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Sverdlovsk

INVESTIGATION OF COALS OF THE SHABASHAK DEPOSIT

/ AFGHANISTAN /

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EASTERN SCIENTIFIC-RESEARCH COAL-CHEMICAL INSTITUTE

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INVESTIGATION OF COALS OF THE SHABASHAK DEPOSIT / AFGHANISTAN /

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Laboratory analyses and half-factory tests were done by the members of coal, coke, enriching and analytical laboratories and by the personnel of half-factory installation of the VUHIN.

Contents

INTRODUCTION

Investigation of technological properties of the Afghanistan coals for estimation of their fitness in metallurgical coke production was done in the VUHIN according to the agreement with the Department of Foreign Relations of the Geological Committee of the USSR.

The object of the investigation is the Shabashak deposit coal which is being prospected by Soviet specialists.

The following work is stipulated by the project:

a/ Laboratory investigation of 65 core and trench samples, taken at different depths in prospecting mines to determine the quality of the deposit coals and ascertain the oxidation zone.

b/ Test of three enlarged samples in not full-factory conditions to estimate coals as raw materials for coking and preliminary characteristic of enrichment.

The materials of the investigation are summed up in two chapters:

I. General characteristic of coals

2. Technological tests.

CHAPTER I

General features of the coals of the Shabashak deposit.

I. Brief geological information.

The Shabashak deposit is situated in eastrn part of the Darrah-i-Suf coal bearing area, in the Samangan province of the northern Afghanistan. The dimensions of the prospected area made approximately 2,5 by 2 km.

Productive deposits of about 650 m thick, belonging to the Middle Jurassic age, supposedly, are folded in a number of folds of latitudinal trend/Fig.I/.

The deposit was investigated by way of holes and also by small and comparatively deep prospecting holes - trenches and adits.

As a whole 29 coal seams are found at the deposit, IOof which have workable thickness from 0,8 to 3mm. They are seams I, 3, 7, 8, I4, I6, I7, 23, 26, 27.The indexing of seams is done from bottom to top according to their location in the coal-bearing strata. Some more thick and persistent beds 3, 7 and 23 are traced along the strike at 2-3 km and at a depth in the dip plane to 500 m.

The coal seams mainly have complex structure, including rock interlayers of different thickness- from 0,0I to 0,25 m. Coal bands are also not uniform

The structure of the coal seams in accordance with geological documentation of sampling is shown in Figs. 2a, 2b, 2c, 2d, 2e, 2f.

In table I the data of seam thickness and structure and sample characteristic are summed up. As it is seen, the samples represent all the seams of workable thickness. All in all I03 samples are taken, I00 of them are of small weight- from 0,5 to I5 kg, the majority are band and by layers samples.

Enlarged - technological samples up to I00 kg in weight each - are taken from the main more thick and persistent seams 3, 7 and 23.

2. Method of investigation.

For estimation of coal technological properties, particularly their fitness for coking, the method, shown in Fig, 3, is worked up in the VUHIN. The method embraces the possibility of investigation both in laboratory and not complete industrial conditions and allows the necessary data to be obtained for characteristic of initial coal quality, their dressing and concentrate properties /I/.

Different sample setting , and in the main, their small weight, but special technological samples, did not allowed all investigations to be done completely according to the scheme.

The following order was accepted for the general characteristic of physico-chemical properties- determination of petrographic composition, degree of metamorphism, humidity, ash content, elementary composition, volatile matter, calorific power, caking, content of sulphur and phosphorus.

The initial coals of seam samples, taken from adits from the deepest place, and also technological samples, were subjected to complete technical / W^a, A^c, V , S^c_{total}, Pc / and qualitative-petrographic analyses, to determination of calorific power, numbers of swelling and plastometric tests; ash content was also determined.

In the concentrates of these samples, besides the above, the elementary composition of coal and the degree of its metamorphism were determined.

Initial coals of core and also trench samples of some coal bands and layers of the seam, taken from the adit, were investigated on a reduced scale- content of analytic moisture, ash, volatile matter issue and number of swelling were determined.

The concentrates were obtained only from the most important samples, necessary for the solving of the task. Their estimation was done on the basis of the same indexes, as those concentrates of seam samples, but the determination of ash content.

The concentrates of small weight samples, from 0,5 to I5 kg were obtained by way of coal delaminating, crushed to I,5 mm in a solution of carbon tetrachloride of I/4 kg/l in density and of coals, being weathered very much, / taken from seam outcrops/, - density of division being I,6 kg/l.

Table I

Characteristic of seams and samples taken

Seam	Thickness, m from-to	Structure	Openings	Samples			
				Bedded	Patches or seams	Technological	Total quantity
I	0.95-I.40	compound	Trenches	2			2
3	2.I5-2.30	"	Adit, trench	3	2	I	6
5	0.60-0.7I	simple	Well, trench	2			
7	I.7I-2.82	compound	Adit, wells, trenches	2	30	I	33
8	0.56-0.94	simple	Adit, wells	9			
I4	0.83-I.60	"	Adit, well, trenches	4			4
I5	I.99	compound	Trench	I			I
I6	I.80-2.I6	"	Adit, well, trench	I	5		6
I7	0.83	simple	Well	I			I
I8	0.60	"	"	I			I
20	0.80	"	"	I			I
23	2.47-3.09	compound	Adit, well, trenches		28	I	29
26	0.75-2.I5	"	Well, trench	I	2		3
27	I.83-2.I0	"	" "	I	4		5
			Total:	29	7I	3	I03

The concentrates of technological samples were obtained according to the scheme, shown in Fig.3.

All the investigations, but determination of numbers of swelling and metamorphism degree through the microscope, estimation of dressing were done according to the standard methods.

Numbers of swelling were determined by the method IGI-VUHIN/2/ They give general information of coal caking. This method is expressive and allows the determination to be done of small weight of coal / I gr./. ALL the gamma of caking coals with the plastic layer from the outlined layer to 30-33 mm is characterised by th numbers of swelling ~ from 5 to I53 mm.

The degree of metamorphism of coals through the microscope is determined by the reflecting power of vitrinite in oil immersion / R_m, %/. This method is advantageous in comparison with the visual one, used before, as the data are expressed in figures here and at more extended scale for each stage./3/.

The estimation of the coal enrichment is preliminary for enlarged samples by GOST IOIOO-62 on the basis of the results of coal delamination in the solution of $ZnCl_2$ of various density.

3. Petrographic characteristic.

First impressions of petrographic non-uniformity of the Shabashak deposit coals are obtained from macroscopic , though not complete, description of seams. As it is seen from Fig,2 their basis is semi-lustreous type of coal of different structure - from more or less uniform not-clear-banded to sharp banded and striated Semi-lustreous type in the majority of cases alternates with semi-dull and dull varieties of coals, not seldom containing high ash content.

Microscopical investigation, the main results of which are given in table 2, shows more clear the main features of the coal material composition. Complex microcomponent composition is typical for the coals of all seams.

Ranging of content of the main groups of microcomponents /GOST 94I4-60/ in seam samples, as well as in in separate beds and seams of coal / see Annex I/ is rather wide, that is also caused by different content of mineral inclusions.

Investigation of concentrates gives more clear comprehension

Petrographical characteristic of coals of the Shabashak deposit

Sample characteristic					Degree of metamorphism		Microcomponent composition, %				
VUHIN number	P number	Name of seam	Sample location	Thickness, m	Rm, %	stage, substage	L	Vt	SV	F	Ml
I.	2	3	4	5	6	7	8	9	I0	II	I2
653254	287	I	Trench [illegible]	I.03	-	-	I	62	I7	I0	I0
653I64	techn. sample No.3	3	Adit No.2, 25 m from the mouth	2.I6	-	gaseous, high	I	59	I0	II	I9
653I79	-"-	3	Ditto, concentrate	2.I6	-	-"-	I	65	I2	I0	I2
654439	-"-	3	Ditto, after secondary dressing	2.I6	-	-"-	I	67	I0	I2	I0
653551	-"-	3	Ditto, concentrate of density < I.4; yield 60 %	2.I6	0.85	-"-	I	68	I2	I4	5
653324	293	5	Trench 6	0.73	-	-	2	59	I8	I3	8
65 94	232	5	Well No.5 at a depth of 268.45-269.05 m	0.6	-	gaseous, high	2	60	I5	I6	7
651049	232	5	Ditto, concentrate of density < I.4; yield 85%	0.6	0.92	-"-	2	70	I5	I0	3
65I08	technol. sample No.I	7	Adit No.I, 40 m from the mouth	2.47	-	-"-	2	55	I0	I6	I7
65593	-"-	7	Ditto, concentrate from semi-factory installation	2.47	-	-"-	2	6I	I4	I3	9

1	2	3	4	5	6	7	8	9	10	11	12
6528I	Technol. sample No.I	7	Ditto, concentrate of density I.4; yield 62%	2.47	0.89	gaseous, high	I	74	II	9	5
65743	234	7	Well No.5, depth 2I0.80-2I2.53 m, concentrate of density < I.4; yield 33%	I.73	0.92	-"-	2	72	I0	I2	4
6574I	232	7	Well No.6, depth 749.05-35I.2 m, concentrate of density < I.4; yield 4I%	2.I5	0.93	-"-	I	74	[illegible]	I2	6
65I58	240	8	Adit 3, 29 m from the mouth	0.9	-	-"-	I	50	I4	25	I0
65746	240	8	Ditto, concentrate of density <I.4; yield 68%	0.9	0.89	-"-	2	54	I7	23	4
653256	266	8	Adit 3, 25 m from the mouth	0.94		-"-	2	60	II	I4	I3
653585	266	8	Ditto, concentrate of density <I.4; yield 7I%	0.94	0.88	-"-	I	70	I0	I5	4
65I02	2I8	I4	Well 5, depth 46.5-48,I8m	I.63	-	-"-	I	59	I5	I6	9
65740	2I8	I4	Ditto, concentrate of density <I.4; yield 83 %	I.63	0.87	-"-	I	70	9	I7	3
653I95	35I	I6	Adit 5, I4 m from the mouth	I.90	0.80	-"-	2	60	I4	I2	I2

I	2	3	4	5	6	7	8	9	I0	II	I2
6592	23Ia	I6	Well 6, depth I29.45-I3I.25 m, upper patch, concentrate of density <I.4, yield 85 %	0.30	0.82	-"-	I	76	II	8	4
65I00	23Ia	I6	Ditto, lower patch, concentrate of density <I.4; yield 79%	I.40	-	-"-	I	72	II	I3	3
65I54	228	I7	Well 6, at a depth of I28.2-I28.95 m	0.83	-	-"-	I	60	9	I2	I7
658I3	228	I7	Ditto, concentrate of density <I.4; yield 58%	0.83	0.86	-"-	I	64	I2	I8	5
65I53	226	I8	Well 6, at a depth of II5.3-II5.9 m	0.60	-	-"-	I	57	I4	I2	I7
658I0	226	I8	Ditto, concentrate of density <I.4; yield 55%	0.60	0.84	-"-	I	73	II	7	8
659I	224	20	Well 6, depth 88.40-89.20	0.80	-	-"-	2	73	8	9	8
65808	224	20	Ditto, concentrate of density <I.4; yield 85%	0.80	0.82	-"-	2	76	6	I3	3
652669	Technol. sample No.2	23	Adit No.4, 26 m from the mouth	2.62	-	-"-	I	63	I2	II	I3
653I78	-"-	23	Ditto, concentrate from semi-factory installation	2.62	-	-"=	I	70	I3	I2	4

1	2	3	4	5	6	7	8	9	10	11	12
6592	231a	16	Well 6, depth 129.45-131.25 m, upper patch, concentrate of density <1.4, yield 85 %	0.30	0.82	-"-	1	76	11	8	4
65100	231a	16	Ditto, lower patch, concentrate of density <1.4; yield 79%	1.40	-	-"-	1	72	11	13	3
65154	228	17	Well 6, at a depth of 128.2-128.95 m	0.83	-	-"-	1	60	9	12	17
65813	228	17	Ditto, concentrate of density <1.4; yield 58%	0.83	0.86	-"-	1	64	12	18	5
65153	226	18	Well 6, at a depth of 115.3-115.9 m	0.60	-	-"-	1	57	14	12	17
65810	226	18	Ditto, concentrate of density <1.4; yield 55%	0.60	0.84	-"-	1	73	11	7	8
6591	224	20	Well 6, depth 88.40-89.20	0.80	-	-"-	2	73	8	9	8
65808	224	20	Ditto, concentrate of density <1.4; yield 85%	0.80	0.82	-"-	2	76	6	13	3
652669	Technol. sample No.2	23	Adit No.4, 26 m from the mouth	2.62	-	-"-	1	63	12	11	13
653178	-"-	23	Ditto, concentrate from semi-factory installation	2.62	-	-"-	1	70	13	12	4

1	2	3	4	5	6	7	8	9	10	11	12
653350	Technol. sample No.2	23	Ditto, concentrate of density < I.4; yield 81%	2.62	0.78	gaseous, high	I	72	I0	I4	3
653336+ 653339	347+347a	26	Trench 86, summary sample by patches	2.07	-	-	I	55	I3	I9	I2
653259	300	26	Well 7, depth 6I.45-62.20 m	0.75	-	-	I	4I	7	I2	38
653553	300	26	Ditto, concentrate of density < I.4; yield 35%	0.75	0.69	gaseous, high	3	80	7	7	3
65326I	296a+ 296 б	27	Well 7, depth 53.40-55.I5	2.32	-	-"-	I	66	I4	I5	4
653552	-"-	27	Ditto, concentrate of density < I.4; yield 87%	2.32	0.73	-"-	I	72	I3	II	3

of microcomponent composition of coals.Their basis is vitrinite, the content of which ranges between 55-75% and in some bands reaches 80%. At more effective enrichment and more opening of grains the vitrinite content increases as a rule.

