AN INTERIM REPORT ON
THE PRE-FEASIBILITY STUDY FOR THE DEVELOPMENT
IN
TSAV AREA, MONGOLIA
(PHASE Ⅱ)

MARCH 1994

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

AN INTERIM REPORT ON
THE PRE-FEASIBILITY STUDY FOR THE DEVELOPMENT
IN
TSAV AREA, MONGOLIA
(PHASE Ⅱ)

MARCH, 1994

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

Preface:

In response to a request from the Mongolian government the Japanese government initiated geological surveys for the purpose of regional development in Tsav, located in the eastern part of Mongolia's Dolnot prefecture. These surveys were entrusted to Japan International Cooperation Agency(JICA). As the scope of these surveys is included in the field of geological and mineralogical sciences, JICA further commissioned the actual undertaking of the surveys to Metal Mining Agency of Japan(MMAJ).

This survey for the second year was conducted in 1993 by the Metal Mining Agency of Japan. We dispatched a survey team comprising eleven members (four of whom were sent to continue tunnel prospecting) from July 1 to September 4, 1993 to complete preliminary operations for the survey.

The survey was based on the detailed survey rules and regulations established on July 30, 1992. Between August 10 and December 5, 1993, nine investigators were additionally sent to conduct tunnel prospecting.

Thanks to the cooperation of the relevant institutions of the Mongolian government, our surveys were completed as scheduled.

This report represents the results of the second year survey and will form a part of the final report.

In closing, we would like to extend our deep appreciation to the related institutions of the Mongolian government, as well as the Ministry of Foreign Affairs, the Ministry of International Trade and Industry, the local area Japanese Embassy, and to each of the many persons involved.

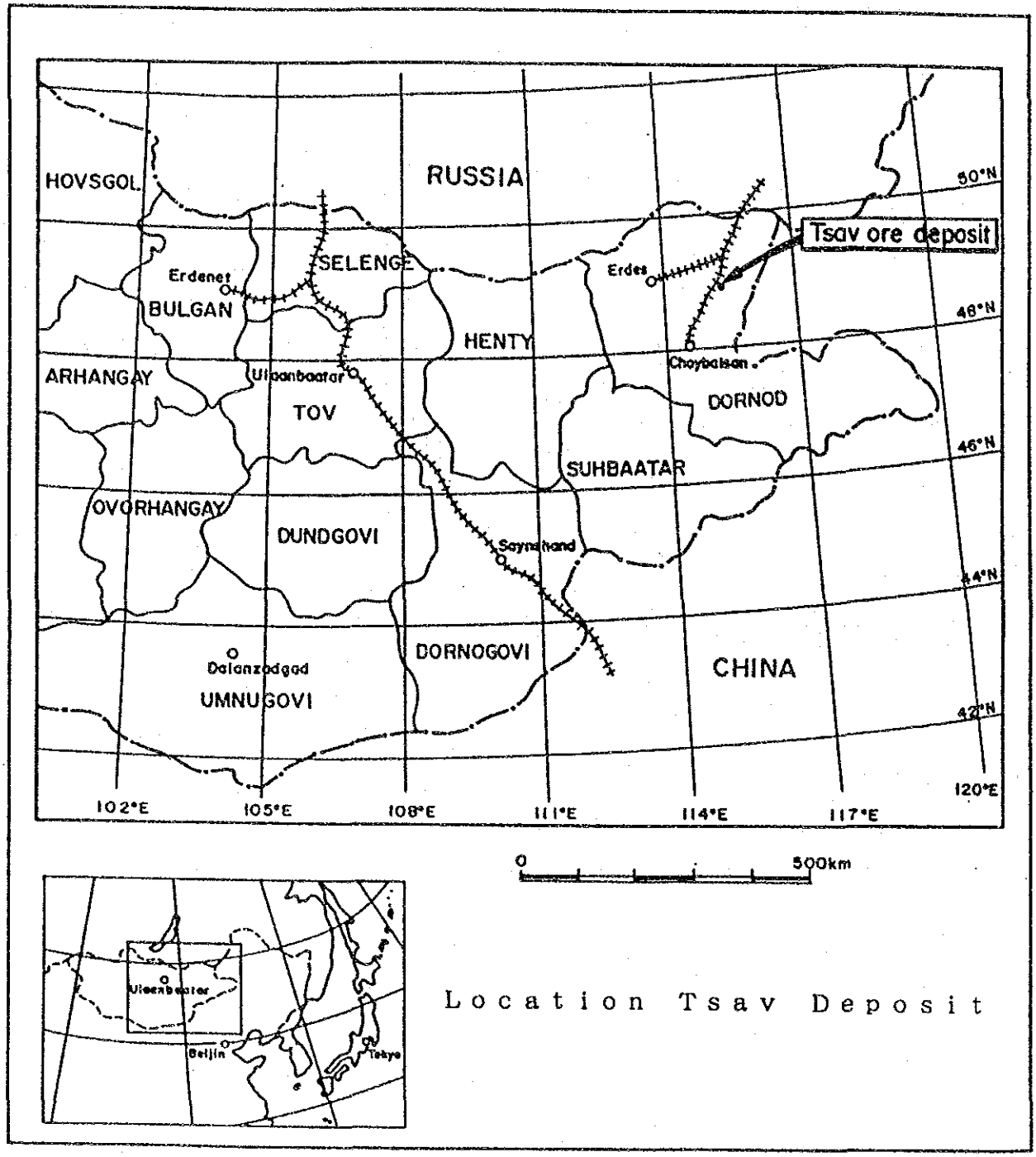
March 1994

Kensuke Yanagiya

Kensuke YANAGIYA
President
Japan International Cooperation Agency

Takashi Ishikawa

Takashi ISHIKAWA
President
Metal Mining Agency of Japan



Location Tsav Deposit

Contents

Table of Contents

Part I. General Remarks

Part II. Results of Tunnel Prospecting

Appendices

Part I GENERAL REMARKS

Part I. General Remarks

Chapter 1. Introduction

1.1 Purpose of the study

The purpose of the study is to carry out tunnel prospecting and drilling at upper parts from the level 180m (630m above sea level) of the Tsav deposits to explore the fourth vein where the investigation is most advanced, and to draw up a mine development plan through the exact recognition of the characteristics of the mentioned vein, as well as through mineral processing test to be conducted on the collected minerals. The tunnel prospecting comprises the excavation of a inclined shaft from the surface and a drift at -60m level (750m above sea level), while the drilling is carried out inside the tunnel as well as from the surface.

The study also aims to promote technology transfer pertaining to exavation, mining and machinary control by means of those works and training of counter parts in Japan.

1.2 Scope of the study

Mongolia possesses an exceptional potential for the production of virtually all types of metal ores producing, presently, copper, molybdenum, tin, and fluorite. Through tapping and development of its resources, it is expected that Mongolia will also become an important supplier to the world increasing demands for copper, lead, and zinc, etc in the future.

The reform of Mongolia's economic structure has steadily progressed since 1987. However, in recent years, the scale of its resource development efforts has scaled down considerably due to the diminished technological cooperation from the former Soviet Union and other Eastern European Countries. This decrease of Mongolia's mineral resource industry, an industry vital to the foreign currency earnings of the nation, has caused the industry to enter a period of stagnation.

Our concentrated studies in Tsav, an area in the northeastern section of Mongolia's Dolnot prefecture, indicate an exceptional potential for a commercially feasible mine. The Mongolian government has also expressed a strong interest in the development of the area, and in

February of 1992 made a request for Japanese the technical cooperation to detect the potential of polimetallic deposit (lead, zinc, copper, and silver) in the area.

The development of a new mine will have a significant effect on the economic growth of Mongolia while at the same time it we'll lead to the increase of additional stable supply source of metal ore resources for Japan. From these perspectives, Japan decided to positively support the development of this area making arrangements for new budget for the development program study and project implementation preparation.

Under these circumstances, Japan dispatched a preliminary stydy team and held a conference with the Mongolian government regarding the study to be conducted. And, in July 30, 1992, the rules and regulations for the escavation of study were established.
Under these formally established rules and regulations, a study team consisting of seven members was consigned to the designated area between August 31 and September 19 and the framing for the study was initiated.
Based on the frame were prepared from July 1 to December 5, 1993, 20 investigators in total were sent to conduct tunnel prospecting.

Chapter 2. Topographical conditions of the designated area.

2.1 Location and transportation

The Tsav mineral deposits are in the Somon area of the Choybalsan district of the Dolnot prefecture in the eastern region of Mongolia. It is located approximately 120 kilometers northeast of Choybalsan City (refer to map the location map). The first survey area, conducted in 1989, encompassed an area of approximately 45 km^2 and included the Tsav ore deposits. As indicated on the map, this area is located between a north latitude of 48° 50′ to 49° 00′ and an east longitude of 115° 15′ to 115° 30′. The geographical coordinates at the heart of the Tsav ore deposits which includes an area of approximately 12 km^2 is at a north latitude of 48° 55′ 40″ and an east longitude of 115° 20′ 33″.
Approximately 5 kms west of the Tsav ore deposits is the main trunk line of the Siberian Railway which runs in a southerly direction from Siberian Railway's Bolsha Station across the border towards Choybalsan to Elentsav (Sorobefusuku), and then on to Choybalsan (Bayan Toumen).

The distance to the neighboring Habilka Station is approximately 17 kms.

An unpaved road which is manageable throughout the year runs between the Tsav ore deposits and Choybalsan. It takes approximately three hours by car. In July of 1992, a new customs house (the name in Chinese reads 35 Kokuzantou Customs) was established at the border of the autonomous Chinese Mongolian State located approximately 50 kms eastsoutheast of the Tsav ore deposits. For three months following July thecustoms house conducted business during the first half of each month. From the Tsav ore deposits the customs house can be reached by unpaved road in approximately ninety minutes.

2.2 Topography

The Tsav topography is a moderate one which includes a small but long, extinct volcano and a hilly terrain undulating intermittently with open plains. Its topography is characteristic of mountainous regions. The slope gradient of the Tsav ore deposit area does not exceed 5 to 10 degrees. It is a moderately hilly terrain with smooth slopes. The highest peak is 825 meters above sea level. The difference between the lowest mountain ridge and valley is 50 to 80 meters.

2.3 Vegetation and Climate

Vegetation of the Tsav ore deposit area is typical of steppe lands with a variety of grain plants and an absence of trees. The nearest wooded area is located towards the northwest and is approximately 150 kilometers away.

The climate reflects characteristics that are typical of a continental dry environment. The daily and annual changes in temperature and atmospheric pressure is striking. Winter consists of many windy days with little precipitation. On the average, annual snowfall does not exceed 80 to 150 millimeters. The daily temperature changes in spring are severe. Dry air, strong winds, and sand storms are characteristic of that season. Summer is short and mild. The temperature differences between day and night are severe. The primary wind direction is northwest with an average speed of three to five meters per second. The maximum wind speed is between 20 to 25 meters per second. The average temperature throughout the year is 0℃. The lowest recorded temperature is -37.5℃ (1987). The highest recorded temperature is -37.5℃ (1982).

According to the Choybalsan meteorological observatory, the average annual rainfall for the region is 244 millimeters. However, according to the Eldes Town (Maludai Mine) observatory, the average annual rainfall is 402 millimeters.

The table belows show the average temperature and rainfall on a monthly basis (source, the Eldes meteorological observatory).

Month	1	2	3	4	5	6	7	8	9	10	11	12
Temp. (℃)	-20	-18	-8	0	+11	+16	+18	+16	+9	+1	-10	-17
Rainfall (mm)	3	2	4	11	15	51	91	117	36	3	7	3

The depth of the frozen earth surface in winter is between 2.4 to 4.2 meters. By the end of June, it completely thaws. There are not permanently frozen surfaces in the designated area. There are no continuously flowing springs or watercourses in the vicinity of the Tsav ore deposits.

