

- Ultimate analysis (dry, ash free)			
C %	-	68.3	73.2
H %	-	5.5	4.5
O %	-	24.6	21.4
N %	-	0.7	0.8
S %	-	0.9	0.1
- Free Swelling Index	-	0	-

#### 5) Coal reserves

According to our report of Part I: Renovation Study, the minable coal reserves of the Shineus Area is a total of 595 million tons for the Seam I, II and V, 484 million tons of which is estimated for the Seam I and II within 250 m below the surface. The total geological reserves in the whole deposit is roughly estimated at 2,700 million tons for all eight seams.

#### 6) State of mining

The Shivee Ovoo Coal Mine began at the Shineus Area in 1987 and started to produce in 1992. The total produce until 1993 was 748.4 thousand tons and has been mainly utilized by power plants at Ulaanbaatar. The details of mining status is shown on the report of Part I.

### (17) Chandgantal Deposit

#### 1) Locality and topography

The Chandgantal Deposit is present within the East Megablock and in Hentiy Province. The center of the deposit is in latitude 47° 25' N and in longitude 110° 25', 280 km east of Ulaanbaatar, 160 km east-southeast of Baganuur and 40 km west of Ondorhaan which is the capital town of Hentiy Province (Figure 44). The land surface of the deposit forms a flat steppe at 1,150 m above the sea level.

#### 2) History of exploration

1941 : Discover of the coal deposit

- tow seams of 1.5 m thick

1962-63 : Detailed exploration by former Soviet Union

- trenching : 116 points

- drilling : 21 holes, 30-110 m/hole

interval of 150-450 m

with geophysical logging

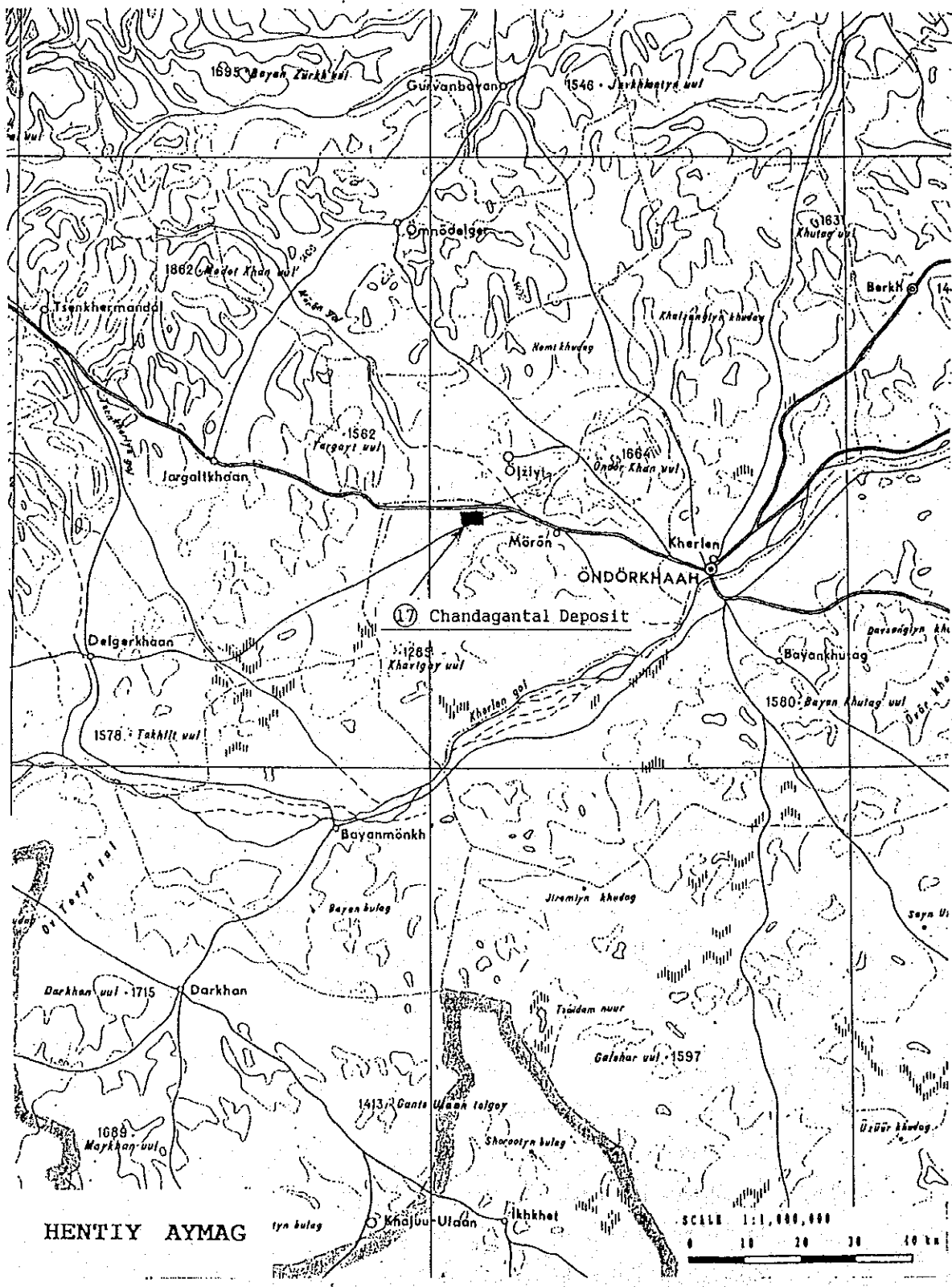


Figure 44 Deposit locality map middle of Hentiy Aymag

### 3) Coal geology

The Chandgantol Deposit belongs to the Choir-Niarga Coal-bearing Basin. The deposit extends for 1.5 km north-south and 2 km east-west with an area of about 3 km. Coal seams are embedded the same as the Baganuur Deposit in the Tevshiingovi Formation of the Dsunbayan Group in the Early Cretaceous time. The basic geological structure is formed of a homoclinal structure with a reverse fault (Figure 45). The coal seams trend west-northwest and gently dip 5-8° south. At the northeast part, the seams are cut by the reverse fault trending northwest and dipping 70° south with a displacement of over 20 m.

There are a total of five coal seams ranging in thickness from 0.10 to 49.95 m. The minable seam is named the Seam II°, which ranges in thickness from 30.45 to 49.95 m with two to five partings. The thickness of partings ranges from 0.10 to 3.40 m. The remarkable characteristics of the deposit are a thick coal seam of nearly 50 m and a thin overburden of 0 to 30 m only at the wide area.

### 4) Coal quality

The coals are classified into B2(Mongolia, Russia) Sub-bituminous C(U.S.A) and Lignite F(Japan -JIS). The general coals contain 30.6% moisture(as received), 12.3% moisture(air dried), 11.7% ash(dry), 46.5% volatile matter(dry, ash free), 0.9% sulfur(dry). The calorific value is 3,000-3,400 kcal/kg(as received) and 6,580 kcal/kg(dry, ash free).

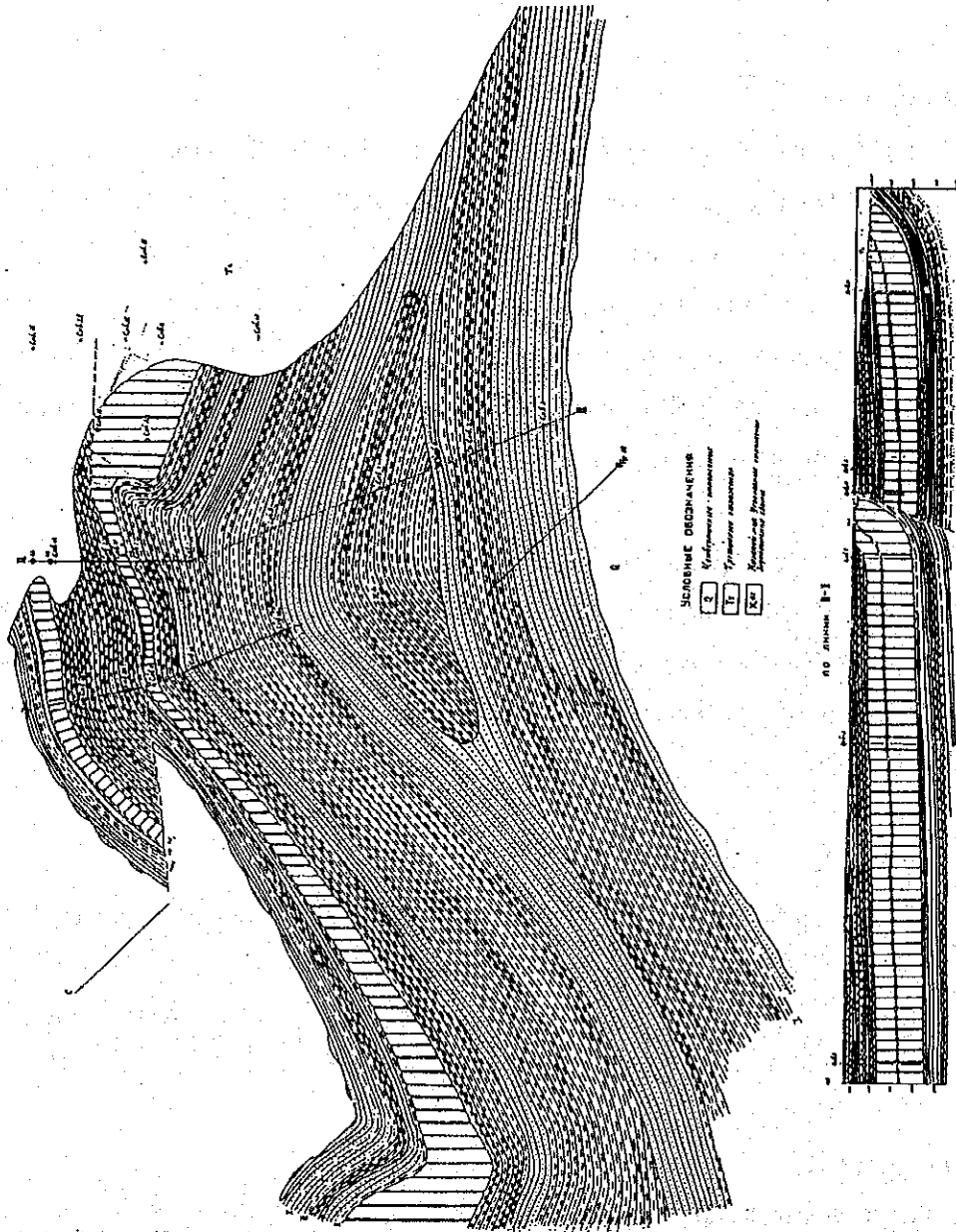
### 5) Coal reserves

For the area of 1.2 km x 0.8 km within 100 m below the surface, the coal reserves is estimated at 122.85 million tons of minable reserves(A + B + C<sub>1</sub>) and 212.99 million tons of total geological ones(A + B + C<sub>1</sub> + C<sub>2</sub>).

### 6) State of mining

The Chandgantol Coal Mine began to mine by opencut in 1966. The total produce until 1993 was 1.65 million tons with an average of 120,000 tons/y and has been utilized by local consumers restricted in Hentiy Province. The mine produced 55 thousand tons in 1993. The level of groundwater is 15 m in depth. This deposit is regarded as having a large potential of development because of plenty of reserves and a small stripping ratio (Figure 46).

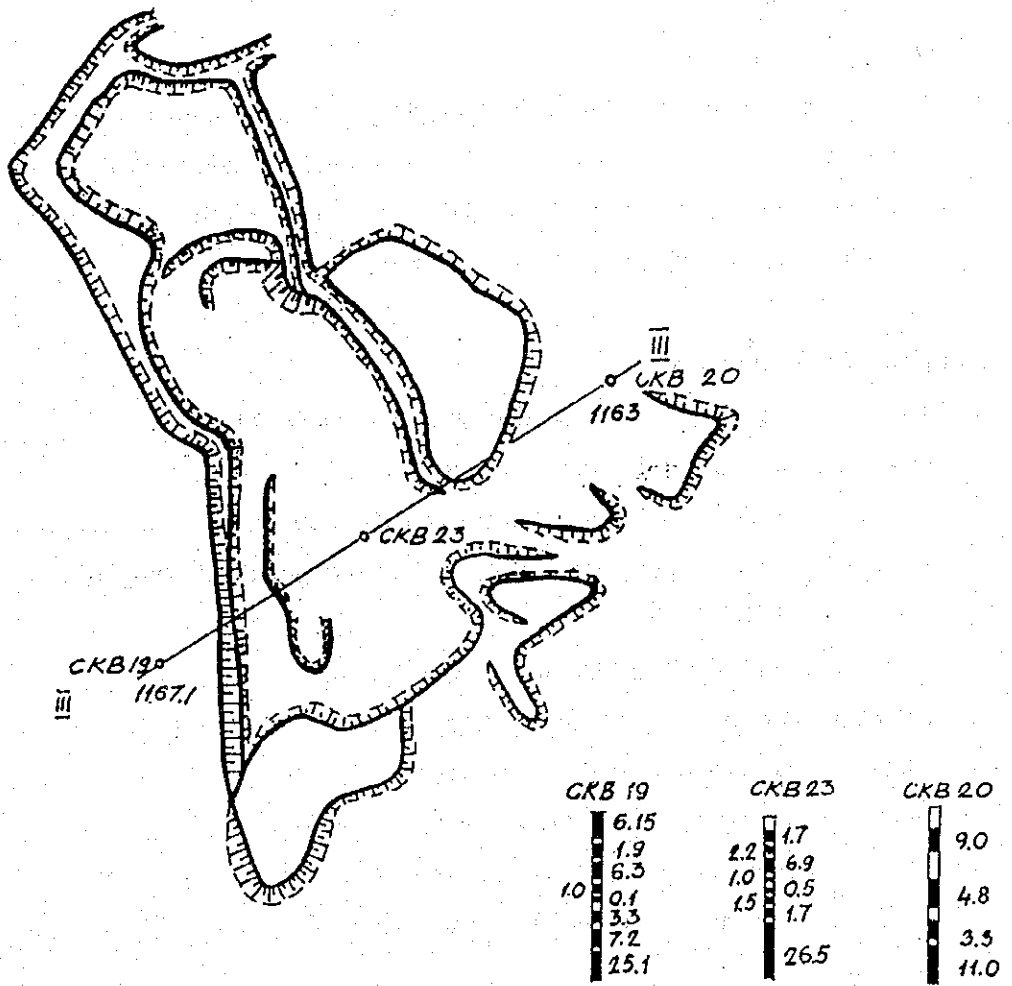
ГЕОЛОГО - ЛИТОЛОГИЧЕСКАЯ КАРТА  
 МЕСТОРОЖДЕНИЯ УГЛЯ ЦАЙДАМ-МЫР  
 БОРТОВАЯ ВЕЩКА ЛО  
 Масштаб 1:2000  
 1982г.



