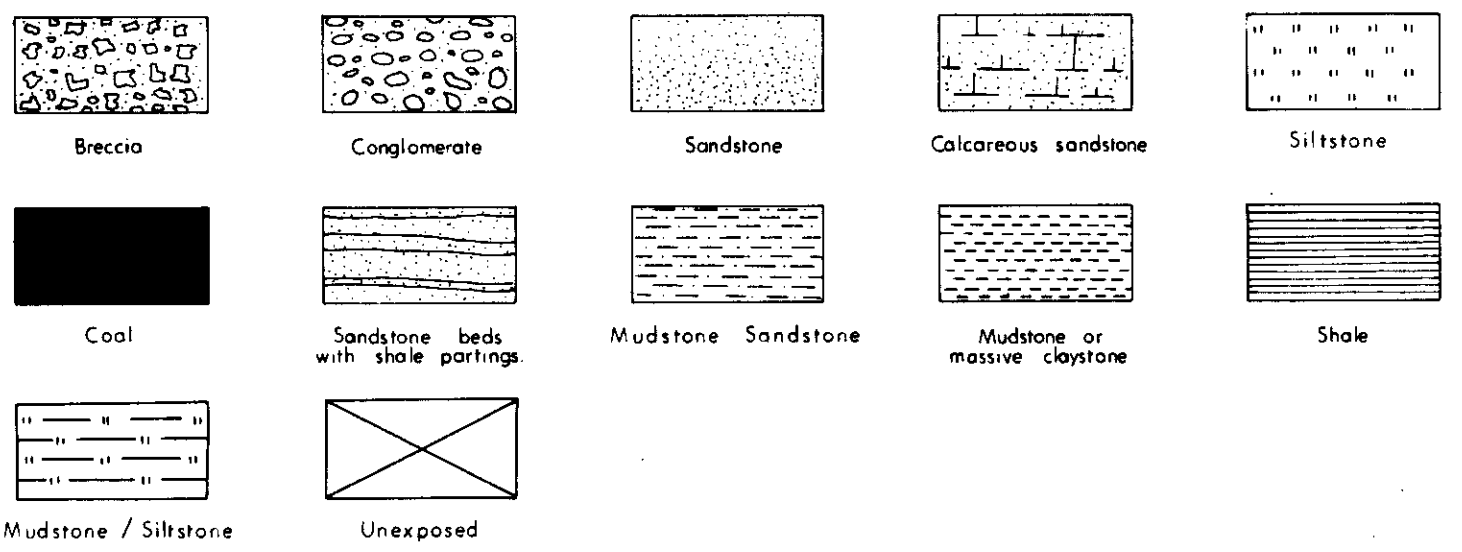
DRILLING METHOD Surface Section

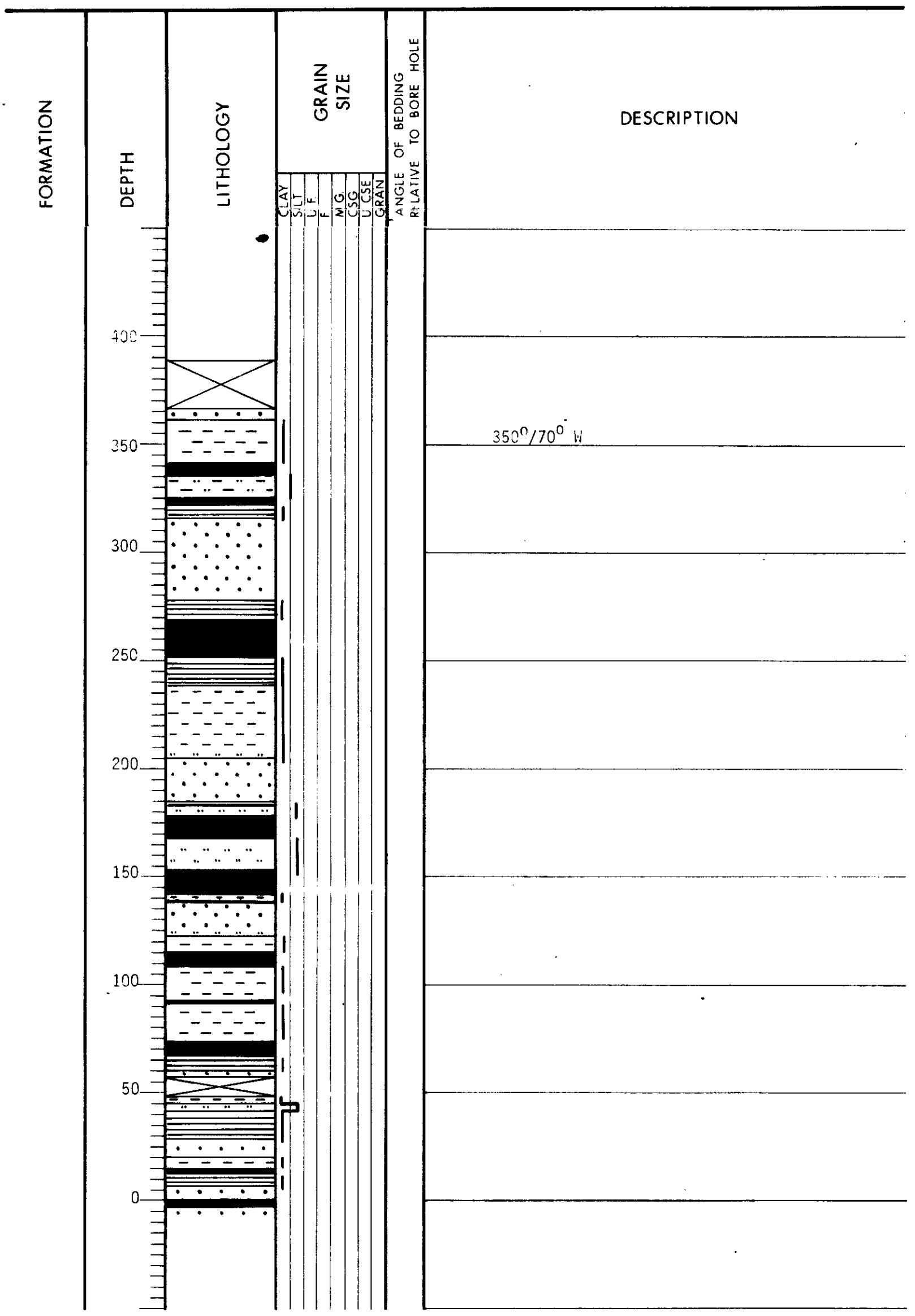
HOLE SIZE N/A DATE OF COMPLETION AUGUST ±(&%

LOGGED BY W. Poelman

REMARKS Section measured downstream in creek on Big Vleary Ridge 7000 feet southeast of Elk River bridge.

LITHOLOGIC SYMBOLS





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E. ELK RIVER 76 (3) b

274

DRILL HOLE SECTION 75-C AREA Elk River

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 1419

MECHANICAL LOGS RUN N/A

DRILLING METHOD Surface Section

HOLE SIZE N/A DATE OF COMPLETION Sept. 1975

LOGGED BY G. Singhal

REMARKS Measured on tributary of Bleasdell Creek (west side of Elk Valley)

LITHOLOGIC SYMBOLS

Breccia

Conglomerate

Sandstone

Calcareous sandstone

Siltstone

Coal

Sandstone beds with shale partings

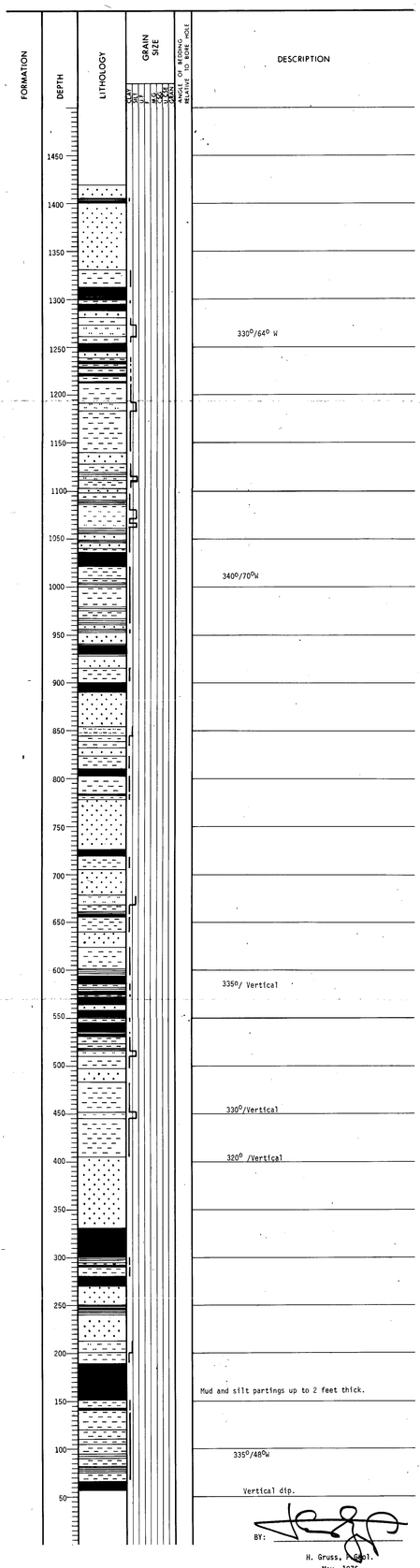
Mudstone/Sandstone

Mudstone or massive claystone

Shale

Mudstone/Siltstone

Unexposed



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K-ELK RIVER 76 (8) B

274

DRILL HOLE SECTION 75-H AREA Elk River

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 1142

MECHANICAL LOGS RUN N/A

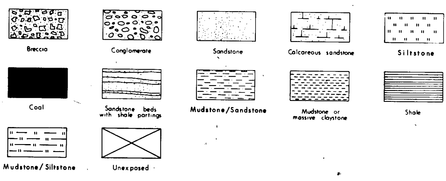
DRILLING METHOD Surface Section

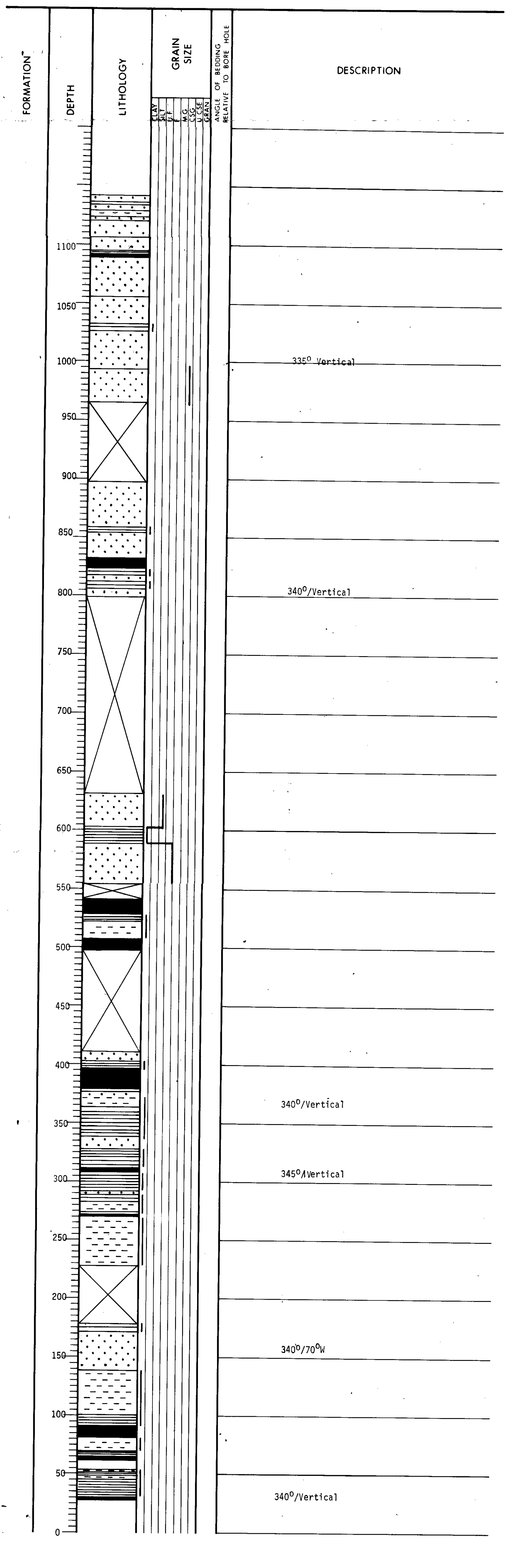
HOLE SIZE N/A DATE OF COMPLETION September 1975

LOGGED BY G. Singhal

REMARKS Measured in trench on west side of Elk Valley 4000 feet west of junction of Bleasdell Creek and Elk River.

LITHOLOGIC SYMBOLS





BY:

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May, 1976

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STRATIGRAPHIC LOG
ELK RIVER 76 F/3A

274

DRILL HOLE SECTION 75-1 AREA Elk River

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 2759

MECHANICAL LOGS RUN N/A

DRILLING METHOD Surface Section

HOLE SIZE N/A DATE OF COMPLETION September 1975

LOGGED BY G. Singhal

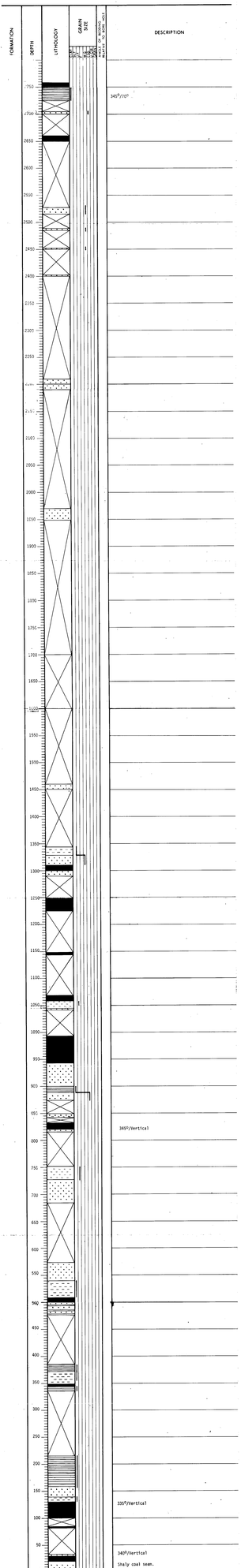
REMARKS Measured in major trench on west side of Elk Valley 9000 feet southwest of Elk River bridge.

LITHOLOGIC SYMBOLS

Boulder | Conglomerate | Sandstone | Calcareous sandstone | Siltstone

Coal | Sandstone, bank with shale partings | Mudstone/Sandstone | Mudstone or massive siltstone | Shale

Mudstone/Siltstone | Unexposed



BY: H. Gruss, P. Geol.

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STRATIGRAPHIC LOG

K - ELK RIVER 76(3)B

274

DRILL HOLE SECTION 75-J AREA Elk Valley

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 1201

MECHANICAL LOGS RUN N/A

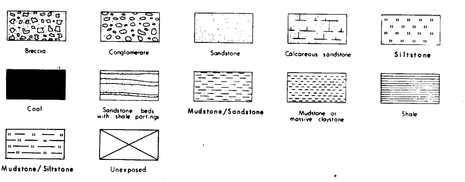
DRILLING METHOD Surface Section

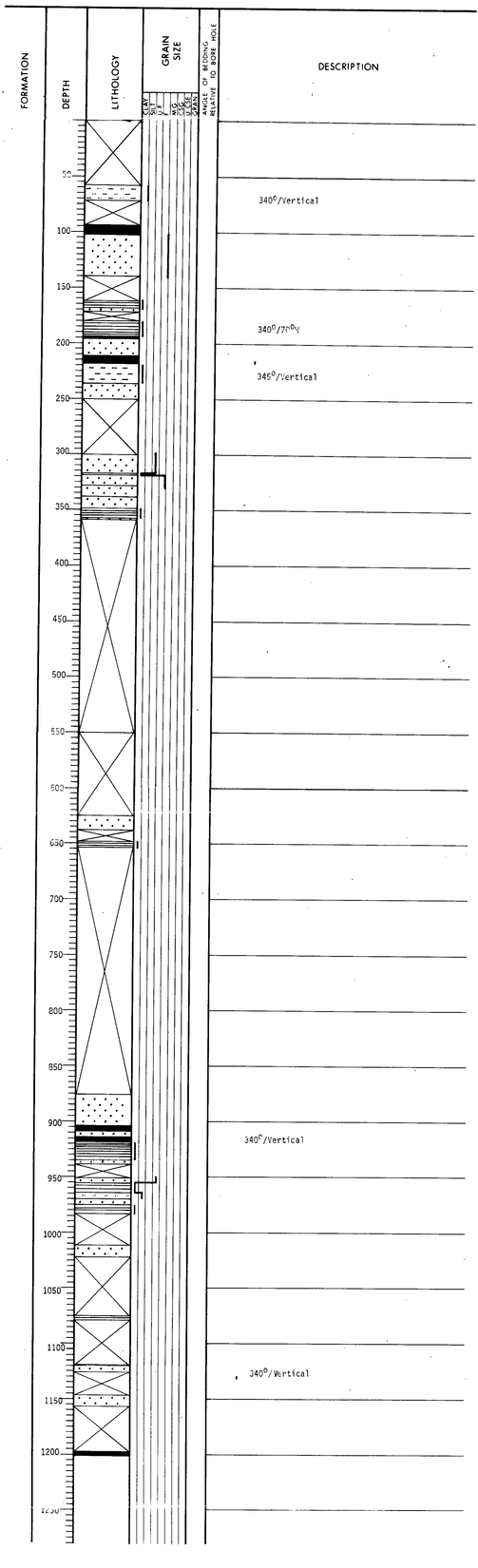
HOLE SIZE N/A DATE OF COMPLETION September 1975

LOGGED BY G. Singhai

REMARKS Measured on west side of Elk Valley in trench 1000 feet north of Bloasdell Creek.

LITHOLOGIC SYMBOLS





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K-ELK RIVER 76(2)B.

274

DRILL HOLE SECTION 75-K AREA Elk River

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 600

MECHANICAL LOGS RUN N/A

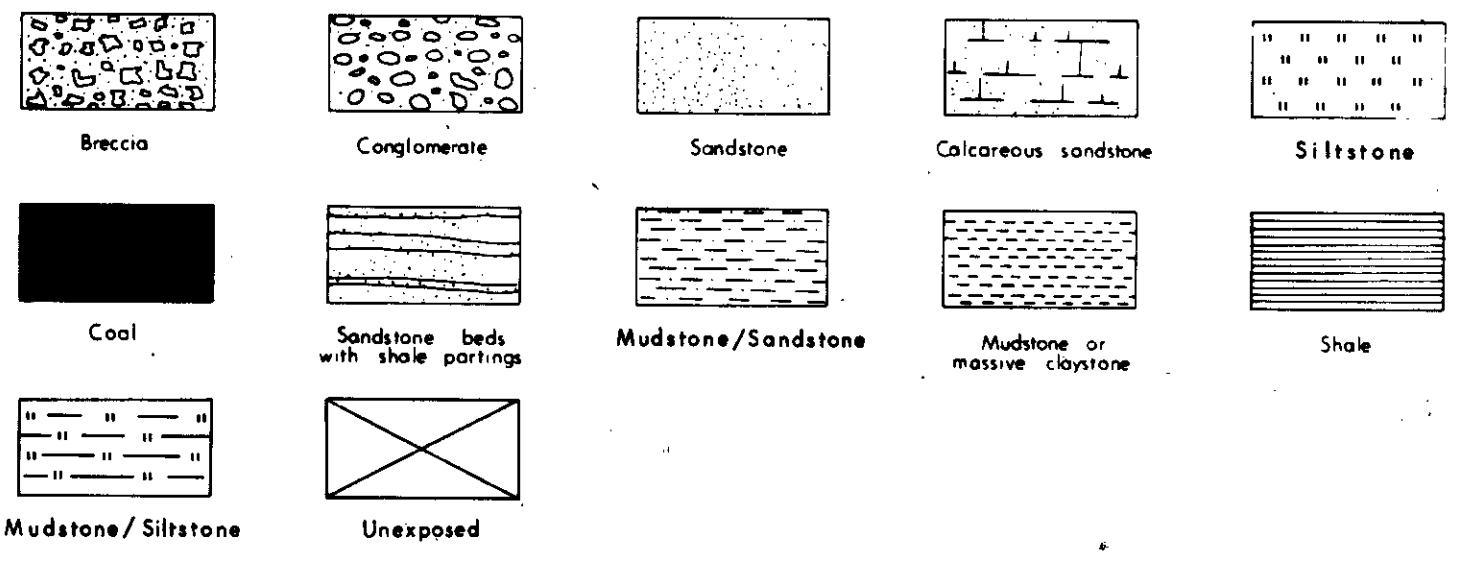
DRILLING METHOD Surface Section

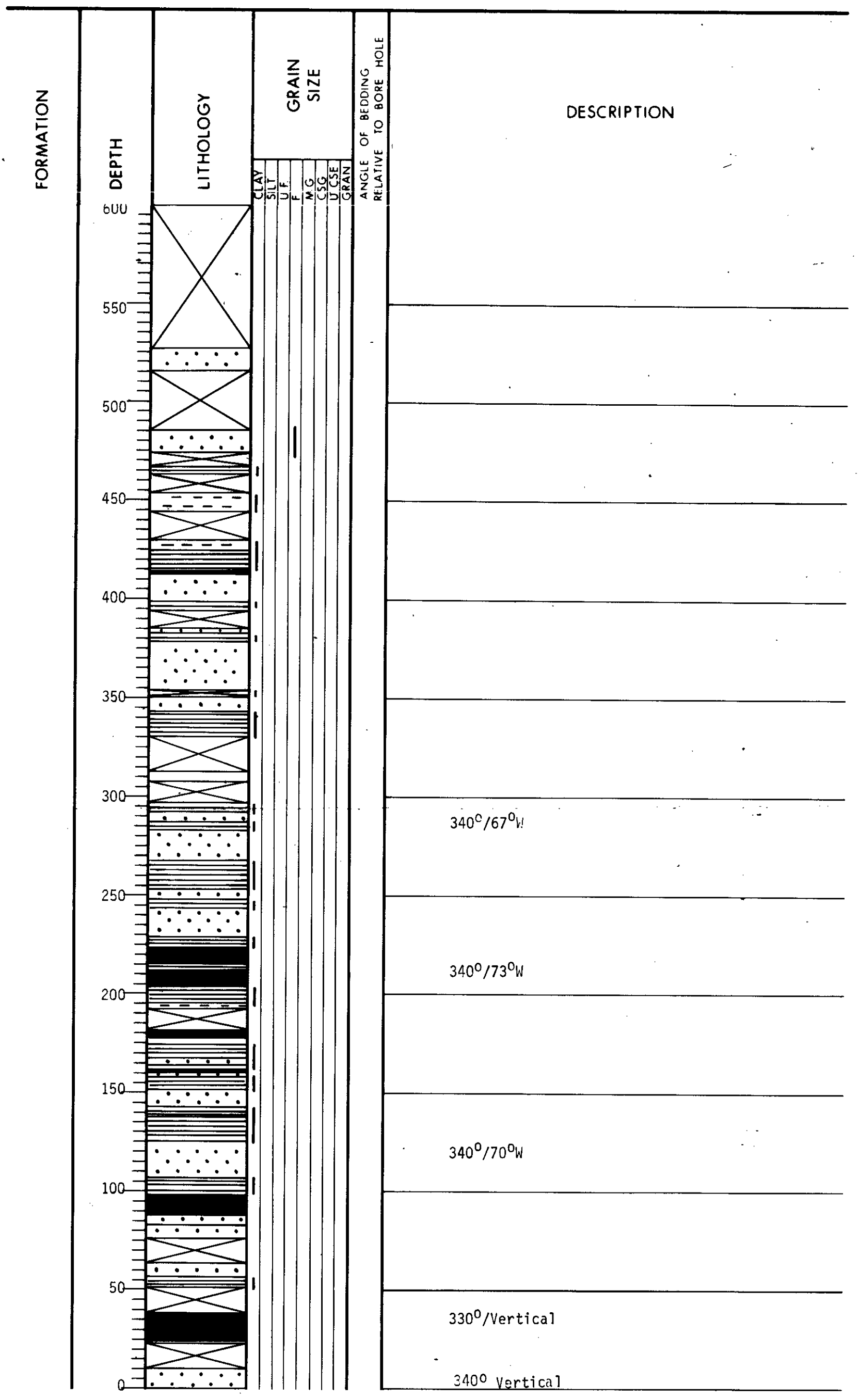
HOLE SIZE N/A DATE OF COMPLETION September 1975

LOGGED BY G. Singhai

REMARKS Measured on west side of Elk Valley in trench 6000 feet west southwest of Elk River bridge.

LITHOLOGIC SYMBOLS





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K-ELK RIVER 76(3).B

274

DRILL HOLE SECTION 75-L AREA Elk Valley

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 110

MECHANICAL LOGS RUN N/A

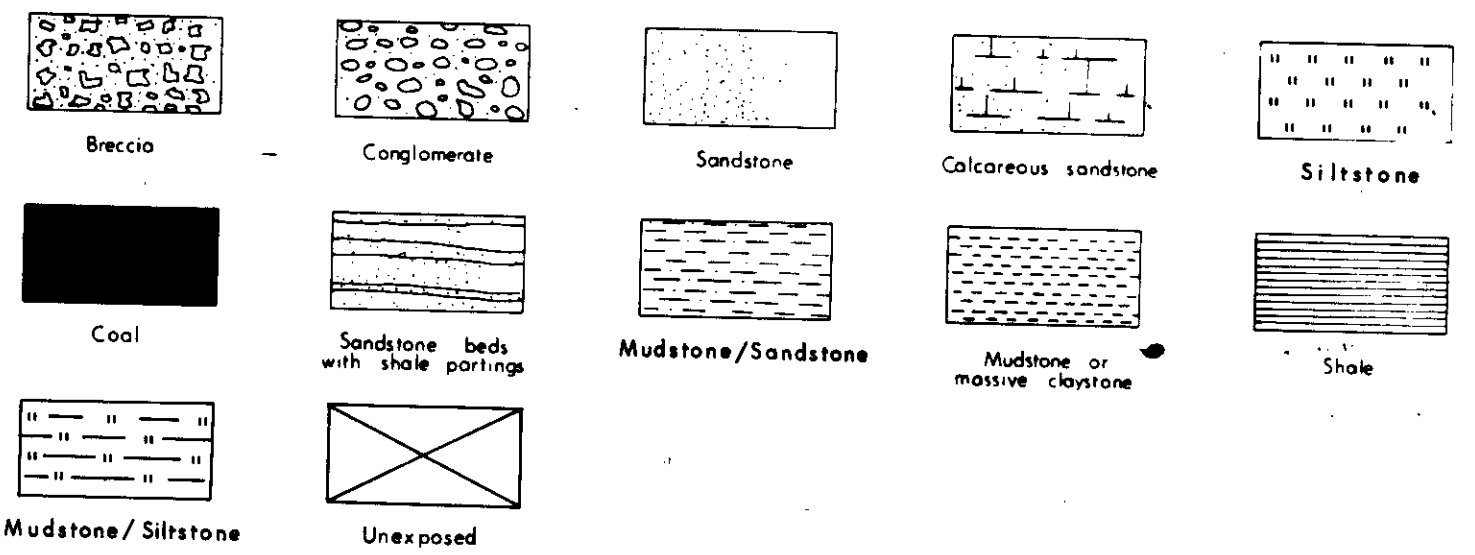
DRILLING METHOD Surface Section

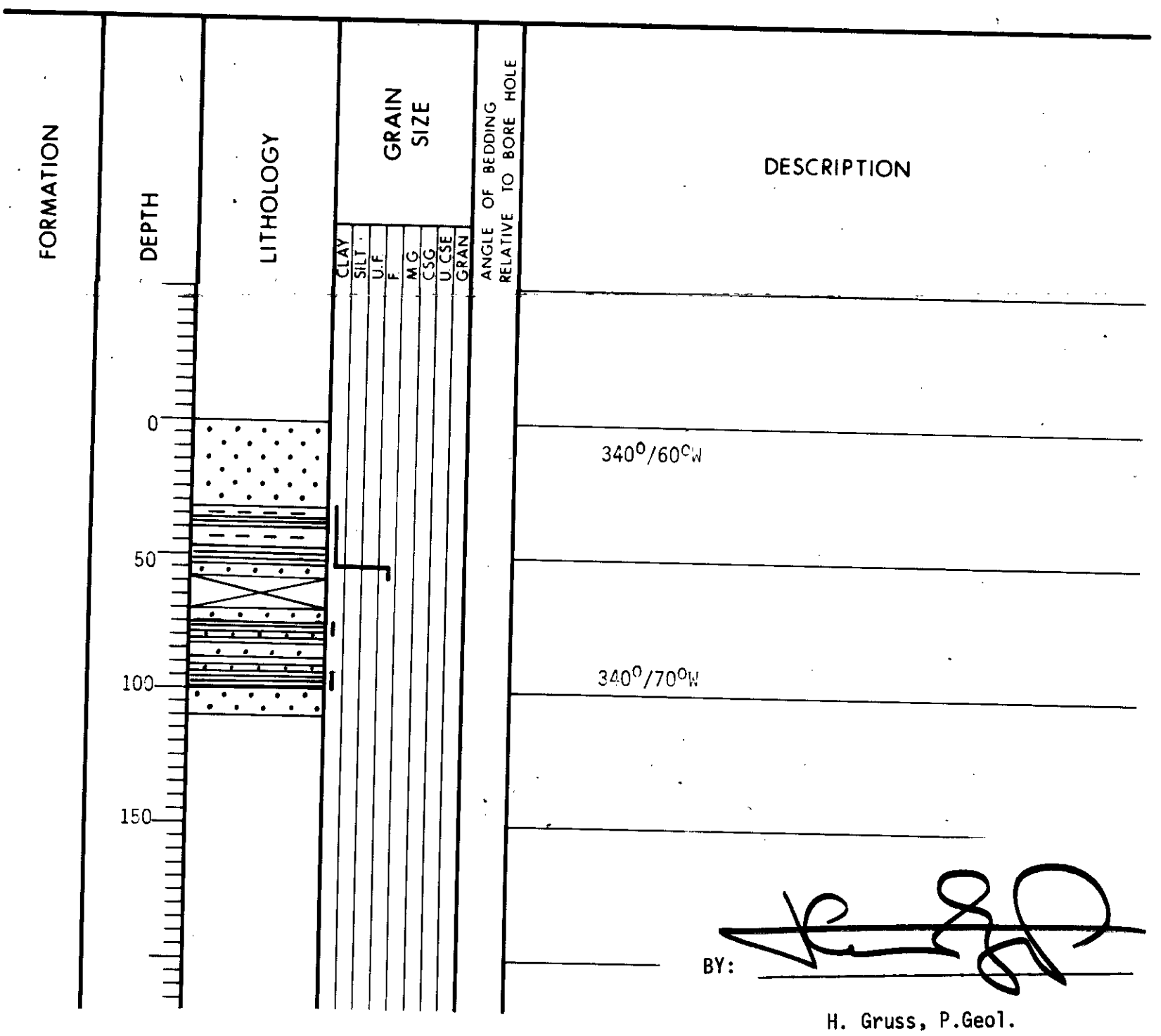
HOLE SIZE N/A DATE OF COMPLETION September 1975

LOGGED BY G. Singhai

REMARKS Measured on west side of Elk Valley in trench adjacent to creek 7000 feet west of Elk River bridge.

