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REPORT No. 2

OF 1949

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FUEL RESEARCH INSTITUTE

OF SOUTH AFRICA.

SURVEY REPORT NO. 96.

ONDERWERP:
SUBJECT: REPORT ON 12 BOREHOLES DRILLED BY MESSRS. SEBATO INVESTMENTS, LTD., ON THE FARM ELANDSFONTEIN 8, DISTRICT WITBANK, IN THE YEARS 1945 - 1946.

AFDELING:
DIVISION: CHEMISTRY.

NAAM VAN AMPTENAAR:
NAME OF OFFICER: W. H. D. SAVAGE.

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

REPORT NO. 2 OF 1949.

SURVEY REPORT NO.96.

REPORT ON 12 BOREHOLES DRILLED BY MESSRS. SEBATO INVESTMENTS, LTD. ON THE FARM ELANDSFONTEIN 8, DISTRICT WITBANK, IN THE YEARS 1945 AND 1946.

A series of 12 boreholes was drilled by Messrs. Sebato Investments Ltd. on the north-western portion of Elandsfontein 8, district Witbank in the years 1945 and 1946. Of these boreholes Nos. 12, 11 and 2 were not sampled or analysed by the Fuel Research Institute. The two former boreholes, from the borehole records, did not contain any coal seams worth analysing, No. 12 having only 1 foot of coal at 58 ft., and No.11 having 2 ft. of shaly coal at 52 ft., 3 ft. 6in. of coal shale at 120 ft., and 6 in. of coal at 146 ft. 2 in. In borehole No. 2 only the top and bottom seams of 7 ft. 9 in. and 3 ft. 7 in., respectively, are thick enough for mining. If these seams are similar in quality to the upper portion of the No.4 Seam and the No.2 Seam, respectively, in borehole No.3, they will have no economic value. In addition the top seam is close to the surface and mining would be difficult due to caving of the roof.

Of the boreholes sampled, No.1 and the 7 inch seam in borehole No.3 were sampled by officers of the Fuel Research Institute and the samples prepared at the Institute. The other cores were sampled by Dr. Hall of Messrs. McLachlan & Lazar, in some cases in conjunction with officers of the Fuel Research Institute. The samples from boreholes 8 and 9 were floated at -1" + ½" at a specific gravity of 1.6 by Dr. Hall and prepared samples of these floats and sinks and samples from the other boreholes were received at the Fuel Research Institute.

In the borehole records there are a few cases where the thickness of the beds does not exactly correspond with the increase in total depth. There are also minor differences between depths and thicknesses of seams in the borehole records, and those supplied in the core boxes for sampling. The greatest difference was in borehole No.6 where the borehole record gave the seam at 59 ft. 3 in. to 68 ft. 7 in., and the depths given for sampling were from 50 ft. to 59 ft. 3 in.

Correlation of Seams: The sections of the boreholes showing the coal seams interesected are given in Figure 1. A very tentative correlation of the seams is indicated by the dotted lines. The area covered by the boreholes is large, and the distance betw een boreholes is never less than 2000 ft., with the three northerly boreholes separated from the rest by 4000 ft. The Karroo measures outcrop along the western boundary of Elandsfontein 8, except for the portion north of the railway line where they swing to the west across Rondebult 4. The irregularity in number and appearance of the coal seams and the frequent occurrences of grits and secondary Dwyka show that the seams were deposited here under disturbed conditions such as often occur at the limits of the area of deposition.

All the/.....

All the above considerations make the correlation of the coal seams a difficult matter, and much closer drilling, which is not warranted by the quality of the coal, would be necessary to establish the identity of the seams with any certainty. The seam in borehole No.12 is difficult to identify, and the correlation in borehole No.11 is based on the assumption that the bottom seam is No.1. The seam in borehole No.1 is correlated as No.1, due to the similarity of this seam with the No.1 Seam in the old Premier Colliery area of Nooitgedacht 12 to the north. The correlation of boreholes 10A, 9, 3, 5 and 2 is regarded as being substantially correct, and the top seam in borehole No.10A is considered more likely to be split from the No.4 Seam than the No.5 Seam. The sequence of the seams in boreholes 10A and 9 is very similar to that in borehole 57 in the western corner of Schoongezicht 13. In borehole No.6 the correlation is again doubtful, and the bottom seam in borehole No.4 may be the No.2 Seam. The seam in borehole No.8 is very similar to that in borehole No.1, and is thus regarded as the No.1 Seam. The bottom seam in borehole No.7 is considered to be the No.1 Seam.

<u>The nomenclature used for the seams in this report is throughout that shown in Figure 1, and in the discussion that follows of the quality of the seams it must be realised that any errors in correlation will stultify the conclusions arrived at.</u>

No igneous intrusions were encountered in any of the boreholes, and the volatile matter content of the samples is normal for this portion of the Witbank coalfield.

<u>No. 4 Seam:</u> In borehole No. 10A a 5 ft. seam, which is regarded as the Upper No.4 Seam, was struck at 104 ft. The coal was very inferior, having 46.9% ash.

The No.4 Seam proper was sampled and analysed in boreholes 10A, 9, 3 and 4. In the latter borehole the seam is only 5 ft. thick and is very inferior. In the other three boreholes there occurs at the bottom of the seam a band of coal varying from 59 inches in borehole No.3 to 96 inches in borehole No.9 with a calorific value of about 12.0 lbs/lb., about 16% ash and 22% to 25% volatile matter. Assuming that the average thickness and quality of the lower portion of the seam are maintained over the triangle enclosed by these three boreholes and extend over an equal area beyond these limits, an in situ reserve of approximately 3,000,000 tons of coal is present in 230 acres with an average mining thickness of 6 ft. 6 in. on a basis of 2000 tons per acre foot. If the mining thickness in borehole No.3 is increased from 59 inches to 109 inches, the product here would have a calorific value of about 11.2 lbs/lb. and 18.5% ash. The upper coal in these boreholes is very inferior, but borehole No. 10A has 41 inches of coal with 11.9 lbs/lb. calorific value and 17.5% ash separated from the rest of the seam by 9 ft. of carbonaceous shale. This band of coal is too thin at this quality for mining even if it extends across on to Schoongezicht 13.

<u>No. 3 Seam:</u> This seam was encountered only in boreholes 3, 2 and 5, and analysed only in borehole No.3. Here it consists of bright coal high in volatile matter and with fairly well developed swelling properties and is reasonably low in ash content. These results are typical of the No.3 Seam.

No. 2 Seam:/.....

No. 2 Seam: The No.2 Seam was not present in boreholes 1 and 8 and was only sampled in boreholes 3, 4, 5 and 6. Here the seam varies from 24 to 102 inches in thickness with ash contents between 30% and 40%. The seam is of no value.

