No. 13

REPORT
ON
THE MINERAL EXPLORATION
IN
THE UUDAMTAL AREA
MONGOLIA

(PHASE III)

MARCH 1994

JAPAN INTERNATIONAL COOPERATION AGENCY

METAL MINING AGENCY OF JAPAN

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PREFACE

In response to the request of the Mongolian Government, the Japanese Government decided to conduct a Mineral Exploration in the Uudam Tal Area Project and entrusted the survey to the Japan International Cooperation Agency(JICA) and the Metal Mining Agency of Japan(MMAJ).

The JICA and MMAJ sent to Mongolia a survey team headed by Mr. Eitaro SATO from June 27 to October 2, 1993.

The team exchanged views with the officials concerned of the Government of Mongolia and conducted to Japan, further studies were made and the present report has been prepared.

We hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

We with to express our deep appreciation to the officials concerned of the Government of Mongolia for their close cooperation extended to the team.

March, 1994

Kensuke YANAGIYA
President
Japan International Cooperation Agency

Takashi Ishikawa
President
Metal Mining Agency of Japan

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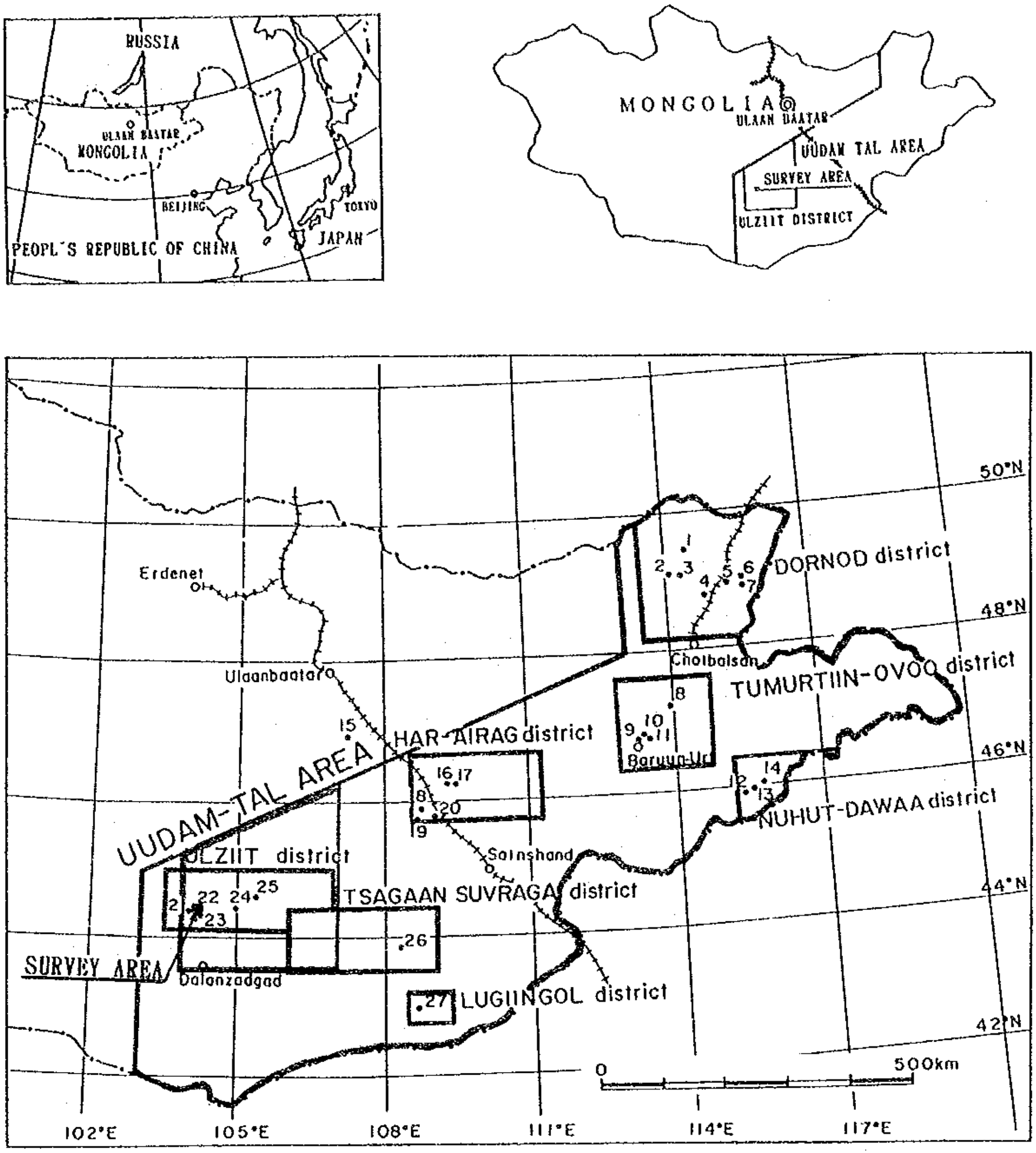


NAME OF DISTRICTS AND ORE DEPOSITS

LEGEND

- Phase I
- Phase II
- Phase III

DORNOD district
1 Tsagaan-Chuluut Hudag
2 Ulaan
3 Mardai
4 Delger-Munkh
5 Tsav
6 Salhit
7 Bayan-Uul

TUMURTIIN-OVOO district
8 Arin-Nuur
9 Tumurtiin-Ovoo
10 Salaa
11 Salhit

NUHUTT-DAWAA district
12 Yuguzer
13 Tsentr
14 Nuhutiin-Tsagaantolgoi

HAR-AIRAG district
15 Chuluut-Tsagaan-Del
16 Adag
17 Bor-Undur
18 Maihanta
19 Tsagaantakhilch
20 Hongor

ULZIIT district
21 Mushgia-Hudag
22 Olon-Ovoot
23 Bayan-Hushuu
24 Dugshih
25 Onh

TSAGAANSUVRAGA district
26 Tsagaansuvraga

LUGIINGOL district
27 Lugiingol

Fig. I -1 Location and Accessibility of the Survey Area

Summary

This report has been compiled to explain the results of the third year's survey of Uudam Tal Area, Mongolia, conducted under the Bilateral Technical Cooperation for the Exploration of Mineral Resources. The survey was intended to clarify occurrence of useful mineral resources by studying geological conditions of the area. The field survey was executed from June to October, 1993.

During the third year's survey, eight boreholes totaling 850 meters were drilled at the Olon-ovoot Deposit and its surrounding zones of geophysical anomalies, located in Ulziit District where the preceding year's survey revealed gold concentration at outcrops. As the result, the following information was obtained concerning the Olon-ovoot Deposit.

1) Gold is concentrated in quartz veins and wall rock, especially in coarse-grained pyrite. The ore deposit extends for more than 50 meters down from the surface.
2) To a depth of some 50 meters below the surface, primary ore is dominant, and nature of the primary ore and gold grades show little variation.
3) From the above mentioned facts, Olon-ovoot Deposit is considered to reach further to the depth. Tsagaan-tolgoi Ore Body was proved to continue more than 50m down from the outclop by 3 drillings in this survey, and the total prospective ore reserve is assumed to be 262,800 tons(3.2 g/t Au).
   It is somewhat difficult to estimate the total potential ore reserve of Olon-ovoot Deposit only by the drilling data of this year, but 700,000 tons of reserve at gold grade of about 3 g/t will be prospected supposing that the deposit is twice as long as the confirmed vertical length at Tsagaan-tolgoi in this survey. And by further exploration of ore-indications and geophysical anomalies around there, the amount will be expected to inclease.
4) Open pit mining would be suitable for the deposit, as the veins are relatively wide and their outcrops form a hillock.
5) The genetic age of the deposit is estimated to be Early Permian, as the age of potassium-argon dating of the auriferous coarse-grained pyrite alteration zone is 284 ± 14Ma while that of the muscovite in the auriferous quartz vein with visible gold is 283 ± 14Ma, showing good coincidence between them.
6) High resistivity zone detected by the geophysical survey in the south of Tsagaan-tolgoi remained future subject.
7) The large, low-resistivity zone in the north-east of the deposit was ascertained to be originated from the saline water contained in the porous trachybasalt lavas of the Jurassic age, which excludes the posssibility of occurrence of a large sulphide deposit.

In the light of these survey findings, it is considered desirable to further continue drilling work, therby confirming extension to the deep

and to the lateral of Olon-ovoot Deposit and also to conduct feasibility study including application tests of heap leaching process.

Part I GENERAL REMARKS

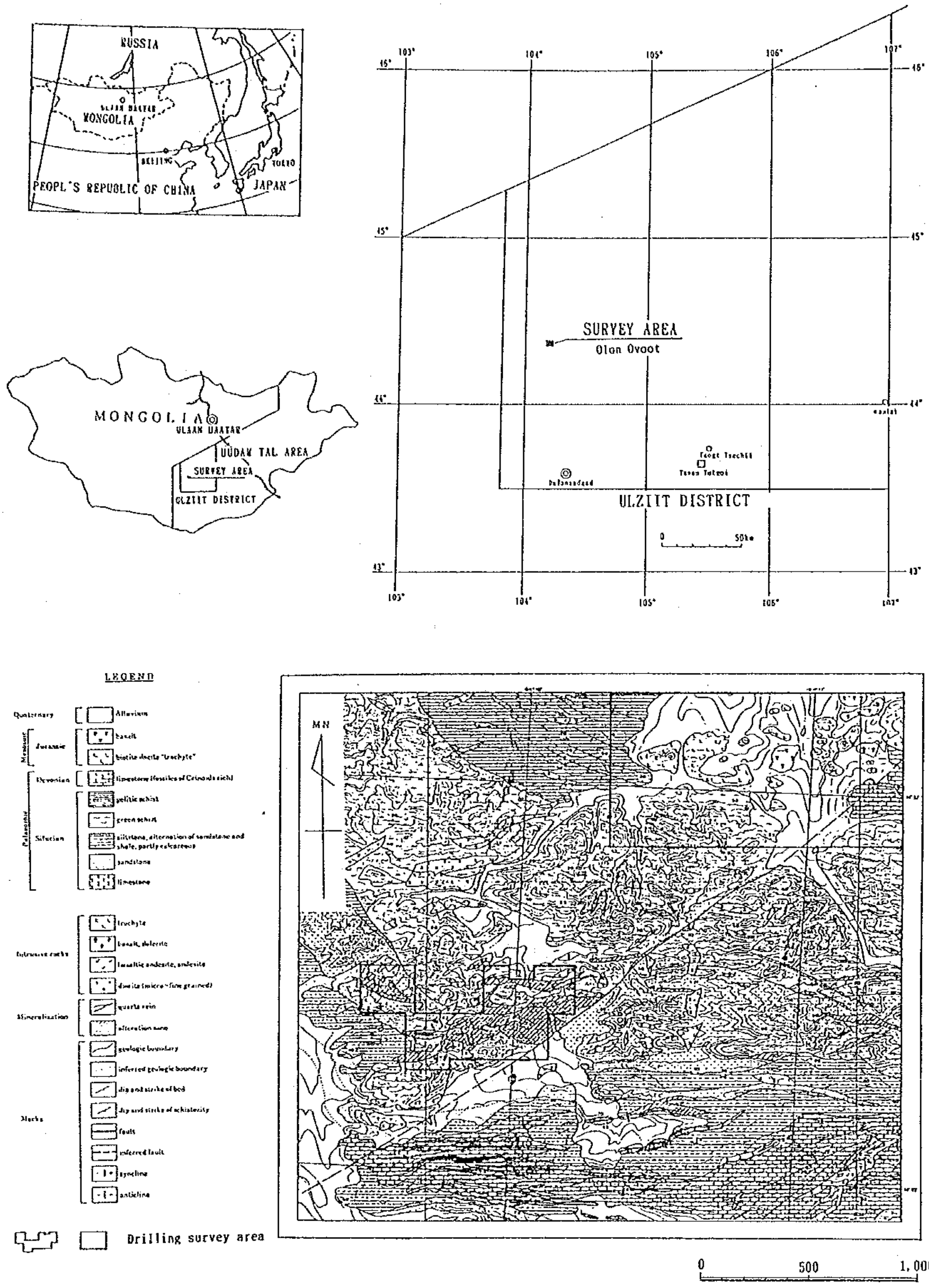


Fig. I-1-1 Location Map of the Survey area

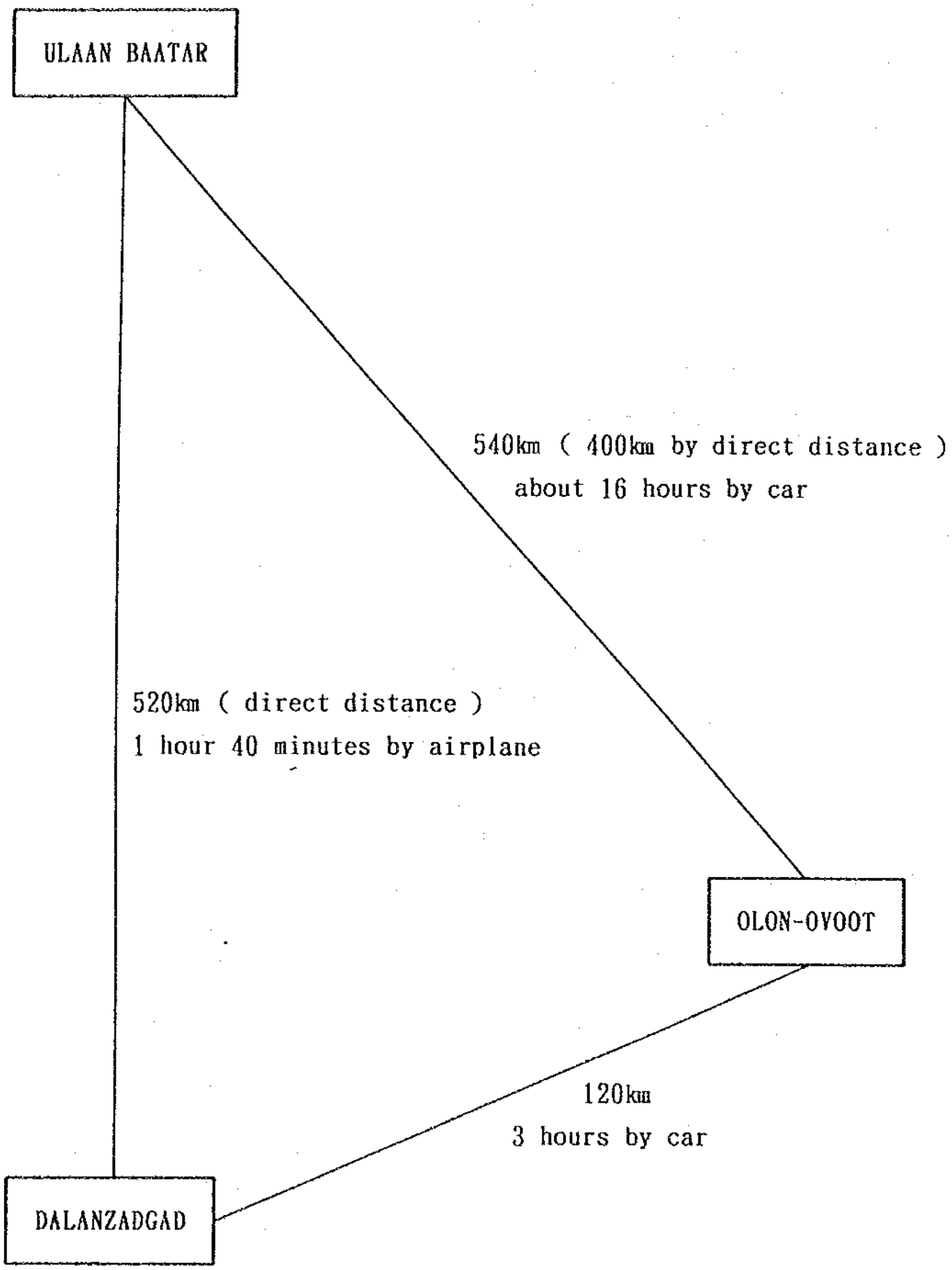


Fig. I -1-2 Accessibility of the Survey Area

Chapter 1 Introduction

1-1 Antecedents and objects of survey

In recent years, Mongolia has adopted an economic open-door policy toward the West, thereby promoting introduction of foreign capital and technology.