The content of semivitrinite and fusinite is relatively rather high in coals, while leuptinite does not exceed I-2%.

More over, the detailed investigation of the coals in passing light showed that the vitrinite of these coals is not a uniform matter. In its composition there are not only structureless / Fig.4a/ and poor structural / Photo 4B/ fragments , but there is a considerable number of remains with well preserved cell structure/ Photo 4 c/. There are no bright orange-red and red tints in the vitrinite colour. All this indicates indirectly the oxidizing environment of coal formation which being negative unfavourable factor for coal to show caking properties.

By the degree of metamorphism, as it is seen from the data of the reflection/R_m = 0,73-0,94%/ the coals of the investigated seams are at the stage of gaseous ones, presicely - at the substage of gaseous high- and medium meteamorphized. Increasing of metamorphism is found from upper seams to lower ones, and the tendency of increasing of metamorphism together with the increasing of the seam occurrence depth , particularly seam No.7, is traced.

4. Ash content and enricment.

The materials of the investigation of the united seam sample, some bands and layers , shown in annex I, prove that the ash content in coals mn is mainly high. It ranges between I4-30%, and only for some seams it does not exceed I0% /seams 5,20 and 27/. High ash content is the result of complex structure of coals and contamination of coal with rock interlayers, and dispersion mineral inclusions, which are extremely many in number in the dull varieties of coal.

The investigation of the coal enrichment was done by enlarged samples, taken for technological tests. The results of coal delamination in the solutions of chlorous zinc of different density kg/l are given in table No.3. These data

Theoretical balance of dressing products and evaluation of dressing capacity of coals of the Shabashak deposit

Technological sample No.	Name of seam	Ash content of coal by technological sample	Characteristic of grade I2-Imm %		Delamination in heavy liquid, of grade I2-I mm						Content of fractions of middling product in non-rocky mass %	Evaluation of dressing capacity by GOST I0I00-62
					Concentrate of density < I.4, %		Middling product of density I.4-I.8%		Waste of density > I.8, %			
			yield of coal from bedded sample	ash	yield	ash	yield	ash	yield	ash		
3	seam 3	20.0	62	23.2	57.6	8.6	29.6	30.4	I2.8	73.5	34.0	very difficult
I	seam 7	2I.4	68	24.5	59.7	8.5	27.6	3I.0	I2.7	73.0	32.0	very difficult
2	seam 23	I5.6	6I	I6.6	80.4	4.3	6.6	26.6	I3.0	82.8	7.5	middle

These data indicate difficult enrichment of high ash coals of seams 3 and 7 and better enrichment/ average/ of coal of seam 23. ASH content of the obtained concentrate of seams 3 and 7 made approximately 8,5%, and seam 23 - 6,6%.

Simultaneously the flotating of grade 1-0 mm was studied. The tests were done in the laboratory mechanical flotation -tool acoording to the method, accepted in the VUHIN, time of flotation being 10 minutes. As apolar reagent petrolium for tractors was taken, as surface-active reagents camphor oil and fractions of highest alcohols of the Lisichansky chemical enterprise wore taken.

The resullts of flotation are summed up in table 4. Concentrate I is achieved in the duration of the first two minutes of flotation. It was found that for high-ash tailings hightened outlay of surface-active reagent will be needed; but when even 5% of camphor oil in the admixture of the reagents took part, ash content of tailings did not exceed 44,0%. Ash content of flotation concentrate in this case made 9,4%, at the concentrate yield, being equal to 85,5%.

Coal of seam No7 is especially difficult for flotation. At an average reagent regime , being optimal for the majority of coals of the Kuznetsk and Karaganda basins, the concentrate yield made 30-40%. Increasing of the concentrate yield up to 85-86% required hightened outlay of surface-active reagents.

The reasons of difficult flotating of coals could not be found on the basis of the investigations done.

For more complete characteristic of mineral part of coals the composition of ore is investigated, and the results are summed up in table No.5. They show that ash composition of coals is more or less uniform; as in initial coals as well as in concentrates silica and alumina predominate, making up to 90% together.

5. Physico-chemical properties

In table No.6 the results of investigation of main/ workable seam coals of samples from the deepest openings, where oxidazing processes do not influence, are shown.

By the cited data, especially if concentrate analyses are taken into consideration, it is seen that the indices' ranging of the main coal properties are regular and change, mainly

Results of technological sample flotation of coals of grade I-0 mm of the Shabashak deposit

Experiment No.	Name of reagent	Expenditure of reagent, kg/tn	I concentrate		II concentrate		Summary concentrate		Tailings	
			yield %	ash %	yield %	ash %	yield %	ash %	yield %	ash %
			Technological sample No.3, seam 3							
I.	Tractor kerosene 98% Camphor-oil 2%	I.5	42.I	₹.I	28.7	I2.0	70.8	9.5	29.2	35.0
2.	Tractor kerosene 95% Camphor-oil 5%	I.5	69.4	8.0	II.9	I3.8	8I.3	I0.9	I8.7	40.0
			Technological sample No.I, seam 7							
3.	Tractor kerosene	I.5	II.3	6.3	48.2	7.7	59.5	7.4	40.5	24.6
4.	Tractor kerosene 98% Camphor-oil 2%	I.5	45.9	6.9	25.8	I0.I	7I.7	8.I	28.3	3I.5
5.	Tractor kerosene 95% Camphor-oil 5%	I.5	7I.I	8.3	I4.4	I4.9	85.5	9.4	I4.5	44.0
			Technological sample No.2, seam 23							
6.	Tractor kerosene	I.5	2.3	6.2	9.3	8.0	II.6	7.I	88.6	23.5
7.	Tractor kerosene 95% Alcohols of the highest order 5%	2.0	65.5	5.8	I9.5	9.5	86.0	7.I	I4.0	40.0

Composition of coals' ash of the Shabashak deposit

Characteristic of samples			Components						
VUHIN No.	Party No.	Sample location	SiO_2	CaO	MgO	Fe_2O_3	Al_2O_3 + TiO_2	SO_3	Total
I	2	3	4	5	6	7	8	9	I0
		Seam 3							
653I64	Technolo-gical sample No.3	Adit No.2, 25 m from the mouth, 2I m from the day surface	48.07	3.46	I.II	2.09	43.50	0.70	98.93
653I79	-"-	Ditto, concentrate from semi-factory installation	46.44	4.36	I.I4	3.39	42.56	0.36	98.25
		Seam 7							
65I08	Technolo-gical sample No.I	Adit No.I, 40 m from the mouth , 32.4 m from the day surface	50.24	2.60	I.I4	2.20	4I.I9	I.68	99.05
65593	-"-	Ditto, concentrate from semi-factory installation	49.05	3.24	I.26	3.2I	4I.33	I.76	99.85
6528I	-"-	Ditto, concentrate of density I.4	46,22	3.96	I.44	3.68	4I.96	I.65	98.9I
		Seam 8							
65I58	240	Adit No.3, 29.5 m from the mouth, 3I m from the day surface	50.56	2.65	I.70	3.58	38.47	2.63	99.59
65746	240	Ditto, concentrate of density I.4	50.38	I.59	I.33	5.34	38.98	0.I2	97.74
		Seam 23							
652669	Technolo-gical sample No.2	Adit No.4, 26 m from the mouth, 24 m from the day surface	49.40	3.97	I.82	6.99	34.05	I.75	97.98
653I78	-"-	Ditto, concentrate from semi-factory installation	45.26	6.45	~~I.47~~ I. 47	5.99	36.76	~~I07~~ I.07	97.00

Table 6

PHYSICO-CHEMICAL PROPERTIES OF COALS OF THE SHABASHAK DEPOSIT

Characteristic of samples				Content of vitrinite (Vt), %	Reflected capacity of vitrinite (km,%)	Technical analysis, %					Elementary composition for organic mass, %					Q	Indices of caking capacity, mm	
VUHIN No.	Party No.	sample location	thickness of seam, m			W^a_{total}	A^c	V^r	S^c	P^c	C	H	N	S org.	O		thickness of plastic bed	numbers of swelling, mm
I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7	I8 (y)	I9
						SEAM 3												
653I64	Technological sample 3	Adit No.2, 25m from the mouth, 2Im from the day surface	2.I6	59	-	2.5	20.0	36.9	0.52	0.I38	-	-	-	-	-	7863	outlined	6
653I79	"	Ditto, I concentrate from semi-factory plant	"	65	-	3.0	I4.2	36.4	0.54	0.I5I	82.5I	5.47	I.68	0.63	9.7I	8I38	I0-II	9
654439	"	Ditto, after secondary dressing	"	67	-	2.5	II.9	36.6	0.55	0.I44	82.92	5.44	I.66	0.63	9.35	8I06	I2-I3	I2
65355I	"	Ditto, concentrate of density <I.4; yield-60%	"	68	0.85	2.0	7.2	36.0	0.55	0.I6I	82.38	5.4I	I.76	0.60	9.85	8I70	I2	I0
653348	"	Ditto, concentrate of density <I.4; yield-55%	"	70	0.84	2.2	6.4	37.0	0.65	-	82.85	5.69	I.74	0.70	9.02	805I	I3	27
						SEAM 5												
6594	232	Well No.5, at a depth of 268.45-269.05 m	0.6	60	-	I.9	8.8	36.3	-	-	-	-	-	-	-	-	I3	I6
65I049	"	Ditto, concentrate of density <I.4; yield -85%	"	70	0.92	2.3	4.4	36.4	0.68	0.062	83.43	5.60	I.78	0.70	8.44	8II7	I3	I6
						SEAM 7												
65I08	Technological sample No.I	Adit I, 40 m from the mouth, 32.4m from the day surface	2.47	55	6	2.6	2I.4	37.3	0.55	0.05I	-	-	-	-	-	7902	8	8

I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7	I8	I9
						SEAM I4												
65I02	2I8	Well 5, depth 46.5-48.I8 m	I.63	59	-	2.6	I0.9	36.4	-	-	-	-	-	-	-	-	-	5
65740	"	Ditto, concentrate of density <I.4; yield 83%	"	70	0.87	2.5	4.4	35.6	0.39	0.073	82.6I	5.22	I.76	0.4I	I0.0	8005	8	4
653257	350	Adit 6, I9.2m from the mouth, II.0 m from the day surface	I.36	63	-	2.8	I5.2	36.7	-	-	-	-	-	-	-	-	-	2
						SEAM I6												
6592	23Ia	Well 6, depth I29.45 -I3I.25, upper patch	0.30	-	-	3.5	8.5	36.4	-	-	-	-	-	-	-	-	8	8
658II	"	Ditto, concentrate of density <I.4 ; yield 84 %	"	76	0.86	3.0	4.8	36.7	0.32	traces	8I.45	5.26	I.26	0.34	II.33	7920	8	8
65I00	23I	Ditto, lower patch	I.40	-	-	3.3	9.9	36.6	-	-	-	-	-	-	-	-	-	4
65733	"	Ditto, concentrate of density <I.4; yield 77%	"	72	-	3.3	4.2	36.3	0.32	0.002	8I.8I	5.28	I.6I	0.34	I0.96	7909	6	4
653I95	35I	Adit 5, I4 m from the mouth, I6 m from the day surface	I.90	60	0.80	3.4	I3.8	38.0	-	-	-	-	-	-	-	-	-	4
						SEAM I7												
65I53	228	Well 6, at a depth of I28.I2-I28.95 m	0.83	60	-	2.9	I9.6	35.6	-	-	-	-	-	-	-	-	-	I
658I0	"	Ditto, concentrate of density I.4; yield 58%	"	64	0.86	2.8	6.I	36.0	0.66	traces	8I.83	5.26	I.52	0.66	I0.73	7963	6	4
						SEAM I8												
65I53	226	Well 6, at a depth of II5.30-II5.90 m	0.60	-	-	3.0	I9.9	38.0	-	-	-	-	-	-	-	-	-	3
658I0	"	Ditto, concentrate of density <I.4; yield 55%	"	73	0.84	2.5	6.8	38.6	0.49	0. I52	8I.33	5.53	I.6I	0.53	II.0	802I	7	5
						SEAM 20												
659I	224	Well 6, at a depth of 88.40-89.20 m	0.80	73	-	3.6	9.3	37.7	-	-	-	-	-	-	-	-	-	3
65809	"	Ditto, concentrate of density <I.4; yield 85%	"	76	0.82	2.8	4.2	37.I	0.40	0.087	80.97	5.38	I.67	0.42	II.56	7960	6	5