СТРАТИГРАФИЧЕСКИЙ СРЕЗ  
 по профилю А-А'  
 Масштаб 1:1000

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

Figure 45 Geological map of Chandagantal Deposit



Геологический разрез III - III

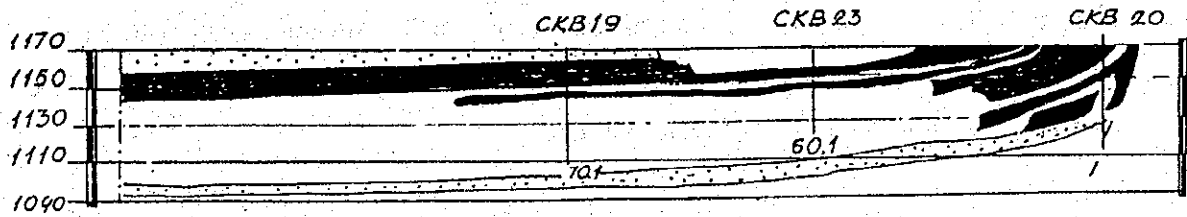


Figure 46 Schematic of Chandagantal Mine

## (18) Talbulag Deposit

### 1) Locality and topography

The Talbulag Deposit is within the East Megablock and at the north of Suhbaatar Province. The center of the deposit is in latitude 46° 55' N and in longitude 112° 58', 35 km northwest of Suhbaatar which is the capital town of Suhbaatar Province (Figure 47). The land surface of the deposit forms a flat steppe at 1,040 m above the sea level.

### 2) History of exploration

- 1939 : Discovery of the coal deposit by former Soviet Union
- 1943 : Exploration by former Soviet Union
  - evaluated as a hopeless deposit because of the poor coal quality
- 1967 : Exploration by a joint expedition of Mongolia and Hungary
  - drilling : 4 holes
  - confirmed coal thickness of 2.7-33.8 m
- 1969-70 : Exploration by Mongolia (Area I)
- 1980 : Detailed exploration (Area II)
- 1991 : Exploration (northeast area)
  - drilling : 7 holes
  - confirmed a continuity of coal seams

### 3) Coal geology

The Talbulag Deposit belongs to the Sukhe Bator Coal-bearing Basin. The deposit shows an elongated basin extending for 17 km northeast long and 5-6 km northwest, with an area exceeding 70 km<sup>2</sup>. Coal seams are embedded in the coal-bearing formation correlated with the Tévshingovi Formation of Early Cretaceous age.

The basic geological structure is formed of a gentle synclinal basin structure with an axis tending northeast (Figure 48). The coal seams gently dip less than 10° in general but 8-15° near the surface at the Area II including the existing mining site (Figure 49). The lowest seam level in the deposit is estimated about 300 m below the surface. The coal seams which show a comparatively well continuity in the whole deposit are a total of five seams : the Seam I to V in ascending order, of which three seams such as the Seam II, III and IV are minable seams. The seam

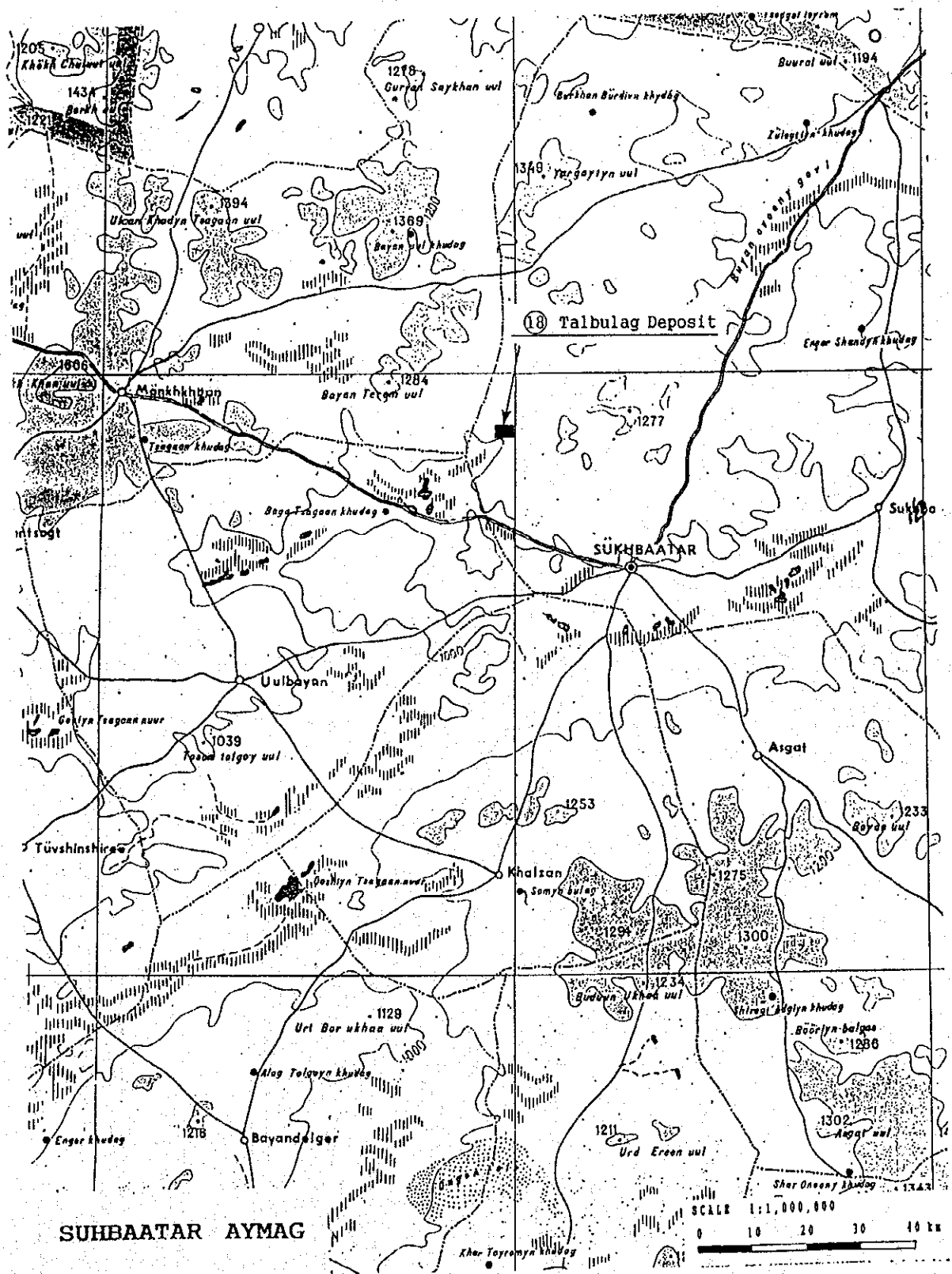


Figure 47 Deposit locality map in Suhbaatar Aymag

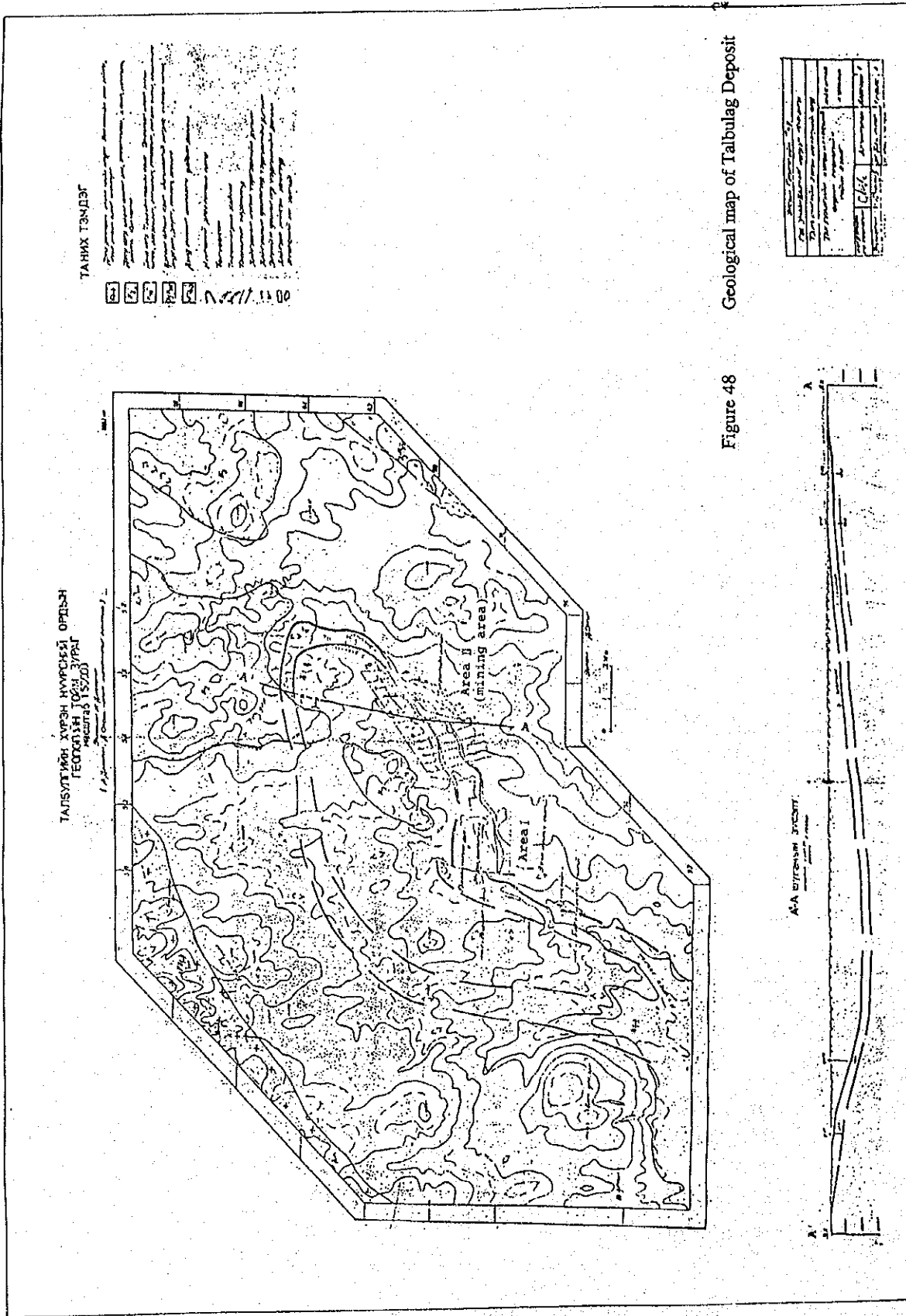


Figure 48 Geological map of Talbulag Deposit



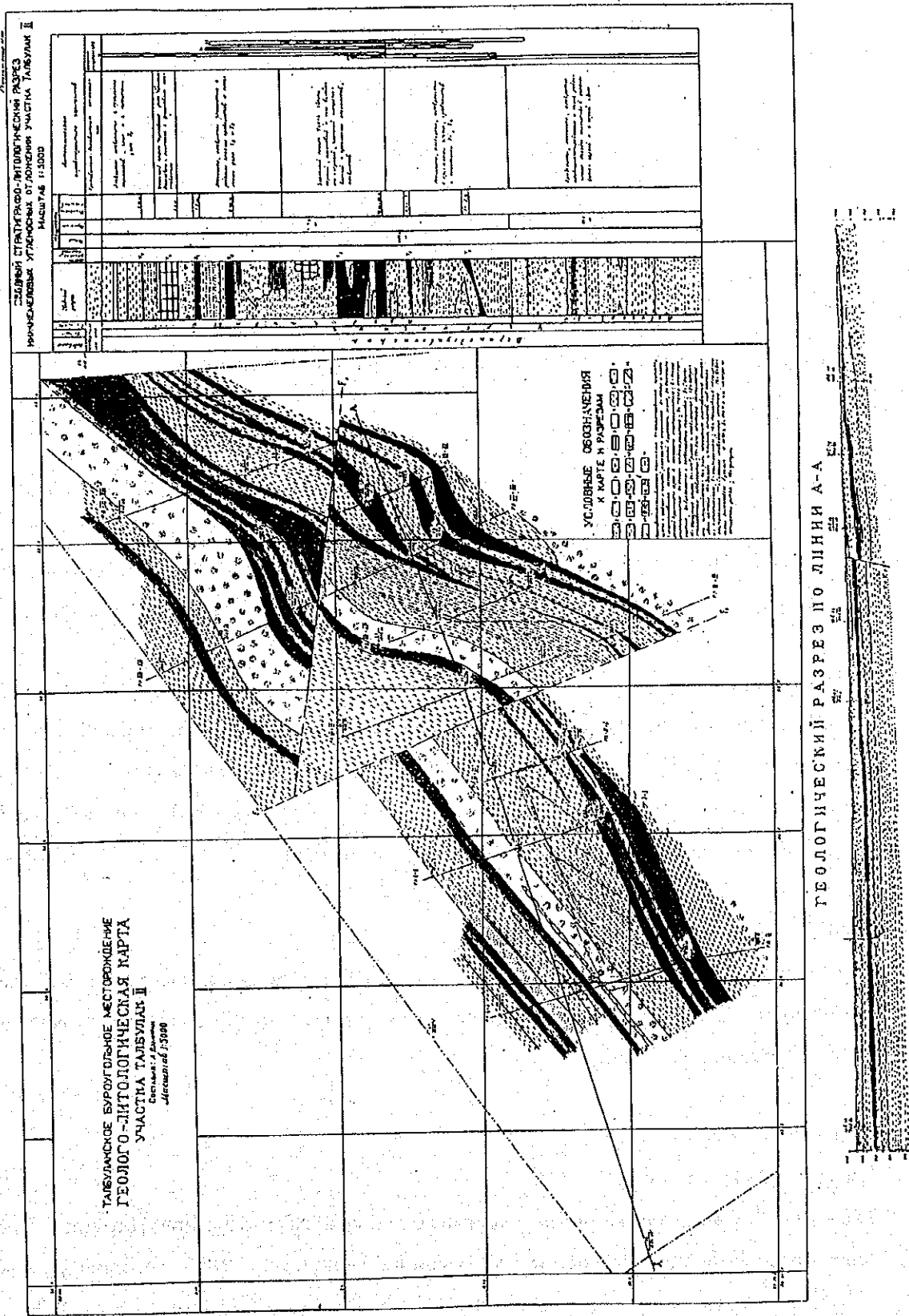


Figure 49 Geological map of Talbulag Mine

conditions at the Area II show at Figure 50. All seams have a variable thickness as follows:

Seam	Thickness	Interval
I	0.5- 7.5 m	10-15 m
IV	2.0- 8.2 m	10-50 m
III	9.1-30.3 m	?
II	1.0- 4.8 m	20-30 m
I	0.3- 3.5 m	

For the whole deposit, the detailed exploration has not yet been conducted.

