V/O "TECHNOEXPORT" of the USSR

Contracts Nos 640 of November 24, 1962 and 1378 of December 20, 1965.

ROYAL AFGHAN GOVERNMENT
MINISTRY OF MINES AND INDUSTRIES
DEPARTAMENT OF GEOLOGY AND MINES

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R E P O R T

on the geological work, carried out by the coal-prospecting party in Northern Afghanistan in 1965

V O L U M E I

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K a b u l

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L I S T

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The present report has been compiled by the results of the geological work, carried out by the coal-prospecting party at the deposits of Northern Afghanistan in 1965. The work was carried out in accordance to contract 640 of November 24, 1962 and contract 1378 of December 20, 1965, concluded between V/O "Technoexport" of the USSR and the Ministry of Mines and Industries of the Royal Afghan Government.

The report consists of three volumes:

Volume I - the report text,

Volume II - the reserve tables and annexes of the initial data,

Volume III - the graphical annexes on 30 sheets.

Volume I contains the materials, describing general informations about the work region, its geological structure, presence of coal, the coal quality of the studied deposits of Sar-i-Asia, Masjit-i-Choobi, Chal, Zamburak, and Bazarak. Besides, the questions of hydrogeology, conditions of Sar-i-Asia deposit explotation are elucidated, and also the calculation reserve results are given.

Volume I is divided into three sections. The first of them /chapters II-X/ states the prospecting work results at the Sar-i-Asia deposit. The mapped drilling results of the Masjit-i-Choobi deposit area are stated in section II /chapter XI/. The third section deals with the results of the reconnainssance routes at the Chal, Zamburak, and Bazarak deposit region.

Volumes II and III illustrate the conclusions, stated in volume I.

As a result of the carried out work presence of coal, quality and reserves of the Sar-i-Asia deposit coal have been studied, to the north of the Masjit-i-Choobi deposit coal has been discovered under the covering of the Cretaceous deposits and perpective of the Chal-Zamburak region deposits for coke coal has been confirmed.

All the work volumes, envisaged by the planned task and the contracts of 640 and 1378 have been fulfilled.

Chapter I.

INTRODUCTION.

Geological-exploration work for coal in Afghanistan was started in 1965 in accordance with contract 640 of November 24, 1962, concluded between V/O "Technoexport" of the USSR and the Ministry of Mines and Industries of Afghanistan. The stated work was continued in 1965 in accordance with contract 640 of November 24, 1962 and contract 1378 of December 20,1965.

During 1963-1964 , in accordance with the Ministry of Mines and Industries desire, geological-exploration work was carried out at the coal deposit of Shabashek /the Samangan province/; as a result of the work the reserves of coal for energetics were explored and estimated by categories $B+C_1$ - 20,7 mln.tones, C_2 - 23.7 mln. tones. The total deposit reserves have been estimated at 73.8 mln.tones.

In 1965 searching and prospecting were carried out at the Sar-i-Asia deposit, situated in 12 km SE of the Shabashek deposit /32 km by the motor road/.

Development of actual reserves of coal for energetics is of great importance for the country economics.

The coal deposits of KKarKar, Ishpushta, being mined at present, do not meet the country requirements in coal; the mined coal quality is low; and because of the complex tectonic structure the coal is crushed, powdered. The reserves of the mentioned deposits are limited.

Acccriding the project on prospecting work fo coal in 1965 at the Sar-i-Asia deposit such kindsof work were carried out: surface studying, a geological map on a scale 1:5000 has been compiled, mine and borehole workings were sunk. The work results are described in the report.

In 1965 the coal-prospecting party also worked at the deposits of Masjit-i-Choobi /the Hert province/, and searching for coke coal was undertaken at the region of Ishkemish /the Talikan province/ at the deposits of Chal, Zamburak, Bazarak. The results of work at the stated deposits also are given in the report.

In 1965 the party fulfilled the following kinds and volumes of geologic-exploration work:

Table 1.

Ser. Nos	Work kinds	Unit of measurement	Fulfilment		Including work areas	
			by project	fulfilled	Sar-i-Asia	Masjit-i-Choobi
1	2	3	4	5	6	7
1.	Topographic survey, scale 1:5000	sq.km.	4.0	3.1	3.1	-

1.	2	3	4	5	6	7
	2. Geological survey on a scale 1:5000	sq.k.	4.0	3.1	3.1	-
	3. Core drilling	l.m	1160.0	968.1	580.0	388.1
	4. Sinking of inclines, cross-cuttings	" "	100.0	122.9	122.9	-
	5. Trench sinking	m^3	1000.0	1075.0	1075.0	-
	6. Sampling	sample	200	245	239	6

A small underfulfilment of the projected work is explaned by the following reasons:

a/ by drilling work the project has not been fulfilled for 131.9 m because the boreholes depth at the Masjit-i-Choobi deposit area turned out smaller, as it was projected. It is connected with the real smaller thickness of the drilled Albian conglomerates;

b/ by geological survey on a scale 1:5000 the plan underfulfilment is connected with the fact, that the real area of the Sar-i-Asia deposit is smaller for 1 sq.km. than it was supposed.

The following Soviet specialists take part in the field work: engineer-geologists - Kudryashov, N.S., Androsov, V.N., Sanjapov, A.T., engineer-geophysicist - Shakhovsky, B.P., hydrogeologist - Marinov, B.N., drilling and mine foremen - Ignatyuk,A.F., Marchenko,A.Z., Sidor,J.A., Lipnitsky, P.A., Minak, V.F., Ilyushin, A.P., dieselist - Yagodkin,A.J., cook - Bikov, V.A., interpreter - Pirimov,A. For a short term in the party mine foreman: Orechkin, I.D. and Archebasov, V.V. worked.

From the Afghan side the party leadership was carried out by the party chief Muhammad Kabir Taksili, at which disposal there were 50 Afghan specialists: drilling and mine workers, dieselists, compressorers, drivers, and etc. Quantity of hired workers ranged from 80 to 120 a day.

The field work was started on the 5th of June and finished on the 2 nd of November of 1965.

Methodical guidance of the field work and indoor treatment was given by Manucharyants, O.A. - chief of the Soviet specialists' group and by Lavrov, J.N. - chief geologist of the group.

From the Afghan side general guidance of the party work was carried out by the President of the Departement of Geolofy and Mines - Mirzad, S.H.

Section I.

Geologic-exploring work at the coal deposit of Sar-i-Asia.

CHAPTER II.

GENERAL INFORMATION OF THE DEPOSIT REGION .

The Sar-i-Asia coal deposit is situated in the Doab district of the Samangan province, in the Darya-i-Khulm river head in North Afghanistan.

The deposit coordinates:

35°32'50'' – 35°34'15'' NL and

67°33'00'' – 67°33'47'' EL.

In the vicinty of the deposit the ancient so called "Silk" way run, connected Bukhara and Iran with India and passed from Mazar-i-Sharif via Boyni Qara, Darra-i-Suf, Shah Bashak,Sar -i-Asia to the village of Doab Mekh-iZarin in the Curhab valley and futher through the Ishkari Pass to the city of Kabul /see Fig.No1/.

In 1965 along the way north-west of the deposit a motor road of 32 km long was built, which has connected Sar-i-Asia with Shah Bashak which had motor communication with the city of Mazar-i-Sharif and Haibak (Samangan).

In 1965 the group of the Soviet specialits – road-builders carried out observation of two versions of a probable rout between the deposit and south-eastward to the village of Doab. The first version was: from Sar-i-Asia via the Kotal-i-Sabzak Pass and further via the village of Madar to Doab; it proved to be unacceptable because of building complexity in the region with steeply rocky slopes and high relative altitudes for short distances. The second version – from the Sar-i-Asia deposit via Aimok, Doab-Shahpasand to Ishpushta. This rout should to be taken as a base for road-building but it will be a complex engineering erection with large capital investiments.

The distances of transportation from the Sar-i-Asia deposit by the motor roud /via Shah Bashak, Darra-i-Suf/ are given in table No2

Table No2.

Ser Nos	Settlements	Distances in km	
		Via Mazar-i-i Sharif	Via Haibak
1	2	3	4
1	Shah Bashak	32	32
2	Darra-i-Suf	68	68
3	Boyni Qara	146	–
4	Mazar-i-Sharif	207	–
5	Tashkurgan /Khulm/	263	–
6	Haibak /Samangan/	324	180
7	Pul-i-Khumri	414	270
8	Doshi	464	320
9	Doab Mekh-i-Zarin	567	423
10	Shashpul /confluence of the Kalu and Bamian rivers	637	503

1	2	3	4
11	Haji-Gak	662	528
12	Kabul via the Salang Pass	650	506
13	Kabul via the Shiber Pass	829	685
14	Kabul via the Haji-Gak Pass	802	668

Here the asphalt motor road is being only between Pul-i-Khumry and Kabul /via the Salang Pass/ and another is buing built between Pul-i-Khumri and Mazar-i-Sharif. The road from Darra-i-Suf to Mazar-i-Sharif is covered with gravel, and between Sar-i-Asia and Haibak there is a natural road, practicable only during dry seasons of the year.

In the vicinty of the deposit there are the following settlements: Sar-i-Asia, Sar-i-Je, Alauddin, Aimok, Balagh Ali, the farm of Yakniqol, where workers may be employed. The natives mainly are Khazars and Aimaks /Uzbeks/. South eastern beyond the Kotal-i-Sabzak Pass Tatars and Abashes live.

The natives are occupied with cattle-breeding and agriculture /cultivate wheat and barley on bagar soils/.

The region topography is mountain, strongly rugged with deep downcuttings of river and creek valleys. The divides have plane surfaces, but somwhere they have a form of sharp ridges.

The highest elevations in the region reach 3954.63 m /mountain Koh-i-Chauli Khan/, the lowerest-in the valley near Sar-i-Asia village 2420 m. Relative altitudes reach 1500 m.

The area of the rugged topography is restricted in the west and south by the high scarps of Cretaceous-Paleogene limestones beyond which a mountain undulating plateau extends; the highest elevations of the region occure on its surface.

The deposit area covers the left slope of the Andrak Valley, steeply falling from the scarp foot of Cretaceous-Paleogene limestones. In the north the deposit is limited by the deep downcutting of the valley of Yakniqol , running in latitudinal direction. In the south the area boundary is the wide valley of Sabz Nan creek. Approximately half way along of two mentioned creeks there is a deeply entrenched valley named by us "Central". The slope steepness , especially in the nothern and central parts of the area, reaches 30-35°. The slopes are cut by numerous small creek valleys. The relative altitudes of the examined area range from 50 to 150 - 200 m.

Rivers of the region. A little southwest of the deposit down the confluence of Rod-i-Cabzak and Sar-i-Je creeks the Andrak rivulet is born, it is a headwater of the Darya-i-Khulm. A little down the confluence the rivulet runs to the tongue of an ancient rock-slide, slided from the right valley slope and overlied its Thalweg. Here a lake has formed with the length of 300m and the wide 200 m- 250 m, somewhere the lake has been overgrowned with canes. / Measuremnt of the lake depths was not done/ The lake run-off takes place through a steep falling , entrenched channel runs into the valley alittle to the south of Sar-i-Asia village. Judge by the swamped valley to the north from this place, we may suppose that a part of water percolates through the dam - rock-slide. To the north of the deposit Yakhniqol creek falls into the river. The Andrak river has approximately a permanent discharge, increasing in the periods of snow melting and autumn rains.

Climate. The region climate is continental with a clearly expressed microclimate. Meteorological observations has not been carried out in the region; using of the data of the Baglan, Mazar-i-Sharif and Salang stations is not value. At the deposit area we has noted a fresh summer with little temperature fluctuations. It gets colder in the middle of October and early in November it snows. Snow cover melts in April-March, but on the west slope of the mountain Koh-i-Chauli Khan snow lies all the year round. The predominant wind direction is north-west.

Flora and Fauna. Aborial flora is almost absent. Shrubs and grasses grow in the valleys and partly on their slopes. There are thickets of cane. over the lake. The animal kindom is characterized by wide variety. In the region there are: bears, wolves mountain goats, hares, foxes; birds: mountain partridges, mountain turkeys. During bird transmigration there are many wild ducks. In the Andrak river and in the lake fish is fond: trout, marinka.

History of Geological Study.

The first mentioning about coal presence on the Chehil area belongs to H.H.Hayden /1911/.

In the end of thirties the deposit area was envistigeted by an Afghan geologist Mr. Holam-Ali Khan, in his report he noted coal outcrops on the Chehil area. This author meant by all appearance the coal outcrops near the lake, to the north of Sar-i-Je vellage.

In 1963 the area was investigeted by the Soviet group of geologists under the guidance of K.Ja.Mikhaylov /7/carried out a geological survey on a scale 1:200 000. Studying the region coal-bearance the Soviet geologist: B.R.Pashkov, V.V.Kulakov, and B.N.Androsov investigated the coal outcrops along "Central" creek. They discovered 14 coal seams, which were numbered from the top to bottom stratigraphically.

Besides the geological map on a scale 1:200 000, a sketch geological map on a scale 1:2000 was also compiled by the geologists for the "Central" area.

Up to 1965 no detail work was carried out at the deposit.

Chapter III.

GEOLOGICAL STRUCTURE OF THE DEPOSIT AREA.

The Sar-i-Asia coal deposit is located in the region with a complex geological evelution during Mesozoic and Cenozoic.

The present knowledge about this region, as of a part of the North Afghan Coal Basin, is especially preliminary and will be broaden when special investigations are being carried out.

But even in this report we may try to describe the general features of the region geological structure and to correlate the data about the coal deposits of the North Afghan Coal Basin.

1. Stratigraphy.

The deposit area /see Fig. 2 and 3/ is composed of a thick sedimentary series of Meso-Cenozoic age; they distinguesh deposits of Triassic, Jurassic, Cretaceous-Paleogene, Neogene, and Quaternary systems.

a/ Triassic.

At the region it is represented by a series of strongly dislocated and faulted sandstones, aleurolites and coaly argillites; they are widly diestributed in the central part of the Chehil erosion window.

In the upper part of the section occure tuffs, which, by all appearance, are analogies of the Doab effusive series, distributed eastwards of the region.

The lithological composition of the sedimentary series section ressembles the section of the Triassic deposits, exposed to the north of the Chehil-Dukhtaran river, near the Shah-Bashak deposit. There the series age is determined as Rhaetian stage according to fauna determination.

Because of the fossil absence this series is conditionally assigned to Upper Triassic. The total appearant thickness of the deposits, assigned to Triassic, is estimated at 500 m.

b/ Jurassic.

At the area of Reg-Bulak village /12 km westward/ the Jurassic deposits are overlain the Triassic without any hiatus or time value. Eastwards, near the Kara-Kotal Pass and in Ishpushta there is a clear unconformaty and the Jurassic overlaps the Triassic transgressively /K.Ya.Mikhaylov's verbal information/.

On the area of the Chehil erosion window character of the contacts are not clear, because of a tectonic strusture complicaсy the true contacts of Jurassic and Triassic are not fixed.

At the Sar-i-Asia area /see Fig. 2 and 3/ the Jurassic deposits have been suffered tectonic, mainly disjunctive, dislocations; the movements had place in Lower Cretaceous and resulted that some blocks were uplifted and later eroded. These facts explane the absence of Jurassic in the central part of the Chehil erosion window, where the Triassic deposits are overlapped by Cretaceou-Paleogene marine deposits. Jurassic deposits are preserved in the west, south, and south-eastern parts of the "erosion window", where the coal deposits and manifestations of Ackhorak Payan, Kotal-i-Sabzak, Sar-i-Je, and Sar-i-Asia are situated.

At the deposit area the Jurassic deposits, earlier distinguished as "Saigan series" /H.Hayden/, have been subdivided into three suites, dated as Lower-Middle, Middle and Upper divisions.

Regbulak suite/J_{1-2} rg/.

The deposits of this suite was described at the Shah-Bashak deposit area, in 14 km to the north-west of Sar-i-Asia.

There the section is composed of an uniform alternation of consolidated argillite-like clays, aleurolites, fine-grained sandstones. The sandstones are light-gray, calcareous, polymict, often cross-bedded. The sandstone thickness reaches 10-30 m and the general ranging of the strata thickness in the section is 5-6 - 50 m. Along whole the thickness of the suite an abundance of flora detritus and impressions of poorly preservation occures. Somewhere siderite partings and separate enclosings are observed.

The degree of the suite coal saturation is changeable. Among the argillite-like clay strata there are thin interlayers of coal and coaly clays. Their thickness does not exceed 0.3 m and only in the upper part of the section it reaches 0.5 - 0.6 m /near Reg-Bulak? and 2.5 m /near Karan-Kul/.

The lower suite boundary is taken by the top of the massive calcareous sandstone with Triassic pelecypod fauna.

The upper boundary is determined conditionally by the sandstone stratum, below coal seam 1 of the Shah-Bashak deposit .

The total suite thickness reaches 660 m.

The suite age is established as Lower-Middle Jurassic because from the lower part of the suite T.A.Sikstel has detrmined Dictyophyllum /J_1/, but the fossils from the lower part of the overlaying Shahbashak suite point out at the upper parts of Middle Jurassic.

The question about the presence of the Regbulak suite over the peripheral parts of the erosion window is not clear now, because the stratigraphic boundaries between Triassic and Jurassic deposits nowhere are ascertained for sure. The contacts of these systems are tectonic one and the $J_u$rassic deposits are represented by the overlaying Shahbashak and Bashak suites.

Shahbashak suite (J_2 sh).

The suite deposits occurs in the section of the Shahbashak coal deposit, there they are productive ones and are represented by ~~the~~ inequigranular sandstones, aleurolites, argillite-like often coaly clays, seams and sheds of coal.

The productive series section of Sar-i-Asia is represented by the analogous interstratification. In both sections there are the same quantity of coal accumulation cycles and coincidence of the sandstone stratum positions. This fact allows to state, that the coal-bearing series occures under the covering deposits of Cretaceous-Paleogene over all 12 km distance between Shah-Bashak and Sar-i-Asia.

Flora determinations from the sections of the Shahbashak suite of both deposits, carried out by T.A.Sakstel, show the indentity and Middle Jurassic age of the flora.

The conclusion, that the Shah-Bashak deposit /its lower part/ and the Sar-i-Asia deposit are confined to one coal-bearing series is proved by the coal outcrops near the Urta-buz area, located between the deposits.

Taking into account these data we may can add some more about the upper suite boundary. At Shah-Bashak the gravelly sandstone floor, in some places transistory into gritstone and laying in the erosion surface of the underlying rocks, has been assumed as the suite boundary; there coal seams 10 and 11 are traced for a short distance. The clay rock strata, laying over the gravelly sandstone, contain four coal seams /No: 12, 13, 14, and 15/ well fixed in the field. Above thick strata of mainly coarse-grained mottled sandstones occure. The same picture we can see at the Sar-i-Asia deposit /see Fig.9/, but there the upper strata are composed of conglomerate and gritstone.

Taking into account the likness of both sections a correction should be done, andthe upper suite boundary at Shah-Bashak is to lay by the floor of the upper sandstone strata. It will more correspond to the facts, because at Daniture the Upper Jurassic boundary is assumed by the floor of the analogous mottled sandstone horizon.

The suite thickness, including the correction, range from 260-360 m at

Shah-Bashak and to 460 m at Sar-i-Asia.

Bashak suite (J_3 bsh).

As stated above, in the base of the suite the basal horizon of conglomerates and gritstone occures /at Sar-i-Asia/, transistoring westward /Shah-Bashak, Daniture/ into the coarse-grained mottled sandstone. Higher in the section a series of rhythmically alternating inequigranular sandstones, aleurolites argillite-like clays, and coal beds. At Shah-Bashak there are 12 coal beds in the suite deposits and 6 of them are workable.

Like the Shahbashak suite the Bashak suite keeps constancy of the section composition eastward of Darra-i-Suf coal area. Correlation of Shah-Bashak and Sar-i-Asia sections shows the indentity of the suite composition and continuity under the covering Cretaceous-Paleogene deposits.

At the region accumulation of coal in the Upper Jurassic time took place by a unit cycle, that is confirmed by the sections at Sgsh-Bashak and Sar-i-Asia. But at Sar-i-Asia there was a considerably supplay of terrigene materials to the peat boggs, as a result, there no workable coal seams and their levels are occupied by thin interbedding of coal and coaly clays. It is naturally and , in all probability, it is connected with the fact, that the Sar-i-Asia region has been situated nearer th the axial parts of the Jurassic range of "Palaeofarand" and was in the zone of intensive Pre-Jurassic dislocations.

The suite age is established as Upper Jurassic according to T.A.Sikstel's fauna determination: Taeniopteris reversa Pryn., Ctenis sp., Dictyophyllum sp., Podozamites sp., collected in borehole 6 at the Shah-Bashak deposit.

The suite thickness reaches 510 m.

c/Cretaceous system.

At the deposit region Cretaceous deposits are widly distributed: they occure at the elevated divides and plung northward.

Deposits of the Lower division has not beem determined in the region and Cretaceous is represented only by Upper division. It is composed by marine sediments and overlies with a heatus and time value on different horizons of Jurassic and Triassic.

The most complete section of the Cretaceous deposits has been studied near the village of Chehil Dukhtaran at the Shah-Bashak deposit region. There Cretaceous is represented by the deposits of Cenomanian, Turonian, Maestrichtian, and Danian stages. Deposits of Coniacian, Santonian and Companian stages are absent due to the Pre-Maestrichtian erosion and the deposits of Danian stage practically are not diestinguished from the Paleocene Bukhar limestone /3/, see, Fig. 2 and 3.

Cenomanian and Turonian stages (Cr_2 cm-t).

Cenomanian and Turonian deposits with fauna were not find on thw area. Thin /13m/ strata of interbedding fine-grained sandstones, micaceous clays, marls and sandy limestone presumably are assigned to Cenomanian. These strata are overlied by brownish, yellowish-gray and gray, somewhere brecciated limestone, which, by analogy with Danitur and other regions, are established as Turonian. The limestone includes dark-gray clay intercalations, which thicness being 0.8 - 7.0 m.

The total thickness of the Cenomanian-Turonian deposits makes up 36m /3/.

Maestrichtian stage (Cr_2 m).

The ersion surface of the Turonian limestone, but without any angular unconformity, is overlapped by Maestrichtian deposits,subdivided into two parts.

The lower part is made up of organic calcarenite limestones with marl and argillite interbeds. In the base there are lenses and interbeds of quartz gritstones, somewhere with lenticules and inclusions of redeposited coals. Near Chehil-Dukhtaran in the limestone such fossils : Praeradiolites sp. and Gurepleura sp. were found; in Poe-Kotal creek, between Shah-Bashak and Sar-i-Asia, Discocaphites sp., Echinocorys ex.gr. Ovatus deske, Gryphaea vesicularis Lam. were collected.

The thickness of the lower part is 59 m.

The upper part of the section is made up in the base of glauconitic limestones with small marl pebble inclusions. Higher gray and bluiesh-gray marls lie; they contains : Cyclothyris cf. bandasii Orb., Carnethyris sp., Echinocorys aff. cipliensis Lamb.

The upper Maestrichtian boundary is taken by the marls roof, because overlain limestones contains fossils of Danian stage.

The thickness of the upper part is 63.4 m.

The total thickness of the Maestrichtian deposits reaches 123 m.

d/ Cretaceous-Paleogene system .

Danian stage - Paleocene (Cr_2 d - Pg_1).

To this age unit we assigned a series of homogenous limestones, conformably overlain the Maestrichtian deposits. In the Danian-Paleocene deposit section we distinguesh /upward/:

a/ glauconitic limestone with Echinocerys aff. sulcatus Goldf., Echinocorys aff pyrenaicus Slumes, - 23 m,

b/ limestone, aphanitic, or organic calcarenite, - 93 m,

c/ marls with Cyclothyris sp. ind, Gryphaea sp., - 20 m,

d/ Limestone, organic calcarenite and compact with glauconitic limestone interlayers, containing Hemiaster sp., Echinocorys sp., - 124 m.

The total thickness makes up 260 m.

The fauna from the lower part of this section has Danian appearance and the fauna from the upper part has yet Thanetian appearance. It is not excepted that the middle part is to be assigned to Montain stage, but distinguishing of these stages is impossible, because of scarcity of fauna collections.

e/ Neogene system.

In the region to Neogene deposits we assign a series of red-coloured clays and conglomerates with thickness reaches 200 m; the deposits are widly distributed on the plateau area between the Shah-Bashak and Sar-i-Asia deposits /see Fig. 2/. The series overlaps the underlying Paleocene rocks with a stratigraphic and angular unconformity; The series is distingueshed as non-divided the Shafay and Kashtangin suites /Pg_3-N_1/ - /7/.

f/ Quaternary system.

Quaternary system deposits are widly distributed at the region. In a form of a thick covering the deposits overlap different more old formations.

In Quaternary we distinguesh the deposits of Lower, Middle, Upper, and Recent divisions.

The lower deposits occure at the Shah-Bashak deposit area, on the divide between Shah-Bashak and Darvazah, in the valley slope of the Chehil-Dukhtaran and on the plateau area, between Shah-Bashak and Sar-i-Asia. They are represented by consolidated loams with inclusions of pebbles and rounded boulders. The thickness of this section part ranges 10 - 15 m.

Middle division is represented by boulder-pebbly deposits 6 - 8 m thick, occured over the right valley slope of the Chehil-Dukhtaran river.

Upper division includes proluvial-talus deposits of the slopes: sandy loams and pale-yellow loams with inclusions of non-rounded fragments of Cretaceous and Jurassic rocks; the fragments sizes reache 1,5-2m in diameter.

The thickness of the proluvial-talus deposits is very changable and ranges from meter parts to 15 - 20 m.

Recent division includes alluvial, colluvial and lacustrine deposits.

The alluvial deposits are represented by fluvial facies: rgavels,sands, and bedded sandy loams, overlapped by loess-like loams. They are widly developed in the Andrak Valley and by Yakhniqol creek.

The colluvial deposits occure here and there along the scarp feet, made of the Cretaceous-Paleogene deposits; and are represented by large angular lumps of limestones.

Presence of lacustrine deposits is supposed to occure southward of the lake, near the village of Sar-i-Je. There is a large plane area, named "Chechil" that means "plane" in Persian. Taking into account that the area surface lies on the same level, as the lake elevation,it may be supposed that the plane formation has resulted because of lake decreasing and the area is composed of lacustrine deposits.

2. Tectonics.

The study region is confined to the south periphery of the Tajik-Afghan depression, to the north limb of the Hindu-Kush anticlinal structure. Transition from the Paleozoic framing to the depression is gradual and represented by an extensive slope, formed by Mesozoic-Cenozoic rocks, gently folded.

The process of the region tectonic formation includes a considerable period, started at time of the Hercynic orogen and has being developed during Cimmerian and Alpine time. It stipulates the complicacy of the tectonic structure of the region. Analysing of the Mesozoic-Cenozoic deposit dislocations allows to conclude that, the region structure has being formed by an inherited structure plane during a long period, at least from Lower Jurassic up to day. The tectonic history and structures of the region is disclosed on the area of the Chehil "erosion window", where the Cretaceous-Paleogene deposits have been eroded and the Jurassic and Triassic formations are exposed.

Theee some phases of tectogenesis are determined. The first phase took place in Upper Triassic,or in Lower Jurassic*; as a result, the Triassic deposits were folded into sharp plications and considerably faulted. Next, the second phase of the Cimmerian cycle has clearly exposed in Upper Jurassic - Lower Cretaceous time.