I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7	I8	I9
							SEAM 23											
652669	Technological sample 2	Adit 4, 26 m from the mouth, 24 m from the day surface	2.62	63	-	5.4	I5.6	37.I	0.57	0.094	-	-	-	-	-	7802	outlined	I
653I78	-"-	Ditto, concentrate from semi-factory plant	"	70	-	4.2	6.0	37.3	0.38	0.089	8I.45	5.23	I.69	0.40	II.23	79I7	outlined	2
653350	-"-	Ditto, concentrate of density<I.4; yield 8I%	"	72	0.78	3.7	4.2	36.3	0.32	-	8I.3I	5.24	I.75	0.34	II.36	7953	outlined	2
65I55	2I9	Well 6, at a depth of 52.35-56.0m; upper patch	2.I5	-	-	3.8	I4.0	36.8	-	-	-	-	-	-	-	-	-	2
65739	-"-	Ditto, concentrate of density<I.4; yield 75 %	"	59	0.78	3.9	4.0	35.9	0.34	0.082	8I.83	5.I3	I.66	0.36	II.02	79I4	outlined	I
							SEAM 26											
653259	300	Well 7, at a depth of 6I.45-62.20 m	0.75	4I	-	3.9	36.3	40.6	-	-	-	-	-	-	-	-	-	0
653553	"	Ditto, concentrate of density <I.4; yield 35%	"	80	-	4.I	5.2	38.2	0.35	0.006	80.23	5.27	I.38	0.37	I2.75	7832	-	5
							SEAM 27											
65326I	296a and 296	Well 7, at a depth of 53.4-55.I5 m, upper patch, depth 55.I5-55.72, lower patch	2.32	66	-	5.6	6.6	40.2	-	-	-	-	-	-	-	-	outlined	0
653552	"	Ditto, concentrate of density<I.4; yield 87%	"	72	0.73	4.0	3.3	40.2	0.28	0.032	79.82	5.28	I.38	0.29	I3.23	7859	outlined	2

according/ly to metamorphism.

Thus with increase of metamorphism / from upper seams to lower/ it is observed:

- decrease of the volatile matter yield from 40 to 35%
- increase of carbon content from 80 to 83%, and decrease of oxygen content from I3 to 8,5%.
- increase of calorific power from 7800 to 8200 Cal.
- increase of caking, expressed by the indices of the plastic layer from the outlined to I2-I3 mm. As to swelling indices, the latters differentiate the coals not clearly enough, though it is found out that upper seam coals give the swelling numbers to 9 mm, and lower ones - from 9 to 27 mm.

The cited data show, that the Shabashak deposit coals are gaseous and in the main poorly caking. The best in caking coals of the lower seam group/ to 8 inclusive/ with ppastic layer I0-I2 mm are distinguished out of them. Caking of coals of other seams is characterised by the plastic layer less than 8 mm, and for seams 23, 26 and 27 it is not measured practically/marked on/.

The Shabashak coal deposit have little sulphur content. The sulphur content ranges from 0,28 to 0,72%. According to phosphorus content there are coals with low content / from traces to 0,004%/ and with high content / from 0,030 to 0,I52%/ of phosphorus.

The highest phosphorus content is in coals of seams 3 and I8.

6. Depth of the oxidation zone.

Taking into consideration tha fact, that the technological properties of coals change under the influence of oxidation, it was important to establish the representation of samples in this respect, sent for experimental coking.

Coking material, at present, let the question to be solved in two lines:

a/ Comparison of the properties of technological sample concentrates, taken from the adits, with the properties of concentrates of core samples of the same seams, exposed by holes at greater depth.

b/ Comparison of properties of coals of seams 7 and 23 by the samples, taken from different depths from the day surface in adits, where technological samples were taken.

Table 7

Materials for establishment of the oxidation zone depth of coals of the Shabashak deposit

Characteristic of samples / concentrates/				Content Vt, %	Technical analysis,%			Elementary composition for organic mass, %					Q	Indices of caking capacity, mm	
VUHIN No.	Party No.	Sample location	Depth from day surface, m		W^a	A^c	V^r	C	H	N	$S_{org.}$	O		plastic bed	swelling
		Seam 7													
6574I	233	Well 6	349.05	74	I.9	6.3	36.3	82.79	5.53	I.53	0.45	9.70	808I	I2	II
65743	234	Well 5	2I0.80	72	2.I	6.0	36.3	82.92	5.43	I.63	0.6I	9.4I	8087	I2	I7
6528I	technolo-gical No.I	Adit I, total	32.4	74	2.0	6.9	35.8	82.77	5.45	I.74	0.54	9.50	8007	I2	I4
65744	I50	Adit I, lower patch	32.4	74	2.2	4.0	35.7	82.86	5.37	I.80	0.60	9.37	8I3I	II	9
65732	24I	" "	30.0	78	2.2	4.3	37.0	82.83	5.58	I.83	0.55	9.2I	8I0I	I2	I9
65359I	I94a	" "	20.0	78	2.2	4.I	37.0	82.89	5.46	I.83	0.22	9.62	8I76	I3	II
653345	I93a	" "	I8.0	69	2.5	3.9	36.I	83.06	5.52	I.79	0.58	9.05	8I00	I2	8
653344	I60a	" "	I6.0	7I	2.6	4.8	36.2	82.52	5.48	I.75	0.60	9.65	8I59	I0	II
653346	I59a	" "	I3.0	70	2.5	6.4	36.2	82.45	5.52	I.79	0.63	9.52	8I30	II	8
653347	I58a	" "	I0.0	70	2.6	6.8	35.7	82.82	5.46	I.7I	0.60	9.4I	8068	I0	I0
653355	I57a	" "	9.0	75	2.6	7.0	36.0	82.20	5.54	I.85	0.59	9.84	8070	I0	5
653349	29I	Trench 8, lower patch	-	67	9.2	6.7	37.3	73.06	3.92	I.63	0.48	20.9I	6603	0 /button in powder/	0
653588	285	Trench I6, lower patch	-	72	II.6	6.6	39.I	7I.88	3.95	I.7I	0.33	22.I3	6474	"	0
		Seam 23													
65739	2I9	Well 6	52.35	59	3.9	4.0	35.9	8I.83	5.I3	I.66	0.36	II.02	79I4	outlined	I
653350	technolo-gical No.2	Adit 4, total	24.0	72	3.7	4.2	36.3	8I.3I	5.24	I.75	0.34	II.36	7954	"	2
658I2	244	Adit 4, upper patch	3I.0	68	3.9	3.4	35.8	8I.34	5.29	I.69	0.33	II.35	7889	"	I
653834	27Ia	" "	I7.0	70	3.2	4.4	35.6	8I.7I	5.34	I.63	0.40	I0.92	80II	"	-
653554	I92a	" "	I4.0	75	3.9	2.8	37.I	80.55	5.I3	I.80	0.2I	I2.30	7878	"	2
653833	270a	" "	I2.0	80	3.9	2.7	36.3	8I.24	5.I8	I.70	0.45	II.43	7925	0/button slightly agglutinated/	2
653926	273a	" "	7.0	73	4.3	3.9	36.4	8I.I9	5.20	I.75	0.2I	II.65	7754	-"-	0
543924	274a	" "	4.5	42	I5.3	5.5	42.I	67.57	3.23	I.6I	0.28	27.3I	5705	0 /powder/	I
653925	356	Trench I47, upper patch	-	63	I2.3	5.I	40.2	69.89	3.59	I.59	I.I8	24.75	6078	-"-	0

These materials can be used for the characteristic of the oxidation zone depth.

The results of the investigation of seams 7 and 23 are given in table 7. They proved, that the coal of technological samples, taken out of adits, is not oxidized practically. Thus, coal of sample No.I, taken from seam 7 in adit NoI at a depth of 32,4 m, was close to the coal of core samples /No. 233, 234/ by its quality , taken at a depth of over 200 m. The same can be said of tachnological sample No.2 / seam 23/.

The materials of the investigation also show, that the depth of the oxidation zone in the place of the above adit laying /No.I and No.4/ is not great, making approximately IO-I5 m. But as it is known, that sampling mine openings are layed,as a rule, in lowered parts of the relief, where the oxidation zone is less, it would be prematurely to spread the established depth/ IO-I5 m/ to the whole deposit. To solve this problem changing of coals' properties in openings, layed at the divides shoul be studied.

7.Yield of chemical products.

For coals of technological samples the yields of chemical products of half-coking were determined by GOST 3I68-53 and coking by the method of VUHIN /4/. The results of investigations are respectively shown in table 8 and 9.

As the above material is of referent character, it does not require special explanation.

Table 8

Yields of chemical products of semi-coking for the coal of the Shabashak deposit

Concentrate of samples	Tar	Pyrogenous water	Semi-coke	Yield of gas, m^3/tn	Gas + waste, %
Technological sample No.3, seam 3	9.65	4.85	78.10	50.0	7.20
" " No.I, seam 7	II.0	4.75	78.30	56.60	-
" " No.2, seam 23	I0.75	6.30	76.70	6I.50	6.45

Gas composition

Concentrates of samples	CO_2	C_mH_n	CO	H_2	C_2H_6	CH_4	N_2
Technological sample No.3, seam 3	9.65	4.83	9.40	I3.I7	II.2	47.7	4.05
Technological sample No.I, seam 7	I0.0 12.80	4.20 4.50	8.80 I4	I4.35 12.00	I5.30 8.5	44.80 47.0	2.55 4.50
Technological sample No.2, seam 23	4.30	II.40	12.00	8.5	47.0		

Table 9

Yields of chemical products of coking of the Shabashak deposit coals

Sample No.	Name of coals	Technical analysis, %			Yield of dry coal, %						Yield of gas actually, m^3/tn	Yield of gas, for conventional fuel at 4000cal m^3/tn	Gas composition, %								Specific gravity	Calorific power of gas
		W^a	A^c	V^r	pyrogenous water	tar	benzol	ammonia	coke	gas + waste			H_2O	CO_2	C_mH_n	O_2	CO	H_2	CH_4	N_2		
653I79	Technological sample No.3, seam 3, I concentrate from semi-factory plant	3.04	I4.I6	36.43	7.44	4.50	I.0I	0.38	7I.58	I5.09	303	335	0.46	3.9I	2.76	0.50	II.92	52.I6	26.23	2.06	0.5423	4428
654439	Technological sample No.3, seam 3, concentrate from semi-factory plant after secondary dressing	2.52	II.88	36.58	7.24	4.99	I.42	0.39	69.35	I6.6I	3I4	349	0.38	3.8I	3.27	0.50	II.28	5I.83	25.83	3.I0	0.5486	4452
65593	Technological sample No.I, seam 7, concentrate from semi-factory plant	2.4I	II.49	35.00	6.98	4.76	I.43	0.39	68.96	I7.48	3I0	347	0.53	3.6I	2.95	0.50	II.48	50.85	27.00	3.08	0.5520	4479
6528I	Technological sample No.I, seam 7, concentrate of density < I.4	2.0I	6.92	35.83	7.I9	5.0I	I.73	0.39	69.04	I6.64	225	253	0.70	3.22	2.93	0.50	II.3I	50.63	27.33	3.34	0.550I	4496
6574I	Sample 233, seam 7, well No.6, depth 349.05-35I.2m, concentrate of density < I.4	I.94	6.29	36.30	7.25	5.66	I.90	0.30	68.35	I6.54	323	36I	0.67	2.72	2.85	0.50	I0.73	5I.84	27.I2	3.57	0.5336	4475
653I78	Technological sample No.2, seam 23, concentrate from semi-factory plant	4.I6	6.02	37.28	7.66	3.76	I.52	0.49	66.98	I9.59	347	354	0.50	5.65	2.I9	0.50	I4.60	5I.40	22.6I	2.55	0.58I9	4083
653350	Technological sample No.2, seam 23, concentrate of density < I.4	3.69	4.I5	36.32	7.06	4.I5	I.40	0.39	67.49	I9.5I	345	355	0.36	3.97	2.I2	0.50	I5.I0	52.34	22.68	2.93	0.5578	4II6
6550I7	Mixture of concentrates of technological samples Nos. I and 3 / experiment I22-5/	2.50	II.50	36.24	6.92	4.04	I.33	0.4I	70,I0	I7.20	309	330	0.46	4.38	2.53	0.50	II.85	5I.78	25.09	3.4I	0.5557	4279

Chapter II

Technological tests

Laboratory investigation

As mentioned above, the coals of the prospected area of the Shabashak deposit are gaseous, poorly caking, petrographically non-uniform. It is well known, that it is practically impossible to obtain blast-furnace coke under usual conditions of coking in chamber furnaces out of such coals.