#### 4) Coal quality

The coals are classified into Lignite B1 (Mongolia, Russia), Lignite A (U.S.A) or Lignite F (Japan -JIS). The typical coal contains 30.6% total moisture (as received), 9.5% moisture (air dried), 14.0% ash (dry), 47.0% volatile matter (dry, ash free), 0.8% total sulfur (dry) and shows a calorific value of 2,850 kcal/kg (as received) and 6,000 kcal/kg (dry, ash free).

#### 5) Coal reserves

At the Area II including the present mining site, the coal reserves within 100 m below the surface is estimated at 5.19 million tons for total geological reserves (A + B + C<sub>1</sub> + C<sub>2</sub>), of which 4.86 million tons is minable reserves (A + B + C<sub>1</sub>). For the whole deposit, the geological reserves is roughly estimated at 421.3 million tons in 1991.

#### 6) State of mining

The Talbulag Coal Mine began to mine by opencut in 1976. The total produce until 1993 was 1.53 million tons with an average of 100,000 tons/y and has been utilized by local consumers restricted in Suhbaatar Province.

### (19) Aduunchuluun Deposit

#### 1) Locality and topography

The Aduunchuluun Deposit is present within the East Megablock and in Dornod Province. The center of the deposit is in latitude 48° 05' N and in longitude 114° 28'. The mining site is

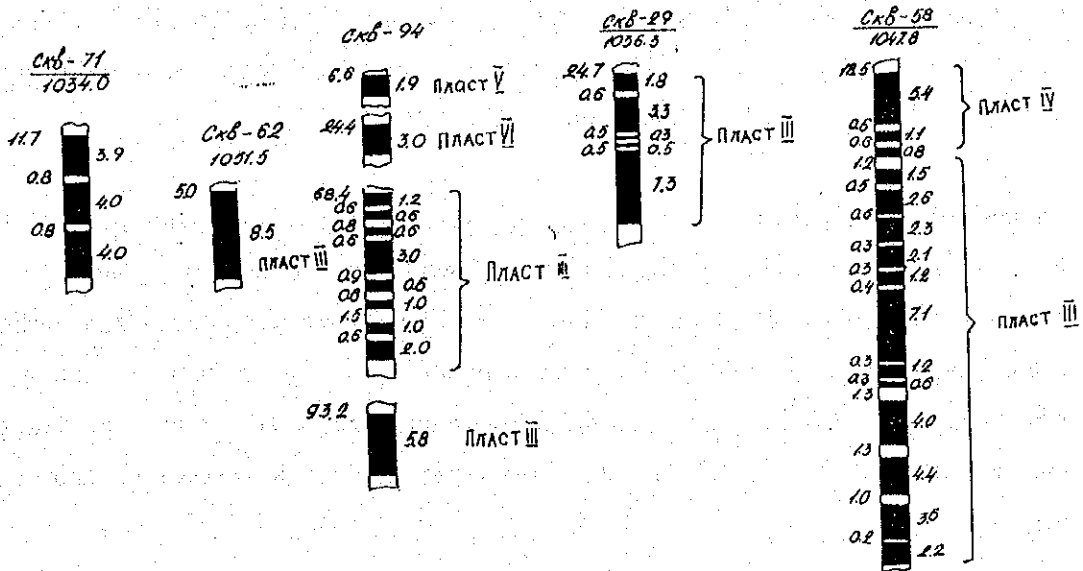
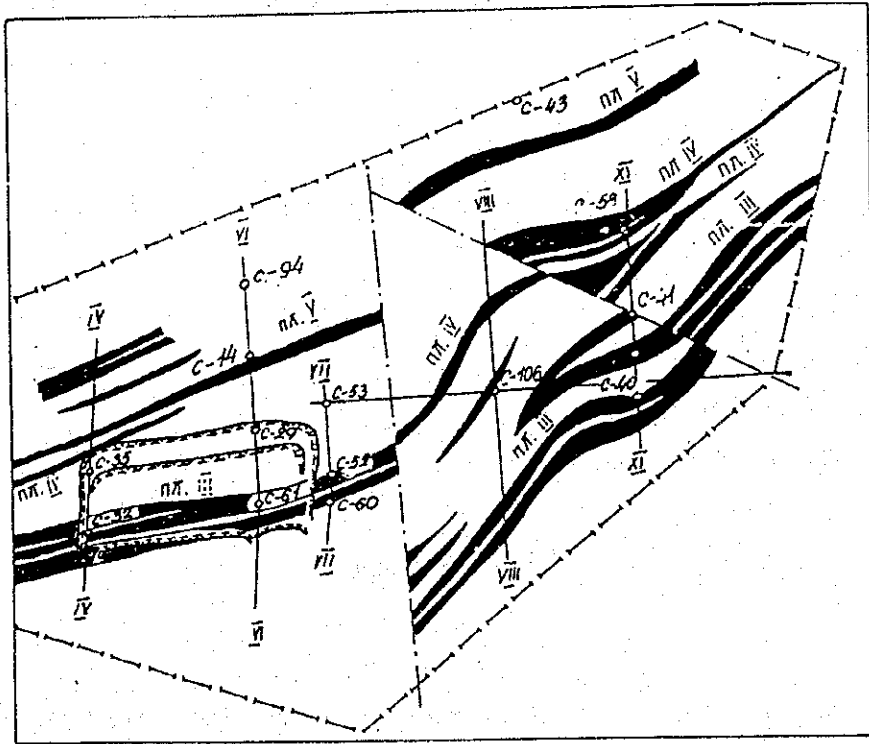


Figure 50

Seam conditions of Talbulag Mine

located 6.5 km north of Choy Balsan which is the capital town of Dornod Province(Figure 51). The land surface of the deposit is at 750-780 m above the sea level and forms a flat to hilly steppe.

## 2) History of exploration

1951-53 : Discovery of the coal deposit by former Soviet Union at drill holes for uranium exploration

- drilling: 52 holes

1955 : Mining (small quantity)

1957 : Start of underground mining

1962 : Detail exploration by former Soviet Union

1967 : Change to opencut mining

1988-89 : Exploration for the whole deposit by Mongolia

## 3) Coal geology

The Aduunchuluun Deposit belongs to the Sukhe Bator Coal-bearing Basin. The deposit shows a basin extending for about 8 km northwest and 4-7 km northeast, with an area of about 40 km<sup>2</sup>. Coal seams are embedded in the Tevshiingovi Formation, 200-250 thick, of Early Cretaceous age. The Tevshiingovi Formation is unconformably covered by sediments of Neogene to Late Cretaceous age. The thickness of covering sediments ranges from 0 to 70 m, tending to thicken toward the east and north (Figure 52).

The basic geological structure is formed of a gentle synclinal basin structure with an axis tending northeast. Embedded coal seams are composed of two seams: the upper seam and the lower seam with an interval of 60-70 m. The lower seam is named the Avraga Seam and presently being mined (Figure 53). The seam has a variable thickness ranging from 1 to 50 m in the whole deposit and from 25 to 40 m at the present mining area. The upper seam ranges in thickness from 1 to 5 m, and the distribution is restricted within the northeastern half of the deposit.

## 4) Coal quality

The coals are classified into Lignite B1 (Mongolia, Russia), Lignite A (U.S.A) or Lignite F (Japan -JIS). The average coal contains 45.2% total moisture (as received), 9.4% moisture (air

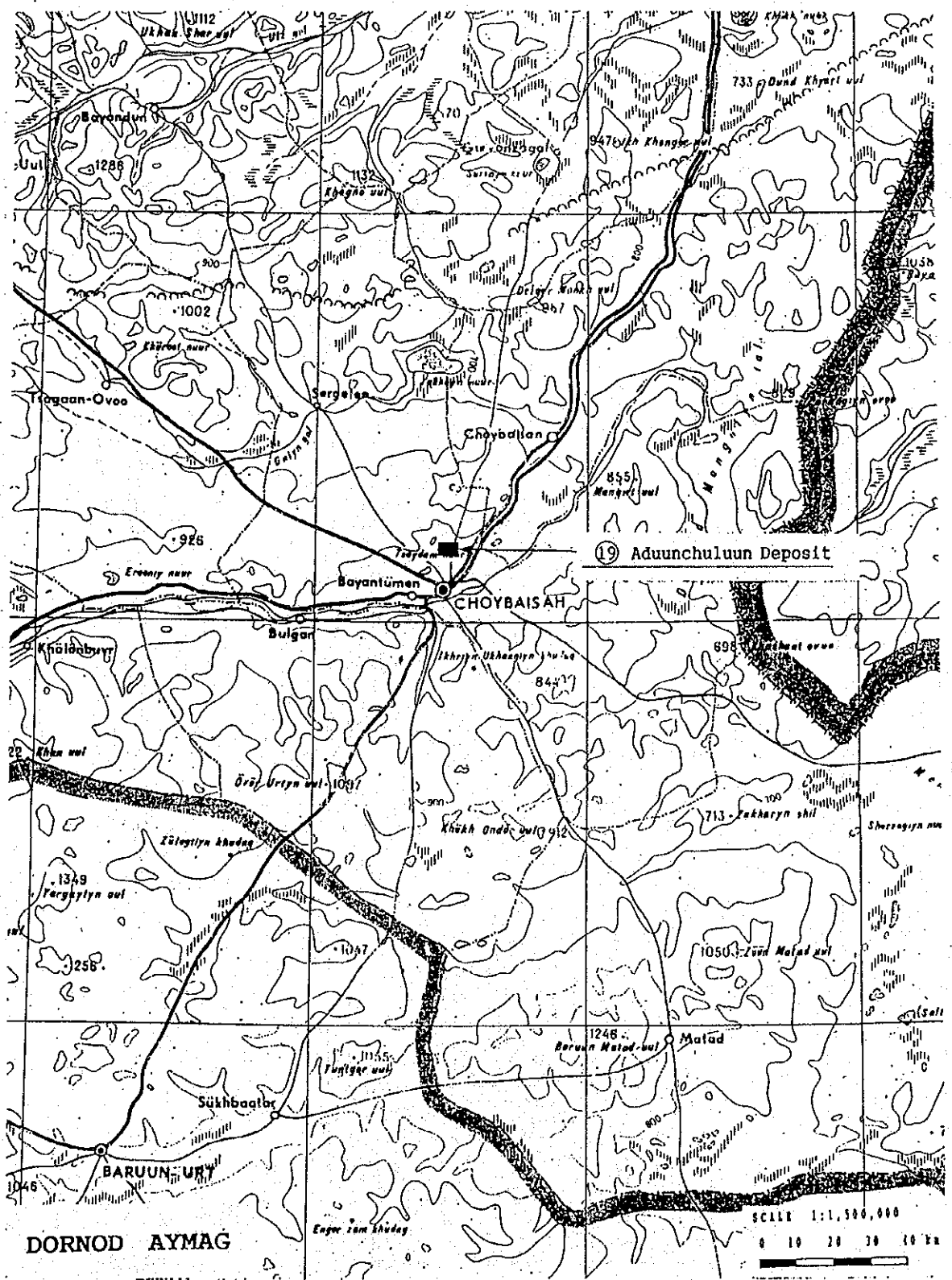
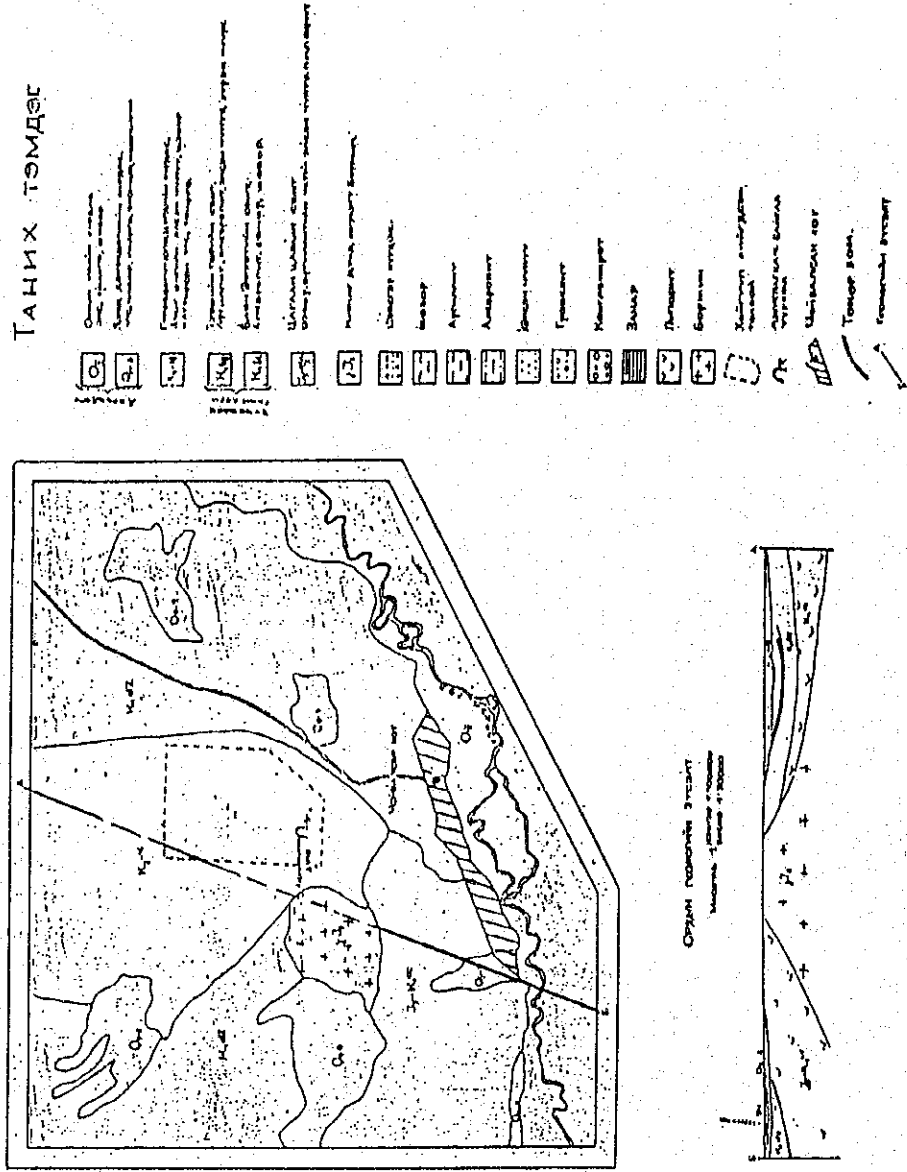