With respect to the bilateral technical cooperation with Japan in the mining field, Mongolia made its first official request in October, 1989 for the survey of Mushgia-hudag rare earths deposit. In response to the request, Japan's first project finding mission was sent to Mongolia, which resulted in confirming that, besides rare earths, there are copper, lead and zinc survey projects which can be objects of the survey under the bilateral technical cooperation.

In November, 1990, two additional requests were presented by Mongolia and the MITI, JICA and MMAJ sent the second project finding mission in March, 1991. The mission reached an agreement with the State Geological Center[1), MPR[2) on the details of surveys to be conducted from the fiscal 1991 and a Scope of Work(S/W) was elaborated and signed on March 16, 1991. The survey area is called Uudam Tal, having a total area of 500,000km^2 .

The survey was aimed to grasp occurrence of ore deposits by studying the geological conditions in the Uudam Tal Area.

1st year : Collection and analysis of the existing data and geological survey including satellite image analysis were conducted of seven districts set up within the survey area, from which to select promising districts.

2nd year : On the basis of the 1st year's survey findings, geological reconnaissance was conducted on nine sections totaling 12, 180km^2 within Ulziit District, where major mineral indications are distributed.
For Olon-ovoot Deposit, semi-detailed geological survey and geophysical survey(12km^2), as well as geochemical survey (0.5km^2), were carried out.
With respect to Dornod District, existing data were analysed.

3rd year : On the basis of the previous year's survey findings, Core drilling of eight boreholes, with a total extension of 850m, was carried out for the Olon-ovoot Deposit in Ulziit District.

Note : 1) As of August, 1992, the State Geological Center, MPR, was reorganized into the "Ministry of Geology & Mineral Resources." And, it was reorgarized into the "Ministry of Energy, Geology and Mining in January, 1994. "

2) As of February, 1992, the country's name was changed to "Mongolia. "

1-2 Conclusions and recommendations of the second year's survey

1-2-1 Conclusions of the second year's survey

Conclusions of the second year's survey may be summarized as follows:

1) Ulziit District

a) Olon-ovoot Deposit

i. This deposit consists of six quartz vein zones formed in the Permian period ; the size of quartz veins is 25m in the maximum width and 50-150m in extension totaling 1,000m.

ii. Gold concentration is centered around the quartz veins. The total area of the deposit on the ground surface is 2,200km^2 or more at gold grade of 3 g/t.

iii. Geophysical prospecting revealed that the quartz vein possibly extend 350m or more under the surface at an inclination of 80° or more.

iv. From the above, a substantial, additional ore reserves can be expected in the Olon-ovoot Deposit, subject to prospecting in the deep.

b) Geological reconnaissance area

i. In the sections of Soirig, Sologoi and North-harmagtai, respectively, there exist large scale quartz veins and massive silicified bodies.

ii. Although they are of low grades at the surface, they are considered to be well deserving risks of exploration in search of blind gold deposits, for the following reasons:

- Their homogenization temperature of fluid inclusion is lower than that of Olon-ovoot Deposits.
- There are geological proofs that they were formed on or near the ground surface.
- There are abundant indications that suggest boiling of ore-forming fluid.

c) Others

i. The low-resistivity zone with magnetic anomaly discovered some 2km northeast of Olon-ovoot Deposit is due possibly to a sulfide deposit containing magnetite or pirrhotite.

2) Dornod District(Analysis of the exising data)

a) The area north of Choibalsan Sedimentary Basin, where the Jurassic-Cretaceous systems prevail, is notable for possible distribution of blind polymetallic deposits.

b) Russia has conducted regional gravity survey of this area, particulars of which have not yet been provided to the Mongolian side.

1-2-2 Recommendations based on the second year's survey

The following survey items were recommended for the third year's survey.

1) Ulziit District

a) Core drilling to confirm extension to the deep of Olon-ovoot Deposit.
b) Geophysical prospecting to confirm extension of the high magnetic, low-resistivity zone detected in the northeast of the geophysical survey area.
c) Expansion eastward of the geological survey area and investigation of mineral indications in the entire survey area.
d) Evaluation survey(geochemical and geophysical) of mineral indications of the large quartz veins and massive silicified bodies which have been confirmed in such areas as Soirig, Sologoi and North-harmagtai.
e) Geophysical prospecting(TEM method) to confirm extension of the quartz veins of Olon-ovoot Deposit.
f) Geochemical prospecting aimed at mineral indications in the north of Olon-ovoot.

2) Dornod District

It will be desirable to study a concrete survey plan only after Russian survey data have been obtained and analysed.

Table I-1-1 Dispatchment of the Survey Mission

Number of engineers	Deperture	Arrival	Term of dispatchment
Geologist 1 person	June 27	Oct. 1	97 days
Drilling engineer 1 person	June 27	Oct. 1	97 days
Drilling engineer 2 persons	June 27	Sept. 21	87 days
Total 4 persons			368 person・days

Table I-1-2 Outline of the Survey

SURVEY ITEM	QUANTITY	LABORATORY WORKS	QUANTITY
Drilling	8 holes (total 850m)	① Thin sections	10 pcs
		② Polished sections	4 pcs
		③ Whole rock chemical analysis	5 pcs
		④ Ore analysis (Au, Ag)	201 pcs
		⑤ X-ray diffraction test	20 pcs
		⑥ Dating (K-Ar method)	3 pcs
		⑦Fluid inclusion test	10 pcs

1-3 Outline of the third year's survey

1-3-1 Scope and objects of survey

Under the third year's survey, drilling of eight boreholes totaling 850m was executed, on the basis of the preceding year's recommendations, within the semi-detailed geological survey area, which is same as the geophysical prospecting area and includes Olon-ovoot Deposit. The survey was intended to obtain ore reserves by means of confirming continuity in the deep of Olon-ovoot Deposit and also to confirm the geophysical anomaly zone 2km north of Olon-ovoot Deposit.

1-3-2 Survey work

Following is an outline of the survey work executed.

All the drilling eguipment including spareparts were carried in from Japan. Fuel oil was transported from Ulaan Baatar while drilling water was from a well at Bayan-khushuu Village, both by tank-trucks.

Drilling operation was carried out in three shifts, in principle, by three units consisting respectively of Japanese specialists and Mongolian counterparts.

The base camp was set up in Olon-ovoot. Locations and directions of boreholes were determined jointly by the Japanese team leader and the Mongolian leader. Position and orientation were done by summary survey with pocket compasses and a measuring tape.

Various sampling methods were applied to drill cores obtained, after identification and photo-taking. Results of core identification were successively compiled into research drawings in order to facilitate checking of an expected direction of ore deposit extension, which was reflected to the succeeding drillings.

Assay Sampling was done on ores classified by geological facies.

1-3-3 Organization of survey party

1) Planning for survey

Working plan for the third year's survey was drawn up between the following members.

a) Site meeting

Japanese side :

OKAMOTO Nobuyuki, MMAJ

Mongolian side :

Dambiin SANJAADORJ, Ministry of Geology & Mineral Resources(MGMR)
Galsangiin JAMSRANDORJ, MGMR
Tsegdmiin RENCHINDORJ, GEOLOGY Co.
Dagva BATBOLD, GEOLOGY Co.

2) Survey party

A Japanese survey team, composed of a team leader and drilling experts, was sent to the site from 27 June to 2 October, 1993. The team members and the Mongolian counterparts are listed below.

a) Japanese side :

SATO Eitaro	General supervision and drilling survey	MINDECO
AOYAMA Tsutomu	Drilling survey	-do-
ECHIZENYA Shigeo	-do-	-do-
CHIBA Yukio	-do-	-do-

b) Mongolian side :

Dagva BATBOLD	General supervision and drilling survey	GEOLOGY Co.
Khishigsuren ENKHTUVSHIN,	Drilling survey	-do-
Dendev GANBUD,	-do-	-do-
Dashtseden BATCHULUUN,	-do-	-do-
Jamsuran ERDENEOCHIR,	-do-	-do-