Chapter 3. Outline of the study in this year(1993)

Under the framework that were designed in 1992, the following tunnel prospecting was conducted

(1)Name :regional development program study
(2)Investigation area :Tsav area, Mongolia
(3)Period :1993, 06, 24～1994, 02, 25
(4)Content of Study :Tunnel Prospecting and Temporary Construction etc

- Mine mouth :construction of Portal
  Width 8.0(m) x Height 6.0(m)x Thickness 0.8(m)
- Tunneling
  - Quantity
    - Inclined Shaft :247.4m
    - Waste Pit :30 (15x2 places)
    - Depository :130m^3 (65x2 places)
    - Transformer Station :15
    - Pump Station :15
    - Project Section :11.92m^2 (Width 4.0(m) x Height 3.4(m))

Project Gradient
of Inclined Shaft:8° 30'
Project Direction
of Inclined Shaft:N68° 30' E

・Temporary Construction

Fuel Storage	:setting Tanks(Gasoline, Light Oil Kerosene)etc.
Electricity	:setting Control Panel, Switch Board etc
Comunication	:Setting INMARSAT, Interphone 10 sets, etc
Power Station	:setting Generator(750KVA X 2units) Contorol Panels and Fuel Tank, etc
Air Supply	:laying Pipe(4" x 30m)
Water Supply	:(A)Drinking water supply
Drainage	: setting Tank, Pump, Pipe(2" X 250m with heat insulator)etc (B)Underground water supply setting pipe(2" X 250m with heat insulator)etc (C)Deep-Well-Pump setting Pump, Pipe etc
Ventilation	:setting Fan(Contrafan 75kw), FRV Air Duct(800m/mϕx271m)

・Building & Repair

Dormitory

Building of Gel	:5 Geles of 10mϕ, 3Geles of 6mϕ included a dining room, bathroom toilet, kichen and laundry

Office

Building of Gel	:2 Geles of 10mϕ included toilet
Workshop	:(Width 12.0(m) x Length 20(m) x Height 7.75(m)) included 5t traveling crane, service pit
Gurage	:6 Containeres
Improvement of Power Station	:setting Gate Doors, Windows

Improvement of
Magazine :setting Gate Doors

Chapter 4. Progress Schedule

	Content of Study	Quantity	June	July	August	September	October	November	December	Junuary	Febrary	Note
1	Mobilization											
2	Transportation											
	Procurement											
	Temporary Construction											
	Fuel storage											
	Electric-Comunication											
	Power station											
	Air Supply											
	Water Supply											
	Drainage											
	Ventilation											
	Building & Repairs											
	Dormitories											
	Office											
	Workshop											
	Garage											
	Power Station											
	Magazine											
3	Mine-Portal											
	Tunneling											
	Inclined Shaft	247.4m										
	Waste Pit	30										
	Transformer Station	15m³										
	Depository for Vehicle	130										
	Pump Station	15										
	Floor Concreting											
4	Transportation											
5	Demobilizatin											
6	Report											

Part Ⅱ Results of Tunnel Prospecting

Part Ⅱ. Results of Tunnel Prospecting

Chapter 1. Summary of the study

1.1 Purpose of the study

The purpose of this study was to analyze the conditions of the deposit and study the geography of the Tsav deposit in the Tsav region, Mongolia, and to draw up a mine development plan. The survey also aimed to transfer technologies to Mongolian institutions through the tunnel prospecting.

1.2. Study Site

Based on the location of the foot wall of the forth deposit (X coordinate: 77,989.0; Y coordinate: 22,386.9) and at an elevation of 790 meters in the Tsav deposit, we dug a canal at N68° 30'E and gradient 8° 30' to form a mine mouth.

1.3 Summary of each excavation work

1) Inclined shaft

Excavation was based on a blasting method which combined a hydraulic mobile jumbo (drilling machine) and LHD (an abbreviation for "load, haul, dump" and comprising a diesel-operated wheel loader for the mine interior), using the trackless method. We used the burn-cut method for blasting, while adopting the smooth blasting method to blast the outercircumference of the tunnel so as to leave the rock mass undamaged. We used steel timbering or rockbolts for support, where necessitated according to the conditions of the rock after the excavation.

2) First Waste pit

We began excavating 15 meters along the horizontal pit in the direction of 30° from the inclined shaft direction at 126 meters from the beginning of the inclined shaft. We used the same method as that used in the inclined shaft excavation works.

3) Transformer Station

We extended the width of the left side at 134 meters from the beginning of the inclined shaft. We used virtually the same excavation method as that used in the inclined shaft excavation works. (Because a free surface existed, we did not use the burn-cut method).

4) Pump Station

We extended the width of the left side at 142 meters from the beginning of the inclined shaft. We used the same excavation method as that used for the transformer station.

5) First Depository

We extended the width of the right side at 158 meters from the beginning of the inclined shaft. We used the same excavation method as that used for the transformer station.

6) Second Depository

We extended the width of the right side at 223 meters from the beginning of the inclined shaft. We used the same excavation method as that used for the transformer station.

7) Second Waste pit

We began excavating 15 meters along the horizontal pit in the direction of 30° from the inclined shaft direction at 243 meters from the beginning of the inclined shaft.

1.4 Study method

1.4.1 Length of drift

Work	Project	Result
Inclined Shaft	247.4m	247.4m
Type 1	20.7m	20.7m
Type 2	25.2m	25.2m
Type 3	21.0m	21.0m
Type 3-1		36.2m
Type 4	180.5m	144.3m
First Waste Pit	15.0m	16.5m
Second Waste Pit	15.0m	15.0m
First Depository	65.0m^3	65.0m^3
Second Depository	65.0m^3	65.0m^3
Transformer Station	15.0m^3	15.0m^3
Pump Station	15.0m^3	15.0m^3
Total	277.4m 160.0m^3	278.9m 160.0m^3

1.4.2 Specifications of drift

(1) Effective section for each drift

	Area(m^2)	Width(m) x Height(m)
Inclined shaft type 1	13.42	(4.3 x 3.55)
Inclined shaft type 2	13.67	(4.35x 3.575)
Inclined shaft type 3	11.96	(4.0 x 3.4)
Inclined shaft type 3-1	13.32	(4.0 x 3.4)
Inclined shaft type 4	11.96	(4.0 x 3.5)

(2) Gradient of inclined shaft

8° 30´ (degree)

(3) Height of mine mouth

787.1m

(4) Direction of inclined shaft

N 68° 30´ E

1．4．3 Main Equipment

Equipment	Specifications	Quantity	Note
Drill Jumbo	Hydraulic 2 Boom	1	use as rock-bolt
Mortal Charger Car	TOYOTA Hilux	1	Mortal Pump(MM151)
Load Haul Dump	3.8m³ class	2	
Explosive Chager	TOYOTA Hilux	1	AN-FO charger(75Kg)
Compressor	21m³/min	1	
Mini-Back-Hoe	0.1m³ class	1	with Breaker
Jack-hammer	30Kg class	2	
Track	2t, attached with crane	1	
Track	1t, Hilux, WCabin	1	
Wagon	Landcruser 80type	1	
Wagon	Landcruser 70type	1	
Generator	750KVA	2	
Generator	55KVA	1	
Generator	10KVA DCA-13SPK	2	
Submersible Pump	5.2KW BS-2102HT	3	
Submersible Pump	2.2KW BS-2066	2	
Deep-well Pump	3.7KW SP-5A-19type	2	
Fan	1,000mmφ, 300mmAq, 75Kw	1	
Car Washer	Pressure 65Kg/cm²	1	
High-speed Cutter		2	
Baby-Compressor	3.7P-14V5, 230 Liter	1	
Electric Welder	BPZ-400-3	2	
Engine Welder	BLW-150SS	1	
Feed-Pump	25BISND5.4	1	
Fuel-Pump		2	for vehicles
Fuel-Pump		1	for generator
INMARSAT Communication		1	
Travelling Crane	5t electric crane	2	

1.4.4 Form of Work

① Working time

staff	9:00～18:00
first shift	9:00～17:00
second shift	17:00～ 1:00
third shift	1:00～ 9:00

② Number of Men

Member of Japanese study team		
Engineer	20	persons (including 7 supervisors)
Member of Mongolian study team		
Staff	12	persons (including 3 foremen)
Driller	6	
Mechanic	3	
Electrician	3	
Operator of Generator	3	
Surveyor	2	
Kitchen worker for Japanese	3	
Kitchen worker for Mongolian	4	
Clerk	3	
Lodge keeper	4	
Driver	3	
Laundry and sweeping worker	2	
Assistnt worker for mongolian	5	
Interpreter	4	

1.4.5 Dormitory

For dormitory, the Japanese servey team built Gels (five buildings of ten meters in diameter and three buildings of six meters in diameter). Additional facilities included a dining room (one building of ten meters in diameter), four buildings serving as bathroom/toilet facilities (20 feet containers), a kitchen and a laundry (both 40 feet containers). Drinking water was carted from a tank at a well dug by the former Soviet Union and located six kilometers from Tsav. This was stored in a 50-cubic-meter tank. A septico tank with capacity to treat 21 persons processed polluted water.

The Mongolian side built a wooden prefabricated office which doubled as dormitory (52.5 meters x 12.5 meters).

Electricity was supplied to buildings for both parties using an

independent 750 KVA power generation system.

1.5 Organization of study teams

(1)Japanese team

Name	Duty	Company
Kunitoshi OE	General Manager	(MINDECO)
Mamoru OOSHITA	Chief Admistrator	(〃)
Yoshio OONO	Chief Mecanical Engineer	(〃)
Michihiko HASEGAWA	Chief Electrical Engineer	(〃)
Hisayoshi FURUMORI	Chief Foreman for Tunneling	(〃)
Yukou TAKAHASHI	Chief Foreman for Tunneling	(〃)
Masanao WASHIYA	Chief Foreman for Tunneling	(〃)
Kazuo YOKOKAWA	Vice Foreman for Tunneling	(〃)
Hideo MIZUGUCHI	Vice Foreman for Tunneling	(〃)
Masaki SUMIYA	Vice Foreman for Tunneling	(〃)
Rikio OOE	Vice Foreman for Tunneling	(〃)
Minoru YAMAMOTO	Vice Foreman for Tunneling	(〃)
Hiroyuki HASHIMOTO	Vice Foreman for Tunneling	(〃)
Takeshi NAMIKI	Supervisor for Mecanical Engineer	(〃)
Yukikazu KAWAUCHI	Supervisor for Mecanical Engineer	(〃)
Iwao SASAHARA	Supervisor for Mecanical Engineer	(〃)
Yasuyuki KITAJIMA	Supervisor for Civil Engineer	(〃)
Kouji OOSHITA	Supervisor for Electrical Engineer	(〃)
Naoto OONOBORI	Supervisor for Electrical Engineer	(〃)
Hiroshi FUKAMI	Supervisor for Electrical Engineer	(〃)

MINDECO :MITSUI MINERAL DEVELOPMENT ENGINEERING CO.,LTD.