Figure 51 Deposit locality map in Dornod Aymag

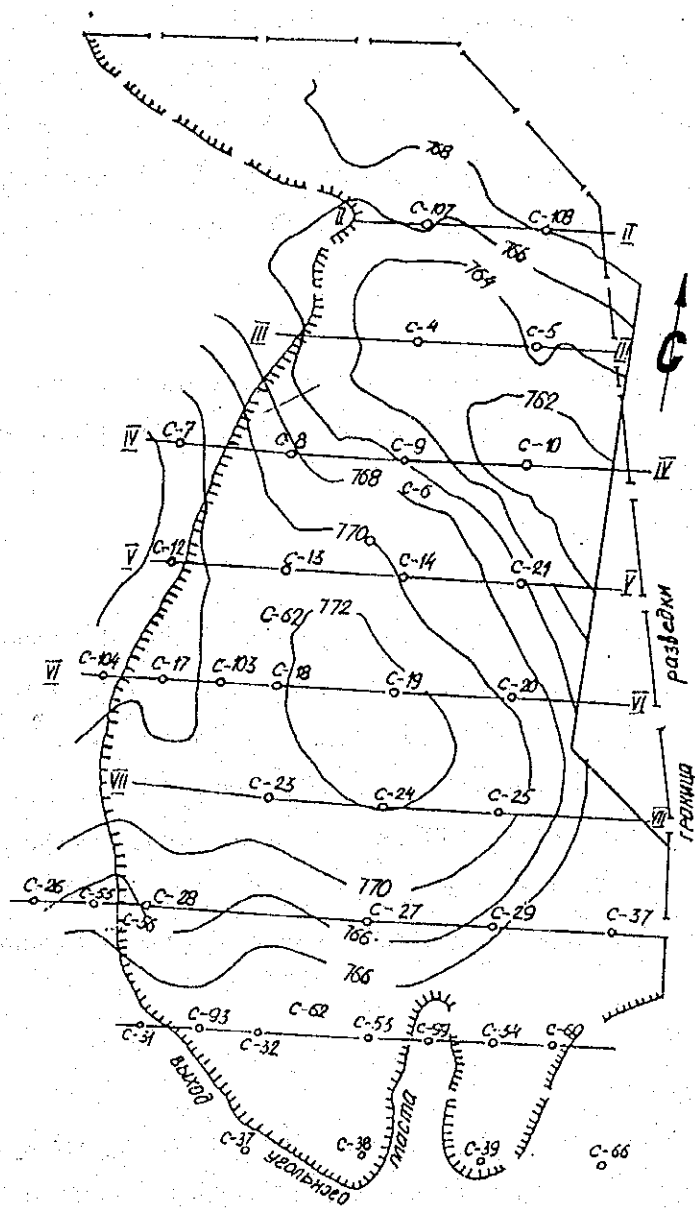
# АДУУНЧУЛУУНЫ ОРДЫН РАЙОНЫ ГЕОЛОГИЙН ЗУРАГ



## Давхарга зүйн багана

Тайлбар	Хэвтээ	СЭРМ	СЭМТ	Индикс	Геологийн эхлэл	Бүрдэн	Чулуулагийн эмчилгэл	Анхны нэр
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>
О <sub>3</sub>	О <sub>2</sub>	Т <sub>1-2</sub>	К <sub>1-2</sub>	С <sub>1-2</sub>	М <sub>1-2</sub>	З <sub>1-2</sub>	Д <sub>1-2</sub>	С <sub>1-2</sub>

Figure 52 Geological map of Adunchuluun Deposit



P.A. VII-VI

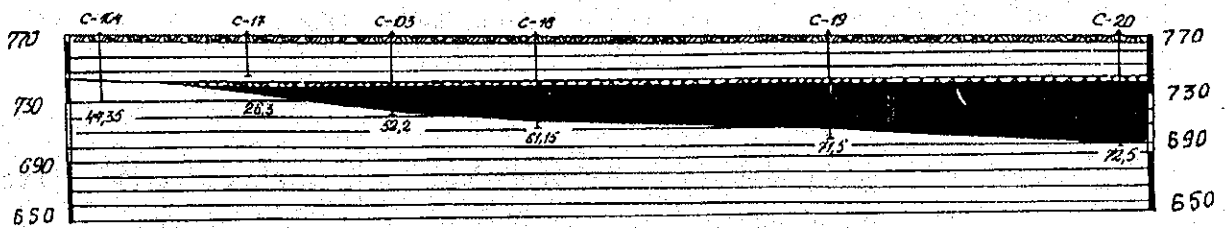


Figure 53 Schematic of Aduunchuruun Mine

dried), 16.7% ash (dry), 48.1% volatile matter (dry, ash free), 1.1% sulfur (dry) and shows a calorific value of 2,400 kcal/kg (as received) and 6,480 kcal/kg (dry, ash free). The Aduunchuluun coal is one of the lowest grade coal in Mongolia. In regard with utilization of the coal, there is an unfavorable point such that the uppermost 0.5-2.5 m thick of coal seam highly contains uranium, maximum 300 g/t and average 30-50 g/t as oxidized uranium.

#### 5) Coal reserves

In the western half deposit including the present mining site, extending for 5 km in strike direction and 3 km in dip direction, the minable reserves within 60 m below the surface is estimated at 430 million tons.

#### 6) State of mining

The Aduunchuluun Coal Mine began to mine by opencut in 1955 and by underground mining in 1957. The mine changed again to opencut mining with annual produce of 100 thousand tons in 1967 and expanded the production capacity to 600 thousand tons per year in 1984. The total produce until 1993 was 8.42 million tons and has been utilized mainly by the power plant at Choy Balsan. From 1988 to 1990, 100 thousand tons per year of coal was exported to former Soviet Union. Recently the mine is facing with such a problem as drainage of groundwater, increasing of stripping ratio, treatment of stripped overburden and contaminated coals.

### (20) Narynsokhait Deposit

#### 1) Locality and topography

The Narynsokhait Deposit is within the Middle-South Megablock and at the southwest of Omnogovi Province. The center of the deposit is in latitude 42° 50' N and in longitude 101° 40', 30 km north of the border with China, 300 km south-west of Dalanzadgad which is the capital town of Omnogovi Province (Figure 54). The land surface of the deposit is at 1,510-1,540 m above the sea level and forms a flat desert in Govi Desert.

#### 2) History of exploration

1991 : Reconnaissance survey for the whole deposit and detailed exploration for two blocks by drilling



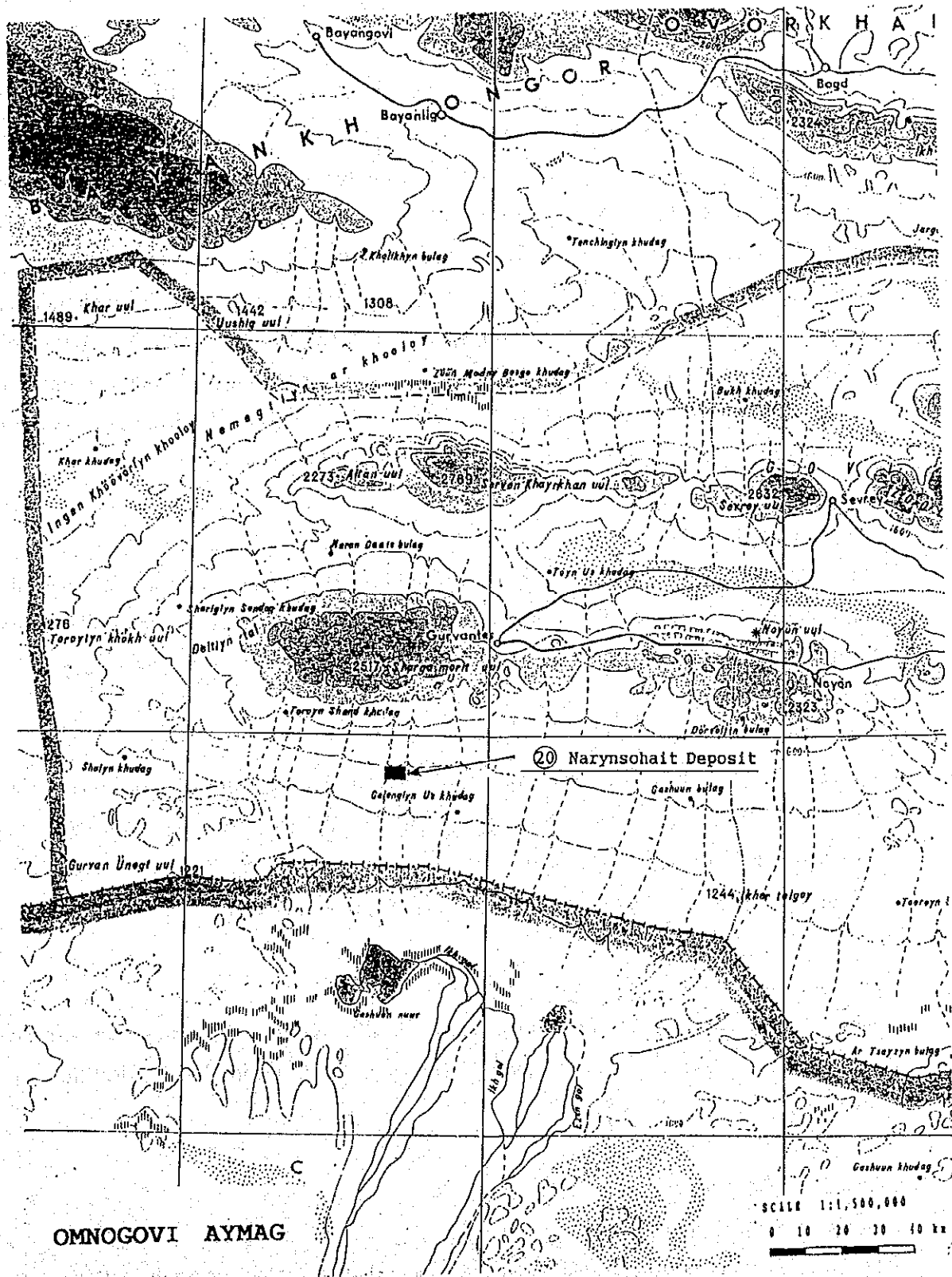


Figure 54 Deposit locality map in west of Omnogovi Aymag

### 3) Coal geology

The Narynsokhait Deposit belongs to the South Gobi Coal-bearing Basin. The deposit extends for 90 km east-west long and 14 km north-south wide. Coal seams are embedded in a coal-bearing formation regarded as of Late Permian age, probably correlated with the Tavantolgoi Formation. The geology has not yet been clarified in detail. The basic geological structure is formed of a homoclinal structure. The formation trends east-west and dips 30-60° south (Figure 55). The coal-bearing formation contains five to seven coal seams, of which minable seams consist of the Seam I at the west block and the Seam V at the east block. Both coal seams are about 100 m in thickness and similar to the Seam IX and XIII in the Tavantolgoi Deposit at the point of seam conditions. There are partially observed intrusive rocks at the east of the deposit, and influenced the coal quality to alter into Anthracite etc.

### 4) Coal quality

The Narynsokhait coal is regarded as being classified into GJ (Mongolia, Russia). The analytical data on coal quality has not been obtained this time. Based on the geological conditions of the deposit, it is assumed for the coal to have the same as the quality of the Tavantolgoi coal.

### 5) Coal reserves

For the two blocks where the detailed exploration was conducted, the minable reserves (A + B + C<sub>1</sub>) within 100 m below the surface, up to 1,450 m above the sea level, is estimated about 40-50 million tons with a stripping ratio of 1.2. The total geological reserves (A + B + C<sub>1</sub> + C<sub>2</sub> + P) above 200 m in depth is roughly estimated at 200-250 million tons.

### 6) State of mining

MEGM has no plan to develop the deposit. However, there is such a information that a private sector intends to develop a mine to export the coking coal to China in 1995. The details of development plan is unknown.