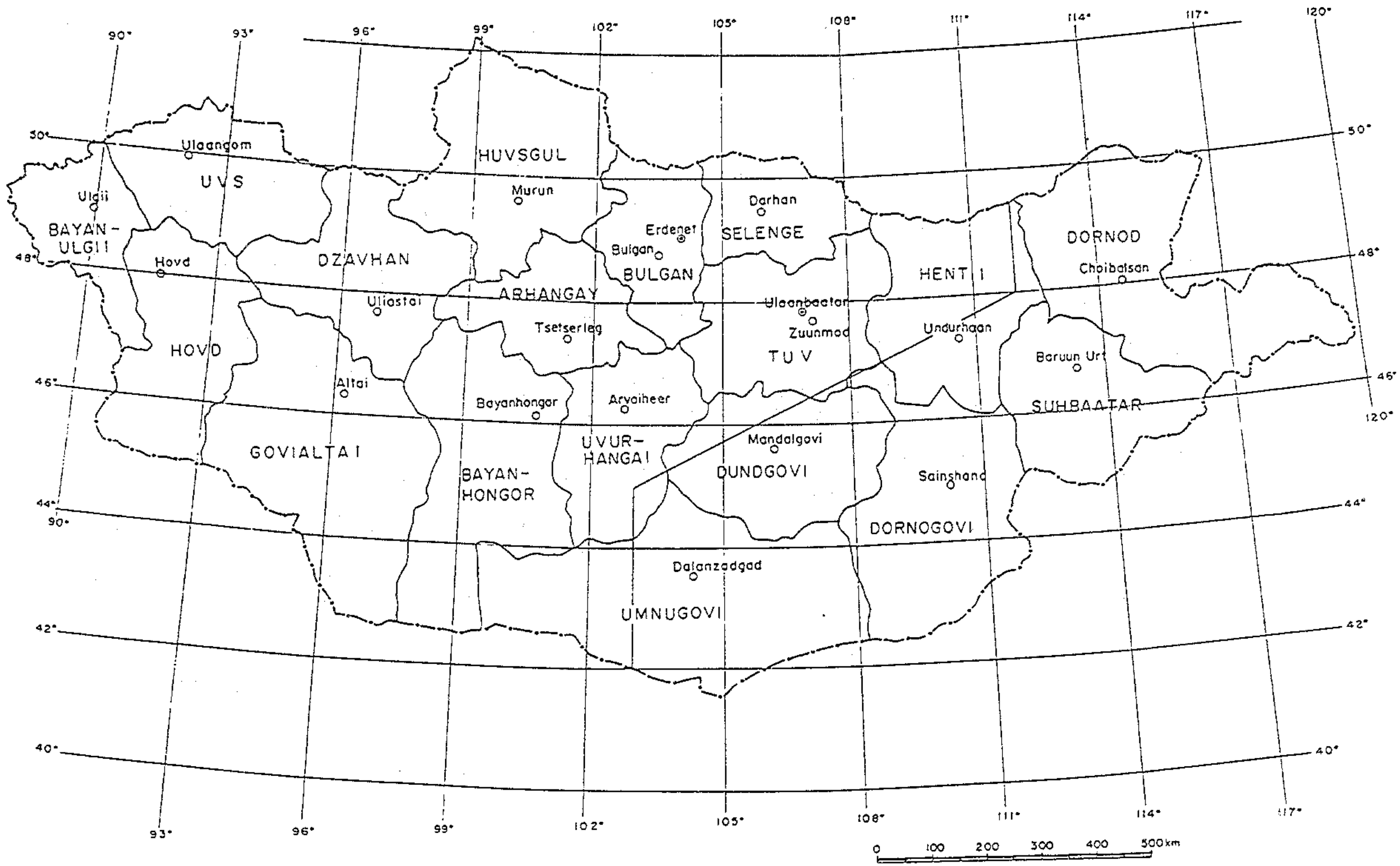


Fig. I-2-1 Administrative Division

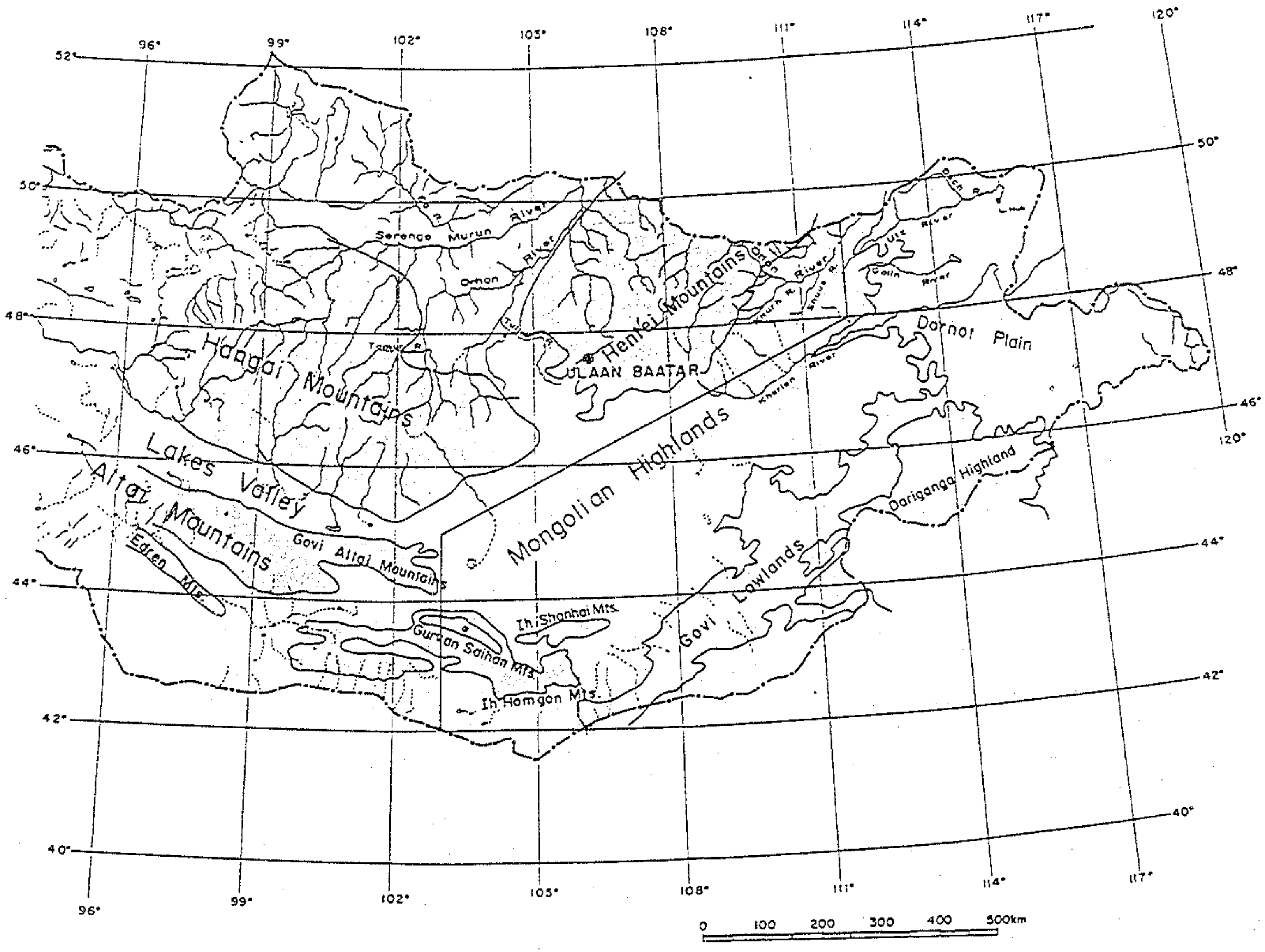


Fig. 1-2-2 Geographic Features

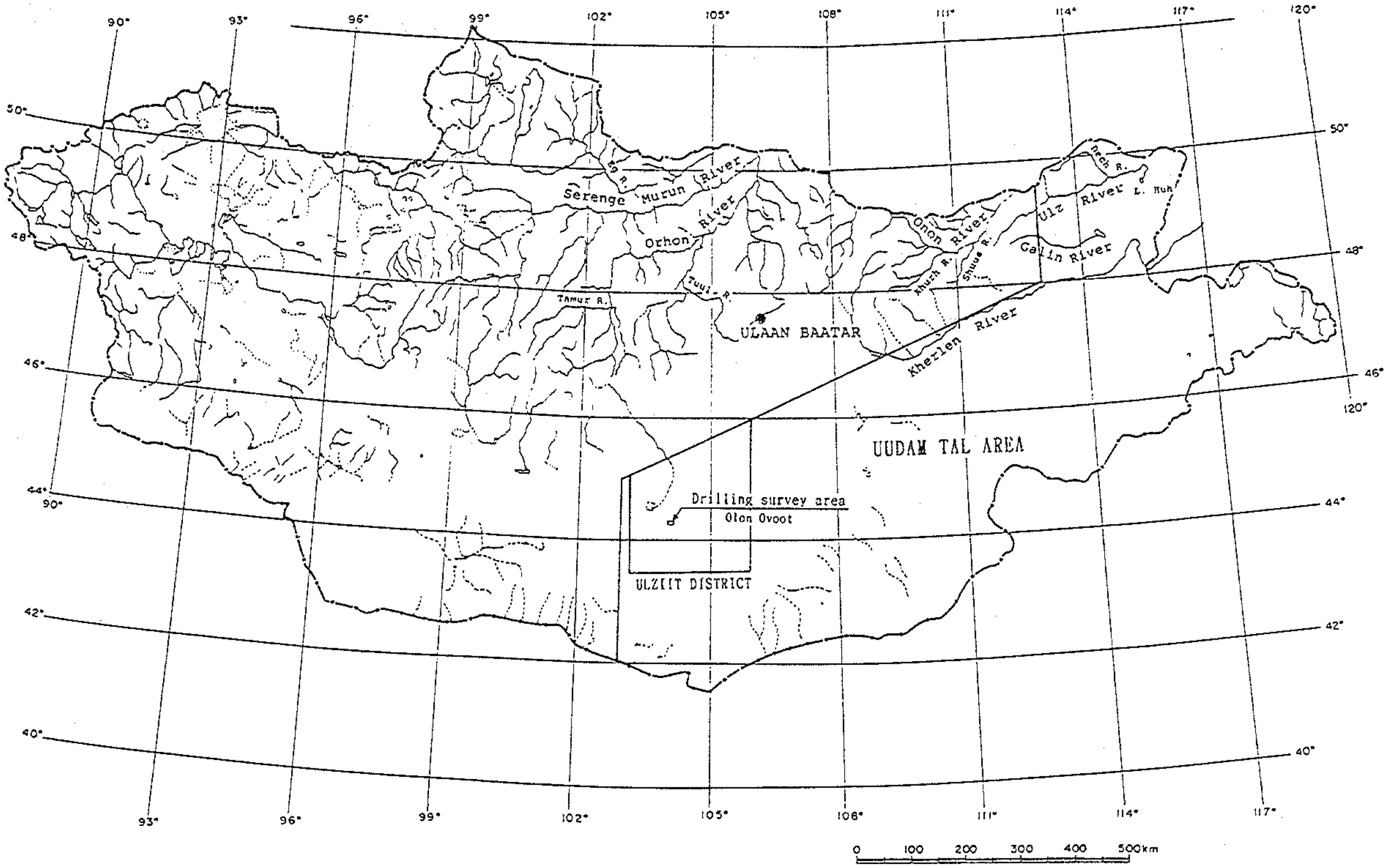


Fig. I-2-3 Drainage Systems

Chapter 2 Geography of Survey Area

2-1 Location and transportation

The third year's survey was conducted on Olon-ovoot Deposit in the west of Ulziit District and the nearby geophysical anomaly zones. Olon-ovoot Deposit is located at latitude 44° 22′ 28″ north and longitude 104° 09′ 44″ east. The elevation is approximately 1,200m above sea level. In administrative division terms, the deposit is located in the Mandal Ovoo Village, South Govi.

Between Ulaan Bartar and Olon-ovoot, a vast steppe-desert area with the elevation of 1,000 to 1,500m extends for 450km, and it takes 16 to 24 hours by car due to the poor road conditions. By air, it takes one hour and forty minutes from Ulaan Baatar to Dalanzadgad, from where it takes two hours by car to Olon-ovoot. As of October, 1993, domestic flights were reduced because of serious shortage of fuels; there are two flights a week between Ulaan Baatar and Dalanzadgad.

It is critically necessary for a movement between Ulaan Bartar and the deposit site to be made by two or more vehicles, as the area is sparsely populated semi-desert or desert.

2-2 Topography and drainage system

2-2-1 Topography

The survey area is situated in the southwestern part of Mongolian Highlands which is an undulating, elevated block with the elevation of 1,000-1,200m, composed of Paleozoic orogenic beds. The surroundings of Olon-ovoot Deposit is a hilly zone with numerous folds, being true to its name('Olon'=many, 'ovoot'=hill). Generally, the southern part of the hilly zone is higher. The elevation diminishes northward. Ridges tends to extend in the east-west direction reflecting the Paleozoic belt structure. The lowest point is 1,165m at a low flatland in the north of the zone, whereas the highest is 1,266m in the east of the deposit.

2-2-2 Drainage system

There is no river with constant water flow in the survey area. Only a small wadi(locally called 'Sair'), in which water flows temporarily at the time of raining, flows into a nearby lowlands and disappears.

In the Paleozoic orogenic zone composed of alternated beds of sandstone and shale around Olon-ovoot Deposit, a drainage system develops extending in the east-west direction in grid or stripe patterns, which reflects the geological structure. In general, a dendritic drainage system develops in an igneous rock area whereas, in the Cretaceous area, it tends to develop in feather-veined shape.

2-3 Climate and vegetation

2-3-1 Climate

Table I-2-1 Major Climatic Indices

Mean Monthly and Annual Temperature (°C)

Meteorological station	*Mean Monthly*												*Annual average*
	Jan.	*Feb.*	*March*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	
Altai	−18.9	−17.0	−8.9	−0.5	6.9	12.6	14.0	12.7	6.3	−1.8	−10.8	−16.9	−1.8
Arvaiheer	−15.5	−13.9	−6.6	1.4	8.5	14.2	15.4	14.0	8.4	1.2	−8.2	−14.1	0.4
Baruun Urt	−21.5	−18.6	−8.5	2.9	11.2	17.4	19.9	17.9	11.2	1.3	−10.1	−18.9	0.4
Bayanhongor	−18.4	−16.8	−7.9	1.0	9.3	15.0	15.9	14.4	7.9	−0.8	−10.8	−17.4	−0.7
Bulgan	−21.3	−19.2	−9.5	0.8	8.6	14.7	16.3	14.4	7.5	−1.3	−11.4	−19.2	−1.6
Choibalsan	−21.3	−18.8	−9.1	2.4	11.1	18.0	20.6	18.2	10.7	1.8	−10.5	−18.9	0.4
Dalanzadgad	−15.4	−12.2	−3.2	6.1	13.6	19.4	21.2	19.5	13.2	4.8	−5.8	−14.0	3.9
Hovd	−25.4	−20.8	−7.3	3.8	11.5	17.5	18.9	16.9	10.4	1.3	−10.1	−20.3	0.3
Mandalgov'	−18.0	−15.3	−7.0	2.7	10.6	16.9	18.8	17.2	10.3	1.8	−8.3	−16.8	1.1
Mörön	−23.8	−19.7	−8.3	1.5	9.1	15.7	16.9	14.7	7.8	−1.2	−12.3	−21.5	−1.8
Ölgii	−17.8	−15.2	−6.4	1.9	8.9	14.8	14.5	14.6	8.3	−0.1	−9.1	−16.3	−0.2
Öndörhaan	−23.2	−20.2	−9.5	2.3	10.4	16.8	18.8	16.8	9.7	0.6	−12.2	−21.1	−0.9
Sainshand	−18.4	−11.8	−4.7	5.9	14.0	20.6	23.2	21.1	13.8	4.3	−7.5	−16.5	3.4
Sühbaatar	−23.3	−19.6	−8.0	3.3	10.5	17.2	19.1	16.6	9.8	0.5	−10.0	−19.9	−0.3
Tsetserleg	−15.6	−14.1	−6.9	1.1	8.1	13.3	14.7	13.1	7.4	0.2	−8.4	−14.1	0.1
Ulaanbaatar	−26.1	−21.7	−10.8	0.5	8.3	14.9	17.0	15.0	7.6	−1.7	−13.7	−24.0	−2.9
Ulaangom	−33.0	−30.2	−19.0	−0.2	11.1	17.7	19.2	16.9	10.0	0.1	−11.3	−26.8	−3.8
Uliastai	−23.1	−21.2	−11.3	0.3	7.9	14.1	15.4	13.7	7.1	−1.4	−13.9	−21.6	−2.8
Zuunmod	−20.5	−18.4	−9.9	0.1	7.9	13.8	15.4	13.7	7.4	−0.7	−11.1	−18.9	−1.8

Note: Mongolia's climate is sharply continental. Throughout the year, there are 250 sunny and 9–23 cloudy days. The duration of the period with a mean daily temperature higher than 0°C lasts about 170–190 days, increasing to the south and south-east up to 200–215 days.

Mean Monthly Precipitation (mm)

Meteorological station													*Total yearly*
	Jan.	*Feb.*	*March*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	
Altai	1.2	1.8	6.7	9.9	14.1	28.9	44.4	42.2	14.8	7.6	3.3	2.0	176.9
Arvaiheer	0.9	1.8	4.2	8.8	17.1	40.6	91.7	61.9	17.9	4.8	2.8	1.7	254.2
Baruun Urt	2.2	1.7	3.3	7.0	13.7	31.1	57.0	42.1	23.2	5.8	2.7	1.9	191.2
Bayanhongor	1.9	3.2	4.5	9.3	15.2	33.8	66.4	54.5	16.4	7.1	2.6	1.5	216.3
Bulgan	1.4	2.1	3.9	9.4	24.5	57.1	101.0	77.9	30.2	11.4	3.6	1.5	324.3
Choibalsan	1.9	2.4	3.0	6.7	14.8	40.8	75.7	59.4	27.1	8.2	3.3	2.7	246.0
Dalanzadgad	1.1	1.5	2.8	5.6	11.2	23.9	33.5	34.6	12.4	2.9	1.9	1.1	132.5
Hovd	1.6	1.2	1.7	5.4	13.1	17.7	34.5	27.6	9.6	3.2	1.5	2.1	119.0
Mandalgov'	0.7	1.4	2.0	3.3	10.2	33.0	46.5	45.6	14.1	3.8	1.8	1.4	163.8
Mörön	1.5	0.9	2.1	6.4	13.8	46.2	70.1	60.6	22.3	6.2	2.5	1.9	234.5
Ölgii	0.8	0.6	1.2	4.3	10.9	23.5	33.8	15.4	12.2	2.2	0.9	1.3	107.1
Öndörhaan	1.8	2.6	4.7	7.4	15.8	47.0	73.3	58.9	29.5	7.3	3.7	2.2	254.2
Sainshand	0.7	1.4	1.3	4.2	10.4	19.6	34.9	27.0	9.8	4.3	1.5	1.0	116.1
Tsetserleg	2.5	3.7	5.9	17.4	32.5	68.5	90.9	76.0	27.7	11.2	6.0	2.3	344.0
Ulaanbaatar	1.5	1.9	2.2	7.2	15.3	48.8	72.6	47.8	24.4	6.0	3.7	1.6	233.0
Ulaangom	2.2	2.1	3.5	4.2	7.1	23.2	36.0	27.2	14.0	4.5	7.7	3.6	135.3
Uliastai	2.6	2.6	5.6	9.6	15.0	33.8	65.2	42.1	21.9	8.0	4.9	5.7	217.0
Zuunmod	1.4	2.1	3.8	8.9	14.4	49.8	83.8	64.8	29.6	6.0	3.6	2.6	270.8

Note: Precipitation is extremely irregular according to different seasons of the year. During the coldest months (October–March) just 8–10 per cent of the total annual precipitation falls and 67–78 per cent during the three summer months (June–August). The lowest precipitation is in January and the highest in July.