(2)Mongolian team

Name	Duty	Company
Lodoin AYUR	General Project Manager Director of TSAV Company	(MGMR and TSAV Company)
R.BATBAYAR	Chief Engineer	(TSAV Company)
Y.LUTBAATAR	Tunnel Superintendent	(〃 〃)
N.TSOLMON	Economist	(〃 〃)
B.halzan	Administration Manager	(〃 〃)
D.MUNHTSETSEG	Chief Accountant	(〃 〃)
SH.NAMHAINYAMBUU	Electrical and mechanical Engineer	(〃 〃)

TS. NOROVSAMBUU	Chief Geologist	(〃 〃)
V. HURELTUMOR	Foreman for Tunneling	(〃 〃)
L. HURELBAATAR	Foreman for Tunneling	(〃 〃)
B. BAATARHUU	Foreman for Tunneling	(〃 〃)
TS. DASHZEVGE	Foreman for Treasurer	(〃 〃)

MGMR :THE MINISTRY OF GEOLOGY AND MINERAL RESOURCES OF MONGOLIA

Appendices

1. Progress Schedule

	Content of Study	Quantity	June	July	August	September	October	November	December	Junuary	Febrary	Note
1	Mobilization		28	1	5	9						
2	Transportation			6								
	Procurement			1					1			
	Temporary Construction											
	Fuel storage			1		16						
	Electric·Comunication				28							
	Power station				27							
	Air Supply						30					
	Water Supply				19							
	Drainage				30							
	Ventilation					3			30			
	Building & Repairs											
	Dormitories				8							
	Office					10	9					
	Workshop				8							
	Garage						10	20				
	Power Station				3							
	Magazine					20		10				
3	Mine-Portal			1		3						
	Tunneling											
	Inclined Shaft	247.4m				26			29			
	Waste Pit	30					26	28	29	1		
	Transformer Station	15m³						1 3				
	Depository for Vehicle	130						4 6		25 27		
	Pump Station	15						1 3				
	Floor Concreting											
4	Transportation											
5	Demobilizatin					4 9			5 9			
6	Report											

2. Tunnel Prospecting

Period	Starting Date		1993, 07, 01						
	Tunnel Starting Date		1993, 08, 26						
	Tunnel completing Date		1993, 12, 01						
	Completing Date		1993, 12, 05						
Required days			up-to-1993, 12, 01			up-to-1993, 12, 05			Note
			day	rate (%)		day	rate (%)		
	Tunnel		84	63.2	54.6	84	61.3	53.2	10days are double
	Construction		49	36.8	31.8	49	35.8	31.0	
	Others					4	2.9	2.5	
	Sub-total		133	100.0	86.4	137	100.0	86.7	
	Day off		21		13.6	21		13.3	
	Total		154		100.0	158		100.0	
Required men			Tunnel		Construction		Others		Note
	Worker	Interior	580						
		Exterior	1,755		1,569		124		
	Engineer	Interior	1,840						
		Exterior			1,267		88		
	Total	Interior	2,420						
		Exterior	1,755		2,836		212		
	Total		4,175		2,836		212		
Efficiency			up-to-1993, 12, 01			up-to-1993, 12, 05			Note
	per working day		1.86			1.81			
	per tunneling day		2.95			2.95			
	per required day		1.61			1.57			
	per required man		0.035			0.034			
Timbering	number of timbering		85			85			
	length of timbering(%)		103.1m (41.7%)			103.1m (41.7%)			

3.. Details of required days for Tunneling

Works		Period of tunneling							Breakdown		Additional construction								
		Construction	day	tunnel	day	Dismantle	day	Total	working	day off	Generator	day	Dormitory	day	Workshop	day	Floor Concrete	day	Total
Preparation		7/1～8/25	day 56		day		day	day 56	day 49	day 7	7/6～9/2	day 59	7/1～8/23	day 54	7/1～8/18	day 49		day	day
Inclined Shaft				8/26～11/29	92			92	78	14							11/12 11/17～20 11/27	6	
First Waste Pit				10/26～10/28	3			3	3										
Second Waste Pit				11/29～12/1	3			3	3										
Transformer Station				11/1～11/3	(3)			(3)	(3)										
Pump Station				11/1～11/3	(3)			(3)	(3)										
First Depository				11/4～11/6	(3)			(3)	(3)										
Second Depository				11/25～11/27	(3)			(3)	(3)										
Demobilizatin						12/2～12/5	4	4	4								12/1～3	3	
Total			56		98		4	158	158	21		59		54		49		9	

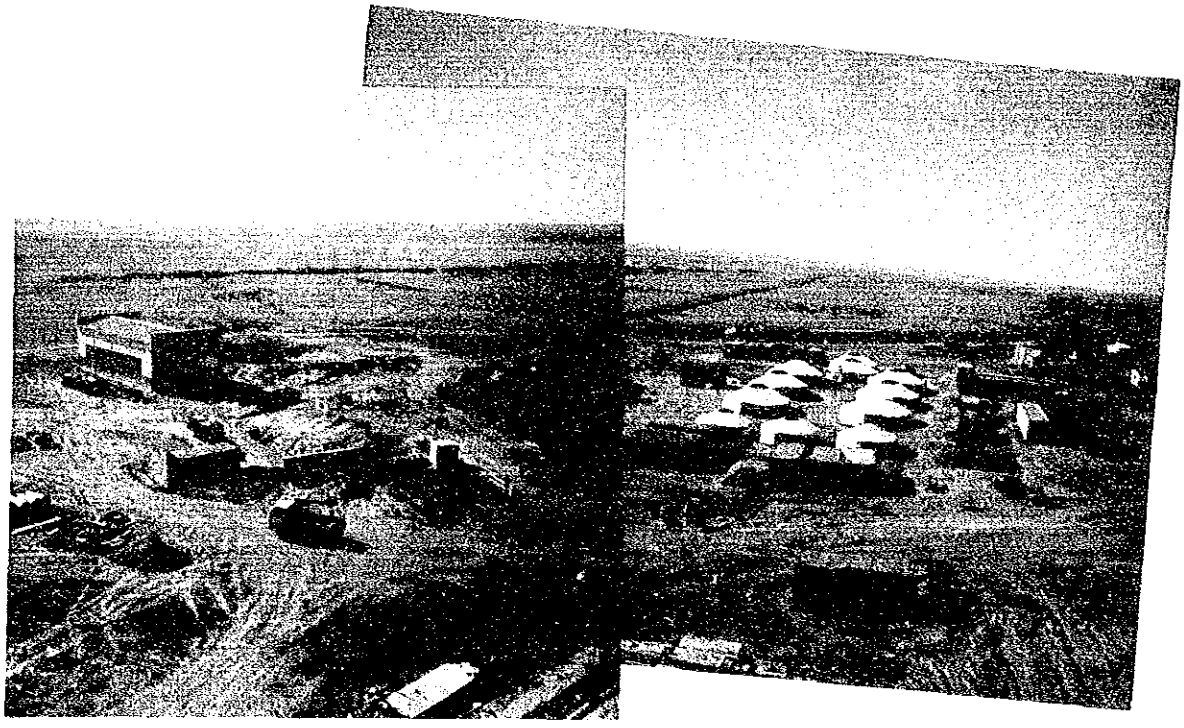
4. Each Work Progressive Efficiency

Works		Number of shift		Number of person		Each Working Time									
		Tunneling Shift	Total Shift	Engineer	Worker	Driling	Loading Hauling	Other's Interior	Other's Exterior						Total
Preparation		Shifts	Shifts 49	persons 1,267	persons 1,569	h	h	h	h 19,160						h
Inclined Shaft		229	229	1,715	2,144	609	483	7,229	17,152						
First Waste Pit		9	9	66	95	27	18	427	760						
Second Waste Pit		8	8	59	96	34	29	260	768						
Transformer Station		(3)	(3)												
Pump Station		(3)	(3)												
First Depository		(5)	(5)												
Second Depository		(5)	(5)												
Demobilization			4	88	124				992						
Total		246	295	3,195	4,028	670	530	7,916	38,832						

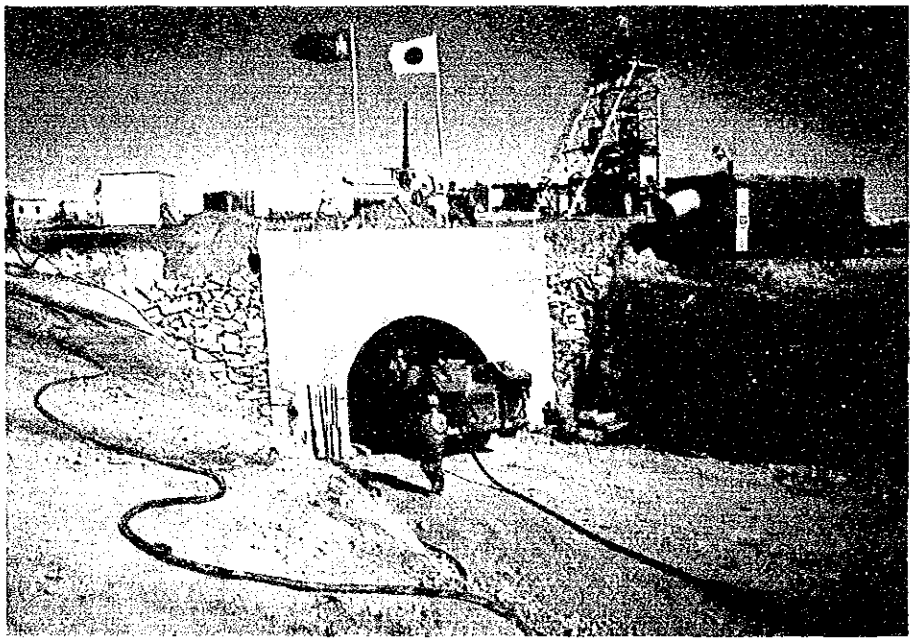
5. Item of Consumptive Materials in 1993

Article	Specifications	Quantity	Note
Bit		pieces	
	51m/mφ R32	66	
	89m/mφ R32	12	
	38m/mφ R28	55	
	insert	10	
Rod			
	38m/mHEX L=3,700	28	
	32m/mHEX L=2,365	15	
Shankrod			
	38m/mφ HD-150	20	
Sleeve			
	38m/mφ	31	
	38/32m/mφ	15	
Explosive			
Ammonita		7,524Kg	
Detonator		7,122 pieces	
Timberings	Inclined Shaft		
	Type 1	28 set	
	Type 2	21	
	Type 3	14	
	Type 3-1	27	
Rock-bolt	22m/mφ L=2.0m	1,244 pieces	
Pipe			
	2inch	1,060.5m	
	4inch	1,057.1	
Light Oil		181,428 liter	
Gasoline		2,279	
Kerosene		13,400	
Lubricant			
	Engine Oil 10#	800	
	Engine Oil 30#	800	
	Engine Oil 40#	3,800	
	Hydraulic Oil 32#	1,200	
	Ger Oil 75#	400	