Possibly, that is why we do not find the Regbulak suite /?/ at Sar-i-Asia and in the vicinty.

During this cycle dislocations of the Jurassic and older deposits took place with a fold formation and block displacement. As a result of that dislocations was uplifting of the Koh-i-Chauli-Khan mountain. The amplitude of vertical displacement has reached more than 1 km /see Fig 2/. We observed a stratigraphic adjoining of the Cenomanian-Turonian deposits to the Triassic ones on the mountain top. The phase finished in Lower Cretaceous, after than, the region was planed with formation of a crust of weathering.

During Upper Crataceous and Lower Paleogene the region developed under more stable conditions. The Cenomanian transgression brought to formation of a warm epicontinental basin. In the end of the Turonian oscilating movements excited a regression of the sea; as a result of it was the time value, included Coniacian, Santonian, and Campanian stages of Upper Cretaceous and Maestrichtian overlaps the eroded surface of the Turonian deposits. Maestrichtian period was characterized by a new subsidence of the region, as a result a new transgression of the warm shallow sea began. In Maestrichtian the tectonics movements had a form of oscilations of the sea bottom, that led to rewashing of the bottom sediments /presence of marl pebbles/. During Danian-Paleogene time the tectonic regime was stable and sediments of the shallow sea were being deposited.

In the upper part of Pliocene the third - Alpine-phase has started; as a result the sea regression had place and orogenesis with formation of the contemporary structures has begun. The history of the Alpine orogenesis at the region is very complex and is outside of this report competence.

As a result of existance of these three tectogenesis phases they distinguesh three structural stages in the sedimentary series of Mesozoic-Cenozoic.

The lower stage is formed by the fold strustures of the Triassic rocks. These structures have forms of strong small folds with a large number of faults, some of which are the main elements of the region tectonic structure.

The Middle stage is represented by the fold structures, composed of the Jurassic deposits. The structures also have forms of strong folds with widly distributed faults. The stage is characterized also by block dislocations, especially in the central and notthern parts of the "erosion window".

The third - Upper - stage is imposed on a small area beyond the region boundaries. The stage is composed of the Cretaceous-Paleogene deposits, overlain with an angular and stratigraphic unconformity the different horizons of the dislocated and eroded Jurassic and Triassic rocks. The rocks of the Upper structural stage are folded into genle undulating folds. The Upper stage may be subdivided into three substages, formed /upward/ by Cretaceous-

Paleogene deposits, Neogene, and Quarternary age.

The tectonic structure of the Middle structural stage is predetermined by some great dislocations by which block displacement has taken place. These dislocations also has stipulated the configuration of the "erosion window".

Two thrusts of sublatitudinal strike, traced for along distance by the dislocation plane, may be assigned to such great dislocations. The first thrust strikes in the north of the "erosion window" and cuts the Yakhniqol Valley. The second thrust is located in 5-6 km to the south. Both faults are branched and accompanied by small dislocations. One of such dislocations occuresin the left slope of the Andrak Valley near the deposit; it has a thrust form with the sub-meridianal strike. These dislocations are the natural boundaries of the Koh-i-Chauli Khan uplift, because the block movements of Triassic rocks have taken place along the dislocations. The same dislocations have emposed on the periphery of the "erosion window", on the area composed of Jurassic and Cretaceous-Paleogene rocks. The dislocation amplitudes decrease upwards the stratigraphic section and in Cretaceous-Paleogene rocks they reach only some tens of meteres; and sometimes they die out and empose as zones of crush. This fact points out that the dislocations are suffering rejuvenation.

The zones of tectonic dislocations are accompanied by development of gravitational lanslides. Later usually are confined to the sandy-loam talus or to Cretaceous-Paleogene limestones.

In the left slope of the Andrak Valley there are two large landslides, sliding from the west slope of Koh-i-Chauli Khan mountain. The tongue of one landslide has partioned off the valley of Andrak and the lake has formed between Sar-i-Asia and Sar-i-Je villages. The other slide occures opposite Alauddin village. Besides these landsledes, there are numerous small ones, some of which are described below in chapter IV.

3. Region coal presence.

The region of the Sar-i-Asia deposit is characterized by presence of some coal deposits and occurances, confined to the different productive horizons of the Jurassic deposits /see, Dr. Nos 1 and 2/. This part of the North-Afghan Coal basin in detail has been described in some reports /3,7/; that's why we deal only with the deposits located in the vicinty of the Sar-i-Asia deposit. They are:

The coal deposit of Shabashak was explorated with the help of the Soviet specialists in 1963-1964. Its reserves are 44.4 mln tons including 23.71 mln.t. of reserves by categories $B+C_1$. There are 29 coal seams at the deposit and 12 of them have minable thickness.

15 coal seams, including 7 workable seams, are confined to the deposits of the Shahbashak suite. Among the deposits of the Bashak suite there are 14 coal seams and 5 of them are workable. The total average thickness of 12 workable seams makes up 18.03 m. The coal seams of the Shahbashak suite and the lower seams of the Bashak suite /16 – 22/ are assigned to gas coal rank of group G_6, which may be used for coke production for blast-furnaces of small size. Coal of the upper seams of the Bashak suite is of long-flame rank. The coal humidity is not high – 1.71 – 2.62% for gas coals and 3.06 – 3.80% for long-flame coals. Ash content is 13.7% /at an average/. Volatile yield ranges from 34.7% to 41.7%, average yield – 38%. Sulphur content is very low /0.21–0.72%/.Phosphorus content ranges from 0 to 0.321%. Elementary composition: carbon content /C^g/ 77.8% – 84.1%, hydrogen /H^g/ – 5.17 – 5.85%, nitrogen /N^g/ – 1.09–1.74%. Calorific value is higher for the lower seams /8250–8050/ and lower for the upper ones /7950–7620/. Petrographic coal composition: content of vitrain components 59–93% /at an average – 77%/, semivitrain components – 1.5–27%, at an average 11%; fusenite – 2–28%, at an average 11%, leptynite – 0–5%, at an average 2%. Total meagre components average 18%.

Urta-buz coal occurrence is located in 1.5 km to the south of the Pass of the same name /in 6 km SE of Shah-Bashak by the motor road/, it is represented by one coal seam of 60 cm thick, included in the rock block of a tectonic wedge form; the rock age is,possibly, Upper Jurassic. The coal occurrence value is not clear.

Sar-i-Asia coal deposit is situated south-eastward of the coal occurrence of Urta-buz and is confined to the west periphery of the Chehil erosion window. The coal presence of this deposit is given below in chapter IV. It should be noted once more, that 14 coal seams are confined to the Shahbashak suite deposits, and they may have counterparts at another deposits and occurrences, situated to the south-east.

Sar-i-Je coal occurrence is located near the village of the same name, in 1.5 km to the south of the Sar-i-Asia deposit, on the left slope of the Andrak Valley. There a strong anticline is exposed and the basal horizon of the Bashak suite takes part in the structure formation.Along two fold limbs the horizon is underlied by a coal seam, corresponding to coal seam 14 of the Sar-i-Asia deposit.

It is evident, that this occurrence is a south prolongation of the Sar-i-Asia deposit,from which it is separated by the shift F_3 /see Dr.3 and 4/.

Between the coal occurrence and the shift there supposes to be a sincline structure, where the productive strata of the Shahbashak suite are located at a considerable depth.

Sabzak deposit is located near the Kotal-i-Sabzak Pass, in 3 km eastwards of Sar-i-Jo. There are three coal seams, the thickness of one of them reaches 2.42m. The coal is represented by semi-lustrous variety for 55%. Dull fusain coal averages 15% and dull ash coal – 5%. Coaly rock partings in the coal seams somewhere average 5%. Very often the coal is crushed to a such degree that its type is not distingueshed. The ash content is average, coal enrichment – easy and average. The coal metamorphism corresponds G_3-D_1 rank, that is a transitional type from long-flame to gas one. The coal may be used as a good power fuel. It is undoubtedly, the deposit coal is confined to the Shahbashak suite. And, probably, the coal seams are counterparts of the seams of the Sar-i-Asia deposit.

Ackharak Payan coal occurrence is located in 12 km to the east of the Sabzak deposit and, by all appearance, it is a counterpart of the deposit. There have been stripped 3 coal seams of 0.4, 0.5, and 2.85 m thick. The minable seam shows a complex structure and the coal is crushed very much. Its ash content is average and high. The coal metamorphism corresponds to G_3-D_1 rank, that a transitional variety from long-flame to gas one. Under a microscope the coal consits of vitrinite for 88-99%. The value of this coal occurrence is not clear now and will be determined after carrying out of special estimation-prospecting work.

Chapter IV.

Geology of the deposit.

1. Stratigraphy.

In the geological structure of the Sar-i-Asia deposit area take part the deposits of Triassic, Jurassic, Cretaceous-Paleogene and Quaternary systems.

a/Triassic.

The Triassic deposits are distributed in the eastern part of the deposit and composed the hanging wall of upthrow fault F_1 /see Dr.3,4, and 5/.

As it was noted in chapter III the Triassic deposits are distingueshed conditionally by the analogy with the occurrence at the Chehil and Dukhtaran river basin. At the Sar-i-Asia deposit Triassic is represented by very dislocated strata /see Fig.7/ of aleurolites and sandstones with thin interbeds of coaly argillites and coals. The section of the Triassic deposits at the deposit area is not clear enough, because of the heavy dislocations of the rocks and absence of clear stratigraphic boundaries.

The apparent thickness of the Triassic deposits ranges 460 - 500 m /see Dr.3/.

b/Jurassic.

The Jurassic deposit occure in the lower wall of thrust F_1. According to the different dislocatin degree of the Triassic and Jurassic deposits later overlap with an angularstratigraphic inconformiry and time value the different horizons of the underlying rocks.

The lower Jurassic boundary is unknown as the Triassic has been thrust over the Shahbashak suite, and it is not excepted, that the Regbulak suite is present at a depth in the lower wall of thrust F_1 /see Dr.3,4 and 5/.

The available for studying part of the Jurassic section is represented by the Shahbashak and Bashak suite, the first one is productive and contains minable coal seams.

Shahbashak suite (J_2sh).

The most complete section of the suite occures in the central part of the deposits area, between trench 9 in the east and trench 12 in the west.

In the base of the exposed part of the suite occure strata of middle-grained bedded sandstone, ferruginated,5,5 m thick.

Higher interstratification of fine- and middle-grained sandstones, aleurolites, consolidated argillite-like clays with coal seams and sheds is observed. Among this stratification /which thickness reaches 160 m/ there are 6 coal seams /1 - 6/ , and two of them are minable only on a part of the area; seams 1, 3, 5, and 6 are unworkable. In the upper part of the interbedding such fossils were collected: Coniopteris spectabilis Brick., Nilssonia sp., Stenorahis ex. gr. clavata Nath., Podozamites sp., Podozamites ex.gr. Lanceolatus L. et H., Phoenácopsis sp., Anomozamites sp., which according to T.A.Sekstil's conclusion point out Jurassic age of the described part of the section.

The overlying strata of the suite expose a cycle structure. They distinguesh 9 cycles, each begins with inequigranular sandstones and end with clay rocks. Later usually contains seams and sheds of coal.

In the base of the first cycle occure coarse-grained sandstone strata, 6 m thick; they are overlied by more fine-grained rocks. The cycle is ended with strata of consolidated aleurolitic clays, including coal seam 7 of workable thickness /see below, in section 2 "Presence of coal"/; the cyale thickness ranges 24 m.

The second cycle is represented in the base by fine-grained sandstone strata, overlied by aleurolites /thickness - 14 m/, higher in the section they intercolate with consolidated argillite-like clays and with fine-grained sandstone interlayers. In the upper part of the cycle argillite-like clays contain numerous inclusions of flora detritus, poor preserved flora imprints and vitrinized fossil logs. The second cycle thickness is about 30 m.

The third cycle is characterized by a less thickness /15m/ and consists of a coarse-grained sandstone bed, graded higher into aleurolites and argillites. They are overlied by coal seam 8, the most constant seam at the deposit /see section "Presence of coal"/.

In the base of the forth cycle there are strata of massive middle-grained sandstones, somewhere ferruginated, their thickness reaches 9.5 m, they are overlied by interbedding of sandstone and aleurolite, with thickness is 13 m. In the upper part, between argillite-like clays there is coal seam 9, exposing a workable thickness at the most part of the area. The total thickness of the forth cycle reaches 48 m.

The fifth cycle may be subdivided into two parts. The lower part is made of interbedding of fine- and middle-grained, coarse-grained sandstones; they are polymictic, somewhere cross-bedded, with gritstone lenses. The total thickness of the sandstones is 34 m. Higher, argillite-like clays include a thick coal bed of of interbedding coals and coaly clays; it was named coal seam 10. The bed is very distinctive and traced over the whole area. The cycle rock thickness makes up 60 m.

The next, sixth, cycle begins with thick strata /about 25 m/ of fine-grained sandstones, including thin more fine-grained sandstone and aleurolite interlayers. On some levels of the cycle the strata overly each other with erosion. In the upper part among interbedding of argillite-like and sandstone rocks occure two beds of thin interbedded argillite-like clays with coal, in some places the coal sheds thickning turn into one coal seam. These coaly beds are distinguished as coal seam 11/12 by us.

The seam roof contains numerous flora imprints. From the collection of trench 18 T.A.Sikstel has determined: Equisetites ex.gr. ferganensis Sew., Elatides curvifolia Dunk., Coniopteris sp., Eboracia /?/ sp., Equisetites longifolia Brick., and from trench 31 - Ptilophyllum cutchense Mor., pointed out Middle Jurassic age of this part of the section. The cycle rock thickness makes up 64 m.

In the base of the seventh cycle occure strata of fine- and middle-grained micaceous, not clear bedded sandstone, with thickness is 10.27 m.

Interbedding strata of clays with subordinate sandstone intercalations and coal seam 13 /see Dr. 8/ occure higher in the section. The coal bed exposes a complex structure and is non-minable over the whole area /see below, section "Presence of coal"/. The cycle thickness makes up 28 m.
The eighth cycle is the last but one in the section. It begins with strata of fine-grained sandstones with sideritic nudles and carbonized plants in quantity. In the sandstone were collected: Baiera ahnertu Krust., Ebrocia lobifolia (Phil.), Conite sp., Ptilophyllum cutchense Mor., Nilssonia ex.gr. vittaeformis Pryn. The sandstone thickness is 10.56 m; the overlying part of the cycle is made of interbedding of sandstones with clays and ends with non-workable coal seam 14 of a complex structure /see Dr.11/. The total thickness of the cycle rocks reaches 20 m.

The last-ninth cycle lies with erosion on the underlying rocks. In trench 12 the basal fine-grained sandstone is observed immediately on the coal seam /14/ roof. The cycle section is represented by interbedding of argillite-like clays with aleurolites and limonite interlayers, coaly clays and coal intercalations /not more, than 5 cm thick/. The thicknesses of the limonite interlayers are: 0.05, 0.10, and 1.85 m. Their thickening is observed from the bottom to top of the section. The cycle thickness amounts about 12 m.

The normal thickness of the described part of the Shahbashak suite ranges about 460 m.

The lithological section of the suite is variable by the lateral, because of the changable thickness of the sandstones.

The sandstones mainly are fine- and midlle-grained gray and brownish-gray with clayish and clay-ferruginous cements. They show clearly traced ridges with porous erosion forms, resulted of leaching /see Fig.11, 12/.
Content of the sandstones in the section of "Central"sai makes up 50.45%.

The aleurolites are mainly gray or brownish-gray, bedded, compact. Their constant graduation into the argillite-like clays are always observed. The aleurolite content in the section reaches 9.57%.

The argillite-like clays /making up 29.2% of the whole section/ are coloured in gray, dark-gray and greenish-gray. Among them often occure intercalations of coaly clays and vitrinized or lignitic stems of plants, flora detritus. The thickness of the clay strata renge from parts of metre to 3-4 m.

The coaly clays make up 1.3% of the section. The coal content of the suite section reaches 7%. The described limonites make up 0.45% of the whole section thickness.

The upper part of the suite, including 6-9 cycles, by all appearance, is analoguos to that part of the Shahbashak suite, which contains coal seams: 12, 13, 14, and 15 /see Dr.9/.

According to T.A.Sikstel's conclusion at the deposit area the Shahbashak suite is characterized by fossil plants only in the lower and upper parts of the section. Abundant remains of Coniopteris spectabilis in the right base of the strata, under a condition of a complete absence of all relict forms, allow to establish the age not older than Aalenian.

In the upper part narrow-leaved Baiera and coniferas appear. This changing of the plants prints out intensification of the climate aridness, That may falls on the end of Middle Jurassic or on the beginning of Later Jurassic epoch.

T,A.Sikstel has noted, that parallel with a considerable resembblance of the flora complexes of the Sar-i-Asia deposit and of the south-west Hissar spurs /Uz.SSR/, the first complex has theirown specifity in prevalence of thermophilic forms. The typical ginkgo has not been met, there are no also mesophilic forms of the Cladophlebis genus, but xerophile, coniferas, and cycadophites occure more often.

Bashak suite - (J_3 bsh).

At the deposit area the suite conformably overlies the underlying Shahbashak suite. The Bashak suite deposits are widly distributed in a band form in the west part of the deposit and southward of it, on the area, between the Sabz-Nau river and the village of Sar-i-Je /see, Dr. 3 /.

In the base of the suite there are thick strata of interbedding conglomerates and gritstones with inquigranular sandstones. In the middle part of the strata there is a clay horizon of 5 m thick, clearly traced over the whole area /see,Dr. 9/.

The described basal strata is the base of a big cycle, the upper part of which is composed of frequent intrebedding of mainly fine-grained sandstones and clays with thin coal intercalations. In the lower part of this interbedding occures a horizon of thin alternation of coals and coaly clays, which, as it may be seen on Dr.9, corresponds to coal seam 16/17 at Shahbashak, though at the Sar-i-Asia area it is not a coal bed. The upper and midlle parts of the interbedding also contain analogous thin coal interbeds and interlayers, and each one has a counterpart at Shah-Bashak, where this part of the section is subdivided into a number of cycles. The first cycle thickness makes up 125 m.

The next - second cycle begins with strata of middle-grained sandstones, in the base of which occures an interbed of quartzite gritstones. The total thickness of the strata is about 9 m. Higher, an alternation of sandstones, and aleutolites,and clays with beds of thin interlayering of coals and clays /"cakes"/ is observed. In this part of the section five subcycles are distinguеshed, each of them in the upper part has or such "cakes", or coal interlayers. The total cycle thickness is 36 m.

The third cycle in the base begins with strata of gritstones, 2.6 - 3.0 m. thick, higher they gradually changing into aleurolites and clays. The upper part is made of an alternation of gray clays and aleurolites with a bed of fine-grained quartz sandstone in the base. The thickness of the cycle makes up 23 m.

In the base of the forth cycle sandstone strata occure of 20 m thick. The upper part of the strata is composed mainly of fine-grained sandstones about 7m/ grading higher into coarse-grained, somewhere gravelly, sandstones. An alternation of sandstones with aleurolites lies higher. The clays include two coaly argillite beds. The cycle is crowned with fine-grained saidstenes. The total cycle thickness reaches 40 m.

The fifth cycle is represented by alternate strata of conglomerates, gritstones, inequigranular sandstones and is ended with strata of consolidated clays. The total thickness of this part of the section makes up 35 m.

More higher horizons of the Bashak suite at the deposit are absent because of the Lower Jurassic ~~xxxxxxxxxx~~ erosion. The total thcikness of the Bashak suite at the deposit makes up 278 m.

The lithology of the suite deposits is constant ~~xxx~~ over the whole deposit area.

The conglomerates - mainly small pebbled, contain middle-rounded pebles of flint, quartz, and expose a calcareous-clay cemenet; they makes up 6.25% of the suite thickness. The gritstones show the same composition and make up 4.15% of the section. The sandstones make up 39.63%, aleurolites - 10.29%, clays - 31.61%, colay clays - 5.08%, coals - 1.5% and 1.49% of the section thickness has not been stripped under Quaternary deposits.

The general colouration of the suite rocks is very characteristic. If the Shahbashak suite deposits are coloured in brownish, that the Bashak suite deposits have light-gray coloures, because of clay predominance.

The suite age is established as Upper Jurassic by analogy with the Shah-Bashak deposit, as was said above.

c/ Jurassic.

At the deposit area Jurassic rocks are poorly distributed and occure only at the west periphery of the area. They are represented by Cenomanian, Turonian, and Maestrichtian stages. The overlying strata of non-divided Danian-Paleocene deposits occure more westwards and are absent at the deposit.

Cenomanian /?/ and Turonian stages (Cr_2 cm-t).

Cenomanian and Turonian deposits overlap Jurassic deposits with a stratigraphic unconformity and heatus .

The section of Cenomanian /?/-Turonian deposits is represented from bottom to top:

1. Limestone, white, organic; - 5 - 7 m,
2. Sandstone, fine-grained gray with abundance of dark-coloured grains - 1,5 - 2 m,
3. Clay, greenish-gray, plastic, gypsiferous, - 5 - 7 m

The total thickness - 11.5 - 16 m.

Maestrichtian stage - (Cr_2 m).

Maestrichtian depåsits at the area is represented by strata of calcarenite-organic limestones, containing marl and aleurolite interbeds. In the base strata occure lenses of grijstones as a result of pre-Maestrichtian erosion. The gritstånes contain small coal inclusions. The limestone thickness is 60 m.

Higher in the section glauconitic limestone beds lie and they were described above in the part "Strattigraphy" of chapter III. The observed thickness of the glauconitic limestone reach 55 - 60 m. The total thickness of Maestrichtian deposits is 115 - 120 m at the deposit area.

d/ Qurternary.

Quarternary deposits are widly spreaded at the deposit area, where they lie as a relatively thin covering over the more ancient formations .

Among Quarternary deposits we distinguesh Upper and Recent stages, subdivided into a number of geological types.

Upper and Recent stages .

Proluvial-talus deposits - (d-Pl Q_{3-4}).

These deposits are widly distributed and sre closely connected to each other at the deposit area. Among them predominance of talus is observed, but proluvial deposits occure only in the thalwegs of nerrow-cutting gorge valleys .

On the geological map /see Dr.No 4/ the talus-proluvial deposits are shown only in some places, where their thickness exceeds 3-4m. On the other places they are not shown.

The talus-proluvial deposits are represented mainly by loess-like loams, rarely by sandy loams with inclusions of Jurassic and Cretaceous rock boulders. The highest thickness of the deposits is known on the left side of "Central" sai, where it reaches 10-15 m /see Fig.No 13//. The quantity of the fragmental material sharply exceeds in the north-west part of the deposit area, where talus and proluvial covering is distributed on a large area and overlaps outcrops of the Bashek and in a great part of the Shabahsek suites.

Recent stage .

Alluvial deposits - (al Q4).

Alluvial deposits are widly distributed in the north of the deposit area in the valley of Yakhniqol creek. Here, as it was noted, they are represented by fluvial and lower terrace deposits /see Fig.No 17/.

The fluvial alluvium is represented by shingles, sands, bedded sandy loams, often with inclusions of poorly rounded fragments of the native rocks.

The fluvial alluvium compose the deposits of flood-planes and above the floodplane terraces. The flood-plane terrace is made of shingles, sands and sandy loams mainly. The terrace high reaches 0.8m - 1.0 m. The above flood-plane terrace is composed of mainly loess-like loams, including rock fragments. This terrace is well preserved by both valley sides and is traced for 3 km up to the junction of the creek and the Andrek river.

Colluvial deposits (c Q4).

On the deposit area such deposits are not distinguished, because the limestone blocks, parted from Cretaceous deposits , do not make ~~xx~~ areal accumalations.

2. Tectonics of the deposit area.

The Sar-i-Asia deposit is located in the region with a complex tectonic structure, that's why the deposit area is charatcterized by a complex structure with fold and fault dislocations.

At the deposit area three structural stages are clearly distingueshed and were described in part "Tectonics".

In the formation process of the tectonic structure of the deposit area we may clerly observe phasic development, emposed in the fold formation in the first stages and faults dislocations later, which complicated folded structures.

a/ Fild dislocations.

The deposit structure is represented by an anticline fold with submeridional trend; the fold was named "Sar-i-Asia anticline". The fold structure is observed by Central creek /exploration line V/ and to the north, near exploring line III /see, Dr. 4, 5 and 6 /.

The fold core is composed of the Shahbashak suite deposits. The overlying rocks of the Jurassic Bashek suite and Cretaceous-Paleogene deposits occur only in the west fold limb, as its east limb has been completely eroded while the vertical uplifting by fault F_1.

Within the limits of the study area the Sar-i-Asia anticline exhibits a symmetrical structure in the south, near exploring line V-V and assymetrical - near exploring line III-III.

In the south the dip of the limbs ranges 60-70°. Near exploring line III-III the eastern limb dips at angles of 40-45° and the western one - 60-65°.

The eastern fold limb is complicated with small folds, expressed in plicating and overturning of the rocks.

The western anticline limb gradually smoothes out from 60-70° to 25030° in the direction of the fold limb pitch at the western part of the area of the Bashek suite distribution. But in the south, near exploring line VII-VII, we observed increasing of the dipping angles up to 65° by outcrops of the Bashek suite, and up to 85° in borehole 2. Not excepting, that the dip increasing is a local phenomenon, connected with the fault F_3 zone influence.

The mode of the upper bend conduct is not clear, because of strong fault dislocations of the area.

The western limb of the Sar-i-Asia anticline grades into a gentle wide syncline of a submeridional trend; the structure occurs in the upper valley of Yakhniqol creek, beyond the area limits /see, Dr. 3/.

The syncline limbs are composed of the Bashek suite deposits and the core is made of the Cretaceous-Paleogene deposits. The western fold limb has been exposed by erosion in the valley of Yakhniqol creek; it is composed of argillites, aleurolites, sandstones and thin coal sheds. The fold is an asymmetrical structure. Its eastern limb dips to the west at angles of 25-30°, and the western one is inclined to the east at angles of 42-45°.

Besides the described structures in the north-eastern part of the deposit there is an overturned syncline, occured in the block of the Shahbashak suite, restricted by faults F_1, F_4, F_6 and F_8. By all appearance this fold is a relict structure of the eastern limb of the Sar-i-Asia anticline, existed before the displacements by faults F_1 and F_4.

b/ Fault dislocations.

As it was said in chapter III the deposit has suffered a long period of the structure formation and fault rejuvenation.

Analyzing of the fault dislocations, distributed on the deposit area, allows to distinguish four stages of the fault evolution.

Faults F_2 and F_3 are considered to be the oldest ones; they are regional dislocations with sublatitudional strikes. By all appearance they appeared in the Hercynian folding and were rejuvenated in the final phases of the Cimmerian and in Alpine foldings.

Fault F_2 is developed in the valley thalweg of Yakhniqol creek and is defined by the position of the Triassic deposits in the right valley side and of the Bashek suite in the left valley side on the same elevation /see, Dr. 3/. The fault character is not clear at the deposit area. The vertical fault amplitude ranges 600-800 m.

Fault F_3 is noted in the south of the deposit, in 2 km southward of and parllel to Fault F_2. It was shown along the valley thalweg of Sabz-Nau creek. The fault is fixed by the displacement of the Bashek suite deposits in the both valley sides; as a result on the same elevations the Bashek and Shahbashak suites lie /see, Dr. 4 and 6 /. By its character fault F_3 is a horizontal displacement; its amplitude reaches 500-550 m. The displacement plane character is not clear.