LITHOLOGIC SYMBOLS





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274

DRILL HOLE SECTION 75-M/N AREA Elk Valley

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 41 (M); 201 (N)

MECHANICAL LOGS RUN N/A

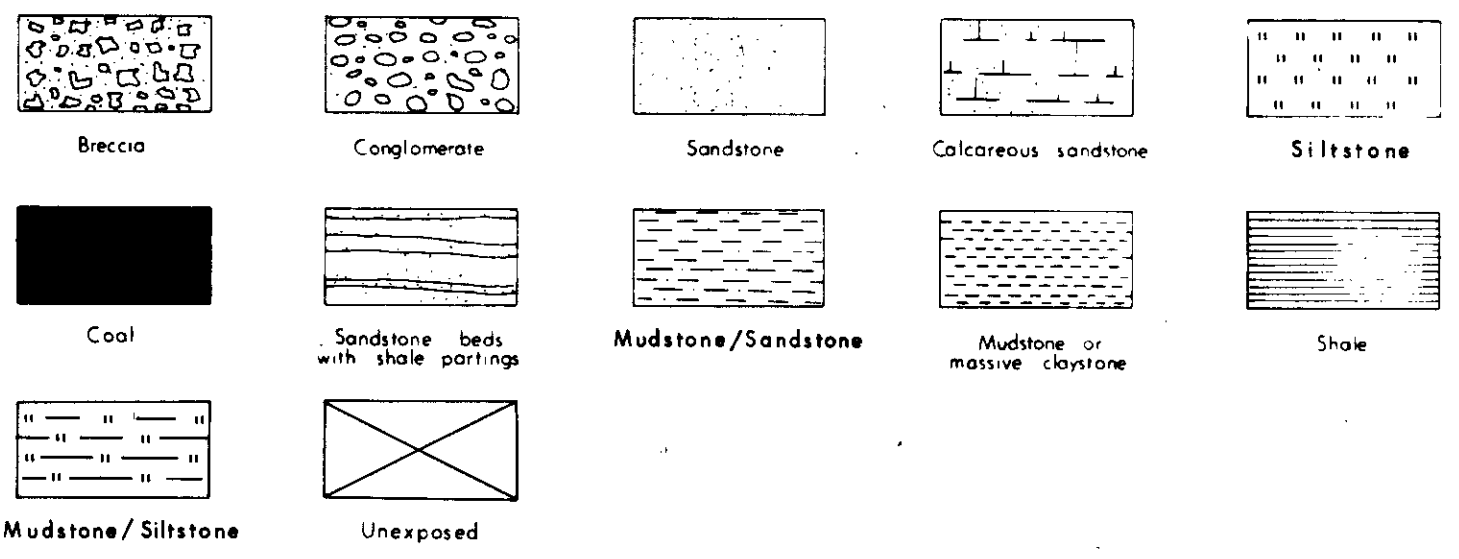
DRILLING METHOD Surface Section

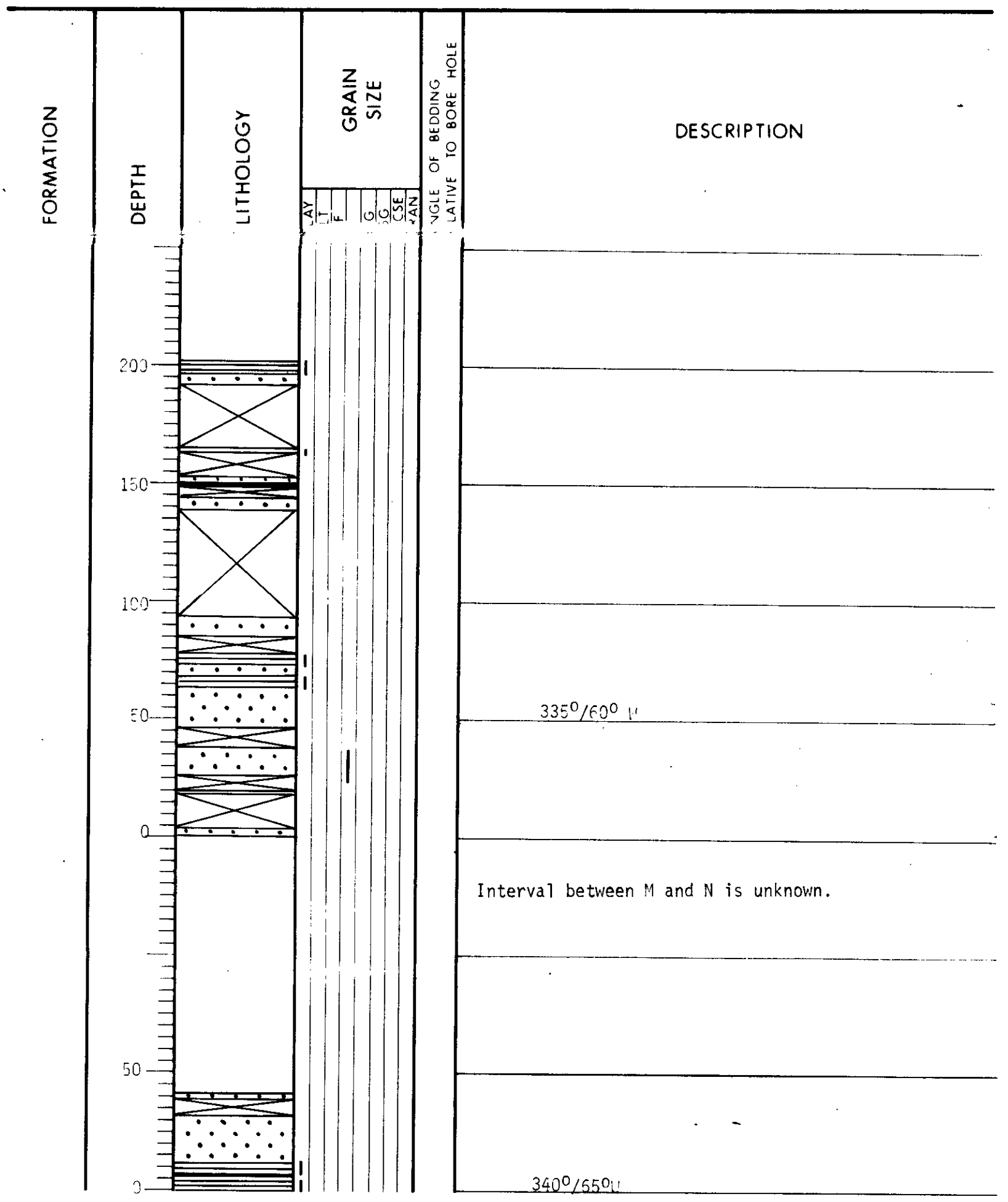
HOLE SIZE N/A DATE OF COMPLETION September 1975

LOGGED BY G. Singhai

REMARKS Measured on west side of Elk Valley in trench 8000 feet west northwest of Elk River bridge.

LITHOLOGIC SYMBOLS





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K-ELK RIVER 76(3)B.

274

DRILL HOLE SECTION 75-0 AREA Elk Valley

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 700

MECHANICAL LOGS RUN N/A

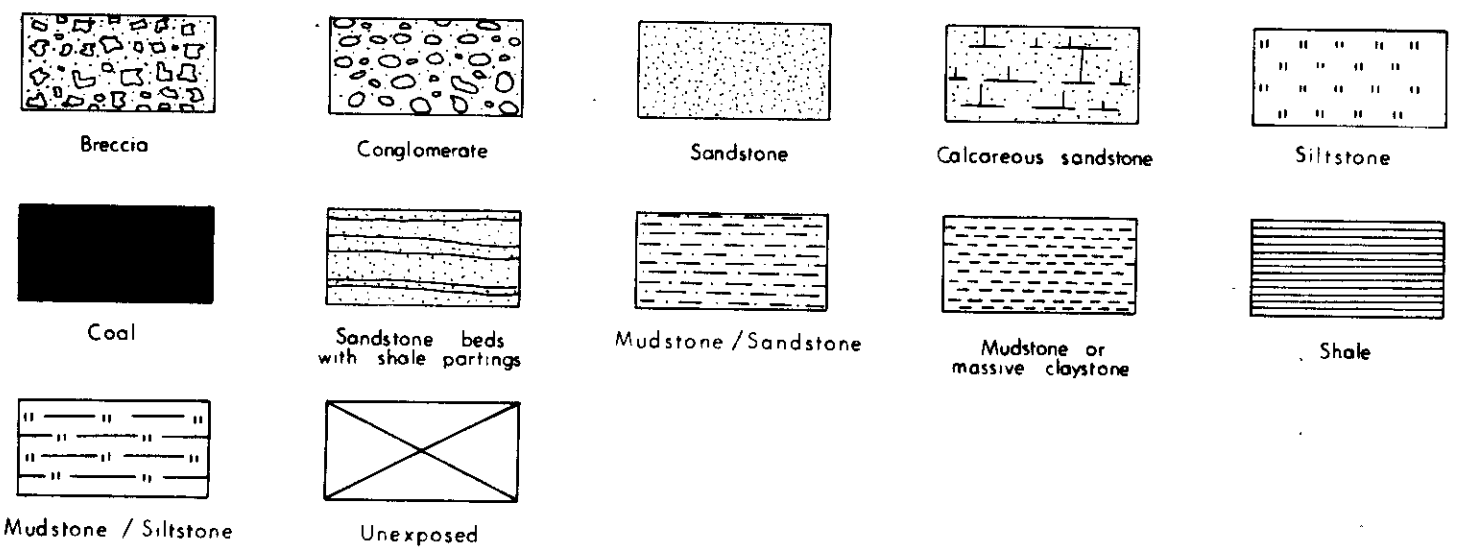
DRILLING METHOD Surface Section

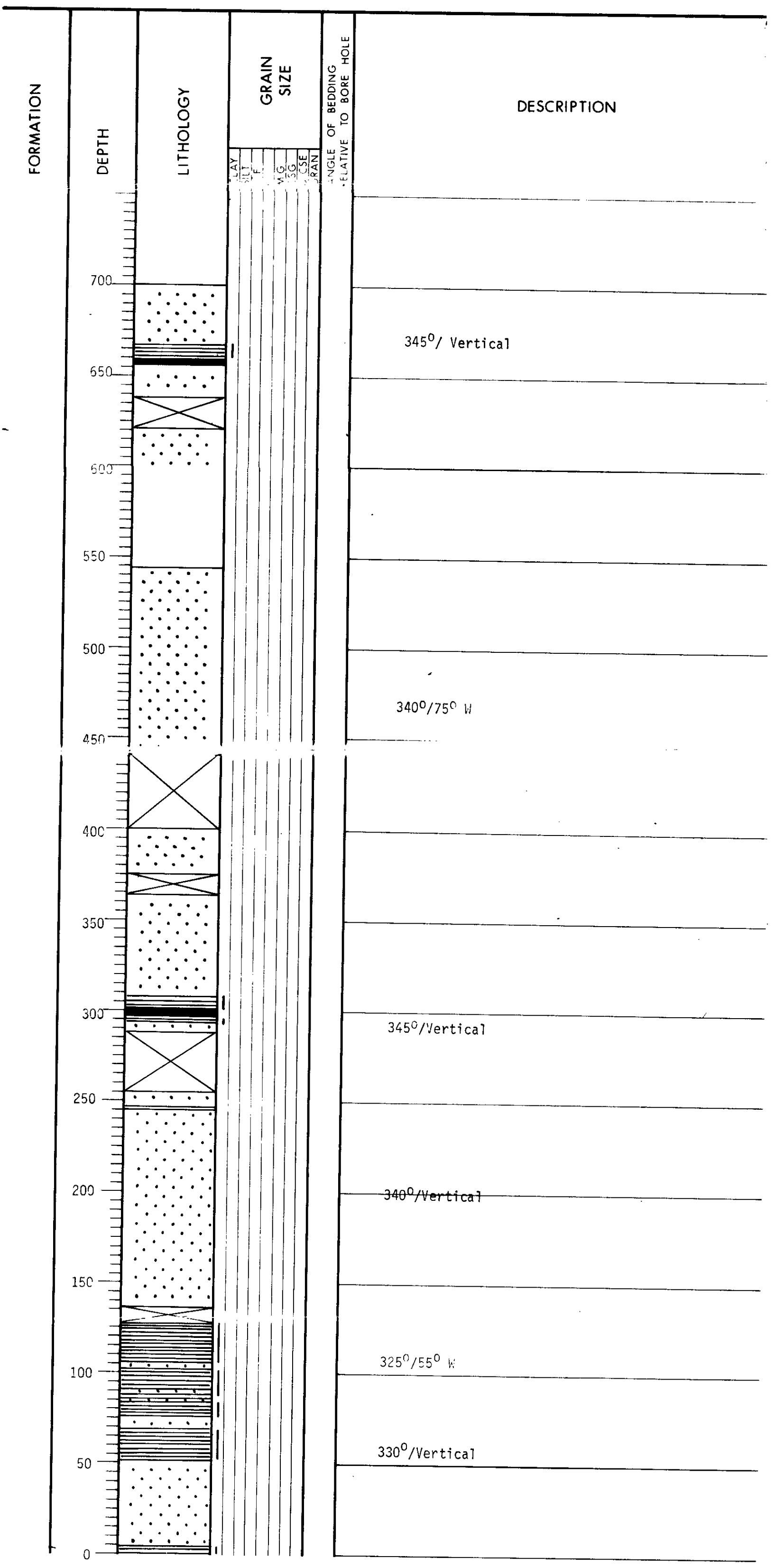
HOLE SIZE N/A DATE OF COMPLETION September 1975

LOGGED BY G. Singhai

REMARKS Measured on west side of Elk Valley in Gardner Creek

LITHOLOGIC SYMBOLS





BY: H. Gruss, P.Geol.

May, 1976

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K-ELK RIVER 76(3)B

274

DRILL HOLE Section 75-P AREA Elk River

COMPANY Elco Mining Ltd.

COORDINATES N/A

GROUND ELEVATION N/A TOTAL DEPTH 900'

MECHANICAL LOGS RUN N/A

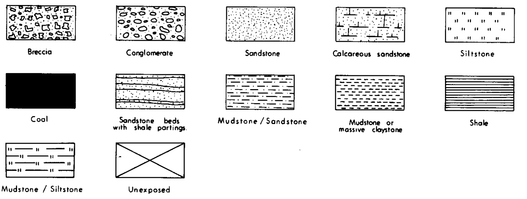
DRILLING METHOD Surface Section

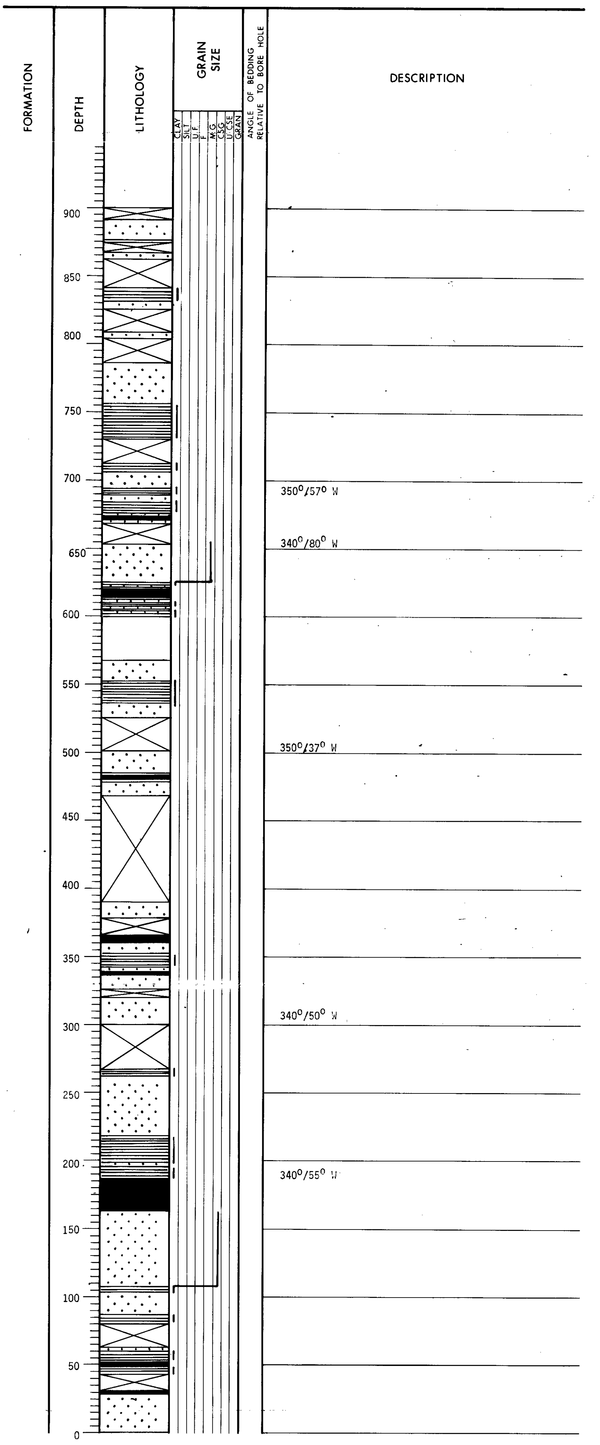
HOLE SIZE N/A DATE OF COMPLETION

LOGGED BY G. Singhai

REMARKS Measured on west side of Elk Valley in a trench on north side of creek 12,000 feet northeast of Elk River bridge.

LITHOLOGIC SYMBOLS





BY: H. Gruss, P.Geol.

May, 1976

K-ELK RIVER 76(4)#B-1

CONFIDENTIAL

EVALUATION OF
EXPLORATION AND TESTWORK
July 1975 - April 1976
on the
ELK RIVER COAL PROPERTY

VOLUME I (b)

COAL PREPARATION

CALGARY/DUSSELDORF
May 1976

ELCO MINING LIMITED

VOLUME Ib

COAL PREPARATION

CONTENTS

1. Summary

All Western Canadian coal operators had to overcome considerable starting problems - expensive alterations to the preparation plants became necessary before they could be operated economically - as they initially did not succeed to establish the correct ash content and size distribution of the raw coal plant feed. The raw coal ash and fines content was much higher in practice than anticipated due to the exceptionally high dilution from the hanging and footwall and from the partings. In order to avoid the various problems encountered in Western Canada the bulk testing program of Elco Mining Ltd. was designed to establish the actual characteristics of the plant feed including dilution and the washability of raw coal with approximately the same ash content and size distribution that will apear in practice. Furthermore, it was intended to produce clean coal from bulk samples for quality investigations and semi-industrial coke oven tests.

During the 1975 program 15 Elk River Seams were bulk sampled and a total of 420 st (381 mt) of raw coal including dilution from hanging and footwalls and partings were recovered. Washability tests were carried out by Birtley Engineering, Calgary, and Montan Consulting, Essen.

The raw coal of 15 single seams and 2 composites made up according to the expected blend in mining plan A and C were washed in the pilot preparation plant at Birtley Engineering, Calgary, consisting of heavy media cyclone, water only cyclones and flotation cells. The raw coal analyzed and fed to the pilot plant was crushed to below 3/4" (19 mm) in size in order to generate a content of fines -28 mesh (0.6 mm) that can be expected in a commercial plant.

The evaluation of the preparation test results and the preliminary design of the preparation plant was conducted by Techman Ltd., Calgary. Kaiser Engineers was asked to review the preparation

concept developed by Techman Ltd. and to establish a cost analysis of the preparation plant. The evaluation by Techman Ltd. resulted in an ash content of the raw coal feed to be between 30 to 35% by assuming a dilution of 16.4%. The fines content below 28 mesh (0.6 mm) of the raw coal is expected to average 35%. However, the plant design must be very flexible to allow for considerable changes in the characteristics of the plant feed due to the fact that 15 seams with different quality parameters will be mined.

Techman Ltd. established the following clean coal recovery and ash content:

Equipment	Size Fraction	Raw Coal*) Wt%	Raw Coal*) Ash%	Clean Coal Recov %	Clean Coal Ash%
Heavy Media Bath	4" x ½" (100 - 12.5 mm)	22.9	51.4	36.7	10.4
Heavy Media Cyclone	½" x 28 mesh (12.5 - 0.6 mm)	53.7	32.3	60.7	8.65
Water Only Cyclone	28 mesh x 65 mesh (0.6 - 0.2 mm)	10.6	17.9	73.5	8.0
Flotation Cells	65 mesh x 0 (0.2 - 0 mm)	13.5	17.7	75.0	9.65
Plant including rotary breaker (pit-to-rail)	4" x 0 (100 - 0 mm)	100.0	33.0	[illegible]	[illegible]

*) Data from washability tests used for yield calculations by Techman Ltd., The raw coal fines content expected [illegible] will be higher.

The average washability of the Elk River coal indicates that with a feed ash content of 33% a clean coal product with an ash content of 9% can be produced at about 59% recovery and of 9.5% ash at about 61% recovery.

The washability of the Elk River coal appeared to be more favourable than initially expected. The dilution should not have a negative effect on the washability due to the very hard and heavy nature of the dilution rock. The early proposal of Techman Ltd. to split the washing plant into two separate streams for hard and soft coals was therefore abandoned.

A comparison of the recent test results on bulk, channel and borehole samples with previous data showed good agreement. Thus, they can be considered as representative of the Elk River run-of-mine coal to be mined in the open pit area investigated to date. Techman Ltd. considers the data that has been estalbished so far as sufficient and does not require any additional bulk tests to design the preparation plant. However, the recommendation was made to carry out attrition and rotary breaker tests on raw coal left over from the 1975/76 testing program to establish the exact size distribution of the plant feed and the amount of dilution rock that can be rejected in the rotary breaker.

Kaiser Engineers expects the same content of raw coal ash and fines below 28 mesh (0.6 mm) of 33% and 35% respectively as Techman Ltd. Furthermore, it was assumed that 40% of dilution rock or approximately 4.8% of the plant feed could be discarded by the rotary breaker. The preparation plant performance would thus be as follows:

Equipment	Size Fraction	Raw Coal Wt%	Raw Coal Ash%	Clean Coal Recov.%	Clean Coal Ash%
Heavy Media Bath	4" x ½" (100 x 12.5 mm)	13.0	53.4	48.1	10.0
Heavy Media Cyclone	½" x 28 mesh (12.5 - 0.6 mm)	52.0	31.6	64.6	9.4
Water only Cyclone	28 mesh x 65 mesh (0.6 - 0.2 mm)	17.0	19.1	81.0	9.0
Flotation Cells	65 mesh x 0 (0.2 - 0 mm)	18.0	15.8	80.0	9.5
Preparation plant excluding rotary breaker (plant-to-rail)	4" x 0 (100 - 0 mm)	100.0	33.2	68.0	9.4

The data available indicates that a clean coal product of 9.5% ash content at a plant-to-rail recovery excluding the rotary breaker of 68.0% can be achieved unter both mine plan A and C. The pit-to-rail recovery including the rotary breaker was calculated by Kaiser Engineers to be between 59.0 and 70.4 % and averaging 64.7 %, in order to produce clean coal of 9.5 % ash content.

Comparing the assessments of Techman Ltd. and Kaiser Engineers it can be noted that the pit-to-rail recovery at 61% established by Techman Ltd. is more conservative than the figure calculated at 64.7% by Kaiser Engineers. The higher recovery developed by Kaiser Engineers can be explained with the higher percentage of fines - 28 mesh (0.6 mm) of 35% used for the calculation of the recovery. Techman Ltd. based the recovery calculation on the figure from the washability data which amounted to 25% only. The recovery in the fines circuits, however, is much higher than in the coarse sections.

The preparation plant was designed to handle 4 million short tons per year of clean coal from the open pit mine and 0.4 million short tons per year from an underground hydraulic mine. The plant availability was estimated to be 67% resulting in a throughput of 1200 short tons per hour (1088 mt/h) of raw coal and 744 short tons per hour (675 mt/h) of clean coal.

2. Introduction

The aim of this report is to describe the Elk River coal testing program conducted by Elco Mining Ltd. in 1975/1976 and to evaluate the results of this work as well as of previous studies done to date on the Elk River coal in order to establish sufficient data to design the preparation plant. The previous studies included data obtained by North American Coal Co. in 1968, Scurry-Rainbow Oil Ltd. in 1969 and Emkay Canada Natural Resources Ltd. in 1970/1971. The already available information lacked continuity and was based on coal samples that excluded dilution and partings.

The washability and the characteristics of the raw coal must be determined as accurately as possible to being able to design the preparation plant. All the preparation plants previously built in Western Canada had to overcome considerable problems during the start up period, as they failed initially to accurately establish the raw coal ash content and the feed size distribution. Costly alterations to the preparation plants became necessary and high financial losses incurred.

The ash content of the plant feed was much higher than anticipated due to an unexpected high dilution. Furthermore the Western Canadian coals are very friable and exhibit an unusually high percentage of fines, as they have been subjected to severe tectonic stress. Most of the coals produce very flat particles rather than cubical ones, thus reducing the efficiency of the conventional coal cleaning equipment. In addition, the coals oxidize very quickly on surface, whereby the coking properties will not be affected so much, thus the floatability will be reduced.

In order to avoid the previous problems experienced by Western Canadian coal operators the testing program was set up by ELCO MINING Ltd. to clarify existing data and to obtain additional information on the coal quality and possible amounts of dilution.

For this purpose the coal samples extracted during the three phase program, including small diameter boreholes, adits and trenches, as described in detail in volume Ia "Geology", were tested by BIRTLEY ENGINEERING, Calgary, and MONTAN CONSULTING, Essen. The results were evaluated by TECHMAN LTD., Calgary, Henry J. Kaiser and Exploration und Bergbau GmbH, Dusseldorf. The bulk sample testing program was designed to establish the actual characteristics of the plant feed including dilution and the washability of raw coal with approximately the same size distribution that will appear in practice. Furthermore, it was intended to produce clean coal for coke oven testing.

3. Objectives

The primary objectives of the 1975 coal testing program can be summarized as follows:

1) To supply washability data that would more closely represent the actual preparation plant flowsheet for the size fractions
   a) 2"x½" (50 - 12.5 mm) - heavy media bath
   b) ½"x28 mesh (12.5 - 0.6 mm) - heavy media cyclones
   c) 28 mesh x 65 mesh (0.6 - 0.2 mm) water only cyclones
   d) 65 mesh x 0 (0.2 - 0 mm) - froth flotation.

   All the previous data was split into ± 28 mesh fractions.

2) To include the partings and dilution in the plant feed sample, as they could have detrimental effects on the washability. Partings were previously excluded from the samples and the effects of dilution could not be accurately estimated.

3) To set up a washability that more closely approximated the actual plant feed size distribution, thereby ensuring the relevance of the washability data No washability tests were run on the fines previously.

4) To set up a preliminary channel sampling program which would ensure that bulk samples were taken beyond any oxidation zones which had detrimental effects on previous coke tests.

5) To develop a drillhole evaluation program which would correspond with the bulk testing and indicate the representativeness of the bulk tests.

6) To develop sufficient background data so that the size distribution of the plant feed could be determined. The sample of previous tests contained only 15.5 % minus 28 mesh (0.6 mm) coal. However, the actual amount of fines can be expected to be above 30 %.

7) To produce clean coal from bulk samples in the coal washing plant for quality investigations and semi industrial coke oven tests.

4 Description of Testing Program

4.1 Borehole Samples

The cores from the small diameter drilling program were analysed as shown in Figure 1.

Both borehole and channel samples arrived in closed plastic bags containing from 6 kg to 20 kg of coal. This coal was first air dried prior to being crushed in a jaw crusher and sub-samples for the further work being extracted.

Any coal of ¼"x0 (6.35-0 mm) in size was pulverized in a cornmill to minus 10 mesh (1.68 mm) before being split to a lesser quantity to prepare pellets for petrographic analyses.

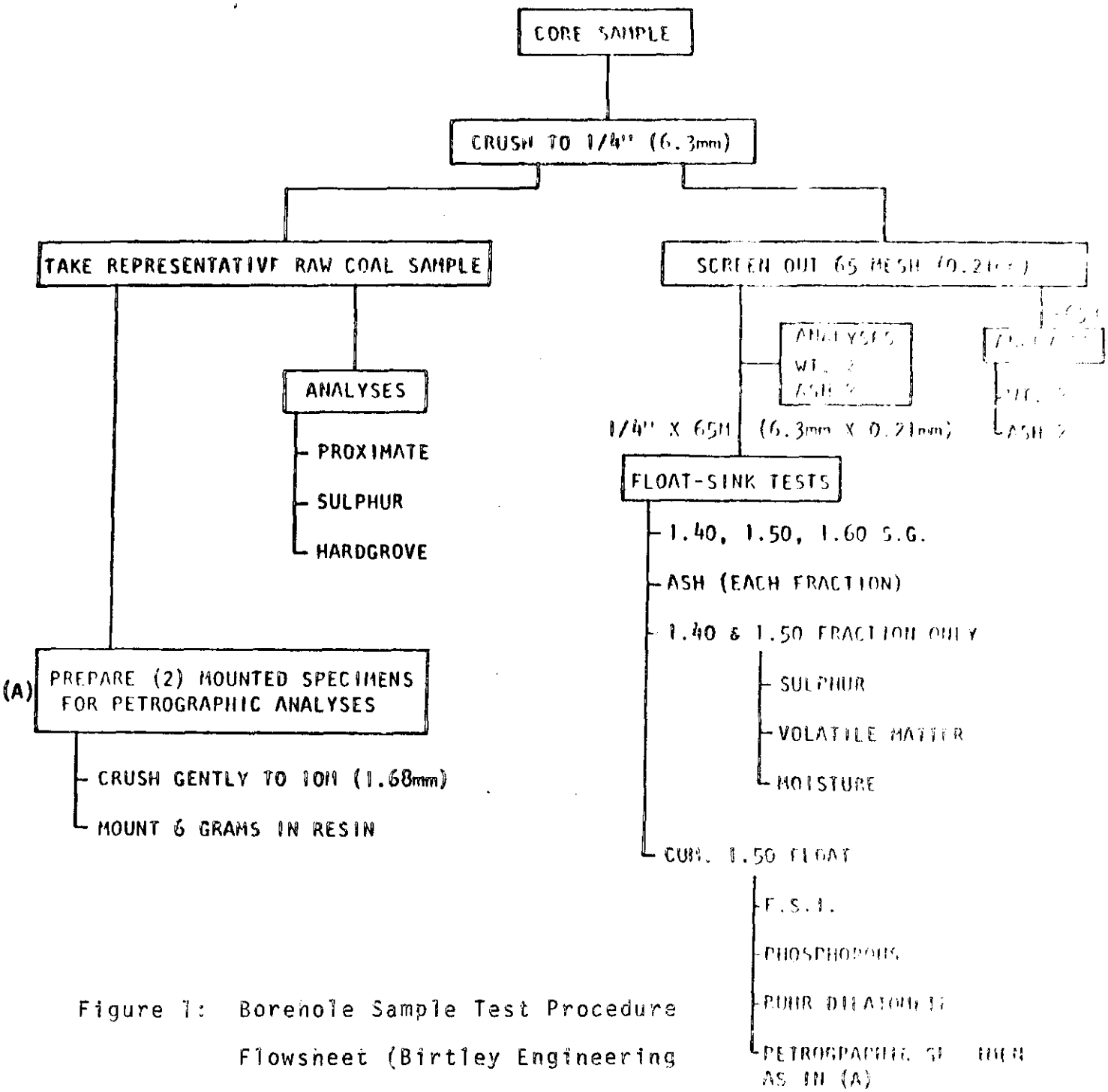


Figure 1: Borehole Sample Test Procedure Flowsheet (Birtley Engineering 1975)

Prepared coal for petrographic analysis was sealed in plastic containers and sent to Ruhrkohle in Germany, there to be stored for possible later testing.

The samples were analysed at three specific gravity levels (1.4, 1.5 and 1.60 g/cm^3) so that insight can be gained as to the amount of near gravity material that can be expected, as well as confirming the washability data.

4.2 Channel Samples

Prior to extracting the bulk samples, channel samples were taken to ensure that the oxidation zone had been passed and to establish the raw coal ash content.

The channel samples were processed at Birtley Engineering in the same way as the core samples.

In Germany the testing procedure as illustrated on Figure 2 was applied by Montan Consulting.

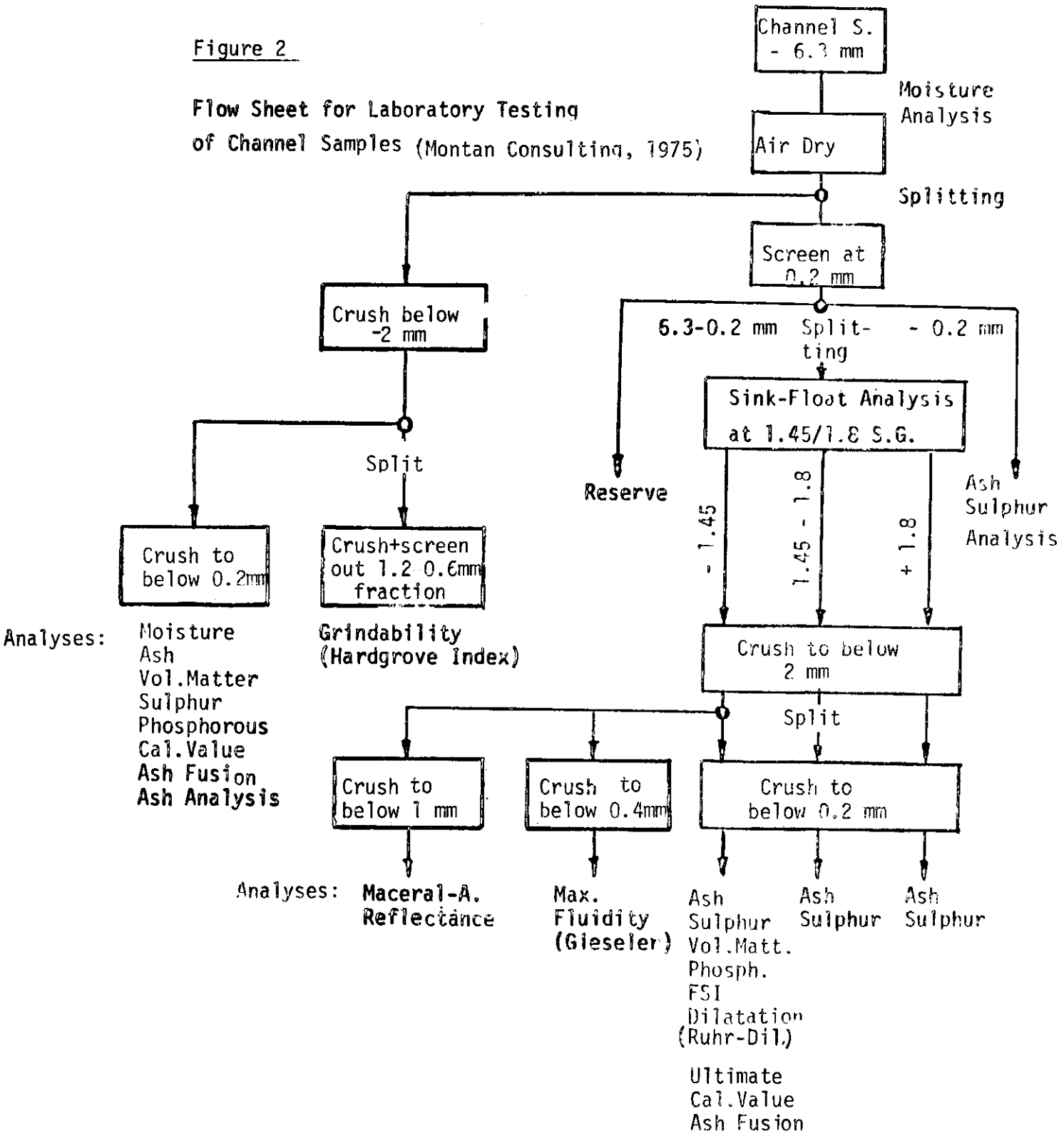
The sample was split for raw-coal and clean-coal analysis

Raw Coal Analysis : The material was crushed to minus 2.0 mm and split. From one part of the sample the 1.2 - 0.6 mm fraction was recovered for grindability testing. The other split was further crushed to minus 0.2 mm, followed by a full scale raw coal analysis (moisture, volatile matter, ash, sulphur, phosphorous, gross calorific value, ash fusibility and ash analysis).

Clean Coal Analysis: The material was screened at 0.2 mm, and the undersize analysed for ash and sulphur content. The oversize was floated at 1.45 and 1.6 g/cm^3 S.G.

Figure 2

Flow Sheet for Laboratory Testing of Channel Samples (Montan Consulting, 1975)



The -1.45 S.G. fraction was split. One part was further reduced to minus 1.0 mm for maceral analysis and reflectance measurements. The second part was reduced to minus 0.4 mm for Gieseler fluidity testing. The third part was crushed to minus 0.2 mm for a subsequent full scale clean coal analysis (volatile matter, ash, sulphur, phosphorous, F.S.I., Ruhr-Dilatometer test, ultimate analysis, gross calorific value and ash fusibility).

The ash and sulphur content of the 1.45 - 1.8 and + 1.8 g/cm^3 S.G. fractions were determined.