No.1 Seam. The No.1 Seam is absent in boreholes 12, 6 and 2, and was not sampled in boreholes 11, 10A and 3. In borehole No.1, which is separated from the rest of the boreholes analysed by an area of thin coal, the seam consists of 7½ inches of high volatile "gas coal" with 12.8 lbs/lb. calorific value and 14.2% ash separated by 8½ inches of gritty carbonaceous shale from 49 inches of mixed dull and bright medium volatile coal with 12.3 lbs/lb. calorific value and 15.5% ash. This constitutes a seam of fair quality but the absence of boreholes in the vicinity towards the south and east prevents the estimation of the area where the seam is thick enough for mining. The remaining samples cover an area covering the south and south-east of the property. Here the seam is thin but of fair quality in borehole No.5, with 30 inches, and borehole No.7, with 36 inches of mineable coal. In borehole No.8 the seam is thicker and similar to borehole No.1 though the coal is slightly thicker and poorer in quality. In borehole No.4 the seam attains its maximum thickness of 90 inches of rather low volatile dull coal with 12.0 lbs/lb. calorific value and 15.7% ash. Further north in borehole No.9 the seam has thinned to 52 inches of which only 36 inches was recovered. This consisted of dull rather low volatile coal with about 12.3 lbs/lb. calorific value and 16.2% ash.

It must again be stressed that the correlation of seams used is only tentative and liable to error, particularly as regards the No.1 Seam. It is for this reason that no calculations of reserves of mineable coal have been made for the No.1 Seam.

Included in this report are three tables, an appendix, and two figures as follows:-

TABLE NO. I.

BOREHOLE RECORDS.

BOREHOLE NO.1.

Commenced: 9/11/45. Completed: 20/11/45.

Collar Level: 198.3' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
43'	20'	Surface Soil & Clay.	43'
3' 6"	3' 6"	Black Shale.	46' 6"
1' 6"	1' 6"	Coarse Grit.	48'
3' 6"	3' 6"	Black Shale.	51' 6"
4"	4"	Coarse Grit.	51' 10"
17' 4"	17' 4"	Coarse Grit.	69' 2"
3"	3"	Carbonaceous Shale.	69' 5"
9' 9"	9' 6"	Coarse Grit.	79' 2"
8' 3"	8'	2nd Dwyka.	87' 5"
5' 6"	5' 3"	Banded Sandstone.	92' 11"
1' 10"	1'10"	Gritty Sandstone.	94' 9"
1' 3"	1' 3"	Coarse Grit.	96'
7' 3"	7' 3"	Carbonaceous Shale.	103' 3"
2' 6"	2' 6"	" " & Grit Bands.	105' 9"
5' 3"	4' 9"	Coal with 8" Grit Band.	111'
15'	15'	2nd Dwyka.	126'
6' 6"	6' 6"	Carbonaceous Shale.	132' 6"
4' 4"	4' 4"	Coarse Grits.	136' 10"
6' 6"	6' 5"	2nd Dwyka.	143' 4"
14' 6"	14' 6"	Laminated Shale.	157' 10"
20' 6"	20' 6"	Banded Shale.	178' 4"
2'	2'	Carbonaceous Shale.	180' 4"
2'	2'	2nd Dwyka.	182' 4"
3' 6"	3' 6"	Banded Shale.	185' 10"
10' 2"	10' 2"	2nd Dwyka.	196'
12'	12'	Grey Granite.	208'

BOREHOLE NO. 2.

Commenced: 26/11/45. Completed: 7/12/45.

Collar Level: 149' above Datum.

Diameter 6 inches.

Thickness of Bed	Core Recovered.	Nature of Strata.	Total Depth.
2'	-	Surface Soil.	2'
28'	10'	Clay.	30'
4' 9"	4' 9"	Carbonaceous Shale.	34' 9"
7' 9"	7' 9"	Coal.	42' 6"
7' 6"	7' 6"	Carbonaceous Shale.	50'
1' 8"	1' 8"	Coal.	51' 8"
4' 10"	4'10"	Sec. Dwyka.	56' 6"

TABLE NO. I (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO. 2 (Contd.).

Commenced: 26/11/45. Completed: 7/12/45.

Collar Level: 149' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
2' 7"	2' 7"	Carbonaceous Shale.	59' 1"
2' 2"	2' 2"	2nd Dwyka.	61' 3"
7' 9"	7' 9"	Carbonaceous Sandstone.	69'
7' 7"	7' 7"	Sandstone and Shale.	76' 7"
3' 6"	3' 6"	Carbonaceous Shale.	80' 1"
1' 8"	1' 8"	Coal.	81' 9"
7' 10"	7' 10"	Shaly Sandstone.	89' 7"
16' 1"	16' 1"	Coarse Grits.	105' 8"
1' 8"	1' 8"	2nd Dwyka.	107' 4"
3'	3'	Coarse Grits.	110' 4"
1'	1'	Shaly Sandstone.	111' 4"
3' 7"	3' 7"	Coal.	114' 11"
2' 8"	2' 8"	Carbonaceous Shale.	117' 7"
7'	7'	2nd Dwyka.	124' 7"
76' 6"	76' 6"	Carbonaceous Shale.	201' 1"
1' 11"	1' 11"	Coarse Sandstone.	203'
5' 6"	5' 6"	Carbonaceous Shale.	208' 6"
- 6"	- 6"	Sandstone.	209'
12' 6"	12' 6"	Dwyka.	221' 6"

BOREHOLE NO. 3.

Commenced: Completed: 3/1/46.

Collar Level: 137.8' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
2'	-	Soil.	2'
22' 2"	-	Clay.	24' 2"
9' 10"	9'	Grit.	34'
5"	-	Clay.	34' 5"
3' 2"	3'	Shale.	37' 7"
2' 6"	2' 6"	Coal.	40' 1"
11"	11"	Sandstone and Shale.	41'
15' 8"	15' 8"	Coal.	56' 6"
12' 10"	12'	Sandstone and Shale.	69' 4"
7"	7"	Coal.	69' 11"
30' 5"	30'	Sandstone and Shale.	100' 4"
5' 1"	5'	Coal.	105' 5"
47' 9"	47'	Sandstone.	153' 3"
46' 6"	46'	Sandstone and Shale.	199' 6"
11"	11"	Coal.	200' 5"
121' 7"	116'	Sandstone and Shale.	322'

TABLE NO. I (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO. 4. (CONTD.).

Commenced: 7.1.1946. Completed: 23.1.1946.

Collar Level: 172.9' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
20'	-	Surface Soil.	20'
20'	1'	Clay.	40'
15'	10'	Sandstone.	55'
40'	40'	Sandstone and Shale.	95'
5'	5'	Coal.	100'
33' 3"	33'	Sandstone and Shale.	133' 3"
6'	6'	Sec. Dwyka.	139' 3"
2'	2'	Sandstone and Shale.	141' 3"
2'	2'	Coal.	143' 3"
25' 7"	25'	Shale and Grit and Sandstone.	169'
7' 6"	7' 6"	Coal.	176' 6"
4'	4'	Sec. Dwyka.	180' 6"
92'	92'	Sandstone and Shale.	272' 6"
4' 6"	4' 6"	Dwyka.	277'

BOREHOLE NO. 5.

Commenced: 28. 1.1946. Completed: 27.2.1946.