## (21) Ulaan-Ovoo Deposit

### 1) Locality and topography

The Ulaan-Ovoo Deposit is present within the Middle-East Megablock and at the northwest of Selenge Province. The center of the deposit is in latitude 50° 20' N and in longitude 105° 00'



E, 5 km west of Tushig, 90 km northwest of Shaamar which is on the Trans-Mongolian Railway, 85 km west of Suhbaatar which is the capital town of Selenge Province (Figure 35). The land surface of the deposit is at the south foot of a mountain, 780-810 m above the sea level and forms a forestall slope .

### 3) History of exploration

- 1974-75 : Reconnaissance survey by Mongolia and former Soviet Union according to information from local residents
- 1979 : Detailed exploration by Mongolia
- 1993- : Detailed exploration by Erdenet Company
- 1994- : Developing as a private mine by Erdenet Company

### 3) Coal geology

The Ulaan-Ovoo Deposit belongs to the Orkhon Selenge Coal-bearing Basin (Region). The deposit confirmed by exploration shows a half-basin opened toward the south, extending for 3 km east-west and 2 km north-south with an area of 6 km<sup>2</sup>. Coal seams are embedded in the coal-bearing formation of 600 m thick, which is correlated with the Sharyngol Formation of Middle-Late Jurassic age. The basic geological structure is formed of a synclinal basin structure with an axis tending north-south. The coal seams dip 15-20° north or northwest in general, though steeply dip 60-70° east at the western part (Figure 56). There are two coal seams of the upper and lower seams. The upper seam ranges in thickness from 24.6 to 63.1 m with many partings. The lower seam was recently confirmed to attain to 15 m thick with drilling by Erdenet.

### 4) Coal quality

The coals are classified the same as the Sharyngol Coal, into B3-D (Mongolia, Russia), Subbituminous B-A (U.S.A.) or Subbituminous E - Lignite (Japan-JIS). The typical coal contains 13.4% moisture (as received), 7.3% moisture (air dried), 11.2% ash (dry), 46.0% volatile matter (dry,ash free), 0.29% sulfur (dry). The calorific value is 4,270 kcal/kg (air dried) and 7,370 kcal/kg (dry, ash free).



### 5) Coal reserves

According to the governmental report in 1981, the coal reserves of the north exploration area, 1.5 km (east-west) x 0.45 km (north-south) within 150-160 m below the surface, is estimated at 23.56 million tons of minable reserves (A + B + C<sub>1</sub>). The geological reserves (C<sub>2</sub>) is estimated at 18.56 million tons.

### 6) State of mining

Erdenet Company is privately developing the deposit as the Ulaan-Ovoo Coal Mine in order to supply to own plants.

## (22) Khoot Deposit

### 1) Locality and topography

The Khoot Deposit is present within the Middle-East Megablock and at the east of Dundgovi Province. The center of the deposit is in latitude 45° 39' to 46'N and in longitude 107° 39' to 46'E, 90 km southwest of Choir on the Trans-Mongolian Railway, 120 km east-southeast of Mandalgovi which is the capital town of Dundgovi Province (Figure 57). The land surface of the deposit forms a flat steppe at 1,220-1,200 m above the sea level on the north of the Govi Desert.

### 2) History of exploration

- 1964 : Exploration by a joint expedition of Mongolia and former Soviet Union
  - drilling : 24 holes, maximum depth of 130 m
- 1992-94 : Exploration by a private sector (Mr. Munkhtogoo)
  - drilling : 51 holes, maximum depth of 100 m
- 1993 : Start of opencut mining by the private sector

### 3) Coal geology

The Khoot Deposit belongs to the Middle Govi Coal-bearing Basin. The deposit confirmed by exploration extends for 5 km north-south and 5 km east-west with an area of about 25 km<sup>2</sup>. Coal seams are embedded in the coal-bearing formation of Jurassic age. The basic geological structure is formed of a homoclinal structure with faults (Figure 58). The coal seams strike east-northeast and gently dip 5- 12° south. There are a total of five coal seams: the Seam I to the Seam V in ascending order. The average of thickness and intervals is below:

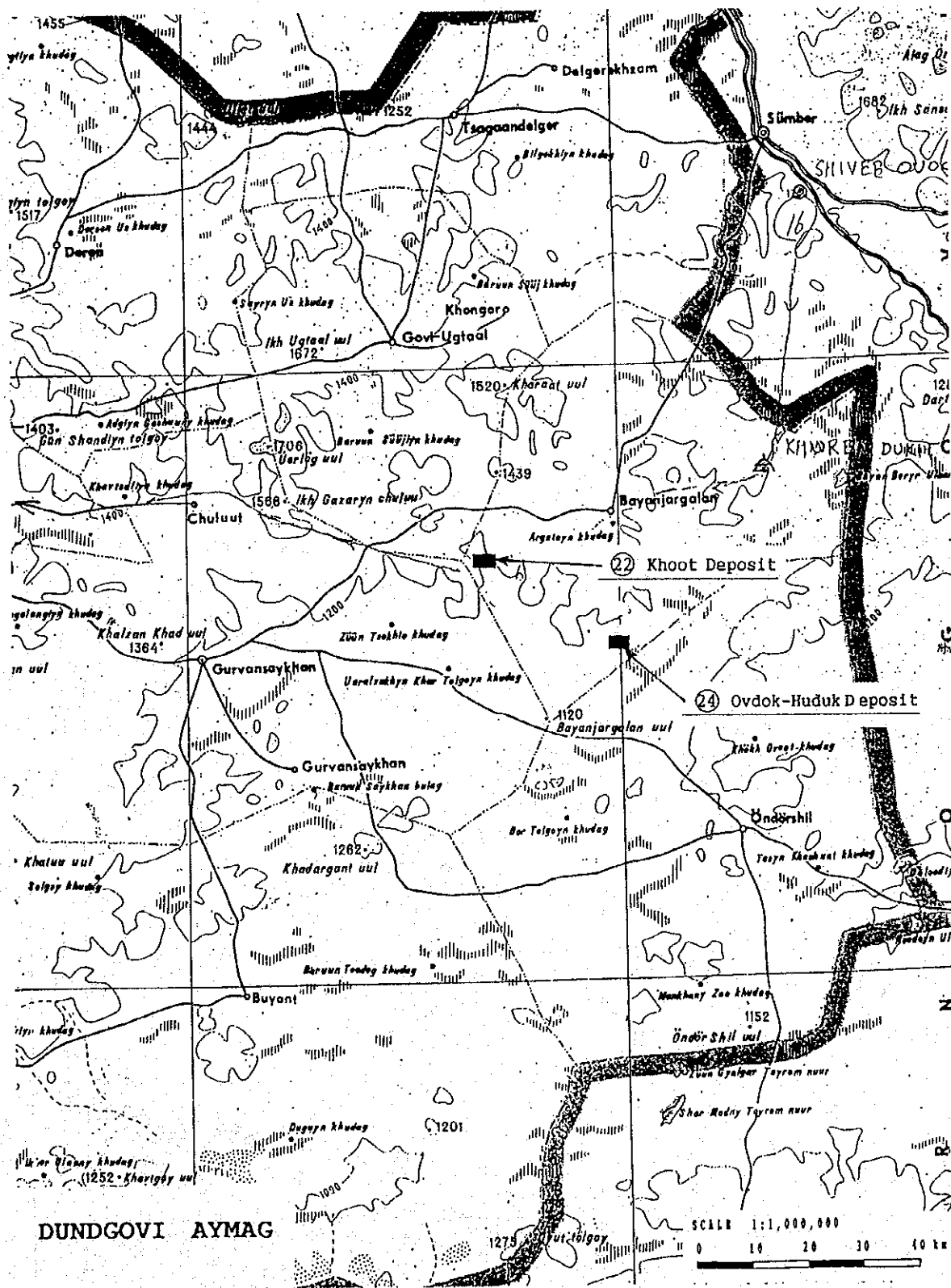


Figure 57 Deposit locality map in east of Dundgovi Aymag





Seam	Seam Thickness (coal thick.)	Interval
V	8.0 (8.0)m 10 m at the west	18 m
IV	6.4 (4.1)m	70 m
III	13.2 (5.5)m	70 m
II	14.1 (7.3)m	60-70 m
I	29.3 (13.1)m	

The existing mine shown as "A" at Figure 58 is working only the Seam V. Figure 59 shows the geological conditions of the mining site.

#### 4) Coal quality

The coals are classified the same as the Sharyngol coal into B3-D (Mongolia, Russia) Subbituminous B-A coal (U.S.A) and Subbituminous E-Lignite F (Japan -JIS). The typical coal contains 13.8% total moisture (as received), 7.5% moisture (air dried), 14.5% ash (dry), 43.0% volatile matter (dry, ash free), 0.7% total sulfur (dry) and show a calorific value of 4,800 kcal/kg (as received) and 7,030 kcal/kg (dry, ash free). The coals produced at the existing mine contain 23% total moisture (as received), 13.4-35.0% ash (dry), 45.0% volatile matter (dry, ash free), less than 1.0% total sulfur (dry) and show a calorific value of over 3,000 kcal/kg (as received) and 6,600 kcal/kg (dry, ash free). Deep coals are estimated as of higher than present coals in quality.

#### 5) Coal reserves

The coal reserves within 100 m below the surface is estimated as a total of 190.9 million tons as follows:

Seam	Reserves(million tons)	Rank
V	82.3	(C <sub>1</sub> )
IV	9.3	(C <sub>2</sub> )
III	26.4	(C <sub>2</sub> )
II	65.8	(C <sub>2</sub> )
I	7.1	(C <sub>2</sub> )
190.9		



#### 6) State of mining

The Khoot Mine has begun as a small scale opencut mine by Mr. Munkhtogoo in July, 1993. The produce in 1993 was a total of 3,800 tons and utilized by local consumers, of which 100 tons of coal was sent to Mandalgovi City.

#### 7) Oil shale resources

In the deposit, there is a worthy characteristic of mention that a oil shale bed conformably overlies the coal bearing bed with a interval of 10-20 m above the Seam V. The oil shale bed has a maximum thickness of 100 m. According to the report by Mr. Munkhtogoo in 1994, owner of the Khoot Mine, the oil yield of oil shale samples, about 370 samples, generally ranges from 4 to 15%, 22% in maximum. On the project "Research on exploration and development of mineral resources in Mongolia" conducted by Institute of Geology and Mineral Resources in Mongolia and Geological Survey of Japan and financed by Agency of Industrial Science and Technology, Ministry of International Trade and Industry of Japan in 1991-92, a total of 10 oil shale samples were analyzed to show that the oil yield ranges from 2.89 to 11.82%, 7.88% on average. One sample collected during our study in 1994 was analyzed in Japan to show such results as oil yield of 5.3%, moisture of 4.9%, ash(shale) of 83.8%. Based on a general opinion that the value of 10 US gallon per ton (about 4.7%) is frequently used as the lowest limit of oil yield for oil shale, the Khoot oil shale can be regarded as having the potential of utilization. The oil yield of the Fushun oil shale in China, which is being mined and utilized, is only less than 4%. If the coal below the oil shale bed is mined by opencut, mining cost for the oil shale can be estimated so low that the development plan of the Khoot mine should be considered with the utilization of oil shale.

The oil shale reserves at the area within 100 m below the surface, containing over 5.5% of oil yield, is estimated as 612.36 million tons:  $18,900 \text{ km}^2(\text{area}) \times 16.2 \text{ m}(\text{thickness}) \times 2.0$  (specific gravity). Regarding as 7.0% of oil yield on average, the total oil yield is estimated as 42.9 million tons.

#### (23) Tsaidamnuur Deposit

##### 1) Locality and topography

The Tsaidamnuur Deposit is within the Middle-East Megablock and at the southeast of Tov Province. The center of the deposit is in latitude  $47^{\circ} 22' \text{N}$  and in longitude  $108^{\circ} 00' \text{E}$ , 100 km

southeast of Ulaanbaatar, 20 km south from the railway connecting Baganuur and Ulaanbaatar, also 20 km east from the Trans-Railway (Figure 38). The land surface of the deposit is at 1,400 m above the sea level and forms a flat to gently undulating steppe.

## 2) History of exploration

1940's : Firstly recorded by Russian geologists

1980's : Exploration (roughly) by Mongolia

- prospecting line : 12 lines, interval of 4 km

- additional line : 2 lines

- drilling : about 80 holes, interval of 1-2 km

## 3) Coal geology

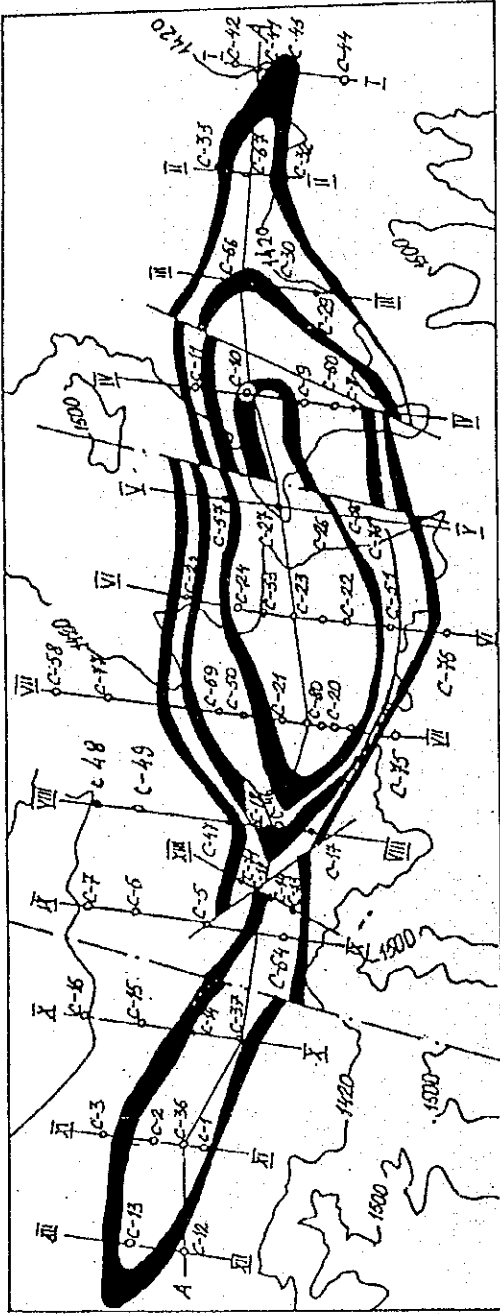
The Tsaidamuur Deposit belongs to the Choir-Niarga Coal-bearing Basin. The deposit shows a elongated basin extending for 40 km northeast and 10-15 km wide, with an area exceeding 500 km<sup>2</sup>. Coal seams are embedded, the same as the Baganuur and Shivee Ovoo Deposits, in the Tevshiingovi Formation of the Dsunbayan Group in Early Cretaceous time. The basic geological structure is formed of a elongated synclinal basin structure with an axis tending northeast. It is presumed that the basin structure is cut by three transverse faults tending northwest, being subdivided into four blocks (Figure 60). The dip of coal seams is regarded as less than 10° in general. The lowest seam level in the deposit is estimated at 400-500 m below the surface (Figure 61).