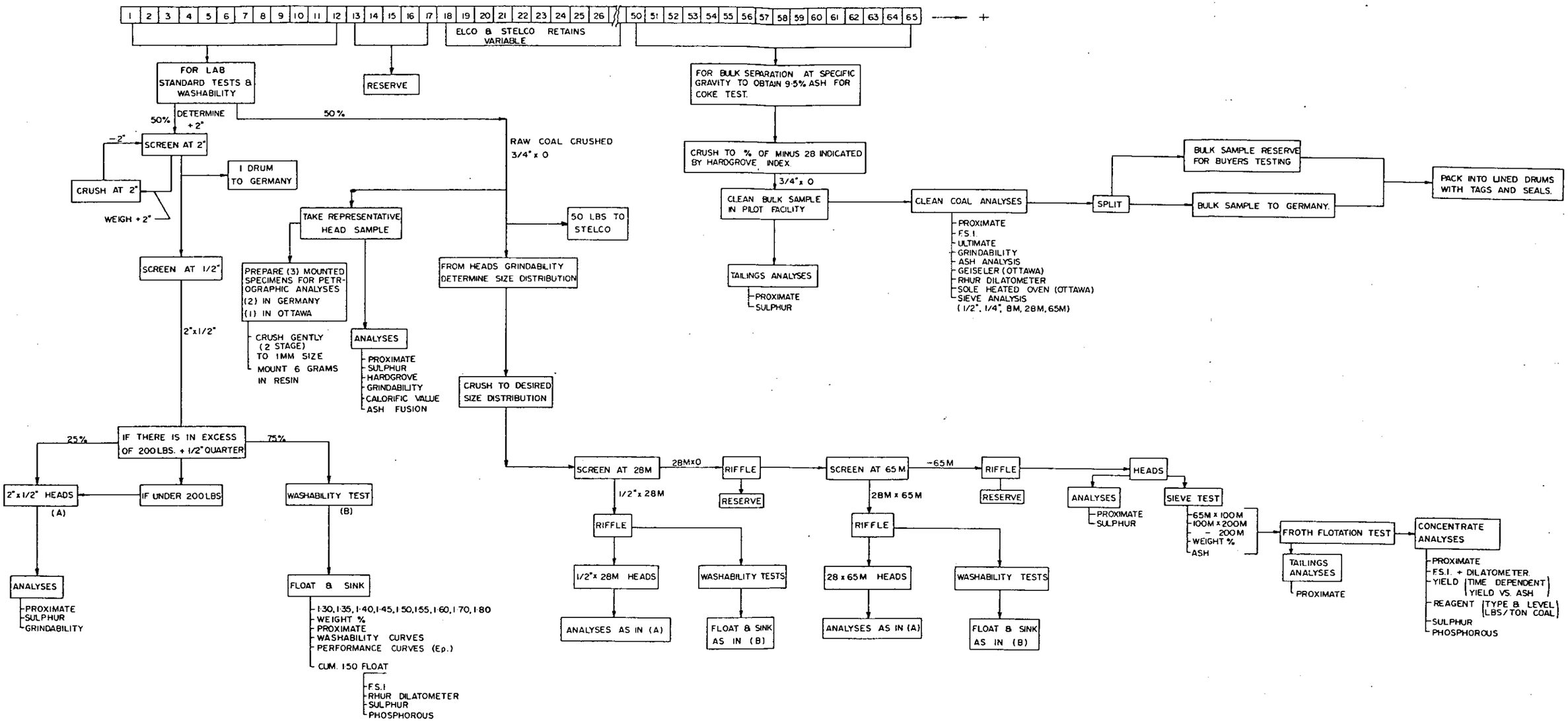
4.3 Bulk Samples

4.3.1. Sample Preparation

381 t of raw coal containing the anticipated dilution of 15 seams were extracted and trucked to the laboratory of Birtley Engineering, Calgary. The coal samples were offloaded on a mixing pad and thoroughly homogenized by using a front end loader. Upon completion of mixing, the bulk sample was coned and split for washability testing and to retain a raw coal reserve for later testing. One barrel of raw coal of each seam were dispatched to Bergbau Forschung, Essen. The remainder of the coal was washed in the pilot plant to produce clean coal for semi-industrial coke oven tests. The retained coal for the reserve was placed in poly-lined barrels with dry-ice and stored outdoors. The dry ice was later omitted upon being advised by the Canadian Metallurgical Research Institute of the Department of Mines, Ottawa, that dry-ice had a detrimental effect on the coking properties of Western Canadian coal. The coal was therefore stored in airtight sealed plastic bailers.

The bulk sampling and testing program at Birtley Engineering carried out according to the procedure shown in Figure 3

NOTE : FOR "BULK" OR LARGE SCALE TEST THE FOLLOWING PROCEDURES APPLY FOR EACH SEAM.
ORIGINAL BULK SAMPLE TO BE DELIVERED FROM FIELD IN SCALED TRUCKS
SAMPLES TO BE BLENDED BY LABORATORY & PRODUCTS STORED IN DRUMS (APPROX. 400 LBS. EACH)



NOTE : (1) ALL HEAD SAMPLES WILL BE RETAINED AND STORED IN A MANNER TO INHIBIT OXIDATION.
(2) DRUM COSTS AND PACKING FOR HEAD SAMPLES AND CLEAN COAL TO BE INCLUDED.
(3) LABELS TO BE INSIDE LINER, ATTACHED TO LINER SEAL AND TO BE PAINTED ON BARRELS.

FIGURE 3

GWS
BIRTLEY ENGINEERING (CANADA) LTD
Subsidiary of Great West Steel Industries Ltd

THE FINAL BULK SAMPLE FLOWSHEET FOR ELCO MINING LTD. FOR 1975 ELK RIVER PROGRAMME

DATE 13 JAN 76
SCALE N.T.S
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The raw coal was crushed to below 2" (50 mm) and a sample of the size fraction 2" x ½" (50 - 12.5 mm) was extracted for further testing.

It could be proven on Western Canadian coals that a relationship exists between the Hardgrove Grindability Index of the coal and the plant feed size as shown on figure 4. In order to obtain the feed size that could be expected in practice, it was necessary to determine the grindability on the raw coal and to crush the sample to approximately the size distribution related to the Hardgrove Index. This was done by crushing the sample to below 3/4" (19 mm) so that a representative amount of the fines fraction 28 mesh x 0 (0.6 - 0 mm) would be produced.

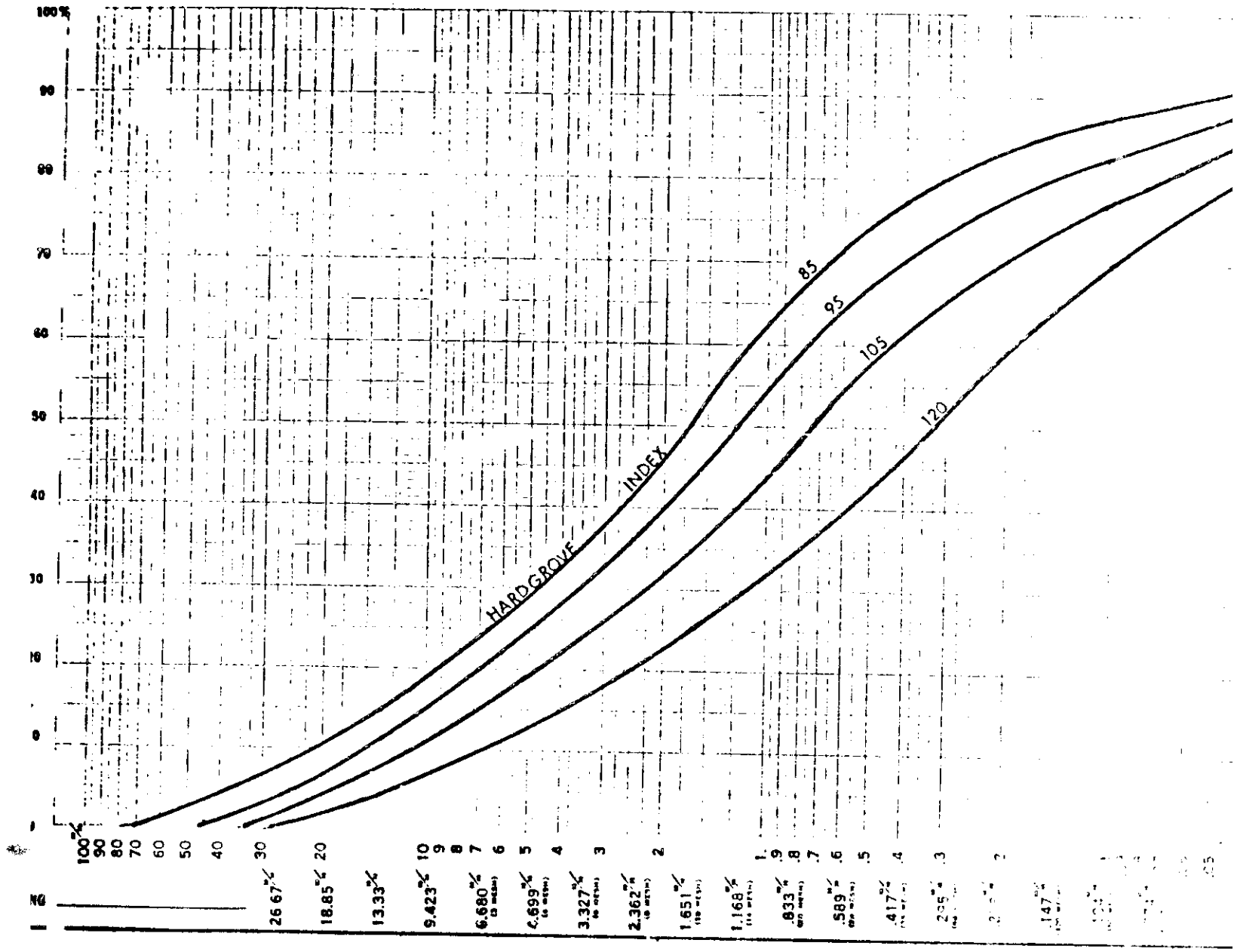
4.3.2. Washability

Washability curves were drawn from primary data for the 2" x ½" (5 - 12.5 mm) raw coal as well as for the 3/4" x 28 mesh (19 - 0.6 mm) and 28 mesh x 65 mesh (0.6 - 0.2 mm) fractions of the sample crushed below 3/4" (- 19 mm).

The washability of the raw coal fraction 2" x ½" (50 - 12.5 mm) was back-calculated out of the 3/4" x 28 mesh (19 - 0.6 mm) size fraction in order to simulate the removal of material from the 3/4" x 28 mesh (19 - 0.6 mm) size fraction which was introduced from the 2" x 3/4" (50 - 19 mm) raw coal being crushed to below 3/4" (19 mm). The remaining calculated washability will approximate the ½" x 28 mesh (12.5 - 0.6 mm) size fraction of the actual plant feed.

This procedure is unusual in washery design, but it was necessary to obtain reliable results of the true washability of the feed to the various preparation plant circuits. Prior to accepting this procedure, it was found that the amount of 3/4" x ½" (19 - 12.5 mm) material in the raw coal crushed to below 3/4" (19 mm) was in the range of only 2% and could be considered to be negligable, as it

Figure 4: SIZE DISTRIBUTION OF WESTERN CANADIAN COALS AS A FUNCTION OF HARDGROVE GRINDABILITY INDEX



was within the range of accuracy of the testing procedure.

4.3.3. Froth Flotation Tests

Froth flotation tests were conducted at 10% pulp density and a reagent level of 0.48 lbs/short ton (0.24 kg/mt). The reagent used was a mixture of Kerosene and MIBC in the ratio 4:1. The tests were conducted in a standard MEMCO laboratory flotation cell with a one minute conditioning time and one minute floats.

4.3.4 Pilot Plant Washing

The raw coal of 15 seams and of two raw coal composites, made up from the single seams proportionately according to the mining plans A and C, were washed in the three circuit pilot preparation plant of Birtley Engineering

The composition of the two raw coal composites A and C is shown in Tables 1 and 2.

The pilot plant consists of a 14" (350 mm) DSM heavy media cyclone, 6" (150 mm) DSM Water Only Cyclones, and froth flotation cells.

The flowsheet of the pilot plant has been illustrated in Figure 5. The washing procedure was as follows:

The raw coal is dumped by a front end loader into a feed hopper, and has to pass a 2" (50 mm) screen to ensure that the bucket elevator receiving the feed does not handle oversize material. The 2" oversize coal is crushed manually to pass the 2" screen, but large waste material is collected in barrels and reported as shale for the heavy media circuit. The bucket elevator discharges the minus 2" feed at a rate of 5 to 7 metric tons per hour, into a rotary 3/4" (19 mm) screen on the third deck. The 3/4" oversize

Table 1 Proportioning of Raw Coal Composite A

Seam	Recovered Raw Coal Reserves Mill.st	Recovered Dilution *) Rock Mill.st	Total Run-of-Mine Reserves Mill.st	Percentage of raw coal Composite %
2	14.954	1.265	16,219	8.8
3	5.946	0.659	6,605	3.6
4	26,957	2.387	29,344	15.8
6	4,710	0.734	5,444	2.9
7	3,911	0.329	4,241	2.3
8	15,510	0.587	16,097	8.7
9	11,913	0.893	12,806	6.9
10	17,665	0.773	18,438	10.0
11	4,188	0.215	4,403	2.4 **)
12	10,551	1.788	12,339	6.7
13	11,345	1.254	12,599	6.8
14	9,787	0.723	10,510	5.7
15	8,954	1,673	10,627	5.7
16	6,363	1.671	8,034	4.3
17	7,575	0.392	7,967	4.3
18	6,183	0.774	6,957	3.8
19	2,129	0.308	2,437	1.3
	168,641	16.426	185,067	100.0

*) Includes parting up to 3' (0.9 m) and 6" (0.15 m) footwall and hanging-wall dilution

**) No sample could be taken from seam 11 and 19. As the quality of seam 12 and 18 is similar to the adjacent seam, the sample taken from this seam was increased accordingly.

Table 2. Proportioning of Raw Coal Composite C

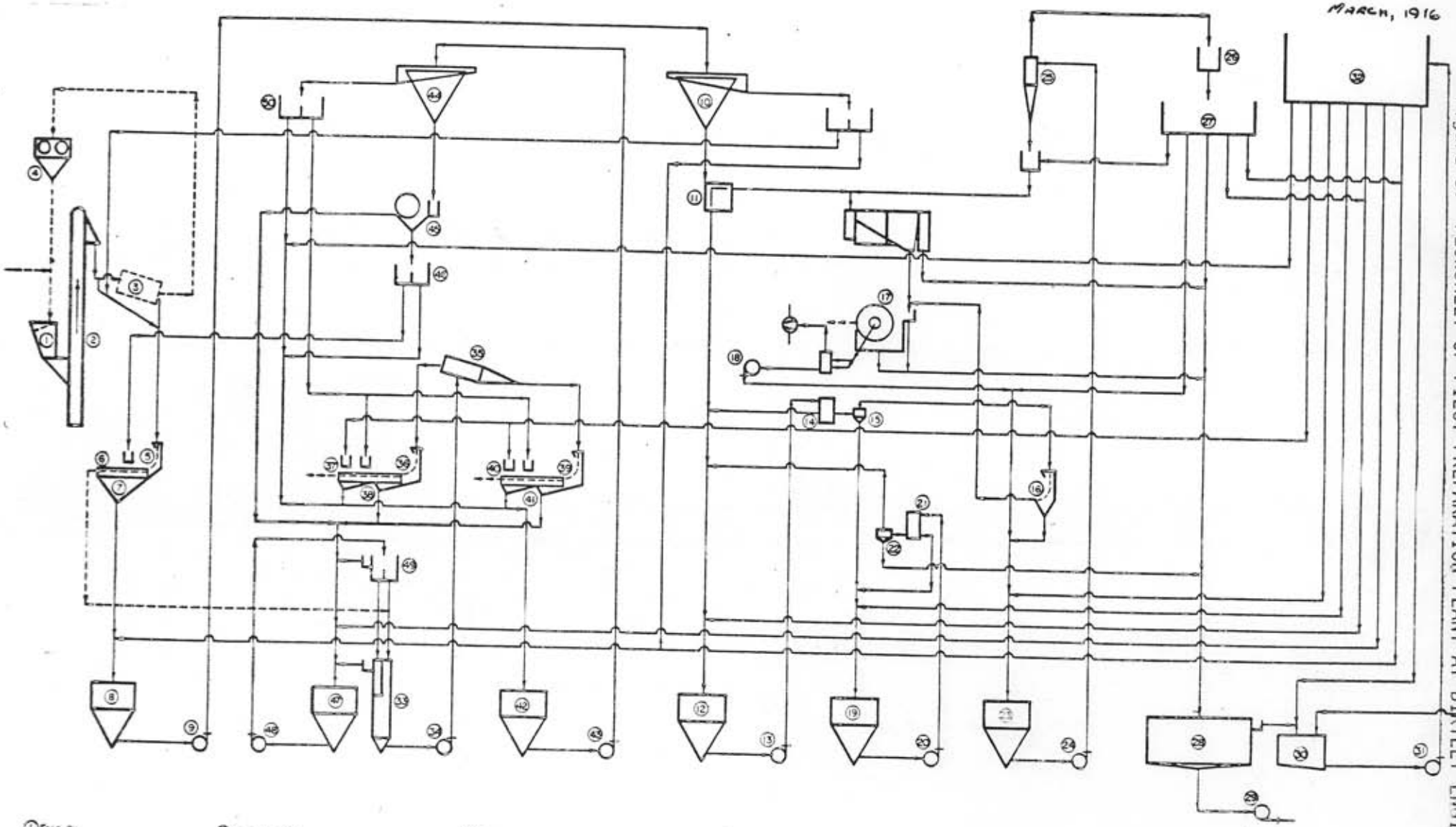
Seam	Recovered Raw Coal Reserves Mill.st	Recorded Dilution*) Rock Mill st.	Total Run-of-Mine Reserves Mill.st	Percentage of raw coal Composite %
2	13,155	1,491	14,646	9.7
3	5,430	1,243	6,673	4.4
4	23,717	3,445	27,162	18.1
6	4,313	2,018	6,331	4.2
7	3,672	0,653	4,325	2.9
8	13,583	2,404	15,987	10.6
9	10,804	0,989	11,793	7.8
10	15,941	1,345	17,286	11.5
11	3,385	0,665	4,050	2.7 **)
12	9,453	1,967	11,429	7.6
13	9,927	3,269	13,196	8.8
14	6,282	1,978	8,260	5.5
15	4,218	1,246	5,464	3.6
16	1,432	0,949	2,381	1.6
17	1,003	0,371	1,374	0.9
18	0,067	0,049	0,116	0.1
	126,382	24,091	150,473	100.0

*) Includes partings up to 3' (0.9 m) and 6" (0.15 m) footwall and hanging wall dilution.

**) No sample could be taken from seam 11. As the quality of seam 12 is similar, the sample taken from this seam was increased accordingly.

Figure 5: FLOWSHEET OF PILOT PREPARATION PLANT AT BIRTLEY ENGINEERING

MARCH, 1976



1. Feed Bin
2. Elevator
3. Rotary Screen
4. Jaw Crusher
5. Sieve Bend
6. Desliming Screen
7. Underflow Collector
8. 25 Ton Raw Coal Collection Tank
9. Pump
10. Settling Cone
11. Diverter
12. Primary Water Only Cyclone Feed Tank
13. Pump
14. Distributor
15. Primary Water Only Cyclone
16. Sieve Bend
17. Vacuum Filter
18. Filtrate Water Pump
19. Secondary Water Only Cyclone Feed Tank
20. Pump
21. Distributor
22. Secondary Water Only Cyclone
23. Thickening Cyclone Feed Tank
24. Pump
25. Thickening Cyclone
26. Overflow Distributor
27. Head Box
28. Thickener
29. Waste Disposal Pump
30. Clarified Water Collection Tank
31. Clarified Water Pump
32. Clarified Water Head Box
33. Cyclone Feed Tank
34. Pump
35. D.S.M. Cyclone
36. Sieve Bend
37. C.C. Drain and Rinse Screen
38. Underflow Collector
39. Sieve Bend
40. Discard Drain and Rinse Screen
41. Underflow Collector
42. Dilute Medium Tank
43. Pump
44. Settling Cone
45. Magnetic Separator
46. Splitter Box
47. Correct Medium Tank
48. Pump
49. Distribution Box
50. Sprinkler Box
51. Pump

TEST PLANT FLOWSHEET

COAL SCIENCE & MINERALS TESTING

DEPT OF BIRTLEY ENGINEERING (CANADA) LTD, CALGARY, ALTA

falls via a chute into a 5" x 8" (125 - 200 mm) jaw crusher where it is crushed to below 3/4" and recycled through the feed system. The 3/4" x 0 (19 - 0 mm) screen underflow is washed with water onto a 28 mesh (0.6 mm) sieve bend and slot screen for desliming.

The 3/4" x 28 mesh (19 - 0.6 mm) coal is the feed to the 14" (350 mm) DSM heavy media cyclone on the second deck. The slurry of coal and correct medium is pumped to the cyclone from the mixing tube at a pressure of 9 to 10 psi (1.3 - 1.4 kg/cm^3). The overflow and underflow products are discharged onto a common, but split 28 mesh slot screen preceded by a 28 mesh sieve bend where the magnetite is washed off into the correct and dilute medium tanks directly below. Additional clean spray water and baffles across the clean coal stream ensure that a minimum of magnetite is retained in the clean product. The clean coal and shale are collected in barrels by means of individual chutes for weighing.

The dilute medium is pumped to a thickening cone on the third deck from where it is fed to a 30" (750 mm) magnetic separator. The recovered magnetite is sluiced back to the correct medium tank. The specific gravity of the medium is monitored manually, using a density meter, and adjusted for loss by adding cyclone grade magnetite directly to the correct medium tank.

The 28 mesh x 0 (0.6 - 0 mm) coal collected in the slimes tank ground level, is pumped to the thickening cone on the third deck. From this point it can be fed directly to the froth circuit or as is usual, to the water cyclone system.

Coal to the 6" (150 mm) DSM water cyclone is pumped at a pulp density of 10% to 20% from the cylcone feed tank at a pressure of 20 psi (3 kg/cm^3), and a flow rate of 85 Imperial gallons per minute. (360 l/min). A mechanically adjustable vortex finder facilitates the settings for a desired ash content.

The underflow or waste product is routed to the static thickener while the overflow is fed by gravity to a rapped 0.25 mm sieve bend. The sieve bend overflow is the water cyclone product at approximately 65 mesh (0.2 mm) oversize, and directed to the Eimco disc filter for dewatering.

The sieve bend underflow gravitates to the thickening cyclone feed tank, from where it is pumped to the 20^{0} - 8" (200 mm) cyclone. This thickening cone serves a dual purpose:

1) it removes undesireable - 325 mesh (0.05 mm) slimes from the flotation feed, and
2) it provides a feed of proper density (20% - 30% solids) to the froth cells.

The flotation circuit consists of two Birtley-Humboldt multi-wobble cells in series. Since these cells were installed on September 12, 1975, there appears to be a marked improvement in tailings ash contents, indicating excellent recovery of froth product in comparison to the previously installed cells. A rotary reagent feeder introduced 4:1 Kerosene: Methylisobutylcarbinol into the circuit at the feed entry point for better conditioning.

The tailings join the water cyclone underflow in the static thickener to form the thickener tails. The froth enters the Eimco disc filter and is dewatered along with the sieve bend overflow to form the filter cake or fines product. This and the heavy media clean coal are combined to form the clean coal product or clean mix. This product is analysed as outlined in the flow sheet (Fig. 1).

Each circuit was sampled for feed, product and waste in addition to the 0.25 mm sieve bend overflow and filter cake. Each sample was analysed for ash content and Free Swelling Index. Size analysis were performed on fines circuit samples at 65 mesh (0.2 mm) and 100 mesh (0.15 mm). Float-sink of the heavy media clean coal and shale and the water cyclone plus 100 mesh (0.15 mm) overflow and underflow provide the necessary data to calculate the probable

error curves for the two circuits.

For details refer to the report of Birtley Engineering on "Analysis and Washing of Bulk Samples from the Elk River Deposit" of January 1976.

The heavy media clean coal and the filter cake were thoroughly homogenized and the resultant clean mix sampled and analysed.

The clean coal designed for shipment to Germany (Montan Consulting) and Italy (Italsider) for coke oven testing was placed into barrels lined with plastic bags, containing approximately 180 kg each.Samples of clean coal of each seam and of the blends according to mining plan A and C were also dispatched to Stelco, Hamilton and to the Canadian Metallurgical Research Institute, Ottawa. Stelco received in addition bulk samples of clean coal of the blends A and C for coke oven testing.

An inventory of the raw and clean coal handled by Birtley Engineering is given in Table 3.

4.3.5. Attrition Test

In Germany, an attrition test on the raw coal samples of seams 3 and 6 was conducted by Montan Consulting. The purpose of this test was to simulate the attrition caused by the mining operation and during handling the coal before it is fed to the preparation plant in order to establish the approximate size distribution of the plant feed that can be expected in practice.

The raw coal samples were subjected to abrasion in a modified micum drum (Harhoff drum) normally used for testing the strength of blast furnace coke. The drum was tumbled under standard conditions to obtain the amount of fines below 0.5 mm related to the Hardgrove Grindability Index of the raw coal without crushing the

Table 3: INVENTORY OF THE RAW COAL AND CLEAN COAL HANDLED BY BIRTLEY ENGINEERING.

Seam		2	3	4	6	7	8	9	10	12	13	14	15	16	17	18	Blend A	Blend C	TOTAL
Raw Coal																			
Received	mt	27.5	11.7	35.9	11.8	17.4	27.5	24.1	25.1	50.3	29.4	20.9	20.4	26.2	22.5	30.7	10.3	10.08	401.78
Washed	mt	14.9	4.85	13.4	5.5	11.3	13.3	12.1	17.1	21.6	12.77	7.3	6.63	15.06	17.4	16.2	9.1	8.2	206.71
Reserve	mt	12.6	6.85	12.5	6.3	6.1	14.2	12.0	8.0	28.7	16.63	13.6	13.77	11.14	5.1	14.5	1.2	1.88	185.07
Reserve	bbls *)	70	38.1	69.4	35.0	33.89	78.89	66.67	44.44	159.44	92.39	75.56	76.5	61.89	28.33	80.56	6.67	10.44	1028.21
Clean Coal																			
Washed	mt																		
Shipped to Europe	mt	4.93	2.72	8.23	2.56	2.67	4.42	3.60	5.87	5.29	2.30	3.06	3.06	3.40	4.13	4.08	2.03	4.14	66.49
Shipped to STELCO	mt	0.102	0.102	0.123	0.059	0.114	0.102	0.109	0.110	0.102	0.123	0.102	0.122	0.102	0.99	0.102	2.20	-	4.66
Reserve	mt	0.068	0.238	0.068	0.289	0.323	-	4.40	3.47	4.83	0.68	0.063	0.068	0.697	6.02	5.76	0.17	0.17	27.26
Reserve	bbls **)	0.4	1.4	0.4	1.7	1.9	-	25.9	20.4	28.4	4	0.4	0.4	4.1	35.4	33.9	1.0	1.0	160.7

*) 1 bbl raw coal weighs approximately 180 kg
**) 1 bbl clean coal weighs approximately 170 kg

coarse rock material to a larger extend than it would be in practice. The procedure was interrupted frequently to determine the amount of fines below 0.5 mm and was stopped finally after the percentage of fines according to the grindability of the raw coal as shown in Figure 4 was reached.

5. Test Results

5.1. Borehole Samples

The results of the analytical work carried out on the borehole samples by Birtley Engineering are shown in the volume Ia Geology of the final report of Elco Mining Ltd. For details refer to the report of Birtley Engineering on "Core and Channel Analysis for the 1975 Elk River Test Program" of January 1976.

A summary of the borehole test results is given in Table 4 a for the open pit area and in Table 4b for the area of a possible hydraulic mine.

5.2. Channel Samples

The results of the laboratory tests on the channel samples conducted by Birtley Engineering and Montan Consulting are shown in the volume Ia Geology of the final report of Elco Mining Ltd. For details refer to the report of Birtley Engineering on "Core and Channel Analysis for the 1975 Elk River Test Program" of January 1976.

A summary of the channel sample test results is given in Tables 5 and 6. It can be noted that a good agreement exists between the results obtained by both laboratories.

Table 4: DRILL HOLE SUMMARY (Birtley Engineering 1975)

a) Open Pit Area

SEAM No.		Total Footage	Ash % WF	VM % WF	S %WF	Yield %	Ash %WF	VM %WF	FSI	G-Value
12	EB-6	32.3'	24.4	21.7	0.60	72.1	5.7	27.5	8	
13	EB-6	18.4'	27.7	21.7	0.60	67.6	6.1	28.8	8½	
	EB-15	18.9'	52.2	16.1	0.54	43.7	5.4	25.9	7	
	WT. Average (by footage)	18.6'	40 1	18.9	0.57	55.5	5.8	27.3	7 3/4	
14	EB-6	40.6'	32.9	22.4	0.69	59.6	4.7	29.8	8½	
	EB-12	9.5'	21.3	23.1	0.73	72.1	5.3	28.4	8½	
	EB-15	12.0'	31.6	19.6	0.77	56.9	7.0	26.6	8	
	EB-18	14.0'	21.9	22.8	0.68	70.5	7.9	27.9	8	
	WT. Average (by footage)	19.0	29.2	22.1	0.71	62.7	5.7	28.8	8½	
15	EB-7	43.2'	64.7	14.1	0.52	25.5	5.2	30.7	9	
	EB-10	14.0'	40.3	20.5	0.44	54.8	5.2	30.4	9	
	EB-12	22.0'	19.5	23.1	0.46	74.4	4.6	28.5	8½	
	EB-15	20.2'	26.7	20.7	0.65	65.8	5.7	27.5	8½	
	EB-16	19.0'	34.4	21.8	0.76	63.7	6.6	28.7	8½	
	EB-18	12.8'	18.7	23.6	0.72	77.3	6.9	27.5	8	
	WT. Average (by footage)	34.1'	39.0	19.4	0.58	54.4	5.6	29.0	8½	
16	EB-7	14.2'	25.6	22.7	0.59	65.7	5.5	30.0	8½	
	EB-10	17.6'	16.0	24.1	0.67	81.7	3.9	28.0	8	
	EB-12	9.5'	15.5	24.7	0.67	79.8	4.2	29.3	9	
	EB-15	25.2'	32.0	20.7	0.65	57.1	7.4	28.3	8½	
	EB-16	15.9'	22.9	24.3	0.89	73.1	7.0	29.6	8½	
	EB-17	44.9'	24.4	24.6	1.18	70.9	7.8	29.9	8½	
	EB-18	14.1'	25.2	24.9	1.45	67.1	7.3	30.5	7½	
	EB-19	10.7'	10.6	29.0	0.92	88.7	4.7	31.7	8	
	WT. Average (by footage)	18.4'	23.4	24.0	0.93	70.7	6.6	29.6	8½	
17	EB-7	10.3'	17.0	27.1	0.80	81.1	3.8	33.1	8½	
	EB-10	28.5'	32.0	23.0	0.53	62.3	4.2	30.1	8½	
	EB-12	6.3'	12.1	27.5	1.20	87.5	3.9	30.8	9	
	EB-13	9.2'	36.2	27.5	0.42	56.2	7.6	33.1	8	
	EB-14	18.0'	38.1	20.4	0.67	62.0	7.0	30.9	8½	
	EB-16	19.6'	29.9	23.0	0.64	61.1	6.0	30.9	8	
	EB-17	6.5'	34.1	22.6	0.63	60.2	9.5	32.8	8	
	EB-19	7.7'	21.8	27.9	1.13	74.6	4.4	31.6	8½	
	WT. Average (by footage)	13.3'	29.8	23.5	0.68	65.6	5.6	31.0	8½	
18	EB-7	27.8'	14.4	28.4	0.50	86.4	4.8	34.7	8	
	EB-8	6.4'	29.3	27.7	0.71	63.8	7.4	32.8	8	
	EB-10	19.8'	12.0	27.1	0.37	90.5	4.5	30.6	7½	
	EB-11	19.8'	18.2	27.8	0.25	78.9	4.8	32.3	8	
	EB-12	17.4'	33.8	22.2	0.74	54.0	6.7	31.8	8½	
	EB-13	15.5'	17.5	25.8	0.41	78.1	5.4	32.4	7½	
	EB-14	17.0'	17.8	26.4	0.56	80.9	4.7	32.4	8	
	EB-16	20.6'	33.5	23.2	0.67	54.2	6.4	32.7	8	
	EB-17	5.6'	7.3	27.6	0.79	93.8	3.0	32.3	8½	
	EB-19	5.5'	34.9	24.1	0.61	55.9	9.3	34.3	7½	
	WT. Average (by footage)	15.5'	21.1	26.0	0.52	74.9	5.4	32.6	8	
19	EB-8	33.9'	31.0	25.4	0.66	60.0	6.8	36.4	8	
	EB-11	24.2'	25.8	24.9	0.69	69.9	6.7	34.4	8	
	EB-12	4.0'	37.8	21.2	0.88	56.9	9.3	30.6	8	
	EB-13	6.3'	35.9	23.4	0.81	49.6	9.8	34.6	8	
	EB-14	14.6'	31.2	25.2	0.70	63.6	6.2	35.0	8	
	EB-16	11.5'	48.0	20.5	0.97	33.1	10.6	35.2	7	
	EB-17	7.4'	19.5	28.0	1.17	81.8	5.9	33.3	8	
	WT. Average (by footage)	14.6'	31.4	24.6	0.76	60.6	7.3	35.0	8	
20	EB-9	19.1'	37.6	24.4	0.91	54.0	9.2	37.6	6½	
	EB-11	15.8'	32.9	26.0	0.61	61.8	8.4	36.1	8	
	EB-13	8.4'	41.8	22.2	0.65	43.7	11.2	36.0	7	
	EB-14	6.7'	63.6	14.7	0.43	21.9	8.5	34.4	NA	
	EB-17	6.6'	21.9	28.3	0.70	78.6	9.6	34.8	7	
21	EB-13	12.3'	34.2	29 5	0.44	54.0	7.5	36.5	7½	