The both described faults are traced far beyond the deposit area and they dislocate the Triassic and Cretaceous-Paleogene deposits. These faults are the natural north and south boundaries of the deposit.

The Sar-i-Asia deposit is supposed to be confined to the rock block, uplifted by faults F_2 and F_3. The both faults appeared in the first stage and were rejuvenated in the forth stage.

The next stage is characterized by the development of fault F_1. This fault shows a submeridional trend and is the natural east boundary of the deposit; the fault is fixed alóng the eastern periphery. The displacement plane dips to the east at an angle of 60°. It has an upthrow fault character, by which the Triassic deposits have been thrust over the different horizons of the Shahbashak suite. The crest line of the displacement plane and the surface is clearly traced by outcrops /see, Dr. 6 /. The fault amplitude is unknown.

In the vicinty of exploration line IV-IV the plane of fault F_1 is displaced by by fault F_4. Noted fault F_4 and faults F_5,F_6,F_7,F_8,F_9,F_{11}, and F_{12} appeared, undobtedly, later than fault F_1, in the third stage of the fault formation.

Fault F_4 shows a north-west strike of the displacement plane and is fixed by outcrops, in trenches 21 and 39, in borehole 1.The displacement plane strikes NE and dips 60°. The vertical amplitude of the fault makes up 55 m in the north and reaches 120 m by line II–II. The fault occurs in the Shahbashak suite and is represented by a shift-upthrust. The north-eastern limb is upcast.

Fault F_7, splitting from fault F_4, is also a shift-upthrust. It dislocates the Shahbashak suite to the north of trench 39 and is subparallel to F_4. The displacement plane also dips NE at an angle of 60°. The vertical fault amplitude ranges about 40 m.

Fault$_5$ is exposed in doubling of the outcrops of coal seam 10 and in increasing of the Shahbashak suite thickness in the vicinty of exploring lines V–V and VI–VI. The displacement plane terikes NNW and dips 60°. The vertical displacement amplitude is 80–90 m with a tendency of dying out north-wastwards. Fault F_5 is a shift-upthrust. In trench 61 an apophysis of the fault was fixed by doubling of the thickness of seam 10 /see, Dr 4, 11, and 20/. In the vicinty of exploring lines V–V and VI–VI in the Shahbashak suite deposits, between large faults F_1 and F_5 two faults F_{10} and F_{11} were discovered with their displacement amplitudes /by normal/ accordingly 20 and 10 m. The faults are not traced for a long distance and expose submeridional strikes of the displacement planes and dip eastward at an angle of 60° /see, Dr. 4,5,6 /.

Described faults F_4, F_5, F_7, F_{10} dislocate the productive strata of the Shahbashak suite, which dips opposite to the fault pitching. As a result in the fault zones some heaves are observed.

Faults F_6 and F_8 strike among the productive strata in the north-eastern part of the deposit, in the vicinty of exploring line II–II. These faults limit the noted relict syncline fold.

Fault F_6 is not fixed on the surface, but is defined by a difference of the structures along the valley sides of the nameless sai, followed the fault zone. The angles of the displacement plane inclination and the fault character are not clear.

Fault F_8, defindd by a crushed zone of 15 in width, strikes to the north in parallel to fault F_6.

The last of the discovered faults at the deposit area faults F_9 and F_{12} are, striking in the western part of the deposit area among the Bakhek suite deposits.

Fault F_9 and two splitting faults are fixed by the displacement of the conglomerate strata. Its type and position are not clear; the displacement amplitude makes up 70 m.

Fault F_{12} has been determined by the displacement of the sandstone strata and Cenomanian-Turonian limestone in the west of the deposit area. The fault type and its mode of occurrence are not clear. The limestone displacement ranges 90 m /by the displacement plane/. The above named faults stipulate the complicacy of the deposit tectonic structure.

Gravitational landslides.

Gravitational landslides are widly distributed at the deposit area. Mostly they are confined to the above described faults.

The largest landslide occurs in the north-west of the deposit where three limestones blocks of Cretaceous-Paleogene age were observed; They slided by the right slope of Yakhniqol creek under gravity. Two of these blocks lie on the Shahbashak and Bashak deposits in the right valley side and the third occurs in its thalweg /see, Dr.18/.

Besides there are many landslides of Quaternary talus-proluvial deposits in different parts of the area. /see, Dr. 4/.

3. Presence of coal at the deposit area.

There are 14 coal seams in the productive strata section of the Sar-i-Asia deposit /see, Dr.4,7,8,10,and 11/.

Seam 1 is traced for 1100 m along the upthrust F_1 and lies for 10-15 m above the tectonic contact of the Shahbashak suite with the Triassic rocks. The seam was stripped by trench 49, 9, and 77 for 465 m. In trench 49 the seam is strongly crushed and to the south of the trench it is not traced because of the thick covering of Quaternary deposits. Northward of trench 49 the seam is also dislocated up to trench 9 for a distance of 325 m. In trench 9 the seam shows a complex structure and is thick. The seam consists of two patches of coal, parted by an argillite interlayer of 0.40 m thick. The patches of coal contain 10 rock partings, their thickness ranges from 0.02 – 0. 05 m. The total thickness of coal in trench 9 is 4.68 m, and the workable thickness of the pure coal equals 3.69 m. Further northward the seam has been traced for 140 m up to trench 77. There it consists also of two patches, parted by a coaly clay of 0.52 m. thick. But in the trench rock partings are absent, except of one parting near the roof. Northward thining out of the seam may be observed; its thickness in trench 77 decreases to 2.51 m and the workable thickness of the pure coal is 1.91 m. To the north of trench 77 the seam is fixed by coal outcrops and fragments at least for 350 m. and then it is sheared by fault F_4.

Because of the strong dislocation of the coal seam and its closeness to the fault F_1 the seam is considered as unpracticable one.

Seam 2 has been traced for about 1250 m in the west limb of the anticline; there it was stripped for 300 m by trenches 50, 58, 59, and 8. The seam lies for 27 m higher than seam 1. The seam thickness ranges from 3.72 to 0.78 m with the thickness of pure coal from 2.75 to 0.58. The workable thickness persists for 80 m in the south part /see, Dr. 4 and 10/. Northwards the seam is thinning out /trench 8/, on account of it the seam has not been fixed in borehole 1 where its level is represented by a bed of coaly clays /see Dr. 8/. The seam structure is complex; it consists of some patches of lustrous, semi-dull, rare /in trench 8/ dull coals, parted by clays, coaly argillites and aleurolites with thickness from 0.02to 0.52 m. Southward from borehole 1 the seam has not been studied at deep levels.

Judging from the seam thickness variation in trenches 50-8 and by its absence in borehole 1 we may conlude that the seam has lenses-like occurrence and as workable one may be cosidered only on a part of the area., in an interval of trenches 50-59. There the seam is relatively persistent.

Seam 3 occurs for 18 m above seam 2 and has been traced for 1330 m in the west structure limb and for 70 m in the east one. In the west limb the seam was stripped in trenches 51,7,67, and 78 on the outcrop area of 1000 m. The seam is represented by interlayering of semi-lustrous coal patches and clay and argillite partings, but in the north semi-dull coal intercalates with the same rock partings. The total seam thickness range from 2.84 to 0.74 m the thickness of pure coal makes up 2.32 - 0.51 m.

Intensive variation of the seam structure and thicknesses of coal patches in the seam is observed. In the sections /see, Dr.10/ they may seen, that the seam shows lens-shaped structure and somewhere /in trench 67/ it is unminable in spite of considerable total thickness of pure coal, because of the complex seam structure and rock partings. The seam lens-shaped is confirmed at a depth,in borehole 1, where coal is replaced by coal argillites.

Within the study area seam 3 is unstable and is not interesting for mining of a large scale.

The natives mine the seam in near trench 7.

Seam 4. occurs for 18 m higher than seam 3, shows a complex struture: consist of interbedding of semi-lustrous coal patches and argillite-like and coal clays partings. The thickness of rock partings is very changable: from 0.01 to 0.29 m /see, Dr.10/. The seam has been traced by trenches 52,6,68,and

79 for 1000 m in the west fold limb and is fixed in the west limb. The total thickness in the trenches ranges from 2.19 to 0.13 m and of the pure coal – from 1.49 to 0.10m. An average thickness of the pure coal in the trenches makes up 0.66 m. By no one section the seam shows a workable thickness, because of complicacy of its structure. In borehole 1 the seam has been cut at a depth of 164.63 m its total thickness being 2.95 m, but the thickness of the coal patches only 2.85 m.

By all appearance, seam 4 is lens-shaped and unminable, unstable one.

Seam 5 occurs in both fold limbs. In the east limb it was stripped by one trench 22. Coal seam outcrops were traced along its strike for 1350 m and at an interval of 1000 m by the strike the seam was uncovered by trenches 53, 69, 5 and 80. The seam lies in 10 m higher than seam 4. The total thickness ranges from 2.40 to 0.38 m and the pure coal thickness ranges from 1.51 to 0.29 m. A minable thickness was observed only in trenches 53 and 5 /0.99 and 0.86 m/. see, Dr.10.

The seam exposes a complex structure and consists of interbedding of semi-lustrous and argillite-like, coaly clays, To the north of trench 5 the thickness of the rock partings encreases and the seam becomes unworkable.

At a depth the seam has not been cut, because of its replacement by coaly argillite-like clays. All the facts point out, that the seam is unstable one and it has practical value on a very limited area /about 290 m/ between tranches 53 and 5 . The seam outcrop near trench 5 is mined by the natives /see, Fig.19/.

Seam 6 lies in 29 m higher than seam 5 and exposes a complex structure, changing lateraly. It was stripped by trench 23 in the eastern fold limb /see, Dr. 11/ for a distance of 1225 m by trenches 48, 54, 4, 70, and 29 in the west limb.

The total thickness of the seam ranges from 1.30 to 0.55 m.; the thickness of the rock partings widly vary, as a result a workable thickness of the seam appears only in some places: in the south, in trench 48 and in 860 m to the north in trench 70.

Its lenticular shape, complicacy of the structure do not allow to choose any part for mining; it is considered to be unstable and unpracticable.

Near outcrop 578 /see Dr.6/ the seam is mined by the natives /see, Fig. 20/.

Seam 7 occurs in 41 m above seam 6 and is traced for the most part of the area in both fold limbs. In the east limb it has been stripped by a single trench 24 /see, Dr.11/; in the west limb it has been traced along the strike for 1000 m by trenches 55, 3, 71 and outcrop 14 and has been cut at a depth of

82.75 m in borehole 1.

In all these points the seam has good minable properties.

The total seam thickness in the west limb ranges from 2.59 to 1.29 m with the same thickness of coal patches. The average thickness of pure coal in the limits of the study area makes up 1.58 m. The thickness ranges about the average exceed 30%, and the seam is considered to be relatively stable.

The seam is represented by mainly semi-lustrous coal. In the south in trench 55, 3 and 71 there are 3-1 argillite-like clay partings of 0.01-0.13 m thick.

Seam 8 is the most stabile workable seam at the deposit. It occurs in 42 m higher, than seam 7 and is well traced over the whole area. The seam has been traced by outcrops along the west limb for 1380 m by trenches 47, 56 11, 72, 27, and 30 and investigated in incline /slope/ 1, /see,Dr. 10 and 17/. There the total seam thickness ranges from 4.72 to 2.56 m and the thickness of coal mass ranges from 4.56 to 2.51 m. At a depth, in borehole 1 the seam has not been cut, as the borehole passed through the heav of fault zone F_4.

The seam structure is complex. It is composed of mainly semi-lustrous coal patches, rare by semi-dull and dull coal patches, parted by thin /0.01-0.10 m/ clay and argillite interlayers. The seam is characterised by presence of two contiguous clay interbeds, confined to the middle part of the seam and they are traced for a big part of the seam trend: from trench 47 to trench 27.

The average coal thickness of the seam coal mass makes up 3.51 m on the study area. The thickness rahges about the average do not exceed 30% /not more than 1.053 m/. It permits to assign seam 8 to a stable variety within the study area.

Seam 9, occured in 42 m above seam 8, is fixed even over the whole area. In the west structure limb it has been traced for 1130 m by trenches 57 and 60, by cutting in incline 2 /trench 10/ and by trench 73, 20, 37, 34, 33, and 32. At a depth the seam was studied in incline 2 and borehole 1 /see,Dr.4,8,10/.

In the south the seam for the first time was stripped on the left sai slope of Sabz Naw by trench 57, where the total seam thickness is 0,69 m and the summary thickness of coal patches makes up 0.67 m. Northward exceeding of the the thickness takes place and as a workable one the seam is traced for 850 m up to trench 20. The total seam thickness ranges from 3.58 to 2.55 and the summary thickness range of the coal patches is within the limits of 3.16 - 2.48 m. The seam shows a complex structure and is represented by patches of semi-lustrous and in some places, trench 73, 20, by semi-dull coal, interbedding with coaly clay partings, which thickness ranges from 0.02 to 0.22 m. Northward of trench 20 to trench 37 thinning of the seam may be observed, because of the surface relief cutting . There for a distance of 100 metres the seam becomes thinner: from 2.49 to 0.40 m, replacement of the composition matter of the coal mass take place. The semi-lustrous and semi-dull coal, noted in trench 20 are replaced by strongly oxidized fusite coal, stripped in trench 37. Further to the north in trench 34 the seam exposes a simple structure, workable thickness and is composed of semi-lustrous coal. The reason of this phenomenon was discovered in the sides of a rain rill, between trenches 20 and 37 /see, Fig. 21/. The thinning out and matter changing of the seam take place here because of presence of ~~[illegible]~~ an ancient relief bench, may be the slopes of a valley during the period of the peat formation, the bench later on was overlapped by the high peat bog. Further to the north from trench 34, by all appearance, the same phenomenon was observed in trench 33; after that the seam again exposes a workable thickness and is represented by mainly semi-lustrous coal.

In borehole 1 the seam has been cut at a depth of 74,00 m, there it has a simple structure and thickness of 1.74 m.

The average thickness of coal mass /pure coal/ by 10 sections, including the thinning out, makes up 1.77 m.

The seam is relatively stable minable one.

Seam 10. It is a very characteristic key horizon of the deposit. It lies for 46 above seam 9 and is traced for 2350 m in the west limb and for 1270 m in the east fold limb /see. Dr. 4/.

In the west limb the seam was traced for 1750 m by trenches 46, 62, 64, 14, 61, 1, 74, 19, and 35. The seam was also penetrated at an interval of 20,90 - 32,60 m by borehole 1 /see, Dr. 12/.

In all places of the intersections the seam is represented by a thick horizon of interbedding of semi-lustrous, semi-dull and dull coal and coal rocks. The total seam thickness ranges from 12.89 to 3.29 m and changing of the thickness of the coal mass /pure coal/ ranges from 7,47 to 1.34 m. It was stated, that the thickness and structure of the seam are changed for short distances without any regularity. The percentage of rock partings in the seam is high enough. It ranges from 41.7 to 85.2% and averages 54.3% A high variation of the composition, content of rock partings do not permit to choose the seam as a whole or some its parts for mining, that will be unprofitable, because of a high ash content of the mine mass. On the section /see Dr. 11/ it may be seen that the seam splits in the north and south of the area; where the coal patches are replaced by the enclosing rocks, That more yet decreases its value.

Seam 10 is considered as a genetically unit formation, confined to a peat bog, migrated on the surface and in time.

Seam 11/12 lies by 66 m above seam 10 and is traced for 1250 m in the west structure limb. There it was stripped by trenches 75,18 and 31. At that place the total seam thickness ranges from 6.14 to 0.27 m and the thickness variation of the coal patches - within 1.56 - 0.17 m. The seam structure is complex; it is represented by interbedding of coal patches of semi-lustrous and dull coal and argillite-like clay partings. The parting thicknesses often exceed the coal patches thickness.In the south /trench 75/ branching of the seam was observed; there two seams 11 and 12 were distingueshed; besides, a tendency of thinning out in the north direction was established in trenches 18 and 31.

Content of rock interbeds averages 68.2%. The seam is of non-value.

Seam 13/see Dr.11/ is traced for 2150 m in the west fold limb and lies by 54 m above seam 11/12. It was stripped by trenches 45,15,13, and 76 along the coal exposure for 700 m. At a depth the seam was penetrated within intervals of 272.90 - 292.00 m in borehole 2.

The total seam thickness ranges from 6.40 to 2.64 m and the thickness of coal mass - from 2.59 to 1.52 m. Like seams 10 and 11/12 seam 13 is characterized by a complex structure and is represented by interbedding of semi-lustrous, rare semi-dull coal patches and rock partings. In spite of a high summary thickness of the coal patches the seam is unminable one, because of its complex and variable structure. The average content of the rock interbeds makes up 52.3%.

Seam 14 the most upper seam in the Shahbashak suite section. It occurs by 20 m above seam 13 and is fixed for 2200 m along its exposure in the west anticline limb. There the seam has been traced for 400 m by trenches 66, 12 and 76. At a depth the seam was cut at a level of 247.2 m in borehole 2.

The total seam thickness ranges from 5.53 to 0.88 m with variation of the coal mass thickness from 3.93 to 0.72 m.

The seam structure is complex. It is composed of interbedding of semi-lustrous, rare semi-dull coal and coaly rocks.A workable thickness of the seam was fixed only in trenches 66 and 12, where it ranges ffom 0.88 to 2.20 m. Northwards and southwards the seam is unminable.

It is not excepted, that more detail exploring work will permit to choose an area by which reserve calculation will be made. In this report reserve calculation by this seam was not done.

Besides the described coal seams there are a number of coal interbeds in the Shahbashak suite section, but they all are unworkable /see Dr. 8/.

As a results of the work, carried out in 1965, at the deposit area the following coal seams were distingueshed by which reserve calculation was made.

Table 3

Seam Nos	Useful /calculated/ seam thickness, from - to in m. / Average thickness, /number of intersections/	Seam structure	Normal distance between seams in metres	Note
	Shabashek suite.			
7	1.29 - 2.59 / 1.58 -/5/	simple		Relatively stable.
			42.0	
8	2.51 - 4.56 / 3.51 - /6/	complex		Stable.
			42.0	
9	0.40 - 3.16 / 1.77 - /10/	complex		Relatively stable, somewhere thins out to unworkable thickness.

The average summaty thickness of these three seams is 6.86 m. This thickness is a real for recent period of studying of the deposit.

Chapter V.

CHARACTERISTIC OF EXPLORING WORK.

In 1965 at the deposit such work kinds were carried out: topographic and geological survey on a scale 1:5000, sinking of mine workings /trenches, inclines/and core drilling, well logging and sampling.

Methods of exploring work.

The exploring work methods were chosen according to the geological and geomorphological structure of the deposit area, confined to a complex structure /III group of deposits - deposits of geosincline and intermediate types/.

According to the standarts of the USSR the distances between exploring workings /lines/ were accepted as 300 - 400 m within one tectonic element. Such network thickness is sufficient for establishing of coal seam synonymy and stable degree.

Because of steep topography of the deposit area and heavy pitch of the coal formation, the coal exposures were traced by trenches.

In the north and south parts of the deposit area, in places of gentle dip of the rocks and smooth relief two boreholes were drilled. Two inclines /slopes on the maps/ were sunk for studying of the oxidized zone, quality of non-oxidezed coal and its volume wieght; the workings were located in the central part of the deposit.

Belew description of the named work kinds and their methods is given.

1.Topogeodesic work.

The following topogeodesic work kinds were carried out at the Sar-i-Asia deposit area.

Table 4.

Ser. Nos	Work kinds	Unit of measurement	Fulfilled work volumes	note
1.	Analytical net of category II	Point	12	
2.	Microtriangulation	"	14	
3.	Basismeasuring with Ederin device	l.km.	0.8	
4.	Solar azimuth calculation	azimuth	2	
	Topographic survey.			
5.	Plane-table survey on a scale 1:5000	km^2	3.1	
6.	Underground survey	l.km	0.083	
7.	Location of workings and outcrops	Station	654	

The work area is located on map sheet 502 - D /scale 1:100 000/ of the Afghan Layout, that corresponds to map sheet I-42-22 of the international layout. The work area is assigned to the 5th category of difficulty according to its characteristics and work condition.

There is no any State point af geodizic grid at the region; for supplying the topographic survey on a scale 1:5000 with a geodezic base an analytical net of category II and for the surveyng base a microtriangulation net were carried out. /see Fig.22/.

For calculation of coordinates and elevations as initial point the station of the analytical net БП-1 was taken; its coordinates: X - 3933179.70, Y - 12362955.00, H - 2565.7. This point was identified on the map on a scale 1:50 000 of the American edition. The coordinates were calculated graphically. The coordinates are given in Mercator projection, transversed on Hayford spheroid; as initial point the astronomical point of Herat North aws taken; $B=34^{0}23'09''$ NL, $\angle = 62^{0}10'58''$ ELg.

Analitycal net of category II.

The analitycal net was carried out as a file of triangles between two bases. The longest side was 1343 m and the shortest - 307 m. The horizontal angles were measured with 2" theodolite ST-02 by three circle stages. The vertical angles were measured with the same theodolite by one stage.

The mean squre error of a measured angle by the errors of all net triangles equals $m_{\beta} = \pm \sqrt{\frac{[vv]}{3}} = \pm 8''.6$
The maximum correction to the measured angles equals 8".6б according to the aquation. The mean error in the triangle net equals 11".5 The maximum error in the net triangles is 26".4.

On the surface the points of the analitycal net were marked with monoliths with metallic centres; the points were dug around in a square form.

Wooden stakes of 6-10 cm in diameter and 2.0 - 2.5 m in length surveyed as outward marks. The stakes on the ground were edged with stones up to 1 m in diameter. Equalization of the analitycal net was amde by the method of the least squares by the typical scheme.

For orienting two solar azimuth calculations were done. The mean square ~~err~~ error of the azimuth determination equals $M_{\alpha} = \sqrt{\frac{[vv]}{n(n-1)}} = \pm 15''.0$

Bais measuring.

For calculation of the analitycal net sides basis 1 and basis 2 were measured at the end of the triangle file.The final length of the first basis was 307.208 m and the second - 480.066 m. The mean square error of the first basi $M = \pm 0.25$ mm and of the second - $M = \pm 0.03$ mm.

The basis measuring was carried out with invar wires Nos 5373, 5484, 5487 in right and opposite directions. The wires were checked up with comparator MIIGAIK in 1963 in Moscow.

Topographic survey.

The points of the analitycal net of category II surveyed as a geodezic base for the plane-table topographic survey. At an average two points of the analitycal net and two points of the microtriangulation were per 1 square km. The contour intervals equal 5 meteres. The survey was made on a pure base and rectangular grid. The work was carried out in accordance to the requirements of the instructions for topographic survey on scales I:5000 and I:2000/issue of 1965/.

2.Geological survey on a scale I:5000.

The area of 3.1 km^2 was surveyed with the purpose of compiling of a geological map of the deposit/scale I:5000 on the prepared topographic base/.

The survey was carried out by a method of tracing along the strikes of coal seams, key horizons, interseams, boundaries of Quaternary deposits /where its thickness exceeded 3,5-4/m/ and Cretaceous-Paleogene formation, tectonic zones, faults and so on. The natural and artificial exposure, outcrops were mapped by means of instrumental location /653 stations/.

Mapping of the Triassic, Cretaceous-Paleogene and Quternary deposits wasé made by means of semi-instrumental location of the stations and by measuring azimuth trevarses from the initial point with a tape measure and surveyor's compass /59 stations/. At the area, composed of the Shabashak suite, 544 outcrops and workings were investigated, i.e. 410 stations per 1 km^2. It meets the requirements of this scale.

3. Mining and drilling work.

a/ Trenches.

For tracing of the coal seams and their sampling 80 trenches were sunk; the total volume was 1075 m^3. 71 trenches stripped coal seams and sheds, 8 trenches - bedrocks and 1 trench - a tectonic zone. The trenches were dug by hand to a depth of 3 m with shovels and hacks without timbering /see Dr. 19,20,21/.

The trench location is given on draughts 4 and 6. The trench numbers are given in table 5; the trenches are grouped by the seams, stripped by them:

Table 5.

Ser Nos	Trenchig of:	In all	Including by coal seams												
			L	2	3	4	5	6	7	8	9	10	11/12	13	14
1	Coal seams in the west limb	60	49 9 77	50 58 59 8	51 7 78 67	52 6 68 79	53 5 69 80	48 54 4 70 29	55 3 71	47 56 11 72 27 30	57 60 10 73 20 37 34 33 32	46 62 64 14 61 1 74 19 35	75 18 31	45 65 13 76	66 12 76
	Total		3	4	4	4	4	5	3	6	9	9	3	4	3
2	Ditto in the east limb	4	-	-	-	-	22	23	24	-	-	36	-	-	-

Trenches 28,39,63,17, and 38 have stripped coal sheds. Trenches 2,15, and 16 were carried out for exposing of the coal series section, and trenches 40,41,42,43,44 - for the purpose of exposing the section of Upper Jurassic. One trench has been sunk in a tectonic zone and trenches 25 and26 stripped unknown coal seams.

b/. Inclines /slopes on the maps/.

In 1965 two inclines were driven in coal seams 8 and 9 /see Fig. 23/. Driving was carried out with miner's picks MO-10, worked from compressor DK-9. The rock lifting was made with skips and help of electric winch T-144 with motor capacity of 2.8 kilowatt. Water discharging was carried out with suction-pump C-774. The incline section was 3.0 m^2 and the crosscutting section - 1.4 m^2. The workings timbering was made of uncomplet door-frames with entire timbering of the roof and partly of the walls.

The inclines were sunk along the seam roof. The whole seam thicknesses, their roofs and floors were stripped by crosscuttings at places of sampling and documenting.

The volume of fulfilled work :

Table 6

Ser. Nos	Incline Nos	Section in m^2	Length in l.m.		Total volume in l.m.	note
			incline	crosscut		
1	1	3.0	35.0	31.35	66.35	Seam 8
2	2	3.0	35.0	21.55	56.55	Seam 9
Total			70.0	53.90	122.90	

The incline / No1, see Dr. 4 and 17/ was driven by seam 8; its length equaled 35 m. At intervals: 5,10,15,20,25,30 and 35 m from the incline crosscuts were sunk for cutting the whole thickness. The summary length of all crosscuts makes up 31.35 m. The inclination angle /to the horizon/ was 16°. The vertical deepening from the surface equals 37.10 m.

Incline 2 /see Dr. 4 and 18/was driven by seam 9. The incline length from the mouth makes up 35 m. From the incline at marks of 5,10,15,20,25,30,and 35 m crosscuts were sunk with the total length of 21.55 m. The inclination of the working makes 16°. The vertical deepening of the face equals 38.6 m.

Allocation of the mine workings by the coal seams trends in the west fold limb is given below:

Table 7.

Seam Nos	Traced distances along strike in m.	Quantity of workings pc.	Intervals between workings in m.		Average intervals between workings in m.
			maximum	minimum	
1	465	3	325	140	232
2	300	4	235	15	100
3	1000	4	450	200	334
4	1000	4	425	225	334
5	1000	4	450	275	334
6	1225	5	450	225	206
7	550	3	300	250	275
8	1380	6	375	200	276
9	1130	9	300	30	141
10	1270	9	480	40	158
11/12	330	2	-	-	330
13	700	4	300	180	234
14	400	3	220	200	200

4.Mechanical borehole drilling.

In 1965 at the deposit two exploring boreholes of core drilling were sunk.The total work volume was 580 m. Xh average borehole depth equaled 290 m. The maximum depth - 300m and minimum 280 m.