Mean Monthly and Annual Wind Velocity

Meteorological station	*Mean Monthly*												*Annual average*
	Jan.	*Feb.*	*March*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	
Altai	2.7	3.0	3.4	4.3	4.4	3.8	3.0	3.0	3.1	3.5	3.5	2.8	3.3
Arvaiheer	2.8	3.1	3.6	5.0	4.8	4.0	3.3	3.1	3.4	3.5	3.5	3.0	3.6
Baruun Urt	3.0	3.2	3.6	4.9	4.8	4.4	3.4	3.1	3.5	3.4	4.9	3.1	3.8
Bayanhongor	2.8	2.8	3.0	3.8	3.9	3.1	2.8	2.7	3.0	3.0	3.2	2.9	3.1
Bulgan	0.6	1.7	2.3	3.0	3.0	2.6	2.1	1.9	2.2	2.1	2.0	1.7	2.2
Choibalsan	3.8	4.1	4.5	5.4	4.5	4.1	3.5	2.2	3.7	4.0	4.0	4.3	4.1
Dalanzadgad	3.0	3.5	4.4	5.6	5.6	4.4	4.0	3.6	3.7	3.4	3.8	3.1	4.0
Hovd	0.9	1.3	2.0	2.7	2.8	2.3	1.8	1.7	1.8	1.9	1.7	1.0	1.8
Mandalgov'	3.9	4.2	4.4	5.5	5.8	4.9	4.2	3.7	3.9	3.6	4.0	4.0	4.3
Mörön	1.0	1.4	2.2	3.3	3.2	2.1	1.7	1.6	1.7	1.7	2.1	1.4	1.9
Ölgii	2.4	2.9	2.5	3.2	3.5	3.2	2.5	2.9	2.6	2.9	3.3	2.1	2.8
Öndörhaan	3.4	3.3	3.9	4.8	4.8	4.0	3.7	3.3	3.5	3.5	3.3	3.4	3.7
Sainshand	3.8	4.0	4.7	5.7	5.8	5.0	4.1	3.8	4.0	3.9	4.1	4.2	4.4
Sühbaatar	1.7	1.9	2.4	3.2	3.4	2.8	2.3	2.4	2.5	1.7	2.3	2.2	2.4
Tsetserleg	2.4	2.5	2.8	3.5	3.3	2.4	2.1	2.0	2.4	2.6	2.8	2.5	2.6
Ulaanbaatar	0.9	1.4	2.3	3.4	3.7	3.4	2.6	2.4	2.3	1.9	1.3	0.8	2.2
Ulaangom	0.8	0.9	1.1	1.7	2.3	2.1	1.6	1.5	1.5	1.5	1.3	0.9	1.4
Uliastai	1.2	1.2	1.6	2.6	2.7	2.5	2.3	2.2	2.5	1.7	1.2	1.1	1.9
Zuunmod	1.7	2.2	2.8	3.6	3.7	2.8	2.3	2.0	2.5	2.3	2.5	2.1	2.8

Note: The mean annual wind velocity varies from 2–3 metres per second over a large part of the country's territory to 5 metres per second in the extreme south-east. Throughout the course of the year, it is calm, which is one of the essential peculiarities of the wind regime.

The survey area comes under the desert climate zone, which has scanty precipitation throughout a year(Table I-2-1). Hilly zones are covered with rocky desert and low flatlands with soil desert.

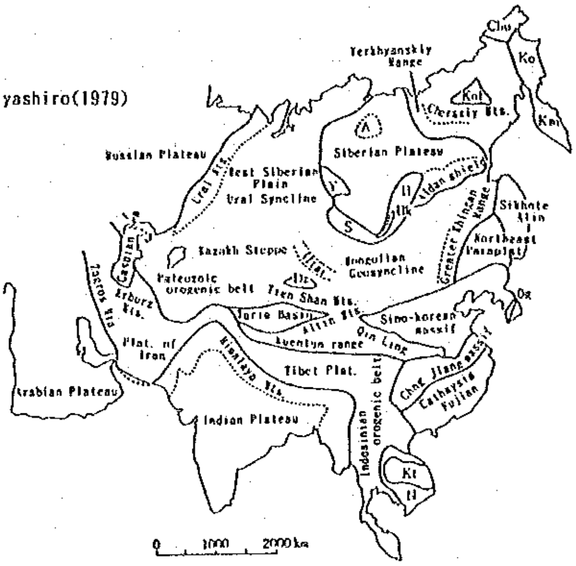
The annual average temperature in the nearby city of Dalanzadgad is 3.9 ℃. The monthly average varies from 23.2 ℃ in July to -21.3 ℃ in January. Annual fluctuation is said to range from max.37.5℃ to -36.5 ℃. At Olon-ovoot, hot wind and sandstorm of 40 ℃ or more blow sometimes in summer. The variation range of temperature in a day is very wide, reaching 20℃ or more in summer.

Annual precipitation tends to diminish southward, which is presumed to be less than 100mm in most part of the survey area. Precipitation concentrates in the five months of a year from May to September, whilst winter is the dry season with monthly precipitation of less than a few mm. The survey area is windy throughout a year, especially from March to May and in November. Sandstorm occurs 40 to 50 days a year.

2-3-2 Vegetation

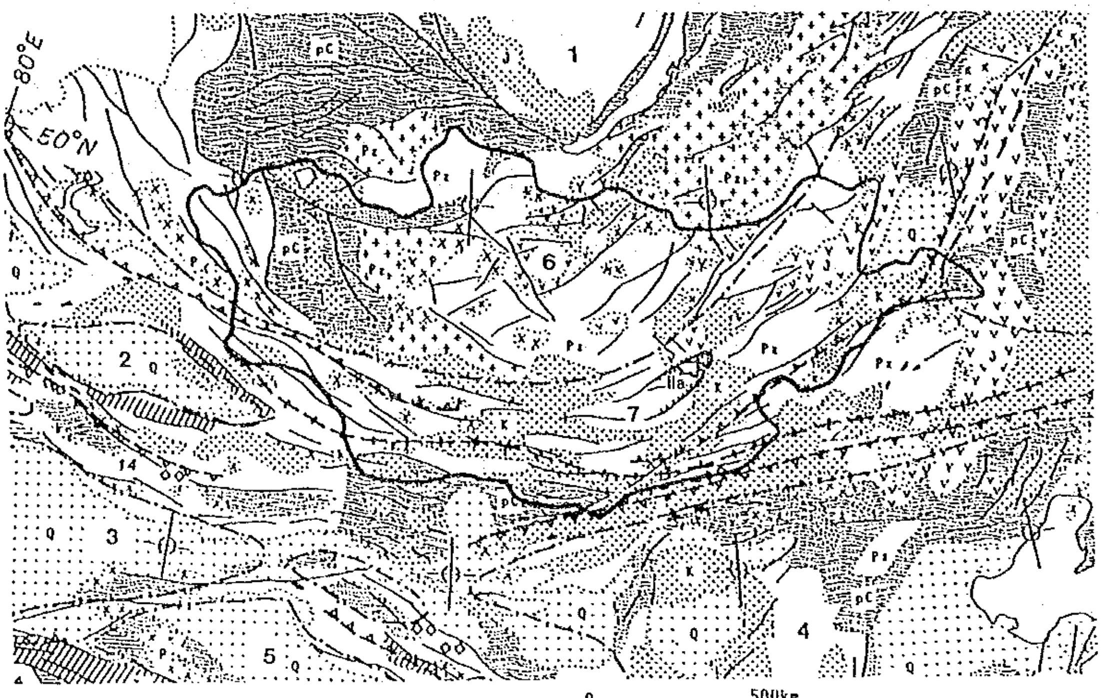
Due to the scanty precipitation, the survey area is rocky desert or soil desert where a plant called 'taana' in Mongolian grows sporadically Generally, the area has few arbors. In an oasis or along a large 'sair' however, some trees are seen occasionally. Sair and occasionally moist lowlands are thinly covered with shrubs peculiar to the Govi, called 'Harmag' and 'Zag'.

Miyashiro(1979)



LEGEND

A: Anabar Plateau
B: Baikal Mts.
Bk: Lake Baikal
Chu: Chukotskiy Pen.
Dz: Dzungaria Basin
Km: Kamchtka Pen.
Ko: Koryak Mts.
Kol: Kolyma massif
Kt: Kontum massif
H: Hersinian ologenic belt
Og: Ogcheon Geosyncline
S: Sayan Mts.
Y: Yenisei Mts.



Taira and Tashiro(1987)

L E G E N D

Sedimentary rocks
- Quaternary(Nonmarine)
- Palaeozoic(Sedimentary and Metamorphic Rocks)
- Nonmarine Sedimentary Rocks

pC: Precambrian
Pz: Paleozoic
P : Permian
J : Jurassic
K : Cretaceous
Q : Quaternary

Igneous rocks and metamorphic rocks
- Tertiary igneous rocks (chiefly volcanic rocks)
- Mesozoic volcanic rocks
- Permo-Mesozoic Granitic Rocks
- Paleozoic Igneous Rocks
- Precambrian and Early Paleozoic Basement Rocks
- Ophiolites
- Blue Schists
- Ilar-Airag Block(middle Proterozoic) gneiss, crystalline schist, marble, gneissose granite

- Fault
- Approximate Location of Ancient subduction zone
- Approximate Location of suture zone
- Approximate boundary of continental blocks

1 Siberian Block
2 Junggar Block
3 Tarim Block
4 Sino-korean Block
5 Tsaidam Block
6 Sajany AFB(Early Paleozoic)
7 Altay-Hinggan AFB(Late Paleozoic)

Fig. I-3-1 Geologic Setting of the Area

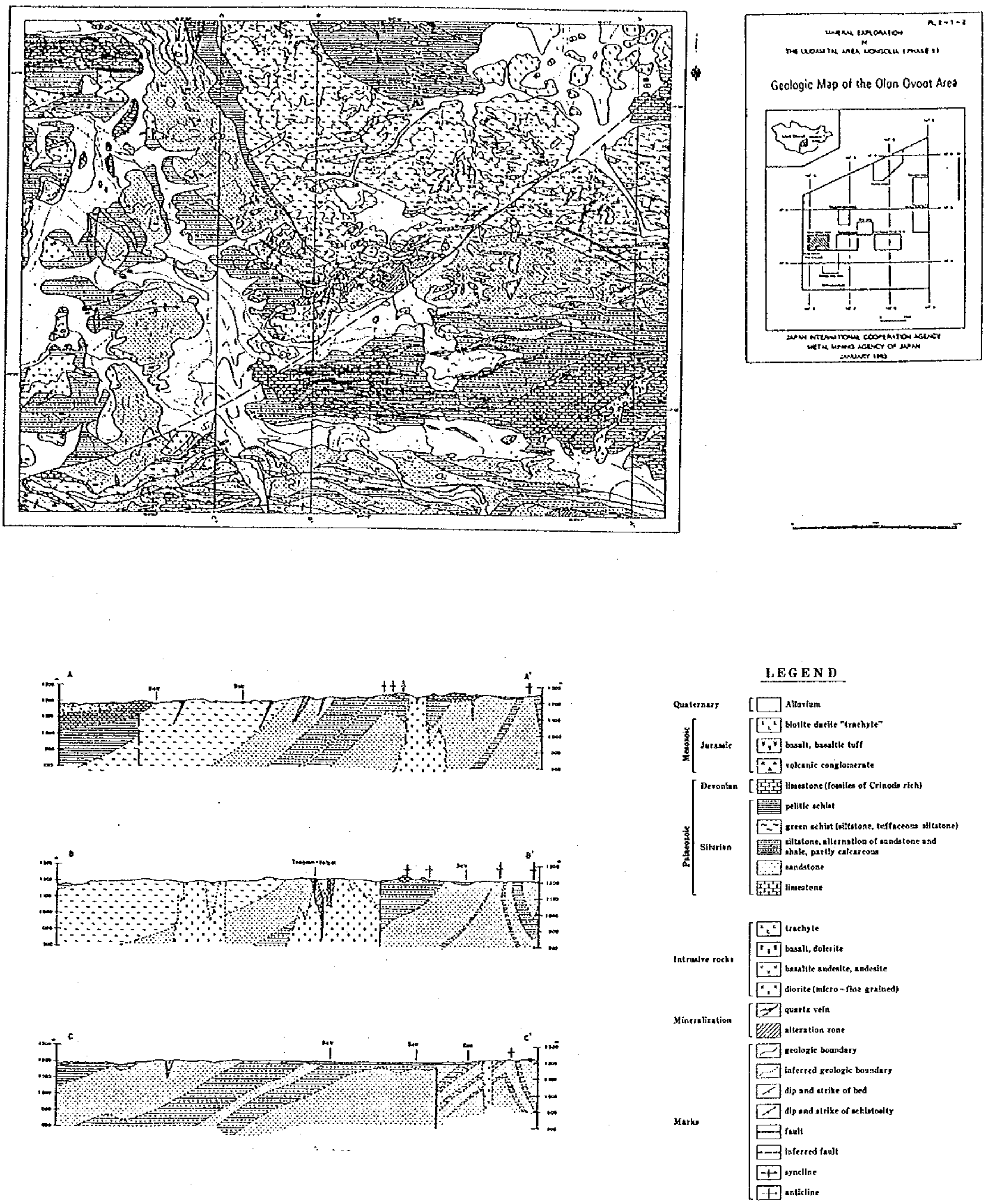
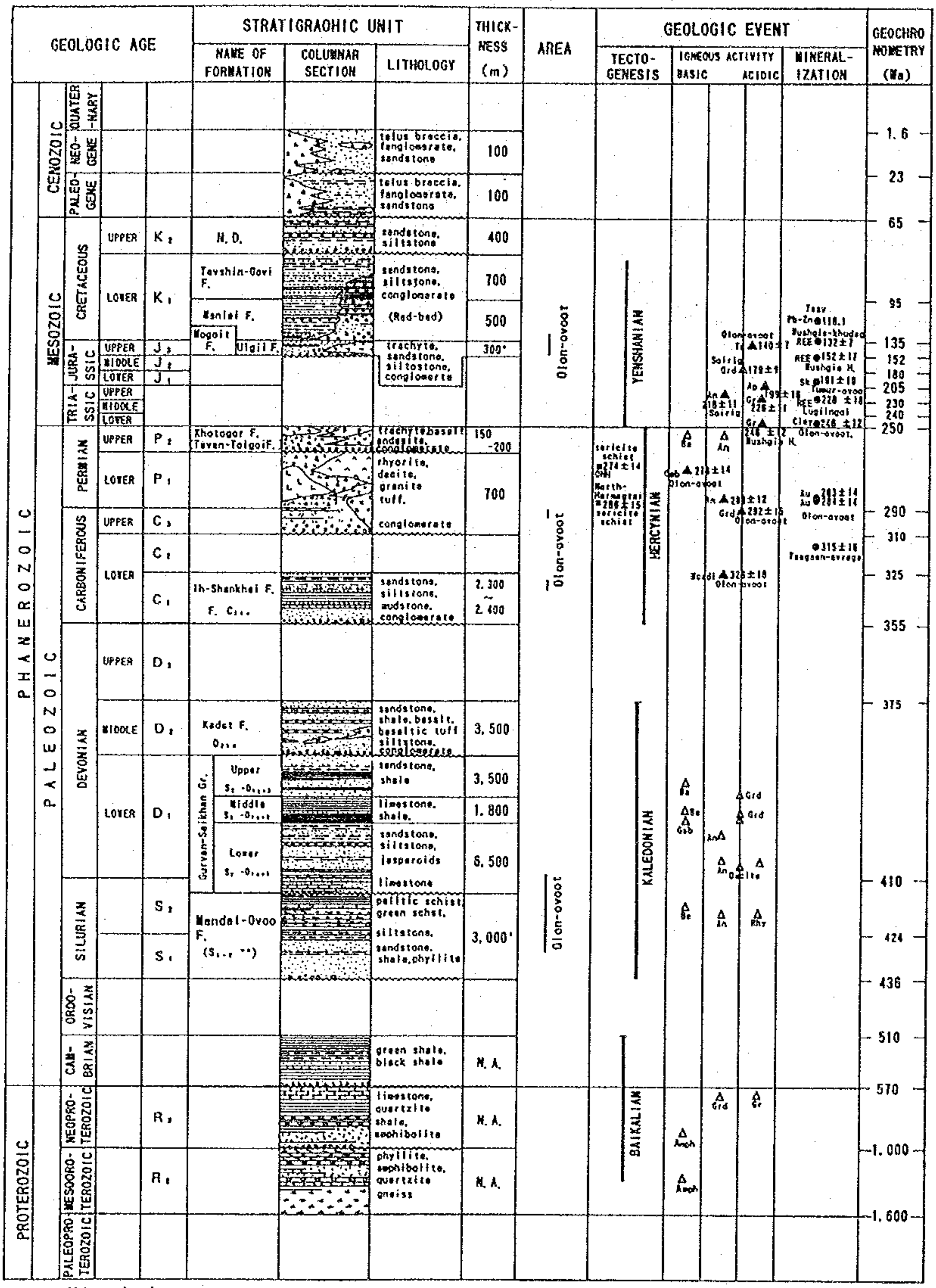