TABLE 4. DRILL HOLE SUMMARY (BIRTLEY ENGINEERING 1975)

a) Open Pit Area

Seam	Drill-hole #	Seam-thick-ness(m)	RAW COAL Vol. Matt. % db	RAW COAL Ash % db	RAW COAL Sul. % db	CLEAN COAL (1.5 g/cm³) Yield %	CLEAN COAL (1.5 g/cm³) Vol. Matt. % db	CLEAN COAL (1.5 g/cm³) Ash % db	CLEAN COAL (1.5 g/cm³) Swel. Ind.	CLEAN COAL (1.5 g/cm³) G-Val.
12	EB-6	9,85	21,7	24,4	0,60	72,1	27,5	5,7	8	1,035
13	EB-6	5,6	21,7	27,7	0,60	67,6	28,8	6,1	8 1/2	1,048
	EB-15	5,8	16,1	52,2	0,54	43,7	25,9	5,4	7	1,046
	Ø	5,7	18,9	40,1	0,57	55,5	27,3	5,8	8	1,047
14	EB-6	12,4	22,4	32,9	0,69	59,6	29,8	4,7	8 1/2	1,059
	EB-12	2,9	23,1	21,3	0,73	72,1	28,4	5,3	8 1/2	1,068
	EB-15	3,7	19,6	31,6	0,77	56,9	26,6	7,0	8	1,057
	EB-18	4,3	22,8	21,9	0,68	70,5	27,9	7,9	8	1,076
	Ø	5,8	22,1	29,2	0,71	62,7	28,8	5,7	8 1/2	1,065
15	EB-7	13,2	14,1	64,7	0,52	25,5	30,7	5,2	9	1,059
	EB-10	4,3	20,5	40,3	0,44	54,8	30,4	5,2	9	1,058
	EB-12	6,7	23,1	19,5	0,46	74,4	28,5	4,6	8 1/2	1,076
	EB-15	8,9	20,7	26,7	0,65	65,8	27,5	5,7	8 1/2	1,063
	EB-16	5,8	21,8	34,4	0,76	63,7	28,2	6,6	8 1/2	1,070
	EB-18	3,9	23,6	18,7	0,72	77,3	27,5	6,9	8	1,071
	Ø	10,4	19,4	39,0	0,58	54,4	29,0	5,6	8 1/2	1,067
16	EB-7	4,3	22,7	25,6	0,59	65,7	10,0	5,5	8 1/2	1,062
	EB-10	3,8	24,1	16,0	0,67	81,7	28,0	3,9	8	1,042
	EB-12	2,9	24,7	15,5	0,67	79,8	29,3	4,2	9	1,062
	EB-15	7,7	20,7	32,0	0,65	57,1	28,3	7,4	8 1/2	1,081
	EB-16	4,9	24,3	22,9	0,89	73,1	29,6	7,0	8 1/2	1,083
	EB-17	13,7	24,6	24,4	1,18	70,9	29,9	7,8	8 1/2	1,066
	EB-18	4,3	24,9	25,2	1,45	67,1	30,5	7,3	7 1/2	1,082
	EB-19	3,3	29,0	10,6	0,92	88,7	31,7	4,7	8	1,088
	Ø	5,6	24,0	23,4	0,93	70,7	29,6	6,6	8 1/2	1,074
17	EB-7	3,1	27,1	17,0	0,80	81,1	33,1	3,8	8 1/2	1,055
	EB-10	8,7	23,0	32,0	0,53	62,3	30,1	4,2	8 1/2	1,062
	EB-12	4,9	27,5	12,1	1,20	87,5	30,8	3,9	9	1,080
	EB-13	2,8	27,5	36,2	0,42	56,2	33,1	7,6	8	1,077
	EB-14	5,5	20,4	38,1	0,67	62,0	30,9	7,0	8 1/2	1,079
	EB-16	6,0	23,0	29,9	0,64	61,1	30,9	6,0	8	1,060
	EB-17	2,0	22,6	34,1	0,63	60,2	32,8	9,5	8	1,063
	EB-19	2,35	27,9	21,8	1,13	74,6	31,6	4,4	8 1/2	1,083
	Ø	4,05	23,5	29,8	0,68	66,6	31,9	5,6	8 1/2	1,072
18	EB-7	8,5	28,4	14,4	0,50	86,4	34,7	4,8	8	1,067
	EB-8	1,95	27,7	29,3	0,71	63,8	32,8	7,4	8	1,031
	EB-10	6,0	27,1	12,0	0,37	90,5	30,6	4,5	7 1/2	1,028
	EB-11	6,0	27,8	18,2	0,25	78,9	32,3	4,8	8	1,063
	EB-12	5,3	22,2	33,8	0,74	54,0	31,8	6,7	8 1/2	1,089
	EB-13	4,7	25,8	17,5	0,41	78,1	32,4	5,4	7 1/2	1,057
	EB-14	5,2	26,4	17,8	0,56	80,9	32,4	4,7	8	1,061
	EB-16	6,3	23,2	33,5	0,67	54,2	32,7	6,4	8	1,089
	EB-17	1,7	27,6	7,3	0,79	93,8	32,3	3,0	8 1/2	1,083
	EB-19	1,7	24,1	34,9	0,61	55,9	34,2	9,3	7 1/2	1,092
	Ø	4,7	26,0	21,1	0,52	74,9	32,6	5,4	8	1,068
19	EB-8	10,3	25,4	31,0	0,66	60,0	36,3	6,3	8	1,054
	EB-11	7,4	24,9	25,8	0,69	69,9	34,4	6,7	8	1,071
	EB-12	1,2	21,2	37,8	0,88	56,9	30,6	9,3	8	1,076
	EB-13	1,9	23,4	35,9	0,81	49,6	34,6	9,8	8	1,067
	EB-14	4,5	25,2	31,2	0,70	63,6	35,0	6,2	8	1,069
	EB-16	3,5	20,5	48,0	0,97	33,1	35,2	10,6	7	1,091
	EB-17	2,3	28,0	19,5	1,17	81,8	33,3	5,9	8	1,053
	Ø	4,5	24,6	31,4	0,76	60,6	35,0	7,3	8	1,066
20	EB-9	5,8	24,4	37,6	0,93	54,0	37,6	9,2	6 1/2	1,059
	EB-11	4,8	26,0	32,9	0,63	61,8	36,3	8,4	8	1,068
	EB-13	2,6	22,2	41,8	0,45	43,7	36,0	11,2	7	1,070
	EB-14	2,0	14,7	63,6	0,43	23,9	34,4	8,5	8	1,060
	EB-17	2,0	28,3	21,9	0,70	78,6	34,8	9,6	7	1,090
21	EB-13	3,8	39,5	34,2	0,44	54,0	36,5	7,5	7 1/2	1,072

Average by weight

TABLE 4. DRILL HOLE SUMMARY

b) Hydraulic Mine Area

Seam	Drill-Hole #	Yield %	Volat. Matt. dab	Ash % db	Swell. Index	G-Val.
2	EB 31	73,5	20,80	7,10	8 1/2	0,970
	EB 47	8,8	21,10	8,10	7 1/2	0,981
	EB 52	65,9	20,45	8,25	9	1,023
	EB 53	59,5	21,1	9,2	9	1,023
	Ø	52,0	20,9	8,2	8 1/2	0,999
3	EB 31	67,8	19,1	8,6	3 1/2	-
	EB 36	51,6	18,9	8,6	3 1/2	-
	EB 47	30,7	21,4	6,1	9	1,023
	EB 51	38,0	-	-	3	-
	EB 52	85,8	25,2	6,6	9	1,058
	EB 53	97,7	21,2	5,7	8	0,964
	Ø	61,9	21,2	7,1	6	1,015
4	EB 31	67,8	19,1	8,6	3 1/2	-
	EB 36	51,6	18,9	8,6	3 1/2	-
	EB 47	81,5	19,1	7,9	2	-
	EB 51	38,0	-	-	3	-
	EB 52	85,8	25,2	6,6	9	1,058
	EB 53	80,6	18,9	10,7	3	-
	Ø	67,6	20,2	8,5	4	-
6	EB 31	54,2	21,2	16,2	8	1,017
	EB 36	78,4	21,0	7,3	9	0,996
	EB 47	15,7	20,7	9,7	3	-
	EB 51	11,	-	-	8	1,026
	EB 52	45,8	20,1	5,7	8 1/2	1,068
	EB 53	93,4	19,9	8,3	3 1/2	-
	Ø	49,8	20,6	9,4	6 1/2	1,027
7	EB 31	65,0	20,7	7,8	2 1/2	-
	EB 36	11,1	20,8	8,4	9	0,997
	EB 47	54,0	22,1	8,1	7	-
	EB 51	87,4	20,3	3,3	9	1,028
	EB 53	59,4	21,3	9,7	7 1/2	0,892
	Ø	55,4	21,0	7,5	7	0,972
8	EB 31	54,4	20,5	9,2	3 1/2	-
	EB 36	62,8	20,8	8,4	4 1/2	-
	EB 47	90,1	21,7	7,0	7	-
	EB 53	91,7	21,3	6,1	6	-
	Ø	74,8	21,1	8,2	5 1/2	-
9	EB 27	81,6	26,4	6,2	9	1,065
	EB 31	59,8	22,1	7,2	9	1,044
	EB 36	25,1	22,4	14,5	8	-
	EB 47	70,8	21,1	9,1	3	-
	Ø	59,3	23,0	9,3	7	1,056
10	EB 27	78,0	28,1	5,7	9	1,056
	EB 31	75,3	22,5	7,4	7 1/2	1,020
	EB 36	41,5	20,7	7,7	3	0
	EB 47	60,5	22,1	7,1	7 1/2	0,994
	Ø	63,8	23,4	7,0	7	1,023
12	EB 27	68,8	29,5	6,6	9	1,069
	EB 31	72,4	24,8	5,9	9	1,050
	EB 36	37,4	23,6	10,3	8 1/2	0,864
	EB 47	46,6	23,6	7,6	9	1,052
	Ø	56,3	25,4	7,6	9	1,009
13	EB 27	88,8	30,0	4,2	9	1,062
	EB 36	57,9	25,6	7,0	9	1,049
	EB 42	45,6	24,7	9,0	9	1,022
	Ø	64,1	26,8	6,7	9	1,044
14	EB 27	93,0	32,5	3,4	9	1,072
	EB 33	92,5	25,8	4,0	9	1,037
	EB 42	91,5	20,8	6,3	8 1/2	0,995
	Ø	92,3	26,4	4,6	9	1,035
15	EB 33	85,3	28,8	4,3	9	1,149
	EB 39	94,0	29,0	3,1	9	1,052
	EB 42	47,5	26,1	4,9	9	1,036
	Ø	75,6	28,0	4,1	9	1,079
16	EB 33	38,9	29,6	8,3	9	1,076
	EB 39	22,0	28,1	6,6	8	1,043
	Ø	30,5	28,9	7,5	8 1/2	1,060
17	Ø EB 39	44,8	30,9	5,6	7	1,058
18	Ø EB 39	66,8	32,0	4,7	8	1,069

Arithmetic Average

ELCO MINING LIMITED PAGE

TABLE 5 except See 361.2 App-3

ELK RIVER COAL PROJECT

RESULTS OF TESTS ON CHANNEL SAMPLES (BIRTLEY ENGINEERING - 1975)

SEAM		2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	18
Raw Coal																	
Volatile Matter (db)	%	15.5	13.6	14.9	12.1	16.9	13.9	15.8	18.0	17.8	16.9	14.4	18.3	18.0	20.9	22.3	25.9
Volatile Matter (dab)	%	25.0	21.2	21.7	27.4	20.1	25.2	23.2	23.2	24.5	27.1	34.2	29.7	32.9	32.4	33.6	37.5
Ash Content (db)	%	37.9	35.8	31.2	55.9	16.1	44.9	31.9	22.3	27.2	37.6	57.9	39.3	45.2	35.5	33.5	31.0
Fixed Carbon (db)	%	46.3	50.7	77.7	32.0	67.1	41.2	52.3	59.7	55.1	45.6	55.3	42.0	40.1	48.4	44.1	43.2
Sulphur Content (db)	%	0.50	0.38	0.31	0.46	0.70	0.39	0.35	0.33	0.32	0.62	0.81	0.69	0.61	0.65	0.63	0.55
Screen Size-																	
6.35-0.2 mm	%	86.9	85.7	84.2	90.6	95.3	83.2	87.2	90.6	84.0	89.7	91.5	93.6	89.8	89.1	89.7	90.0
- 0.2 mm	%	13.1	14.3	15.8	9.4	4.7	16.8	12.8	9.4	16.0	10.3	8.5	6.4	10.2	10.9	10.3	10.0
Clean Coal																	
(Size Fraction 6.35-0.2 mm)																	
Yield at 1.5 g/cm^3 S.G.	%	54.7	58.0	52.9	15.3	71.3	37.9	59.4	69.2	67.5	48.2	33.1	49.3	44.2	55.7	59.7	62.0
Volatile Matter (db)	%	19.2	19.2	18.8	21.1	17.4	18.8	19.8	19.7	20.9	22.6	24.1	26.7	26.5	28.9	30.3	31.1
Volatile Matter (dab)	%	21.1	20.6	20.3	23.2	19.3	20.6	21.2	21.2	22.3	24.3	26.5	29.4	28.6	31.3	32.0	32.8
Ash Content (db)	%	9.1	6.7	7.2	3.3	9.7	8.7	6.8	6.9	6.1	7.2	9.0	5.9	7.2	7.8	5.4	5.1
Fixed Carbon (db)	%	71.6	74.1	73.7	69.6	72.9	72.5	73.4	73.4	72.9	70.3	66.8	67.4	66.3	63.4	64.3	63.7
Sulphur Content (db)	%	0.59	0.77	0.45	1.03	0.78	0.88	0.72	0.50	0.50	0.87	1.19	0.93	0.82	0.84	0.81	0.90
Phosphorus Content (db)	%																
Swelling Index		8-1/2	7-1/2	4-1/2	8	3	4-1/2	6	5-1/2	8	9	9	9	9	8	8-1/2	9
Ruhr Dilatometer Test																	
Softening Temperature	°C.	378	408	425	411	432	429	409	411	410	391	396	372	397	384	335	395
Resolidification Temp.	°C.	429	466	476	464	-	-	474	468	471	453	467	451	458	446	453	440
Contraction	%	22	24	16	24	14	14	19	18	17	21	19	22	26	23	27	20
Dilatation	%	36	4	-10	69	-14	-14	-17	-17	0	83	123	256	94	140	164	65
G-Value		1.015	0.955	0.803	1.030	0	0	0.430	0.306	0.935	1.046	1.055	1.088	1.042	1.057	1.062	1.029

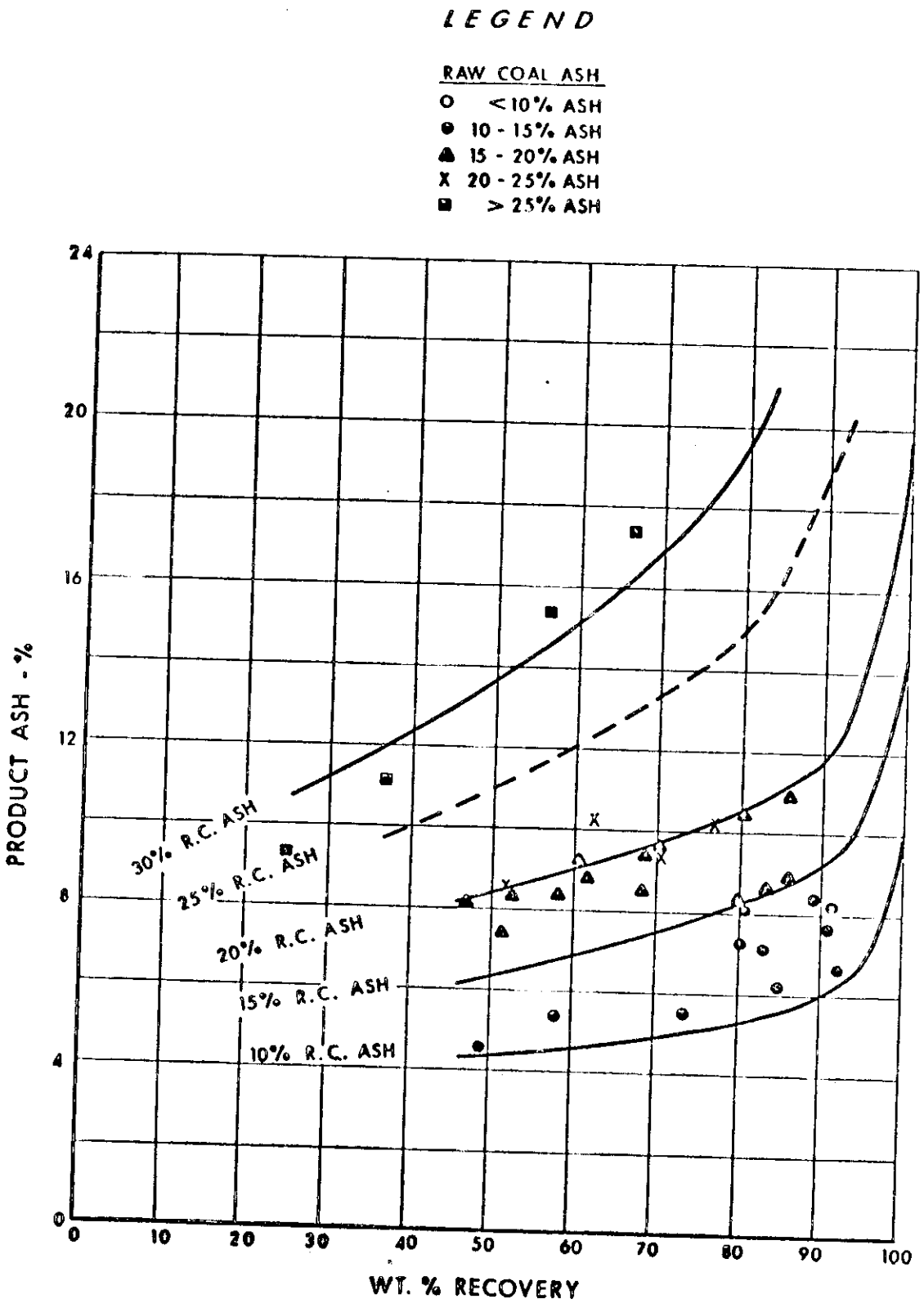
ELCO MINING LIMITED TABLE 5 averages (see Vol. 2 App 3) PAGE

ELK RIVER COAL PROJECT / RESULTS OF TESTS ON CHANNEL SAMPLES (MONTAN CONSULTING 1975)

		2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	18	Blend+ A	Blend+ C
RAW COAL																			
VOLATILE MATTER (db)	%	15.0	13.2	14.3	12.1	16.6	13.3	14.5	16.7	17.4	16.1	13.9	18.1	16.7	20.3	22.2	24.7		
VOLATILE MATTER (dab)	%	23.5	19.0	20.6	25.1	19.8	23.3	21.7	22.3	23.4	27.0	30.1	30.4	30.7	31.7	33.0	37.1		
ASH CONTENT (db)	%	36.5	36.3	30.6	51.7	16.3	42.9	33.5	25.2	25.7	40.4	53.8	40.4	45.6	35.8	32.7	33.5		
FIXED CARBON (db)	%																		
SULPHER CONTENT (db)	%	0.46	0.41	0.39	0.61	0.69	0.44	0.38	0.39	0.40	0.68	0.93	0.77	0.66	0.75	0.91	0.62		
PHOSPHOROUS CONTENT (db)	%	0.021	0.114	0.030	0.057	0.090	0.062	0.072	0.030	0.059	0.087	1.110	0.069	0.087	0.107	0.090	0.074		
SCREEN SIZE																			
6.3 - 0.2 mm	%	87.0	84.4	84.8	88.9	75.4	84.2	86.8	91.9	89.4	85.6	90.3	90.9	89.5	88.5	89.7	89.0		
- 0.2 mm	%	13.0	15.6	15.2	11.1	24.6	15.8	13.2	8.1	10.6	14.4	9.7	9.1	10.5	11.5	10.3	11.0		
HARDGROVE GRINDABILITY INDEX	Δ H	92	105	97	74	92	88	87	83	83	79	90	87	80	32	78	86		
GROSS CALORIFIC VALUE (db)	kcal/Kg	5134	5243	5663	3755	6958	4525	5415	6088	6053	4763	3586	4750	4221	5130	5350	5292		
ASH FUSION (OXID ATMOSPHERE)																			
INITIAL DEFORMATION TEMP.	°C	1295	1347	1337	1350	1300	1325	1315	1360	1315	1317	1263	1276	1275	1271	1226	1190		
SOFTENING TEMP. SPHERICAL	°C	1545	1573	1597	1640	1600	1620	1615	1655	1635	1593	1516	1580	1540	1520	1437	1290		
FLUID TEMP.	°C	1580	1627	1625	1650	1640	1640	1640	>1675	1675	1620	1570	1606	1565	1561	1479	1335		
CLEAN COAL(SIZE FRACTION 6.3 - 0.12mm)																			
YIELD AT 1.45 g/cm^3	%	44.4	57.0	58.9	14.5	69.8	32.0	55.1	63.8	65.4	42.2	28.6	47.1	37.2	52.0	58.9	57.6		
VOLATILE MATTER (db)	%	18.8	18.2	17.0	19.6	17.1	17.7	18.5	18.7	20.6	22.8	23.7	26.3	25.4	28.1	29.3	31.0		
VOLATILE MATTER (dab)	%	20.5	19.3	18.2	21.2	18.5	19.4	19.7	19.9	21.9	24.2	25.6	27.9	27.1	30.1	30.8	32.7		
ASH CONTENT (db)	%	8.2	5.7	6.8	7.5	7.7	8.8	6.0	6.2	5.8	6.0	7.5	5.6	6.3	6.7	4.9	5.2		
FIXED CARBON (db)	%																		
SULPHER CONTENT (db)	%	0.56	0.51	0.47	1.10	0.70	0.63	0.48	0.49	0.46	0.58	1.14	0.88	0.83	0.87	0.83	0.77		
PHOSPHOROUS CONTENT (db)	%	0.012	0.052	0.015	0.074	0.106	0.048	0.047	0.022	0.030	0.047	0.060	0.060	0.050	0. 090	0.050	0.043		
SWELLING INDEX		8	7	2½	9	3½	4	6	3½	6	8½	8½	8½	7½	8	8	8		
RUHR DILATOMETER TEST																			
SOFTENING TEMP.	°C	385	396	410	391	419	414	406	414	402	386	381	365	371	362	364	357		
RESOLIDIFICATION TEMP.	°C	460	472	471	476	-	-	480	491	476	470	471	469	455	462	461	458		
CONTRACTION	%	31	28	23	22	27	34	31	33	34	27	28	27	31	34	35	33		
DILATATION	%	23	2	-3	53	-	-	-19	-24	-13	85	125	183	73	116	125	159		
G - VALUE		0.987	0.834	0.896	1.042	-	-	0.743	0.697	0.841	1.052	1.063	1.102	1.044	1.065	1.070	1.089		
GIESELER PLASTOMETER TEST																			
MAX. FLUIDITY	DDPM	237	14	11	71	-	2	5	3	7	212	549	1419	249	1483	1918	3100		
MACERAL ANALYSIS																			
VITRINITE	%	35	58	45	89	31	51	52	48	55	74	76	77	64	66	72	79		
EXINITE	%	0	0	0	0	0	0	0	0	0	1	1	5	3	5	6	8		
INERTINITE	%	58	42	50	4	65	42	42	48	47	19	14	13	29	21	19	9		
MINERAL MATTER	%	7	4	5	7	4	8	6	4	7	6	9	5	4	8	3	4		
MEAN REFLECTANCE OF VITRINITE	%	1.46	1.49	1.44	1.38	1.44	1.45	1.45	1.41	1.32	1.32	1.20	1.16	1.14	1.01	0.98	0.94		
VOLATILE MATTER OF VITRINITE (dab)	%	23	22	23	24	23	23	23	23	25	25	28	29	29	32	34	35		

+) Calculated from data of Single seams

Figure 6: FROTH FLOTATION TEST RESULTS (1975)
Product Ash vs. Recovery as a Function of Raw Coal Ash Content (65 Mesh x 0)



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TECHMAN LTD. Jan./76

5.3. Bulk Samples

5.3.1. Washability

The washability data on the coarse coal fractions above 65 mesh (0.2 mm) was compiled by BIRTLEY ENGINEERING. For details refer to the report on Birtley Engineering on "Analyses and Washing of Bulk Samples from the Elk River Deposit" of January 1976.

5.3.2. Froth Flotation Test

The results of the froth flotation tests on the fine coal fraction below 65 mesh (0.2 mm) are plotted as Figure 6. For details refer to the report of Birtley Engineering on "Analyses and Washing of Bulk Samples from the Elk River Deposit" of January 1976. In general, for the same raw coal ash content level, the as content of the minus 65 mesh (0.2 mm) coal is lower at recoveries above 75% than it was for tests conducted on 28 mesh x 0 (0.6 - 0 mm) coal in 1971.

Overall, a good low ash fine coal product can be expected for Elk River coal which is not the usual case for Western Canadian coals. Froth ash contents below 9 - 10% are unusual.

5.3.3. Pilot Plant Washing

The results of the pilot plant washing tests were compiled by Birtley Engineering. For details refer to the report of Birtley Engineering on "Analysis and Washing of Bulk Samples from the Elk River Deposit" of January 1976.

The test results of the single seams and of the two composites prepared according to mining plan A and C of Birtley Engineering have been summarized in Table 7 for raw coal and in Table 8 for clean coal. The clean coal was also tested by the Canadian Metallurgical Research Institute, Ottawa. The results are given in Table 9.

ELCO MINING LIMITED

PAGE

TABLE 7

ELK RIVER COAL PROJECT

see also Appendix 3 of Vol. 2

ANALYSIS OF RAW COALS FROM BULK SAMPLES (BIRTLEY ENGINEERING - 1975)

SEAM			2	3	4	6	7	8	9	10	12	13	14	15	16	17	18	BLEND A	BLEND C
Volatile Matter (db)	%		15.1	16.2	16.1	16.7	15.8	16.4	18.6	18.9	17.1	13.8	16.9	17.8	20.0	22.1	23.4	17.7	16.6
Volatile Matter (dab)	%		(24.2)	(20.8)	(23.0)	(21.9)	(23.7)	(23.8)	(24.5)	(24.7)	(29.9)	(32.5)	(33.9)	(32.3)	(32.8)	(34.7)	(35.8)	(26.2)	(25.2)
Ash Content (db)	%		37.4	22.1	27.9	24.0	33.5	31.2	24.1	23.5	42.8	57.6	50.3	44.7	40.0	36.3	34.5	32.3	34.1
Fixed Carbon (db)	%		47.5	61.7	56.0	59.3	50.7	52.4	57.3	57.6	40.1	28.6	32.8	37.5	40.0	41.6	42.1	50.0	49.3
Sulphur Content (db)	%		0.39	0.44	0.34	0.72	0.56	0.48	0.28	0.39	0.55	0.75	0.98	0.64	0.79	0.72	0.58	0.46	0.46
Screen Size - 0.6 mm	%		32.9	37.7	23.8	33.2	33.0	23.0	18.8	32.9	20.6	17.0	17.6	18.0	23.6	14.8	19.6	21.4	28.2
Hardgrove Grindability Index	ΔH		88	109	96	84	91	91	92	82	74	74	64	78	77	72	82	83	83
Gross Calorific Value (db)	Kcal/kg		5275	6789	6227	6600	5860	5860	6377	6397	4573	3417	4192	4504	4943	5371	5457	5655	5560
Ash Fusibility (Oxid. Atmosphere)																			
Initial Deformation Temp.	°C.		>1445	1390	>1470	1375	>1470	>1470	1470	>1445	1470	1430	1470	1430	1390	1470	1310	>1470	>1470
Softening Temp. Spherical	°C.			>1445		>1445			>1470		>1470	1470	>1470	1470	1470	1470	1340		
Softening Temp. Hemispherical	°C.											>1470		>1470	>1470		1380		
Fluid Temperature	°C.																1450		

ELCO MINING LIMITED TABLE 8 PAGE

ELK RIVER COAL PROJECT

ANALYSIS OF CLEAN COALS FROM BULK SAMPLES (BIRTLEY ENGINEERING 1975)

SEAM		2	3	4	6	7	8	9	10	12	13	14	15	16	17	18	BLEND A	BLEND C
Volatile Matter (db)	%	19.4	18.7	17.9	18.3	18.6	18.6	19.5	21.0	21.7	22.6	25.1	25.0	26.5	28.3	29.4	21.6	20.1
Volatile Matter (dab)	%	21.4	20.6	19.6	20.4	20.9	20.5	21.3	23.2	24.0	25.5	27.2	27.2	29.7	30.7	31.6	23.7	22.2
Ash Content (db)	%	9.3	9.3	8.4	10.4	10.8	9.3	8.6	9.3	9.8	11.3	7.9	7.9	10.7	7.2	7.2	8.8	9.5
Fixed Carbon (db)	%	71.3	72.0	73.7	71.4	70.6	72.1	71.9	69.7	68.5	66.1	67.0	67.1	62.8	64.5	63.4	70.2	70.6
Sulphur Content	%	0.50	0.53	0.35	0.64	0.56	0.40	0.38	0.45	0.68	0.96	0.84	0.86	0.70	0.72	0.75	0.65	0.48
Phosphorous Content (db)	%	0.019	0.139	0.025	0.12	0.044	0.065	0.029	0.025	0.047	0.057	0.051	0.044	0.093	0.068	0.043	0.047	0.051
Screen Analysis																		
+ 12.5 mm	%	1.3	0.8	2.4	2.7	1.2	3.1	4.9	4.8	2.5	4.9	4.0	4.3	1.9	2.9	5.3	4.6	4.3
12.5 - 6.35 mm	%	9.3	7.0	17.2	11.7	6.8	15.9	16.0	12.9	12.6	23.8	21.3	21.8	8.8	15.5	24.1	21.0	11.4
6.35 - 2.4 mm	%	15.8	22.6	27.2	24.7	13.6	24.3	22.6	22.7	22.7	17.2	21.2	14.9	21.4	29.4	15.9	25.6	31.0
2.4 - 0.6 mm	%	29.2	35.2	34.0	36.6	26.9	30.2	31.5	40.1	36.8	31.0	29.1	23.3	34.7	32.9	22.2	32.8	31.5
0.6 - 0.2 mm	%	21.3	17.3	8.7	13.2	26.8	12.8	12.3	11.2	12.0	13.6	10.5	14.8	9.0	8.6	24.3	7.7	11.6
- 0.2 mm	%	23.1	17.1	10.5	11.1	24.7	13.7	12.7	8.3	13.4	10.4	13.9	20.9	24.2	10.7	8.3	8.3	10.2
Swelling Index		9	8	4	3-1/2	6	6-1/2	6	7-1/2	9	8-1/2	9	8-1/2	8	8	8-1/2	7-1/2	7
Ruhr Dilatometer Test																		
Softening Temperature	°C	400	415	434	422	420	416	414	416	398	396	394	384	379	377	390	405	408
Resolidification Temp	°C	461	474	-	-	-	475	461	474	461	462	459	459	456	455	460	462	455
Contraction	%	21	19	14	16	19	21	23	20	12	23	23	30	25	13	25	16	17
Dilatation	%	59	25	-14	-16	-19	-16	-18	-16	78	103	209	105	127	145	187	20	-8
G-Value		1.027	1.009	0	0	0	0.671	0.694	0.630	1.057	1.051	1.064	1.052	1.065	1.085	1.067	1.007	0.966
Ultimate Analysis (dab)																		
Carbon	%	93.1	93.4	95.1	93.0	96.3	92.6	93.9	93.5	92.9	93.7	93.5	92.9	92.7	94.4	94.6	94.3	93.6
Hydrogen	%	4.9	5.0	4.9	4.7	5.0	4.9	4.9	5.2	5.2	5.4	5.7	5.5	5.7	5.8	6.1	5.2	5.0
Nitrogen	%	1.4	1.1	1.3	1.3	1.2	1.4	1.4	1.7	1.7	1.8	2.0	1.9	1.7	1.8	2.1	1.6	1.5
Oxygen	%	3.6	3.3	3.4	3.6	3.5	4.0	3.6	4.2	3.7	4.5	4.3	4.6	4.4	5.2	5.5	3.3	3.8
Hardgrove Grindability Index	ΔH	109	118	107	93	106	93	84	82	99	107	100	100	87	76	95	97	99
Ash Analysis																		
SiO_2	%	66.04	50.52	56.94	54.83	56.80	57.54	56.14	56.56	61.68	64.56	59.36	60.30	55.02	54.84	57.48	58.26	56.50
Al_2O_3	%	24.06	27.71	28.16	26.57	30.92	29.92	31.62	28.46	26.09	26.44	23.82	23.44	21.93	21.17	24.19	23.82	23.92
Ti_2O_3	%	4.68	9.65	9.65	5.72	6.43	6.50	7.15	8.29	5.50	5.36	8.15	8.51	12.65	16.42	10.08	8.08	11.33
TiO_2	%	1.88	1.69	1.96	1.55	2.17	1.82	2.42	1.84	2.31	2.11	2.06	2.39	1.97	1.75	1.99	1.64	1.78
P_2O_5	%	0.47	3.40	0.68	2.70	0.99	1.59	0.77	0.62	1.09	1.15	1.48	1.29	2.00	2.19	1.40	1.30	1.21
CaO	%	0.62	4.90	0.70	2.87	0.50	1.54	0.67	0.64	0.58	0.59	1.54	1.36	1.92	1.96	1.40	0.92	0.92
MgO	%	0.17	0.17	0.30	0.25	0.27	0.20	0.18	0.27	0.20	0.23	0.30	0.27	0.40	0.27	0.36	0.86	0.95
SO_3	%	0.24	0.27	0.21	0.60	0.31	0.21	0.30	0.35	0.33	0.27	0.46	0.48	0.67	0.43	0.33	0.56	0.56
Na_2O	%	0.04	0.05	0.03	0.07	0.05	0.04	0.08	0.06	0.04	0.08	0.07	0.07	0.08	0.07	0.06	0.09	0.10
K_2O	%	0.14	0.13	0.01	0.26	0.26	0.14	0.25	0.18	0.34	0.71	0.60	0.57	0.69	0.47	0.60	0.84	0.76