Photograph



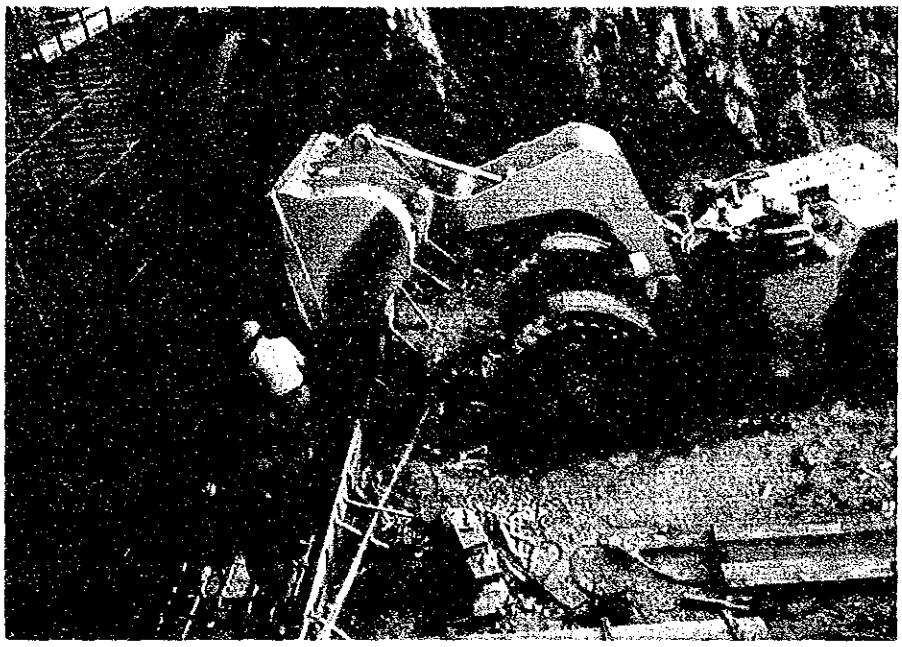
General view of Tsav



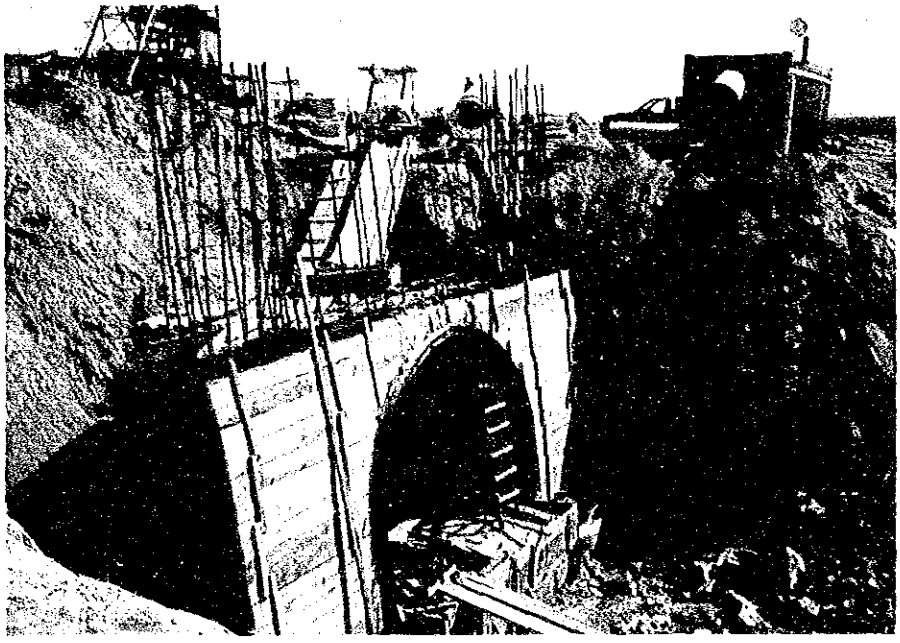
Mine portal

Excavation of mine portal

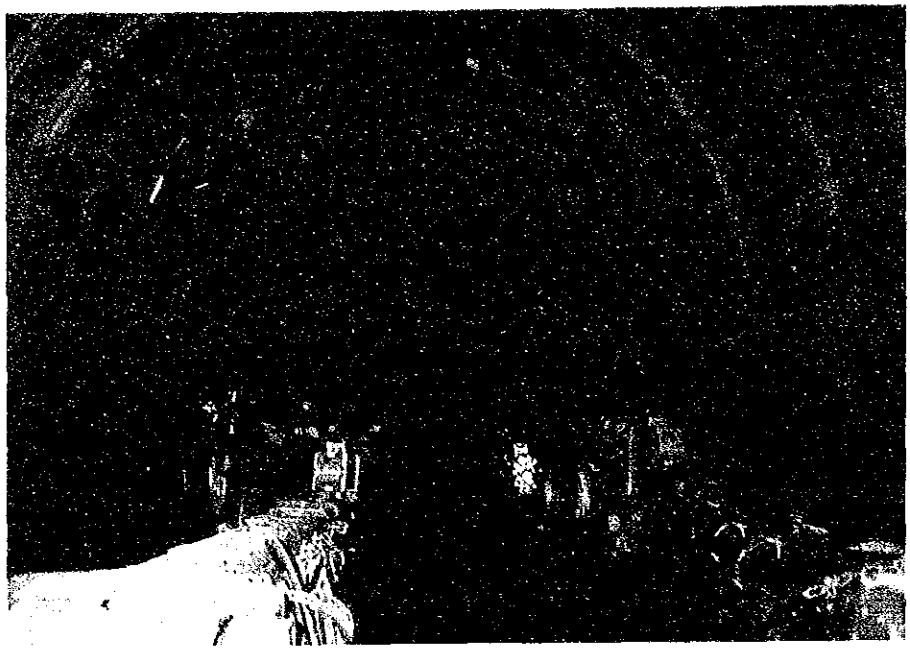
Construction of mine portal (frame)



Construction of mine portal (base)

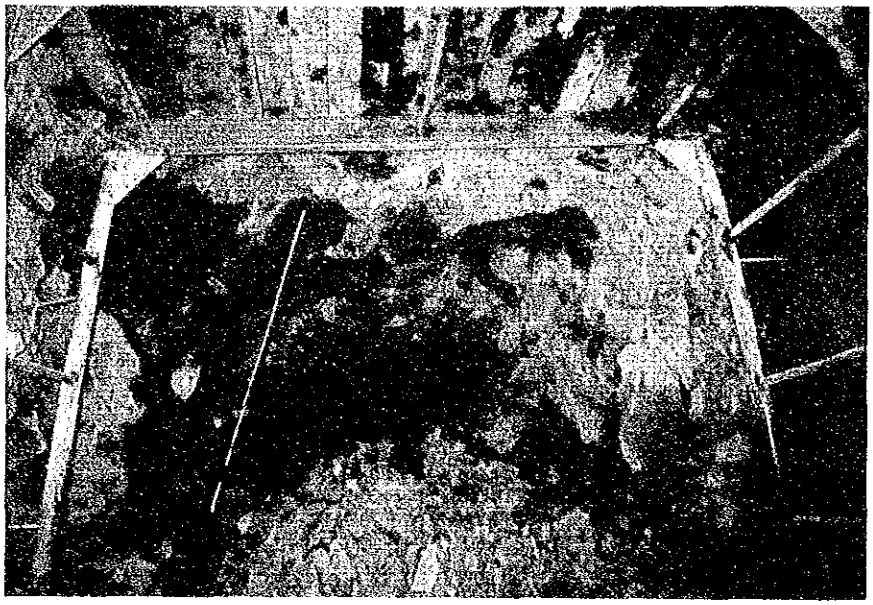


Construction of mine portal (assemble)



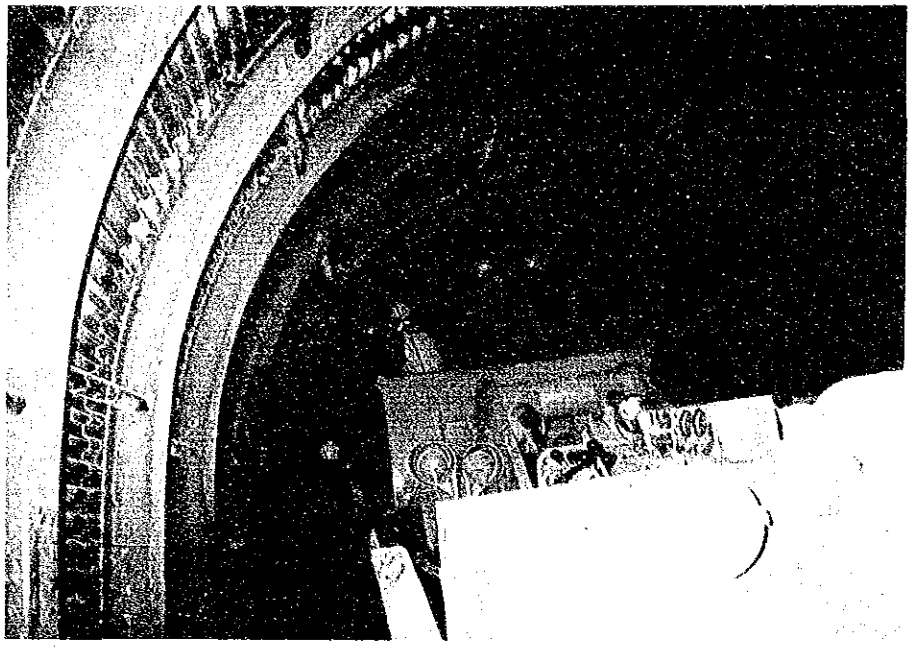
Drilling (hydraulic jumbo)