Collar Level: 99.3' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
21'	-	Surface Soil & Clay.	21'
14'	14'	Sandstone.	35'
4' 6"	4'	Sandstone Shaly.	39' 6"
4"	4"	Coal.	39' 10"
10' 2"	10' 2"	Shaly Sandstone.	50'
17'	17'	Carb. Shale.	67'
5' 8"	5' 8"	Coal.	72' 8"
27' 4"	27' 4"	Shale, Grit & Sandstone.	100'
2' 2"	2' 2"	Sec. Dwyka.	102' 2"
57'	57'	Coarse Grit & Sandstone.	159' 2"
2' 6"	2' 6"	Coal.	161' 8"
9"	9"	Carb. Shale.	162' 5"
5"	5"	Coal.	162' 10"
1'	1'	Carb. Shale.	163' 10"
86' 2"	86' 2"	Sandstone.	250'
36' 4"	36' 4"	Shale.	286' 4"
36' 8"	36' 8"	Shale.	323'
7'	7'	Dwyka.	330'

TABLE NO. I (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO. 4. (CONTD.).

Commenced: 7.1.1946. Completed: 23.1.1946.

Collar Level: 172.9' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
20'	-	Surface Soil.	20'
20'	1'	Clay.	40'
15'	10'	Sandstone.	55'
40'	40'	Sandstone and Shale.	95'
5'	5'	Coal.	100'
33' 3"	33'	Sandstone and Shale.	133' 3"
6'	6'	Sec. Dwyka.	139' 3"
2'	2'	Sandstone and Shale.	141' 3"
2'	2'	Coal.	143' 3"
25' 7"	25'	Shale and Grit and Sandstone.	169'
7' 6"	7' 6"	Coal.	176' 6"
4'	4'	Sec. Dwyka.	180' 6"
92'	92'	Sandstone and Shale.	272' 6"
4' 6"	4' 6"	Dwyka.	277'

BOREHOLE NO. 5.

Commenced: 28. 1.1946. Completed: 27.2.1946.

Collar Level: 99.3' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
21'	-	Surface Soil & Clay.	21'
14'	14'	Sandstone.	35'
4' 6"	4'	Sandstone Shaly.	39' 6"
4"	4"	Coal.	39' 10"
10' 2"	10' 2"	Shaly Sandstone.	50'
17'	17'	Carb. Shale.	67'
5' 8"	5' 8"	Coal.	72' 8"
27' 4"	27' 4"	Shale, Grit & Sandstone.	100'
2' 2"	2' 2"	Sec. Dwyka.	102' 2"
57'	57'	Coarse Grit & Sandstone.	159' 2"
2' 6"	2' 6"	Coal.	161' 8"
9"	9"	Carb. Shale.	162' 5"
5"	5"	Coal.	162' 10"
1'	1'	Carb. Shale.	163' 10"
86' 2"	86' 2"	Sandstone.	250'
36' 4"	36' 4"	Shale.	286' 4"
36' 8"	36' 8"	Shale.	323'
7'	7'	Dwyka.	330'

TABLE NO. I (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO. 4. (CONTD.).

Commenced: 7.1.1946. Completed: 23.1.1946.

Collar Level: 172.9' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
20'	-	Surface Soil.	20'
20'	1'	Clay.	40'
15'	10'	Sandstone.	55'
40'	40'	Sandstone and Shale.	95'
5'	5'	Coal.	100'
33' 3"	33'	Sandstone and Shale.	133' 3"
6'	6'	Sec. Dwyka.	139' 3"
2'	2'	Sandstone and Shale.	141' 3"
2'	2'	Coal.	143' 3"
25' 7"	25'	Shale and Grit and Sandstone.	169'
7' 6"	7' 6"	Coal.	176' 6"
4'	4'	Sec. Dwyka.	180' 6"
92'	92'	Sandstone and Shale.	272' 6"
4' 6"	4' 6"	Dwyka.	277'

BOREHOLE NO. 5.

Commenced: 28. 1.1946. Completed: 27.2.1946.

Collar Level: 99.3' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
21'	-	Surface Soil & Clay.	21'
14'	14'	Sandstone.	35'
4' 6"	4'	Sandstone Shaly.	39' 6"
4"	4"	Coal.	39' 10"
10' 2"	10' 2"	Shaly Sandstone.	50'
17'	17'	Carb. Shale.	67'
5' 8"	5' 8"	Coal.	72' 8"
27' 4"	27' 4"	Shale, Grit & Sandstone.	100'
2' 2"	2' 2"	Sec. Dwyka.	102' 2"
57'	57'	Coarse Grit & Sandstone.	159' 2"
2' 6"	2' 6"	Coal.	161' 8"
9"	9"	Carb. Shale.	162' 5"
5"	5"	Coal.	162' 10"
1'	1'	Carb. Shale.	163' 10"
86' 2"	86' 2"	Sandstone.	250'
36' 4"	36' 4"	Shale.	286' 4"
36' 8"	36' 8"	Shale.	323'
7'	7'	Dwyka.	330'

TABLE NO. I (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO. 4. (CONTD.).

Commenced: 7.1.1946. Completed: 23.1.1946.

Collar Level: 172.9' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
20'	-	Surface Soil.	20'
20'	1'	Clay.	40'
15'	10'	Sandstone.	55'
40'	40'	Sandstone and Shale.	95'
5'	5'	Coal.	100'
33' 3"	33'	Sandstone and Shale.	133' 3"
6'	6'	Sec. Dwyka.	139' 3"
2'	2'	Sandstone and Shale.	141' 3"
2'	2'	Coal.	143' 3"
25' 7"	25'	Shale and Grit and Sandstone.	169'
7' 6"	7' 6"	Coal.	176' 6"
4'	4'	Sec. Dwyka.	180' 6"
92'	92'	Sandstone and Shale.	272' 6"
4' 6"	4' 6"	Dwyka.	277'

BOREHOLE NO. 5.

Commenced: 28. 1.1946. Completed: 27.2.1946.

Collar Level: 99.3' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
21'	-	Surface Soil & Clay.	21'
14'	14'	Sandstone.	35'
4' 6"	4'	Sandstone Shaly.	39' 6"
4"	4"	Coal.	39' 10"
10' 2"	10' 2"	Shaly Sandstone.	50'
17'	17'	Carb. Shale.	67'
5' 8"	5' 8"	Coal.	72' 8"
27' 4"	27' 4"	Shale, Grit & Sandstone.	100'
2' 2"	2' 2"	Sec. Dwyka.	102' 2"
57'	57'	Coarse Grit & Sandstone.	159' 2"
2' 6"	2' 6"	Coal.	161' 8"
9"	9"	Carb. Shale.	162' 5"
5"	5"	Coal.	162' 10"
1'	1'	Carb. Shale.	163' 10"
86' 2"	86' 2"	Sandstone.	250'
36' 4"	36' 4"	Shale.	286' 4"
36' 8"	36' 8"	Shale.	323'
7'	7'	Dwyka.	330'

TABLE NO.1 (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO. 6.

Commenced: 2.3.1946. Completed: 21.3.1946.

Collar Level: 78.1' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
18'	-	Surface Soil & Clay.	18'
10' 9"	10' 9"	Sandstone.	28' 9"
9'	9'	Carb. Shale.	37' 9"
21' 6"	21' 6"	Laminated Shale.	59' 3"
9' 4"	9' 4"	Coal with band of Shale.	68' 7"
1' 8"	1' 8"	Carbonaceous Shale.	70' 3"
30' 9"	30' 9"	Coarse Sandstone.	101'
1' 11"	1' 11"	Sec. Dwyka.	102' 11"
3' 6"	3' 6"	Carb. Shale.	106' 5"
16' 7"	16' 7"	Coarse Sandstone.	123'
5'	5'	Carb. Shale.	128'
142'	142'	Coarse Sandstone.	270'
8' 4"	8' 4"	Indurated Shale.	278' 4"
20'	20'	Coarse Sandstone.	298' 4"
46' 8"	46' 8"	Indurated Shale.	345'
20'	20'	Dwyka.	365'
13'	13'	Waterberg Sandstone.	378'

BOREHOLE NO. 7.