ELK RIVER PROJECT

TABLE 9

Coal Analysis obtained on clean coal at Ottawa in 1975

Seam		2	3	4	6	7	8	9	10	12	13	14	15	16	17	18	Blend A	Blend C
Volatile Matter (db)	%	20.6	19.8	18.8	17.9	19.0	19.7	20.3	21.8	23.4	24.0	26.8	26.9	27.3	29.5	31.2	20.5	20.6
Volatile Matter (dab)	%	22.7	22.0	20.5	20.0	21.2	21.7	22.3	24.1	25.8	26.8	29.0	29.1	30.7	32.1	33.7	22.5	22.7
Ash Content (db)	%	9.4	9.9	8.3	10.4	10.2	9.3	9.0	9.7	9.3	10.7	7.5	7.5	11.1	8.0	7.5	8.7	9.3
Fixed Carbon (db)	%	70.0	70.3	72.9	71.7	70.8	71.0	70.7	68.5	67.3	65.3	65.7	65.6	61.6	62.5	61.3	68.8	70.1
Sulphur Content (db)	%	0.56	0.51	0.43	0.66	0.61	0.46	0.45	0.42	0.75	1.00	0.83	0.79	0.83	0.81	0.78	0.56	0.57
Phosphorous Content (db)	%																0.050	0.058
Screen Size - 3.15 mm	%	82.9	81.8	64.3	61.3	82.7	60.3	64.4	65.1	65.6	62.6	65.0	70.7	77.4	68.8	71.1	61.2	61.9
Swelling Index		8	7 1/2	2.1/2	1 1/2	4	4	3 1/2	5 1/2	8 1/2	8 1/2	8	8	7	7 1/2	7 1/1	6 1/2	6
Ruhr Dilatometer Test																		
Softening Temperature	°C	400	410	409	428	423	417	419	418	398	396	384	390	385	381	377	406	410
Resolidification Temperature	°C	483	489	-	-	-	-	-	-	475	473	472	477	476	472	471	483	490
Contraction	%	30	29	22	19	29	26	23	27	32	28	28	27	25	28	29	22	23
Dilatation	%	42	8	-	-	-	-	-	-	52	92	197	93	86	120	173	1	-18
G - Value		1.015	0.952	0	0	0	0	0	0	1.021	1.049	1.083	1.058	1.061	1.071	1.085	0.926	0.578
Gieseler Plastometer Test																		
Max. Fluidity	DDPM	73	72	0.9	0.6	1.3	1.4	1.7	1.7	75	166.5	697	207	350	733	2050	8.2	4.0
Linear Expansion *)	%	-5.3	-5.0	-12.3	-10.7	-5.4	-5.9	-9.6	-4.5	0.9	-4.8	-2.0	-4.6	-10.5	-12.6	-11.7	-9.2	-10.3
Ultimate Analysis (dab)																		
Carbon	%	90.0	89.4	90.9	90.1	89.6	89.3	89.0	89.3	88.4	87.4	87.7	88.4	87.1	87.3	86.0	88.7	89.3
Hydrogen	%	5.0	4.7	4.7	4.7	4.8	4.7	4.7	5.0	5.1	5.1	5.4	5.2	5.3	5.4	5.5	4.9	5.0
Nitrogen	%	1.4	1.3	1.3	1.2	1.3	1.3	1.4	1.6	1.7	1.7	1.8	1.6	1.7	1.7	1.8	1.5	1.4
Oxygen	%	3.1	4.1	3.6	3.2	3.6	4.1	4.3	3.8	4.0	4.2	4.2	3.9	5.1	4.7	5.8	4.2	3.6
Chlorine	(db) %	0.020	0.010	0.010	0.010	0.005	0.000	0.002	0.002	0.000	0.000	0.000	0.005	0.009	0.010	0.007	0.000	0.005
Petrographic Analysis																		
Vitrinite	%	56.3	53.9	36.1	42.4	55.6	41.7	45.2	48.0	72.8	67.7	81.2	66.6	62.6	71.9	75.7	56.1	48.3
Exinite	%	0	0	0	0	0.1	0	0	0	0	0	0.2	0.7	2.2	4.3	4.0	1.0	0.1
Inertinite	%	1.9	1.2	2.2	1.6	1.5	1.0	2.0	1.3	1.3	1.0	1.7	2.9	1.7	1.9	1.8	2.3	1.5
Mineral Matter	%	5.7	5.6	4.6	5.9	5.8	5.2	5.1	5.5	5.3	6.2	4.3	4.3	6.4	4.6	4.3	4.9	5.3
Semi Fusinite	%	29.9	32.4	42.9	36.9	30.0	39.8	36.4	33.5	15.2	19.5	9.1	19.6	19.9	12.5	9.1	25.8	35.1
Mean Reflectance of Vitrinite	%	1.43	1.45	1.43	1.42	1.44	1.40	1.36	1.32	1.26	1.19	1.15	1.12	1.05	1.01	0.98	1.26	1.31
Hardgrove Grinability Index	ΔH																	
Gross Calorific Value (db)	kcal/kg	7870	7806	7929	7715	7740	7820	7806	7756	7815	7681	7979	7909	7573	7898	7937	7859	7803
Ash Fusion																		
Mitial Deformation Temp.	°C	1477	1232	1416	>1482	1399	>1482	>1482	1343	1427	1416	1316	1293	1177	1154	1243	1427	1415
Softening Temp. Spherical	°C	>1482	1410	>1482		>1482			>1482	>1482	>1482	1460	1449	1343	1304	1433	>1482	>1482
Softening Temp. Hemispherical	°C		1466									>1482	>1482	1410	1377	>1482		
Fluid Temp.	°C		>1482											1483	1410			
Ash Analysis																		
SiO_2	%																	
Al_2O_3	%																	
Fe_2O_3	%																	
TiO_2	%																	
P_2O_5	%																1.32	1.44
CaO	%																	
MgO	%																	
SO_3	%																	
Na_2O	%																0.12	0.12
K_2O	%																0.71	0.66
Calculated ASTM Stability Index		52.2	49.8	24.0	33.0	51.3	35.0	40.0	43.1	62.3	60.4						52.8	46.6

The pilot plant performance is shown in Table 10.

The purpose of these pilot plant washings was to produce clean coal samples, for semi-industrial coke oven tests and to gain an indication on the quality of the product that can be achieved in a commercial preparation plant. This pilot testing may not be interpreted as an equipment performance evaluation, although some of the results can be used as guidelines for plant design.

The overall plant yield of 51.7% at 8.9% product ash is very low, the reasons being as follows:

1. The raw coal mixing and handling section of the pilot plant had a considerable amount of spillage.

2. For the initial part of the run, the plant was operated at a lower specific gravity cut point than was optimum. As a result some coal was lost.

3. During the operation of the heavy media cyclone, the feed pressure often fluctuated and sometimes even caused the cyclone to collapse sending all the material to refuse. Furthermore, the cyclone feed rate is about 3 t/h whereas the cyclone capacity is 35 t/h. The equipment has therefore an extensive excess of capacity.

4. The sieve bend screen on cyclone overflow cooked periodically during the first few bulk tests until an improvised rapper was constructed which helped to improve the recovery within the 28 x 65 mesh (0.6 - 0.2 mm) fraction.

5. The froth flotation pulp was held back until a 10% by weight of solids was achieved and then fed to the froth cells. The froth cells were then well attended throughout the run and the reagent addition adjusted accordingly. Since Western Canadian coals are very hydrophobic, the added pulp circu-

Table 10: PILOT PLANT PERFORMANCE

(*Totals in Percent)

SEAM NO.	HEAVY MEDIA CIRCUIT			WATER CYCLONE CIRCUIT			FROTH FLOTATION		PRODUCT			FEED
	ACTUAL YIELD	THEOR-ETICAL YIELD	ASH	ACTUAL YIELD	THEOR-ETICAL YIELD	ASH	ACTUAL YIELD	ASH	ASH BAL-ANCE YIELD	ACTUAL COMB-INED YIELD	COMB-INED ASH	ASH
2	36.2	44	8.3	75.3	82	11.9	67.5	8.6	49.0	34.1	9.2	37.2
3	78.8	83	8.3	79.9	95	8.7	92.8	12.2	81.6	85.0	9.3	21.9
4	71.7	71.5	8.1	59.1	86	8.1	80.0	9.9	68.6	68.6	8.3	27.7
6	55.9	67	9.8	74.0	92	11.4	87.5	10.8	72.4	44.6	10.3	23.8
7	27.4	45	9.8	70.1	75	13.6	75.9	8.4	51.7	32.0	10.6	33.1
8	61.3	64	9.5	78.2	88	7.7	77.0	6.0	72.0	56.4	9.3	31.0
9	75.2	73	8.6	91.2	97	7.4	82.6	7.1	78.0	61.7	8.6	17.1
10	70.9	76	8.8	89.8	95	7.5	76.8	5.5	79.9	64.6	9.2	23.2
12	49.2	46	8.2	64.4	83	9.2	67.0	9.5	54.1	51.9	9.8	42.5
13	21.8	24	9.2	57.6	58	10.2	63.3	11.7	33.9	19.7	11.1	57.1
14	41.3	42	7.1	63.9	69	6.7	83.2	8.4	46.4	44.3	7.8	49.8
15	41.7	42	8.3	---	75	7.2	64.9	7.5	48.2	44.7	7.8	44.3
16	44.3	53	9.1	76.4	85	13.0	75.2	12.3	54.0	53.1	10.6	39.7
17	58.8	70	8.2	82.2	87	8.1	84.4	9.4	53.3	54.3	6.9	35.9
18	57.3	55	6.6	68.6	90	9.7	84.6	9.8	63.6	61.2	7.0	34.2
Average	52.8	57.0	8.5	68.7	83.8	9.4	77.5	9.1	60.4	51.7	9.1	34.6
Wt. Avg.												
Scheme 'A'	55.8	58.5	8.4	72.7	84.5	8.9	76.6	8.8	62.0	53.7	8.9	33.8
Scheme 'C'	56.4	59.2	8.6	71.8	84.5	8.9	76.0	8.6	63.2	53.5	9.2	32.9
Composite												
Scheme 'A'	56.7	62.0	8.1	---	82.2	7.9	70.1	9.0	65.1	52.7	8.3	32.1
Scheme 'C'	57.5	56.0	8.9	---	80.8	7.0	81.6	9.8	66.7	50.0	9.5	33.9

lation probably improved the floatability of the coal. This, in actual operation the froth flotation recovery could be lower.

6. No accurate method other than ash balance was available for determining the weights of the feed and the various products.

7. Because the coal is very friable, fines were lost to the heavy and dilute media.

Overall, the ash balance is probably the best indicator of the commercial scale plant recovery. It may also be low because of the problems experienced in the heavy media cyclone circuit.

The two composite runs indicate that the clean coal yields of a commercial plant should be about 65% at 8.9 % product ash on a plant feed ash content of 28 6%.

5.3.4. Attrition Test

The results of the attrition test on raw coal of seams 3 and 6 conducted by Montan Consulting are summarized in Table 11.

It can be noted that the ash content of the fines fractions is much lower than obtained during the previously described test and experienced in Western Canadian coal mines, although during the attrition test a fines content of the coal was achieved that can be expected in practice for this kind of coal. The reason is that in the Harhoff drum the coal was desintegrated more severely than the hard rock and the rock material crushed the coal during rotation. The results are therefore unrealistic and cannot be used for designing the preparation plant.

ELCO MINING LIMITED

PAGE

ELK RIVER COAL PROJECT

TABLE 11 - RESULTS OF ATTRITION TESTS ON RAW COAL OF SEAMS 3 AND 6 (MONTAN CONSULTING 1975/76)

SEAM 3: RAW COAL CRUSHED TO 56% BELOW 0.5 MM

SCREEN SIZE	SCREEN SIZE OF ORIGINAL RAW COAL		SCREEN SIZE OF RAW COAL AFTER ATTRITION		SINK-FLOAT ANALYSIS OF DENSITY FRACTIONS																											
					< 1.30		1.30 - 1.35		1.35 - 1.40		1.40 - 1.45		1.45 - 1.50		1.50 - 1.55		1.55 - 1.60		1.60 - 1.70		1.70 - 1.80		>1.80 g/cm³		COAL < 1.45 g/cm³		MIDLINGS		REJECT >1.80 g/cm³		RAW COAL		
	Wt. %	Cum. Wt. %	Wt. %	Cum. Wt. %	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Wt. %	Ash (db)%	Cum. Ash %
50 - 20 mm	17.1	17.1	5.2	5.2	--	--	0.01	6.95	0.01	18.19	--	--	--	--	0.02	36.73	--	--	--	--	0.01	69.19	5.15	94.94	0.02	(12.57)	0.03	(47.55)	5.15	(94.94)	5.2	(94.35)	94.35
20 - 12 mm	10.5	27.6	2.7	7.9	0.10	4.81	0.03	8.09	0.10	11.91	0.06	18.44	--	--	0.04	27.72	0.01	53.87	0.03	39.02	0.02	47.98	2.31	93.23	0.29	(10.42)	0.30	(35.78)	2.31	(93.23)	2.7	(82.21)	90.20
12 - 10 mm	3.5	31.1	0.7	8.6	0.05	2.80	0.01	8.45	0.03	9.00	0.02	15.01	0.01	16.38	0.01	23.70	0.01	28.99	0.01	36.94	0.01	46.18	0.54	91.64	0.11	(7.22)	0.05	(30.44)	0.54	(91.64)	0.7	(74.00)	88.88
10 - 6 mm	2.8	33.9	1.5	10.1	0.26	2.70	0.03	8.45	0.15	13.96	--	--	0.01	24.07	0.02	28.56	0.01	31.82	0.04	40.86	0.03	49.81	0.90	88.11	0.49	(7.08)	0.11	(38.72)	0.90	(88.11)	1.5	(58.02)	84.30
6 - 3.15 mm	14.3	48.2	5.7	15.8	1.87	2.84	0.56	8.91	0.49	12.73	0.21	20.03	0.05	27.79	0.12	29.88	0.08	36.92	0.08	41.29	0.07	47.61	2.17	89.24	3.13	(6.63)	0.40	(36.41)	2.17	(89.24)	5.7	(40.17)	68.38
3.15 - 1 mm	21.0	69.2	13.2	29.0	5.75	3.01	2.75	8.94	0.63	13.25	0.74	20.76	0.26	25.71	0.37	40.19	0.16	49.81	0.35	64.96	0.16	75.16	2.03	90.17	9.87	(6.65)	1.30	(49.45)	2.03	(90.17)	13.2	(23.71)	48.05
1 - 0.5 mm	11.3	80.5	14.8	43.8	7.45	4.01	4.03	8.2	1.49	17.09	0.32	27.27	0.32	36.29	0.16	49.80	0.06	59.36	0.06	66.67	0.12	75.49	0.79	87.38	13.29	(7.32)	0.72	(50.20)	0.79	(87.38)	14.8	(13.68)	36.43
0.5 - 0.2 mm	10.1	90.6	28.6	72.4	12.72	1.65	5.27	5.21	5.15	11.48	2.17	17.01	1.24	18.70	0.19	21.09	0.31	32.60	0.31	38.03	0.25	53.08	0.99	79.21	26.31	(5.71)	2.30	(27.11)	0.99	(79.21)	28.6	(9.98)	25.98
0.2 - 0.063 mm	6.8	97.4	27.4	93.8	6.78	3.50	8.24	5.38	3.05	13.88	2.23	15.01	0.14	33.36	0.47	50.16	0.18	61.64	0.18	74.76	0.09	78.28	0.10	82.32	20.30	(7.09)	1.00	(56.83)	0.10	(82.32)	21.4	(9.76)	22.28
50 - 0.063 mm		97.4		93.8	34.98	(2.81)	20.98	(6.46)	11.10	(13.08)	5.75	(17.41)	2.03	(23.67)	1.34	(40.04)	0.82	(44.60)	1.06	(55.15)	0.76	(63.60)	14.98	(91.15)	72.81	(6.58)	6.01	(40.76)	14.98	(91.15)	93.8	(22.28)	22.28
Ultra Fines - Below 0.063 mm	2.6	100.0	6.2	100.0																											6.2	11.32	21.60
	100.0		100.0																												100.0	(21.60)	

SEAM 6: RAW COAL CRUSHED TO 32% BELOW 0.5 MM

50 - 20 mm	18.4	18.4	10.0	10.0	0.13	9.93	0.18	13.68	--	--	--	--	--	--	--	--	--	--	3.78	38.20	0.24	50.40	5.67	79.07	0.31	(12.11)	4.02	(38.93)	5.67	(79.07)	10.0	(60.86)	60.86
20 - 12 mm	11.2	29.6	8.3	18.3	0.29	6.12	2.19	8.38	0.23	13.46	0.52	19.72	0.37	24.79	0.26	30.77	0.32	38.31	0.30	43.64	0.25	59.10	2.57	79.54	4.23	(11.10)	1.50	(38.20)	2.57	(79.54)	8.3	(37.19)	50.12
12 - 10 mm	3.7	33.3	2.1	20.4	0.16	7.32	0.50	8.44	0.35	13.20	0.16	20.27	0.06	24.34	0.11	30.67	0.07	37.85	0.07	42.71	0.08	54.21	0.54	79.62	1.17	(11.33)	0.39	(37.98)	0.54	(79.62)	2.1	(33.84)	48.45
10 - 6 mm	2.6	35.9	4.3	24.7	0.40	6.50	0.32	7.39	1.34	11.27	0.43	19.93	0.26	20.12	0.17	30.05	0.24	37.85	0.16	44.94	0.12	52.47	0.86	78.56	2.49	(11.50)	0.95	(34.64)	0.86	(78.56)	4.3	(39.02)	45.24
6 - 3.15 mm	12.4	48.3	11.5	36.2	2.17	6.20	1.05	8.66	2.89	11.79	1.78	21.55	0.06	25.25	0.82	33.96	0.18	43.44	0.37	43.95	0.33	53.20	1.85	77.39	7.89	(12.04)	1.76	(40.03)	1.85	(77.39)	11.5	(26.83)	39.39
3.15 - 1 mm	19.9	68.2	20.0	56.2	4.11	3.18	6.66	9.35	2.63	11.33	1.79	19.08	0.70	25.78	0.42	28.83	0.45	33.84	0.78	41.45	0.39	49.84	2.07	75.92	15.19	(9.17)	2.74	(35.46)	2.07	(75.92)	20.0	(19.68)	32.38
1 - 0.5 mm	11.6	79.8	11.9	68.1	5.23	3.11	2.82	8.20	1.42	13.06	0.51	19.22	0.44	25.27	0.34	32.13	0.15	33.45	0.29	46.20	0.16	53.55	0.54	79.54	9.98	(6.79)	1.38	(36.07)	0.54	(79.54)	11.9	(13.49)	29.08
0.5 - 0.2 mm	10.2	90.0	16.7	84.8	5.37	3.40	4.78	3.60	3.16	8.39	1.93	17.52	0.07	23.76	0.07	34.27	0.30	35.39	0.34	44.81	0.17	55.71	0.51	75.00	15.24	(6.28)	0.95	(41.46)	0.51	(75.00)	16.7	(10.38)	25.39
0.2 - 0.063 mm	6.8	96.8	11.6	96.4	3.46	5.82	3.41	6.90	2.47	8.84	1.13	13.75	0.42	18.82	0.38	31.72	0.22	34.52	0.07	50.54	0.02	62.68	0.02	72.62	10.47	(7.74)	1.11	(29.14)	0.02	(72.62)	11.6	(9.90)	23.53
50 - 0.063 mm		96.8		96.4	21.32	(4.12)	21.91	(7.42)	15.49	(10.78)	8.25	(18.63)	2.38	(23.58)	2.57	(31.83)	1.93	(33.52)	6.16	(40.33)	1.76	(53.29)	14.63	(78.35)	66.97	(8.53)	14.80	(37.20)	14.63	(78.35)	96.4	(23.53)	23.53
Ultra Fines - Below 0.063 mm	3.2	100.0	3.6	100.0																											3.6	13.46	23.17
	100.0		100.0																												100.0	(23.17)	

In Brackets - Calculated Value Without Brackets - Analytical Value

6. Evaluation of the Test Results by Techman Ltd.

6.1. Raw Coal Ash Content and Size Distribution

In order to establish the raw coal ash content of the plant feed, Techman assumed in the "Report on Coal Preparation" of March 1976 a dilution of 16.4 % by weight, resulting in a feed ash of 30-35%. To ensure that the washability data developed in 1975 was more representative of the anticipated plant feed, six inches (0.15 m) of hanging wall and in some cases of footwall and partings up to 3' were included with each bulk sample. Because of the very hard nature of footwall and hanging-wall and because the contacts are very distinct with the exception of the footwall of seam 9, and minor fringes of shale and clay in other seams, the coals tested were conservative as far as ash content was concerned.

Table 12 compares the raw coal ash content of previous investigations where no dilution was extracted to the data developed during the bulk testing program in 1975. The raw coal ash content of the bulk samples increased from 22% by about 11% to 33%. Similarly the drill hole sample ash content increased by about 6% on seams 12 to 18.

The washability of the recent bulk samples has not been adversely affected due to the very hard and heavy nature of the dilution. It has actually improved on several seams. Thus, the raw coal ash content of the recent bulk tests can be considered as representative of the Elk River run-of-mine coal.

Table 13 a to d shows the raw coal ash contents for the various size fractions for all the washability data to date. The raw coal content reported for the 1975 pilot plant tests was determined by reconstituting the refuse and clean coal rather than using the number presented by Birtley in the Report "Analysis and Washing of Bulk Samples from the Elk River

Table 12. Comparison of the Raw Coal and 1.50 g/cm^3 float ash content developed in 1975 to previous data.

Seam	DRILL HOLE DATA				WASHABILITY DATA	
	1970-1971		1975		1970-71	1975
	Raw Coal	1.5 float	Raw Coal	1.5 float	Raw Coal	Raw Coal
2	19.4	7.6			14.2	37.2
3	12.5	3.5			16.1	21.9
4	20.8	9.6			25.7	27.7
5	-	-			-	-
6	19.8	7.4			14.3	23.8
7	20.3	7.4			31.6	33.1
8	19.9	8.7			26.5	31.0
9	20.1	7.4			21.7	17.1
10	16.8	7.9			18.0	23.2
11	24.2	11.1			-	-
12	22.9	9.3	24.4	-	25.4	42.5
13	20.5	9.7	39.9	12.3	33.2	57.1
14	19.2	8.8	26.9	5.4	22.7	49.8
15	27.5	9.3	34.1	15.7	30.5	44.3
16	25.3	11.6	21.5	6.5	16.2	39.7
17	13.5	4.6	27.7	8.9	7.0	35.9
18	24.9	7.1	21.9	10.3	22.7	34.2
19			32.7	8.4	27.1	-
20			39.6	13.7		-
21			34.2	-		-
Average	20.5	8.2	30.3	10.2	22.1	34.6
Wt.Scheme "A"	19.9	8.5			22.3	33.8
Wt.Scheme "C"	20.0	8.4			22.9	32.9

Scheme "A" - Techman, Report on Preparation, March 1975.

Scheme "C" - Techman, Mining Concept, etc., September 1975

Table 13: Raw Coal Ash Content for the various Size Fractions

a) 2" x ½" (50 - 12.5 cm)

SEAM	(+28 Mesh) WASHABILITY 1971 WT.%	(+28 Mesh) WASHABILITY 1971 ASH%	WASHABILITY 1975 WT.%	WASHABILITY 1975 ASH%	(+28 Mesh) PILOT TESTS 1975 WT.%	(+28 Mesh) PILOT TESTS 1975 ASH%
2	86.1	14.1	50.0	35.5	67.9	36.6
3	82.2	16.0	48.7	12.9	37.7	23.9
4	79.4	27.4	58.3	26.6	76.2	24.8
6	85.5	14.4	46.8	22.8	66.8	32.2
7	90.8	31.9	44.7	38.5	58.1	40.9
8	77.8	30.1	50.3	28.2	77.0	30.4
9	87.2	23.4	56.0	21.9	81.2	23.8
10	83.9	19.0	50.9	19.7	67.1	23.1
12	75.0	28.8	51.1	37.2	79.4	40.9
13	88.7	33.9	63.7	60.5	83.0	62.9
14	87.0	23.8	51.8	41.1	82.4	45.6
15	85.7	32.1	47.9	42.6	82.0	41.8
16	87.5	16.7	47.5	33.9	76.4	44.6
17	91.5	6.3	56.6	23.0	85.2	31.4
18	85.0	23.2	62.4	35.3	80.4	37.3
Average	84.5	22.7	52.4	32.0	73.4	36.7
Wt. Scheme 'A'	82.6	24.5	53.5	32.5	74.9	35.4
Wt. Scheme 'C'	82.9	25.3	53.1	32.0	73.6	34.8

b) ½" x 28 mesh (12.5 x 0.6 mm)

SEAM	WASHABILITY (+28 Mesh) 1970-1971 WT.%	WASHABILITY (+28 Mesh) 1970-1971 ASH%	WASHABILITY 1975 WT.%	WASHABILITY 1975 ASH%	WASHABILITY 1975 WT.%	WASHABILITY 1975 ASH%
2	77.5	28.2	86.1	14.1	17.9	57.8
3	75.0	9.4	82.2	16.0	13.6	68.8
4	83.2	30.1	79.4	27.4	17.9	34.0
6	87.1	19.7	85.5	14.4	20.0	43.7
7	84.1	23.6	90.8	31.9	13.4	53.1
8	79.5	26.5	77.8	30.1	26.7	51.9
9	78.0	16.9	87.2	23.4	24.2	36.9
10	83.3	19.4	83.9	19.0	16.2	45.4
12	74.1	29.5	75.0	28.8	28.3	60.6
13			88.7	33.9	19.3	80.4
14			87.0	23.8	30.6	65.6
15			85.7	32.1	34.1	61.2
16			87.5	16.7	28.9	62.2
17			91.5	6.3	28.6	64.3
18			85.0	23.2	34.2	23.2
Average	80.2	22.6	84.5	22.7	23.6	53.9
Wt. Scheme 'A'			82.6	24.5	22.2	51.4
Wt. Scheme 'C'			82.9	25.3	21.5	53.5

c) 28 mesh x 65 mesh (0.6 - 0.2 mm)

SEAM	WASHABILITY (-28 Mesh) 1970-1971 WT.%	ASH%	WT.%	ASH%	WASHABILITY 1975 WT.%	ASH%	PILOT TESTS 1975 WT.%	ASH%
2	22.5	17.7	14.0	12.3	4.9	24.1	14.5	22.7
3	25.0	10.6	17.2	18.2	22.3	11.1	28.2	16.5
4	16.8	18.3	20.6	16.6	11.3	18.8	15.7	24.8
6	12.9	12.1	14.5	13.0	11.1	14.7	23.4	23.7
7	15.9	13.5	9.2	24.0	15.1	28.8	19.3	37.5
8	20.5	13.2	22.2	14.0	18.9	16.0	10.5	16.5
9	22.0	9.5	12.8	13.0	10.3	11.9	9.1	11.2
10	16.7	11.6	16.1	11.8	9.4	11.0	16.3	12.2
12	26.0	16.5	25.0	14.9	8.7	20.4	9.7	24.6
13			11.3	27.1	7.4	35.4	12.8	29.2
14			13.0	16.1	7.0	30.2	12.7	23.4
15			14.3	12.2	11.9	21.7	6.8	19.5
16			12.5	11.1	11.3	25.0	8.8	23.7
17			8.5	14.2	9.6	18.1	9.0	17.0
18			15.0	15.4	8.0	18.3	9.4	21.6
Average	19.8	13.7	15.1	15.6	11.1	20.4	13.7	21.6
Wt. Scheme 'A'			16.5	15.2	10.6	17.9	12.5	20.9
Wt. Scheme 'C'			17.1	15.5	12.1	17.6	14.1	21.0

d) 65 mesh x 0 (0.2 - 0 mm)

SEAM	(-28 Mesh) WASHABILITY 1971 WT%	ASH%	WASHABILITY 1975 WT%	ASH%	PILOT TESTS 1975 WT%	ASH%
2	14.0	12.3	27.2	20.0	17.6	16.4
3	17.2	18.2	15.4	11.0	20.6	15.3
4	20.6	16.6	12.5	16.2	8.1	15.8
6	14.5	13.0	22.1	13.1	9.8	16.4
7	9.2	24.0	26.8	19.9	22.6	19.5
8	22.2	14.0	4.1	13.7	12.5	12.1
9	12.8	13.0	6.5	11.4	9.7	13.0
10	16.1	11.8	23.5	11.8	16.6	12.1
12	25.0	14.9	11.9	17.9	10.9	18.8
13	11.3	27.1	9.6	33.0	4.2	28.3
14	13.0	16.1	10.6	26.1	4.9	22.5
15	14.3	12.2	6.1	21.9	11.2	19.7
16	12.5	11.1	12.3	20.9	14.8	24.8
17	8.5	14.2	5.2	19.9	5.5	17.0
18	15.0	15.4	11.6	16.2	10.2	16.2
Average	15.1	15.6	13.7	18.2	11.9	17.8
Wt. Scheme 'A'	16.5	15.2	13.5	17.7	11.4	17.0
Wt. Scheme 'C'	17.1	15.5	14.3	17.4	10.9	16.7

Deposit" of January 1976. The reason for not accepting the Birtley figure is that the values never add up to the actual total raw coal ash. In general they are about 3% lower due to the exclusion of the pilot plant feed oversize in some cases, and sampling error in others.

As it was said before, the previous data was somewhat misleading because the partings and dilution were excluded for testing purposes, and the size distribution included a low percentage of minus 28 mesh (0.6 mm) coal. A summary of the recent washability data, although it was still lower in fines than the plant, will be designed for, is much more representative of the anticipated plant feed. The +½" (12.5 mm) size fraction is quite high, but is within the upper limit of design.

The ash content and the screen analysis of the plant feed will be as follows:

Screen Size	Average Raw Coal Wt.%	Average Raw Coal Ash %	Range of Raw Coal Ash %
4"x½"(100-12.5mm)	22.2	51.4	21 - 70
½"x28mesh (12.5-0.6 mm)	53.7	32.3	15 - 36
28 mesh x 65 mesh (0.6-0.2 mm)	10.6	17.9	14 - 30
65 mesh x 0 (0.2 - 0 mm)	13.5	17.7	12.5 - 30
4" x 0 (100- 0 mm)	100.0	33.0	15 - 45

Because of the problems that often occur in strip mines which utilize very large equipment, the maximum ash levels should not be understated. The maximum values listed previously are suitable for process design, but may not be good for refuse handling conveyor design.

During the initial years, the plant feed ash will undoubtedly be higher than it will be once the mine labour force stabilizes and people become properly trained. This means that some excess capacity will have to be designed into the plant. The excess capacity can later be used to increase the production.

Table 14: Comparison of the 1.50 (9 cm^3) Float Ash Content developed in 1975 to previous data

SEAM	1971 & Earlier Drill Holes	1975 Drill Holes	U.K. Test Work Mar.'71	Cyclone Engineer. Tests. Mar.'71	Birtley Bulk Tests Oct.'71	Birtley Bulk Tests Dec.'75
2	9.35		11.6	10.9	8.81	9.8
3	6.98		--	6.7	7.46	6.3
4	8.11		9.5	7.8	7.05	6.7
5	--		--	--	--	--
6	8.49		9.2	8.8	8.22	9.2
7	8.40		10.0	8.8	13.09	9.5
8	7.46		6.9	7.0	8.15	7.3
9	7.26		6.7	8.1	6.71	6.8
10	6.34		6.9	6.1	7.20	6.4
11	8.01		--	--	--	--
12	7.17	5.7	9.1	6.1	6.94	7.4
13	6.92	5.75			7.46	7.1
14	6.82	6.23			7.29	7.0
15	5.95	5.70			7.96	6.0
16	6.06	5.98			5.63	7.6
17	4.67	5.80			3.61	5.4
18	5.18	5.70			6.85	5.5
19	3.14	7.90			7.81	
Avg.	7.07				7.52	7.2
Wt. Average Scheme 'A'	7.49				7.61	7.3
'C'	7.50				7.60	7.3

Table 15: SUMMARY OF NEAR GRAVITY MATERIAL of + 28 Mesh (0.6 mm) Coal (Corrected to 1.8 S.G. Float)

SEAM NO.	1971 BULK TESTS			1975 BULK TESTS		
	1.45	1.5	1.55	1.45	1.50	1.55
	Specific Gravity			Specific Gravity		
2	58.6	33.1	16.7	52.0	27.8	17.0
3	30.2	15.6	9.2	35.8	17.2	9.7
4	41.4	18.3	10.5	50.4	33.7	13.6
4A	24.3	11.3	8.2			
6	36.0	16.9	11.2	57.0	27.1	17.6
7	55.4	38.9	29.5	42.0	30.7	22.6
8	34.9	19.7	14.7	40.6	19.7	11.5
9	21.9	16.1	9.7	33.2	19.3	12.1
10	26.5	13.2	6.6	34.1	17.2	10.4
12	18.2	12.7	9.1	26.8	18.3	13.6
13	27.3	20.3	16.6	27.4	21.2	17.2
14	21.3	14.6	11.4	18.4	12.1	9.8
15	24.4	19.4	18.4	22.4	16.0	12.6
16	17.7	14.3	11.8	19.9	14.4	11.7
17	7.9	6.4	5.6	14.5	9.7	7.2
18	16.5	12.6	8.5	12.3	9.0	8.1
Average	28.9	17.7	12.4	32.5	19.6	13.0
Wt. Scheme 'A'	29.9	17.3	11.6	34.6	20.9	12.8
Wt. Scheme 'C'	31.6	18.2	12.0	38.2	22.7	13.5

Table 16: Comparison of the Sulphur Content developed in 1975 to previous Data.

SEAM NO.	1.50 Specific Gravity			Clean Coal 1975 Pilot Tests	Raw Coal Pilot Tests
	M-K Drill-holes	M-K Bulk Samples	E & B 1975 Drillholes		
2	0.45	0.52		0.49	0.39
3	0.51	0.54		0.53	0.44
4	0.40	0.52		0.35	0.34
5					
6	0.72	0.75		0.64	0.71
7	0.63	0.60		0.55	0.55
8	0.51	0.42		0.40	0.48
9	0.49	0.43		0.38	0.28
10	0.49	0.38		0.45	0.38
11	0.65				
12	0.72	0.64	0.60	0.68	0.55
13	0.82	0.86	0.57	0.94	0.74
14	0.76	0.81	0.71	0.83	0.97
15	0.67	0.81	0.58	0.85	0.63
16	0.73	0.80	0.93	0.70	0.78
17	0.76	0.68	0.68	0.71	0.71
18	0.62	0.69	0.52	0.73	0.57
Average	0.62	0.63	0.66	0.62	0.57
Wt. Scheme 'A'	0.56	0.56		0.57	0.52
Wt. Scheme 'C'	0.56	0.56		0.54	0.49

6.3. Volatile Matter

The Elk River coals vary in volatile matter considerably over seam 2 to 18 as it can be seen on Figure 7.