Charging explosive



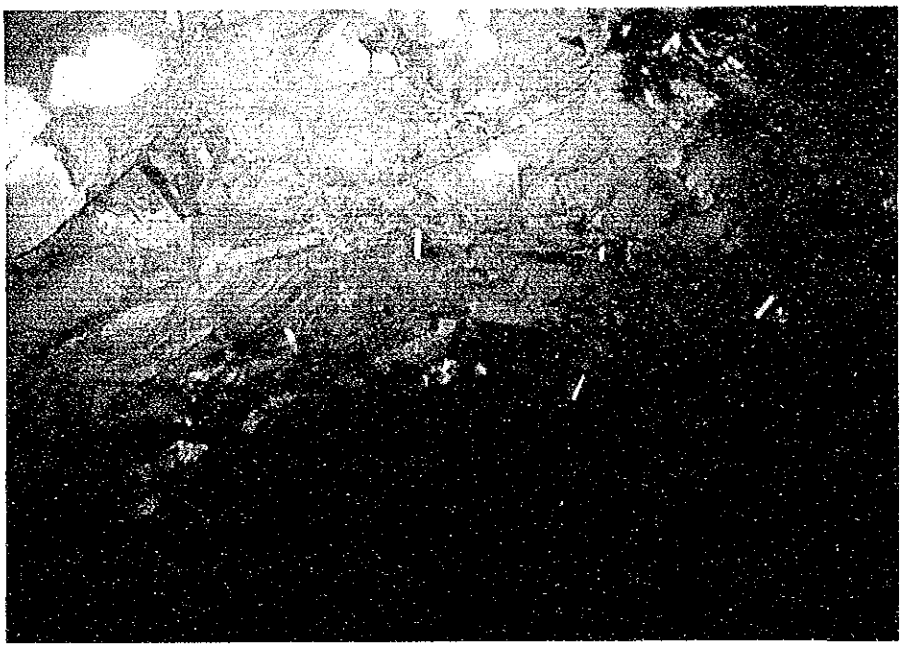
Scaling

Excavation for timbering

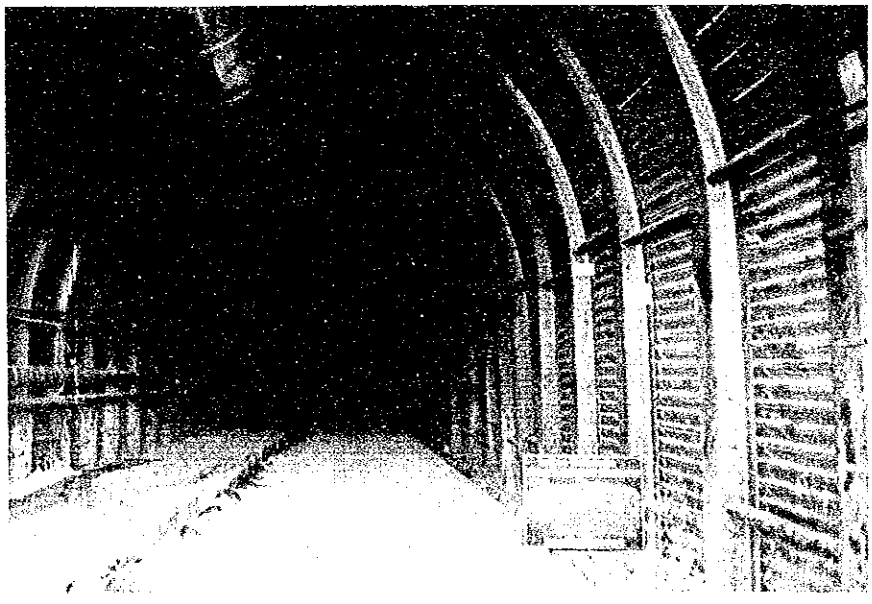


Timbering

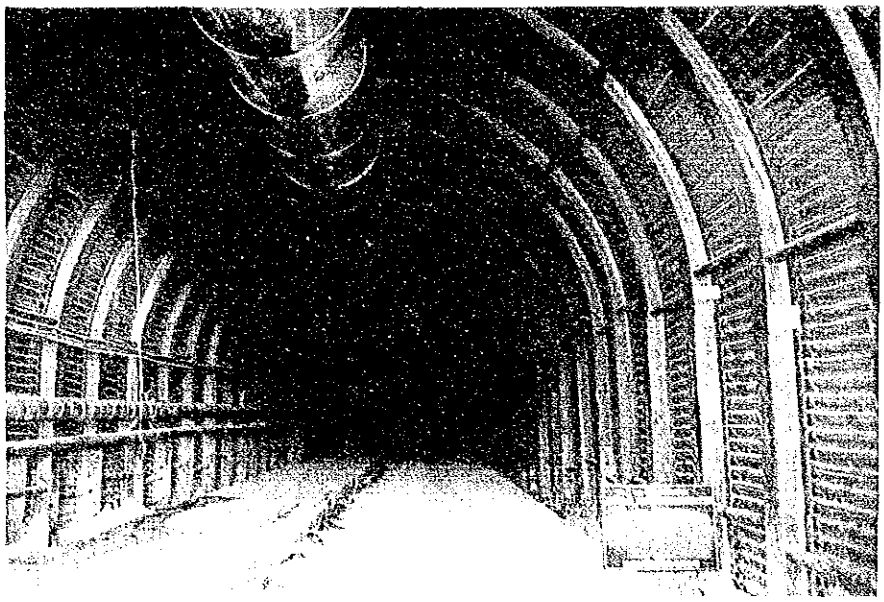
Timbering (steel board)



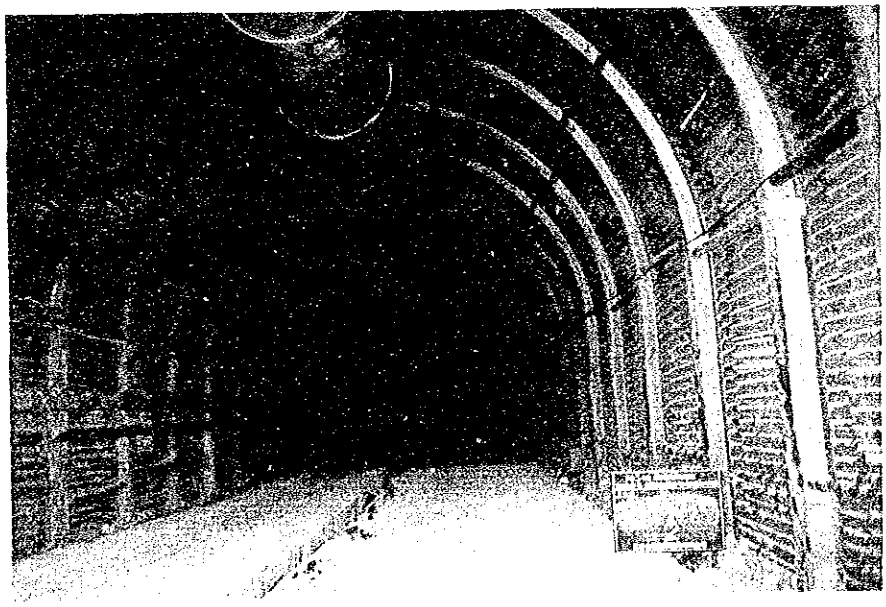
Rock-bolt (type 4)



Starting point of tunneling in 1993



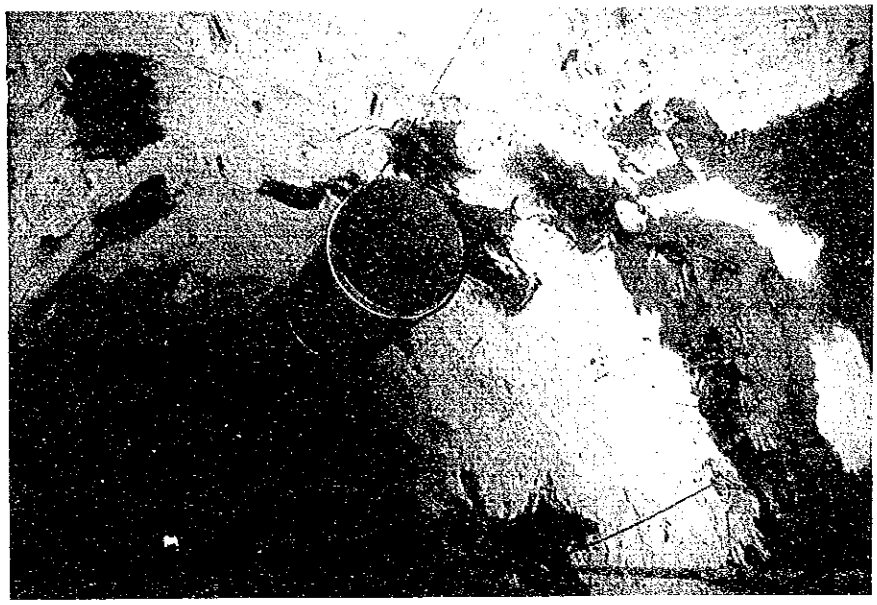
Inclined shaft (type 1)



Inclined shaft (type 2)

Inclined shaft (type 3)

Inclined shaft (type 3-1)

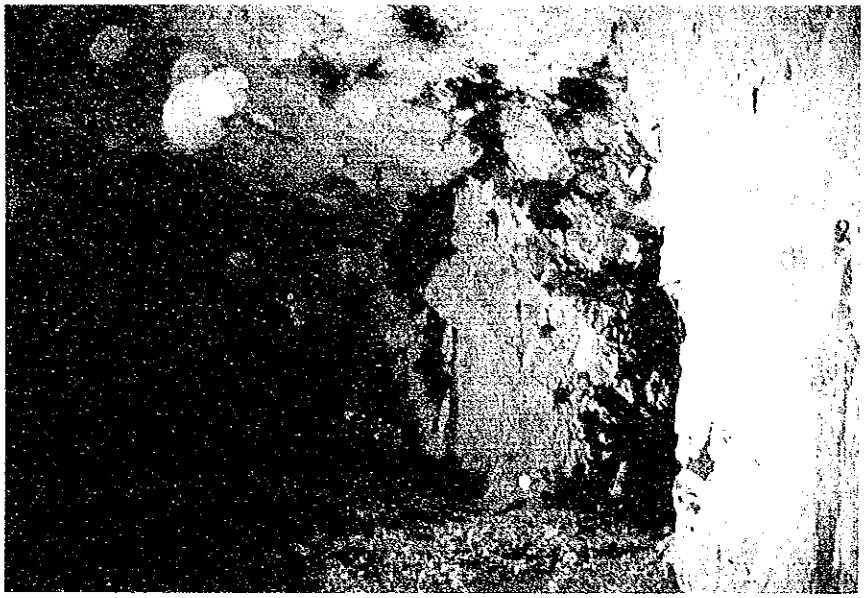


Inclined shaft (type 4)