Commenced: 25.3.1946. Completed: 11.4.1946.

Collar Level: 62.2' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
29'	6'	Surface Soil and Clay.	29'
8'	8'	Carb. Shale.	37'
13'	13'	Grit.	50'
9"	9"	Carb. Shale.	50' 9"
1' 10"	1' 10"	Coal.	52' 7"
17' 6"	17' 6"	Carb. Shale.	70' 1"
6'	6'	Coarse Sandstone.	76' 1"
6'	6'	Coarse Grit.	82' 1"
9'	9'	Sec. Dwyka.	91' 1"
5'	5'	Coal.	96' 1"
3' 11"	3' 11"	Sandstone.	100'
16'	16'	Coarse Grit.	116'
34'	34'	Sandstone.	150'
60'	60'	Shaly Sandstone & Slate.	210'
37'	37'	Slate.	247'
7'	7'	Dwyka.	254'

TABLE NO. 1 (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO. 8.

Commenced: 13.4.1946. Completed: 27.4.1946.

Collar Level: 99' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
27'	5'	Surface Soil & Clay.	27'
16'	16'	Black Shale.	43'
9' 9"	9' 9"	Secondary Dwyka.	52' 9"
9' 7"	9' 7"	Grit.	62' 4"
8' 2"	8' 2"	Black Shale.	70' 6"
7' 2"	7' 2"	Coal & Shale.	77' 8"
3'	3'	Black Shale.	80' 8"
69' 4"	69' 4"	Sandstone.	150'
40'	40'	Black Shale.	190'
40'	40'	Dwyka.	230'
5'	5'	Waterberg Slate.	235'

BOREHOLE NO. 9.

Commenced: 30.4.1946. Completed: 23.5.1946.

Collar Level: 172.9' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
74'	74'	Surface Soil & Clay.	74'
2' 10"	2' 10"	Sandstone.	76' 10"
1'	1'	Carb. Shale.	77' 10"
14'	14'	Coal.	91' 10"
9' 2"	9'	Grey Shale.	101'
3'	3'	Sandstone.	104'
8' 4"	8' 4"	Grey Mic. Shale.	112' 4"
46' 1"	46' 1"	Carb. Shale.	158' 5"
28' 7"	28' 7"	Sandstone & coarse grit.	187'
4"	4"	Carb. Shale.	187' 4"
1' 1"	1' 1"	Coal.	188' 5"
12' 2"	12' 2"	Carb. Shale.	200' 7"
12' 2"	12' 2"	Coarse Sandstone.	212' 9"
4' 4"	3' 1"	Coal.	217' 1"
6"	6"	Carb. Shale.	217' 6"
16' 9"	16' 9"	Sec. Dwyka.	234' 3"
28' 9"	28' 9"	White Sandstone.	263'
17' 7"	17' 7"	Black Shale.	280' 7"
60' 8"	60' 8"	Black Shale.	340' 9"
11' 3"	11' 3"	Dwyka.	352'

TABLE NO. 1 (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO.10A.

Collar Level: 193.6' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
74' 6"		Surface Soil and Clay.	74' 6"
5' 7"		Shaly Sandstone.	80' 1"
2' 8"		Grey, black shale.	82' 9"
9"		Brownish Sandstone.	83' 6"
8' 11"		Grey, black shale.	92' 5"
1' 5"		Carbonaceous shale.	93' 10"
3' 6"		Coarse grey sandstone.	97' 4"
1' 3"		Light grey shale.	98' 7"
5"		Carbonaceous shale.	99' 0"
5' 0"		COAL - SEAM A. (14" ground away.)	104' 0"
21' 10"		Grey, black shale, hard.	125' 10"
4' 2"		Coarse white sandstone.	130' 0"
3' 5"		COAL - SEAM B.	133' 5"
9' 1"		Carbonaceous shale.	142' 6"
13' 0"		COAL - SEAM C. (Badly ground away, about 12" lost.)	155' 6"
1' 0"		Carbonaceous shale.	156' 6"
8' 0"		Coarse white sandstone.	164' 6"
11' 6"		Fine grained white sandstone.	176' 0"
3' 6"		Light grey shale.	179' 6"
6' 0"		Fine grained white sandstone.	185' 6"
24' 6"		Carbonaceous shale.	210' 0"
2' 0"		COAL - SEAM D, shaly coal, not sampled.	212' 0"
14' 9"		Carbonaceous shale.	226' 9"
24' 9"		Coarse grits.	251' 6"
9' 0"		Carbonaceous shale with grit bands.	260' 6"
29' 6"		Coarse grits.	290' 0"
2' 6"		Carbonaceous shale.	292' 6"
7' 6"		Coarse grits.	300' 0"
1' 6"		COAL - SEAM E. Shaly coal. Not sampled.	301' 6"
6' 6"		Carbonaceous shale with coarse grit bands.	308' 0"
16' 6"		Secondary Dwyka. Pebbles small till bottom 3' where they are large with Felsite predominating.	324' 6"
2' 6"		Carbonaceous shale.	327' 0"
3' 0"		Secondary Dwyka (small pebbles).	330' 0"
75' 4"		Fine grained white micaceous sandstone.	405' 4"
74' 8"		Coarse white sandstone with carbonaceous shale laminae.	480' 0"
5' 0"		Carbonaceous slaty shale.	485' 0"

TABLE NO. 1 (CONTD.).

BOREHOLE RECORDS.

BOREHOLE NO. 11.

Commenced: 1.8.1946. Completed: 21.8.1946.

Collar Level: 195' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
49'	4'	Surface Soil and Clay.	49'
1'	1'	Carbonaceous Shale.	50'
2'	2'	Shaly Coal.	52'
6"	6"	Carbonaceous Shale.	52' 6"
9' 2"	9' 2"	" "	61' 8"
34' 4"	34' 4"	Coarse Grit.	96'
1'	1'	Yellow Shale.	97'
3'	3'	Carbonaceous Shale.	100'
16' 6"	16' 6"	Coarse Grit.	116' 6"
3' 6"	3' 6"	Coal Shale.	120'
11' 5"	11' 5"	Shaly Sandstone.	131' 5"
6' 11"	6' 11"	Coarse Grit.	138' 4"
6"	6"	Carbonaceous Shale.	138' 10"
6' 10"	6' 10"	Coarse Grit.	145' 8"
6"	6"	Coal.	146' 2"
3' 10"	3' 10"	Shaly Sandstone with pebbles.	150'
17' 6"	17' 6"	Shaly Sandstone with pebbles.	167' 6"
2' 6"	2' 6"	Black Shale.	170'
30'	30'	Black Shale.	200'
50'	50'	Brown & Grey Shale.	250'
18'	18'	Felsite mixed with hard grey rock fragments.	268'

BOREHOLE NO. 12.