Fig. I-3-2 Geologic Map of the Survey area



Abbreviation:

F.: formation N.D.: not determined N.A.: not analyzed Tc: trachyte
Gb: gabbro Grd: granodiorite Gr: Granite Ba: basalt An: andesite
Tr: trachyte Rhy: rhyoreite Ap: aplite Amph: amphibolite

Fig. I-3-3 Stratigraphic Column of the Survey Area

Chapter 3 General Geology

The survey area is situated in a Paleozoic orogenic belt held between Siberian Massif and Sino-Korean Massif(Fig.I-3-1). Geology of the area surrounding Olon-ovoot Deposit is composed of Silurian, Devonian and Jurassic in ascending order, and intrusives which intrude into Paleozoic (Fig.I-3-2).

The Silurian, composed of crystalline schist originated in marine sediments, crpos out in the most part of the third year's survey area. It consists of alternated beds of sandstone and siltstone, silststone, medium to fine-grained sandstone, green schist and mudstone, in ascending order, as well as intrusives of medium to fine-grained diorite, medium to fine-grained granodiorite, basaltic andesite, basalt, trachyte, etc.

The Devonian, composed of white-colored limestone rich in fossils of crinoids, is distributed in the northwest, south and northeast of the survey area. The thickness of formation reaches more than 50m. This formation folds with an axis of the east-west direction and its structure is unconformable with the underlying Silurian. In the survey area, the two adjoining systems are sharply bordered.

The Jurassic, composed of unaltered lavas of basalt and biotite-rhyorite, crops out in the northeastern part of the survey area. This formation forms a Mesozoic bottomset bed along the northern margin of a upheaved Paleozoic block. The intrusive rock consists of medium to fine-grained diorite, middle to fine-grained granodiorite, basaltic andesite, basalt, trachyte, etc. Medium to fine-grained diorite and medium to fine-grained granodiorite, distributed in the whole survey area as small intrusive bodies, are frequent especially near Olon-ovoot Deposit. Basaltic andesite and basalt are often found in the western part of the semi-detailed survey area, as small intrusive bodies.

The geological structure is devided into two large blocks by Olon-ovoot Fault which goes through the center of the survey area from northeast to southwest. The block east of the fault shows a fold structure with an axis of the east to west direction, similarly to the regional geological structure in and around the survey area. In contrast, the block west of the fault changes the strike to the NW-SE direction near the fault, which constitutes its structural peculiarity.

The deposit is located in the intersection of Olon-ovoot Fault and Silurian sandstone bed, where intrusive rocks also occur densely.

There are six quartz vein zones with the maximum width of 25m and extensions ranging from 50 to 100m, which are arranged in an arc form in the west of Olon-ovoot Fault. The total extension of the quartz vein zones reaches 1,000m. In addition to the quartz vein zones, silicified, Carbonatized and pyritized network-type alteration zones of 200m in the maximum width also develop around Olon-ovoot Deposit, a part of which extends for more than 1km northeastward along the fault. Similar alteration zones are found on the east side of the fault and in the northeastern part of the suevey area.

The genetic age of Olon-ovoot deposit is inferred to be Early Permianin view of the fact that the K-Ar dating of the auriferous pyritized alteration zone is 284±14Ma and that of muscovite in the auriferous quartz veins is 283±14Ma.

Chapter 4 Survey Results and Comprehensive Analysis

4-1 Geological structure

The survey area is situated in the Paleozoic orogenic belt between Siberian Massif and Sino-Korean Massif. In the survey area, Paleozoic formation consisting of Silurian and Devonian folds heavily with an axis of the E-W to NE-SW direction.

As regards faults, the most conspicuous, regionally, are those of E-W strike parallel with Central Mongolian tectonic line and fold axis, which are followed by those of NE-SW, NW-SE directions. Olon-ovoot Fault which borders on the southern part of Olon-ovoot Deposit is a normal fault having a left lateral movement.

Olon-ovoot Deposit is located in the place where the paleozoic orogenic bed consisting of Silurian and Devonian shows a'Z' winding and is cut off by Olon-ovoot Fault. The place is abundant with various kinds of intrusive bodies, which constitutes a structural peculiarity.

4-2 Characteristics of Mineralization

Olon-ovoot Deposit occurs in Silurian sandstone and in fine-grained granodiorite intruding into the sandstone. Gold concentration spreads over a part of quartz veins and wall rock. Without distirction between quarts veins and wall rock, pyrite-rich portions are generally of high grade. A part of gold is thickly concentrated in coarse-grained pyrite disseminating into fine-grained diorite, which characterizes the deposit.

The veins, composed of milky-white quartz poor in sulfides, falls under mesothermal type gold deposit. The veins generally lack banded structure of calcite, adularia or other gangue minerals, or sulfides. Pyrite concentrates and disseminates especially in wall rock, and such portions are of high grades in general. Also gold often occures in quartz veins in the form of visible gold. Grades in vein vary widely. On the whole, silver is scanty and no 'Ginguro'(silver black) is found.

Gold rich part are apparently conformable, the homogenization temperatures of fluid inclusion ranging from 220 to 250℃ wall rock alterations are mainly pyritization and propylitization, as well as altered zones of sericite-quartz or sericite-chlorite, accompanied by a small amount of kaolinite in the neighborhood.

The third year's drilling survey revealed that around 50m under the surface, primary ore in which pyrite remains is dominant and gold concentration of exploitable grades has been found in it. Furthermore, it was confirmed that gold mineralization still continue 50m under the surface and its characteristics and grade keep stable.

4-3 Mineralization control

The surveys so far undertaken have revealed the following mineralizations controls.

i) In Olon-ovoot Deposit, gold distribution spreads over quartz veins and wall rock. Generally, pyrite-rich portions are of high grade (spacial control).

ii) In view of the fact that K-Ar dating on whole rock of auriferous coarse-grained pyritized alteration zones is 284 ±14Ma and that of muscovite in quartz veins with visible gold is 283 ±14Ma, the gold mineralization stage is inferred to be Early Triassic(Time control).

iii) Wall rock alterations are mainly pyritization, propylitization and altered zones of sericite-quartz or sericite-chlorite, accompanied by a small amount of kaolinite in the vicinity(Geochemical control).

iv) Ore parts are apparently concordant, having homogenization temperatures of fluid inclusion within a range of 170-250℃, while the deep of the deposit also shows similar temperature ranges(Temperature control). In this respect, however, further study will be required since the gold concentration stage and the time of quartz vein formation might not necessarily be simultaneous.

4-4 Potentialities of occurrence of ore deposits

4-4-1 Hydrothermal deposit

It was confirmed by the drilling survey that Olon-ovoot Deposit continues for more than 50m below the surface. Further downward extension is presumable since there is no remarkable changes in size, grade and nature of the veins 50m under the surface. Therefore, it is highly likely that the deposit has potential ore reserves of more than 700,000t at an average Au grade of 3g/t.

From these findings, it can be inferred that there are high potentialities of occurrence of hydrothermal gold deposits formed in or around Permian period in the large region in southern Mongolia, which has geological background similar to that of Olon-ovoot Deposit. The large, massive silicified zones and quartz veins confirmed by the second year's survey in Uzliit District also suggest such potentialities.

4-4-2 Copper deposits

It has been found that the large, low gravity zone accompanied by magnetic anomaly, which was captured by the second year's survey at the northeast corner of the geophysical survey area, is due to high salinity water contained in the Jurassic porous basalt lavas. Accordingly, the possibility of occurrence of porphyry type copper deposits with skarn is excluded.

Chapter 5 Conclusions and Recommendations

5-1 Conclusions

i) In Olon-ovoot Deposit, gold is concentrated in a part of quartz veins and their wall rock.

ii) In the deposit, gold grade and vein size do not decline to a depth of 50m below the surface; accordingly, the deposit is presumed to extend further to the deep.

iii) It is somewhat difficult to estimate the total potential ore reserve of Olon-ovoot Deposit only by the drilling data of this year, but 700,000 tons of reserve at gold grade of about 3 g/t will be prospected supposing that the deposit is twice as long as the confirmed vertical length at Tsagaan-tolgoi in this survey. And by further exploration of ore-indications and geophysical anomalies around there, the amount will be expected to inclease.

iv) The deposit is relatively wide, a substantial part of which is amenable to open pit mining; therefore, it is highly probable that the deposit can be exploited favorably though small in size.

v) K-Ar dating revealed that quartz vein in the deposit was formed in Early Permian.

vi) Confirmation of gold concentration in primary ores suggests high potentialities of gold deposits not only in the large guartz veins found by the second year's survey but also in a wide region of southern Mongolia, which has similar geological backgound.

vii) The large, low gravity zone with magnetic anomaly detected by the second year's survey at the northeastern corner of the geophysical survey area was found to be due to underground saline water contained in the porous basalt lavas, which excluded the possibility of occurrence of a sulfide deposit.

5-2 Recommendations

On the basis of the above conclusions, it is recommendable to implement the following surveys at Olon-ovoot Deposit in the future.

- Further drilling survey to determine ore reserves and grade
- Heap leaching tests
- Feasibility study(including pit design) after above mentioned survey works