Thus the program of investigations of the obtained coal samples was widened and supplied with investigations , on the basis of which it was possible to judge of the possibility of obtaining metallurgical / blast furnace or casting/ fuel out of the coals by means of other technological schemes. It was taken into account that coals of other type are absent for the present in Afghanistan, and so the possibility of coke obtaining by the charging method is excluded.

The enriched coals of technological samples of seams 3, 7 and 23 were tested under labotatory conditions as the raw material for the following processes:

I. Production of moulded coke by way of coal heating to the temperature of plastic condition with the following moulding and heating of the moulding. The process has being worked out in the USSR and now it is at a stage of an experimental-industrial installation.

2. Coking with ramming of the coal charge, it is a wide known method used at many enterprises, using the coals of the Selesia Projecting of the plant with ramming has been projecting by Giprokoks, particularly.

3. Production of coke-briquette fuel.
Technology has being worked up in the USSR for production blast-furnace fuel, and at present being at the stage of half-factory tests.

4. Production of lumpy fuel by way of briquette oxidation, produced out of semi-koke with liaison, is used in industry in Polish People's Republic for obtaining cupola furnace fuel, and being transformed a little it is used in the Rumanian People's Republic.

for production of blast furnace fuel.

Estimation of quality of the obtained samples by the described method was done according to the following laboratory data: Appearing specific gravity, porosity and textural durability /GOST 9521-60/.

The results of laboratory investigations are following.

I. Production of moulded coke.

Production of moulded coke is done according to the method of the Institute of Combustible minerals /IGI/, suggested for estimation of coal moulding capacities /5/. Heating of coal was done before moulding in a rotating furnace with an electric heater at a speed of 70 degrees a minute. Moulding of plastic mass was done in pneumo-press with heated matrix. Recording of changing of coal load level during moulding and after removing of pressure was done automatically. Tempering of moulding was done in crucible furnaces at a speed of temperature rising of 3 degree a minute. The final temperature of coking is taken as 900°.

As the index of plastic mass readiness the relative swelling of moulding K is accepted, which represent the ratio of moulding height increase after the removing of the pressure mmmg ΔH to the height of moulding under the pressure H, being expressed in per cents.

$$K = \frac{\Delta H}{H} \cdot 100$$

Well prepared plastic mass is, usually, characterised by the value K, being equal to 15-16%.

For the tests coal of seam No.7 was used, the coal is typical for lower seams of the deposit. Taking into consideration the coal properties/ thickness of the plastic layer/ being 10-11 mm; volatile matter yield - 35-36%/, the experiments were done in the following regime: part of coal weight equal to 120 gr. , being crushed about 90% for the sieve of 3 mm was heated up to 380-430° before moulding during 5-6 minutes, then it was transferred to the press glass-matrix. In this case the temperature of the matrix corresponded to the coal temperature or was 10° higher. In all the experiments the moulding was done under the pressure of 10 kg/cm^2; coal was under load for 30 seconds.

As it cleared out, mouldings, obtained at a temperature of

380°, had low plasticity, not uniform texture and were easily broken. Thus the further experiments were done with mouldings, obtained at coal heating to 390-430°, the latters happened to be plastic enough and in their fracture they had melted texture with separate impregnations of hard fractions/ Fig.5/. These mouldings were subject to the following thermal treatment - tempering. The results of the experiments, made for the selection of the optimal technological regime, for coal of seam No.7, are shown in table I0.

Table I0.

Characteristic of mouldings and moulded coke, produced out of coal of seam 7.

Characteristic of the moulded mass		Characteristic of coke		
Temperature of moulding °C	Relative swelling /K/, %	Appearing specific gravity, g/cm³	Porosity %	Textural durability, %
390	I2,3	0,800	42,6	60,0
400	I6,2	0,880	44,3	62,I
4I0	I2,3	0,87I	44,4	59,0
420	I0,8	0,920	42,4	53,0
430	I0,8	0,990	38,8	69,0

Temperature of optimal plasticity of coal of seam 7 should be considered 400°, at which the index of plasticity K / relative swelling at pressure removal/ makes I6,2%. Though the coke out of these mouldings appeared to be of lower durability/ textural durability - 62,I%/, probably, because of hightened porosity /44,3%/ and not enough strong pores' walls of the coke. Technical characteristic of the coke is as follows: ash content - 20,8%, volatile matter issue - I,8%.

The best result concerning textural durabilty /69,0%/ was obtained at coal heating up to 430°. Plasticity of the moulded mass decreased in this case down to I0,8%, that could be explained by more deep decomposition of coal. As a result of faster removal of volatile matter of the formed mass the porosity lowered, pores' walls became stronger and textural durability of the coke increased.

Thus, on the basis of laboratory investigations, the obtained results, concerning the possibility of production of moulded coke out of similar type of coals of the Shabashak deposit , give hope. For the final conclusion the test in half-factory conditions are necessary, because higher speeds of coal heating can be reached, the speeds will help to obtain better in quality mouldings.

2. Coking with coal ramming.

One of the methods of coke production out of poor caking coals with the plasitc layer I0-I2 mm is the coking of preliminary condensed coal to 0,9 - I,0 gr/cm^3.

The final estimation of coal fitting for the coke production out of condensed loading in laboratory conditions could not be done. Though these investigations help to the correct selection of technological conditions of the coal preparation, particularly, finding out the influence of condensation of coal charge upon the durability of the produced coke.

For laboratory investigations the VUHIN method was used/6/. Out of coal, moistened to I0%/ the optimum at which the highest durability of the rammed coal cake is achieved/ the briquettes of 73 mm in diametr and 65 mm in height were prepared. Condensation was done with the help of hand screw-press. The density of the briquettes changed from 0,8 g/cm^2 to I,I g/cm^2. Correspondingly to the given density of the briquettes part of the coal weight changed from 240 to 330 gramms. The produced briquette together with the matrix-retort is installed in crucible electric furnace. The temperature had risen for 20 minutes; then the temperature of the furnace was rising at a speed of 3^0 a second. The process was over at a temperature of 900^0 in the centre of the retort.

Coals of seam 7, seam3 and their admixtures, and admixture of coals of seams 3 and 23 were tested. The results of coking are as follows: / table II/ briquettes of coals of seams 7 and 23 had fractures after coking but they were not broken.

The coke material was well melted /Fig.6/, Briqettes, obtained from the coal of seam 23, were easily broken; and in their fractures they had coarse-grained melted mass. Thus later this coal was used in mixture with the best in caking coals.

The conducted investigations allow the following conclusio

Table II

Determination of influence of coal briquettes' density upon coke properties

Name of coal, composition of mixture	Density of briquette, g/cm^3	Characteristic of coke			Tecpnical analysis %	
		Apparent specific gravity, g/cm	Porosity %	Structural strength, %	A^c	V^r
Seam 4	0.8	0.820	44.6	65.3	-	-
	0.9	0.883	44.6	76.0	-	-
	I.0	0.990	38.0	77.5	-	-
	I.0	0.937	39.3	77.0	I7.8	I.5
Seam 3	0.8	0.896	47.I	6I.5	-	-
	0.9	0.950	42.7	74.4	-	-
	I.0	I.0I0	4I.4	77.2	2I.0	I.9
	I.I	0.954	40.3	77.6	-	-
Seam 7 - 50%	0.8	0.8I5	42.8	64.2	-	-
Seam 3 - 50%	0.9	0.904	40.2	74,5	-	-
	I.0	0.90I	4I.0	77.0	I6.7	I.7
	I.I.	0.945	38.5	77.4	-	-
Seam 3 - 50% Seam 23 - 50%	I.0	I.030	3I.5	58.I	I4.9	I.6
Seam 3 - 70% Seam 23 - 30%	I.0	0/992	35.3	67.2	-	-
Seam 3 - 80% Seam 23 - 20%	I.0	0.954	35.3	69.8	I7.4	I.4
Seam 3 - 90% Seam 23 - I0	I.0	0.935	43.7	72.0	-	-

sions to be done: together with increasing of density of the coal charge of all the tested samples the textural durability of the coke increases. Though beginning with the density of I,0 g/cm^3, and for coal of seam 7 with the density of 0,9 g/cm^3 the textural density does not increase, practically. Apparent specific gravity of coke increases, and its porosity together with the condensation of the charge lowers correspondingly.

It must be noted that the textural density of 77% and the porosity on the order of 40% for the coals of seams 3 and 7 and their mixtures at the condensation of I,0 g/cm^3 correspond to metallurgical coke by these indices.

By the obtained data it followed that, probably, it is possible to condense only the coal cake up to the volumetric weight of 0,9 - I,0 t/m^3.

As at the tests of coal of seam 23 negative results were obtained, the coal was tested in mixture with the coal of seam 3 in the following proportions/%/: 50:50; 30:70; 20:80; I0:90. When testing the admixtures the condensity was taken equal to I,0 g/cm^3. In these admixtures the most favourable results were obtained in charges with the participation of coal of seam 23 at a quantity of no more than 20-I0%; and in this case the textural durability of the coke made 69,8-72%. Thus, the coal of seam 23 in mixture could be used in the restricted amount, and when the coal being introduced in the charge, the durablity of the coke decreases. The data of the laboratory investigations were used for the determination of the regime of half-factory coking at the VUHIN installation, the results of which are given in the next part of the report.

3. Production of coke-briquette fuel.

The investigation was done with using of the coal of seam 7 and 23 in crushing 90% for sieve 3 mm.

As the binding matter the extract "DYOSOL" - the waste of oil industry / temperature of softening 35°/ was tested.

In the experiments, made with coal of seam 7, the amount of the binding matter changed from 5 to 7%, and with coal of seam 23 the optimal amount of the liasom matter being 7%.

The method of briquette production/?/ was as follows: the coal was charged into heated mixer and kept to tempe-

[illegible] mixture of 70-80

Table I2

Quality of briquettes and coke-briquettes from the coal of the Shabashak deposit, made by the method of briquetting with binder

Name of coal	Charge, %		Apparent specific gravity of raw briquettes, g/cm³	Characteristic of coke-briquettes						
	coal	duosol		Technical analysis, %			Structural strength, %		Apparent specific gravity, g/cm³	Porosity, %
				W^a	A^c	V^r	grade + I mm	grade + 3mm		
Seam 7	93	7	I.I8	0.98	I7.99	I.49	73.2	4I.5	I.02	38.7
	95	5	I.I6	0.93	20.47	I.54	69.2	36.4	I.07	32.0
Seam 23	93	7	I.07	-	9.85	2.43	30.8	I.6	I.05	33.0

rature of 70-80° and after that was layed with liquid "Dyosol". The mixture had being intermingled at a temperature of 75° for 20 minutes. The produced charge was briquetted at a hydraulic press in a prees-form, heated to 70-80° at the given pressure of 200 kg/cm^2.

The briquette was discharged from the press-form and cooled in the air down the room temperature, and then was sent for coking. The dimensions of the briquettes are as follows: diametr - 50 mm, height - 40-45 mm.

Coking of the briquettes was done in a tubular furnace, in a metallic retort by the following graph: into the furnace heated to 300° a retort was installed, the temperature rose for 1,5° a minute up to 600° and, from 600° to 900° - 3° a minute. At the final temperature the coke was kept for 30 minutes. After the end of the exposure the retort was taken out of the furnace and after being cooled the briquettes were sent for the analysis.

The investigation of coal of seam No.7 /table 23/ showed that it is possible to obtain out of it, by briquetting with the liason in the amount of 5-7%, the coke-briquettes with satisfactory textural durability and, as a rule, with lowered porosity. The produced coke-briquettes are well melted, dense, lustreous, grey in colour./Figs. 7 and 8/.

The coke-briquettes, obtained from seam 23, though looked good in appearance, had low textural durability.

4. Production of the lumpy fuel by way of briquette oxidizing, obtained out of semi-coke with binder.

Essence of the process, worked up in the Polish People's Republic, is in following: not caking or poorly caking coal with high yield of the volatile matter is subject to half-coking / more exactly average-temperature coking/; the coke is being crushed, mixed with heavy fractions of the primary tar of the half-coking of these coals, the mixture being briquetted, and the produced briquettes undergo oxidation treatment at a temperature of 200-300°. Under the influence of oxygen under sufficient temperature regime forming of hard space frame take place, the latter imparts greater mechanical durability to the briquette.

a. Production of average-temperature coke.

For production of average-temperature coke the enriched coal of seams Nos. 3 and 7 of 0-I2 mm in size was used, Coking was done in the enlarged laboratory furnace, where the metallic retort with coal, located as thin circular layer of 25 mm thick was put.