Commenced: 23.8.1946. Completed: 5.9.1946.

Collar Level: 174.1' above Datum.

Diameter 6 inches.

Thickness of Bed.	Core Recovered.	Nature of Strata.	Total Depth.
20'	-	Sandstone.	20'
10'	1'	Clay.	30'
8'	7'	Shale.	38'
19'	15'	Shaly Sandstone.	57'
1'	1'	Coal.	58'
42'	42'	Sandstone.	100'
18'	18'	Shaly Sandstone.	118'
19'	18'	Sandstone.	137'
24'	24'	Dwyka.	161'
33'	31'	Sandstone.	194'
63'	61'	Shaly Sandstone.	257'
25'	23'	Shale.	282'
14'	7'	Dwyka.	296'

TABLE NO. 2.

DETAILS OF SAMPLING.

UPPER NO. 4 SEAM.

Borehole Number.	F.R.I. Sample Number.		Width Ins.	Depth Ft.	Depth Ins.	Description.
				99	0	ROOF:
10A	P 418	D	54			Mainly dull coal (6" core lost).
				104	0	FLOOR:

NO. 4 SEAM.

Borehole Number.	F.R.I. Sample Number.		Width Ins.	Depth Ft.	Depth Ins.	Description.
3	P 30			37	7	ROOF: Carbonaceous shale.
		F	30			Dull non-banded shaly coal verging on carbonaceous shale.
			11			Carbonaceous shale. Not Sampled.
		E	38			Dull non-banded shaly coal verging on carbonaceous shale.
		D	41			Mixed mainly dull coal.
		C	31			Bright banded coal.
		B	19			Dull non-banded coal.
		A	59			Bright banded coal.
				56	8	FLOOR:
4	P 76			95	0	ROOF:
			(22			Dull stony coal.
			(10			Carbonaceous shale. (Excluded).
			(18			Dull stony coal.
			(10			Carbonaceous shale. (Excluded).
				100	0	FLOOR:
9	Q 453			77	10	ROOF:
		B	72			Mixed coal and shale.
		A	96			Mainly dull coal.
				91	10	FLOOR:
10A	P 418			130	0	ROOF:
		C	37			Mainly dull coal (4" core lost).
				133	5	FLOOR: Carbonaceous shale.
				142	6	ROOF: Carbonaceous shale.
		B	72			Mixed dull coal and shale.
		A	72			Dull coal. (12" core lost).
				155	6	FLOOR:

TABLE NO.2 (CONTD.).

DETAILS OF SAMPLING.

NO. 3 SEAM.

Borehole Number.	F.R.I.Sample Number.	Width Ins.	Depth Ft.	Depth Ins.	Description.
3	0 596		69	4	ROOF: Coarse sandstone.
		7			Bright coal.
			69	11	FLOOR: Carbonaceous shale and sandstone.
					NOTE: Core broken.

NO. 2 SEAM.

Borehole Number.	F.R.I.Sample Number.	Width Ins.	Depth Ft.	Depth Ins.	Description.
3	P 31		100	0	ROOF:
		4			Carbonaceous shale. Not Sampled.
		33			Bright coal.
		28			Dull coal. Not Sampled.
			105	5	FLOOR:
4	P 77		141	3	ROOF:
		24			Dull non-banded shaly coal.
			143	3	FLOOR:
5	P 194		67	0	ROOF:
		68			Dull stony coal.
			72	8	FLOOR:
6	P 196		50	0	ROOF:
		102			Mixed carbonaceous shale and shaly coal.
		9			Shale. Not sampled.
			59	3	FLOOR:

NO. 1 SEAM.

Borehole Number.	F.R.I.Sample Number.	Width Ins.	Depth Ft.	Depth Ins.	Description.
1	0 582		101	10	ROOF: Secondary dwyka.
		30			Carbonaceous shale. Not Sampled.
	B	7½			Bright gas-like coal.
		8½			Carbonaceous shale with gritty sandstone laminations. Not Sampled.
	A	49			Alternating bands of bright and dull coal - dull predominating. Core broken.
		1			Pyritic carbonaceous shale. Not Sampled.
			109	10	FLOOR: Dwyka.

TABLE NO.2 (CONTD.).

DETAILS OF SAMPLING.

NO. 1 SEAM.

Borehole Number.	F.R.I.Sample Number.		Width Ins.	Depth Ft.	Depth Ins.	Description.
4	P 78			169	0	ROOF:
			90			Dull non-banded tough coal, similar to No.1 seam in the Witbank District.
				176	6	FLOOR:
5	P 195			159	2	ROOF:
			30			Mixed dull and bright coal.
				161	8	FLOOR:
7	P 197			91	1	ROOF:
		B	24			Carbonaceous shale and dull coal.
		A	36			Mixed mainly dull coal.
				96	1	FLOOR:
8	Q 452			70	6	ROOF:
		B	18			Bright pyritic coal.
			8			Gritty carbonaceous shale. Not Sampled.
		A	51			Dull coal.
			9			Carbonaceous shale. Not Sampled.
				77	8	FLOOR:
9	Q 454			212	9	ROOF:
		A	36			Dull non-banded coal.
			6			Carbonaceous shale. Not Sampled.
				217	7	FLOOR: NOTE: 16" of core missing.

TABLE NO. 3.

CALORIFIC VALUES, PROXIMATE ANALYSIS AND SWELLING NUMBERS.

Borehole Number.	F.R.I. Sample Number.	Yield %.	Width Ins.	Cal. Val. lbs./lb.	H_2O %.	Ash %.	Volatile Matter %.	Fixed Carbon %.	Swelling Number.
Upper No. 4 Seam.									
10 A	P 418 D	-	54	-	2.0	46.9	16.7	34.4	-
No. 4 Seam.									
3	P 30 F	-	30	-	2.7	38.6	18.4	40.3	-
	E	-	38	-	2.9	37.1	19.1	40.9	-
	D	-	41	-	2.8	28.1	23.3	45.8	-
	C	-	31	11.1	3.0	19.4	26.6	51.0	1Ag
	B	-	19	-	3.0	26.2	21.4	49.4	-
	A	-	59	11.9	3.0	15.6	25.1	56.3	F
4	P 76	-	40	-	2.5	47.1	15.3	35.1	-
9	Q 453								
	B_1 Fl. at 1.59 S.G.	49.3	-	11.2	2.6	18.9	18.3	60.2	-
	B_2 Sink " " "	50.7	-	-	2.1	51.3	14.8	31.8	-
	B Whole Coal.		72	-	-	35.3	-	-	-
	A_1 Fl. at 1.59 S.G.	88.6	-	12.5	2.7	12.9	22.5	61.9	-
	A_2 Sink " " "	11.4	-	-	1.9	44.8	19.6	33.7	-
	A Whole Coal.		96	-	-	16.5	-	-	-
10 A	P 418 C	-	37	11.9	2.0	17.5	25.6	54.9	1½
	B	-	72	-	1.8	32.6	20.7	44.9	F
	A	-	72	12.2	2.0	15.2	23.3	59.5	1½
No. 3 Seam.									
3	0 596	-	7	12.6	2.4	13.0	37.4	47.2	3

TABLE NO. 3 (CONTD.).