Part II PARTICULARS

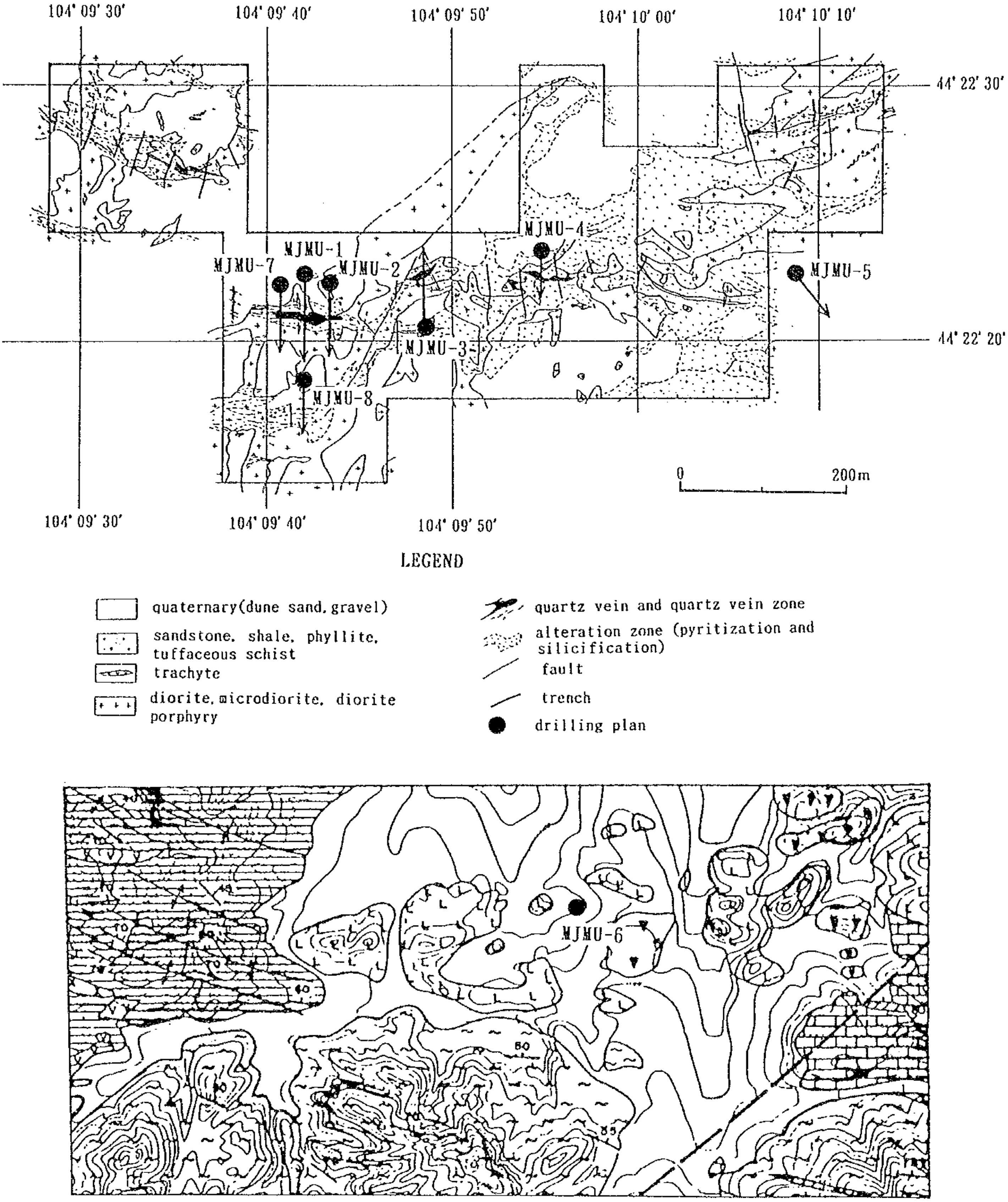
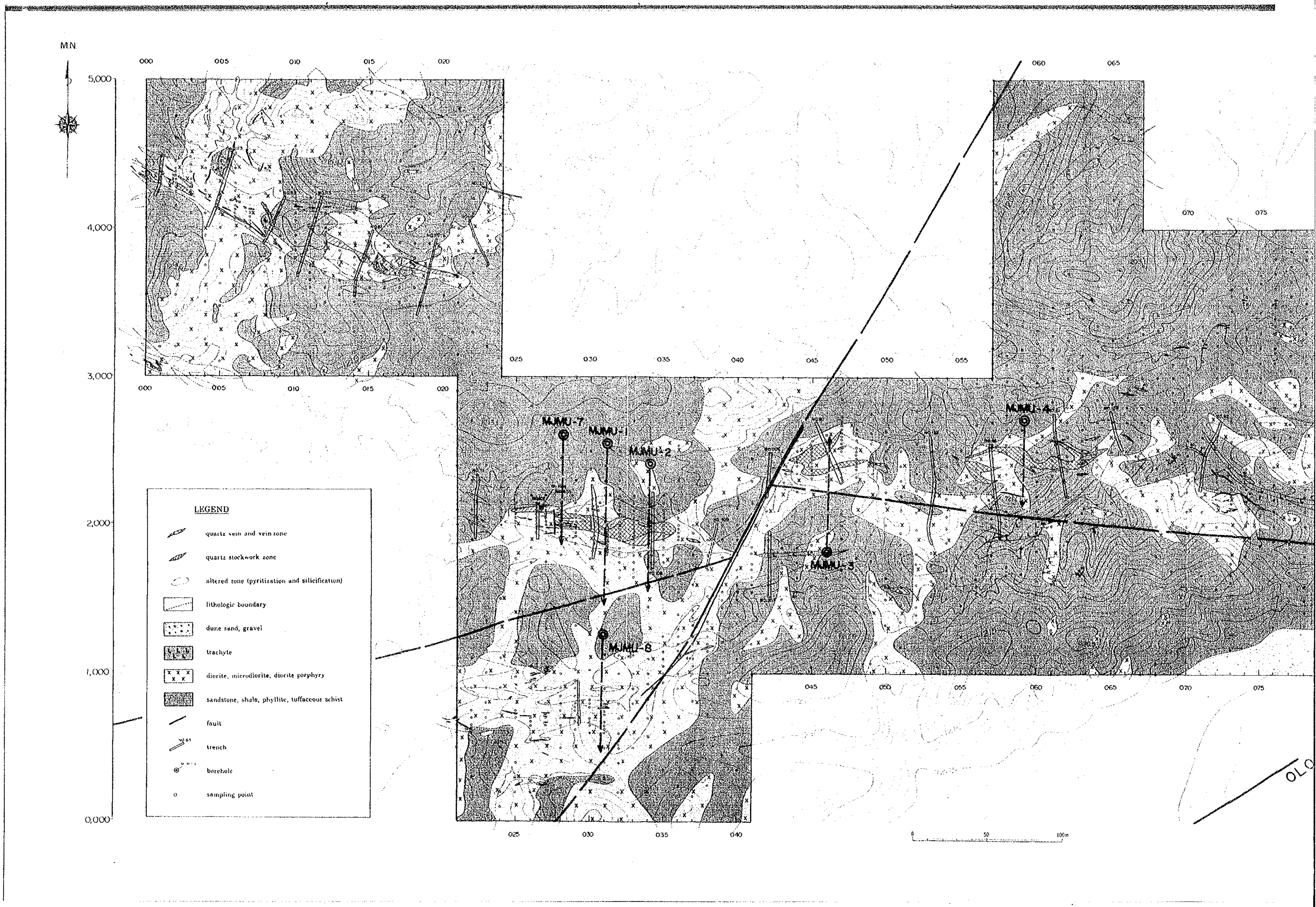


Fig. Ⅱ-1-1 Location of the Drillings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MJMU-7
MJMU-1
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MJMU-3
MJMU-4
MJMU-8
LEGEND
quartz vein and vein zone
quartz stockwork zone
altered zone (pyritization and silicification)
lithologic boundary
dune sand, gravel
trachyte
diorite, microdiorite, diorite porphyry
sandstone, shale, phyllite, tuffaceous schist
fault
trench
borehole
sampling point
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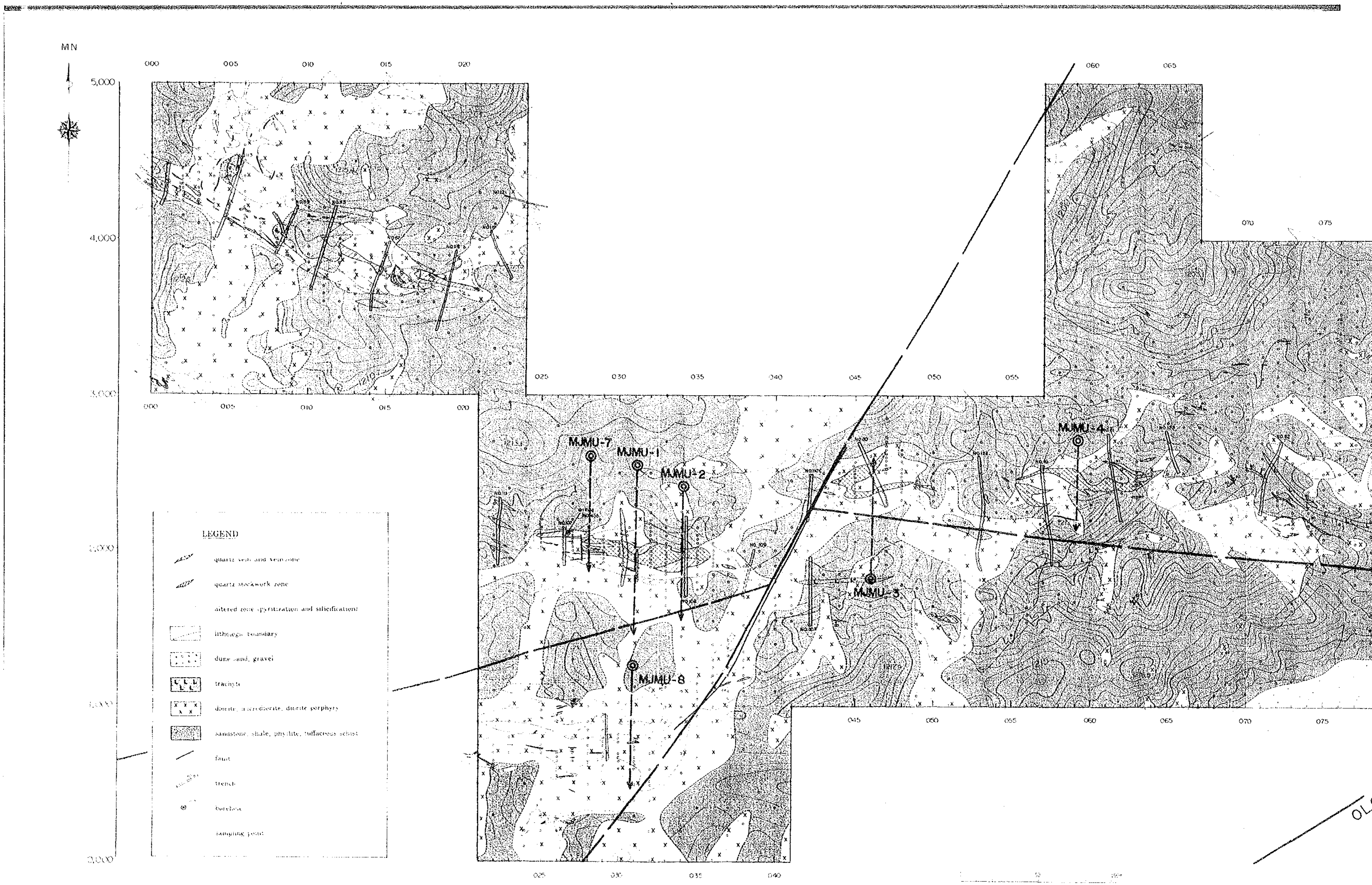
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MJMU-7
MJMU-1
MJMU-2
MJMU-3
MJMU-4
MJMU-8
LEGEND
quartz vein and vein zone
quartz stockwork zone
altered zone (pyritization and silicification)
lithologic boundary
dune sand, gravel
trachyte
diorite, microdiorite, diorite porphyry
sandstone, shale, phyllite, tuffaceous schist
fault
trench
borehole
sampling point