First waste pit

Transformer station

Pump station

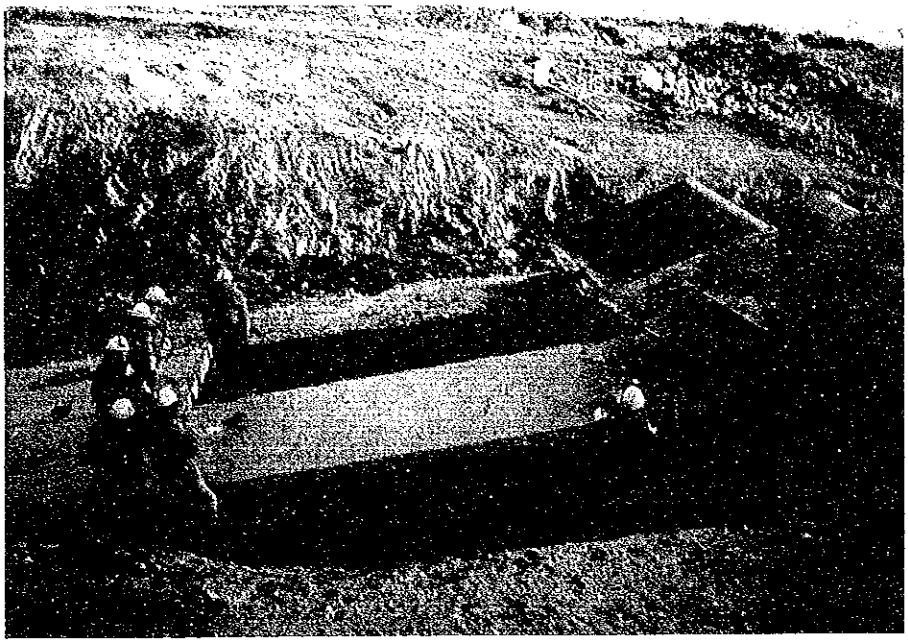


First depository for heavy machines

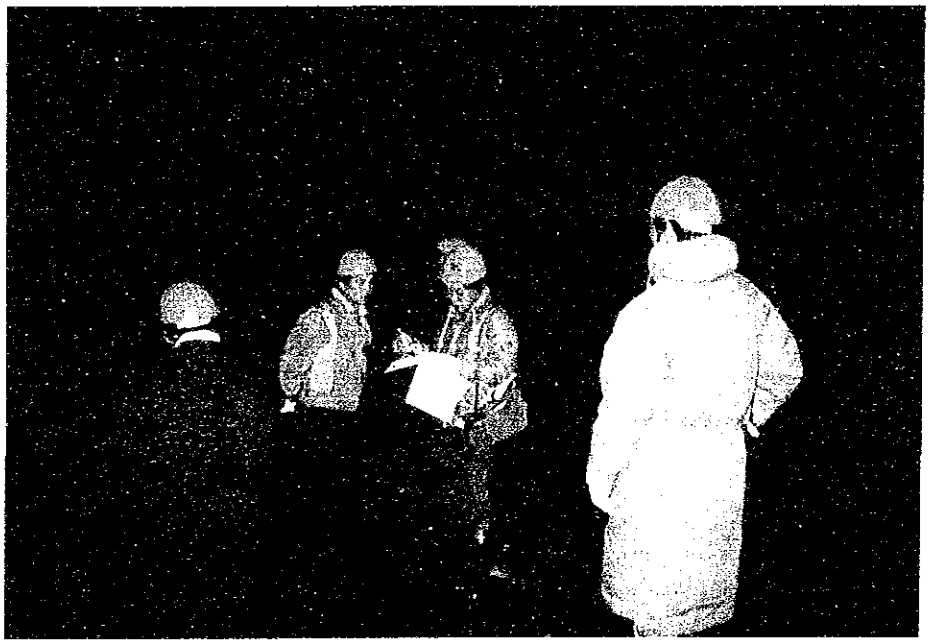
Second depository for heavy machines

Second waste pit

Termination point of tunneling in 1993

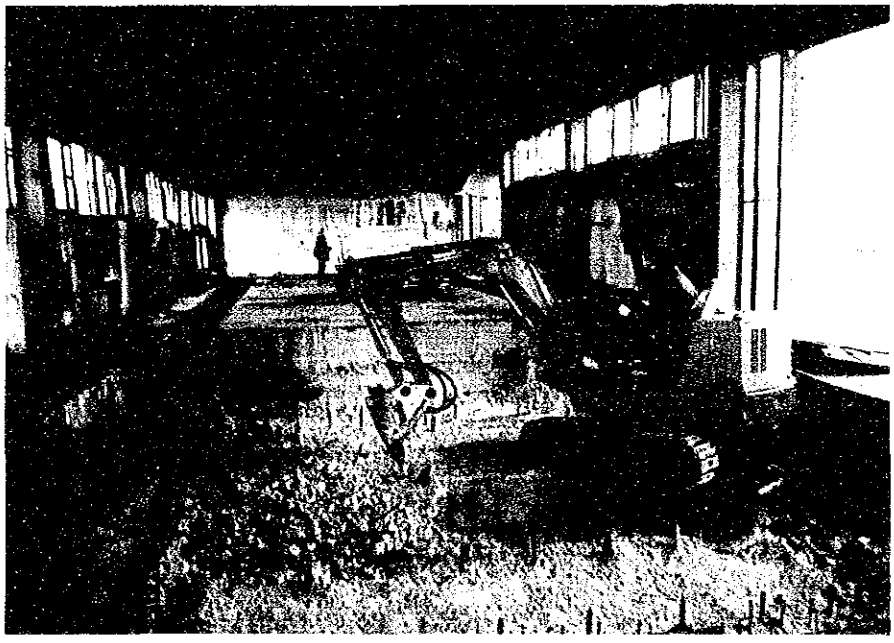


Establishment of PC plate



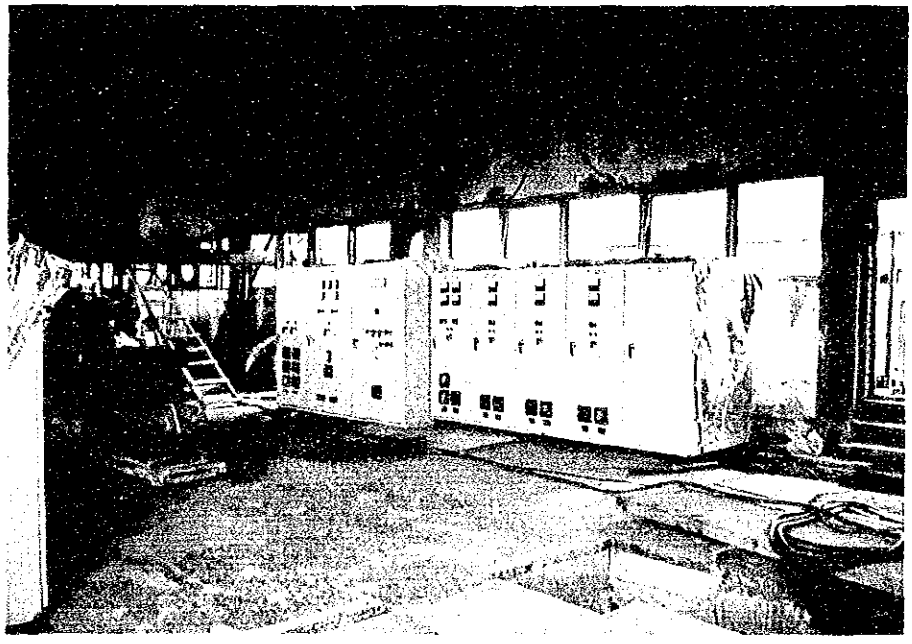
Inspection by MMAJ

Establishment of TV-antena



Base for generator

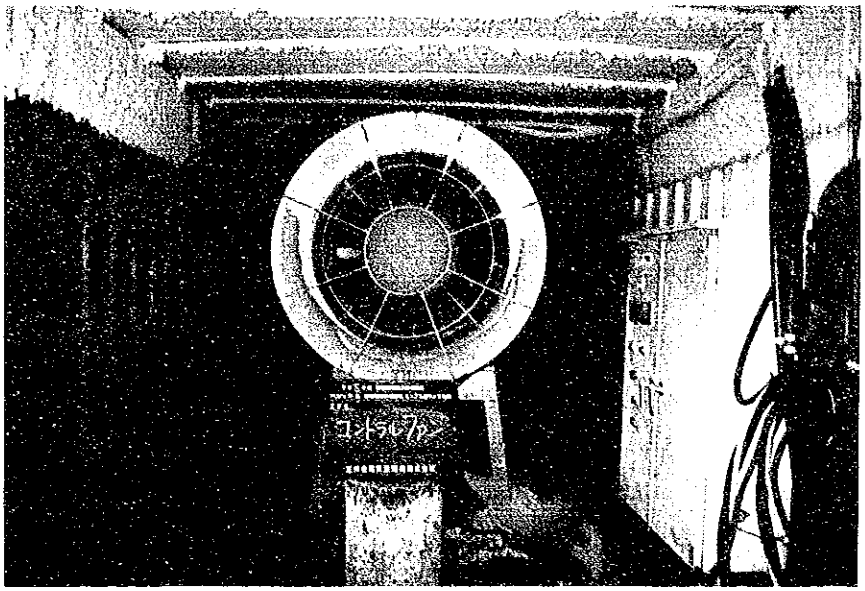
Establishment of 750 KVA generator



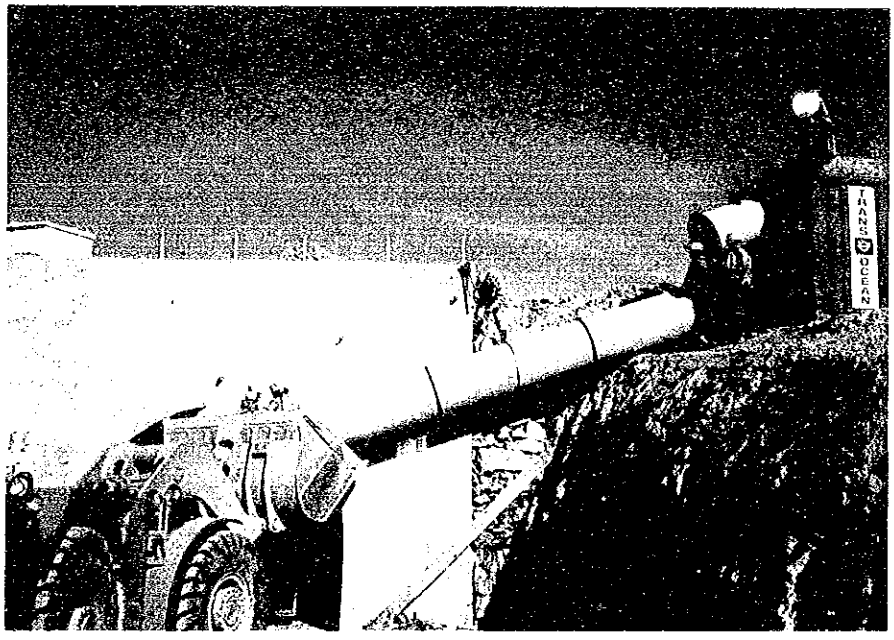
Control panel for generator

Establishment of deep-well pump

Establishment of water tank

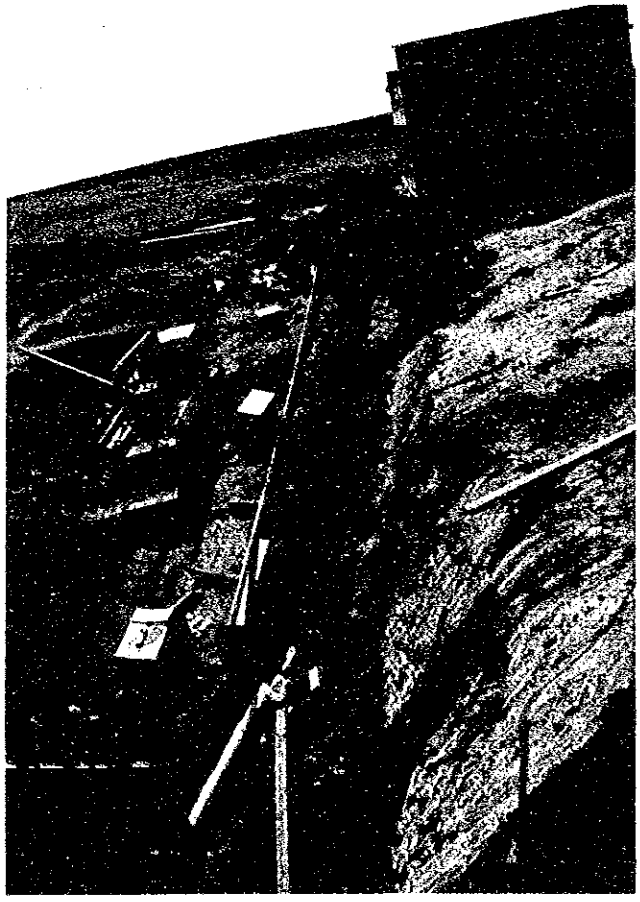


Establishment of fan

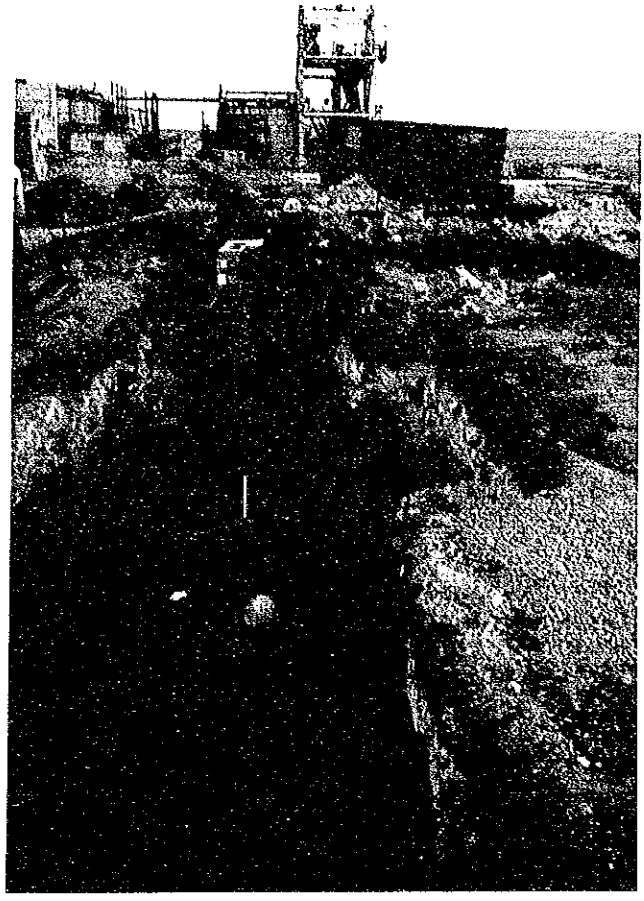


Establishment of ventilation tube

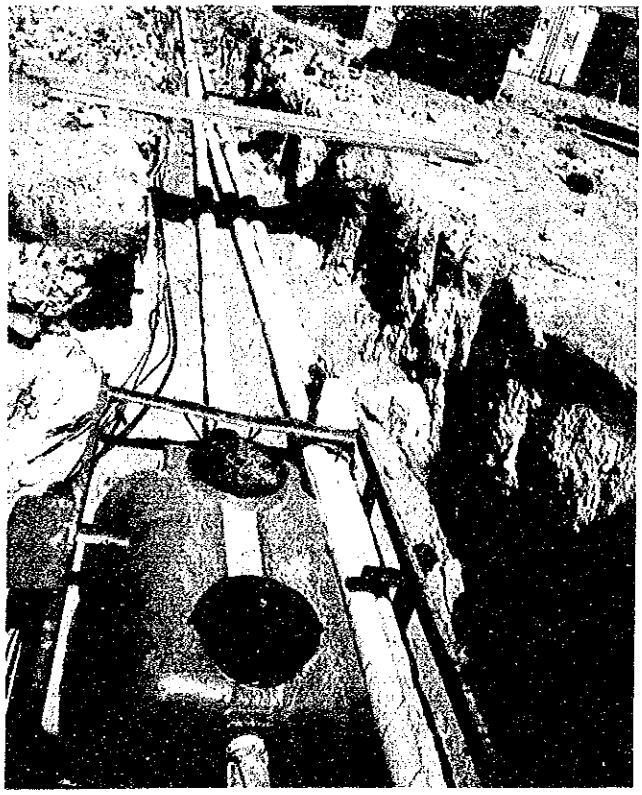
Establishment of ventilation tube (FRV)