The drilling was carried out by drilling rig UHB-ZAM. The borehole construction was chosen according to necessity of drilling the coal seams with diametr 111 or 91 mm for obtaining of representative coal samples. The borehole construction is given in graphical enclosures, see Df.14 and 15 /boreholes sections.

For drilling reinforced drill bits /MP-2, MP-6.CM ,CT/.were used and drilling fluid of no~~r~~mal quality ; specific wieght 1.18 - 1.20, viscosity 25". Clay for the drilling fluid was ob tained from the lower part of the Jurassic deposits, occured in the valley of Iakhniqol.

Quatenary deposits and upper weathered part of bedrocks were fastened with drilling pipes, which after borehole lquidation were lifted completely.

Borehole 1. /see Dr.4,12,14/ was located in the right valley slope of Iakhniqol Creek /see Fig. 24/. The borehole was drilled with the purpose of studying of xxxxxxxx coal presence and coal quality at a depth, near the meridional fault /F2/. As a whole~~ø~~ by the borehole its coring equals 72.7%, and by the Quaternary deposits - 100%, by the enclósing rocks - 71.1%, and by the coal seams - 81.6%. The drilling was finished at a depth of 280.0 m.

Borehole 2. /see Dr.4,13,15/ was sunk in the lower part of the Bashek suite for cutting of coal seams 14,13,11/12,10 and 9 in the left valley side of unnamed sai in the south of the deposit. The reason of borehole sinking there was a gentle dipping of the coal series rocks. But while drilling grade increasing of the dip angles /up to 85°/ was observed; on account of this fact, at a depth of 300 m only coal seams 14,13, and 11/12 were cut. The core yield averaged 59.9% by the borehole, including: by the Bashek suite - 33.0%, by the bedrocks - 82.5% and by the coal - 86.0%.

An average labour productivity made up 5.27 m per 1 drilling shift,or 263.5 l.m. per 1 drilling set for a month by two shifts a day.

Inclinometring .

Measuring of the inclination of the borehole axis was carried out only in borehole 2 and it was made with device ISH-4. At a measuringpoint the angle and azimuth of the axis inclination were determined. As awhole ten measurements were carried out. Before lowering the device reading was compared with the reading of a dial. Correctness of the inclinometer measurements was checked up by 6 repeated control measuring. The total number of the measurements made up 16. Hence, 37.5% of the measurements were control ones.

The results of the inclinometer measurements are given in table 4.

Treating of the inclinometer data included determination of the measured point coordinates, the floors of coal seams and compiling of the vertical and horizontal projections of the borehole. The treating method of the data is analigous to the method, accepted by us at the Shah Bashak deposit.

Table 8

Depth of borehole in m	Sum of lengths of horizontal projections in m	Coordinate increments in m.		Vertical projection of borehole.
		X	Y	
300.0	13.02	7.78	10.59	299.63

Drowing of the hole crookness is given in Fig. 25.

Methods of drilling of coal seams.

Drilling of the coal seams at the Sar-i-Asia deposit was made according to the method, worked out and tested at the Shah Bashak deposit.

Drilling of the boreholes was carried out with the help of reinforced drill bits with diameters of 152, 112 and 91 mm. The intervals, drilled by different diameters are given below:

Table 9.

Work volumes in l.m.	Linear metres, drilled by different diameters in mm				Average diameter of drilling in mm
	152	131	112	91	
580	29.70	-	535.60	14.70	113.51

The intervals of the all met coal seams were drilled with a diameter of 112 mm.

Liquidation tamping of the boreholes.

Tamping of the boreholes was done with the purpose of isolating of the coal seams and to avoid ground water inflow into the worked out space. According to the requirements, accepted in the USSR, the boreholes were tamped with a thick clay fluid.

5. Logging.

Logging of the boreholes was carried out with the purpose of of more precise definition of the lithological subdivision, determination of coal seams, their depth of occurrence, structure and thickness with the help of geophysical methods. Concerning the methods of this work we should to elucidate this matter completely, as logging was carried out both at the Sar-i-Asia deposit and at the Masjid-i-Coobi deposit. /The work results of the later deposit area are given in chapter XI/.

The present logging method is a develòped one of the method, worked out and approbated at the Shah Bashak deposit.

By the total volumes of drilling in 1965, equaled 968.1 m /including 388.1 m at the deposit of Masjit-i-Choobi/ the volume of logging made up 872 m. Only intervals near the boreholes ends and covered with driving pipes were not logged /see Dr. 12 - 15 and 24 - 26/.

The total volume work at two deposits was:

Table 10

Ser Nos	Work kinds, carried out by method:	Unit of measurement	Work volumes	Including by the deposits			
				Sar-i-Asia		Masjid-i-Choobi	
				B.h 1	B.h. 2	B.h.1	B.h. 2
1	2	3	4	5	6	7	8
	1. Standart logging on a scale 1:200						
1.	Method "KC" 2 parameters	l.m.	1734	510	542	296	384

1	2	3	4	5	6	7	8
2	Method "VP"	l.m.	872	255	271	149	197
3.	Method "PS"	"	872	255	271	149	197
		2. Detailed logging on a scale 1:50					
4.	Method "KS" 2 parameters	l.m.	218	84	60	32	42
5.	Method "VP"	"	109	42	30	16	21
6.	Method "PS"	"	109	42	30	16	21
7.	Control measurements	"	820	225	140	319	136
	Total volume	l.m.	4724	1413	1344	979	888
8.	Resistivity logging	point	4	2	1	1	1

The logging work was carried out on a base of an electronic automatic logging station АЭКС - 900 No 459 with changed scheme of the current panel, permited to regord six curves of the provoked potential /PP/

The method complex, used in 1965, was worked out and approbated during exploring of the Shabashek deposit. This complex includes such methods:

a/ Method of apparent resistivity, recorded by lateral device of mutual feedding M 0.95 A 0.1 B and by normal device B 0.95 A 0.1M,

b/ Method of provoked potential PP"+", recorded by normal device B 0.95 A 0.1 M with current strength of 15-20 mA on a scale of recording of 25 mV per 1 cm,

c/Measuring of drilling fluid resistivity with a laboratory resistivimeter.

The automatic recording of curves was made with a speed of 250-400 m. per hour,on a scale 1:200 and 100-120 m/h on a detailed scale 1:50. Later the curves were transfered to the combined geologic-geophysic sections of the borehole /see Dr. 12-15 and 24-26/.

Method of logging diagram interpretation.

Method of log interpretation is based on the generally accepted rules of treating of logging data /4/. The interpretation of the diagrams was made according to the lithological composition of the section, to the geophysical method of investigations, to the type and size of probe.

As a result of the interpretation geological and electrical characteristics of the rocks are given below:

a/ Relatively high anomalies have: limestones /400 - 500 ohms/, sandstones /200 - 400 ohms/, and coal seams /200 - 400 ohms/.,

b/ Small resistances /to 100 ohms/ are confined to argillite-like clays and aleurolites.

Distinguishing of coals by complex interpretation of log data was based on the experience of coal distiguishing at the Shabashak deposit but including the characteristic features of coal anomalies on its log diagrams. The later are:

1/ Relatively high resistance /to 400 ohms/ by the method of apparent resistivity /KS/,

2/ Strongly marked, with clear boundaries anomalies at the curves, recorded by method VP /to 200 mV/, what was usually absent in the borehole sections of another rocks. Excepted some anomalies of sandstones in borehole 1.

The method VP should be considered as a main method for distinguishing of coal seams. All other methods are subsidiary.

During the field work, for the purpose of quality determination and checking up of the interpretation, repeated control measuring was carried out by all employed methods.in a volume of 820 l.m. /23%/.

The applayed standart complex of geophysical methods and the method of datum interpretation meet the requirements, accepted in the USSR and they may be recommended for exploration work at coal deposits of Afghanistan.

As a result of the carried out geophysical investigations there is a possibility of compiling of well-founded geological sections of the boreholes, especially detailed in coal seam intervals. Logging gave main data within all intervals of poor coring or its absence. Accepted after interpretation a geological section was compared with the section, compiled by drilling data and than the final section of a borehole was compiled. While compiling we took into account the quantity and positional levels of the lifted cores, the results of control measuring of hole depths and results of interpretation by all methods separately and in complex. All the factual sections were treated on a scale 1:200 and the coal seam intervals - on a scale 1:50 /see Dr. 14,15,26/.

The results of comparing of the coal seam thickness by drilling and logging for the seam, taken fo r reserve calculation , are given in table 11.

Table 11.

	Log data		Drilling data	
	Numbers of sections	Summary thickness	Numbers of sections	Summary thickness
1. Total sections of the seams taken for reserve calculation	2	3.35	2	5.15

1	2	3	4	5
Accepted by logging, including:				
a/with exceeded thickness according to drilling data	1	1.50	1	2.75
b/ditto with diminished thickness	absent	-	absent	-

At the deposit of Sar-i-Asia in the boreholes 6 coal seams were fixed by logging. For reserve calculation the seam thicknesses according ~~kkkk~~ the log data were accepted only once in borehole 1. In this case the seam thicknesses were increased for 0.75 m relatively the drilling data.

Below the geophysical results by the boreholes at the Sar-i-Asia deposit are given.

<u>Borehole 1</u> /see Dr.12 and 13/. Here four coal seams xxxxx of workable thickness were met in the section. Out of them three seams, their thickness and depth of occurrence were confirmed by electic logging. According to the drilling data seam 8 in the interval of 80.00 - 82,75 m exposed its thickness equaled 1.5 m and according to the log data - 2.75 m. Carried out complex of logging work completely confirmed the lithological section obtained by drilling.

<u>Borehole 2</u> /see Dr 13 and 15/. First of all it should be noted that in the hole all rocks show high angles of dipping - to 75 - 80° /see Dr. 3/. It is naturally, along the lithological section a devirgence between the drilling and log data is observed. So, within the intervals of 154-162 m and 170-174 m there are two coal seams with the thickness Of 0.75 and 2.10 m according to the drilling data, but the electric logging does not distinguish them. It should be born in mind that reducting thicknesses by the hole to the normal one the later make only 0.38 and 1.05m / the coring by the second seam equals only 20-25%/. Within intervals 238-247 m by the drilling there are two coal seams with the apparent /hole/ thickness Of 2.20 and 6.00 m; by the logging only one seam is distinguished; and its thickness makes 2.50 m. /the true thickness of the first seam equals 0.19 m, of the second - 0.53 m. The summary thickness reach 0.72 m/. Within interval 272.00-292.00 a coal seam of 20.0 m thick by the hole was distinguished by the drilling data; according to the log data this seam is only of 9.60m thick. Taking into account the dip angle of 75° reduction gives only 4.74m of the true thickness.

Besides the conclusion of the log results, we correlated the coal seams while interpretation of method "VP", as the most effective one by some boreholes, drilled at the deposits of Shabashek, Sar-i-Asia and Majid-i-Choobi /see Dr.16/. Analysis of the log data of method"VP" at the named coal deposits indicates that strongly pronounced anomalies "VP" of the coal seams, in some times exceeded /by magnitude in mV/ the rock anomalies, are observed at all three deposits. This fact once more confirms our choosing rightness of the geophysic method of hole investigation.

All the results of geophysic investigations were utilized completely for the report compiling.

6.Sampling .

Sampling of coals was carried out in order to obtain their quality characteristics and to determine oxidised zone size. The surface and uderground exploring workings were sampled by trenching and specimen picking; and the boreholes were sampled by core.

All the picked samples were sent for chemical and petrographic studying; which results give a trustworthy quality value of the coal and allow to outline of coal utulization.

Sampling of mine workings.

Trench sampling was carried out according to GOST-3249-46. Samples were picked out by means of trench sincking of the separate coal patches of a complex seam /differential samples/. In a case if the thickness of a coal patch exceeded 1 meter /e.g. in seams 8 and 9/ samples were picked out successivelly and the trench length did not exceeded 1 m. the section of sampling trench equaled 3x7 cm and in the inclines - from 5x7 to 7x10 cm. The trench length was limited by the thickness of coal patches and ranged from 0.2 to 1.6. The sample weight ranged from 1.0-9.0 kg depending on the trench section and thickness of sampled intervalas.

Before sampling a face was evened and mapped, then a sample trench was marked out and upon which the sample cut on the tarpaulin, had spread before.

In 1965 202 samples were pickked out in the mine workings, including 159 bed-differential samples and 43 samples of rock partings.

Distribution of the samples by kinds of workings, seams, sample type and by analyses is given in table 12.

Table 12

Ser. Nos	Seam No	Numbers of seam sections: Total	Numbers of seam sections: Including sampled ones	Quantity of samples picked out	Including by sample types: Bed-differential samples	Including by sample types: Rock-parting samples	Analysis kinds: Technical analysis of S,P content; spec. gravity	Analysis kinds: Techn. ultimate analysis of	Analysis kinds: Techn. analysis of rock partings
				Trenches.					
1	1	3	2	11	11	-	11	-	-
2	2	4	-	-	-	-	-	-	-
3	3	4	2	4	4	-	4	-	-
4	4	4	2	3	3	-	3	-	-
5	5	4	2	4	4	-	4	-	-
6	6	5	2	3	3	-	3	-	-
7	7	3	3	4	4	-	4	-	-
8	8	6	6	19	19	-	19	-	-
9	9	9	6	9	9	-	9	-	-
10	10	9	1	6	6	-	6	-	-
11	11/12	2	-	-	-	-	-	-	-
12	13	4	-	-	-	-	-	-	-
13	14	3	1	1	1	-	1	-	-
14	interbeds	2	2	2	2	-	2	-	-
	Total	62	29	66	66	-	66	-	-
				Inclines /slopes/.					
15	8	7	7	63	50	13	48	2	13
16	9 6	7	7	73	43	30	40	3	30
	Total	14	14	136	93	43	88	5	43
All together		77	43	202	159	43	154	5	43

The bed-rock samples were picked out for estimating of possible admixtures to the coal during mining.

Sample treating was carried out in accord of the enclosed scheme /see Fig. 26/.

The final reliable weight of sample was calculated by Chethott formula $Q=kd^2$, Q - sample weight in kg, k - coefficient of grain irregular distribution, d - grain dimeter in mm.

The quantity of "k" has accepted as 0.4 and the final diemeter - 3 mm.

Picked up and treated samples were packed into jars and germitized with paraffin.

Sanding the samples to laboratories we distinguihed the following category of thrustworthiness of samples;:

Table 13

Categories of thrustworthiness	Kind of workings	Sampling depth from the surface in m.
I	Inclines	over 30
II	" "	from 15 to 30
III	" "	from 2 to 15
IV	Inclines and trenches	from 0 to 2

Distribution of all quantity of the picked samples by the thrustworthiness categories and analysis kinds is given in the following table:

Table 14

Ser. Nos	Kind of workings	Quantity of samples	Including by Categories of thrustworthiness				Including by analysis kinds		
			I	II	III	IV	Technical analysis of P,S content, spec.gravity	Technical ultimate analysis O	Technical analysis of bedrock partings
1	Trenches	66	-	-	-	66	66	-	-
2	Inclines	136	22	50	64	-	88	5	43
	Total:	202	22	50	64	66	154	5	43

Lump sampling. This sampling kind was carried out for control of the results of specific gravity determination by the method of the coal cutting from blocks /see chapter "Reserve calculation". In all 44 lump samples were cut; 25 of them were taken from the incline 1 and 19 from incline 2. All the lump samples were sent for analysis of humidity, ash content and volume weight.

Sampling methods for determination of the oxidation zone size.

Sampling for the size determination of the oxidized zone took place in inclines 1 and 2. The value of the sampling work made up 136 samples /see Table 14/.

Samples were cut over the whole seam thickness in 5 m of the face driving, /see Dr. 17,18/.

Incline 1 /seam 8/ was sampled at levels 0.5,10,15,20,25, 30,and 35 metres. In all 8 exposures were sampled in an average interval of 5 m from each other. Besides in the incline 50 bed-differential samples of coal and 13 samples of bed-rock partings were picked out.

Incline 2 /seam9/ sampled in 8 exposures at leveles: 0.5,10,15,20, 25,30, and 35 m. In addition 43 bed-differential samples and 30 samples of bed-rock partings were cut.

The results of the oxidation zone studying are given in the chapter of "Coal quality".

Core sampling.

While drilling coal seams the coal core was obtained in column forms ~~fxxxx~~ and from the seams of complex structure the core had fragment composition. All élicited from the core pipe cores was washed layed in boxes and described. In a case if the core was represented by fragments the rock chips were picked by hand.

The core yield was estimated by its ratio to the hole seam thickness independently was it calculateb by drilling or by logging. The core yield was calculated by the pure coal pathhes, excepting rock partings /see table annex 6/.

In a case if the coal core has being very chiped the volume weight was determined and then evaluated into linear size.

The sampling method was of two kinds. In some sections the cores dix were not picked from the rock partings, that approximately corresponds to a bed-mining sample. In other sections all the rock fragments were picked out and the sampled were divided into sections, that corresponds to a bed-differential sample. Picked out rock partings were sent for ash content and specific gravity determination.

The core yield by the drilled coal seams including the core categories of thrustworthiness is given in table 15.

Coring was carried out by all drilled coal seams. The core samples were sent fob analyses of humidity, ash content, volatile matter, specific gravity and sulphur and phosphorus content. The following categories of thrustworthiness were distinguished in the samples ,sent to laboratories:

Table 16

Category of thrustworthiness	Depth of sampling from the surface in m.	Core yield by seam in %%
I	Over 30 m	over 50
II	from 15 to 30	"
III	from 2 to 15	"
IV	without limits	less than 50

Table 15

Ser. Nos	Coal seam Nos	Total quantity of sections: Number of sections	Total quantity of sections: Core yield	Number of sections without coring	Number of sections with core yield in %%: L - 20: Number of sections	L - 20: Core yield in %	21 - 40: Number of sections	21 - 40: Core yield in %	41 - 60: Number of sections	41 - 60: Core yield in %	61 - 80: Number of sections	61 - 80: Core yield in %	81 - 100: Number of sections	81 - 100: Core yield in %
1.	4	1	100.0	-	-	-	-	-	-	-	-	-	1	100.0
2.	7	1	34,7	-	-	-	1	34,70	-	-	-	-	-	-
3.	9	1	86.5	-	-	-	-	-	-	-	-	-	1	86.5
4.	10	1	94.0	-	-	-	-	-	-	-	-	-	1	94.0
5.	13	1	89.0	-	-	-	-	-	-	-	-	-	1	89.0
6.	14	1	95.7	-	-	-	-	-	-	-	-	-	1	95.7
In total		6	87.5	-	-	-	-	34.70	-	-	-	-	5	91.8

***

The total number of the core samples makes up 37. Their distribution by the category of thrustworthiness and analysis kinds is such:

Table 17

Ser. Nos	Coal seam Nos	Sections: In total	Sections: Sampled ones	Number of cut samples	Sample distributions by categories of thrustworthiness: I	II	III	IV	Sample distributions by analysis kinds: Technic. analysis of S.P. content, specific gravity	Technic and ultimate analysis Q	Technic. analysis of rock partings
1	4	1	1	3	3	-	-	-	-	3	-
2	7	1	1	1	1	-	-	-	-	1	-
3	9	1	1	2	2	-	-	-	-	1	1
4	10	1	1	15	4	11	-	-	5	9	1
5	13	1	1	4	4	-	-	-	4	-	-
6	14	1	1	7	7	-	-	-	7	-	-
7	interbeds	2	2	5	5	-	-	-	4	-	1
Total		8	8	37	26	11			20	14	3

Calculation of average analysis data of the samples was made by calculation of average-weights by summary hole thickness of the coal patches. The method of averageweighted ash content calculation, including pollution with rock interbeds, is analogous to the method accepted by the Shabashek deposit exploration /3/.

Control of sampling.

The inner control was made by 6 samples. For the outer control 20 samples were sent to the USSR; in addition ultimate analysis and calorific value of the samples were determined. Coincidence of the analysis results is good. Divergence of the analysis results of the common and control samples does not exceed permissible limits.

Chapter VI.

Quality of the deposit coals.

This chapter was compiled on the base of the results of chemical-technical and coal petrographic analyses of the coal samples; the anlyses were done by the complex laboratory of Departament of Geology and Mines of Ministry of Mines and Industries in Afghanistan and by the coal-chemical laboratory of Institute of combustible products /Moscow/.

1. Investigation methods.

The most part of the samples was cut in the mine workings and only a smal part-in the boreholes. The samples are representative enough and they characterize all the coal seams of the deposit /see Dr. 10,11/.

As a rule every coal patch of a coal seam was sampled. Trench /channel/ samples and bed-differentiated ones, and whole-bed samples were the most used type of sampling. The samples included rock partings which thickness was less 0,02 m .

In all coal samples were determined: humidity /W^a/, ash content /A^c/, volatile matter /V^r/, total sulphur/S^c /, phosphorus content /P^c/, and specific gravity of coals and rock partings /d/. All determinations were made in accordance to the standart methods widly used in the USSR for analysis of coking coals and coals for power economy.

The inner control was carried out by all analysis kinds. For every sample parallel determination of moisture, ash content, volatile matter and others was made. In a case of inadmissible divergence of the parallel analyses , analyzing was repeated.

The outer control, as was said above, was made by Coal-chemical laboratory of Institute of combustible products. It should be noted, that divergences between the analysis results of Kabul complex laboratory and the control analises from Moscow were within the limits in the most case. The only exception was constant divergence of volatile matter determination /V^r/, which always was higher in the analyses from Kabul for 2-3% than in the analyses from Moscow coal-chemical laboratory. This constant divergence is conditioned ,possibly, by different atmospheric presure in Moscow and Kabul, that stipulated a little different development of thermal destruction of the organic matter of coals.

By all seam sections were determined: avarage indices of the comercial /techical/ and ultimate analyses, heating value and other by the method average-weighted. The calculation formula:

$$a_{av} = \frac{a_1 \cdot M_1 + a_2 \cdot M_2 + a_3 \cdot M_3 + \ldots\ldots + a_n \cdot M_n}{M_1 + M_2 + M_3 + \ldots\ldots\ldots\ldots + M_n} ,$$

here a_1, a_2 and etc are percentage contents of W^a, A^c, V^r, and other indices of each coal patch, and M_1, M_2, M_3 ..... – thickness of separate coal patches .

The average indices of the seam quality on the whole over the deposit area were determined as arithmetical mean of the average-weighted indices, corresponding indices of each seam section. For calculating of quality indices by every seam we took the data only of non-oxidized ar slightly oxidized samples, cut mainly in the inclines and boreholes. At calculating average ash content we used also the data of oxidized coal samples from the numerous trenches, because their ash content little differed from it of non-oxidized samples.

Coal-petrographic analysis was made for the most stable in thickness coal seams, so as seams 7,8,9. With the help of quantitative-petrographic analysis /GOST 9414-60/ estimation of microcomponent composition of the organic matter of coals was done as for separate coal patches as for a seam on the whole by some seamsections. For this the average microcomponent composition for every seam section was calculated, as in the case of calculating of average chemical-technological indices, by the method of average-weighted. The average petographic composition of each seam was calculated as average-weighted.

The inner control of quantitative-petrographic analises was made by means of parallel calculation of the same polished briquettes. Permissible divergences should not exceed 3%. In reality the divergences of parallel analises were less 3% according to the control data. But for very oxidized coals divergences may reach greater, especially by the group of semivitrinite /sv/; that makes calculations very approximate.

Coal rank was determined by means of comparison with standarts by the method of doubled polished sections. The method point is visual comparison through microscope of standart polished sections with known coal rank and polished sections of investigated coals. Here the ~~xxxxxxx~~ spore vessels colours of both polished sections were taken into account so as vitrinite colour.

Darker colour of spore vessels and vitrinite in comparison with the standart indicates at less coal rank. In contrast, if the vitrinite and spore vessel colours of the standart are darker, it means that the investigated coal is of higher rank than the standart.

Determination of coal rank is based also on other indications. For instance, presence of high anisotropic fusainized inclusions or graphite-like margins around semifusinite grains points at thermal influence of metamorphism. In part, this fact points at possible thermal metamorphism of coal which has taken place under condition of faults, widly distributed.

General characteristic and estimation of the deposit coals.

The Sar-i-Asia deposit coals are represented mainly by semilustrous and transitional types from semilustrous to semi-dull with fine and rough striated-banded macrostructure.

Non-oxidized coals of the deposit are characterized by considerable hardness and solidity. By their carbonification rank the coals are hard ones with humic nature.

a/Chemic-technological characteristics and petrographic peculiarities of the coals.

Moisture /W^a/of the coals , as it is given in table 1 of annex 9 in the second part of the report, ranges from 3,64 to 4.84 % for seams 1 - 14. Besides, the upper-lying seams have higher moisture.

Moisture content of the coal samples, cut in the trenches, reaches high quntity /W^a = 6.85-12.25%/. These numbers indicates at a high oxidation degree of the coal samples from the trenches in comparison with the samples from the inclines or boreholes. For the estimated seams of the deposit an average moisture content makes up for seam 7 - 3.67, for seam 8 - 3.71 and for 9 - 4.75%.

Ash content /A^c/ of the deposit coals ranges considerably reaching in some seams at an average 18.2 - 27.0%. And some coal seams are characterized by low ash content - 7 - 14.4%. In general it may be considered to be stated that an average ash content in seam 7 equals 14.2%, in seam 8 - 9.5% and in seam 9 - 10.5%, These seams , by which the reserve calculation was made, expose the lowest ash content. But, uncluding rock impurity, ash content of comercial coals of all these seams /aspecially for the rest seams/ will be higher.

Volatile matter /V^g/ for all the deposit coals is given separately for non-oxidized and oxidized coals. So, the non-oxidized coals of lower seams 1 - 4 contain 33.3 - 36.9% of velatile matter, and the upper seams contain 38.1 - 41.4%.

For estimated seams 7,8, and 9 an average volatile matter content makes up 36.76 - 36.00% by non-oxidized samples. Oxidized coals are characterized by high content of volatile matter to 42 - 52%.

Total sulphur content /S^c_t/ usually is not high. It ranges at an average from parts ~~%~~ to 1.225, besides oxidized coals expose lower sulphur content, than non-oxidized. The total sulphur content of the non-oxidized samples, for ~~all~~ the main coal seams of the deposit, makes up : in seam 7 - 1.00%, in seam 8 - 1.22%, in seam 9 - 0.82 %. Coal-petrographic investigations has determined, that higher sulphur content of non-oxidized coals is conditioned by sulphide inclusions /marcasite/. As a whole the deposit coals are considered as low-sulphur.

Phosphorus content /P^c/ ranges from 0.027 to 0.164%. In the estimated seams /7,8,9/ phosphorus content ranges from 0.042 to 0.069%. No regularity of phosphorus distribution was observed.

Elementary composition of the coals is given only for non-oxidized samples and is evaluated for combustible matter. It ranges within such limits: carbon content /C^g/ ranges from 77.48% to 81.83%, by average quantities. Hydrogen content, as a rule, is low and makes up 4.63 - 4.99%. Content of oxygen together with organic sulphur /O^g+S^g/ in the elementary composition of the coals reaches 11.40 - 16.28%. It should be noted, that there is no any regular changing in the elementary composition of the coal seams, depending on their stratigraphic position in the section. Thus , the upper and the lower seams at the deposit contain less carbon /77.48 - 79.14/, considerably diffe differ by this from the middle seams /7,8,9/ containing carbon in a quantity of 79.60 - 81.62 %.