Basically the coals can be classified as low volatile (seams 2 to 10), medium volatile (seams 11 to 15) and high volatile (seams 16 to 18).

6.4. Sulphur Content

The sulphur content of all coal seams is summarized in Table 16. The variations in the sulphur content of the blend will be between 0.5 and 0.6 %, and lower than for example of Ruhr coals. The sulphur content of the upper seams (11 to 18) is higher than that of the lower seams (2 to 10).

The sulphur content of Western Canadian coals is normally lower than the figure established for Elk River coal. The sulphur is generally of organic nature (80% organic, 20% pyritic), as appears to be the case with Elk River coals. The sulphur content of the coke should therefore be even lower.

6.5. Phosphorous Content

Table 17 summarizes the content of P_2O_5 as a percent of clean coal ash and the phosporous content as a percent of clean coal.

The average phosphorous content is about 0.05 % of the clean coal and should not exceed 0.06 % during mining operations. It is somewhat higher than for example of Ruhr coals which average 0,026 %.

The seams 3, 6 and 16 show a very high phosphorous level of about 0.1 % and above. Fortunately, these seams are very thin.

Figure 7: VOLATILE MATTER OF THE VARIOUS COAL SEAMS

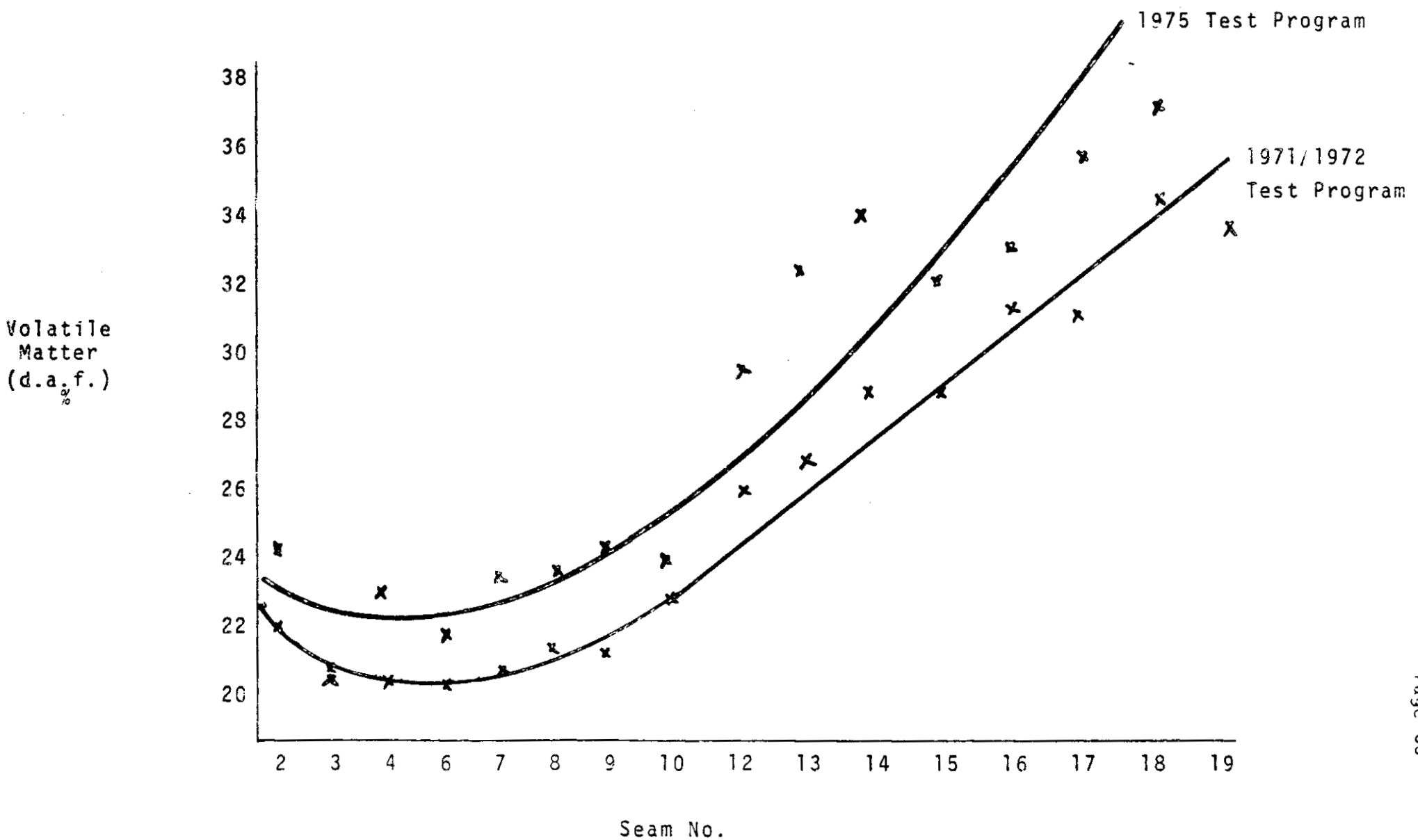

Table 17: Comparison of the Phosphorous and P_2O_5 Content developed in 1975 with previous Data.

SEAM NO.	1971 PILOT TESTS P_2O_5 (%) in C.C. ASH	1971 EMR TESTS CLEAN COAL PHOSPHOROUS (%)	1975 PILOT TESTS P_2O_5 (%) in C.C. ASH	1975 PILOT TESTS CLEAN COAL PHOSPHOROUS (%)
2	0.3	0.014	0.47	0.019
3	2.8	0.101	3.40	0.139
4	1.1	0.041	0.68	0.025
6	4.1	0.162	2.70	0.122
7	1.2	0.045	0.94	0.044
8	2.2	0.066	1.59	0.065
9	1.2	0.038	0.77	0.029
10	0.8	0.022	0.62	0.025
12	1.5	0.059	1.09	0.047
13	1.5	0.067	1.16	0.057
14	1.3	0.057	1.48	0.051
15	1.5	0.061	1.28	0.044
16	2.3	0.097	2.00	0.093
17	1.4	0.046	2.19	0.068
18	1.1	0.051	1.40	0.043
19	1.6	0.064	---	---
Average	1.62	0.062	1.45	0.058
Wt. Scheme 'A'	1.42	0.053	1.21	0.048
Wt. Scheme 'C'	1.43	0.052	1.13	0.046
Composite 'A'			1.30	0.047
Composite 'C'			1.21	0.051

6.6. Alkalinity

The alkalinity of the Elk River coals is very low, as is shown in Table 18. It is much lower than, for example, in US coals.

Of interest is the unusual phenomena that the content of K_2O is generally about five times as high as the content of Na_2O This is completely reverse of what is normally expected in Western Canada. The high potassium is possibly associated with minerals such as glouconite or potassium illinite.

7. Considerations for Plant Design by Techman Ltd.

7.1. Washability

After summarizing all the test work done to date, some reasonable assumptions must be made to predict the characteristics of the coal which should be used for plant design. Obviously, it is not possible to incorporate the washability and drill hole data established for each seam in the entire design. Techman Ltd. has therefore prepared a set of data showing the range of variation expected in the plant operation. For this reason it is not important that each bulk sample had precisely the estimated amount of dilution or fines content. These values can differ considerably also in practice. It is more important to establish the extent of variations in the plant feed and to design in the flexibility which will allow the plant to operate with adverse conditions of coal characteristics. Techman, therefore, considers the data developed to-date to be sufficient to predict the minimum, average and maximum washability that is necessary for the design of the Elk River preparation plant. A precise washability which would represent the average of all coal mined over the life of the mine is rather meaningless for plant design, but necessary for product evaluation. During the 1975 bulk testing program, dilution was added to the coal in sometimes greater

Table 18. Alkali Content of Elk River Coals (EMR Ottawa, 1971/71)

Seam No.	Na_2O of Ash	K_2O of Ash	Total Alkali % of Ash	% of C.C.
2			0.7	0.07
3			0.7	0.06
4			0.7	0.06
6			0.3	0.03
7			0.8	0.07
8			1.6	0.11
9			0.7	0.05
10			1.0	0.06
12			1.3	0.12
13	0.1	1.8	1.9	0.19
14	0.2	1.4	1.6	0.16
15	0.2	1.0	1.2	0.11
16	0.3	1.5	1.8	0.17
17	0.2	0.9	1.1	0.08
18	0.2	1.4	1.6	0.17
19	0.2	1.8	2.0	0.18
Average			1.19	0.11

and sometimes lesser proportions than might occur during mining so that the overall coal characteristics developed in 1975 would be as representative as possible of the actual mined coal. The dilution will undoubtly vary considerably from area to area depending on the geological conditions, operator training, equipment, weather, visibility and other factors. Any further assessment of the dilution therefore is not necessary. Because of the hard and heavy nature of the dilution, any additional dilution will merely increase the 2.60 g/cm^3 specific gravity fraction and will not adversely affect the product. As a result, Techman has made no attempt in the report "Elk River Coking Coal Project Coal Quality Analysis" of March 1976 to alter the washabilities developed during the 1975 bulk testing program, as they are considered to be the best possible representation of the coal in place as it will be mined.

Borehole data was evaluated and compared to bulk test data. Because of the inherent problems of drill core recovery and consequently testing of incomplete samples, the results of the bulk sample tests must be used to determine the range of the expected coal quality for plant design.

Average Washability: Techman calculated the average washability of the plant feed by assuming that the 16% dilution as per Techman report on coal preparation of March 1975 was followed.The reserves were then weighted accordingly.This assumption is not precisely correct for each seam, but on the average the raw coal ash content compared within a few percent.

Tables 19 a to c show the weighted average washabilities of the various size fractions. The washability curves have been plotted in Figures 8 a to c. Techman has used for this calculation the reserve figures shown in mining plan A, report of March 1975, and weighted all the washabilities against those reserve figues. In addition, the weight percent of each of the fractions was considered in the overall washability. For details refer to Techman Report "Elk River Coking Coal Project Coal Quality Analysis" of March 1976.

Table 19 a. Weighted Average Washability for Size Fraction 2" x ½" (50-12.5 mm) of Plant Feed.

Maximum S.G.	Wt. (%)	Ash (%)	Cumulative Floats		Cumulative Sinks		± 0.1 S.G. Corrected to 1.8 S.G. Float
			Wt.%	Ash%	Wt.%	Ash%	
MINING SCHEME "A"							
1.3	8.78	2.91	8.78	2.91	91.22	56.10	
1.35	13.72	6.63	22.50	5.18	77.50	64.86	
1.4	6.88	11.39	29.38	6.63	70.62	70.07	63.3
1.45	3.46	16.08	32.84	7.63	67.16	72.85	33.6
1.5	2.09	21.36	34.93	8.45	65.07	74.50	19.6
1.55	1.46	27.19	36.39	9.20	63.61	75.59	9.9
1.6	1.08	31.36	37.47	9.84	62.53	76.37	11.2
1.7	2.08	38.08	39.55	11.32	60.45	77.67	9.4
1.8	1.81	46.36	41.36	12.86	58.64	78.64	
+1.8	58.64	78.64	100.00	51.43			
	100.00						
MINING SCHEME "C"							
1.3	6.96	2.94	6.96	2.94	93.04	57.28	
1.35	15.85	6.71	22.81	5.27	77.19	67.75	
1.4	7.33	11.67	30.14	6.89	69.86	73.61	68.7
1.45	3.89	15.51	34.03	7.87	65.97	77.04	35.6
1.5	2.25	21.87	36.28	8.28	63.72	79.25	20.1
1.55	1.50	27.90	37.78	9.48	62.22	80.23	9.9
1.6	1.07	32.10	38.85	10.10	61.15	81.07	10.9
1.7	2.14	39.86	40.99	11.63	59.01	82.58	9.3
1.8	1.84	49.15	42.83	13.23	57.17	84.16	
+1.8	57.17	84.16	100.00	53.50			
	100.00						

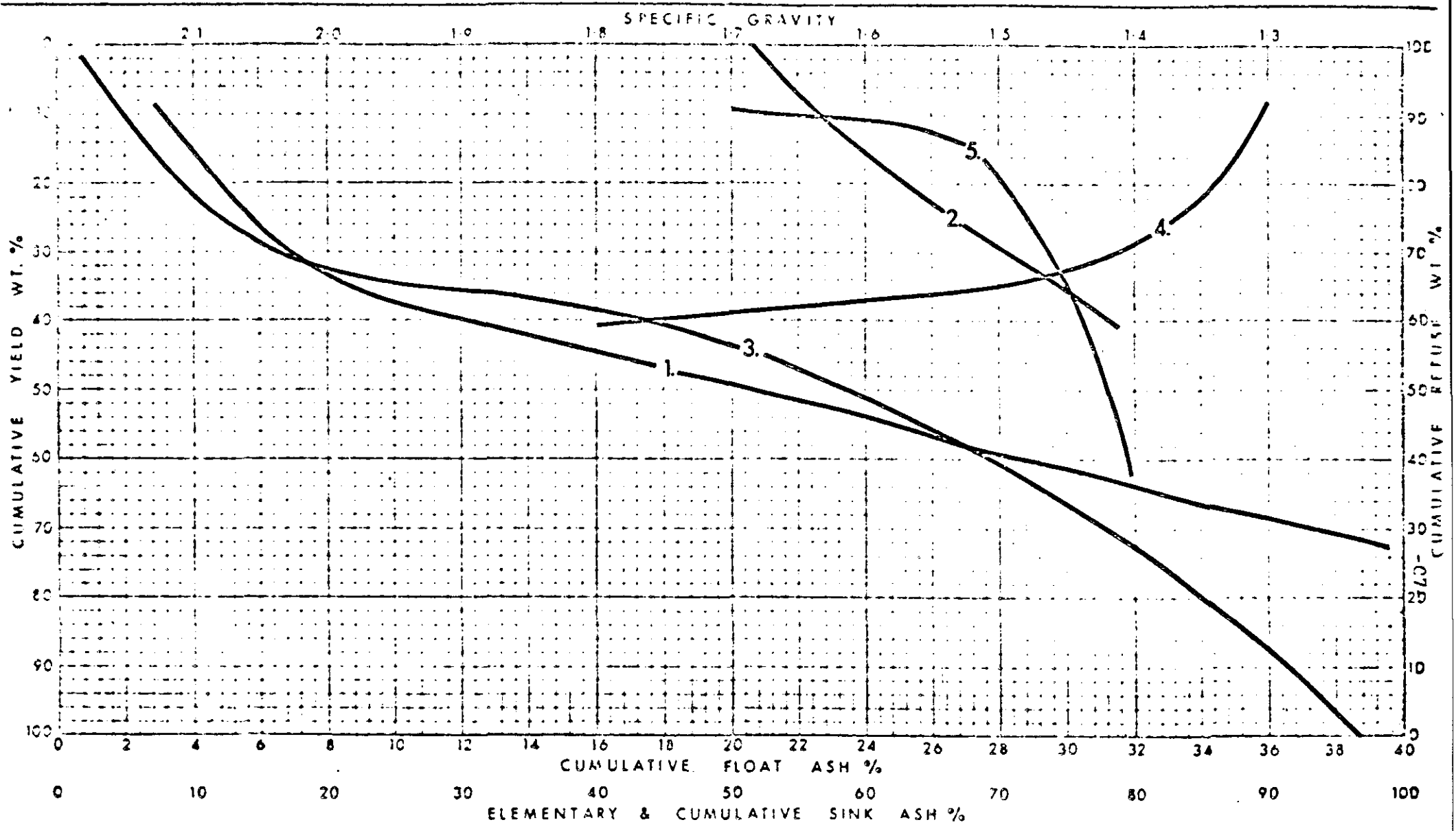

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Figure 8a: AVERAGE WASHABILITY
(Mining Plan "A" for Size Fraction
2" x ½" (50 - 12.5 mm)

Table 19 b: Weighted Average Washability for Size Fraction ½" x 28 mesh (12.5-0.6 mm) of Plant Feed.

Maximum S.G.	Wt. (%)	Ash (%)	Cumulative Floats		Cumulative Sinks		± 0.1 S.G. Corrected to 1.8 S.G. Float
			Wt.%	Ash%	Wt.%	Ash%	
MINING SCHEME "A"							
1.3	25.16	2.35	25.16	2.35	74.84	42.38	
1.35	12.97	5.89	38.13	3.55	61.87	50.03	
1.4	11.57	10.23	49.70	5.11	50.30	59.19	51.7
1.45	7.57	14.43	57.27	6.34	42.73	67.12	35.6
1.5	3.26	21.17	60.53	7.14	39.47	70.91	21.0
1.55	1.93	25.55	62.46	7.71	37.54	73.24	11.5
1.6	1.59	32.19	64.05	8.32	35.94	75.07	8.3
1.7	2.18	38.25	66.23	9.30	33.77	77.44	6.4
1.8	2.18	45.84	68.41	10.46	31.59	79.60	
+1.8	31.59	79.60	100.00	32.31			
	100.00						
MINING SCHEME "C"							
1.3	21.69	2.28	21.69	2.28	78.31	40.21	
1.35	13.94	5.39	35.63	3.50	64.37	47.74	
1.4	13.11	9.56	48.74	5.13	51.26	57.51	56.7
1.45	8.46	14.85	57.20	6.57	42.80	65.94	39.5
1.5	3.56	20.52	60.76	7.38	39.24	70.07	22.9
1.55	2.06	25.11	62.82	7.97	37.18	72.55	12.2
1.6	1.68	31.75	64.50	8.59	35.50	74.48	8.6
1.7	2.17	37.56	66.67	9.53	33.33	76.89	6.4
1.8	2.22	44.93	68.89	10.67	31.11	79.30	
+1.8	31.11	79.30	100.00	31.98			
	100.00						

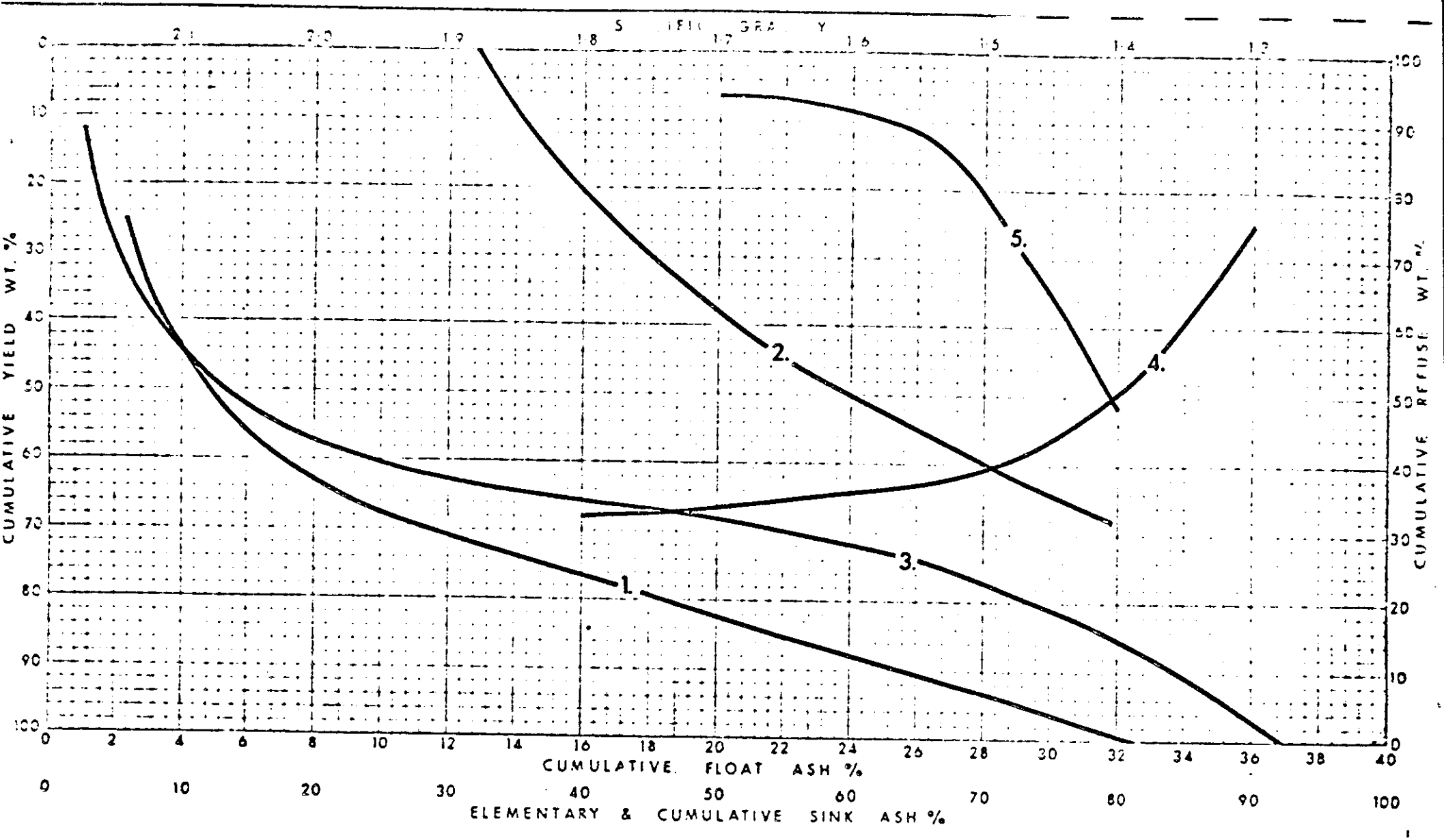

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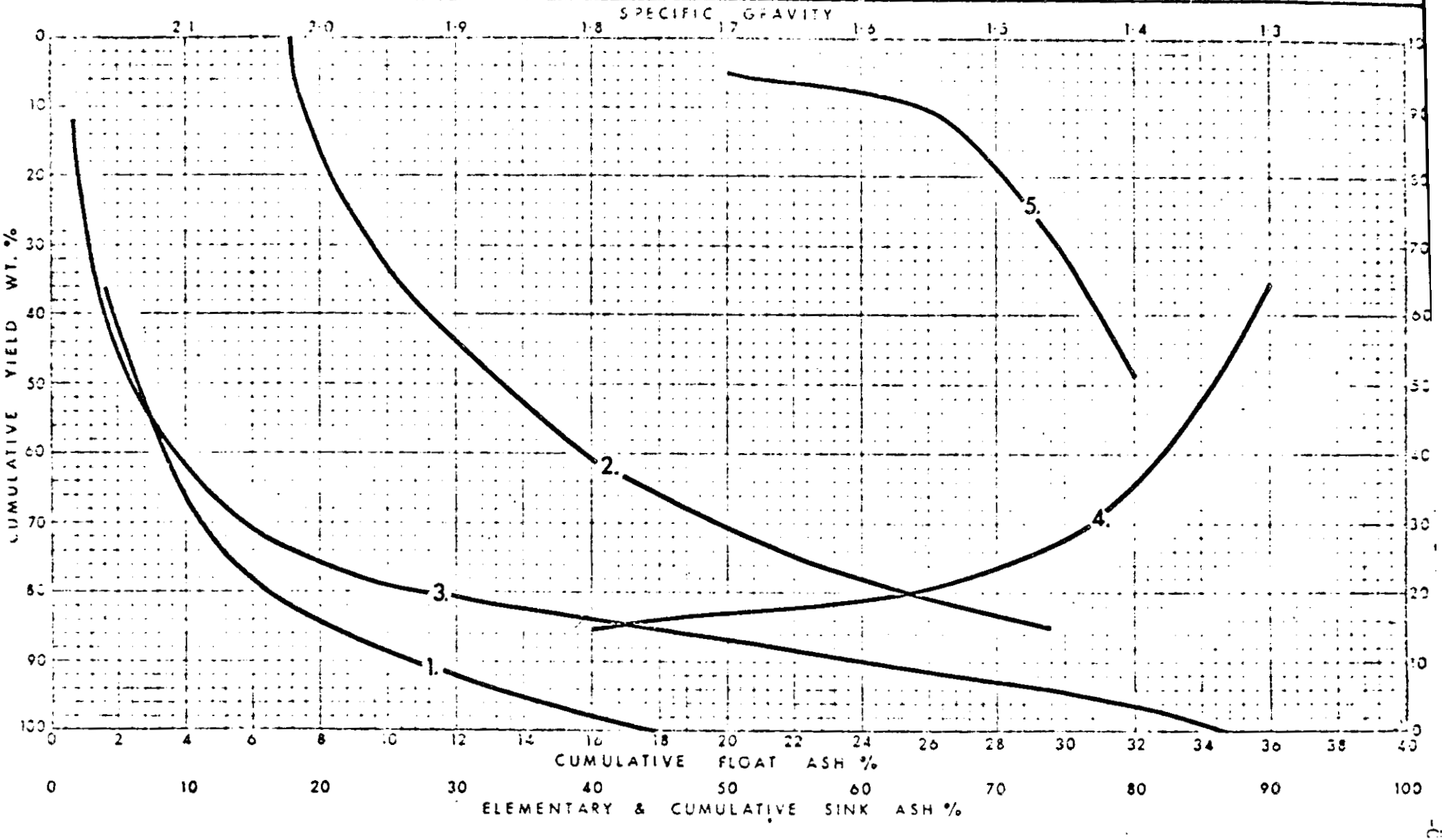
Figure 8 b: AVERAGE WASHABILITY (Mining Plan "A" for Size Fraction ½" x 28 Mesh (12.5 - 0.6 mm)

Table 19 C: Weighted Average Washability for Size Fraction 28 mesh x 65 mesh (0.6-0.2 mm) of Plant Feed.

Maximum S.G.	Wt. (%)	Ash (%)	Cumulative Floats		Cumulative Sinks		± 0.1 S.G. Corrected to 1.8 S.G. Float
			Wt.%	Ash%	Wt.%	Ash%	
M I N I N G							
1.3	35.25	1.73	35.25	1.73	64.75	26.73	
1.35	18.11	4.92	53.36	2.81	46.64	35.21	
1.4	11.24	8.86	64.60	3.86	35.40	43.58	48.8
1.45	7.66	13.01	72.26	4.83	27.74	52.02	30.6
1.5	4.81	18.84	77.07	5.71	22.93	56.18	19.6
1.55	2.52	25.29	79.59	6.33	20.41	63.12	9.7
1.6	1.83	30.23	81.42	6.86	18.51	66.64	7.8
1.7	2.37	36.65	83.79	7.70	16.21	70.75	4.9
1.8	1.80	44.13	85.59	8.47	14.41	74.05	
+1.8	14.41	74.05	100.00	17.92			
	100.00						
M I N I N G							
1.3	33.14	1.57	33.14	1.57	66.86	25.59	
1.35	18.55	4.62	51.69	2.61	48.31	33.64	
1.4	12.16	8.37	63.85	3.75	36.15	42.15	51.3
1.45	8.33	12.63	72.18	4.78	27.82	50.97	32.8
1.5	5.08	18.43	77.26	5.67	22.74	58.26	20.8
1.55	2.60	24.97	79.86	6.30	20.14	62.56	10.0
1.6	1.90	30.07	81.76	6.86	18.24	65.91	8.0
1.7	2.41	36.64	84.17	7.71	15.83	70.38	4.9
1.8	1.76	43.88	85.93	8.45	14.07	73.70	
+1.8	14.07	73.70	100.00	17.63			
	100.00						



LEGEND

1. CUMULATIVE FLOAT ASH CURVE
2. CUMULATIVE SINK ASH CURVE
3. ELEMENTARY ASH CURVE
4. SPECIFIC GRAVITY CURVE
5. WT. SPECIFIC GRAVITY DISTRIBUTION CURVE

Figure 8 c: AVERAGE WASHABILITY (Mining Plan "C")for Size Fraction 28 x 65 Mesh (0.6 - 0.2 mm)

The 2" x ½" (50 - 12.5 mm) size fraction represents about 22% of the plant feed which is about what will occur in the maximum coarse condition during actual operation if a 4" (100 mm) top size is assumed. The results are therefore fairly accurate.

The plus 2" (50 mm) material was crushed and thus appeared in the 2" x ½" (50 x 12.5 mm) fraction. Normally about 10 to 20% of this material, representing about 2 - 4% of the plant feed, would be rejected from the Bradford rotary breaker. Therefore, the washability of the 2" x ½" (50 - 12.5 mm) fraction is slightly conservative.

The washability of the ½" x 28 mesh (12.5 - 0.6 mm) fraction was calculated by eliminating the 2" x ½" (50 - 12.5 mm) washability from the plus 28 mesh (0.6 mm) material. It was necessary to crush the raw coal to below 3/4" (19 mm) to feed the pilot plant and to produce a representative amount of fines.
Since the washability of the minus 28 mesh (0.6 mm) fines fraction is somewhat better than that of the ½" x 28 mesh (12.5 - 0.6 mm) fraction, the coarser fraction will probably have slightly better washability at the expense of the fines fraction.

The washability and probable error curves derived by Techman (Report of March 1976) from the weighted average data demonstrate clearly that there is very little difference in the washability characteristics of the coal from mining plan A to plan C. Consequently, it can be assumed that slight alterations in mine planning or dilution will not greatly affect the plant operation.

Best Washability: The best washability is important for the size of the clean coal circuitry as well as for parts of the coal cleaning equipment.

Basically, it was assumed for the best washability that at times there will be no dilution in the mined coal, for example, when thicker seams are being mined, and that the raw coal fractions below 1.80 g/cm^3 specific gravity are proportionately the same.

The size and ash distribution of the plant feed will be for the best washability as follows:

Size	Weight %	Ash %
2" x ½" (50 - 12.5 mm)	10	20.75
½" x 28 mesh (12.5-0.6 mm)	55	15.0
28 mesh x 65 mesh (0.6-0.2 mm)	20	14.0
65 mesh x 0 (0.2 - 0 mm)	15	12.5
2" x 0 (50 - 0 mm)	100	15.0

Tables 20 a to c show the best washability anticipated during the mining operation.The product ash will remain the same, the recoveries will be 80 to 85 %.

Worst Washability: The worst washability has to take into account severe dilution in cases when only the smaller seams are being mined or the shot rock and coal slump together off of the mine face.

The worst dilution in the Techman Report of March 1975 showed 25% by weight dilution or an increase of 9% over the average dilution assumed to be 16 %. As the standard deviation of the raw coal ash from the drill hole data was 8.5 %, therefore the anticipated 9% increase in the dilution material should adequately cover the worst design condition. Approximately 50% of the additional dilution is expected to be rejected by the rotary breaker; the actual increase will be only 4.5%.

The size and ash distribution of the plant feed will be for the worst washability as follows:

Table 20 a: Weighted best Washability for the Size Fraction 2" x ½" (50 - 12.5 mm) of Plant Feed

2" x ½"

MAXIMUM S.G.	WEIGHT (%)	ASH (%)	Cumulating Floats		Cumulative Sinks	
			WT%	ASH%	WT%	ASH%
1.30	18.68	2.91	18.68	2.91	81.32	25.46
1.35	29.19	6.63	47.87	5.18	52.13	35.05
1.40	14.64	11.39	62.51	6.63	37.49	44.29
1.45	7.36	16.08	69.87	7.63	30.13	51.17
1.50	4.45	21.36	74.32	8.45	25.68	56.35
1.55	3.11	27.19	77.43	9.20	22.57	60.37
1.60	2.30	31.36	79.73	9.84	20.17	63.98
1.7	4.43	38.08	84.16	11.32	15.84	70.85
1.8	3.85	46.36	88.01	12.86	11.99	78.64
+1.8	11.99	78.64	100.00	20.75		
	100.00					

Table 20 b: Weighted best Washability
½" x 28 mesh (12.5 - 0.6 mm)

	WT	ASH	Cumulative Floats		Cumulative Sinks	
Maximum S.G.	(%)	(%)	WT%	ASH%	WT%	ASH%
1.30	34.36	2.35	34.36	2.35	65.64	21.62
1.35	17.71	5.89	52.07	3.55	47.93	27.44
1.40	15.80	10.23	67.87	5.11	32.13	35.89
1.45	10.34	14.43	78.21	6.34	21.79	46.08
1.50	4.45	21.17	82.66	7.14	17.34	52.47
1.55	2.64	25.55	85.30	7.71	14.70	57.30
1.6	2.17	32.19	87.47	8.32	12.53	61.63
1.7	2.98	38.25	90.45	9.30	9.55	68.99
1.8	2.98	45.84	93.43	10.46	6.57	79.60
+1.8	6.57	79.60	100.00	15.00		

Size Fraction

Table 20 c: 28 mesh x 65 mesh (0.6 - 0.2 mm)

	WT	ASH	Cumulative Floats		Cumulative Sinks	
Maximum S.G.	(%)	(%)	WT%	ASH%	WT%	ASH%
1.30	37.71	1.73	37.71	1.73	62.29	23.41
1.35	19.38	4.92	57.09	2.81	42.91	28.89
1.40	12.03	8.86	69.12	3.86	30.88	36.70
1.45	8.20	13.01	77.32	4.83	22.68	45.26
1.50	5.15	18.84	82.47	5.71	17.53	53.00
1.55	2.97	25.29	85.44	6.33	14.56	59.01
1.6	1.96	30.23	87.40	6.86	12.60	63.53
1.7	2.54	36.65	89.94	7.70	10.06	70.32
1.8	1.93	44.13	91.87	8.47	8.13	80.32
+1.8	8.13	80.32	100.00	14.00		

Size	Weight %	Ash %
2" x ½" (50 - 12.5 mm)	20	71.75
½" x 28 mesh (12.5 - 0.6 mm)	50	35.61
28 mesh x 65 mesh (0.6 - 0.2 mm)	15	17.92
65 mesh x 0 (0.2 - 0 mm)	15	17.70
2" x 0 (50 - 0 mm)	100	37.50

Tables 21 a to b show the adjusted washability for the worst design condition. Most of the 4.5 % increase in dilution material will appear in the 2" x ½" (50 - 12.5 mm) fraction and a small amount in the ½" x 28 mesh (12.5 - 0.6 mm) fraction. The dilution in the - 28 mesh (0.6 mm) fraction is negligable because of the hard and coarse nature of the sandstone, siltstone and mudstone forming the dilution.