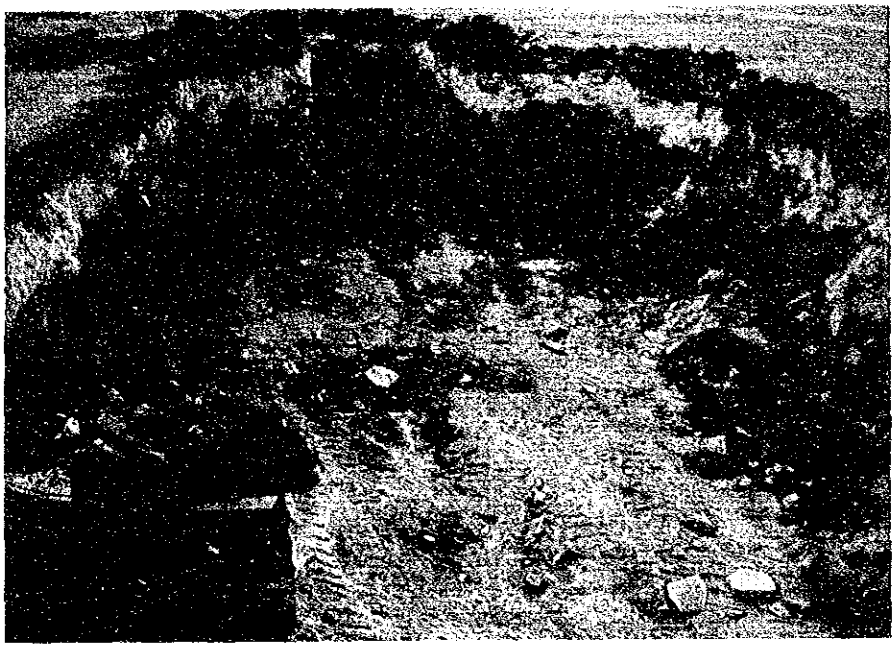
Establishment of drainage tube



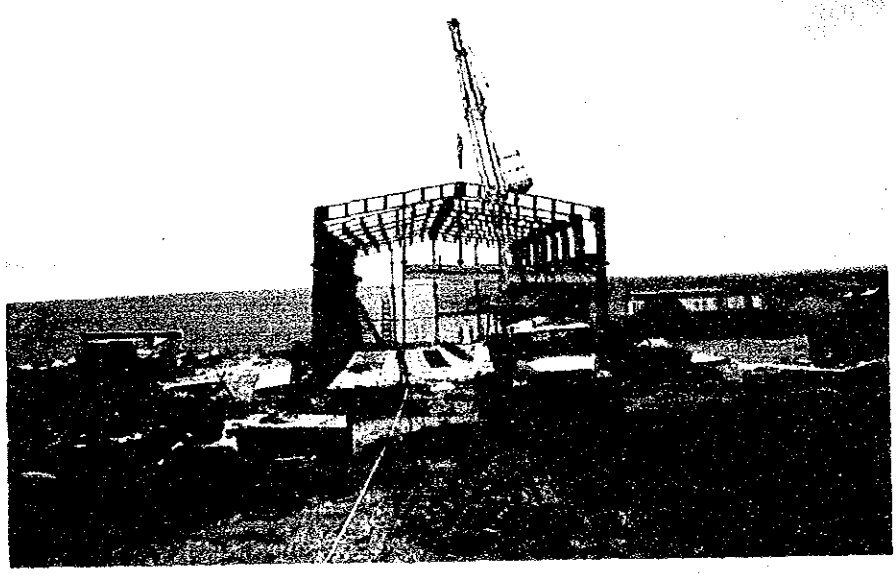
Establishment of drainage, feed tube



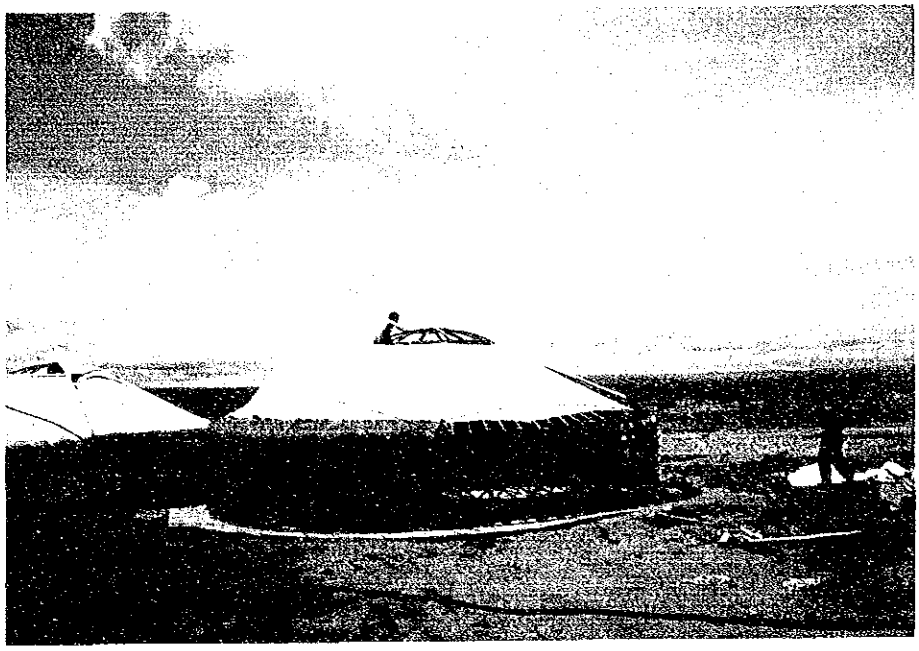
Establishment of septic tank



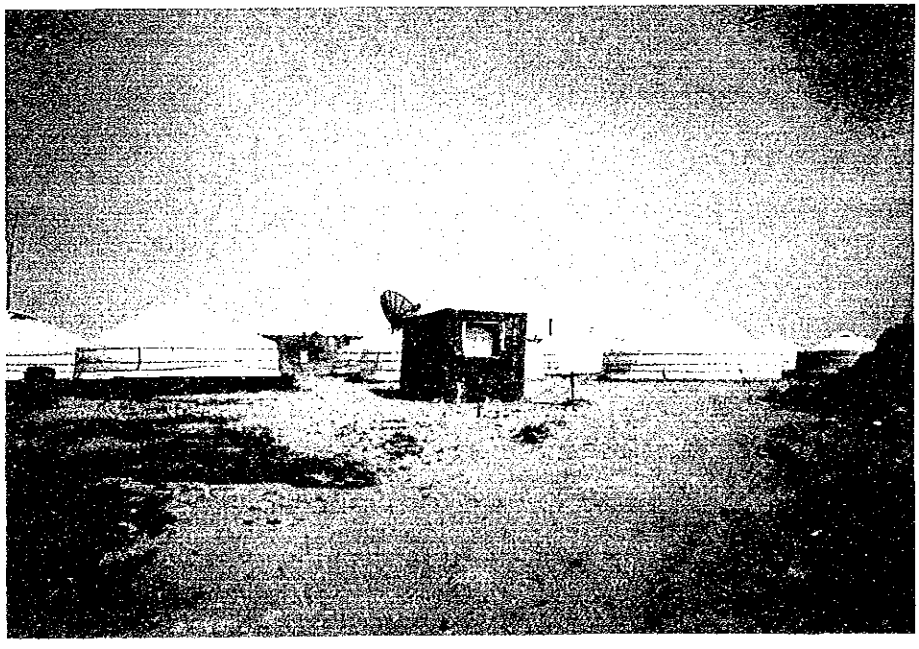
Constraction of drainage pond



Constraction of workshop



Construction of office



INMARSAT & TV antena

22550

22500

22450

N

To Ereentsav 110km

Ware house

Guard house

Dormitory(Mongolia)

Office(Mongolia)

Garaga

Office (Japanese)

Laundry

Kitchen

50mm φ x 2

Portable water tank(50m³)

Pump station & emergennncy Power station

Dormitory (Mongolia)

Bath & Toilet

TV Antenna

INMARSAT

Dormitory (Japanese)

Ware House

100mm φ x 2

50mm φ

Septic tank

50mm φ

100mm φ

Sauna

High Voltage Switch Station

Ware House

Ware house

Guard house

Dormitory(Mongolia)

Office(Mongolia)

Dining & Kitchen(Mongolia)

Old inclined shaft (natural refrigerator)

Office (Japanese)

Laundry

Kitchen

50mm φ x 2

Portable water tank(50m³)

Pump station & emergency Power station

Bath & Toilet

TV Antenna

Dormitory (Mongolia)

NMARSAT

Ware House

Dormitory (Japanese)

100mm φ x 3

50mm φ

Septic tank

50mm φ

100mm φ

Sauna

High Voltage Switch Station

Ware House

Dining
& Kitchen(Mongolia)

Old inclined shaft
(natural refrigerator)

Dormitory
(Mongolia)

Sauna

22500

22450

22400

22350

Garaga

Office
(Japanese)

Laundry
Kitchen

50mm φ x 2

Portable water
tank(50m³)

Dormitory
(Mongeli

Pump station
& emergennecy
Power station

Bath
& Toilet

TV
Antenna

INMARSAT

Ware House

Dormitory
(Japanese)

100mm φ x 2

50mm φ

Sauna

Septic
tank

50mm φ
100mm φ

High Voltage
Switch Station

Distribution
Station

Ware House

50mm φ x 2

50mm φ x 2

Kerosene(25m³)

Light oil(25m³)

Water Tank
(for drilling)