It is interesting, that the average calorific value /Q_b^g/ of the middle seams is a little higher, than of the rest seams. Calorific value extrime quantities for separate samples makes up 7339 - 7921 calories.

Caking capacity. of the Sar-i-Asia coals was not determined. Only visual qualitative estimation of the crucible assay button was made by xxxx the analyses of volatile matter content /V^g/ of the coals. According to these data the main part of the unoxidized samples is characterized by agglutinated non-volatile residuum; that definitely points at weak caking properties of such coals. Our petrographic investigations complitely confirmed such conclusion for the most commercial interesting coal seams 7, 8, 9. According to such unfavourable petrographic composition of these coal seams /Table 2, Annex 9, part II/, it is difficult to suppose, that coals, even of high rank, will show higher caking and it is simply impossible for the present gas rank of the coals.

According to the facts, stated above, coking - the most important property of coal and connecting with caking - will expose also weakly. Basing on the petrographic data we may state, that the Sar-i-Asia coals cannot give a strong coke. It will be impossilble also to use the coals as charge components, because gas coals of such petrographic composition require a consoderable quantity of coal rank as; J, KJ,K and OS, which are absent in Afghanistan.

Thus, on the result base of coal-petrographic, chemic-technological investigation of the Sar-i-Asia xxxxx deposit the coals may be assigned to gas, weakly caking coals and may by used only as products for energetics.

3.Oxidation zone at the Sar-i-Asia coal deposit.

Determination of the oxidation zone boundaries is necessary for right estimation of perspectives of a coking coal deposit, as coking always is lowered by weathering and oxidxtion and not rare complétely disappeared.

For the deposit of energetic coals precise determination of the oxidized zone boundaries is not necessary thing and it does not influence at the deposit estimation. It is conditioned by the fact, that for energetics highly oxidized coals may be utilized. Nevertheless, the matter is to be studied by geologists.

As the chemic-technological results show, in highly oxidized coals the moisture, volatile matter reach considerable meanings. For instance: even in all the samples from the trenches moisture content exceeds 8-9%, and volatile matter makes up more, than 40%. At the same time in ~~slightly~~ slightly oxidized or non-oxidized samples from the boreholes of inclines these indices accordingly reach 3-5% and 34-38%.

In the inclines, which were driven especially for oxidized zone determination, changing of moisture content and volatile matter shows such character. In the incline mouths moisture content reaches 12%, volatile matter makes up 40%. But in 5 metres from the mouth of incline 1 moisture content approximates to that content of slightly oxidized coals /$W^a = 3.45 - 6.36\%$/. In 10 m from the mouth variation of moisture is considerably less /$W^a = 3.14–4.76\%$/. It should seem, that the incline has passed through the oxidized zone. But in 15 metres from the mouth moisture variations appear again - from 3.5 to 10.35%. Further, while deepening, variation range of moisture is getting lower. The analogical pictures may be seen in incline 2, driven by seam 9. If moisture exceeding is considered as one of the ~~xxxxx~~ criterions of oxidized zone presence, than at a distance of 20 m from the mouth in both inclines slightly and non-oxidized coal occurs. Thus, the oxidized coal zone at the Sar-i-Asia deposit strikes to a depth of 15 - 20 m. But oxidized coal may be met deeper, that is conditioned by the tectonic and relief features of the area.

Chapter VII.

HYDROGEOLOGY OF THE DEPOSIT AREA.

Studying of the underground water at the Sar-i-Asia deposit was carried out in a volume, corresponding to the prospecting period. The obtained data allow to characterize the general conditiones of the ground water accumulation, its distribution over the deposit area and over the stratigraphic section by separate lithologic units. About the inundation degree of the coal seams we may judge by the difference of the spring run-offs of separate lithological horizons; it reflects a relative difference of the rock permeability. The chemical composition of the underground water, studied not only on the Sar-i-Asia deposit area, but also all over the region of the coal deposits in Central

Afghanistan, allow to characterize some questions of the underground water formation connected with the geological structure peculiarties.

Hydrogeological work was carried out in August-September of 1965. For this period were observed: springs, physic-geological phenomena, relief, its ruggedness, stratigraphic formation exposure on the area of 6 km^2 in square; immediatelly on the prospecting area the rock jointing was studied by the inclines and bore-pits; the Andrak river and its tributaries discharge was measured. The total hydrogeological work volume is given in table 18.

Table 18.

Ser. Nos	Work kinds	Unit of measurement	Work volumes
1	Rout observation	km^2	6
2	Spring description	spring	18
3	Study of jointing	ground	6
4	Measuring of river discharges	measurement	3
5	Picking of samples for reduced chemical analysis	sample	21

The total conditions of the underground water accumulation at the Sar-i-Asia deposit may be considered as unfavourable. From the north, east, and south the deposit is llimited by the deep-cutted valleys of the Andrak river and its left tributaries: Sar-i-Je and Yakhniqol. Relative elevations of the inner parts of the deposit above the river level reach 500 m and as a whole the deposit is located above the Andrak river basis. Besides, the deposit is rugged by some deep sais. Thus , there are all conditions for intensive drainaging of the surface and the rock,composed the deposit.

The sharply expressed relief influence associates with irregularity of atmospheric precipitation, which mainly fall in winter or in spring. The spring rains are usually heavy, in its turn , this stipulates rapid water run-of, but not infiltration.

Nevertheless, at the deposit the underground water is formed in all main stratigraphic formations, videlicet: in Triassic, Jurassic and Cretaceous deposits. The rock composition, their water-reserve peculiarities are such , that they exclude complete drainage and what is more, additional ground recharge of some formations with water of the adjointing formations. takes place.

1. Waters of the Triassic deposits.

These waters were observed by the right side foot of the Anфdrak river valley, i.e. eastwards of the deposit in two springs /stations 1, 17, annex 10 /. Spring 17 is a typical ascension one, it has three gryphons groups and a funnel-like depression of 3 m in diameter. To the north and south of this spring on the same hypsometric level a band of green thick grass strikes, pointed out at ground water seepage. The spring discharge makes up 2 - 2.5 l/sec. The spring is slightly gassy, the emanation period of a spontaneous gas makes up 1 - 1.5 minutes.

As it was noted above, the Triassic deposits are represented by a very dislocated rock series, i.e. their collecting properties are represented by a jointy type.

The fact, that spring 1 is located under the analogous conditions, on the prolongation of the straight part of the valley down the stream, permits to suppose, that both springs are confined to the same fault zone in the Triassic.

The experience of hydrogeological investigations, carried out in the USSR, shows, that with a permissible error spring flows, by means of simple graphical correlations, may be evaluated into specific well discharges, supposed drilled in the places of spring outflows. So, if the spring flow is 2.5 l/sec, supposed specific well discharge will makes up roughly 1.8 - 2.0 l/sec. After that, we may characterize the hydrogeological features of a separate stratigraphic series by the data of spring run-offs, using the known dependance of well specific discharges on the rock water-carrying : k m = 1.3 q. Just in such way it was stated, that the rock water-carrying in the dislocated zones of the Triassic deposits varies in wide limits: from 30-50 to 200 - 250 m^3/day at the deposit area, but this water-carrying being not high.

The chemical composition of the Triassic water is hydro-carbonate- /78[x]/- magnesium /33/- calcium /47/. The total salonation equals 0.5 g/l /see annex 11, part 11. table 17/. The water is moderate hard /5.5 mg/eqv/., cold /5°/, transparent, without any taste, odour and colour. Judjing by the presence of nitrate compunds the water of spring 17 is always polluted.

2. Waters of the Jurassic deposits.

Waters of the Jurassic deposits are of a right interest from the point of view of mining conditions. The waters are distributed all over the area in a form of springs and even byond the exploring area /see Dr. 3/.

In contrast to the Triassic Jurassic rocks are more clayey and

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x - here and further in brackets content in percentage-equivalent is given.

especially important they expose mainly pory collecting properties. Of two suites, distingueshed in Jurassic, the Bashek suite /J_3bsh/, crowened the section, is the most clay-bearing /about 50% of the section is composed by clays/,and the Shahbashak suite is represented mostly by sandstones and gritstones, interbedded with aleurolites and other sandy-clayey varieties. In an other word, the Shahbashak suite deposits are represented by more complete collections of the sedimentary rhythms.

All the lithological horizons of Jurassic dip monoclinaly at angles of 60–25° to the west. Erosion has conditioned formation of the region of alimination directly on the left valley side, including also the deposit area.

Water-carrying of the Jurassic coal-bearing series is small, because of the clayesh composition and pory collectors. According to this reason the Jurassic is weakly drained, in spite of a high relatively elevation of its upper parts above the river levels. The springs, occured on the Jurassic area, show a low flow, that is explained by a small water-carrying of the rocks. The maximum spring flows reach hardly 0.5 – 0.6 l/sec, besides these springs are confined to the contact zone of the Jurassic and Triassic deposits, and assigning them to Jurassic is conditionally enough. The most part of the springs expose flows from 0.004 to 0.21 l/sec. Judging by the spring flows /see annex 10, volume II/, we may suppose, that water-carrying of the Jurassic deposits, including the productive horizons, does not exceed 25 – 50 m^3/day and the most typical meaning is not more than 1 – 10 m^3/day. Heightened water-carrying, as in a case of the Triassic deposits, is confined to dislocated zones, for instance to the tectonic contact zone of the Jurassic and Triassic deposits, striking near the east deposit boundary. As it was stated, from this zone to the west smaller faults split /see Dr.3, 4/, which also may have heightened water-carrying and water-bearing.

Comparing the spring flows from different parts of the Jurassic deposit area /normal location of the Jurassic exposures relatively the Andrak valley side permits to do it/ we may notice, that the springs, confined to the Shahbashak suite, show a little higher flows. This phenomenon co-ordinates with the lithologocal features of the suite.

The water table depth in the Jurassic deposits has not been studied especially, but we judge about it by the springs. Evident, that the sai divisions are drained to a depth, little differs from their relative elevations above the sais. In the sai thalwegs the ground water depth changes probably from some metres to a minimum. In borehole 1, for instance, located in the upper part of the Andrak valley side, the ground water plane was met at a depth of about 16 m. /the hole mouth elevation above the Yakhniqol river level is about 50 m /.

By their hydraulic properties the Jurassic deposit waters may be assigned mainly to the type of non-pressure waters, and only along tectonic lines pressure and high pressure waters may occur, especially near the contact of Jurassic and Triassic. There are some ascending, slightly gas springs /points 10-12/.

The chemical water composition is various. They clearly distinct two types: hydrocarbonate and sulphate, but there are two varieties of hydrocarbonate type. The first of them reflects the initial stage of components accumulation and at a definite degree of mineralization and is superseded by sulphate type according the following scheme:

Table 19.

Total mineralization in g/l	0.2 – 0.6	0.6 – 1.2	1.2 – 1.8	more 1.8
Chemical composition of waters	HCO_3•Ca•Mg	HCO_3•SO_4•Ca•Mg	SO_4•HCO_3•Ca•Mg	SO_4•Ca•Mg

This hydrochemical row reflects the process formation of chemical compositions under oxidizing-reducing conditions.

The other hydrocarbonate variety of waters is characterized by the following hydrochemical row:

Table 20

Total mineralization in g/l	0.2 – 0.6	0.6 – 1.2	more 1.2
Chemical composition of water	HCO_3•Na•Ca	HCO_3•Na•Ca•Mg	HCO_3•Mg

The row nature is not clear yet.

The sulphate type of waters, determined by spring flow, at the Sar-i-Asia deposit is formed only under oxidizing-reducing processes; one of the main conditions is presence of sulphides. Sulphate waters, formed under right solution and leaching of sulphate rocks, has not been discovered here, even the geological survey data stated their presence in the Jurassic series.

The total salination of the Jurassic waters ranges from 0.24 to 2.3 g/l. It was noted, that springs with small flows have higher salination of waters. For instance: the flows of spring with maximum salination 2.1-2.3 g/l hardly reach 0.01-0.002 l/sec. This phenomenon allows to think about local possibility of salination rising of the ground water because of high evaporation in the spring places of seepaging.

The physical properties of the Jurassic deposits waters are changed in accordance of their chemical composition and salination from soft with palatable test to very hard brackish waters.

3. Waters of the Createceous deposits.

As the Triassic deposits water so the Createceous waters are distributed byond the boundaries of the prospected area, closely to its west boundary. We discovered three springs,confined to the Crataceous limestones. Two of them are located near the contact of Jurassic and Cretaceous deposits /springs 15, 18/; they are charectirezed by low flows 0.01-0.1 l/sec., while the third spring /s.5/, confined to the Maestrichtian limestones, shows flow 7.0 l/sec. This spring with name of Yakhniqol feeds the creek of the same name, wich falls into the Andrak river. Thacks to this spting the difference of water-collecting propetties of different aged formations , composed the left side of the Andrak river, is distinguished; and the Jurassic series is considered as the least pervious.

The chemical water composition of the Crataceous deposits is hydrocarbonate of calcium or calcium-natrium. The total salination reaches 0.3-0.36 g/l. Waters are soft, their hardness does not exceed 2.9mg-eq /approximately 8^{o}/, cold, polatable for test, without odour and colour.

Classifying by hydrogeological conditions the Sar-i-Asia deposit should be assigned to the type of slightly flooding simple, but with complicated geological-engineering conditons / type of midlle complicacy/. The complicacy includes presence of non-cemented or slightly cemented sandy-clayey rocks, contained coal seams, and tectonic dislocation of the deposit. Parallel with parametric characteristic of the coal seams water-bearing, these questions are to be paid a special attention at the stage of more detail prospecting work.

Water-supplay condition at the Sar-i-Asia deposit is to be considered as favourable. Water-supplying may be realized by the ground waters, confined to the Triassic or Cretaceous deposits depending on locations of any dwelling and industrial units. The Jurassic deposit waters partly may be used as for drinking,as for technical requires. But in every case the water quality is to be controlled in proper times.

Chapter VIII.

CONDITIONS OF THE DEPOSIT DEVELOPMENT.

The question about deposit exploitation at the recent stage of studying may be discussed only preliminaliry.

According to the standarts, accepted in the USSR, for mine projection the workable coal seams of the Sar-i-Asia deposit may be considered as:

coal seam 7 - a seam of middle thickness and coal seams 8 and 9 - seams of high thickness. The seams dip is mainly steep /more 45°/. Moderate dip /25-45°/ was noted only in the north-west of the deposit.

Comercial reserves of the deposit may be estimated while development of the deep horizons and they will provide a mine with annual output of 100 000 tones of coal during 30 years /including coal losses in the bowel/. Method of the deposit development - underground. The coal seam position of seams 7,8,and 9 permits their combined mining. The distance between these workable seams averages 42 metres and is given in table 3 in "presence of coal" of chapter IV.

Below, preliminary data about characteristics of the deposit rocks are given.

1. Hardness and stability of the rocks.

The coal seams floors are represented mainly by argillite-like clays and aleurolites /see Fig. 27/, their resistance is weak. While drilling of the boreholes in the section presence of swelling clays was stated.

The roofs of the coal seams are composed of mainly argillite-like clays and sometimes of aleurolites. Sandstones occur usually a little higher and may be exposed by field workings.

The rock physicalmechanical properties are given in table 21.

Table 21.

Ser. Nos	Rocks	Principal properties	Rock hardness ratio by Protodyakonov	Physic-mechanical properties	Stability	Fragmentary in mm.
1.	Argillite-like clays, aleurolites	High making small ability, anisotropy of physic-mechanical characteristics	3	Degree of compression to 300 kg/cm²	Weak medium	50-200
2.	Sandstones	Dependence of ~~xxxxxxxxxxx~~ hardness and deformations on cement and clastic product composition	6	Ditto, more 500 kg/cm²	Good	10-100

Coals of the Sar-i-Asia deposit are hard enough and distroyed only with a help of mechanical means. Stability of the coals is good, but during sinking of the inclines exfoliation of coal patches along clay partings was observed. Cleavage of the coals is not high. Changing of the coal mechanical ~~xpx~~ properties from water influence is unimportant. Coal moisture is small.

While mining the coals with miner's picks coal fragments make up 2-30 cm in diameteres. The coal hardness ratio by Protodyakonov equals 3.5-4.

2. Presence of gas and silicosis danger.

During sinking of the inclines and boreholes presence of gas was not stated. But it may be partly explaned by degassing of the seams near the surface. This explanation may be confirmed by the mining experience of Karkar exploitation, where gas emanation was stated at a considerable depths. The fact predetermines of gas survey organization at the deposit and supplaying the mine with explosion-safety equipment.

The coals of the Sar-i-Asia deposit are to be considered as non-spontaneous combusting. The base for such state is the fact that coal exposures, spoil banks of the past coal mining never spontaneous combust, in spite of intensive oxidation.

The question of silicosis danger at the deposit mining cannot be judged because of the small volume of mine workings, carried out by us. The results at the Shabashek deposit and by analogy we may conclude that the deposit does not carry silicosis danger /at the Shabashek deposit quartz content in the coals ranges from 0.4 to 1.2%, that is too less of 10% limit/.

As it concerns silicosis danger of field workings, so there quartz content will range in wide limits, depending on the mined rocks. By analogy with Shabashek quartz content variation may exceed the danger limit of 10%. That is why, the faces, bottoms of prospecting workings are to be assigned to silicosis dangerous.

Conditions of the deposit development.

The deposit relief is quite favourable for constructing of mine enterprise - shaft sinking and production premises building.

Workman's settlement is recommended to locate in the velley of the Yakhniqol river, on its terrace along the right side there are some suitable grounds for building.

Water-supplaying of the mine was discussed above in chapter VII.

Chapter IX.

RESERVE CALCULATION.

1. Conditions of calculation

The reserve calculation at the Sar-i-Asia deposit was carried out on base of the following conditions, accepted and approbated at the Shabashek deposit:

1. The lower limit of coal seam workable thickness - 0.8 m,

2. Maximum permissible ash content - 30%,

3, Maximum thickness of the rock partings in a coal seam of complex composition - 30% of the total thickness,

4. Maximum ash content of coals, including contamination mix with parting rocks in seams of complex composition. - 30%.

2.Boundaries of the estimated area and methods of calculation.

Reserve estimation is given for a part of the deposit area in the limits of the west structure limb, characterized by certain tectonic structure and persistence of the coal seams. The estimated area has been covered with the geological survey on a scale 1:50 000 and geological prospecting work. The east natural boundaries of the estimated area are the coal exposures on the surface or under Quternary deposits. In the north they conjugate with faults F_4 and F_2 planes. The south boundary of estimating strikes along the line of seams and fault F_3 plane crossing. In the west the boundary is represented by the crossing line of seams floors and horizon of +2500 m /Herat coordinate system/.

The reserve calculation was carried out by the method of geological blocks by hypsometric plans, projected on a horizontal plane. The scale of the calculating hypsometric plans has been taken 1:5000 with contour intervals 50 m. The reserves have been calculated by horizons of 100 m on the elevations of +2700, +2600, +2500 m /see Fig. 7/.

The reserves were calculated by the formula:

$$Q=B\cdot Sec\ a_{\cdot}m\cdot D$$, here

Q - coal reserves in thousands of tons,

B - projection on a horizontal plane of the area between contour lines ,divisible 100 m, in thousands of m^2.

a - median dip angle of the seam between two contour lines,

m - median useful thickness for the datum figure in metres,

D - coal volume weight in t/m^3.

3, Estimation by categories.

Subdividing the estimated area for blocks of different categories of the reserves was carried out in accordance to the standarts, accepted in the USSR /5/ which envisage such distances between exploring openings within one tectonic element:

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Table 22.

Ser. Nos	Degree of stability of coal seams	Distances between exploring openings in m. for categories		
		A	B	C_1
1.	Stable	600-800	1200-1600	2400 - 3200
2.	Relatively stable	300-400	600-800	1200-1600

The deposit exploring stage does not permit to distinguesh reserves of categoty A and B because of absence of cutting of the coal seams at deep horizons on the most part of the area.

The present estimation envisages the reserve qualification by categories C_1 and C_2. The reserve contour of category C_1 has been determined on the base of the exploring openings and extrapolation by the geological data for a half of the distance between exploring openings. Category C_2 has been determined on the base of non-limited geological extrapolations.

All distingueshed reserves are balance reserves.

4. Initial date.

The horisontal projection of the area was determined by in the estimated blocks by trice outlining of the contours by planimeter "Reiss" No 564 with the scale point equals 250. The measuring error did not exceed of telerated.

The average dip angles of the coal seams has been determined graphie cally at a scale 1:5000 for the present contour intervals. Methods of angle measuring included measuring of the horizontal projection of the seam exposures between two adjacent contour lines /of equal elevation/ within the estimated block and angle calculating by pallets, corresponding to the horizontal projection. For control analogous measuring was made for the whole seam . The calculated average angles are given in the tables of calculation / Table 3, part II./.

The average useful thicknees of the estimating blocks were calculated as arithmetical mean of the normal coal seams' thickness, determined by exploring openings. The normal coal seams' thickness in the exploring openings has been determined in accordance of the accepted standarts and are given in table 1 of part II.

Coal volume wight was estimated by method of test cutting of coals in inclines 1 and 2 from coal seams 8 and 9. The results of estimating are:

Table 23

Place and date of coal cutting	Coal weight in kg.	Size of niche-like groove in m			Volume of niche-like groove in m^3	Volume coal weight in t/m^3
		Height	Width	Depth		
Incline 1, 24,10,1965	710.0	1.0	1.0	0.54	0.54	1.31
Incline 2, 26,10,1965	768.0	1.0	1.0	0.60	0.60	1.28

The average volume weight equals 1.29 or in round numbers 1.30 t/m^3.

Estimating of the volume weight was made in accordance to the methods, described in annex 8 of part II.

For the purpose of control in inclines 1 and 2 while coal cutting at the same time 44 lumps of coal were picked and laboratory-analytical determination of the coal volume weight was carried out in the coal-chemical laboratory of the Departement of Geology and Mines in Kabul.

The average coal volume weight by 25 lumps, picked at level 30 m in incline 1, makes up 1.33 and by 19 samples from incline 2 /level 30 m/ it equals 1.31. The average meaning by two inclines equals 1.32 or in round numbers 1.30.

Meaning 1.30 t/m^3 has been accepted for the reserve calculation for the present stage of the deposit exploration.

The oxidized zone of the coals has not been distinguished for the reserve calculation, as oxidized coals are good energetic fuel /see above, chapter VI, annex 7 and 9 of part II/.

5.Characteristics of calculating by the seams.

Seam 7 /see Dr.7/. The reserves by this seam were calculated in the west structure limb within the area, the boundaries of which were given above. The reserves are assigned to categories C_1 and C_2. The blocks of category C_1 /I and II/ were distinguished between the seam exposure at the surface and contour line +2600, on the base of outcrop 14 and trenches 71,3 and 55. Category C_2 is suspension to category C_1. Category C_2 reserves were determined in 3 blocks /III, IV, V/ by the horizon from +2600 to +2500 m. The blocks were subdivided into some subblocks in accordance of the seam dip angles.

The reserves by seam 7 equals 1138.8 th.tones including 203,2 th.tones of category C_1 and 935,6 th.tones of category C_2.

Seam 8 /see Dr.7/. The reserves also were calculated by the west fold limb and are qualified for category C_1 and C_2. The reserves of category C_1

were calculated by two blocks /I and II/, between the seam exposure and elevations +2700 and +2600 m. Calculating is based on trenches 30,27,72, and incline 1. The reserves of category C_2 were estimated in blocks III, IV, V, and VI. Blocks III and IV were distingushed on the area above horizon +2600 m.; it bases on trench 56 and 47. Blocks V and VI are a sus_pension to the reserves of Category C_1. They were estimated by horizon 2500 - 2600 m.

The seam within the estimated area contains 2927.5 th.tones of coal. Including 506,2 th.tones of category C_1 and 2421.3 th.tones of category C_2.

Seam 9 /see Dr.7/. The seam reserves were calculated also in the west fold limb. Here, above horizon +2600 m and in the hanging side of fault F_5 the reserves of category C_1 were calculated /blocks I,II, and III/. The reserves of category C_1 bases on trenches 32, 33, 34, 37, 20, 73, 60, 57 and incline 2. Category C_2 was outlined as a suspension to category C_1 in the hanging side of fault F_5 /horizon 2600-2500 m/ and in the lying side of the fault from the seam exposure line to horizon +2500 m. Zones of local seam thinning /trenches 33,37, and 57/ were not distinguished, even they were included in calculating of the seam average thickness.

The seam reserves has been estimated as 1771.7 th.tones, including 356.5 th. tones of category C_1 and 1417.2 th.tones of category C_2.

6. Total results of the reserve calculation.

The coal deposit of Sar-i-Asia reserves may be estimated in such a manner:

Table 24

Ser. Nos	Seam numbers	Coal ranks	Reserves by categories in th.tones			Total reserves
			B	C_1	C_2	
1	7	Gs- Gv	-	203.2	935.6	1138.8
2	8	Gv	-	506.2	2421.3	2927.5
3	9	Gv	-	356.5	1417.2	1771.7
	Total		-	1065.9	4774.1	5838.0

These figures estimate the reserves of seams 7,8, and9, the most perspective for mining.

The reserve distribution by the seams, blocks and horizons is given in table 3 of part II.

Chapter X.

OTHER MINERALS.

It should be kept in mind that, besides of coal there are other minerals.

Lead. Kon-i-Sabzak lead manifestation was described by Mikhaylov in 1963. It is located in 0.7 km to SSE from the Sabzak Pass and confined to the lower horizons of Cretaceous /Cenomanian-Turonian/. The occurrence is connected with a zone of limonitization in brecciated limestones. Among the gossan matter there are relics of grains of arsenopyrite, galena; green copper and gypsum. In ancient time the minerglisation was mined; the quarry relic indicates at this. Significance of the object is not yet clear.

Limestones of Cretaceous-Paleogene age are widly distributed and own inexhaustible reserves. The limestones may be considered as raw materials for cement and lime production /8,9/.

Quarrystone and building stone. Reserves of such kind of building materials may be find among sandstones of the Triassic and Jurassic deposits. Sandstones are widly distributed and represented by fine and medium-grained polymictic rocks, their cement usually is argillaceous and argillaceous-calcareous.

Silting materials and building clays.

As raw materials for silting of waste openings and for burnt brick production loess-like loams, widly distributed at the deposit area. The loess-like loams occure on large parts of the area /see Dr.4/ and their thicknesses reach 5-7 and more meteres.

Clays for drilling muds. For preparing of drilling mud they may use greenish-gray plastic clays of Turonian age, which we used in 1965. Mining of the clays took place in the right valley slope of Yakhniqol creek, near borehole 1 in a quarry. There clay mining is not difficult thing, because the clays has been dislocated, they formed landslides and occur near the motor road. Thickness of the clay bed reaches 7 m /see above, chapter IV/. The described clays allow to obtain drilling muds with specific graviry of 1.25 and viscosity of 25".

Raw materials for production of tiles, thin slabs, blocks and severage pipes production. The materials were discovered in trenches: 3, 4, 7, 10, 16 while sampling of the argillite-like clays. Sampling was carried out by the Soviet specialits of the prospecting party for non-metalliferous minerals. Analyses of the chemical compositions of clays and their refractoriness has pointed out that the clays are to be assigned to the group of refractory clays, but are not suitable for refractory production.

S e c t i o n II.

Mapping drilling at the area of Masjid-i-Choobi deposit.

Chapter XI.

GEOLOGY OF THE MASJIT-I-CHOOBI DEPOSIT AREA.