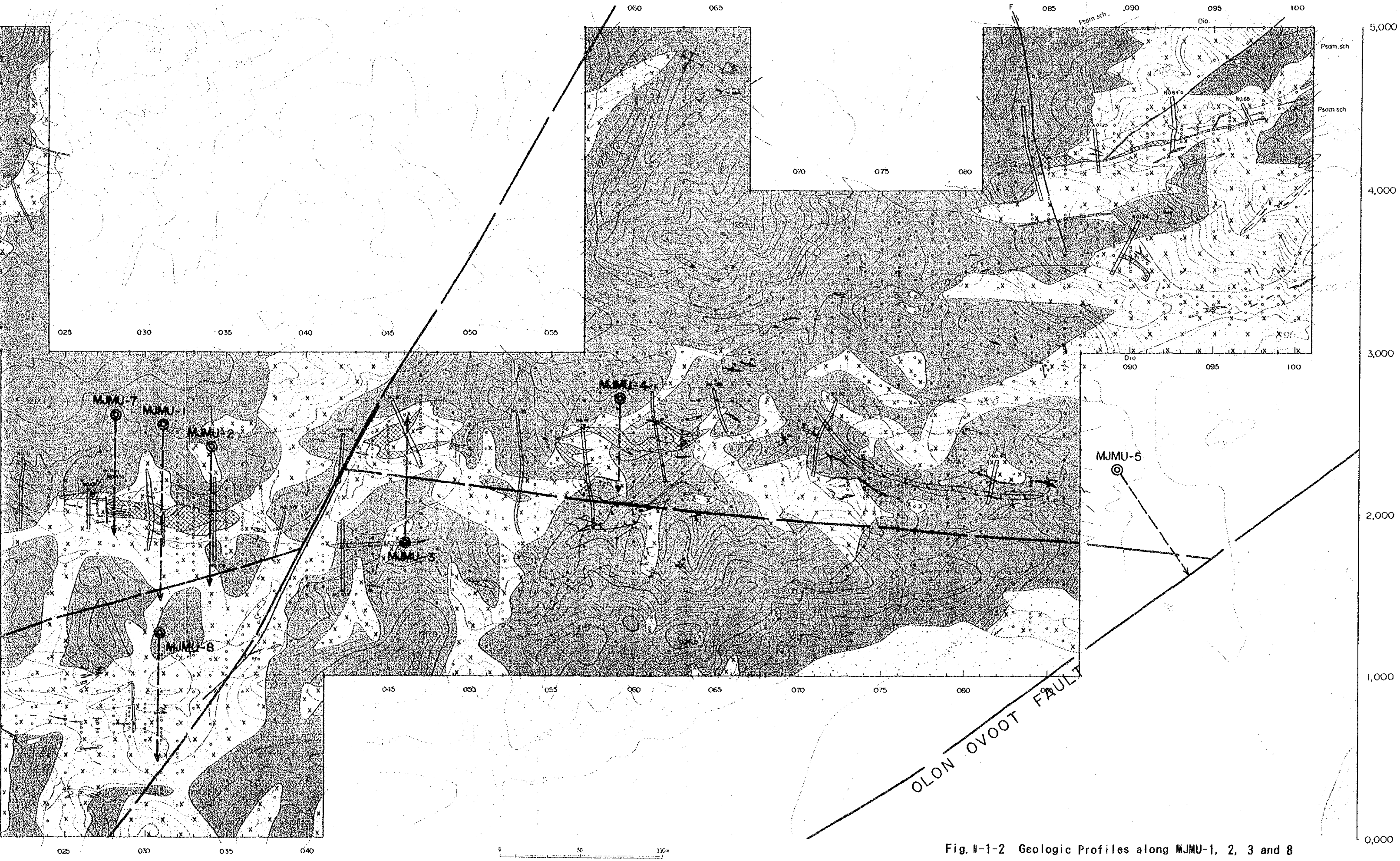


Fig. II-1-2 Geologic Profiles along MJMU-1, 2, 3 and 8

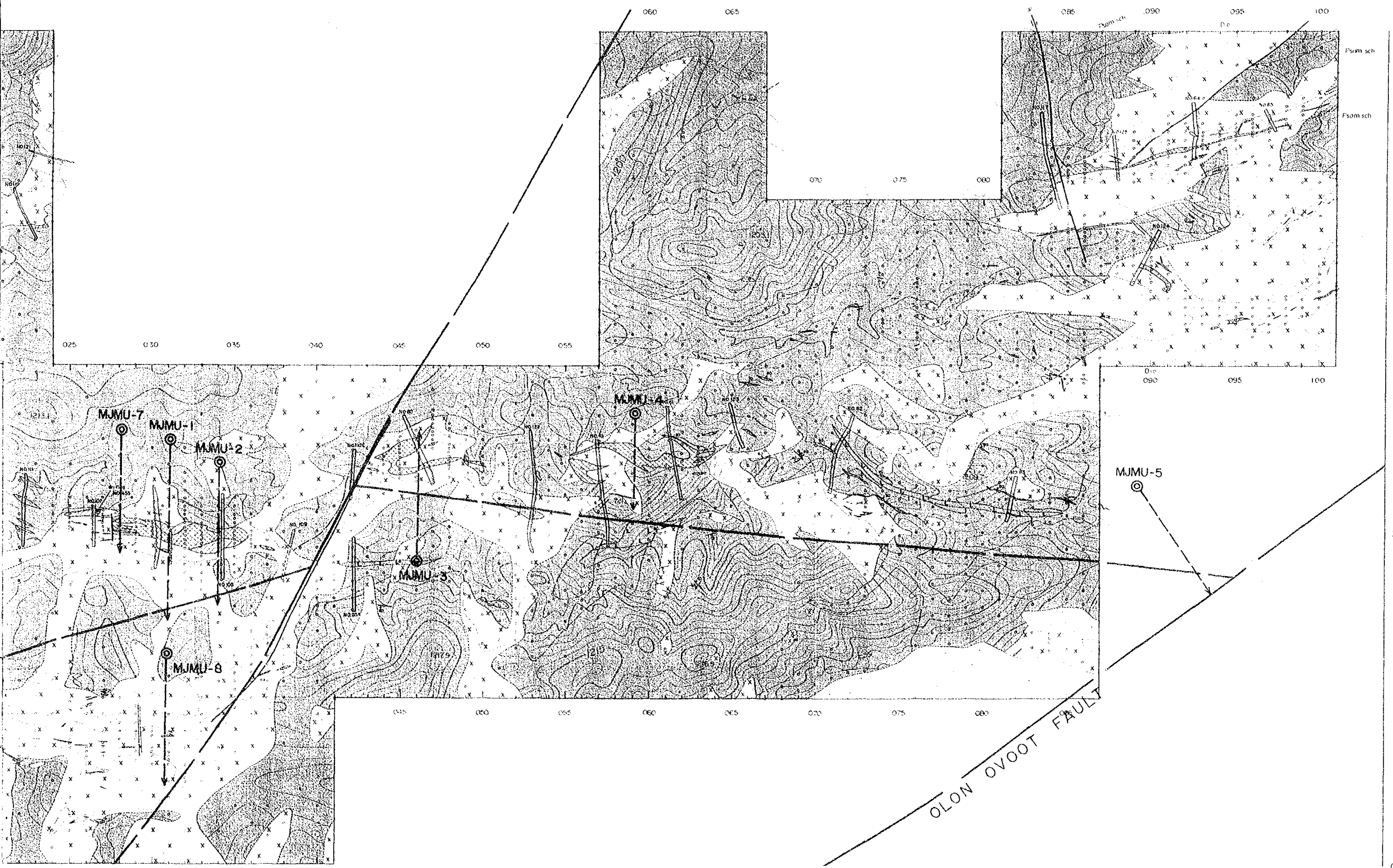


Fig. II-1-2 Geologic Profiles along MJMU-1, 2, 3 and 8

Table Ⅱ-1-1 Location, Inclination, Length and Purpose of the Drillings

NAME	LOCATION*			DIRECTION (digree)		LENGTH (m)	NOTE
	X	Y	Z				
MJMU-1	0.47	54.23	1208.2	180°	- 45°	151.40	To check the continuity of Ts. T. ore body
MJMU-2	29.91	40.86	1206.6	180°	- 40°	110.70	To check the continuity of Ts. T. ore body
MJMU-3	150.14	-16.32	1207.9	0°	- 40°	100.60	To check the continuity of mineralization
MJMU-4	280.14	74.50	1203.1	180°	- 55°	100.80	To check the continuity of mineralization
MJMU-5	582.00	35.94	1197.7	145°	- 40°	100.40	To check geophysical anomaly and fault
MJMU-6	1551.2	1399.7	1176.0	—	- 90°	91.00	To check geophysical anomaly
MJMU-7	-29.98	58.84	1206.6	180°	- 45°	103.50	To check the continuity of Ts. T. ore body
MJMU-8	0	-73.95	1208.1	180°	- 40°	103.30	To check the continuity of mineralization
TOTAL	8 Holes					861.70	

*Base point of the survey : Tsagaan-tolgoi (X= 0, Y= 0, Z= 1213.6m)

Table Ⅱ-1-2 Laboratory Works

Boring No.	Laboratopry Works Testing Items							Total	Notes
	TS	PS	WRCA	OA	XRD	K-Ar	FI		
MJMU-1	3	1	2	41	7	1	5	60	
MJMU-2	-	-	-	31	4	-	1	36	
MJMU-3	1	-	-	30	1	-	-	32	
MJMU-4	1	-	-	17	1	-	-	19	
MJMU-5	-	-	-	21	3	-	-	24	
MJMU-6	2	-	1	0	1	-	-	4	
MJMU-7	2	1	1	34	1	1	1	41	
MJMU-8	1	1	1	27	2	1	3	36	
Total	10	3	5	201	20	3	10	252	

Notes:

TS: Thin section, PS: Polished section, WRCA: Whole rock chemical analysis,
OA: Ore analysis (Au, Ag), XRD: X-ray diffraction test, K-Ar: K-Ar dating
FI: Fluid inclusion study

Chapter 1 Drilling Survey

1-1 Purpose of survey

The Survey has been aimed to clarify geological conditions and occurrence of ore deposit and to discover new deposits in Uudam Tal Area, Mongolia. Another purpose of the Survey is to effect technology transfer to the host country's counterpart organizations throughout the survey period.

The third year's drilling survey was carried out to confirm continuity of mineralization into the deep of Olon-ovoot Deposit where gold concentration was ascertained by the preceding year's geochemical prospecting, and also to confirm the geophysical anomaly zones detected in the area ajacent to the south margin of Olon-ovoot Deposit and some 2.5km northeast of the deposit. Major objectives of the drilling survey are itemized below:

i) Confirm continuity to the deep of Olon-ovoot Deposit

ii) Clarify occurrence and grade of gold and silver to a depth of 50m from the surface

iii) Check the geophysical anomaly zones

iv) Clarify characteristics of Olon-ovoot Deposit, in order to provide guidelines for future prospecting of gold deposits in Govi area

v) Promote transfer of drilling technology through the survey

1-2 Survey method

1-2-1 Summary of survey

For the abovementioned objectives, drilling work was carried out within the area indicated in Fig.II-1-1. From the preceding year's survey findings, the center of Olon-ovoot Deposit in terms of ore reserves and grade had been presumed to be at Tsagaan-tolgoi and its surrounding ore bodies, therefore, the third year's survey was concentrated on this area. As the deposit was presumed to steeply dip nothward, drilling angles were designed to be as low as possible so that boreholes may intersect the quartz veins at the highest possible angles. For supervision and direction, the chief leader of survey party was stationed always at the work site, in principle. A drilling machine L-38-98(drilling capacity BQ 725m) was used for the survey.

Drilling work was done in 3 shifts in principle. For each shift, a 6-man unit consisting of one each of Japanese and Mongolian drilling masters and 4 workers was organized.

For drilling, the wire-line method was applied while the final drill diameter was NX to ensure improved core rececvery and a shorter work period.

The drilling work lasted for 74 days from July 8 to September 19, 1993. The work schedule by boreholes is shown below:

Boreholes	Drill length	Core length	Core recovery
MJMU-1	151.4m	147.8m	97.8%

MJMU-2	110.7	109.2	98.6
MJMU-3	100.6	100.6	100.0
MJMU-4	100.8	96.6	95.8
MJMU-5	100.4	97.6	97.2
MJMU-6	91.0	91.0	100.0
MJMU-7	103.5	103.5	100.0
MJMU-8	103.3	103.3	100.0

1-2-2 Drilling Work

1) Transportation of equipment

The survey was done with a full set of drilling equipment transported from Japan by ship(Yokohama-Tianjin, China), by rail(Tianjin-Beijin-Ulaan Baatar) and by a large truck and a crane truck(Ulaan Baatar-work site). Haulage of equipment between boreholes was done by a power shovel, trucks and by manpower.

2) Preparation of haulage road and drilling sites

Preparation of drilling sites and haulage road to new drill sites were done by a buldozer, a power shovel and manpower.

3) Preparation for drilling operations

Preparation for drilling operations was done in the order of boreholes MJMU-1, -2, -3, -4, -5, -6, -7 and -8, so that drilling may be carried out successively.

4) Water for drilling

Water for drilling was transported by a tank truck from a well at Bayn-khushuu village some 20km away from the work site and stocked in a storage tank. Water was used in circulation.

5) Positioning and orientation

Drilling positions and directions were determined by summary survey using pocket compasses and a measuring tape. Measurement of boreholes after drilling was done without, since borehole deviation was considered insignificant due to the short lengths of drilling.

6) Drilling operations

i) Borehole MJMU-1

Direction: 180°
Inclination: -45°
Drilling period: July 11 thru 17, 1993
Drilling length: 151.40m
Core length: 147.80m
Core recovery: 97.8%

- 0.00m-2.00m:

A 2m weathered zone from the mouth of borehole was drilled with an NW metal bit. As heavy collapse of borehole and water leakage took place an NW casing pipe was inserted and TK-60 drilling mud water was used for borehole protection and for stopping loss of water.

- 2.00m-87.90m:

drilling was done with NQ-WL diamond bits and TK-60 mud water till 87.90m. At 51.2m and 74.9m points, whole water leakage occurred and afterwards, the leakage did not stop; drilling continued to 87.90m, where BW casing pipes were inserted.

Rock types for this section were fine-grained sandstone(0.00-20.60m and 53.45-65.80m), fine-grained diorite(20.60-53.55m and 66.20-87.90m). From 46.80m tp 52.10m and from 64.20m to 78.60m, large quartz vein zones were captured.

- 87.90m-151.40m:

BQ-WL diamond bits and TK-60 mud water were used. Leakage being weak, drilling advanced with mud replenishment. Type of rock for this section was fine-grained diorite. Medium-grained sandstone (xenolith) was found between 145.20m and 146.20m while, between 146.20m and 149.10m, an epidotized trachyte dike was observed. Seven quartz veins ranging from 5cm to 1m in width were found between 80.55m and 90.30m.

ii) MJMU-2

Direction: 180°
Inclination: -40°
Drilling period: July 23 thru 27, 1993
Drilling length: 110.70m
Core length: 109.20m
Core recovery: 98.6%

- 0.00m-1.80m:

For 1.80m from the mouth, drilling was done with an NW metal bit and an NW casing pipe was inserted. For protection of borehole and prevention of leakage, TK-60 mud water was used.

- 1.80m-110.70m:

NQ-WL diamond bits and TK-60 mud water were used. At 31.30m and 70.50m points, a whele water leakage occurred, which, however, spontaneously recovered by some 80% and drilling continued with replenishment of mud water.

Rock types are fine-grained diorite(0.00-19.40m), fine-grained sandstone(19.40-31.60m) and fine-grained diorite(31.60-110.70m). Between 81.20m and 82.40m, trachyte was found. Large size quartz veins were captured between 35.20m and 36.80m and also between 46.65m and 55.60m. In the sections 9.60-12.00m, 69.80-70.50m and 80.80-88.30m, small fault fracture zones were observed.

iii) MJMU-3

Direction: 0°
Inclination: -40°
Drilling period: August 1 thru 5, 1993
Drilling length: 100.60m
Core length: 100.60m
Core recovery: 100.0%

- 0.00m-2.00m:

The initial 2m weathered section was drilled with an NW metal bit. An NW casing pipe was inserted to protect the borehole and to prevent leakage. For drilling, TK-60 mud water was used for protecition of borehole and prevention of leakage.

- 2.00m-100.60m:

  Drilled down to 100.60m with a WL diamond bit, using TK-60 mud water. At 32.0m point, collapse and whole water leakage took place. As the leakage recovered spontaneously to some 70%, drilling operation continued with replenishment of mud water.

  Rock types are trachyte(0.00-8.50m), fine-grained diorite(8.50-24.00m), fine-grained sandstone(24.00-92.20m), and fine-grained diorite(92.20-110.70m). Seven fault fracture zones were encountered between 56.50m and 66.70m.

iv) <u>MJMU-4</u>

Direction: 180°
Inclination: -55°
Drilling period: August 10 thru 14, 1993
Drilling length: 100.80m
Core length: 96.60m
Core recovery: 95.8%

- 0.00m-2.00m:

  This weathered section was drilled with an NW metal bit. To accommodate heavy borehole collapse and water leakage, an NW casing pipe was inserted. For drilling, TK-60 mud water was used to protect the borehole and to stop leakage.

- 2.00m-100.80m:

  Drilled with NQ-WL diamond bits and TK-60 mud water down to 100.80m. At 17.80m and 74.10m points, about 30% of water leaked, which however recovered to some 90% by use of Telstop. Drilling continued with replenishment of mud water.

  Rock types are medium-grained sandstone(0.00-8.90m and 20.40-72.60m), medium to fine-grained sandstone(76.60-79.50m and 81.20-87.70m) and siltstone(87.70-93.60m and 97.70-100.80m). Fine grained diorite was found(8.90-20.40m and 93.60-97.70m), as well as trachyte(72.60-76.60m and 79.50-81.20m). There were fault fracture zones(78.70-79.40m and 81.20-83.50m).

v) <u>MJMU-5</u>

Direction: 145°
Inclination: -40°
Drilling period: August 19 thru 22, 1993
Drilling length: 100.40m
Core length: 97.60m
Core recovery: 97.2%

- 0.00m-1.10m:

  The weathered zone of 1.10m was drilled with an NW metal bit, and an NW casing pipe was inserted to prevent collapse of the borehole. For drilling, TK-60 mud water was used to protect borehole and stop water leakage.

- 1.10m-100.40m:

Drilled down to 100.80m with NQ-WL diamond bits. TK-60 mud water was used for the whole section. At 13.40m and 19.20m points, whole water leakage took place, which recovered to 70% by the use of Telstop. Drilling continued with replenishment of mud water.

Rock types are fine-grained diorite(0.00-21.60m and 31.70-48.40m), trachyte(21.69-31.70m) and fine-grained sandstone(48.40-100.40m). Large fault fracture zones were met between 29.80m and 32.80m and between 78.70m and 79.50m.

vi) MJMU-6

Direction: -

Inclination: -90°

Drilling period: August 27 thru 30, 1993

Drilling length: 91.00m

Core length: 91.00m

Core recovery: 100.0%

- 0.00m-5.50m:

The weathered zone down to 5.50m was drilled with a metal bit and an NW casing pipe was inserted for prevention of collapse and leakage. For the same purposes, TK-60 mud water was used for drilling operation.

- 5.50m-91.00m:

Using NQ-WL diamond bits, drilling advanced down to 91.10m. For the whole section, TK-60 mud water was used. At 7.20m point, a whole water leakage took place but it recovered to about 70% by the use of Telstop. Drilling was continued with replenishment of mud water.

Rock types are tuff breccia of trachyte(0.00-6.00m and 49.80-51.60m), trachyte lava(6.00-49.80m), tuff breccia of basaltic trachyte(51.66-52.90m, 62.80-64.30m, 77.20-79.00m and 81.50-83.80m), trachybasalt lava(52.90-62.80m, 64.30-77.20m and 79.00-81.50m) and tuff breccia composed of trachybasaltic breccia(83.80-91.00m).

vii) MJMU-7

Direction: 180°

Inclination: -45°

Drilling period: September 4 thru 8, 1993

Drilling length: 103.50m

Core length: 103.50m

Core recovery: 100.0%

- 0.00m-2.30m:

The initial weathered zone was drilled with an NW metal bit and an NW casing pipe was inserted. For borehole protection and leakage prevention, TK-60 mud water was used for drilling.

- 2.30m-103.50m:

Drilled down to 100.80m with NQ-WL diamond bits and TK-60 mud water. At 52.50m point, leakage of approx. 30% occcurred, which recovered to approx. 80% by the use of Telstop. Drilling was continued with replenishment of mud water.