7.2. Froth Flotation

In order to project the laboratory results compared to actual plant operation, a factor of 0.5% ash at 20 % feed ash and 0.75 % at 10 % and 15 % ash should be added to test data. Recoveries will in general be the same. The higher ash content is attributable to colder water in the froth circuit, larger flotation cells and higher reagent levels to maximize recoveries at all times and the general inflexibility of a large scale commercial operation.

Another phenomena frequently being observed in Western Canadian coals is a higher product ash content at recoveries of 30 to 40 % than at recoveries in the 50 to 60 % range. This has not been observed on the Elk River coals, because all the test results show much higher recoveries.

Figure 9 shows the anticipated plant recovery and product ash at various raw coal ash contents. The probable errorof plant operation

Table 21 a: Weighted worst Washability for Size Fraction 2" x ½" (50 - 12.5 mm)

2" x ½"

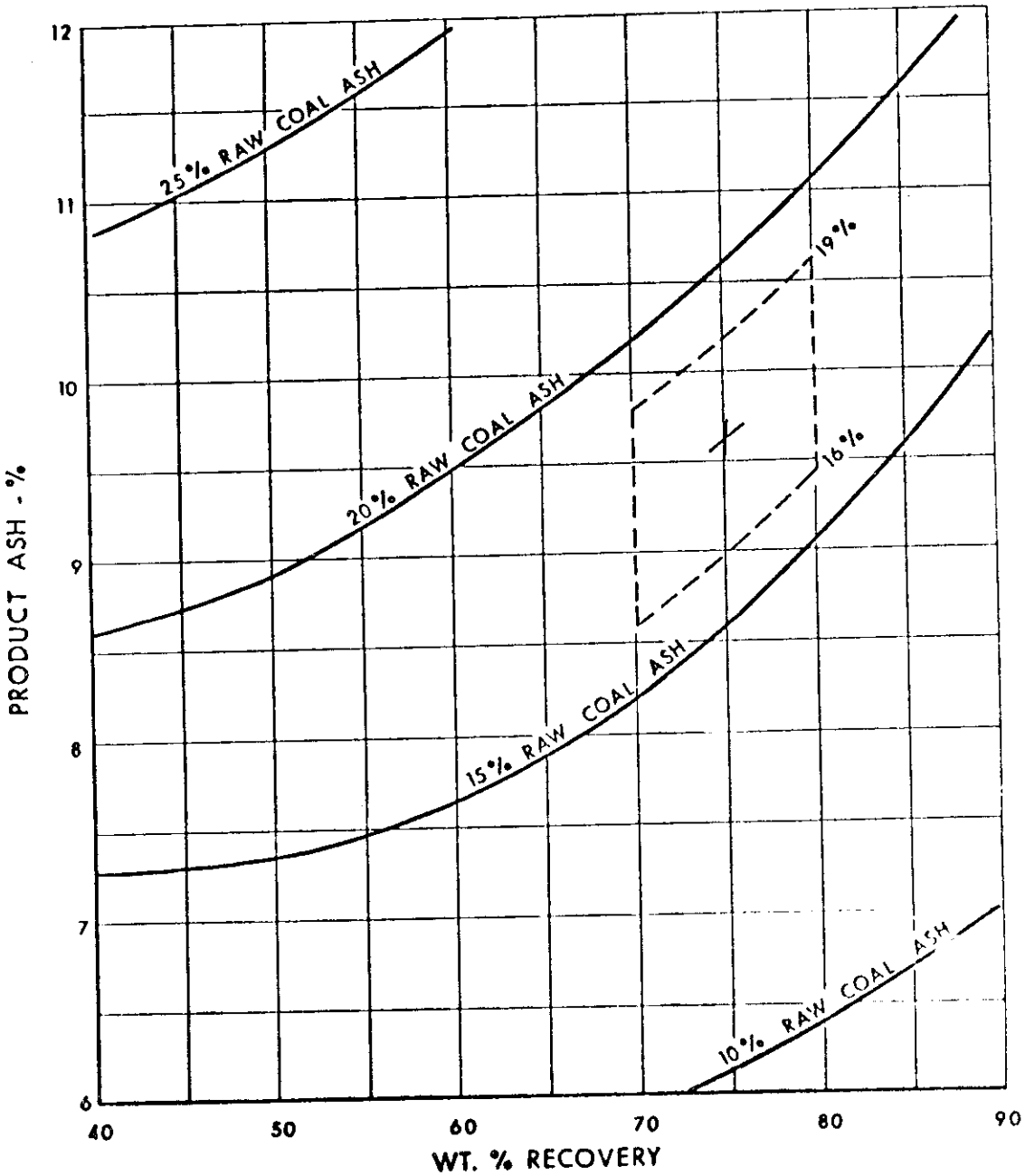
Maximum S.G.	Wt. (%)	Ash (%)	Cumulating Floats		Cumulative [illegible]	
			WT.%	ASH%	WT.%	ASH%
1.30	6.19	2.91	6.19	2.91	93.81	76.24
1.35	9.68	6.63	15.87	5.18	84.13	84.30
1.40	4.85	11.39	20.72	6.63	79.28	88.77
1.45	2.44	16.08	23.16	7.63	76.84	91.08
1.50	1.47	21.36	24.63	8.45	75.37	92.44
1.55	1.03	27.19	25.66	9.20	74.34	93.34
1.6	.76	31.36	26.42	9.84	73.58	93.98
1.7	1.47	38.08	27.89	11.43	72.11	95.12
1.8	1.27	46.36	29.16	12.86	70.84	96.00
+1.8	70.84	96.00	100.00	71.75		
	100.00					

Table 21 b: Weighted worst Washability for Size Fraction ½" x 28 mesh (12. 5 - 0.6 mm)

½" x 28 Mesh

MAXIMUM	WT.%	ASH	Cumulative Floats		Cumulative Sinks	
S.G.	(%)	(%)	WT.%	ASH%	WT.%	ASH%
1.30	23.85	2.35	23.85	2.35	76.15	46.01
1.35	12.29	5.89	36.14	3.55	63.86	53.75
1.40	10.97	10.23	47.11	5.11	52.89	62.78
1.45	7.17	14.43	54.28	6.34	45.72	70.36
1.50	3.09	21.17	57.37	7.14	42.63	73.92
1.55	1.83	25.55	59.20	7.71	40.80	76.04
1.6	1.51	32.19	60.71	8.32	39.29	77.78
1.7	2.07	38.25	62.78	9.30	37.12	80.20
1.8	2.07	45.84	64.85	10.46	35.15	82.00
+1.8	35.15	82.00	100.00	35.61		

Figure 9: Predicted Plant Flotation Ash and Recovery



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for purpose of product evaluation is shown as a box within the curves.

7.3. Dilution

Because the previous bulk samples had no dilution and the dilution of the bulk samples taken in 1975 was defined, the dilution can be assessed by difference between the two raw coal samples.

The previous bulk samples compared to the 1975 bulk sample was as follows:

	1970	1975
Weight % 3/4"x28 mesh (19-0.6 mm)	83.9 %	67.1 %
Ash %	18.30 %	24.95 %
Weight % Parting + Dilution		25.5 %
Weight % Dilution over 1970 samples (at 85% ash)		18.0 %

The fines fraction of both samples had about the same ash content of 11%. It is therefore reasonable to assume that almost all dilution appeared in the plus 28 mesh (0.6 mm) fraction.

Table 22 summarizes the data assumed in estimating the dilution to be 85 % ash.

Because of the very hard nature of the dilution, it will have almost no effect on product quality and will report to tailings in the cleaning circuit. This if the dilution in the plant feed decreases by 1%, the plant recovery will increase by 1%.

Table 22: DILUTION (by Weight %)

SEAM	Increase in Dilution Over 1970-71 Bulk Samples	Total Dilution from Seam Descriptions (*)	Total Calculated Dilution (**)
2	32.4	6.4	29.2
3	8.4	17.6	6.5
4	3.4	21.6	15.1
6	13.4	13.9	9.3
7	2.8	16.0	23.1
8	21.2	38.1	20.0
9	(7.3)	18.0	(0.6)
10	7.8	22.5	8.4
12	28.7	44.8	27.0
13	46.1	58.9	58.7
14	43.5	48.2	47.9
15	25.3	57.3	39.7
16	34.2	35.4	32.9
17	37.1	26.6	27.3
18	18.5	29.8	24.7
Average	21.0	30.3	24.6
Wt.Avg. Scheme 'A'	20.0	30.0	23.3
Scheme 'C'	18.4	28.9	21.8

*Includes all partings.

**Assuming coal has 1.45 S.G. (17.5% Ash) & Rock Dilution has 2.50 S.G. (85.0% Ash)

7.4. Size Distribution

Experience has shown in the Western Canadian coal industry that the normal methods of determining the size distribution of the plant feed are not functional. As a result, all the present coal preparation plants in Western Canada had undersized fines circuits initially. In order to ensure that the same error does not occur at Elk River, the amount of fines present in the plant feed was estimated by Techman based on Western Canadian coal experience. A program was laid out which would develop Hardgrove Grindability data sufficiently to confirm those predictions.

The Hardgrove Index is a good measure of the strength of coal materials. Unfortunately, due to its very contrasting softness compared with the hard rocky intrusive materials, the Hardgrove Index on high ash coals probably reflects the properties of the rock rather than of the coal. A better measure of the size distribution is an attrition test similar to the one being developed by Kaiser Resources on the Balmer Elk View preparation plant.

Figure 10 shows the relationship between the Hardgrove Index and the - 28 mesh (0.6 mm) fines fraction of plant feed developed for Western Canadian coals. According to this illustration, the Elk River blend of coals will produce about 35% - 28 mesh (0.6 mm) material in the average.

Table 23 compares the Hardgorve Grindability Indices of the bulk samples taken in 1971 to those of 1975. All the seams show reasonable correlation except 2, 3, 4 and 12. Seam 2 was to be driven beyond the oxidation zone and would be expected to be harder. The coaly properties of seam 4 changed so the physical coal characteristics also changed. Seam 4 was sampled in a different area, resulting in a chance of its characteristics. The full width of seam 12 was sampled in 1975 so harder material was introduced to the sample.

Figure 10: Minus 28 Mesh (0.6 mm) Fines Content as a Function of Grindability Index of 9% Ash Clean Coal

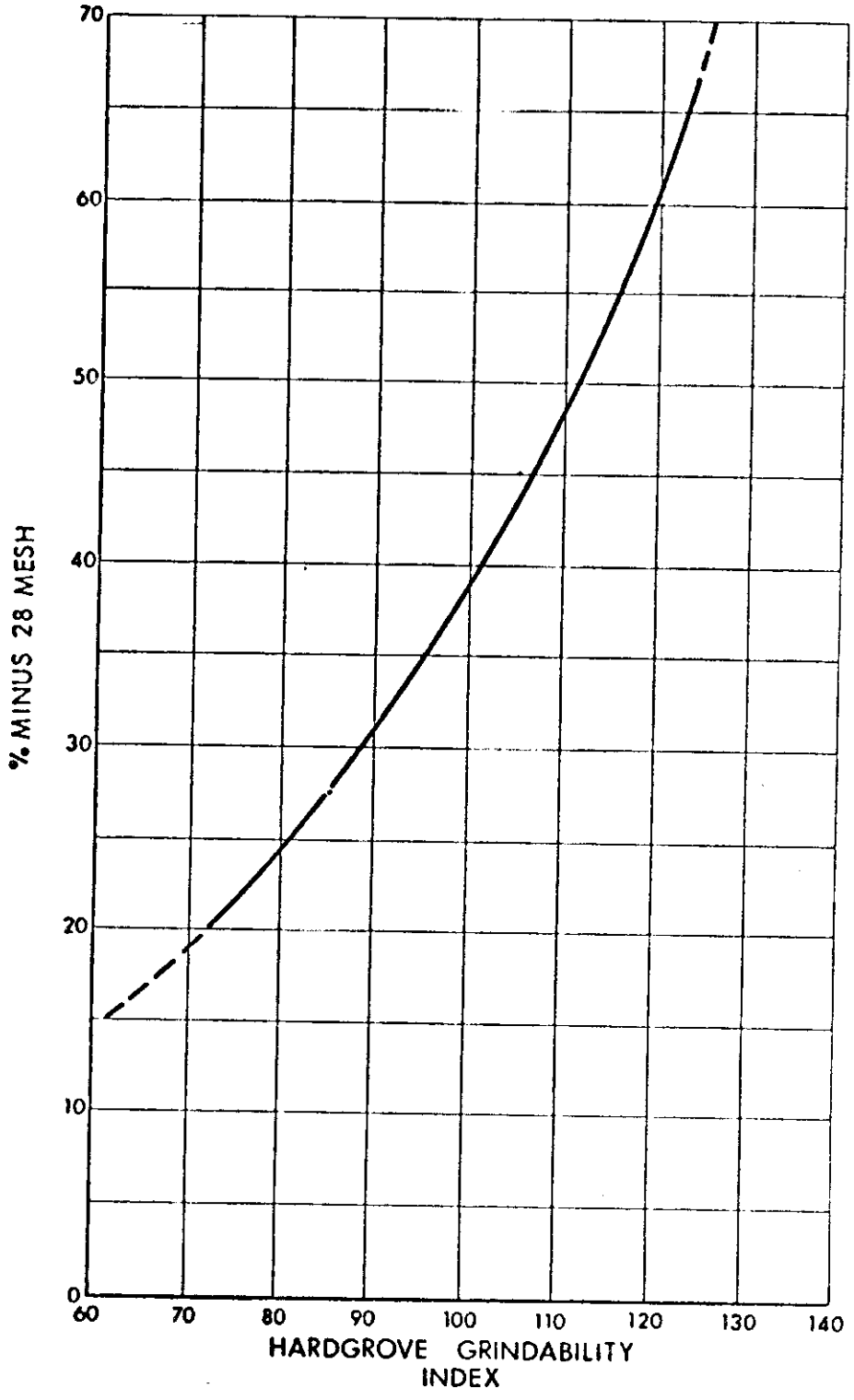

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Table 23: SIZE DISTIRBUTION AS A FUNCTION OF GRINDABILITY INDEX

SEAM	1971 EMR Values	1975 Bulk Samples	Estimated (%) -28 Mesh
2	124	109	47
3	131	118	59
4	89	107	46
7	81	88	30
7	103	106	45
8	97	93	33
9	85	84	27
10	88	82	26
12	132*	99*	38
13	106	107	46
14	96	100	39
15	97	100	39
16	78	87	29
17	70	76	22
18	89	95	35
19	71		
Average	96	97	37
'A'	97.7	97.1	37.6
'C'	100.8	98.4	38.7

(*) The 1971 value was high because only the upper part of the seam was sampled.

Table 24 summarizes the size distribution in the current washability data. The size distribution is shown in Figure 11.

The ½" x 28 mesh (12.5 - 0.6 mm) fraction will normally comprise 58 % of the feed. For design purpose, 60 % should be sufficient.

The - 28 mesh (0.6 mm) fines fraction only constituted 24.1 % of the feed. However, a higher fines content of 40 % - 28 mesh (0.6 mm) should be assumed for plant design.

7.5 Product Evaluation by Techman Ltd.

The product evaluation has been based on the washability curves shown in Figures 8 a to c . Table 25 shows the product evaluation for the average condition.

The weight percent and ash percent of the various fractions were not adjusted to the figures expected to be in practice, as this alteration would require recalculating the washability data. However, the product ash and yield can be derived from the probable error curves given in the Techman report of March 1976.

Since the plant feed will be finer in size than as it is shown in Table 25 , the probable error values have been chosen on the conservative side so that the product evaluation is not erroneously low. Techman also did not use the conventional equations relating to particle size distribution quoted by DSM, as these equations do not take into account the shape of the coal particles or the amount of near gravity material present. Western Canadian coal experience indicates that probable errors approaching the calculated error are seldom achieved, especially in heavy media cyclones, due to the more flat instead of cubical shape of the coal particles and the high amount of near gravity material.

Table 24: SIZE DISTRIBUTION BASED ON WASHABILITY DATA

Seam	Oversize in Bulk Samples[1]	Plant Feed[1]			
	+2"	2" x ½"	½" x 28M	28 x 65M	65M x 0
2	4.5	17.9	50.0	4.9	27.2
3	7.7	13.6	48.7	22.3	15.4
4	4.0	17.9	58.3	11.3	12.5
6	5.4	20.0	46.8	11.1	22.1
7	2.9	13.4	44.7	15.1	26.8
8	8.5	26.7	50.3	18.9	4.1
9	9.9	24.2	56.0	10.3	6.5
10	4.6	16.2	50.9	9.4	23.5
12	10.6	28.3	51.1	8.7	11.9
13	17.6	19.3	63.7	7.4	9.6
14	13.4	30.6	51.8	7.0	10.6
15	11.1	34.1	47.9	11.9	6.1
16	13.9	28.9	47.5	11.3	12.3
17	12.1	28.6	56.6	9.6	5.2
18	13.4	18.0	62.4	8.0	11.6
Average	9.3	23.6	52.4	11.1	13.7
Wt. Avg. 'A'	8.7	22.2	53.5	10.6	13.5
Wt. Avg. 'C'	7.9	21.5	53.1	12.1	14.3
Scheme 'A'	8.0	20.4	49.4	9.8	12.4

(1) The breaker rejects will probably be 10-20% of the +2" fraction

(2) Plant feed is normalized to 100%.

Figure 11: SIZE DISTRIBUTION CURVE OF PLANT FEED

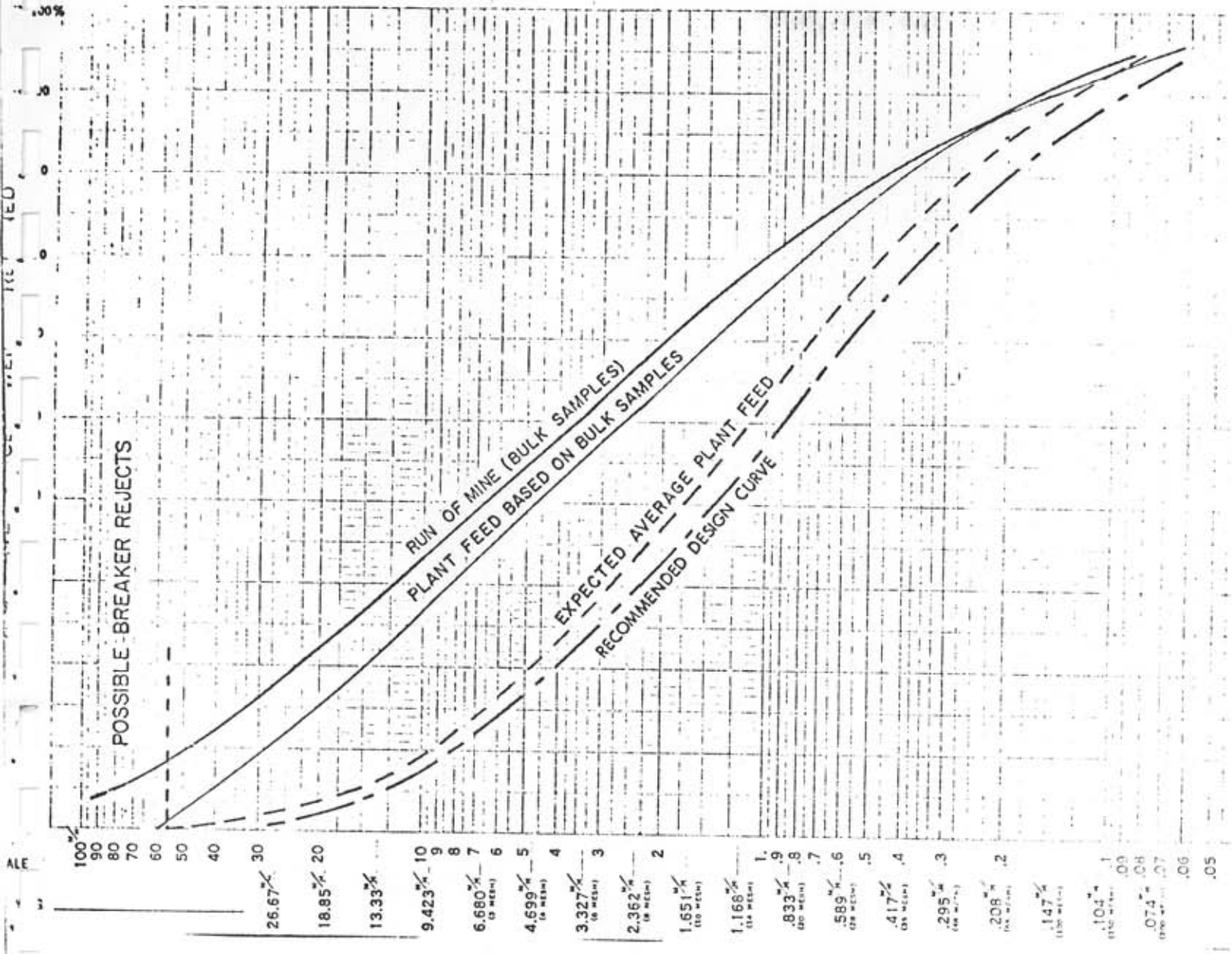

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Table 25 : PRODUCT EVALUATION

CIRCUIT EQUIPMENT	SIZE FRACTION	WT. +) (%)	RAW COAL ASH %	SPECIFIC GRAVITY CUT	PROBABLE ERROR	PRODUCT ASH %	YIELD (%)
M I N I N G S C H E M E " A "							
Heavy Media Bath	4" x ½"	22.2	51.4	1.55	0.04	10.4	36.5
Heavy Media Cyclones	½" x 28M	53.7	32.3	1.55	0.08	8.65	60.7
Compound Water Cyclones	28M x 65M	10.6	17.9	1.70	0.15	8.0	75.5
Froth Flotation	65M x 0	13.5	17.7			9.65	75.0
Combined Product	2" x 0	100.0	33.0			9.0	58.8
M I N I N G S C H E M E " C " (Assuming the Same Cutpoint as Scheme "A")							
Heavy Media Bath	4" x ½"	21.2	53.5	1.55	0.04	10.8	38.0
Heavy Media Cyclones	½" x 28M	52.6	32.0	1.55	0.08	8.75	61.0
Compound Water Cyclones	28M x 65M	12.0	17.6	1.70	0.15	8.0	75.5
Froth Flotation	65M x 0	14.2	17.4			9.55	75.0
Combined Product	2" x 0	100.0	32.8			9.1	59.9
(Assuming the Same Product Ash as Scheme "A")							
Heavy Media Bath	4" x 0	21.2	53.5	1.52	0.04	10.4	36.5
Heavy Media Cyclones	½" x 28M	52.6	32.0	1.54	0.08	8.65	60.2
Compound Water Cyclones	28M x 65M	12.0	17.6	1.70	0.15	8.0	75.5
Froth Flotation	65M x 0	14.2	17.4			9.65	76.0
Combined Product	2" x 0	100.0	32.8			9.0	59.3

Wt. According to Average Washability

The theoretical versus actual probable errors are as follows assuming the theoretical values are calculated using the DSM equations.

Heavy Media Vessel (1.55 S.G.)

$$e_p = 0.017\ d_p - 0.05$$

$$= 0.021$$

Heavy Media Cyclone (1.55 S.G.)

$$e_p = 0.027\ d_p - 0.01$$

$$= 0.027\ (1.55\ MM) - 0.01$$

$$= 0.034$$

Compound Water Cylcones

e_p = 0.12 is the best reported separation for a Western Canadian coal preparation plant.

	Theoretical	Actual
Heavy media vessel	0.021	0.04
Heavy media cylcone	0.034	0.08
Two-stage compound water cyclone	0.12	0.15

Part of the justification for using probable error values approximately double the theoretical values is that the theoretical values are always based on a system adjusted for a uniform feed with no misplaced material, i.e. no fines in the heavy media cyclone circuit.

In the case of a heavy media vessel, it is impossible to account for the imperfect mixing and consequently variation in media density across the vessel, and the effects of poorly sized magnetite. The only source of magnetite in Western Canada is Craigmont Mines, which does not produce a graded sized dense media such as it is available in the Eastern United States. In addition to the above problems, the heavy media cyclones are usually adapted to an optimum amount of refuse and overflow and wide variations in refuse volume, i.e. 20% by weight rejects to 50% rejects, cause the cylcones to perform inefficiently. Also, because of the fine nature of the Western Canadian coals, misplaced material, i.e. minus 28 mesh (0.6 mm) coal is always present in variable amounts in the heavy media cylcone circuit, which tends to act as media thereby changing the separation specific gravity as well as hindering separation by increasing the viscosity of the media. Fortunately, the Elk River coal seams have very little clay content which also increases the media viscosity.

Disregarding operator error, the technical problems associated with the operation of a heavy media plant warrant conservative probable error and design conditions when assessing the plant's capability to clean coal. Therefore, the average plant product ash may not be the most economically desirable product.

In addition to the average product, it is important to realize the flexibility of heavy media coal cleaning equipment. As examples, Tables 26a and b show the lowest cleaning density based on reaching the 20 %near gravity material beyond which separation becomes formidable according to BIRD,and the highest cleaning density. The lowest density yields an 8.3% ash product with a 55% recovery in mining plan "A", while the higher density yields a 9.5% ash product at 61% recovery. The specific gravity of 1.6 was chosen as the highest

Table 26 a): PRODUCT EVALUATION BY MINIMIZING ASH CONTENT OF CLEAN COAL

CIRCUIT EQUIPMENT	SIZE FRACTION	WT. (%)	RAW COAL ASH %	SPECIFIC GRAVITY CUT	PROBABLE ERROR	PRODUCT ASH %	YIELD (%)
MINING SCHEME "A"							
Heavy Media Bath	4" x ½"	22.2	51.4	1.50	0.04	9.8	34.5
Heavy Media Cyclones	½" x 28M	53.7	32.3	1.48	0.08	7.75	55.5
Compound Water Cyclones	28M x 65M	10.6	17.9	1.60	0.15	7.3	71.5
Froth Flotation	65M x 0	13.5	17.7			9.65	75.0
Combined Product	2" x 0	100.0	33.0			8.3	55.1
MINING SCHEME "C"							
Heavy Media Bath	4" x ½"	21.2	53.5	1.50	0.04	10.2	35.5
Heavy Media Cyclones	½" x 28M	52.6	32.0	1.48	0.08	7.75	55.5
Compound Water Cyclones	28M x 65M	12.0	17.6	1.60	0.15	7.3	71.5
Froth Flotation	65M x 0	14.2	17.4			9.55	75.0
Combined Product	2" x 0	100.0	32.8			8.4	56.5

Table 26 b): PRODUCT EVALUATION BY MINIMIZING RECOVERY

CIRCUIT EQUIPMENT	SIZE FRACTION	WT. (%)	RAW COAL ASH %	SPECIFIC GRAVITY CUT	PROBABLE ERROR	PRODUCT ASH	YIELD (%)
M I N I N G Plan "A"							
Heavy Media Bath	4" x ½"	22.2	51.4	1.60	0.04	11.5	38.2
Heavy Media Cyclones	½" x 28M	53.7	32.3	1.60	0.08	9.2	63.5
Compound Water Cyclones	28M x 65M	10.6	17.9	1.80	0.15	8.65	78.7
Froth Flotation	65M x 0	13.5	17.7			9.65	75.0
Combined Product		100.0	33.0			9.5	61.0
M I N I N G Plan "C"							
Heavy Media Bath	4" x ½"	21.2	53.5	1.60	0.04	11.9	39.5
Heavy Media Cyclones	½" x 28M	52.6	32.0	1.60	0.08	9.25	64.0
Compound Water Cyclones	28M x 65M	12.0	17.6	1.80	0.15	8.65	79.0
Froth Flotation	65M x 0	14.2	17.4			9.55	75.0
Combined Product		100.0	32.8			9.6	62.2

practical operating density because the ash, above this density, is greater than 35%, so very little increase in recovery would result in a much higher product ash.

The anticipated recovery as a function of the raw coal and product ash content is shown on figure 12. This figure was developed by plotting the product ash content and recovery from the average washability condition and then calculating the dilution material decrease at lower plant feed ash.

The average washability indicates that with a feed ash content of 33% a product with an ash content of 9% can be produced at about 59% recovery and of 9.5 % ash at about 61% recovery.

As can be seen from the tables 26a and b the mining plan "C" had almost no effect on the recovery or ash content of clean coal. It appears to be possible that a product with an ash content of 9% can be achieved economically . Past experience in the Fernie Area has proved that a product ash content of 9.5 % is more viable.

The recovery of each single seam calculated from washability data for a product ash content of 9.5% is shown on Table 27.

Figure 12 : ANTICIPATED RECOVERY AS A FUNCTION OF RAW COAL AND PRODUCT ASH CONTENT

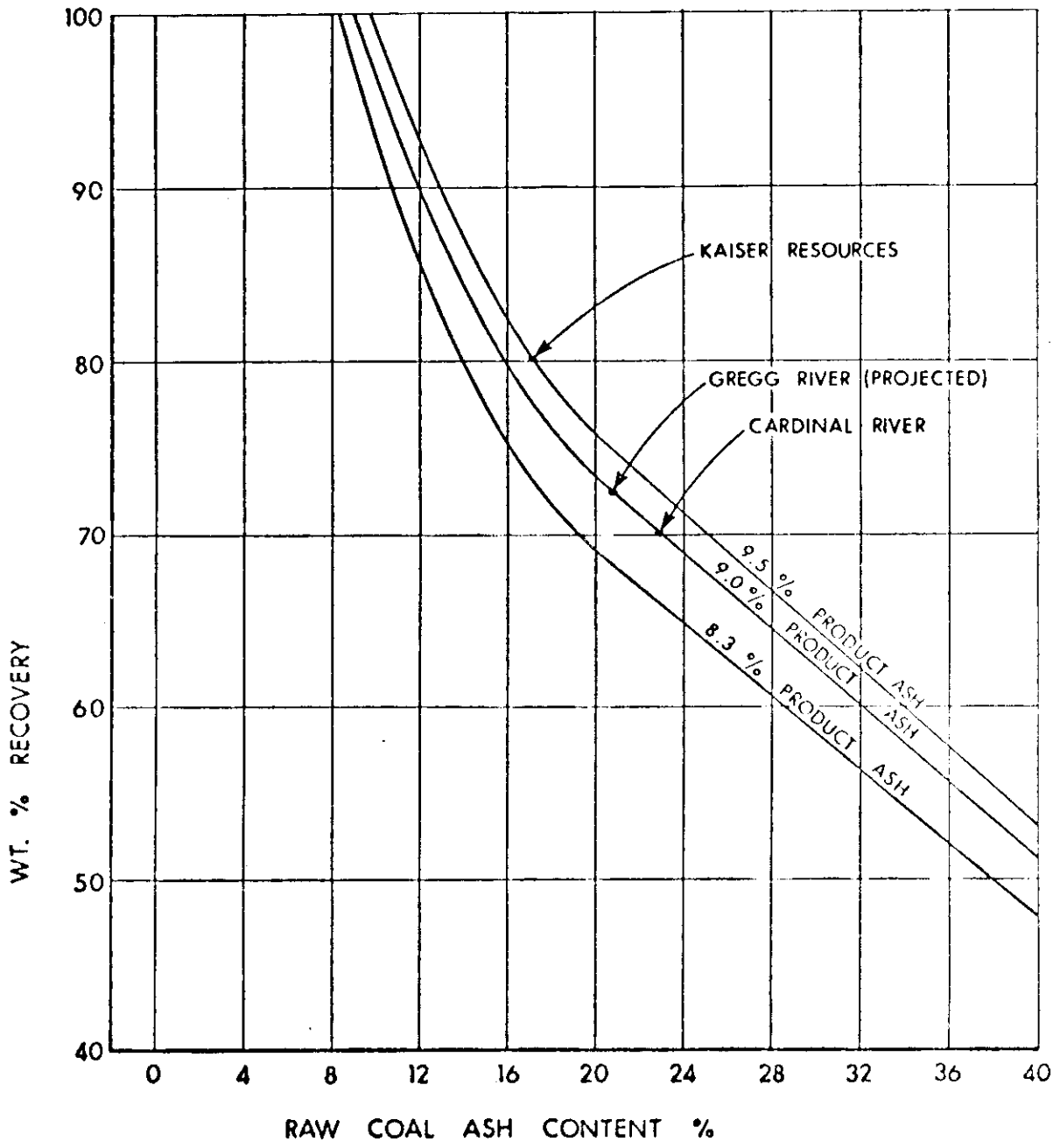


TABLE 27: RECOVERIES FOR SINGLE SEAM COALS CALCULATED FOR A PRODUCT ASH CONTENT OF 9.5 %

SEAM	RECOVERY %
2	55.1
3	82.9
4	75.2
6	66.8
7	52.6
8	66.3
9	73.7
10	77.9
12	48.5
13	24.6
14	42.4
15	44.2
16	47.3
17	66.7
18	68.4
AVERAGE:	61.2

8. Review and Evaluation by Kaiser Engineers

8.1. Ash Content and Size Distribution of the Raw Coal

Table 28 compares Kaiser Engineers' estimates for the dilution and the ash content of the raw coal with those of Techman Ltd. Despite differences in the dilution of the individual seams, Kaiser Engineers arrive at the same average ash content for the raw coal feed as Techman Ltd. around 33%. Techman Ltd. gives to 32.8 % and Kaiser Engineers 32.1% for the Mining Plan C. Kaiser Engineers also find no significant difference between the raw coal ash content of the Mining Plans A and C.

The ash content and the size distribution of the raw coal is estimated by Kaiser Engineers as follows:

Size Fraction	Size Proportion Mean %	Size Proportion Range %	Ash Content %
4" x ½" (100-12,5 mm)	13	9 - 18	53.4
½" x 28 mesh (12.5-0.6 mm)	52	46 - 53	31.6
28 mesh x 65 mesh (0.6 - 0.2 mm)	17	14 - 22	19.1
65 mesh x 0 (0.2 - 0 mm)	18	15 - 23	15.8
4" x 0 (100 - 0 mm)	100		32.1

Kaiser Engineers compute 35% for the -28 mesh (0.6 mm) fines fraction. As mentioned earlier Techman Ltd. arrived at the same figure.