Borehole Number.	F.R.I. Sample Number.	Yield %.	Width Ins.	Cal. Val. lbs./lb.	H_2O %.	Ash %.	Volatile Matter %.	Fixed Carbon %.	Swelling Number.
No. 2 Seam.									
3	P 31	-	33	-	2.4	37.2	20.3	40.1	-
4	P 77	-	24	-	2.7	32.4	17.1	47.8	-
5	P 194	-	68	-	2.4	36.7	20.1	40.8	-
6	P 196	-	102	-	2.0	40.6	19.6	37.8	-
No. 1 Seam.									
1	0 582 B	-	7½	12.8	1.8	14.2	36.1	47.9	1½
	A	-	49	12.3	2.0	15.5	26.7	55.8	F
4	P 78	-	90	12.0	2.8	15.7	22.4	59.1	F
5	P 195	-	30	12.7	2.2	13.7	27.9	56.2	F
7	P 197 B	-	24	-	2.2	41.2	19.5	37.1	-
	A	-	36	12.0	2.2	16.0	26.0	55.8	P
8	Q 452								
	B_1 Fl. at 1.6 S.G.	92.7	-	12.5	2.1	14.8	32.2	50.9	-
	B_2 Sink " " "	7.3	-	-	1.9	37.5	24.7	35.9	-
	B Whole Coal.	-	18	-	2.1	16.5	31.7	49.7	-
	A_1 Fl. at 1.6 S.G.	82.1	-	12.6	2.5	14.1	22.2	61.2	-
	A_2 Sink " " "	17.9	-	-	1.6	49.2	16.5	32.7	-
	A Whole Coal.	-	51	-	2.4	20.4	21.2	56.0	-
9	Q 454								
	A_1 Fl. at 1.6 S.G.	90.5	-	12.8	2.2	12.8	23.7	61.3	F
	A_2 Sink " " "	9.5	-	-	1.8	48.5	16.5	33.2	-
	A Whole Coal.	-	36	-	2.2	16.2	23.0	58.6	-

NOTE: Swelling Numbers were done on the float at a Specific Gravity of 1.6 on -1 mm. coal, except for samples P418 D and 0 582 B where the whole coal was used.

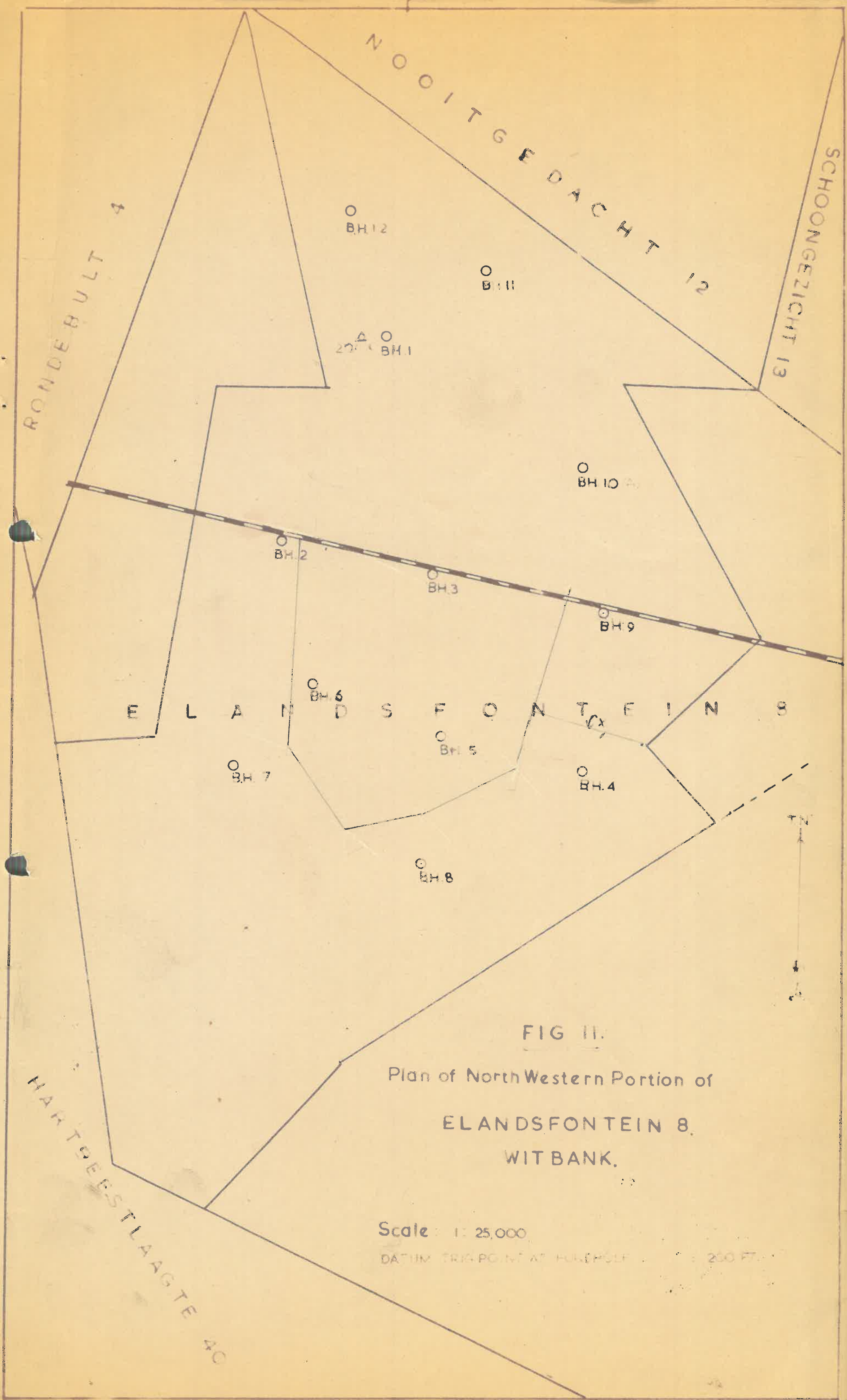

FIG II.

Plan of North Western Portion of

ELANDSFONTEIN 8.

WITBANK.

Scale 1: 25,000

APPENDIX.

ANALYTICAL METHODS AND THEIR SIGNIFICANCE.

I. SAMPLING:

Sampling is carried out according to South African Standard Specification, S.A. No. 13 of 1937, "Standard Methods for the Sampling of Coal in South Africa," issued by the South African Standards Institution.

II. PREPARATION OF SAMPLES:

The samples are prepared in the manner specified in "Standard Methods for the Sampling of Coal in South Africa", S.A. No. 13 of 1937. The laboratory samples are ground to pass a 60 mesh B.S.S. sieve (square aperture : 0.25 mm) except in the case of specific gravity analysis (float and sink tests) and hydrogenation tests, for which minus 16 mesh B.S.S. (square aperture : 1 mm.) material is used.

N O T E: THE FOLLOWING ANALYSES ARE ALL CARRIED OUT ON AIR-DRY COAL.

III. PROXIMATE ANALYSIS:

(1) Moisture Content: This is the loss of weight when heating 1 gram of coal at 105 - 110°C for one hour, expressed as a percentage.