Final temperature of coking made 750°. Average-temperature coke of coal of seams 3 and 7 was obtained as dense baked mass / Fig.9 pos.I/, and of coal of seam 23- as easily broken sticked mass.

The obtained coke was crushed in a roller crusher up to the class of 0 - 3 mm - 90-95%. The coke characteristic is represented in table I3.

Table I3.

Characteristic of average-temperature coke.

Name of coal	Technical analysis		
	W^a	A^c	V^r
Seam 7	I,2	I5,7	2,63
Seam 3	4,I	20,I	2,29
Seam 23	4,4	9,25	2,62

Binding component

As a binding component a heavy part of the primary tar of the Angar factory was used. The tar was produced in the furnaces of the Lurgi system at an average-temperature coking/ temperature being 700-800° of the enriched coals of the Cheremkhovsky deposit /$V^c \sim 35\%$/. The tar was divided into fractions at definite temperature regimes. As the binding component, the remain after destillation of the fraction, boiling at a temperature of 3I0°, was used. /The fraction yield less than 3I0° made 6-7%/. The temperature of softing of the binding component made 40°/ by the ring-pivot method.

At test of coal seams 3 and 23 as binding matter the primary tar with the temperature of softening 30° was used.

c. Preparation of briquettes.

The briquettes were prepared by the method, described in part 3, "Production of coke-briquette fuel".

Out of average-temperature coke, obtained from coal seam 7, 2 series of briquettes were prepared, containing I0 and I3% of the

Table I4

Quality of raw briquettes

Name of coal	Composition of mixture		Technical analysis, %			Sieve composition (%) after four downthrows from h -I.5 m, grades in mm				Sieve composition (%) after 300 rotations in a drum, grades in mm			
	coke	tar	W^a	A^c	V^r	+40	25-40	I0-25	- I0	+40	25-40	I0-25	-I0
Seam 3	90	I0											
	88	I2											
Seam 23	90	I0				98.8			I.2	84.2			I5.8
	88	I2											

of the binding liason matter. At preparing of briquettes out of average-temperature coke of coal seams 23 and 3 the amount of the liasom matter in the second series of the experiments was reduced down to I2%/ as it was determined that the content of the primary tar in the coal of the Shabashak deposit is not more than II%/. The briquette shape is cylindrical, the diametr of the briquette is 5I mm, height is 47-49 mm, weight is 90-I00 gr. Ten briquettes were manufactured for each experiment.

Technical characteristic of the raw briquettes is shown in table No. I4.

d. Thermooxidation of the briquettes.

Low -temperature oxidation of the raw briquettes was done in special arranged retort, to the lower part of which by the copper coil, tightly fitting the walls of the retort, definite quantity of the air for oxidation was supplied in the course of heating. The retort with briquettes was put in a heated furnace and together with the beginning of the air supply from the laboratory gas-blower the given temperature regime was fixed. The temperature of oxidation was the same in all the experiments, equalling 250°. The duration of the oxidation changed from 5 to I0 hours.

e. Determination of the quality of the oxidized briquettes.

The following determinations were done for the characteristic of the quality of the produced fuel, besides technical composition, inferred and true specific gravities, textural durability and porosity:

I. Durability of the ready briquettes for throwing down / part of weight, equalling 0,5 kg, the height of falling down - I,8 m, number of throwings - 4/;

2. Durabilty of ready briquettes in the laboratory fire-bar drum of the IGI / d=330 mm; l=255 mm/ at 300 and 600 rotations. Sifting was done on the sieves with square holes of 40,25 and I0 mm.

Besides, measuring and weighting of the briquettes was done before and after oxidation trearment.

The results of the experiments of the briquette fuel production are represented in table No.I5.

Table I5

Results of experiments in obtaining briquette fuel

Name of coal	Experiment No.	Composition of mixture: COKE	Composition of mixture: tar	Apparent specific gravity of briquettes, g/cm³	Conditions of oxidative treatment: expenditure of air, l/hr	Conditions of oxidative treatment: temperature, °C	Conditions of oxidative treatment: duration, hr.	Quality of oxidative briquettes: Sieve composition (%) after downthrow, grades in mm: +40	25-40	10-25	-10	Sieve composition (%) after 300 rotations in a drum, grades in mm: +40	25-40	10-25	-10	Sieve composition (%) after 600 rotations in a drum, grades in mm: +40	25-40	10-25	-10	Structural strength, %	Specific gravity, g/cm³: apparent	true	Porosity, %	Technical analysis: A^c	V^r
Seam 7	I	90	I0	0.976	30	250	5	98.4	-	-	I.6	-	-	-	-	-	-	-	-	5I.8	I.II8	I.60I	29.8	I5.I	7.03
	2	87	I3	0.997	"	"	5	99.0	-	-	I.0	-	-	-	-	-	-	-	-	60.6	I.I25	I.6I8	30.4	I4.7	8.39
	3	87	I3	"	"	"	I0	98.3	-	-	I.7	-	-	-	-	-	-	-	-	63.9	I.I35	I.620	30.2	I4.6	8.85
Seam 3	4	90	I0	I.035	30	250	5	98.0	-	-	2.0	94.3	-	-	5.7	88.6	-	-	II.4	56.0	I.2II	I.502	I9.3	8.3	I0.80
	5	88	I2	I.073	"	"	5	98.7	-	-	I.3	96.4	-	-	3.6	93.2	-	-	6.8	6I.2	I.222	I.499	I8.4	8.9	I3.75
	6	90	I0	I.035	"	"	I0	97.2	-	-	2.8	94.5	-	-	5.5	89.0	-	-	II.0	60.9	I.252	I.532	I8.0	9.8	6.38
Seam 23	7	90	I0	0.946	30	250	5	97.2	-	I.2	I.6	92.8	-	-	7.3	86.0	-	-	I4.0	55.8	I.068	I.606	33.5	I9.4	5.78
	8	88	I2	0.953	"	"	5	97.4	-	I.5	I.I	95.0	-	-	5.0	90.4	-	-	9.6	60.9	I.082	I.583	3I.6	I8.2	6.6I
	9	90	I0	0.943	"	"	I0	96.5	I.I	0.7	I.7	93.2	-	-	6.8	87.I	-	-	I2.9	60.0	I.085	-	-	I9.8	6.I6

In all the experiments the oxidized briquettes have more or less satisfactory mechanical durability - briquettes are not breaking and fracturing /Fig.9, pos.2 and3/. While being tested in the drum, the intermediate classes do not appear - only grating of sharp edges of the cylindrical briquettes takes place. Worse results of the total durability are obtained, when coke of coal seam 23 participates.

With the increase of the share of chemically active liason in the briquettes, at the similar duration of the thermo-oxidation process, durability of the oxidized briquettes increases. Increase of the oxidation treatment from 5 to I0 hours at the same amount of liason, does not influence much the mechanical durability of the oxidized briquettes depends on both factors: it increases approximately by 5 unites with the increase of the share of the liason in briquettes and by the same value it increases at the double increased duration of thermo-oxidation.

The peculiarity of the method of low-temperature oxidation is the formation during the time of oxidation and heating process of the frame along the perimeter of the briquette, which is well melted, lustreous texture- more distinctly expressed in the experiment with samples of coals of seams 3 and 7, and less distinct- with sample of seam 23; there follows melted but not lustreous zone, and at last in the centre there is a dark, not melted core. The depth of melting depends on the amount of the liason in briquettes and to a considerable degree on the duration of the oxidizing treatment, that offers the possibility to improve the texture of the oxidized briquettes at the minimum expense of the liason/Experiments 6 and 9/. It looks like the time of oxidation as if compensates the shortage of the liason in the briquettes, if to take into consideration the degree of the texture of the oxidized briquettes, being melted, and the index of its durability. Though in order to obtain the complete disappearance of the non-melted core in the centre of the briquette, a considerable time of oxidation treatment is required. In the conclusion it can be mentioned that some specific features of the quality of

the briquette fuel, caused by the method of its obtaining should be mentioned:

a/ Practically, the absence of sedimentary phenomena in the process of thermo-treatment of the briquettes; in some cases insignificant increase of the volume of the ready briquettes is noticed.

b/ A considerable number of the volatile matter remains in the oxidized briquettes

c/ The yield of the ready product is rather high- 97-98%.

d/ The quality of coals, used for the production of the average-temperature coke, does not influence essentially the quality of the briquette fuel.

e/ Briquettes, oxidized within the period of 5 hours, have satisfactory durability against percussion and grating effects even when the content of the liason is 10%. At the minimal expense of the binding by way of the increasing of the duration of the oxidation process up to 10 hours the texture of the briquette fuel can be considerably improved, the index of durability becomes more or less satisfactory.

g/ The briquette fuel has rather low porosity; ~ 30%.

Not complete factory tests.

At a half-factory installation of the VUHIN in the city of Sverdlovsk experimental coking of coals of the Shabashak deposit with ramming of coal charge were done.

Coking was done in a coking-furnace with double-sided electric heating in a chamber with the volume of loading up to 250 kg of the condensed charge.

Thermo-technical conditions of heating correspond to nowadays factory dinas furnaces with the width of the camera - 400m. The temperature of the wall heating from the inside makes 1080°. Coking is finished when in the centre of the coal load the temperature reaches 950°.

The investigation of the obtained coke includes:

a/ determination of the coke durability by the data of the small drum/ M40 and M10, in%/ and modelled fire-bar drum of Sundgren, accepted in the USSR / by the data " remain in the drum and content of 10-0 mm class in the fall out", in kg/;

b/ determination of the sieve characteristic;

c/ technical analysis.

It must be noted that coke, produced in half-factory furnace to a considerable degree corresponds to the coke, made in the furnaces of industrial type.

For coking coal of seams 3 and 7 was used, which before was enriched according to the following scheme: crushing to I2 mm, sifting for the classes I2-I and I00 mm, enrichment of the class I2-I in the separating mashine and and the class of I-0 mm in the flotating mashine, composition of the concentrates of separation and flotation mixture out of in equal ratio of coals of seams 3 and 7.

Ramming of the charge was done in a special installation when the compactness of the charge reached 0,98-I,0 g/cm^3. Before the coal is being moistened to I0-II%. The sieve composition of coal is 95%, for the sieve of 3 mm.

Character of the coal mixture loaded in the chamber is as follows:

Y - II mm

A^c - II,5%

V^r - 36,2%

Coal obtained at the result of enrichment allowed two parallel coking are to be done. The results are shown in table I6.

The data, shown in the table prove, that even at coking of compacted charge out of best coking coals of the Shabashak deposit the coke of lowered durability was produced. Though the coke of the chamber had rather good sieve composition, however it cannot endure great mechanical load, and demolishes forming small classes and dust. The data of the investigation in the drum prove it.

The datum of the"remain" in a fire-bar drum was obtained within 225-230 kg at the content of the I0-0 mm class being 70-89 kg in the fall out. The data of the small drum are also rather low: M40 is about 50%, and M_{I0}- I6%. Textural durability of the coke is 72-77%.

The last published review, dedicated to the quality of the coke, produced in different countries,/8/, shows that coke produced out of coals of seams 3 and 7 is worse than others, used in a blast-furnace process. To some degree it approaches the quality of coke of the Klerton works /USA/. The latter is characterised by the indices - M40 - 40-49% and MI0 - I2-I3%. If by the data of M40 the quality of the coke is beyond doubt, then by the data MI0, characterising the degree of its grating , coke of the coals of the Shabashak deposit is not satisfactory.

Such coke was never used for the blast-furnaces in the USSR, As a rule Soviet factories use the coke with the drum sample of over 310 kg/ by Sundgren/.

Before VUHIN made experimental blast-furnace castings with the coke of lowered mechanical durability. Some selected materials of the results of such tests are given below.

So, in 1951 during 6 days the casting in the blast-furnace of 600 m^3 at the SVobodny Sokol plant was done; it was done with the coke, the remain of which in the drum of 257-285 kg at the content of the class 10-0 mm is 70 kg in the fall out. The results of casting were satisfactory for that period and the conclusion of the possibility of increasing of the blast-furnace running was drawn.

In the same blast-furnace in 1949 eighteen-day castings were done; the coke data were at the remain in the drum -250-287 kg, at the content of 10-0 class - 67-109 kg in the fall out.

Though in this case the furnace productivity decreased by 18,3%,however it was explained by technical reasons - being late to load the blast-furnace with raw materials. At that period of the blast-furnace operating the reduction of coke expense and limestones was noticed, as the coke being used usually for the blast-furnace, had considerable content of sulphur.

Thus the investigations showed, that functioning of the blast-furnaces of small volume on the coke with the drum sample about 250 kg is possible.

To clear out the possibilities of the Shabashak coal using in the charge with other coals at a half-factory installation the coking of the charge of the following composition was done*:

coal of seams 3 & 7 of the Shabashak deposit - 50;
Kuznetsk coal of ж grade - 20;
" " $К_2$ " - 30.