In summer of 1965 at the Masjit-i-Coobi deposit area two core boreholes were drilled with for the purpose of ascertaining of general coal-bearing perspectives.

Basis, for sinking of prospecting boreholes, was Afghan's request about studying of general perspectives of the area coal-bearing.

As a result of the geological survey /8/ a supposition was expressed about possible stripping of the Middle Jurassic coal-bearing series at a small depth to the north of the known deposit of Masjit-i-Choobi, at the region of the Laman cirque /Laman depression/.

In accordance to these data the coal prospecting party carried out here mapping drilling, which aiming to determine presence of the Middle Jurassic coal-bearing deposits at the region of the Laman cirque.

For fulfilment of the task from the Shabashek deposit necessary technics were transported to the Herat region, access roads were built to the places of borehole sinking. The total length of the access roads made up 30 km.

Drilling work were started on the tenth of June and finished on the 15 th of August. Drilling was carried out with drilling machine UHB-ZAM under assitance of the Soviet specialists.

For description of the geological sturcture of the region we have utilized the geological surveying party materials of a scale 1:200 000 /3/.

1. General informations about the work region.

The deposit is located at the valley head of the Rod-i-Karuh, in 100 km eastwards from Herat and 3 km upstream from Hamam village; it altitude is +2300 m. The deposit is connected with Herat by a ground road, suitable for motor transport the whole year round.

In 1945 at the deposit for the first time primitive mining of the coal was organized by Department of Mines. In 1945 the deposit was observed by Holam Mohammad. In 1945 the deposit was investigated by Afghanistan Gelogical Survey for the purpose of estimating and perspecitve exposing. The work was carried out by D.Lemmon and Abdul Latif Khan. In 1964 the region was covered by a geological survey on a scale 1:200 000 with the assitnace of the Soviet specialists. For the deposit area a sketch geological map on a scale 1:14120 was compiled. At the present time the deposit coals are mined by preliminary methods at a small quantity /about 1 tone per day/.

2. Geological sructure of the area.

In geological structure of the Masjit-i-Choobi deposit area take part the deposits of Permian, Triassic, Jurassic, Cretaceous and Paleogene /see Dr. 23/. The deposit is directly confined to the Middle Jurassic series.

From the structure point of view the deposit is located in the north limb of the large anticline of sublatitudional trend. The coal-bearing Middle-Jurassic series expose stable monoclinal dip to the north /dip azimuth - 0-350°/ dip angle - 13-15°/. Besides the main monocline structure, there are some very gentle anticline and syncline bends with sublatitudional strike axises.

The Middle Jurassic deposits and underlying Triassic have been dislocated by faults of upthrow fault type. The fault planes are usually inclined to the south at angles of 60-80°. Their amplitudes of dislocations range from parts of metre to hudreds of metres. But these faults dislocating the deposits of Jurassic and Triassic do not affected the overlying deposits of Albian and more younger age.

Stratigraphy

a/ Permian and Triassic deposits.

At the deposit region the most ancient ~~thxxxx~~ deposits are red-coloured terrigene deposits of Permian age. The thickness of the Permian deposits, which are widly distributed to the south of the deposit, reahhes 34000-3800m. They are overlapped by Triassic with an angular unconformity and erosion.

The Triassic deposits have been limited developed and are represented by interbedding of sandstones, aleurolites, tufogenic sandstones, tuffs and lavas. The Triassic deposits expose mainly monocline occurrence with north-east dip at angles of 20 - 45°. In some places they have been folded into folds of north-east trends and dislocated by faults. The thickness of the Triassic series reaches 4180 - 5150 m.

b/ Jurassic deposits. Middle division.

The Middle Jurassic coal-bearing deposits are represented mainly by compact aleurolites, containing charred vegetal detritus, argillites, some times coaly, quartz sandstones with admixture of grit materials and coal seams. In the section the aleurolites predominate and the sandstones are suberdinate.

The total thickness of the Middle Jurassic deposits at the deposit region ranges from 73.00 to 97.00 meteres. The interbedding shows a rhythmical structure, but the rhythms thickness considerably changes even for short distances. The Middle Jurassic series is overlied by conglomerates and limestones of Albian stage with a vaguely expresed angle unconformity .

c/ Cretaceous deposits.

The deposits of Albian stage are mainly represented by a horizon of basal conglomerates /27 m in thickness/ with gritstones and sandstones. Higher interbedding of limestones, marls and clays occures. The observed thickness of the Albian deposits makes up 95 m.

The Albian deposits are overlapped, possibly with small erosion, by carbonate-argillaceous deposits of Cenomanian and Turonian stages /Cr_2 cm-t/; they are represented by clays, marls and limestones. The thickness of the Cenoma-Turonian deposits at the Laman cirque area reaches 80 m.

United Coniacian, Santonian and Campanian stages are represented by lithologically monotonous carbonate series, consisting of limestones, marls, clays and aleurolites. The total thickness of the deposits at the Laman depression reaches 270 m.

Higher in the section occure Maestrichtian and Danian deposits, represented by marls, clays and aleurolites in the lower part /30-50m/ and red-coloured strata, overlying unconformably the underlying rocks, in the upper part. The red-coloured strata are composed of sandstones, aleurolites, limestones, clays and gypsum, gritstones and conglomerates. Its maximum thickness is about 145 m. Thus, the thickness of the Maestrichtian and Danian deposits /in the lower and upper parts/ makes up 175 - 195 m.

d/ Paleogene deposits.

At the Laman cirque area in Paleogene deposits they distinguesh Suzak and Alay stages. These deposits are distrubuted to the north of the Masjit-i-Choobi deposit, framing from the west, north and east the Laman cirque.

The Paleogene deposits conformably overly the Cretaceous formation and occure very gentle. They are usually represented by sandstones, aleurolites, clays, rarer marls and limestones. Their total thicknes reaches 480 m.

Thus, the coal-bearing series to the north of the Masjit-i-Choobi deposit is overlapped by the thick series of the Cretaceous-Paleogene deposits. But , in 6 km northwards from the deposit in the right tributary head of the Laman river there is a deep relief cutting, exposing the most section part, as a result in the river bottom the basal horizon of Albian stage occurs , which overlied the coal-bearing series. This fact served as a base for organization of the prospecting drilling with the purpose of ascertaining of the coal-bearing Jurassic deposits under the Albian conglomerates.

Presence of coal.

In the coal-bearing series section of the Masjit-i-Choobi deposit two coal seams were discovered; their thickness makes up 1.0 and 2.6 m. The lower seam occurs in 21-22 m from the section base. The Upper seam lies in 40 m below the Albian conglomerate floor. The coal seams with interruption are traced for 3 km along the right valley slope. There are three the most exposed ground parts: South-eastern, Central, and North-western. The distances between these areas make up 1-12 km /see Dr.23/.

South-eastern area.is located in the valley head of the Rod-i-Karuh river on its right bank. The coal seem occurs in the lower part of the Middle Jurassic section /Lower seam/ and shows ichangable dip azimuth; it ranges from east /100-95°/ to south /150-160°/, and the seam dip angles range from 15-25 to 35°.

The seam thickness varies from 1.3 m to 2.6 m. Coaly argillite partings 0.01 - 0.03 m thick occur in the middle and upper seam parts.

Sometimes they may observe parting of the seam with formation of thin interbedding structure, containing up to 40-45% of argillite partings.

The seam floor and roof are represented by compact coaly argillites.

Central area is situated in 1 km to the north-west of the South-eastern area, on the same valley slope. There is one coal seam, early mined very intensively. The seam lies in 22 metres above the Jurassic section base /"lower seam"/. The seam dip azimuth is 0-350°, the dip angles make up 13-15 °. The seam thickness in the old openings equals 2.0 m, and the thickness of coal patches reaches 1.8 m. Mining of the coal was stopped because of water inflow into the mines.

North-west area is located in 1 km to the north-west from the previous area. Before this area part also was mined. In 1965 there an incline was driven to a depth of 72m. The coal seam lies in 40 m below the basal conglomerates of Albian stage. The seam exposes a simple structure , dips to the north at an angle of 14°. The seam floor is compact argillites, and the roof - coaly argillites.

At this area , below the main coal seam there are some coal sheds, which thicknesses range from cm to 0.10, rare 0.15 m. In 36 m below there is another coal seam of simple structure and 0.25 m thick. Correlating the sections of the Jurassic deposits of all three areas we may conclude that the Upper seam of the North- west area is an independent seam and which is absent at the other two eastern areas. The Lower seam of this area is a counterpart of the lower seam 0.25 m thick.

On the base of petrographic studying and chemical analysis of the coals it has been stated, that the coals of the Masjit-i-Choobi deposit are to be asigned to rank "G" - gas coals and may be utilized as energetic fuel.

3. Results of the exploring drilling.

As it was said above, while the geological survey on a scale 1:200 000, carried out in 1964 presence of the basal conglomerate horizon of Albian stage in the Leman cirque was stated. The fact served as a base for supposing about presence of the Jurassic coal-bearing deposits here, and which should be discovered at a small depth.

For verifying of the supposition borehole 1 was sunk in the head of the right tributary of the Leman river, in 6 km to the north of the Masjit-i-Choobi deposit.

The geographical coordinates of the borehole: 34°39'50" NL and 63°08' 30" ELg. The borehole was sunk on the base of the Albian conglomerate.

The borehole log: 0 - 11.6 m - poorly cemented conglomerate and gritstone of Albian stage /see Dr. 24,26 and 28/. Below Jurassic aleurolites and sandstones were cut. At a depth of 23,14 m a coal seam of a complex structure was drilled; the seam is represented by thin interbedding of coal and coaly argillites. The seam thickness equals 0.8 m. At a depth of 27,5 m a thin coal shed /0.20m/, Below, up to a depth of 80 m interbedding of conglomerate, gravellite and sandstone strata was drilled. Deeper, up to a depth of 113.0 m aleurolites predominate. At a depth of 113.0 m the contact between Jurassic and Triassic was noted, the later is represented by mainly redish tufogenic rocks. The borehole drilling was stopped at a depth of 158.10 m in the deposit of Triassic

According to the logging data there was no considerable differances between the data of drilling and logging. Within the interval of 22.8 - 23.80 m logging has shown interbedding of coal and aleurolite, that approximatelly corresponds to the data of drilling. In addition in the borehole investigations by the work methods were carried out, because at the deposit drilling took place for the first time.

The thickness of the Jurassic deposit series, drilled in borehole 1 makes up 105 m. By its lithological composition the series differs a little from the coal-bearing series of the Masjit-i-Choobi deposit. Here the series contains rather more conglomerates and gritstones, i.e. northwards quantity of coarse materials increased in the section.

Chemical analyses of the coal seam samples have given such results:

Table 25

Ser. Nos	Analysis results				
	W^a	A^s	V^a	V^g	Character of nonvolatile residium
1	0.46	72.50	16.47	-	powder

The coal seam, exposed by borehole 1, practically is a bed of coaly argillites with coal partings. By all appearance it corresponds to the Upper seam of the north-west area part of the Masjit-i-Choobi deposit. Taking into account that in this region the coal seams usually show a lenticular shape and sometimes they expose parting for a short distance, it should not be accepted, that workable coal seams should be exposedat a depth at the Laman cirque area. But searching of the areas, suitable for coal minig will require a considerable value of drilling work.

Near borehole 1 in the slope bluff of the creek head /in 650 m from the borehole/ there is a coal seam outcrop /see Fig. 29/. The following section is exposed in the outcrop:

1. Sandstone, quartz, finegrained; its thickness about 1.5 m,
2. Aleurolite, redish-gray very destructed - 0.45 m,
3. Argillite, dark-gray - 0.5 m,
4. Coal, dull with lenticules of semi-dull coal, very oxidized - 0.9 m,
5. Argillite, gray very crushed - 0.65 m,
6. Aleurolite, gray - 1.0 m.

The coal seam in this outcrop contain much ash and only in its upper part there is a shed of pure semi-dull coal, its thickness is 0.20m. The lower part of the seam is represented practically By coaly argillite with thin partings of ash dul coal.

Judging by the rèlief position of the outcrop, the coal seam, described above, has been cut in the borehole also. The seam structure confirms this too.

According to the chemical analysis result this seam coal is very ash one: A^s = 22.4% in the upper seam paert and 64.90% in the lower one. /Practically the lower seam part is repersented by coaly argillites/.

The chemical analysis results of the sample from the outcrop:

Table 26

Ser. Nos	Sample No	Thickness of sampled interval	Analysis results					
			W^a	A^s	V^a	V^g	Character of non-volatile resi	S^s_{ob}
1.	2	0.30	9.71	22.40	28.63	40,00	powder	0.41
2.	3	0.60	3.25	64.90	18.50	-	" - " -	0.35

Besides the described borehole for correlation of the north-west and central areas and the coal seams of these areas other borehole 2 was sunk between the noted areas, in the middle course of the right tributaries of the Rod-i-Karuh river.

The borehole geographical coordinates: 34°36'15" NL and 63°09'20" E.g.

The borehole has drilled the sections of the Cretaceous, Jurassic, and Triassic deposits /see Dr.25 and Fig.28/. To a depth of 101.40 m the borehole was sunk through the Cretaceous deposits; Cenomanian-Turonian and Albian stages. The rocks are represented by limestones, marls and clays, in the base of which a basal stratum of conglomerates was exposed. The coal-bearing series of Middle Jurassic is represented mainly by aleurolites with subordinate clay partings and sandstone beds. At a depth of 181.40 m the upper red-coloured sandy /tufogenous?/ rocks of Triassic age were exposured. The borehole bottom was stopped at a depth of 230 m. At a depth of 146.35 m in this borehole the coal seam 0.59 m thick was met; the same seam crops out at the North-west area part of the deposit.

The electric logging data completely confirm the lithological section, obtained while drilling, excepting interval 146.35 - 146.95 m , where according drilling there is a coal seam 0.59 m thick . The logging gives 0.78 m thick.

The seam, exposed by borehole 2, keeps its structure and thickness down the dip to the north for a distance of 250 m. from the seam outcrop on the surface within the North-west area.

By the carried out chemical analyses of the core sample from the borehole and the channel sample from the driving operation incline, the coal may by conditionally asigned to G /?/ - gas rank, according to the volatile matter content; but plastometric determination was not done and only one determination of the coal elementary composition has been made. Below the data of the pointed out analyses is given.

Table 27

Ser. Nos	Sample No	Thickness of the sampled interval	Analyses results					
			W^a	A^s	V^a	V^g	Character of non-volatile residium	S^s_{ob}
1	4	0.59	1.20	40.20	22.49	38.05	Sticked	0.31
2	5	0.60	1.34	16.80	28.73	35.00	melted swelled	3.13

In the sample /No5/ , picked out at a depth of 26.6 m in the incline, some determinations was carried out; the results of which are: $S^s_{sulph.}$ - 0.1 , $S^s_{pyr.}$ - 2.20 , $S^s_{org.}$ - 0.92, C^g - 81.93, H^g - 5.02, N^g - 0.84

and O^g - 8.98 %. The sample calorific value made up 8057.

Besides, in August of 1965 the "Lower" coal seam was sampled on the South area. The sample was picked out in the incline at a depth of 55 metres.

The results of the chemical analysis are given in the following table:

Table 27

Ser. Nos	Sample No	Analysis results							
		W^a	A^c	V^g	Character of button	S^s_{ob}	S^s_{sulph}	S^s_{pyr}	S^s_{org}
1	6	1.65	20.60	30.00	caked	2.89	traces	2.24	0.45

According to these results the coal of this seam may be used as energetic fuel. Taking into account the seam thickness /up to 2.6 m/ and its presence within the South-eastern and Central areas, it becomes clear it is necessary to obtain more detail, data about the geological structure and presence of coal of these areas, With such purpose at the deposit geological prospecting work should be carried out, including studying of the deposit from the surface and investigation of the seam down the dip in core boreholes. As a results of such work the coal reserves should be calculated by the comercial categories, which should provided reliability of the deposit mining.

S e c t i o n III.

Reconnaissance survey at the region of the Chal and Zamburak deposits.

Chapter XII.

CHAL AND ZAMBURAK DEPOSIT REGION.

The Chal and Zamburak deposit region occupies a special position in the group of the coal deposits of North Afganistan.

In literature there is information about presence of two coal thin seams /0.31 and 0.56 m/ of rank "K" /coking/ and one seam /0.8 m thick at the Zamburak deposit, the coal may be assigned to rank "Ж" /fat/ /2/.

This datum has stipulated the heightened interest to these two deposits.

In 1963 while geological surveying on a scale 1:200 000 for coal the Chal deposit was observed by the soviet specialists and coal samples were picked out. The samples were sent for pertographic and chemical analyses.

By appearance the coal is represented by semi-lustrous striated, thin-banded, rough striated, indistincly striated varieties /60%/, by lustrous vitrain coal, associated with dull fusain one /20%/ and kaolin-like mineral /5%/ and 15% of non-determined type of strong crushed scaly coal.

The results of preliminary petrographic studying has pointed out that the coal by its rank may be assigned to III_3-IV_1, i.e. to the transitional type from fat to coking . The petrographic composition of the coal is characterized by high content of microcomponents of the vitrinite group /95.4% for the Chal and 72.0-98% for Zamburak deposits/. It should be kept in mind , here the microcomponent contents and coal composition are given for ash-free coal matter /see annex 12 of part II /. The ash part of the coal matter contain a considerable quantity of clay material and constently some quartz. Calcite and pyrite are present in small quantity.

According to chemical-technical investigation the coal are to be asigned to the group of ash coal and with low ash content. Volatile matter makes up 23-26%. As the samples were picked out from the oxidized zone the coal moisture has turned out high - 4.56%. Non-volatile residium is represented by caked one in a less oxidized sample and powdered - in a sample with hith moisture. Some coal characteristics, obtained from the samples of 1963 are given below:

Table 29

Sample Nos	Analyses results			Character of coke residium
	W^a	A^s	V^g	
4595-1	4.56	11.05	26.38	powdered
4595	2.05	19.75	22.70	caked

Obtained preliminary results of the coal petrographic and chemical analyses conditioned studying the coal-bearing features and coal quality of these deposits.

In 1965 the deposit area was surveyed at a scale 1:200 000 and some reconnaissance routs were carried out by the coal-prospecting party. As a result of these works, outcrops of new coal seams were discovered at the Chal and Zamburak deposit area and at the adjoining areas /Bazarak sai and othes/. It was stated, thet presence of coal covered a considerable area, that the Chal, Zamburak and Bazarak deposits were interdependent and confined to the Jurassic series of 1000-1200 m thick.

Below brief characteristics of the region presence of coal are given.

Chal deposit.

The deposit is located in 20 km to the north-east of the district centre of Ishkamish of the Taliq-an province, connected by a gravel motor road with the town of Khanabad /45 km/.

From Ishkamish to the Sar-i-Pul-i-Chal Pass there is a ground road, suitable for motor transport. From the Pass tb the deposit there is a steep path of 2.5 - 3.0 km in length. By small expenditure the path should be turned into a road, suitable for motor vehicle driving.

At the Chal deposit the early studied coal outcrops are situated in the sxxt east slope of the left tributary of the Rod-i-Chal river, flowing out near the Pass /see Dr.27/.

There two known coal seams occure in interbedding strata of shales and sandstones with rare interbeds of gritstone; the strata thickness equals 40 m; the rocks have been folded into a strong, overturned to the north, anticline fold. Because of the wide disturbance of loess-like loams, overlapped all the more ancient formations,studying of the coal-bearing character and thickness of the series becomes impossible without special prospecting work. We have stated a considerable degree of coal presence in the section, that is confirmed by blossom presence in the head of the Pass sai. Besides, to the east of the pointed outcrops / along the coal-bearing series strike/ in the left and right tributaries of the Rod-i-Chal river blossom accumulations and coal exposures were discovered. Thus, in the first to the east sai there are two coal bmdx sheds /they were not stipped/ which, by all appearance, are the same beds, that were stripped near the Pass. In the next /to the east/ sai there has been also stripped one coal shed of 0.30 m thick/outcrop 11, see Dr. 27/ . Further eastwards, in the left valley slope of the river, opposite the village of Kaltatay, in the sai /outcrop 5/ there are blossom traces and coal fragments.

Here among the strata of sandstones, tuffs, shales, effusive rocks and rare gritstône interbeds there are three coal seams, judjing by the coal blossom presence. /This coal manifestation was distingueshed as Darra-i-Kolon by the geologists of the geological-prospecting party/.

The upper seam is observed here in an old mine working. The seam apparent thickness equals 1 m. The rock dip azimuth is 130° and dip angle - 60-65°. Further eastwards, in 1.5 km up the stream from the village of Kaltatay in a scarp of the left river slope two coal beds have been stripped /outcrop 4/. The coal beds are included among shale strata with argillites, lying between tuff-sandstones and effusive rocks.

The first seam /down the stream/ shows a complex structure /see Fig.30/, it consists of seven coal patches, four lower of which may be included for mining. The total coal seam thickness equals 1.71 m and pure coal makes up 1.25m.

According to the data /annex 12/ of petrographic composition study of this seam /sample 4/ the coal differs by heightened content of vitrinite /95.4%/. By its rank the coal is to be assigned to meagre coal. Additional studying of the coal petrographic features has a little corrected its composition and rank. By the new data the petrographic composition of the most part of the samples is characterized /for ordinary coal/ by vitrinite content from 46 to 69%. Besides, because of a heightened content of inorganic components and their dispersed distribution in the coal matter, also a heightened content of semi-vitrinite /15-23%/ is exposed. By coal metamorphism the coal varies from coke slightly metamorphosed to coke coal high metamorphosed /according the classification of VUKHIN/. It should be noted especially that organic matter of the coal shows clearly features of thermal action. By appearance the coal sometimes shows metallic lustre.

The second coal seam has been stripped in 120 m up the stream and is represented by four separate patches /see Fig. 30/, the upper one of which is 0.32 m thick. The coal of the seam has been crushed and turned into foliated fine coal.

Along the strike the seams have not been traced, but taking into account the complex tectonic structure of the area, we may suppose uneven distribution upon it. The dip angles of the seams are steep /about 60-65°, the dip azimuth 130°/.

On the opposite bank in the middle and upper stream of the right tributaries of the river coal blossom manifestation was observed, that pointed out at the coal presence there. In the middle stream of the sai two coal sheds have been stripped of 0.2 and 0.3 m thick. The stripped horizons here, by all appearance, correspond to the very upper part of the coal series.

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Coal chemical studying points out at high moisture and heightened, for this rank, volatile matter content. That is why, including the petrographic and coal chemical features by the rank characteristic the coal may be estimated as meagring, slightly caking coal.

The chemical analysis results are given in the table:

Table 30

Ser. Nos	Seam No	Sample No	Analyses results W^a	A^a	V^r	Character of coke button
1	1	4	2.86	36.39	21.87	powdered-like
2	II	10	4.31	31.83	28.28	" - " - "

The heightened coal ash content is explained by picking the samples from the oxidized zone, from shallow trenches.

Thus, from all said above it is evident, that the earlier date about presence of coal at the Chal deposit were incorrect; the deposit coal saturation was lowered and the coal rank was determined erroneously /2/.

In spite of intensive dislocation of the rocks, presence of strong, sometimes small folds, and difficulty of section correlation, we may even now to state presence some horizons with coal seams at the Deposit of Chal.

Zamburak Deposit

The deposit is located in 8.5 km to the east-north-east of the Chal deposit /from the Sar-i-Rut-i-Chal Pass/, in the vicinty of Zamburak village /see Dr. 27/.

There along the river of Rod-i-Zamburak /outcrops 6,7,8/ the coal-bearing series is exposed with barge intervals /from 200 to 250m/, it contains workable coal seams /see Fig.30/.

Earlier by literature data only one coal seam was known /outcrpp 6/ - /2/.

As a result of the carried out prospecting work more five workable coal seems have been discovered.

The coal-bearing series at the Zamburak deposit is represented by interbedding of argillites, sandstones, tuff-sandstones and sheet-like effusive bodies, among which coal seams are included. By all appearance, far not complete part of the coal-bearing series is exposed there; the section part corresponds to the lower horizons of the region coal-bearing series, and the upper exposed section part may be correlated with the horizon of outcrop 4 of the Chal deposit.

In the village of Zamburak area eastwards a slight plunge of the coal-bearing series take place. There near outcrops 6 and 8, how can one say, periclinal closing of the anticline is observed, connecting with this fact a small part of the section is exposed. But near outcrop 8, where, by all appearance, the lowerest horizons are exposed and unclosing of the structure to the aest and south directions is outlined.

The tectonic structure of the region is very complex and is characterized by high dislocation of the formations, folded into strong folds , and by presence of faults of different amplitude of the displacements.

The first coal seam /outcrop 6/ has been stripped on the left river bank, a little downstream of the upper village of Zamburak /see Dr.27, Fig 30/. The seam exposes a simple stucture, is of 0.69 m thick and represented by interbedding of semi-lustrous and dull varieties. The lower seam part /0.25m/ is represented by strongly crushed foliated coal. The lump coal shows slightly metallic lustre. The dip azimuth - 353^0 and angle - 50^o.

The second seam has been stripped in 150 m down the stream in the river-bed /near the water-mill/. The coal of the seam is very crushed and represented by dull and semi-lustrous varieties. The seam thickness makes up 1.05 m. In the middle seam part there is an argillite partings of 0.03 m thick.

The third seam has been stripped on the right river bank, about the river level, in 560 m up stream of seam II. The seam is represented by very crushed to foliated fine coal with metallic lustre; among the coal there are lenticulare interbeds of very crushed aleurolitic sandstones. In the seam roof and floor welded tuffs occure.

The forth seam /outcrop 7/ has been stripped on the left bank, in 140 m up stream of the previous seam. Between the outcrops on the left bank, in the slided part there are many blossom manifestations, pointed out at presence of coal. This coal may be stripped only by deep strippings. This seam represents a coal lense, occured in a tectonic block. The seam thickness in its middle part equals 1.91 m. In the upper seam part there are four rock partings from 0.02 to 0.09 m thick. The total seam thickness, without its upper part, makes up 1.62 m, and the thickness of the pure coal is 1.53 m. In the outcrop, in the upper slope part, the seam has been cut by a fault. The lower outcrop part is covered. In the seam floor there are effusive rocks.

The fifth and sixth seams have been stripped on the right bank of the Rod-i-Zamburak river, in 130 m up-stream of the fourth seam /outcrop 8/. The seams occure among tuffs and effusive rocks. The coal shows strong metallic lustre.

There, in the slope cliff occure from top to bottom:

1. Effusive rocks,
2. Aleurolite - 1 m,
3. Coaly argillite - 1 m,
4. Tuff-sandstones - 4 m,
5. Coal seam V ,
6. Tuff-sandstone - 1.5 m,
7. Argillite - 0.15m,
8. Sandstone - 0.10 m,
9. Effusive rocks - 0.35 m,
10. Sandstone - 0.15 m,
11. Coaly argillite - 0.25 m,
12. Coal seam VI ,
13. Argillite strongly changed, with quartz streaks of 1 cm thick - 0.10 m,
14. Effusive rocks - 0.20 m,
15. Tuff-sandstone - 3.00 m,
16. Aleurolite - 4.00 m,
17. Effusive rocks , their apparent thickness - 0.7 m.

The described picture of the section is very characterized for the deposits as a whole.