There are observed in the deposit a total of seven to eight coal seams showing a variable thickness with partings and splitting. The maximum seam thickness is confirmed to reach to 70 m by drilling. The detailed geological conditions of coal seams have not yet been clarified owing to the low degree of exploration.

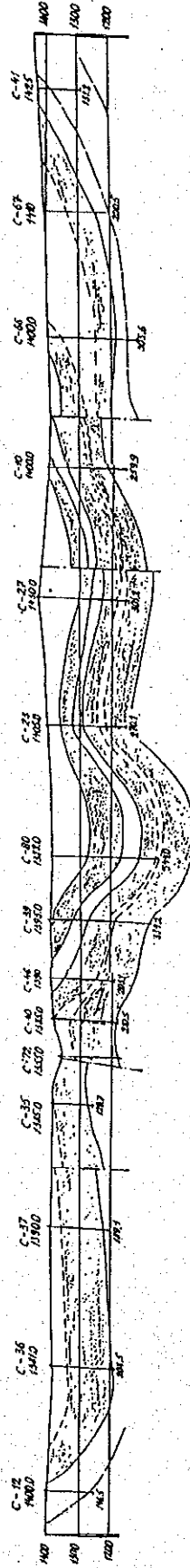
## 4) Coal quality

The coals are classified into Lignite B2 (Mongolia, Russia) sub-bituminous C coal (U.S.A) or Lignite F (Japan -JIS). It is reported that the general coals show the same quality as the Baganuur's.





PROFILES A-A



PI V-VI

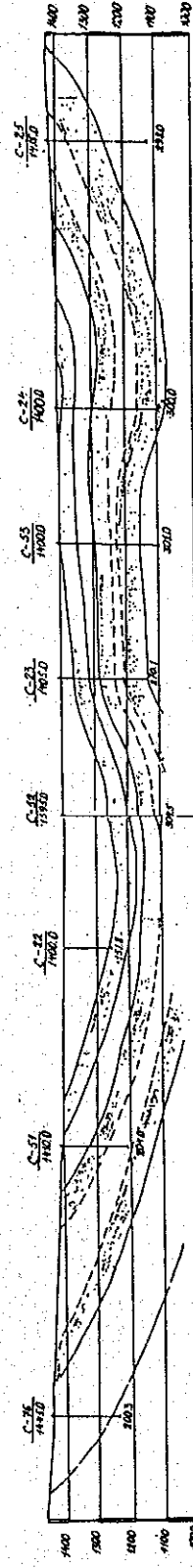


Figure 61 Seam conditions of Tsaidamuur Deposit

### 5) Coal reserves

The total geological reserves for the whole deposit within 500 m below the surface is roughly estimated as 4,000 million tons (C<sub>2</sub>+P). The reserves within 300 m below the surface is a total of 1,700 million tons (C<sub>2</sub>), of which 500 million tons is estimated at the central area where thick coal seams are regarded as being favorably distributed for opencut mining. Since the detailed exploration has not yet been conducted, the minable reserves is not estimated.

### 6) State of mining

There is not any activities for mining and/or exploration.

## (24) Ovdok-Huduk Deposit

### 1) Locality and topography

The Ovdok-Huduk Deposit is within the Middle-East Megablock and at the east of Dundgovi Province. The center of the deposit is in latitude 45° 32'N and in longitude 108° 00'E, 140 km east-southeast of Mandalgovi which is the capital town of Dundgovi Province (Figure 57). The Trans-Railway connecting with Ulaanbaatar is 90 km away northeast from the deposit. The land surface of the deposit is about 1,000 m above the sea level and forms a flat steppe on the north of Govi Desert.

### 2) History of exploration

- 1964 : Reconnaissance survey for the Southwest area by former Soviet Union based on the information from local residents
- 1965 : Reconnaissance survey for the Central area by former Soviet Union
- 1968-70 : Pre-detailed exploration for the Southwest area by Mongolia
- 1971-72 : Detailed exploration for the Central area by Mongolia
- 1974 : Additional sampling survey for sulfur contents
- 1992 : Additional exploration  
confirmed a coal seam of 60 m thick by drilling to the east of the Central area

### 3) Coal geology

The Ovdok-Huduk Deposit belongs to the Middle Govi Coal-bearing Basin (Region). The whole deposit extends for 16 km northeast long and 3 km northwest wide. In the deposit, there are separated two areas: the Central area and the Southwest area. Both areas have the

same extent of 5-6 km x 3-3.5 km each. Coal seams are embedded in the coal-bearing formation of Early Cretaceous age. The basic geological structure is formed of a gently synclinal basin structure. The syncline axis trends northeast at the Southwest area and east-west at the Central area (Figure 62). The minable coal seam is one each at the both areas. The seam of the Central area shows 30-60 m in thickness. At the Southwest area, it has a maximum thickness of 60 m and contains many partings to split. By drilling at the point to the east of the Central area in 1992, a coal seam was confirmed at 90 m below the surface with a thickness of 60 m. The minable portion of the Central area appears to extend widely to the east.

#### 4) Coal quality

The coals are classified the same as the Early Cretaceous coal into Lignite B1-B2 (Mongolia, Russia) sub-bituminous C (U.S.A) and Lignite F (Japan -JIS). The typical coals contains 36.0% total moisture (as received), 13.9% ash (dry), 45.0% volatile matter (dry, ash free), 2.7% total sulfur (dry) and shows a calorific value of 3,070 kcal/kg (as received) and 6,300 kcal/kg (dry, ash free). Such high sulfur contents of 5.0% in maximum might be an impediment to utilize the coal. According to the Coal Laboratory of MEGM, it is reported that the coal has an available property for coal liquefaction such as low contents of Inertinite less than 10% by maceral analysis.

#### 5) Coal reserves

The coal reserves is estimated at 159.5 million tons of minable reserves (A + B + C<sub>1</sub>) for the Central area and 168.2 million tons of geological reserves (B + C<sub>1</sub> + C<sub>2</sub>) for the Southwest area. The total geological reserves of the deposit is presumed to be about 500 million tons.

#### 6) State of mining

There is not any activities for mining and/or exploration.

### (25) Sainshand Deposit

#### 1) Locality and topography

The Sainshand Deposit is within the Middle-East Megablock and at the north of Dornogovi Province. The center of the deposit is in latitude 44° 50'N and in longitude 110° 8'E, 18 km southwest of Sainshand which is the capital town of Dornogovi Province and one of main stations of the Trans-Railway connecting with Ulaanbaatar (Figure 42). The land surface of the



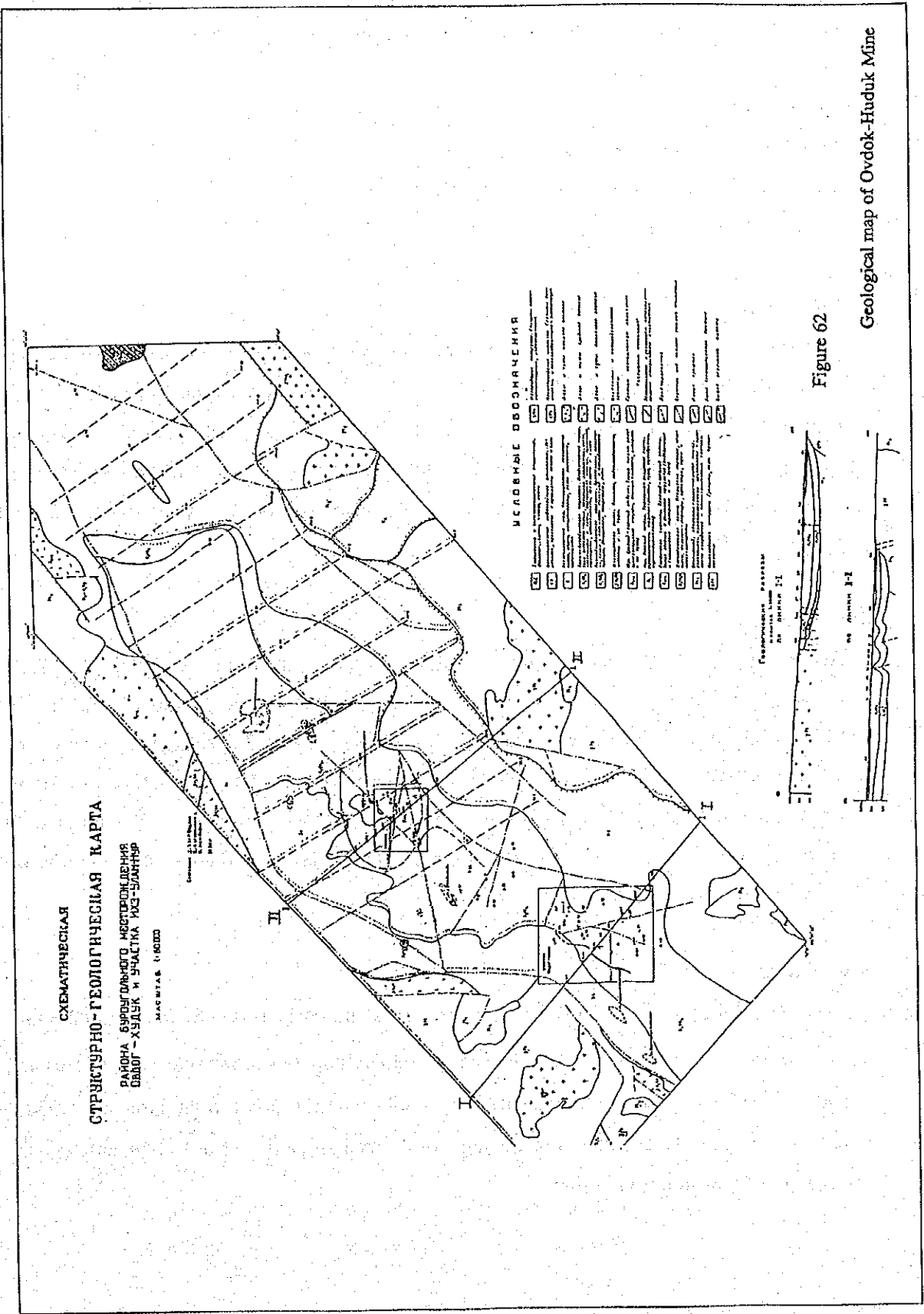


Figure 62

Geological map of Ovdok-Huduk Mine

deposit is about 1,000 m above the sea level and forms a flat semidesert.

## 2) History of exploration

1930's : Utilized by former Soviet Union's army

1939-40 : Exploration by former Soviet Union

- details unknown

## 3) Coal geology

The Sainshand Deposit belongs to the East Gobi Coal-bearing Basin. The details are not clarified, although the deposit is estimated as 10 km<sup>2</sup> in area. Coal seams are embedded in a coal-bearing formation regarded as of Jurassic age. The basic geological structure is formed of a folding structure with faults. The formation steeply dips 60-85°. The coal-bearing formation contains many thin coal seams, of which minable seams consist of three seams of 1-3 m in thickness. The details are unknown.

## 4) Coal quality

According to the former Soviet Union's report in 1940, the Sainshand coal contains 2.1-7.2% moisture (air dried), 6.1-25.7% ash (dry), 16.3-29.7% volatile matter (dry, ash free), 74-77% Carbon, less than 6% Hydrogen. The calorific value is 5,050-6,730 kcal/kg (base unknown). Taking into the geological age and low contents of volatile matter with high contents of Carbon, the coal is probably classified into G-GJ (Mongolia, Russia) High volatile bituminous B (U.S.A.) or Bituminous C-Subbituminous E (Japan-JIS). At the point of coal quality, the Sainshand coal is expected to be a high quality coal.

## 5) Coal reserves

According to the former Soviet Union's report in 1940, the coal reserves for the area of 2.3 km<sup>2</sup> within 120 m below the surface is estimated at 0.629 million tons of minable reserves (A + B), and total geological reserves for the area of 7.7 km<sup>2</sup> within 300 m below the surface is 1,052.8 million tons. The latter reserves is too large for the area to seem to be uncertain, although the ground of estimation is unknown.

## 6) State of mining

There has been no activity for mining since 1950's when the former Soviet Union's army worked up to 35 m below the surface by underground mining to utilize for its own fuel.

### (26) Hulstnuur Deposit

#### 1) Locality and topography

The Hulstnuur Deposit is present within the East Megablock and at the east of Hentiy Province. The center of the deposit is in latitude 48° 20'N and in longitude 112° 33'E, 65 km northeast of Bayan-Ovoo which is 120 km away from the capital town of Hentiy Province, Ondorkhaan. The deposit is close to the border with Dornod Province (Figure 63). The land surface of the deposit is about 1,000 m above the sea level and forms a flat to gently undulating steppe with lakes in the east of the deposit.