Out of the above charge rather solid coke is produced without being rammed; the following data are characteristic to it:
remain in the drum / kg/ - 303
content of class 10-0 mm in the fall out / kg/ - 66.

Thus the Shabashak deposit coals can be used in charges at rather a big quantity.

* A^c - 10,4% V^r - 30,1% Y - 12 min.

Table I6

Characteristic of coke of semi-factory coking with ranning of coal charge

Experiment Nos.	Period of coking, hr,min	Sieve composition, %					Indices of fire-bar drum, kg		Indices of small drum		A^c, %	V, %
		+80 mm	80-60 mm	60-40 mm	40-25 mm	25 mm	residue	grade I0-0 mm	M40	M I0		
I22-5	I7.40	I7.4	32.7	27.7	I2.6	9.6	230	70			I7.3	I.[illegible]
I47-5	I8.I5	20.2	3I.8	25.4	I0.4	I2.2	225	89	49.7	I6.0	I7.I	I.5

It should be noted in the conclusion that the results of all the tests done, were not satisfactory, concerning the possibility of arranging of modern metallurgical work only on the coals of the Shabashak deposit.

At the same time under the conditions of coke being rammed, the latter, fitting the blast-furnaces of small size can be produced out of the coals of lower seams.

It is not excluded also, that these coals would be acceptable for the production of moulded coke, though the completion of works on this process for big industrial enterprises can be possible, presumably, not earlier than in 1968-1969.

If such terms are acceptable for the beginning of projecting of mines and the metallurgical plant in Afghanistan, then it would be expedient to make experimental half-factory tests of the Shabashak deposit coals of seams 3 and 7 type; for this not less than 1000 kg of nonoxidized coals is required.

As to the method of production of coke-briquette fuel with using of binder of oil origin and technology of the briquette fuel by the Polish method, the possibility of their putting into life depends on both- the presence of corresponding oil materials in Afghanistan and on the consent of Soviet projecting institutions to project such installations.

CONCLUSIONS

As a result of the analyses of 100 samples of small weight / core and trench ones/ and 3 enlarged technological samples of coals of the Shabashak deposit, taken from its prospected part it was established:

1. The coals are gaseous/ high and medium substage/, petrographically not uniform/ the vitrinite content in the concentrate is 55-75%/ and mainly they are poorly caking/ the thickness of plastic layer is 12 mm and less/.
2. Increasing of coal caking is observed in stratigraphic section of the deposit from upper seams to lower ones.
3. The depth of the oxidation zone is not determined accurately at the deposit. By the materials of the investigation of the coals out of

adits, the oxidation zone does not exceed IO-I5 m.

4. According to characteristic of enrichment and ash content the coals of lower seams, especially of lower better caking ones, are attributed to the coals with high ash content and difficult for enrichment.
   Out of main workable seams only coal of seam 23 has better indices.
   At present methods of enrichment ash content of the concentrate of over I mm in size will make as an average for the coal of lower and middle seams 9-9,5%.
   Very bad flotation of dust is observed. The reason of it was not found out.
5. The coals are attributed to low sulphurous / less than 0.75%/ with different phosphorus content/ from traces to 0,I5%/.
6. At the present technology of coking in chamber furnaces the metallurgical coke cannot be obtained out of the deposit coals, including coal of lower seams.
   Producing of satisfactory, concerning durability, coke was possible out of charge only with using 50% of the Shabashak deposit coals of seams 3 and 7 in combination with the Kuzbass basin coals of the grades [illegible] /20%/ and K2 /30%/.
7. Ramming of the coal charge showed the possibility of producing out of coals of seams 3 and 7 the coke with the data of tests in a small drum M40- about 50%, and MIO - I6%, and in the fire-bar drum - about 230 kg at the content of IO-0 class- the fall out is 70-90 kg.
   By its physico-mechanical properties the coke of the above characteristic cannot be used in the present blast-furnaces.
   At the same time the data, with which the institute operated, show that coke produced of rammed coals, can be used as technological fuel for blast-furnaces of small size.
8. Laboratory investigations proved the possibility of producing the moulded coke out of coals of lower seams according to the technological schemes, worked out in the USSR. For final conclusion on this problem, the investigations in half-factory conditions must be done.

Taking into consideration the real terms of work finishing of this process for industrial conditions, projecting of installations for producing of moulded coke , can be begun not earlier than in 1968-1969.

9. Laboratory tests proved that the coals of the deposit can be used for production of coke-briquetting fuel with using of binder of oil origin and technology of briquette fuel production by the Polish method.

Possibility of their realization depends on the presence of proper oil materials in Afghanistan and the consent of projecting institutions to project such installations.

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Results of laboratory investigation of coals of the Shabashak deposit

VUHIN number	Party number	Sample characteristic: Sampling location	Seam thickness, m	Core yield, /lineal/, %	Petrographical characteristic: Microcomponent composition, % L	Vt	SV	F	Me	Degree of metamorphism: Rm, %	stage	Technical analysis, % W^a	A^c	V	S^c	P
I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7
							Seam I									
653254	287	Trench No.77	I.03	furrow	I	62	I7	I0	I0	0.75	gaseous /oxidized coal/	I0.2	9.2	38.3	-	-
653335	288	" No.50	I.04	"	I	46	I9	25	9	-		I8.I	8.8	39.7	-	-
							Seam 3									
653I64	technological sample 3	Adit No.2, 25 m from the mouth, 2I m from the day surface	2.I6	-	I	59	I0	II	I9	-	gaseous, high	2.5	20.0	36.9	0.52	0.I38
653I79	-"-	Ditto, concentrate	2.I6	-	I	65	I2	I0	I2	-	-"-	3.0	I4.2	36.4	0.54	0.I5I
653439		- " - after secondary dressing			I	67	I0	I2	I0	-	-"-	2.5	II.9	36.6	0.55	0.I44
65355I	-"-	- " - mixture of concentrate, density I.4, grade-I2-I mm and I-0 mm			I	68	I2	I4	5	0.85	-"-	2.0	7.2	36.0	0.55	0.I6I
6532I8	354	Adit No.2, 25 m from the mouth, 2I m from the day surface	2.I5	-	-	-	-	-	-	-	-"-	2.2	I7.I	37.I	-	-
653I87	353	Ditto, the upper part of the seam	2.I5	-	-	-	-	-	-	-	-"-	2.0	23.0	35.8	-	-
653I73	352	Ditto, the lower part of the seam	-	-	I	60	I3	I2	I4	-	-"-	4.2	I5.4	38.6	-	-
653I80	355	Adit No.2, I8 m from the mouth, I5 m from the day surface	2.3	-	-	-	-	-	-	-	-"-	I.9	I9.2	36.8	-	-
653348	II	Ditto, concentrate, density I.4; yield 55%	2.3	-	I	70	I2	I2	5	0.84	-"-	2.2	6.4	37.0	0.65	-
6532I3	289	Trench No.53	2.22	-	I	49	20	I5	I5	-	-"-	I7.8	20.9	4I.I	-	-
653556	II	Ditto, concentrate of density I.6; yield 63%	2.22	-	I	5I	I8	20	I0	-	-"-	I4.2	I2.6	4I.2	0.38	-

Elementary composition for organic mass, %						Indices of coking ability, mm	
C	H	N	S org.	O	Q	thickness of plastic seam (y)	numbers of swelling
I8	I9	20	2I	22	23	24	25
-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	0
-	-	-	-	-	7863	I0	6
82.5I	5.47	I.68	0.63	9.7I	8I38	I0-II	9
82.92	5.44	I.66	0.63	9.35	8I06	I2-I3	I2
82.38	5.4I	I.76	0.60	9.85	8I70	I2	7
-	-	-	-	-	-	-	6
-	-	-	-	-	-	-	4
-	-	-	-	-	-	-	3
-	-	-	-	-	-	8	4
82.85	5.69	I.74	0.70	9.02	-	I3	27
-	-	-	-	-	-	-	0
66.89	3.26	I.64	0.44	27.77	5670	0	0

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
								Seam 5								
6594	232	Well No.5 at a depth of 268.45-269.05 m	0.6	100	2	60	15	16	7	-	gaseous, high	1.9	8.8	36.3	-	-
651049	"	Ditto, concentrate of density 1.4; yield 85%	0.6	100	2	70	15	10	3	0.92	-"-	2.3	4.4	36.4	0.68	0.062
653324	293	Trench No.6	0.73	-	2	59	18	13	8	-	-	10.0	7.2	38.8	-	-
								Seam 7								
6593	234	Well No.5 at a depth of 210.8-212.53 m	1.73	100	-	-	-	-	-	-	gaseous, high	2.0	28.3	37.6	-	-
65743	"	Ditto, concentrate of density 1.4; yield 35.0%	"	-	2	72	10	12	4	0.92	-"-	2.1	6.0	36.3	0.57	traces
65157	233	Well No.6 at a depth of 349.05-351.2 m	2.15	100	-	-	-	-	-	-	-"-	2.0	31.7	38.7	-	-
65741	"	Ditto, concentrate of density 1.4; yield 41.0%	2.15	100	1	74	7	12	6	0.93	-"-	1.9	6.3	36.3	0.42	traces
65108	technological sample I	Adit No.I, 40 m from the mouth, 34,4 m from the day surface	2.47	-	2	55	10	16	17	-	-"-	2.6	21.4	37.3	0.55	0.051
65281	-"-	Ditto, concentrate of density 1.4; yield 60%	2.47	-	1	74	11	9	5	0.89	-"-	2.0	6.9	35.8	0.5	0.056
65593	-"-	Ditto, concentrate	2.47	-	2	61	14	13	9	0.89	-"-	2.4	11.5	35.0	0.55	0.057
65110	156	Adit No.I, 40 m from the mouth, 32.4 m from the day surface, upper patch	0.60	-	1	45	10	19	25	0.89	-"-	2.2	28.9	39.8	-	-
65734	156	Ditto, concentrate of density 1.4; yield 35.0%	0.60	-	1	72	11	9	7	0.89	-"-	1.9	6.2	36.2	-	-
6597	155	Ditto, middle part of the seam	0.93	-	2	50	11	18	19	0.89	-"-	2.2	17.8	35.5	-	-
65745	155	Ditto, concentrate of density 1.4; yield 59 %	0.93	-	1	70	12	13	4	0.89	-"-	1.9	5.7	34.9	0.58	-
65109	150	Ditto, lower part of the seam	0.93	-	2	65	9	14	10	0.89	-"-	2.5	10.9	36.6	-	-
65744	150	Ditto, concentrate of density 1.4; yield 79%	0.93	-	2	74	12	8	4	0.89	-"-	2.2	4.0	35.7	0.57	-
6598	243	Adit No.I, 35 m from the mouth, 30 m from the day surface. The upper part of the seam	0.55	-	1	45	10	10	34	-	-"-	2.2	32.4	39.6	-	-

: I7	I8	: I9	: 20	: 2I	: 22	: 23	: 24	: 25
-	-	-	-	-	-	-	I3	I6
0.062	83.43	5.60	I.78	0.70	8.44	83I7	I3	I6
-	-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	-	3
traces	82.92	5.43	I.63	0.6I	9.4I	8087	I2	I7
-	-	-	-	-	-	-	-	3
traces	82.79	5.53	I.53	0.45	9.70	808I	I2	II
0.05I	-	-	-	-	-	7902	8	8
0.056	82.77	5.45	I.74	0.54	9.50	8007	II-I2	I4
0.057	82 89	5.48	I.82	0.63	9.I8	8054	I0	9
-	-	-	-	-	-	-	-	3
-	82.99	5.5I	I.68	0.74	9.08	8044	I2	9
-	-	-	-	-	-	-	-	7
-	82.64	5.38	I.67	0.62	9.69	8I3I	I2	II
-	-	-	-	-	-	-	-	I3
-	82.86	5.37	I.80	0.60	9.37	8I3I	II	9
-	-	-	-	-	-	-	-	2