Fifth seam /upper in the section/ exposes a complex structure /see Fig. 30/ with rock partings of 0.4 - 0.08 m thick. The total seam thickness equals 1.71 m and the summary thickness of the pure coal makes up 1.53 m. The seam exposes a false roof, represented by alternation of thin layers of argillie, coaly argillite with sandstone and coal. The main coal matter mass is represented by semi-lustrous banded and semi-dull coal with bands of lustrous one. The coal, especially in the seam roof, shows metallic lustre. In the lower seam part the coal is crushed, with friction planes. Pinches and swells are characterized for the seam. As was said above, the seam in its central part is 1.71 m thick. Eastwards and westwards the seam thickness decreases up to 0.96 m for a distance only of 10 meteres. Such thickening, pinches and swells may be explaned by seam squeezing-out during folding. Strong coal rolling while squeezing points out at presence of intrabeds movements.

Sixth seam occures in 2.45 m below the previous seam and in its upper part; it contains two rock partings of 0.05 and 0.04 m thick. The total seam thickness equals 1.16 m and the coal patches thickness makes up 1.07 m. The coal is analogous to the coal of seam V, but in the lower part of seam VI dull varieties with very thin layers of coaly argillite are predominated.

Coal seam V and VI have been traced by their blossoms and fragments for a distance of 100-150 m. The seam dip is north-western and dip angle - 40°.

Besides the described above seam, to the south-west of the seams outcrops, in the left tributaries of the Rod-i-Chal river /outcrops 12,13, 14,15,16/ there are coal blossoms, pointed out at coal presence.

In outcrop 16 a coal seam with a complex structure occures; the seam thickness equals 1.50 m and the thickness of the coal patches makes only 0.7 m. By all appearance there expose the upper horizons of the coal-bearing series, which occure at the Chal deposit area/outcrop 9/.

Thus, the coal-bearing series of the deposit Chal and Zamburak is the same one and is traced along the strike from SW to NE for 8 km.

At present time correlation of the coal seams of these deposits is impossible because of bad exposuring of the area and lack of detail geological work.

The coal of the Zamburak deposit is characterized by high rank /see Annex 12/. The coal matter, evaluated for ash-free mass, contains much vitrinite - 86.0 - 98.5%. Calculating for normal coal the vitrinite content is less and makes 60 - 70% and semi-vitrinite is present in 5 -15%.

The chemical analysis data of the samples, picked out at the Zamburak deposit are given in table 31

Table 31.

Ser. Nos	Seam No	Sample No	Analyses results			Character of Coke button
			W^a	A^s	V^r	
1.	I	10776	8.13	11.83	29.64	powder-like
2.	II		9.14	34.68	36.69	- " - " -
3.	III	III	1.52	45.50	17.04	" - " - " -
4.	IV	IV	3.81	33.92	23.22	" - " - "
5.	V	V	1.49	38.78	14.77	" - " -"
6.	VI	VI	1.19	36.77	14.91	" - " - "

It si characteristic that the most part of the samples expose high moisture - 3.8-9.14%. This fact indicatives of high degree of coal oxidation and hightened content of volatile matter /23.22-36.69%/. The other part of the samples /III,V,VI / has been less oxidized.

Taking into account the data of petrographic studying, coal of all the seams of Zamburak are to assigned to meagring and meagre coal.

Bazarak Deposit.

The deposit of Bazarak is located in 5 km by air to the south of the vellage of Zamburak, in the head of the right brunchig of the same name sai. With the Zamburak deposit it is connected only by a pack path. The pack path runs along the sai of Bazarak and the Rod-i-Chal river and comes to the Chal deposit /see. Dr.27/.

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There is no any information in literature about this deposit . It was shown to us by the natives.

There in the sai head the same coal-bearing series is exposed, that occure at the described deposits. The coal-bearing series has been folded into smal strong folds.

At the deposit four coal seams have been discovered workable seams/ and and some coal sheds were stripped in the sai head, in 6 km from its mouth /outcrop 1 and 3/.

One coal workible seem and two coal sheds, occured between interbeds of tuffs and tuffites, have been stripped by trenches at outcrop 2.

The first seam /see Fig. 30/ shows a complex structure and total thickness of 1.47 m and the summary thickness of the coal patches makes up 1.15 m. By appearance the coal is reperesented mainly by dull and semi-dull varieties in the upper seam part and by semi-lustrous in the lower part. In the seam floor and roof occure tuff-sandstones.

Down the section /in 3.5m/ coal seam 2 lies, the seam is represented mainly by semi-dull and semi-lustrous coal, its thickness equals 0.34 m. The shed has been very crushed in its upper part.

The third, lower shed /seam 3/ is represented by the analogous petrographic varieties, the pure coal thickness makes up 0.28 m. The coal of all beds expose strong metallic lustre. The seam dip is nothern and at an angle of 80°.

In 200 m upstream of the sai and slightly higher stratigraphically there are three coal seams, occured in the right slope /outcrop 3/.

The fourth /lower/ seam consists of four coal patches, divided by rock partings. The total seem thickness equals 1.03 m. The coal is mainly dull, semi-dull with lenticules and layers of semi-lustrous coal.

The fifth seam, of complex structure, occures in 10 m higher in the section. The seem thickness is about 2.05 m. The upper seem part is represented by semi-dull coal with layers of semi-lustrous /o.45m/. The lower part is divided by a sandstone interbed /0.15 m/ and contains dull coal with high ash content; there are three rock partings of 0.04 -0.06 m thick.

The sixth seam occures in 3.5 m above the preveous seam and is represented by coal patches, parted by rock interbeds /sandy/. The seam has not been stripped. Its apparent thickness is about 2 m.

At this area the coal-bearing series has been folded into small, often dislocated folds.

Besides the described ssams , in the sai head , on its both banks there are numerous black spots of blossom and black rock interbeds, pointed out at presence of coal seams and sheds.

The coal of the Bzarak deposit differs by high vitrinite content /98.0-100%, evaluated for ash-free matter/. Vitriuite content of normal coal is lower and makes up 59.0-64.0%. Repeated petrographic studying, carried out at Kabul in 1966, has shown that coal matter contains microcomponents of semivitrinite /8-16%/ and fusenite /3-12%/. Those data considerably corrects estimation of the meagring components /Σ OK/ of the deposit coal.

By matamorphism degree the Bazarak coal is estimated as fat highly-metamorphosed - middle-metamorphosed coking coal /see Annex 12/. It should be noted, that thermal influeince at the deposit coal was less in comparison with the deposits of Chal and Zamburak.

Chemical analysis of the cut samples shows that the Basarak sai coal are characterized by the following indices:

Table 32.

Ser. Nos	Seam No	Sample No	Analyses results			Character of coke button
			V^a	A^s	V^g	
1.	I	2	4.40	23.18		slightly caked
2.	II	2/1/	9.79	51.58	33.10	powder-like
3.	III	2/2/	1.11	37.97	29.14	melted, swelled
4.	IV	3/1/	3.68	25.02	27.70	powder-like
5.	IV	3/2/	3.94	25.55	28.98	" - "

In the table it is seen that the most part of the samples have been oxidized /V^a= 3.68-9.79%/. Ash content, as a rule, is high /A^s= 25.02-51.6%/. One sample 2/2/ is characterized by low moisture content /1.11/ and has given melted, swelled button.

Taking into account the data of chemical and coal-petrographic analyses, we may supposel, that there are coking and meagring coals at the deposit, but it requires more procise determination while future detail work.

Thus, as a result of coal analysing of the noted deposits, the most perspective for presence of coking coal is the deposit of Bazarak. It is hardly probable presence of coking coals at the deposits of Chal and Zamburak /coals of ranks "Ж" and"K"/.

Judging by the fesults of the preliminary investigation, we may outlined a deffinete regularity of distribution in the coal-bearing-series section of rank coal composition. That is: the most metamorphosed coal/ranf T/ is confined to the lower parts of the coal-bearing effusive-terrigene formation, where quantity of effusive rocks is considerably high than in the upper parts of the formation. Besides,in the lower horisons more often occures coal, crushed up to foliated fine fragments, thet also influences on the metamorphism degree.

Coal, similar rank "K",is to be searched in the middle and upper hori - rizons of the coal-bearing series, where quantity of the effusive rocks considerably decreases and crushing is observed rarer.

The deposits of CHal, Zamburak, and Bazarak represent a unit coal-bearing basin, wothin which a number of coal seams can be discovered while more detail geological work.

The perspectives of possible discovering of coking coal at this tegion are not limited by the deposits mentioned above. The geological-surveying party of a scale 1:200 000 in 1965 fond some manifestations of coking coal in the vicinty of the village of Taqcha-Khana /Arashakh deposit/ and to the south of it, in the region of Namakab.

Chapter XIII

CONCLUSIONS.

The main geological results of the coal-prospecting party, worked in 1965, are:

1.On the Sar-i-Asia deposit.

It was stated, in the geological structure of the area take part deposits of Triassic, Jurassic, Cretaceous-Paleogene systems. Two suites are distinguished in the Jurassic deposits. The lower one - Shah-Bashak suite is composed of sandstones, aleurolites, afgillites and clays with coal seams and sheds. The total suite thickness is about 460 m Higher in the section the Bashek suite occures, represented by interbedding of sandstones, clays and aleurolites with a horison of conglomerate and gritstone in the base. The coal of this suite shows thin heights and does not form workable seams. The Bashek suite thickness equals 278 metres.

The deposit is characterized by a complex tectonic structure. The productive Shah-Bashak suite has been folded into an anticline of submeridional trend; the east fold limb has been cut by fault F_1. The west fold limb exposes steep dipping near the fold bend /up to 85°/ and futher from the bend it smooths out. The stucture complicacy of the depòsit is conditioned by a large number of faults, boundaring the deposit from the north, east and south and dislocated the coal-bearing series.

There are 14 coal seams in the Shah-Bashak suite section, and only three of which /7,8, and 9/ are minable seams, which summary average thickness equals 6.86 m /workable carbon ratio equals 1.49%/. The rest coal seams are characterized by complex structures and lenticular shapes; they are unprofitable for mining because of an inadmissible content of rock partings.

Seams 7, 8, and 9 coals expose a low ash content (A^{S}_{sr} = 9.6 – 14.2 %), low sulphur and phosphorus content (S^{S}_{ob} = 0.82 – 1.22%, P^{C}= 0.42 – 0.069%). By the volatile matter content (V^{S}), elementary composition, calorific value and petrographic features the coals are assigned to gas coal, slightly caking and can be used as energetic fuel.

According to the hydrogeological conditions the deposit is assigned to a type of slightly flooded simple, but of complicated geology-engineering conditions. Questions of the parametric characteristics of coal seams flooding and of degree of geology-engineering conditions complyeacy are to be determined in the process of a certain more detail geological-exploration work.

The deposit coal seams are represented by seams of middle /No 7/ and high /No 8, 9/ thicknesses, and exposing a steep dip. The method of mining is assumed as undergrouned with compatible extracting of seams 7, 8, and 9/ In the future a special attention will to be paid to the questions of dust, gas and silicosis danger.

The deposit reserves have been estimated for the area part of the west limb, from the seams exposures to horizon +2500 m, and qualyfied by categories C_1 and C_2. The summary reserves of seams 7, 8, and 9 have been estimated in 1065.9 thousand tones by category C_1 and 4774.1 th.tn. by category C_2. The total reserves make up 5838.0 th.tn. not including their perspectives of increasing at the expence of the deep horizons of the west limb structure.

At the region some deposits of other useful minerals have been discovered.

Determination , that the Shah Bashak and Sar-i-Asia deposits are confined to the same parts of the Jurassic deposits, points out at:

a/the distinguished suites at Shah Bashak are not local formations and

b/by all appearance the coal seams are distributed under a sheet of the Cretaceous-Paleogene limestones between Shah Bashak and Sar-i-Asia.

It is obvious, that in the future, at places of deep erosions new perspective areas for mining will be find. It should be kept in mind, that the Bashak suite coal saturation decreases south-eastward of Shah Bashak , new area are to be present in the vicinty of Shah Bashak. Hence, the perspectives of the Shahbashak deposit cannot be limited by the area studied by us.

2. On the Masjid-i-Choobi deposit

The Masjit-i-Choobi coal deposit represents a great interest for energetic and fuel base of the Herat province.

The mapping drilling, carried out in 1965, has determined coal-bearing perspectives to the north of the deposit, that considerably encreases the object significance.

The question about reserve increasing will be solved after carrying out geological-prospecting work at the deposit .

3. By the Chal and Zamburak deposits region.

As a result of our observation and reconnaissance routes two coal seam shows about the Chal deposit and five new seams at the Zamburak deposit have been discovered. A new deposit of Bazarak with six coal seams have been exposed.

Correlation of the deposits /Chal, Zamburak and Bazarak/ is being outlined, permiting to consider them as parts of the united coal-bearing region.

The visited region is the most perspective one for discovering of coke coal reserves in Afghanistan and requires a special attention and organization of exploring work. This work is to include studying the areas of the most perspective deposits /including the Bazarak deposit/, sampling of the seams and careful investigation of their quality.

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Translated by Semshova.

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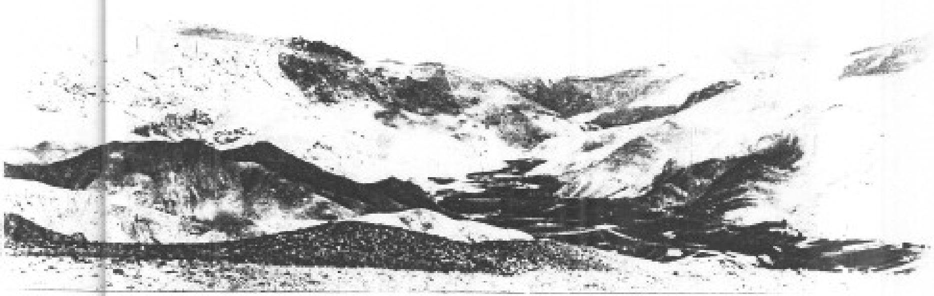


Рис.№ 1. Долина р.Андрак. Вид к северу от канавы № 42.

Fig.No.I. Andrak Valley. View to the north of trench No.42.

Рис. № 2. Лагерь партии в долине р.Андрак.

Fig.No.2. The party camp in the Andrak vakley.

Рис.№ 3. Сооружение серпантина на дороге Шабашек - Сар-и-Асийа около пос. Балакли.

Fig.No. 3. Road steamer construction near Balagh-Ali village on the road of Shah Bashak - Sar-i-Asia.

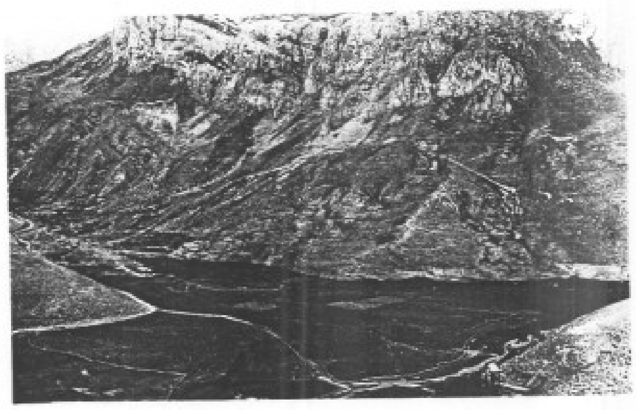


Рис.№ 4. Урочище Чихиль. Влево видна долина р.Руд-и-Сабзак. В левом борту её долины - верхнеюрские и мел-палеогеновые отложения. Вид с северо-запада.

Fig.No. 4. The Chehil area. The Rod-i-Sabzak valley to the left. Upper Jurassic and Cretaceous-Paleogene deposits are seen in the left valley slope. View from north-west.

Рис.№ 5. Долина р.Андрак. В правом борту - выхода триасовых отложений.

Fig.No. 5. The Andrak valley. Triassic daposits outcrop in the right slope.

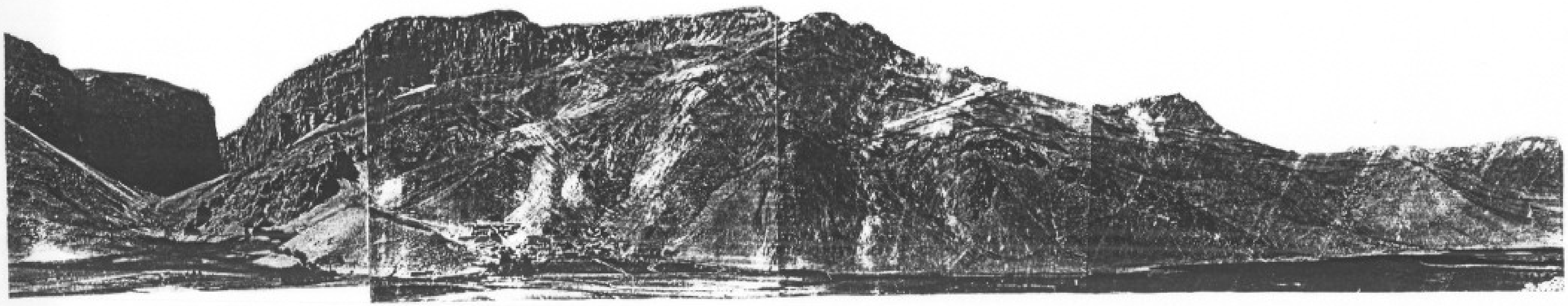


Рис.№ 6. Панорама западного борта урочища Чихиль. К северу от кишлака Сар-и-Джес видна антиклинальная складка, в ядре которой обнажена верхняя часть шабашокской свиты.

Fig.No.6. Panorama of the Chehil area western part. Northwards of Sar-i-Je village the anticline fold is seen; the core of which is composed of the Shah Bashak suite upper part.

Рис. № 7. Брахисинклиналь в меловых отложениях к югу от урочища Чихиль. Вдали пер. Кутал-и-Сабзак.

Fig. No. 7. Brachy-syncline formed by Cretaceous deposits to the south of the Chehil area. The Kotal-i-Sabzak Pass in the distance.

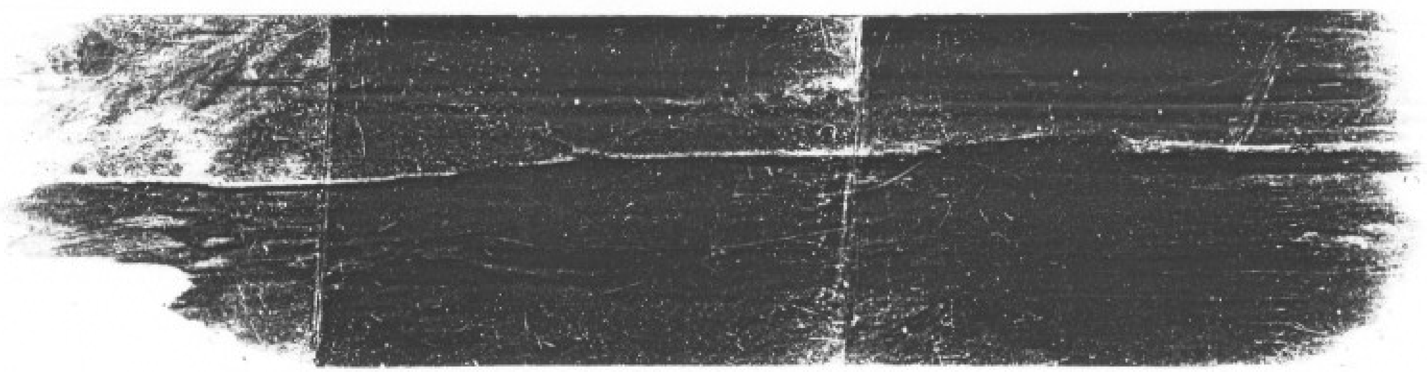


Рис.№ 8. Общий вид завального озера выше кишлака Сар-и- Асийа.

Fig.No.8. General view the rock-dammed lake, upstream of the Sar-i- Asia.

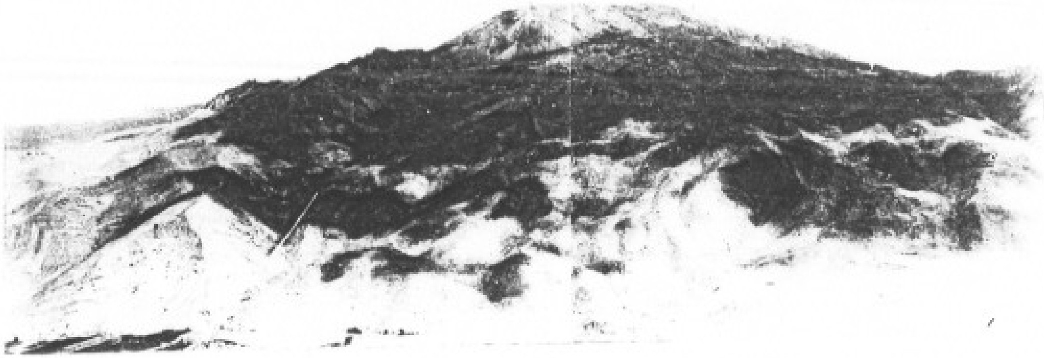
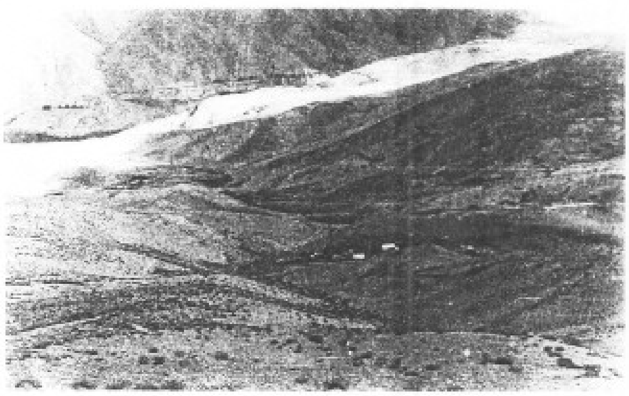


Рис.№ 9. Западный склон горы Кох-и-Чаули-хан. Справа - оползень, образовавший

Fig.No.9. The west hillside of Koh-i-Chauli Khan mountain. To the right - the landslide, formed the rock-dammed lake.

Рис.№ 10. Долина р.Сабз-нау. Фото к востоку от скважины № 2.

Fig.No.IO. The Sabz-Nau valley. The photo - to the east of borehole 2.



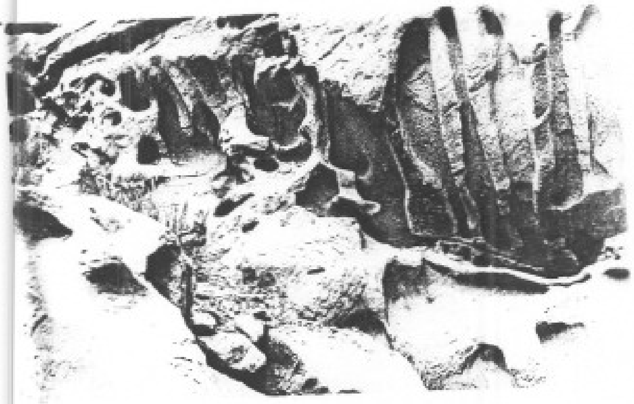


Рис.№№ 11-12. Формы выветривания песчаников шахбашекской свиты.

Fig.Nos. II-I2. Weathering forms of the Shah Bashek suite sandstones.

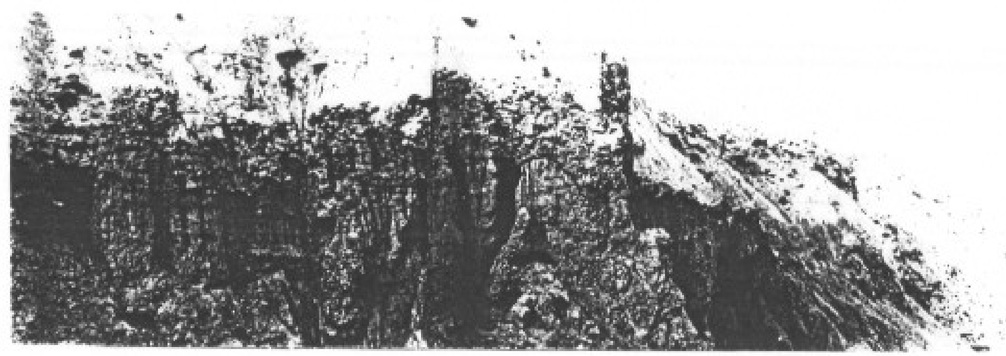


Рис.№ 13. Делювиально-пролювиальные отложения в левом борту сая Центрального.
Fig.No.13. Talus-proluvial deposits on the left sai slope of "Central".

Рис. № 14. Останцы в делювиально-пролювиальных отложениях.
Fig.No. I4. Stone remnants in talus-proluvial deposits.

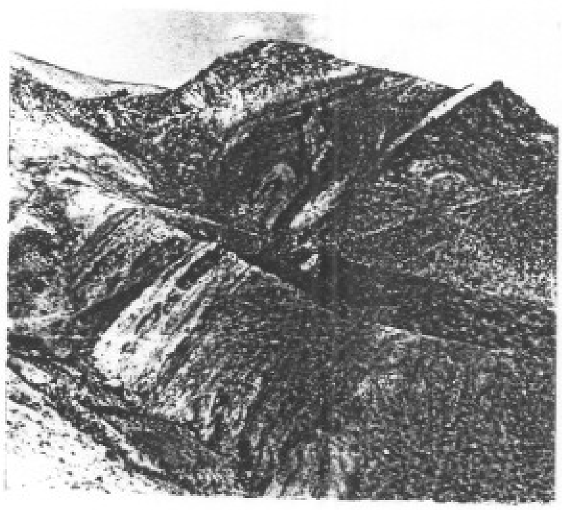


Рис. № 15. Контакт отложений шабашекской и башекской свит.
Видна канава № 1.
Fig.No. I5. The shah bashak and bashek suites contact. Trench No.I is seen.

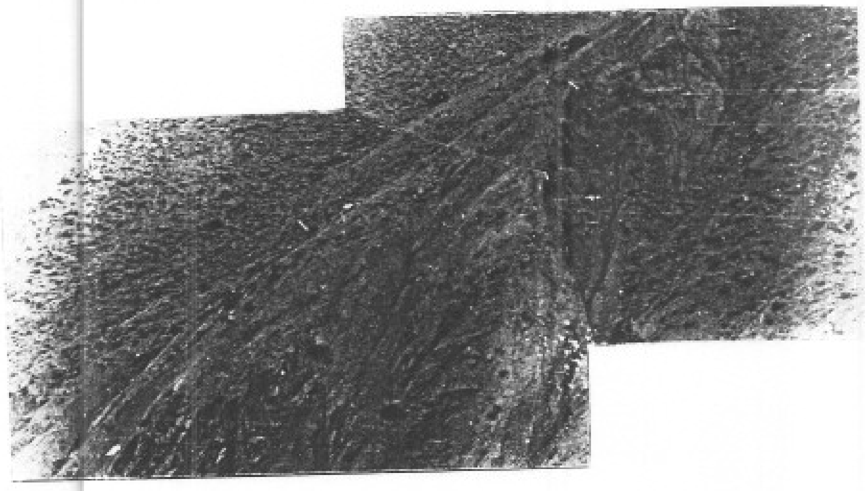


Рис. № 16. Нарушение F_1 в правом борту ручья Центрального.

Fig.No.16. Fault F_I in the right slope of Central creek.