#### 2) History of exploration

1944 : Discovery of the coal deposit by former Soviet Union

1966-68 : Geological mapping survey

- recorded the deposit on the map

1980-81 : Exploration by Mongolia

- pre-detailed exploration at the north flank area

- detailed exploration at the northeast part (1.2 km x 1.2 km)

#### 3) Coal geology

The Hulstnuur Deposit belongs to the Choybalsan Coal-bearing Basin. The deposit shows a elongated basin extending for 12 km east-west long and 5 km north-south wide with an area of about 50 km<sup>2</sup>. Coal seams are embedded in the coal-bearing formation correlated with the Tevshingovi Formation of Early Cretaceous age. The basic geological structure is formed of a gentle synclinal basin structure with an axis tending east-west (Figure 64). The minable coal seams seem to occur restrictively at the north flank area of syncline and the east part in the deposit. The coal seams at the northeast part, at which the detailed exploration was conducted, strike west-northwest and dip 8-15° south in general. The coal-bearing formation contains a total of seven coal seams with a variable thickness and splitting, of which two seams, the Seam V (lower seam) and VII (upper seam), are minable at the northeast part. The Seam V ranges in thickness from 2 to 9.8 m and split toward the deep, and the Seam VII ranges from 9.0 to 32.6

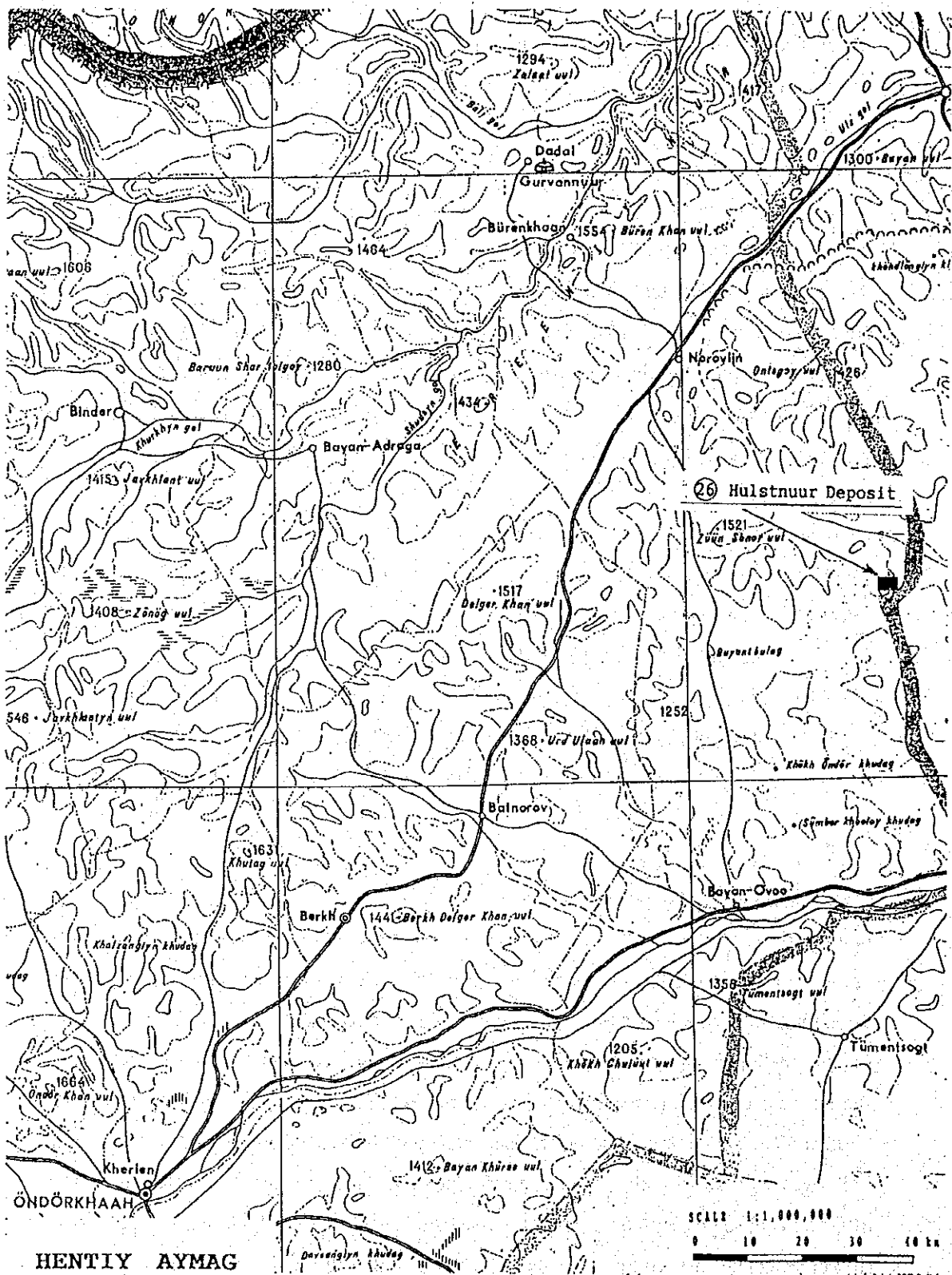
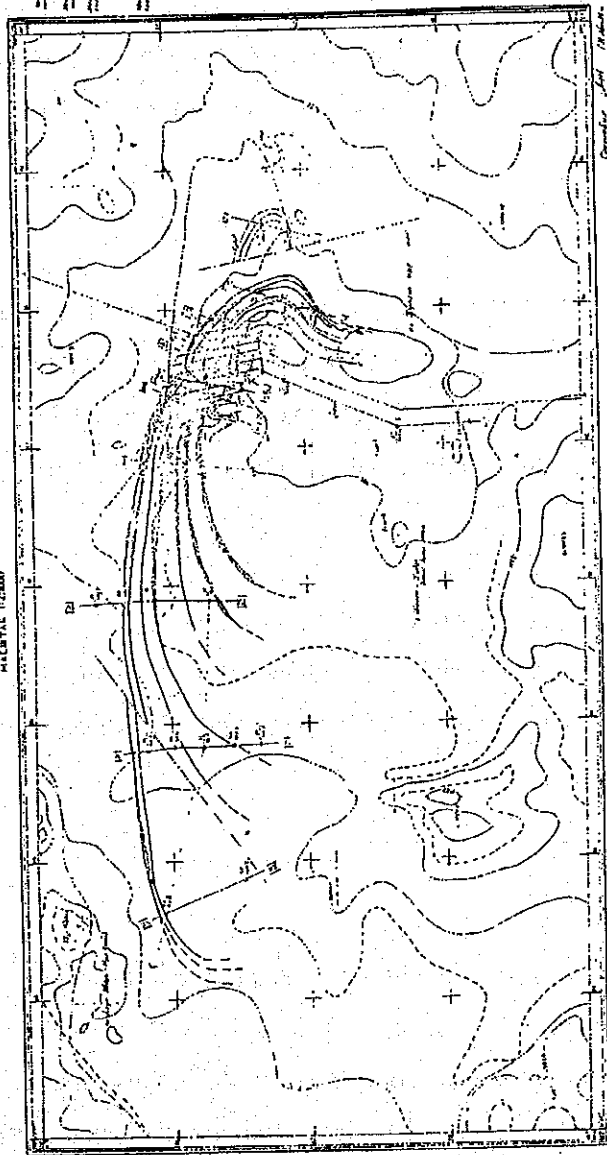


Figure 63 Deposit locality map in east of Hentiy Aymag

СХЕМАТИЧЕСКАЯ  
ГЕОЛОГИЧЕСКАЯ КАРТА  
МЕСТОРОЖДЕНИЯ ХУЛТ-НУР  
МАШТАБ 1:2000



СТРАТИГРАФИЧЕСКАЯ КОЛОННА  
Масштаб 1:2000

№	Имя	Содержимое	Ссылка
1	Песчаник	Средне- и мелкозернистый, слоистый	1:1
2	Глина	Среднезернистая, слоистая	1:1
3	Песчаник	Среднезернистый, слоистый	1:1
4	Глина	Среднезернистая, слоистая	1:1
5	Песчаник	Среднезернистый, слоистый	1:1
6	Глина	Среднезернистая, слоистая	1:1
7	Песчаник	Среднезернистый, слоистый	1:1
8	Глина	Среднезернистая, слоистая	1:1
9	Песчаник	Среднезернистый, слоистый	1:1
10	Глина	Среднезернистая, слоистая	1:1
11	Песчаник	Среднезернистый, слоистый	1:1
12	Глина	Среднезернистая, слоистая	1:1
13	Песчаник	Среднезернистый, слоистый	1:1
14	Глина	Среднезернистая, слоистая	1:1
15	Песчаник	Среднезернистый, слоистый	1:1
16	Глина	Среднезернистая, слоистая	1:1
17	Песчаник	Среднезернистый, слоистый	1:1
18	Глина	Среднезернистая, слоистая	1:1
19	Песчаник	Среднезернистый, слоистый	1:1
20	Глина	Среднезернистая, слоистая	1:1

- УСЛОВНЫЕ СОЗНАЧЕНИЯ
- 1. Песчаник
  - 2. Глина
  - 3. Песчаник
  - 4. Глина
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  - 19. Песчаник
  - 20. Глина

РАСЧЕТ ПО ДАННЫМ А-А'

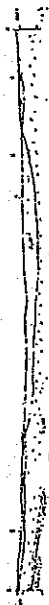


Figure 64 Geological map of Hulstnurr Deposit

m. There is formed of some lakes at the area where the occurrence of thick coal seam is presumed.

#### 4) Coal quality

The coals are classified the same as the Baganuur coal into B2 (Mongolia, Russia), Sub-bituminous C (U.S.A) or Lignite F (Japan -JIS). The typical coal contains 30.1% total moisture (as received), 10.19% moisture (air dried), 12.7% ash (dry), 47.5% volatile matter (dry, ash free), 0.66% sulfur (dry) and shows a calorific value of 4,430 kcal/kg (air dried) and 6,470 kcal/kg (dry, ash free).

#### 5) Coal reserves

For the northeast part of 1.2 km x 1.2 km, the coal reserves within 50 m below the surface is estimated at 11.2 million tons as minable reserves (A + B + C<sub>1</sub>) and 8.50 million tons as geological reserves (C<sub>2</sub>). Although the area and depth for calculation are unknown, a total of 171 million tons is estimated as additional geological reserves (C<sub>2</sub> + P).

#### 6) State of mining

Although a little coal is being utilized by local residents, there is no plan for development in large scale by MEGM at present. Because, the deposit is situated far from consumed sites, and groundwater of shallow level and existing lakes appear to impede the progress of opencut mining.

### (27) Tugrugnuur Deposit

#### 1) Locality and topography

The Tugrugnuur Deposit is present within the Middle-East Megablock and at the southeast of Tov Province. The center of the deposit is in latitude 46° 55'N and in longitude 108° 07'E, 150 km southeast of Ulaanbaatar, 110 km south of Nalaykh, 20 km southeast of the south end of the Tsaidamnuur Deposit, 20 km east from the Trans-Railway connecting with Ulaanbaatar (Figure 38). The land surface of the deposit is at 1,300 m above the sea level and forms a flat to gently undulating steppe.

## 2) History of exploration

- 1952 : Firstly recorded
- 1984 : Exploration (roughly) by Mongolia
  - drilling : 6 holes
  - trenching

## 3) Coal geology

The Tugrugnuur Deposit belongs to the Choir-Niarga Coal-bearing Basin. The deposit is regarded as extending 10 km x 10 km with an area of about 80 km<sup>2</sup>, although the extension of coal seams is not clarified because the exploration has not yet been conducted sufficiently. Coal seams are embedded, the same as the Baganuur, Shivee-Ovoo and Tsaidamnuur Deposits, in the Tevshiingovi Formation of the Dsunbayan Group in Early Cretaceous time. The geological structure is characterized by a dome structure accompanied with a synclinal fold around it (Figure 65). The coal-bearing formation occurs at the synclinal structure around the dome. The dip of coal seams appears to be gently less than 10°. There are two groups of coal seams the same as the seam conditions of the Shivee Ovoo Deposit, the upper and lower groups. A total of three drill holes encountered coal seams. One coal seam was observed at the Hole C-2 from 5.2 to 50.5 m in depth with a seam thickness of 45.3 m (Figure 66). Although the details on geological conditions, in particular coal seam conditions, have not yet been clarified, it is expected that the occurrence of coal is the same as one of the other deposits of Early Cretaceous age, such as the Shivee Ovoo Deposit and the Tsaidamnuur Deposits.

## 4) Coal quality

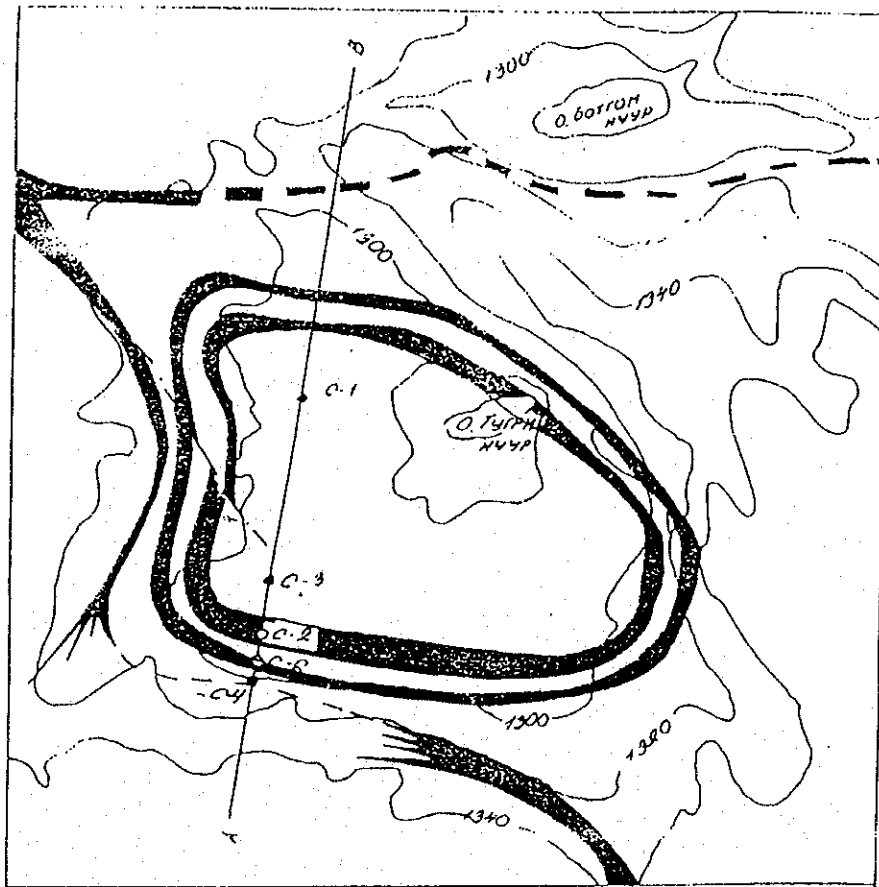
The coals are estimated to be classified into Lignite B2 (Mongolia, Russia) sub-bituminous C coal (U.S.A) or Lignite F (Japan -JIS). Although it can not be regarded as showing the typical quality because of restricted data, one coal sample contained 7.31% moisture (air dried), 14.89% ash (dry), 50.63% volatile matter (dry, ash free) and 0.81% sulfur (dry). The calorific value was 6.242 kcal/kg (dry, ash free).