I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7
65747	243	Ditto, concentrate of density I.4: yield 35.0%	0.55	-	2	76	5	II	5	-	gaseous, high	2.3	6.I	37.6	-	-
65I03	242	Ditto, the middle part of the seam	0.90	-	I	53	6	II	23	-	-"-	2.2	25.9	36.7	-	-
65807	"	Ditto, concentrate of density I.4; yield 53.0%	0.90	-	I	73	7	I3	6	-	-"-	2.2	7.0	36.2	-	-
65I04	24I	Ditto, the lower part of the seam	0.90	-	I	77	6	6	I0	-	-"-	2.2	II.8	37.9	-	-
65732	24I	Ditto, concentrate of density I.4; yield 85.0%	0.90	-	I	78	7	I0	4	-	-"-	2.2	4.3	37.4	0.52	-
653I97	26I	Adit No.I, 30 m from the mouth, 24m from the day surface	2.32	I00	I	60	I2	I0	I7	-	-"-	2.6	I9.9	37.8	-	-
653I9I	I95	Ditto, upper part of the seam	2.32	-	-	-	-	-	-	-	-"-	2.5	34.9	4I.2	-	-
653I77	I95	" middle part of the seam	-	-	-	-	-	-	-	-	-"-	2.I	22.I	36.4	-	-
653205	I95a	" lower part of the seam	-	-	-	-	-	-	-	-	-"-	3.0	I4.3	38.I	-	-
653I75	I94	Adit No.I, 25 m from the mouth, 20 m from the day surface, upper part of the seam	-	-	-	-	-	-	-	-	-"-	2.6	36.5	39.2	-	-
653I89	I94	Ditto, middle part of the seam	-	-	-	-	-	9	-	-	-"-	2.0	I9.I	35.6	-	-
653I8I	I94a	" lower part of the seam	-	-	-	-	-	-	-	-	-"=	2.6	I0.2	37.7	-	-
65359I	I94a	Ditto, concentrate of density I.4; yield 82 %	-	-	3	78	8	7	4	-	-"-	2.2	4.I	37.4	0.I9	-
6533I6	I93	Adit No.I, 20.5 m from the mouth, I6 m from the day surface. Upper part of the seam	-	-	-	-	-	-	-	-	-"-	2.4	34.8	37.9	-	-
6532I4	I93	Ditto, middle part of the seam	-	-	-	-	-	-	-	-	-"-	2.I	2I.7	36.6	-	-
653I83	I93a	Ditto, lower part of the seam	-	-	-	-	-	-	-	-	-"-	2.5	I3.I	37.5	-	-
65345	I93a	Ditto, concentrate of density I.4; yield 80%	-	-	2	69	I2	I4	3	-	-"-	2.5	3.9	36.I	0.55	-
65320I	I60	Adit No.I, I8 m from the mouth, I6 m from the day surface. Upper part of the seam	-	-	-	-	-	-	-	-	-"-	3.0	34.8	39.I	-	-
65334I	I60	Ditto, middle part of the seam	-	-	-	-	-	-	-	-	-"-	2.6	25.5	36.7	-	-
653I86	I60a	Ditto, lower part of the seam	-	-	-	-	-	-	-	-	-"-	2.6	I7.I	36.8	-	-
653344	I60a	Ditto, concentrate of density I.4; yield 67%	-	-	I	7I	II	I3	4	-	-"-	2.6	4.8	36.2	0.57	-
653I82	I59	Adit No.I, I6 m from the day surface. Upper part of the seam	-	-	-	-	-	-	-	-	-"-	2.5	30.7	38.0	-	-

I7	I8	I9	20	2I	22	23	24	25
-	*	-	-	-	-	-	I0	9
-	-	-	-	-	-	-	-	4
-	-	-	-	-	-	-	I2/I3	9
-	-	-	-	-	-	-	-	I9
-	82.83	5.58	I.83	0.55	9.2I	8I0I	I2	I9
-	-	-	-	-	-	-	-	4
-	-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	-	3
-	-	-	-	-	-	-	-	8
-	-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	-	3
-	-	-	-	-	-	-	-	I2
-	82.89	5.46	I.85	0.20	9.62	8I76	I3	I[I]
-	-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	-	3
-	-	-	-	-	-	-	-	9
-	82.65	5.47	I.79	0.58	9.5I	-	I2	8
-	-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	-	3
-	-	-	-	-	-	-	-	3
-	82.52	5.48	I.75	0.60	9.65	8I.59	I0	II
-	-	-	-	-	-	-	-	I

I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7
653I74	I59	Ditto, middle part of the seam	-	-	-	-	-	-	-	-	gaseous, high	2.5	23.6	36.8	-	-
653I76	I59a	Ditto, lower part of the seam	-	-	-	-	-	-	-	-	-"-	2.3	I4.8	37.2	-	-
653346	I59a	Ditto, concentrate of density I.4; yield 8I %	-	-	I	70	II	II	7	-	-"-	2.5	6.4	36.2	0.58	
653320	I58	Adit No.I, I2.3 m from the mouth, I0 m from the day surface. Upper part of the seam	-	-	-	-	-	-	-	-	-"-	2.0	I9.8	36.5	-	-
653204	I58	Middle part of the seam	-	-	-	-	-	-	-	-	-"-	2.2	24.0	35.8	-	-
653I84	I58a	Lower part of the seam	-	-	-	-	-	-	-	-	-"-	2.3	I3.8	36.4	-	-
653347	I58a	Ditto, concentrate of density I.6; yield 86 %	-	-	I	70	II	I3	5	-	-"-	2.6	6.8	35.7	0.55	-
653334	I57	Adit No.I, 9.I m from the mouth, 9 m from the day surface. Upper part of the seam	-	-	-	-	-	-	-	-	-"-	2.4	30.7	38.I	-	-
653I88	I57	Ditto, middle part of the seam	-	-	-	-	-	-	-	-	-"-	2.2	26.3	36.7	-	-
65I93	I57a	" lower part of the seam	-	-	-	-	-	-	-	-	-"-	3.I	I3.I	37.9	-	-
653555	I57a	Ditto, concentrate of density I.4; yield 89 %	-	-	2	75	I0	9	4	-	-"-	2.6	7.0	36.0	0.54	-
653330	29Ia	Trench 8, upper part of the seam	-	0	I	52	I5	I8	I4	-	-"-	I0.6	I6.7	39.9	-	-
653I98	29I	Ditto, lower part of the seam	-	-	I	63	I2	I8	6	-	-"-	8.9	II.6	38.6	-	-
653349	29I	Ditto, concentrate of density I.6; yield 83 %	-	-	2	67	I7	7	7	0.78	gaseous /oxidized coal/	9.2	6.7	37.3	0.45	-
653338	285a	Trench I6, upper part of the seam	-	-	I	66	I0	I0	I3	-	-"-	2I.2	I5.0	-	-	-
653I94	285	Ditto, lower part of the seam	-	-	I	7I	I0	8	I0	-	-"-	I3.2	9.8	39.8	-	-
653588	285	Ditto, concentrate of density I.6; yield 90 %	-	-	2	72	I0	I0	6	-	-"-	II.6	6.6	39.I	0.3I	-
						Seam 8										
653343	295	Well 6, depth 3I9.0-3I9.58 m	0.58	-	I	43	I3	23	20	-	-"-	2.4	24.9	35.3	-	-
653832	"	Ditto, concentrate of density I.4; yield 46 %	0.58	-	I	64	I3	I6	6	0.88	-"-	2.3	5.7	35.2	0.I8	0.003
65I58	240	Adit No.3, 29.5 m from the mouth, 3I m from the day surface	0.90	-	I	50	I4	25	I0	-	-"-	2.6	I4.3	35.6	0.6I	0.004
65746	"	Ditto, concentrate of density I.4; yield 68.0%	0.90	-	2	54	I7	23	4	0.89	-"-	2.4	4.5	34.I	0.7I	traces

I8	I9	20	2I	22	23	24	25
-	-	-	-	-	-	-	2
-	-	-	-	-	-	-	9
82.54	5.52	I.79	0.63	9.52	-	II	8
-	-	-	-	-	-	-	4
-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	8
82.82	5.46	I.7I	0.60	9.4I	-	IC	I0
-	-	-	-	-	-	-	3
-	-	-	-	-	-	-	3
-	-	-	-	-	-	-	9
82.20	5.54	I.85	0.59	9.84	8070	I0	5
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	0
73.06	3.92	I.63	0.48	20.9I	6603	button, loose	0
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	0
8I.88	3.95	I.7I	0.33	22.I3	6474	-	0
-	-	-	-	-	-	-	4
82.94	5.46	I.63	0.20	9.77	8I83	-	7
-	-	-	-	-	80I4	-	7
83.05	5.26	I.70	0.74	9.25	8I45	9	7

I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7
683206	279	Adit No.3, 30 m from the mouth, 30.5 m from the day surface	0.90	-	-	-	-	-	-	-	gaseous, high	3.8	I2.7	36.2	-	-
653586	279	Ditto, concentrate of density I.4 ; yield 70 %										3.0	4.3	36.9	0.37	
653256	266	Adit No.3, 25 m from the mouth	0.94	-	2	60	II	I4	I3	-	-"-	2.4	I4.I	36.5	-	-
653585	266	Ditto, concentrate of density I.4; yield 7I %	0.94	-	I	70	I0	I5	4	-	-"-	2.2	4.I	36.I	0.55	-
653332	265	Adit No.3, 2I m from the mouth, 22 m from the day surface	0.88	-	-	-	-	-	-	-	-"-	5.4	6.8	38.4	-	-
653322	264	Adit No.3, I7.2 m from the mouth, I8 m from the day surface	0.90	-	-	-	-	-	-	-	-"-	3.I	I0.9	33.9	-	-
653258	263	Adit No.3, II.8 m from the mouth, I3 m from the day surface	0.90	-	-	-	-	-	-	-	-"-	3.0	II.3	34.7	-	-
653I92	262	Adit No.3, 7.3 m from the mouth, 8 m from the day surface	0.80	-	-	-	-	-	-	-	-"-	3.9	9.7	34.4	-	-
6533I7	277	Adit No.3, 2.5 m from the mouth, 3 m from the day surface	0.80	-	-	-	-	-	-	-	-"-	7.0	9.2	36.I	-	-
653315	I52	Well . . . . . , seam 8	-	-	I	7I	6	4	I8	-	-"-	4.7	I9.4	35.3	-	-
							Seam I4									
65I02	2I8	Well 5, depth 46.5-48.I8 m	I.63	-	I	59	I5	I6	9	-	-"-	2.6	I0.9	36.4	-	-
65740	2I8	Ditto, concentrate of density I.4; yield 83 %	I.63	-	I	70	9	I7	3	0.87	-"-	2.5	4.4	35.6	0.39	0.073
653257	350	Adit No.6 , I9.2 m from the mouth, II.0 m from the day surface	I.36	-	2	63	I2	I3	I3	-	-"-	2.8	I5.2	36.7	-	-
6532I5	360	Trench I99	0.83	-	I	35	27	24	I0	-	-"-	I5.7	I3.3	39.5	-	-
65321I	363	Trench I54	I.59	-	I	60	I4	I8	7	-	-"-	II.0	9.I	36.2	6	-
							Seam I6									
6592	23Ia	Well 6, depth I29.45-I3I. 25 m	0.30	I00	-	-	-	-	-	-	-"-	3.5	8.5	36.4	-	-
658II	23Ia	Ditto, concentrate of density I.4; yield 84.6%	-	-	I	76	II	8	4	0.82	-"-	3.0	4.8	36.7	0.32	traces
65I07	23I	Ditto, rocky interbed	0.I0	I00	-	-	-	-	-	-	-"-	2.8	8I.3	-	density	
65I00	23I	Ditto, lower patch	I.40	I00	-	-	-	-	-	-	-"-	3.3	9.9	36.6	-	-

I7	I8	I9	20	2I	22	23	24	25
-	-	-	-	-	-	-	-	3
	82.09	5.39	I.79	0.39	I0.34	8050	7	5
-	-	-	-	-	-	-	-	5
-	82.90	5.47	I.87	0.58	9.I8	8I65	II	II
-	-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	-	3
-	-	-	-	-	-	-	-	2
-	-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	-	5
0.073	82.6I	5.22	I.76	0.4I	I0.0	8005	8	4
-	-	-	-	-	-	-	-	2
-	-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	8	8
traces	8I.45	5.26	I.62	0.34	II.33	7920	8	8
	2. 272	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	4