Table 28 Assessment of Dilution and Ash Content of Raw Coal by Kaiser Engineers and Techman Ltd.

Seam Number	% Wt Coal Reserves	% Ash (Dry Basis) 3/4" x 28M	% Ash (Dry Basis) 28M x 0	Head Ash % 3/4" x 0 (Dry Basis)	% Wt Dilution @ 2.40 Spec Grav	% Ash (Dry Basis) Dilution	% Wt ROM Coal	Kaiser Engineers % Ash ROM Coal (Dry Basis)	Techman Head Ash % Techman Report March 1975 Table 3, Page 6
2	10.29	14.45	12.00	*14.10	10.19	80.0	9.58	20.81	20.00
3	4.25	16.29	17.42	16.38	18.62	80.0	4.37	28.22	20.00
4	16.51	27.04	16.78	24.92	12.69	80.0	17.78	31.91	25.00
5	1.11	26.60	24.17	26.36	38.77	80.0	1.52	47.16	25.00
6	3.38	13.75	12.77	13.60	31.87	80.0	4.15	34.76	45.00
7	2.87	31.34	24.24	30.68	15.09	80.0	2.83	38.12	30.00
8	10.63	30.65	14.09	26.97	15.04	80.0	10.47	34.95	35.00
9	8.45	22.88	13.11	21.63	8.38	80.0	7.71	26.52	25.00
10	12.48	18.30	11.50	17.20	7.77	80.0	11.32	22.08	20.00
11	2.63	28.84	14.90	25.35	16.42	80.0	2.63	34.32	
12	7.40	28.84	14.90	25.35	17.29	80.0	7.48	34.80	30.00
13	7.77	33.89	27.07	33.12	25.38	80.0	8.64	45.02	40.00
14	4.92	22.74	16.19	21.87	23.94	80.0	5.41	35.78	50.00
15	3.30	32.13	12.23	29.29	22.77	80.0	3.57	40.83	50.00
16	1.12	16.67	11.10	15.97	39.86	80.0	1.56	41.49	55.00
17	0.79	10.47	12.42	10.64	27.01	80.0	0.91	29.37	45.00
18	0.05	23.22	15.37	22.04	42.17	80.0	0.07	46.48	50.00
Group I	61.73			22.35	14.15	80.0	60.15	30.50	
Group II	36.31			23.71	18.63	80.0	37.31	34.19	
Group III	1.96			13.97	35.32	80.0	2.54	37.29	
Composite of Seams 2-18	100.00			22.68	16.36	80.0	100.00	32.05	32.80

*Based on October 1971 Birtley data

Kaiser Engineers anticipate wide fluctuations in the size distribution of the raw coal. They feel the preparation plant should be designed in a conservative manner so as to obtain a product constant in terms of quality and quantity.

8.2. Preparation-Plant Yield and Ash Content of the Clean Coal

When calculating the average washability characteristics of Elk River coal Kaiser Engineers assumed (raw coal ash content 32.1 %) that 45% of the dilution rock with a specific gravity of 1.80 g/cm^3 would be rejected by the preceeding rotary breaker. This rejects amounts to 4.8% of the raw coal feed. Table 29 gives the average washability data. The relationship between the flotation plant yield, the ash content of the flotation product, and the ash content of the flotation feed is shown in Fig. 18.

From the washability data, Kaiser Engineers calculated the following average plant-to-rail yield and average ash content of the clean coal for the Elk River preparation plant:

Size Fraction	Raw Coal Size Proportion %	Clean Coal Yield %	Clean Coal Ash Content %
Heavy media bath: 4" x ½" (150 - 12.5 mm)	13.0	48.1	10.1
Heavy media cyclone: ½" x 28 mesh (12.5 - 0.6 mm)	52.0	64.6	9.4
Water compound cyclone: 28 mesh x 65 mesh (0.6 - 0.2 mm)	17.0	81.0	9.0
Flotation: 65 mesh x 0 (0.2 - 0 mm)	18.0	80.0	9.5
Plant excl. rotary breaker: 4" x 0 (100 - 0 mm)	100.0	68.0	9.4

Table 29 Average Washability of Elk River Coal
(calculated by Kaiser Engineers)

Composite, 4" x 1/2" - 2" x 1/2"
19[illegible]" Birtley Data

a)

Spec Grav	% Wt	% Ash	Cumulative Float % Wt	Cumulative Float % Ash
1.30 float	8.51	3.08	8.51	3.08
1.30 x 1.35	19.51	6.24	28.02	5.28
1.35 x 1.40	9.46	11.43	37.49	6.83
1.40 x 1.45	4.76	15.65	42.25	7.82
1.45 x 1.50	2.80	21.29	45.05	8.66
1.50 x 1.55	1.79	27.70	46.83	9.39
1.55 x 1.60	1.20	32.27	48.03	9.96
1.60 x 1.70	2.55	39.79	50.58	11.46
1.70 x 1.80	2.17	50.62	52.75	13.07
1.80 sink	47.25	81.39	100.00	45.35

Composite, 1/2" x 28 M
[illegible] Birtley Data

b)

Spec Grav	% Wt	% Ash	Cumulative Float % Wt	Cumulative Float % Ash
1.30 float	20.95	2.32	20.95	2.32
1.30 x 1.35	13.37	5.10	34.32	3.40
1.35 x 1.40	12.54	8.94	46.86	4.88
1.40 x 1.45	8.07	13.62	54.93	6.17
1.45 x 1.50	3.41	20.44	58.34	7.00
1.50 x 1.55	2.73	23.74	61.08	7.75
1.55 x 1.60	1.61	30.30	62.68	8.33
1.60 x 1.70	2.07	38.57	64.75	9.30
1.70 x 1.80	2.15	45.20	66.90	10.45
1.80 sink	33.10	79.75	100.00	33.39

Composite, 28 M x 65 M
[illegible]5 Birtley Data

c)

Spec Grav	% Wt	% Ash	Cumulative Float % Wt	Cumulative Float % Ash
1.30 float	31.42	1.73	31.42	1.73
1.30 x 1.35	17.67	4.64	49.09	2.78
1.35 x 1.40	11.31	8.18	60.40	3.79
1.40 x 1.45	7.68	12.08	68.08	4.73
1.45 x 1.50	4.98	18.15	73.06	5.64
1.50 x 1.55	2.65	25.53	75.71	6.34
1.55 x 1.60	1.93	31.57	77.64	6.96
1.60 x 1.70	2.48	37.66	80.12	7.92
1.70 x 1.80	1.86	45.12	81.98	8.76
1.80 sink	18.02	76.10	100.00	23.83

Fig. 18 Relationship between Yield and Ash Content in the Flotation Plant (per Kaiser Engineers)

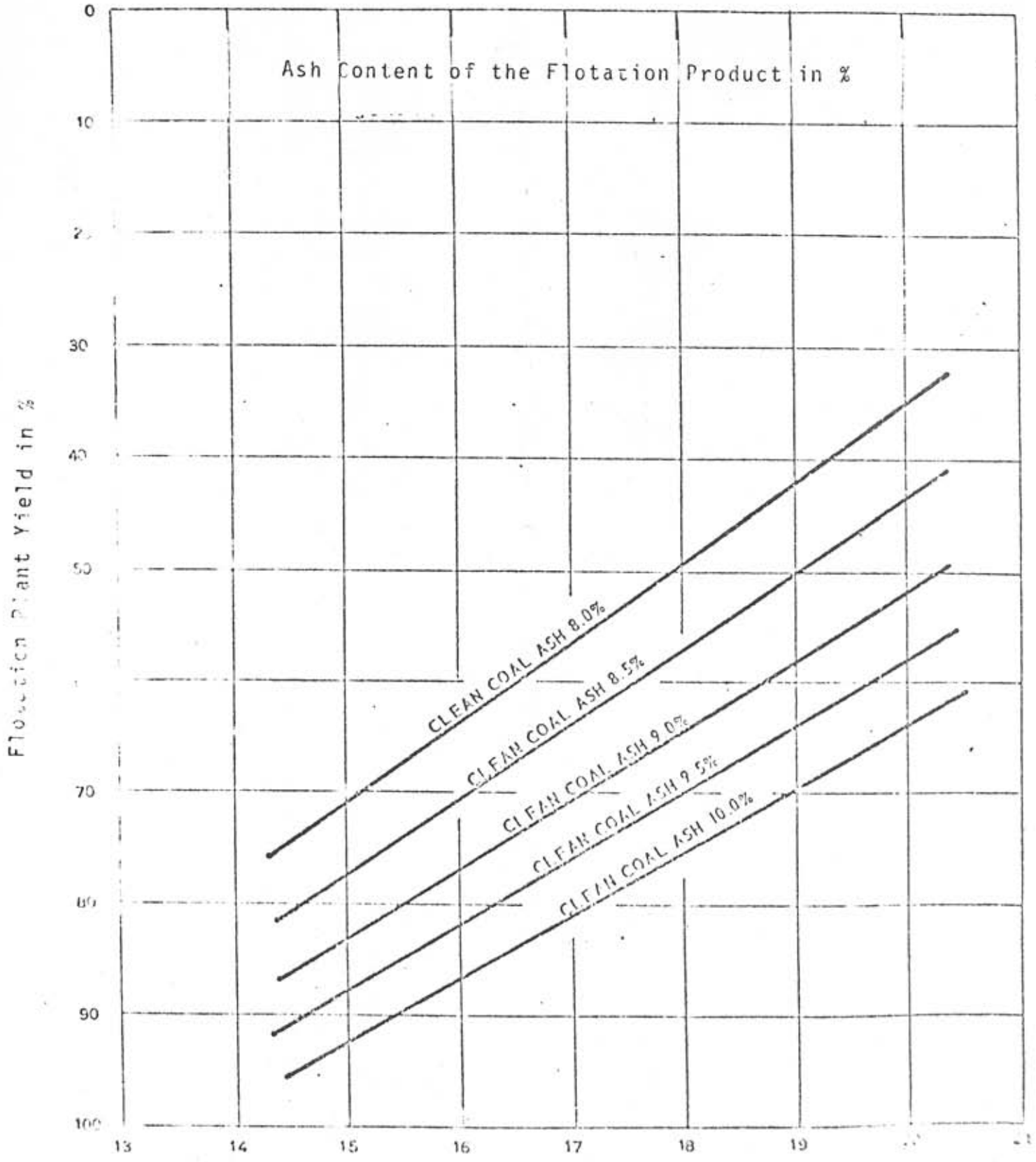


Fig. 14 shows the mean plant-to-rail preparation yield as a function of the clean-coal ash content. This is 68% when producing clean coal with an ash content of 9.4% and 66% with a clean-coal ash content of 9%.

Plotted in Fig. 15 is the pit-to-rail-yield of the Elk River preparation plant (including the rotary breaker) as a function of the clean-coal ash content. Given a raw-coal ash content of 32.1% a yield between 59.0% and 70.4% is predicted when producing clean coal with an ash content of 9.5%. The average yield is expected to be 64%.

8.3. Final Assessment of Kaiser Engineers

Kaiser Engineers arrive a pit-to-rail yield of 64.7%, when producing clean coal with an ash content of 9.5%. Their yield is higher than the 61% yield of Techman Ltd.; this difference lies largely in the fact that Techman Ltd. took as a basis for their yield estimate a fines - 28 mesh (0.6 mm) content of 24.1%, given in the pilot washing data. Whereas Kaiser Engineers based their yield estimate in a fines content of 35% anticipated in a commercial plant. Both consulting companies expect the same high yield of around 80% in the fines fraction.

Both Kaiser Engineers and Techman Ltd. propose that the effects and anticipated quantities of dilution should be studied during the Feasbility Phase. Commercial scale tests should establish what amounts of dilution should be studied during the Feasbility Phase. Commercial scale tests should establish what amounts of dilution can be discarded ahead of the preparation plant, e.g. by a rotary breaker. Attrition tests should also be carried out to determine accurately the size distribution of the raw-coal feeds. A size distribution drum for attrition testing is to hand at the Balmer mine of Kaiser Resources Ltd. Conditions

Fig. 14 The Plant-To-Rail Yield of the Elk River Preparation Plant as Function of the Clean-Coal Ash Content (per Kaiser Engineers)

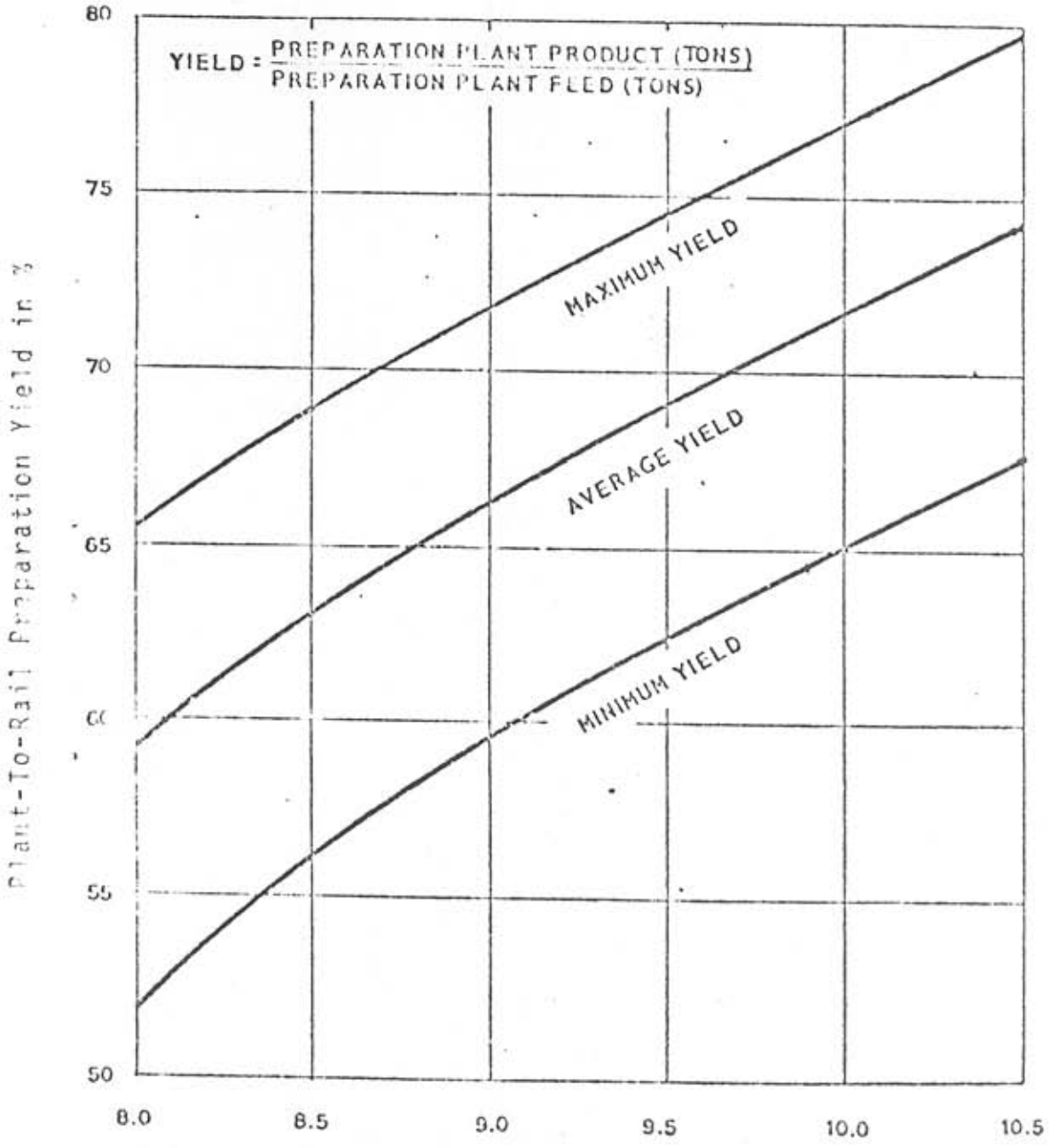


Fig. 15 The Total Pit-To-Rail Yield of the Elk River Preparation Plant as Function of the Clean Ash Content (per Kaiser Engineers)

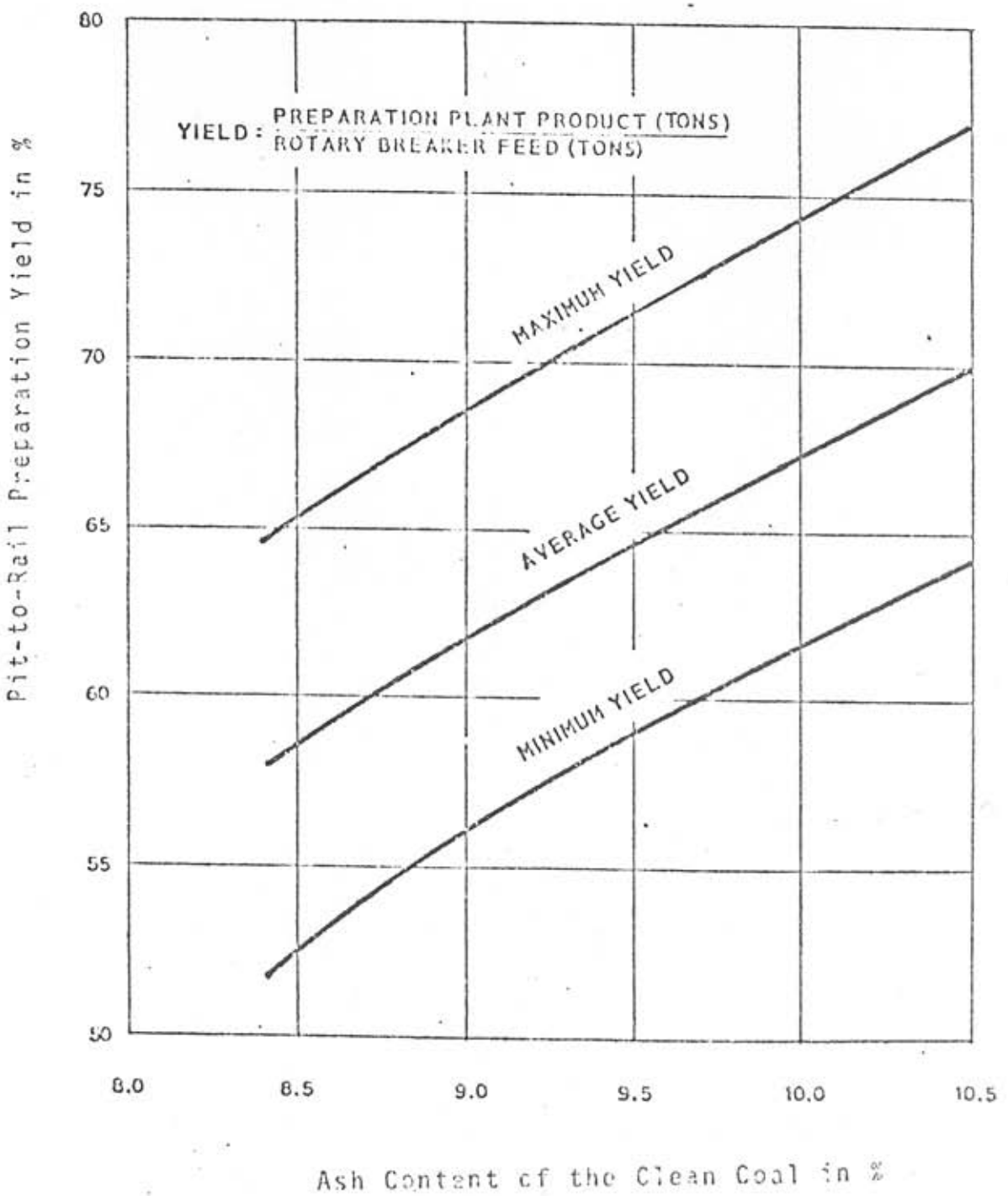
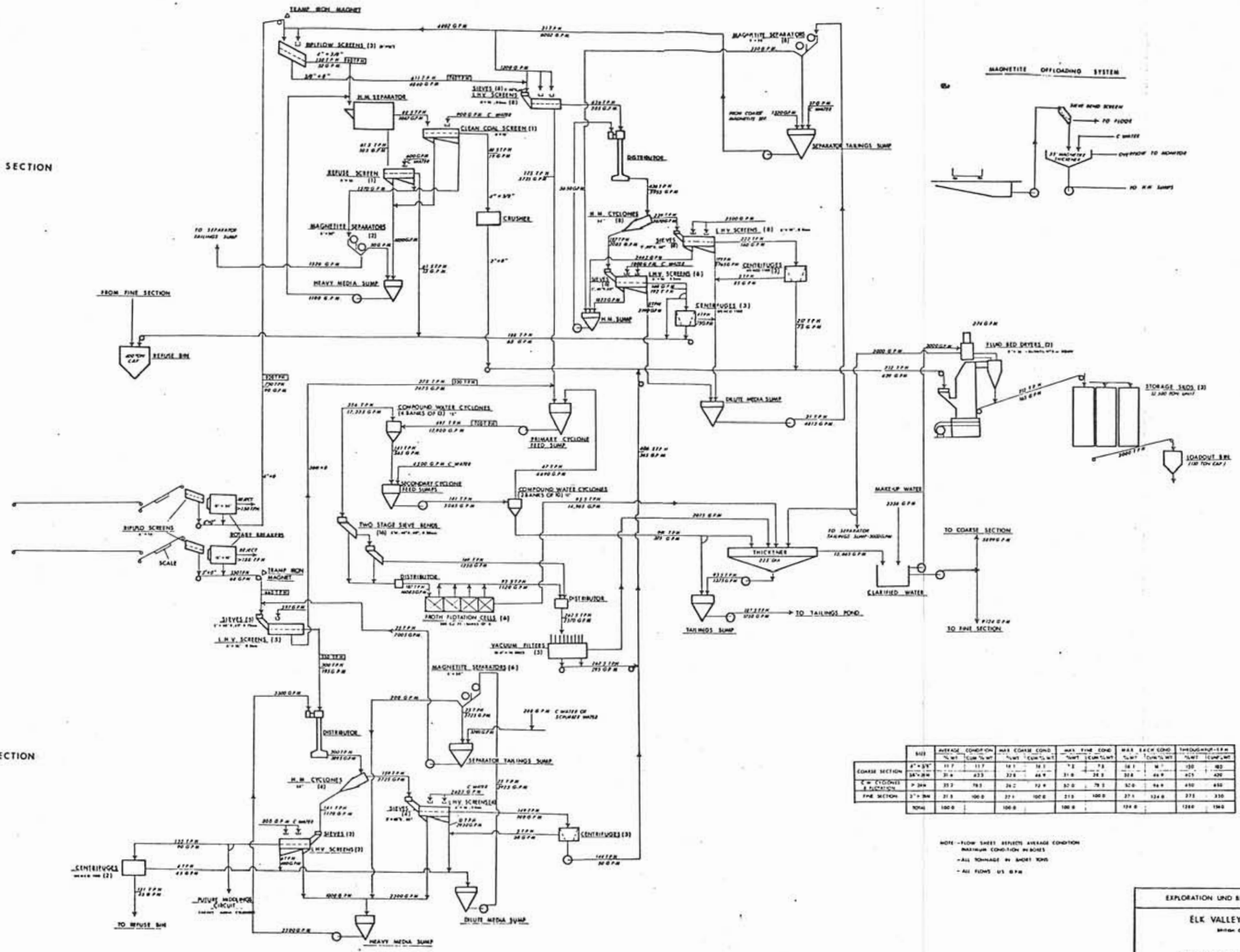


Figure 16

The Flowsheet of the Elk River Preparation Plant (per Techman Ltd.)

"HARD" COAL SECTION

"SOFT" COAL SECTION



SIZE	AVERAGE CONDITION % WT	AVERAGE CONDITION CUM % WT	MAX COARSE COND % WT	MAX COARSE COND CUM % WT	MAX FINE COND % WT	MAX FINE COND CUM % WT	MAX EACH COND % WT	MAX EACH COND CUM % WT	THROUGHPUT - T.P.H. % WT	THROUGHPUT - T.P.H. CUM % WT
COARSE SECTION 4" x 3/8"	11.7	11.7	14.1	14.1	7.5	7.5	14.1	14.1	150	150
COARSE SECTION 3/8" x 28 M	31.4	43.1	32.8	46.9	31.8	39.3	32.8	46.9	625	625
C.W. CYCLONES & FLOTATION + 28 M	35.2	78.3	34.2	81.1	32.0	71.3	32.0	78.9	650	650
FINE SECTION 0" x 28 M	21.5	100.0	27.1	100.0	21.5	100.0	27.1	126.0	375	350
TOTAL	100.0		100.0		100.0		126.0		1260	1340

NOTE - FLOW SHEET REFLECTS AVERAGE CONDITION
MAXIMUM CONDITION IN BOXES
- ALL TONNAGE IN SHORT TONS
- ALL FLOWS U.S. G.P.M.

EXPLORATION UND BERGBAU GMBH OF CANADA

ELK VALLEY COAL PROJECT
BRITISH COLUMBIA, CANADA

PRELIMINARY FLOW SHEET

SCALE NOT TO SCALE
DRAWING NO 1571-00
DRAWN BY MASTAN REDDY
APPROVED BY
DATE APR 6
REVISION NO FM-113

TECHMAN LTD.

2. However, the system for two separate preparation streams should be retained for reasons of flexibility (e.g. maintenance). The high throughputs of 1,280 short tons per hour of run-of-mine-coal (plant availability 71%, yield 55%) make a single-stream preparation process less desirable.

3. Greater economy can be achieved by heating a single drying unit with natural gas.

4. The system comprising several raw coal blending beds of intermediate stockpiles and front-end loaders for reclaiming the coal and feeding the conveyors should be retained for reasons of flexibility. Under the prevailing climatic conditions these loading units have a high availability. Techman Ltd. views as less suitable the mechanized tippers and reclaimers proposed by E+B as alternatives. They are too complex and are said to habe a very low availability in Western Canada.

5. Either jigs or heavy-media vessels should be examined, in addition to the rotary breaker as the means for rejecting the dilution rock before the preparation plant.

6. Filters instead of centrifuges should be used to dewater the fines as the centrifuges would need more frequent maintenance.

9.2. Kaiser Engineers

The capacity of the preparation plant proposed by Kaiser Engineers is 4.4 mill. short tons p.a. including 0.4 mill. short tons p.a. of hydraulically mined coal. Given 67% as the availability of the plant, the run-of-mine throughput works out as 1,200 short tons per hour, corresponding to 744 short tons per hour of clean coal. A conservative 62% the pit-to-rail preparation yield has been used in this calculation. The flowsheet for the Elk River Preparation plant is shown in Fig. 17.

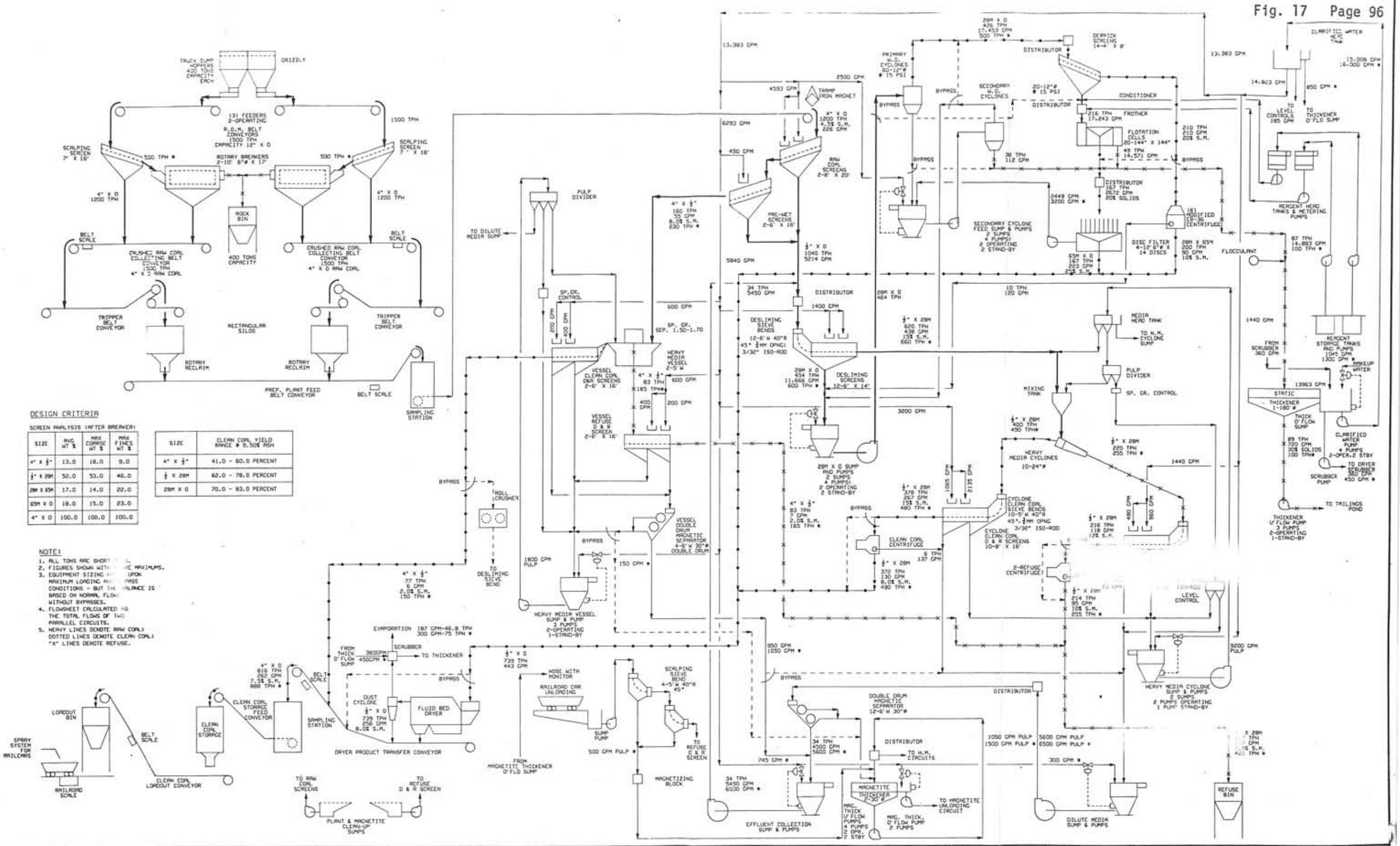
DESIGN CRITERIA

SCREEN ANALYSIS (AFTER BREAKER):

SIZE	AVG. WT %	MAX COARSE WT %	MAX FINES WT %
4" x ¼"	13.0	18.0	9.0
¼" x 28M	52.0	53.0	46.0
28M x 65M	17.0	14.0	22.0
65M x 0	18.0	15.0	23.0
4" x 0	100.0	100.0	100.0

SIZE	CLEAN COAL YIELD RANGE @ 9.50% ASH
4" x ¼"	41.0 - 60.0 PERCENT
¼" x 28M	62.0 - 78.0 PERCENT
28M x 0	70.0 - 83.0 PERCENT

NOTE:
1. ALL TONS ARE SHORT [illegible]. FIGURES SHOWN WITH [illegible] ARE MAXIMUMS.
2. EQUIPMENT SIZING [illegible] UPON MAXIMUM LOADING AND BYPASS CONDITIONS - BUT THE BALANCE IS BASED ON NORMAL FLOW WITHOUT BYPASSES.
3. FLOWSHEET CALCULATED AS THE TOTAL FLOWS OF TWO PARALLEL CIRCUITS.
4. HEAVY LINES DENOTE RAW COAL; DOTTED LINES DENOTE CLEAN COAL; "X" LINES DENOTE REFUSE.



NO.	DATE	REVISION	BY	APP.	APP.

REFERENCE DRAWINGS — NUMBER

NOTES

DESCRIPTION — COST ACCOUNT

WORK COVERED BY THIS DRAWING CHARGED TO COST ACCOUNT ABOVE

CONSTRUCTION APPROVAL

APPROVAL	DATE

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PROFESSIONAL SEAL

		DATE
SCALE	NONE	
DESIGNED BY	SV	5/14
DRAWN BY	ADS	
CHECKED BY	Richard A. Terry	5/14
APPROVED BY	J. P. [illegible]	5/17/74
APPROVED BY	D. M. [illegible]	5/17/74

KAISER CANADA — HENRY J. KAISER COMPANY (CANADA), LTD.

ELCO MINING LTD

COAL PREPARATION PLANT PROCESS FLOW SHEET

JOB No. 75208 — DWG. No. 101-C — REVISION R-

GRAPHIC SCALES IN/FT: 1/8" 0 5 10 15; 1/4" 0 5; 3/8" 0 1' 2' 3' 4' 5' 6' 7'; 1" 0 100 200 300; 1" = 200' 0 200 400; 1" = 100' 0 100 200; 1" = 60' 0 60 120; 1" = 40' 0 40 80

Kaiser Engineers consider that the Techman Ltd. blending beds, of max. capacity 500,000 short tons are not necessary. Two blending silos of around 50,000 short tons capacity should be sufficient.

10. Final Assessment by E+B

The preliminary preparation concept developed by Techman Ltd. was confirmed in principal by Kaiser Engineers and can be regarded as a reasonable basis for the economic project analysis. E+B agrees with Kaiser Engineers, that the yield figures given by Techman Ltd. are too conservative. Therefore, the washability data developed by Kaiser Engineers is being used.

The problem of raw coal blending will be dealt with during the Feasibility Phase. In the opinion of E+B both Techman Ltd. and Kaiser Engineers suggestions are unsatisfactory and need further checking.

The test results to date indicate that no expensive commercial scale washing tests in an existing Western Canadian preparation plant are required for Elk River coal. To obtain bulk samples for commercial scale washing tests to check the performance and efficiency of the proposed machines and methods under normal commercial conditions, and to acquire definite knowledge on the dilution and size distribution of the run-of-mine coal, a test pit was tentatively considered in summer 1975. This seems no longer to be justified in view of the high cost of such a test pit. However, a final decision will be reached before start-up of the feasibility phase.

The Elk River preparation plant will be designed with adequate capacity reserves so as to be able to cope with the anticipated fluctuations in the quality data of the raw coal feed.

During the feasibility phase, rejection of the dilution rock will be investigated. Also to be clarified is whether changes in the preparation flowsheet, e.g. the use of the less expensive jigs that are easier to operate but do not have such a high separating efficiency, represent meaningful alternatives.