50mm φ

Mine
Mouth

Compressor

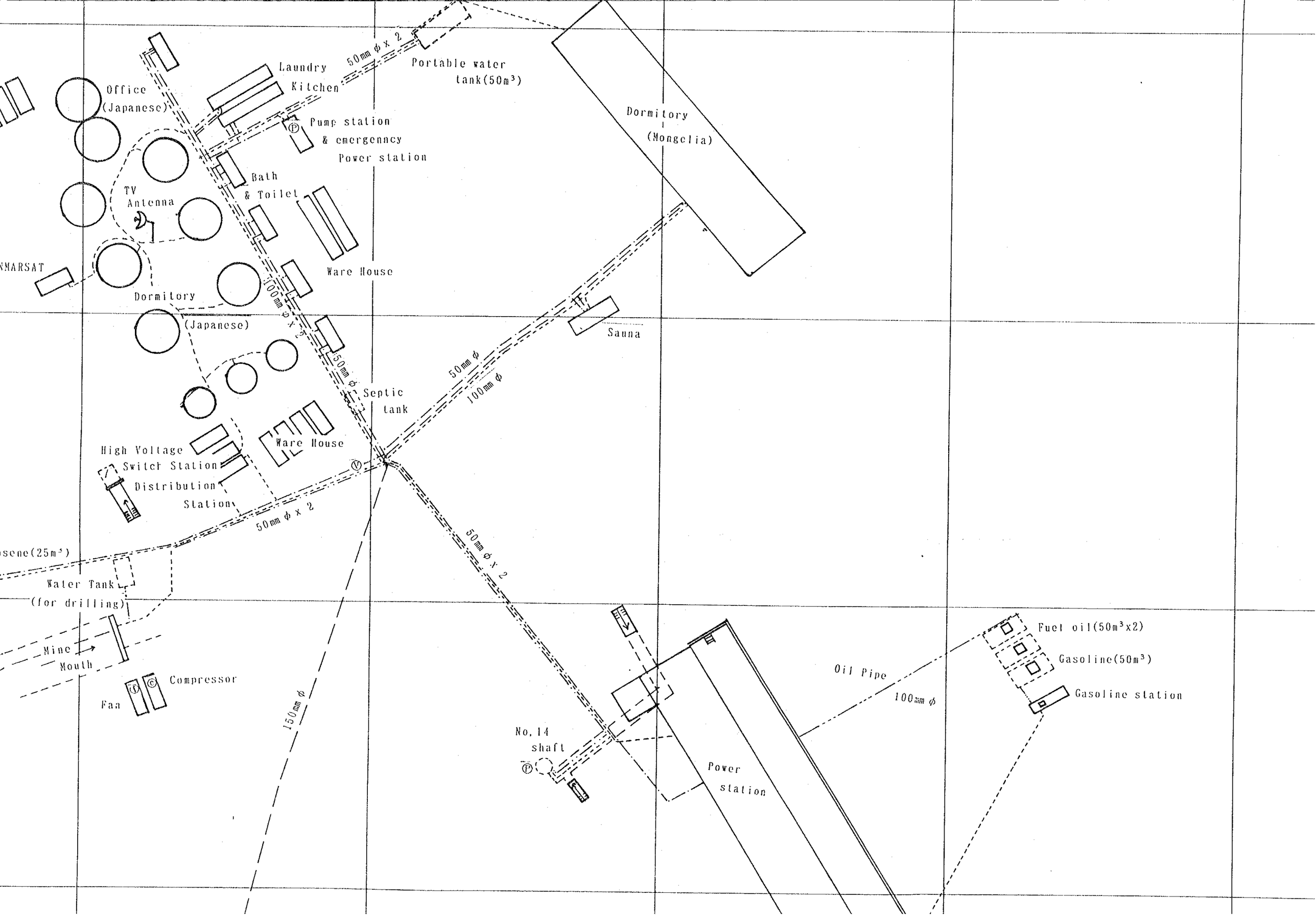
Fan

150mm φ

Work shop

No. 14
shaft

Drainage


Office
(Japanese)
Laundry
Kitchen
50mm φ x 2
Portable water
tank(50m³)
Dormitory
(Mongolia)
Pump station
& emergennecy
Power station
Bath
& Toilet
TV
Antenna
NMARSAT
Ware House
Dormitory
(Japanese)
100mm φ x 2
50mm φ
Septic
tank
Sauna
50mm φ
100mm φ
High Voltage
Switch Station
Distribution
Station
Ware House
50mm φ x 2
sene(25m³)
Water Tank
(for drilling)
Mine
Mouth
Compressor
Fan
150mm φ
50mm φ x 2
No. 14
shaft
Power
station
Oil Pipe
100mm φ
Fuel oil(50m³x2)
Gasoline(50m³)
Gasoline station

Dormitory
(Mongolia)

Sauna

Oil Pipe
100mm φ

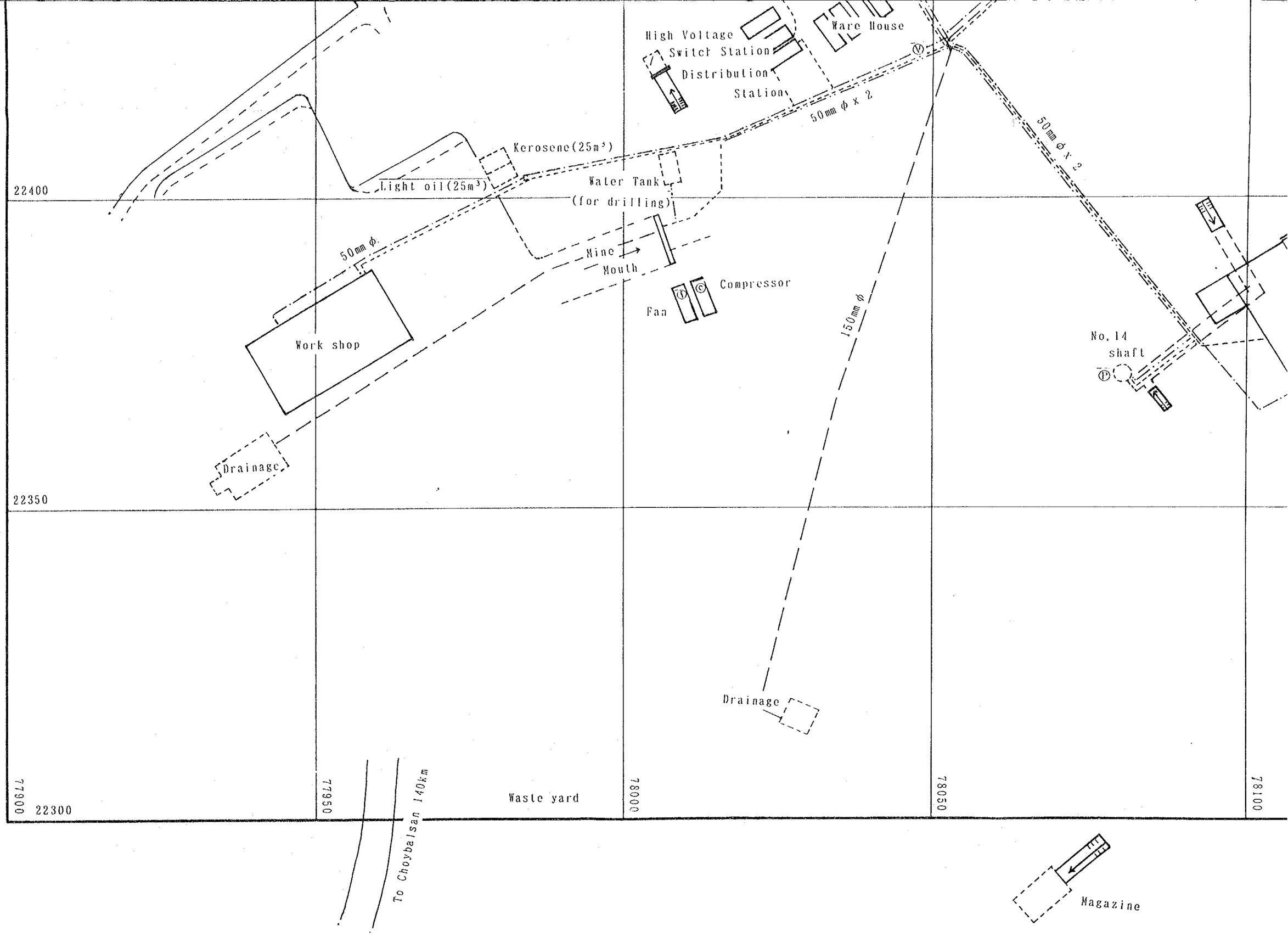
Fuel oil(50m³x2)

Gasoline(50m³)

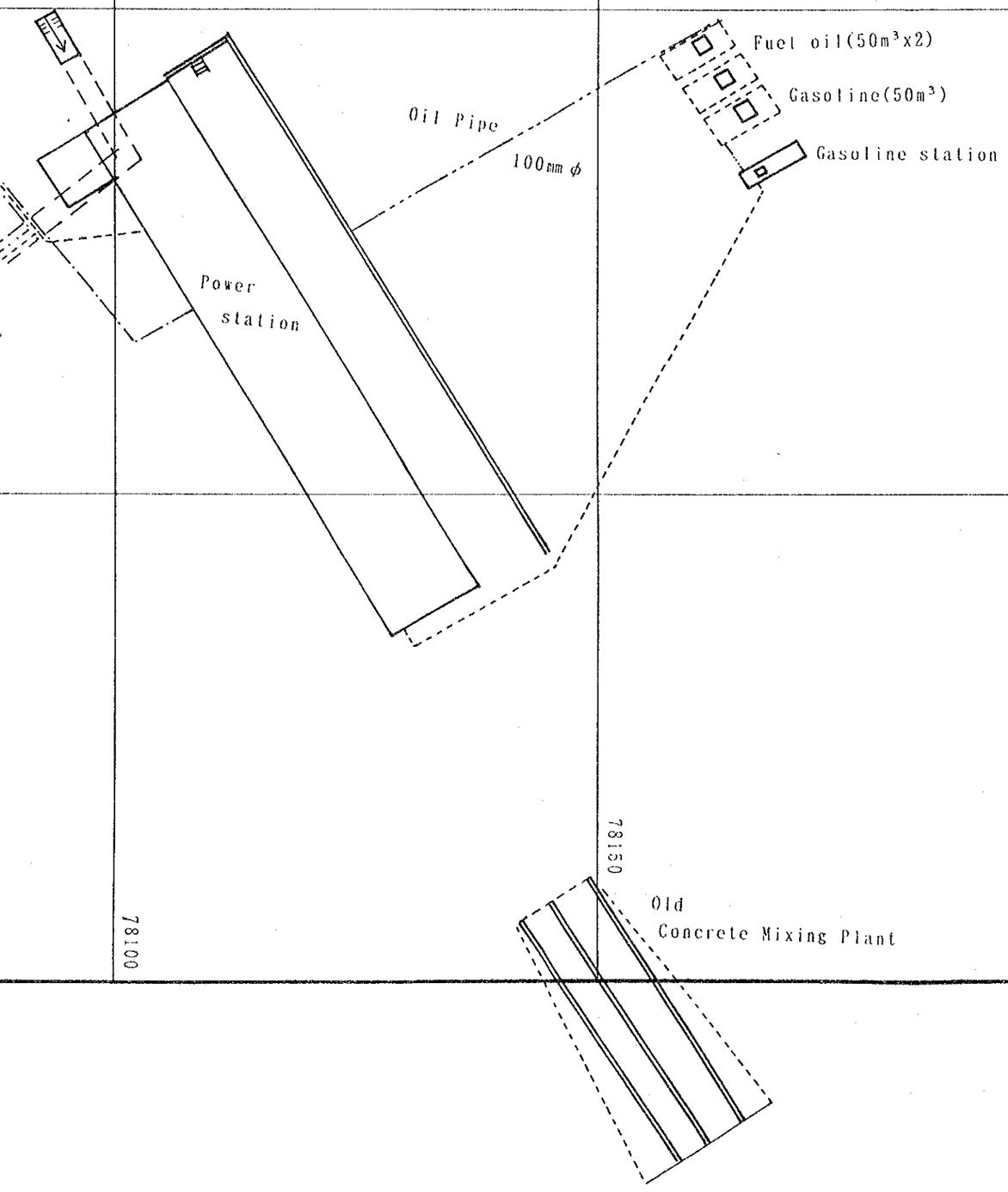
Gasoline station

Power
station

Legend


High Voltage
Switch Station
Distribution
Station
Ware House
50mm φ x 2
Kerosene(25m³)
Light oil(25m³)
Water Tank
(for drilling)
50mm φ
Mine
Mouth
Compressor
Fan
Work shop
Drainage
150mm φ
50mm φ x 2
No. 14
shaft
Drainage
Waste yard
To Choybalsan 140km
Magazine
22400
22350
22300
77900
77950
78000
78050
78100

High Voltage
Switch Station
Distribution
Station
Ware House
50mm φ x 2
50mm φ x 2
150mm φ
Water Tank
(for drilling)
Mine
Mouth
Compressor
Fan
No. 14
shaft
Power
station
Oil Pipe
100mm φ
Fuel oil(50m³x2)
Gasoline(50m³)
Gasoline station
Drainage
Old
Concrete Mixing Plant
Magazine
78000
78050
78100
78150
78200



Legend

- Electric cable
- Water pipe
- Water pipe(for Drilling)
- Drain pipe

78350

78300

Title	General View of Mine Site		
Scale	1/500	Date	1993.8.30
Drawing-No			