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
65733	231	Ditto, concentrate of density I.4; yield 77.0%	I.40	100	I	72	11	13	3	-	gaseous, high	3.3	4.2	36.3	0.32	0.002
653195	351	Adit No.5, 14 m from the mouth, 16 m from the day surface	I.90	-	2	60	14	12	12	0.80	-"-	3.4	13.8	38.0	-	-
653340	359	Trench 150, upper part	0.35	-	-	-	-	-	-	-	-"-	14.1	10.0	40.7	-	-
653217	359a	Ditto, lower part	I.72	-	I	57	16	17	7	-	-"-	19.2	9.4	40.4	-	-
653190	361	Trench 170, upper part	0.30	-	I	69	15	9	7	-	-"-	17.6	9.7	40.6	-	-
653212	362	Ditto, lower part	I.58	-	-	50	22	20	8	-	-"-	13.2	10.5	40.0	-	-
							Seam 17									
65154	228	Well No.6, at a depth of 128.12-128.95 m	0.83	100	I	60	9	12	17	-	-"-	2.9	19.6	35.6	-	-
65813	228	Ditto, concentrate of density I.4; yield 58.0%	0.83	100	I	64	12	18	5	0.86	gaseous, high	2.8	6.1	36.0	0.66	traces
							Seam 18									
65153	226	Well No.6, at a depth of 115.30 - 115.90 m	0.60	100	I	57	14	12	17	-	-"-	3.0	19.9	38.0	-	-
65810	226	Ditto, concentrate of density I.4; yield 55.0%	0.60	100	I	73	11	7	8	0.84	gaseous, high	2.5	6.8	38.6	0.49	0.152
							Seam 20									
6591	224	Well No.6 at a depth of 88.40-89.20 m	0.80	81	2	73	8	9	8	-	-"-	3.6	9.3	37.7	-	-
65809	224	Ditto, concentrate of density I.4; yield 85.0%	0.80	81	2	76	6	13	3	0.82	gaseous, high	2.8	4.2	37.1	0.40	0.087
							Seam 23									
65155	219	Well No.6, at a depth of 52.35-56.0m Upper part of the seam	2.15	-	-	-	-	-	-	-	-"-	3.8	14.0	36.8	-	-
65739	219	Ditto, concentrate of density I.4; yield 75.0%	2.15	81	I	59	20	16	4	0.78	gaseous high, transitional to middle	3.9	4.0	35.9	0.34	0.082
6596	220	Ditto, rocky interbed	0.05	100	-	-	-	-	-	-	-"-	1.6	86.9		density	2.631
65152	221	Ditto , middle patch	0.90	-	-	-	-	-	-	-	-"-	3.8	15.5	39.0	-	-
65808	221	Ditto, concentrate of density I.4; yield 75 %	0.90	100	I	80	8	7	4	a	-"-	3.0	5.4	37.0	0.28	-
65105	222	Ditto, rocky interbed	0.25	-	-	-	-	-	-	-	-"-	4.2	58.21	-	density	1.923
6595	223	" lower interbed	0.30	-	-	-	-	-	-	-	-"-	3.7	14.9	36.4	-	-
651048	223	Ditto, concentrate of density I.4; yield 61.0%	0.30	100	2	70	11	12	5	-	-"-	3.6	5.0	36.3	0.72	0.01

I8	I9	20	2I	22	23	24	25
8I.8I	5.28	I.6I	0.34	I0.96	7909	6	4
-	-	-	-	-	-	-	4
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	I
8I.83	5.26	I.52	0.66	I0. 73	7963	6	4
-	-	-	-	-	-	-	3
8I.33	5.53	I.6I	0.53	II.0	802I	7	5
-	-	-	-	-	-	-	3
80.97	5.38	I.67	0.42	II.56	7960	6	5
-	-	-	-	-	-	-	2
8I.83	5.I3	I.66	0.36	II.o2	79I4	outlined	I
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	2
8I.39	5.36	I.53	0.30	II.42	7979	outlined	I
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	2
8I.30	5.I3	I.54	0.76	II.27	7996	outlined	I

I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7
653262	I90	Adit No.4, 29.5 m from the mouth, 25.0 m from the day surface	0.80	-	-	-	-	-	I0	II	gaseous, high	2.6	4.6	36.8	-	-
653590	I90	Ditto, concentrate of density I.4 ; yield 93 %	0.8	-	I	7I	I2	I3	3	-	-"-	3.8	2.5	36.5	0.5I	-
653323	I9Ia	Adit No.4, 26.05 m from the mouth, 24 m from the day surface. Upper part of the seam	I.70	-	-	-	-	-	-	-	-"-	3.8	7.4	35.2	-	-
65375I	I9Ia	Ditto, concentrate of density I.4; yield 83 %	I.70	-	I	70	I3	I2	4	-	-"-	3.5	3.0	35.5	0.75	-
6533I9	I9I	Ditto, middle part of the seam	0.93	-	-	-	-	-	-	-	-"-	4.5	6.3	38.9	-	-
6599	244	Adit No.4, 24.5 m from the mouth, 3I m from the day surface. Upper part of the seam	0.80	-	I	60	I0	24	5	-	-"-	5.2	7.3	36.I	-	-
658I2	244	Ditto, concentrate of density I.4; yield 69.0 %	0.80	-	I	68	I3	I4	4	-	-"-	3.9	3.4	35.8	0.3I	0.09I
65I0I	245	Ditto, middle part of the seam	0.80	-	I	62	9	23	5	-	-"-	4.0	4.7	36.9	-	-
6573I	245	Ditto, concentrateof density I.4; yield 92.0 %	0.80	-	I	75	I0	I0	4	-	-"-	3.7	3.7	36.4	0.30	
65I06	246	Ditto, rocky interbed	-	-	-	-	-	-	-	-	-"-	I.8	85.49	-	-	density
65I56	247	" lower patch	0.86	-	I	70	7	I2	I0	-	-"-	4.4	9.8	37.4	-	-
65742	247	Ditto, concentrate of density I.4; yield 84.0 %	0.86	-	I	84	7	5	3	-	-"-	3.5	4.4	38.2	0.54	-
6533I8	27Ia	Adit No.4, 20 m from the mouth, I7 m from the day surface, upper part of the seam	I.54	-	-	-	-	-	-	-	-"-	3.I	I8.9	37.3	-	-
653834	27Ia	Ditto, concentrate of density I.4 ; yield 65 %	I.54	-	I	70	II	I5	3	-	-"-	3.2	4.4	35.6	0.38	
653I96	27I	Ditto, middle part of the seam	0.84	-	-	-	-	-	-	-	-"-	4.3	7.2	38.2	-	-
653200	I92a	Adit No.4 , I8 m from the mouth, I4 m from the day surface. Upper part of the seam	I.60	-	-	-	-	-	-	-	-"-	5.7	6.0	37.I	0.20	-
653554	I92a	Ditto, concentrate of density I.4; yield 80 %	I.6	-	2	75	I3	7	3	-	-"-	3.9	2.8	37.I	0.2I	-
653260	I92	Ditto, lower part of the seam	0.84	-	-	-	-	-	-	-	-"-	5.0	8.2	38.7	-	-
653327	270a	Adit No.4, I5 m from the mouth, I2 m from the day surface. Upper part of the seam	I.68	-	2	70	I2	II	4	-	-"-	5.3	5.2	36.I	-	-
653833	270a	Ditto, concentrate of density I.4; yield 89 %	-	-	I	80	8	9	2	-	-"-	3.9	2.7	36.3	0.44	-
653329	270	Ditto, lower patch	0.84	-	-	-	-	-	-	-	-"-	2.I	I7.5	36.3	-	-
653255	272a	Adit No.4, I2 m from the mouth, 9.5 m from the day surface. Upper part of the seam	I.82	-	-	-	-	-	-	-	-"-	3.8	9.6	36.0	-	-

I8	I9	20	2I	22	23	24	25
-	-	-	-	-	-	-	I
80.24	5.07	I.78	0.52	I2.39	7746	outlined	I
-	-	-	-	-	-	-	I
8I.05	5.07	I.7I	0.77	II.40	7880	0	0
-	-	-	-	-	-	0	4
-	-	-	-	-	-	-	2
8I.34	5.29	I.69	0.33	II.35	7889	outlined	I
-	-	-	-	-	-	-	2
80.67	5.20	I.7I	0.3I	I2.II	77I9	outlined	I
2.50	-	-	-	-	-	-	
-	-	-	-	-	-	-	4
80.43	5.25	I.58	0.56	I2.I8	7794	-	I
-	-	-	-	-	-	-	2
8I.7I	5.34	I.63	0.40	I0[illegible].92	80II	outlined	5
-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	2
80.55	5.I3	I.80	0.2I	I2.3I	7878	outlined	2
-	-	-	-	-	-	-	2
-	-	-	-	-	-	-	I
8I.24	5.I8	I.70	0.45	II.43	7925	0	2
-	-	-	-	-	-	0	
-	-	-	-	-	-	-	3

I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7
653587	272a	Ditto, concentrate of density I.6; yield 79 %	I.82	-	I	70	I3	I3	3	-	gaseous, high	3.I	3.3	36.3	0.34	-
653342	272	Ditto lower part of the seam	0.84	-	-	-	-	-	-	-	-"-	4.6	8.3	37.8	-	-
653202	273a	Adit No.4, 9 m from the mouth, 7 m from the day surface	I.78	-	-	-	-	-	-	-	-"-	5.0	5.5	37.I	-	-
653926	273a	Ditto, concentrate of density I.6; yield 96 %	I.78	-	I	73	II	I2	3	-	-"-	4.3	3.9	36.4	0.20	-
653203	273	Ditto, lower part of the seam	0.84	-	-	-	-	-	-	-	-"-	5.5	6.2	37.8	-	-
653328	274a	Adit No.4, 6 m from the mouth , 4.5 m from the day surface. Upper part of the seam	I.73	-	-	-	-	-	-	-	-"-	6.8	7.I	34.8	-	-
653924	274a	Ditto, concentrate of density I.6; yield 95 %	I.73	-	I 42	22 42	2222	8 29	6	-	-"-	I5.3	5.5	42.I	0.26	-
653I85	274	Ditto, lower part of the seam	0.85	-	-	-	-	-	-	-	-"-	6.5	7.4	33.8	-	-
653I99	356	Trench I47, upper part of the seam	I.65	-	I	53	I7	I9	I0	-	-"-	I4.6	8.2	40.4	-	-
653925	356	Ditto, concentrate of density I.4; yield 86 %	I.65	-	I	63	I3	I7	6	-	-"-	I2.3	5.I	40.2	0.I7	-
6532I6	357	Ditto, lower part of the seam	0.7I	-	I	67	II	9	I0	-	-"-	I6.3	I0.0	42.2	-	-
65333I	358	Trench I49, upper part of the seam	I.89	-	I	46	I9	I8	9	-	-"-	2I.4	7.3	40.7	-	-
653326	358a	Ditto, lower part of the seam	I.02	-	2	46	I6	I6	20	-	-"-	II.I	20.6	38.0	-	-
652669	technologi-cal sample 2	Adit No.4, 26 m from the mouth, 24 m from the day surface	2.62	-	I	63	I2	II	I3	-	-"-	5.4	I5.6	37.I	0.57	0.094
653I78	-"-	Ditto, concentrate from	-	-	I	70	I3	I2	4	-	-"-	4.2	6.0	37.3	0.38	0.089
653350	-"-	Ditto, concentrate of density I.4; yield 80.0 %	-	-	I	72	I0	I4	3	0.75	gaseous, high	3.7	4.2	36.3	0.32	-
								Seam 26								
653259	300	Well No.7, at a depth of 6I.45-62.20m	0.75	-	I	4I	7	I2	38	-	-"-	3.9	36.3	40.6	-	-
653553	"	Ditto, concentrate of density I.4; yield 35 %	-	-	3	80	7	7	3	0.69	-"-	4.I	5.2	38.2	0.35	0.006
653356	347	Trench 86, lower part of the seam	0.55	-	I	59	II	I5	I4	-	-"-	I4.5	I5.I	43.86	-	-
653339	347a	Trench 86, middle part of the seam	I.52	-	I	53	I4	22	I0	-	-"-	I5.8	9.6	4I.95	-	-

I8	I9	20	2I	22	23	24	25
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	I
8I.I9	5.20	I.75	0.2I	II.65	7754	outlined	0
-	-	-	-	-	-	-	I
-	-	-	-	-	-	-	I
67.57	3.23	I.6I	0.28	27.3I	5705	0	I
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	0
69.89	3.59	I.59	0.I8	24.75	6078	-	0
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	0
-	-	-	-	-	7802	outlined	I
8I.45	5.23	I.69	0.40	II.23	79I7	-"-	2
8I.3I	5.24	I.75	0.34	II.36	7953	-"-	2
-	-	-	-	-	-	-	0
80.23	5.27	I.38	0.37	I2.75	7832	-	5
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	0

I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5	I6	I7
							Seam 27									
65326I	296a and 296	Well No.7, at a depth of 53.4-55.I5 m, Upper part of the seam. Depth 55.I5-55.72 - lower part of the seam	2.32	-	I	66	I4	I5	4	-	gaseous, high	5.6	6.6	40.2	-	-
653552	-"-	Ditto, concentrate of density I.4; yield 87 %	-	-	I	72	I3	II	3	0.73	-"-	4.0	3.3	40.2	0.28	0.032
653337	348	Trench I05, lower part of the seam	2.I0	-	I	5I	I8	22	8	-	-"-	20.8	9.6	42.5	-	-
65332I	349	Trench No.94, upper part of the seam	0.37	-	I	50	I7	24	8	-	-"-	I7.7	I0.4	4I.3	-	-
653333	349a	Ditto, lower part of the seam	I.44	-	I	53	20	I6	I0	-	-"-	I5.9	7.9	4I.6	-	-

I8	I9	20	2I	22	23	24	25
-	-	-	-	-	-	outlined	0
79.82	5.28	I.38	0.29	I3.23	7959	-"-	2
-	-	-	-	-	-	-"-	0
-	-	-	-	-	-	-	0
-	-	-	-	-	-	-	0

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