In cases where the moisture content of the coal exceeds 4% an inert gas (e.g. purified nitrogen) is passed over the coal while it is heated to this temperature.

(2) Ash Content: This is the residual ash after combusting 1 gram of coal in a muffle furnace. The coal is slowly heated to 775°C (± 25°C) and kept at this temperature until constant weight is reached while air circulates through the furnace. The result is expressed as a percentage.

(3) Volatile Matter Content: This is calculated from the loss of weight obtained by heating 1 gram of coal at 925°C for 7 minutes by subtracting the weight of moisture present in the coal, and expressing the result as a percentage.

(4) Fixed Carbon Content: This is obtained by subtracting the sum of moisture, ash and volatile matter contents, expressed as percentages, from 100.

IV. CALORIFIC VALUE:

This value, reported in Evaporative Units (lbs/lb), is calculated from the amount of heat generated by combusting 1 gram of coal in oxygen at 30 atmospheres pressure in a Berthelot or Scholes type of combustion bomb.

The determination is carried out according to South African Standard Specification, S.A. No. 5 of 1940, "The Determination of the Comparative Calorific Values of Coals in South Africa".

V./......

V. PRELIMINARY FLOAT AND SINK ANALYSES:

Twenty gram portions of minus 16 mesh B.S.S., air-dry coal are separated into different specific gravity fractions in a centrifuge using benzol and carbon tetrachloride mixtures of varying specific gravity. The apparatus and method used is based on that described in Jnl. Chem. Met. Min. Soc. of South Africa, Vol. 34, No. 8, p.263 (1934). "The Specific Gravity Investigation of Coal Samples: Further Studies and a new Technique" by P.E. Hall.

(a) The percentage float at a S.G. of 1.45 is the percentage by weight of the coal which has a S.G. less than 1.45. This float contains the majority of the swelling constituents of the coal when these are present in a sample.

(b) The percentage float at a S.G. of 1.58 is the percentage by weight of the coal which has a S.G. less than 1.58. It represents approximately the amount of coal substance present and also gives a rough figure for the performance of an ordinary washer on the coal. This figure subtracted from 100 gives approximately the amount of adventitious mineral matter in a coal sample.

(c) The ash content of the float at S.G. 1.45 is generally well below that obtainable at the same specific gravity on large coal (see section IX, subsections (3) and (4)).

(d) The ash content of the float at 1.58 represents the amount of mineral matter intimately associated with the coal substance and is generally well below that obtainable at the same specific gravity on large coal (see section IX, sub-sections (3) and (4)).

(e) The Swelling Number or Index is the ratio of the final to the initial volume of 1 gram of coal heated strongly under standard conditions and is a measure of the swelling propensities of the coal.

This test is based on the "Swelling Index" test described in British Standard Methods for the Analysis and Testing of coal and coke, No.1016 - 1942, p.64.

1 or 1Ag denotes a residue of definite coke structure but no swelling. F denotes a residue easily friable and possessed of no coke structure. P denotes a residue in powder form. A value of 3 or more indicates definite coking possibilities.

VI. ULTIMATE ANALYSIS:

For the purpose of further and more detailed investigation composite samples are usually prepared by mixing - in proportion to the amount of coal which they represent - samples of the same type of coal from the same seam. The composition of such samples is usually based on the characteristics of various bands of coal as revealed by their description and proximate analyses, or may be such as to represent a whole seam or an extractable portion thereof.

The ultimate analysis is generally carried out on the float at a S.G. of 1.58 (-16 mesh B.S.S. coal). This procedure is adopted in order to eliminate, as far as possible, the effects due to the presence of adventitious mineral matter.

(a) Carbon and Hydrogen: Two methods are in use viz.,
1. A method based on that described in B.S. Methods No. 1016 of 1942, "Analysis and Testing of Coal and Coke", page 31.

2. The/......

2. The Fenton Modification of the Belcher and Spooner Method. See: Belcher and Spooner, Fuel Sci. Pract. 20, 130-3 (1941). Belcher and Spooner, Ind. Chemist 19, 653, (1943). Fenton, G.W., Jnl. Soc., Chem. Ind. (Trans.) 62, 160 - 3 (1943).

(b) Nitrogen: The method followed is that described by Beet, Fuel in Science and Practice, Vol. XI, p.196 (1932); Vol. XIII, p. 343 (1934) and Hall, Jnl. Chem. Met. and Min. Soc. of S.Afr., Vol. XXXVI, No. 2, p.28 (1935), with slight modifications.

(c) Total Sulphur: This is determined by an Eschka fusion method.

The results are expressed on a dry-ash-free basis, so as to present the composition of the organic substance itself, unmixed with mineral matter.

The oxygen content is obtained by subtracting the sum of the carbon, hydrogen, nitrogen and sulphur percentages from 100. The value obtained therefore includes all analytical errors.

VII. FORMS OF SULPHUR:

The figures showing the forms of sulphur in a sample are on an "as received" basis, i.e. including adventitious mineral matter.

The extraction of the mineral (i.e. "Sulphate" + Pyritic") sulphur from a sample is done with dilute nitric acid, as described in B.S. methods No. 1016 of 1942, page 45.

The Organic Sulphur is obtained by difference, viz. the difference between the Total Sulphur and the Mineral Sulphur.

The total sulphur content of the floats at 1.58 S.G. is usually also included in the "forms of sulphur" table. This is done for comparative purposes since it indicates the minimum sulphur content obtainable by washing large coal, if the pyrites occurs in nodular form. With finely disseminated pyrites in the coal the sulphur content will not be reduced to the extent shown.

VIII. CARBONIZATION ASSAYS:

Two forms of carbonization assays are done, viz: the low temperature (600°C) and the high temperature (900°C). The apparatus and methods are based on those described in "Methods of Analysis of Coal and Coke", D.S.I.R., Fuel Research, Physical and Chemical Survey of the National Coal Resources No.44, (London, H.M. Stationery Off., 1940).

LOW TEMPERATURE GRAY-KING ASSAY:

This is carried out at a temperature of 600°C on the floats at a S.G. of 1.58 and is used, primarily for correlative purposes, either as a means of characterising a new coal or for establishing the variation in a given type of coal. The results can also be used, however, for determining the type and quantity of the products which the coal under test would furnish in a large scale low temperature carbonization retort.

No direct relationship between the retort and assay yields obtained from South African coals has been deduced but the following interpretation has been found to be applicable overseas. Depending on the type of plant, the large scale tar yield varies from 50 - 80% of that given by the assay. The gas yield is also slightly higher than can be obtained in practice. The

yield of/.....

The yield of coke will be very close to that given by the assay. "Standard" to "very swollen" coke residues indicate coals which will probably produce satisfactory smokeless fuels, while those which are appreciably more friable or shrunken than "standard", indicate coals which will not yield satisfactory large scale coke products.

The assay is carried out on the float at 1.58 S.G. for the same reasons as are outlined in Section VI (ultimate analysis) and also since that fraction would most nearly represent the ordinary washed product from the seam or portion of the seam under consideration.

HIGH TEMPERATURE GRAY-KING ASSAY:

This test is only made on such seams or portions of seams as appear to be possible sources of coking or gas coals. Usually the float at a S.G. of 1.45 is used as representing probably the optimum quality of coal which could be commercially produced by the best possible washing.