## 5) Coal reserves

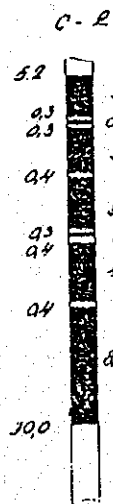
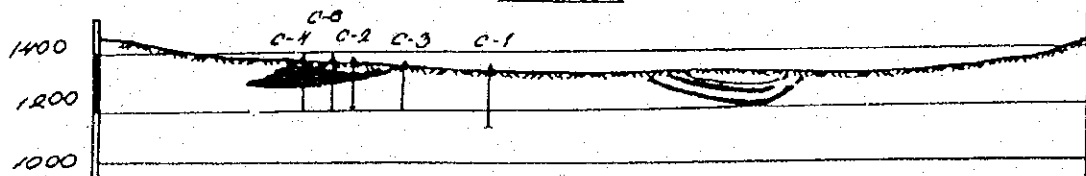
The total geological reserves for the whole deposit within 300 m below the surface is roughly estimated as 695 million tons, although the reliability is of scarcity because of the extremely low degree of exploration.



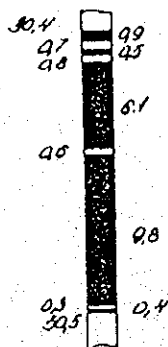




Рн А-В



продолжение C-2



C-4

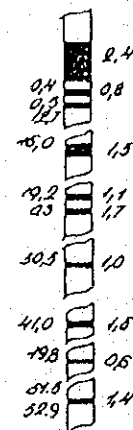
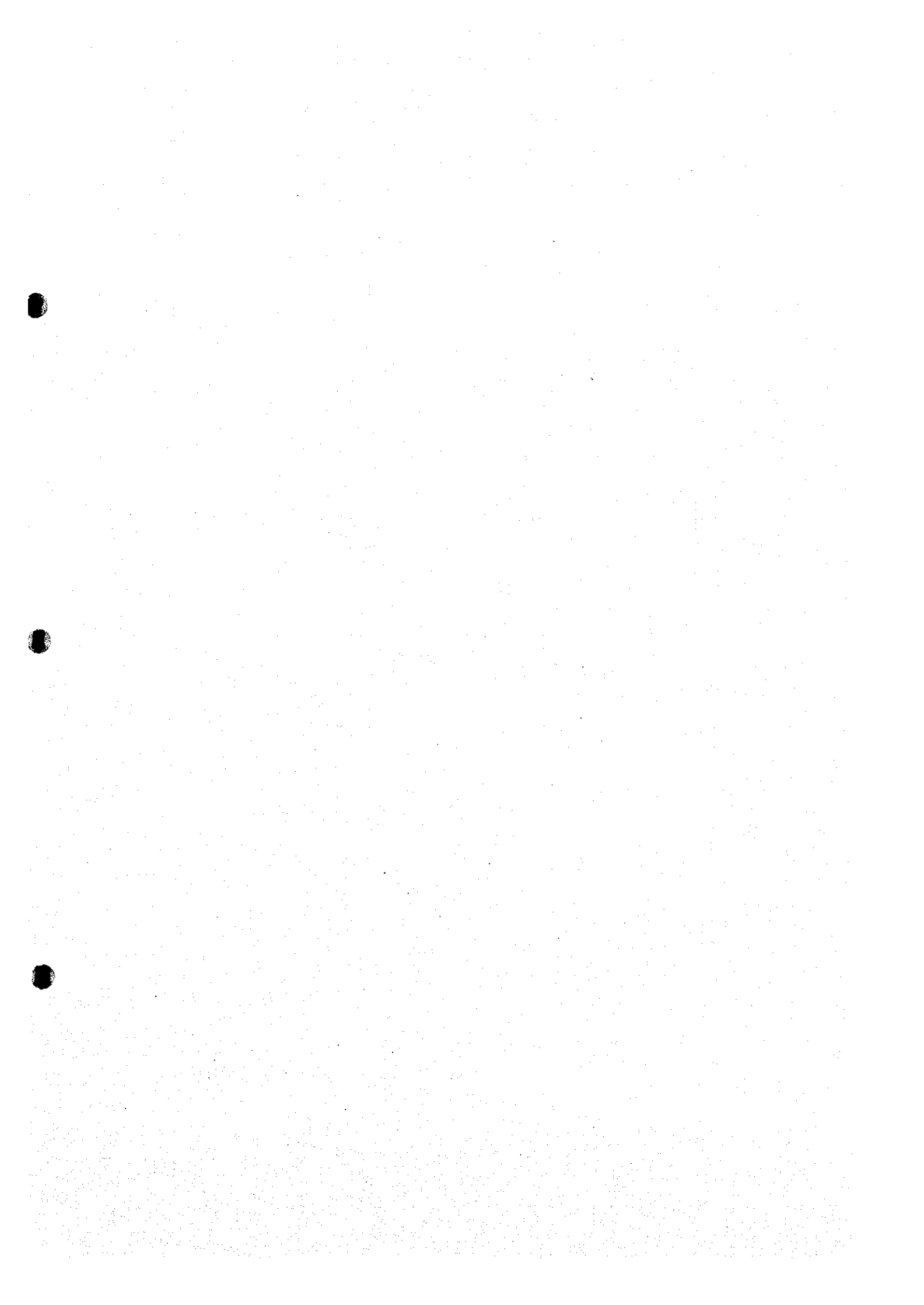


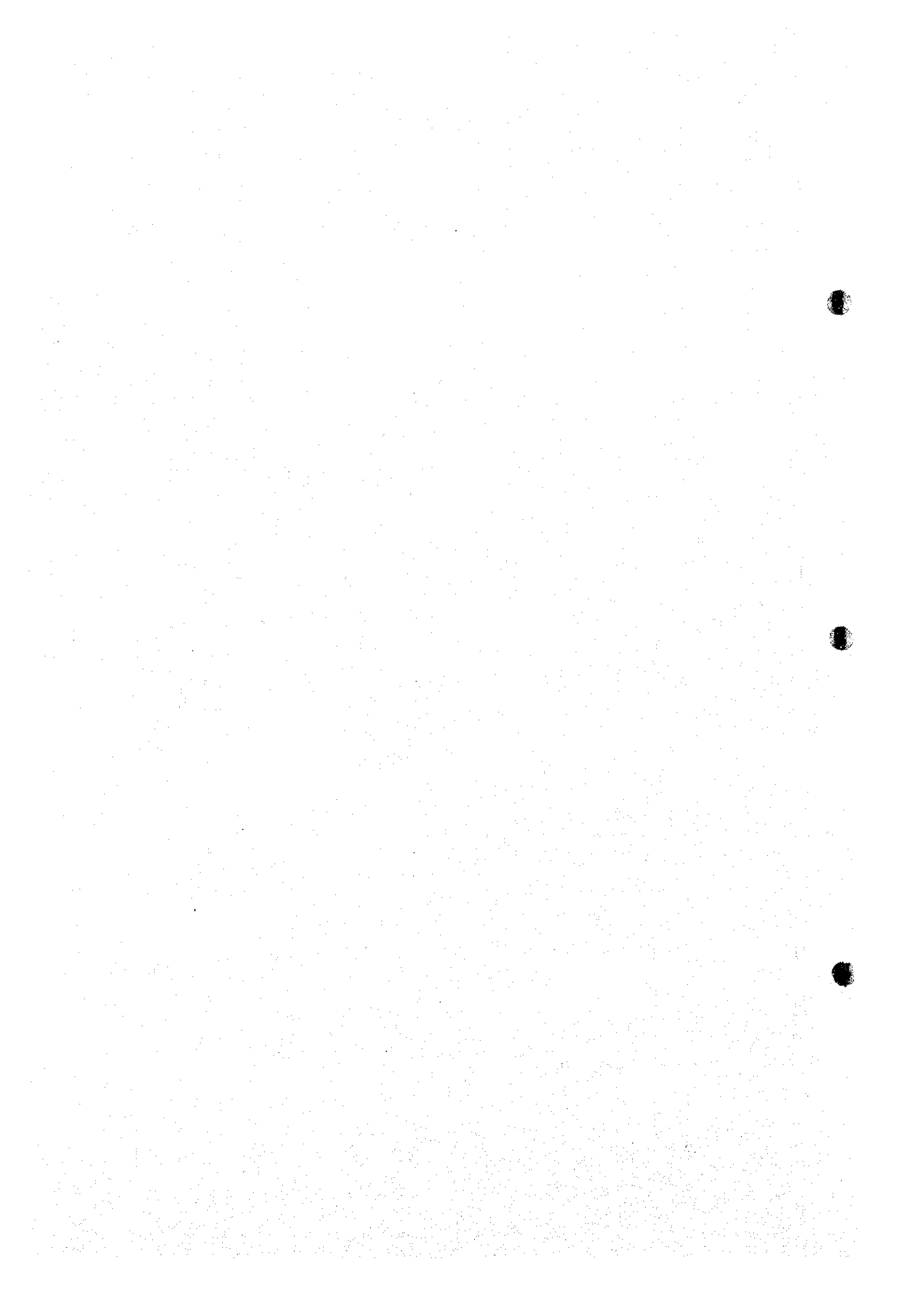
Figure 66

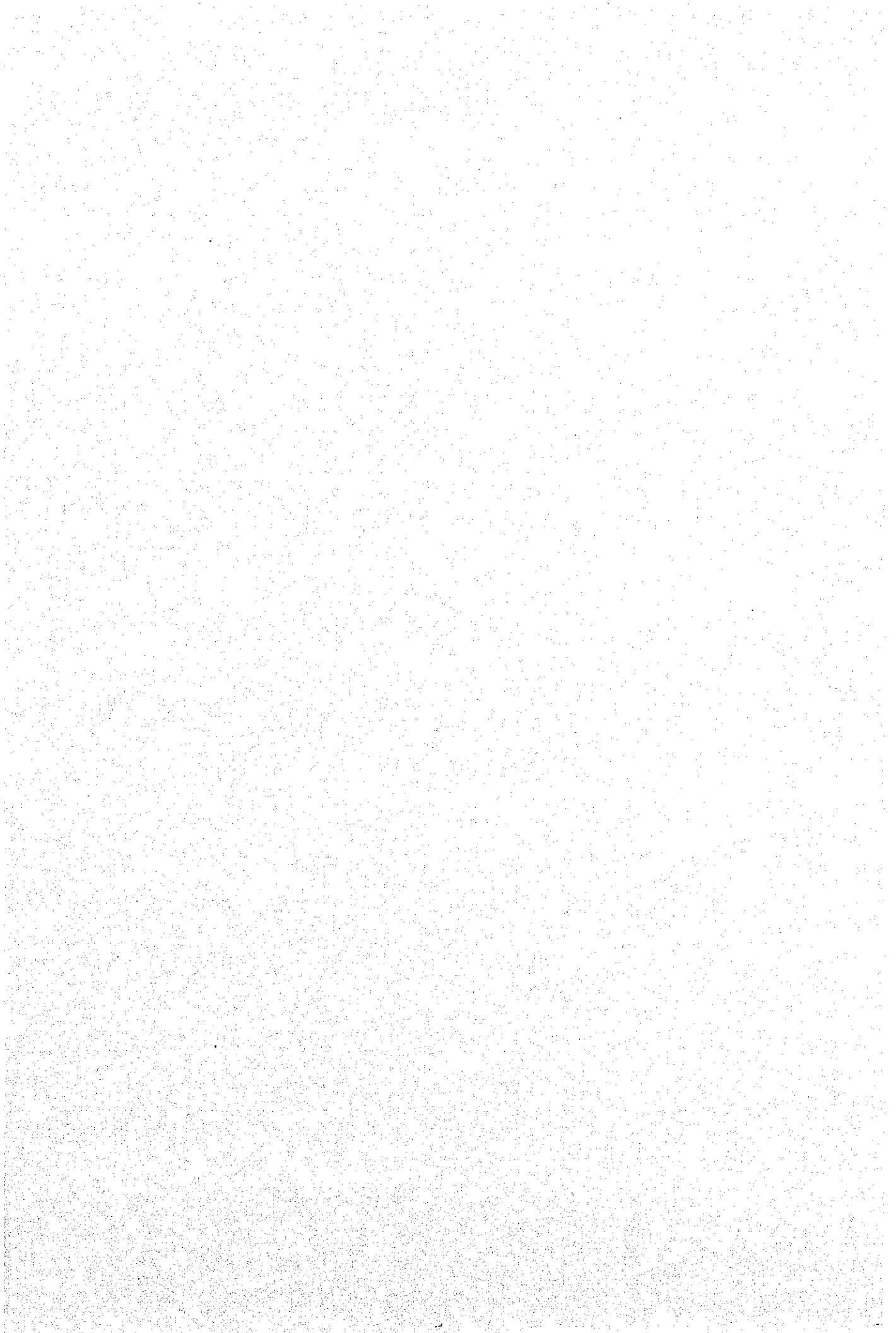
Seam conditions of Tugruguur Depopst

6) State of mining

There is not any activities for mining and prospecting.







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