Rock types are fine-grained sandstone(0.00-17.60m, 54.65-72.00

m, 95.20-96.60m and 98.50-103.50m) and fine-grained diorite(17.60-54.65m, 72.00-94.80m and 97.32-98.50m). Large quartz vein zones were captured between 56.40m and 75.00m and also between 92.15m and 97.32 m.

viii) MJMU-8

Direction: 180°
Inclination: -50°
Drilling period: September 12 thru 16, 1993
Drilling length: 103.30m
Core length: 103.30m
Core recovery: 100.0%

- 0.00m-2.00m:

The weathered zone of 2m was drilled with an NW metal bit and an NW casing pipe was inserted. For protection of the borehole and prevention of leakage, TK-60 mud water was used.

- 2.00m-103.30m:

Drilled down to 100.80m using NQ-WL diamond bits and TK-60 mud water. At 25.30m point, whole water leakage took place which recovered by the use of Telstop to some 80%. Drilling continued with replenishment of mud water.

Ore types are fine-grained diorite(0.00-2.60m, 5.75-25.90m, 41.90-44.70m, 59.50-71.20m and 73.00-103.30m), fine-grained sandstone(2.60-5.75m, 25.90-41.90m, 54.80-59.50m and 71.20-73.00m) and trachyandesite-trachybasalt(44.70-54.80m). Milky white-colored quartz veins were captured(19.70-21.10m, 22.70-23.20m and 24.60-24.80m).

7) Core identification and sampling

Core identification was successively done and the results were recorded as geologic core logs with a scale of 1/200. Geological sections were also drawn. Drilling was so designed and executed to make effective drillings to achieve the survey purposes.

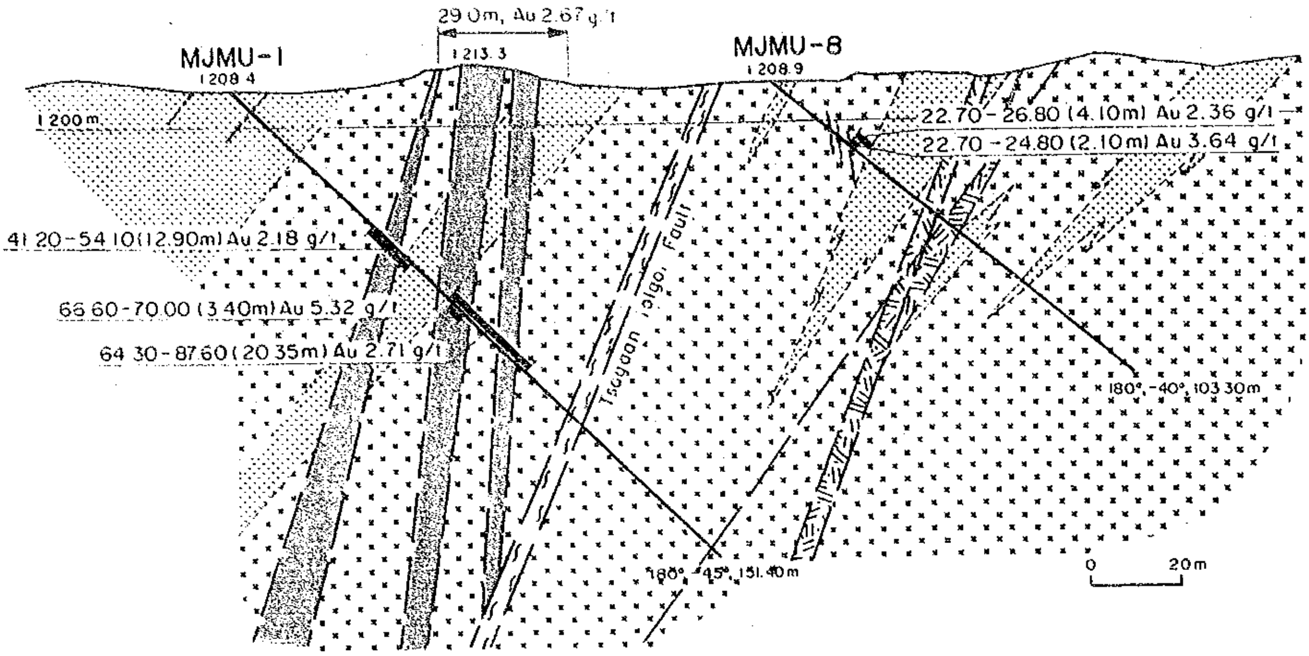
Ore sampling for chemical analysis was done mainly of quartz veins. In case mineralization and alteration are observed, altered wall rock was also sampled. Thus, 201 pieces of samples were taken.

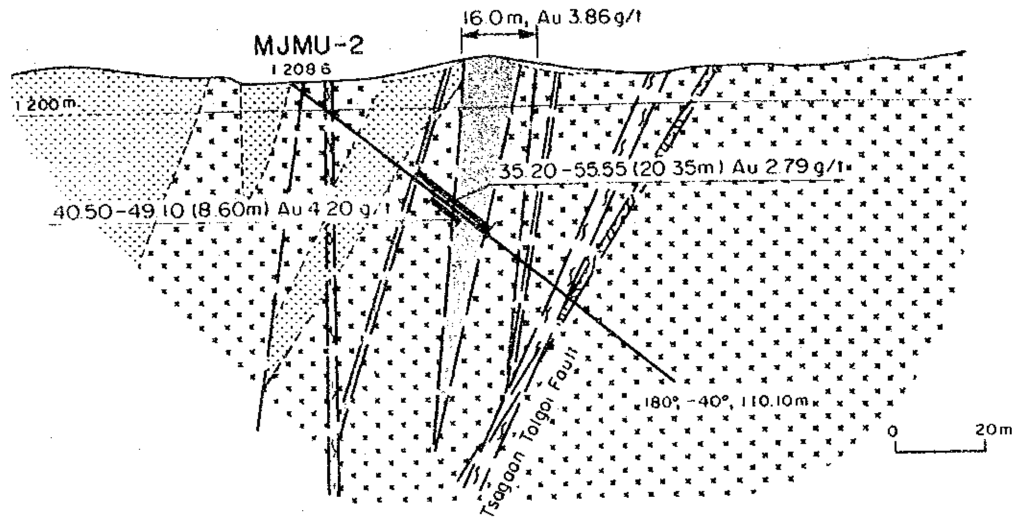
Microscopic observation and chemical analyses were excuted on the samples of ores and rocks in which mineralization is observed. The whole rock chemical analysis was conducted of the 13 items, ie., SiO_2, Al_2O_3, Fe_2O_3, FeO, K_2O, Na_2O, CaO, MgO, MnO, Cr_2O_3, P_2O_5, TiO_2 and ignition loss. Assay of ore was done on the two elements, Au and Ag. The detection limits were set at 1ppb for Au and 0.2ppm for Ag. Contents of these examinations are shown in Tables I-1-2 and II-1-2.

1-3 Survey results

1-3-1 Geology

As the result of drilling survey, large auriferous quartz veins and gold mineralization zones were captured by drilling at MJMU-1, -2 and -7 in Tsagaan-tolgoi and at MJMU-8 in the south of Tsagaan-tolgoi(Tables II-1-





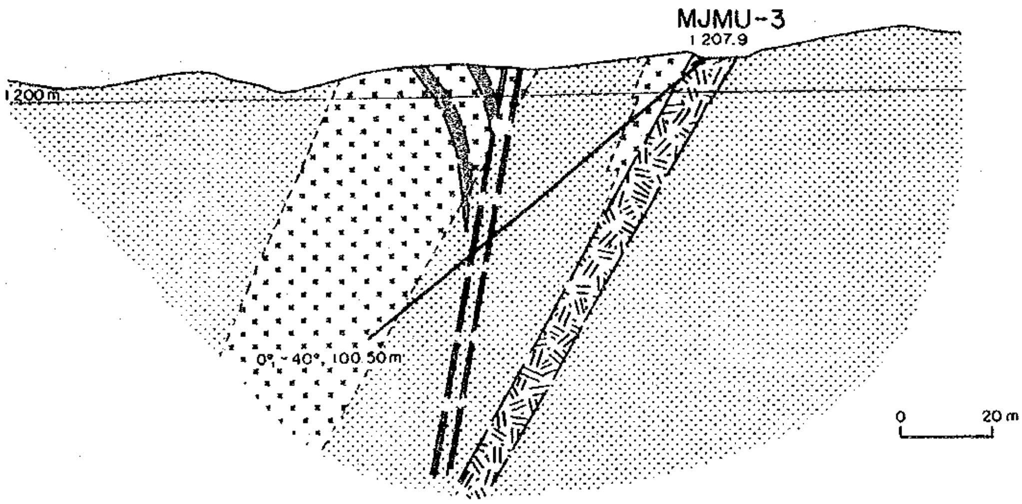


Fig. II-1-3 Geologic Profiles along MJMU-1, 2, 3 and 8

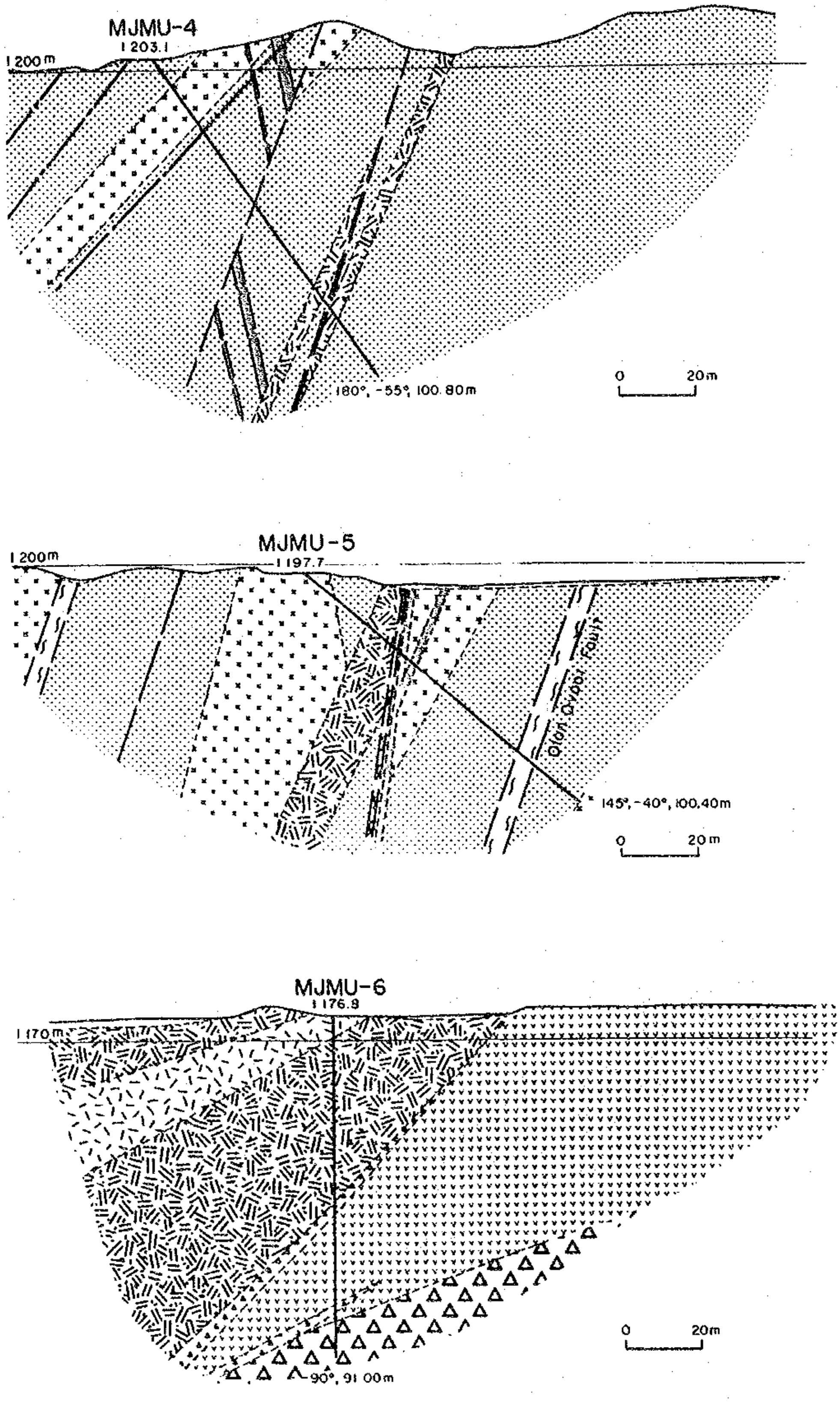
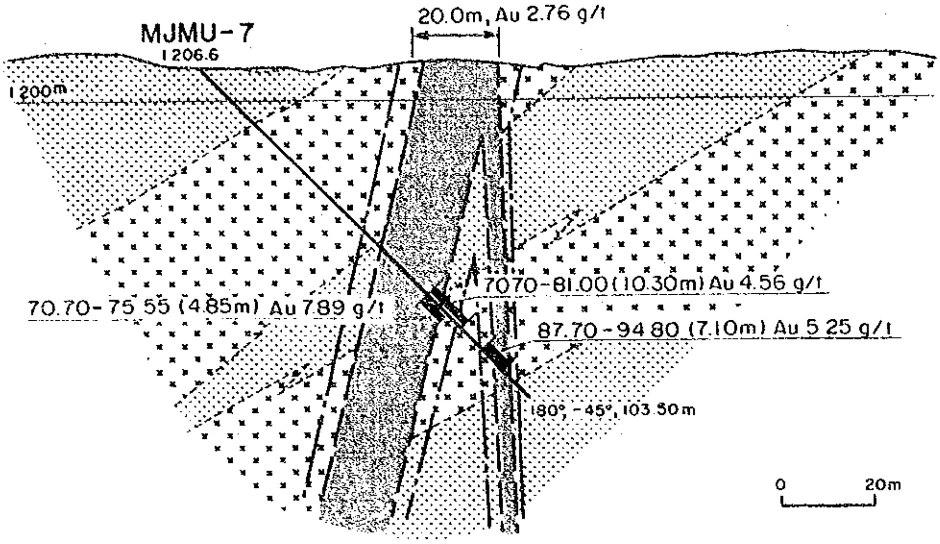


Fig. Ⅱ-1-4 Geologic Profiles along MJMU-4, 5 and 6



LEGEND

CENOZOIC	Quaternary	gravel, sand
MESOZOIC	Jurassic	trachytic tuffbreccia
		trachyte
		trachybasaltic tuffbreccia
		trachybasalt~trachyandesitic basalt
		tuff breccia, volcanic conglomerate
PALEOZOIC	Permian	microdiorite
	Silurian	sandstone, siltstone

quartz vein, quartz vein zone

hydrothermal alteration zone

geologic boundary

fault

drilling

Fig. II-1-5 Geologic Profile along MJMU-7