A temperature of 900°C is employed and a vapour cracking unit kept at a constant temperature of 800°C is installed.

The calorific value of the gas is usually determined, and the "therms/long ton" calculated therefrom.

The High Temperature Gray-King Carbonization Assay has been designed specifically to simulate large scale gas making conditions both in horizontal and continuous vertical retorts. Here again no direct relationship between the retort and assay yields has been deduced for South African coals and it is necessary to rely entirely on overseas results. The assay conditions are such that the factors of comparison with horizontal retort practice approach unity. It is considered that the factors for coke oven practice should not diverge unduly from unity in spite of a number of variables such as type of plant, type of coal and size of coal. The factors retort/assay for gas yield, gas calorific value and coke yield are fairly close to unity. The assay yield of tar is low and the factor varies from 1.2 to 1.7 as the coal varies from strongly to weakly-swelling. Coke residues described as "friable" and "pulverulent" obtained from the assays indicate coals unsuitable for large scale coke production. Coke residues from "standard" to "very swollen" indicate that the coals will probably yield satisfactory cokes under large scale conditions.

The best gas coals so far tested in South Africa give about 18 - 20% gas, and they yield 65 - 70 therms of gas per long ton of coal. The highest calorific values of the gas so far found vary from 5400 to 5700 calories per cubic metre at N.T.P. (dry, gross).

IX. DETAILED FLOAT AND SINK ANALYSIS:

Intensive float and sink analyses together with their attendant ash and swelling number determinations, are usually made on composite coal samples ground to -16 mesh B.S.S.

This work is carried out for the purpose of the following:-

(i) the/.....

(i) the characterization of types of coal and the subsequent use of this data in correlation.

(ii) the investigation, in a more detailed manner, of the possibilities and results of washing.

(iii) the investigation of the gravity distribution of the swelling constituents of the coal.

Where the latter two aspects - which are, of course, closely related - command the most attention, floats corresponding to possible washery products are preferred, since from them the yields and characteristics of the cleaned products can be readily obtained. This involves making cuts at various specific gravities and analysing the resulting floats. Such a method is known as "cumulative" float and sink analysis.

On the other hand, where the characterisation and correlation of coal seams are involved, the separation into a series of fractions of narrow specific gravity range is adopted. In this way, any change in the nature or behaviour of the coal fractions with change in specific gravity is more easily appreciated and more strongly emphasised than would be the case in the cumulative method. This type is known as "fractional" float and sink analysis.

For those properties which are additive, e.g. ash content, the cumulative figures can be built up from the fractional and vice versa. This cannot be done in the case of non-additive properties. Nevertheless, swelling numbers - strictly speaking a non-additive property - can be calculated with fair accuracy from fractional to cumulative figures if the swelling number for any fraction is not greater than 9 8 or less than 1½Ag.

Where desirable, complete float and sink analyses of both types are done.

When using float and sink analysis figures as guides to possible commercial results, it must always be remembered that the laboratory separations are made on fine coal (-16 mesh B.S.S.) and depend entirely on specific gravity differences. The products are, therefore, cleaner and more uniform than would be obtained from a commercial washer, whether operating on run-of-mine or sized coal. The analytical figures represent optimum conditions and due allowance must be made for this when interpreting them into commercial practice.

Comparative figures obtained from many float and sink analyses carried out on both -16 mesh B.S.S. and commercial coal sizes have demonstrated the value of the laboratory scale tests and have suggested the following interpretation which can be given to the figures:-

(1) The shape of the graph of percentage yield vs. Specific Gravity obtained from fine coal is usually similar to that obtained from the commercial sizes of the same coal. This means that the washability of the coal can be fairly satisfactorily predicted from the -20 mesh size float and sink analysis.

(2) The large scale percentage of float may be less or more than the figure obtained in the laboratory on fine coal at the same Specific Gravity.

(3) The percentage ash on the float obtained at any Specific Gravity from large coal is usually from 2 - 4 units higher than the value obtained from a laboratory separation. If the coal is poor (i.e. containing more than 18 - 20 ash) it is advisable to make liberal allowances, i.e. usually more than 4 units in the ash content.

(4) It has also been found that the smaller the size of the coal to be washed on a large scale, the more closely does the percentage yield and the percentage of ash in the product approach the laboratory coal float and sink analyses. This means, for example, that the allowance made in estimating the washability of pea coal need not be so great as that for, say, round coal.

The differences between the laboratory fine coal float and sink experiments and the commercial washing of large coal depend on the structure of the coal. Where the "impurities" in the coal occur mainly as large aggregations which break away easily from the associated "clean coal" the differences will be small. On the other hand where the "impurities" occur as numerous narrow bands in the "clean coal", with or without additional small nodular impurities, the differences will be large. With coals of this type differences of up to 6% in ash content at similar yields have been encountered. Most South African coals normally lie somewhere between the extreme cases quoted above.

X. <u>ASH FUSION TEMPERATURES</u>:

Ash fusion temperatures are usually determined by heating pellets or cones of the ash at a standard rate inside a tube furnace in an oxidising-reducing atmosphere, and observing the minimum temperature at which the pellet will fuse.

Alternatively, or in addition, sintering, softening and fusion temperatures of ashes are sometimes determined in the Bunte-Baum apparatus.

A knowledge of the composition and behaviour of the ash from any coal is of importance from both a fundamental and technical aspect. The use of coal in many industrial appliances, e.g. producers and forced draught boilers, is seriously limited by the behaviour of the ash.

The mineral matter from which the ash is derived occurs in two forms:-

(a) <u>Inherent mineral matter</u> which occurs as an integral part of the coal and is not separable therefrom by ordinary means, e.g. picking or washing.

(b) <u>Adventitious mineral matter</u> which may be again sub-divided into:

(i) more or less isolated pockets and more continuous bands included in the coal seams,

(ii) mineral matter derived from accompanying strata.

Run of mine coal would normally contain all the forms of mineral matter described above. The greater portion of (b) (ii) as well as some of (b) (i) will be removed by effective picking. An efficiently washed product would contain (a) and only to a limited extent (b) (i).

In order/.....

In order to evaluate the ash fusion temperatures of ordinary picked but unwashed coal, the tests are carried out on the whole coal samples which resemble such coal fairly closely. The ash fusion temperature of the floats at a S.G. of 1.58 is also determined to obtain the amount of improvement (or otherwise) obtainable by washing the coal. Here it must again be borne in mind that the sample was reduced to -16 mesh B.S.S. size before being washed and that results will reflect optimum conditions.

A direct correlation between ash fusion temperature as determined in the laboratory and behaviour of the ash in practice has not so far been possible. Although the determinations are carried out under conditions designed to resemble as closely as possible those actually obtaining in a furnace, the differences between small and large scale conditions are appreciable. The results indicate, however, the probable behaviour of the ash in practice and the following scheme may be used for interpreting the laboratory results:-

<u>ASH FUSION TEMPERATURES</u>:

(a) below 1250°C - likely to cause clinkering trouble under all furnace conditions.

(b) 1250 - 1400°C - unlikely to produce clinker under general conditions, although trouble may be experienced with appliances like producers and forced draught boilers.

(c) above 1400°C - highly refractory ash which will probably not clinker under any conditions.