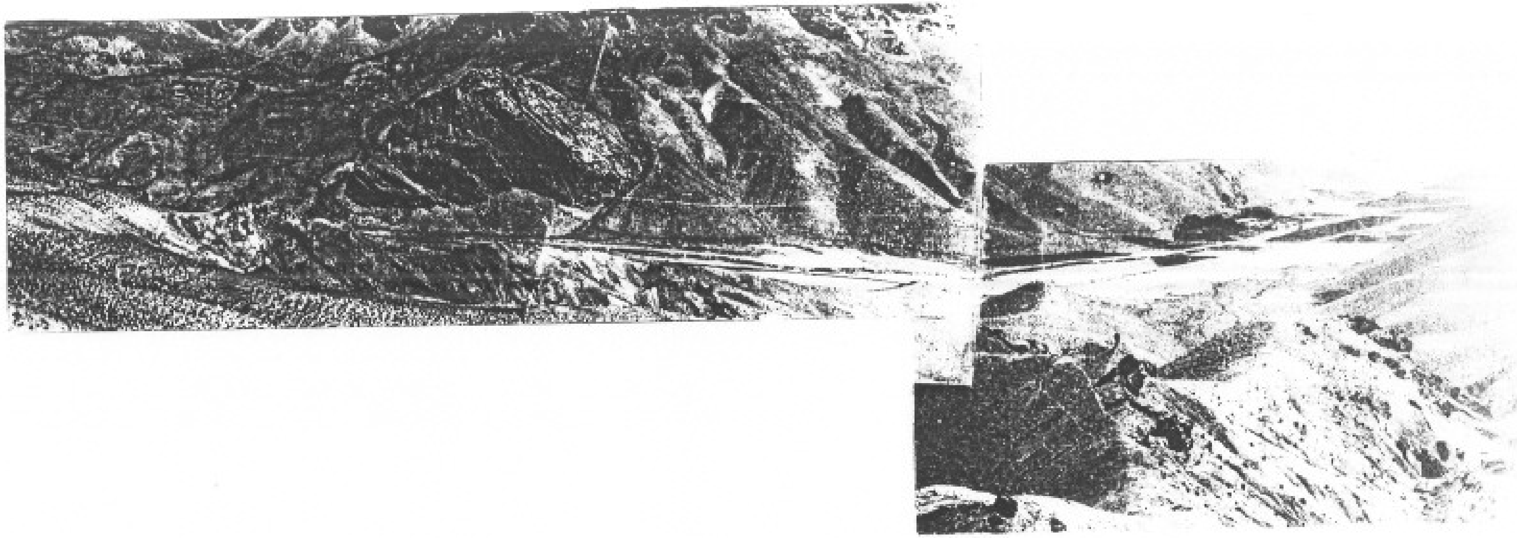


Рис.№ I7. Долина р.Яхни-куль. Отложения башекской свиты и мел-палеогеновые отложения в левом борту. Отложения шабашекской свиты и триас - в правом борту. Под аллювием долины - нарушение F_2.

Fig.No.I7. The Yakhniqol valley. The Bashek suite and Cretaceous-Paleogene deposits in the left slope. The Shah Bashek suite and Triassic deposits in the right slope. Under the valley alluvium fault F_2 strikes.

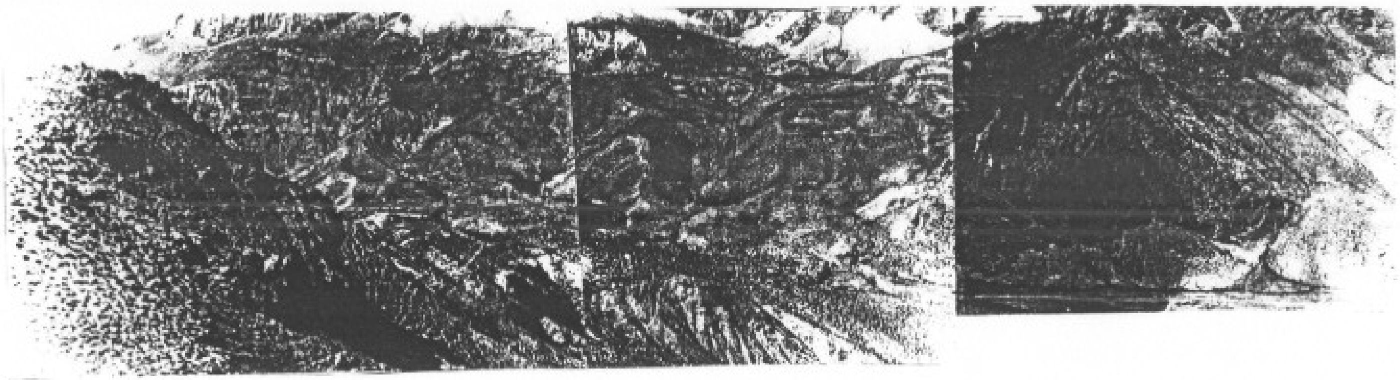


Рис.№ 18. Оползневые явления в долине р.Яхни-куль на северо-западе месторождения.

Fig.No. 18. Landslide phenomena in the Yakhniqol Valley, at the north-west of the deposit.

Рис. № 19. Выход угольного пласта 5 у канавы № 5.
Fig.NO. I9. Outcrop of coal seam 5 near trench No.5

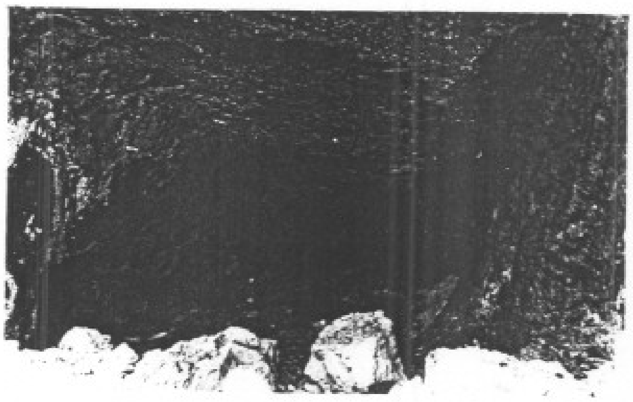


Рис. № 20. Выход угольного пласта 6 у обнажения № 578. Кустарная отработка выхода.
Fig.No. 20. Coals seam exposure near outcrop No. 578. Domestic mining.

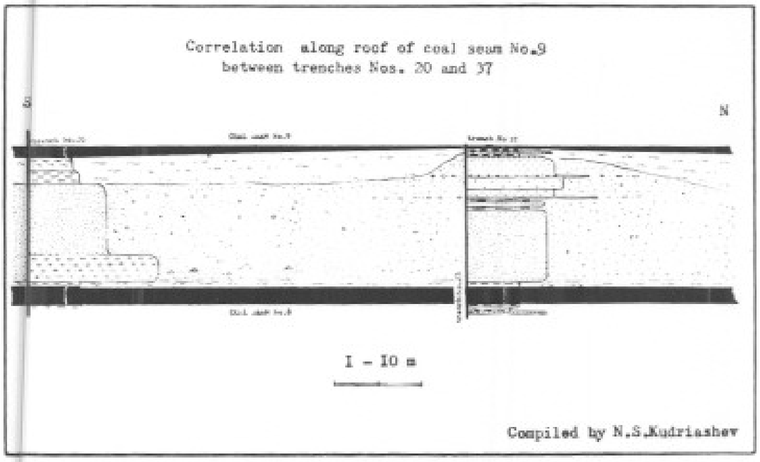


Рис.№ 21. Сопоставление по кровле угольного пласта 9 между канавами №№ 20 и 37.

SCHEME

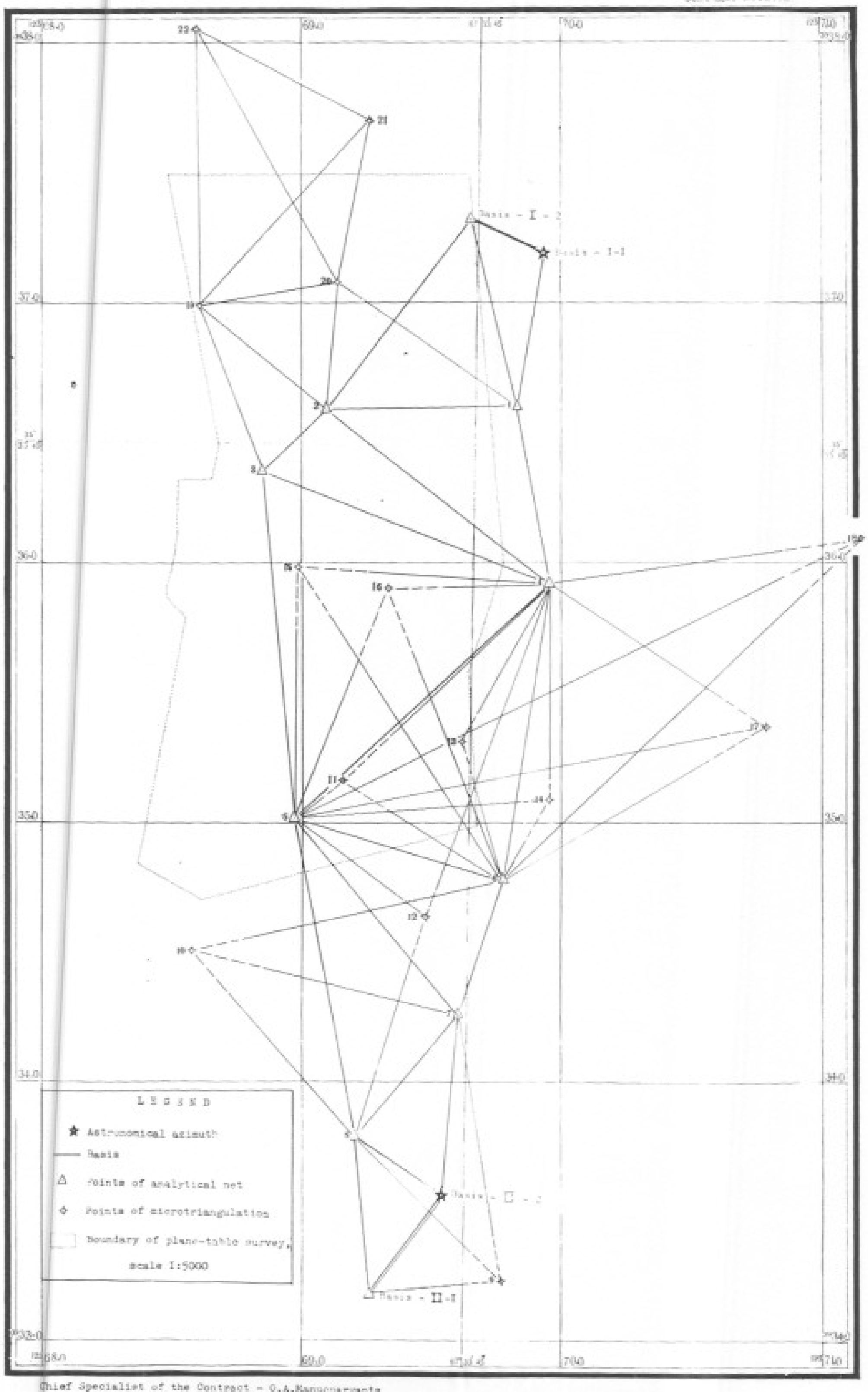
of topo-geodezic works made

in 1965

at SARI-ASSIA area

1:25000

V O TECHNOEXPORT



Chief Specialist of the Contract - O.A.Manucharyants

Technical Instructer of Topo-geodesic Crew - N.I.Polushkin

Compiled by Muhamad Aslam

Рис.№ 23. Устья уклонов №№ 1 и 2. Виден контакт отложений шабашекской свиты с делювиально-пролювиальными отложениями.

Fig.No.23. Inclines I and 2 mouths. The contact of the Shah Bashak suite and talus-proluvial deposits.

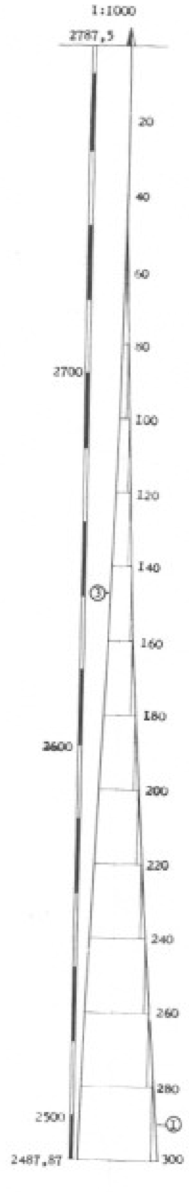
Рис.№ 24. Долина р.Яхни-куль. Слева – буровая скважина № 1.

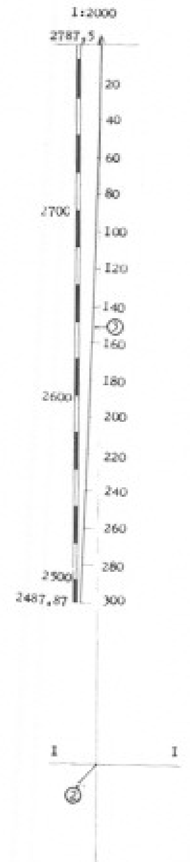
Fig.No.24. The Yachniqol valley. Borehole I to the left.

GRAPH OF WELL DEVIATION N. 2

ГРАФИК ИСКРИВЛЕНИЯ СКВАЖИНЫ №2

I 9 6 5





L E G E N D

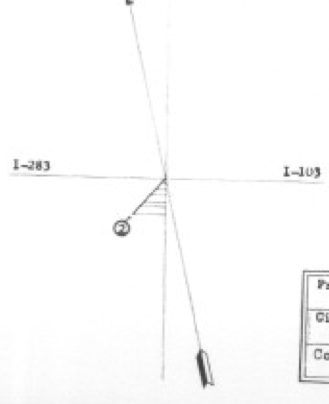
1 -Forming vertical and horizontal increased co-ordinate

2 -Borehole projection on horizontal plane

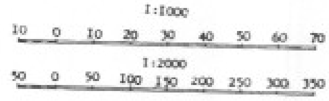
3 -Borehole projection on geological plane.

N o t e s :

1. Diagrams are made on a scale of I:1000 and pantographed on a scale of I:2000,
2. Hole depths are pointed at the curve ends. Bench mark is pointed at the hole mouth.



SCALES:

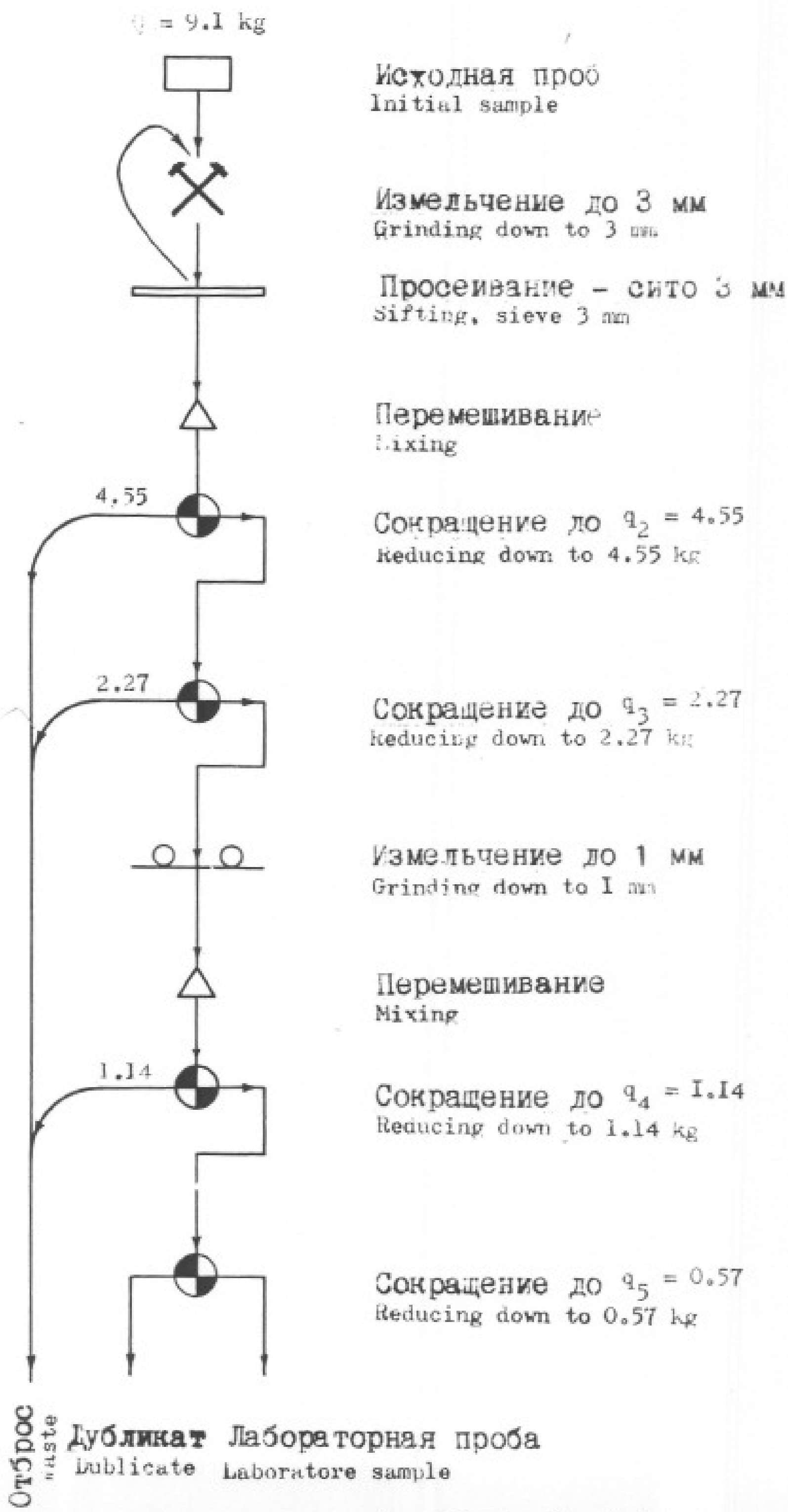


President of Department S.H.Mirzad		V.O. TECHNOEXPORT
Cief specialist of Soviet Technoexpert O.A.Manuchariants		MOSCOW USSR
Compiled by Illiushin		Contract No. I378

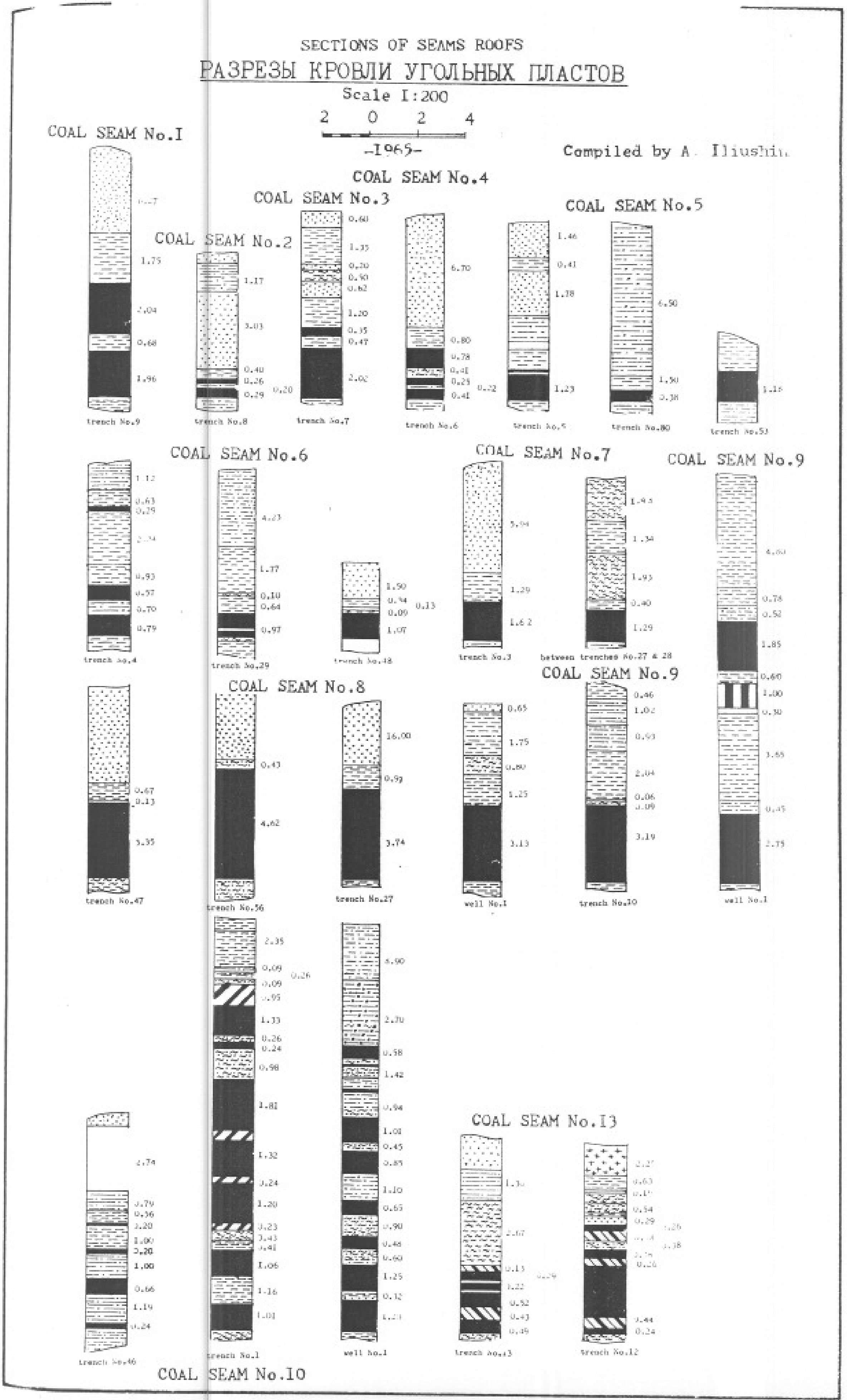
Fig.No.

СХЕМА
обработки проб для химического анализа

SCHEME
of sample treatment for chemical analysis



Compiled by N.S.Kudriashev


SECTIONS OF SEAMS ROOFS
РАЗРЕЗЫ КРОВЛИ УГОЛЬНЫХ ПЛАСТОВ
Scale I:200
2 0 2 4
-1965-
Compiled by A. Iliushin
COAL SEAM No.I
COAL SEAM No.2
COAL SEAM No.3
COAL SEAM No.4
COAL SEAM No.5
COAL SEAM No.6
COAL SEAM No.7
COAL SEAM No.9
COAL SEAM No.8
COAL SEAM No.9
COAL SEAM No.13
COAL SEAM No.10

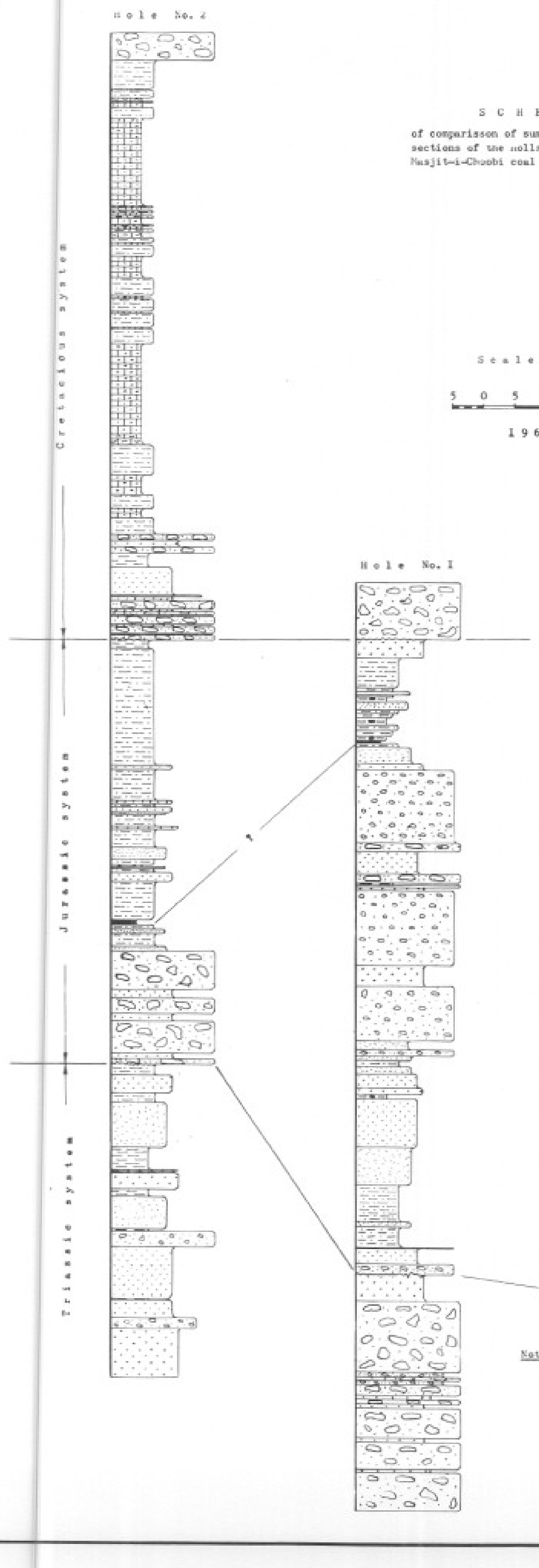
S C H E M E

of comparisson of summary stratigraphic sections of the holls Nos. I & 2 at the Masjit-i-Choobi coal deposit area

Scale I : 500

5 0 5 I0 I5 20 m

I 9 6 5



Note : See conventional sings on annex No.

Compiled by E.Ja.Martchenko

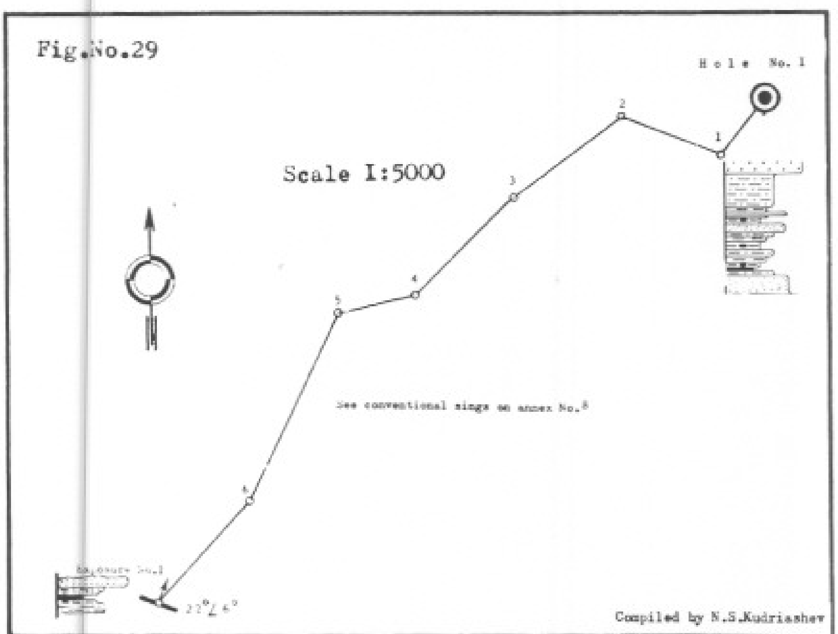


Рис.№ 29. Схема полуинструментального хода от скважины № 1 к обнажению угля в районе Ламанского цирка.

Fig.No. 29. Scheme of the semiinstrumental traverse from borehol No.I to the coal outcrop at the vicinity of the Laman cirque.